

BTS2048-UV-S-WP

<https://www.gigahertz-optik.de/en-us/product/BTS2048-UV-S-WP>

Product tags: UV , Spectral Data , Erythema , UV and Blue Light Hazard , ICNIRP , Waterproof



Description

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

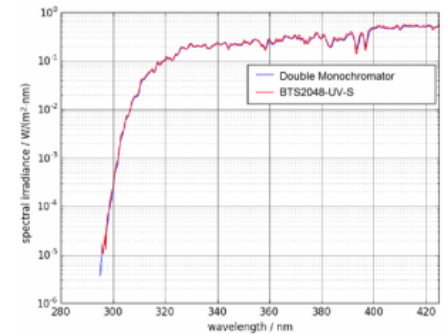
The BTS2048-UV-S-WP is a high-quality spectralradiometer whose compact design and elaborate optical, electronic and mechanical interfaces make it ideal for high precision outdoor UV measurements. Due to its innovative filter and spectrometer design it is able to measure solar radiation with a very good straylight reduction performance. Accordingly even the edge of the sun below 300 nm can be resolved for a couple of magnitudes (see figure 2). With the included S-BTS2048 application software precise measurements and data analysis (Erythema, ICNRIP, etc.) can be intuitive performed. 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.



BTS2048-UV-S-WP

BiTec sensor for high-end light measurement

One of the outstanding features of this exceptional spectroradiometer is its BiTec sensor. This 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 (see technical article [BTS Technologie](#)).



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

The spectrometer unit is based on a diode array with a utilizable 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, this CCD chip 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 increased thereby the SNR.

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.

Precise spectral radiometry (low straylight)

To facilitate optimum use of the CCD sensor's dynamic range and to overcome the problems of most array spectroradiometers in the UV range, there is a remote controlled filter wheel (Open, Closed, optical filters) 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 measurements time is significantly lower. Since for the BTS2048-UV-S a filter wheel with 8 filter



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

positions is implemented a further 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 backthinned CCD and the spectrometer unit are temperature controlled in a second housing. In this housing humidity is removed by a exchangeable cartridge. To avoid dust, rain or snow 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 an large advantage for outdoor use. Especially in terms of size of the device. The f2 adjustment of the cosine corrected field of view to less than 3% makes it possible to use the BTS2048-UV-S-WP for direct measurement in absolute radiometric measurands

- Irradiance (W/m^2)
- Spectral irradiance ($W/(m^2 nm)$)

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, the 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 weatherproof designed as well.

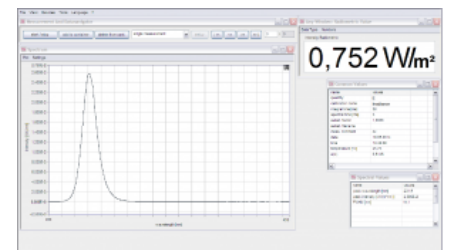
User software with flexible desktop structure

Among the BTS2048-UV-S-WP delivery contents is 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 from which the user can choose graphical and numerical display windows:

- 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.



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

- Data logger. Zoom function.
- etc.

Traceable calibration

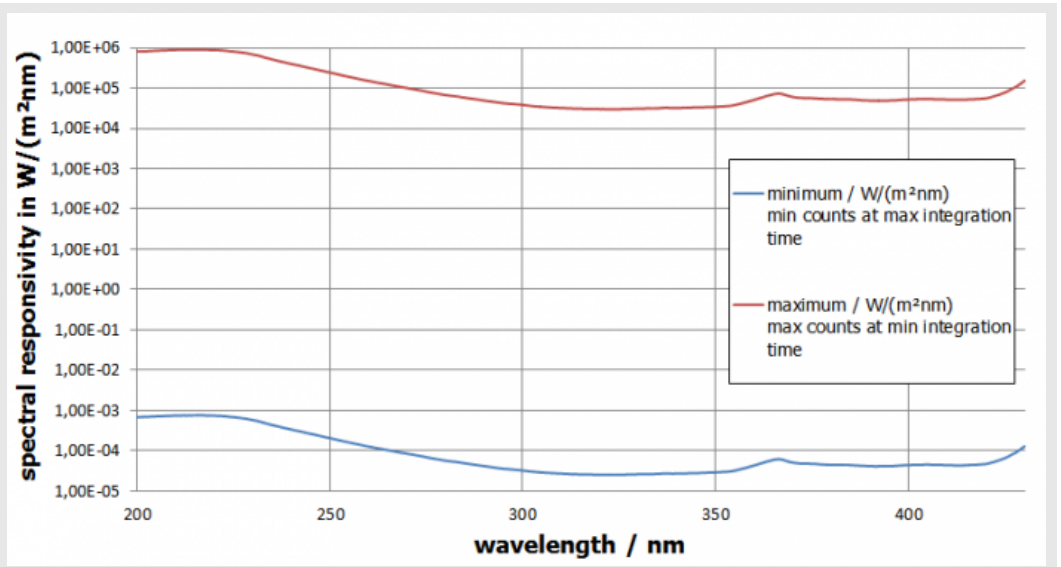
Calibration of the BTS2048-UV-S-WP, including its accessories, is performed by Gigahertz-Optik calibration laboratory for optical measurands with reference to national and international calibration standards. Due to the small dimensions of the device it can be shipped easily for re-calibration purposes.

Specifications

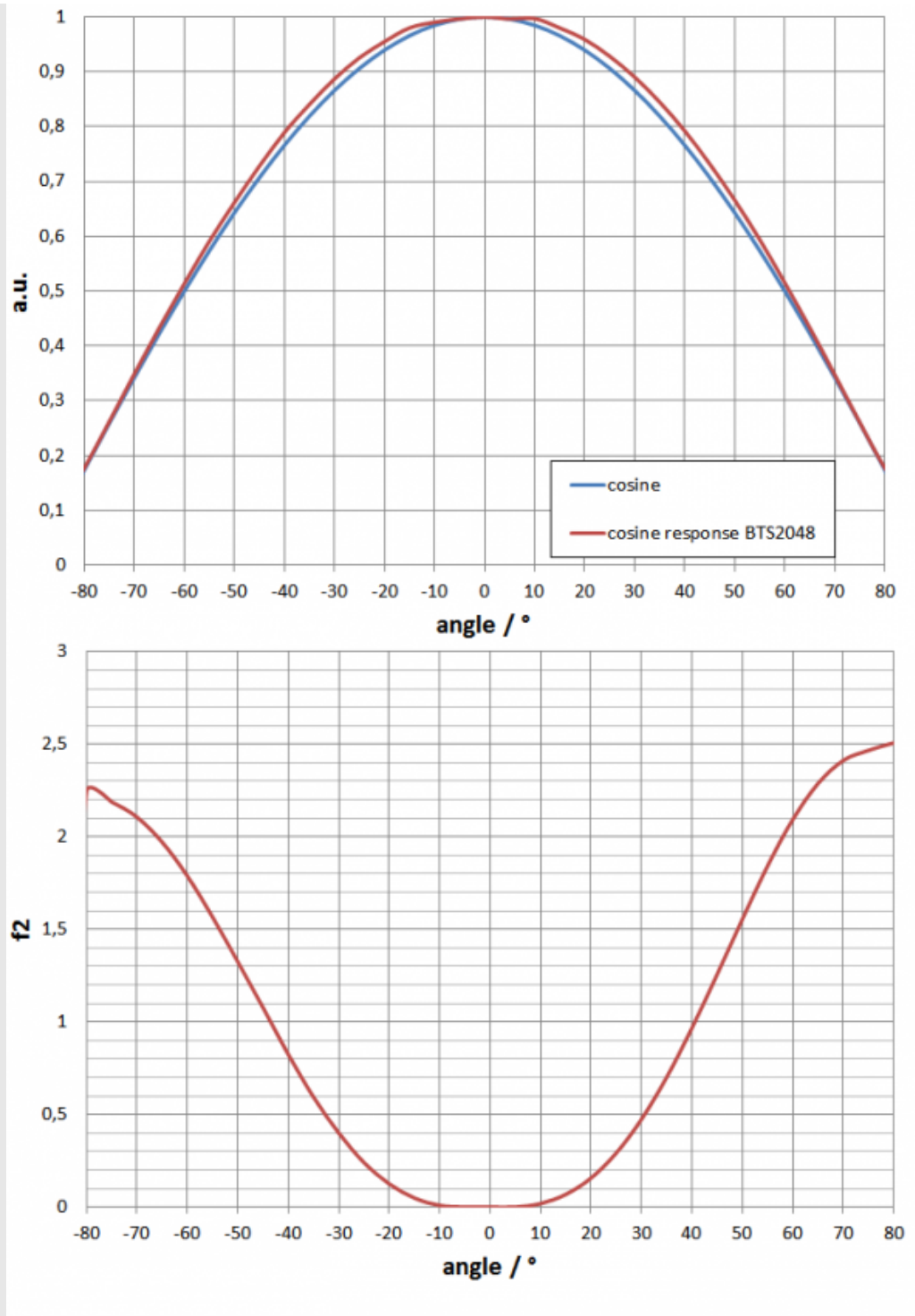
General											
Short description	CCD based spectroradiometer with large dynamic for CW-, Datalogger- and Single measurements of spectral irradiance and derivative quantities (spectrum, erythema, ICNIRP, etc.) in the UV spectral region for outdoor use.										
Main features	Compact measurement device. 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.										
Range of measurement	Spectral: $3E-4 \text{ W/(m}^2\text{nm)}$ to $3E5 \text{ W/(m}^2\text{nm)}$ @325nm, 190 nm to 430 nm. Integral: $1E1 \text{ W/m}^2$ noise equivalent to $2E10 \text{ W/m}^2$										
Typical applications	Diodearray spectrometer for scientific outdoor measurement tasks. Erythema, ICNIRP, solar-cells, etc.										
Calibration	Factory calibrations traceable to PTB calibration standards.										
Product											
Measurands	Spectral irradiance ($\text{W/(m}^2 \text{ nm)}$), irradiance (W/m^2), peak wavelength, center wavelength, centroid wavelength, Erythema, ICNIRP.										
Input optics	Diffusor, cosine corrected field of view ($f2 \leq 3 \%$)										
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 $a^*(s_2(\lambda))$ respectively $F^*(s_2(\lambda))$.										
Calibration uncertainty	Spectral irradiance <table style="width: 100%; border: none;"> <tr> <td style="width: 80%;">(200 - 249) nm:</td> <td style="text-align: right;">± 12 %</td> </tr> <tr> <td>(250 - 339) nm:</td> <td style="text-align: right;">± 7 %</td> </tr> <tr> <td>(340 - 399) nm:</td> <td style="text-align: right;">± 5 %</td> </tr> <tr> <td>(400 - 430) nm:</td> <td style="text-align: right;">± 4 %</td> </tr> <tr> <td colspan="2">Spectral irradiance responsivity (200 - 430) nm</td> </tr> </table>	(200 - 249) nm:	± 12 %	(250 - 339) nm:	± 7 %	(340 - 399) nm:	± 5 %	(400 - 430) nm:	± 4 %	Spectral irradiance responsivity (200 - 430) nm	
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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
S/N	5000 *5
Dynamic range	>9 Magnitudes
Responsivity range spectral irradiance	(3E-4 - 3E5) W/(m ² nm) @325nm *6*7
typ. measurement time	W/m ² of a Halogen lampe from (250 - 400) nm 1 4,4 s 10 440 ms 100 44 ms
different 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	Spectral responsivity with radiometric matching. Online correction of the radiometric matching through spectral measurement data (spectral mismatch factor correction).
Measurement time	(0.1 - 6000) ms
Measurement range	seven (7) measurement ranges with transcendent offset correction
Calibration	Irradiance ± 6 % *10
Measurement range	(1E1 - 2E10) W/m ² *11
Graphs	

Spectral responsivity



f2

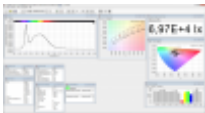




Miscellaneous

Processors	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
Mount	3x M6 screw threads
Temperature range	Storage: (-10 to 50) °C Operation: (-25 to 50) °C *9
Temperature stability	inside WP housing (electronics): $\leq \pm 1$ °C CCD Chip: $\leq \pm 0.25$ °C
Info	<p>*1 It is recommended to perform a new dark signal measurement for every change in the integration time</p> <p>*2 typical value, the uncertainty of the dominant wavelength depends on the spectral distribution of the LED</p> <p>*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.</p> <p>*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</p> <p>*6 Minimum 500/1 S/N. Maximum at full scale control.</p> <p>*7 Irradiation only allowed for a short time so as to avoid thermal damage</p> <p>*8 during USB connection, not all functions are available due to the limited current supply e.g. no Ethernet and TEC cooling</p> <p>*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.</p> <p>*10 With $a(Z)$ correction by a Deuterium lamp</p> <p>*11 By a deuterium lamp</p>

Configurable with

Produktname	Product Image	Description	Show product
S-BTS2048		Application software for BTS2048 variants.	https://www.gigahertz-optik.de/en-us/product/S-BTS2048
S-SDK-BTS2048		Software Development Kit for BTS2048 variants.	https://www.gigahertz-optik.de/en-us/product/S-SDK-BTS2048

Produktname	Product Image	Description	Show product
BTS2048-VL-TEC-WP		<p>Bi-technology sensor light meter for high quality solar VIS measurements.</p> <p>Features: Weatherproofed, high spectral resolution, short measurement time, entrance optic with diffusor for irradiance and spectral irradiance, etc.</p>	https://www.gigahertz-optik.de/en-us/product/BTS2048-VL-TEC-WP

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.
15298474	S-BTS2048	User software for BTS2048 and variants.