KEITHLEY A GREATER MEASURE OF CONFIDENCE

Problem: Errors in Low Current Measurements

One of the most common causes of error when measuring low currents (<1nA) is offset current, which can come from the test setup or the measuring instrument.

Potential Cause: Insulating Material

Current can leak through an insulating material or over its surface. The insulating material may itself store or generate charge.

Remedies

A. Choose a good insulator—Several properties are important when evaluating an insulator material:
   1. Volume Resistivity—Leakage of current directly through the material.
   2. Surface Resistivity—Leakage across the surface, a function primarily of surface contaminants.
   3. Water Absorption—Leakage dependent on the amount of water that has been absorbed by the insulator.
   4. Piezoelectric or stored charge effects—The creation of charge unbalances (and thus current flow) or voltage shift due to mechanical stress.
   5. Triboelectric effects—The creation of charge unbalance due to frictional effects when materials rub against each other.
   6. Dielectric Absorption—The tendency of an insulator to store/release charge over long periods of time.

For a listing of common insulating materials and their characteristics, see the Keithley *Low Level Measurements* handbook, Section 2.2.2.

B. Keep the insulator clean—Oils and salts from the skin can degrade insulator performance, and contaminants in the air can be deposited on the insulator surface, reducing its resistance. Clean the insulator with a cotton swab dipped in methanol. After cleaning allow the insulator to dry for several hours at low humidity before use, or dry it with dry nitrogen gas.

C. Guard the insulator—Use a driven guard that surrounds the insulator; a guard that surrounds the entire high impedance area is even better.

Potential Cause: Meter Bias Current

Ammeters have some small current that flows when the input is open.

Remedy

Choose an electrometer or picoammeter to minimize meter bias current. Meter bias currents can be greatly reduced by enabling the instrument's Current Suppress feature with the input terminals disconnected and the Zero Check switch open.

Potential Cause: Detector Dark Current

Photomultiplier tubes usually have a small current flowing even when they are not illuminated.

Remedy

This current can be cancelled out from the measurement by using the built-in zero suppression feature of the picoammeter or electrometer. KEITHLEY

KEITHLEY

Keithley Instruments, Inc. 28775 Aurora Road • Cleveland, Ohio 44139 • 440-248-0400 • Fax: 440-248-6168
1-888-KEITHLEY (534-8453) • www.keithley.com

No. 2560
1004