LED Solutions Guide
Smart Choices for LED Lighting Control
LED lighting is sweeping the industry.

Despite the many advantages of LED technology, determining the correct dimming and control solutions for LED lighting systems can be challenging. Leviton controls provide effective and reliable solutions with an expanding range of control options for the LED market. LED technology is here, and Leviton controls are leading the way.

<table>
<thead>
<tr>
<th></th>
<th>60W Traditional Incandescent</th>
<th>43W Energy-Saving Incandescent</th>
<th>15W CFL</th>
<th>12W LED</th>
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<td>Energy $ Saved (%)</td>
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Selecting a Compatible LED Control Solution: What You Need to Know

An LED control solution is made up of several components:
- **Lighting Controller**—controls the driver
- **Driver**—powers the LED lamp/fixture
- **LED lamp/fixture**—controlled by the driver

Standard LED Control System Diagram

Ensuring a Compatible Solution

When planning an LED control solution, it is important to understand that different driver types require different solution technologies. In order to ensure a compatible solution, first determine:

1. What kind of driver does the fixture use?
2. With this driver type, what are the options for control?
   - Switching
   - 0-10V VDC Sinking Dimming
   - 0-10V VDC Sourcing Dimming
   - Line Voltage Forward Phase Control Dimming
   - Line Voltage Reverse Phase Control Dimming
   - DMX
   - Color Changing/Tuning
3. Once you determine the driver type, refer to the following LED control solution pages for a range of options in LED compatible control.
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<th>Switching</th>
<th>0-10 VDC Sinking</th>
<th>0-10V VDC Sourcing</th>
<th>Line Voltage Forward Phase Control (Incand/MLV)</th>
<th>Line Voltage Reverse Phase Control (ELV)</th>
<th>DMX</th>
<th>Color Changing/Tuning</th>
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<td>TBL03</td>
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*Note: Other products may be required for a complete LED control system. Contact your local Leviton representative for more details.
**Switching Control**

**Residential Grade**

**Decora® Wall Switch Sensors**
- Optimal management of lighting and motor loads that uses passive infrared detection
- Occupancy (Auto-ON) and Vacancy (Manual-ON) models
- Single-pole and 3-way versions available
- IPS05, IPV05 and other models also available

**Humidity Sensor and Fan Control**
- Detects excess humidity and automatically activates ventilation fan, turns off when humidity level has dropped
- For use with most bathroom ventilation fans and fan/light combinations
- User-friendly controls for adjustment of humidity level sensitivity and time-out settings
- IPHS5 model only

**Decora Digital Switch with Bluetooth® Technology**
- Switch with a 24-programmable and countdown timer
- Use the smartphone or tablet app to control lights or set timing functions
- Rechargeable battery keeps time during temporary power outages
- DDS15 model only

**Vizia +®**
- Electronic switch with push pad that always returns to neutral position regardless of status
- Single-pole or 3-way when used with the VPOSR switch remotes
- VPS15 models only
- Can also be used in light commercial applications

**Vizia RF +®**
- Features Z-Wave® radio frequency technology—no new wiring required
- Compatible with Leviton Decora products
- One touch control of lights and appliances, scene transitions, zone control and timed events
- Remote control operation

**Switching Control**

**Commercial Grade**

**Low Voltage Occupancy Sensors**
- Turn lights ON when movement is detected
- Available in multiple styles and configurations to accommodate a number of applications including high-bay, long-range, wide view and more

**Decora Wall Switch Sensors**
- Switch and occupancy/vacancy sensor combinations for a wide variety of commercial applications
- Available in passive infrared (PIR) and multi-technology (PIR and ultrasonic) versions

**Provolt™ Self-Contained Ceiling Mount Occupancy Sensors**
- Line voltage occupancy sensors and photocells in one unit for true daylight harvesting
- Provides consistent daylight levels to maximize energy savings by actively switching and dimming connected loads in response to available natural light
- Integrated design eliminates need for separate power pack, occupancy sensor and photocell wiring

**Dimensions® D4000 System**
- Requires models with dimmers to be configured in non-dim mode or with network connected relays
- Flexible pushbutton lighting control solution
- Easy operation, configuration and installation via a wide range of entry stations and accessories, including room-combine stations
- Scalable products suitable for 4- to 6-channel standalone systems through complete network environments

**Dimensions D8000 System**
- Requires network connected relays or other load control device which can be configured as non-dim
- Advanced distributed lighting control for over 2,000 channels
- Accommodates complex projects by integrating theatrical, architectural and energy management lighting control systems

www.leviton.com/led
Switching Control
Commercial Grade

Omni-Bus Lighting Network
- Use as a standalone or integrate with Leviton automation system for apps/touchscreens and advanced programming
- Flexible topology with use of splitters—connect all modules together using a low voltage CAT5 UTP bus
- Integrates with nearly any momentary dry-contact switch interface and low voltage LEDs
- Multi-button programmable wall switches operate any load or scene

a-2000® Dimming Cabinets
- Universal, high-performance cabinets and multiple dimmer modules that work with virtually any load type
- Perfect solution for spaces requiring a single dimming source for a broad range of loads

Lumina™ Gateway Eco-System
- Features Lumina RF 2.4 GHz frequency technology—wireless means rapid retrofits
- Designed for the small commercial marketplace, offering energy management automation, scheduling and remote access
- Incorporate sensors, load controls, thermostats, touchscreens and more
- Free iOS and Android apps to control every business location

LevNet RF™ Wireless Self-Powered Solutions
- Wireless solutions have no wires, no batteries and are self-powered, providing continual lifetime savings
- Installs in 1/4 the time of traditional wired controls and enables rapid retrofitting for minimal impact to operations
- Delivers energy code compliant lighting control for automatic shut-off, level control, dimming, daylight zone control and plug load/receptacle control capabilities

Integrated Room Control (IRC)
- Delivers compact, easy to install energy code compliant lighting control for automatic shut-off, level control, dimming, daylight zone control, demand response and plug load/receptacle control capabilities
- Easy ordering, specifying and installation with a room-in-a-box kitted solution

Sector® Digital Lighting Control System
- Single-point, distributed control system combining all lighting management functions into one system with the fewest connection points
- Offers easy specification, simple installation and superior flexibility
- Lighting control layouts can be altered to match building changes using intuitive software

GreenMAX® Relay Control System
- Industry-leading 25,000A short circuit current rating at 277V
- Preset “Behaviors” simplify setup of common sensing, dimming, switching and advanced daylight harvesting applications
- BACnet IP native for seamless BMS integration

Satellite Dimmer Pack
- Portable 4-channel dimmer packs utilize DMX and Microplex protocols to switch and dim LED lighting for entertainment applications
- Cutting-edge D4DMX features resettable circuit breakers in lieu of fuses
- One-button setup of digital DMX addressing via LED panel

iSeries e High Density Dimming System
- 120V/230V wall-mountable racks accommodate 24 to 96 hot-swappable single and dual dimmer modules for high-density entertainment applications
- Options include handheld terminals for onsite or remote control and redundant control for seamless backup
### 0-10V VDC Sinking Dimming

#### Residential Grade

**Decora Rocker Slide**
- Full-range dimming for LED fixtures using 0-10V power supplies
- No power pack required
- Single-pole or 3-way when used with a 3-way switch
- Dual voltage 120V/277V; 50mA maximum sink current
- DS710 model only

**IllumaTech® Slide**
- Smooth, captured slide bar for LED fixtures using 0-10V power supplies
- No power pack required
- Single-pole or 3-way when used with a 3-way switch
- Dual voltage 120V/277V; 28mA maximum sink current
- IP710-LF model only

### 0-10V VDC Sinking Dimming

#### Commercial Grade

**Renoir II Wallbox Dimmers**
- Elegant dimmers rated for universal voltage
- Complete load type offering in all form factors
- Up to 5-way multi-location dimming
- AWRMG-7DW, AWSMT-7DW and AWSMG-7DW models only

**Dimensions D4000 System**
- Requires PE300 controlled by D4104, D4106 or D4206
- Flexible pushbutton lighting control solution
- Easy operation, configuration and installation via a wide range of entry stations and accessories, including room-combine stations
- Scalable products suitable for 4- to 6-channel standalone systems through complete network environments

**Power Extender PE300**
- Allows a dimming zone’s power handling capacity to be extended to full control of a 20A circuit
- Emulates the characteristics of the dimmer that it is connected to for dimming range and resolution
- Works with any Dimensions multi-zone controller or other device providing a 0-120V phase control signal

**a-2000 Dimming Cabinets**
- Universal, high-performance cabinets and multiple dimmer modules that work with virtually any load type
- Perfect solution for spaces requiring a single dimming source for a broad range of loads

**Lumina Gateway Eco-System**
- Features Lumina RF 2.4 GHz frequency technology—wireless means rapid retrofits
- Designed for the small commercial marketplace, offering energy management automation, scheduling and remote access
- Incorporate sensors, load controls, thermostats, touchscreens and more
- Free iOS and Android apps to control every business location

**LevNet RF Wireless Self-Powered Solutions**
- Wireless solutions have no wires, no batteries and are self-powered, providing continual lifetime savings
- Installs in 1/4 of the time of traditional wired controls and enables rapid retrofitting for minimal impact to operations
- Delivers energy code compliant lighting control for automatic shut-off, level control, dimming, daylight zone control and plug load/receptacle control capabilities
### 0-10V VDC Sinking Dimming
#### Commercial Grade

**Dimensions D8000 System**
- Requires connection to device capable of providing 0-10V sourcing signal—consult factory for details
- Advanced distributed lighting control for over 2,000 channels
- Accommodates complex projects by integrating theatrical, architectural and energy management lighting control systems
- Requires an NPC DLR or XP

**Integrated Room Control (IRC)**
- Delivers compact, easy to install energy code compliant lighting control for automatic shut-off, level control, dimming, daylight zone control, demand response and plug load/receptacle control capabilities
- Easy ordering, specifying and installation with a room-in-a-box kitted solution

**Sector Digital Lighting Control System**
- Single-point, distributed control system combining all lighting management functions into one system with the fewest connection points
- Offers easy specification, simple installation and superior flexibility
- Lighting control layouts can be altered to match building changes using intuitive software

### 0-10V VDC Sourcing Dimming
#### Commercial Grade

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- Lighting control layouts can be altered to match building changes using intuitive software
## Line Voltage Forward Phase Control Dimming

### Residential Grade

**Decora Digital Dimmer with Bluetooth Technology**
- Optimizes dimming for dimmable LED, CFL, halogen, MLV and Mark-10® Powerline loads
- Digital dimmer with 24-hour programmable and countdown timer
- Use app on smartphone or tablet to control lights and set timer functions
- DDMX1 model only

**Decora Rocker Slide**
- Microprocessor optimizes dimming performance for dimmable LED, CFL and incandescent loads
- DSM10 model also controls magnetic low voltage loads
- Single-pole or 3-way when used with a 3-way switch
- DSL06 and DSM10 models only

**IllumaTech Slide**
- Optimizes dimming for dimmable LED, CFL, halogen and incandescent loads
- Single-pole or 3-way when used with a 3-way switch
- IPL06 model only

**SureSlide®**
- Optimizes dimming for dimmable LED, CFL, halogen and incandescent loads
- Preset model (6674) contains ON/OFF switch that preserves selected light level
- Single-pole or 3-way when used with a 3-way switch
- 6672 and 6674 models only

**Vizia RF +**
- Features Z-Wave® radio frequency technology—no new wiring required
- Compatible with Leviton Decora products
- One touch control of lights and appliances, scene transitions, zone control and timed events
- Remote control operation

**Decora Dimming Sensor**
- Occupancy (Auto ON) or Vacancy (Manual ON) models available
- Functionality of a sensor with dimming capability to control light level
- Single-pole or 3-way when used with a 3-way switch
- IPVD6 and IPSD6 models only

**Table Top Dimmer**
- Smooth, full-range dimming for dimmable LED, CFL and Incandescent loads
- Table top dimmer contains 6-ft cord to provide additional accessibility
- TBL03 model only

### Commercial Grade

**Renoir II Wallbox Dimmers**
- Elegant dimmers rated for universal voltage
- Complete load type offering in all form factors
- Up to 5-way multi-location dimming
- See data sheet for line voltage forward phase control models

**Omni-Bus Lighting Network**
- Use as a standalone or integrate with Leviton automation system for apps/touchscreens and advanced programming
- Flexible topology with use of splitters—connect all modules together using a low voltage CAT5 UTP bus
- Integrates with nearly any momentary dry-contact switch interface and low voltage LEDs
- Multi-button programmable wall switches operate any load or scene

**Power Extender PE100**
- Allows a dimmer’s power handling capacity to be extended to a full 1,920W/VA on 120V input power
- Works with magnetic low voltage and incandescent
- Works with any Dimensions controller
Line Voltage Forward Phase Control Dimming
Commercial Grade

a-2000 Dimming Cabinets
- Universal, high-performance cabinets and multiple dimmer modules that work with virtually any load type
- Perfect solution for spaces requiring a single dimming source for a broad range of loads

Dimensions D4000 System
- Requires use of D4104, D4106 or D4206 to provide direct control or network connectivity to D4006, a-2000 or other phase control dimmer
- Flexible pushbutton lighting control solution
- Easy operation, configuration and installation via a wide range of entry stations and accessories, including room-combine stations
- Scalable products suitable for 4- to 6-channel standalone systems through complete network environments

Dimensions D8000 System
- Requires network connectivity to an a-2000, D4006 or other phase control dimmer
- Advanced distributed lighting control for over 2,000 channels
- Accommodates complex projects by integrating theatrical, architectural and energy management lighting control systems
- Requires an NPC DLR or XP

Satellite Dimmer Pack
- Portable 4-channel dimmer packs utilize DMX and Microplex protocols to switch and dim LED lighting for entertainment applications
- Cutting-edge D4DMX features resettable circuit breakers in lieu of fuses
- One-button setup of digital DMX addressing via LED panel

Rack Mount Dimmer
- Digital dimming system combines portability with rugged construction for entertainment applications
- Multiple channel and voltage configurations available with knockout or stage-pin panels

iSeries e High Density Dimming System
- 120V/230V wall-mountable racks accommodate 24 to 96 hot-swappable single and dual dimmer modules for high-density entertainment applications
- Options include handheld terminals for onsite or remote control and redundant control for seamless backup

Line Voltage Reverse Phase Control Dimming
Residential Grade

Decora Rocker Slide
- Full-range dimming for electronic low voltage loads
- Sleek design with rocker switch and slender dimmer control side bar
- Single-pole or 3-way when used with a 3-way switch
- No break off of fins required in multi-gang installations
- DSE06 model only

IllumaTech Slide
- Controls electronic low voltage loads
- Preset dimming with smooth, captured slide bar for fine adjustment of lighting levels
- Single-pole or 3-way when used with a 3-way switch
- IPE04 model only

SureSlide
- Preset dimming for electronic low voltage loads
- Single-pole or 3-way when used with a 3-way switch
- 6615 model only
Line Voltage Reverse Phase Control Dimming
Residential Grade

**Vizia RF +**
- Features Z-Wave® radio frequency technology - no new wiring required
- Compatible with Leviton Decora products
- One touch control of lights and appliances, scene transitions, zone control and timed events
- Remote control operation

**Vizia + Electronic Low Voltage Dimmer**
- Digital dimmer for use with electronic low voltage loads
- Programmable fade rates and energy save mode
- Single-pole or 3-way when used with Vizia + remotes (VP00R)
- VPE06 model only

Line Voltage Reverse Phase Control Dimming
Commercial Grade

**Renoir II Wallbox Dimmers**
- Elegant dimmers rated for universal voltage
- Complete load type offering in all form factors
- Up to 5-way multi-location dimming
- AWRMG-ExW, AWSMT-ExW and AWSMG-ExW models only

**Dimensions D4000 System**
- Requires network connectivity to device providing reverse phase control dimming or connection through a PE400
- Flexible pushbutton lighting control solution
- Easy operation, configuration and installation via a wide range of entry stations and accessories, including room-combine stations
- Scalable products suitable for 4- to 6-channel standalone systems through complete network environments

**Dimensions D8000 System**
- Requires network connectivity to device providing reverse phase control dimming or connection through a PE400
- Advanced distributed lighting control for over 2,000 channels
- Accommodates complex projects by integrating theatrical, architectural and energy management lighting control systems

**Omni-Bus Lighting Network**
- Use as a standalone or integrate with Leviton automation system for apps/touchscreens and advanced programming
- Flexible topology with use of splitters—connect all modules together using a low voltage CAT5 UTP bus
- Integrates with nearly any momentary dry-contact switch interface and low voltage LEDs
- Multi-button programmable wall switches operate any load or scene

**Power Extender PE400**
- Allows a dimmer’s power handling capacity to be extended to a full 1,000W/VA on 120V input power
- Works with electronic low voltage and incandescent
- Works with any Dimensions controller
**DMX Control**

**Commercial Grade**

**Sapphire™ LCD Touch Screen**
- Advanced distributed lighting control
- Provides flexibility of a fully customizable user interface with the convenience of native Leviton controls
- Integrated scheduler and astronomical time clock
- Requires an NPC DLR or XP

**Dimensions D4000 System**
- Flexible pushbutton lighting control solution
- Easy operation, configuration and installation via a wide range of entry stations and accessories, including room-combine stations
- Scalable products suitable for 4- to 6-channel standalone systems through complete network environments
- Requires an NPC DLR or XP

**Dimensions D8000 System**
- Advanced distributed lighting control for over 2,000 channels
- Accommodates complex projects by integrating theatrical, architectural and energy management lighting control systems
- Requires an NPC DLR or XP

**NPC DLR**
- Provides exceptional convenience and flexibility as an interface for remote devices, displays and networking of theatrical and architectural control devices
- Allows for devices to communicate over ColorNet network

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**Color Changing/Tuning Control**

**Commercial Grade**

**Sapphire™ LCD Touch Screen**
- Advanced distributed lighting control
- Provides flexibility of a fully customizable user interface with the convenience of native Leviton controls
- Integrated scheduler and astronomical time clock

**Dimensions D4000 System**
- Flexible pushbutton lighting control solution
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- Scalable products suitable for 4- to 6-channel standalone systems through complete network environments

**Dimensions D8000 System**
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- Accommodates complex projects by integrating theatrical, architectural and energy management lighting control systems

**Sector Digital Lighting Control System**
- Single-point, distributed control system combining all lighting management functions into one system with the fewest connection points
- Offers easy specification, simple installation and superior flexibility
- Lighting control layouts can be altered to match building changes using intuitive software
What to Know: Planning an LED Lighting Control Solution

Basic System Configuration

Before selecting products to control your LED lighting, it's important to understand the necessary components required for LED control and identify your lighting's control/communication protocol. Lighting controls interface with LED lighting to perform one or more of three primary functions: switching, dimming and color changing.

Every LED lighting control system must include a lamp and driver, or fixture with integral driver, plus a lighting controller. The driver provides the exact voltage and current needed to generate the desired light output. The driver also translates the signals from line to low voltage when using a line voltage controller with an LED lamp or fixture.

Lighting controls include occupancy sensors, dimmers, timers, sophisticated relay cabinets, multi-level switching systems, and comprehensive daylight harvesting systems. The performance of any individual controller or system is directly related to the functional limitations of the most restrictive component selected. For example, if a dimmer is capable of dimming down to 1% but the LED driver is only able to dim to 30%, then the minimum dimming level will be 30% (the lowest common denominator).

Control/Communication Protocols

0-10V Dimming

In a 0-10V system, all controls send a dedicated output signal to the driver in the form of 0-10V analog voltage. The driver's purpose is to provide the appropriate LED drive current in response to that signal. There are two types of 0-10V controls, sourcing and sinking, and the two are not compatible with each other.

Sinking: Controllers supporting this type of signal “sink” absorb different amounts of voltage to indicate the dimming level. Each driver acts like its own power supply, allowing even a small controller to support a large numbers of devices. Driver setup is identical to a 0-10V fluorescent dimming ballast and is compatible with the same types of controllers.

Sourcing: A driver requiring a 0-10V sourcing control operates using a more traditional 0-10V analog controller. The controller provides all voltage and current and adjusts the voltage to set the dimming level.
**Phase Control Dimming**

There are two types of phase control: **forward (or leading edge)** and **reverse (or trailing edge)**.

In general, phase control dimming and control technologies involve gating the output to allow only a portion of the sine wave to reach the load. This has the effect of decreasing the average amount of power that reaches the load and consequently allows the load to dim. Forward phase dimming is when the front part of the sine wave is gated; reverse phase dimming is when the back half of the sine wave is gated. Some load types, most notably some electronic low voltage and some LED, tend to react better to reverse phase than forward phase control; although it is possible to design both load types to work well with either. Note that NEMA SSL 7 requires that an LED driver produce a well-behaved forward phase control load.

**Forward Phase Control**: Line voltage forward phase control is required for magnetic low voltage and typically used with incandescent loads. With this technology, the front part of the sine wave is truncated to generate specific output levels. Use of the forward phase protocol may present some dimming performance issues that should be considered prior to system specification.

**Reverse Phase Control**: Line voltage reverse phase control is required for electronic low voltage and provides for solid dimming performance with many LED drivers. With reverse phase control, the back part of the sine wave is truncated to vary output.

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**Digital Multiplex (DMX)**

DMX control signals are traditionally used in theatrical environments; however, due to the unique needs of high channel count, color changing LED fixtures in architectural applications they are occasionally used there as well. DMX is an RS-485 digital protocol where each “universe” takes a single wire run on cable designed for RS-485 transmission. Each universe is capable of communicating level information very quickly on 512 “channels” of information. A color changing fixture will typically require three channels: one each for red, green and blue. Some fixtures add additional channels for other functions.

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**Lutron 3-Wire**

This control type uses three wires: one fixed, unvarying line voltage that switches power on/off, a dimming variable phase controlled line voltage wire, and a neutral wire. Wallbox dimmers designed for fluorescent 3-wire have some form of low-end trimpot to set the minimum light level or RMS voltage. It generally provides good immunity to electrical noise and precise dimming of fluorescent lighting.
Leviton Service and Support
System design, product selection, installation and service come together with Leviton’s extensive service and support options. We’ll help you design your system and make the right product selections for an LED lighting control system that does what you want it to do, while also saving electricity, meeting codes and standards, and even garnering rebates.

It all starts with the Leviton sales representative. Our lighting control specialists are here to support you every step of the way.

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• Occupancy sensor layout services—have a team of experts create occupancy sensor layouts directly on your CAD drawings, complete with a List of Equipment at no cost—go to portal.leviton.com
• LightLogger® Program—get an accurate estimate of your energy-savings potential with this exclusive payback analysis tool—go to www.leviton.com/logger
• ez-Learn—get sensor smart in just 90 minutes from the comfort of your home or office with this exclusive 24/7 online training—go to www.leviton.com/ezlearn
• ASAP Lighting Design software—point-and-click software allows you to quickly and simply design, specify and enter orders—go to www.leviton.com/asap
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