

Light is flexible

The Connection Between Architectural Lighting Design and LED Driver Technology

Combining art and science to achieve quality of light and efficacy

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Architectural Lighting Design

Introduction

In the past, architectural lighting was used primarily in high-end properties but today, it is an integral part of any new build or old structure upcycling project. Design trends such as sustainability and open or multi-use spaces require new lighting concepts that combine aesthetic appeal with optimum functionality and energy efficiency.

New developments in lighting technology help architects and lighting designers create and fulfill their visionary ideas—without compromise. The technology and economics now mean that architectural lighting can enhance virtually any interior space—not just luxury or upscale projects.

Building interiors that impress and delight are based on the thoughtful integration of architecture and light.



Combining Art with Science

Architectural lighting design requires a strong technical aptitude as well as creativity and artistic vision. According to the International Association of Lighting Designers (IALD), knowledge of physics, optics, electricity, ergonomics, business, codes, environmental issues, construction, vision and the art of design are all essential to creating great lighting solutions. Today's lighting professionals must comprehend these foundational areas and the latest LED and controls technologies, the Internet of Things (IoT), human centric lighting, and so much more.

Successful architectural lighting designers understand how to manipulate light and coordinate light sources to bring value to a building and enhance its architectural features. The light they specify can create cohesive space and bring emotional value and comfort to occupants. And, their lighting designs improve energy and lighting efficiencies.

Architectural lighting design takes a holistic approach to illuminating a space with top consideration given to the aesthetic, functional, and energy efficiency aspects of light.



Aesthetic Lighting

Aesthetic lighting goes beyond the fixture styles selected.

Light has an aesthetic effect on a space and its objects and architectural features. Each appears a certain way because of lighting. Often, aesthetic lighting will give the effect required without the source of light being seen or noticed.

Aesthetic lighting also has an emotional impact on the occupants of a space by creating an experience and influencing how people feel about that space. It is especially important in commercial office space as well as experience-focused industries such as hospitality and retail where it can directly influence business.

Enhance brand impact

Corporate branding is critical in commercial real estate with building owners and tenants requiring prominent, accurate display of their company brands in typically high traffic, interior spaces. Lobbies and common areas often become showpieces with striking architectural features requiring quality architectural lighting and design. Lighting aesthetics play a critical role in meeting corporate brand requirements because firms can create brand impact with visitors as soon as they enter their space.

Focus on the experience

The hospitality industry leverages aesthetic lighting by focusing on 'the experience'. Quality lighting plays a key role in creating that all-important mood and atmosphere. For example, a singular space can transition throughout the day from a coffee and breakfast room in the morning, to a low-key gathering space for craft cocktails in late afternoon and evening, to a vibrant social spot until late night. Architectural lighting design offers the flexibility to adjust lighting to support space changes throughout the day.



Functional Lighting

Lighting design has a practical or functional aspect. It enables our ability to live, work, or play in a space by supporting the activities, occupant movement, and safety in that space.

There is an ergonomic aspect to functional lighting. The location of luminaires, the combination of different types of lighting, determining the amount of natural light in a space and how it is leveraged, avoiding glare, and creating light that is in sync with nature's circadian rhythm, all play a role in supporting occupants and their activities.

Increase Occupant Comfort and Productivity

Every space has mandatory illumination requirements. The functional aspect of architectural lighting design will determine the required amount of light, the distribution of light in the space, and much more based on the purpose of the space and occupant tasks or activities. For example, an area where workers are on computers all day needs different lighting for productivity and comfort than a lobby, cafeteria or conference room.

In addition to addressing basic comfort requirements, functional lighting can support the WELL Building Standard aimed at helping people work, live, perform and feel their best. WELL Light concept guidelines are designed to support the human body's circadian system as this can affect productivity and sleep quality. The guidelines also aim to enhance visual acuity.

Support Occupant Safety

Lighting is essential to safety. Functional lighting addresses the need to light all areas—even those only occasionally used—for safe mobility. Additionally, occupants need to get out of a building safely in an emergency, even if the power goes down. Emergency lighting along egress paths plays a critical role in a lighting plan.



Energy Efficiency

Advances in lighting technologies, coupled with building code requirements, have resulted in a sharp decline in the amount of electricity used for lighting commercial buildings. However, a building's lighting system is still a dominant consumer of electrical energy and a major source of heat. According to the U.S. Energy Information Administration (EIA), lighting energy consumption still accounts for 17% of all electricity consumed in U.S. commercial buildings, so there is still room for substantial improvement in this area.

Code Compliance

Energy standards and codes including IECC, ASHRAE 90.1, and California Title 24 continue to evolve. And, according to ACEEE, U.S. cities are adopting or advocating for stricter building energy codes to address climate change. Lighting plays a critical role in code compliance and has an immediate impact on energy consumption.

Efficacy

Efficacy is top of mind in any architectural lighting design. Inefficient luminaires require more electrical power to produce the same illumination level as those with high efficacy levels. Inefficient luminaires run hotter, causing color shifts and reducing luminaire lifetime. Additionally, utility companies use efficacy to determine rebate eligibility.

Lighting designs focus on ways of improving lighting system efficiencies by using energy-efficient lighting components, controls, and systems in combination with daylighting strategies, architectural dimming and more, at both the lighting system and individual luminaire level.



Technology's Role in Architectural Lighting

Architectural luminaires are the foundation of a lighting design plan. They come in a wide choice of fixture styles, finishes and sizes. Some are basic, while others use unique materials and are considered works of art.

Often, luminaire selection is solely based on the physical aesthetics of the fixture. However, the inner workings of the luminaire—specifically its LED driver technology—play a critical role in meeting the goals and objectives of a lighting design plan. And not all LED drivers are created equal

Why the Science Inside Matters

LED drivers significantly influence the performance, reliability and lifetime of a luminaire. Think of the LED driver as the 'heart' of an LED fixture. The driver sends the appropriate level of electrical current to the LEDs to produce the intended level of light. It is the primary component that determines luminaire dimming capabilities, startup times and much more. It directly impacts the quality of light and how well and how long a luminaire performs.



Architectural-Grade LED Drivers

Architectural-grade LED drivers differ from other LED drivers. Packed with performance, they offer a combination of features and functionality that supports architectural lighting design flexibility and reliability. A designer could choose the most beautiful architectural fixture in the world, but if it does not come with an architectural-grade LED driver, their lighting design vision and objectives may not be met. The quality of light and the efficacy of a luminaire depends largely on the specifications of the LED driver used.

The key performance characteristics of architectural-grade LED drivers are:



Synchronized ON/OFF Timing & Dimming Controls



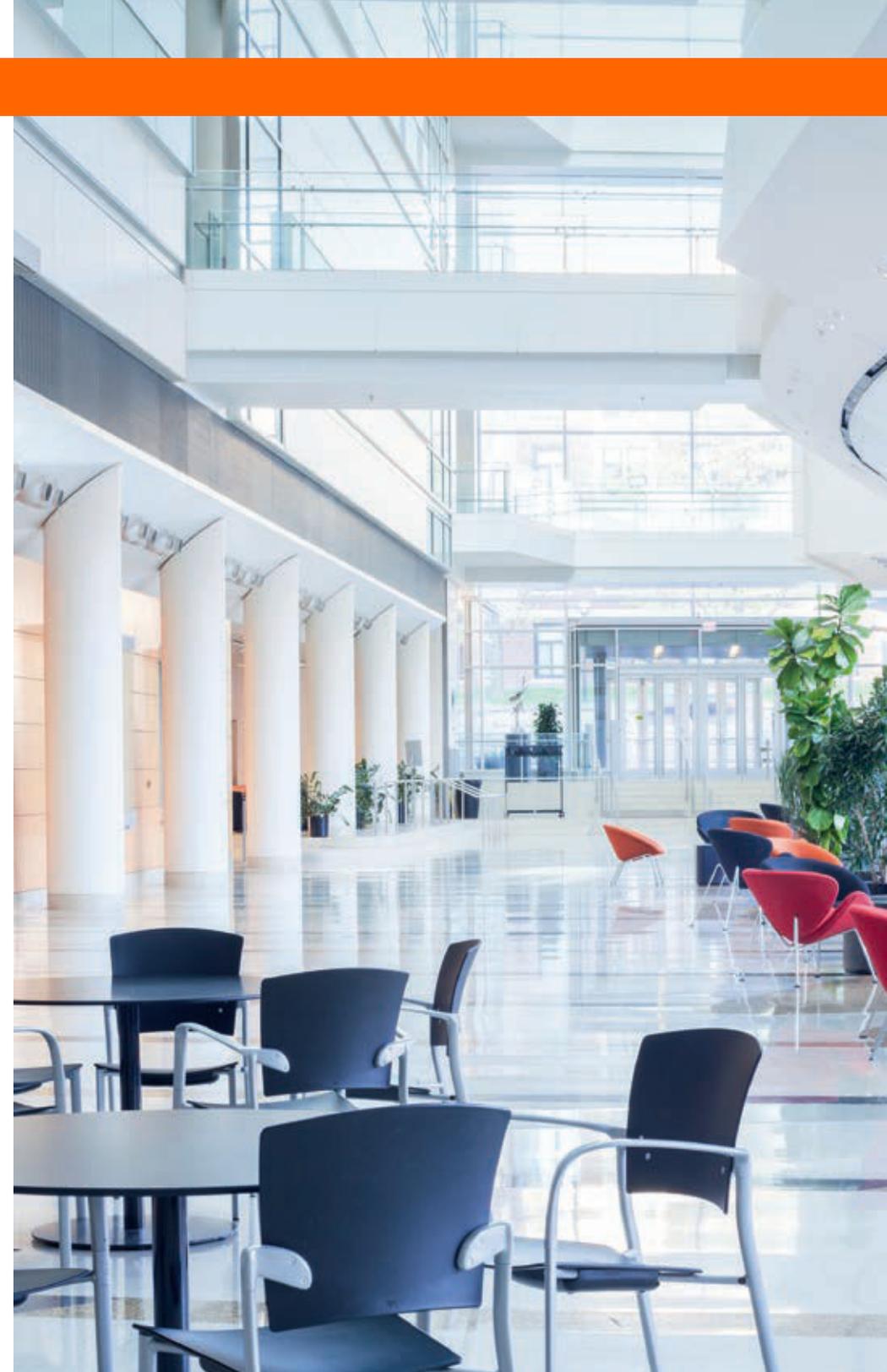
True 1% Dimming Across the Full Programmable Current Range



DIM-to-OFF



Dimming Interface Protection from AC Line





Synchronized ON/OFF Timing & Dimming Controls

Consistent ON/OFF timing and dimming levels across multiple luminaires is a basic requirement of any architectural lighting design. Differences in start-up time between luminaires will cause a highly visible “popcorn” effect. This effect can occur as well within individual linear luminaires that contain multiple LED drivers.

‘Mix and Match’ LED Drivers with Different Wattage

Architectural-grade LED drivers can be ‘mixed and matched’ (85W, 50W, 48W, 30W, 20W) in a space or across a single linear luminaire and still have synchronized ON/OFF timing and dimming performance. By leveraging these drivers with different wattage, specification requirements can be achieved efficiently without compromising light quality.



True 1% Dimming Across the Full Programmable Current Range

Dimming to one percent (1%) is becoming a standard claim, but the truth is many on the market only meet 1% at a specific point or section of the programmable output current range.

Architectural-grade LED drivers offer true 1% dimming — 1% dimming across the driver’s entire programmable output current range. This key specification gives lighting designers the flexibility and precise light output they require, while guaranteeing the spec can be met by the luminaire OEM.





DIM-to-OFF

DIM-to-OFF enables luminaires to smoothly transition from dim to OFF and save energy without needing additional control equipment to turn off the fixture. The driver will enter standby mode when turned off by the dimming controller. This feature is available in some but not all LED drivers, yet building codes in some areas require this functionality.

Select architectural-grade LED drivers have a programmable AUX output that extends the DIM-to-OFF capability to fixture-integrated sensors and controls. These smart components receive power directly from the LED driver with no additional power pack required. And, power stays on even when the main LED power output is off.



Dimming Interface Protection from AC

Miswiring is a common mistake during installation because 277V neutral wires can be gray, as can 0-10V control wires. To protect a fixture from failing to deliver light output or dimming capabilities, the LED driver must protect itself from miswiring AC voltage across the 0-10V dimming interface.

Fixtures with highly reliable architectural-grade LED drivers provide a visual warning in the case of miswiring, and will operate properly once the fault is rectified.



Are your LED Drivers Architectural Grade?

As you can see, not all LED drivers are created equal. Architects, designers, and luminaire manufacturers need reliable LED drivers that meet precise lighting design specifications and support the flexibility required in architectural lighting design.

To be considered architectural-grade, an LED driver must:

- Synchronize ON/OFF timing and dimming control, even when multiple LED drivers of different wattages are used in a single linear luminaire.
- Support 1% dimming accuracy across the entire LED driver programmable output current range.
- Smoothly transition between ON and OFF (DIM-to-OFF) and offer a programmable AUX power output option to extend these capabilities to fixture-integrated sensors and controls without an additional power pack.
- Protect the LED driver dimming circuit, making it immune from miswiring in the field to AC line voltage. Provide a visual warning of the miswiring.

OPTOTRONIC® Programmable LED drivers meet these architectural-grade driver requirements. They support the flexibility and reliability lighting designers seek and are available in a wide range of architectural luminaires.



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