BTS2048-UV-S-WP

https://www.gigahertz-optik.com/en-us/product/bts2048-uv-s-wp

Product tags: UV

Description

BTS2048-UV-S-WP BiTec sensor spectroradiometer for high-quality outdoor UV measurements

The BTS2048-UV-S-WP is a high-quality spectroradiometer whose compact design and elaborate optical, electronic and mechanical interfaces make it ideal for high precision outdoor UV measurements. Due to its innovative filter and spectrometer design it is able to measure solar radiation with a very good straylight reduction performance. Accordingly, even the edge of the sun below 300 nm can be resolved for some orders of magnitude (see figure 2). With the included S-BTS2048 application software, precise measurements and data analysis (Erythema, ICNRIP, etc.) can be performed intuitively. In addition, the spectral range can be extended from the UV to the NIR with the complementary BTS2048-VL-TEC-WP. Applications in the whole Si spectral region (e.g. solar-cells) are possible.

BiTec sensor for high-end light measurement

One of the outstanding features of this exceptional spectroradiometer is its BiTec sensor. It combines the special properties of a photodiode with those of a back-thinned CCD diode array. Through bilateral correction of measurement signals from both sensors, the BiTec sensor ensures precise radiometric and spectral-radiometric measurement values over a large dynamic range.

Spectrometer based on a high-quality back-thinned CCD detector

The spectrometer unit is based on a CCD with usable spectral responsivity range between 190 nm and 430 nm. It has a 0.7 nm optical bandwidth and a pixel resolution of 0.13 nm/pixel. Due to the back-thinned technology, the CCD is substantially more sensitive as compared to conventional front-illuminated CCD chips. Furthermore, the CCD is one stage cooled (1TEC) to reduce the dark current and and thereby increase the signal to noise ratio.

Precise spectral radiometry (low straylight)

To facilitate optimum use of the CCD sensor's dynamic range and to overcome the problems of most array spectoradiometers in the UV range, a remote-controlled filter wheel (open, closed, optical filters) is located in the optical beam path. This filters combined with smart measurement and stray light correction routines enables high quality measurements of the BTS2048-UV-S. Results are comparable with double monochromator results (see figure). However, the measurement duration is significantly lower. Since the BTS2048-UV-S contains a filter wheel with 8 filter positions, a futher smart measurement routine for stray light reduction is implemented compared to the BTS2048-UV.

WP means weather proofed

The housing of the BTS2048-UV-S-WP is designed for outdoor measurements. The cooled back-thinned CCD and the spectrometer unit are temperature controlled in a second housing. In this housing, humidity is removed by an exchangeable cartridge. In order to avoid deposits of dust, rain or snow on the entrance optics on the entrance optics the quartz dome is blow-dried by warm air.
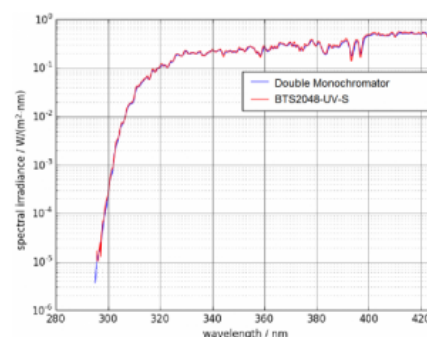
Diffuser window directly connected instead of light guide

As for the input optics, the BTS2048-UV-S-WP has an incorporated diffuser window with a cosine corrected field of view. The fact that a light guide has not been used improves sensitivity and calibration stability which is a big advantage for outdoor use. The device's compact size is also of significant benefit. The f2 error of the cosine corrected field of view to less than 3%

BTS2048-UV-S-WP

Comparison of a solar measurement of the BTS2048-UV-S and a standard double monochromator. The BTS2048-UV-S achieves about the same quality in a measurement time of a few s compared to about 1.5 min of the double monochromator.

Entrance optic is blow-dried by warm air to prevent dirt, rain or snow

makes it possible to use the BTS2048-UV-S-WP for direct measurement in absolute radiometric quantities:

 Irradiance (W/m²)

 Spectral irradiance (W/(m² nm))

State of the art interface

The BTS2048-UV-S-WP is controlled via a USB 2.0 or Ethernet interface. With regards to the communication speed and cable length, the Ethernet port is superior to the USB2.0 interface. Furthermore, data preparation occurs in the BTS2048-UV-S-WP to optimize the data-transfer speed. For this purpose, an independent, high-performance microprocessor is incorporated. Data and power interface are of course of weather-proof design as well.

User software with flexible desktop structure

The BTS2048-UV-S-WP's scope of delivery includes the S-BTS2048 user software. One of the characteristic features it has to offer is the flexible desktop that can be individually configured by the user.

This entails a potpourri of graphical and numerical display windows from which the user can choose:

 Freely definable numerical displays in decimal or scientific representation. Zoom function.

 Numerical display fields for radiometric, spectral and other measurands.

 Measurement protocol of the selected measurement parameters.
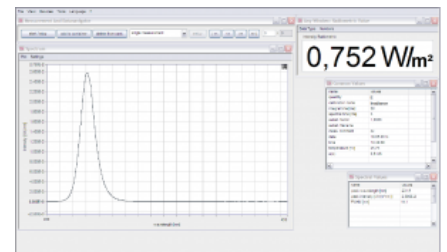
 Spectrum. Zoom function.

 Data logger. Zoom function.

Traceable calibration

Calibration of the BTS2048-UV-S-WP, including its accessories, is performed by Gigahertz-Optik calibration laboratory for optical measurands with reference to national and international calibration standards. Due to the small dimensions of the device it can be shipped easily for re-calibration purposes.

Side View of the BTS2048-UV-S-WP

S-BTS2048 software for the BTS2048-UV-S-WP

The WP version in a winter measurement campaign

Specifications

General

Short description	CCD based spectroradiometer with large dynamic for CW-, Datalogger- and Single measurements of spectral irradiance and derivative quantities (spectrum, erythema, ICNIRP, etc.) in the UV spectral region for outdoor use.
Main features	Compact measurement device. Bi-Tec detector with back-thinned CCD-diodearray spectrometer (0.7 nm optical bandwidth, electronic Shutter, high dynamic) and SiC-Fotodiode. High stray light reduction. Filter wheel with aperture and optical filters. Entrance optic with diffuser which is cosine FOV. Weatherproof housing for outdoor use. Ethernet and USB interface.
Measurement range	Spectral: 3E-5 W/(m²nm) to 3E4 W/(m²nm) @325nm. Responsivity from 190 nm to 430 nm. Integral: 2E5 W/m² to noise equivalent level by 5E-3 W/m²
typical applications	Diodearray spectrometer for scientific outdoor measurement tasks. Erythema, ICNIRP, solar-cells, etc.
Calibration	Factory calibrations traceable to PTB calibration standards.

Product

Measured Quantity	Spectral irradiance (W/(m² nm)), irradiance (W/m²), peak wavelength, center wavelength, centroid wavelength, Erythema, ICNIRP.
Input optics	Diffusor, cosine corrected field of view (f2 ≤ 3 %)
Filter wheel	8 positions (open, closed, optical filters). Use for remote dark current measurement and stray light reduction.
BiTec	Parallel measurement with diode and array is possible, thereby linearity correction of the array through the diode and online correction of the spectral mismatch of the diode through $a*(s_z(\lambda))$ respectively $F*(s_z(\lambda))$.
Calibration uncertainty	Spectral irradiance (200 - 249) nm: ± 12 % (250 - 339) nm: ± 7 % (340 - 399) nm: ± 5 % (400 - 430) nm: ± 4 % Spectral irradiance responsivity (200 - 430) nm

Spectral Detector

Integration Time	2 µs - 60 s *1
spectral range	(190 - 430) nm
Optical Bandwidth	0.8 nm
Pixel resolution	~0.13 nm/Pixel
Number of pixels	2048
Chip	Highly sensitive back-thinned CCD chip, one stage cooled (1TEC)
ADC	16bit (25 ns instruction cycle time)
Peak wavelength	± 0.05 nm
Band-pass correction	mathematical online band-pass correction is supported
Linearity	completely linearized chip >99.6%
Stray Light	Out of Bound method < 1E-4 *3 Bandpass method < 1E-5 *3
Base line noise	5 cts *4
SNR	5000 *5
dynamic range	>9 Magnitudes

spectral irradiance responsivity range	(3E-5 - 3E4) W/(m²nm) @325nm *6*7
typical measurement time	W/m² of a Halogen lampe from (250 - 400) nm
	1 4,4 s 10 440 ms 100 44 ms
Measurement modes	Standard measurement mode: 200 nm to 430 nm
	Out of Range stray light corrected measurement mode (OoR SLC): 200 nm to 430 nm
	Stray light corrected bandpass mode for solar measurements (solar BP SLC): 285 nm to 420 nm
	Universal stray light corrected bandpass measurement mode (BP SLC): 245 nm to 420 nm
Integral Detector	
Filter	Mathematical adjustment of the responsivity to a rectangular function from 220 nm to 360 nm (SMCF on-line correction to the radiometric function with the measured spectral data).*
	* The spectral responsitivity of the diode does not correspond to a rectangular function (not possible with optical filters). When measuring light sources with a spectrum that deviates from the calibration spectrum of the integral detector (UV LED, peak at 405 nm), the measurement result is corrected using SMCF. The uncertainty of this correction depends on the quality of the measured spectrum (noise) and the size of the correction factor (spectral range).
Measurement time	(0.1 - 6000) ms
Measurement range	seven (7) measurement ranges with transcendent offset correction
Calibration	Irradiance ± 6 % *[10]
Measurement range	(5E-3 - 2E5) W/m² *[11]
Graphs	
spectral responsivity	[image src="/var/www/html/web/assets/36e1c6d80b/responsivity-BTS2048-UV-v2.png" id="6370" width="600" height="319" class="leftAlone ss-htmleditorfield-file image" title="responsivity BTS2048 UV v2"]
f2 (directional response/cosine error)	[image src="/var/www/html/web/assets/cos-BTS2048-VL2.png" id="6366" width="600" height="849" class="leftAlone ss-htmleditorfield-file image" title="cos BTS2048 VL2"]
Miscellaneous	
Microprocessor	32bit for device control,16bit for CCD array control, 8bit for photodiode control
Interface	USB V2.0, Ethernet (LAN UDP protocol), RS232, RS485
Data transfer	Standard for 2048 float array values via ethernet 7ms, via USB 2.0 140 ms
Input Interfaces	2x (0 - 25) VDC, 1x optocoupler isolated 5 V / 5 mA
Output Interfaces	2x open collector, max. 25 V, max. 500 mA
Trigger	Trigger input incorporated (different options, rising/falling edge, delayed, etc.)
Software	User software S-BTS2048 Optional software development kit S-SDK-BTS2048 for user software set-ups based on .dll's in C, C++,C# or in LabView.
Power Supply	With power supply: (90-295) V 150 W
Dimensions	Diameter: 160 mm
	Height: 222 mm
	(see detailed drawing)

Weight	2.85 kg
Mounting	3x M6 screw threads
temperature range	Storage: (-10 to 50) °C
	Operation: (-25 to 50) °C　　　*9
Info	*1 It is recommended to perform a new dark signal measurement for every change in the integration time
	*2 typical value, the uncertainty of the dominant wavelength depends on the spectral distribution of the LED
	*3 typical value, measured 100nm left of the peak of a cold white broadband LED with and deep blue LED peak. The dynamic which can be resolved within one measurement depends on the number of averages and the light source. Typical for a solar measurement is a dynamic of 4.5 orders of magnitude resolution within one measurement.
	*4 *5 typical value measured without averaging for a 4ms measurement time and full scale control of the array. Averaging results in quadratic rise of the S/N i.e. quadratic fall of the base noise e.g. averaging to a factor 100 improves the S/N by a factor 10
	*6 Minimum 500/1 S/N. Maximum at full scale control.
	*7 Irradiation only allowed for a short time so as to avoid thermal damage
	*8 during USB connection, not all functions are available due to the limited current supply e.g. no Ethernet and TEC cooling
	*9 Device requires for temperature stabilization approx. 25min (power supply is needed for outdoor use). In measurement is performed in the warm-up phase, or if measurements are performed under varying temperatures, dark signal measurement is required for each measurement.
	*10 With a(Z) correction by a Deuterium lamp
	*11 By a spectral power distribution of a deuterium lamp, maximum radiation only allowed for a short time so as to avoid thermal damage
Stability	inside WP housing (electronics): ≤ ± 1 °C
	CCD Chip: ≤ ± 0.25 °C
Housing	Spectroradiometer unit: IP67
	Outdoor housing itself: IPx5

Downloads

Type	Description	File-Type	Download
BTS2048-UV-S-WP Technical datasheet	BTS2048-UV-S-WP Brochure	pdf	https://www.gigahertz-optik.com/assets/Uploads/Technical-Datasheet-BTS2048-UV-S-WP-210x297-EN-RZ-web.pdf
BTS2048-Series	BTS2048 'Not just another spectrometer' brochure	pdf	https://www.gigahertz-optik.com/assets/Uploads/BTS2048-broschuere-DINA4-hoch-V2-WEB.pdf

Configurable with

Product Name	Product Image	Description	Show product
BTS2048-VL-TEC-WP		Bi-technology sensor light meter for high quality solar VIS measurements. Features: Weatherproofed, high spectral resolution, short measurement time, entrance optic with diffusor for irradiance and spectral irradiance, etc.	https://www.gigahertz-optik.com/en-us/product/bts2048-vl-tec-wp
S-SDK-BTS2048		Software Development Kit for BTS2048 variants.	https://www.gigahertz-optik.com/en-us/product/s-sdk-bts2048
SUT-1711		Sun tracker for use with e.g. BTS2048-xx-WP series meter for direct solar irradiance measurement. Features: Tubular level, compact size, weather proof, included software	https://www.gigahertz-optik.com/en-us/product/sut-1711
BTS-Solar		Sun tracker for the use with e.g. BTS2048-xx-WP series meter in direct solar irradiance measurement. Features: Tubular level, compact size, weather proof, included software	https://www.gigahertz-optik.com/en-us/product/bts-solar

Purchasing information

Article-Nr	Modell	Description
Product		
15298728	BTS2048-UV-S-WP	Measuring device, users guide, software CD, calibration certificate.
Calibration		
15300809	K-BTS2048-UV-S	Recalibration of the BTS2048-UV-S with calibration certificate
Software		
15298470	S-SDK-BTS2048	Software development kit, software CD with users guide.
Accessories		
15310402	BHO-27	Carry case for BTS2048-XX-WP and accessories.
15307929	BTS2048-XX-WP-Z02	tube for the measurement of the direct solar irradiance
15307925	S-T-RECAL-BTS2048	Software module for functional enhancement of S-BTS2048 software. Support of BTS2048 series light meter re-calibration via the user.