BTS2048-VL-TEC

http://www.gigahertz-optik.de/en-us/product/BTS2048-VL-TEC

Product tags: VIS

Description

BTS2048-VL-TEC, CCD spectroradiometer with thermoelectric cooling of the CCD detector

The BTS2048-VL-TEC variant of the BTS2048-VL incorporates thermoelectric cooling of its CCD detector. The device meets all the requirements of a high-end diode array spectroradiometer and is favourably priced despite its cutting-edge design.

Thermoelectric cooling of the CCD detector minimizes the dark noise signal and enables integration times ranging from 2 µs to 60 s whereas those of the BTS2048-VL lie between 2 µs and 4 s. The BTS2048-VL-TEC is therefore ideal for applications with very low light intensities. It is also ideal for luminous flux measurements in which the integrating sphere connected to the device is significantly heated up by high-power lamps.

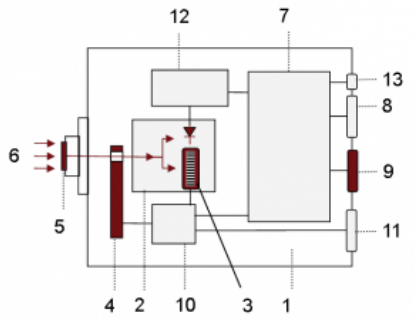
The BTS2048-VL-TEC spectroradiometer with thermoelectrically cooled CCD detector

User software and developer software

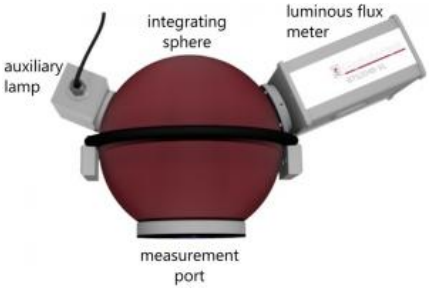
The standard S-BTS2048 user software has a customizable user interface and a large number of display and function modules which can be activated when configuring the BTS2048-VL-TEC with the respective accessory components from Gigahertz-Optik GmbH. The S-SDK-BTS2048 developer software is offered for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

Calibration

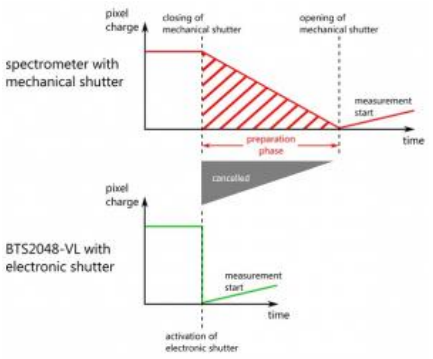
One essential quality feature of photometric devices is their precise and traceable calibration. The BTS2048-VL-TEC is calibrated by Gigahertz-Optik's calibration laboratory that was accredited by DAkkS (D-K-15047-01-00) for the *spectral responsivity* and *spectral irradiance* according to ISO/IEC 17025. The calibration also included the corresponding accessory components. Every device is delivered with its respective calibration certificate.



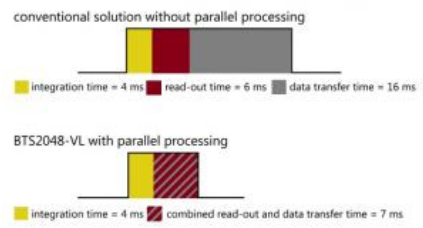
1) BTS2048-VL-TEC 2) BiTec sensor with Si photodiode, CCD array spectrometer 3) TE cooled CCD 4) Filter wheel with OD1, OD2 and shutter54) Precise cosine diffuser 6) Light incident 7) Microprocessor for data procesing and communication 8) USB 2.0 Interface 9) High Speed ethernet Interface 10) Microprocessor CCD sensor control 11) Trigger In/Out 12) Microprocessor photodiode 13) DC voltage supply



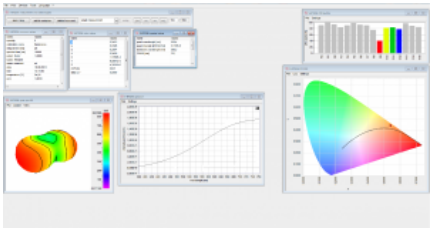
Direct attachment of the device to accessory components



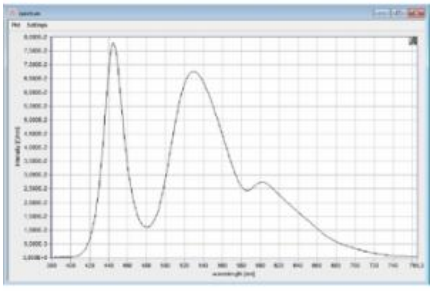
Electronic Shutter reduces the measurement time



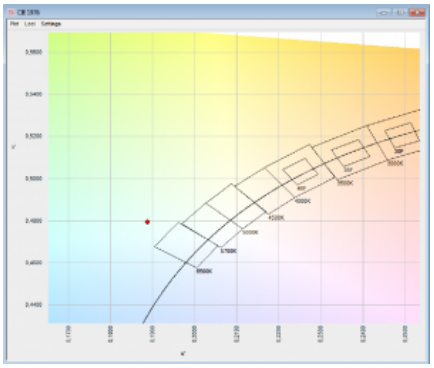
Ethernet interface reduces the datatransfer time



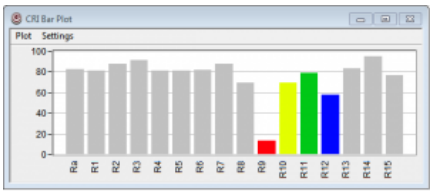
S-BTS2048 User software interface



Graphical view of the spectrum



CIE 1976 Chromaticity diagram



CRI Bar Plot

Specifications

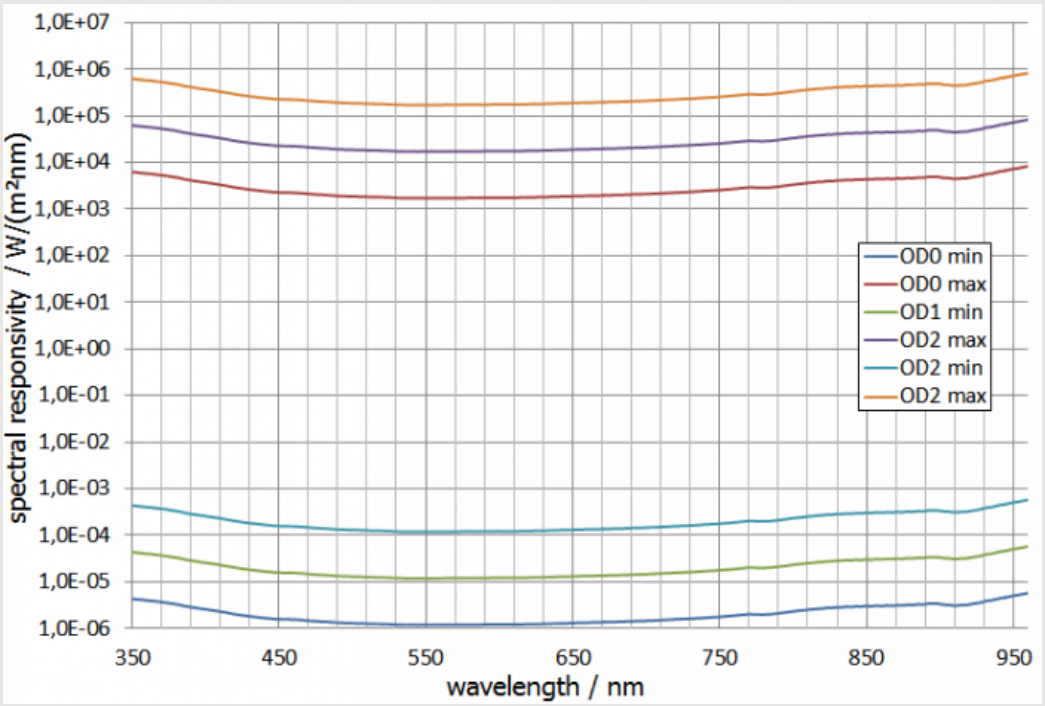
General	
Short description	High speed TE cooled CCD spectroradiometer with a wide dynamic range for CW and pulsed measurements of irradiance/illuminance, spectrum, luminous color, and color rendering index. Accessories for measurement of other parameters
Main features	Compact device. BiTec detector with back-thinned TE cooled 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 attenuation filters. Input lens with a diffusor window that has a cosine field of view. Automatic PWM synchronization
Measurement range	Spectral: 0.2 lx to 3E8 lx 280 nm to 1050 nm (min. level by white LED with low saturation). Integral: photometric 360 nm to 830 nm, 0.1 lx Noise signal up to 3E8 lx
typical applications	CCD spectroradiometer for design applications. Module 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/(m² nm)), irradiance (W/m²), 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	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	Diffusor, cosine corrected field of view (f2 ≤ 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*($s_z(\lambda)$) respectively F*($s_z(\lambda)$).
Spectral Detector	
Calibration uncertainty	Spectral irradiance (350 - 399) nm: OD0: ± 6 % OD1: ± 7 % OD2: ± 8 % (400 - 800) nm: OD0: ± 4 % OD1: ± 4 % OD2: ± 4 % (801 - 1000) nm: OD0: ± 6 % OD1: ± 6 % OD2: ± 6 % (1001 - 1050) nm: OD0: ± 6 % OD1: ± 7 % OD2: ± 8 % Spectral irradiance responsivity (350 - 1050) nm
Integration Time	2 µs - 60 s *1
spectral range	(280 -1050) nm
Optical Bandwidth	2 nm
Pixel resolution	~0.4 nm/Pixel
Number of pixels	2048
Chip	One stage cooled highly sensitive back-thinned CCD chip
ADC	16bit
Peak wavelength	± 0.2 nm
Dominant wavelength	± 0.5 nm *2
Δy Δx uncertainty	± 0.0015 (Standard illuminant A) ± 0.0020 (common LED)
Repeatability Δx and Δy	± 0.0001
ΔCCT	Standard illuminant A 30K; LED up to +/- 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	>10 Magnitudes
spectral irradiance responsivity range	(1E-6 - 1E5) W/(m²nm) *6*7
CRI (color rendering index)	Ra and R1 to R15
typical measurement time	10 lx 2,5 s *10 100 lx 250 ms *10 1000 lx 25 ms *10
Integral Detector	
Filter	Spectral responsivity with fine CIE photometric matching. Online correction of the photometric matching through spectral measurement data (spectral missmatch factor correction).
Measurement range	Nine (9) measurement ranges with transcendent offset correction
Measurement range	Max measureable illuminance value 3E8lx *7 Noise equivalent illuminance value 1E-1lx

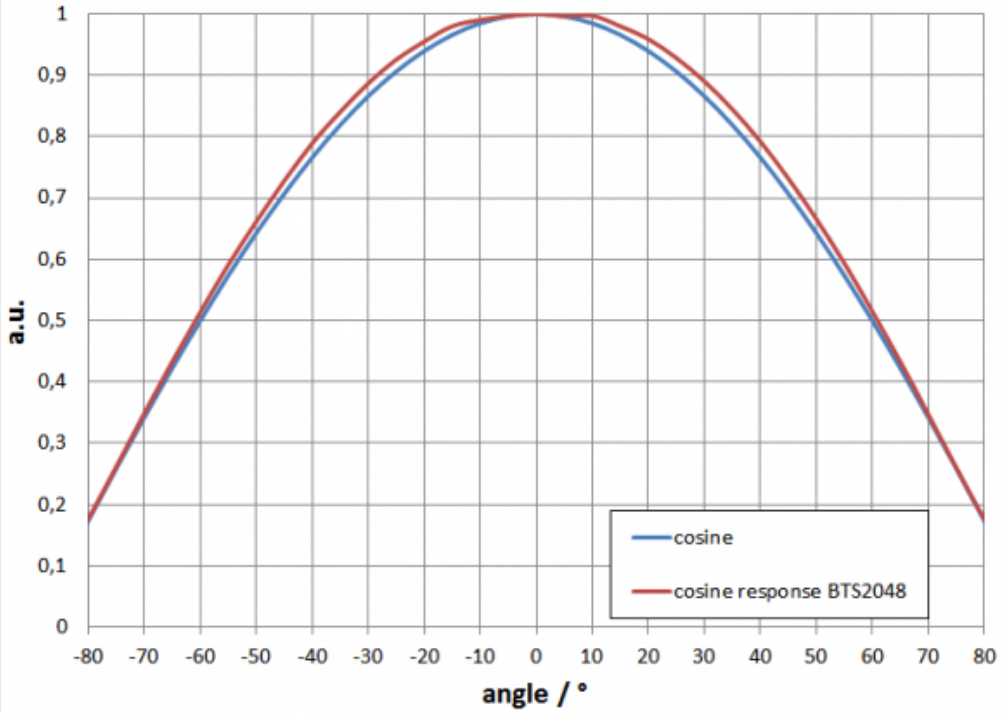
Calibration	Illuminance ± 2,2 %
f1'	≤ 6 % (uncorrected) ≤ 1.5 % (f1' a*($s_z(\lambda)$) respectively F*($s_z(\lambda)$) corrected by spectral data, done automatically by BTS technology)

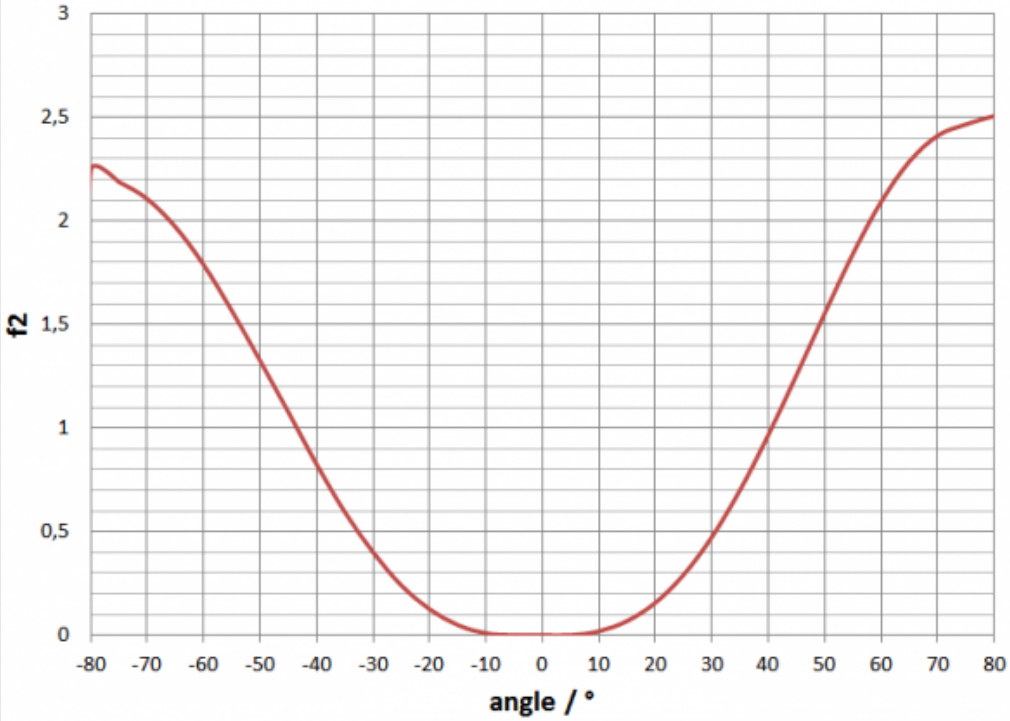
Graphs

spectral responsivity



f2 Cosine Error





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	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) °C Operation: (10 to 30) °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* **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 measurement of a white LED and 20000 counts (signal-dark) saturation*
temperature range	CCD Chip: ≤ ± 0.25 °C
Option: 150mm Integrating Sphere (UMBB-150)	
spectral radiant flux responsivity range (spectral measurement)	(5E-9 - 5E2) W/nm
Luminous flux measurement range (integral measurement)	(3E-5 - 1E5) lm
Sphere diameter	150 mm
typical measurement time	measurement with 20000 cts: 1 lm 80 ms 10 lm 8 ms 100 lm 800 µs optimized measurement time with 5000 cts and noise reduction: 10 lm 2 ms
Calibration	Luminous flux: ± 4 % Spectral radiant power: (350 - 399) nm: OD0: ± 8 % OD1: ± 10 % OD2: ± 10 % (400 - 800) nm: OD0: ± 4,5 % OD1: ± 4,5 % OD2: ± 4,5 % (801 - 1000) nm: OD0: ± 6,5 % OD1: ± 6,5 % OD2: ± 6,5 % (1001 - 1050) nm: OD0: ± 8 % OD1: ± 10 % OD2: ± 10 % Spectral radiant power responsivity (350 - 1050) nm
Option: 210mm Integrating Sphere (UMBB-210)	
spectral radiant flux responsivity range (spectral measurement)	(1E-8 - 1E3) W/nm
Luminous flux measurement range (integral measurement)	(7E-5 - 2E5) lm

Sphere diameter	210 mm
typical measurement time	measurement with 20000 cts: 1 lm 160 ms 10 lm 16 ms 100 lm 1600 µs optimized measurement time with 5000 cts and noise reduction: 10 lm 4 ms
Calibration	Luminous flux: ± 4 % Spectral radiant power: (350 - 399) nm: OD0: ± 8 % OD1: ± 10 % OD2: ± 10 % (400 - 800) nm: OD0: ± 4,5 % OD1: ± 4,5 % OD2: ± 4,5 % (801 - 1000) nm: OD0: ± 6,5 % OD1: ± 6,5 % OD2: ± 6,5 % (1001 - 1050) nm: OD0: ± 8 % OD1: ± 10 % OD2: ± 10 % Spectral radiant power responsivity (350 - 1050) nm
Option: 1000mm Integrating Sphere (UMTB-1000-HFT)	
spectral radiant flux responsivity range (spectral measurement)	(2E-7 - 2E4) W/nm
Luminous flux measurement range (integral measurement)	(1E-3 - 4E6) lm
Sphere diameter	1000 mm
typical measurement time	measurement with 20000 cts: 10 lm 450 ms 100 lm 45 ms 1000 lm 4,5 s optimized measurement time with 5000 cts and noise reduction: 10 lm 112 ms
Calibration	Luminous flux: ± 4 % Spectral radiant power: (350 - 399) nm: OD0: ± 8 % OD1: ± 11 % OD2: ± 11 % (400 - 800) nm: OD0: ± 4,5 % OD1: ± 5 % OD2: ± 5 % (801 - 1000) nm: OD0: ± 6,5 % OD1: ± 7 % OD2: ± 7 % (1001 - 1050) nm: OD0: ± 8 % OD1: ± 11 % OD2: ± 11 % Spectral radiant power responsivity (350 - 1050) nm
Option: Goniometer (GB-GD-360-RB40)	
spectral radiant intensity responsivity range	(1E-6 - 1E5) W/(sr nm) ; by 1m measurement distance
Luminous intensity measurement range (integral measurement)	(1E-1 - 3E8) cd ; by 1m measurement distance
Calibration	Luminous intensity: ± 4 % Spectral Radiant intensity: (350 - 399) nm: OD0: ± 7 % OD1: ± 8 % OD2: ± 9 % (400 - 800) nm: OD0: ± 4 % OD1: ± 4 % OD2: ± 4 % (801 - 1000) nm: OD0: ± 6 % OD1: ± 6 % OD2: ± 6 % (1001 - 1050) nm: OD0: ± 7 % OD1: ± 8 % OD2: ± 9 % Spectral radiant intensity responsivity (350 - 1050) nm

Option: ILED-B (CP-ILED-B-IS-1.0-HL)	
spectral radiant intensity (ILED-B) responsivity range (spectral measurement)	(5E-8 - 5E3) W/nm
measurment range ILED-B (integral measurement)	(3E-4 - 1E6) cd
Calibration	Luminous intensity ILED-B: ± 4 % Spectral Radiant intensity ILED-B: (350 - 399) nm: OD0: ± 7 % OD1: ± 8 % OD2: ± 9 % (400 - 800) nm: OD0: ± 4 % OD1: ± 4 % OD2: ± 4 % (801 - 1000) nm: OD0: ± 6 % OD1: ± 6 % OD2: ± 6 % (1001 - 1050) nm: OD0: ± 7 % OD1: ± 8 % OD2: ± 9 % Spectral radiant intensity responsivity (350 - 1050) nm

Configurable with

Produktname	Product Image	Description	Show product
ISD-100HF-BTS2048-VL		System for the luminous flux and light color measurement of individual 2π and 4π light light sources. Features: Integrating sphere with 100cm diameter, auxiliary lamp and a hemispherical shell for opening and closing, compact spectral light meter with Bi-Tec sensor for acurate measurement of the luminous flux, spectral radiant power, CCT, CRI, chromaticity coordinates, etc.	http://www.gigahertz-optik.de/en-us/product/BTS2048-VL-ISD-100HF-V06
GB-GD-360-RB40-2-BTS2048-VL		System for measurement of the luminous intensity distribution of 2π spot lamps and LEDs. Features: Goniometer bench with adjustable measurement distance of up to 2000 mm. Light meter for precise measurement of the luminous intensity distribution, spectral data, CCT, CRI, chromaticity coordinates, User software, etc.	http://www.gigahertz-optik.de/en-us/product/BTS2048-VL-GB-GD-360-V01-2
TPI21-TH		Measurement system for the testing of LEDs and LED assemblies. Features: CIE S025 compatible, temperature control, Keithley 2400 source, BTS2048-VL spectroradiometer, automatic measurement procedure, intuitive fast DUT contacting, etc.	http://www.gigahertz-optik.de/en-us/product/tpi21-th
ISD-15-BTS2048-VL		Compact integrating sphere spectroradiometer as monolithic module for LED test system Integration in CW and pulse measurement mode. Features: Integrating sphere with 15 cm Diameter, auxiliary lamp, high-end CCD-sensor spectralradiometer with Bi-Tec detector for fast and acurate measurement of the luminous flux, spectral radiant power, CCT, CRI,	http://www.gigahertz-optik.de/en-us/product/ISD-15-BTS2048-VL
ISD-25-BTS2048-VL		System for the luminous flux and light color measurement of individual 2π LED lamps up to 76.2 mm. Features: Integrating sphere with 25cm diameter and auxiliary lamp, CCD-sensor spectralradiometer for acurate measurement of the luminous flux, spectral radiant power, CCT, CRI	http://www.gigahertz-optik.de/en-us/product/ISD-25-BTS2048-VL

Produktname	Product Image	Description	Show product
BTS2048-VL-CP-ILED-B-IS-1.0-HL		CCD-sensor spectral radiometer for measurement of CIE 127B averaged LED intensity. Features: Measurement Adapter with compact integrating sphere for uniform active area. High-end CCD-sensor spectral Radiometer for CW and pulse measurements.	http://www.gigahertz-optik.de/en-us/product/BTS2048-VL-CP-ILED-B-IS-1.0-HL

Purchasing information

Article-Nr	Modell	Description
Product		
15298687	BTS2048-VL-TEC	Measuring device, hard cover box, users guide, S-BTS2048 software, calibration certificate.
Re-calibration		
15300499	K-BTS2048-VL-I	Recalibration of the BTS2048-VL with calibration certificate
Options		
15309109	BTS2048-VL-Z09	Front tube to limit the field of view of spectralradiometer BTS2048-VL to 20 mm or 2.2 mm diameter in 200 mm distance. For blue light hazard applications.
15309268	BTS2048-VL-Z10	Front tube to limit the field of view of spectralradiometer BTS2048-VL to 20 mm or 2.2 mm diameter in 200 mm distance. Tube manufactured of aluminum including black inner coating. Suitable for higher temperatures at measurement location. For blue light hazard applications.
Software		
15298470	S-SDK-BTS2048	Software development kit, software CD with users guide.