

6220/6514/ 2000/7001



The Model 6220 Current Source offers material researchers $\pm 0.1\text{pA/step}$ to $\pm 105\text{mA}$ DC output, combined with $10^{14}\Omega$ output resistance.



The Model 6514 Electrometer provides $>200\text{T}\Omega$ input impedance and $<3\text{fA}$ input bias current.



The Model 2000 6 1/2-Digit Multimeter provides $0.1\mu\text{V}$ of sensitivity.



The Model 7001 Switch/Control Mainframe controls the 7152 4x5 Low Current Matrix Card, which provides contacts with $<1\text{pA}$ offset current.

Ordering Information

6220	DC Current Source
6514	Programmable Electrometer
2000	Digital Multimeter

Options

7001	Switch System
7152	4x5 Low Current Matrix Card

High Impedance Semiconductor Resistivity and Hall Effect Test Configurations

Alternative Economical Approaches to Hall Coefficient and Resistivity Measurements

Occasionally, when working with samples with very high resistivity, semi-insulating GaAs, and similar materials with resistivities above $10^8\Omega$, alternative system configurations may be able to produce more reliable data than standard, pre-configured Hall Effect systems. Such systems demand careful shielding and guarding, and typically include a current source, two electrometer buffers, and an isolated voltmeter. The schematics show two suggested configurations for these high resistivity applications: one that requires manual switching and one with automated switching.

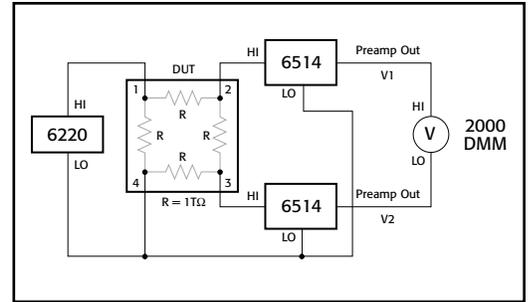
The range of the systems shown here is very wide. The high resistance end is limited by the minimum output of the current source. A current of 100pA can be supplied with an accuracy of about 2%. If the resistance of each leg of the sample is no more than $1\text{T}\Omega$, the maximum voltage developed will be 100V , within the range of the Model 6220 current source and the Model 6514 electrometer. This system will provide good results with samples as low as 1Ω per leg, if a test current level of 100mA is acceptable. Even at $100\text{m}\Omega$ per leg, accuracy is approximately 2%.

Leakage currents are the most important sources of error, especially at very high resistances. One important advantage of this circuit is that a guard voltage is available for three of the sample terminals, which virtually eliminates both leakage currents and line capacitance. The fourth terminal is at circuit LO or ground potential and does not need guarding.

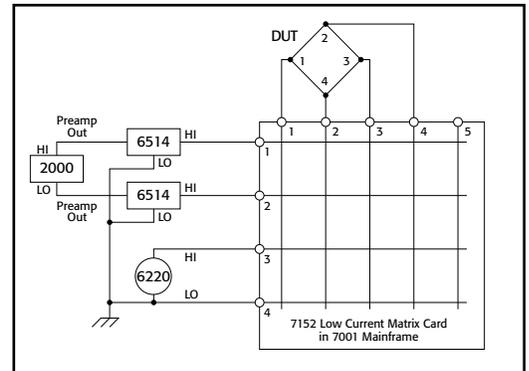
Call Keithley for additional guidance in selecting equipment for specific high resistivity applications.

ACCESSORIES AVAILABLE

7007-1	Shielded IEEE-488 Cable, 1m (3.3 ft)
7007-2	Shielded IEEE-488 Cable, 2m (6.6 ft)
7078-TRX-10	Triax Cable, 3m (10 ft)
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI Bus
KUSB-488B	IEEE-488 USB-to-GPIB Interface Adapter



The equipment configuration with manual switching (above) was developed for very high resistance van der Pauw or Hall Effect measurements. This measurement system includes a Model 6220 current source, two Model 6514 electrometers (used as unity-gain buffers), and a Model 2000 digital multimeter (DMM). The current source has a built-in guard, which minimizes the time constant of the current source and cable. The insulation resistance of the leads and supporting fixtures for the sample should be at least 100 times the DUT resistance (R). The entire sample holder must be shielded to avoid electrostatic pickup. If the sample is in a dewar, this should be part of the shield.



One Model 7152 Matrix Card, housed in a Model 7001 mainframe, is used to connect the electrometers and the current source to the sample. Two Model 6514 electrometers are used as unity gain buffers, and their output difference is measured with a Model 2000 DMM. To ensure faster measurement time, guarded measurements are made by turning the Guard switch ON for both of the Model 6514s, and by guarding the Model 6220 output. Call Keithley's Applications Department for cabling information.

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Hall Effect systems for high resistivity applications

LOW LEVEL MEASURE & SOURCE