Tech Note

Measurement of High Ohmic Value Resistors

High ohmic valued chip resistors exhibit characteristics of both insulators and normal resistors. As a result, a chip resistor may have a significant voltage coefficient of resistance, i.e., the resistance may vary with the applied voltage. This mandates that a fixed voltage source rather than a fixed current source be utilized when measuring these devices. Resistances can then be computed as volts/amperes.

The applied voltage for a high ohmic value chip resistor is often specified as appropriate for the application to assure correlation. Typical values of applied voltage are 1 and 5 volts DC. This requirement leads to the measurement of very low currents and the attendant problems of such measurements.

The problems of low current measurements include:

1. Noise currents generated in the connecting cables when flexed (triboelectric effect)
2. Noise from sources other than the cables
3. Cable, fixture and probe leakage currents
4. Cable, fixture and other stray capacitances
5. Radio Frequency Interference (RFI)
6. Characteristically high Temperature Coefficients of Resistance (TCRs)

These problems can be minimized by:

1. Properly connecting the resistor to the measurement system.
2. Properly guarding and shielding to reduce or eliminate electrostatic noise.

IMS recommends that all meters be calibrated to recognized, traceable, standards. Typical connections are shown in Figure 1.

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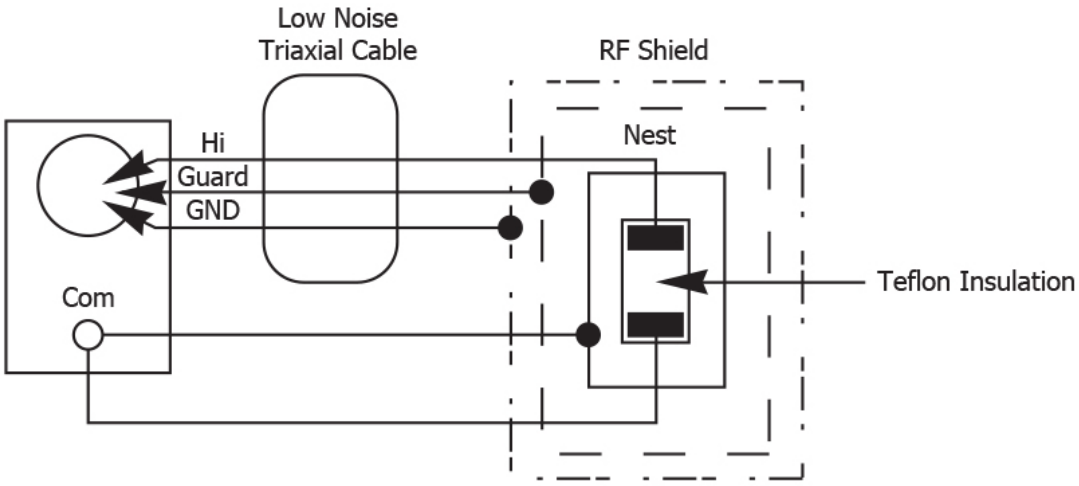
Figure 1
Accurate and stable electrometer with voltage source internally connected to ammeter preferred. (example Keithley 6517B or equivalent)



3. Properly connected triaxial cabling.
4. Provide humidity and temperature controls for 21 deg C +/- 3 deg C and a recommended relative humidity of 50% ±20%.
5. Keep all cables as short as possible to minimize measurement response time. Tie down and stabilize cable movements to minimize triboelectric effects.
6. Fixture design is critical. The fixture must not only accommodate the R.U.T. but it needs to have sufficient insulation resistances for the applicable resistance being measured as well as possessing sufficient isolation from moving objects and the operator.
7. Verify the accuracy of the measurement station periodically. Use an appropriate high ohmic value reference resistor of known value at the measurement conditions. The reference resistor should have a low Temperature Coefficient of Resistance (TCR) and a low Voltage Coefficient of Resistance (VCR) to tolerate the normal variations in temperature and measurement voltage. Qualify the entire measurement station (including the test fixtures) to a guardbanded tolerance that covers all variations contributed by the entire measuring system.

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