Lutron energy-saving products

PowPak® dimming module (actual size)

Radio Powr Savr™ occupancy/vacancy sensor (actual size)

Pico® wireless control (actual size)

Quick Install Energy Solutions

Featuring Energi TriPak®

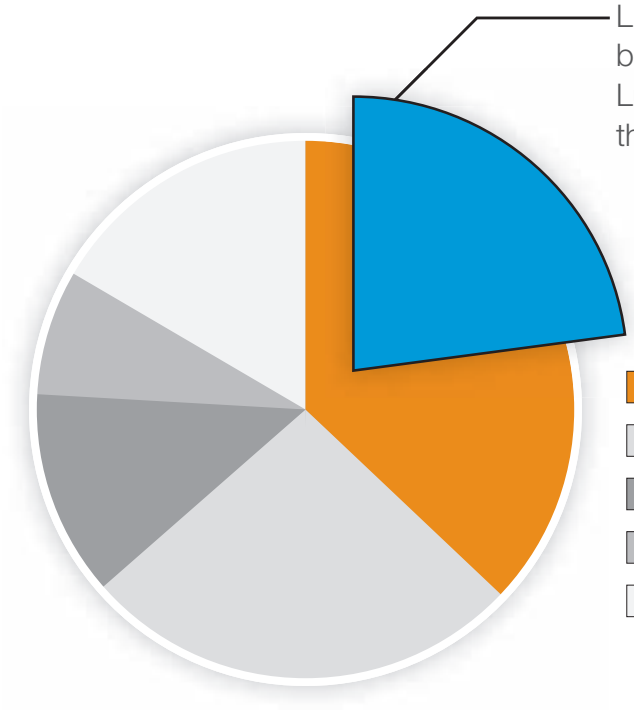
LUTRON®

save energy with Lutron™ ®

Energi TriPak®

Energi TriPak is a family of wireless energy-saving products featuring Radio Powr Savr™ sensors, Pico® controls and PowPak®/Maestro Wireless® load controllers. These components, when combined:

- save up to 60%[1] of lighting electricity usage
- increase occupant comfort and productivity
- control virtually all loads
- reduce installation and programming costs



Lighting consumes more electricity in commercial buildings than anything else—about 38%[2] a year. Lutron solutions can save up to 60%[1] or more of that lighting energy.

Annual electricity use[2]

Lighting	**38%**
HVAC	29%
Refrigeration	12%
Office Equipment	7%
Other	14%

Lighting typically accounts for 38%[2] of electricity usage in new construction and retrofit commercial applications, which include spaces such as classrooms and offices. These applications benefit from Energi TriPak energy savings through strategies like automatic occupancy/vacancy sensing and daylight harvesting.

Studies show that proper lighting is beneficial to space occupants. By providing task-appropriate lighting and individual lighting control, Energi TriPak improves comfort and occupant satisfaction, resulting in increased productivity.[3]

Energi TriPak requires no additional wiring. The components communicate wirelessly via Lutron's reliable Clear Connect® Radio Frequency (RF) technology. In addition, simple button press programming eliminates the need for factory commissioning.

Sources located on back cover.

Energi TriPak design and application guide

What is Energi TriPak?

Energi TriPak consists of transmitting devices that send out RF commands to the load controllers. The load controllers receive the RF command and perform the appropriate action based on the information received.

Transmitting devices

Sense

Radio Powr Savr™ wireless sensors

Occupancy/vacancy

Daylight

Adjust

Pico® wireless control

Wall-mount

Tabletop

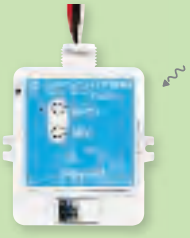
Hand-held

Load controllers

Conserve

PowPak® load controllers

Dimming module with EcoSystem®



Relay module

Contact closure output module

Plug-in dimming module

Plug-in appliance module

Stairwell fixture with PowPak stairwell controller

Maestro Wireless®

Dimmer

Switch

Tabletop lamp dimmer

Benefits

Easy to install and program

- All points of control are wireless for simple installation with no new wiring
- Simple button programming for all devices

Saves energy and money

Simply incorporate the following energy-saving control strategies:

- Personal dimming control
- Occupancy/vacancy sensing
- Daylight harvesting
- High-end trim
- Plug load control
- HVAC integration

Cost-effective

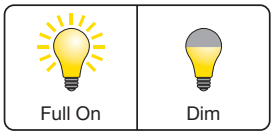
- No commissioning required
- Overall labor costs reduced due to wireless communication—no additional wiring

Meets codes and standards

Provides the opportunity to meet the following codes and standards:

- LEED NC 2009
- ASHRAE Energy Code 90.1-2010
- IECC (International Energy Conservation Code)
- ASHRAE Green Standard 189.1-2011
- IgCC (International Green Construction Code)
- CEC Title 24 (California Energy Commission)

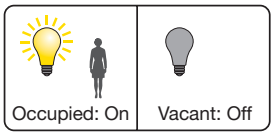
Energy-saving control strategies



Personal dimming control

Gives occupants the ability to set the light levels.

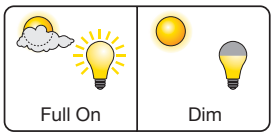
Potential lighting energy savings: 10-20%[4]



Occupancy/vacancy sensing

Turns lights on when occupants are in a space and dims lights to a low level or turns lights off when they vacate the space.

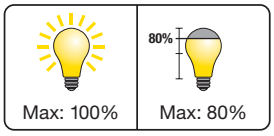
Potential lighting energy savings: 20-60%[5]



Daylight harvesting

Dims electric light when daylight is available to light the space.

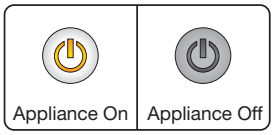
Potential lighting energy savings: 25-60%[6]



High-end trim

Sets the maximum light level based on customer requirements in each space.

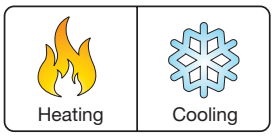
Potential lighting energy savings: 10-30%[7]



Plug load control

Automatically turns off loads after occupants leave a space.

Potential controlled loads savings: 15-50%[8]



HVAC integration

Controls heating, ventilation, and air conditioning systems through contact closure.

Potential HVAC savings: 5-15%[9]

Sources located on back cover.

Meets codes and standards

LEED NC 2009

Can contribute to:

- SS Credit 8 Light Pollution Reduction (1 point)
- EA Prerequisite 2 Minimum Energy Performance
- EA Credit 1 Optimize Energy Performance (up to 19 points)
- IEQ Controllability of Systems: Lighting (1 point)
- IEQ Daylight and Views: Daylight (1 point)
- Innovation in Design (up to 5 points)
- RP Credit 1 Regional Priority (up to 4 points)

ASHRAE Energy Code 90.1-2010

- Automatic Receptacle Control (8.4.2)
- Automatic Lighting Shut-off (9.4.1.1)
- Space Control (9.4.1.2)
- Automatic Daylight Controls (9.4.1.4 and 9.4.1.5)
- Additional Controls, Stairwell Lighting (9.4.1.6 g)

IECC 2012 (International Energy Conservation Code)

- Interior Lighting Controls (C405.2.1.1)
- Light Reduction Controls (C405.2.1.2)
- Occupancy Sensors (C405.2.2.2)
- Automatic Daylighting (C405.2.2.3.2)
- Multi-level Lighting Controls (C405.2.2.3.3)

ASHRAE Green Standard 189.1-2011

- Occupancy Sensor Controls with Multi-level Switching or Dimming (7.4.6.2)
- Occupancy Sensors (7.4.6.4)

IgCC Public Version 2 (International Green Construction Code)

- Interior Light Reduction Controls (609.3)
- Automatic Daylight Controls (609.5)
- Plug-load Controls (609.6)

CEC Title 24 2008 (California Energy Commission)

- Area Controls (131 a)
- Multi-level Lighting Controls (131 b)
- Daylight Areas (131 c)
- Shut-off Controls (131 d)

Energi TriPak® application: Public restroom

In public spaces, such as bathrooms, lighting is often on even when the space is unoccupied. Automatic lighting control with occupancy sensing is an ideal energy-saving lighting solution.

Energy-saving strategies

Occupancy sensing

Potential lighting energy savings:

50%[5]

Radio Powr Savr™ ceiling-mount occupancy/vacancy sensor communicates with load controllers to turn lights on or off

Lutron® Clear Connect®
Wireless Signal **Sent**

Lutron® Clear Connect®
Wireless Signal **Received**

PowPak® relay module with Softswitch® switches loads in response to wireless sensors and controls (mounted in ceiling)

Energi TriPak® application: Private office

Providing personal lighting control in a private office application helps improve occupant comfort.

Energy-saving strategies

Occupancy/vacancy sensing
Daylight harvesting
Plug load control

Potential lighting energy savings:

45%

Radio Powr Savr™ daylight sensor communicates with load controllers to turn lights on or off based on amount of daylight available

PowPak® plug-in appliance module turns phantom loads on or off in response to wireless sensors and controls (located under desk)

Lutron® Clear Connect®
Wireless Signal **Sent**

Lutron® Clear Connect®
Wireless Signal **Received**

Radio Powr Savr ceiling-mount occupancy/vacancy sensor
communicates with load controllers to turn lights on or off based on occupancy

Maestro Wireless® switch
provides manual control and switches lighting loads in response to wireless sensors and controls

Pico® wireless control
allows manual control of loads; place on desk top or mount to wall

Maestro Wireless tabletop lamp dimmer
provides manual control and dims table lamps in response to wireless sensors and controls

Energi TriPak® application: Classroom

A best-practice classroom combines energy efficiency with a high-quality learning environment. Classroom lighting plays a particularly critical role because of the direct relationship between good lighting and student performance.[10]

Energy-saving strategies

Personal dimming control
Occupancy/vacancy sensing
Daylight harvesting
High-end trim
HVAC integration

Potential lighting energy savings:

60%

PowPak® dimming module with EcoSystem® dims lighting loads in response to wireless sensors and controls (mounted in ceiling)

Pico® wireless controls allows manual control of loads; place on desk top or mount to wall

Lutron® Clear Connect®
Wireless Signal **Sent**

Lutron® Clear Connect®
Wireless Signal **Received**

EcoSystem H-Series digital ballast
combines superior 1% dimming performance and Lutron reliability

Radio Powr Savr™ daylight sensor
communicates with load controllers to dim lights based on amount of daylight available

PowPak contact closure output module
integrates with HVAC system or other third-party equipment through contact closures, allowing the equipment to respond to wireless commands (mounted in ceiling)

Radio Powr Savr corner-mount occupancy/vacancy sensor
communicates with load controllers to turn lights on or off based on occupancy

Define your space

Use the following steps to plan and design an ideal energy-saving solution based on the use of the space and the needs of its occupants.

Step 1 Is occupancy/vacancy sensing required?

Select the style of the Radio Powr Savr™ occupancy/vacancy sensor based on mounting and coverage requirements . . . . . **pg. 14**

Step 2 Is daylight harvesting required?

Select the Radio Powr Savr daylight sensor . . . . . **pg. 15**

Step 3 Is control of overhead lighting required?

a. Select the control(s) required based on style and load capacity . . . **pgs. 16-19**
b. Select the stairwell fixture with PowPak stairwell controller for stairwell applications . . . . . **pg. 20**

Step 4 Is control of task lighting required?

Select the style of plug-in device required . . . . . **pg. 21**

Step 5 Is control of plug loads required?

Select the style of plug load controller required . . . . . pg. 22

Step 6 Is third-party equipment integration required?

Select the PowPak contact closure output module . . . . . pg. 24

Step 7 Are personal or additional points of control required?

a. Select the style of the Pico® wireless control required . . . . . pg. 25
b. Select accessories for Pico wireless control . . . . . pg. 26

Lutron® Clear Connect®
Wireless Signal **Sent**

Lutron® Clear Connect®
Wireless Signal **Received**

Step 1 Occupancy/vacancy sensor selection

Radio Powr Savr™ wireless occupancy/vacancy sensors

Design statement: Specify a wireless occupancy/vacancy or vacancy-only sensor to turn lights on and/or off based on the space occupancy.

Radio Powr Savr wireless ceiling-mount occupancy/vacancy sensor dimensions
W: 3.57" (91 mm)
H: 3.57" (91 mm)
D: 1.13" (29 mm)

Radio Powr Savr wireless wall/hall/corner-mount occupancy/vacancy sensor dimensions
W: 1.8" (46 mm)
H: 4.35" (110 mm)
D: 1.35" (34 mm)

Features
- Available in ceiling-mount, wall-mount, corner-mount and hallway options
- Lutron XCT™ signal processing technology greatly enhances the performance of passive infrared (PIR) sensors, enabling them to detect minor motions that other sensors could not previously detect
- Utilizes Lutron reliable Clear Connect® RF technology to communicate wirelessly with wireless load controllers (wallbox controls, remote-mount modules, fixtures and/or plug-in devices)
- RF range: 60 ft (18 m) line of sight, or 30 ft (9 m) through walls
- Vacancy model available to meet CA Title 24 requirements
- 10-year battery life

Benefits
- Front-accessible buttons make set up easy
- Sensors have simple test modes to verify ideal locations during installation

Models

Sensors*

LRF2-OCR2B-P-WH—ceiling-mount occupancy/vacancy sensor
LRF2-OWLB-P-WH—wall-mount occupancy/vacancy sensor
LRF2-OKLB-P-WH—corner-mount occupancy/vacancy sensor
LRF2-OHLB-P-WH—hallway occupancy/vacancy sensor

Accessories

L-CMDPIRKIT—ceiling-mount sensor lens masking kit
L-CRMK-WH—ceiling-mount sensor recess-mounting bracket
WGOMNI-CPN3688—wire guard for ceiling-mount sensor
WGWS-CPN3688—wire guard for wall-mount and hallway sensors
STI-9618-CPN3688—wire guard for corner-mount sensor

* Vacancy-only models available

Lutron® Clear Connect®
Wireless Signal **Sent**

Step 2 Daylight sensor selection

Radio Powr Savr wireless daylight sensor

Design statement: Specify a wireless daylight sensor to dim or switch zones of light in response to available daylight.

Radio Powr Savr wireless daylight sensor dimensions
W: 1.60" (41 mm)
H: 1.60" (41 mm)
D: 0.7" (17 mm)

Features

- Utilizes Lutron reliable Clear Connect RF technology to communicate wirelessly with wireless load controllers (wallbox controls, remote-mount modules, and/or plug-in devices); a load controller can communicate with only one daylight sensor
- RF range: 60 ft (18 m) line of sight, or 30 ft (9 m) through walls
- Features Lutron reliable proportional daylight open loop control
- Has a light range 0-107,000 Lux (0–10,000 fc) and a photopic response that matches the human eye
- Designed to give a linear response to changes in viewed light level
- 1 sensor is capable of switching and continuous dimming of multiple zones
- 10-year battery life

Benefits

- Simple calibration
- Multiple ceiling-mount methods available for different ceiling materials
- Front accessible test buttons make set up easy

Models

LRF2-DCRB-WH—daylight sensor

Lutron® Clear Connect®
Wireless Signal **Sent**

Step 3a Overhead light control selection

PowPak® relay module

Design statement: The PowPak relay module is designed for spaces where local control is not currently available, but is required.

PowPak relay module dimensions
W: 2.89" (48 mm)
H: 3.44" (87 mm)
D: 1.25" (32 mm)

Features
- General purpose switch (all lighting loads; motor loads; receptacles)
- Receives input from up to 9 Pico® wireless controls, 6 Radio Powr Savr™ occupancy/vacancy sensors, and 1 Radio Powr Savr daylight sensor via Lutron reliable Clear Connect® RF technology
- Model available with a dry contact closure output for integration with third-party equipment; contact closure output provides occupancy status
- 16 A model features patented Softswitch® technology that extends relay life to 1,000,000 cycles
- 120/277 V~ input

Benefits
- Save energy with the addition of occupancy sensing, daylight harvesting and personal control without the need for additional wires
- Button press programming to associate the module with the Radio Powr Savr sensors and Pico wireless controls

Mounting
- Mounts through a 1/2" NPT trade-size knock-out to a junction box or to a fixture. Can also be mounted inside of a standard 4" x 4" junction box

Models
RMJ-5R-DV-B—5 A lighting loads (1/6 HP @ 120 V~ or 1/3 HP @ 277 V~ motor loads)
RMJ-5RCCO1-DV-B—5 A lighting loads (1/6 HP @ 120 V~ or 1/3 HP @ 277 V~ motor loads) with (1) contact closure output
RMJ-16R-DV-B—16 A lighting loads (1/2 HP @ 120 V~ or 1 1/2 HP @ 277 V~ motor loads, 15 A 120 V receptacles)
RMJ-16RCCO1-DV-B—16 A lighting loads (1/2 HP @ 120 V~ or 1 1/2 HP @ 277 V~ motor loads, 15 A 120 V~ receptacles) with (1) contact closure output

PowPak dimming module with EcoSystem®

Design statement: Specify the PowPak dimming module with EcoSystem for the application that requires dimming of fluorescent and LED fixtures and simple reconfiguration of lighting zones.

PowPak dimming module with EcoSystem dimensions
W: 2.89" (48 mm)
H: 3.44" (87 mm)
D: 1.25" (32 mm)

Features
- Controls up to 32 EcoSystem, EcoSystem H-Series or Hi-lume® 3D ballasts, or Hi-lume A-Series LED drivers*
- Receives input from up to 9 Pico wireless controls, 6 Radio Powr Savr occupancy/vacancy sensors, and 1 Radio Powr Savr daylight sensor via Lutron reliable Clear Connect RF technology
- Lutron EcoSystem technology facilitates individual ballast addressing, connection of multiple control devices, and control of ballasts individually or in groups
- 120/277 V~ input

Benefits
- Enables simple reconfiguration of the space, without having to move a single wire
- Dimming saves money and energy—for every percentage reduction in lighting level, there is nearly equal reduction in the energy usage of the dimmed light source
- Additional savings can be achieved through occupancy sensing, daylight harvesting, high-end trim and personal dimming control without the need for additional wires
- Button-press programming means no commissioning required

Mounting
- Mounts through a 1/2" NPT trade-size knock-out to a junction box or to a fixture. Can also be mounted inside of a standard 4" x 4" junction box

Models
RMJ-ECO32-DV-B—controls up to 32 EcoSystem, EcoSystem H-Series or Hi-lume 3D ballasts, or Hi-lume A-Series LED drivers

* For more information on EcoSystem, EcoSystem H-Series and Hi-lume 3D ballasts, and Hi-lume A-Series LED drivers, please visit www.lutron.com.

Dimming ballasts require rapid start sockets. For more information, see Lutron App Note #122.

Lamp Socket Wiring Tester available to easily troubleshoot ballast wiring issues; see page 37 for ordering information and pricing.

Lutron® Clear Connect®
Wireless Signal **Received**

Maestro Wireless® switch

Design statement: Specify a Maestro Wireless switch for applications in which a local switch already exists.

Maestro Wireless switch dimensions
W: 2.94" (75 mm)
H: 4.69" (119 mm)
D: 1.44" (38 mm)

Features
- Digital on/off tap switch
- Utilizes Lutron reliable Clear Connect® RF technology to communicate wirelessly with up to 9 transmitting devices (Radio Powr Savr™ sensors and/or Pico® wireless controls)
- Models available to control up to 8 A of lighting load
- Controls always operate locally, do not require system control
- Available in 27 finishes to complement any décor

Benefits
- Save energy with the addition of occupancy sensing and daylight harvesting without the need for additional wires
- Button press programming to associate the control with Radio Powr Savr sensors and Pico wireless controls

Mounting
- Requires a 1-gang U.S. wallbox. 3 1⁄2" (89 mm) deep recommended, 2 1⁄4" (57 mm) deep minimum

Models
MRF2-8S-DV-XX—8 A lighting, 3 A fan (1/10 HP motor, 120 V only), spec grade, 120–277 V~, no neutral
MRF2-6ANS-XX—6 A lighting, 3 A fan (1/10 HP motor), 120 V~
MRF2-8ANS-120-XX—8 A lighting, 5.8 A fan (1/4 HP motor), spec grade, 120 V~

(XX in the model number represents color/finish code; please visit www.lutron.com for color choices.)

Lutron® Clear Connect®
Wireless Signal **Received**

Maestro Wireless dimmer

Design statement: Select a Maestro Wireless dimmer for applications in which a local switch already exists and dimming is required.

Maestro Wireless dimmer dimensions
W: 2.94" (75 mm)
H: 4.69" (119 mm)
D: 1.44" (38 mm)

Features
- Digital dimmer with LEDs that indicate light level
- Incorporates advanced features such as fade on/fade off, long fade off, and rapid full on
- Utilizes Lutron reliable Clear Connect RF technology to communicate wirelessly with up to 9 transmitting devices (Radio Powr Savr sensors and/or Pico wireless controls)

Benefits
- Dimming saves money and energy—for every percentage reduction in lighting level, there is nearly equal reduction in the energy usage of the dimmed light source
- Ability to set high-end trim based on customer requirements
- Button-press programming to associate the control with Radio Powr Savr sensors and Pico wireless controls

Mounting
- Requires a 1-gang U.S. wallbox. 3 1⁄2" (89 mm) deep recommended, 2 1⁄4" (57 mm) deep minimum

Models
MRF2-600M-XX—600 W incandescent/halogen, 120 V~
MRF2-6MLV-XX—600 W/600 VA incandescent/halogen/MLV, 120 V~
MRF2-6ND-120-XX—600 W/600 VA incandescent/halogen/MLV, spec grade, neutral wire, 120 V~
MRF2-10D-120-XX—1000 W/1000 VA incandescent/halogen/MLV, spec grade, 120 V~
MRF2-F6AN-DV-XX— 6 A, 3-wire fluorescent, spec grade, 120–277 V~
MRF2-6ELV-120-XX—600 W ELV, 120 V~

(XX in the model number represents color/finish code; please visit www.lutron.com for color choices.)

Lutron® Clear Connect®
Wireless Signal **Received**

Step 3b Stairwell fixture selection

Stairwell fixture with PowPak® stairwell controller

Design statement: The stairwell fixture with PowPak stairwell controller saves energy by reducing light levels when the stairwell is occupied and lowering light levels when it is unoccupied.

Stairwell standard fixture dimensions
W: 51.13" (1299 mm)*
H: 4.375" (111 mm)
D: 3.875" (98 mm)

NEW Stairwell LED fixture dimensions
W: 28.25" (718 mm)
H: 4.75" (121 mm)
D: 4.00" (102 mm)

Features

- Incorporates a Lutron digital dimming ballast or LED driver and wireless lighting control (PowPak stairwell controller) programmed to occupied and unoccupied light levels specific to the project
- Occupied and unoccupied light levels are field adjustable
- Utilizes Lutron reliable Clear Connect® RF technology to communicate wirelessly with up to 9 Radio Powr Savr™ occupancy/vacancy sensors
- Available in 2, 3, or 4 ft**, 1 or 2 lamp, and T8, T8 reduced wattage, T5HE, or T5HO fluorescent lamp options; and 2 ft, 1500 (17 W) or 2200 (29 W) lumens LED options
- Universal input voltage 120/277 V~
- Ceiling or wall surface mount

Benefits

- Sensor is not integral to the fixture, providing the flexibility to group multiple fixtures to a single occupancy/vacancy sensor and/or multiple occupancy/vacancy sensors to a single fixture
- Easy to install, wireless communication between devices means no additional wiring required

Models***

FXSWXX14CP232U51SMXXWH—4 ft, 2 lamp, T8 fluorescent, factory preset: 50% high-end, 10% low-end; 120/277 V~
FXSWXX14CP232U82SMXXWH—4 ft, 2 lamp, T8 fluorescent, factory preset: 80% high-end, 20% low-end; 120/277 V~
FXSWXX12SLLC1U51SMXXWH—2 ft, 17 W, 1500 lumens, 4000 K LED, factory preset: 80% high-end, 10% low-end; 120/277 V~
FXSWXX12SLLC1U82SMXXWH—2 ft, 17 W, 1500 lumens, 4000 K LED, factory preset: 10% high-end, 20% low-end; 120/277 V~

* Width provided for 4 ft fixture; consult the product specification submittal for width measurements for 2 and 3 ft fixtures.
** 8 ft fixture available upon request.
*** Partial list only, for complete list of available fixtures, including information on the stairwell retrofit kit solution, visit www.lutron.com/stairwellfixture.

Lutron® Clear Connect®
Wireless Signal **Received**

Step 4 Task lighting control selection

Maestro Wireless® tabletop lamp dimmer and PowPak plug-in dimming module

Design statement: Both the tabletop lamp dimmer and the plug-in dimming module provide control of task lighting and the ability for remote control. Use the tabletop dimmer to provide personal lamp control. Select the plug-in module if you wish to conceal the controller.

Maestro Wireless tabletop lamp dimmer dimensions
W: 2.44" (62 mm)
H: 3.25" (83 mm)
D: 0.94" (24 mm)

PowPak plug-in dimming module dimensions
W: 2.3" (58 mm)
H: 3.3" (84 mm)
D: 1.2" (30 mm)

Features
- Digital dimmer for use with incandescent/halogen table and floor lamps up to 300 W
- Configure dimming module to switch non-dimmable lighting loads
- Light levels can be fine-tuned to the desired light level
- Incorporates advanced features such as fade on/fade off, long fade off, and rapid full on
- Utilizes Lutron reliable Clear Connect RF technology to communicate wirelessly with up to 9 transmitting devices (Radio Powr Savr sensors and/or Pico® wireless controls)
- Controls always operate locally, do not require system control
- Available in white or black
- Dimming module available in 1- or 3-receptacle models

Benefits
- Easy to install, requires no wires or tools
- Easily incorporate task lighting into lighting solution, while saving energy through dimming
- Button-press programming to associate the plug-in dimmer with the same Radio Powr Savr sensors and Pico wireless controls that control the overhead lighting

Models
MRF2-3LD-XX—300 W tabletop lamp dimmer, incandescent/halogen, 120 V~
MRF2-3PD-1-XX—300 W plug-in dimming module, 1-receptacle, incandescent/halogen, 120 V~
MRF2-3PD-3-XX—300 W plug-in dimming module, 3-receptacle, incandescent/halogen, 120 V~

(XX in the model number represents color/finish code; please visit www.lutron.com for color choices.)

Step 5 Plug load control selection

PowPak® plug-in appliance module

Design statement: Specify a PowPak plug-in appliance module to directly control plug loads, such as computer monitors or printers.

PowPak plug-in appliance module dimensions
W: 2.3" (58 mm)
H: 3.3" (84 mm)
D: 1.2" (30 mm)

Features

- Utilizes Lutron reliable Clear Connect® RF technology to communicate wirelessly with up to 9 transmitting devices (Radio Powr Savr™ occupancy/vacancy sensors and/or Pico® wireless controls)
- Control up to 15 A of general purpose load (1/2 HP motor load); no minimum load required
- Patented Softswitch® technology extends relay life to 1,000,000 cycles
- Can be hidden discretely behind furniture
- Controls always operate locally, do not require system control
- Available in white or black, and 1- or 3-receptacle models

Benefits

- Save energy by switching off plug loads when space is unoccupied
- Button-press programming to associate the plug-in appliance module with the same Radio Powr Savr occupancy/vacancy sensors and Pico wireless controls that control the overhead lighting

Models

MRF2-15APS-1-XX—15 A plug-in appliance module, 1-receptacle, 120 V~
MRF2-15APS-3-XX—15 A plug-in appliance module, 3-receptacle, 120 V~

(XX in the model number represents color/finish code; please visit www.lutron.com for color choices.)

PowPak relay module with Softswitch

Design statement: Specify a PowPak relay module with Softswitch to switch receptacles, controlling plug loads which consume energy when space is not in use.

PowPak relay module with Softswitch dimensions
W: 2.89" (48 mm)
H: 3.44" (87 mm)
D: 1.25" (32 mm)

Features

- 16 A general purpose switch for control of 15 A 120 V~ receptacles
- Receives input from up to 9 Pico wireless controls, 6 Radio Powr Savr occupancy/vacancy sensors, and 1 Radio Powr Savr daylight sensor via Lutron reliable Clear Connect RF technology
- Model available with a dry contact closure output for integration with third-party equipment; contact closure output provides occupancy status
- Patented Softswitch technology extends relay life to 1,000,000 cycles
- 120/277 V~ input

Benefits

- Save energy by switching off power to plug loads when space is unoccupied
- Button press programming to associate the module with the Radio Powr Savr sensors and Pico wireless controls

Mounting

- Mounts through a 1/2" NPT trade-size knock-out to a junction box or to a fixture. Can also be mounted inside of a standard 4" x 4" junction box

Models

RMJ-16R-DV-B—16 A general purpose switch (15 A 120 V~ receptacles)
RMJ-16RCCO1-DV-B—16 A general purpose switch (15 A 120 V~ receptacles) with (1) contact closure output

Lutron® Clear Connect®
Wireless Signal **Received**

Step 6 Third-party integration control selection

PowPak® contact closure output module

Design statement: A PowPak contact closure output module is designed for spaces where integration with third-party equipment through contact closures is desired.

PowPak contact closure output module dimensions
W: 2.89" (48 mm)
H: 3.44" (87 mm)
D: 1.25" (32 mm)

Features

- Single dry contact closure device
- Receives input from up to 9 Pico® wireless controls, 6 Radio Powr Savr™ occupancy/vacancy sensors, and 1 Radio Powr Savr daylight sensor via Lutron reliable Clear Connect® RF technology
- Voltage: 24 V AC/DC
- Maximum load of 1 A @ 24 VDC or 0.5 A @ 24 VAC; no minimum load required
- Maintained output type

Benefits

- Button-press programming to associate the module with the Radio Powr Savr sensors and Pico wireless controls

Mounting

- Screw tabs provided for surface mounting. Can also be mounted to a 1/2" NPT trade-size knock-out on a junction box

Models

RMJ-CCO1-24-B—(1) contact closure output

Step 7a Wireless control selection

Pico® wireless controls

Design statement: Use a Pico wireless control anywhere in the space to control loads with a touch of a button.

3-button with Raise/ Lower

2-button with Raise/ Lower

3-button

2-button

Pico wireless control dimensions
W: 1.28" (33 mm)
H: 2.60" (66 mm)
D: 0.33" (8 mm)

Features
- Utilizes Lutron reliable Clear Connect RF technology to communicate wirelessly with wireless load controllers (wallbox controls, remote-mount modules, and/or plug-in devices)
- RF range: 30 ft (9 m) through wall
- Available in multiple button configurations with options for preset and raise/lower buttons
- 10-year battery life

Benefits
- Easily add a new and/or additional point of control without the need for new wires
- Easy configuration for use as a handheld control, car visor control, wall-mount control, or tabletop control with use of the optional pedestal

Models
PJ-3BRL-GXX-YYY—3-button with Raise/Lower
PJ-2BRL-GXX-YYY—2-button with Raise/Lower
PJ-3B-GXX-YYY—3-button
PJ-2B-GXX-YYY—2-button

(XX in the model number represents color/finish code and YYY represents labeling options. Please visit www.lutron.com/Pico for more information.)

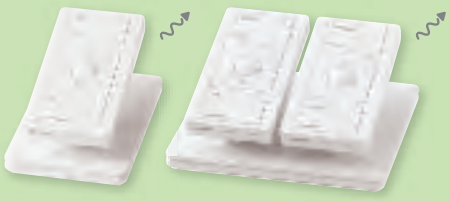
Step 7b Wireless control accessories selection

Pico® wireless control accessories

Design statement: Use accessories to enhance the flexibility of the Pico wireless control.

Wall-mount with Claro faceplate with Pico faceplate adapter

Wall-mount with Pico single Euro faceplate with adapter



Single and double pedestals

Features

- Pico wireless controls are designed to fit in the opening of a Claro® or Euro Pico faceplate
- Claro faceplates are available in finishes to complement the Pico wireless control
- European-style faceplates with adapters afford an architectural-style appearance and are available in both matte and metal finishes
- Tabletop pedestals are offered to support up to 4 Pico wireless controls and are available in white and black

Benefits

- Pico faceplate adapter and Euro Pico faceplate with adapter allow for easy installation of the Pico wireless control in a faceplate
- Tabletop pedestals help ensure that the Pico wireless control is always within reach

Models

Wall-mount accessories

PICO-FP-ADAPT—Pico faceplate adapter for Claro faceplate
CW-1-XX—Claro 1-gang faceplate
CW-2-XX—Claro 2-gang faceplate
CW-3-XX—Claro 3-gang faceplate
CW-4-XX—Claro 4-gang faceplate
PFP-1-B-FXX-CPN5692—Single Euro Pico faceplate with adapter
PFP-2-B-FXX-CPN5692—Double Euro Pico faceplate with adapter

Tabletop accessories

L-PED1-XX—Single pedestal
L-PED2-XX—Double pedestal
L-PED3-XX—Triple pedestal
L-PED4-XX—Quadruple pedestal

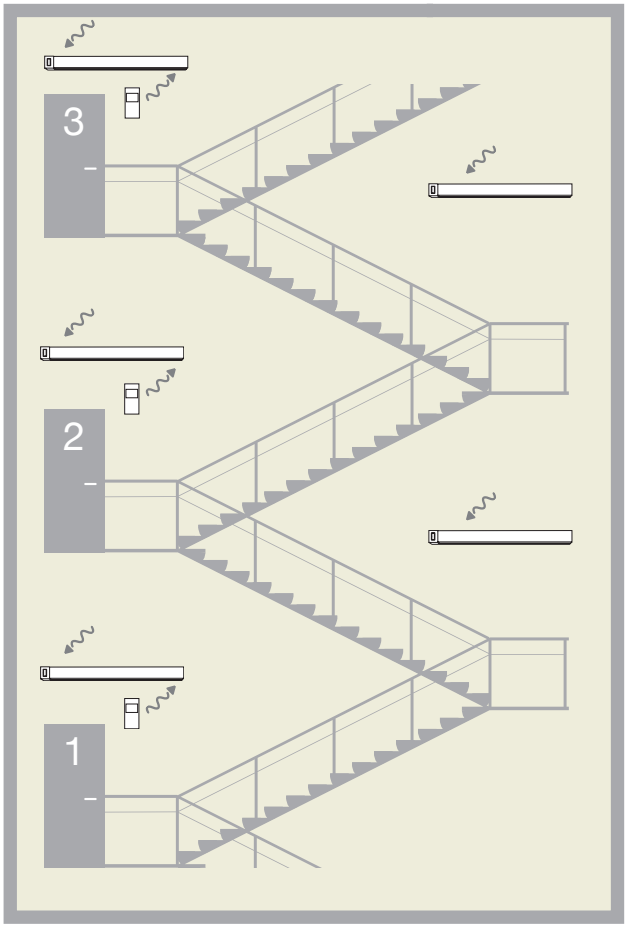
(XX in the model number represents color/finish code; please visit www.lutron.com for color choices.)

Lutron® Clear Connect®
Wireless Signal **Sent**

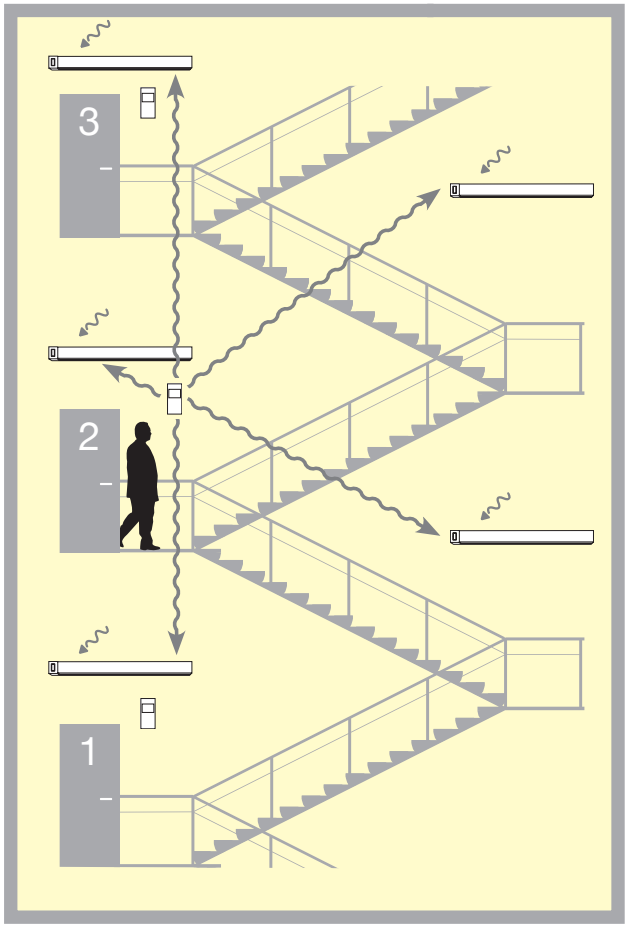
Stairwell Retrofit Solution

The stairwell fixture with PowPak® stairwell controller communicates wirelessly with Radio Powr Savr™ occupancy/vacancy sensors. Based on the stairwell occupancy information received from the sensors, the PowPak stairwell controller automatically adjusts the light output. The occupied and unoccupied light levels are field adjustable to meet the project's code requirements.

Unoccupied: 10% light level



Occupied: 50% light level



Stairwell standard fixture with PowPak stairwell controller

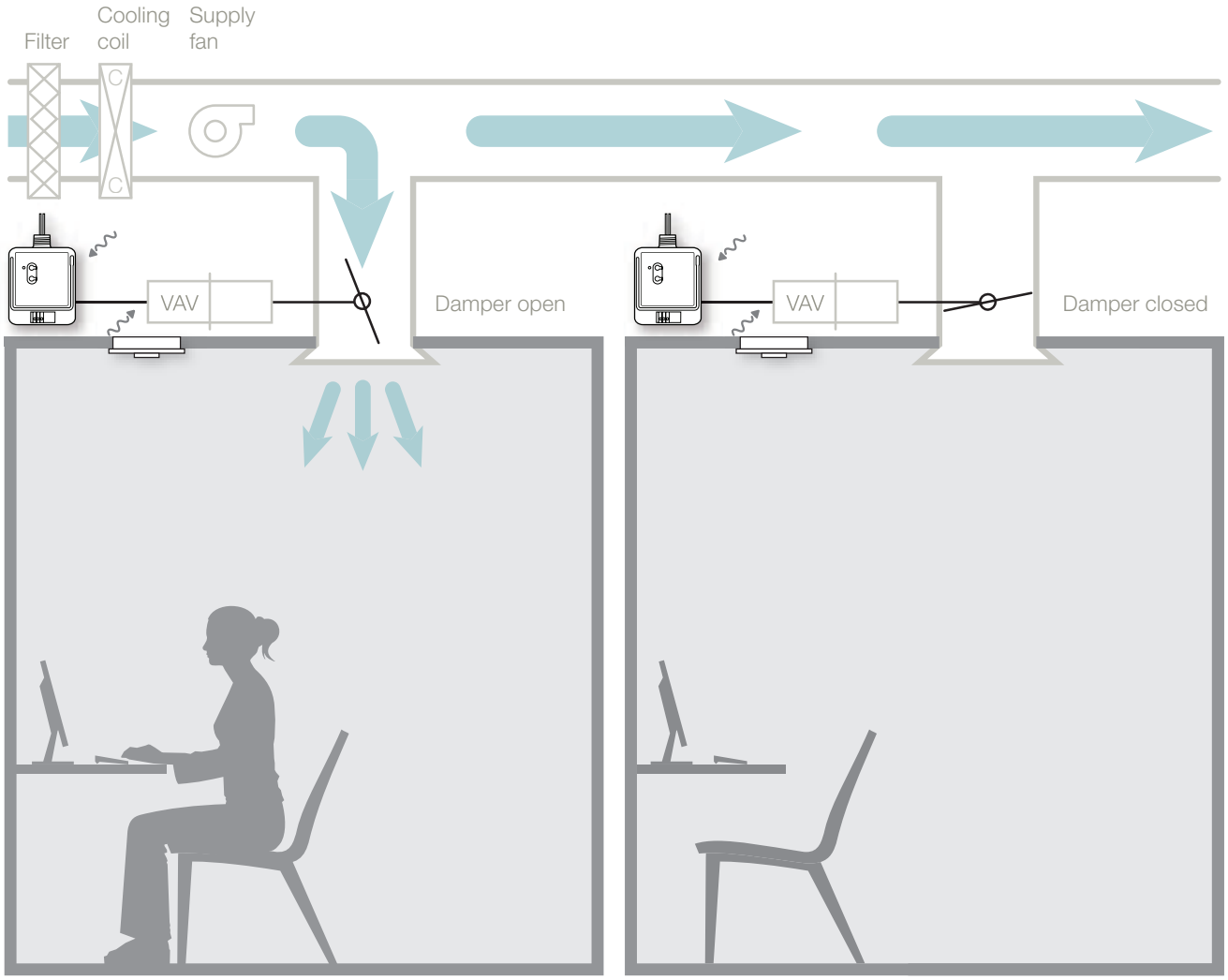
Radio Powr Savr occupancy/vacancy sensor (wall-mount)

Lutron® Clear Connect® Wireless Signal **Sent**

Lutron® Clear Connect® Wireless Signal **Received**

Variable Air Volume (VAV) integration

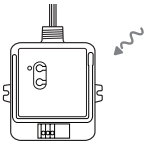
In response to information received from a Radio Powr Savr™ occupancy/vacancy sensor, the PowPak® contact closure output module communicates room occupancy to the VAV terminal unit. By not heating or cooling an unoccupied room, the electricity consumed by the HVAC system can be reduced.



Occupied **Unoccupied**

Radio Powr Savr occupancy/vacancy sensor (ceiling-mount)

PowPak contact closure output module

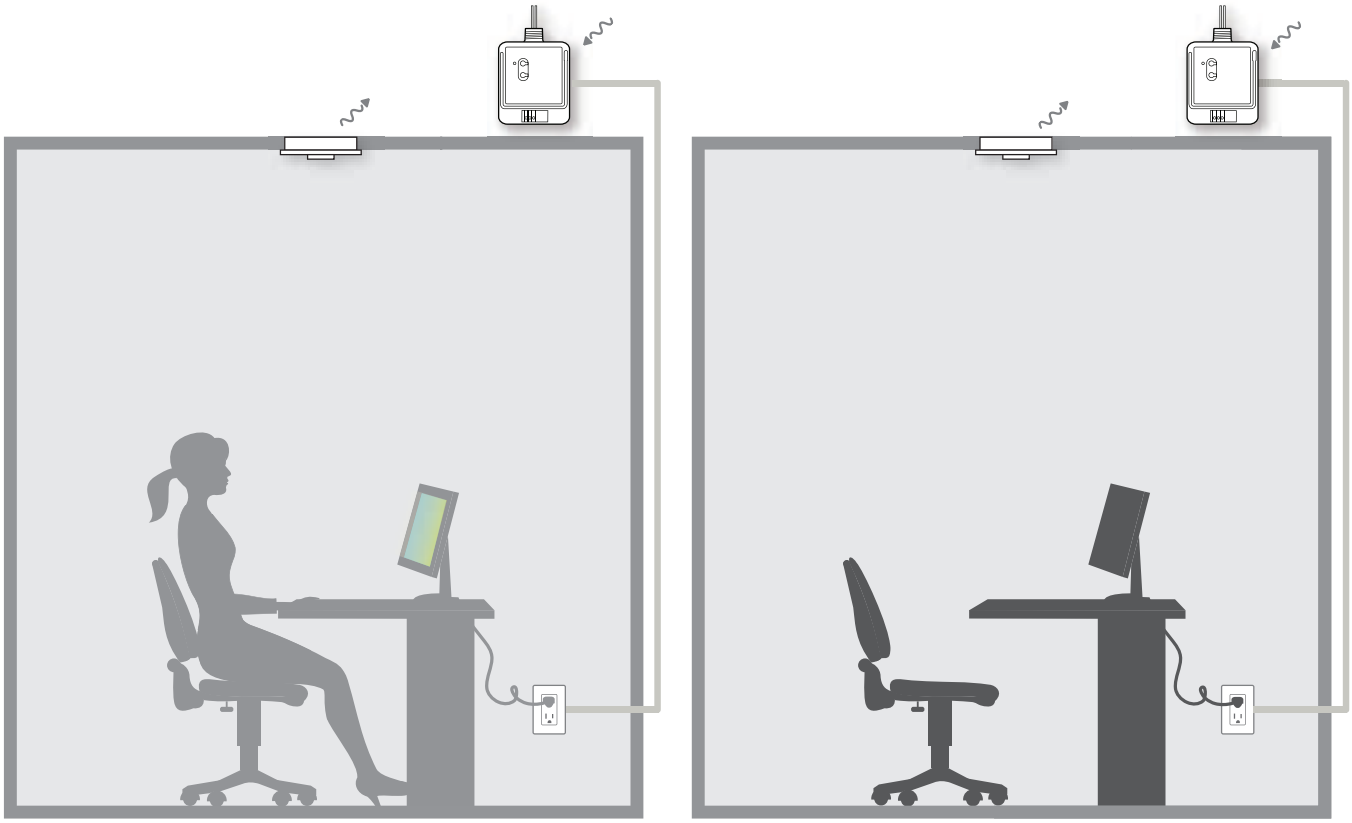


Lutron® Clear Connect® Wireless Signal **Sent**

Lutron® Clear Connect® Wireless Signal **Received**

Plug load control by switching receptacles

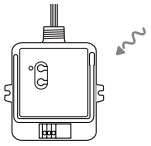
Plug loads, such as task lighting, computer monitors, and printers, account for greater than 5% of commercial electricity usage[2]. By utilizing the PowPak relay module with Softswitch® and a Radio Powr Savr occupancy/vacancy sensor to switch receptacles, energy savings can be obtained. The occupancy/vacancy sensor communicates room occupancy wirelessly to the relay module. Based on the occupancy status received, the relay module switches the power to the receptacles on or off, reducing the amount of energy consumed.



Occupied **Unoccupied**

Radio Powr Savr occupancy/vacancy sensor (ceiling-mount)

PowPak relay module with Softswitch



Sources located on back cover.

Alternate stand-alone solution

Maestro® occupancy sensing controls*

Design statement: Maestro occupancy sensing switches and dimmers are alternate energy-saving solutions for smaller spaces with unobstructed views.

Maestro occupancy sensing switch dimensions
W: 2.83” (75 m)
H: 4.61” (119 m)
D: 1.125” (30 mm)

NEW Maestro dual circuit occupancy sensing switch dimensions
W: 2.83” (75 m)
H: 4.61” (119 m)
D: 1.125” (30 mm)

Features

- Lutron XCT™ signal processing technology greatly enhances the performance of PIR sensors, enabling them to detect minor motions that other sensors could not previously detect
- 180˚ sensor field-of-view, must have unobstructed view
- Up to 30 ft x 30 ft major motion coverage and 20 ft x 20 ft minor motion coverage
- Adjustable timeout - 1, 5, 15, or 30 minutes
- High-low sensitivity adjustment
- Vacancy/partial-on models available to meet CA Title 24 requirements
- Switch models feature ambient light detection, and are available in single or dual circuit
- Available in 27 colors to complement any décor

Benefits

- Save energy automatically with the simple addition of occupancy/vacancy sensing
- Dual circuit sensor provides bi-level control of two circuits, as required by specific energy codes
- Easy to install, directly replaces an existing control with no new wiring required

Models**

Switch

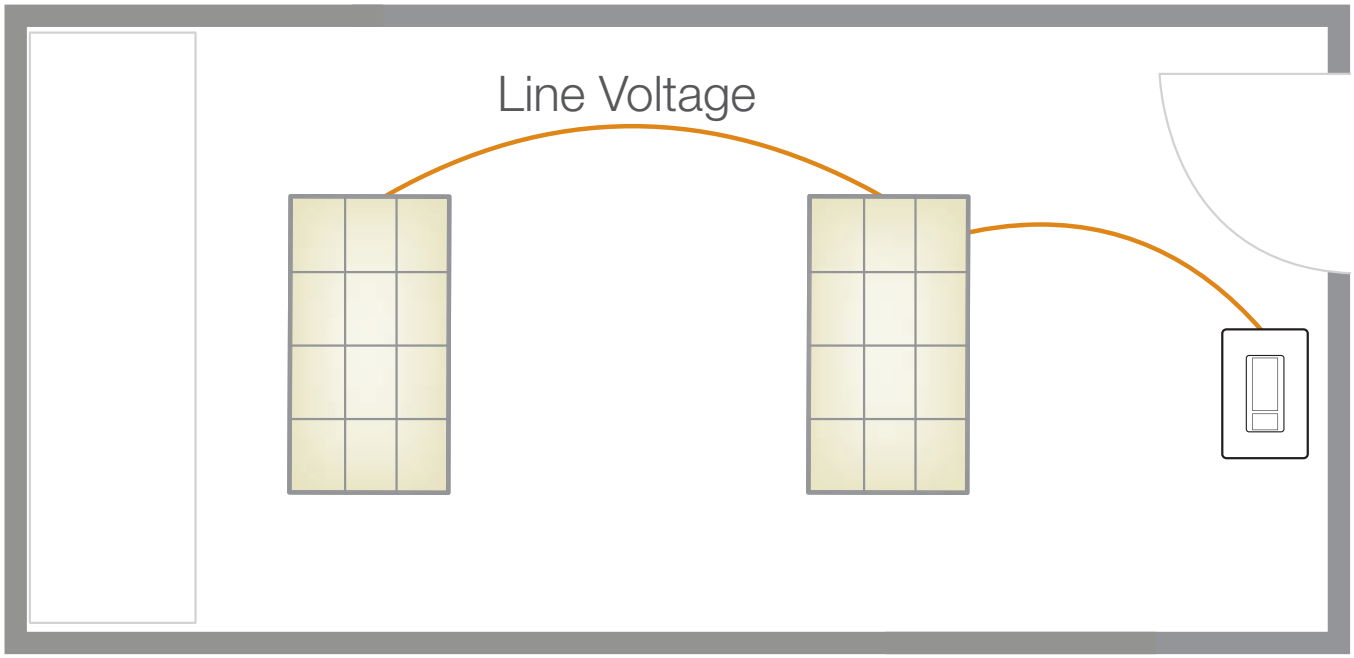
MS-OPS2-XX—2 A lighting, occupancy/vacancy, 120 V~
MS-OPS5M-XX—5 A lighting, 3 A fan (1/10 HP motor), occupancy/vacancy, 120 V~
MS-OPS6M2-DV-XX—6 A lighting, 3 A fan (1/10 HP motor, 120 V only), occupancy/vacancy, 120-277 V~
MS-OPS6M2N-DV-XX—6 A lighting, 3 A fan (1/10 HP motor, 120 V only), occupancy/vacancy, neutral wire, 120-277 V~
MS-OPS6-DDV-XX—dual circuit, 6 A lighting, 3 A fan (1/10 HP motor, 120 V only) per circuit, occupancy mode, 120-277 V~

Dimmer

MSCL-OP153M-XX—600 W incandescent/halogen, 150 W dimmable CFL/LED, occupancy/vacancy, 120 V~

(XX in the model number represents color/finish code; please visit www.lutron.com for color choices.)

Storage room—switching, 1 zone



Product key:

Maestro occupancy sensing switch
(mounted in 1-gang Claro® faceplate)

Switched lighting load

* Maestro occupancy/vacancy sensing switches and dimmers are not components of Energi TriPak® and cannot communicate with Radio Powr Savr™ sensor or Pico® wireless controls.

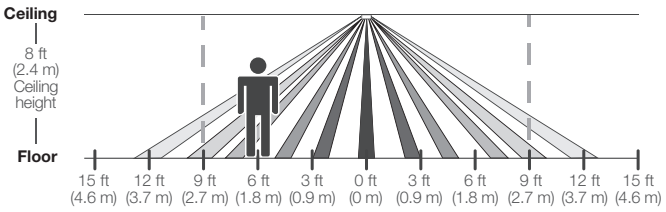
** Vacancy/partial-on models available

Sensor coverage diagrams

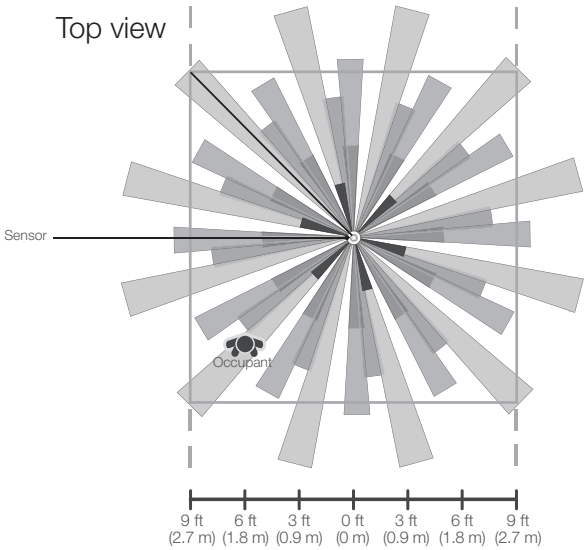
Ceiling-mount, 360°

Coverage varies by ceiling height

Floor view



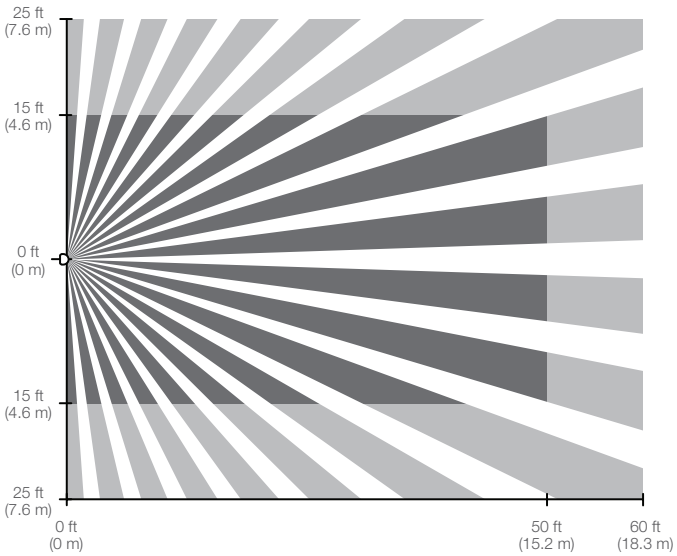
Top view



Wall-mount*, 180°

1,500 ft² — minor motion; 3,000 ft² — major motion

Top view



Key:

- Minor motions
- Major motion

Ceiling-mount sensor coverage chart (for sensor mounted in center of room)

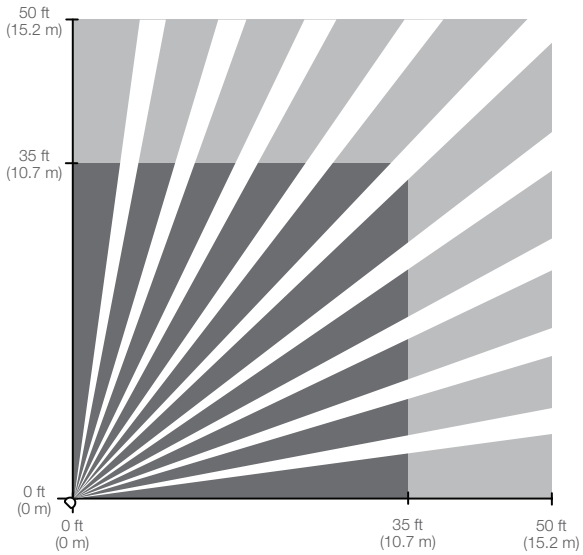
Ceiling height	Maximum room dimensions for complete floor coverage	Radius of coverage at floor
8 ft (2.4 m)	18 x 18 ft (5.5 x 5.5 m)	13 ft (4.0 m)
9 ft (2.7 m)	20 x 20 ft (6.1 x 6.1 m)	14.5 ft (4.4 m)
10 ft (3.0 m)	22 x 22 ft (6.7 x 6.7 m)	16 ft (4.9 m)
12 ft (3.7 m)**	26 x 26 ft (7.9 x 7.9 m)	19 ft (5.8 m)

* Sensor mounting shown at 7 ft (2.1 m). Mounting height should be between 6 and 8 ft (1.6 and 2.4 m).
** 12 ft (3.7 m) is the maximum mounting height allowed.

Corner-mount*, 90°

1,225 ft² — minor motion; 2,500 ft² — major motion

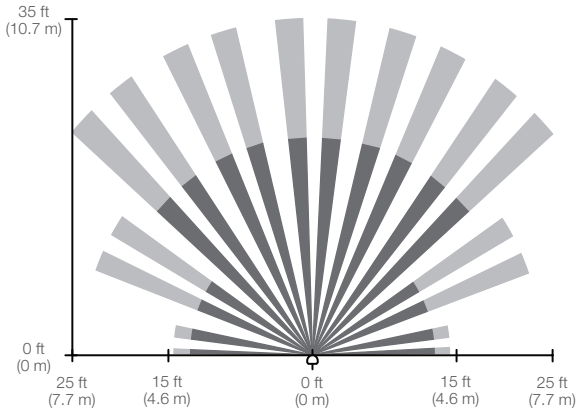
Top view



In-wall, 180°

400 ft² — minor motion; 900 ft² — major motion

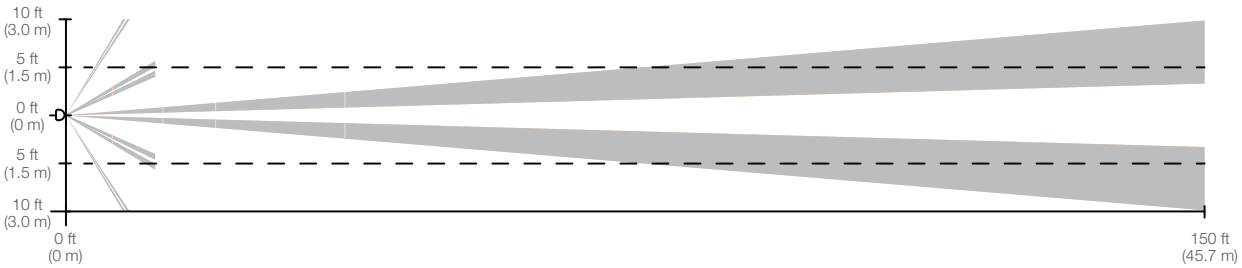
Top view



Hallway*, long narrow field of view

Coverage varies by hallway width and length

Top view



Hallway sensor maximum recommended length chart (sensor centered within hallway)

Width of hallway		Length of hallway	
6 ft	(1.6 m) or less	50 ft	(15.2 m)
8 ft	(2.4 m)	100 ft	(30.5 m)
10 ft	(3.0 m) or more	150 ft	(45.7 m)

* Sensor mounting shown at 7 ft (2.1 m). Mounting height should be between 6 and 8 ft (1.6 and 2.4 m).

Ordering information

Model number	Description	List Price (US)
Maestro Wireless® switches*		
MRF2-6ANS-XX	6 A lighting, 3 A fan (1/10 HP motor), 120 V~	88.00
MRF2-8ANS-120-XX	8 A lighting, 5.8 A fan (1/4 HP motor), spec grade, 120 V~	120.00
MRF2-8S-DV-XX	8 A lighting, 3 A fan (1/10 HP motor, 120 V only), spec grade, 120–277 V~ , no neutral	150.00
Maestro Wireless dimmers*		
MRF2-600M-XX	600 W incandescent/halogen, 120 V~	88.00
MRF2-6MLV-XX	600 W/600 VA incandescent/halogen/MLV, 120 V~	100.00
MRF2-6ND-120-XX	600 W/600 VA incandescent/halogen/MLV, spec grade, neutral wire, 120 V~	130.00
MRF2-10D-120-XX	1000 W/1000 VA incandescent/halogen/MLV, spec grade, 120 V~	130.00
MRF2-F6AN-DV-XX	6 A lighting, 3-wire fluorescent, spec grade, 120–277 V~	180.00
MRF2-6ELV-120-XX	600 W ELV, 120 V~	189.00
Maestro Wireless tabletop lamp dimmer		
MRF2-3LD-XX	300 W lamp dimmer, incandescent/halogen, 120 V~	130.00
PowPak® stairwell fixtures**		
FXSWXX14CP232U51SMXXWH	4 ft, 2 lamp, T8 fluorescent, factory preset: 50% high-end, 10% low-end, 120/277 V~	390.00
FXSWXX14CP232U82SMXXWH	4 ft, 2 lamp, T8 fluorescent, factory preset: 80% high-end, 20% low-end, 120/277 V~	390.00
FXSWXX12SLLC1U51SMXXWH	2 ft, 17 W, 1500 lumens, 4000 K LED, factory preset: 50% high-end, 10% low-end, 120/277 V~	500.00
FXSWXX12SLLC1U82SMXXWH	2 ft, 17 W, 1500 lumens, 4000 K LED, factory preset: 80% high-end, 20% low-end, 120/277 V~	500.00
PowPak relay module		
RMJ-5R-DV-B	5 A general purpose switch	89.00
RMJ-5RCCO1-DV-B	5 A general purpose switch with (1) contact closure output	99.00
RMJ-16R-DV-B	16 A general purpose switch	109.00
RMJ-16RCCO1-DV-B	16 A general purpose switch with (1) contact closure output	119.00

Model number	Description	List Price (US)
PowPak dimming module with EcoSystem®		
RMJ-ECO32-DV-B	Controls up to 32 EcoSystem, EcoSystem H-Series or Hi-lume® 3D ballasts, or Hi-lume A-Series LED drivers	170.00
EcoSystem H-Series ballasts†		
EHDT832MU110	T8 linear, 32 W, 1-lamp, 120-27 V~, 1.0 ballast factor	79.00
EHDT832MU117	T8 linear, 32 W, 1-lamp, 120-277 V~, 1.17 ballast factor	79.00
EHDT832MU210	T8 linear, 32 W, 2-lamp, 120-277 V~, 1.0 ballast factor	79.00
EHDT832MU217	T8 linear, 32 W, 2-lamp, 120-277 V~, 1.17 ballast factor	79.00
EHDT528MU110	T5 linear, 28 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT528MU210	T5 linear, 28 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT554MU110	T5HO linear, 54 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT554MU210	T5HO linear, 54 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT817MU110	T8 linear, 17 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT817MU210	T8 linear, 17 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT825MU110	T8 linear, 25 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT825MU210	T8 linear, 25 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT514MU110	T5 linear, 14 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT514MU210	T5 linear, 14 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT521MU110	T5 linear, 21 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT521MU210	T5 linear, 21 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT524MU110	T5HO linear, 24 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT524MU210	T5HO linear, 24 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT539MU110	T5HO linear, 39 W, 1-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT539MU210	T5HO linear, 39 W, 2-lamp, 120-277 V~, 1.0 ballast factor	89.00
EHDT832GU310	T8 linear, 32 W, 3-lamp, 120-277 V~, 1.0 ballast factor	129.00
EHDT832GU317	T8 linear, 32 W, 3-lamp, 120-277 V~, 1.17 ballast factor	129.00
PowPak contact closure output module		
RMJ-CCO1-24-B	(1) contact closure output	89.00
PowPak plug-in dimming module		
MRF2-3PD-1-XX	300 W, 1-receptacle, incandescent/halogen, 120 V~	99.00
MRF2-3PD-3-XX	300 W, 3-receptacle, incandescent/halogen, 120 V~	99.00
PowPak plug-in appliance module		
MRF2-15APS-1-XX	15 A plug-in switch, 1-receptacle, 120 V~	99.00
MRF2-15APS-3-XX	15 A plug-in switch, 3-receptacle, 120 V~	99.00

* Price indicated for gloss finish products.

** Partial list only, for complete list of available fixtures visit www.lutron.com/stairwellfixture.

† Dimming ballasts require rapid start sockets. For more information, see Lutron App Note #122.

Ordering information

Model number	Description	List Price (US)
Radio Powr Savr™ occupancy/vacancy sensors*		
LRF2-OCR2B-P-WH	Ceiling-mount, 360° field of view, occupancy/vacancy sensor	85.00
LRF2-OWLB-P-WH	Wall-mount, 180° field of view, occupancy/vacancy sensor	85.00
LRF2-OKLB-P-WH	Corner-mount, 90° field of view, occupancy/vacancy sensor	85.00
LRF2-OHLB-P-WH	Hallway, occupancy/vacancy sensor	85.00
Simple Energy Retrofit packages**		
MRF2-1S8A-1OC*	(1) Maestro Wireless® 8 A, no neutral switch, 120/277 V~, (1) Claro® 1-gang faceplate, (1) Radio Powr Savr wireless ceiling-mount occupancy/vacancy sensor	198.00
MRF2-1S8A-1OW	(1) Maestro Wireless 8 A, no neutral switch, 120/277 V~, (1) Claro 1-gang faceplate, (1) Radio Powr Savr wireless wall-mount occupancy/vacancy sensor	198.00
MRF2-1S8A-1OK	(1) Maestro Wireless 8 A, no neutral switch, 120/277 V~, (1) Claro 1-gang faceplate, (1) Radio Powr Savr wireless corner-mount occupancy/vacancy sensor	198.00
MRF2-1S8A-1OH	(1) Maestro Wireless 8 A, no neutral switch, 120/277 V~, (1) Claro 1-gang faceplate, (1) Radio Powr Savr wireless hallway occupancy/vacancy sensor	198.00
MRF2-2S8A-1OW	(2) Maestro Wireless 8 A, no neutral switches, (1) Claro 2-gang faceplate, (1) Radio Powr Savr wireless wall-mount occupancy/vacancy sensor	350.00
Radio Powr Savr occupancy/vacancy sensors accessories		
L-CMDPIRKIT	Ceiling-mount sensor lens masking kit	11.80
L-CRMK-WH	Ceiling-mount recess-mounting bracket	17.00
WGOMNI-CPN3688	Wire guard for ceiling-mount sensor, white	80.00
WGWS-CPN3688	Wire guard for wall-mount and hallway sensors, white	80.00
STI-9618-CPN3688	Wire guard for corner-mount sensor, white	80.00
Radio Powr Savr daylight sensor		
LRF2-DCRB-WH	Ceiling-mount daylight sensor	120.00
Pico® wireless controls†		
PJ-3BRL-GWH-YYY	3-button with Raise/Lower, white only	25.00
PJ-2BRL-GWH-YYY	2-button with Raise/Lower, white only	25.00
PJ-3B-GWH-YYY	3-button, white only	25.00
PJ-2B-GWH-YYY	2-button, white only	25.00
PJ-3BRL-GXX-YYY	3-button with Raise/Lower	56.00
PJ-2BRL-GXX-YYY	2-button with Raise/Lower	56.00
PJ-3B-GXX-YYY	3-button	56.00
PJ-2B-GXX-YYY	2-button	56.00

Model number	Description	List Price (US)
Pico accessories		
L-PED1-XX	Pico wireless control single pedestal	15.00
L-PED2-XX	Pico wireless control double pedestal	30.00
L-PED3-XX	Pico wireless control triple pedestal	100.00
L-PED4-XX	Pico wireless control quadruple pedestal	120.00
PICO-FP-ADAPT	Pico wireless control faceplate adapter	8.00
PFP-1-B-FXX-CPN5692††	Single Euro Pico faceplate with adapter	40.00
PFP-2-B-FXX-CPN5692††	Double Euro Pico faceplate with adapter	44.00
Lamp Socket Wiring Tester		
FDB-LSWT-T5/T8	600 V, 100 KHz, 0.125 A max, CAT III	180.00
Maestro® occupancy/vacancy sensing switches*,‡		
MS-OPS2-XX	2 A lighting, occupancy/vacancy sensing switch, 120 V~	29.00
MS-OPS5M-XX	5 A lighting, 3 A fan (1/10 HP motor), occupancy/vacancy sensing switch, 120 V~	41.00
MS-OPS6M2-DV-XX	6 A lighting, 3 A fan (1/10 HP motor, 120 V only), occupancy/vacancy sensing switch, 120-277 V~	49.00
MS-OPS6M2N-DV-XX	6 A lighting, 3 A fan (1/10 HP motor, 120 V only), occupancy/vacancy sensing switch, neutral wire, 120-277 V~	49.00
MS-OPS6-DDV-XX	dual circuit, 6 A lighting, 3 A fan (1/10 HP motor, 120 V only) per circuit, occupancy mode sensing switch, 120-277 V~	89.00
Maestro occupancy/vacancy sensing dimmers*,‡		
MSCL-OP153M-XX	600 W incandescent/halogen, 150 W dimmable CFL/LED, occupancy/vacancy sensing dimmer, 120 V~	54.00
Maestro Wireless/Maestro occupancy sensing control companion devices‡		
MA-AS-XX	Multi-location companion switch, 120 V~	35.50
MA-AS-277-XX	Multi-location companion switch, 277 V~	44.00
MA-R-XX	Multi-location companion dimmer, 120 V~	27.50
MA-R-277-XX	Multi-location companion dimmer, 277 V~	44.00
Faceplates		
CW-1-XX	Claro® 1-gang faceplate	4.90
CW-2-XX	Claro 2-gang faceplate	9.80
CW-3-XX	Claro 3-gang faceplate	15.00
CW-4-XX	Claro 4-gang faceplate	20.00

* Vacancy/partial-on models available to meet California Title 24 section 119(j) requirements.
** Available in white only.
† Price indicated for light or power text/icon labeling only.
†† Price indicated for Arctic White and Midnight only, contact Lutron for additional color options and pricing.
‡ Price indicated for gloss finish only.

Sources

1 Compared with manual (non-automated) controls, up to 60% lighting energy savings is possible on projects that utilize all of the lighting control strategies (occupancy sensing, high-end trim, personal control and daylight harvesting). Actual energy savings may vary, depending on prior occupant usage, among other factors.

2 Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey, released September 2008.

3 Light Right Consortium. Research Study on the Effects of Lighting on Office Workers. http://www.lightright.org.research/index.htm.

4 Galasiu AD, et al. 2007. Energy saving lighting control systems for open-plan offices: A field study. Leukos. 4(1) pg 7-29.

5 VonNieda B, Maniccia D, & Tweed A. 2000. An analysis of the energy and cost savings potential of occupancy sensors for commercial lighting systems. Proceedings of the Illuminating Engineering Society. Paper #43.

6 Reinhart CF. 2002. Effects of interior design on the daylight availability in open plan offices. Study of the American Commission for an Energy Efficient Environment (ACE) Conference Proceedings. To achieve maximum lighting savings, automated shades are utilized.

7 Williams A, et al. 2012. Lighting Controls in Commercial Buildings. Leukos. 8(3) pg 161-180.

8 Ecos. 2011. Commercial office plug load savings assessment. California Energy Commission PIER Program.

9 Lutron study based on reduction in heating (base 60°F) and cooling (base 55°F) degree days with a 2°F thermostat setback and 60% space un-occupancy. EnergyPlus modeling simulations were conducted and predicted similar savings.

10 Phillips, R. W. (1997). Educational Facility Age and the Academic Achievement of Upper Elementary School Students. Unpublished Doctoral Dissertation. University of Georgia.

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