

# BTS2048-VL-F

<https://www.gigahertz-optik.de/en-us/product/BTS2048-VL-F>

Product tags: VIS



## Description

### BTS2048-VL-F, CCD spectroradiometer with light guide input

The only difference between the BTS2048-VL-F and the [BTS2048-VL](#) is that the BTS2048-VL-F has a light guide input and therefore meets all the requirements of a high-end array spectroradiometer.

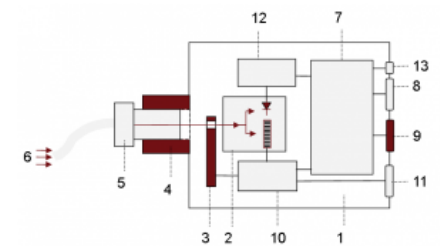
Flexible light guides are convenient for applications where the BTS2048-VL cannot be coupled directly to the input accessories required for the application. The BTS2048-VL-F has a mount to which the light guide can be attached easily using a 10 mm sleeve. Light guides of different lengths, diffuser windows for axial or 90° incident light and adapters for attachment of the light guide to an integrating sphere are among the accessories offered by Gigahertz-Optik. Customized light guides are also available on request.



*The BTS2048-VL spectroradiometer for use with light guide*

### User software and developer software

The standard [S-BTS2048](#) user software has a customizable user interface and a large number of display and function modules which can be activated when configuring the BTS2048-VL-F with the respective accessory components from Gigahertz-Optik GmbH. The [S-SDK-BTS2048](#) developer software is offered for integration of the BTS2048-VL-F in the customer's own software.



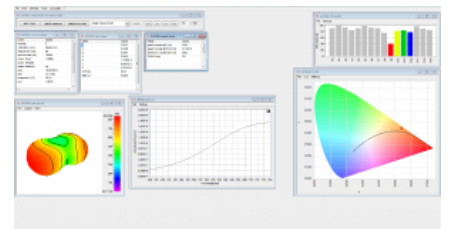
### Calibration

One essential quality feature of photometric devices is their precise and traceable calibration. The BTS2048-VL-F is calibrated by Gigahertz-Optik's 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.

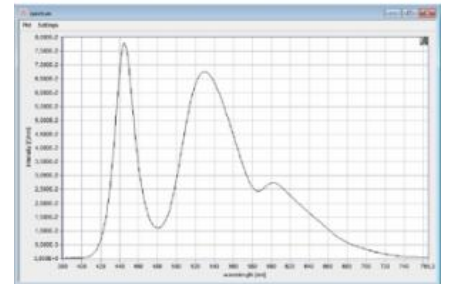
- 1) BTS2048-VL
- 2) BiTec sensor with Si photodiode, CCD array spectrometer
- 3) Filter wheel with OD1, OD2 and shutter
- 4) Light-guide mount
- 5) Light-guide Adapter
- 6) Light incident
- 7) Microprocessor for data processing and communication
- 8) USB 2.0 Interface
- 9) High Speed ethernet Interface
- 10) Microprocessor CCD sensor control
- 11) Trigger In/Out
- 12) Microprocessor photodiode
- 13) DC voltage supply



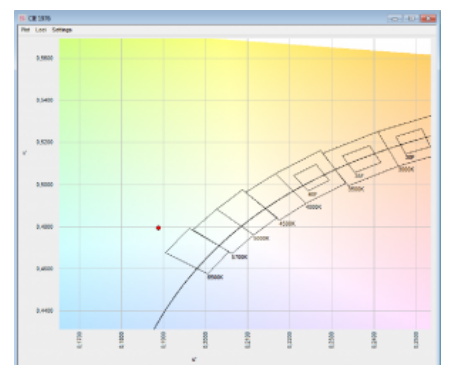
*CP-F16-M-10 light guide adapter*



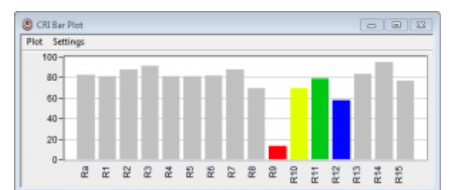
*S-BTS2048 User software interface*



*Graphical view of the spectrum*



*CIE 1976 Chromaticity diagram*



*CRI Bar Plot*

## Specifications

### General

Short description

CCD spectroradiometer with light guide input for coupling the light meter from the application. Wide dynamic range for CW and pulsed measurements. Measurement parameters dependent on the optional accessory, spectrum, luminous color, and color rendering index

Main features	Compact device. BiTec detector with back-thinned CCD (2048 pixels, 2 nm optical resolution, electronic shutter) and Si-photodiode with V( $\lambda$ ) filter. Optical bandwidth correction (CIE214). Filter wheel with shutter and two attenuation filters. Input lens for light guide
Measurement range	Depending on the accessories. Spectral range 280 nm to 1050 nm
typical applications	Separate setup of the CCD spectroradiometer and measurement optics. Measurement device with light guide for integration in test systems for front-end and back-end LED binning
Calibration	Factory calibration. Traceable to international calibration standards

#### Product

Measured Quantity	Spectral irradiance ( $W/(m^2 nm)$ ), irradiance ( $W/m^2$ ), illuminance (lx), spectral radiant intensity ( $W/(sr nm)$ ), radiant intensity ( $W/sr$ ), luminous intensity (cd), dominant wavelength, peak wavelength, center wavelength, centroid wavelength, x, y, $u'$ , $v'$ , X,Y,Z, delta uv, color temperature, color rendering index (CRI) Ra, R1-R15, TM-30-15, CQS, CIE-170, etc.. Option integrating sphere: in addition spectral flux ( $W/nm$ ) and luminous flux (lm) Option goniometer: in addition radiant intensity ( $W/sr$ ) distribution and luminous intensity (cd) distribution
Sensor	With light guide and diffuser  Accuracy class B according to DIN 5032 and CIE No. 69 Accuracy class A for $f1$ , $u$ , $f3$ and $f4$ according to DIN 5032 and CIE No. 69
Input optics	Light guide adapter F16-F
Filter wheel	4 positions (open, closed, OD1, OD2). Use for remote dark current measurement and dynamic range extension.
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	Depending on the light guide


#### Spectral Detector

Integration Time	2 $\mu$ s - 4 s *1
spectral range	(280 -1050) nm
Optical Bandwidth	2 nm
Pixel resolution	$\sim$ 0.4 nm/Pixel
Number of pixels	2048
Chip	Highly sensitive back-thinned CCD chip
ADC	16bit (25 ns instruction cycle time)
Peak wavelength	$\pm$ 0.2 nm
Dominant wavelength	$\pm$ 0.5 nm *2
$\Delta y$ $\Delta x$ uncertainty	$\pm$ 0.0015 (Standard illuminant A) $\pm$ 0.0020 (common LED)
Repeatability $\Delta x$ and $\Delta y$	$\pm$ 0.0001
$\Delta CCT$	Standard illuminant A 30K; LED up to $\pm$ 1.5 % depending of the LED spectrum
Band-pass correction	mathematical online band-pass correction is supported
Linearity	completely linearized chip >99.6%
Stray Light	2E-4 *3
Base line noise	5 cts *4

SNR	5000 *5								
dynamic range	>9 Magnitudes								
CRI (color rendering index)	Ra and R1 to R15								
<b>Integral Detector</b>									
Filter	Spectral responsivity with fine CIE photometric matching. Online correction of the photometric matching through spectral measurement data (spectral mismatch factor correction).								
Measurement time	20 $\mu$ s - 6000 ms <table style="margin-left: 20px;"> <tr> <td>range</td> <td>rise time (10 – 90) %</td> </tr> <tr> <td>0,1,2</td> <td>50 <math>\mu</math>s</td> </tr> <tr> <td>3,4,5</td> <td>65 <math>\mu</math>s</td> </tr> <tr> <td>6,7,8</td> <td>1.5 ms</td> </tr> </table>	range	rise time (10 – 90) %	0,1,2	50 $\mu$ s	3,4,5	65 $\mu$ s	6,7,8	1.5 ms
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Measurement range	Nine (9) measurement ranges with transcendent offset correction								
f1'	$\leq 6\%$ (uncorrected)  $\leq 1,5\%$ ( $f1' a^*(s_z(\lambda))$ ) respectively $F^*(s_z(\lambda))$ corrected by spectral data, done automatically by BTS technology)								
<b>Miscellaneous</b>									
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 ( $\pm 10\%$ ) at 700 mA With USB bus (500mA) *8								
Dimensions	103 mm x 107 mm x 52 mm (Length x Width x Height) + Fiber Adapter								
Weight	500g								
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) $^{\circ}$ C  Operation: (10 to 30) $^{\circ}$ C *9								

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</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</p> <p>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</p> <p>*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. At high temperatures and at the maximum integration time a decreased dynamic can be used.</p>
<b>Option: CP-CD-IL-10 or CP-CD-90-10 (Irradiance)</b>	
spectral irradiance responsivity range (spectral measurement)	<p>(5E-5 - 3E5) W/(m<sup>2</sup>nm)</p> <p>(Note: typically CP-CD-90-10 is 10% insensitive compared to this stated numbers of CP-CD-IL-10)</p>
Illuminance measurement range (integral measurement)	<p>(5E-1 - 1E9) lx</p> <p>(Note: typically CP-CD-90-10 is 10% insensitive compared to this stated numbers of CP-CD-IL-10)</p>

## Configurable with

Produktname	Product Image	Description	Show product
S-SDK-BTS2048		Software Development Kit for BTS2048 variants.	<a href="https://www.gigahertz-optik.de/en-us/product/S-SDK-BTS2048">https://www.gigahertz-optik.de/en-us/product/S-SDK-BTS2048</a>

## Purchasing information

Article-Nr	Modell	Description
<b>Product</b>		
15298737	BTS2048-VL-F	Measuring device, hard cover box, users guide, S-SDK-BTS2048 software, calibration certificate.
15305452	CP-F16-M-10	Adapter for LG-1.5-10 light guides to lightmeters with F16-F mount.
15307119	CP-LG-1.5-10-2	Flexible light-guide with 1.5 mm Diameter fiber, 10 mm diameter mounts and 2 m length.
15305454	CP-CD-IL-10	Diffusor window adapter for LG-1.5-10 light-guides. 37 mm housing diameter.
15305453	CP-CD-90-10	90° diffusor window adapter for LG-1.5-10 light-guides. 37 mm housing diameter.

Article-Nr	Modell	Description
<b>Software</b>		
15298470	S-SDK-BTS2048	Software development kit, software CD with users guide.