Technician License Course

Chapter 3

Section 3.1 - Electricity

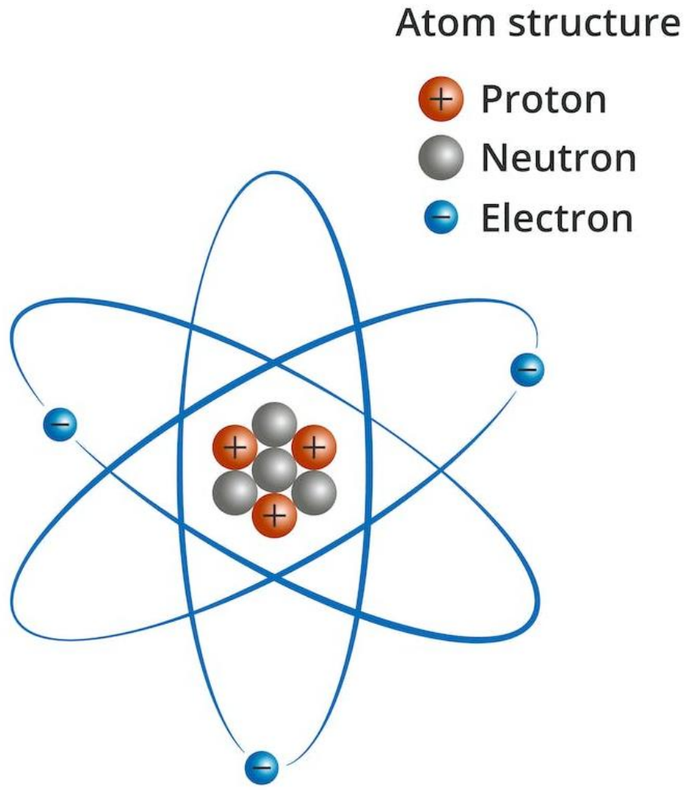
Fundamentals of Electricity

Fundamentals of Electricity

- Radios are powered by electricity and radio signals are a form of electrical energy.
- A basic understanding of how we control electricity allows you to better install and operate your radio.

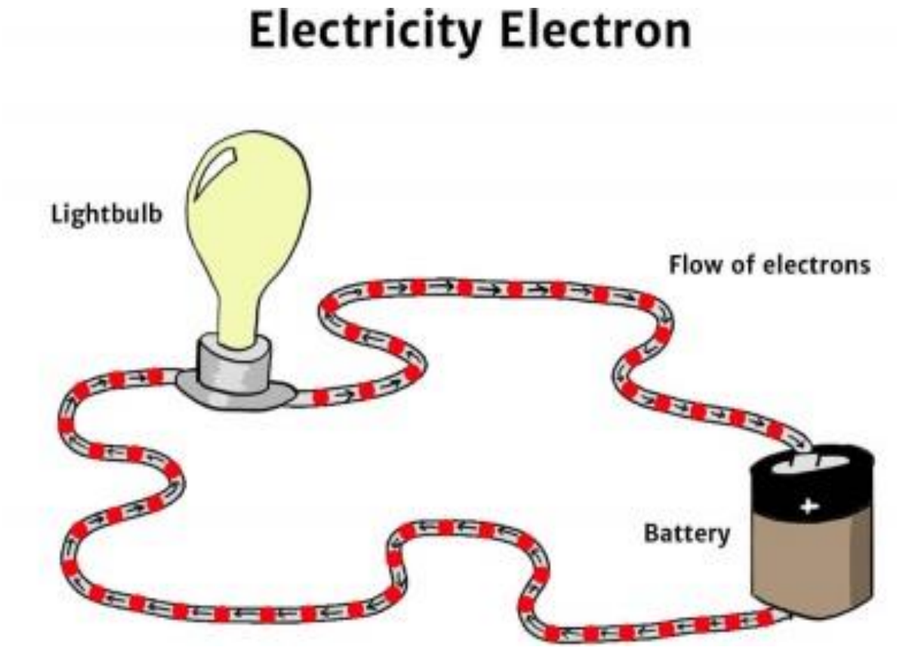
Fundamentals of Electricity

- Electrons are negatively-charged atomic particles, usually surrounding an atom's positively-charged nucleus.
- Depending on the material, the electrons can move in response to an *electromotive force.*
- The electrons can move from atom to atom, or even completely free of the atoms.



Fundamentals of Electricity

- Electrical charge can be positive or negative.
- Opposite charges attract each other
- Electrical current is the flow of *electrons*.
- Electrons want to match up with an atom



Basic Electrical Concepts

Basic Electrical Concepts

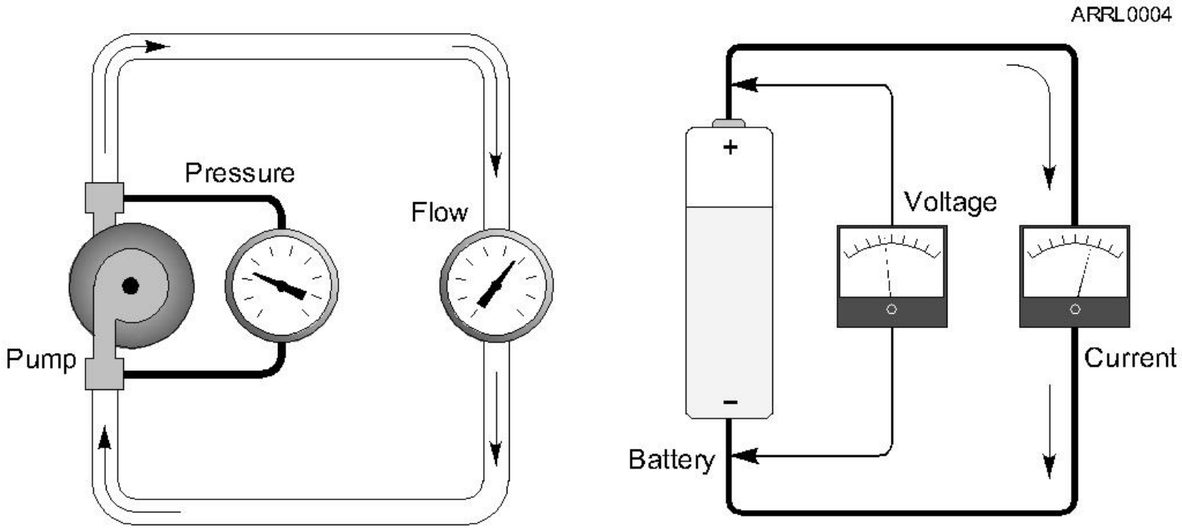
- **Current**: the movement of electrons, measured in *amperes* (A) by an ammeter, and represented by *I* in formulas
- **Voltage**: the amount of electromotive force (emf), also called electrical potential, measured in *volts* (V) by a *voltmeter*, represented by *E* or *V* in formulas

Basic Electrical Concepts

- **Resistance:** the opposition to the movement of electrons, measured in *ohms* (Ω) by an *ohmmeter* and represented by R in formulas.
- Resistance is like friction and turns electrical energy into heat when current flows.
- ***Conductors*** permit current flow (low resistance) and **insulators** block current flow (high resistance).

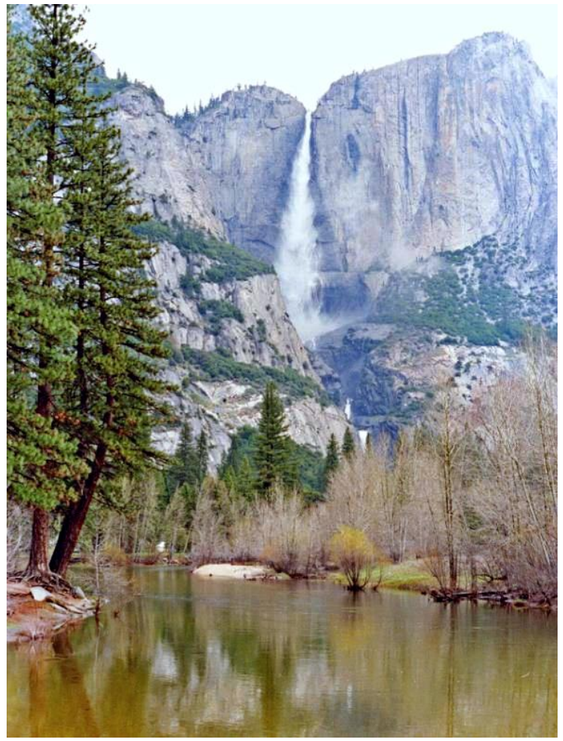
Basic Electrical Concepts

- The flow of water through a pipe is a good analogy to understand the three characteristics of electricity and how they are related.



Electricity: The Water Analogy

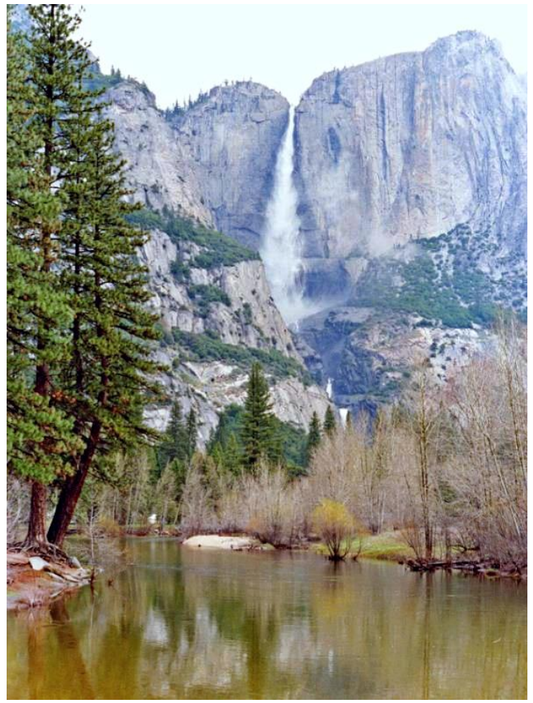
High Voltage, Low Current



Low Voltage, High Current

Basic Electrical Concepts

High Voltage, Low Current



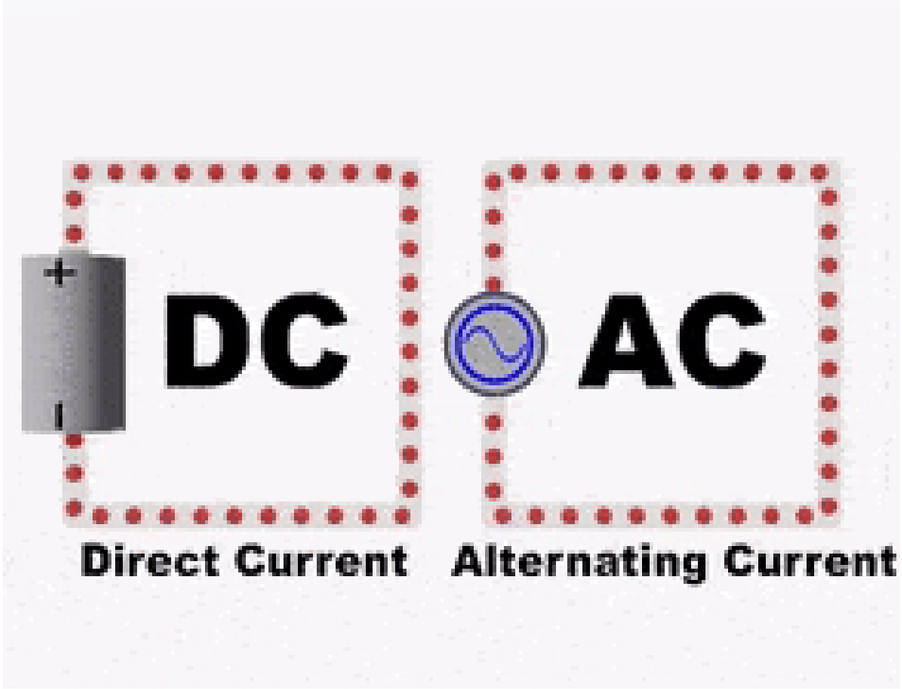
Low Voltage, High Current

Basic Electrical Concepts

- Voltage from a *source* of electrical energy causes current to flow.
- Resistance is a material's opposition to the flow of current.
- Voltage, current and resistance affect each other. For example, higher voltage (bigger push) causes more current (more flow).

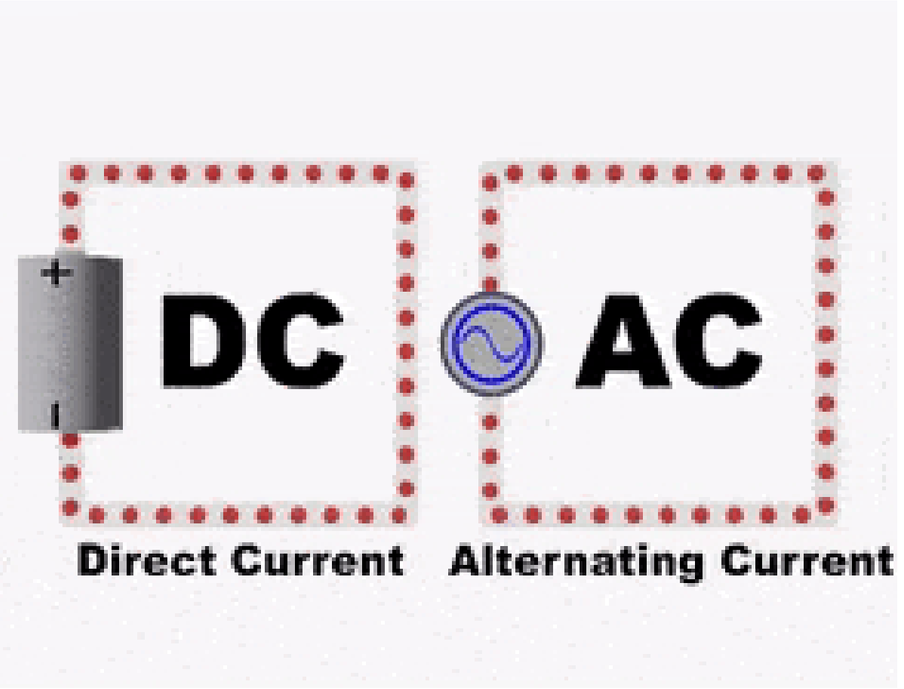
The Two Kinds of Current

- Current that flows in only one direction, is called direct current (dc).
- Batteries are a common source of dc.



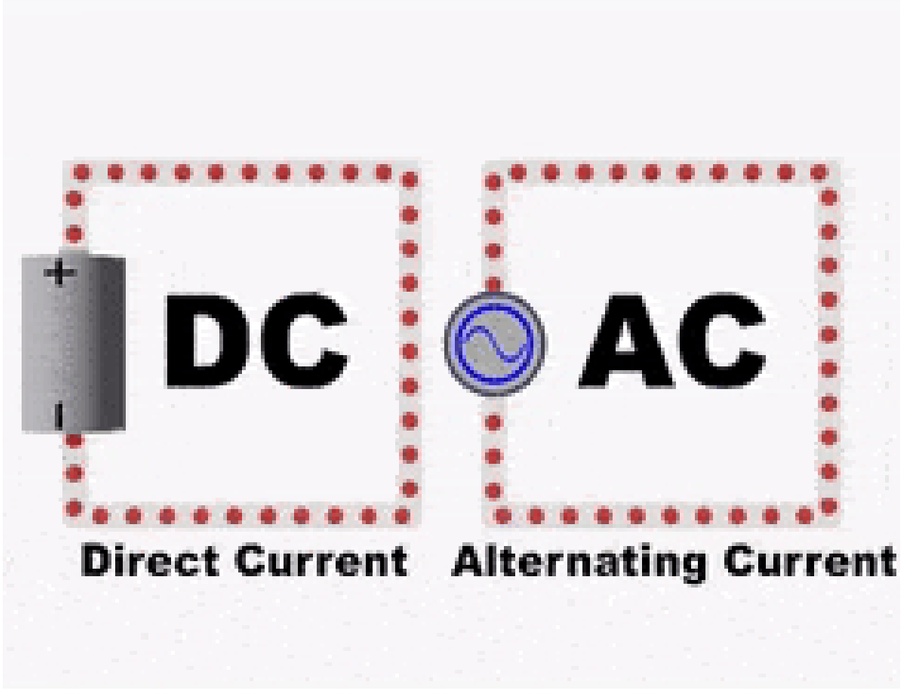
The Two Kinds of Current

- Current that flows in one direction then in the opposite direction is called alternating current (ac).



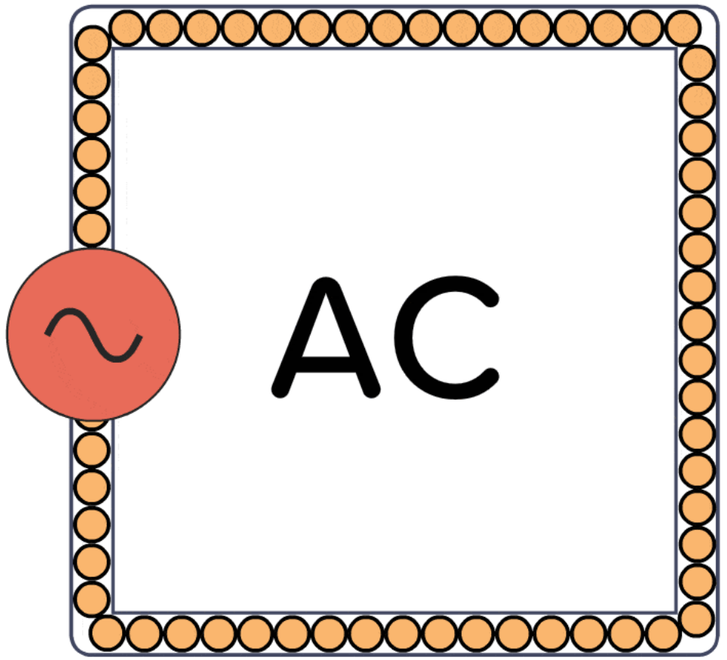
The Two Kinds of Current

- Current that flows in one direction then in the opposite direction is called alternating current (ac).
- Household current is ac



The Two Kinds of Current

- AC current reverses direction on a regular basis
- Each process of reversing is a *cycle*.
- The number of cycles per second is *frequency*, measured in hertz (Hz).
- 1 Hz = 1 cycle per second



The Electric Circuit: An Electronic Roadmap

- For current to flow, there must be a path from one side of the energy source to the other side of the source
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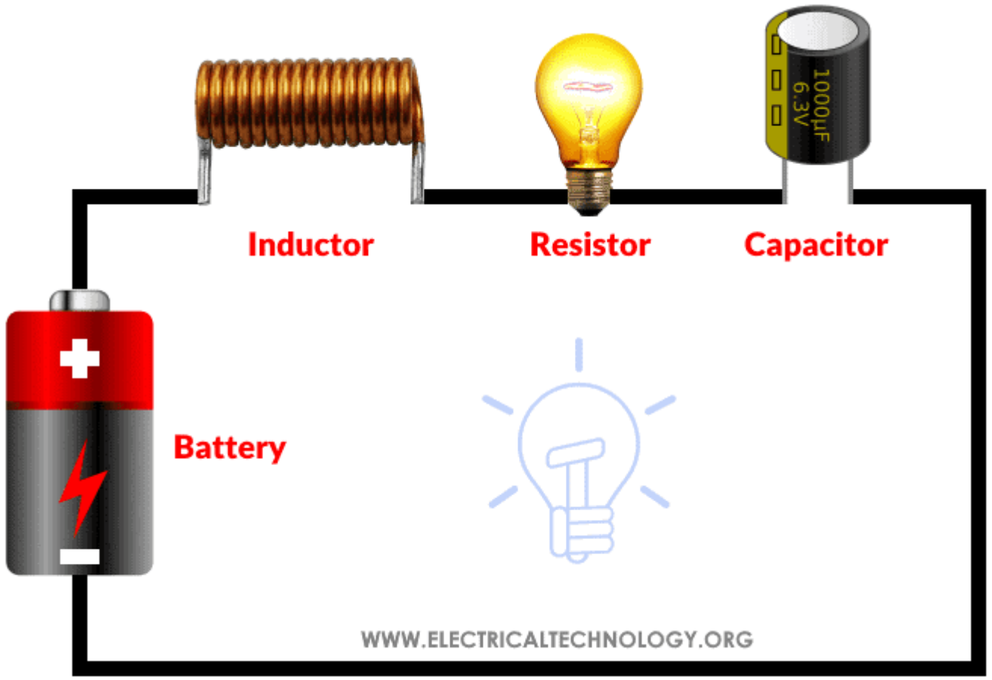
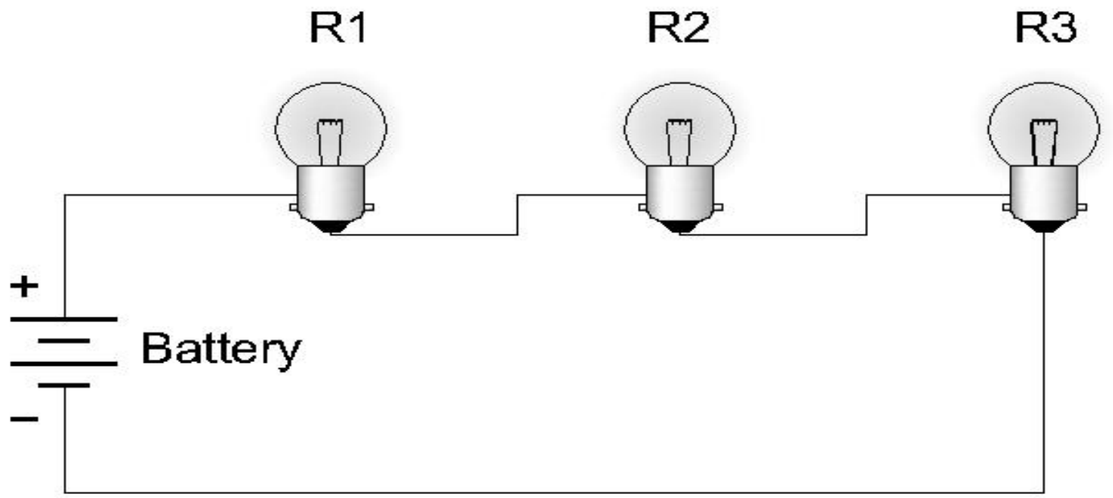


Series vs Parallel Circuits

- There are two types of electric circuits:
  - Serial and,
  - Parallel

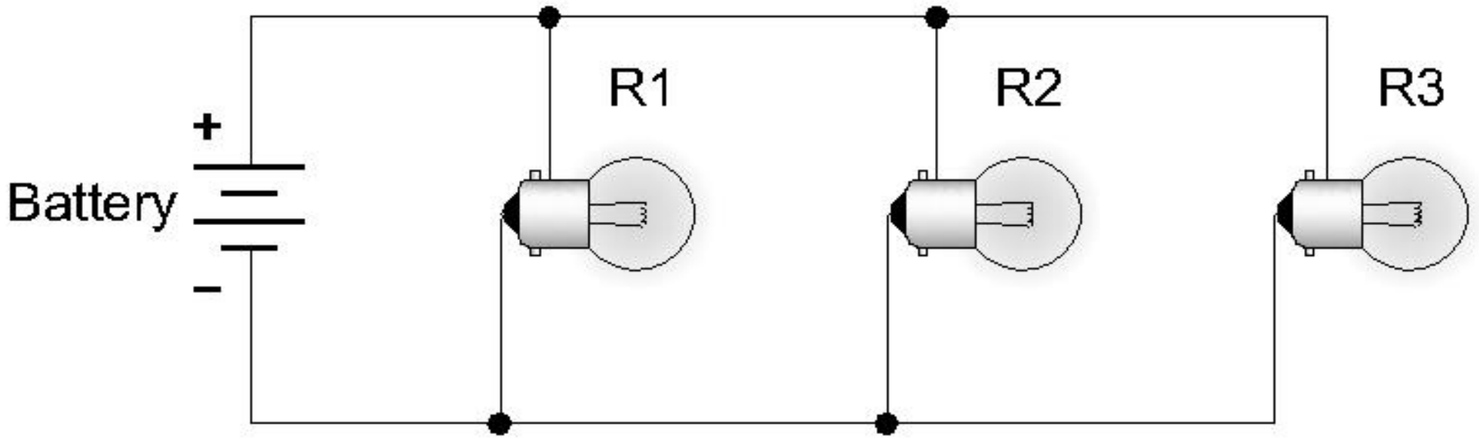
Series Circuits

- Series circuits provide one and only one path for current flow
- Current the same through each component

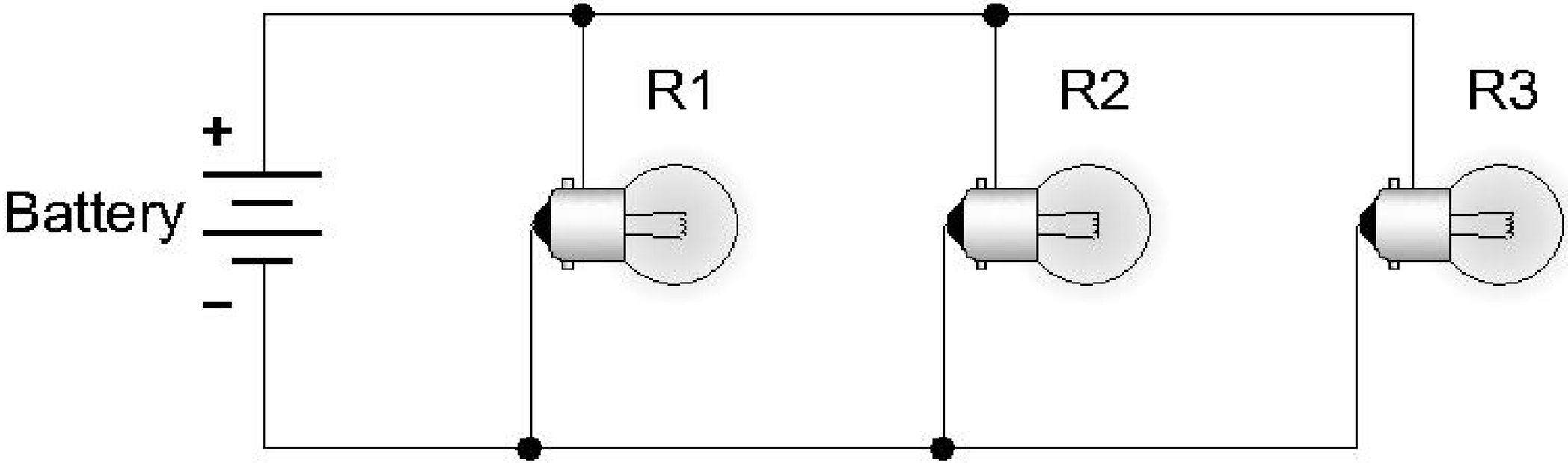


Parallel Circuits

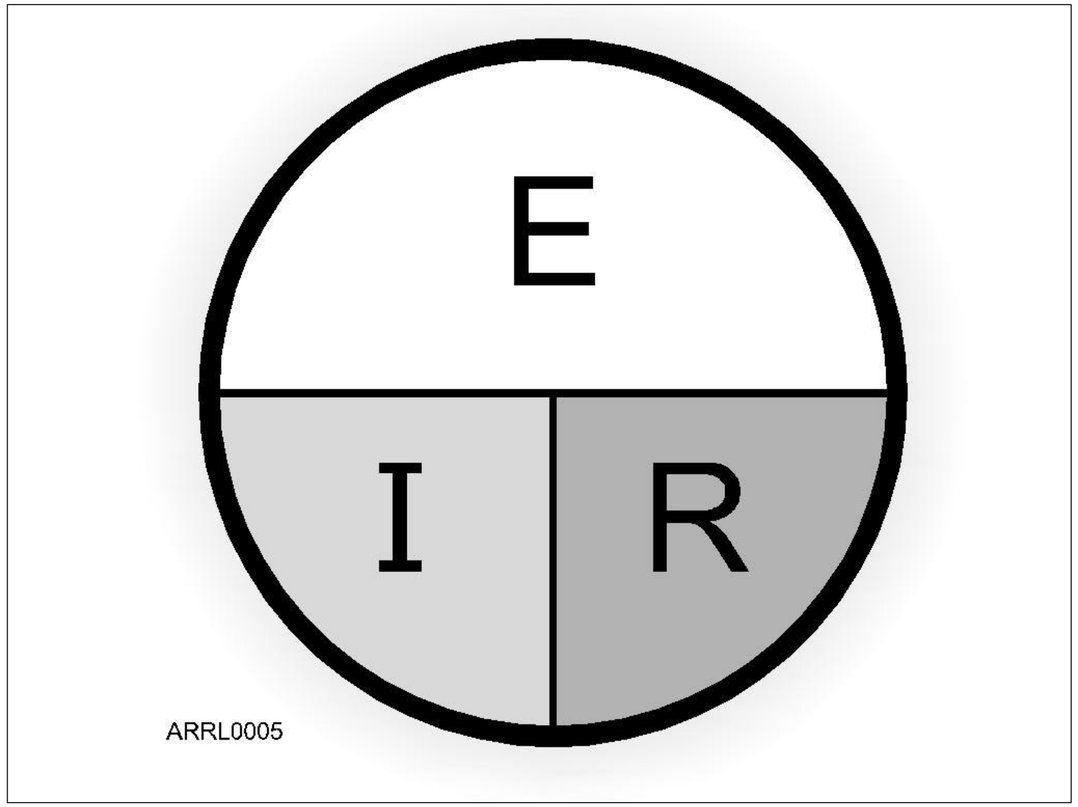
- Parallel circuits provide multiple paths for current flow.
- Voltage is the same across all components



How do you connect a Volt/Amp Meter?

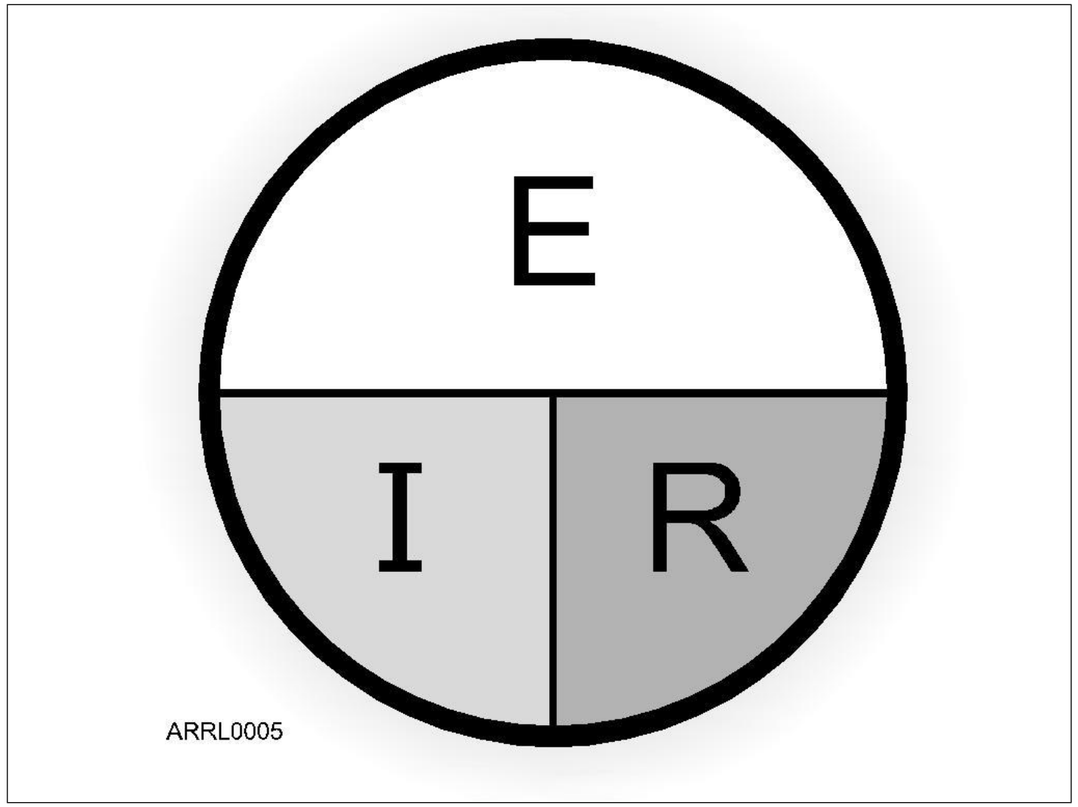


Ohm's Law



$$E = I \times R$$

Ohm's Law



- E represents voltage
  - Units – volts (V)

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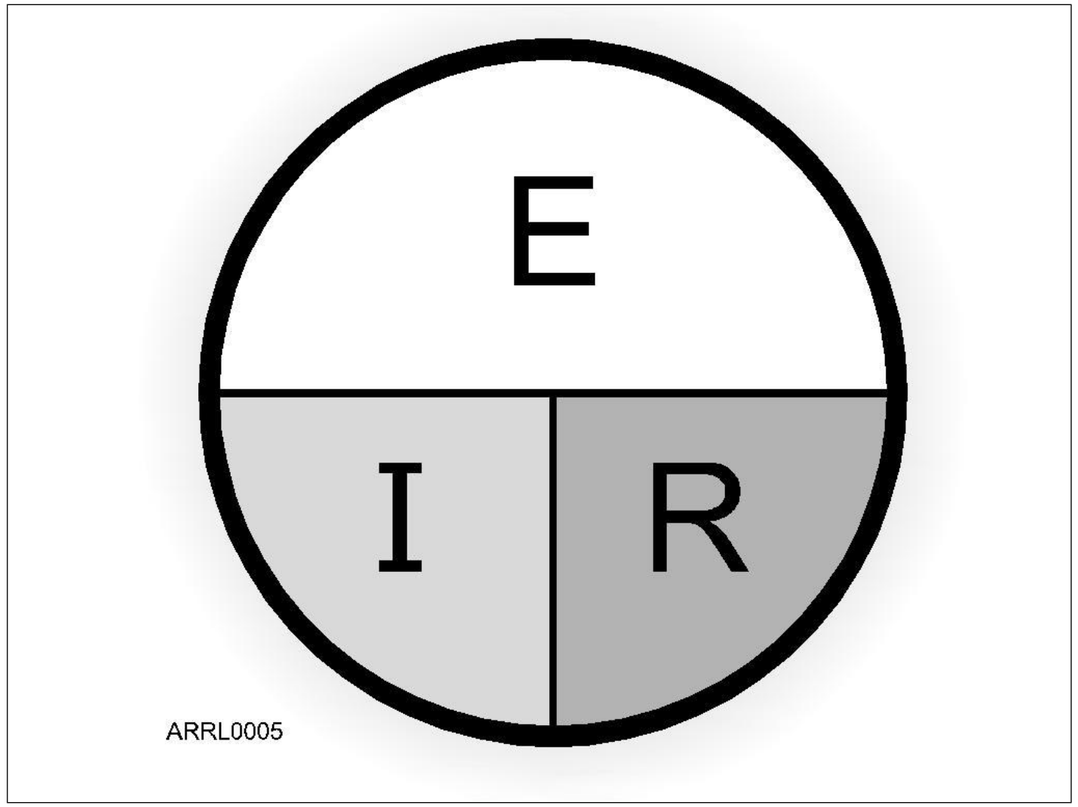

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- I represents current
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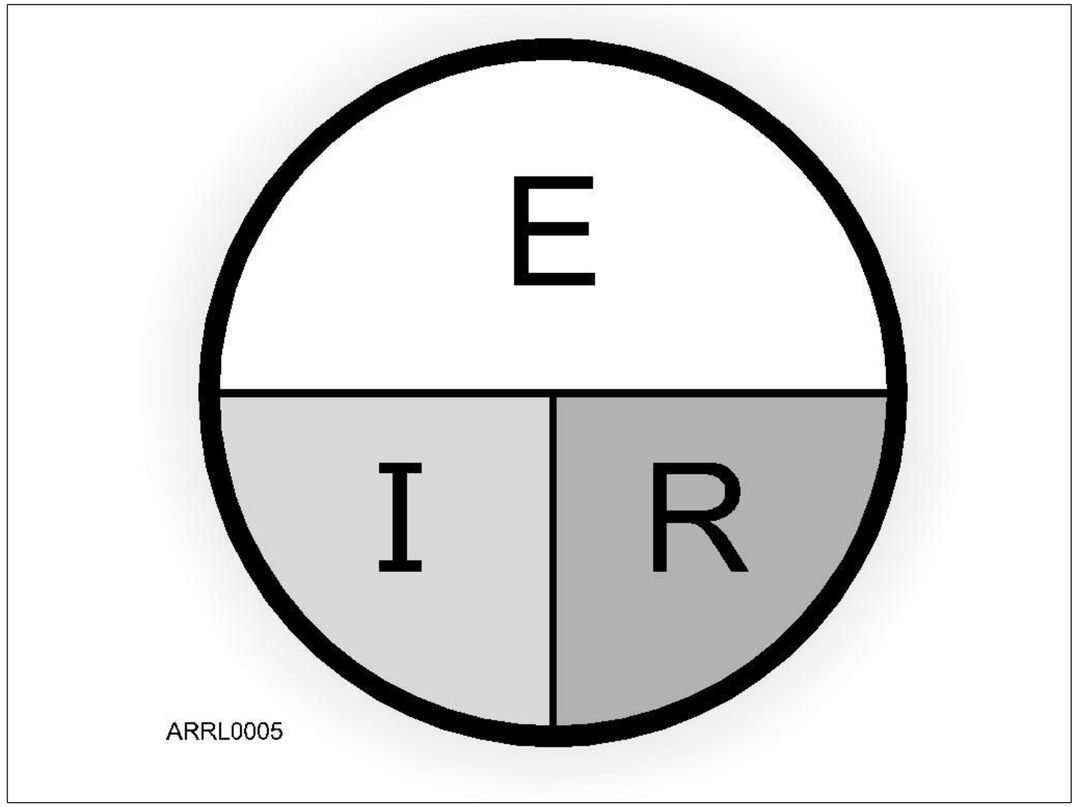

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- I represents current
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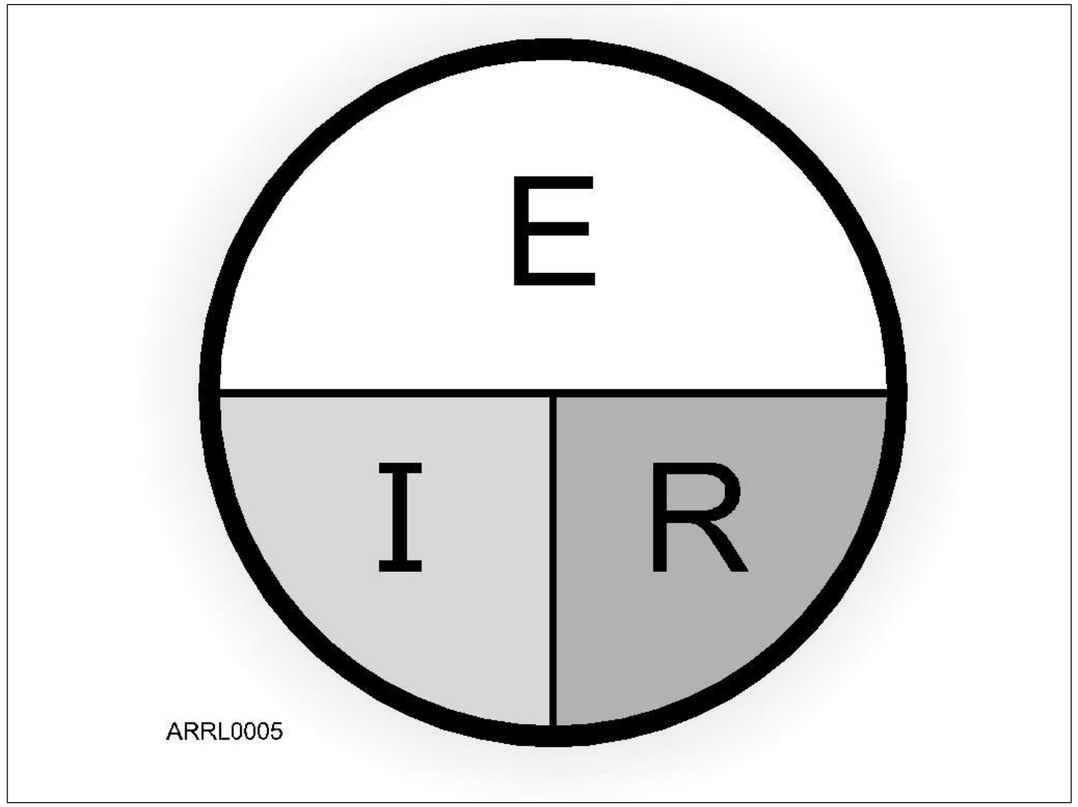
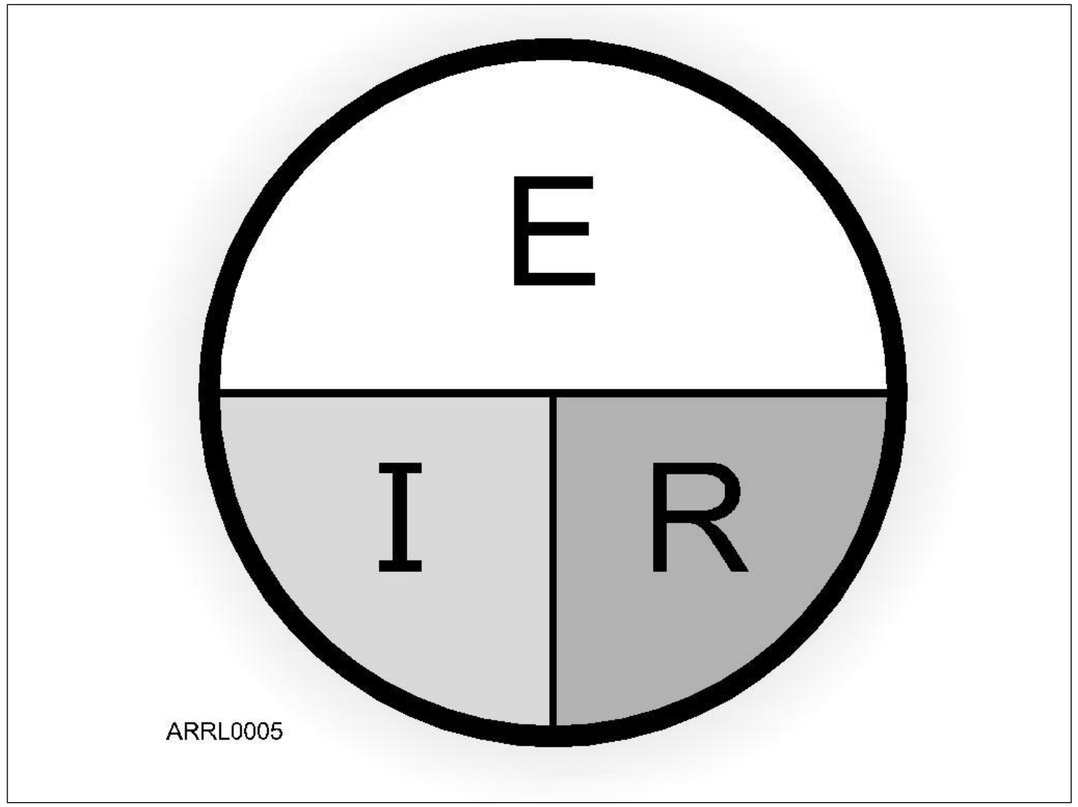
- R represents resistance
  - Units – ohms (Ω)

Ohm's Law



- R = E / I

Ohm's Law



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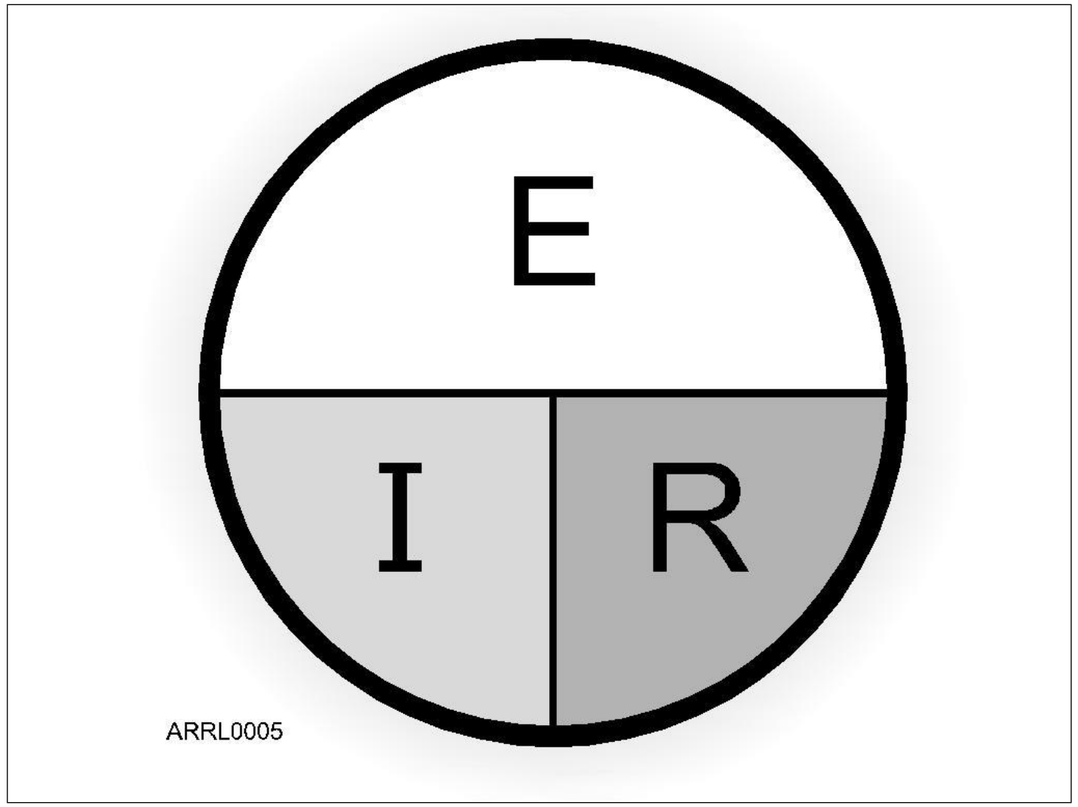

$$R = E / I$$

$$I = E / R$$

$$E = I \times R$$

Power - Electrons Doing Work and Expending Energy

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- Power is the rate at which energy is consumed.
- Power is measured in units of watts (W).

Power Equation

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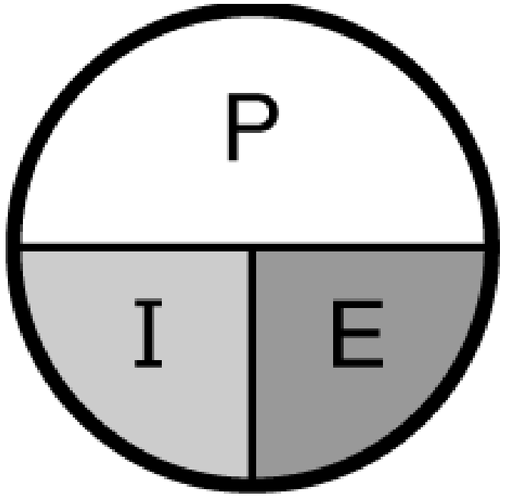

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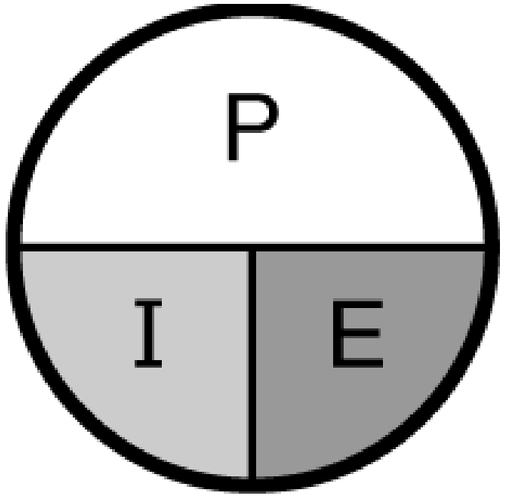

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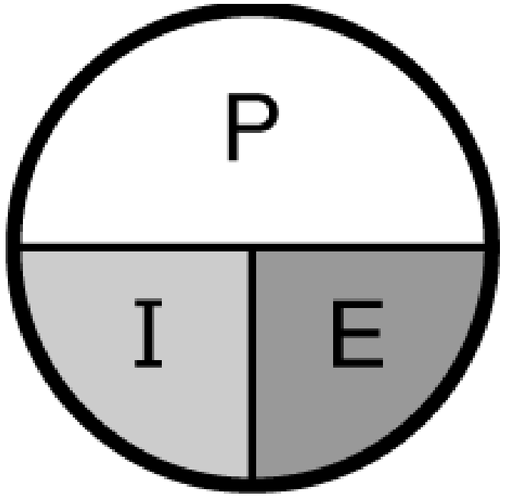

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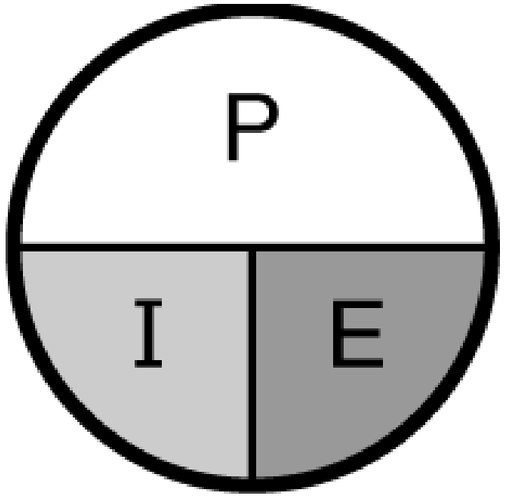

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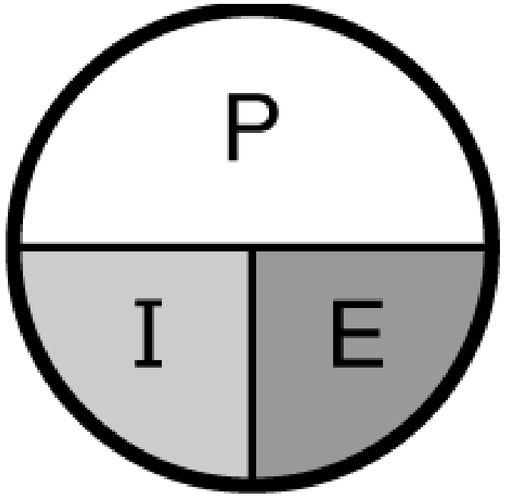

- Like Ohm's Law, if you know two of the values, you can calculate the third.

Are there any questions?