LIGHT MEASUREMENT SOLUTIONS for General and Specialized Lighting
Modern lighting can be designed to not only support people’s visual performance requirements, but also to support emotional and biological needs. This is all possible in conjunction with high energy efficiency. The applications of artificial lighting are diverse and wide-ranging. Solid-state lighting also promotes intelligent concepts in existing applications and opens up many new applications.

Solid-state lighting products and installations require light meters that meet the increasing demands of their development, manufacture, qualification and use. The measurement tasks now required go far beyond those of the incandescent lamp age.

Gigahertz-Optik develops, produces and calibrates light measuring devices for all contemporary general lighting products as well as for many specialist lighting applications. This brochure gives an overview of the diverse range of measurement solutions that are possible with the products from Gigahertz-Optik.
The near limitless color possibilities of LED lighting create many opportunities for lighting designers and requires a range of suitable color quality metrics. Color temperature, CCT, is a widely used ‘light quality’ indicator even though different color light sources can have the same CCT. The CIE general color rendering index, CRI Ra, is also widely specified for lighting products. The limitations of the CIE CRI system have been well investigated with respect to LEDs and alternatives such as the IES TM-30-18 system are also widely used. Spectral measurements are the basis for all such metrics and hence our spectral light meters are recommended for all solid-state lighting (SSL) applications.

**Solutions**
- MSC15 Spectral Light Meter
- BTS256-EF Spectral Light & Flicker Meter
- CSS-45 Spectral Sensor / CSS-D Display
- X1-1 / VL-370x Illuminance Meter
- VL-3701 Precision photometric match
- VL-3705 Scotopic illuminance
- VL-3707 Low level photometric
- Eliminates spectral mismatch errors
- Full colorimetric data, including CRI Ra
- Intuitive touch screen operation
- Range <100 μlx to > 80,000 lx
- Up to 36 detector channels
- 800 to 1000 nm detector

---

**Emergency and security lighting**

While spectral light meters are generally recommended for most solid state light applications, broadband light meters (i.e. filter and photodetector based photometers and radiometers) offer some advantages including very fast measurements, high sensitivity, additional wavelength ranges and the ability to configure multiple detector based systems. For example, emergency lighting standards (e.g. DIN EN 1838 and ISO 30061) require measurement resolution in the μlx range. Some security lights incorporate NIR LEDs so require irradiance measurements in the 800 – 1000nm range.

**Solutions**
- X1-1 / VL-370x Illuminance Meter
- MSC15 Spectral Light Meter
- VL-3701 Precision photometric match
- VL-3705 Scotopic illuminance
- VL-3707 Low level photometric
- Eliminates spectral mismatch errors
- Full colorimetric data, including CRI Ra
- Intuitive touch screen operation
- Range <100 μlx to > 80,000 lx
- Up to 36 detector channels
- 800 to 1000 nm detector

---

**Illuminance**

Illuminance is a measure of the total luminous flux incident on a surface per unit area and is measured in terms of lux. It is fundamentally important when assessing the quality of lighting. CIE 231:2019 “CIE Classification System of Illuminance and Luminance Meters” defines an extensive set of quality indices of which the two most important for solid state lighting are Spectral mismatch, f1’ and Cosine error, f2. Spectral mismatch arises from the non-perfect v(λ) response of filter based illuminance meters and is usually the most significant error source when such lux meters are used to measure LEDs. Spectral light meters largely eliminate this inherent error of broadband light meters and are therefore generally recommended for solid state lighting applications. A good cosine response is most important for measuring extended light sources as found in most room and area lighting situations.

**Solutions**
- VL-370x Illuminance Meter
- P-9802 Multi-Channel Light Meter
- RW-3704 NIR irradiance
- Range <100 μlx to > 80,000 lx
- Up to 36 detector channels
- 800 to 1000 nm detector

---

**Color**

The CIE 1931 Chromaticity diagram

---

**Emergency and security lighting**

While spectral light meters are generally recommended for most solid state light applications, broadband light meters (i.e. filter and photodetector based photometers and radiometers) offer some advantages including very fast measurements, high sensitivity, additional wavelength ranges and the ability to configure multiple detector based systems. For example, emergency lighting standards (e.g. DIN EN 1838 and ISO 30061) require measurement resolution in the μlx range. Some security lights incorporate NIR LEDs so require irradiance measurements in the 800 – 1000nm range.

**Solutions**
- X1-1 / VL-370x Illuminance Meter
- MSC15 Spectral Light Meter
- VL-3701 Precision photometric match
- VL-3705 Scotopic illuminance
- VL-3707 Low level photometric
- Eliminates spectral mismatch errors
- Full colorimetric data, including CRI Ra
- Intuitive touch screen operation
- Range <100 μlx to > 80,000 lx
- Up to 36 detector channels
- 800 to 1000 nm detector

---

**Illuminance**

Illuminance is a measure of the total luminous flux incident on a surface per unit area and is measured in terms of lux. It is fundamentally important when assessing the quality of lighting. CIE 231:2019 “CIE Classification System of Illuminance and Luminance Meters” defines an extensive set of quality indices of which the two most important for solid state lighting are Spectral mismatch, f1’ and Cosine error, f2. Spectral mismatch arises from the non-perfect v(λ) response of filter based illuminance meters and is usually the most significant error source when such lux meters are used to measure LEDs. Spectral light meters largely eliminate this inherent error of broadband light meters and are therefore generally recommended for solid state lighting applications. A good cosine response is most important for measuring extended light sources as found in most room and area lighting situations.

**Solutions**
- VL-370x Illuminance Meter
- P-9802 Multi-Channel Light Meter
- RW-3704 NIR irradiance
- Range <100 μlx to > 80,000 lx
- Up to 36 detector channels
- 800 to 1000 nm detector
HEALTH AND WELLBEING

Flicker

The detrimental health effects of light flicker such as triggering photosensitive epilepsy and stroboscopic effects are well known. Flicker is not an intrinsic characteristic of LEDs but a result of the drive and control circuitry employed. Therefore, quality lighting products and installations should be assessed for flicker in addition to photometric and colorimetric properties.

The variation in light output over time from a light source can have both visual and non-visual detrimental effects on the observer, collectively referred to as ‘temporal Light Artefacts’ (TLAs).

Visually perceptible TLAs include flicker, stroboscopic effects and phantom array effects. Non-visual TLAs are reported to have various physiological and psychological effects such as migraines, epileptic seizures, autistc behaviour, vertigo, etc. Latest regulations and standards require greater assessment of TLAs than can be provided by simple metrics such as flicker index.

The European ecodesign Regulation (EU) 2019/2020 imposes strict requirements for flicker and stroboscopic effect. The metric used for flicker is ‘PstLM’, short-term flicker severity, and the metric used for stroboscopic effect is ‘SVM’, stroboscopic visibility measure. The limits in this new EU directive are set as $\text{PstLM} < 1.0$ and $\text{SVM} < 0.4$.

Contemporary scientific knowledge combined with the spectral flexibility of LEDs offers many possibilities to improve human health and wellbeing through lighting installations. Light is one of the primary drivers of our circadian rhythm, our ‘internal body clock’. Assessing the effectiveness of circadian lighting systems requires the measurement of melanopic illuminance, a standard feature of our spectral light meters.

Human Centric Lighting

The CIE publication 5026:2018 “System for Metrology of Optical Radiation for ipRGC-influenced responses to light” provides metrics to characterize the non-visual stimulus of light. Emerging standards, such as the “WELL Building Standard”, give recommendations for non-visual requirements of lighting. The melanopic stimulus metric, based on the intrinsically photosensitive retinal ganglion cells (ipRGC), together with the spectral composition of the lighting environment, are fundamental to understanding this field.

Solutions

MSC15 Spectral Light Meter

- Comprehensive flicker, photometric and colorimetric measurements
- Ecodesign testing for PstLM flicker and SVM stroboscopic metrics.

BTS256-EF Spectral Light and Flicker Meter

- PLL-1701 Fast transimpedance amplifier
- LPS-CH-500 Waveform generator
- PstLM immunity measurements according to IEC TR 61547-1:2017.
- Power line disturbance simulations and programmable output impedance.
- Compliance tests against IEC 61000-4-13/-14/-28.
- Full CIE 5026:2018 metrics
- Flicker measurement

CSS-45 Remote Spectroradiometer Sensor / CSS-D Display

- Dual sensor head configurations
- Simultaneous horizontal and vertical illuminance
- WELL Building standard performance verification

BTS256-EF Spectral Light and Flicker Meter

- Comprehensive flicker, photometric and colorimetric measurements
- NEMA 77-2017 and IES TLA LM compliant
- Low-cost spectral light meter
- Melanopic irradiance
- Equivalent melanopic lux
- Melanopic daylight equivalent illuminance

CSS-45 Remote Spectroradiometer Sensor / CSS-D Display

- Dual sensor head configurations
- Simultaneous horizontal and vertical illuminance
- WELL Building standard performance verification

BTS256-EF Spectral Light and Flicker Meter

- PLL-1701 Fast transimpedance amplifier
- LPS-CH-500 Waveform generator
- PstLM immunity measurements according to IEC TR 61547-1:2017.
- Power line disturbance simulations and programmable output impedance.
- Compliance tests against IEC 61000-4-13/-14/-28.
- Full CIE 5026:2018 metrics
- Flicker measurement
HORTICULTURAL LIGHTING

LED Grow Lights

The wavelength selectability and energy efficiency of LEDs make them well suited as artificial grow lights in indoor vertical farms as well as for use as supplementary lighting in greenhouses. The intensity and spectral composition of light can be used to control a plant’s growth rate, shape and flowering. Our spectral light meters allow researchers and growers to develop, optimize and monitor the lighting recipes employed thereby offering significant advantages over traditional quantum PAR sensors.

Photosynthetically Active Radiation (PAR), μmol/m²/s: measurement of the total number of photons within PAR wavelength range that reach a surface each second measured over a one square meter area. Analogous to ‘lumens’ for visible light.

Day Light Integral (DLI), mol/m²/d: cumulative measurement of the total number of photons within PAR wavelength range that reach a surface during 24 hour period, measured over a one square meter area.

Solutions

BTS256-EF Spectral Light and Flicker Meter

- Full photometric and colorimetric capabilities
- Assessment of light flicker and stroboscopic effects
- Human Centric Lighting metrics
- Data logging

MSC15 Spectral Light Meter

- Eliminates spectral mismatch errors
- Full colorimetric data, including CRI Ra
- Intuitive touch screen operation

Light Pollution

Light pollution of the night sky resulting from the ever increasing use of artificial lighting is impacting both wildlife species and ecosystems as well as having possible detrimental effects on humans. Research requires the accurate measurement of low level illuminances.

Solutions

VL-3707 low level illuminance detector with P-9710 Multi-functional light meter

- Very low light level photometer with wide dynamic range down to < 0.1mlx
- Precision photometric match and cosine response for accurate measurement of the night sky and all artificial lighting types.

Indoor Work Places

The European standard, EN 12464-1, defines lighting requirements for indoor work areas. It specifies measurement criteria based on the intended use of the lighting including the minimum required average illuminance per task (referred to as “maintained illuminance”) and the minimum required color rendering (specified as a minimum CIE Ra value).

The spectral distribution of SSL can be very different to that of traditional lighting technologies resulting in potentially significant errors in illuminance measurements made with traditional lux meters.

Color rendering index requires the measurement of the spectral power distribution of the light.

Therefore, both measurement requirements are best satisfied by light meters with full spectral measurement capability.

Solutions

BTS256-EF Spectral Light and Flicker Meter

- Full photometric and colorimetric capabilities
- Assessment of light flicker and stroboscopic effects
- Human Centric Lighting metrics
- Data logging

MSC15 Spectral Light Meter

- Eliminates spectral mismatch errors
- Full colorimetric data, including CRI Ra
- Intuitive touch screen operation

LED Grow Lights

The wavelength selectability and energy efficiency of LEDs make them well suited as artificial grow lights in indoor vertical farms as well as for use as supplementary lighting in greenhouses. The intensity and spectral composition of light can be used to control a plant’s growth rate, shape and flowering. Our spectral light meters allow researchers and growers to develop, optimize and monitor the lighting recipes’ employed thereby offering significant advantages over traditional quantum PAR sensors.

Photosynthetically Active Radiation (PAR), μmol/m²/s: measurement of the total number of photons within PAR wavelength range that reach a surface each second measured over a one square meter area. Analogous to ‘lumens’ for visible light.

Day Light Integral (DLI), mol/m²/d: cumulative measurement of the total number of photons within PAR wavelength range that reach a surface during 24 hour period, measured over a one square meter area.

Solutions

BTS256-EF Spectral Light and Flicker Meter

- Full photometric and colorimetric capabilities
- Assessment of light flicker and stroboscopic effects
- Human Centric Lighting metrics
- Data logging

MSC15 Spectral Light Meter

- Eliminates spectral mismatch errors
- Full colorimetric data, including CRI Ra
- Intuitive touch screen operation

Light Pollution

Light pollution of the night sky resulting from the ever increasing use of artificial lighting is impacting both wildlife species and ecosystems as well as having possible detrimental effects on humans. Research requires the accurate measurement of low level illuminances.

Solutions

VL-3707 low level illuminance detector with P-9710 Multi-functional light meter

- Very low light level photometer with wide dynamic range down to < 0.1mlx
- Precision photometric match and cosine response for accurate measurement of the night sky and all artificial lighting types.
LED MEASUREMENT

LED / SSL Testing

The quality of LED / Solid State Lighting products supplied worldwide varies from excellent to very poor. Accurate performance claims require appropriately configured systems incorporating integrating spheres, goniometers and intensity adapters. Latest standards such as CIE S 025 should be adhered to. Traceable calibration of equipment, supplied as standard with all our products, is essential.

LED Binning

Despite the most sophisticated manufacturing technologies employed by the semiconductor industry, light output and color temperature varies from chip to chip. Therefore, binning is employed to maximise yields and to categorise products. Suitable spectroradiometers, exemplified by the BTS2048 series, must offer high speed and high precision measurement of flux and color as well as versatile interfaces for incorporation into wafer probing systems.

The optical parameters that are required to be measured in the development and production processes of SSL include:

- Luminous flux and chromaticity including CCT of the LED
- Luminous flux and chromaticity including CCT of the LEDs assembled on PCBs
- Luminous flux and chromaticity including CCT of the LED with optics
- Luminous intensity
- Luminous intensity spatial distribution

These photometric and colorimetric measures require a selection of input optics configured with a suitably calibrated spectroradiometer. With the BTS256-LED Plus Concept Gigahertz-Optik GmbH offers an affordable spectroradiometer with accessories for all of the above listed measurement tasks.

The quality of LED / Solid State Lighting products supplied worldwide varies from excellent to very poor. Accurate performance claims require appropriately configured systems incorporating integrating spheres, goniometers and intensity adapters. Latest standards such as CIE S 025 should be adhered to. Traceable calibration of equipment, supplied as standard with all our products, is essential.

Solutions

- Luminous flux - BTS256-LED for onboard LEDs
- Illuminance - BTS256-LED-DA diffuser window
- Luminous intensity – BTS256-LED-IB CIE 127 B
- Luminous flux – ISD-xx external integrating spheres
- Intensity distribution - GB-GD-360-R40-2 goniometer
- Compact, fast, high precision
- Use with ISD-xx integrating spheres
- Optional fibre optic coupling
- UV and NIR variants
- 15 cm to 100 cm diameter spheres
- For 2-Pi and 4-Pi measurements
- Bench / floor standing
- High speed, wide dynamic range
- Time-synchronized, pulsed measurements as per CIE S025 and DIN 5032-9
- Direct mount to integrating spheres
- Fibre coupling option
- Averaged LED intensity as per CIE 127 B
- Monolithic module for system integration
- Compact internal integrating sphere ensures uniform active area

BTS2048-VL Spectroradiometer

- ISD-15 / ISD-25 Integrating spheres
- Spectroradiometer

CP-ILED-B-1S-1.0-HL CIE 127 B

Average intensity

ISD-xx Integrating spheres

BTS256-LED Plus Concept

BTS2048-Series Spectroradiometers

LED / SSL Testing

The quality of LED / Solid State Lighting products supplied worldwide varies from excellent to very poor. Accurate performance claims require appropriately configured systems incorporating integrating spheres, goniometers and intensity adapters. Latest standards such as CIE S 025 should be adhered to. Traceable calibration of equipment, supplied as standard with all our products, is essential.

Solutions

- Luminous flux - BTS256-LED for onboard LEDs
- Illuminance - BTS256-LED-DA diffuser window
- Luminous intensity – BTS256-LED-IB CIE 127 B
- Luminous flux – ISD-xx external integrating spheres
- Intensity distribution - GB-GD-360-R40-2 goniometer
- Compact, fast, high precision
- Use with ISD-xx integrating spheres
- Optional fibre optic coupling
- UV and NIR variants
- 15 cm to 100 cm diameter spheres
- For 2-Pi and 4-Pi measurements
- Bench / floor standing
- High speed, wide dynamic range
- Time-synchronized, pulsed measurements as per CIE S025 and DIN 5032-9
- Direct mount to integrating spheres
- Fibre coupling option
- Averaged LED intensity as per CIE 127 B
- Monolithic module for system integration
- Compact internal integrating sphere ensures uniform active area

BTS2048-VL Spectroradiometer

- ISD-15 / ISD-25 Integrating spheres
- Spectroradiometer

CP-ILED-B-1S-1.0-HL CIE 127 B

Average intensity
Board mounted LEDs

The particular current drive conditions as well as the thermal design of the LED carrier board and associated heatsink can significantly influence the optical performance of any assembled LED module or product. Typically, the end use operating parameters differ significantly from the current pulse operation and stable junction temperature of 25°C used in the original LED binning process. Therefore, it is frequently necessary to test individual LED performance in-situ. The two possible measures of the light intensity of assembled LEDs are luminous flux (lm) and luminous intensity (cd).

Temperature effect on LED performance

Good thermal design of LED light sources and luminaires is essential to ensure optimum LED performance with respect to light output and lifetime. LEDs do not radiate significant amounts of heat but within the LED’s semiconductor junction heat is generated which must be dissipated by convection and conduction. The internal quantum efficiency of LEDs decreases as the junction temperature increases. Junction temperature increases as the current through it is increased. Therefore, the operating junction temperature is determined by the drive current, ambient temperature and the efficiency of the heatsink design.

Solutions

BTS256-LED Tester

- Easy in-situ LED measurements

BTS256-LED Concept

- Accessories to extend measurement capabilities:
  - Illuminance - BTS256-LED-DA diffuser window
  - Luminous intensity - BTS256-LED-II
  - CIE 127 B averaged LED intensity
  - Luminous flux - ISD-xx external integrating spheres
  - Illuminance distribution - GB-GD-360-R40-2 goniometer

BTS256-LED Plus Concept

- Automated test routines
- Fast temperature control
- High speed precision spectro-radiometer
- Motorized integrating sphere positioning
- Pulsed and CW current drive interchangeable LED mounting adapters

The BTS256-LED tester incorporates an integrating sphere in conjunction with its BiTecSensor technology enabling the direct measurement of the luminous flux, spectral power distribution, CCT and color rendering (CIE CRI and IES TM-30-18) of in-situ LEDs. The cone-shaped measuring aperture of the integrating sphere is simply positioned over the assembled LED for measurement.

The TP121-TH LED testing system provides fully automated testing routines for SMD and on-board LED devices. The system’s photometric, colorimetric, thermal and electrical measurement parameters all conform to the latest norms and regulations including CIE S 025, IES LM-79-08, and DIN 5032 Part 9.
Blue Light Hazard

Optical radiation is capable of causing damage to our skin, the front surface of our eyes and our retinas. Currently, Blue Light Hazard in the 300-700nm region is of primary interest for LED lighting but UV Hazard may become more significant as such technologies develop. These parameters require specialist measurement devices with specific spectral weighting functions and geometrical properties.

For general lighting service products IEC TR 62778 “Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires” is most relevant. The European Directive 2006/25/EC lays down minimum requirements for the protection of the health and safety of workers from the risks related to artificial optical radiation. Hazards relating to skin and the front surface of the eye require the measurement of irradiance whereas hazards to the eye itself require the measurement of radiance. EN 62471:2008 considers hazards with respect to exposure over a period of up to eight hours:

- Spectral weighting factor applied

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Wavelength Range (nm)</th>
<th>Bioeffect</th>
<th>Eye</th>
<th>Skin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinic UV</td>
<td>200-400†</td>
<td>Cornea - Photokeratitis</td>
<td>Erythema</td>
<td></td>
</tr>
<tr>
<td>Near UV</td>
<td>315-400</td>
<td>Lens – Cataractogenesis</td>
<td>Conjunctivitis</td>
<td></td>
</tr>
<tr>
<td>Blue Light</td>
<td>380-700†</td>
<td>Retina - Photoretinitis</td>
<td>Corneal burn</td>
<td></td>
</tr>
<tr>
<td>Retinal Thermal</td>
<td>380-3800†</td>
<td>Retina - Retinal burn</td>
<td>Cataractogenesis</td>
<td></td>
</tr>
<tr>
<td>IR Radiation/Eye</td>
<td>760-3000</td>
<td>Cornea - Corneal burn</td>
<td>Photokeratitis</td>
<td></td>
</tr>
<tr>
<td>Thermal Skin</td>
<td>380-3000</td>
<td>Skin burn</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† Spectral weighting factor applied

Solutions

- X1-3 Light Hazard Meter
  - Ideal for workplace safety checks in accordance with 2006/25/EC and DIN EN 14255-1
  - XD-45-HB blue light hazard detector
  - XD-45-HUV hazard detector for UV actinic and UV-A radiometric irradiance

- BTS2048-VL-TEC with LDM-1901 Photobiological safety spectroradiometer
  - Photobiological safety testing in accordance with IEC/ EN 62471 and IEC TR 62778
  - LDM-1901 telescope with 100, 11, and 1.7 mrad FOV
  - Camera-based viewfinder
  - Spectroradiometer 300 to 1050 nm

The LCRT-2005-S is specifically designed for light transmission measurement of thin, scratched and clear samples. The measurement geometry comprises an integrating sphere light source and a luminance measurement device. The monitor detector of the light source and that of the receiver are both spectrometers enabling precise simulation of standard light spectra and photometric responsivity in the receiver. The sample is aligned in front of the light source for measurement. The degree of light transmission can thus be determined through diffuse sample illumination for thin scratched samples as well.

Freehand light transmission measurement:
1) 100% adjustment
2) Sample alignment (DUT)
3) Automatic measurement start upon setup
4) Display of the measurement values
INTEGRATING SPHERES

Standard integrating spheres

Gigahertz-Optik manufacturers a range of standard integrating spheres for use with both BTS2048-Series and BTS256-LED spectroradiometers. These configurations offer convenient and accurate measurement of luminous flux, spectral power distribution, color, and color rendering indices of LED devices and solid state lighting products.

Custom integrating spheres

In addition to our range of standard integrating spheres, Gigahertz-Optik offers a universal kit for the custom configuration of integrating spheres. The use of standard components provides cost effective and timely implementation. Complete measurement system solutions are provided.

CALIBRATION

Calibration you can trust

Calibration is a prerequisite for maintaining accuracy in any type of measurement instrument. Therefore, Gigahertz-Optik has always invested heavily to ensure that it is able to offer the highest quality traceable calibrations. Gigahertz-Optik’s calibration laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (D-K-15047-01-00) for spectral responsivity and spectral irradiance according to ISO/IEC 17025. Calibrations carried out by DaKks accredited laboratories offer a secured traceable link to national calibration standards. This is of critical importance for instrument and testing equipment manufacturers in order to be competitive in national and international markets and is absolutely necessary for any quality management system.

Calibration standards

Besides providing traceable calibration of all our measuring devices and systems, Gigahertz-Optik offers a range of calibration standards including reference lamps, detectors and reflectance standards for the calibration and adjustment of optical radiation measurement devices.

<table>
<thead>
<tr>
<th>NMI Standard</th>
<th>National Metrology Institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Standard</td>
<td>Accredited Calibration Laboratory</td>
</tr>
<tr>
<td>Factory Standards</td>
<td>NMI Traceable Calibration Laboratory</td>
</tr>
<tr>
<td>Working Standards</td>
<td>Manufacturer Reference</td>
</tr>
<tr>
<td>Product Calibration</td>
<td>Gigahertz-Optik</td>
</tr>
</tbody>
</table>

Traceability Pyramid shows the unbroken chain of feedback from product calibration to NMI standard.
UV Curing

The high intensity UV radiation used for curing processes places special demands on the radiometers used to control the exposure of work pieces to the UV. Gigahertz-Optik has developed low profile devices for both gas discharge lamps and UV LEDs that are able to withstand the high temperatures involved whilst accurately measuring UV intensities over a very wide dynamic range (from 1 to 40,000 mW/cm²).

UV LEDs

UV LEDs are now frequently replacing conventional UV sources as well as creating many new applications. Therefore, the accurate and traceable measurement of UV LEDs has become increasingly necessary. The measurement of spectral irradiance and spectral radiant flux are generally required. However, UV measurements encounter more challenges than similar visible light tasks due to a number of issues including detector sensitivity, calibration, stray light and fluorescence.

Solutions

- BTS256-UV Spectroradiometer
  - Spectroradiometer 200-550nm
  - Ideal for UV LEDs and process development
  - Stainless steel housing
  - Detectors for gas discharge lamps

- BTS2048-UV Spectroradiometer
  - 200-430nm optimised
  - Integral diffuser
  - Direct mount to spheres
  - Fibre coupling option

- TFU10 UV LED spectral radiant flux
  - Turnkey system
  - Fluorescence free
  - UVA, UVB and UVC LEDs
  - Spectral radiant flux

- X1-1 / RCH-116 Spectral light meter
  - UV LED calibration wavelengths
  - Low profile sensor
  - Safe operator handling

- MSC15-Bili Spectral light meter
  - Ideal for UV LEDs and process development
  - Stainless steel housing
  - Conveyor belt / handheld operation

- Spectroradiometer 200-550nm
  - Integral diffuser
  - Direct mount to spheres

- Spectral radiant flux
  - UVA, UVB and UVC LEDs
  - Spectral radiant flux

- XD-9501/J3 UV Phototherapy meter
  - UVA, UVB and 311nm
  - TL01 and TL12 calibrations
  - Dose/irradiance with X1 meter
  - For 308nm excimer sources

- UV-3711-308 UV detector / P-9710 Meter
  - For 308nm excimer sources
  - Dose/irradiance with X9710

- P9710-2 / ISD-SP-Si
  - ISD-10/15/30-xx
  - ISD-3p-xx

Sun tanning lamps

The compliance and safety testing of sun tanning equipment in accordance with EU regulations and product standards (EN 60335-2-27 and DIN 5050-1) requires the measurement of erythema effective irradiance and checking for any UV-C content.

Solutions

- X1-4 / XD-4S-ERYC Erythema + UVC meter
  - On-site measurements
  - Multi-sensor detector
  - Erythema (UVA + UVB) and UVC

- ISD-3p-xx
  - ISD-10/15/30-xx

UV phototherapy

UV phototherapy is widely used to treat a range of skin conditions such as psoriasis. Accurate patient dosimetry is important to ensure that patients can be treated consistently and to ensure that a patient’s absolute cumulative dose of UV radiation can be accurately recorded so that the long-term skin cancer risks can be best managed. UV phototherapy can involve either narrowband or broadband UVB or alternatively UVA which is used in conjunction with a psoralen.

Solutions

- UV-3711-308 UV detector / P-9710 Meter
  - For 308nm excimer sources
  - Dose/irradiance with X9710

LASER RADIATION MEASUREMENT

Gigahertz-Optik GmbH produces instruments for measuring optical radiation from the lasers and laser diodes that are widely used in measurement, analytical and telecommunication equipment as well as in sensor technologies. The product range includes instruments for measuring continuous, modulated and pulsed radiation.

- P9710-2 / ISD-SP-Si
  - ISD-10/15/30-xx
  - ISD-3p-xx
Gigahertz-Optik has earned an international reputation for its comprehensive line of innovative high-precision products including standard and custom light measurement solutions. On going investment in new technologies ensure state of the art measurement devices to its customers in industry, medicine and science.

**Broadband light measurement devices**
- UV radiometers
- Photometers
- Light hazard meters

**Spectral light meter**
- Handheld devices
- High-end devices
- UV Spectroradiometer
- Weather-proof devices
- Light transmission

**Complementary products**
- Integrating spheres
- Integrating sphere light sources
- Calibration standards
- Electronics, optomechanics
- Optically diffuse materials