BTS2048-UV-S

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

Product tags: UV

Description

Nominated for the Innovation Award Bavaria 2018

BTS2048-UV-S fast BiTec sensor spectroradiometer for high-quality UV measurements

The BTS2048-UV-S is a high-quality spectralradiometer whose compact design and elaborate optical, electronic and mechanical interfaces make it ideal for integration in complex industrial and scientific measurement tasks.

BiTec sensor for high-end light measurement

One of the outstanding features of this exceptional spectroradiometer is its BiTec sensor (see **technical article about 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.

High-quality back-thinned CCD detector

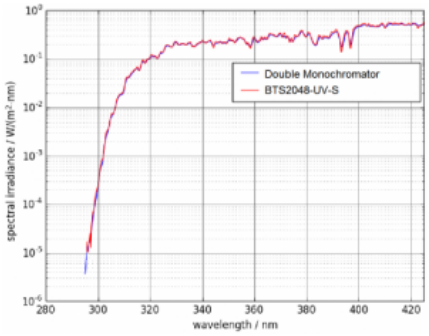
The diode array comprising of 2048 pixels has a utilizable spectral responsivity range between 190 nm and 430 nm. It has a 0.7 nm optical bandwidth and a pixel resolution of 0.13nm/pixel. Due to the back-thinned technology, this CCD chip is substantially more sensitive as compared to conventional front-illuminated CCD chips. Furthermore the CCD is one stage cooled (1TEC).

Flash spectral radiometer

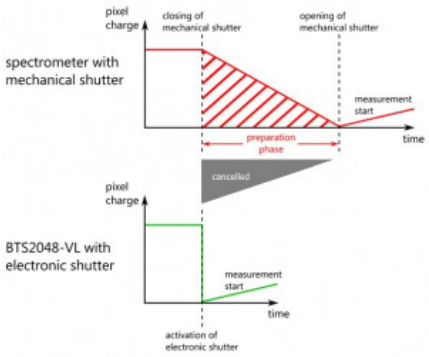
Another of its features is that the back-thinned CCD detector is equipped with an electronic shutter. This makes the measurement within a light flash possible. Together with the diverse trigger functions, integration times of between 2µs and 60000ms, the powerful micro-processor and the very fast LAN interface (7ms for a complete data file), the BTS2048-UV-S qualifies for a wide range of applications.

Precise spectral radiometry (low straylight)

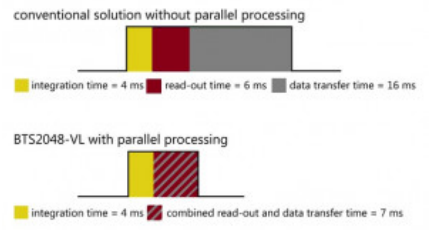
To facilitate optimal use of the CCD sensor's dynamic range and to overcome the problems of most array spectoradiometers in the UV range, a remote-controlled filter wheel (open, closed, optical filters) is located in the optical beam path. This filters combined with smart measurement and stray light correction routines enables high quality measurements of the



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.



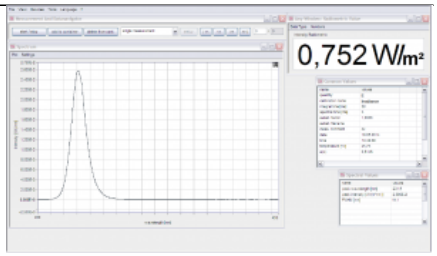
Electronic Shutter reduces the measurement time



Ethernet interface reduces the datatransfer time

BTS2048-UV-S. Results are comparable with double monochromator results (see figure). However, the measurement duration is significantly lower.

The BTS2048-UV-S is equipped with a particular set of filters optimized for solar irradiance measurements of e.g. sun simulators, etc. Those allow a superior stray light suppression compared to other spectroradiometers that puts the device's performance on the same level as double monochromators. The results of a direct intercomparison study are presented **here**. See here also our BTS2048-UV-S-WP version for outdoor measurements.



S-BTS2048 software for the BTS2048-UV-S

However, the BTS2048-UV-S cannot only be used for solar irradiance measurements but for the measurement of other UV sources as well. It also offers two different optimized measurement modes using optical filters for general stray light corrected measurements. One of those modes is based on an out-of-range straylight correction and the second one is based on bandpass filter usage for stray light correction. Gigahertz-Optik's stray light calibration technique in combination with further mathematical stray light correction methods enable the superior stray light suppression when measuring UV sources. **See also our technical article about stray light reduction for spectroradiometers**. The calibration of a BTS2048-UV-S additional stray light correction matrix is available optionally on request.

The BTS2048-UV can directly plugged on a integrating sphere (picture shows the constructional identical BTS2048-VL)

Diffuser window instead light guide

As for the input optics, the BTS2048-UV-S 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. The f2 adjustment of the cosine corrected field of view to less than 3% makes it possible to use the BTS2048-UV-S for direct measurement in absolute radiometric measurands

- Irradiance (W/m²)
- Spectral irradiance (W/(m² nm))
- Radiant intensity (W/sr)
- Spectral radiant intensity (W/sr nm)

Radiant power measurement

In connection with integrating spheres, the BTS2048-UV-S is the optimal light meter for measurement of the radiant power respectively spectral radiant power. The prefixed diffuser window can be positioned in the sphere such that an uninterrupted hemispherical field of view is created. Gigahertz-Optik manufactures a wide range of integrating spheres as well as the necessary accessories e.g. calibration standards.

Ultra fast interfaces

The BTS2048-UV-S is controlled via a USB 2.0 or Ethernet interface. With

regards to the communication speed the ethernet port is superior to the USB2.0 interface. Furthermore, the data preparation occurs in the BTS2048-UV-S to optimize the datatransfer speed. For this purpose, an independent, high-performance microprocessor is incorporated.

User software with flexible desktop structure

Among the BTS2048-UV-S 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.
- CIE 1931 chromaticity diagram. Zoom function.
- Spectrum. Zoom function.
- Data logger. Zoom function.
- etc.

Traceable calibration

Calibration of the BTS2048-UV-S, including its accessories, is performed by Gigahertz-Optik **ISO/IEC 17025 calibration laboratory** for optical measurands with reference to national and international calibration standards.

Specifications

General	
Typical applications	Lightmeter for spectral Irradiance, Erythema, etc.
Measured Quantity	Spectral irradiance (W/(m² nm)), irradiance (W/m²), peak wavelength, center wavelength, centroid wavelength, Erythema. Option integrating sphere: in addition spectral radiant power (W/nm) and radiant power (W)
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 $F^*(s_z(\lambda))$.

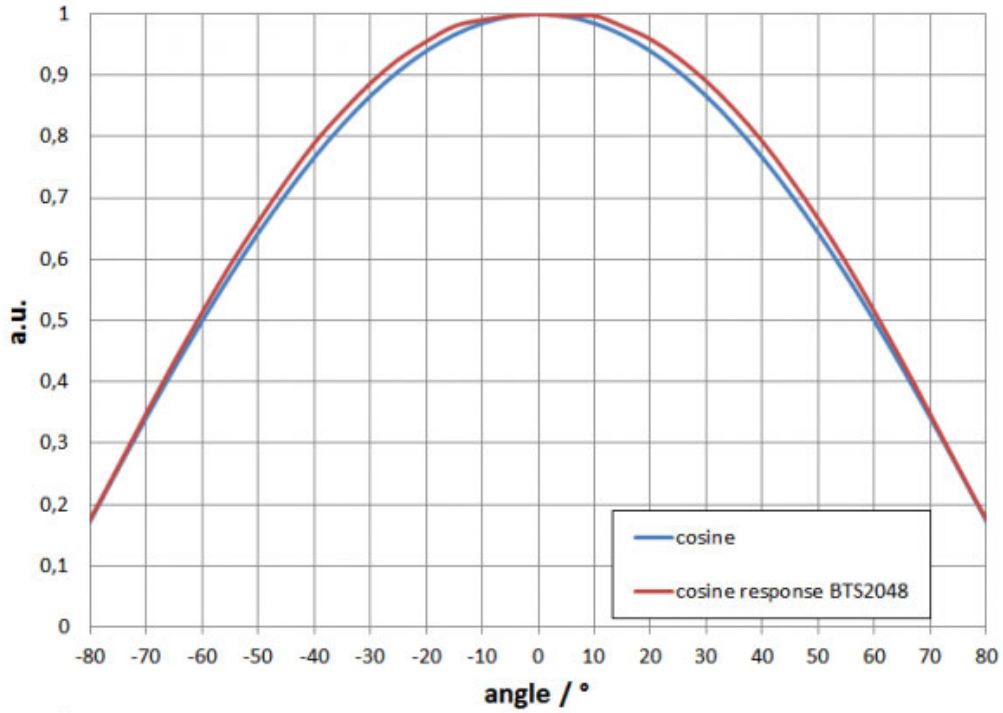
Calibration uncertainty	Spectral irradiance λ u(*k*=2) (200 - 239) nm ± 9 % (240 - 339) nm ± 6.8 % (340 - 359) nm ± 5 % (360 - 399) nm ± 4.3 % (400 - 430) nm ± 4 % Spectral irradiance responsivity (200 - 430) nm
Spectral Detector	
Integration Time	2 µs - 60 s *1
Spectral range	(190 - 430) nm
Optical 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	
Measurement time	(0.1 - 6000) ms
Measurement range	seven (7) measurement ranges with transcendent offset correction
Calibration	Irradiance ± 6 % *[10]
ADC	16bit
Measurement range	Optional: (5E-3 - 2E5) W/m² *[11]

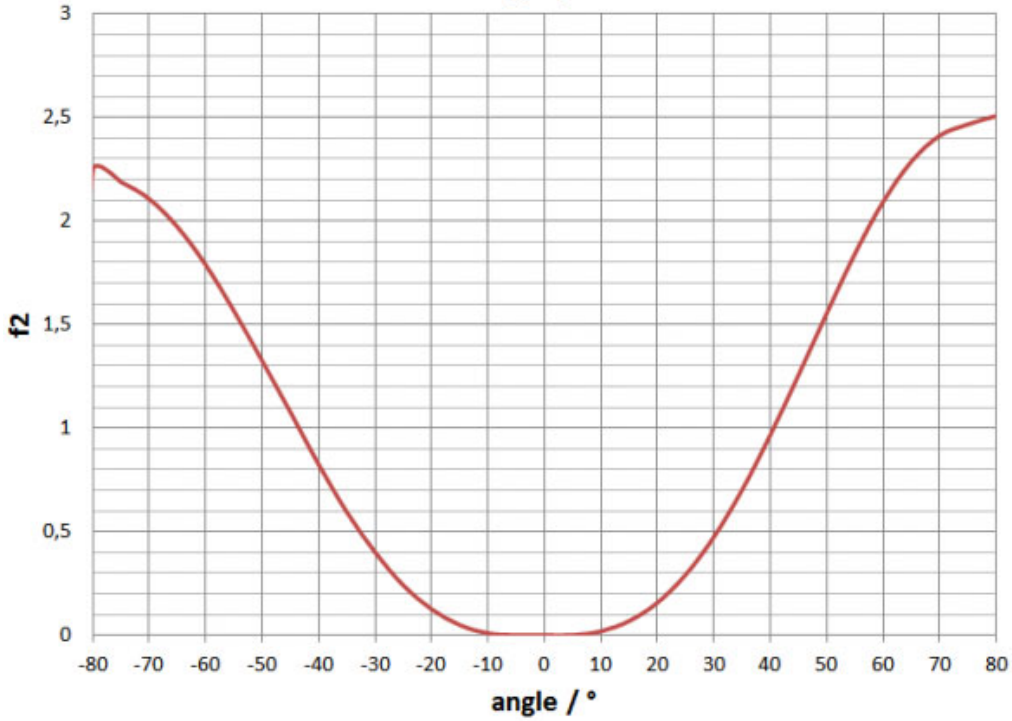
Filter	Optional: Mathematical adjustment of the responsivity to a rectangular function from 220 nm to 360 nm (SMCF on-line correction to the radiometric function with the measured spectral data).* ** The spectral responsitivity of the diode does not correspond to a rectangular function (not possible 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).*

Graphs

Spectral responsivity

f2 (directional response/cosine error)


a.u.
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80
angle / °
cosine
cosine response BTS2048


f2
3
2,5
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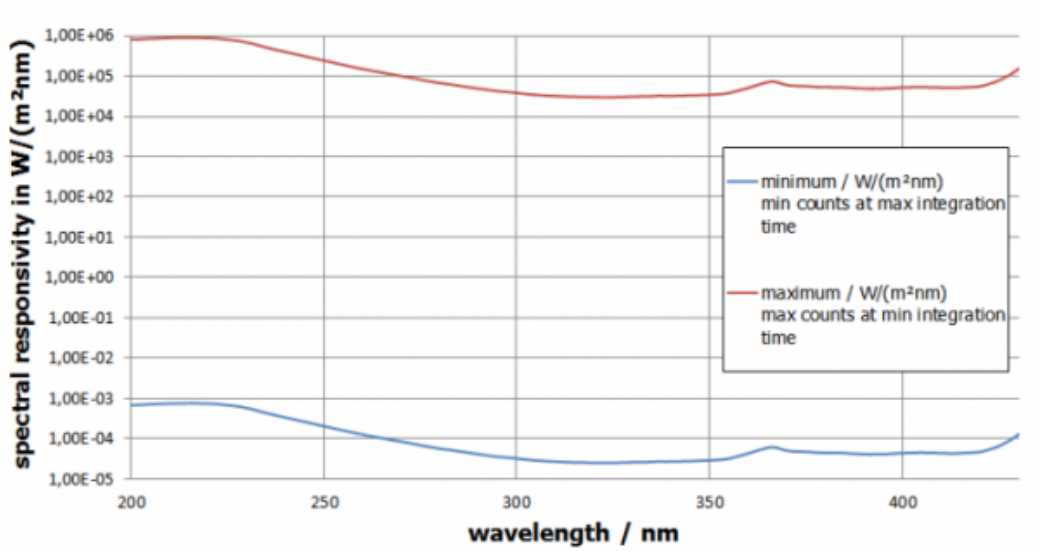
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80
angle / °

Spectral responsivity	

Miscellaneous

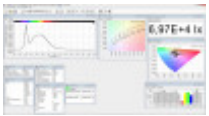
Microprocessor	32bit for device control,16bit for CCD array control, 8bit for photodiode control
Interface	USB V2.0, Ethernet (LAN UDP protocol), RS232, RS485
Data transfer	Standard for 2048 float array values via ethernet 7ms, via USB 2.0 140 ms
Input Interfaces	2x (0 - 25) VDC, 1x optocoupler isolated 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: DC Input 5V (±10 %) at 700 mA With USB bus (500mA) *8
Dimensions	103 mm x 107 mm x 52 mm (Length x Width x Height)
Weight	500 g
Mounting	Tripod and M6 screw threads Front adapter UMPA-1.0-HL for use with integrating sphere port-frame UMPF-1.0-HL
Temperature range	Storage: (-10 to 50) °C Operation: (10 to 30) °C *9
Temperature range	CCD Chip: ≤ ± 0.25 °C

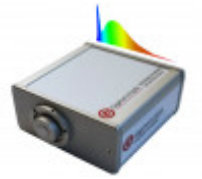
Info	**1 It is recommended to perform a new dark signal measurement for every change in the integration time* **2 typical value, the uncertainty of the dominant wavelength depends on the spectral distribution of the LED* **3 typical value, measured 100 nm left of the peak of a cold white broadband LED with and deep blue LED peak* **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 required for temperature stabilization in approx. 25min. 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*

Downloads

Type	Description	File-Type	Download
BTS2048-Series	BTS2048 'Not just another spectrometer' brochure	pdf	https://www.gigahertz-optik.com/assets/BTS2048_broschuere_DINA4_hoch_V2_2022.pdf

Configurable with

Product Name	Product Image	Description	Go to product
S-BTS2048		Application software for BTS2048 variants.	https://www.gigahertz-optik.com/en-us/product/s-bts2048/
S-SDK-BTS2048		Software Development Kit for BTS2048 variants.	https://www.gigahertz-optik.com/en-us/product/s-sdk-bts2048/
GB-GD-360-RB40		Goniometer for the measurement of 2π sources	https://www.gigahertz-optik.com/en-us/product/gb-gd-360-rb40/

Product Name	Product Image	Description	Go to product
ISS-28P-Xe-V01		Integrating sphere light source with very high light output (sun-like spectra)	https://www.gigahertz-optik.com/en-us/product/iss-28p-xe-v01/
BTS2048 Series		Compact spectroradiometers with excellent optical performance and BiTec technology for precise measurements for lab and field use.	https://www.gigahertz-optik.com/en-us/product/bts2048-series/

Purchasing information

Article-Nr	Modell	Description
Product		
15298727	BTS2048-UV-S	Measuring device, hard cover box, users guide, software, calibration certificate.
Calibration		
15314795	K-BTS2048-XX-SLMC	Determination and implementation of stray light correction matrix.
15310293	K-BTS2048UVS-E-S-V03	Calibration of the BTS2048-UV-S from 200 nm to 400 nm while applying the stray light correction matrix. Calibration certificate.
Re-calibration		
15300809	K-BTS2048UVS-E-S-V01	Re-Calibration of the BTS2048-UV-S from 200 nm - 430 nm with calibration certificate
Software		
15298474	S-BTS2048	User software for BTS2048 and variants.
15298470	S-SDK-BTS2048	Software development kit with users guide.
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.
Accessories		
15312474	BTS2048-Z03	Triggering cable for BTS2048 series measuring devices.
15308779	CP-SRT-E	Tube for stray light reduction.
15316085	BTS2048-XX-Z08	Tube for stray light reduction. 11.5° field of view.
15317385	BTS2048-UV-Z01	Front tube with 80° field of view (i.e. ICNIRP, EN 62471, etc.).
15309109	BTS2048-VL-Z09	Front tube with 11 mrad and 100 mrad field of view. Material: Plastic.
15309268	BTS2048-VL-Z10	Front tube with 11 mrad and 100 mrad field of view. Material: Aluminum.
15298714	BTS2048-VL-Z07	Adapter for mounting an SRT-M37-L accessory. Required for radiance measurements.

Article-Nr	Modell	Description
15298717	BTS2048-VL-Z08	Filter holder for attaching filters in front of COS diffuser of BTS2048 devices. Filter size: 18 mm x 18 mm.
15298718	BTS2048-VL-Z08S	UV transmissive protection screen for mounting in BTS2048-VL-Z08.

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- Repairs & Updates
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