



## LED TERMINOLOGY

- Amp: The unit for measuring rate of flow of electrical current: Current (Amps) = Power (Watts)/Voltage (Volts)
- Beam Angle: The angle between the two directions opposed to each other over the beam axis for which the luminous intensity is half that of the maximum luminous intensity.
- Brightness: The extent to which an object is judged to emit more or less light. The brightness of an object can change depending on whether it is seen against a light or dark background.
- Chromaticity: The quality of a color regardless of its luminance as determined by its hue and saturation.
- Chromaticity Diagram: A horseshoe-shaped line that connects the chromaticities of the spectrum of colors. (See diagram.)
- Color Rendering or Color Rendering Index (CRI): The ability of a light source to reproduce surface colors accurately. A color rendering index is used to describe the performance of a lamp. Color rendering is rated on a scale from 1 to 100. The higher the CRI rating, the more accurately colors will be reproduced.
- Controller Card: A device that controls the output of light. Contains software components for configuring fixtures and hardware components for sending control data to fixtures.

**Coefficient of Variation (CV):** A measurement of illuminance uniformity. The standard deviation of a set of grid values divided by the average.

**Correlated Color Temperature (CCT):** This is the apparent color of the light source and is often described as “warm,” “white” or “cool.” The color temperature is defined in degrees Kelvin (°K). The lower the value, the warmer the color appearance. For example, 2700 °K has a warmer color

appearance than 4000 °K. The color temperature is used to help create the ambiance in a space and should not be confused with color rendering. If there is to be television coverage, color temperatures should not be mixed. Refer to the chart below for examples of color temperatures.

- Daylight Harvesting: Refers to systems that use daylight to offset the amount of electric lighting needed to properly light a space, in order to reduce energy consumption.
- Delivered Light: The amount of light a luminaire delivers to a surface. It is measured in foot-candles (fc) or lux. LEDs are directional and deliver a greater proportion of light to where it is wanted.
- DMX: A signal protocol for controlling dimming and color mixing.
- Driver: An electronic circuit that controls and regulates current flow through another circuit or other components in the circuit.
- Efficacy: The efficiency of a light source. Measured in lumens/watt.
- Electromagnetic Interference (EMI): Electromagnetic radiation from an external source that affects an electrical circuit. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit. These effects can range from a simple degradation of data to a total loss of data. The most common type of EMI occurs in the radio frequency (RF) range. This energy can be radiated by computer circuits, radio transmitters, fluorescent lamps, electric motors, overhead power lines, lightning, and many other sources. Device failures caused by interference — or “noise” — from electromagnetic energy are increasing due to the growing number of products that contain sensitive electronic components.
- Field Angle: The angle between the two directions opposed to each other over the beam axis for which the luminous intensity is 10% that of the maximum luminous intensity. (See diagram under beam angle.)
- Flicker: The (potentially visible) temporal variation of emitted light.
- Foot-candle (fc): A unit of light received on a plane; measured using a light meter.

- Ghosting: An effect that occurs when lighting fixtures in the off state faintly glow as a result of residual voltage in the circuit.
- Glare: Light that causes discomfort or reduces the ability to see because it comes from a source that is too bright compared with its background. Glare can be reduced by dimming the source, blocking the direct view or increasing the background level of luminance. Ephesus measures glare with a calibrated camera in a lumen sphere.
- Heat Sink: A part of the thermal system that conducts or convects heat away from sensitive components such as LEDs.
- Horizontal Illuminance: The quantity of light on a horizontal plane.
- IESNA: International Engineering Society of North America. The IESNA is the recognized technical authority on illumination, communicating information on all aspects of good lighting practice to its members, to the lighting community, and to consumers through a variety of programs, publications, and services.
- Illuminance: The intensity of light falling on a surface area, commonly called light level; expressed in foot-candles or lux. (See diagram.)
- Indirect Lighting: Lighting by distributing 90% to 100% of the emitted light upward.
- Initial Light Levels: The average light levels when the luminaires are new. Measuring initial light levels assures that you receive a system that meets your requirements.
- IP Ratings: "IP" stands for Ingress Protection. IP ratings have two numbers: the first stands for the protection against solid objects, the second for protection against liquids. For example, an IP rating of 65 tells you that the protection against solid objects is a 6 and the protection against a liquid is a 5.
- **Junction Temperature (T<sub>J</sub>):** The highest temperature of the actual semiconductor in an electronic device.
- Kelvin: Kelvin (°K) is a unit of measurement for temperature and is often used in the measure of the color temperature of light sources.

- L70 Hours: Used to describe the LED's expected light output over its stated life span. "L70" predicts when the LED reaches 70% of initial lumen output. Lumen maintenance is a prediction of the number of hours an LED will operate before it fades below a useful level of intensity. Currently, lumen maintenance reporting assumes that dropping below 70% of initial lumen output is the end of life for the emitter.
- LED: Light-emitting diode.
- LED Array: An assembly of LEDs on a circuit board. Can include optical elements and additional thermal, mechanical and electrical interfaces that are intended to connect to the load side of an LED driver.
- LED Chip: The light-producing semiconductor device that may or may not be incorporated into an LED.
- LED Driver: An electronic circuit that inputs power into a current source — a source in which current remains constant despite fluctuations in voltage. An LED driver protects LEDs from normal voltage fluctuations, overvoltages and voltage spikes.
- LED Luminaire: A complete lighting unit consisting of LED-based elements and all necessary components: driver, parts to distribute the light, and parts to position and protect the light-emitting elements and connect the unit to a circuit branch.
- Light Trespass: Spill light that is either annoying or unwanted.
- Light Loss Factor (LLF): A factor used in calculating luminance over a given period of time and under given conditions. It accounts for light loss due to temperature and voltage variations, dirt accumulation on luminaire, lamp depreciation, maintenance procedures and atmosphere conditions.
- Lumen: A unit of luminous flux; overall light output. Lumen output is a measure of the total "amount" of visible light emitted by a source. The higher the number, the more light is emitted.
- Lumen Depreciation: A reduction in output over time. Normally shown in graph form with the percentage reduction in hours. Also see L70 hours.
- Lumen Efficiency: The percentage of total lamp lumens that a luminaire or system emits, minus any blocked or wasted light.

- Lumen Maintenance: The luminous flux at a given time in the life of an LED, expressed as a percentage of the initial luminous flux.
- Lumen Maintenance Curve: A graph illustrating the predicted average light output behavior over time of a single LED or solution.
- Luminance: Quantifies the brightness of a light source or of an illuminated surface that reflects light. Luminance indicates how much luminous power will be detected by an eye looking at the surface from a particular angle of view, thus being an indicator of how bright the surface will appear.
- Luminous Flux: The measure of the perceived power of light, adjusted to reflect the varying sensitivity of the human eye to different wavelengths of light.
- Lux: The SI unit of illuminance and luminous emittance, measuring luminous flux per unit area. It is equal to one lumen per square meter.
- Maintained Foot-Candles: The average illuminance below which the light level is not supposed to fall throughout system life.
- Max to Min Uniformity Ratio: A design criteria to assure that light is distributed evenly across the entire field. A max/min uniformity ratio of 2:1 means that the brightest point is no more than double any other point.
- NEMA Type: The light distribution of a floodlight is referred to as “beam spread” and is classified by its “NEMA type.” The NEMA beam spread indicates the two edges where the light intensity photometric spreads horizontal and vertical to 10% of the maximum beam intensity.
- Obtrusive Light or Spill Light: Uncontrolled light that is directed up into the sky or beyond the boundary of a sports facility.
- Photometry: The science of the measurement of light, in terms of its perceived brightness to the human eye. Photometric studies (also sometimes referred to as “layouts” or “point by points”) are often used to simulate lighting designs for projects before they are built or renovated. This enables architects, lighting designers, and engineers to determine whether a proposed lighting setup will deliver the amount of light intended or required.

- Power Factor (PF): The measurement of the relationship between the AC source voltage and current. Power factors can range from 0 to 1.0, with 1.0 being ideal. Power factor is a measure of how efficiently electrical power is being used. The higher the power factor, the more efficient.
- Power Factor Correction: A system of inductors, capacitors or voltage converters that adjust the power factor of electronic devices toward the ideal power factor of 1.0.
- Pulse-Width Modulation (PWM): A method used by LED drivers to regulate the amount of energy to the LEDs. PWM turns LEDs on and off at a high frequency, reducing total on time to achieve a desired dimming level.
- RGB Color Model: An additive color model in which red, green, and blue light are added together in different proportions to produce a broad range of colors, including white.
- **Scotopic Vision:** The ability to see in reduced illumination.
- Solid-State Lighting: A type of lighting that uses semiconductor light-emitting diodes (LEDs), organic light-emitting diodes (OLED), or polymer light-emitting diodes (PLED) as sources of illumination rather than electrical filaments, plasma (used in arc lamps such as fluorescent lamps), or gas.
- Thermal Management: Controlling the operating temperature of the product through design. Examples include heat sinks and improved air flow.
- Thermal Resistance: A material's ability to conduct heat.
- Tilt Factor: This factor is a function of the lamp position for each fixture and directly affects the lamp performance in that specific floodlight. It is part of the nonrecoverable light loss factor.
- Tunable Color Temperature: LED fixtures that combine channels of RGB color and cool white LEDs to produce a range of color temperatures.
- Uniformity Gradient (UG): Rate of change of illuminance between adjacent (grid) values.

- Uniformity Ratio: Either the ratio of the illuminance in the brightest-lit spots to that in the dimmest areas (max/min), or of the average illuminance of the whole area to that of the dimmest spots (avg/min). The best results as far as visual acuity result when the uniformity ratio is close to one.
- Useful Life: The length of time it takes a light source to reach a certain percentage of its initial lumen output. Commonly defined as lumen maintenance thresholds. (See L70 hours.)
- Vertical Aiming Angles: The degrees below horizontal that light fixtures are aimed at the field. Angles are measured from a horizontal plane at fixture height. Critical in safe, playable lighting design.
- Vertical Illuminance: This is the quantity of light on a vertical plane.
- Volt: The electrical potential difference between oppositely charged conductors.
- Watt: The unit of power. Volts x Amps = Watts