

# BTS2048-UV

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

Product tags: UV



## Description

### UV CCD spectroradiometer vs. broadband CCD spectrometer

The spectral responsivity of conventional CCD detectors usually lies within the 200 nm to 430 nm range. Often, this wide spectral responsivity range of the CCD detector is claimed as the responsivity range of the spectroradiometer. However, this fails to consider the spectral response function of the dispersion grating, which further reduces the detector's responsivity in the UV spectrum. This results in significant errors in the UV measurement signal, primarily through long-wave stray light. The spectral resolution of broadband spectrometers is often not sufficient to guarantee precise measurements of e.g., narrowband UV LEDs.

CCD spectroradiometers that are specifically designed for UV radiation have a constrained spectral range and allow for a very high grating efficiency in connection with a very high spectral resolution. In addition, optical filters can also be used to significantly reduce stray light.

### BTS2048-UV CCD spectroradiometer for UV radiation

The BTS2048-UV meets all the requirements of a high-end UV diode array spectroradiometer and is available at an attractive price despite its cutting-edge technology.

One unique feature of the BiTec sensor is its combination of a back-thinned CCD spectrometer and a Si photodiode that offers high linearity levels enabling extremely fast measurements (see [technical article about BiTec sensor](#)). The fully linearized 2048 pixel CCD detector with thermoelectric cooling offers a very wide dynamic range thanks to its integration time that ranges from 2  $\mu$ s to 60 s. This enables precise measurements of UV LEDs in a broad intensity range. The design offers high optical resolution of 0.8 nm over the entire spectral measurement range from 190 nm to 430 nm.. The spectrometer is also equipped with two optical filters for automatic low stray light measurements (see also our [technical article about stray light reduction for spectroradiometers](#)). Such measurements are necessary for broadband UV lamps and UV LEDs in the presence of other light sources. The very high linearity SiC photodiode within the BiTec detector is used for linearization of the CCD or taken as a reference detector. The radiometric responsivity function of the SiC photodiode enables its use independent of the CCD. The radiometric precision can be auto-corrected using the respective spectral data. The device can therefore be used to perform fast measurements on very weak signals, something that makes the BTS2048-UV perfect for integration in [goniometers](#). Despite its compact dimensions (103 mm x 107 mm x 52 mm – L x W x H), the BTS2048-UV spectroradiometer has a remote-controlled filter wheel with two optical filters and a shutter for dark measurement.

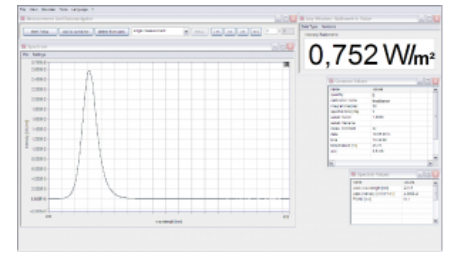
### Precise Spectral Radiometry (low straylight)

To facilitate optimal use of the CCD sensor's dynamic range and to overcome the problems of most array spectroradiometers in the UV range, a remote-controlled filter wheel (open, closed, optical filter) is 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.

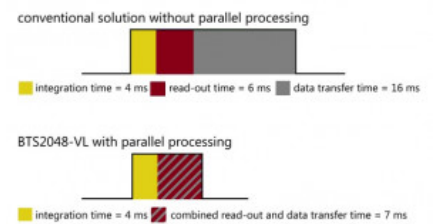
The BTS2048-UV is optimized for general measurements of other UV sources. Gigahertz-Optik's stray light calibration technique in combination with further smart measurement routines enable the superior stray light suppression. [See also our technical article about stray light reduction for spectroradiometers](#). The calibration of a BTS2048-UV additional stray light correction matrix is available optionally on request.

### Absolute calibration of the absolute irradiance down to 200 nm!

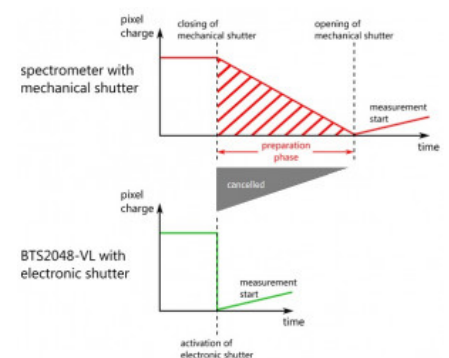
The many years of experience and its well-equipped DAkkS calibration laboratory (D-



S-BTS2048 software for the BTS2048-UV



### Ethernet interface reduces the datatransfer time



### Electronic Shutter reduces the measurement time

---

K-15047-01-00) enables Gigahertz-Optik to offer traceable calibrations down to 200 nm. This broadens the application range of the BTS2048-UV and UV-C-LEDs. For the shortwave spectral range, Gigahertz-Optik GmbH has implemented a special deuterium lamp-based calibration strategy.

---

## Use in front-end and back-end LED test measurements

The BTS2048-UV is perfectly suited for the testing of UV front-end and back-end LEDs in industrial applications. Its CCD detector integrates an electronic zero setting feature of all pixels before a measurement is triggered (electronic shutter). The electronic shutter and triggering of the measurement can be synchronized with a power supply via a trigger port when the test LED is operated in pulsed current mode. The powerful microprocessor only requires 7 ms to transfer a complete dataset to the system computer via the fast LAN interface.

---

## Direct mounting instead of using a light guide

The BTS2048-UV spectroradiometer has a diffusor window and can therefore be used to measure the UV irradiance, incl. spectrum and peak wavelength, without any additional accessory components. With the diffusor window, the BTS2048-UV can also be mounted directly onto accessories such as integrating spheres, radiance lenses, and goniometers in order to measure the radiant power, radiance, and radiance distribution.

---

## User software and developer software

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

---

## Calibration

One essential quality feature of photometric devices is their precise and traceable calibration. The BTS2048-UV is calibrated by Gigahertz-Optik's [ISO/IEC 17025 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.

## Specifications

### General

|                      |   |
|----------------------|---|
| Short description    | UV optimized TE cooled CCD spectroradiometer with a wide dynamic range for CW and short-term measurement of the irradiance, spectrum, and peak wavelength. Accessories for other parameters.  |
| Main features        | Compact device. BiTec detector with back-thinned TE cooled CCD (2048 pixels, 0.8 nm optical resolution, electronic shutter), and SiC photodiode. Optical bandwidth correction (CIE214). Filter wheel with shutter and edge filter. Input lens with diffusor window. Cosine field of view. |
| Measurement range    | 3E-5 W/(m <sup>2</sup> nm) to 3E4 W/(m <sup>2</sup> nm) @325nm. Responsivity from 190 nm to 430 nm.   |
| Typical applications | CCD spectroradiometer for design applications. Module for integration in test systems for front-end and back-end LED testing.   |
| Calibration          | Factory calibration. Traceable to international calibration standards   |

### Product

|                      |  |
|----------------------|--|
| Typical applications | Lightmeter for spectral Irradiance, Erythema, etc.   |
| Measured Quantity    | Spectral irradiance (W/(m <sup>2</sup> nm)), irradiance (W/m <sup>2</sup> ), 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             | 4 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   |              |
|                          | $\lambda$   | $u(k=2)$     |
|                          | (200 - 239) nm  | $\pm 9 \%$   |
|                          | (240 - 339) nm  | $\pm 6.8 \%$ |
|                          | (340 - 359) nm  | $\pm 5 \%$   |
|                          | (360 - 399) nm  | $\pm 4.3 \%$ |
|                          | (400 - 430) nm  | $\pm 4 \%$   |
|                          | Spectral irradiance responsivity (200 - 430) nm   |              |
| 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 measurement mode (BP SLC): 300 nm to 386 nm  |              |
| <b>Spectral Detector</b> |   |              |
| Integration Time         | 2 $\mu$ s - 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          | $\pm 0.05$ 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           |
| Base line noise          | 5 cts   | *4           |
| SNR                      | 5000  | *5           |
| Dynamic range            | >9 Magnitudes   |              |
| Spectral responsivity    | (3E-5 - 3E4) W/(m <sup>2</sup> nm) @325nm   | *6*7         |
| Typical measurement time | W/m <sup>2</sup> of a Halogen lampe from (250 - 400) nm   |              |
|                          | 1   | 4,4 s        |
|                          | 10  | 440 ms       |
|                          | 100   | 44 ms        |
| <b>Integral Detector</b> |   |              |
| Measurement time         | (0.1 - 6000) ms   |              |
| Measurement range        | seven (7) measurement ranges with transcendent offset correction  |              |
| Calibration              | Irradiance $\pm 6 \%$   | *10          |
| ADC                      | 16bit   |              |

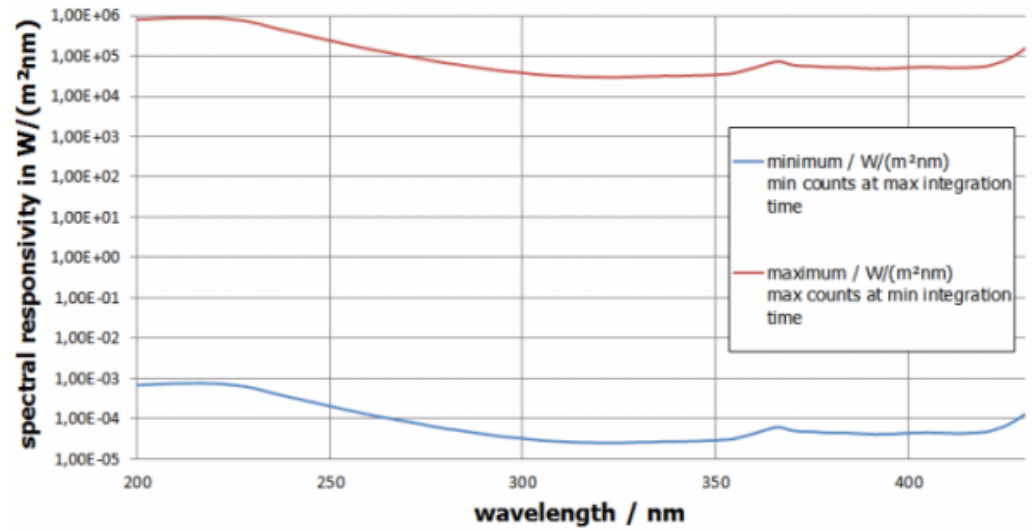
Measurement range Optional: (5E-3 - 2E5) W/m<sup>2</sup> \*11

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).\*

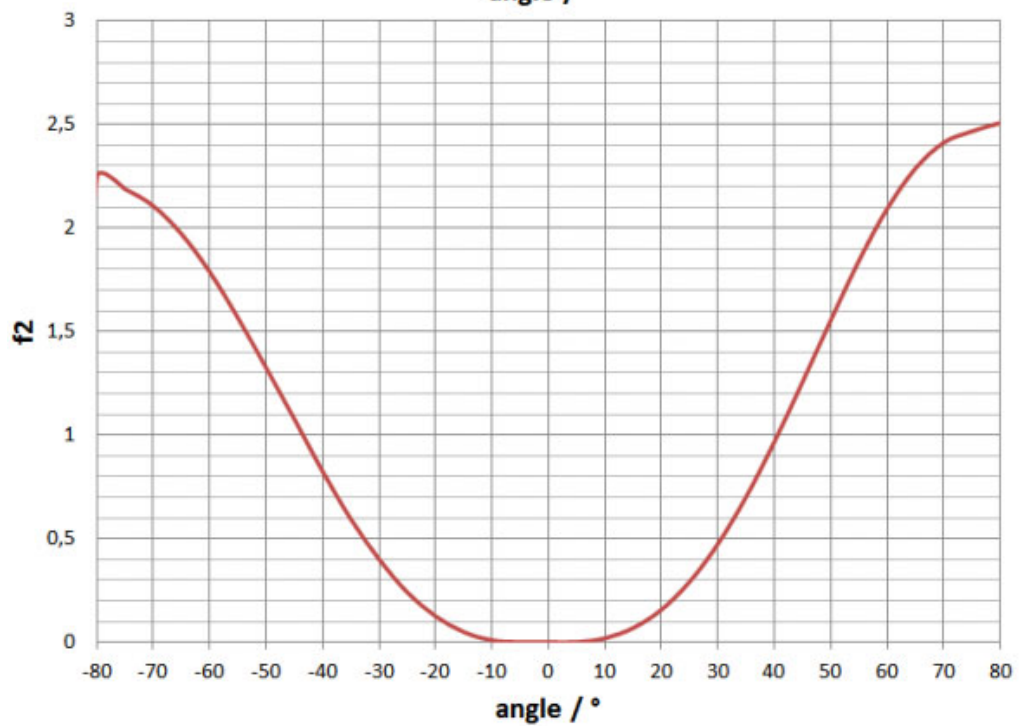
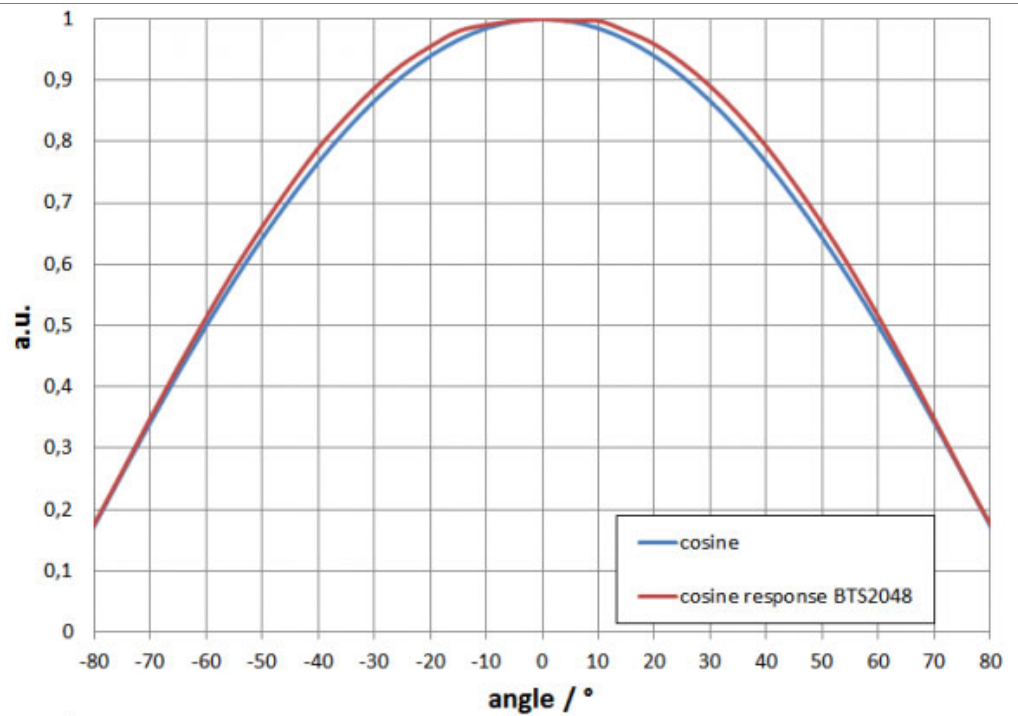
\* The spectral responsivity of the diode does not correspond to a rectangular function (not possible with optical filters). When measuring light sources with a spectrum that deviates from the calibration spectrum of the integral detector (UV LED, peak at 405 nm), the measurement result is corrected 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)



#### 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. |

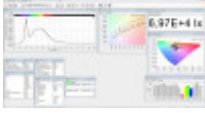


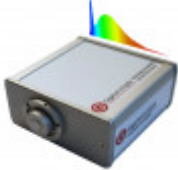
|                   |  |
|-------------------|--|
| Power Supply      | With power supply: DC Input 5V ( $\pm 10\%$ ) at 700 mA<br>With USB bus (500mA) <sup>*8</sup>  |
| Dimensions        | 103 mm x 107 mm x 52 mm (Length x Width x Height)  |
| Weight            | 500 g  |
| Mounting          | Tripod and M6 screw threads<br><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><br>Operation: (10 to 30) °C <sup>*9</sup>  |
| Info              | <p><i>*1 It is recommended to perform a new dark signal measurement for every change in the integration time</i></p> <p><i>*2 typical value, the uncertainty of the dominant wavelength depends on the spectral distribution of the LED</i></p> <p><i>*3 typical value, measured 100 nm left of the peak of a cold white broadband LED with and deep blue LED peak</i></p> <p><i>*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<br/>i.e. quadratic fall of the base noise e.g. averaging to a factor 100 improves the S/N by a factor 10</i></p> <p><i>*6 Minimum 500/1 S/N. Maximum at full scale control.</i></p> <p><i>*7 Irradiation only allowed for a short time so as to avoid thermal damage</i></p> <p><i>*8 during USB connection, not all functions are available due to the limited current supply e.g. no Ethernet and TEC cooling</i></p> <p><i>*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</i></p> <p><i>*10 With a(Z) correction by a Deuterium lamp</i></p> <p><i>*11 By a spectral power distribution of a deuterium lamp, maximum radiation only allowed for a short time so as to avoid thermal damage</i></p> |

Spectral responsivity

## 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>   |
| GB-GD-360-RB40 |  | Goniometer for the measurement of 2π sources   | <a href="https://www.gigahertz-optik.com/en-us/product/gb-gd-360-rb40/">https://www.gigahertz-optik.com/en-us/product/gb-gd-360-rb40/</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> |

## Purchasing information

| Article-Nr            | Modell              | Description  |
|-----------------------|---------------------|--|
| <b>Product</b>        |                     |  |
| 15298858              | BTS2048-UV          | Measuring device, hard cover box, users guide, S-BTS2048 software, calibration certificate.  |
| <b>Calibration</b>    |                     |  |
| 15314795              | K-BTS2048-XX-SLMC   | Determination and implementation of the BTS2048-UV's stray light correction matrix.  |
| 15310292              | K-BTS2048UV-E-S-V02 | Calibration of the BTS2048-UV from 200 nm to 430 nm while applying the stray light correction matrix with calibration certificate.   |
| <b>Re-calibration</b> |                     |  |
| 15300808              | K-BTS2048UV-E-S-V01 | Re-Calibration of the BTS2048-UV from 200 nm to 430 nm with calibration certificate  |
| <b>Software</b>       |                     |  |
| 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. |
| <b>Accessories</b>    |                     |  |
| 15312474              | BTS2048-Z03         | Trigger cable. For use with LPS-20 power supply.   |
| 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.).   |



| <b>Article-Nr</b> | <b>Modell</b>   | <b>Description</b>   |
|-------------------|-----------------|--|
| 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.                             |
| 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.  |

## Contact, Calibration, Service & Support

We are known worldwide for excellent technical consulting and after sales support. Contact us to find together the best solution for you. Our services:

- Technical Consulting & Sales
- After-Sales Support
- Calibrations & Re-Calibrations ([ISO/IEC 17025 Calibration Services](#), [factory calibration](#), [Calibration of Third-Party Products](#))
- Repairs & Updates
- OEM & Feasibility Consulting of Customized Solutions

[Send us your inquiry](#) or contact us by phone or e-mail. We would welcome your feedback too or review us on [Google](#).

### Gigahertz Optik GmbH (Headquarter)

Tel.: +49 (0)8193-93700-0  
Fax: +49 (0)8193-93700-50  
[info@gigahertz-optik.de](mailto:info@gigahertz-optik.de)

An der Kaelberweide 12  
82299 Tuerkenfeld, Germany

### Gigahertz-Optik, Inc. (US office)

Phone: +1-978-462-1818  
[info-us@gigahertz-optik.com](mailto:info-us@gigahertz-optik.com)

Boston North Technology Park  
Bldg B - Ste 205  
Amesbury, MA 01913 USA