

# Hall Effect Measurements Overview

Keithley offers a wide selection of sensitive instruments for Hall Effect and related measurements of both high- and low-resistivity materials. Depending on the individual application and budget, a do-it-yourself system using individual Keithley components may be selected and easily connected to form a system. This section is intended to provide the background needed to make an informed choice.

Generally, it's best to choose a system with capabilities somewhat greater than those required for the immediate application so it addresses future as well as present needs.

## Model 7065 Hall Effect Card

The 7065 is a Hall Effect card used in the 7001 Switch System. The card contains four sensitive DC amplifiers and all switching needed. These amplifiers are switched to connect the card to the sample for making Hall or van der Pauw resistance measurements. The user can select either high or low resistivity settings via software.

### Factors in Choosing a System:

#### Resistance Range

Many testing situations require a system capable of precise measurements over a wide range of resistivities. The range of resistivities of the materials being studied determines the appropriate choices of current-sourcing and voltage-measuring instruments.

For example, testing high resistivity materials such as lightly-doped samples, semi-insulating GaAs, etc., requires a precision low-level, low-noise current source with a high effective output resistance. For very high resistances (on the order of  $10^{12}\Omega$ ), a system utilizing driven guards may be required. This is necessary to ensure that virtually all the current goes through the sample, not through any shunt resistance. The driven guard connection also minimizes the time constant of the measurement.

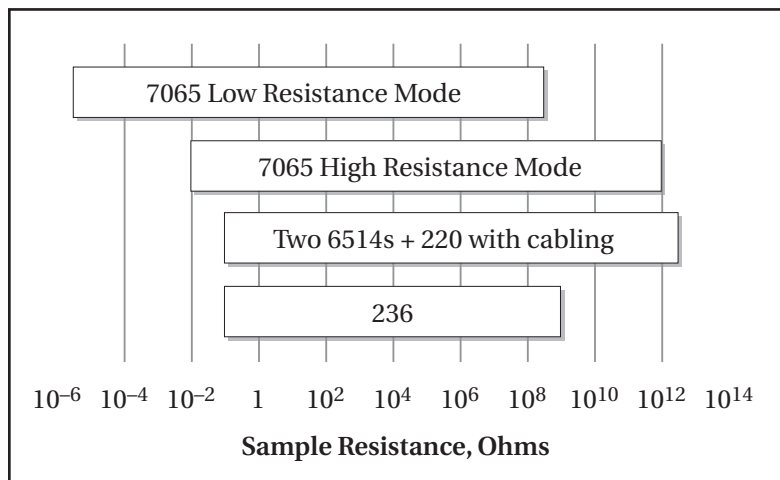
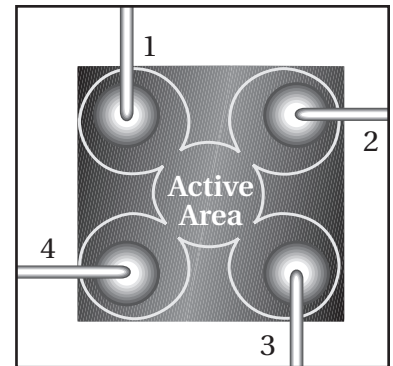
Testing low resistivity samples such as heavily-doped materials or metals requires a higher-value precision current source and a very sensitive voltage-measuring instrument.

#### AC vs. DC

A quality, low-noise DC system that is capable of measuring samples with a wide range of resistivities is usually the best choice. While AC measurements are sometimes used for low resistivity testing, this technique makes the results dependent on time constants and the degree to which all contacts are non-rectifying.

#### Van der Pauw Resistance Measurements

The sheet resistance of the same cloverleaf sample can be measured easily by applying the current to two adjacent terminals (for example, contacts #2 and #3) and reading the voltage at the two opposite terminals (contacts #1 and #4). While no magnetic field is needed for the resistance measurement, the researcher can easily determine the sheet magneto-resistance by making a series of sheet resistance measurements at various magnetic fields.



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