Resistance

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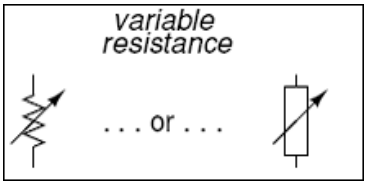
Introduction to Resistance

The current flowing through a conductor encounters some obstruction to the current. This obstruction is called electrical resistance. Every material has some **electrical resistance** and is the reason that the conductor gives out heat when the current passes through it. Energy is used up as the voltage across the component drives the current through it, and this energy appears as heat in the component.

Special components called resistors are made for the express purpose of creating a precise quantity of resistance for insertion into a circuit. They are typically constructed of metal wire or carbon, and are engineered to maintain a stable resistance value over a wide range of environmental conditions.

The most common schematic symbol for a resistor is a zig-zag line: 



Resistors can also be symbolized as having varying rather than fixed resistances. This might be for the purpose of describing an actual physical device that is designed to provide an adjustable resistance, or it could be to show some component that just happens to have an unstable resistance:

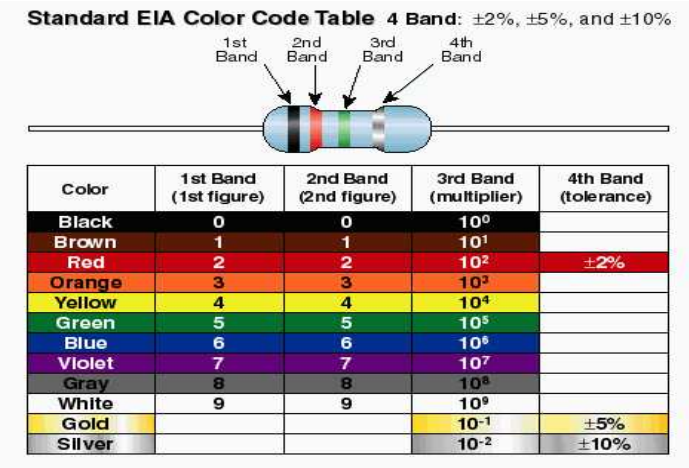
The electrical resistance of a circuit component or device is defined as the ratio of the voltage applied to the electric current which flows through it: $R = \frac{V}{I}$

We need resistance to reduce the flow of electrons through a circuit, so we can build resistors to provide electrical resistance

Unit of Resistance

Resistance is measured in ohms, and the symbol for ohm is the omega ? .

1 ? is quite small for electronics so resistances are often given in k? and M? .



Color	1st Band (1st figure)	2nd Band (2nd figure)	3rd Band (multiplier)	4th Band (tolerance)
Black	0	0	10^0	
Brown	1	1	10^1	
Red	2	2	10^2	±2%
Orange	3	3	10^3	
Yellow	4	4	10^4	
Green	5	5	10^5	
Blue	6	6	10^6	
Violet	7	7	10^7	
Gray	8	8	10^8	
White	9	9	10^9	
Gold			10^{-1}	±5%
Silver			10^{-2}	±10%

1 k? = 1,000? , and 1 M? = 1,000,000? .

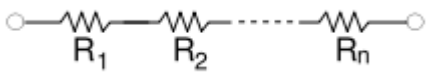
Resistors used in electronics can have resistances as low as 0.1? or as high as 10 M? .

Reading Resistor Values

The resistance of resistors is indicated using color-coded bands on the body of the resistor. The first three color bands indicate the value of the resistor in ohms.

Resistors connected in a series

When resistors are connected in a series their combined resistance is equal to the individual resistances added together. For example if resistors R1 and R2 are connected in a series their combined resistance, R, is given as follows:



Combined resistance in a series: **R = R1 + R2**

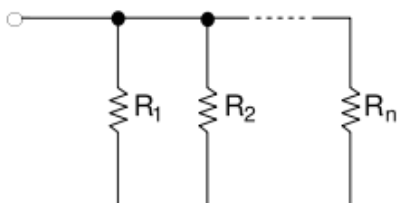
This can be extended for more resistors: **R = R1 + R2 + R3 + R4 + ...**

Resistors connected in parallel

When resistors are connected in parallel their combined resistance is less than any of the individual resistances. There is a special equation for the parallel combination of the resistance of two resistors R1 and R2.

The combined resistance of **two resistors in parallel:**

$$R = \frac{R1 \times R2}{R1 + R2}$$



For more than two resistors connected in parallel, a more difficult equation must be

used. This adds the **reciprocal** ("one over") of each resistance to give the **reciprocal** of the combined resistance, R:

1/R = 1/R1+1/R2+1/R3+--------

The simpler equation for two resistors in parallel is much easier to use!

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Reference links:

- http://www.en.wikipedia.org/wiki/voltage
- http://www.en.wikipedia.org/wiki/energy
- http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elecur.html#c1

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