The Electrical Transport Option (ETO) has now been designed to work in the MPMS 3 platform and allows users to perform AC resistance, Hall effect, I-V, Differential resistance (dV/dI vs. I_{bias} for 4-wire), and Differential conductance (dI/dV vs. V_{bias} for 2-wire) measurements on a sample using a Printed Circuit Board (PCB) sample holder.

The primary operating mode of this 2-channel measurement system uses an AC current excitation and digital lock-in voltage detection to perform 4-wire measurements of electrical resistance or Hall effect in a sample with resistance up to several mega-ohms. For high impedance mode the stimulus-response circuit can operate the voltage source and nano-ampmeter, thus allowing for 2-wire measurements of sample resistance up to 5 giga-ohms.

There are two types of PCB sample holders offered with this option: a 2-sample holder for measurements in a parallel magnetic field and a single-sample holder in a perpendicular magnetic field. These specially designed sample holders allow users to measure magnetic moments by VSM or DC Scan using the same hardware, as well as conduct automated magnetic measurements while applying a voltage bias to the sample using an external source.

**Features**
- 2 channel system
- AC and DC source
- 2- or 4-wire mode
- High impedance mode
- Differential resistance
- Differential conductance
- Parallel and perpendicular sample holders

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**Gadolinium Sample**

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**2-Sample Holder and Rod**
Specifications

Model: M605

Current Source

- Current Range: 10 nA to 100 mA continuous operation
- Frequency Range: 0.1 Hz to 200 Hz AC and DC
  - 0.1 Hz to 200 Hz for 1 μA to 100 mA
  - 0.1 Hz to 25 Hz below 1 μA

Resistance

- Measurement Accuracy:
  - 4-wire: 0.1% (typical for Resistance R < 200 kΩ)
  - 4-wire: 0.2% (maximum for R < 200 kΩ)
  - 2-wire: 0.2% (typical for R = 1 MΩ)
  - 2-wire: 2% (typical for R < 1 GΩ)
  - Relative Sensitivity:
    - 5% (typical for R = 5 GΩ) for 0.1 to 10 Hz
  - Resistance Range:
    - ± 10 nQ RMS (typical)
    - Up to 10 MΩ in 4-wire mode (typical)
    - 2 MΩ to 5 GΩ in 2-wire mode (typical)

Preamp

- Noise:
  - Low Noise Amp: 1 nV/√Hz @100 Hz (typical)
  - 2 nV/√Hz (maximum)
- Programmable Gain:
  - Amp (100 X): 28 nV/√Hz @100 Hz (typical)
  - 30 nV/√Hz (maximum)
- Voltage Input Range:
  - ± 4.5 Volts at 1 X Gain
- Current Input Range for 2-wire High Impedance Mode:
  - ± 250 nA
- Common Mode Rejection:
  - -100 dB @100 Hz

Specifications subject to change without notice
1505-604 Rev. A0 (Feb. 2017)