LUTRON

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Revision E
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Lutron Wired Products for 347 V~ Applications

347 V~ is a common voltage for lighting in existing commercial buildings. Lutron has a number of products for these applications. The purpose of this application note is to give the reader an understanding of Lutron products used to control 347 V~ lighting. This guide focuses on laying out and installing these products for 347 V~ applications.

Table of Contents

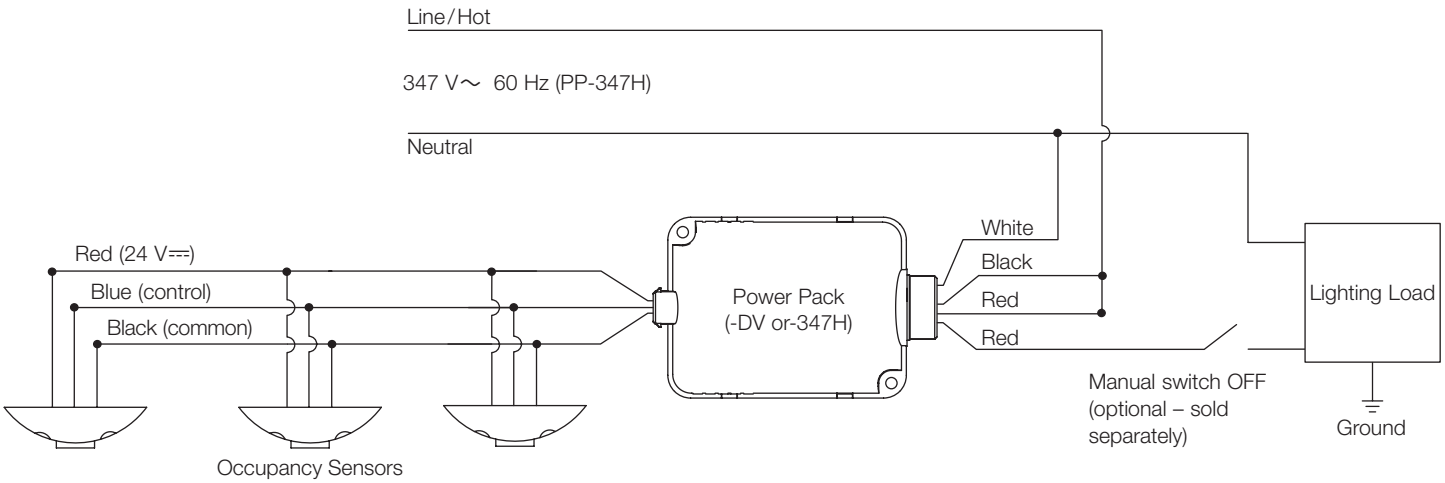
Lutron's PP-347H power packs provide both the 24 V⎓ power supply to operate Lutron wired occupancy sensors or low-voltage dimmers, as well as the 15 A 347 V~ relay to control the load, in one compact housing. The unit can be mounted inside a ballast enclosure or inside/outside a junction box. Each PP-347H power pack can power up to three total devices, including auxiliary PP-SH power packs, occupancy sensors, and low-voltage dimmers. The PP-347H power packs are housed in high-impact UL94 flammability-rated plastic designed for indoor use only (0 °C to 40 °C and 0% to 90% humidity). They comply with requirements for use in other spaces used for environmental air (plenums). The PP-347H power pack fits inside a standard 4 in x 4 in (102 mm x 102 mm) junction box or standard fluorescent fixture ballast cavity, mounts with 0.2 in x 1.3 in (5 mm x 32 mm) pan head screws, or mounts inside a junction box through a 0.5 in (13 mm) knockout with a threaded nipple.

Wired Occupancy Solutions

Lutron's LOS series occupancy sensors can be powered by and control 347 V~ lighting loads through the PP-347H power pack. This allows the power pack to turn on and off 347 V~ lighting automatically based on occupancy. Up to three sensors can control a single power pack. In such applications, the sensors wire in parallel such that the lighting loads turn on when at least one sensor detects motion, but do not turn off until all sensors time out.

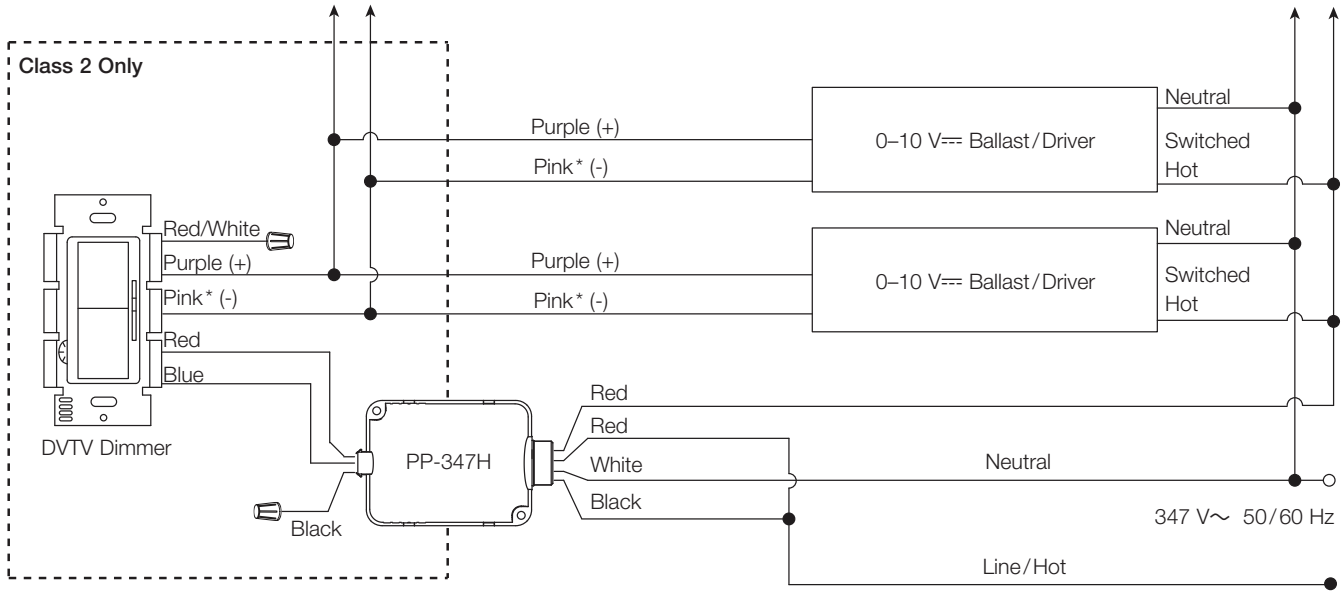
In these applications, the blue signal, red 24 V⎓ power supply, and black common wires are wired to the blue low-voltage input, red 24 V⎓ power supply, and black common wires respectively on the power pack. The red and black wires provide constant 24 V⎓ from the power pack to the sensors. The blue signal wire provides 24 V⎓ to the power pack only when at least one sensor detects motion. The 347 V~ switched hot and neutral wires on each of lighting loads wire to the red switched hot and white neutral outputs respectively on the power pack. As such, when a sensor detects occupancy, the power pack closes its line voltage relay and provides all connected lighting loads 347 V~. When all sensors time out, the power pack opens its line voltage relay and turns off power to all connecting lighting loads.

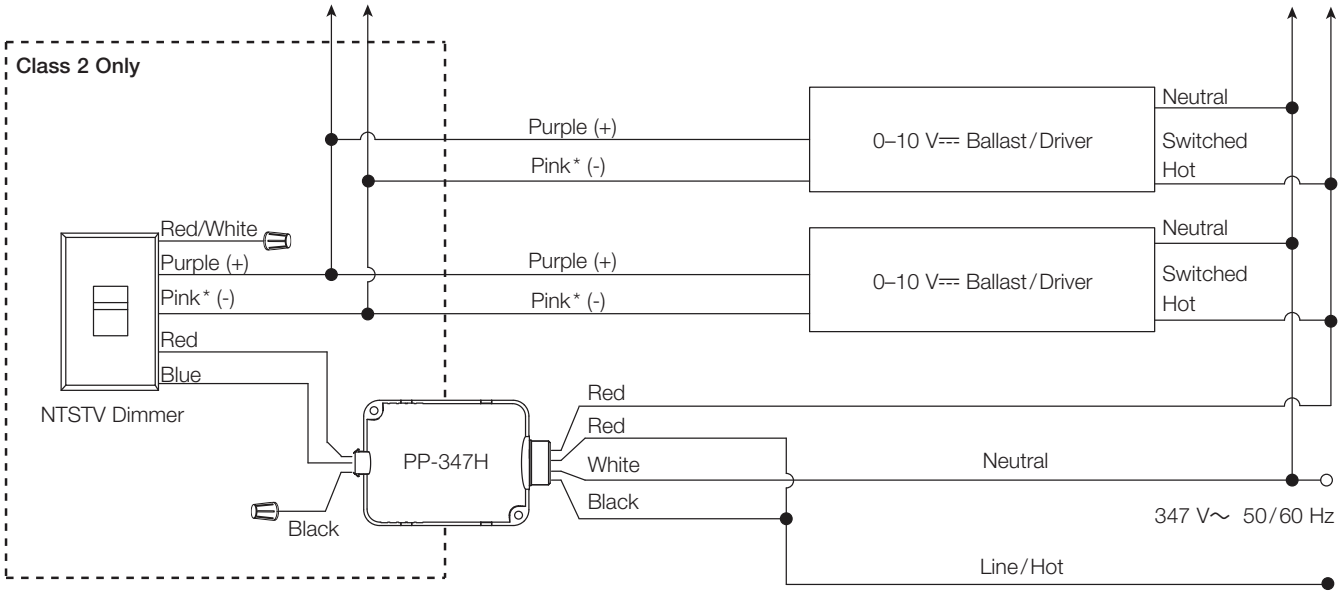
For applications requiring local manual control to override the sensors (e.g. a meeting room in which occupants need to turn off the lights for a presentation), a manual switch can be installed between the power pack and the lighting loads. This manual switch is wired in series between the power pack and lighting loads so that the lighting loads only turn on when the switch is in the on position. Note that this is not true vacancy functionality because the sensors will turn on the lighting loads if the switch is in the on position.



Wired Wallbox Dimming Solutions

The PP-347H power pack can power low-voltage 0–10 V⎓ dimmers including the NTSTV Nova T☆ and DVTV Diva. In these applications, ballasts and drivers provide a 10 V⎓ current source per IEC 60629 Annex E.2. Both the NTSTV and DVTV 0-10 V⎓ dimmers have a high- and low-end trim to adjust the 0–10 V⎓ output for optimal dimming performance. With either aesthetic, Nova T☆ or Diva, the dimmer wires as a 24 V⎓ switch to signal the power pack to switch 347 V~ to the ballast/driver. In these applications, the blue signal and red 24 V⎓ power wires from the dimmer are wired to the blue low-voltage input and red 24 V⎓ power supply wires respectively on the power pack. The red wire provides constant 24 V⎓ from the power pack to the dimmer. The blue signal wire provides 24 V⎓ to the power pack only when the dimmer is in an on position (i.e., any position other than off). The pink* and purple 0–10 V⎓ wires from the dimmer are wired to the pink* and purple wires respectively on each ballast/driver controlled by the dimmer. The 347 V~ switched hot and neutral wires on each of these ballasts/drivers wire to the red switched hot and white neutral outputs respectively on the power pack. As such, when the dimmer is in an on position, the power pack closes its line voltage relay and feeds all connected ballasts/drivers 347 V~ to their switched hot input. The dimmed level of these ballasts/drivers is determined by the 0–10 V⎓ signal returned from the dimmer on the pink* wire.

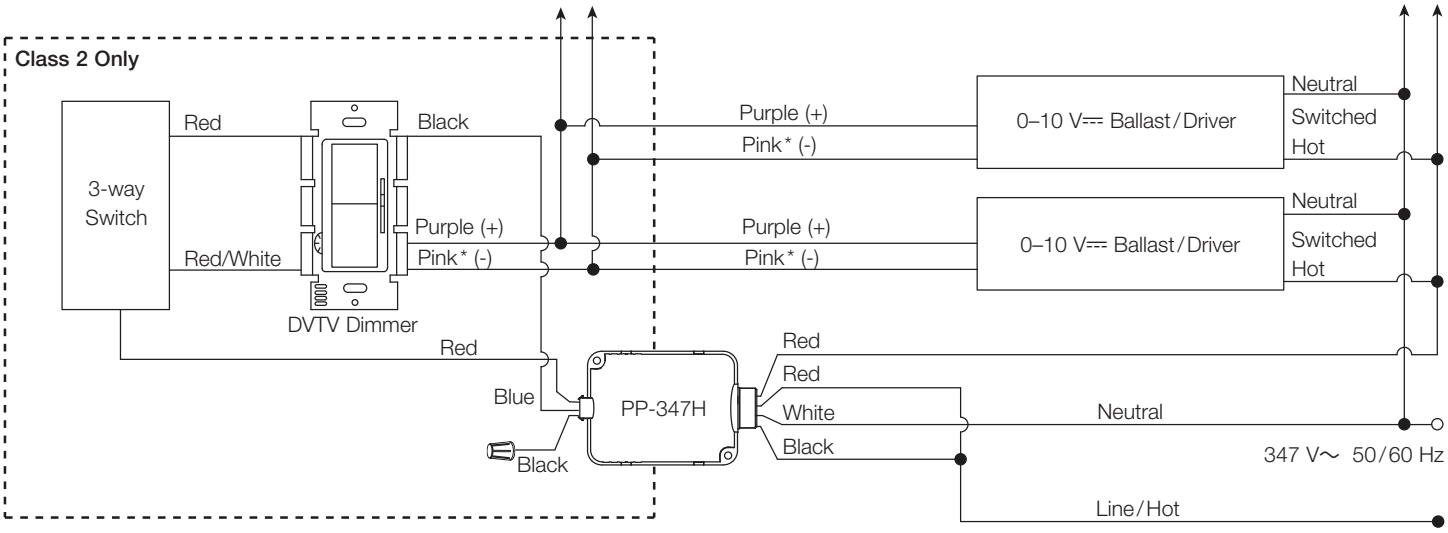




* This wire/terminal may be gray on older products or in retrofit applications.

Wired Wallbox Dimming Solutions *(continued)*

In 347 V~ applications requiring 3-way functionality, the DVTV dimmer can be used in conjunction with a 3-way switch to switch 24 V⎓ to a PP-347H power pack. In these applications, the red 24 V⎓ power wire from the power pack wires to the 3-way switch, the output wires of the 3-way switch wire to the red and red/white line side inputs of the dimmer, and the black relay wire from the dimmer wires to the blue input signal on the power pack so that the power pack receives the 24 V⎓ signal when the 3-way switch or the dimmer are in an on position. The pink* and purple 0–10 V⎓ wires from the dimmer are wired to the pink* and purple wires respectively on each controlled ballast/driver. The 347 V~ switched hot and neutral wires on each of these ballasts/drivers wire to the red switched hot and white neutral outputs respectively on the power pack. As such, when the dimmer or the 3-way switch are in an on position, the power pack closes its line voltage relay and feeds all connected ballasts/drivers 347 V~ to their switched hot input. The dimmed level of these ballasts/drivers is determined by the 0–10 V⎓ signal returned from the dimmer on the pink* wire.



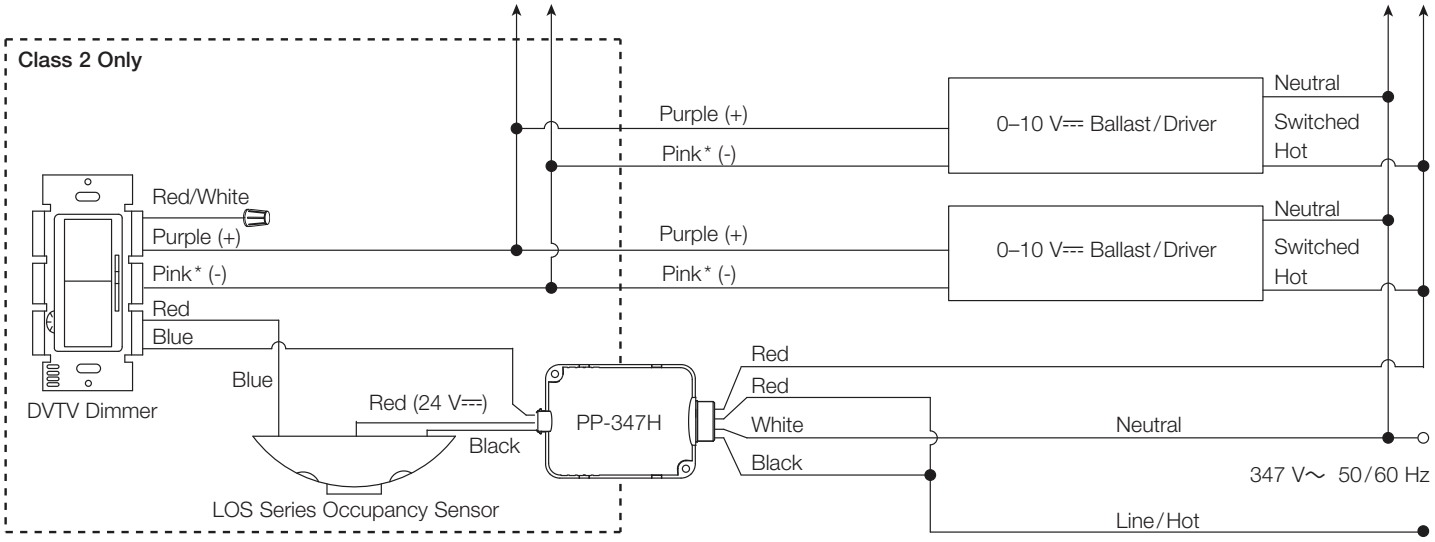
Control Limits

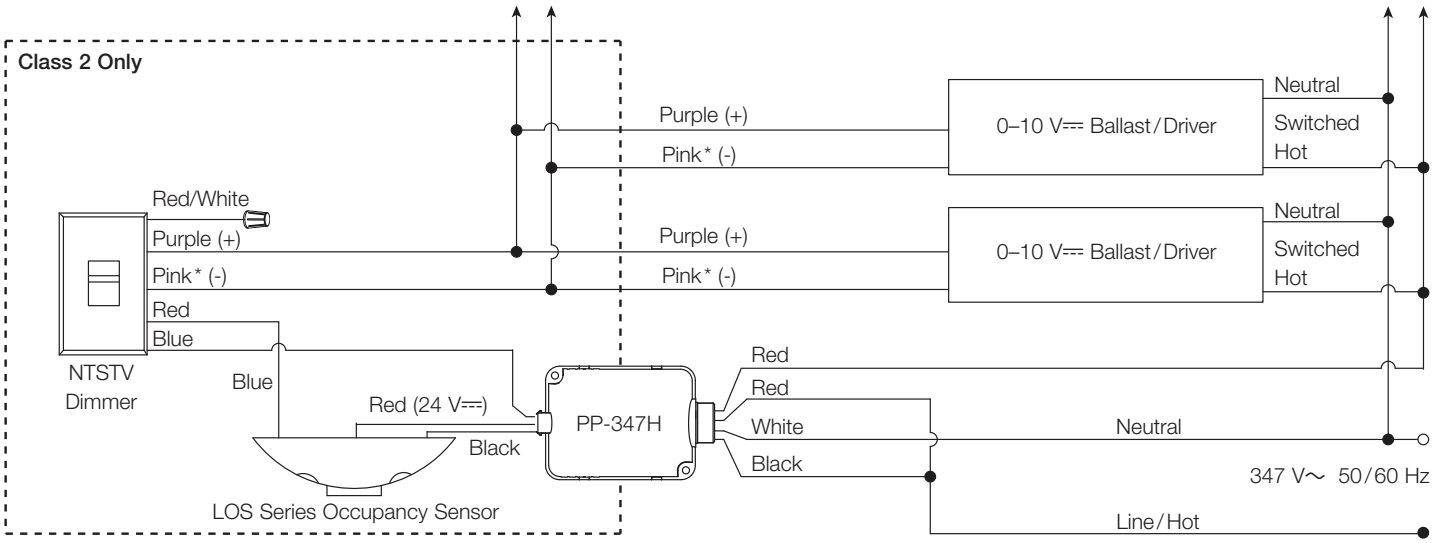
The NTSTV dimmer can sink up to 30 mA of current from 0–10 V⎓ ballasts/drivers. The DVTV dimmer can sink up to 50 mA of current from 0–10 V⎓ ballasts/drivers. Following the IEC 60929 Annex E.2 current draw limit of 2.0 mA per ballast/driver, the NTSTV dimmer can control up to fifteen ballasts/drivers and the DVTV dimmer can control up to twenty-five ballasts/drivers. Ballast/driver inrush current should not exceed NEMA 410 standards.

* This wire/terminal may be gray on older products or in retrofit applications.

Wired Wallbox Dimming with Sensors

For applications requiring occupancy sensing and manual control (e.g., a meeting room where the lights must turn off when unoccupied, but the occupants also need control of the lights for a presentation), a DVTV or NTSTV dimmer can be installed between the sensor and the power pack. Note that in this application, the sensor will turn the lights on upon detecting motion if the dimmer is left in the on position. The dimmer is wired in series between the blue signal input on the power pack and blue signal wire on the sensor to ensure the ballasts/drivers only turn on if the dimmer is in an on position. In these applications, the red 24 V⎓ power and black common wires from the power pack wire to the red and black inputs on the sensor respectively to power the sensor, the blue signal wire from the sensor wires to the red 24 V⎓ input on the dimmer, and the black 24 V⎓ switch output wire from the dimmer wires to the blue input signal on the power pack. The blue signal wire provides 24 V⎓ to the power pack only when the dimmer is in an on position (i.e. any position other than off). If the dimmer is in an on position when the sensor times out, the sensor will turn off power to the dimmer and thus signal the power pack to turn off. The pink* and purple 0–10 V⎓ wires from the dimmer are wired to the pink* and purple wires respectively on each ballast/driver controlled by the dimmer. The 347 V~ switched hot and neutral wires on each of these ballasts/drivers wire to the red switched hot and white neutral outputs respectively on the power pack. As such, when the dimmer is in an on position and the sensor has detected motion, the power pack closes its line voltage relay and feeds all connected ballasts/drivers 347 V~ to their switched hot input. If either the sensor times out or the dimmer is set to off, the power pack opens its line voltage relay and turns off power to the ballasts/drivers. The dimmed level of these ballasts/drivers is determined by the 0–10 V⎓ signal returned from the dimmer on the pink* wire.

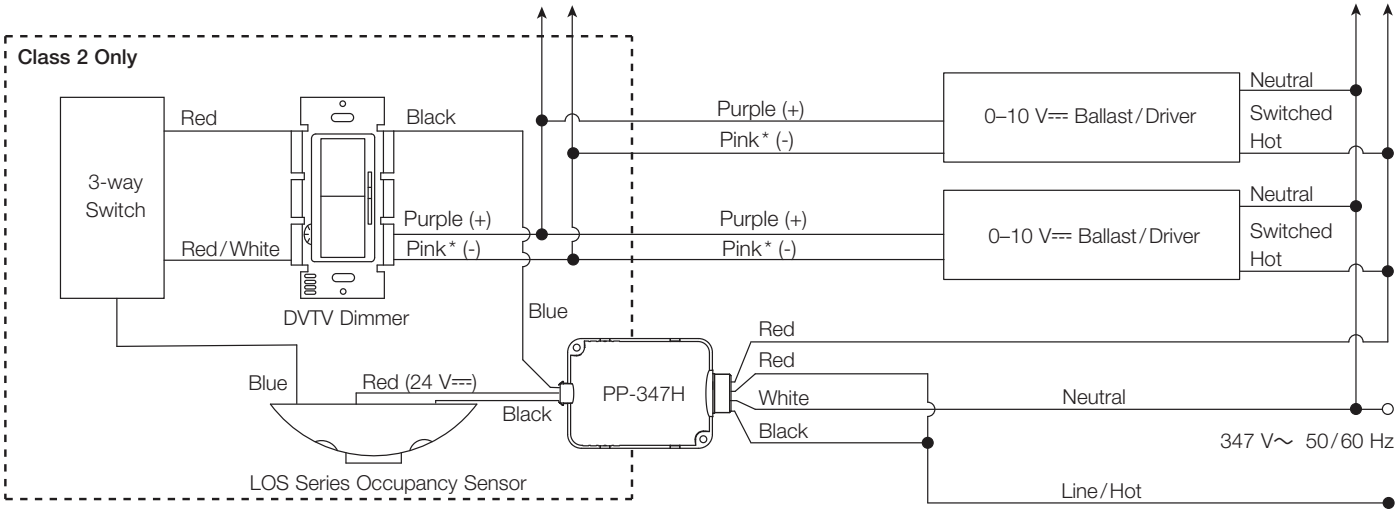




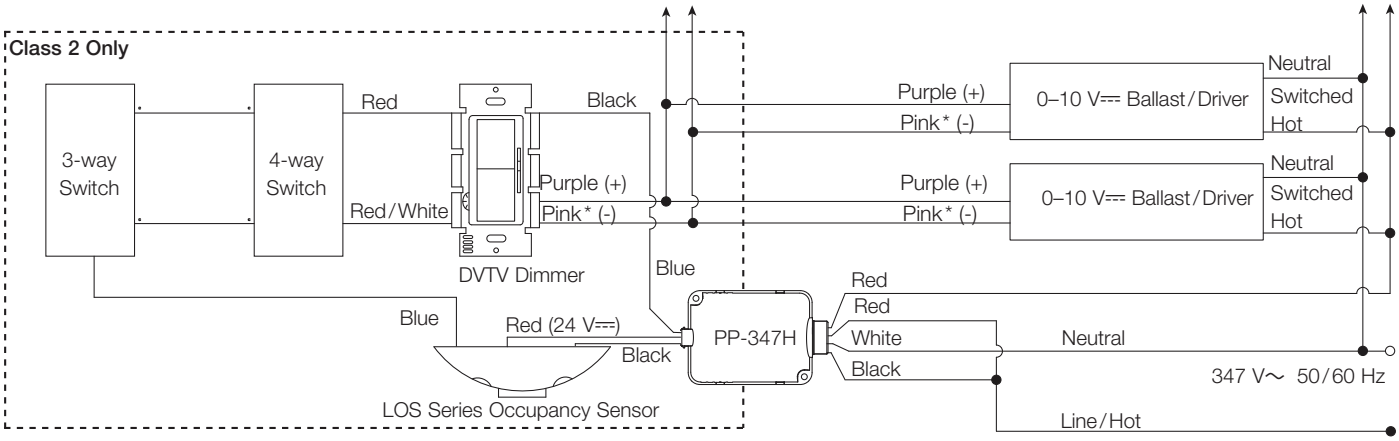
* This wire/terminal may be gray on older products or in retrofit applications.

Wired Wallbox Dimming with Sensors *(continued)*

For applications requiring 3-way occupancy sensing and manual control functionality, a DVTV dimmer can be installed as shown below between the sensor and the power pack. A toggle switch is added to switch the red and red/white line side inputs of the dimmer to provide 3-way functionality. Similar to the previous application, the sensor will turn the lights on upon detecting motion if either the switch or dimmer are in the on position.



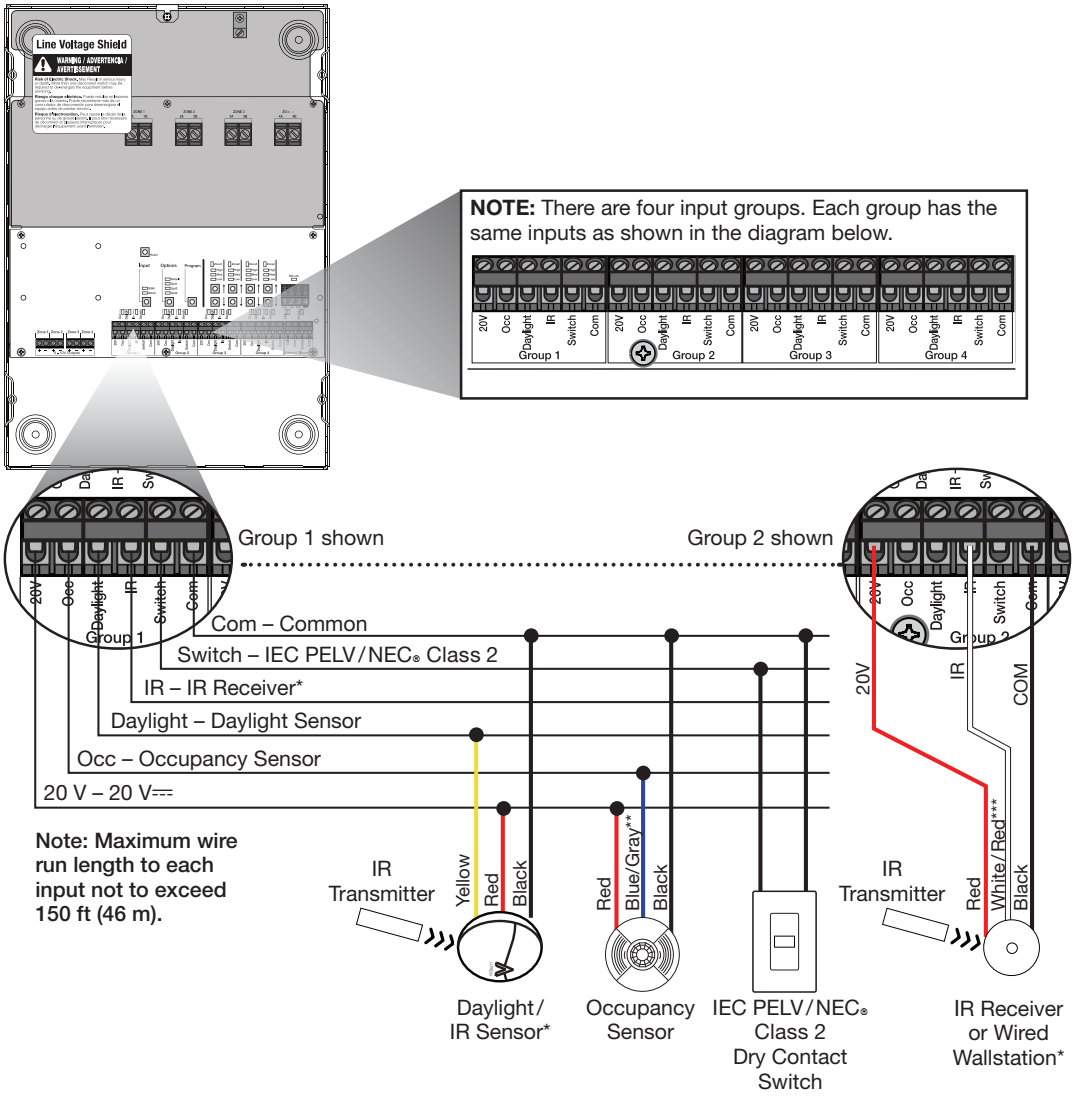
For applications requiring 4-way occupancy sensing and manual control functionality, a DVTV dimmer can be installed as shown below between the sensor and the power pack. Two toggle switches are added to switch the red and red / white line side inputs of the dimmer to provide 4-way functionality. Similar to the previous application, the sensor will turn the lights on upon detecting motion if either of the switches or the dimmer are in the on position.



* This wire/terminal may be gray on older products or in retrofit applications.

Wired Multi-Zone 0–10 V⎓ Distributed Dimming

Most 0–10 V⎓ applications call for multiple zones of dimming control. Such applications range from the need to have a master manual control of multiple occupancy groups, to the need for multiple daylight rows to be controlled as a single occupancy group. The Energi Savr Node panel (QSN-4T16-S-347) is well suited to these 347 V~ lighting control applications. The QSN-4T16-S-347 is a modular panel for the control of 347 V~ switched and 0–10 V⎓ dimmable lighting loads. It features four 0–10 V⎓ dimming outputs with corresponding 347 V~ relays and wired sensor inputs for occupancy, daylighting, manual control, and contact closure integration. It ships with default functionality requiring no commissioning. The QSN panel has four sensor input groups. Each sensor input group provides 20 V⎓ power and has an input for a photo sensor, a wired Pico keypad (or IR receiver), a dry contact switch, and up to three occupancy sensors. Each sensor input group corresponds to a lighting zone on the QSN panel. By default, without any programming, the sensors on input group 1 controls lighting zone 1, input group 2 controls lighting zone 2, input group 3 controls lighting zone 3, and input group 4 controls lighting zone 4.



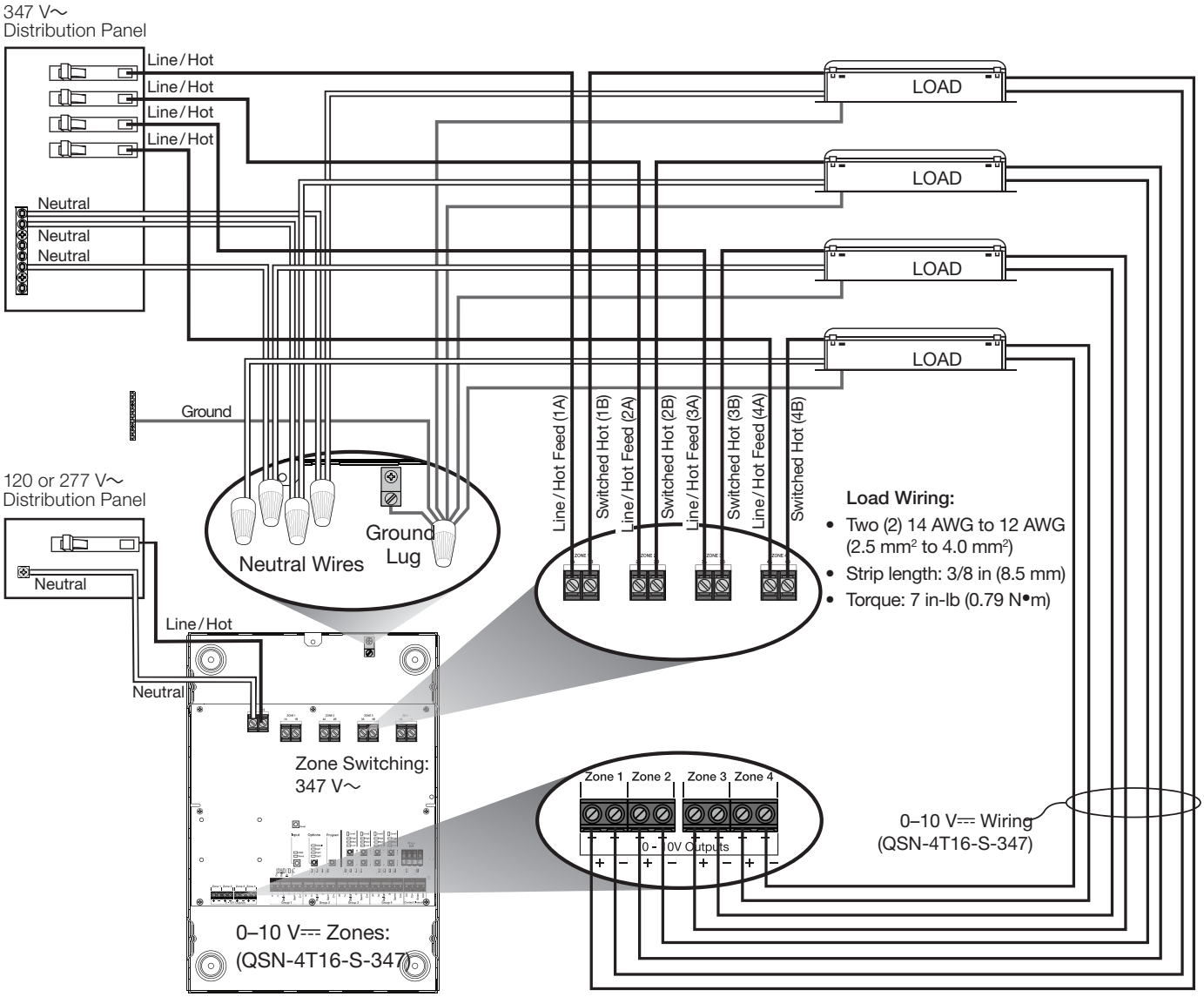
* **Note:** Only one IR device may be connected per input. If the IR signal from a daylight sensor is connected, a wall control may not be connected to the same input, and vice-versa.

** Connect the gray wire on -R model occupancy sensors.

***The red stripe on this wire may be absent on older products or in retrofit applications.

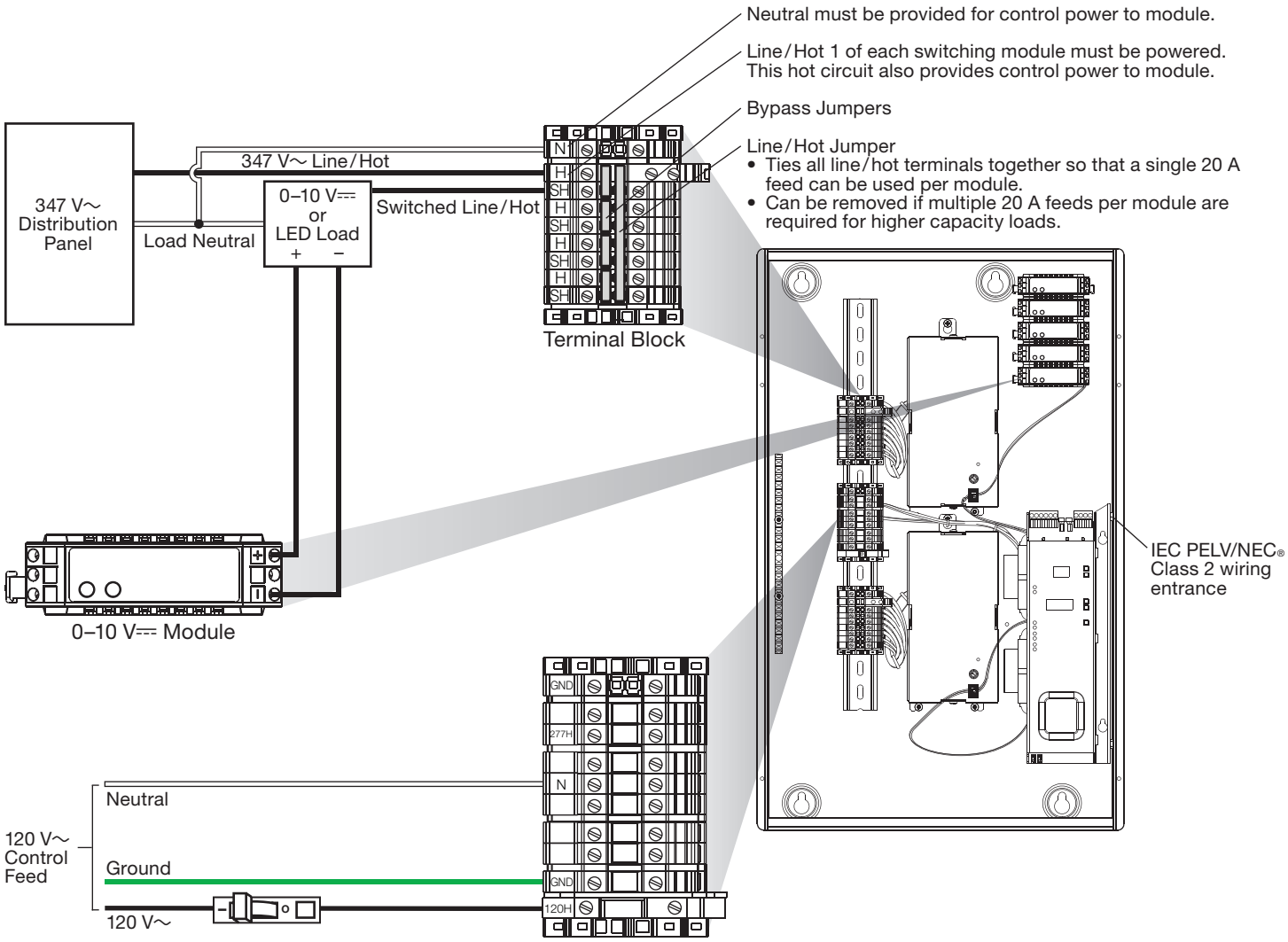
Wired Multi-Zone 0–10 V⎓ Distributed Dimming *(continued)*

Wire 120 or 277 V~ line/hot and neutral to the QSN panel for control as well as up to four 347 V~ line/hot and neutral pairs to the QSN panel for the lighting loads. Terminate the 347 V~ line/hot and neutral pairs on the line side of the relays. Each 347 V~ relay on the QSN panel is rated for 16 A continuous use, which is the maximum continuous load for a 20 A Overcurrent Protection Device (Branch Breaker). Multiple zones can be powered from the same breaker. Wire the switched hot of each output zone to the switched hot input on every driver in that zone. The 0–10 V⎓ control wires are terminated in the lower left corner of the QSN panel. Each 0–10 V⎓ circuit corresponds to a switched hot output and cannot be changed. Programming can be adjusted using integral interface buttons on the ESN board. Each relay is rated for 1,000,000 cycles with patented Softswitch technology. Individual panels function by themselves, but can also be connected together as lighting control network or included in a larger Quantum system.



Wired Multi-Zone 0–10 V⎓ Centralized Dimming

0–10 V⎓ applications requiring centralized control of multiple zones can take advantage of custom Lutron panels CGP2896, CGP748, and CGP2806. These wire similarly to the Energi Savr Node panels, but do not have integrated sensor inputs. 347 V~ Lutron panels are feed-through only and contain XP2 as well as TVM modules. Each XP2 module has four 347 V~ relays with a combined current rating of 64 A (16 A per circuit). Each TVM module has two 0–10 V⎓ circuits capable of sinking or sourcing up to 50 mA per circuit with a maximum of 750 mA total for each set of 12 TVM modules (24 0–10 V⎓ circuits). The first two TVM modules in any panel are statically associated to the first XP2 module in that panel. As such, the drivers fed from the first relay in any panel must be controlled by the first 0–10 V⎓ output in that panel. Similarly, the drivers fed from the second relay must be controlled by the second 0–10 V⎓ output, and so on. The drivers controlled by the last 0–10 V⎓ output in any panel must be fed from the corresponding relay in that panel. Since every zone of 0–10 V⎓ drivers needs both a 0–10 V⎓ output and a relay, a panel can never have more 0–10 V⎓ outputs than relays. The reverse is not true. A panel can have more relays than 0–10 V⎓ outputs to allow for switch (non-dim) zones. 0–10 V⎓ capable circuits may also be used for general switching (non-dim) as needed.



Wired Multi-Zone 0–10 V⎓ Centralized Dimming *(continued)*

347 V~ 0–10 V⎓ dimming panels can be built for standalone systems or Quantum systems. Standalone panels are built with LCP controllers. Quantum panels are built with circuit selectors. 347 V~ LCP panels are available with up to 48 0–10 V⎓ or switching zones. These panel model numbers are formatted as LCPxx-347FT-Tyy-CGP2896, where

- xx is the number of switching circuits from 4 to 48 (must be a multiple of four), and
- yy is the number of 0–10 V⎓ circuits from 2 to 48 (must be a multiple of two and less than xx)
- Panels built under CGP2896 come in 24 in (610 mm) enclosures for up to 12 relays and 12 0–10 V⎓ outputs, 59 in (1499 mm) enclosures for up to 40 relays and 24 0–10 V⎓ outputs, and 63 in (1600 mm) enclosures for up to 48 relays and 48 0–10 V⎓ outputs.

347 V~ Quantum panels are available in two form factors. CGP748 panels are available with up to 40 switching zones and up to 24 0–10 V⎓ zones. These panel model numbers are formatted as CXPxx-347Txx-FT(-2L)-CGP748, where

- xx is the number of switching circuits from 4 to 40 (must be a multiple of four), and
- yy is the number of 0–10 V⎓ circuits from 2 to 24 (must be a multiple of two less than xx)
- Optional 2-link circuit selector by adding “-2L” to the model number before the CGP number
- Panels built under CGP748 come in 24 in (610 mm) enclosures for up to 12 relays and 12 0–10 V⎓ outputs and 59 in (1499 mm) enclosures for up to 40 relays and 24 0–10 V⎓ outputs

CGP2806 panels are available with up to 48 0–10 V⎓ or switching zones. These panel model numbers are formatted as CXPxx-347Txx-FT(-2L)-CGP2806, where

- xx is the number of switching circuits from 28 to 48 (must be a multiple of four), and
- yy is the number of 0-10V circuits from 2 to 48 (must be a multiple of two less than xx)
- Panels built under CGP2806 must have a minimum of 44 relays OR a minimum of 26 0–10 V⎓ outputs (Otherwise the panel would fall under CGP748 above)
- Optional 2-link circuit selector by adding “-2L” to the model number before the CGP number
- All CGP2806 panels will be built in the 63 in (1600 mm) enclosure

All CGP2896, CGP748, and CGP2806 panels require a dedicated 120 V~ control feed.

Lutron Contact Numbers

WORLD HEADQUARTERS
USA
Lutron Electronics Co., Inc.
7200 Suter Road
Coopersburg, PA 18036-1299
TEL: +1.610.282.3800
FAX: +1.610.282.1243

support@lutron.com

www.lutron.com/support

North & South America
Customer Assistance
USA, Canada, Caribbean:
1.844.LUTRON1 (1.844.588.7661)
Mexico:
+1.888.235.2910
Central/South America:
+1.610.282.6701

UK AND EUROPE
Lutron EA Limited
125 Finsbury Pavement
4th floor, London EC2A 1NQ
United Kingdom
TEL: +44.(0)20.7702.0657
FAX: +44.(0)20.7480.6899
FREEPHONE (UK): 0800.282.107
Technical Support: +44.(0)20.7680.4481

lutronlondon@lutron.com

ASIA
Lutron GL Ltd.
390 Havelock Road
#07-04 King's Centre
Singapore 169662
TEL: +65.6220.4666
FAX: +65.6220.4333
Technical Support: 800.120.4491

lutronsea@lutron.com

Asia Technical Hotlines
Northern China: 10.800.712.1536
Southern China: 10.800.120.1536
Hong Kong: 800.901.849
Indonesia: 001.803.011.3994
Japan: +81.3.5575.8411
Macau: 0800.401
Taiwan: 00.801.137.737
Thailand: 001.800.120.665853
Other Countries: +65.6220.4666