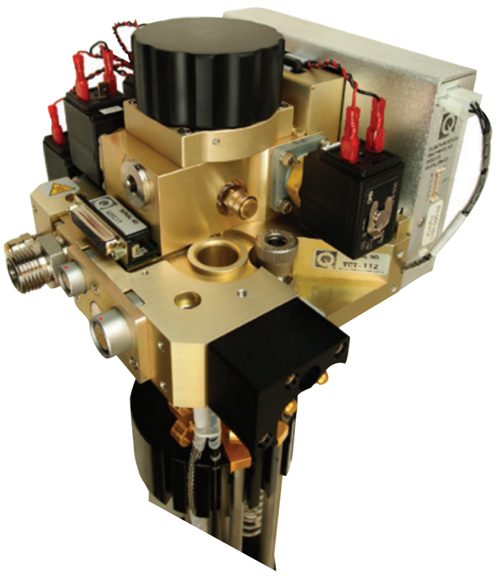
MPMS®3

The next generation of advanced SQUID magnetometry



- Sensitivity & speed
- Cryogen free with EverCool
- Automated operation
- Multiple measurement modes
- More than 30 years of experience in SQUID magnetometry
- Experience of several hundreds of SQUID magnetometers

Quantum Design EUROPE

Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt

Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

Quantum Design's MPMS 3 represents the culmination of more than 30 years of development and design in the world of SQUID magnetometry. Providing users with the sensitivity of a SQUID (superconducting quantum interference device) magnetometer and the choice of multiple measurement modes, the MPMS 3 offers new levels of performance in magnetic research while including those aspects of past Quantum Design SQUID magnetometers that customers have grown to appreciate and rely on.

The MPMS 3 incorporates major advances in data acquisition, temperature control and magnetic field control with ≤10^{-8} emu sensitivity. The award-winning design of Quantum Design's MPMS 3 also provides expanded software functionality within its user-friendly MultiVu interface. Combining the highest level of system performance with the possibility of using all previously available MPMS measurement options, the Quantum Design MPMS 3 truly represents the next generation of advanced SQUID magnetometry.

Data acquisition

The MPMS 3 provides three possible measurement modes: DC scan mode, VSM mode, and AC susceptibility mode.

DC scan mode: Provides continual plotting and capture of raw data points at static or sweeping fields and temperatures. This mode of data capture is similar to, but faster than Quantum Design's historic MPMS XL measurement modes.

VSM mode (optional): Combines Quantum Design's DC SQUID sensor with vibrating sample magnetometer (VSM) technology, providing the ability to achieve <1 x 10^{-8} emu sensitivity at zero magnetic field. Further noise reduction in the design allows this system to achieve an unprecedented <8 x 10^{-8} emu sensitivity at the full field of 7 tesla.

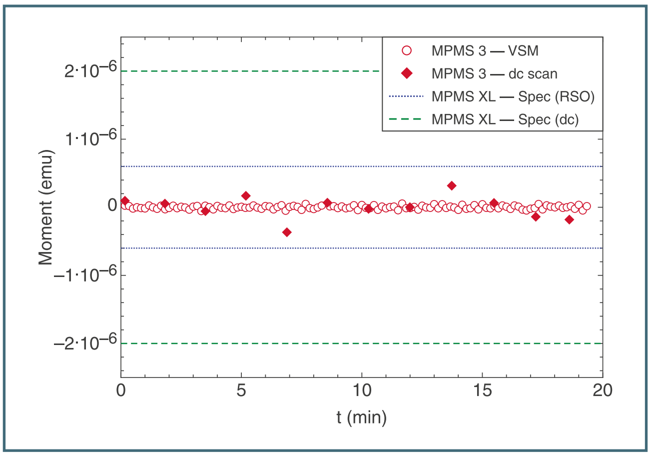
AC susceptibility mode (optional): Using an oscillating magnetic field, this measurement uses the MPMS 3's SQUID and VSM linear motor to measure the AC susceptibility of a sample. Fully integrated functionality and scripting are available within the MultiVu interface.

Temperature control

The MPMS 3 uses an innovative temperature control design that allows you to cool samples from room temperature to a stable 1.8 K in typically less than 30 minutes.

The temperature control insert of the MPMS 3 is a vacuum-insulated chamber into which cold helium is drawn through a variable flow valve, for the purpose of cooling the sample chamber with pumped helium to temperatures as low as 1.8 K. A finely tuned flow impedance and sophisticated temperature control software allow continuous operation at 1.8 K as well as smooth temperature control through the 4.2 K liquid helium boiling point. Heaters on the sample chamber can raise the temperature as high as 400 K. A thermal shield, anchored to a liquid nitrogen tank, intercepts heat from a warm sample chamber and minimizes liquid helium consumption when operating at higher temperatures. By flattening the thermal gradient along the cold end of the temperature control insert, this shield also allows the entire insert to be constructed with a relatively short geometry, minimizing heat capacitance and enabling rapid temperature control.

The diameter of the temperature control insert was selected to allow a 9 mm sample bore and to provide the smallest diameter pickup coils possible to optimize the magnetometer's sensitivity.

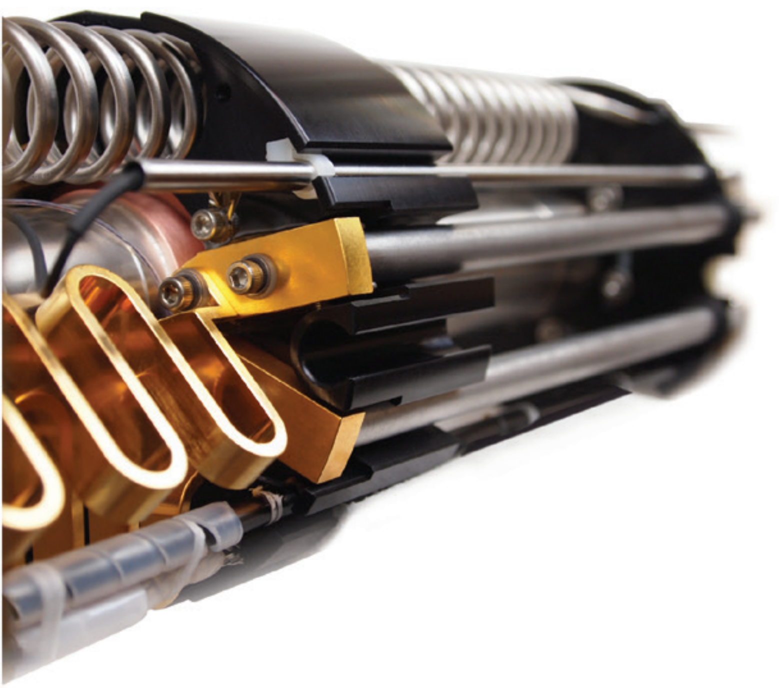


The MPMS 3 provides the lowest noise floor ever available in a Quantum Design SQUID magnetometer (both for DC Scan and VSM measurement modes). [MPMS 3 noise data was collected at full field on an EverCool equipped system with the cold head running.]

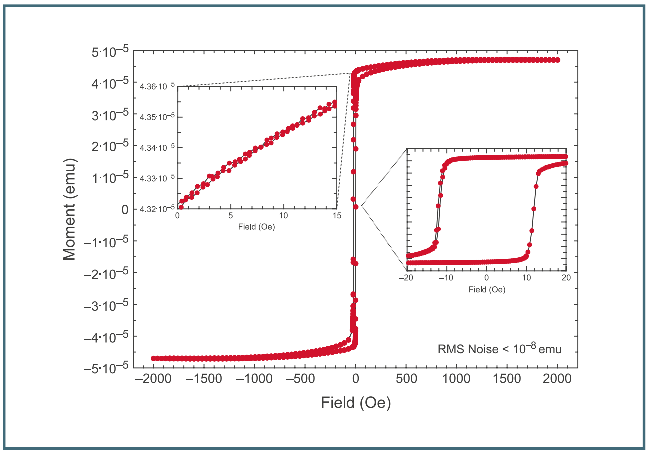
Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry



The MPMS 3 is configured with an integrated environmental shield. This shield allows sensitive measurements to be made in locations with magnetic noise by creating a locally quiet environment. It also serves as a return path for the system's superconducting magnet, permitting use of the system in close proximity to other sensitive devices.

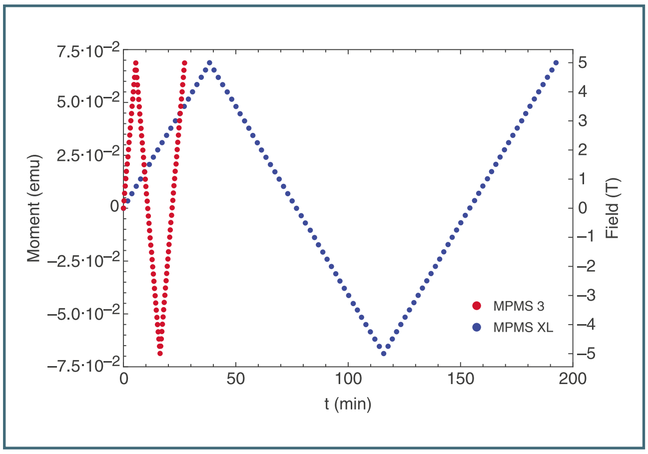


The quality of moment versus field data, at 5 K, is shown for a thin film ferromagnetic sample provided by Professor Eckert of Harvey Mudd College. The left inset illustrates the reproducibility in coming from 2 kOe to zero field. The right inset demonstrates in particular the small field setting resolution of the new MPMS®3 magnet power supply.

Magnet control

The MPMS 3 utilizes a 7 tesla, superconducting, helium-cooled magnet and a hybrid digital/analog magnet controller designed specifically for the MPMS 3 to achieve precise, quiet control of the magnetic field. SQUID precision in a magnetic measurement requires a stable magnetic field. The MPMS 3 accomplishes rapid switching between charging and discharging states and stable fields with a unique, patented superconducting switching element, which changes between superconducting and normal states in less than one second. This allows rapid collection of high precision data.

The high open state resistance and low thermal mass of the MPMS 3's QuickSwitch™ also help to minimize liquid helium consumption when ramping magnetic field, as compared to more traditional superconducting persistent switch technology. Further aiding the instrument's low helium consumption is the use of high temperature superconductor (HTS) magnet leads anchored to a liquid nitrogen tank. The nitrogen shield in this design absorbs a large amount of room temperature heat that would otherwise be conducted to the helium bath.



The MPMS 3's unique, patented superconducting switching element provides increased speed and performance of magnet ramping and stabilization. This leads to faster measurement frequency with decreased time lags between measurements.

Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

MPMS® 3 specifications	
Temperature control	
Feature	New TCM design, Rapid Temp™
Operating range	1.8 K to 400 K
Cooling rate	30 K/min (300 K to 10 K stable in 15 min., typical) 10 K/min (10 K to 1.8 K stable in 5 min., typical)
Temperature stability	±0.5%
Temperature accuracy	lesser of ±1% or 0.5 K
Sample chamber I.D.	9 mm
Magnetic field control	
Feature	QuickSwitch™
Magnetic field range	-70 kOe to +70 kOe
Field uniformity	0.01% over 4 cm
Field charging rate	4 Oe/s to 700 Oe/s
Field charging resolution	0.33 Oe
Remanent field	~5 Oe (typical) when oscillating from full field back to zero
Magnetization measurement	
Feature	SQUID-based magnetometry/susceptibility
Maximum DC moment	10 emu
Sensitivity	≤2500 Oe: <5 x 10^{-8} emu (DC scan) <1 x 10^{-8} emu (VSM, <10 s averaging) >2500 Oe: <6 x 10^{-7} emu (DC scan) <8 x 10^{-8} emu (VSM, <10 s averaging)
Variable drive amplitude	0.1 to 8 mm (peak)
Liquid helium based magnetometer features	
Dewar	Vibration isolation, magnetic shield, thermal radiation shield
Liquid helium usage	4 L/day (typical) + 0.05 L per sample cooldown (may increase with oven use)
Liquid helium capacity	65 L
Liquid nitrogen usage	5 L/day (typical)
Liquid nitrogen capacity	60 L
Hold time	up to 12 days (typical)
General system details for MPMS 3 liquid helium and EverCool dewar	
Power requirements basic system	200 – 230 VAC, 50/ 60 Hz, 10 A max. (approx. 6 – 8 A at typical operation)
Dimensions & weight Main cabinet (without keyboard arm)	105 cm x 84 cm x 200 cm, approx. 400 kg
Dimensions & weight Pump console	61 cm x 71 cm x 61 cm, approx. 65 kg
For MPMS3 EverCool specific requirements, please refer to EverCool option description on next page	

Quantum Design EUROPE

Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt

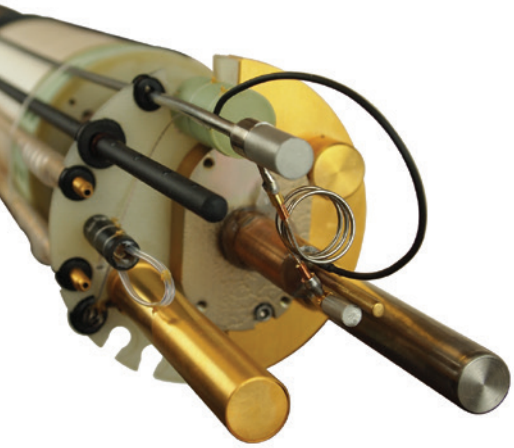
Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

MPMS®3 EverCool® option

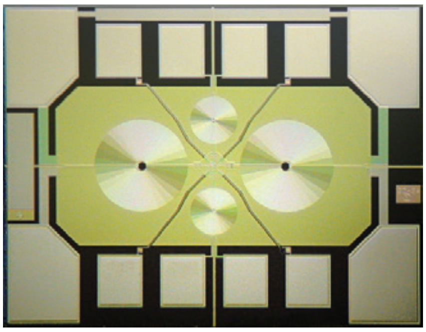
The Quantum Design MPMS 3 EverCool dewar eliminates the need for liquid helium transfers and virtually eliminates all helium loss from the Quantum Design MPMS 3 magnetometer system. For the user, this integrated pulse-tube cryocooler dewar system can be considered cryogen free, as it not only recondenses the liquid helium directly within the EverCool dewar but also accomplishes its initial cool-down directly from helium gas, thereby eliminating the need to use any liquid cryogens for the operation of the MPMS 3.



MPMS 3 EverCool system advantages

- Minimal additional space requirements for the cryocooler compressor
- Production of initial operating charge of liquid helium from helium gas in as little as 30 hours
- Full integration of all EverCool functions within the MPMS 3 MultiVu software, allowing virtually automatic operation of all functions, including helium level control in the MPMS 3 EverCool dewar

The MPMS 3 EverCool dewar is available as an option for the Quantum Design MPMS 3. It requires the use of a water chiller for the water-cooled compressor, as well as the hook up of an external helium gas supply for the purpose of automatically replenishing He gas that is lost under certain conditions, like purging the sample space or using the system under extreme conditions.



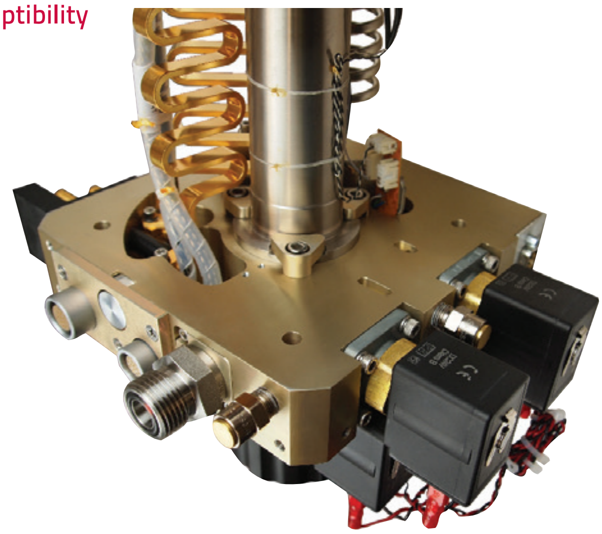
MPMS® 3 EverCool® features	
Helium liquefaction capacity	~9 liquid liters/day. This is the net liquefaction rate while the system is running and represents the amount of liquid helium that can be generated in excess of the normal daily system usage.
Nominal LHe capacity	~16 liters. Full capacity is defined when level reaches bottom of magnet.
Estimated cool-down time	~30 hours to reach thermally steady state, ready for normal system operation. No liquid helium is required for cool-down. An additional 20 hours are necessary to reach the normal helium level.
Potential effect on system sensitivity	The EverCool configuration has a permanently running cryocooler, which has no influence on the system specifications. The noise performance is identical to the standard MPMS 3.
Physical configuration	(a) EverCool Dewar with integrated cold head housed in standard MPMS 3 cabinet; (b) Pumping module, gas handling control and integrated EverCool controller housed in standard MPMS 3 pump console; (c) Compressor with stainless steel hoses connecting to main cabinet.
Water cooled compressor	
Dimension	~46 x 48 x 62 cm³ (L x W x H)
Weight	~120 kg
Compressor hoses	~20 m length, weight: ~35 kg
Choice of power requirements	3 Phase 220/230 VAC 33 A max @ 60 Hz 3 Phase 460 VAC 13A max @ 60 Hz 3 Phase 380/420 VAC 16 A max @ 50 Hz 3 Phase 200/220 VAC 33A max @ 50 Hz
Typical consumption	7.2 kW (9 kW max)
Cooling water requirement	16 °C to 22 °C (non-condensing) with a flow rate of 9 L/min
Water chiller requirement	Available as option. Please contact us in case you want to add a chiller by yourself
Maintenance	
Compressor	After 20,000 operational hours (recorded by timer on compressor)
Cold head	After approx. 30,000 operational hours

Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

AC susceptibility



Many materials display dissipative mechanisms when exposed to an oscillating magnetic field, and their susceptibility is described as having real and imaginary components – the latter being proportional to the energy dissipation in the sample. The key is resolving the component of the sample moment that is out of phase with the applied AC field. SQUID technology is the measurement system of choice because it offers a signal response that's virtually flat over a broad frequency range from 0.1 Hz to 1 kHz. In a SQUID system, the output voltage is proportional to the magnetic flux in the pick-up coil instead of its time derivative as in conventional AC systems. The MPMS 3 therefore is able not only to achieve unprecedented sensitivity in its base configuration, but also a minimal variation in sensitivity over the entire frequency range. The MPMS 3 AC option typically provides better than 5 x 10^{-8} emu sensitivity on the AC moment and better than ±0.5° phase angle sensitivity over the entire AC measurement frequency spectrum.

The MPMS 3 AC option is comprised of a dedicated controller and software package which integrates seamlessly into the existing system and user interface. AC measurements can be performed in the full parameter space (temperature, DC magnetic field) of the base system.

AC susceptibility specifications		
AC frequency range	0.1 Hz to 1 kHz	
AC amplitude[1] (peak)	0.1 Oe to 10 Oe	
AC moment sensitivity[2, 3]	≤ 5x10^{-8} emu (typical)	
AC moment accuracy[4]	≤ ±1% (typical)	
Phase angle accuracy[3, 5]	≤ ±0.5 (typical)	
Frequency[6] and temperature[7] dependencies	on AC moment	≤ ±1% (typical)
	on phase angle	≤ ±0.5 (typical)

[1] Maximum drive amplitude is frequency dependent. Software will dynamically reduce the maximum amplitude at higher frequencies.

[2] Smallest moment change that can be detected.

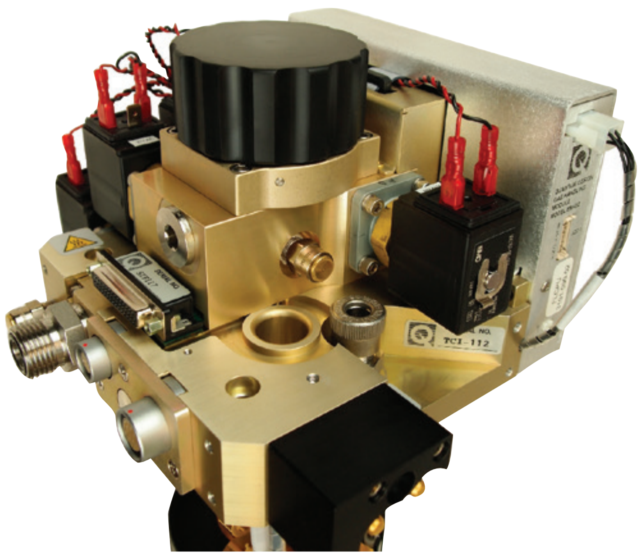
[3] Specification defined for a moment of about 5x10^{-6} emu using reference sample at 300 K with 10 Hz AC frequency and a maximum of 10 s averaging.

[4] Reported AC susceptibility for reference sample agrees with measured DC susceptibility. Specification defined using reference sample at 300 K, DC susceptibility extracted from DC MvsH measurement between ±100 Oe with 5 Oe field steps, AC susceptibility measured at 10 Hz with a maximum of 10 s averaging and an AC amplitude to give moment of at least 2x10^{-5} emu.

[5] Reported phase angle for reference sample agrees with expected value. Specification defined using reference sample at 300 K with 10 Hz with a maximum of 10 s averaging and an AC amplitude to give a moment of at least 5x10^{-6} emu – specification denotes maximum deviation from zero phase angle for reference sample.

[6] Variation for frequencies between 0.1 Hz and 1 kHz for moments larger than 2x10^{-5} emu.

[7] Variation for temperatures between 2 K and 400 K for moments larger than 2x10^{-5} emu.



Quantum Design EUROPE

Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt

Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

Ultra-low field (ULF) capability

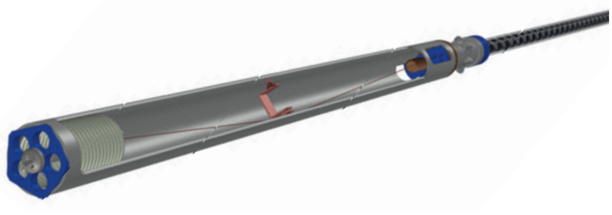
This MPMS 3 option actively cancels residual magnetic flux in the superconducting solenoid so samples can be cooled in a very low field – typically less than ±0.05 Gauss. This is extremely important for measurements of high temperature superconductors and spin glass materials. Besides zero-field measurements, the option also allows fields up to ±20 Gauss with a resolution improved by two orders of magnitude over the standard system.

The ultra-low field option incorporates additional electronics and a custom fluxgate specifically designed for this application. In basic operation, the MPMS 3 measures the residual field profile along the solenoid's longitudinal axis using the fluxgate and then nulls it by setting a DC field using compensation coils installed in the superconducting solenoid.

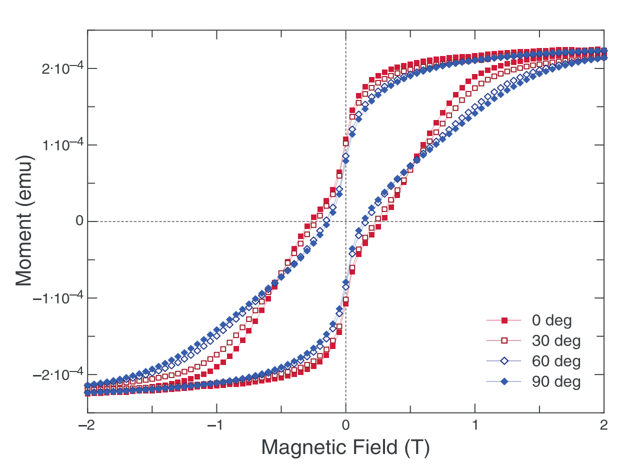
Ultra-low field specifications	
Nulling specifications	
Field nulling window [1]	up to ±10 mm
Field uniformity [2]	±0.05 Gauss
Target field range	-5 Gauss to +5 Gauss
Field stability	24 h
Fluxgate specifications	
Fluxgate range	±10 Gauss
Sensitivity [3]	±0.002 Gauss
Accuracy	±(0.02 Gauss + 0.5% measured field)
Additional specifications	
Magnet profiling length [4]	Up to 50 mm
High resolution field range [5]	±20 Gauss
Field resolution	Better than 0.002 Gauss
Field accuracy	±(0.002 Gauss + 0.5% set field)
[1] Distance from magnet center	
[2] Maximum field at any point along the magnet axis inside the nulling window	
[3] Intrinsic noise on fluxgate reading	
[4] Maximum length along magnet axis which can be profiled	
[5] High resolution field range which can be applied by the option	

Horizontal rotator

The MPMS 3 horizontal sample rotator allows samples to rotate around a horizontal axis. Samples are mounted on a small plate (rotor), which enables sample rotations of up to 360 degrees in 0.1 degree increments. The rotator is constructed of special materials to minimize magnetic contribution from the holders. Additionally, the new sample rod has the stepper motor fully integrated into the sample rod. Under normal operation, the MPMS 3 MultiVu software controls the sample holder plate with the rotator motor, allowing fully automated sample measurements as a function of angle.



Sample stages	Typical sample sizes
Standard platform	4 mm x 4 mm x 2 mm
Thin film	4 mm x 4 mm (flat)
Large sample	4 mm x 4 mm x 4 mm
Specifications	
Range	0° to 360°
Angular step size	<0.1° (typical)
Reproducibility	<1.0° with <10° backlash (typical)



Measurement of a ferromagnetic thin film sample with perpendicular anisotropy on a substrate. Results are shown for ±2 T moment versus field loop at 4 different angles from 0 to 90 degree sample rotation.

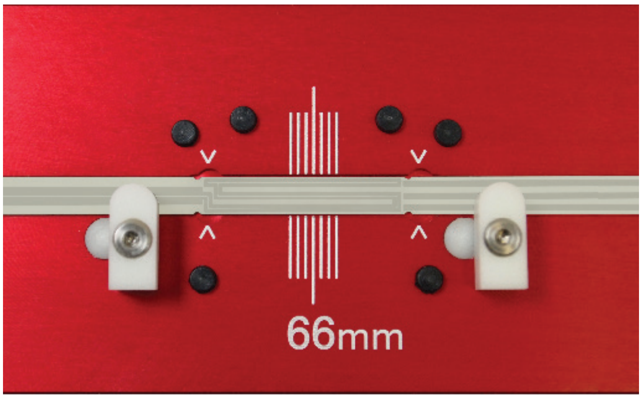
Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

The next generation of advanced SQUID magnetometry

Oven

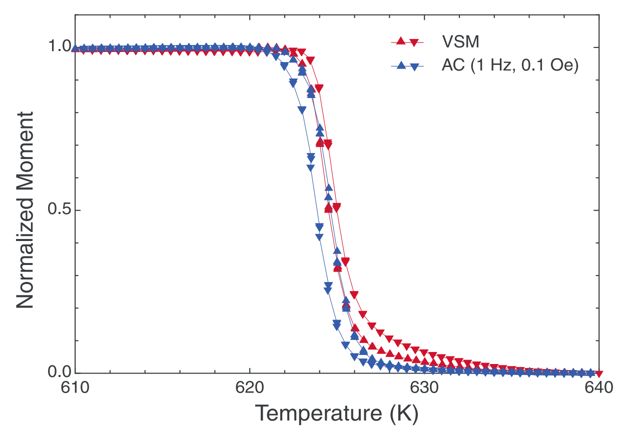
The MPMS 3 oven option allows sensitive magnetometry measurements at controlled temperatures from 300 K up to 1000 K. A heated sample holder allows reaching this temperature range while oscillating the sample inside the detection coils to perform measurements. With the AC measurement option it is possible to measure AC susceptibility in the same temperature range during the same measurement, although with reduced specifications due to the oven sample holder.

The MPMS 3 oven option incorporates additional electronics, a turbo pump unit for generating high vacuum in the sample chamber to minimize helium boil-off at high temperatures, and a dedicated sample holder allowing local temperature control directly at the sample.



MPMS 3 Oven sample mounting platform with oven sample holder

Oven specifications	
Temperature range	300 K – 1,000 K
Temperature accuracy	better than 2% after stabilisation
Temperature stability	±0.5 K
Moment sensitivity	1.0×10^{-6} emu @ H ≤2,500 Oe (300 K, 10 s average) 8.0×10^{-6} emu @ H >2,500 Oe (300 K, 10 s average)
Sample holder specifications	
Overall dimensions	160 mm x 5 mm x 0.5 mm
Heater region	25 mm x ~5 mm in center of holder
Sample mounting location	66 mm from bottom of holder
Maximum recommended sample size	10 mm x 5 mm x 2 mm
Liquid helium consumption may increase with oven use	



Measurement of the magnetization as a function of temperature for a small piece of nickel to examine the Curie temperature using both the VSM and AC measurement techniques with the oven option. 0.5 K step sizes, stabilizing temperature and a 10 Oe applied magnetic field were used to collect the data.

Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

Electrical Transport Option (ETO)

The Electrical Transport Option (ETO) enables users to make several types of transport measurements over a wide range of resistance values and sample types - namely, AC resistance, Hall Effect, I-V curve, differential resistance or differential conductance respectively. The ETO option can perform four-terminal and two-terminal resistance measurements. In the classic four-terminal geometry or 4-wire mode, two leads pass a current through the sample and two separate leads measure the drop of the electric voltage. The 4-wire mode has two channels of electronics to allow the simultaneous measurement of two different samples. Each channel consists of a precision current source and voltage preamplifier coupled to a Digital Signal Processor (DSP) and is feasible for samples with resistances up to several Mega-Ohms.

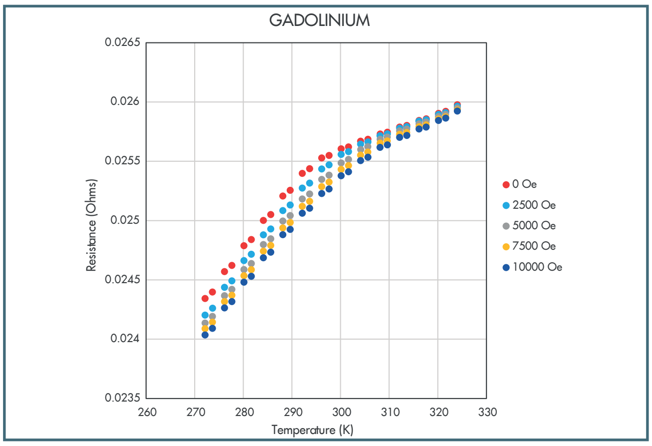
For samples with large resistances the ETO option is capable of a two-terminal geometry (2-wire mode or "electrometer mode"). In this 2-wire mode the system places an AC voltage across the sample and measures the current passing the sample. The voltage source and the nanoamperemeter which is used in this set-up result in the possibility of performing resistance measurements of up to 5 Giga-Ohms.

The hardware of the ETO option consists of two CAN modules housing the electronics, a wired sample rod and special PCB sample holders (Printed Circuit Boards). There are two different styles of sample holders available. One holder is for sample orientation parallel to the magnetic field and the second holder is dedicated for samples mounted perpendicular to the field. The parallel holder can support the two measurement channels of the 4-wire set-up (perpendicular holder: one channel).

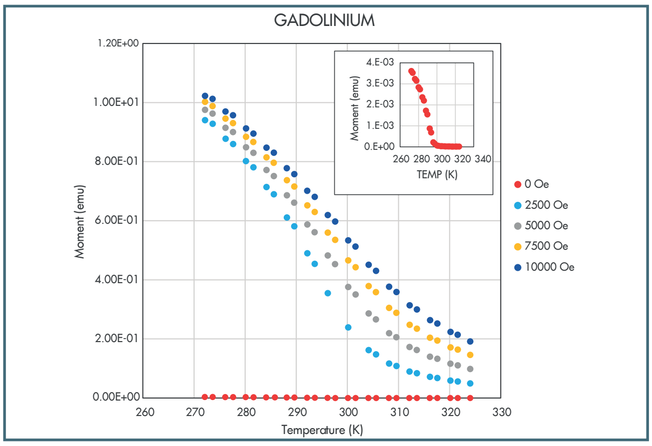
The holders and the ETO rod can be used for resistivity measurement as well as for magnetic measurement with the VSM or in DC scan mode without hardware change.

Electrical Transport Option (ETO) specifications	
Frequency range	0.1 Hz to 200 Hz AC
Common mode rejection	-100 dB at 100 Hz
4-Wire mode	
Resistance range	~10 µΩ to 10 MΩ
Resistance accuracy	2% (typical for R < 1 GΩ) 5% (typical for R = 5 GΩ) for 0.1 to 10 Hz
Excitation current	100 nA to 100 mA
Frequency dependence	Best accuracy at >15 Hz due to the high gain
Differential resistance	dV/dI vs. I_{bias}
Noise (HGA	2 nV/√Hz
Noise floor	±10 nΩ (RMS, typical) for 100 mA
2-Wire mode	
Resistance range	~2 MΩ to 5 GΩ
Resistance accuracy	2% (typical for <1 GΩ) 5% (typical for R = 5 GΩ and <10 Hz)
Input current	250 nA (max.)
Excitation voltage	Up to 10 V
Frequency dependence	Best accuracy at ≤10 Hz
Differential conductance	dI/dV vs. V_{bias}
Noise (PGA	30 nV/√Hz (typical)

Two types of measurements for single set-up



Resistance vs. temperature, 18.3 Hz AC, 4 wire



Moment vs. temperature, VSM

Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

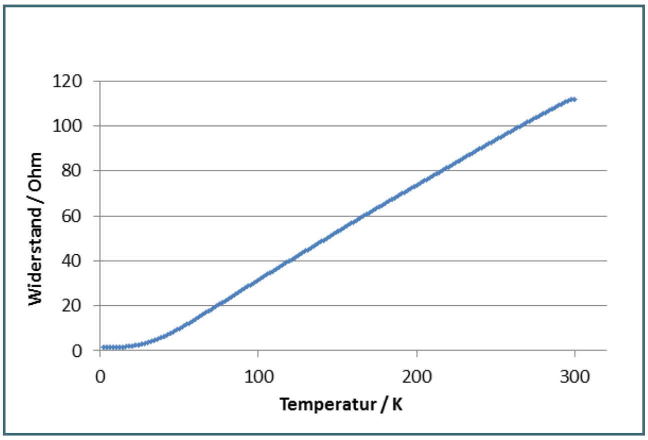
The next generation of advanced SQUID magnetometry

Utility resistivity kit

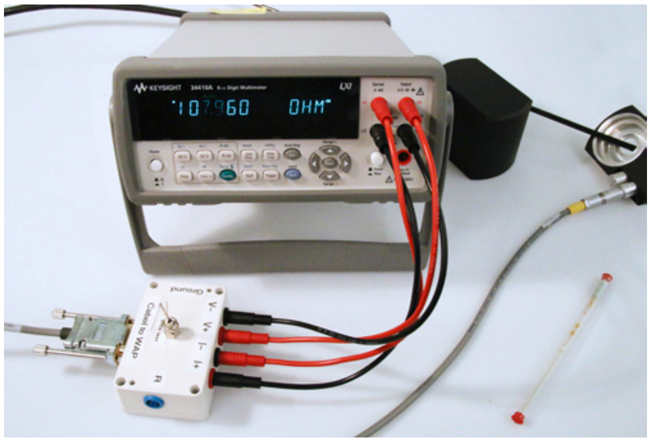
This kit is a multifunctional sample mounting platform, which easily can be integrated into the base MPMS3. The rod and sample holder have five integrated wires, which are dedicated for electric connection of the sample. The kit allows the user to perform a variety of electric measurements within the field and temperature environment of the MPMS3 platform.

It can be accompanied by QDE's M3R kit, which provides automated resistivity measurements. The M3R kit includes an adapter box, a commercial multimeter, and a software package to run the automated measurements. The software package uses scripting to perform for example temperature scans directly from MultiVu. Since the scripts are "open" the user has the possibility to make adaptations according to special requirements.

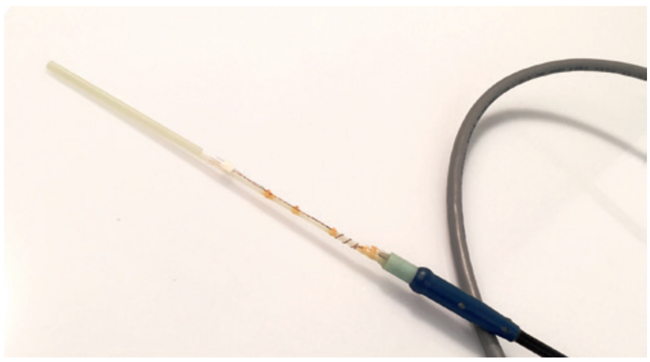
Utility resistivity kit	
Sample rod and holder	
Low current	<100 mA Full temperature range accessible*
High current	Base temperature not accessible*
Model	M311
M3R description	
M3R adapter box	Output five banana sockets plus connector to test holder
Digital multimeter	GPIB-based device e.g. Keysight, Keithley, … (contact QDE for details)
*We do not guarantee temperature accuracy with this option	



Automated measurement of the resistivity of a Pt-100 sensor between 2 and 300 K at zero field.



Sample rod and holder connected to the M3R adapter box



Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: +49 6151 8806-479, adler@qd-europe.com

The next generation of advanced SQUID magnetometry

❶ TLS120Xe

Power supply, lamp and monochromator integrated into single 19″ benchtop enclosure

❷ Wavelength control

With direct front panel control, put the power of monochromatic light at your fingertips

❸ Display

An OLED display reports wavelength, bandwidth, burn time and stability

❹ Output port

Light output port adapter for 1 mm fibre, including iris

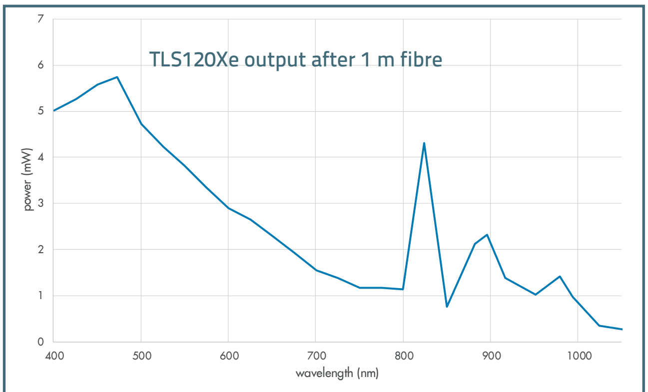
❺ Monitor port

Provided to monitor transmitted optical power to facilitate replacement lamp alignment

❻ USB

Take full control of the TLS120Xe over USB 2.0 using SCPI commands, integrated into MultiVu

Typical intensity



Ordering information	
QDE-TLS120Xe	TLS120Xe High power tuneable light source including optical fibre Ø 1 mm
B-19719	100 W short-arc xenon lamp

The TLS120Xe is a high power tuneable light source that delivers superlative stability, high wavelength agility and the power of continuous tuning. It is compatible with a MPMS3 system with FOSH option.

Key benefits

- Ultra-quiet short-arc xenon light source with starter and constant current power supply
- Integrated solution, housed in 19″ benchtop enclosure
- 120 mm focal length monochromator for excellent spectral selection and continuous tuning
- Wavelength control through front panel or over USB 2.0 using SCPI commands, integrated into MultiVu

Specifications	
Optical performance	
Wavelength range	280 nm – 1100 nm
Bandwidth at FWHM	20 nm
Control	
Interface	USB2.0
Software control	MultiVu
Lamp and monochromator	
Lamp type	Short-arc OFR xenon lamp (100 W, 14 V)
Nominal lamp life time	500 hours
Monochromator focal length	120 mm effective
Grating mount	Single grating on-axis turret
Grating line density	1200
Nominal blaze wavelength	380 nm
Slit type	Fixed slit
Electrical/mechanical	
Overall dimensions	300 mm (length) x 460 mm (width) x 185 mm (height)
Weight	8.8 kg
Power supply	100-240 V AC 50-60 Hz
Orientation	**Horizontal only**
Environmental	
Operating temperature range	10 – 35 °C
Operating humidity range	30% to 70% (no condensation, less than 70% above 30 °C)

Quantum Design EUROPE
Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt
Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com

MPMS®3

The next generation of advanced SQUID magnetometry

High pressure cell

The HMD high pressure cell for magnetic measurements with the MPMS 3 allows an easy sample handling without the need of a hydraulic press. This pressure cell comes in a complete kit containing all accessories.

Specifications	
Compatibel with	MPMS3 DC scan
Model	QDJ-HMD-M13
Maximum applied pressure	1.3 GPa
Sample space diameter	1.7 or 2.2 mm
Sample space length	7 mm max.
Cell diameter	8.5 mm
Temperature range	1.9 to 400 K
Field	7 Tesla
Magnetic background (typical)	$4x10^{-7}$emu/gauss

Kit including high pressure cell for magnetometry and a set of consumables

Helium-3 refrigerator

The iQuantum Helium-3 refrigerator system allows ultra-low temperature measurements with the MPMS 3.

Features

- 0.42 K to 1.8 K temperature range
- < 3hrs cooldown time (300 K to 0.5 K)
- 10 hours operational ^{3}He time
- < 30 minutes ^{3}He re-condense time
- EverCool™ compatible
- Compatible wit AC susceptibility (optional)

Specifications	
Temperature range	0.42 to 1.8K
Temperature calibration accuracy (based on Tc of Cd reference sample)	2%
Cool down time (300 K to 0.5 K)	< 3 hours
^{3}He gas requirement	3 liters
Operational ^{3}He time (typical)	20 hours
Operational ^{3}He time (base temperature, typical)	60 hours
^{3}He re-condense time (typical)	< 30 minutes
Magnetic field rage	± 7 T
Measurement modes supported	DC scan, AC susceptibility (optional)
Data collection speed (m vs h, time/one data point)	20 to 30 seconds

Quantum Design EUROPE

Quantum Design GmbH
Im Tiefen See 58
D-64293 Darmstadt

Dr. Marc Kunzmann: ✆ +49 6151 8806-46, kunzmann@qd-europe.com
David Appel: ✆ +49 6151 8806-499, appel@qd-europe.com
Dr. Tobias Adler: ✆ +49 6151 8806-479, adler@qd-europe.com