Quantum Design

MPMS Application Note 1014-312

Sample Tube Resistance

The sample tube of the MPMS contains thermometers and heaters that control sample space temperature. Thermometer calibration files rely on resistance values measured at the time of calibration. Therefore, the stability of the resistance reading across the thermometer is critical to proper temperature control.

An old, damaged, or defective thermometer, thermometer lead, or heater element can have a resistance significantly different than the value used in the calibration files. If these resistances change a lot from the original calibrated value, temperature control will be compromised or lost entirely.

You can measure and the resistances across these elements. You can perform this measurement with the system cold or at room temperature. Use a hand-held voltmeter with fine-tipped leads to perform this test.

Procedure

1. Set the magnetic field to zero.
2. Set the system temperature to 298 K and allow it to stabilize.

   Note: If it is not possible to set 298 K on the system, stabilize to any temperature, record this temperature, and continue.
3. Note the current system temperature.
4. Disconnect the black-ringed Lemo cable from the back of the probe head. This connector is located above the pumping lines.
5. Refer to **Figure 1** to locate pin one of the Lemo connector.

   Note: Figure 1, and all measurements for this procedure, refers to the female connector of the Lemo connector. Make all measurements by measuring into the system probe, not into the cabinet or cable.

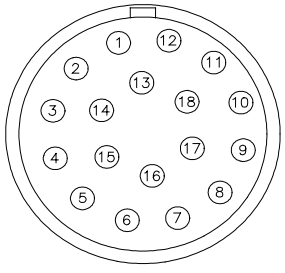

Figure 1. 18-pin Lemo Connector

6. Refer to **Table 1** to measure each set of pins and record the values as measurements are made on the table.

Note: The standard thermometer configuration uses germanium (GRT) and platinum (PLT) thermometers. Only systems equipped with Enhanced Temperature Control, Temperature Sweep Option, or Continuous Low Temperature Control Option have the Cernox thermometers.

Measure Pins	Measured Value	Typical 298 K Resistance (ohms)	Typical 4.5 K Resistance (ohms)
Bottom Cernox/ GRT			
1-2		85-150	2-2.5 K
3-4		85-150	2-2.5 K
1-3		80-95	910
2-4		80-95	1070
Center Cernox/ PLT			
5-6		100-130 (Cernox) 190-210 (PLT)	3 K (Cernox) 81 (PLT)
7-8		100-130 (Cernox) 190-210 (PLT)	3 K (Cernox) 81 (PLT)
5-7		70-90	80
6-8		70-90	80
Heater Resistances			
9-10 Gas Heater		95-110	85
11-12 Chamber Heater		150-170	145

Table 1.

7. After you record all of the values, replace the black Lemo connector.
8. Normally, a damaged thermometer will read a very high resistance value (Mohms) or a total short. It is extremely rare to have both thermometers fail at once. If you determine that both sets of thermometers are giving faulty readings, please verify the pin locations and repeat the measurements. If any of the readings are out of range or open, contact your Quantum Design Service Representative for additional assistance.