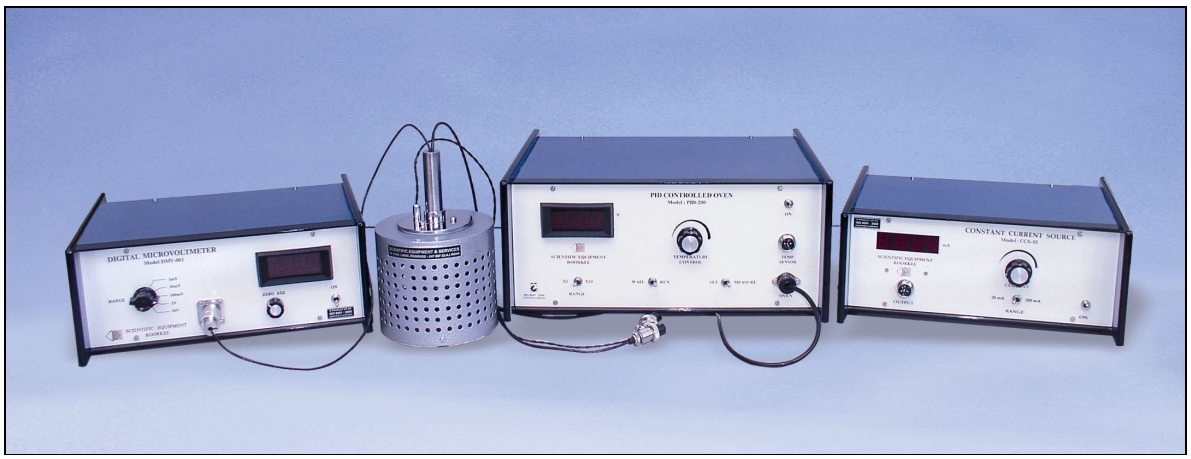


Four Probe Set-Up for Measuring the Resistivity of Very Low to Highly Resistive Samples at Different Temperature

DESCRIPTION

The Four Probe Method is one of the standard and most widely used method for the measurement of resistivity. In its useful form, the four probes are collinear. The error due to contact resistance, which is significant in the electrical measurement on semiconductors, is avoided by the use of two extra contacts (probes) between the current contacts. In this arrangement the contact resistance may all be high compare to the sample resistance, but as long as the resistance of the sample and contact resistance's are small compared with the effective resistance of the voltage measuring device (potentiometer, electrometer or electronic voltmeter), the measured value will remain unaffected. Because of pressure contacts, the arrangement is also specially useful for quick measurement on different samples or sampling different parts of the sample.

DESCRIPTION OF THE EXPERIMENTAL SET-UP

1. Probes Arrangement

It has four individually spring loaded probes. The probes are collinear and equally spaced. The probes are mounted in a teflon bush, which ensure a good electrical insulation between the probes. A teflon spacer near the tips is also provided to keep the probes at equal distance. The probe arrangement is mounted in a suitable stand, which also holds the sample plate and RTD sensor. This stand also serves as the lid of PID Controlled Oven. Proper leads are provided for the current and voltage measurement.

2. PID Controlled Oven

This is high quality temperature controlled oven suitable for Four Probe Set-up. The oven has been designed for fast heating and cooling rates, which enhances the effectiveness of the controller. While the basic design of the controller is around the PID configuration for its obvious advantages, wastage of power is avoided by using a Pulse Width Modulated (PMW) switch. This combination has the advantages of both on-off controller and linear PID controller. The result is a good stable and accurate temperature control.

Platinum RTD has been used for sensing the temperature. A wheatstone bridge and an instrumentation amplifier are used for signal conditioning. Feedback circuit ensures offset and linearity trimming to a great degree of accuracy. The set and measured temperature are displayed on 3½ digits DPM through selector switch.

SPECIFICATIONS OF THE OVEN

Temperature Range	: Ambient to 200°C	*Oven*	: Specially designed for Four Probe Set-Up
Resolution	: 0.1°C	*Sensor*	: RTD (A class)
Short Range Stability	: ±0.2°C	*Display*	: 3½ digit, 7 segment LED with autopolarity and decimal indication
Long Range Stability	: ±0.5°C		
Measurement Accuracy	: ±0.5°C (typical)	*Power*	: 150W

3. Constant Current Source

a) Constant Current Source, Model : CCS-01

(for low resistivity to medium resistivity samples)

It is an IC regulated current generator to provide a constant current to the outer probes irrespective of the changing resistance of the sample due to change in temperatures. The basic scheme is to use the feedback principle to limit the load current of the supply to preset maximum value. Variations in the current are achieved by a potentiometer included for that purpose. The supply is a highly regulated and practically ripples free d.c. source. The constant current source is suitable for the resistivity measurement of thin films of metals/ alloys and semiconductors like germanium.

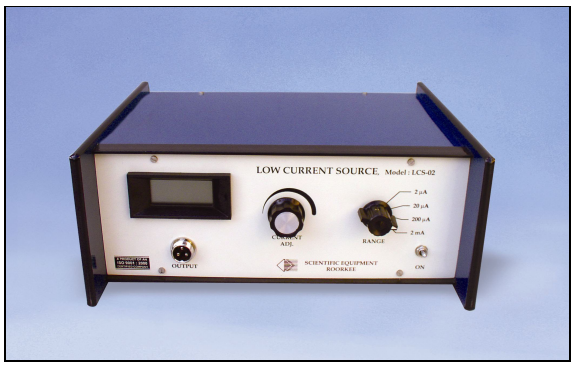
SPECIFICATION

Open Circuit Voltage	: 10 V
Current Range	: 0-20mA, 0-200mA
Resolution	: 10µA
Accuracy	: ± 0.25% of the reading ± 1 digit
Display	: 3½ digit, 7 segment LED with autopolarity and decimal indication
Load Regulation	: 0.03% for 0 to full load
Line Regulation	: 0.05% for 10% changes

b) Low Current Source, Model : LCS-02

(for high resistivity samples)

Low Constant Current Sources are needed, when the sample resistance, is large. As in the case of silicon wafers or high resistivity film deposits. Large resistance makes the measurement prone to pickups from the mains. This problem is reduced to very low level by using the battery instead of mains. Since the current requirement is very small, the batteries should have a reasonably long life. An internal voltage reference of 2.5 volt ensures reliable operation even when the batter voltage falls. A ten turn potentiometer makes the current adjustment very easy.



SPECIFICATION

Open Circuit Voltage	: 15V
Current Range	: 0-2µA, 0-20µA, 0-200µA & 0-2mA
Minimum	: 1nA at 0-2µA range
Accuracy	: ± 0.25% of the reading ± 1 digit
Display	: 3½ digit, 7 segment LCD with autopolarity and decimal indication
Load Regulation	: 0.05% for 0 to full load
Power	: 2 x 9V batteries

4. D.C. Microvoltmeter

Specifications as per datasheet in the catalogue

The experimental set-up is complete in all respect