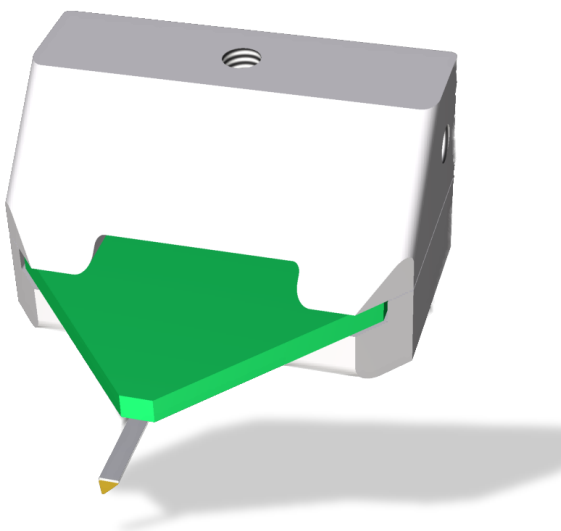
Next generation

Terahertz microprobe series

Application notes

V 09/2022



TeraSpike

Photoconductive THz near-field detector

Caution!

General advices for probe-tip handling

- Do **not** touch the LT-GaAs cantilever or glass-carrier! The device may get damaged.
- Always keep a safe distance between the probe-tip and other objects when handling the probe-tip manually!
- Do **not** drop the probe-tip!
- Always keep the device in a clean and dust-free environment.
- Do **not** use air or nitrogen streams to remove particles from the probe-tip! The thin LT-GaAs cantilever structure may break.
- Keep the optical excitation (permanent or short) below 10 µJ/cm² to avoid thermal damage!
- For gentle use an average fluence / optical excitation below 7 µJ/cm² (approx. 3.5 mW @ 80 MHz and 40 µm spot-size) is recommended.
- Avoid bias voltages (voltage spikes) above 10 V at the probe terminal! Such voltage spikes may be generated by ungrounded sources, switching events or ESD.
- Keep the bias voltage for optical alignment below 3 V (1 V is recommended).
- Laser radiation is partially reflected by the probe-tip. Refer to laser safety instructions.

Specific conditions for TeraSpike TD-1550-X

- The detector tip is made from InGaAs instead of LT-GaAs for these detectors.
- The excitation wavelength should be around 1550nm in this case.
- Keep the bias voltage for optical alignment below 1 V (0.5 - 1 V is recommended).
- For gentle use an average fluence / optical excitation below 4 µJ/cm² (approx. 2 mW @ 80 MHz and 40 µm spot-size) is recommended.
- Overall current from these detectors is higher. Several µA instead of some 100nA.
- The Photo-Current to Dark-Current ratio is smaller than for the LT-GaAs devices.

Preparation
and recommended procedures:

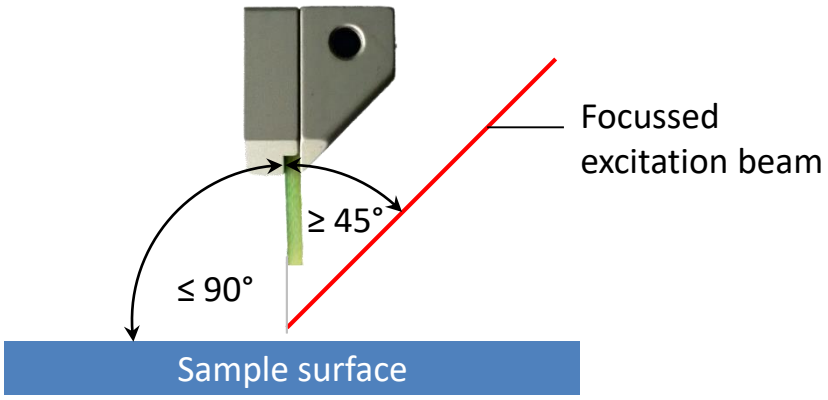
- In order to avoid accidental mechanical damage of the microprobe, it is a good practice to install the microprobe as the last component of the fully prepared measurement set-up. It is recommended to use the dummy device TeraSpike Phantom for first installation tests. For storage please use the provided storage box.

- Although your TeraSpike microprobe is equipped with a voltage protection circuit it is still recommended to prevent electrostatic discharge while handling the microprobe i.e. by wearing a conducting wrist strap.

- Before device installation, block all laser beams in the area of operation to avoid injuries and thermal device damage. Obey the security instructions of your laser manufacturer.

- It is recommended to install a CCD microscope camera or microscope into the set-up in order to monitor the positioning and (for 780nm devices) optical excitation of the microprobe.

Probe orientation range:



Installation

- **Installation of the mount:**

  Install the delivered mount at the desired position into your setup.

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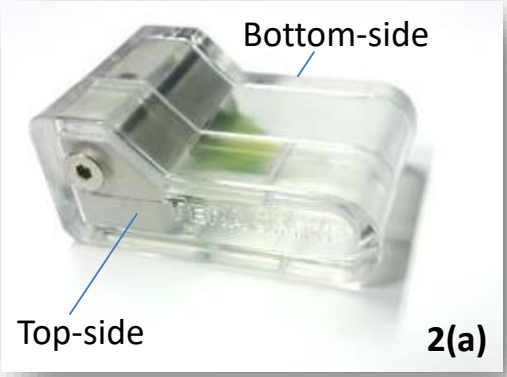
- **Unsealing:**

  Check the TeraSpike microprobe for transportation damage before removal of the seal.

- **Unboxing and installation of the microprobe:**

  (a) The top-side of the storage box is marked with the TeraSpike writing. The bottom side is blank.



2(a)

  (b) First, remove the screw from the bottom side of the storage box. While keeping the box closed put the box on the bottom side. Then remove the screw from the top side of the box and remove carefully the top cover.

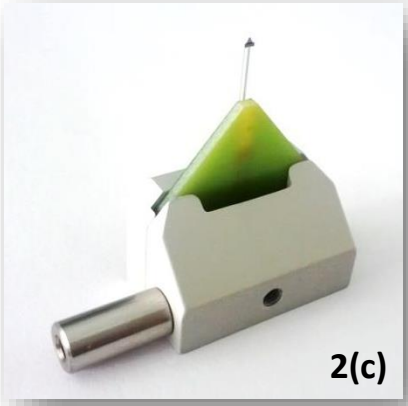

2(b)

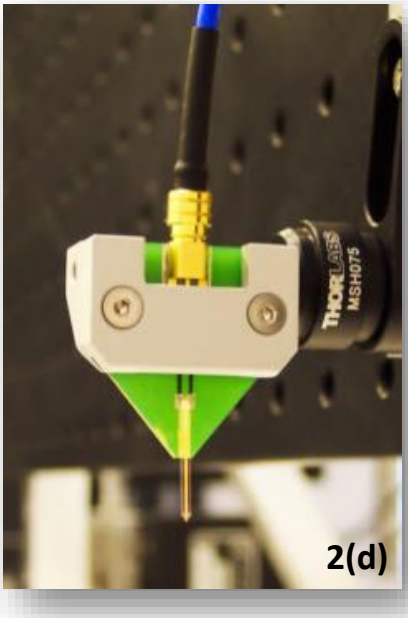
Installation

- **Unboxing and installation of the microprobe (continued):**

  (c) Remove the probe-tip from the box. Be careful not to touch the cantilever of the tip! Fix the post at the desired thread position of the microprobe body tightly.

  (d) Connect the SMP cable to the microprobe. Install the microprobe into your set-up. Again be careful not to touch the tip apex or the glass carrier of the probe to any object.


2(c)



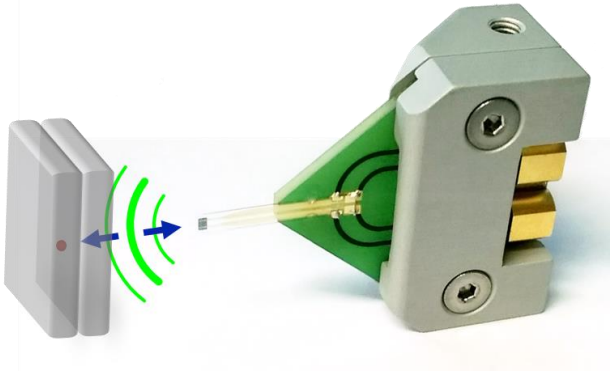
2(d)

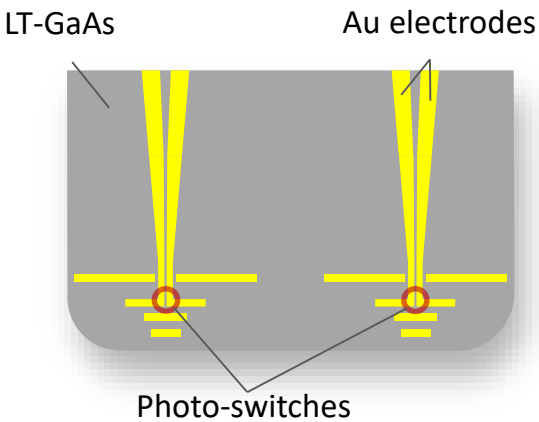
Device operation

1. Connect the probe cable to a grounded stabilized sourcemeter (e.g. Keithley Sourcemeter Model 2400 or 2600) or a current amplifier with biasing option (recommended amplification range 10^6 – 10^8 V/A).
2. Apply 1V bias voltage to the microprobe.
3. The optical excitation intensity on the microprobe should be adjusted to 2-5 µJ/cm². Depending on your optical components the optical excitation power needs to be limited accordingly. For example, for a minimal focal spot-size of 30-50 µm adjust the average power of the optical excitation beam to 3-4 mW for a TD-800-series model.
4. For TD-1550-series models, it is recommended to use reduced optical excitation power in the range of 1.5-2 mW.
5. Unblock, align and focus the optical excitation beam to the tip of the microprobe.
6. Monitor the photo-current with 1 V bias voltage applied. Adjust the optical alignment by maximizing the photocurrent. A min. photocurrent of 100 nA should be reached under the above mentioned conditions. Avoid photocurrents higher than 1 µA by defocussing the optical excitation beam to an appropriate level or by reducing the optical power.
7. Switch off the bias voltage.
8. Connect the current amplifier to the data acquisition unit (e.g. lock-in amplifier or storage oscilloscope).
9. Start your measurements.

TD-800-TR.5 transceiver :
Specific operation notes

- While most operation recommendations remain valid for the TR.5 transceiver micro-probes, some specialties have to be considered:
- The TR.5 transceiver operates in reflection-mode and should always be oriented in a 90° angle to the surface of interest.
- The TR.5 is equipped with two photo-switches instead of just one. Use two TS cables for the electrical connection and two fs laser-beams for optical excitation. Emitter and detector switch are interchangeable. Select one switch as THz detector and one as THz emitter.
- For the detector switch use the same settings as for any other TeraSpike.
- All statements of the above “Caution!” section remain valid for emitter- and detector-switch.
- Follow the excitation beam alignment procedure as stated above for both excitation beams and photo-switches.
- Do not apply any bias voltage to the detector during measurement.
- Apply a bias voltage of up to 10V to that photo-switch that serves as THz emitter during the measurement. (A 9V battery is recommended as low-noise power source)





Maintenance

- For longer periods of disuse please store the probe in the provided box.
- Please do not try to use a stream of air or nitrogen tor remove particles from the detector tip. The cantilever may break if too much stream pressure is applied.

Questions? Please contact us:

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