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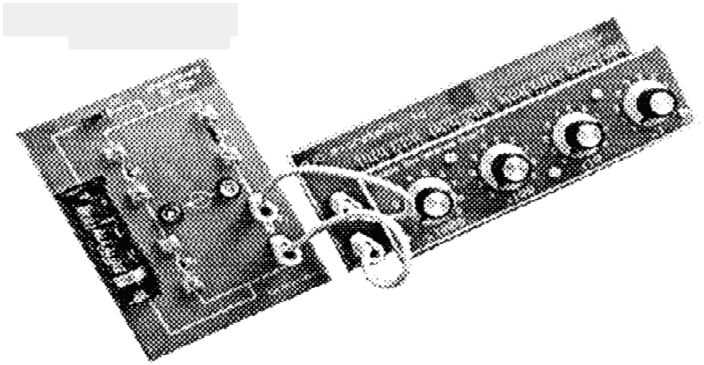
Technical Notes
Wheatstone Bridge



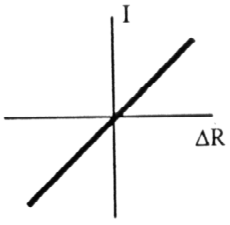
- Connect a multimeter to the mA terminals and set to a range 1 mA or greater.
- Connect a decade resistance box to the R3 terminals. The diagram above shows djb microtech's decade resistance board.
- Switch on and set all the dials on the decade resistance box to zero.
- Starting with the x1000 decade, turn the switch until the sign of the current reading changes - now turn the switch back one position so that the sign is the same as it was originally. If the sign does not change then set back to zero.
- Repeat for the other decades.
- As the current reading gets smaller, switch to a more sensitive range on the multimeter.
- When the reading on the meter is as close to zero as you can get read the value of the switches on the decade resistance box.
- The value of the unknown resistor Rx can be calculated using $\frac{R1}{R2} = \frac{Rx}{R3}$
- The bridge is supplied with R1=R2=4K7.
- Note that if R1=R2 then the value of the unknown resistor is read directly from the decade resistance box.
- Teachers may substitute their own values of resistors to verify the formula or use several Wheatstone Bridge boards, with different resistors, as part of a circus of experiments.
- Switch off when finished.

In an industrial Wheatsone bridge the resistors R1 and R2 would be carefully selected to be very accurate and to vary little over the operational temperature range.

Out of Balance Conditions

The out of balance Wheatstone Bridge has many industrial applications and the theory can quickly be demonstrated with this apparatus.

- Use Rx=2K2 as supplied.
- Balance the bridge by adjusting R3 as normal.
- Now increase the resistance of R3 by say 10R and note the current reading.
- Keep increasing in 10R steps until you have about six readings.
- Repeat, but this time decrease in 10R steps from the balance point.
- Plotting a graph of out of balance current against change in resistance gives a linear relationship.



In practice Rx would be replaced with a device whose resistance changes with some physical property e.g. thermistors, strain gauges, light sensors and pressure sensors. For small variations from balance there is a linear relationship and hence the mA scale could be replaced with a temperature scale, pressure scale.

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