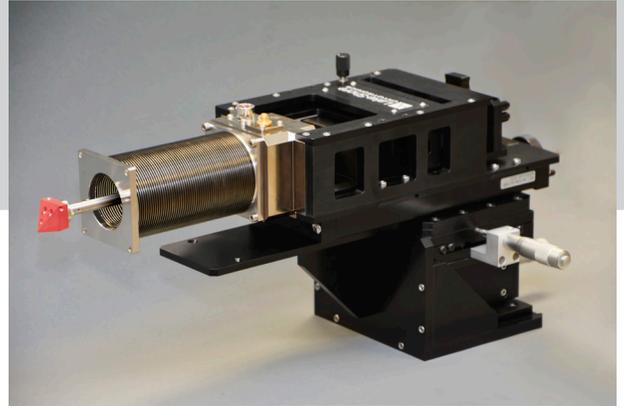
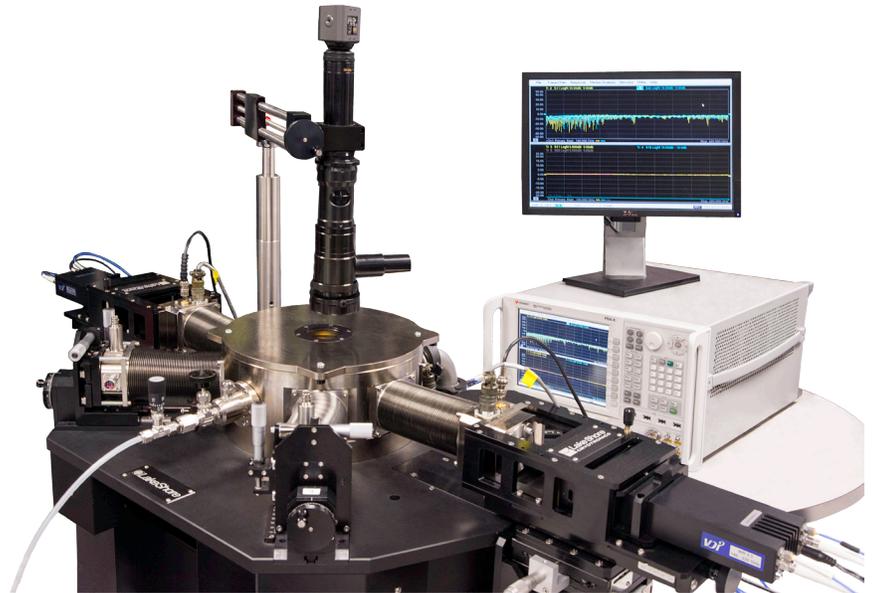


Terahertz Cryogenic Probe Arm Option



NEW! THz-frequency contact probing for cryogenic applications

- For precise on-wafer contact probing of millimeter wave devices at THz frequencies (75 GHz and up) in a Lake Shore cryogenic probe station
- Opens new measurement possibilities for next-generation electronics R&D
- Integrates with network analyzers with suitable frequency extenders
- Enables calibrated S-parameter and other high-frequency electrical measurements to be performed at cryogenic temperatures and in magnetic fields
- Combine two THz probe arms with standard DC/RF/microwave probe arms for a total of 6 simultaneous contact probes
- A breakthrough solution, only available from Lake Shore Cryotronics
- 3-year standard warranty



Low-loss THz waveguide

High-frequency contact measurements require careful consideration to how signals are conducted to and from the device under test. As frequencies rise above 75 GHz and into the previously unobtainable THz regime, signals can deteriorate rapidly using existing waveguides over paths as short as a few centimeters.

Room temperature probing solutions have typically addressed this issue by minimizing the path length between the frequency extender source/detector modules and the probe. However, the connecting waveguides can only be reduced so much before the bulky modules intrude upon the sample space, complicating arm mobility and limiting options for adding other probes.

In a cryogenic probe station, significantly longer signal paths (on the order of 25 cm) are required to traverse the station's vacuum chamber and interior structures. Lake Shore's new THz cryogenic probe arm with its specially developed low-loss THz-frequency waveguide ensures excellent signal integrity over these longer spans.



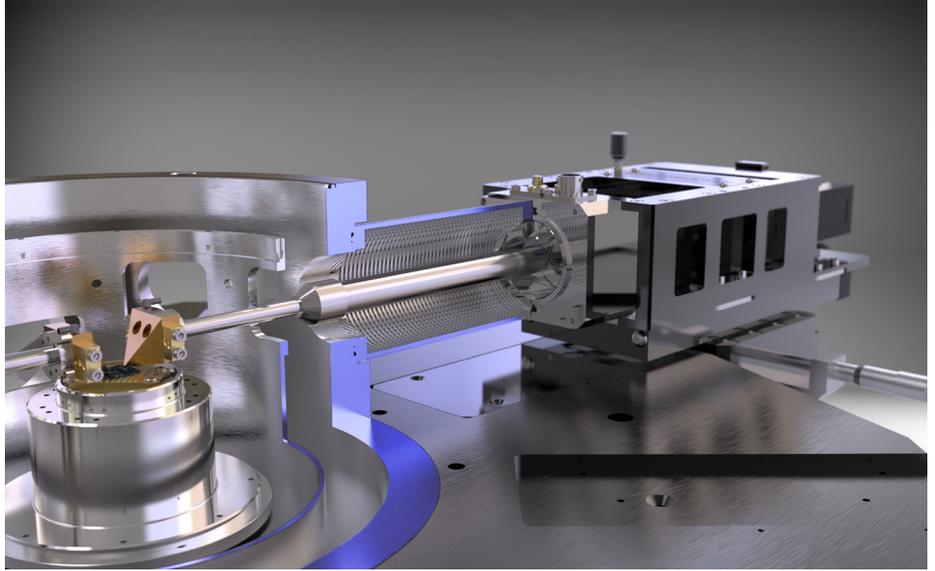
Components of the THz cryogenic probing solution

Probe arm

The THz cryogenic probe arm is a high-frequency probing option for Lake Shore probe stations. It can be mounted in arm positions 2 or 5 on compatible stations. The option consists of a 3-axis micro-manipulated stage with stainless steel welded bellows and includes:

- The probe arm and base with integrated theta planarization
- A DC bias port
- A temperature sensor (for attachment to the probe)
- Feedthrough ports and mounting platform configured for use with a third party frequency extender
- High-frequency waveguide (selected to match the bandwidth of the frequency extender, see below)

Lake Shore supplies the probe arm only. Other required components are the frequency extender and probe, which are supplied by third parties as noted below.



Frequency extender

Currently, the Lake Shore probe arm supports the MiniVNAX extenders from Virginia Diodes, Inc. (www.vadiodes.com). VDI extender modules work with most modern vector network and signal analyzers from suppliers like Keysight, Anritsu, and Rohde & Schwarz. The VDI modules are offered in a range of frequency bands, each band requiring a slightly different output coupling configuration. Lake Shore's waveguide topology must be matched to the frequency band of the extender module.

At present, Lake Shore offers probe arms compatible with the following frequency bands from VDI:

WR-10 (75 to 110 GHz)

WR-5.1 (140 to 220 GHz)

Other frequency bands and other types of frequency extender modules can be accommodated—please contact Lake Shore with your needs.

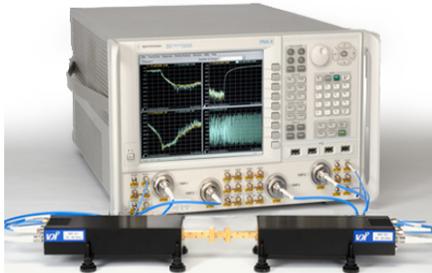


photo from Virginia Diodes, Inc.

Probe

The THz cryogenic probe arm supports custom probes developed by Dominion Microprobes. These T-Wave™ probes are available from Cascade Microtech or Lake Shore.

The micro-machined GSG probe features low-insertion loss coupling to the DUT and DC biasing of probed circuits. The probe is cryogenically qualified and thermally anchored to minimize heat transfer to the DUT. A sensor is attached to monitor probe temperature.

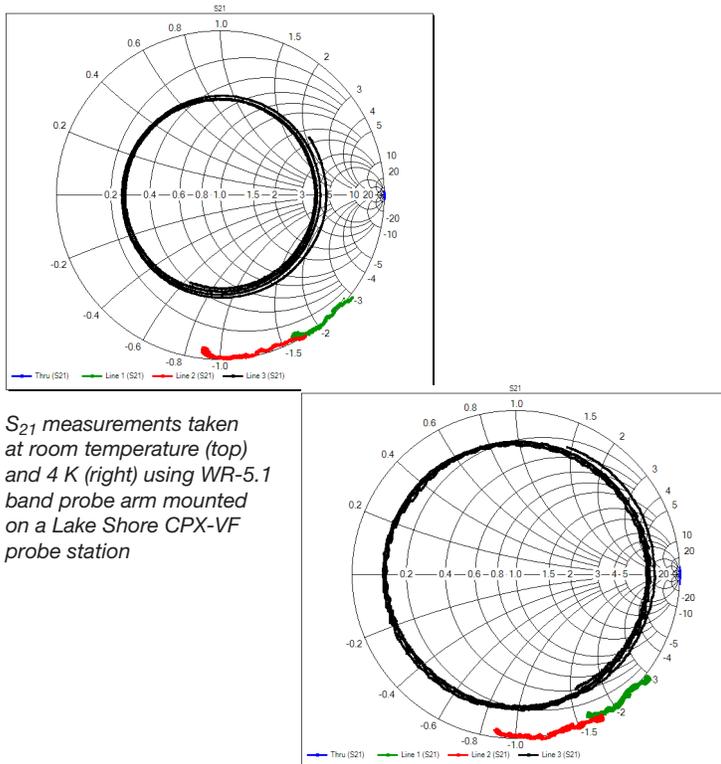


Specifications

	MMS-09-THZ-MVNAX-WR10	MMS-09-THZ-MVNAX-WR51
Frequency band	WR 10 (75 to 110 GHz)	WR-5.1 (140 to 220 GHz)
Waveguide type	Rectangular, internally coated	Circular, internally corrugated
Compatible probe stations	CPX, CPX-VF (CRX-4K and CRX-VF with restrictions)	
Maximum number of THz arms/station (DC/RF/MW/FO MMS arms may be used in the other positions)	Up to 2 (positions 2 and 5)	
Compatible frequency extender	VDI WR10-miniVNAX	VDI WR5.1-miniVNAX
Compatible probes (Cascade)	T110-CRYO-GSG-100 T110-CRYO-GSG-150	T220-CRYO-GSG-050 T220-CRYO-GSG-075 T220-CRYO-GSG-100
Probe planarization	Included	
Temperature range	10 K to 300 K	
Probe sensor type provided	DT-670-LR	
Probe bias/modulation capability	30 V, DC to 1 GHz	
Calibrated dynamic range	TBD	30 dB

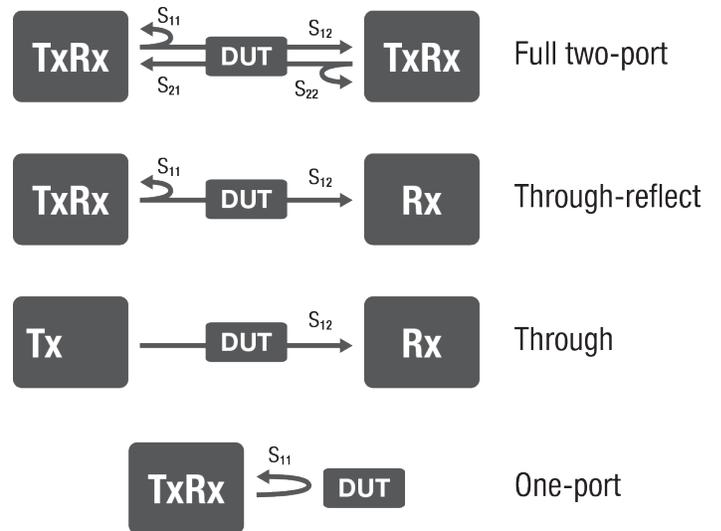
Variable temperature high-frequency research

Lake Shore's THz cryogenic probe arm enables calibrated S-parameter and other high-frequency measurements to be performed at the very low temperatures (and high magnetic fields) required by early-stage researchers. This opens new measurement possibilities for next-generation electronics R&D in areas such as radio astronomy and quantum computing.



S-parameter measurements

Scattering parameters (S-parameters) describe the frequency-dependent electrical behavior of a device under steady-state traveling-wave current and voltage signals. Either a one-port or two-port configuration can be used. Based on signal direction (transmit/receive), the reflection (S_{11} , S_{22}) and transmission (S_{12} , S_{21}) components are measured independently to provide the complete device profile.



Ordering information

Note: It is highly recommended to order the PS-Z16 higher resolution microscope option for use with the THz probe arms.

Probe arms

Arms are fully compatible with CPX and CPX-VF stations and with CRX-4K and CRX-VF stations with some restrictions. THz probe and frequency extender not included. Arms are shipped with dummy probes in place. Lake Shore installation is performed using dummy probe only.

MMS-09-THZ-MVNAX-WR10

THz probe arm for 75 to 110 GHz (WR-10 band)

MMS-09-THZ-MVNAX-WR51

THz probe arm for 140 to 220 GHz (WR-5.1 band)

Options/Accessories

PS-Z16

16:1 zoom microscope upgrade

WinCal XE

RF calibration software (purchase from Cascade)

138-357

WR-10 calibration substrate—impedance standard, 100, 125, 150 μm pitch, mmWave ready, GSG (purchase from Cascade)

138-356

WR-5.1 calibration substrate—impedance standard, 50 to 75 μm pitch, mmWave ready, GSG (purchase from Cascade)

T-Wave probes from Cascade Microtech

It is recommended that Cascade install and calibrate these probes.

T110-CRYO-GSG-100

WR-10 probe; 100 μm pitch

T110-CRYO-GSG-150

WR-10 probe; 150 μm pitch

T220-CRYO-GSG-050

WR-5.1 probe; 50 μm pitch

T220-CRYO-GSG-075

WR-5.1 probe; 75 μm pitch

T220-CRYO-GSG-100

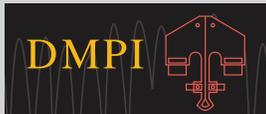
WR-5.1 probe; 100 μm pitch



MeasureOne

As a MeasureOne partner, Lake Shore has fully qualified this cryogenic THz probe arm with Cascade Microtech's T-Wave probes to ensure that our customers receive a solution that works as expected. Our partnership further assures rapid, seamless installation and application assistance. Cascade's expertise in high-frequency calibration and measurement makes them the natural choice for support in these areas, while Lake Shore stands behind the overall cryogenic probing solution.

For information on MeasureOne, go to www.cascademicrotech.com/measureone



A collaborative development

The THz cryogenic probe arm was developed in collaboration with SWISSto12, DMPI, VDI, and the University of Virginia School of Engineering and Applied Science. The parties worked closely together to model, design, implement, and validate the measurement capability of the probe arm in a Lake Shore CPX cryogenic probe station located at the University of Virginia. Further validation and sample measurements were performed using analyzers from Keysight Technologies.

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