

## RESISTANCE WIRE BOARD LA10-410

## INTRODUCTION



This apparatus provides a reliable system for students to investigate the properties of resistance wires. Four nichrome wires are conveniently held on a robust baseboard with simple electrical connection facilities and a metric scale alongside.

## APPLICATIONS

Resistance measurement
Resistivity determinations
Investigations
Electrical measurements
Graphical analysis

## GENERAL DESCRIPTION \& SPECIFICATION

The wires are nichrome, an alloy of Nickel and Chromium, which has a resistivity of $1.081 \times 10^{-6} \mathrm{Wm}$. The wire diameters are $1.00,0.80,0.63$ and 0.40 mm giving resistances of $0.69,1.075,1.73$ and 4.3 W respectively for the 50 cm lengths used on the board. Connection to each wire is by means of a 4 mm socket at one end which can be used with a standard 4 mm connecting lead. Connection to intermediate points, or the far end can be made by using a jockey or crocodile clip.

## METHOD OF USE

Various investigation titles can be given to students and the appropriate amount of guidance given to suit the circumstances. The principal investigations are:

- For a given voltage applied across the same length of wire how is the current flowing related to the wire diameter? For this a low voltage, variable, d.c. power supply is connected across the ends of the thickest wire in series with an ammeter and the voltage adjusted to give a sensible current reading of about 3 to 4 amps . The voltage across the wire is measured and noted. The supply is reduced to zero and connection is made to each wire in turn with the supply adjusted each time to give the same voltage across the wire. Since current is inversely proportional to resistance and resistance is inversely proportional to area of cross section, the current should decrease as the wire diameter decreases following a square law relationship.
- How does the resistance of a wire depend upon its length and diameter? For the length investigation use one of the thinner wires and measure the current through and voltage across different lengths of wire by using the scale and a jockey connection. Resistance should be found to be proportional to length. For the diameter investigation proceed as in the first investigation above calculating the resistance from Ohm's Law each time. The wire diameter can either be given to the student or they can measure it with a micrometer.


## - Calculate the resistivity of the wires.

The equation for this is

$$
\begin{aligned}
\mathrm{s}=\frac{\mathrm{R} \cdot \mathrm{~A}}{\mathrm{l}} \quad \text { where } \quad & \mathrm{s} \text { is the resistivity in } \mathrm{Wm} \\
& \mathrm{R} \text { is the resistance in } \mathrm{W} \\
& \mathrm{~A} \text { is the area in } \mathrm{m}^{2} \\
& \mathrm{l} \text { is the length in } \mathrm{m}
\end{aligned}
$$

Resistance is calculated from voltage and current as in the previous investigations. The area of cross section is found from the diameter using

$$
\mathrm{A}=\mathrm{pd}^{2} / 4 \text { (with } \mathrm{d} \text { in metres). }
$$

The basic circuit for all investigations is:


NOTE: Resistance wires heat up when a current flows. Thinner wires get hotter than thick ones for the same current. Care must be taken to ensure that students use low voltages and currents to keep the wires no more than warm when in use.

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