

## BTS256-EF

<http://www.gigahertz-optik.de/en-us/product/BTS256-EF>

**Product tags:** VIS , Spectral Data , Color Temperature , CRI , Waterproof , WiFi , Luminous Color , LED , Photometry , General lighting



## Description

Traditional lux meters are increasingly being replaced by spectral light meters such as the MSC15. However, the lighting industry also needs high accuracy spectral light meters that can handle more complex measurements. These include measurement of pulse width modulated light and the ability to measure both internal and external illumination, determination of thermal transient behavior of lamps, and so on. The primary criterion that such meters must always meet is the quality of their photometric features. Additional electronic features may improve usability and display quality, but they cannot compensate for substandard measurement results.

Manufacturers of lamps and luminaires for general lighting purposes must consider light flicker when qualifying product safety in terms of EMC immunity requirements. In addition to the influence of mains voltage fluctuations, flicker effects caused by the lamp and the luminaire itself must be taken into account.

With the BTS256-EF, Gigahertz-Optik GmbH, a renowned measuring device manufacturer, offers a universal measuring device for the determination of all relevant light parameters in general lighting. Combined with a programmable AC source, the BTS256-EF becomes a comprehensive flicker test system for lamps and luminaires including voltage fluctuation immunity tests IEC TR 61547-1:2017.

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### BTS256-EF – Highquality, spectral light and color measurement meter

The BTS256-EF is a high-quality measuring device for photometric and colorimetric measurement of general lighting products and conditions. A special feature of the meter is a Bi-Tec sensor. This consists of a fast photodiode and a CMOS array detector. Thus, the meter supports all the requirements of a modern light meter:

- Cosine field of view illuminance measurement for accurate evaluation of extended illumination (class B DIN 5032 part 7 or AA according to JIS C 1609-1:2006)
- Flicker measurement
- Spectral measurement technology, required for LED light, color, color rendering, color effects
- Photodiode for synchronization to pulse width modulated light and flicker measurement
- alpha-opic measurement (CIE: TN-003)
- Compact and robust design for mobile use

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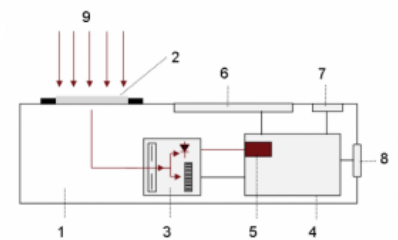
### BTS256-EF – Flicker meter

In its function as a light-flicker meter, the BTS256-EF supports all current [flicker measurements](#):

- Percent Flicker (IES: RP-16-10, CIE: TN-006)
- Flicker Index (IES: RP-16-10, CIE: TN-006)



*BTS256-EF for complex measurements in lighting technology, including flicker measurement*



*Principle illustration of the BTS256-EF*

- 1) BTS256-EF
- 2) Precision cosine diffuser
- 3) BiTec sensor with Si photodiode, CMOS diode array spectrometer and shutter
- 4) Photometric Si-photodiode with fast amplifier
- 5) Microprocessor
- 6) Display
- 7) Control Buttons
- 8) USB 2.0 interface
- 9) Light incident

- FFT Frequency component analysis
- $P_{st}$  Short term flicker severity (CIE: TN-006, IEC TR 61547)
- Stroboscopic Visibility Measure, SVM (CIE: TN-006, IEC TR 63158)
- $M_p$  ASSIST Flicker perception metric

## BTS256-EF – Meter for photosynthetically active radiation (PAR) in plant growth

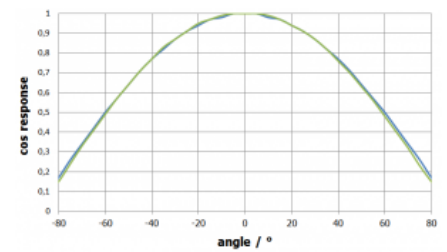
LED grow lights need to be measured in terms of the Photosynthetically Active Radiation (PAR) they produce. This function is supported by the BTS256-EF. The Photosynthetic Photon Flux Density (PPFD) in  $\mu\text{mol}/(\text{m}^2\cdot\text{s})$  can be measured which is a measure of the total number of photons within the PAR wavelength range that reach a surface each second per square meter area. Furthermore, the daylight integral (DLI) can be displayed which represents the total amount of photosynthetically active radiation received by a plant in the course of a day.

## Calibration of the BTS256-EF

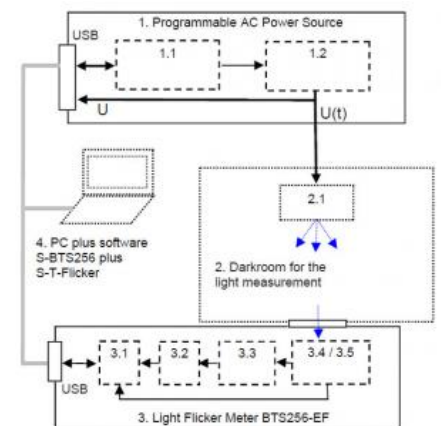
One essential quality feature of photometric devices is their precise and traceable calibration. The BTS256-EF is calibrated by Gigahertz-Optik's calibration laboratory that was accredited by DAkkS (D-K-15047-01-00) for the *spectral responsivity* and *spectral irradiance* according to ISO/IEC 17025. The calibration also included the corresponding accessory components. Every device is delivered with its respective calibration certificate.

## Options for the BTS256-EF light meter

- Software development kit for integration of the device in the user's own software
- In connection with the software tool S-T-Flicker and the programmable AC Source LPS-CH-500 Gigahertz-Optik GmbH offers a functional extension of the BTS256-EF for an test system according to the IEC TR 61547-1:2017 Equipment for general lighting purposes - EMC immunity requirements - Part 1: An objective light flicker and fluctuation immunity test method.



*BTS256-EF light meter with precise cosine field of view function*



*Principle illustration light-flicker test system*

- 1.1 Test waveform generator
- 1.2 Amplifier
  - 2.1 Lamp/luminaire under test
- 3.1 Data processor light
- 3.2 Light data acquisition
- 3.3 Anti-aliasing filter
- 3.4 Fast photodetector
- 3.5 Spectral radiometer
- 4. User software with flicker measurement tool

## Specifications

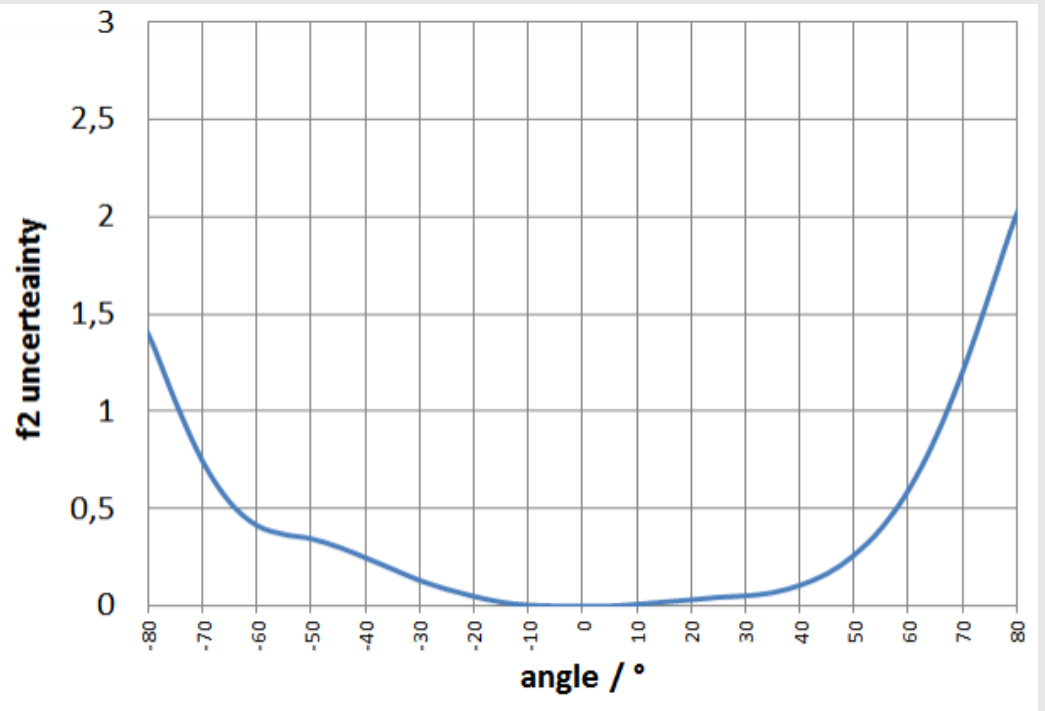
### General

General	
Short description	Spectroradiometer for the illuminance (photopic, scotopic, melanopic), PAR, spectrum, light color, color rendering index, and flicker
Main features	Mobile measurement device, BiTec sensor with a V-lambda photodiode and low stray light CMOS spectroradiometer with a 10 nm optical bandwidth and additional optical bandwidth correction (CIE214), remote-controlled offset shutter, precise cosine-corrected field of view, data logger, automatic PWM synchronization, flicker measurement of $P_{st}$ , SVM, Flicker Index, etc.
Range of measurement	1 lx to 199,000 lx, 360 nm to 830 nm, flicker frequency between 0.25 Hz and 5 kHz
Typical applications	Precise spectral light meter for the lighting industry
Calibration	Factory calibration, traceable to international standards

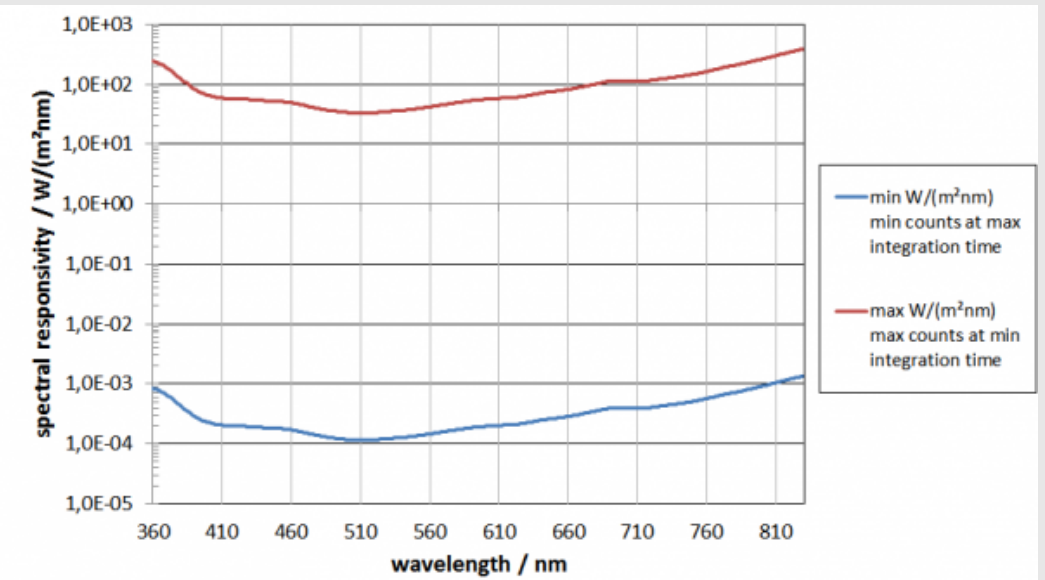
Product																																																														
Lightmeter	class B DIN 5032 part 7 or AA according to JIS C 1609-1:2006 class A DIN 5032 part 7 for f1' and f4, or general precision class according to JIS C 1609-1:2006 class L DIN 5032 part 7 for U response, IR response, f3, f6 and f7																																																													
Light sensor	Bi-Technology sensor with a photometric broadband detector and a array spectrometer. Integrated aperture for automatic dark signal adjustment.																																																													
Input optic	Diffuser window with 20mm diameter, cosine corrected field of view, f2 Error ≤ 3%																																																													
Filter	Spectral responsivity with fine CIE photometric matching. Online correction of the photometric matching through spectral measurement data (spectral mismatch factor correction)																																																													
Flicker	<p>Measurands: Percent flicker (IES:RP-16-10, CIE:TN-006), flicker index (IES:RP-16-10, CIE:TN-006), flicker frequency, fast fourier transformation (FFT), P<sub>st</sub> short-term flicker severity Pst (CIE:TN-006, IEC TR 61547), stroboscopic effect visibility measure SVM (CIE:TN-006, IEC TR 63158), Mp ASSIST</p> <p>Using as a handheld device without software, limited by internal storage:</p> <table border="1"> <thead> <tr> <th>Measurement Time (Sensor)</th> <th>Measurement Time (Flicker)</th> <th>Sampling Rate</th> <th>Upper Cut-Off Frequency</th> <th>Lower Cut-Off Frequency</th> </tr> </thead> <tbody> <tr> <td>50 ms</td> <td>41.0 ms</td> <td>20 µs</td> <td>5 kHz</td> <td>60 Hz</td> </tr> <tr> <td>100 ms</td> <td>81.9 ms</td> <td>40 µs</td> <td>5 kHz</td> <td>30 Hz</td> </tr> <tr> <td>200 ms</td> <td>163.8 ms</td> <td>80 µs</td> <td>2.5 kHz</td> <td>15 Hz</td> </tr> <tr> <td>500 ms</td> <td>327.7 ms</td> <td>160 µs</td> <td>1.2 kHz</td> <td>8 Hz</td> </tr> <tr> <td>1000 ms</td> <td>655.4 ms</td> <td>320 µs</td> <td>0.6 kHz</td> <td>4 Hz</td> </tr> <tr> <td>3000 ms</td> <td>2620 ms</td> <td>1280 µs</td> <td>150 Hz</td> <td>1 Hz</td> </tr> <tr> <td>6000 ms</td> <td>5240 ms</td> <td>2560 µs</td> <td>75 Hz</td> <td>0.5 Hz</td> </tr> <tr> <td>12000 ms</td> <td>10486 ms</td> <td>5120 µs</td> <td>33 Hz</td> <td>0.25 Hz</td> </tr> </tbody> </table> <p>By Software controlled use the above analysis or the following high resolution analysis is possible:</p> <table border="1"> <thead> <tr> <th>Measurement Time (Sensor)</th> <th>Measurement Time (Flicker)</th> <th>Sampling Rate</th> <th>Upper Cut-Off Frequency</th> <th>Lower Cut-Off Frequency</th> <th>Frequency uncertainty acceptable S/N ratio</th> </tr> </thead> <tbody> <tr> <td>5 ms to 180000 ms (3 min)</td> <td>5 ms to 180000 ms</td> <td>20 µs min. (50kHz); 40µs for TLA measurement (25kHz)</td> <td>5 kHz</td> <td>2.5/meas. time</td> <td>1 % ± 0.5 Hz</td> </tr> </tbody> </table>					Measurement Time (Sensor)	Measurement Time (Flicker)	Sampling Rate	Upper Cut-Off Frequency	Lower Cut-Off Frequency	50 ms	41.0 ms	20 µs	5 kHz	60 Hz	100 ms	81.9 ms	40 µs	5 kHz	30 Hz	200 ms	163.8 ms	80 µs	2.5 kHz	15 Hz	500 ms	327.7 ms	160 µs	1.2 kHz	8 Hz	1000 ms	655.4 ms	320 µs	0.6 kHz	4 Hz	3000 ms	2620 ms	1280 µs	150 Hz	1 Hz	6000 ms	5240 ms	2560 µs	75 Hz	0.5 Hz	12000 ms	10486 ms	5120 µs	33 Hz	0.25 Hz	Measurement Time (Sensor)	Measurement Time (Flicker)	Sampling Rate	Upper Cut-Off Frequency	Lower Cut-Off Frequency	Frequency uncertainty acceptable S/N ratio	5 ms to 180000 ms (3 min)	5 ms to 180000 ms	20 µs min. (50kHz); 40µs for TLA measurement (25kHz)	5 kHz	2.5/meas. time	1 % ± 0.5 Hz
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Calibration uncertainty	Illuminance +/- 2.2%																																																													
Spectral Detector																																																														
Chip	CMOS diode-array																																																													
Wavelength Range	(360 - 830) nm																																																													
Optical Bandwidth	10 nm, mathematical optical bandwidth correction according to CIE 214 can be automatically applied																																																													
Data Resolution	1 nm																																																													
Integration Time	(5.2 - 30000) ms																																																													
Shutter	Automatic aperture for dark signal measurements with the same integration time as that of light measurements. Aperture delay = 100ms.																																																													

Typ. Measurement Time	199,999 lx ≤ 5ms (white light) 100 lx ≤ 1s (white light)
Color measurement range spectral	(1 - 199,999) lx
Scotopic	Scotopic measurement range spectral (1 - 199,999) lx Calibration uncertainty of scotopic Illuminance +/-2.2%
Peak wavelength	+/- 1nm
Dominant wavelength	+/- 1nm
Δx, Δy reproducibility	+/- 0.0001 (Standard illuminant type A) +/- 0.0002 (LED)
Δx, Δy uncertainty	+/- 0.002 (Standard illuminant type A) +/- 0.005 (typ. LED)
CCT Measurement range	(1700 - 17000) K
ΔCCT	+/- 50K (standard illuminant type A) +/- 4% (depending on the LED spectrum)
CRI (color rendering index)	Ra and R1 to R15
Stray Light	6E-4 (Blue LED) 6E-4 (Green LED) 6E-4 (Red LED) 1E-3 (White LED) (typical value, measured 100 nm to the left of the peak of the LEDs)
Calibration uncertainty	Spectral irradiance  (360 - 399) nm                            +/- 7 % (400 - 799) nm:                        +/- 4 % (800 - 830) nm:                       +/- 6 % Spectral irradiance responsivity (360 - 830) nm
<b>Integral Detector</b>	
f1'	≤6% (uncorrected) ≤3% (f1' a*(s <sub>z</sub> (λ)) respectively F*(s <sub>z</sub> (λ)) corrected by spectral data, done automatically by BTS technology)
Max. measurable illuminance	≥199,999 lx
Noise equivalent illuminance	≤ 0.01lx
Resolution	12Bit
Measurement Time	(0.1 - 6000) ms
temperatur correction	The measured values of the diode are corrected by means of an internal temperature sensor.
<b>Graphs</b>	

f2 uncertainty




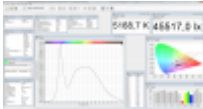
spectral responsivity



**Miscellaneous**

Microprocessor	16Bit, 25ns instruction cycle time
Charging voltage	5VDC, 450mA per USB
Interface	USB 2.0 (Type B USB) Option WiFi: WiFi 2,4 GHz (external antenna, range > 100m)
Temperature	Operation: -10°C bis +30°C Storage: -10°C bis +50°C
Housing	Splashproof IP54
Transport case	333mm x 280mm x 70mm, 650g
Dimension	159mm x 85mm x 45mm (Length x Width x Height)
Weight	500 g

## Configurable with

Produktname	Product Image	Description	Show product
S-SDK-BTS256		Software Development Kit for BTS256 variants.	<a href="http://www.gigahertz-optik.de/en-us/product/S-SDK-BTS256">http://www.gigahertz-optik.de/en-us/product/S-SDK-BTS256</a>
S-BTS256		Application software for BTS256 variants.	<a href="http://www.gigahertz-optik.de/en-us/product/S-BTS256">http://www.gigahertz-optik.de/en-us/product/S-BTS256</a>

## Purchasing information

Article-Nr	Modell	Description
<b>Product</b>		
15308415	BTS256-EF	BTS256-EF meter, user manual (D or E), S-BTS256 user software CD, USB cable for PC operation and battery charging, USB power adapter (EU, USA or GB), BHO-17 hard-top case
15308416	BTS256-EF WiFi	BTS256-EF WiFi meter, user manual (D or E), WiFi antenna, S-BTS256 user software, USB cable for PC operation and battery charging, USB power adapter (EU, USA or GB), BHO-17 hard-top case
<b>Re-calibration</b>		
15300751	K-BTS256-E-I	Recalibration of the BTS256-EF. Including calibration certificate.
<b>Options</b>		
15308526	LPS-CH-500	Programmable power supply with reference source impedance
		Commissioning and training on request
<b>Software</b>		
15298218	S-SDK-BTS256	Software Development Kit; Software and users guide on CD
15308525	S-T-Flicker	Flicker software tool, only usable in combination with LPS-CH-500