BTS256-E Bi-Technology sensor light meter for illuminance, color rendering and luminous spectrum

Technological changes in general lighting

The trend towards LED use in general lighting is unprecedented. This is due to the high energy efficiency, significantly longer lifetime and the diverse design options compared to incandescent bulbs, fluorescent lamps and energy-saving bulbs.

Technologic changes in measurement technology

In the same way incandescent bulbs have been replaced by the new technology, traditional photometers and light meters have also been superseded by advancements in measurement technology. The new measurement techniques must be tailored to match LED lights specifications and besides being used to measure the illuminance, one should also be able to use them for color rendering, luminous color and luminous spectrum measurements.

Bi-Technology light sensor photometer

The BTS256-E light meter is built with the cutting-edge Bi-Technology Light Sensor BTS256 from Gigahertz-Optik. One of its distinguishing features is that it includes a photodiode and a photodiode array. The combination of these two sensor technologies enables the configuration of compact light meters with specifications for high quality light measurement applications.

256-Pixel diode array spectral radiometer

The BTS256 light sensor's diode array supports a 10nm spectral resolution. In conjunction with the 256 pixel, precise measurements of the luminous spectrum are assured even with line spectra. An automatic shutter in front of the diode array enables pixel-dark signal compensation and thus fully utilizing the dynamic range of the diode array detector.

Silicon photodiode with photometric correction filter

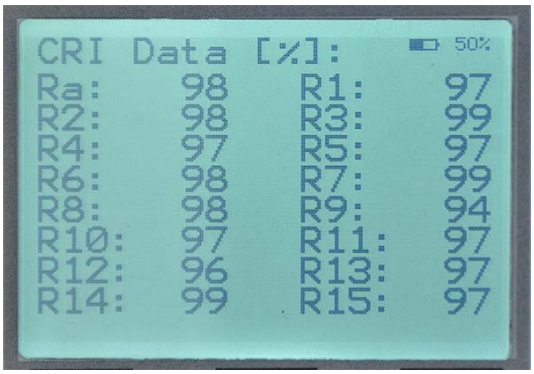
Silicon photodiodes offer an eight decade linear measurement range without causing changes in the signal amplifier's measurement time. Compared to simple diode array spectral radiometers, Bi-Technology light sensors equipped with a Si photodiode offer considerably higher dynamics at constant measurement times. The BTS256-E therefore enables quick and precise measurements over a wide dynamic range.

Bi-directional tuning of the reading

The photodiode signal linearity is used for precise scaling of the spectral measurements, whereas the spectral measurement data is used for spectral mismatch correction of the filter corrected photodiode. Both functions are run in Online Mode.

BTS256-E for mobile use in light measurements

BTS256-E for illuminance measurement



BTS256-E for color rendering measurements

Modulated light measurement (PWM)

Pulse width modulated (PWM) light with short pulses and varying pulse intervals requires the device's measurement rate to be synchronized with the modulation frequency. In the case of the BTS256-E, the light's modulation frequency is measured with a fast photodiode and the measurement rate synchronized automatically.

Cosine corrected field of view

A basic requirement for the precise determination of the illuminance in general lighting is that the device being used should have a cosine corrected field of view. Only then is the accurate assessment of light falling on the reference surface at different angles possible. The 20mm large diameter of the optical gauge reduces the influence of in-homogeneities of the illuminance distribution and boosts the sensitivity.

Use without PC

In addition to its compactness, the BTS256-E offers a variety of measurement, display and memory modes and is therefore suitable for computer independent and mobile use. The rechargeable battery provides sufficient charge for more than eight hours. The USB power adapter enables battery charging without the PC.

Easy to handle and operate

The device is operated using three control buttons and the simply structured menu navigation. The display and control buttons are on the same side as the optical gauge and thus eliminating the need to turn the device in order to operate or take readings. On the bottom side of the device there is a clamp for tripod mounting. If desired, delay time can be set to give the user time to move away from the device during measurement. An acoustic signal marks the end of the measurement. The backlight automatically switches itself off during measurements.

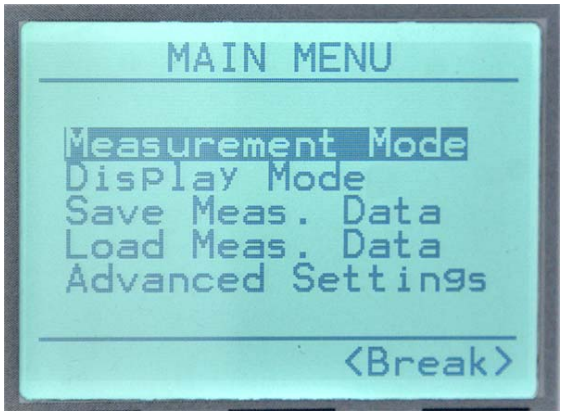
Five measurement modes

- Single measurement
- Continuous measurement
- Time controlled data logger BiTec Sensor
- Time controlled data logger photodiode
- Local distribution of the illuminance

Data memory

The data memory enables readings to be saved. A total of 100 measurement values with all the corresponding units, including the spectral values can be saved. In addition, 5000 photodiode measurement readings can also be saved.

BTS256-E for luminous spectrum measurements



BTS256-E with a simple menu navigation structure

BTS256-E with 20mm cosine-diffuser

Nine different measurement units

The BTS256-E is suited for nine measurement units:

- E Illuminance
- Ee Irradiance
- x, y CIE 1931 color coordinate
- CT color temperature
- u‘, v‘ CIE 1976 color coordinate
- Δ_{uv} deviation from the Planckian locus
- λ_{dom} dominant wavelength
- λp peak intensity wavelength
- $\lambda_{0.5}$ spectral half width
- CRI Color Rendering Index Ra and R1 to R15

These can be displayed in different versions. In addition, the user can individually generate a customized constellation display with up to 11 measurement units. To switch from one display to the other, just scroll through.

Use with PC

The USB interface makes it possible to use the BTS256-E lightmeter with a PC. This enables both data exchange and battery charging.

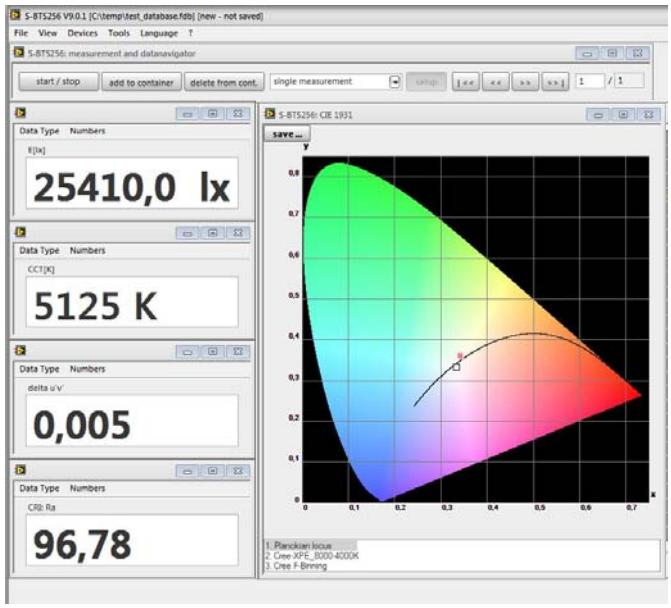
User Software

The S-BTS256-E User Software offers all the functions necessary for measurement, display of the measurement values and data transfer. The software allows setting of both the measurement parameters and data export in ASCII and Excel formats.

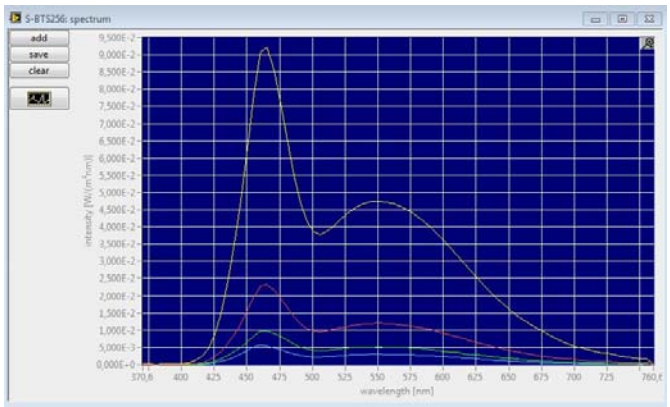
Software Development Kit

For self programmers, Gigahertz-Optik offers the S-SDK-BTS256-E software development kit. This is available for LabView from National Instruments, NET from Microsoft and C/C++. The SDKs simplify the integration of the BTS256-E in in-house Software.

BTS256-E with a hard-top casing for safe transport and storage.



S-BTS256 User Software with a modular setup Desktop



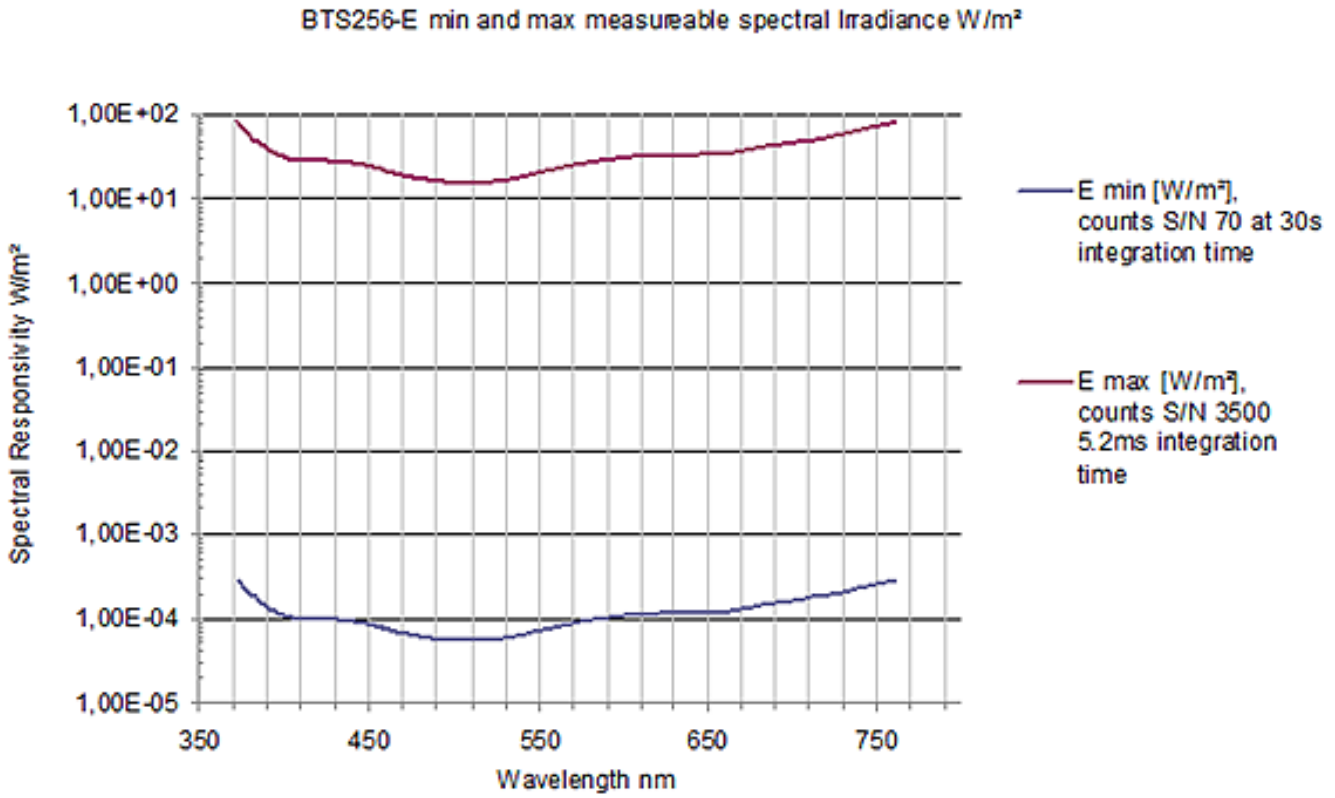
S-BTS256 graphic spectrum display

Measurement modes, settings and readings display

Menu item	**Sub-menu item 1**	**Option**	**Specifications**
Measurement mode	Single measurement	Photodiode and array	E, Spectrum, CT, xy, CRI measurement
	Continuous	Photodiode only	E measurement, high measurement rate
		Photodiode and array	E, Spectrum, CT, xy, CRI
		1 x Array, followed by the photo-diode	First E, Spectrum, CT, xy, CRI measurement. E subsequent measurements only
	Logger timed	Photodiode and array	E, Spectrum, CT, xy, CRI measurement. Cycle time ≥ 5s. Maximum 100 memory locations
		Diode	E measurement. Cycle time ≥ 0.1s. Maximum 5000 memory locations
	Local light distribu-tion	Layout with up to 100 reading points	Layout generated using PC Software. Measure-ment, saving of E, spectrum, CT, xy, CRI
Display mode	User display	Up to 11 measurement units	
	Display template	Graphic, E, x, y, CT	Spectrum and numerical display
	Display template	Graphic, Ee	Spectrum and numerical display
	Display template	E	Illuminance, large numbered
	Display template	Ee	Irradiance, large numbered
	Display template	E, x, y, CT, Δuv	Numerical display
	Display template	E, u', v', CT, Δuv	Numerical display
	Display template	Ee, E, λ –Values	Numerical display
	Display template	CRI	Ra and R1 to R15
Data saving	Memory location	Index 0-99	
Data loading	Memory location	Index 0-99	
Settings	Array settings	Measurement signal resolution	High, Medium, Low
		Exposure time	Pre- measurement, Fix, Continuous adjustment
		Ee spectral range	Setting of the irradiance spectral range
		Scaling using photodiode	Reverse A(z) Correction
	Diode settings	Integration time	50ms, 100ms, 200ms, 500ms
		Amplifier Offset Correction	On/Off
		A(z) Correction	Off, Dynamic, Factor
		Synchronization	Off, Evaluation time 20, 50, 100, 200, 500, 1000ms
	Miscellaneous	Auto Off device	No / Yes after 10, 30, 60min
		Auto Off display backlight	No / Yes after 10, 30, 60min
		Display Off during measurement	No / Yes
		Audio signal after measurement	No / Yes
		Confirmation queries	Yes / Minimize / No
		Customized display	Free selection of the measurement units
		Clear data memory	
	Default Initialization		
Information	Setting parameters		

Specifications

Light sensor	Bi-Technology sensor with a photometric photodiode and a 256 Pixel CMOS photodiode -array. Integrated aperture, automatic dark signal adjustment.
Light input optic	20mm diffuser window diameter, cosine corrected field of view, F2 Uncertainty <3%
Broadband sensor	Silicon photodiode with photometric correction filter. Trans-impedance amplifier with adjustable integration time from 50ms up to 500ms. Seven(7) measurement ranges with offset correction. 16Bit ADC
	Maximum measurable illuminance value ≥199,999 lx Noise equivalent illuminance value ≤ 0.01lx
Spectral sensor	CMOS Diode array-spectral radiometer. Spectral range 380 to 750nm. Pixel resolution 1.5nm. Optical resolution 10nm.
	From 5.2 to 30s integration time, manual or automatic setting
	Automatic aperture for dark signal measurements with the same integration time as that of bright measurement. Aperture delay 100ms
	Measurement time at 199,999 lx ≤ 5ms (White light) Measurement time at 100 lx ≤ 1s (White light)
	Illuminance calibration uncertainty +/-3.2%
	Peak wavelength: +/- 1nm
	Dominant wavelength: +/- 1nm
	Δx, Δy Reproducibility: Standard illuminant A +/-0.0001, LEDs +/- 0.0002 at 2000cts Peak performance
	Δx, Δy Uncertainty: Standard illuminant A +/-0.002, LED +/- 0.004
	CCT Measurement range: 1700 to 17000 K
	ΔCCT: Standard illuminant A 50K; LED up to +/- 4% depending on the LED spectrum
	Color rendering index Ra and R1 to R15
Microprocessor	16Bit, 25ns instruction cycle time
Data saving	100 memory locations for the BiTec Sensors' complete measured data 5000 memory locations for the photodiode's measured data
Charging voltage	5VDC / max. 500mA
Remote interface	USB2; Mini USB port
Temperature	Operation: 10 to 30°C Storage: -10 to 50°C
Dimensions/ Weight	160mm (6.3 in) L x 85mm (3.3) W x 60mm (2.4 in) H. Weight: 500g (1.1 lb)
Carrying case	Hard case, 333 x 280 x 70mm, 650g


BTS256-E min and max measureable spectral Irradiance W/m²
Spectral Responsivity W/m²
1,00E+02
1,00E+01
1,00E+00
1,00E-01
1,00E-02
1,00E-03
1,00E-04
1,00E-05
350
450
550
650
750
Wavelength nm
E min [W/m²], counts S/N 70 at 30s integration time
E max [W/m²], counts S/N 3500 5.2ms integration time

Ordering information

Model	**Item number**	**Description**
BTS256-E	102826	BTS256-E, Users guide (G or E), User Software S-BTS256 on CD, USB cable for use with PC and battery charging, USB power adapter (EU, USA or GB), BHO-17 Hard-top casing
S-SDK-BTS256-E	tbc.	Software Development Kit; Software and users guide on CD
Recalibration:		
K-BTS256-E-I	301374	Recalibration of the BTS256-E LED-Luxmeter