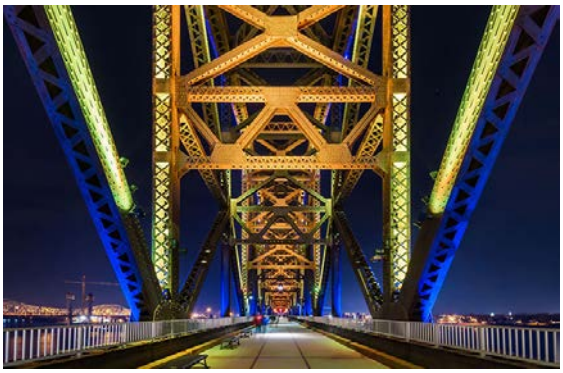
VINCENT
LIGHTING SYSTEMS
Entertainment & Architectural Lighting & Rigging
FOCUSED

ARCHITECTURAL LED 102

A DEEPER LOOK AT TERMINOLOGY AND TECHNOLOGY

WWW.VLS.COM

This guide is intended to give you an understanding of the general lighting process. It is a learning tool only, and is in no way, meant to be substituted for training in lighting and electronics.



Big Four Pedestrian Bridge, Louisville, Kentucky

If you have read through our Architectural LED 101 guide, you likely have some ideas about the type of light fixtures and controls that will work for your space. And you likely still have a few questions. Maybe you've started looking at lighting technology and are perplexed by all the numbers and acronyms. Read on for a greater understanding of the terminology and technologies employed in architectural lighting and LED technology.

VISUALS

COLOR TEMP

One of the first things you'll notice in architectural lighting is color temperature. The perceived color temperature is delineated by measuring in degrees across the Kelvin scale. For reference, Tungsten light bulbs tend to operate around 2700K, while halogen lamps run slightly cooler at 3000-3250K. Daylight is usually described as an even cooler 6500K. LEDs are available to match any of these values, and can also provide color temperatures between the above reference points. Variable White LEDs allow designers and end users the ability to adjust the warmth or coolness of the light. Fixtures with fixed color temperatures will provide smaller price tags, but lock the facility into a single choice. You might be quite happy with being locked into a cool white LED if the space you're lighting is used primarily during the daytime, especially if it includes windows that bring in natural light. You might be satisfied with warmer fixed color temperature LEDs if you're trying to create a cozy atmosphere in a restaurant or residential space.

CRI

Warm or cool, not all white light is created equally. Various manufacturers employ a diverse range of LEDs to create fixtures that hit the mark for acceptable color temperature, and yet some seem to produce a truer white than others. This is the result of color rendering. Measured as a score of 0-100 on the color rendering index, the CRI value delineates how faithfully a particular lighting fixture renders color. The higher the CRI value, the more true-to-life the colors will appear as compared to an ideal reference light source. Museums will often request lighting with a CRI of 90 or greater, since it is their business to faithfully represent the artists' intended color. Such CRI scores are possible when manufacturers pay special attention to building their products to include a full spectrum white, where all wavelengths are equally represented across the entire visible spectrum. Lower CRI scores indicate

that the fixture has peaks and valleys within the visible spectrum, resulting in muted or accented colors, since not all wavelengths are present in the light output.

CQS

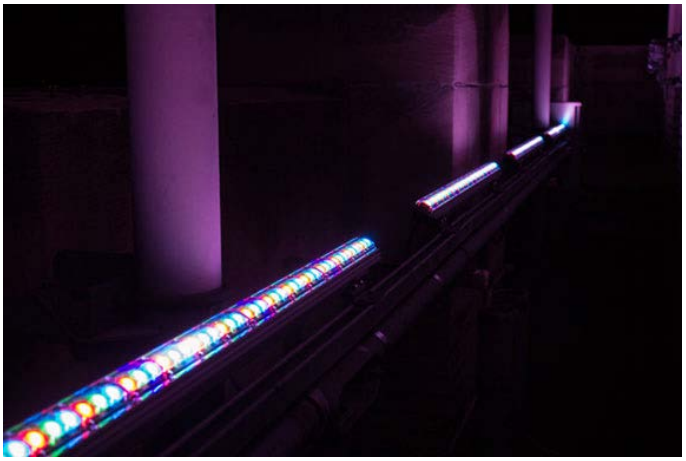
CRI isn't the end of the story. A new metric referred to as the Color Quality Scale is being used. Where CRI depends on a comparison with a color corrected source and diminishes scores for increased illuminance of certain colors, CQS draws comparisons against a static source and accepts that some increased illuminance of a certain color may be desirable. CQS allows for the fact that improving the illuminance of certain colors can be beneficial to creating ambiance or reinforcing brand identity.

INTENSITY & BEAM ANGLE

Many end users are prone to thinking of intensity in terms of wattage, but the migration to LEDs has raised questions over just how much value wattage plays in determining the effective brightness of your lighting. Previously, it had been fair to say that a 100W halogen lamp would always be brighter than a 50W lamp, so it's a big jump to now claim that a 14W LED lamp could be brighter than either one. It's a bigger jump to think that 150W LED fixture could be brighter than a 500W halogen light. Intensity is far more than wattage. Color Temperature and CRI values will play into perception of brightness, but all lamps and fixtures measure their intensity in lumens.

LUMEN MAINTENANCE: IESNA LM90, LM80, LM85, LM70

Lumen maintenance refers to the relative intensity of the fixture as compared to the maximum intensity when the fixture was new. Over time, the phosphorous coating on LEDs develops cracks and imperfections, which lead to diminished performance and reduced lumen output. The varying numerical designators refer to the percentage of light output at the given hours of service, as compared to the initial lumens when the fixture was new. As such, an LM70 figure refers to the number of hours of service when you can expect 70% of the initial output, whereas the LM90 figure demonstrates the number of hours of use before you can expect a 10% decrease in luminous output.



TECHNOLOGY

MAINS DIMMABLE

Mains Dimmable fixtures allow for intensity control via a dimmer. This can be a manual or digitally controlled dimmer. To reduce costs in legacy system upgrades, mains dimmable fixtures can be paired with existing dimming equipment to minimize retrofit costs. While they tend to provide less desirable dimming performance than data controlled fixtures, they can provide a significant reduction in the cost of infrastructure when migrating to LED systems, as they make use of existing centralized or local dimming equipment and controls.

Gulf Tower. ©William E Gossett.

DIMMING ON BOARD

Most LED lighting fixtures allow for a dimming on board control option. This allows the fixture to receive a data stream that dictates the intensity of the fixture as managed by internal processing. Provided that the fixture processes the data input, true 0-100% dimming is possible via a variety of control protocols. Where a full range of dimming is a concern, these types of fixtures and controls are necessary.

CONTROL AND POWER ARCHITECTURE

In a mains dimmable situation, just about any control station can be used to control any compatible dimmer to adjust the intensity of LED lighting fixtures. In a data controlled situation, digital information must be shared over a network to address each fixture. This is especially necessary where color information must be sent to the fixtures, such as variable white fixtures or RGB or RGBAW units. In a data controlled system, power to the lighting fixtures is constant so that the on board processors can manage color and intensity. Typically the power to the fixtures is switched on and off by relays while the data can be delivered in a variety of control protocols.

CONTROL PROTOCOLS

0-10v Analog

One of the oldest lighting control methods employed in architectural lighting is the 0-10v Analog system. These systems use a control voltage, generated at a control panel, to manipulate dimmers and ballasts. As the user adjusts the controls, a low voltage signal is fluctuated and distributed to dimmers and ballasts. 0-10v control is usually not ideal for directly controlling large scale LED installations due to the necessity of numerous wiring runs from a central controller to each group of fixtures. In retrofit applications, most 0-10v controls can be wired to an interface that receives the analog signals, converts them to a different protocol and passes the control out to dimming equipment or directly to LED fixtures.

DMX: Digital Multiplex

Digital Multiplex provides control for numerous groups of fixtures, dimmers, and ballasts. DMX offers 512 control channels in a "universe." Larger projects may require multiple universes, which can be controlled in unison, while the control output is wired separately. In DMX control, each fixture in the universe is programmed to respond to a control channel or block of channels. Some LED fixtures may require multiple channels to provide access to all of their features. A control channel may be used to access the master dimmer in the fixture, while additional channels will address color functions. A control channel will be required for each color LED in the fixture, as well as any onboard effects or features built into the light. Additionally some LED fixtures will require two DMX channels each for dimming and color operations. Ganging two DMX channels increases the resolution of the DMX signal to provide smoother dimming and finer control of LED lighting. The key advantage of DMX is that multiple devices can be controlled over a single control line as each corresponds only to its prescribed control channels.

DALI: Digital Addressable Lighting Interface

DALI controls have proven to be popular with facility managers. Similar to DMX, DALI systems broadcast all control commands to all fixtures, and fixtures respond to commands that are encoded with their address. Up to 64 fixtures can be controlled by a DALI controller, and multiple controllers can be linked to facilitate larger systems. DALI is compatible with a large number of dimmers and ballasts that have been designed for operation via DALI. More recently DALI has been implemented into LED drivers and fixtures. Converters are available to switch between protocols. These allow for DMX controls to access DALI equipped lighting equipment, or for DALI controls to access DMX lighting equipment, 0-10v gear and others. One of the key advantages of DALI is that it is a 2-way system. This allows for the controls to send commands to lights but also allows the lights to report status and outages back to the controls for monitoring and maintenance scheduling.

Network

Network based controls are the newest innovation in architectural lighting control, and they're quickly taking hold. The reason for their widespread adoption is that network controls build on many of the features of other control protocols while operating over familiar hardware similar to what you would find in a local area computer network. Sometimes called IP based controls because they move control information in a similar fashion to how the internet moves data, network controls offer a robust solution for large installations or those with high control throughput. As in DMX or DALI, every fixture, dimmer, or ballast has a unique address on the network. But unlike those other protocols, there is a much greater maximum device count because of the increased bandwidth capacity of network hardware. That same hardware, essentially a combination of CAT6 cable and

Nutter Center. ©Wright State University.

network switches, allows for efficient wiring that saves labor and materials costs during installation. Furthermore, the flexibility of a network based control system allows for any port on the network to become an input or output location. That makes it easy to add a temporary light, move fixtures to different locations in the building, or plug in a controller to program lighting for an event or holiday look. While many new fixtures are directly compatible with network data, others are not. In those instances, gateway devices are used to convert the network data into another protocol that is compatible with the fixture.

WANT TO LEARN MORE?

We hope this information is useful to you and your colleagues. For more information, or if you have any questions, please contact the experienced professionals at Vincent Lighting Systems to discuss your specific needs. You can reach us at **projects@vls.com** or call us at 800-922-5356 and ask to speak to a project specialist.

Big Four Pedestrian Bridge, Louisville, Kentucky

ABOUT VINCENT LIGHTING SYSTEMS

RELIABLE

Vincent Lighting Systems provides reliable entertainment and architectural lighting and rigging products that are inspected, maintained and tested for compliance with industry standards prior to delivery. Our reputation for reliability is backed with a commitment to providing on-time delivery, a personal equipment operation guarantee and after-hours project, rental and production support.

PROFESSIONAL

Every customer of Vincent Lighting Systems can count on a dedicated team of certified and degreed lighting professionals with an accumulated 500+ years of industry expertise, all fully focused on delivering the utmost professional experience.

CREDIBLE

Since 1978, the award-winning professionals at Vincent Lighting Systems have met the needs of entertainment and architectural lighting customers with the broadest range of equipment and products from more than 100 industry manufacturers. We have managed more than 10,000 projects and productions, including specialty architecture, bridges, theatres, schools, houses of worship, weddings and corporate events.