



LIGHT MEASUREMENT

PRO-LITE
TECHNOLOGY

101 USES FOR A SPECTROMETER

As the Ocean Optics channel partner specialising in light measurement, Pro-Lite is able to offer modular fibre optic spectrometer systems with the flexibility to measure the spectroradiometric, photometric & colorimetric output of light sources as well as the optical properties of materials - spectral reflectance, transmittance, absorbance and colour.

This brochure provides an overview of our spectrometers, our application-specific collection optics and the many and varied applications in which our spectrometers are used. While face painting isn't one of them - measuring the colour of paint is!

Pro-Lite provides a solution for almost any application in measuring the colour and brightness of LEDs, luminaires, lamps and displays. From a simple, inexpensive lux meter, to the world's most advanced imaging photometers, from our near-field imaging goniophotometer designed for measuring luminaires to our 3m integrating sphere spectroradiometer, we have a light measurement system that you can rely upon to give you accurate, repeatable data.

To learn more, read over, call Pro-Lite on +44 (0) 1234 436110 or visit us on the web at www.pro-lite.co.uk



*Pro-Lite is the light measurement
channel partner of Ocean Optics*





MEASURING LIGHT SOURCES

SPECTRORADIOMETRY

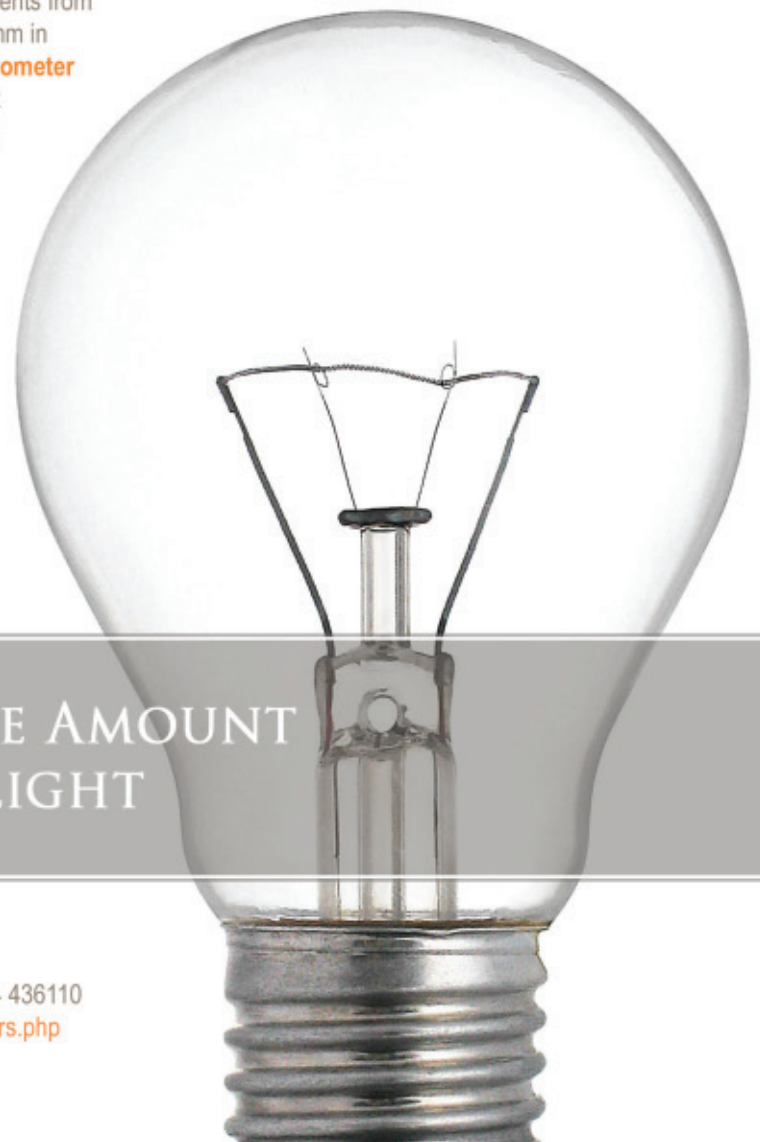
MEASUREMENTS OF THE SPECTRAL, PHOTOMETRIC & COLORIMETRIC PROPERTIES OF LIGHT SOURCES & LEDs

Using optical fibres with interchangeable collection optics and integrating spheres, you can configure - and reconfigure - your Ocean Optics spectrometer for testing the output of lamps, LEDs, optical fibres and lasers - in fact almost any light source. Depending upon the collection optics chosen, your light measurement system can be used to record spectral radiant flux (W/nm), spectral radiant intensity (W/sr.nm) and spectral irradiance (W/m².nm). SpectraSuite software then calculates the derived photometric and colorimetric values, including total luminous flux (lumens), luminous intensity (candelas), illuminance (lux), chromaticity coordinates, correlated colour temperature (CCT, Kelvin), dominant wavelength/purity and colour rendering (Ra).

A spectroradiometer functions in a similar way to a photometer or colorimeter but instead of optically filtering the spectral response of a photodetector to match that of the human eye, measurements are performed spectrally and the photometric and colorimetric properties are computed with reference to the CIE standard observer function for photopic vision and the CIE tristimulus colour matching functions. For narrow-band sources such as LEDs, discharge lamps, CFLs and LCDs, a spectroradiometric measurement yields much more accurate results. In addition, spectral measurements are the only way to determine the colour rendering properties of a light source.

Spectrometer options span the entire UV-VIS-NIR spectrum, from 200-2550nm, with the latest **USB2000+XR Extended-Range Spectrometer** providing measurements from 200-1050nm with a spectral resolution of 2nm in a single instrument. The new **Torus Spectrometer** features a concave holographic grating that results in reduced stray light and increased sensitivity in the 360-825nm range.

The **JAZ Light Meter** is based upon a spectrometer, but unlike standard instruments, the JAZ is fully self-contained and does not need to be tethered to a PC. With on-board photometric processing, plus battery pack, data storage and an integrated display, the JAZ Light Meter is a truly portable spectroradiometer for measuring the spectral irradiance and illuminance of light sources.



MEASURING THE AMOUNT & COLOUR OF LIGHT

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MEASURING REFLECTANCE & TRANSMITTANCE

SPECTROPHOTOMETRY

MEASUREMENTS OF THE SPECTRAL REFLECTANCE, TRANSMITTANCE & ABSORBANCE OF MATERIALS

Measuring optical properties tells us useful information about the composition or performance of a material. An Ocean Optics spectrometer system is available with a wide range of modular, application-specific collection optics and sample handling accessories and can form the basis of a versatile spectrophotometric system, with the ability to measure reflectance, transmittance and absorbance. Sampling optics provide for directional and diffuse reflectance/transmittance measurements, while companion light sources give sample illumination from 215-2000nm.

Reflectance is the proportion of light which reflects from a surface. A spectrophotometer determines the reflectance as a function of wavelength. The reflectance from an object is generally categorised as being either specular or diffuse, or some combination of the two. A material which exhibits a high proportion of specular reflectance will appear "glossy", while a material which scatters the light equally in all directions will appear matte (diffuse).

Transmittance is the proportion of light which transmits through a material. A spectrophotometer determines the transmittance as a function of wavelength. The transmittance through an object is of two types: regular (analogous to specular reflectance) and diffuse.

Absorption is that light which when incident upon a material is neither reflected nor transmitted. Absorption is the logarithm (base 10) of the reciprocal of the transmittance. For example, if the transmittance of a material is 10%, its absorbance is 1.0, while an absorbance of 0.3 corresponds to a transmittance of 0.5 (50%). Beer's Law describes the relationship between the absorption and the optical path length that light experiences upon transmission through a material. Beer's Law describes how the absorption of light through a material varies linearly with the optical path length. Measured spectrally, the absorption or reflectance of light through or from a material defines its colour.

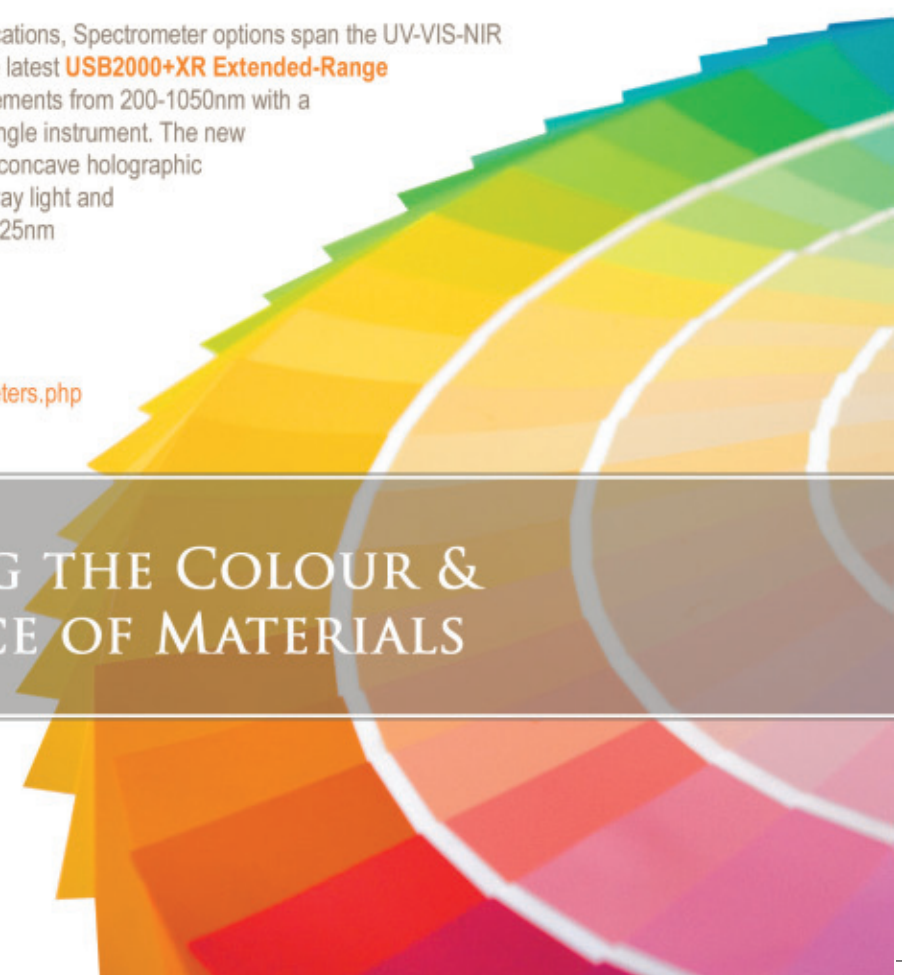
As with spectroradiometric applications, Spectrometer options span the UV-VIS-NIR spectrum from 200-2550nm. The latest **USB2000+XR Extended-Range Spectrometer** provides measurements from 200-1050nm with a spectral resolution of 2nm in a single instrument. The new **Torus Spectrometer** features a concave holographic grating that results in reduced stray light and increased sensitivity in the 360-825nm range.

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MEASURING THE COLOUR & APPEARANCE OF MATERIALS

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SPECTROMETERS

OUR MOST POPULAR SPECTROMETERS FOR SPECTRORADIOMETRIC & SPECTROPHOTOMETRIC MEASUREMENTS

Choose from a range of CCD spectrometers for the 200 to 1100nm range. Unlike scanning monochromators, all Ocean Optics models provide near-instantaneous spectral acquisition and the convenience of optical fibre inputs.

USB2000+

The USB series balances cost against performance. Popular configurations cover 200-850nm or 350-1000nm with ~1.5nm spectral resolution.

USB2000+XR

The new XR extended range version of the popular USB2000+ provides measurements from 200-1050nm with ~2nm resolution in a single spectrometer.

TORUS

The new Torus spectrometer features a concave holographic diffraction grating which results in reduced stray light, increased sensitivity in the 360-825nm range and higher temperature stability. This makes it ideal for UV radiometry & LED colorimetry.

JAZ-ULM-200

The JAZ "Light Meter" is based upon a spectrometer, but unlike standard instruments, the JAZ is fully self-contained and does not need to be tethered to a PC. With on-board photometric processing, plus battery pack, data storage and an integrated display, the JAZ Light Meter is a truly portable spectroradiometer for measuring the spectral irradiance and illuminance of light sources.

HR2000+

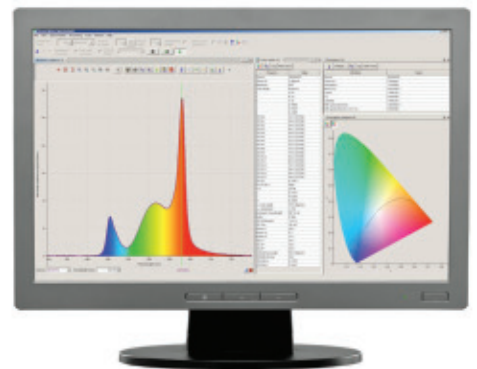
The high resolution HR spectrometer provides a spectral resolution as high as 0.035nm (FWHM) which makes it well suited to laser spectroscopy.

For infrared spectro-radiometry, the **NIRQuest** spectrometer employs a 256 or 512 element InGaAs detector for measurements in the 900-2550nm wavelength range.

SpectraSuite Software

The heart of your light measurement system is SpectraSuite software. SpectraSuite is a modular, Java-based spectroscopy software platform that operates on Windows, Macintosh and Linux operating systems. Together with an Ocean Optics spectrometer, it provides for absolute spectral irradiance processing and computation of derived radiometric, photometric and colorimetric parameters. With appropriate collection optics, SpectraSuite can also report reflectance, transmittance and absorbance.

OmniDriver Developers Software is available to assist with programming your own code.



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COLLECTION OPTICS

COLLECTION OPTICS FOR SPECTRORADIOMETRIC, PHOTOMETRIC & COLORIMETRIC MEASUREMENTS OF LIGHT SOURCES & LEDs

The power of an Ocean Optics spectrometer is its versatility. A range of interchangeable collection optics allows you to configure - and reconfigure your light measurement system for numerous applications.

Irradiance Receivers

An irradiance receiver is used to measure spectral irradiance ($W/m^2.nm$), spectral radiant intensity ($W/sr.nm$), illuminance (lux) and luminous intensity (candelas) and is designed to impart a cosine angular response to the input of a spectrometer or optical fibre. Accurate irradiance measurements must correctly scale the reduced irradiance of rays received at high angles of incidence.

Our economical cosine receiver is the **CC-3 Transmission Diffuser**. This simply screws onto the SMA connector of an optical fibre input to a spectrometer. A **CC-3-DA Direct Attach Diffuser** fits at the spectrometer input.

The **Labsphere E-1000 Integrating Sphere Receiver** features a near perfect cosine response for more accurate measurements. For average (near-field) intensity measurements of single LEDs in accordance with CIE 127, the **I-1000** and **I-2000** intensity heads are available.

Integrating Spheres

An integrating sphere provides the means of capturing the total output of a light source and for measuring the total radiant flux (W/nm) and luminous flux (lumens). Integrating spheres can be used to measure the total (4π) flux with internally mounted sources, or the forward (2π) flux from samples placed at a port on the sphere wall.

For single LED emitters, the **FOIS-1 Integrating Sphere** features a 9.5mm aperture for 2π (forward) flux measurements. The FOIS-1 connects to the spectrometer via optical fibre.

For measuring larger light sources, the **Labsphere LMS-Series Interior Access Integrating Spheres** are available in sizes from 25cm to 3m diameter. All LMS spheres provide for both 2π and 4π flux measurements, while spheres of 50cm and above allow the sample to be placed inside the sphere for 4π flux measurements in both a base-up and base-down orientation.

To study the variation in LED flux and colour with current, voltage and temperature, the **Labsphere TOCS-Series of Integrating Sphere Spectroradiometers** is available.

Calibration Options

For absolute spectroradiometric measurements, the spectral responsivity of your spectrometer with collection optics must be calibrated. A choice of factory calibration or calibration light sources is offered.

The **SPEC-CAL** factory irradiance calibration service (300-1050nm) is available for spectrometers equipped with the CC-3 & CC-3-DA cosine diffusers. The **SPEC-CAL-UV** service covers 215-1050nm, while the **SPEC-CAL-NIR** service provides for calibrations in the 900-2400nm band. If you prefer to perform your own calibrations, order the **LS-1-CAL** or the **HL-2000-CAL** (300-1050nm) calibration lamps. The **DH-2000-CAL** combines a deuterium and a tungsten lamp for extended range UV calibrations (215-1050nm).

The E-1000 irradiance & I-1000/2000 intensity heads are user-calibrated with the **IES-1000 Light Source**.

The FOIS-1 integrating sphere is calibrated for 2π flux with the **LS-1-CAL-INT**, while the larger Labsphere LMS-series spheres are calibrated for 4π flux with an **SCL-Series Spectral Flux Standard Lamp** or for 2π flux with the **FFS Spectral Forward Flux Standard**.



E-1000 Irradiance Receiver



LMS-100 25cm Integrating Sphere

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COLLECTION OPTICS

COLLECTION OPTICS FOR MEASURING REFLECTANCE, TRANSMITTANCE & ABSORBANCE

A wide range of application-specific collection optics, sample handling accessories and illumination light sources form the basis of versatile spectrophotometric systems with the ability to measure reflectance, transmittance and absorbance.

Reflectance Measurements

For measuring relative reflectance, the **R-series Reflectance Probes** surround a central illumination fibre with 6 collection fibres. These probes are suitable for directional reflectance and fluorescence measurements.

For 0/45 directional reflectance measurements, the **RPH-2 Probe Holder** is equipped with SMA fibre optic adaptors which provide for sample illumination at 90 deg & collection of reflected light at 45 deg.

The **ISP-REF Integrating Sphere** features an internal lamp for diffuse/diffuse reflectance measurements. When coupled to an external light source, the ISP-REF illuminates a sample at 8 deg and collects total hemispherical reflectance. It allows specular included and specular excluded measurements to be performed.

The **ISP-R Series Integrating Spheres** provide directional/diffuse reflectance measure-

ments. With diameters of 30, 50 & 90mm, the ISP-R spheres employ an external light source to illuminate at 8 deg to the surface normal and collect the total hemispherical reflected light. Gloss trap versions allow specular included and specular excluded measurements to be performed.

The **Labsphere RTC-060-SF** is a 15cm integrating sphere with centre-mount sample holder that provides for measurements of total hemispherical reflectance as a function of angle, as well as total, diffuse & specular reflectance and transmittance. The RTC-060-SF is used with a collimated illuminator such as the Labsphere KI-120.

Calibration of your reflectance spectrophotometric system is performed using a reflectance standard. The **STAN-SSH** is a front surface mirror that provides certified specular reflectance in the 200-2500nm range. **Labsphere Spectralon Diffuse Reflectance Standards** provide stable, diffuse reflectance in the 250-2500nm range and are used to calibrate integrating sphere systems.

Transmittance/Absorbance Measurements

For measuring the

transmittance of filters and non-scattering materials, the **74-ACH Adjustable Collimating Lens Holder** is available. It is a versatile assembly for mounting two 74-AC lenses at multiple positions for transmission measurements of large or thick samples not easily accommodated by sampling optics such as the **FHS-UV In-Line Filter Holder**.

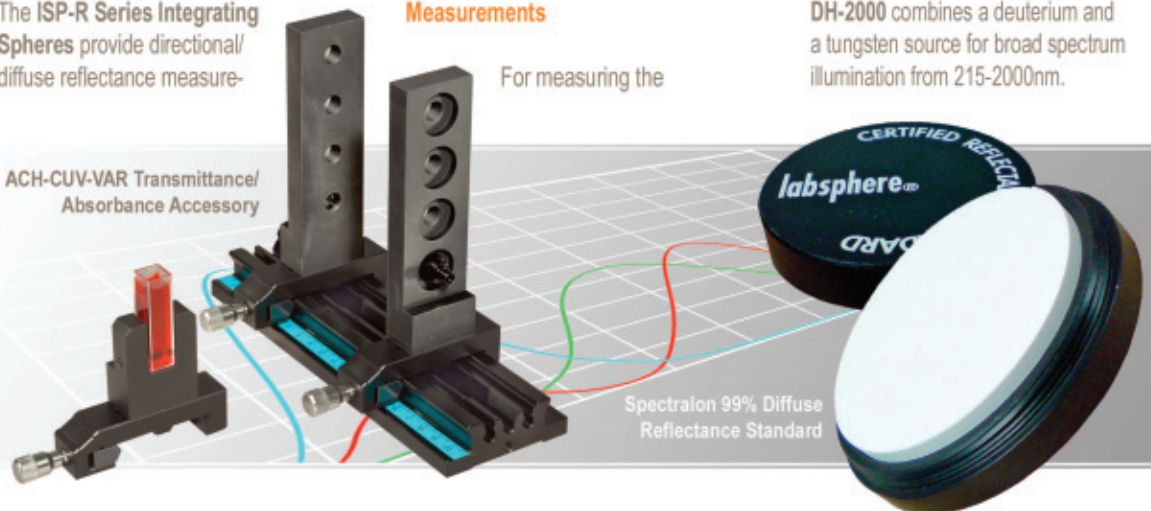
The **ACH-CUV-VAR Adjustable Collimating Lens and Cuvette Holder** combines the functionality of the 74-ACH with a 1cm path length cuvette holder.

The **CUV-UV Cuvette Holder** for 1-cm path length cuvettes couples via optical fibers to a spectrometer and a light source for absolute absorbance measurements of aqueous solutions.

Illumination Light Sources

Your spectrophotometric system is completed with a suitable fibre-optic illumination light source. The **LS-1** is a low power tungsten lamp for illumination in the 360-2000nm band. The **HL-2000** is a higher power tungsten lamp with shutter, filter holder and variable attenuator options. The **D-2000** is a deuterium source for use from 215-400nm, while the **DH-2000** combines a deuterium and a tungsten source for broad spectrum illumination from 215-2000nm.

ACH-CUV-VAR Transmittance/
Absorbance Accessory



Spectralon 99% Diffuse
Reflectance Standard

PRO-LITE
TECHNOLOGY

Pro-Lite Technology Ltd
Innovation Centre
University Way
Cranfield
Bedfordshire
MK43 0BT
United Kingdom

Tel: +44 (0) 1234 436110
info@pro-lite.co.uk
www.pro-lite.co.uk

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