BTS256-EF

https://www.gigahertz-optik.com/en-us/product/bts256-ef/

Product tags: VIS , Handheld device ,

Description

Development from Lux Meter to Spectral Light Meter

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.

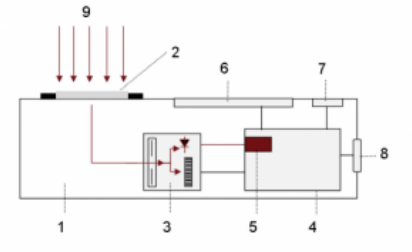
Spectral light meter with flicker measurement function

From a formal point of view with the CIE 231:2019 and DIN 5032-7:2024 photometers with built-in spectral mismatch correction by spectral measurements are treated the same way as classic photometers. Resulting parameters such as f_1' can be determined in accordance with DIN EN 13032-1, provided that the spectral and integral measurements are performed with the same input optics, which is always the case with our BTS devices. The BTS were already ahead of their time, and standardization has now caught up.

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

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. The European Commission's Ecodesign Regulation now requires SVM and Pst measurements and even specifies limit values for them.

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. See **technical article about the measurement of TLA (Temporal Light Artefacts)**.



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

BTS256-EF – High-Quality, 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.

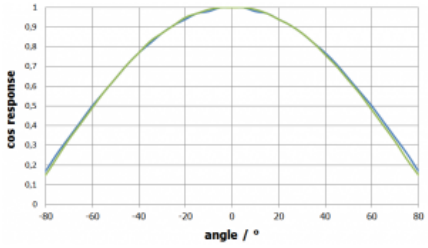
*One of its unique features is the from Gigahertz-Optik developed **innovative BiTec sensor** that consists of a V(lambda) filtered Si

photodiode and a spectroradiometer unit. This makes it extremely linear, stable, and fast and is therefore a guarantee for higher measurement accuracy which is not accompanied by any disadvantages. Both sensors can be used independently and the mutual correction of the sensors is advantageous for accuracy, speed and versatility.

Thus, the meter **supports all the requirements of a modern spectral light meter** allowing also high accuracy for LED measurements:

- 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 illuminance and irradiance measurement (CIE S 026:2018)
- Compact and robust design for portable hand-held use

5) Microprocessor
6) Display
7) Control Buttons
8) USB 2.0 interface
9) Light incident

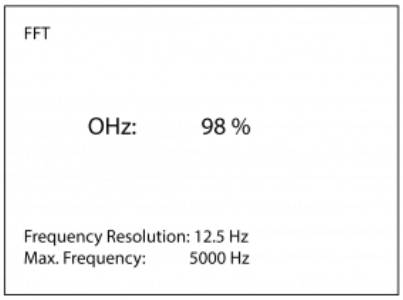


BTS256-EF light meter with precise cosine field of view function

A High Accuracy Light Flicker Meter suited also for LEDs

In its function as a light-flicker meter, the BTS256-EF supports all current **flicker measurands/quantities**:

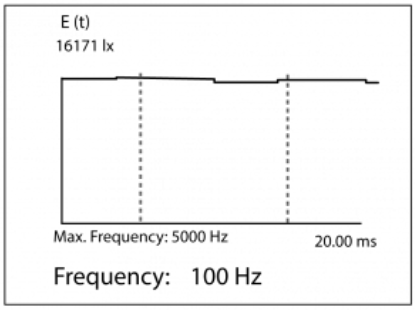
- Percent Flicker (IEEE Std 1789-2015, IES: RP-16-10, CIE:TN-006, CIE:TN-012)
- Flicker Index (IEEE Std 1789-2015, IES: RP-16-10, CIE:TN-006, CIE:TN-012)
- FFT Frequency component analysis
- P_{st} Short term flicker severity (CIE:TN-006, CIE:TN-012, IEC TR 61547)
- Stroboscopic Visibility Measure, SVM (CIE:TN-006, CIE:TN-012, IEC TR 63158)
- M_p ASSIST Flicker perception metric
- Joint Appendix JA10



BTS256-EF Flicker Measurement (FFT and max. Frequency)

The measurands Percent Flicker, Flicker Index and the FFT frequency component analysis are available in the BTS256-EF's stand-alone configuration. All other measurands are only accessible when the BTS256-EF is remote-controlled via the included S-BTS256 software. The same is true for the Wi-Fi version of the BTS256-EF. There is a limitation though: The measurands PstLM and SVM require a very high data throughput that can only be realized via a USB cable. These are not available when the BTS256-EF WiFi is connected via Wi-Fi.

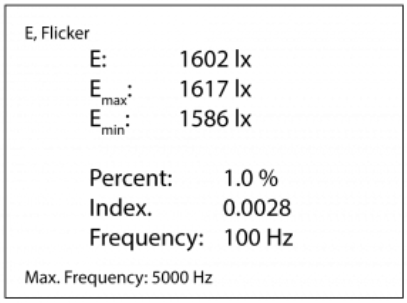
In addition, the BTS256-EF allows **flicker tests according to IEC TR 61547 when operated in combination with power supply LPS-CH-500**. These tests aim to probe flicker stability when light sources are operated in an AC circuit under the influence of disturbance signals.



BTS256-EF Flicker Measurement (Temporal Plot)

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 µmol/(m²*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 Flicker and General Lighting Meter

One essential quality feature of photometric devices is their precise and traceable calibration. The BTS256-EF is calibrated by Gigahertz-Optik's ISO 17025 highes quality 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.

BTS256-EF Flicker Measurement (Flicker Percent, Flicker Index, Flicker Frequency)

DALI Alliance Tests IEC 62386-209

Enables CCT measurements to be fully automated in the official DALI Alliance tests in accordance with IEC 62386-209 (colour control gear).

Further Options for the Spectral Light Meter BTS256-EF

- Software development kit for integration of the device in the user's own software
- In combination with 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.

Specifications

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, color quantities (x, y, u´, v´, X,Y,Z, delta uv, color temperature, color rendering index (CRI) Ra, R1-R15, TM-30-20, CIE224, CQS, CIE170, alpha-opic, etc.), flicker measurement of Pst, SVM, Flicker Index, etc.
Measurement range	1 lx to >199,000 lx, 360 nm to 830 nm, Flicker measurement of all common quantities with sampling rates up to 200 kHz
Typical applications	Precise spectral light meter for the lighting industry
Calibration	Factory calibration, traceable to international standards
Product	
Sensor	class B DIN 5032 part 7 or AA according to JIS C 1609-1:2006 class A DIN 5032 part 7 for f_4, or general precision class according to JIS C 1609-1:2006 class L DIN 5032 part 7 for f_1' and UV response, IR response, f_3, f_6 and f_7
Sensor	Bi-Technology sensor with a photometric broadband detector and a array spectrometer. Integrated aperture for automatic dark signal adjustment.
Input optics	Diffuser window with 20 mm diameter, cosine corrected field of view, f_2 Error ≤ 3%
Filter	Spectral responsivity with fine CIE photometric matching. Online correction of the photometric matching through spectral measurement data (spectral missmatch factor correction)

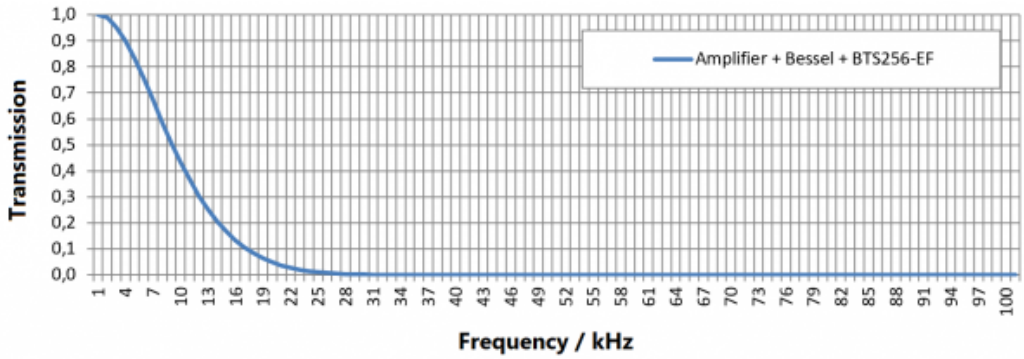
Flicker	Measurands: Percent flicker (IES:RP-16-10, CIE TN 006:2016, CIE TN 012:2021), flicker index (IES:RP-16-10, CIE TN 006:2016, CIE TN 012:2021), flicker frequency, fast fourier transformation (FFT), P_{st} short-term flicker severity Pst (CIE TN 006:2016, CIE TN 012:2021, IEC TR 61547:2020), stroboscopic effect visibility measure SVM (CIE TN 006:2016, CIE TN 012:2021, IEC TR 63158), Mp ASSIST, joint appendix JA10. The **measurement range extends** to the following range when the BTS256-EF is used in combination with a PC (by USB, not not suited for WiFi) and the S-BTS256 or S-SDK-BTS256 **software**:

Measurement time (Flicker)	Sampling Rate	Upper Cut-Off Frequenc	Low
1 ms - 180 s		**(3dB)** see details in the graph	0.00

The BTS256-EF has a **limited** internal memory and can thus only access the following frequency range **when used as a handheld** meter (without a PC):

Measurement Time (Sensor)	Measurement Time (Flicker)	Sampling Rate	Upper Cut-Off Frequency	Lowe
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 H

Filter Transmission Amplifier:



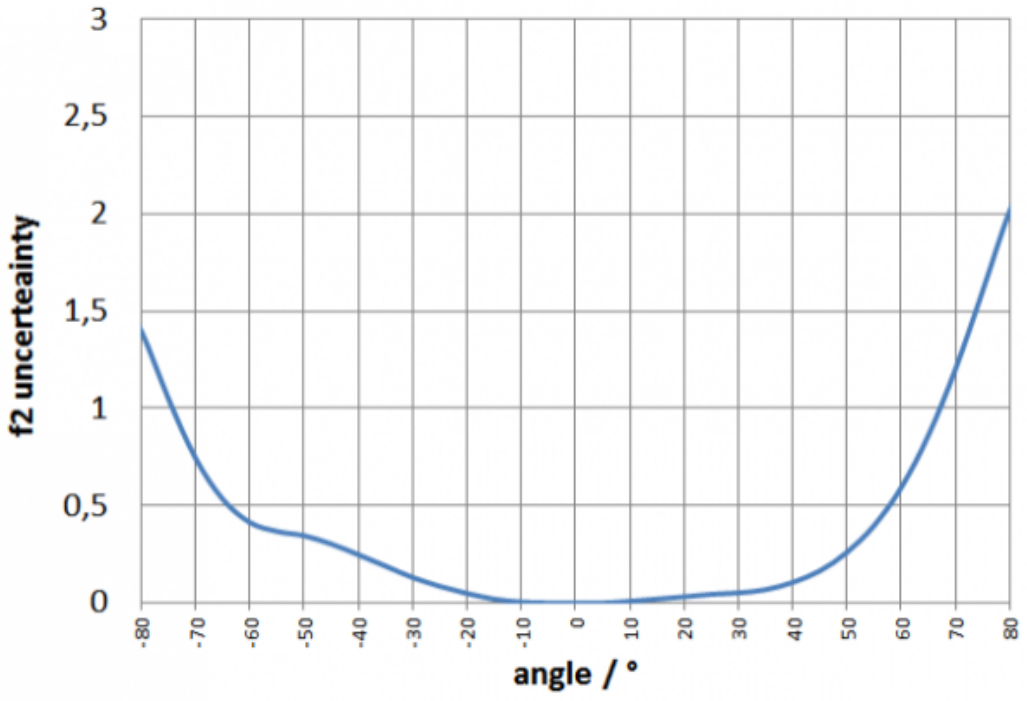
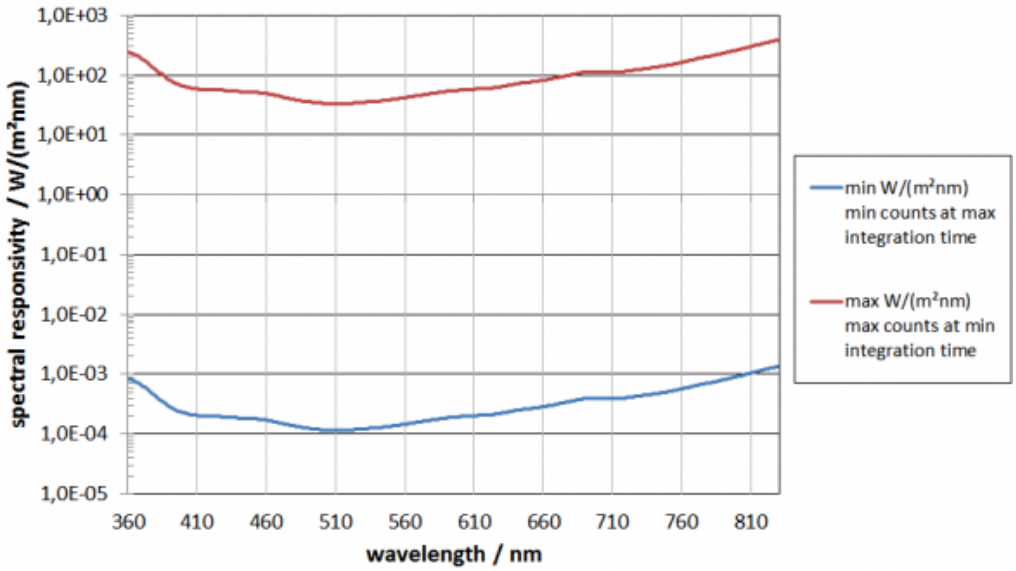
3dB Range 0 to 5 = 10 kHz, Range 6 to 8 = 200Hz

(for Flicker measurements only range 0 to 5 are recommended)

Spectral Detector	
Chip	CMOS diode-array
Spectral 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.

Typical 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
Repeatability Δx and Δy	+/- 0.0001 (Standard illuminant type A) +/- 0.0002 (LED)
Δy Δx uncertainty	+/- 0.0020 (Standard illuminant type A) +/- 0.0035 (typ. LED)
CCT Measurement range	(1700 - 17000) K
ΔCCT	+/- 50K (standard illuminant type A) +/- 2% (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 λ u(*k*=2) (360 - 399) nm ± 5,5 % (400 - 479) nm ± 4 % (480 - 779) nm ± 3,8 % (780 - 830) nm ± 4,3 % Spectral irradiance responsivity (360 - 830) nm
Integral Detector	
Calibration uncertainty	Illuminance ± 2.2%
f1' (spectral mismatch)	≤6% (uncorrected) ≤1.5% (f1' a*($s_z(\lambda)$) respectively F*($s_z(\lambda)$) corrected by spectral data, done automatically by BTS technology)
max. illuminance	≥199,999 lx (limited by temperature)
Noise equivalent illuminance	≤ 0.01lx
Measurement time	(0.1 - 6000) ms
Temperature range	The measured values of the diode are corrected by means of an internal temperature sensor.

Graphs

f2 (directional response/cosine error)	
Spectral responsivity	

Miscellaneous

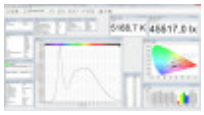
Microprocessor	16Bit, 25ns instruction cycle time
Power Supply	5VDC, 450mA per USB
Interface	USB 2.0 (Type B USB) Option WiFi: WiFi 2,4 GHz (external antenna, range > 100m)
Temperature range	Operation: +10°C bis +30°C Storage: -10°C bis +50°C
Housing	Splashproof IP54
Transport case	333mm x 280mm x 70mm,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

Weight	500 g
Battery runtime	Lithium-Ion battery with 1600 mAh 10 hours with display backlight on and continuous measurement 48 hours in stand-by with backlight off
Info	The typical uncertainty considerations in the data sheet refer to the calibration conditions (temperature, humidity, warm-up, modulation, etc.) and, as this is not possible, do not include user effects such as aging, contamination, etc.

Downloads

Type	Description	File-Type	Download
Brochure	Light measurement solutions for general and specialized lighting	pdf	https://www.gigahertz-optik.com/assets/Uploads-v2/generallighting-broschuere-DINA4-hoch-v2.pdf

Configurable with

Product Name	Product Image	Description	Go to product
S-SDK-BTS256		Software Development Kit for BTS256 variants.	https://www.gigahertz-optik.com/en-us/product/s-sdk-bts256/
S-BTS256		Application software for BTS256 variants.	https://www.gigahertz-optik.com/en-us/product/s-bts256/
LPS-CH-500		Signal Generator for example for testing of flicker properties of lamps and luminaires according to IEC TR 61547-1:2017	https://www.gigahertz-optik.com/en-us/product/lps-ch-500 with s-t-flicker/

Purchasing information

Article-Nr	Modell	Description
Product		
15312815	BTS256-EF	BTS256-EF meter, user manual (D or E), S-BTS256 user software as a download, USB cable for PC operation and battery charging, USB power adapter (EU, USA or GB), BHO-17 hard-top case
15312983	BTS256-EF WiFi	BTS256-EF WiFi meter, user manual (D or E), WiFi antenna, S-BTS256 user software as a download, USB cable for PC operation and battery charging, USB power adapter (EU, USA or GB), BHO-17 hard-top case
Calibration		

Article-Nr	Modell	Description
15311565	KP-BTS256E-E-S	Optional DIN EN ISO/IEC 17025:2018 (DAkkS) accredited test of the BTS256-EF's illuminance and spectral irradiance sensitivity in the wavelength range according to the device specifications.
Re-calibration		
15300751	K-BTS256E-E-S	Recalibration of the BTS256-EF's illuminance and spectral irradiance sensitivity. Calibration certificate.
15311564	KKP-BTS256E-E-S	Factory calibration with following DIN EN ISO/IEC 17025:2018 accredited test of the BTS256-EF. Calibration and testing certificate.
Options		
15308526	LPS-CH-500	Programmable power supply with reference source impedance
		Commissioning and training on request
Software		
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

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- Technical Consulting & Sales
- After-Sales Support
- Calibrations & Re-Calibrations (ISO/IEC 17025 Calibration Services, factory calibration, Calibration of Third-Party Products)
- Repairs & Updates
- OEM & Feasibility Consulting of Customized Solutions

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