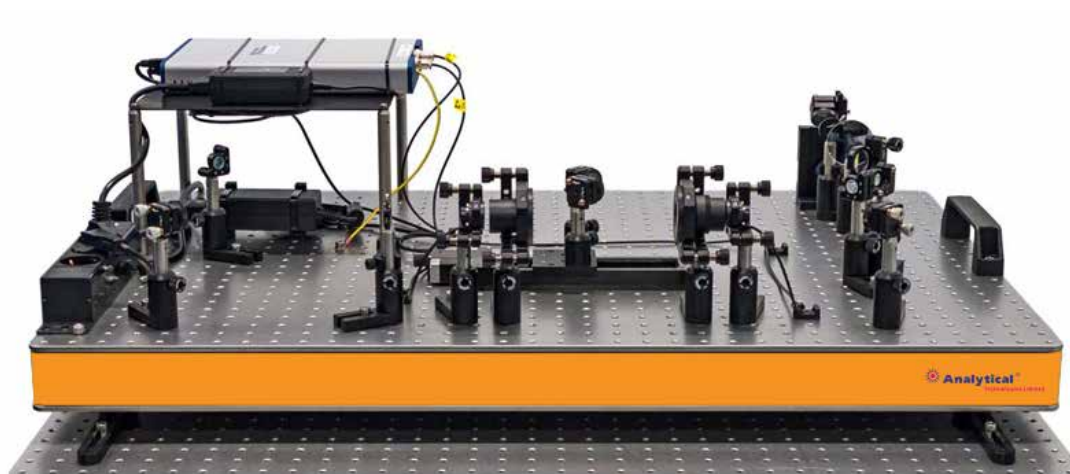


THz-3008

Pre-Assembled Terahertz Spectrometer



EPCC / PRODUCTS / APPLICATION / SOFTWARE / ACCESSORIES / CONSUMABLES / SERVICES

Analytical Technologies Limited

An ISO 9001 Certified Company

www.analyticalgroup.net

- The pre-assembled THz systems are designed to use a fs laser provided by the customer. The beam paths for the emitter and detector antennas will be pre-aligned on an optical breadboard. Therefore, it is only required to feed the laser beam into the optical setup. Hence, the system is designed for customers who are familiar with optical setups but may not be as familiar with THz spectrometers. The linear stage and the data acquisition system are controlled using the T3DS software package that comes pre-installed on a laptop.

We provide spectrometers for pulse lasers with 780 nm, 1060 nm and 1560 nm wavelength with the following parameters:

- Pulse duration: ~ 100 fs
- Repetition rate: 50 - 100 MHz
- Average optical power: ~ 40 mW

►► **Spectrometer types :**

Spectrometer performance

The performance of the pre-assembled time-domain spectrometer depends mainly on the used fs laser. The best results are possible with a pulse laser at ~ 800 nm wavelength, having pulse duration < 100 fs, and pointing stability < 25 μ rad.

Due to dispersion and nonlinear effects in an optical fiber the THz bandwidth and dynamic range of spectrometers with fiber coupled antennas is lower than set-ups with free space optical path.

General parameters

- Maximum scan range*: 500 ps
- Spectral resolution @ maximum scan range*: 2 GHz
- Collimated THz beam diameter: 22 mm
- Focused THz beam diameter @ 1 THz: ~ 1 mm
- Electric power: 110 - 230 V, single phase

►► **Spectrometer configurations with fs laser :**

►► **TDS with ~ 800 nm laser**

TDS with free space optical path

- Bandwidth**: 0.05 - 4.5 THz
- Dynamic range**: ≥ 85 dB

TDS with fiber coupled antennas and free space optical delay

- Bandwidth^{**}: 0.05 - 3.5 THz
- Dynamic range^{**}: ≥ 70 dB
- Pre-aligned grating based dispersion compensation

TDS with free space optical path antennas and additional fiber coupled antennas**Free space optical path antennas:**

- Bandwidth^{**}: 0.05 - 4.5 THz
- Dynamic range^{**}: ≥ 85 dB

Additional fiber coupled antennas:

- Bandwidth^{**}: 0.05 - 3.5 THz
- Dynamic range^{**}: ≥ 70 dB
- Pre-aligned grating based dispersion compensation

►► TDS with ~ 1060 nm laser**TDS with free space optical path**

- Bandwidth^{**}: 0.05 - 3.0 THz
- Dynamic range^{**}: ≥ 60 dB

TDS with fiber coupled antennas and free space optical delay

- Bandwidth^{**}: 0.05 - 2.5 THz
- Dynamic range^{**}: ≥ 55 dB
- Pre-aligned grating based dispersion compensation

►► TDS with ~ 1550 nm laser**TDS with free space optical path**

- Bandwidth^{**}: 0.05 - 1.5 THz
- Dynamic range^{**}: ≥ 65 dB

TDS with fiber coupled antennas and free space optical delay

- Bandwidth^{**}: 0.05 - 1.5 THz
- Dynamic range^{**}: ≥ 55 dB
- Antennas with dispersion compensating fiber

TDS with free space optical path antennas and additional fiber coupled antennas

- Bandwidth^{**}: 0.05 - 1.5 THz
- Dynamic range^{**}: ≥ 65 dB
- Antennas with dispersion compensating fiber

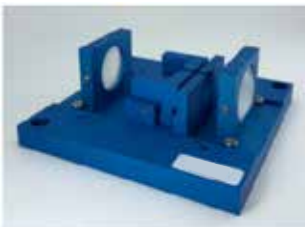
TDS with fiber coupled antennas, time delay in the THz path

- All-fiber, no open laser beam for improved safety
 - T3DS Software package on USB flash drive, without laptop
 - Bandwidth^{**}: 0.05 - 1.5 THz
 - Dynamic range^{**}: ≥ 65 dB
 - Antennas with dispersion compensating fiber
-
- Pre-assembled THz spectrometers come on a breadboard without housing and with the T3DS software package installed on a laptop. spectrometer can be delivered with housing.
 - In case you order a free space THz system with housing the sample compartment will enable you to purge the THz beam path with nitrogen - similar as for a system.
 - The options available for the benchtop spectrometer can also be ordered for the pre-assembled spectrometer.

►► Optional parts for pre-assembled THz spectrometers :

The measurement capabilities of the pre-assembled THz spectrometers listed above can be extended by additional devices.

> SHT - Sample Holder Transmission **more..**



SHT - Sample Holder Transmission

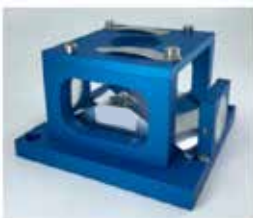


SHT on base structure

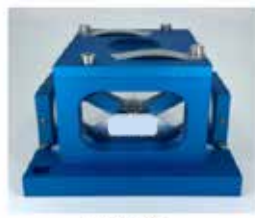
The sample holder transmission consists of a plate, two sleds with focusing THz lenses, one adapter for large samples (at least 30 x 30 mm) with collimated THz beam and one adapter for small samples (at least 10 x 10 mm) with focused THz beam.

The SHT needs as support the sample holder base (SHB) which is not included, but comes with every TDS system.

> SHR - Sample Holder Reflection **more..**



SHR - Sample Holder Reflection



SHR front side

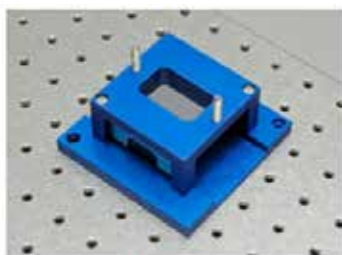
The sample holder reflection consists of a plate, two sleds with focusing THz lenses, one adapter for large samples (at least 30 x 30 mm) and one adapter for small samples (at least 10 x 10 mm). The angle of incidence or the SHR is 30° by default.

The sample holder for reflection measurements requires the base structure (SHB) which is not included, but comes with every TDS system.

> SHA - Sample Holder Attenuated Total Reflection (ATR).



SHA with lid



SHA without lid

The sample holder for ATR measurements on strong absorbing liquids or solids with a refractive index lower than 2.5 consists of a mounted silicon prism with refractive index 3.416. The incidence angle of the THz beam on the prism base is 51.6 deg.

The sample holder for ATR measurements requires the base structure (SHB) which is not included, but comes with every TDS system.

> SHB - Sample Holder Base.



SHB - Sample Holder Base



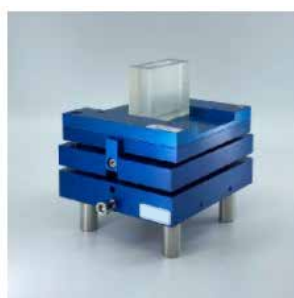
SHB with sample holder reflection (SHR)

The sample holder base SHB is required for sample holder transmission (SHT), sample holder reflection (SHR) and sample holder attenuated total reflection (SHA). It comes with every TDS system and ensures the correct adjustment of the sample holders in the THz beam.

> CUV - TPX CUVette for THz transmission measurements of liquids.



TPX cuvette

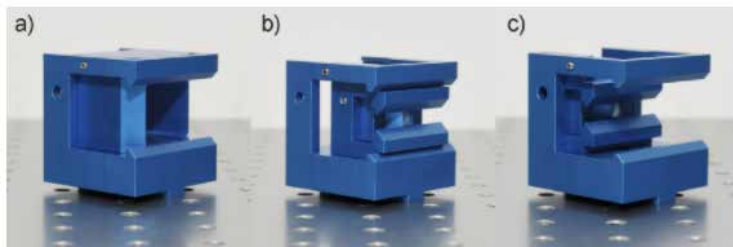


Cuvette on base structure

The TPX Cuvette can be used for transmission measurements of liquids. For the best results we recommend using our Sample Holder Transmission (SHT) to position the TPX Cuvette properly in the THz beam path. The SHT comes with every TDS10XX Spectrometer but is not part of the cuvette.

- Material: TPX (Polymethylpentene)
- Complex refractive index $n+i\cdot k= 1.46 + i\cdot 8.5\cdot 10^{-4}$
- Dimensions: 50 mm x 20 mm x 41 mm (L x W x H)
- Thickness of TPX walls: 2 x 5 mm
- Liquid path length: 10 mm
- Time delay of empty cuvette: 15.3 ps

> SHF - Sample Holder for Fiber coupled antennas



SHF for a) collimated beam, b) focused beam in reflection, c) focused beam in transmission

The sample holder for fiber coupled antennas consists of a base structure, one adapter for large samples (at least 30 x 30 mm) with collimated THz beam and one adapter for small samples (at least 10 x 10 mm) with focused THz beam. The SHF can be used for both, transmission and reflections measurements.

> FSU - Fast Scan Unit



FSU - Fast Scan Unit

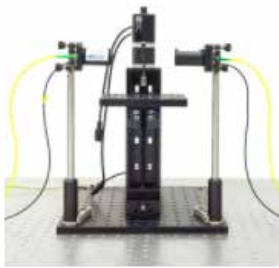


FSU with electronic box

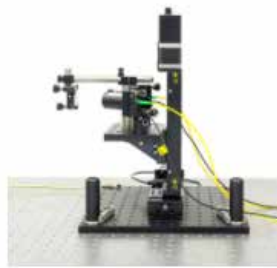
The Fast Scan Unit is used to change the laser beam path with a frequency of a few Hz in order to get a real time picture of the THz signal. It is typically used as an extension to simplify the signal optimization. Due to the limited scan range and time resolution it cannot be used to collect data at the same quality as with a slow scan measurement. However, the much faster data acquisition allows to change the optical or THz beam while watching the signal live.

- 100 Hz @ 5 ps scan
- 10 Hz @ 40 ps scan

> IU150 - Imaging Unit 150 mm x 150 mm



IU150 in transmission



IU150 in reflection

Imaging measurement in reflection



coin
visible image

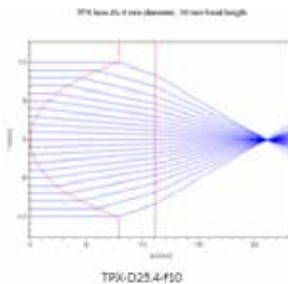


THz amplitude / time delay
height profile image



Integrated THz spectrum
specular reflectance image

> 2TPX - set of two mounted TPX lenses 1" diameter



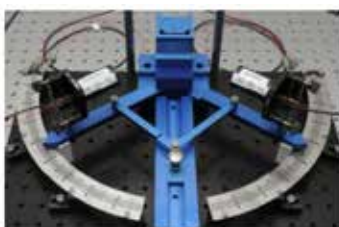
Set of two mounted TPX lenses

Set of two mounted aspheric TPX lenses with 1" diameter for transmission measurements on small samples or for THz imaging.

Lenses with the shortest focal length of 10 mm ($F^* = 0.5$) ensures a spatial resolution of 0.3 mm for frequencies > 1 THz.

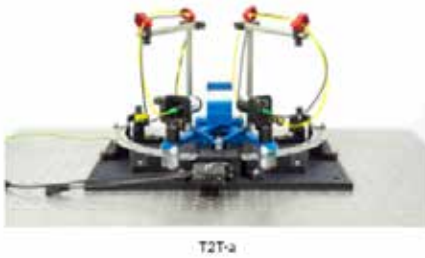
- Available focal length: 10mm, 25mm, 32.5mm, 50 mm, 67 mm, ..

> T2T-m - Theta-2-Theta angular scanning unit, manually operated



The incidence angle theta of the Theta-2-Theta reflection unit is manually set. The reflection angle theta is automatically set equal to the incidence angle theta (specular reflection). Needs fiber coupled antennas outside the spectrometer.

T2T-a - Theta-2-Theta angular scanning unit, automatically operated

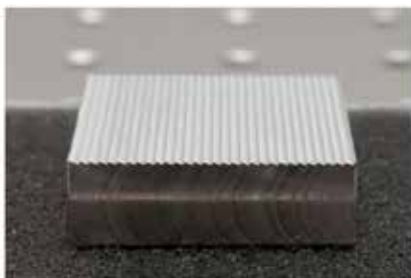


The reflection angle θ is automatically set equal to the incidence angle θ (specular reflection).

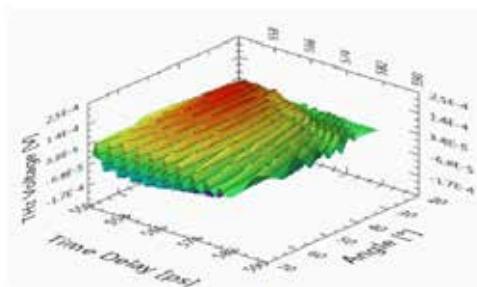
An automatic angular scan is possible using the spectrometer software T3DS.

Needs fiber coupled antennas outside the spectrometer.

Measurement examples using the T2T-a: Angular scan of a reflected, collimated THz beam



Object: ruled Al grating
1 mm groove width



Angular scan for reflected beam
on ruled grating

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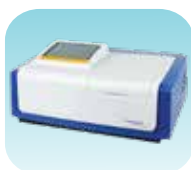
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CLIA



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Size Analyzer



Ion Chromatograph



Water purification
system

Regulatory compliances



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