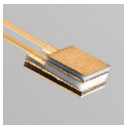
Lake Shore CRYOTRONICS

PRODUCT GUIDE

Lake Shore Cryotronics, Inc. • 575 McCorkle Boulevard • Westerville, Ohio, 43082
T: +1 614 891 2243 • F: +1 614 818 1600 • sales@lakeshore.com • www.lakeshore.com

LAKE SHORE

Temperature Products



Cryogenic Temperature Sensors

Measure from <10 mK to over 1,500 K using our comprehensive line of sensors. Industry-leading sensors include Cernox® thin-film RTDs featuring low magnetic field-induced errors and excellent stability over repeated thermal cycling and under extended exposure to ionizing radiation. Others include silicon diode, germanium, and ruthenium oxide (Rox™) sensors as well as platinum RTDs and specialty sensors with NIST-traceable calibrations.

Cryogenic Temperature Probes

Ideal for measuring inside fluid containers, cryostats, and other liquid storage systems, these probes provide highly reliable sensor performance in a thermowell or direct cryogen contact. Customizable for specific applications, probes can be configured with many sensor types for superior performance from room temperature to 4 K and below.

AC Resistance Bridges

Optimized for measurement and control of dilution refrigerators operating below 100 mK, AC resistance bridges make it easy to perform multiple tasks that were once very difficult to perform reliably at sub-1 K ranges: temperature measurement, automatic or manual temperature control, and device or sample impedance measurements.

Controllers, Monitors, and Sources

Our temperature instruments measure multiple sensors and sensor types in applications requiring high sensitivity at ultra-low temperatures. Controllers are available with up to eight inputs and four independent control outputs, and monitors come with up to 12 independent sensor channels. Our DC current source provides stable currents for test and measurement applications.

Temperature Sensor Input Modules

For precision remote monitoring of sensors used in large-scale cryogenic facilities down to 1 K, Lake Shore offers multi-input modules that enable reliable real-time monitoring over PLC-based networks.

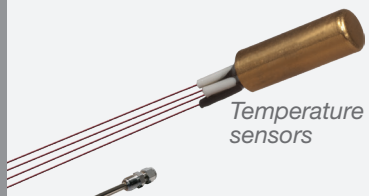
Also available: Cryogenic accessories (cable, wire, grease, varnish, and more)

Cernox®

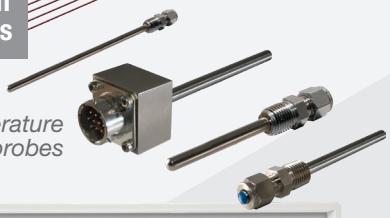
The most accurate thin film sensor for use in magnetic and radiation environments

HR HIGH RELIABILITY SERIES

High reliability cryogenic temperature sensors for mission-critical applications



Temperature sensors



Temperature probes

Model 372 AC resistance bridge

Model 335 controller

Model 121 current source

Model 336 controller

Model 240-8P cryogenic temperature sensor input module

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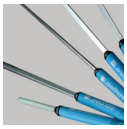
Magnetic Products

Teslameters/gaussmeters

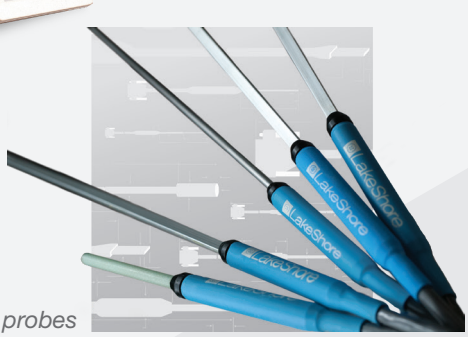
Measure both DC and AC magnetic fields and control DC fields with these highly accurate instruments. Ideal for both industrial QC and scientific R&D applications, gaussmeters offer a broad measurable field range (from 1 mG to 350 kG) in an easily programmable instrument. Available in both handheld and benchtop units.

Model 410 handheld gaussmeter and the F71 3-channel teslameter

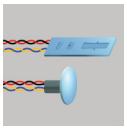


Hall Probes

Lake Shore offers a number of Hall probes with axial, transverse, multi-axis, and tangential field orientation for measuring magnetic flux density. Choose from high-stability, high-sensitivity, and ultra-high-sensitivity types in a wide range of lengths and thicknesses. Hall probes are also available for cryogenic applications.



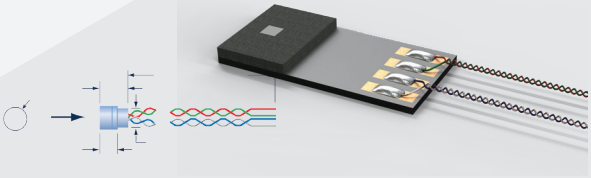
Hall probes



Magnetic Sensors

We offer compact Hall sensors for reliably measuring magnetic field magnitude in axial or transverse configurations. Available with 4-lead cable assemblies, Hall generators can be ordered in general purpose and instrumentation quality packages for either surface- or channel-mount applications. Cryogenic Hall sensors are also available.

Hall sensors



Fluxmeters

Measure total flux in industrial and research measurement system settings, such as in BH loop or hysteresisgraph measurement applications. Our fluxmeters feature compensated analog integration for faster instrument response than those with digital circuitry alone.

Model 480 fluxmeter

Helmholtz Coils, Field Standards, and Search Coils

For producing moderate-volume uniform magnetic fields, our Helmholtz coils are available with standard field or magnetic moment measurement capabilities. We also offer field probes for search coils when measuring in narrow gaps or where field gradients require the use of smaller coil diameter.

Helmholtz and search coils

Also available: Magnetic accessories (reference magnets, extension cables, and more)

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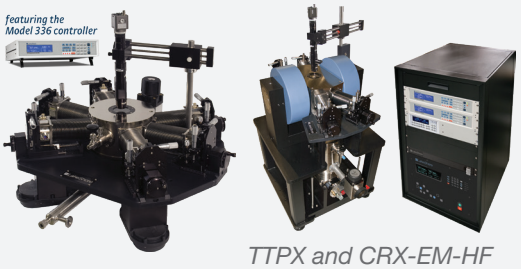
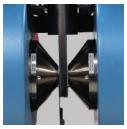
Material Characterization Products

Cryogenic Probe Stations

Best-in-class, micro-manipulated platforms for non-destructive, on-wafer probing of device samples as a function of temperature and field using magneto-transport, DC, electro-optical, and RF/microwave measurements. Models available for probing as low as 1.6 K and in fields to more than 2 T.



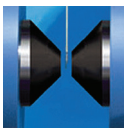
TTPX and CRX-EM-HF probe stations



Hall Effect Systems

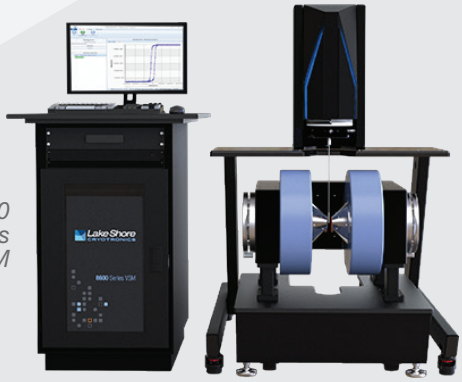
Advanced systems available in a variety of electromagnet configurations for performing Hall and magneto-transport measurements as a function of field and temperature. Available with an AC field Hall option for exploring properties of very low-mobility materials (down to 0.001 cm^2/V s).

Model 8407 Hall measurement system

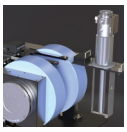


Vibrating Sample Magnetometer Systems

Optimized for characterizing DC magnetic properties of a broad range of sample materials, these magnetometer systems offer high sensitivity, accuracy, and speed, as well as a wide temperature-dependence measurement range (4.2 K to 1,273 K) and variable fields to 3.26 T. Featuring support for first-order-reversal-curve (FORC) measurements and analysis.

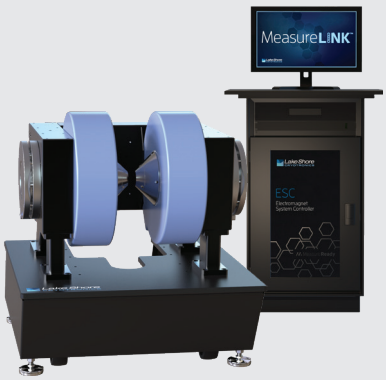


8600 Series VSM



Modular Characterization Systems

The multi-purpose MCS-EMP electromagnet platform provides all of the essential components required for automated, variable field experiments. Each MCS-EMP builds on a 4-inch or 7-inch electromagnet with pole caps, magnet base, and pedestal. Magnets feature ExactGAP™ precision-settable sample gaps. 2-inch pole caps are standard on the 4-inch MCS-EMP, and convertible 4-inch/2-inch caps are standard on the 7-inch MCS-EMP. Optical access is optional.



MCS-EMP modular characterization system

Also available: Electromagnet and superconducting magnet power supplies

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MeasureReady

MeasureReady® instruments for materials characterization

155 AC/DC current and voltage source—DC-low noise performance without compromising AC bandwidth

The low-noise MeasureReady 155 precision current and voltage source combines premium performance with unprecedented simplicity for materials scientists and engineers requiring a precise source of voltage and current.

- Low RMS noise: from 200 nV (10 mV)/7 pA (1 µA)
- Bipolar, 4-quadrant power source
- DC and AC modes supported up to 100 kHz (155-AC only)
- Full scale ranges—voltage: 10 mV to 100 V, current: 1 µA to 100 mA
- 0.001% programming resolution (from 100 nV/10 pA)
- In-phase reference output for use with a lock-in amplifier (155-AC only)
- Manual and autorange function
- Front and rear input connectors
- Touchscreen user interface
- USB and LAN connectivity (GPIB option)
- 3-year standard warranty

M91 FastHall™ measurement controller—a new approach to Hall measurement

The MeasureReady M91 is a revolutionary, all-in-one Hall analysis instrument that delivers significantly higher levels of precision, speed, and convenience to researchers involved in the study of electronic materials.

Simpler and more convenient

- All-in-one instrument
- Automatically selects optimal excitation and measurement levels
- Automatically executes measurement steps
- Provides complete Hall analysis
- Easy to integrate with lab systems

Makes better measurements, faster

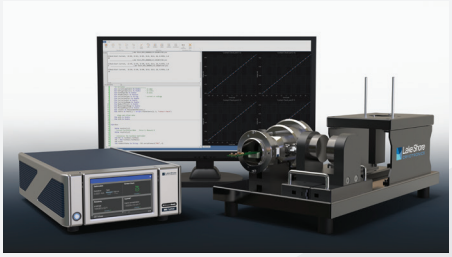
- No need to reverse the magnetic field with FastHall
- Up to 100× faster for low mobility materials
- Improves accuracy by minimizing thermal drift

Cost effective

- Build a new Hall system or upgrade an existing one
- Add state-of-the-art Hall measurement capability to any lab
- Use with any type of magnet

FastHall measurement capability contained in a complete characterization platform

MeasureReady FastHall Station



- Proprietary FastHall technology enables low-mobility measurements without field reversal in seconds
- Mobility measurements down to 0.01 $cm^2/V\ s$ for van der Pauw samples with resistances from 10 mΩ to 1 GΩ
- Completely guarded triaxial cabling to fully shielded, insertable, light-tight sample chamber plus an LN_2 option
- MeasureLINK-MCS software provides standard sequences, charts, exportable reports and user customizable scripts
- Easy to use spring pin and solder sample holder cards accommodate up to 10 mm × 10 mm van der Pauw and Hall bar type samples
- Measurement times greatly reduced through patented FastHall method
- Available gate bias instrument option and ability to easily integrate third-party sources and instruments
- Simple, repeatable, and reversible permanent magnet with nominal fields of 1 T and optional 0.8 T for LN_2

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MeasureLINK™

MeasureLINK™-MCS software

MeasureLINK-MCS software is the key component of each MeasureReady™ MCS system. It facilitates field control, temperature control, measurement sequencing, and integration functions.

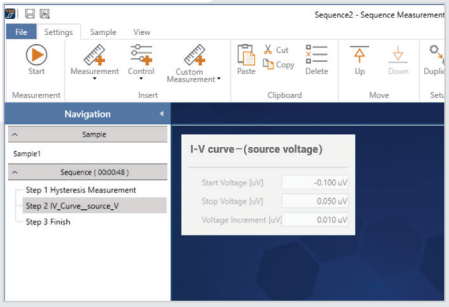
This flexible software allows the user to monitor the real-time performance of the MCS system and to construct measurement sequences from a set of predefined controls. The menu-driven graphical user interface (GUI) provides the ability to control field and temperature to a specific setpoint or to loop these parameters through a range of settings with a specified step value. The sequences can be saved and recalled for use in repeated measurements.

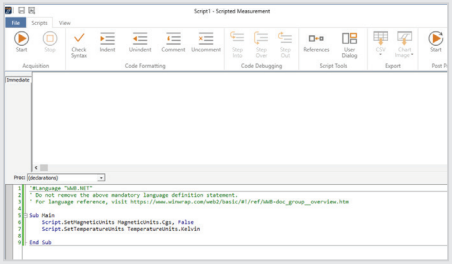
MeasureLINK-MCS software features

- Temperature and field control
- Measurement sequences
- Integrate Lake Shore or third-party instruments
- Integration with other lab software
- Custom measurements with scripting

Sequence screen

Build a sequence of steps that define the desired measurement protocol





Script screen

Extend your system functionality by creating custom scripts

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JANIS

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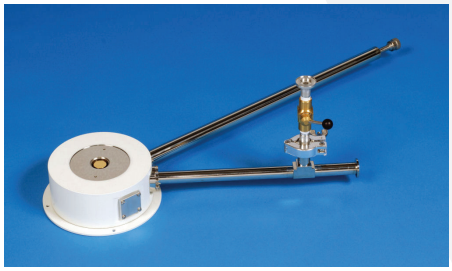
Cryostats for spectroscopy and electrical measurements

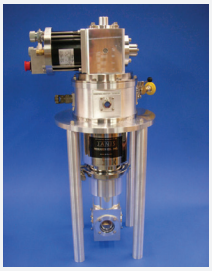
Lake Shore Cryotronics offers a comprehensive range of Janis brand products specifically designed for spectroscopic measurements. Cooled by liquid helium, liquid nitrogen, or a closed-cycle refrigerator (CCR), a cryostat is available for most spectrometer-based applications. In addition, electrical access and sample holders add the capability for resistivity and Hall measurements and other electrically-based techniques.

Solutions include LHe-cooled continuous flow and reservoir cryostats, LN_2-cooled pourfill systems, and 4 K, 7 K, and 10 K closed-cycle refrigerators.

Typical applications:

- FTIR
- ESR
- Optical microscopy
- Mössbauer
- NMR
- VSM
- UV/VIS/NIR
- Hall measurements
- Matrix isolation
- Neutron scattering
- X-ray diffraction
- Nanoscale measurements





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Superconducting magnet systems

These systems feature designs that fully integrate the cryostat, magnet, automatic temperature controller and magnet power supply, complemented by a complete line of ancillary equipment.

Our renowned Janis SuperVariMag, OptiMag and SuperOptiMag systems offer temperatures between 1.5 K and 325 K (with options to 475 K or higher), and can be supplied with or without optical access. Our NbTi systems offer magnetic fields between 5 and 9 T with optional Lambda point refrigerators for reaching higher fields, while our Nb3Sn magnets offer fields of 17 T and beyond.

Micro-manipulated probe systems

In addition to Lake Shore probe stations (page 4), we offer a comprehensive line of Janis brand vacuum and cryogenic probing systems for chips, wafers, and packaged devices. These systems are used by government laboratories, industry, and universities around the world, in various fields including semiconductors, MEMS, superconductivity, electronics, ferroelectrics, materials science, physics, and optics.

Standard cryogenic probing systems and custom designed units are available to match your specific requirements. They include an ultra-high efficiency continuous flow cryostat system, which utilizes liquid helium or liquid nitrogen and offers fast cooldown without introducing vibrations to the sample.

Standard systems offer temperatures from below 3 K to 325 K (or 450 K). Several different probes are available for use with signals ranging from DC to microwave, and a combination of both low and high frequency probes can be supplied with a single system.

Our Woburn, MA office

Janis Research

225 Wildwood Avenue

Woburn, MA 01801-2025

781-491-0888