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## Manual Internal Measurement Setups

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**Sample Holder Base**

**Sample Holder Transmission**

**Sample Holder Reflection**

**Sample Holder Attenuated Total Reflection**

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## Index of Abbreviations

SHA	Sample <b>H</b> older for <b>A</b> ttenuated Total Reflection
SHB	Sample <b>H</b> older <b>B</b> ase
SHR	Sample <b>H</b> older <b>R</b> eflection
SHT	Sample <b>H</b> older <b>T</b> ransmission
TDS	<b>T</b> ime- <b>D</b> omain <b>S</b> pectrometer
THz	Terahertz

## 1 Sample Holder Base

The **Sample Holder Base (SHB)** is required for the utilization of the ...

- Sample Holder Transmission (SHT) > Point 2
- Sample Holder Reflection (SHR) > Point 3
- Sample holder Attenuated Total Reflection (SHA) > Point 4

The **SHB** comes with every Terahertz Time-Domain Spectrometer (TDS) and ensures the correct position of the sample holder in the Terahertz (THz) beam path. It allows you to change the sample holder in two axes (horizontal & vertical), together with the rotation and slope in relation to the THz beam.



Figure 1: Adjustment screws on the Sample Holder Base

- A Adjustment screw for the slope
- B Looking screw for the rotation (360°)
- C1 Looking screw for the vertical movement (up/down)
- C2 Adjustment knob for the vertical movement (up/down)
- D Adjustment screw for the horizontal movement (front/back)

The **SHB** is designed for the internal sample compartment of our TDS systems, but it can be mounted to any other optical breadboard with a 25 mm grid of M6 mounting holes. The height of the THz beam should be ( $\pm$ ) 100 mm. However, the base structure rests on four 40 mm posts (1/2") from Thorlabs, which may be replaced by shorter/longer versions in case your THz beam runs on a lower/higher level.



## Warning

If you built the THz spectrometer yourself, please make sure to align the THz beam at the correct height, parallel to the grid and in the middle between to lines of mounting holes! Otherwise the sample holders can not line up with the THz beam, since the horizontal displacement can not be compensated.

To mount the **SHB** on a suitable breadboard or to change the four posts you need to detach the upper half by loosening the locking screw for the vertical movement (see 1; C1). Then you can detach the posts from the base structure, mount them to the breadboard and put the base structure back together.

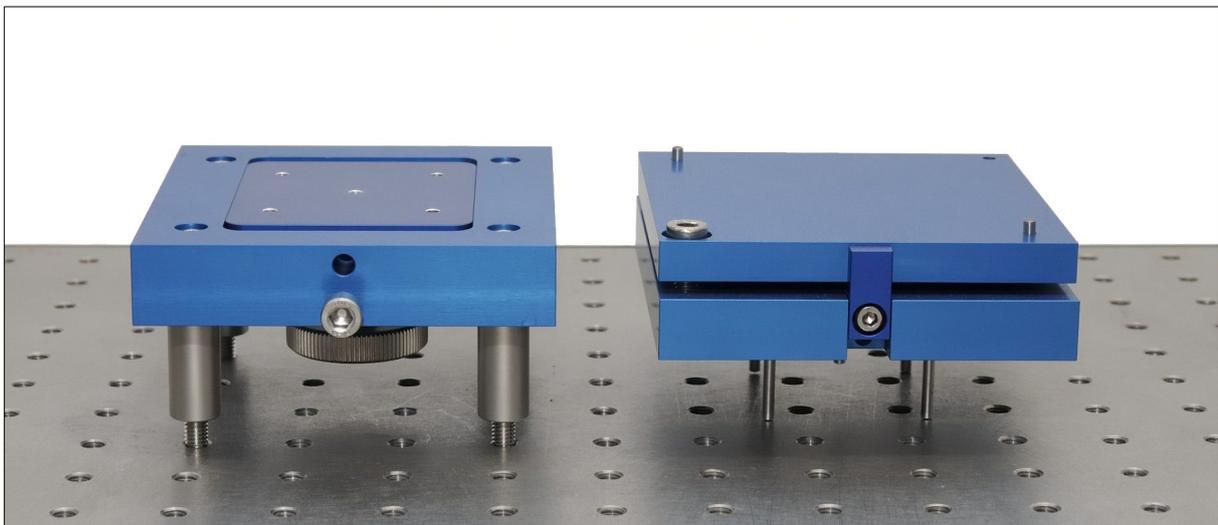


Figure 2: Dissambled SHB for mounting

After each change of the sample holder (**SHT**, **SHR** & **SHA**) it is advised to optimize the THz beam path via the SHB.

## 2 Sample Holder Transmission

The **Sample Holder Transmission (SHT)** comes with every TDS system and consists of a plate, two sleds with focusing THz lenses, one adapter for small samples (at least 10 x 10 mm) and one adapter for large samples (at least 25 x 25 mm).



Figure 3: Sample Holder Transmission on the mandatory Sample Holder Base



### Warning

The adapter for small samples requires the provided focusing THz lenses to ensure that the THz beam is not cut off by the aperture of the adapter. Make sure and that the plane side faces to the sample. Please keep in mind that the focusing THz lenses will shift the THz signal by about 25 ps.

Make sure that you use the correct pair of THz lenses (for the SHT) in case that you own the SHR, too. These two sample holders are equipped with THz lenses with a significantly different focal length. A mix-up would result in a very poor THz signal and spectrum.

The sample has to be placed in the center of the SHT. Therefore the adapter for small and large samples uses different mounting holes.

## 3 Sample Holder Reflection

The **Sample Holder Reflection (SHR)** can be purchased separately and consists of a plate, two sleds with focusing THz lenses, one adapter for small samples (at least 15 x 15 mm) and one adapter for large samples (at least 30 x 30 mm).

**It is meant as an extension of the measurement capabilities of your THz spectrometer, enabling measurements of highly reflecting/absorbing samples.**



Figure 4: Sample Holder Reflection on the mandatory Sample Holder Base



Figure 5: THz beam path in the Sample Holder Reflection



## Warning

(In comparison to the SHT) the SHR shifts the THz signal by about 150 ps, caused by the longer THz beam path.

The adapter for small samples requires the provided focusing THz lenses to ensure that the THz beam is not cut off by the aperture of the adapter. Make sure and that the plane side faces to the sample. Please keep in mind that the focusing THz lenses will shift the THz signal by about 25 ps.

Make sure that you use the correct pair of THz lenses (for the SHR) in case that you own the SHT, too. These two sample holders are equipped with THz lenses with a significantly different focal length. A mix-up would result in a very poor THz signal and spectrum.

## 4 Sample Holder Attenuated Total Reflection

The [Sample Holder Attenuated Total Reflection \(SHA\)](#) can be purchased separately and consists of a plate with a repository for liquids.

**It is meant as an extension of the measurement capabilities of your THz spectrometer, enabling measurements of fluids with a high absorption coefficient and a refractive index lower than 2.5.**

The THz beam is redirected by the silicon ATR prism towards its top surface, where an attenuated total reflection occurs. The THz signal will be altered by the properties of the fluid. However, the penetration depth of the evanescent wave strongly depends on the wavelength. Therefore a quantitative analysis is much more complicated compared to the transmission (SHT) or reflection (SHR) measurements.



Figure 6: Sample Holder Attenuated Total Reflection on the mandatory Sample Holder Base

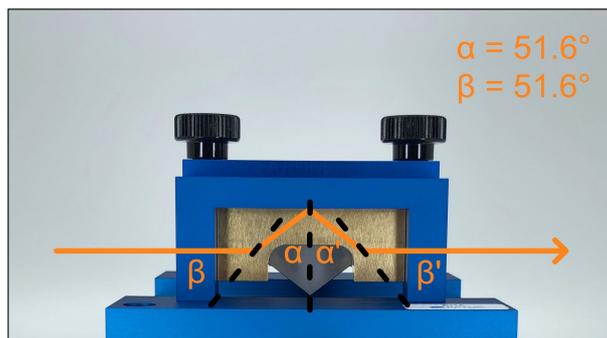


Figure 7: THz beam path in the Sample Holder Attenuated Total Reflection



## Warning

When working with volatile fluids it is required to close the SHA using the provided lid in order to reduce fumes to a minimum. It has to be noted that these fumes could be ignited by the short pulse laser used to drive the THz antennas. Especially at systems without an enclosure of the laser beam path. Therefore, the customer is required to handle the fluids in accordance to their safety data sheet.

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(In comparison to the SHT) the SHA shifts the THz signal by about 350 ps, caused by the high refractive index of the silicon material.

If you built the THz spectrometer yourself, we recommend you to set the THz pulse for transmission measurements at a time delay of ( $\pm$ ) 100 ps. So the SHA can be used together with a 100 mm delay.

## 5 Contact Details

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