

Sponsored By:

[For more articles, new products, videos, news and columns go to Passive Components Week.](#)

[Home](#) > [Passive Components](#) > [Resistors and Potentiometers](#)

This article was posted on 08/22/2014

Why there's an I in Ohm's law: Electronic Products Word of the Week

Explaining $E = I \times R$

Every student in physics and electronic engineering learns Ohm's law, $E = I \times R$, or voltage equals current times resistance. You learn that E is electromotive force, a long term for voltage. R is resistance, easy enough to remember, but I? How does I mean current? One person who answered this question was quite blunt: "You can't expect English to consistently be the language of science."



I, it turns out, means "Intensität," German for "intensity." And when you think about it, current, or flow, is all about intensity. The German is due to the fact that Ohm's law is named for the German physicist and mathematician Georg Simon Ohm (1789 to 1854) and is summarized in a pamphlet entitled "Die galvanische Kette, mathematisch bearbeitet" in 1827. Much more of the famous equation is really not English.

Translated from the pamphlet, Ohm's law states that the current flow through a conductor is directly proportional to the potential difference (voltage) and inversely proportional to the resistance. The units we know that are associated with his law actually developed in succeeding years. The [Encyclopedia Britannica](#) notes that the law was initially coldly received, but Ohm started to receive honors for it in 1841. The units of measure used to define the parts of the law began to be developed after Ohm's death, as I will explain below.

The German for the law gives a clear understanding of $E = I \times R$.

E is electromotive force, which in German is “elektromotorische Kraft.” Still E, but not English. Why isn’t the term “voltage”? Because the volt wasn’t a recognized unit until 1881, when the volt as used today was originally defined at the first International Electrical Conference [[Nature Vol. 24, 512 \(1881\)](#)]. The volt was named for Alessandro Volta (1745 to 1827), the Italian physicist who invented the battery.

To return to I for a moment, the unit for current (or “Intensität,”) is the ampere, abbreviated with a capital A and named for the French physicist [Andre-Marie Ampere](#) (1775 to 1836), who in 1820 developed Ampère’s law, which states that the mutual action of two lengths of current-carrying wire is proportional to their lengths and to the intensities of their currents. Ampère also applied this same principle to magnetism, showing the harmony between his law and French physicist Charles Augustin de Coulomb’s law of magnetic action. In the 19th century, electricity and magnetism were studied together, as they were understood to be related even then.

R, resistance in the electrical sense, is "elektrische Resistenz." Still R, but not English. Ohm himself is honored by the unit for resistance, the ohm. A capital Greek omega (Ω) is used rather than an O because, according to [Yahoo Answers](#), “the letter O is not useful as it can be confused with the number zero.”

By [Leonard Schiefer](#)

Learn more about [Electronic Products Magazine](#)

Learn more about [Electronic Products Digital](#)



[Eric Kinast](#) 9/2/2014 12:25:57 PM

I think there may be a bit more to the story for R. In modern German, Widerstand is the word for a resistor, and Widerstands is electrical resistance. Resistenz more commonly means immunity, or resistance in the sense of resistant to a disease. In many older texts, a lower case omega is used as a symbol for ohms. Note that a lower case omega looks like a w, the initial letter of widerstands, in addition to echoing Ohm's name. (Even today, in some countries, it is still common to use the lower case omega.) Looking through my collection of antique electrical books, the use of the upper case omega didn't seem widespread until the early 20th century.



[Jerry](#) 9/2/2014 10:22:19 AM

Very interesting! I've been using Ohm's Law for over 50 years and never knew why current was "I". I thought perhaps it was because "C" was taken for capacitance - but I see I was wrong. And I was just as wrong as to how E and R came to be. I naively assumed they were from English. It's great for this old dog to learn something new!

- Websites:
- [Electronic Products](#) |
- [EEM](#) |
- [Embedded Developer](#)