

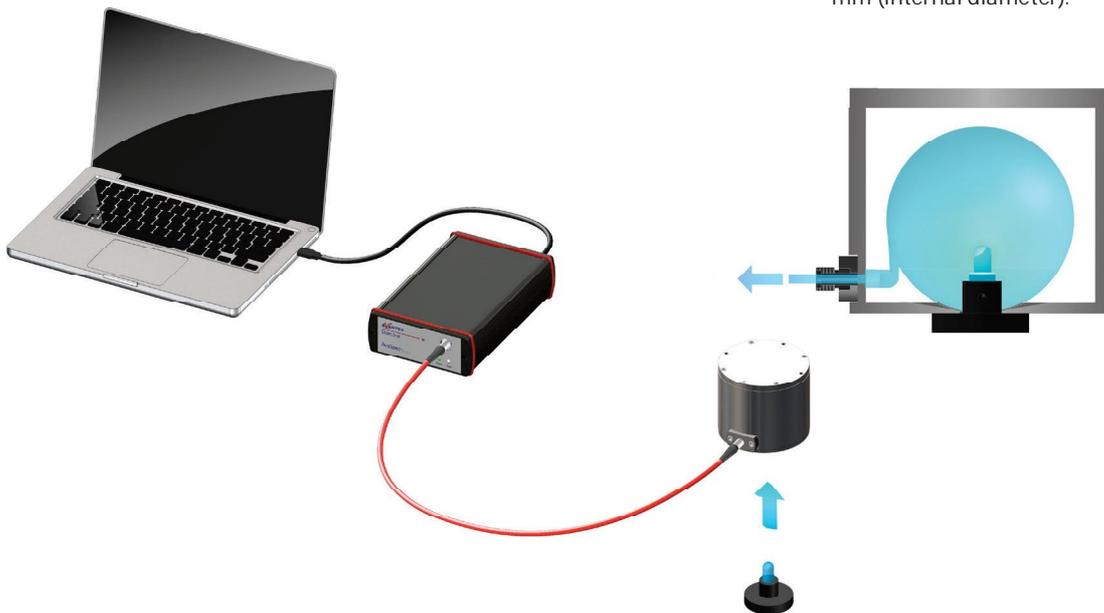
LED measurements

The measurement of LEDs presents unique application requirements for which Avantes has the appropriate instrumentation and applications experience to assist our customers in configuring a system. Avantes' many years of working with LED application has prompted us to develop a variety of system configurations that meets most LED metrology requirements. Light Emitting Diodes can be measured in a wide variety of colors and brightness. Accurate measurement of the LEDs therefore is essential. This can be done in two ways: photometry and radiometry.

Photometry relates to visible radiation alone, just as the response of the human eye. Radiometry goes beyond these limitations. In both photometry and radiometry, the LED can be characterized in emitted power or in intensity. Emitted power is all the power (flux) emitted from the LED in lumens or Watts, collected and measured without regards to the direction of the flux. The intensity is the ratio of the flux, leaving the source and propagating in the element of solid angle containing the given direction, and is expressed in candelas.

parameters and irradiance (excluding flux) a system is typically configured with the AvaSpec-ULS2048-USB2-FCPC spectrometers, a 25 or 50 μm slit and 300 line/mm grating covering the range from 360-1100 nm and provides 1.4 -2.4 nm full width half maximum (FWHM) resolution. A 2 meter fiber-optic cable (FC-UV200-2-FC-SMA) is mated to the instrument and terminated in a cosine function diffuser (CC-UV/VIS/NIR) which has 3.9 mm diameter surface area. The entire system is irradiance calibrated with an NIST source over the specified wavelength range for spectral irradiance ($\mu\text{W}/\text{cm}^2/\text{nm}$). This calibrated system can be operated using Avantes proprietary AvaSoft-IRRAD software which provides the following parameters: X, Y, Z, x, y, z, u, v, CRI, Color Temperature, Dominant Wavelength, Complementary Dominant Wavelength, FWHM, Centroid, Peak Wavelength & Purity. Additionally raw data in scope mode is displayed, as well as the X-Y chromaticity diagram. Optionally, the system can be configured with longer fiber lengths and the AvaTripod to hold the diffuser in place during measurement. The system can be controlled via Avantes dynamic linking library (DLL) interface through LabView, C#, C++ and a number of other programming environments.

For flux measurements the entire LED must be inserted into the port of an integrating sphere. Avantes offers a complete line of integrating spheres ranging from 30-200 mm (internal diameter).



For system calibrations, Avantes offers the AvaLight-HAL-CAL calibration sources which are offered in configurations that are compatible with cosine diffusers and small integrating spheres (30, 50, 80 mm). Avantes also offers two system configurations to enable the CIE Average LED Intensity (ALI) measurements which are specified in the CIE Publication No. 127. AvaSPEC-IRRAD-ILED-A and AvaSpec-IRRAD-ILED-B correspond to the condition A (316

mm measurement distance) and condition B (100 mm measurement distance) standards, respectively. The system is typically based upon the AvaSpec-ULS2048-USB2-FCPC spectrometers which are configured with a 25 or 50 μm slit and 300 line/mm grating covering the range from 360-1100 nm and provide 1.4-2.4 nm (FWHM) resolution. A fiber-optic cable (FC-UV200-2) is mated to the instrument and terminated in our AvaSphere-IRRAD-30 integrating sphere

which couples with the corresponding ILED-TUBE-A or ILED-TUBE-B. The system is irradiance calibrated with a NIST source over the specified wavelength range for spectral irradiance ($\mu\text{W}/\text{cm}^2/\text{nm}$). The ILED-TUBE-A or ILED-TUBE-B is coupled with the AvaLED-Holder-5 mm (LED holder for 5 mm/T1 $\frac{3}{4}$ LEDs) which is coupled with a current stabilized power supply.

LED light measurements



More and more countries ban incandescent lamps from being sold, hugely boosting LED sales. Avantes supplies the needed tools for photometric and radiometric measurements.

The spectrometer is irradiance calibrated to obtain absolute values.

Typical applications:

- Irradiance
- Illuminance
- Radiometric & photometric flux
- Luminous intensity
- Color coordinates

... and many more

Order information: Ava-LED

Spectrometer	AvaSpec-ULS2048-USB2 FC/PC	Grating VA (350-1000nm) 25 μm slit, DLC-UV, OSC AvaSoft-Full & AvaSoft-Irrad Factory-calibrated system for irradiance IRRAD-CAL-VIS
Fiber optics	FC-UVIR600-2-ME-1FCPC	
Included	AvaSphere-50-IRRAD AvaSphere LED adapter	

LED ILED-A/B



The widely used recommendation for LED bulb luminous intensity measurements is CIE's Publication 127. This set contains everything you need: an irradiance calibrated spectrometer, with FC/PC connector for reproduceable setups, with a fiber cable and ILED-A & ILED-B tubes.

Typical applications:

- Luminous intensity
- Radiant intensity
- Low & medium powered LEDs

... and many more

Order information: Ava-ILED-A/B

Spectrometer	AvaSpec-ULS2048-USB2 FC/PC	Grating VA (350-1000nm) 25 μm slit, DCL-UV/VIS, OSC AvaSoft-Full & AvaSoft-IRRAD IRRAD-CAL-VIS
Fiber optics	FC-UVIR600-2-ME-1FCPC	
Included	ILED-A & ILED-B tube, 5 mm LED adapter	

For the latest information,
go to www.avantes.com

