THE VERSATILE TERAHERTZ-SPECTROMETERS

T-SPECTRALYZER

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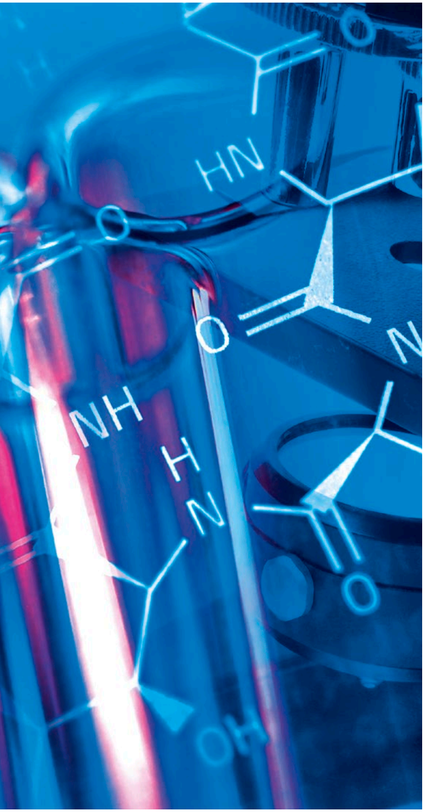
HÜBNER Photonics | Coherence Matters.



TERAHERTZ TECHNOLOGY

VISUALIZING THE INVISIBLE

Due to its non-invasive and non-ionizing properties, terahertz (THz) radiation is unparalleled in its sensing capabilities. Based on state-of-the-art research results, HÜBNER Photonics division has developed innovative and highly compact plug & play systems – allowing contact-free detection, characterization, and analysis as well as hyperspectral imaging of materials by THz spectroscopy within a few seconds.

With us, your analysis is simple and efficient – for research and industry. The HÜBNER Group is a systems provider with a long tradition in the technical industries developing innovative solutions for the world market.

Our expertise enables us to create innovative, intelligent products that make your work easier and more efficient – the T-SPECTRALYZER is part of this expertise.

Fields of application:

- **THz-Time-Domain Spectroscopy**
  - Detecting & characterizing materials
  - Using amplitude and phase information
  - Analysing chemicals in powder and tablet form
  - Analysing liquids and gases
  - Investigating moisture distributions
  - Distinguishing crystalline and amorphous structures
- **THz-Imaging**
  - Identifying flaws and cavities in non-electrically conductive components
- **Non-destructive testing (NDT)**
  - Identifying substances even through plastic pipes and tubes and other packaging
  - Determining the layer thicknesses of multi-layer systems

Operation Principle

Terahertz waves essentially stand for the frequency range of the electromagnetic spectrum ranging between 0.1 THz and 10 THz. Numerous non-conductive materials such as plastics or PVC, compounds, ceramics, paper or clothing appear almost transparent on THz frequencies. Substances such as drugs, explosives, pharmaceuticals, etc. display characteristic absorption properties within this spectral region.

These absorption properties act as a “spectroscopic fingerprint” and can serve to identify the substances concerned, even if these are hidden, for example in a letter.

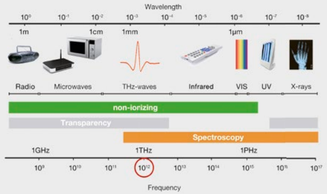


Figure 1: Schematic representation of wavelengths and frequencies

T-SPECTRALYZER T/R/F

MATERIAL ANALYSIS AND CONTACT-FREE INSPECTION

The mobile T-SPECTRALYZER T/R/F series was designed for quick set-up and for routine measurements in everyday analysis tasks. Only a main connection is required to make the system ready to use without further infrastructure. Due to latest technology, the terahertz spectrometer does not require any additional cooling or external gas supply. This ensures a cost-effective operation.
Individual expansion modules and an intuitive user interface support recording, processing and exporting your measurement results.

Thanks to the touchscreen based user-friendly operation no time-consuming and costly training is required. As terahertz waves are completely safe, no expensive safety precautions are necessary.
Within a few seconds the non-destructive and contact-free analysis of your samples is done. Full automation of your measurement process allows for extensive data sets to be taken with minimal high personnel costs. Its standardized hardware and software interfaces seamlessly integrate the spectrometer into your existing network and process flow.

MEASURING MODES AND OPTIONS


Transmission or reflection measurements


Spectral imaging


Large sample tray 335 x 240 mm²


Fiber-coupled transmitter and detector modules


Fiber-coupled transceiver module


Fiber-coupled ATR module

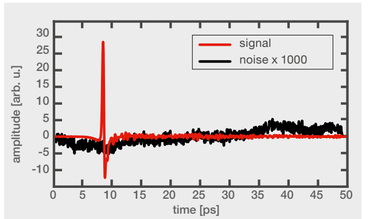


Figure 2: Time-dependent signal and noise information (typical)

DYNAMIC RANGE

f	MINIMUM		TYPICAL	
[THz]	ratio	[dB]	ratio	[dB]
0.5	3,500 : 1	70.9	10,000 : 1	80.0
1.0	2,700 : 1	68.6	7,050 : 1	77.0
1.5	1,350 : 1	62.6	4,240 : 1	72.5
2.0	740 : 1	57.4	2,750 : 1	68.8
2.5	450 : 1	53.1	1,030 : 1	60.3
3.0	160 : 1	44.1	360 : 1	51.1
3.5	50 : 1	34.0	200 : 1	46.0
4.0	15 : 1	23.5	140 : 1	42.9

All shown data measured without extension modules at 8 s of measurement time, 50 ps of measurement range, 20 GHz of frequency resolution, a temperature of 22 °C, relative humidity of 27 %.

DIMENSIONS

Length	600 mm
Width	720 mm
Height	730 mm
Weight	87 kg

SURROUNDINGS & ELECTRICAL SUPPLY

Operating temperatur range	16 – 32 °C
Power supply	115 – 230 V
Power consumption	< 200 W
Frequency	50 – 60 Hz

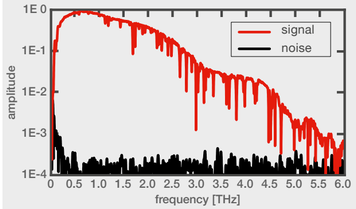


Figure 3: Spectral signal and noise information (typical)

SPECIFICATIONS

Range
- Frequency range: 0.1 THz up to 4.0 THz (3.3 cm^{-1} up to 133 cm^{-1})
- Dynamic range: > 70 dB at 0.5 THz (16.7 cm^{-1})

Frequency resolution
- Standard: 20 GHz (measurement range 50 ps)
- Maximum: 5 GHz (measurement range 200 ps)

Measurement time
- Standard: 8 s (50 ps at 6.25 ps/s)
- Minimum: 2 s (20 ps at 10 ps/s)

Sample scan range/beam diameter
- Standard: 200 x 200 mm^2 (~ 0.2 mm accuracy)
- Beam diameter: ~ 1.5 mm (frequency-dependent)

Software
- Intuitive user-interface
- JCAMP compatible data format
- Compatible with The Unscrambler®
- Customized solutions available upon request

Interfaces
- NAMUR
- OPC
- LAN / WLAN
- USB 3.0

MODULES

Fiber-coupled transmitter and detector modules

Fiber-coupled transceiver module

Fiber-coupled ATR module

T-SPECTRALYZER F

THE FIBER-COUPLED SPECTROMETER

The plug & play THz-Spectrometer T-SPECTRALYZER F facilitates non-destructive and contact-free analysis of your samples. Individual measurement modules and an intuitive user interface support the recording, processing and exporting of your measurement results.
T-SPECTRALYZER F is a high-performance THz-Spectrometer in the frequency range 0.1 – 2.5 THz with a dynamic range of up to 54 dB. Short measurement times of 0.05 s allow the monitoring of processes or spatial mapping of your samples.
The operation is user-friendly – no time consuming training is required. The standardized hardware and software interfaces help you to integrate the spectrometer into your existing network and process flow. No safety precautions are necessary as terahertz waves are completely safe.

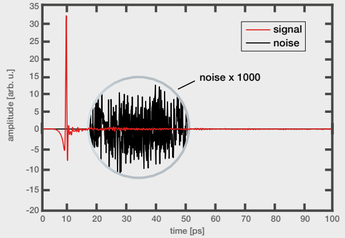


Figure 4: Time-dependent signal and noise information (typical)

DYNAMIC RANGE

f	MINIMUM		TYPICAL	
[THz]	ratio	[dB]	ratio	[dB]
0.5	500 : 1	54.0	900 : 1	59.1
1.0	475 : 1	53.5	850 : 1	58.6
1.5	250 : 1	48.0	450 : 1	53.1
2.0	85 : 1	38.4	150 : 1	43.5
2.5	30 : 1	28.9	50 : 1	34.0
3.0	10 : 1	18.4	15 : 1	23.5
3.5	6 : 1	14.9	10 : 1	20.0
4.0	3 : 1	8.8	5 : 1	14.0

All shown data measured with fiber-coupled transmitter and detector modules, 5 m fiber each, with two collimating and two focusing TPX lenses (four lenses overall), without any sample at 5 s of measurement time, 100 ps of measurement range, 10 GHz of frequency resolution, a temperature of 22 °C, relative humidity of 27 %.

DIMENSIONS

19” rack	
Length	430 mm
Width	270 mm
Height	460 mm
Weight	30 kg
Terahertz transmitter / detector module (each)	
Length	50 mm
Width	50 mm
Height	100 mm
Weight	0.5 kg each

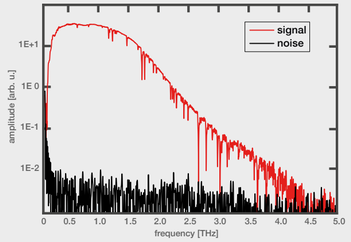


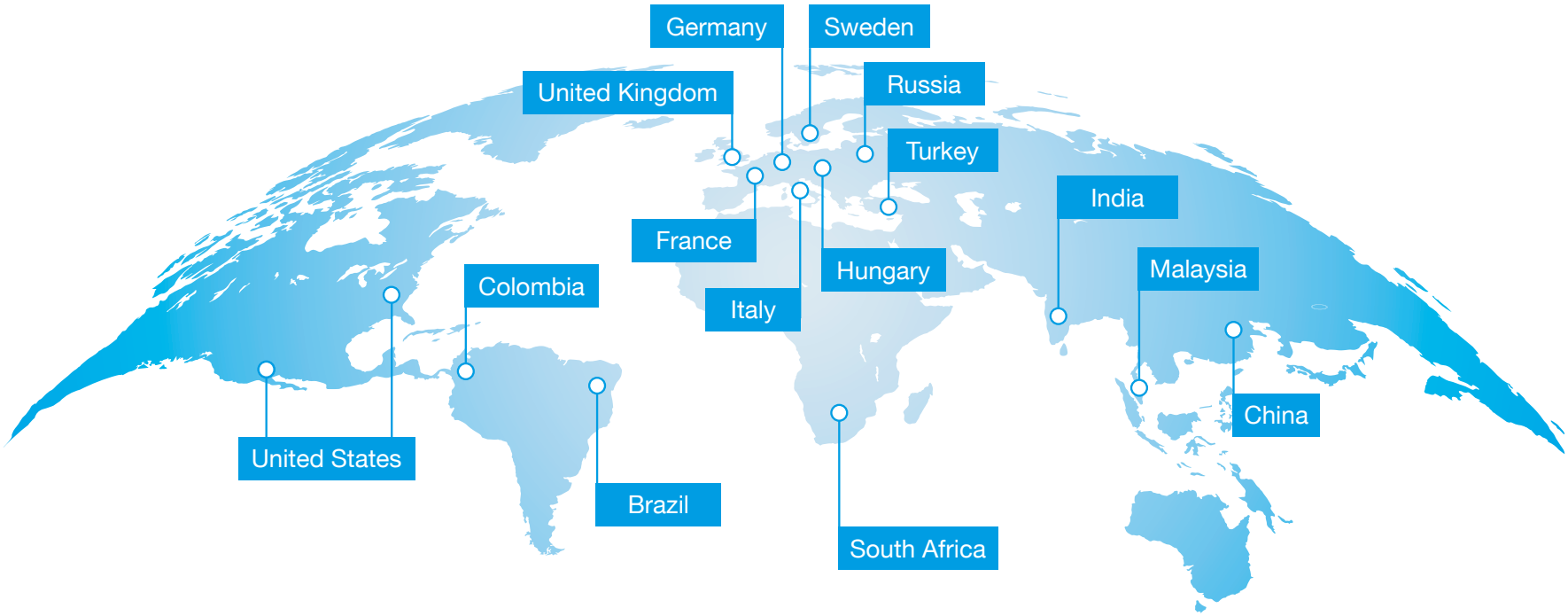
Figure 5: Spectral signal and noise information (typical)

SPECIFICATIONS

Range	
· Frequency range	0.1 THz up to 2.5 THz (33 cm^{-1} up to 82.5 cm^{-1})
· Dynamic range	> 54 dB at 0.5 THz (16.7 cm^{-1})
Frequency resolution	
· Standard	10 GHz (measurement range 100 ps)
· Maximum	5 GHz (measurement range 200 ps)
Measurement time	
· Standard	5 s (100 ps at 20 ps/s)
· Minimum	0.05 s (100 ps at 2.000 ps/s)

SURROUNDINGS & ELECTRICAL SUPPLY

Operating temperatur range	16 – 32 °C
Power supply	115 – 230 VAC
Power consumption	< 200 W
Frequency	50 – 60 Hz



This isn't just another technology company. For more than 70 years, the HÜBNER Group has been around. More than 2,600 employees worldwide serve customers every day – with an understanding based on mutual respect, honesty and products you can trust. Coherence Matters is in our genes and our spirit – all day, every day.

HÜBNER

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