Mathematical Variations of Ohm's Law

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German physicist Georg Simon Ohm discovered the relationship between voltage, current and resistance, circa 1854. In honor of his discovery, the relationship became known as Ohm's Law, and the "Ohm," abbreviated as Ω (the Greek letter omega), ultimately became the officially recognized MKS unit of resistance.

Several mathematical variations and definitions of Ohm's Law exist. These are mathematically summarized in the Ohm's Wheel shown here. With this Wheel, you can start at the hub and derive any variation of the Law by going to the appropriate quadrant. Traditionally, electromotive force, or voltage is represented by an "E," current by an "I" and resistance by an "R." To these three basic parameters have been added power in watts, represented by a "W."

In essence, Ohm postulated that when a potential of 1 volt is placed across a 1-ohm resistance, the current flowing through the resistance would be 1 ampere.

To use Ohm's Wheel to calculate any given parameter, you start at the hub and use the appropriate formula of the three shown in that specific quadrant. For example, if you know the voltage applied to a known value of resistance, you would start at the hub of the unknown current (lower-left) quadrant and discover that voltage (E) divided by resistance (R) will provide the unknown current. If the potential is 10 volts and the current is 1 ampere, you would solve the problem as follows:

$I = E/R$
$I = 10 \text{ volts}/1 \text{ ampere}$
$I = 10 \text{ ohms}$

Now you can go a step further and calculate the power dissipated by the resistor. The easiest way to do this is to use any of the formulas in the power quadrant (lower-right) of the Wheel. In the simplest of these formulas, you just multiply voltage by current:

$W = I \times E$
$W = 1 \text{ ampere} \times 10 \text{ volts}$
$W = 10 \text{ watts.}$

That's all there is to it!

Newcomers to electronics, and even old hands, will want to keep this Ohm's Wheel handy as a reference.

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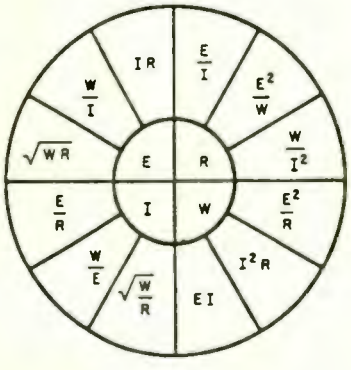
TABLE 1
MATHMATICAL VARIATIONS OF OHM'S LAW



Ohm's Wheel

WHERE E = Potential Difference in Volts
I = Current in Amperes
R = Resistance in Ohms
W = Power in Watts