Model 65

High Resistivity Measurement Package

- **Complete high resistance measurement solution**
- **Package includes measuring instrument, software, and fixturing**
- **Model 65 designed for high resistivity materials testing**
- **0.3% repeatability on 10^{14} Ω-cm material**

Ordering Information

Model 65 High Resistivity Measurement Package

Model 6517A Electrometer/High Resistance Meter, Model 6524 High Resistance Software, and Model 8009 Resistivity Test Fixture

Extended warranty, service, and calibration contracts are available.

Accessories Supplied
Instruction manual
3.5˝ installation disk set
On-line help

The Model 65 includes the Model 6517A Electrometer/High Resistance Meter, Model 6524 software, all meter and fixture cables, and the Model 8009 Resistivity Test Fixture. The Model 8009 includes a high resistance material sample to verify system operation.

Improved High Resistivity Measurements

Many test applications require measuring high levels of resistivity (surface or volume) of materials. The conventional method of making these measurements is to apply a sufficiently large voltage to a sample, measure the current that flows through the sample, then calculate the resistance using Ohm's Law (R=V/I). While high resistance materials and devices produce very small currents that are difficult to measure accurately, Keithley's electrometers and picoammeters have been used successfully in the past for such measurements. However, even with high quality instrumentation, inherent background currents in the material have made these measurements difficult to perform accurately. Insulating materials, polymers, and plastics typically exhibit background currents due to piezoelectric effects, capacitive elements charged by static electricity, and polarization effects. These background currents are often equal to or greater than the current stimulated by the applied voltage. In these cases, the result is often unstable, inaccurate resistance or resistivity readings or even erroneous negative values. Keithley's Model 6517A is designed to solve these problems and provides consistent, repeatable, and accurate measurements for a wide variety of materials and components, especially when used in combination with the Model 6524 software and the appropriate fixturing in the Model 65 system.

Alternating Polarity Method

The Model 6517A uses the Alternating Polarity method, which virtually eliminates the effect of any background currents in the sample. First and second order drifts of the background currents are also canceled out. The Alternating Polarity method applies a voltage of positive polarity, then the current is measured after a specified delay (Measure Time). Next, the polarity is reversed and the current measured again, using the same delay. This process is repeated continuously, and the resistance is calculated based on a weighted average of the four most recent current measurements. This method typically produces a highly repeatable, accurate measurement of resistance (or resistivity) by the seventh reversal on most materials (i.e., by discarding the first three readings). For example, a 1mm-thick sample of $10^{14}\Omega$-cm material can be measured with 0.3% repeatability in the Model 8009 test fixture in the Model 65, provided the background current changes less than 200fA over a 15-second period.

Easy to Use

The factory default settings of the Model 6517A (Measure Time, Offset Voltage, Alternating Voltage, and Readings to Discard) provide good results on many materials. Different materials and conditions may require different settings—the Model 6524 software simplifies determining the appropriate settings for these cases.

Stand Alone Operation

Once the appropriate settings for the Model 6517A have been determined via the 6524 software, they can be programmed into the 6517A, stored in internal memory, and used just like the original default settings. Up to ten different settings can be stored in the Model 6517A. Subsequent measurements can then be made using the 6517A and fixtures alone, without the use of the PC or software. All the operations observed via the software are then done internally to the 6517A and only the final resistance/resistivity measurement result is displayed. This is ideal for production testing or repetitive testing of materials or devices.

ACCESSORIES AVAILABLE

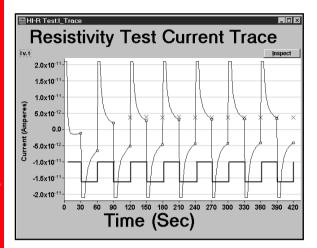|	
4288-1	Single Fixed Rack Mount Kit
6517-RH	Humidity Probe
7007-1	Shielded IEEE-488 Cable, 1m (3.3 ft)
7007-2	Shielded IEEE-488 Cable, 2m (6.6 ft)
KPCI-488A	IEEE-488 Interface/Card for the PCI Bus
KUSB-488A	IEEE-488 USB-to-GPIB Interface Adapter

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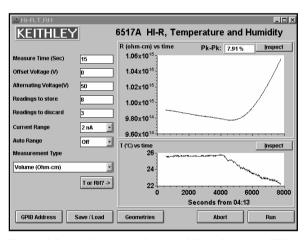
Resistivity Test Current Trace

This graph, using Model 6524 software, shows the actual current waveform that results from the applied Alternating Polarity DC voltage. The square wave represents the alternating applied voltage. From this window, the researcher or test engineer can determine whether the parameters used are appropriate for the material or device under test. This picture also demonstrates the Alternating Polarity method. It shows the material's response to a change in applied voltage, as well as the background currents that are rejected when using this method.

The Model 65 package can eliminate drift and noise in difficult materials, so it is possible to determine characteristics of the material that were previously obscured, such as temperature coefficient. The Model 6524 software allows graphing resistance/resistivity plus temperature or humidity vs. time on the same screen. This makes it easy to observe and calculate the dependence of a sample's resistance/resistivity vs. temperature and humidity.

Model 6524 High Resistance Measurement Software

When used with a PC with an IEEE-488 interface, the Model 6524 software provides a visual overview of the Alternating Polarity resistance measurement method and makes it easy to select the most appropriate parameters (Measure Time, Offset Voltage, Alternating Voltage, and number of Readings to Discard) for the Model 6517A's enhanced resistivity mode. It also simplifies analyzing time constants and correlating results with environmental factors.

The Model 6517A's built-in firmware ensures much tighter timing control and more repeatable results when making Alternating Polarity resistance and resistivity measurements than are possible when using the original Model 6517 electrometer with external software control. The 6517A/6524 combination can be used to determine the impact of voltage and timing parameters on the measurement by sweeping these variables and plotting the result. It can also be used to plot results vs. time, along with temperature or relative humidity, in order to determine the correlation between resistance or resistivity and these environmental factors. The Model 6524 software may also be used with the Model 6517A electrometer to make Alternating Polarity resistivity or resistance measurements and to determine time constants and/or the best exponential fit. In each of these programs, the user may specify the axes as either logarithmic or linear. All tests can be configured to measure volume resistivity, surface resistivity, or resistance.

Model 8009 Resistivity Test Fixture

The Model 8009 Resistivity Test Fixture is designed for measuring the volume and surface resistivity of insulating materials such as dielectric or insulating films. It can also be used to assess the quality of sheets of materials and/or products such as printing paper, photographic film, glass, etc. by measuring the resistance of these items under various conditions. The Model 6517A already contains the geometric parameters of the 8009 for surface and volume resistivity, which are automatically selected when the user switches the fixture for volume or surface mode. The fixture's stainless steel electrodes are built to the ASTM D-257 standard. The Model 8009 is designed to ensure complete electrostatic shielding and can accommodate sheet samples from 64mm to 102mm (2½ to 4 in.) in diameter and up to 3.2mm (⅛ in.) thick. A safety interlock feature automatically turns off the instrument's voltage source unless the fixture's lid is firmly closed. The fixture is specified to operate at voltages of up to 1000V.

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MINIMUM SYSTEM REQUIREMENTS

Pentium Class processor running Windows® 2000/XP.

Keithley KPCI-488A or KUSB-488A GPIB interfaces.

OPTIONS

The Model 6524 High Resistance Measurement Software can be purchased separately in order to employ the Alternating Polarity method with a Model 6517 (the predecessor to the Model 6517A) in software only, using a PC to control the Model 6517 via the IEEE-488 bus. When used with a Model 6517, the Model 6524 software does not allow graphing Resistance/Resistivity vs. Temperature and Humidity or vs. a series of voltage or time parameters.

The 6524 Package Includes Four Programs:

The **6517 Hi-R Test** performs the Alternating Polarity Method by a series of commands from the PC to the 6517A and displays current transients resulting from the alternating stimulus voltage, as well as volume resistivity, surface resistivity, or resistance results. It allows the user to change settings easily and observe the results via the PC. This is useful for research and experimentation and for determining the optimum settings for a given material. Since this program does not use the 6517A's internal Alternating Polarity firmware, it can be used with the 6517 to mimic the 6517A's capabilities.

The **6517 Hi-R Step Response Program** plots and analyzes the current transients that result from a single voltage step. It performs a fit to exponential decays to permit analysis of samples with multiple time constants. It allows easy viewing of the step response current in log or linear scale vs. log or linear time and is particularly useful in determining the appropriate measure time setting. It also can be used with the Model 6517.

The **6517A Hi-R Sweep Test** performs a sequence of Alternating Polarity tests, sweeping one of the following parameters—Alternating Voltage, Offset Voltage, or Measure Time—while measuring current or resistance/resistivity.

The **6517A Hi-R, T, and RH Program** allows plotting resistivity/resistance plus temperature, relative humidity over time.

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