

## ■ Spectroradiometer sensor CSS-45

## ■ Handheld instrument CSS-45 with CSS-D

**Spectroradiometer remote sensor and handheld instrument** for illuminance, color, irradiance (360 nm - 830 nm), PAR and bilirubin.

### Spectroradiometer sensor CSS-45

Some light measurement applications require the light sensor to be installed within a measurement system or operated remotely. Industrial applications often require integration with PLC systems. Continuous and remote operation requires light measurement sensors to be robust. For such tasks, Gigahertz-Optik offers the compact spectral light sensor CSS-45. It is a precise spectroradiometer covering the wavelength range 360 nm to 830 nm.

### Spectroradiometer sensor with outstanding light measurement characteristics

- Individual wavelength and linearity correction guarantee precise measurements of light sources irrespective of intensity and spectral distribution.
- Mathematical bandwidth correction according to CIE 214 for accurate colorimetric measurements.
- Another unique feature of the CSS-45 is its electromechanical shutter which enables the remote-controlled dark adjustment of the sensor. This is essential for temperature-independent and long-term operation of array spectrometers.

- Diffuser with a precise cosine adjustment ( $f2 \leq 1.5 \%$ ) for measuring the illuminance and irradiance of extended light sources and lighting equipment.
- Wide range of illuminance measurement from 1 lx to 350.000 lx, covering applications from emergency lighting to broad daylight conditions.

### Robust and compact

The compact metal housing features an M6 threaded hole and a V-groove around the device for universal attachment of the CSS-45. The dimensions are given in the technical drawing available for download. The housing with its splash-proof electrical connectors meets the requirements of protection class IP62. For IP65 rated protection, a sensor variant with glass dome is required.



Spectroradiometer sensor CSS-45



Handheld instrument CSS-45 with CSS-D

### Measurands

- Illuminance (lx)
- Spectral irradiance ( $W/(m^2 \text{ nm})$ )
- Color coordinates  $x, y$  as well as  $u', v'$
- Color rendering index (CRI)  $R_1$  bis  $R_{15}$  as well as  $R_a$
- TM-30-15  $R_f$  and  $R_g$
- Correlated color temperature (CCT in K)
- Color space CIE 1931
- LED grow lights  
PAR ( $\mu\text{mol}/(m^2 \text{ s})$ )
- Melanopic irradiance (human centric lighting)
- Neonatal phototherapy lamps (bilirubin)

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## Interfaces and Software

The sensor offers both an RS-485 and a USB interface. The addressable RS-485 interface allows very long supply lines. The USB interface enables direct operation via a PC. Multiple CSS-45 sensors can be operated together under RS-485 control as well as in USB remote operation. In addition to the provided end-user software, a software development kit (SDK) is optionally available for simplified integration of the sensor into user written software.

## Numerous metrics for a wide field of measurement applications

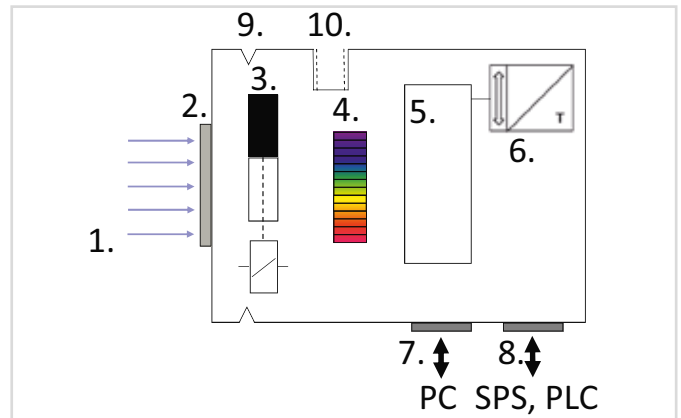
The CSS-45 includes an integrated processor. It calculates a comprehensive set of radiometric, photometric and colorimetric quantities from the measured spectral measurement data.

## Additional metrics support further applications:

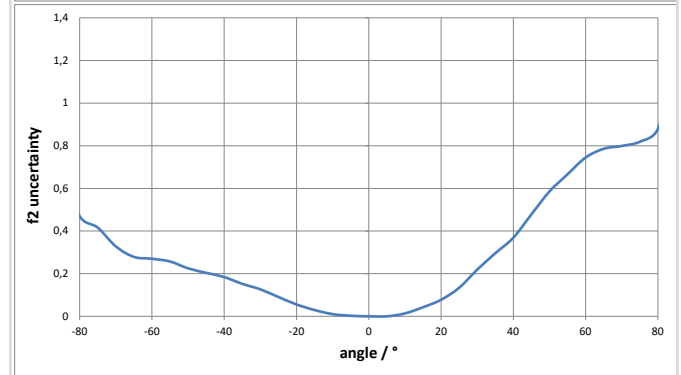
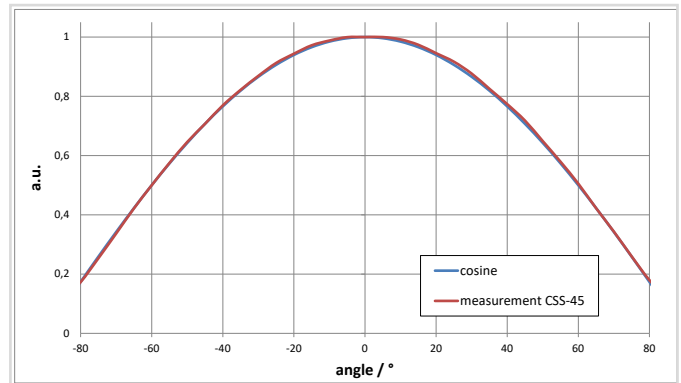
- Horticultural lighting – PAR measurement Photosynthetic Photon Flux Density (PPFD) in  $\mu\text{mol}/\text{m}^2\text{s}$ .
- Human Centric Lighting – melanopic irradiance and illuminance, melanopic daylight equivalent illuminance.
- Phototherapy – total irradiance for bilirubin, Ebi, in  $\text{mW}/\text{cm}^2$  (IEC 60601-2-50) as well as average spectral irradiance in  $\mu\text{W}/\text{cm}^2/\text{nm}$  (American Academy of Pediatrics).

## Traceable factory calibration

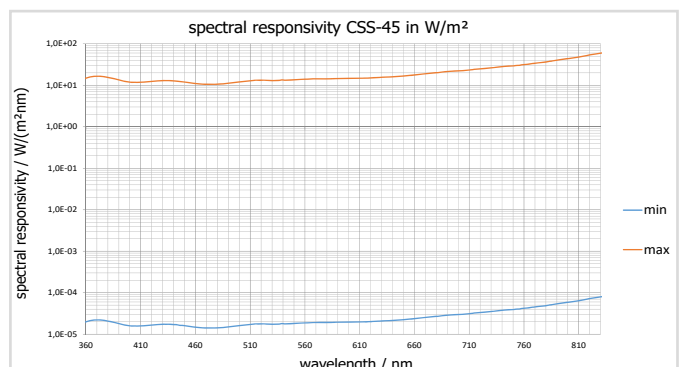
An essential quality feature of light measuring instruments is their precise and traceable calibration. The calibration laboratory of Gigahertz-Optik GmbH guarantees the high quality and traceability of their factory calibrations. Calibration of the CSS-45 is confirmed by a factory calibration certificate.



Schematic draft of CSS-45 sensor  
 1) Incident light 2) Cosine diffuser 3) electromechanical shutter 4) array spectrometer 5) CPU 6) temperature sensor 7) USB connector 8) RS-485 connector 9) V-groove 10) M6 mounting thread



Top: CSS-45 cosine field of view.  
 Bottom: angle dependent f2 error of CSS-45.



Typical spectral responsivity.

## ■ Handheld instrument CSS-45 with CSS-D

### Handheld measurement device CSS-45 with CSS-D

As well as spectroradiometers with integrated displays, Gigahertz-Optik manufactures spectroradiometer sensors that are separated from the operator's handheld controller. These are more suitable for applications that require the sensor to be incorporated within some measurement system or equipment. In some situations the influence of the operator on the measured value can be reduced by the greater distance to the sensor.

#### Sensor with fully integrated spectroradiometer function

The CSS-45 is a complete spectroradiometer in a compact metal housing. With its cosine-corrected field of view, the sensor is suitable for measuring the absolute spectral irradiance without requiring any additional accessories. The sensor calculates a comprehensive range of measurement quantities from the measured spectral data. The high-quality diffuser offers a cosine-adjusted field of view with an f2 error of  $\leq 1.5\%$ . The sensor is therefore qualified for measuring extended light sources and large area lighting devices.

#### Compact control unit

Since measurement data is processed directly in the CSS-45 sensor, the CSS-D unit is used exclusively for controlling the sensor and displaying the measured values. For this purpose, it is connected to the sensor by means of a 2 m long flexible cable. The CSS-D is equipped with a high capacity rechargeable lithium battery which also powers the sensor. The battery can be charged with common USB chargers. The color touch-screen offers a good contrast display.

#### Universal hand-held spectroradiometer

The instrument measures from 360 nm to 830 nm, thereby supporting the CIE spectral range for photometric measurements (ISO/CIE 19476). The spectral bandwidth is 10 nm which, in combination with the mathematical bandwidth correction according to CIE 214, provides a sufficiently high spectral resolution for most photometric and colorimetric applications. The illuminance measurement range is 1 lx to 350.000 lx, exceeding the performance of many other products. An absolute must-have for any array spectroradiometer is the ability to perform a dark current measurement for accuracy and to compensate for temperature influences. The CSS-45 sensor incorporates an electromechanical shutter for this purpose, which performs fully automatic dark current measurements when the operating temperature changes. The meter displays comprehensive radiometric, photometric and colorimetric quantities, all of which are derived from the measured spectrum.

Many additional measurands expand the supported applica-

tions of the handheld spectroradiometer. They are described on the earlier pages about sensor CSS-45.

#### Calibration and adjustment

With its individual wavelength and linearity correction, the meter provides a cost effective solution for high precision light measurements, irrespective of the intensity or spectral distribution of the source.

A key quality feature of Gigahertz-Optik's light meters is their precise and traceable calibration. The calibration laboratory of Gigahertz-Optik GmbH guarantees the high quality and traceability of their factory calibrations. The calibration of the CSS-45 with CSS-D is confirmed by a factory calibration certificate.



*CSS-45 sensor is used in an application separated from the control unit CSS-D.*



*Display screenshot.*

## ■ Spectroradiometer sensor CSS-45

## ■ Handheld instrument CSS-45 with CSS-D

Specifications	CSS-45	CSS-45 with CSS-D	Remark
Illuminance range	1 lx to 350.000 lx		Typ white LED
PAR PPF <sub>D</sub>	7E-3 mol/(m <sup>2</sup> s)	1E4 mol/(m <sup>2</sup> s)	
Bilirubin IEC60601-2-50 irradiance	2E-5 mW/cm <sup>2</sup>	30 mW/cm <sup>2</sup>	
Bilirubin AAP irradiance	1.5E-4 μW/(cm <sup>2</sup> nm)	227 μW/(cm <sup>2</sup> nm)	
Melanopic irradiance	2.5E-4 W/m <sup>2</sup>	380 W/m <sup>2</sup>	Typ white LED
CCT range	(1700 – 17000) K		
Δx, Δy reproducibility	± 0.0002		
Δx, Δy uncertainty	± 0.002		Standard illuminant A
Optical bandwidth	10 nm		Optical bandwidth correction according to CIE 214
Integration time	12 μs to 2.56 s		Automatic setting
Cosine correction	f <sub>2</sub> ≤ 1.5 %		
Interface	RS-485 and USB	USB	
Power supply	Via RS-485 or USB	Battery	CSS-D battery rechargeable via USB
Dimensions	Diameter 45 mm Height: 53 mm	CSS-D (l x w x h): 136 mm x 74 mm x 33,5 mm	
Protection class	IP62	CSS-45: IP62 CSS-D: none	



With its innovative and high-quality products as well as application solutions, Gigahertz-Optik enjoys a high regard from its international customers within the field of optical radiation measurement technology. As a manufacturer, Gigahertz-Optik offers standard and custom-made solutions. Regular investments in new technologies ensure that Gigahertz-Optik is able to offer modern measuring solutions to its customers in industry and science.

### Broadband light measurement devices

- UV Radiometer
- Photometer
- Hazard

### 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

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