Lake Shore CRYOTRONICS

environment by JANIS

DryMag

DryMag 1.5 K cryogen-free measurement system

The Lake Shore DryMag provides cryogen-free cooling to 1.5 K with horizontal fields up to 7 T (optical) or vertical fields up to 12 T (non-optical). Samples are easily accessed by opening a single clamp and removing the top-loading sample positioner. Additionally, samples can be exchanged without warming the cryocooler to room temperature, significantly reducing turnaround time. Samples can be rotated on a vertical axis, with options available to rotate the sample from in-plane to out of plane of magnetic field. In a standard configuration, the cryostat is operated with sample in static exchange gas environment. The cooling of sample holder with the sample in static exchange gas is particularly useful for studying poorly thermal conducting liquid, powder, and irregularly shaped samples that are not easily mounted to the flat surface of a sample holder.

The DryMag can be equipped with optional electrical feedthroughs connectors and necessary wiring for measurements, and is ideal for use in studying the electronic properties of materials. An optional electrical transport measurements package integrates the Lake Shore MeasureLINK software and the M81-SSM synchronous source measure system and the M91 FastHall controller for turnkey automated magnetoelectrical measurements.

Key features

- Cryogen-free
- Horizontal fields to 7 T (optical) or vertical fields to 12 T (non-optical) with optional bottom optical access
- Minimum temperature: 1.5 K (with standard He-4 insert), 300 mK (with optional He-3 insert)
- Maximum temperature: 420 K
- Optional sample rotator
- Top-loading static helium exchange gas configuration
- Helium grade 4 (99.99%) for sample exchange and circulation
- Ceiling height <2.4 m (<2.6 m for He-3 insert)

Optional Hall insert

System components

Superconducting magnet

Superconducting magnet designed for conductive cooled operation in vacuum. Magnet quench protection circuitry included. No persistence switch.

Cold head

Sumitomo two-stage GM mechanical refrigerator with a cooling power of at least 1.0 W at 4.2 K (second stage) to cool superconducting magnet, radiation shield, and 1.5 K pot. Supplied with a water-cooled compressor (fully charged) and 20 m flexible stainless-steel lines. Power source of either 3-phase 200 V, 50/60 Hz or 3-phase 380 to 415 V, 50 Hz; 480 V, 60 Hz. Cold head maintenance ~10,000 h; compressor: 30,000 h. Flow rate of 6 to 9 L/min. Power consumption: 7.5 to 7.8 kW at 60 Hz or 6.6 to 6.9 kW at 50 Hz.

Cryostat

1.5 K continuously operating variable temperature cryostat. Includes a 1.5 K pot and a manual needle valve to regulate the helium circulation flow, and all necessary wiring included for operation. An optional motorized needle valve for remote operation can be provided.

Temperature sensors

Calibrated Cernox sensors located on the sample tube, magnet plate, 1.5 K pot, one of the HTSC leads, radiation shield, and cold head second stage.

Power supply

Lake Shore 625 (or dual 625 for >60 A output) ultra-high stability 4-quadrant superconducting magnet power supply (1 mA/h) that can deliver up to 60 A at a nominal compliance voltage of 5 V. Programmable field sweep capabilities and IEEE-488 or RS-232 interface. Includes digital displays of magnet current (0.1 mA resolution), magnetic field, setpoint, sweep rate (as low as 0.1 mA/s), as well as magnet or power supply voltage. Also includes a built-in persistent switch heater power source and a quench protection/ramp-down circuit.

Sample positioner

The standard sample positioner can be rotated manually from 0° to 360° around the vertical axis of the cryostat. Includes a sample mount with a calibrated Cernox sensor and 50 Ω wound heater. Has one 10-pin feedthrough for heater/sensors, three blank ports for electrical feedthroughs, and a safety relief valve.

Heaters

Non-magnetic heaters on sample tube, radiation shield, and magnet mounting plate.

Manual gas handling system

Scroll pump, helium gas dump with at least 99.99% pure 4 psi helium gas, pressure relief valves, manual valves, compound vacuum gauges and connecting lines and fittings.

Temperature controller

Lake Shore 336 temperature controller to control the temperature of the VTI and sample mount (part of the sample positioner) and to monitor magnet plate and HTS leads. Optional second Lake Shore 336 temperature controller can be included to monitor radiation shield and cold head second stage.

Software

MeasureLINK software to control temperature and magnetic field.

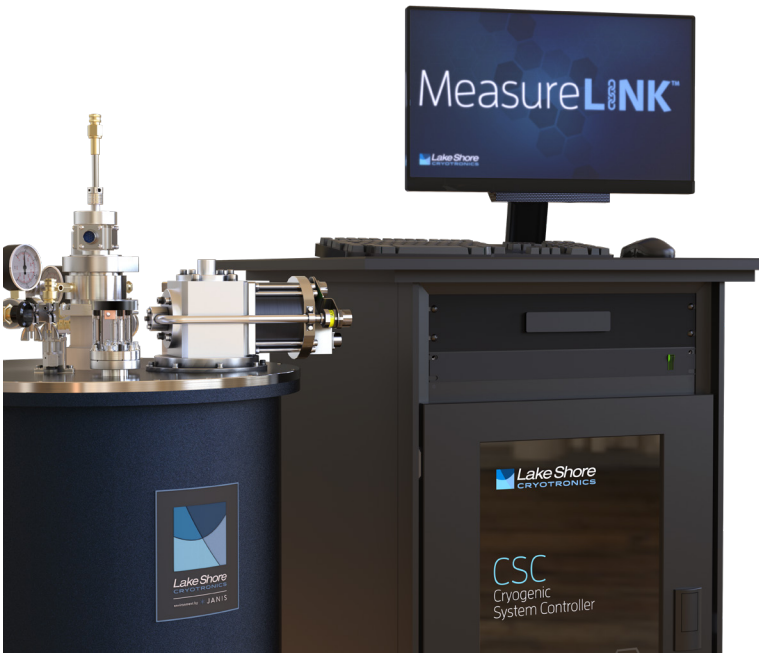
Console

Console with rack-mounted instruments (temperature controller and magnet power supply), power distribution, and PC.

Specifications

DryMag system specifications	
Sample environment	Static exchange gas (vacuum option available)
Control stability	±50 mK
Sample change time	90 min (when system is at 1.5 K)
Recommended maintenance	10,000 h (GM) or 20,000 h (PT)

Model-specific specifications	7T-DRYMAG1.5-XOM	9T-DRYMAG1.5	12T-DRYMAG1.5
Maximum field	7 T	9 T	12 T
Field orientation	Horizontal	Vertical	Vertical
Ramp time to maximum field	60 min	30 min	120 min
Field homogeneity over 1 cm sphere	±0.5%	±0.1%	±0.1%
Maximum field current	<90 A	<60 A	<100 A
Operating temperature	1.5 K to 300 K (420 K optional with a sample in vacuum environment)	1.5 K to 420 K	1.5 K to 300 K (420 K optional with reduced field)
Cooldown	~50 h	~26 h	~40 h
Optical access	Horizontal access	Optional bottom access	No
Sample mount size	19 mm	38 mm	38 mm
Sample space	23 mm	50 mm	50 mm



Ordering information

Options

Sample positioner for vertical field option

Standard	0° to 360° rotation about the vertical axis
Double rotator	360° about the vertical axis and ±90° rotation (with wiring) about the horizontal axis with a resolution of ±1°; includes a 20 mm × 18 m blank sample holder; motorized option available
Precision sample rotator	0° to 90° rotation from in-plane to out-of-plane of magnetic field with a resolution of ±0.2°; includes a 15 mm × 15 mm blank sample holder; motorized option available
Vacuum	For sample in vacuum environment; includes a 34 mm × 19 mm blank sample holder

Hall insert

Hall insert	Triaxially-guarded Hall insert with 8 triaxial feedthroughs on the header with triaxial cables to an 8-pin sample holder; accommodates a 19 mm diameter sample; can be integrated with the M91 FastHall measurement controller

Sample positioner for horizontal field option

Standard	0° to 360° rotation about the vertical axis (from in-plane to out-of-plane of magnetic field)
FTIR	25 mm (1 in) or optional 50 mm (2 in) linear motion and 0° to 360° rotation about the vertical axis (from in-plane to out-of-plane of magnetic field)

He-3 insert

He-3 insert	For operation from 300 mK to 20 K (optional up to 300 K)

Sample holders

Sample holders	20-pin LCC, 20-pin DIP, and 8-pin resistivity or optoresistivity sample holders

Pump

TSJ-85-D	Turbopumping station with scroll backing pump

Electrical feedthroughs

EF-BNC-1-B-AL	(1) BNC grounded
EF-BNC-2-S-AL	(2) BNC grounded
EF-BNC-6-G	(6) BNC grounded
EF-BNC-1-B-NC	(1) BNC insulated
EF-BNC-2-S-NC	(2) BNC insulated
EF-BNC-6-I	(6) BNC insulated
EF-TRIAX-1-B-AL	(1) triaxial grounded
EF-TRIAX-6-G	(6) triaxial grounded
EF-TRIAX-1-B-NC	(1) triaxial insulated
EF-TRIAX-6-I	(6) triaxial insulated
EF-SMA-2-B-AL	(2) SMA grounded
EF-SMA-6-G	(6) SMA grounded
EF-SMA-2-B-NC	(2) SMA insulated
EF-SMA-6-I	(6) SMA insulated
10P-ASSEMBLY	10-pin
19P-ASSEMBLY	19-pin
26P-ASSEMBLY	26-pin
32P-ASSEMBLY	32-pin

Additional temperature sensors

DT-670-CU-HT-1.4L	Silicon diode, calibrated (one included)
CX-1050-CU-HT-1.4M	Cernox® magnetic field independent, calibrated
TC-Y-ZZ-03	Thermocouple, Type E

Installed wiring

CABLEASSY-63340	(1), (2), or (6) coaxial cables, SMA
CABLEASSY-63342	(1), (2), or (6) coaxial cables, BNC
CABLEASSY-63341	(1) or (6) triaxial cables
WIRE-PHBR	(10), (19), (26), or (32) PhBr wires

Accessories

Automated electrical transport measurements

Integrating the M91 FastHall™ controller with DryMag offers breakthrough speed and accuracy. The M91 eliminates the need to reverse polarity of the applied magnetic field during measurements, especially critical for high fields or low mobilities, resulting in measurement times up to 100× faster than typical Hall systems. The integration is seamlessly operated via the supplied MeasureLINK™ software. Applications include Hall voltage, resistance/resistivity, magnetoresistance, Hall coefficient, Hall mobility, anomalous Hall effect, and carrier type/concentration/density.

M81-SSM electronic synchronous source measure system

Contact us for standard/optical sample mounts or for interface cables/adapters for M81-SSM system/cryostat integration.
Also available: specially priced preconfigured M81-SSM/cryostat packages for certain cryostat models—contact Sales for details.

M81-SSM-2	M81-SSM instrument with 1 source and 1 measure channel, including M81-SSM accessory kit (USB-A to USB-C adapter, USB-A male to USB-B male cable, terminal connectors for digital I/O, terminal connectors for chassis ground, quick-start guide) and a 2 m (6.6 ft) LEMO to BNC adapter cable
M81-SSM-4	M81-SSM instrument with 2 source and 2 measure channels, including M81-SSM accessory kit (USB-A to USB-C adapter, USB-A male to USB-B male cable, terminal connectors for digital I/O, terminal connectors for chassis ground, quick-start guide) and a 2 m (6.6 ft) LEMO to BNC adapter cable
M81-SSM-6	M81-SSM instrument with 3 source and 3 measure channels, including M81-SSM accessory kit (USB-A to USB-C adapter, USB-A male to USB-B male cable, terminal connectors for digital I/O, terminal connectors for chassis ground, quick-start guide) and a 2 m (6.6 ft) LEMO to BNC adapter cable
ML-MCS	MeasureLINK-MCS software with scripting development license. Includes complete MeasureLINK installation with Lake Shore instrument drivers, chart recorder functionality and drag-and-drop measurement sequences. Some application packs sold separately.
M81-BNC-DB25	Breakout box with 24 BNC to DB25 connectors with ability to ground the BNC center conductors and float or ground the BNC shells; optional external coaxial cables or cryostat cable available

Other accessories

SP-20	Dry scroll pumping station
TS-85-D	Turbomolecular pumping station
336	Model 336 temperature controller
335	Model 335 temperature controller