

# BTS2048-BS

<https://www.gigahertz-optik.com/en-us/product/bts2048-bs/>

Product tags: VIS



# Description

## BTS2048-BS CCD spectroradiometer for LASER radiation

The BTS2048-BS meets all the requirements of a high performance CCD spectroradiometer for measurement of laser diodes in the blue spectral range.

One of its unique features is its BiTec sensor, which combines a back-thinned CCD based spectroradiometer with a radiometric Si photodiode. This combination provides high linearity levels as well as extremely fast measurements. The fully linearized 2048 pixel CCD detector has a very wide dynamic range thanks to its integrating times that range from 2  $\mu$ s to 4 s. This makes it possible to measure laser diodes over a wide intensity range. The optical grid arrangement limits the spectral measurement range to between 400 nm and 530 nm hence resulting in a very small optical bandwidth (0.3 nm). Si photodiodes exhibit exceptionally high linearity levels across their dynamic range. This makes the photodiode within the BiTec sensor ideal for additional linearization of the CCD ([article on the BTS technology](#)) The radiometric responsivity function of the photodiode may be used independently of the CCD enabling fast CW measurements even at low intensities. Any radiometric mismatch can be auto-corrected using spectral data from the CCD. Despite its compact dimensions (103 mm x 107 mm x 52 mm – LxWxH), the BTS2048-BS spectroradiometer has a remote-controlled filter wheel with two OD filters and a shutter for dark measurement.

### Direct mounting instead of using a light guide

The BTS2048-BS spectroradiometer has a diffuser window and can therefore be used to measure the irradiance, spectrum and peak wavelength, without the need for any additional equipment. The diffuser window also enables the BTS2048-BS to be mounted directly onto accessories such as integrating spheres, radiance intensity measurement lenses, and goniometers in order to measure the radiant power, radiant intensity, and radiant intensity distribution.

### 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-BS with the respective accessory components from Gigahertz-Optik GmbH.

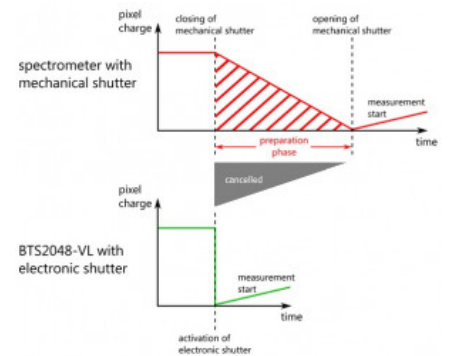
The [S-SDK-BTS2048](#) developer software is recommended for integration of the BTS2048-BS in the user's own software.

## Calibration

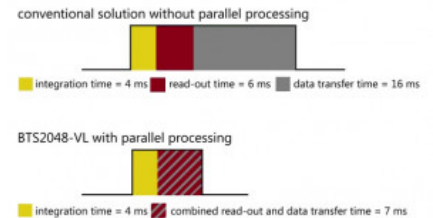
One essential quality feature of photometric devices is their precise and traceable calibration. The BTS2048-BS is calibrated by Gigahertz-Optik's calibration laboratory which has been accredited by DAKKS (D-K-15047-01-00) for the *spectral responsivity* and *spectral irradiance* in line with ISO/IEC 17025. The calibration also included the corresponding accessory components. Every device is delivered with its respective calibration certificate.



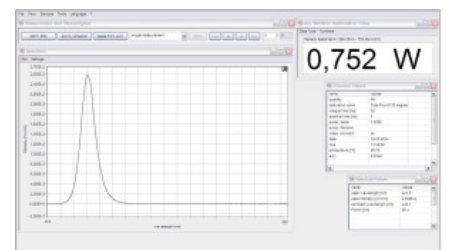
The BTS2048-BS can directly plugged on a integrating sphere



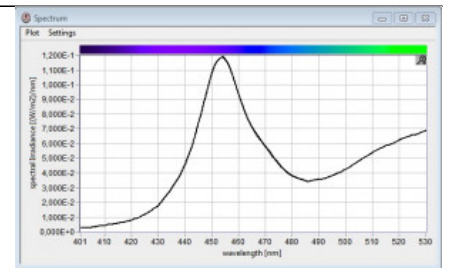
Electronic Shutter reduces the measurement time



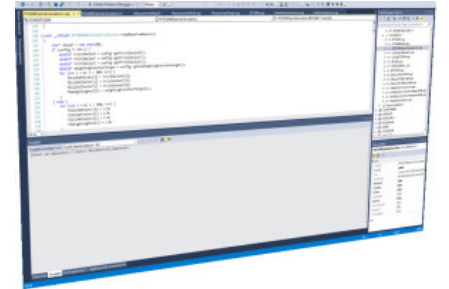
Ethernet interface reduces the datatransfer time



S-BTS2048 User software interface



Graphical view of the spectrum



S-SDK-BTS2048 Software development kit for device integration in customer software

## Specifications

### General

|                      |  |
|----------------------|--|
| Short description    | CCD spectrometer with a wide dynamic range for CW and short-term measurement of the irradiance, spectrum, and peak wavelength. Accessories for measurement of other parameters.  |
| Main features        | Compact device. BiTec detector with a back-thinned CCD (2048 pixels, 0.3 nm optical resolution, 400 nm to 530 nm, electronic shutter) and Si photodiode with a radiometric filter. Optical bandwidth correction (CIE 214). Filter wheel with shutter and attenuation filters. Input lens with a diffusor window. Cosine field of view. |
| Measurement range    | Spectral: (1E-3 - 1E7) W/(m²nm), 400 nm to 530 nm  |
| Typical applications | CCD spectroradiometer for design applications. Module for integration in test systems  |
| Calibration          | Factory calibration. Traceable to international standards  |

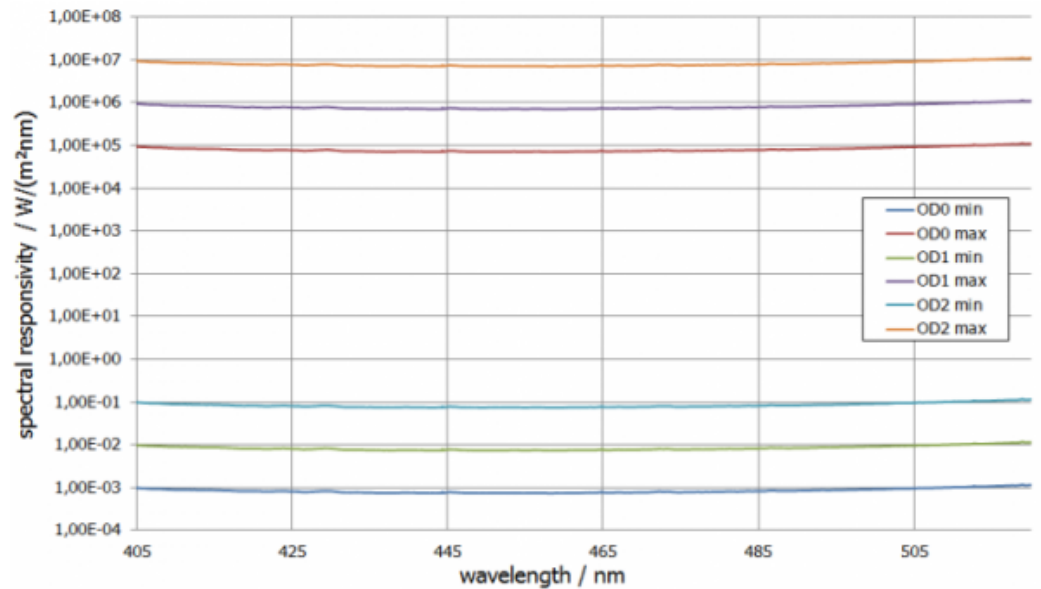
### Spectral Detector

|                   |  |
|-------------------|--|
| Integration Time  | 2 µs - 4 s *1                          |
| Spectral range    | (400 - 530) nm                         |
| Optical Bandwidth | 0.3 nm                                 |
| Pixel resolution  | ~0.07 nm/Pixel                         |
| Number of pixels  | 2048                                   |
| Chip              | Highly sensitive back-thinned CCD chip |
| ADC               | 16bit (25 ns instruction cycle time)   |
| Peak wavelength   | ± 0.025 nm                             |

|  |  |                          |                                |
|--|--|--------------------------|--------------------------------|
| $\Delta$ CCT                           | Standard illuminant A 50K; LED up to $\pm$ 4% depending of the LED spectrum  |                          |                                |
| Band-pass correction                   | mathematical online band-pass correction is supported  |                          |                                |
| Linearity                              | completely linearized chip >99.6%  |                          |                                |
| Stray Light                            | 3E-4   | *2                       |                                |
| Base line noise                        | 5 cts  | *3                       |                                |
| SNR                                    | 5000   | *4                       |                                |
| Dynamic range                          | >9 Magnitudes  |                          |                                |
| Spectral irradiance responsivity range | (1E-3 - 1E7) W/(m <sup>2</sup> nm)   | *5*6                     |                                |
| Typical measurement time               | 10 W/m <sup>2</sup> (400 - 530) nm Standard Illuminant A: 440ms<br>100 W/m <sup>2</sup> (400 - 530) nm Standard Illuminant A: 44ms   |                          |                                |
| <b>Integral Detector</b>               |  |                          |                                |
| ADC                                    | 16bit  |                          |                                |
| Filter                                 | Optional: Spectral responsivity with radiometric matching. Online correction of the radiometric matching through spectral measurement data (spectral mismatch factor correction).  |                          |                                |
| Measurement time                       | 20 $\mu$ s - 6000 ms   |                          |                                |
|  | range  | rise time (10 - 90) %    |                                |
|  | 0,1,2  | 50 $\mu$ s               |                                |
|  | 3,4,5  | 65 $\mu$ s               |                                |
|  | 6,7,8  | 1.5 ms                   |                                |
| Measurement range                      | seven (7) measurement ranges with transcendent offset correction   |                          |                                |
| Calibration                            | Irradiance $\pm$ 5 %   |                          |                                |
| <b>Specification</b>                   |  |                          |                                |
| Measured Quantity                      | Spectral irradiance (W/(m <sup>2</sup> nm)), peak wavelength, center wavelength, centroid wavelength, Option integrating sphere: in addition radiant power (W) and spectral radiant power (W/nm), Option goniometer: in addition spectral radiant intensity and radiant intensity distribution |                          |                                |
| Input optics                           | Diffusor, cosine corrected field of view ( $f_2 \leq 3$ %)   |                          |                                |
| 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 uncertainty                | Spectral irradiance  |                          |                                |
|  | $\lambda$<br>(400 - 530) nm:   | $u(k=2)$<br>OD0: +/- 4 % | OD1: +/- 4 %      OD2: +/- 4 % |

## Graphs

## Spectral responsivity



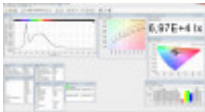

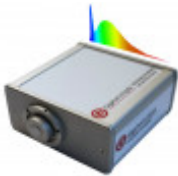

## Miscellaneous

|                   |  |
|-------------------|--|
| 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<br>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<br>With USB bus (500mA) *7   |
| Dimensions        | 103 mm x 107 mm x 52 mm (Length x Width x Height)  |
| Weight            | 500 g  |
| Mounting          | Tripod and M6 screw threads<br>Front adapter UMPA-1.0-HL for use with integrating sphere port-frame UMPF-1.0-HL  |
| Temperature range | Storage: (-10 to 50) °C<br>Operation: (10 to 30) °C *8   |
| Info              | *1 It is recommended to perform a dark signal measurement for every change in the integration time<br>*2 typical value, measured 120nm left of the peak of a LED, blocked by GG435<br>*3 *4 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<br>i.e. quadratic fall of the base noise e.g. averaging to a factor 100 improves the S/N by a factor 10<br>*5 Minimum 500/1 S/N. Maximum at full scale control.<br>*6 Irradiation only allowed for a short time so as to avoid thermal damage<br>*7 during USB connection, not all functions are available due to the limited current supply e.g. no Ethernet<br>*8 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.<br>*9 measurement of a white LED and 20000 counts |

## Downloads

| Type           | Description                                      | File-Type | Download  |
|----------------|--|-----------|---|
| BTS2048-Series | BTS2048 'Not just another spectrometer' brochure | pdf       | <a href="https://www.gigahertz-optik.com/assets/BTS2048_broschuere_DI_NA4_hoch_V2_2022.pdf">https://www.gigahertz-optik.com/assets/BTS2048_broschuere_DI_NA4_hoch_V2_2022.pdf</a> |

## Configurable with

| Product Name   | Product Image   | Description  | Go to product   |
|----------------|---|--|---|
| S-BTS2048      |    | Application software for BTS2048 variants.   | <a href="https://www.gigahertz-optik.com/en-us/product/s-bts2048/">https://www.gigahertz-optik.com/en-us/product/s-bts2048/</a>           |
| S-SDK-BTS2048  |    | Software Development Kit for BTS2048 variants.   | <a href="https://www.gigahertz-optik.com/en-us/product/s-sdk-bts2048/">https://www.gigahertz-optik.com/en-us/product/s-sdk-bts2048/</a>   |
| BTS2048 Series |   | Compact spectroradiometers with excellent optical performance and BiTec technology for precise measurements for lab and field use.   | <a href="https://www.gigahertz-optik.com/en-us/product/bts2048-series/">https://www.gigahertz-optik.com/en-us/product/bts2048-series/</a> |
| LDM-C50        |  | Spectral radiance optic for BTS2048 series with integrated camera. Focus-able achromatic objective, for the usage with BTS2048 series. Different apertures and measurement distances including calibration are possible. | <a href="https://www.gigahertz-optik.com/en-us/product/ldm-c50/">https://www.gigahertz-optik.com/en-us/product/ldm-c50/</a>               |

## Purchasing information

| Article-Nr            | Modell              | Description   |
|-----------------------|---------------------|---|
| <b>Product</b>        |                     |   |
| 15298459              | BTS2048-BS          | Measuring device, hard cover box, users guide, S-BTS2048 software, calibration certificate. |
| <b>Re-calibration</b> |                     |   |
| 15313719              | K-BTS2048BS-E-S-V01 | Re-calibration of the BTS2048-BS from 400 nm to 530 nm with calibration certificate         |
| <b>Software</b>       |                     |   |
| 15298470              | S-SDK-BTS2048       | Software development kit with users guide.  |
| <b>Accessories</b>    |                     |   |

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| <b>Article-Nr</b> | <b>Modell</b> | <b>Description</b>                               |
|-------------------|---------------|--|
| 15312474          | BTS2048-Z03   | Trigger cable. For use with LPS-20 power supply. |

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