Electronics
Electrical Terminology

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In this document, you’ll learn:
In this document, you’ll learn:

- what **voltage**, **current**, and **resistance** mean
In this document, you’ll learn:

- what *voltage, current, and resistance* mean
- how to measure them
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Current

**Current**

The **Current** symbol is \( I \), a property of a point in a circuit; it indicates the rate of flow of electric charge past the point. A current of one ampere equals a flow of one coulomb of charge per second, measured in amperes or amps \([A]\) using an ammeter measured at a point. In a series circuit, the direction of current flow is opposite to the direction of electron flow (Blame Benjamin Franklin.)
Current

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By convention, the direction of current flow in a circuit is opposite to the direction of electron flow (*Blame Benjamin Franklin.*)
Resistance
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- symbol is $R$. 

Resistance is a property of a device that limits the flow of current.
Resistance

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- property of a **device** that limits the flow of current
Resistance

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- property of a device that limits the flow of current
- A potential difference of one volt produces a current of one ampere for a device with one ohm resistance.
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  kΩ (10³ ohms) or MΩ (10⁶ ohms) are common.
Voltage

An eV of work is needed to move an electron through a potential difference of one volt. A joule of work is needed to move a coulomb of charge through a potential difference of one volt. Potential difference is measured in volts using a voltmeter.
Voltage

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- Potential *difference*
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- Potential **difference**
- Measured in volts using a voltmeter
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Voltage (continued)

- measured *across a device or between two points*;
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- if measured at a *point* in a circuit, that means it is measured between the point and *ground*
Water analogy
Water analogy

- Voltage → pressure
- Electric current → water current
- Wires → large smooth pipes carrying water current
- Resistors → narrow or obstructed pipes which limit current

3.3K 100k
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Current, Resistance, and Voltage

Water analogy

Ohm’s Law

Power

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- increase the water pressure
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- increase the voltage
If we want to increase the current in a circuit we can:
- increase the voltage
- lower the resistance
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Voltage (or potential) across a resistor is proportional to the current flow through the resistor.
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- An **ohmic device** is one for which the ratio between voltage and current is constant; i.e. it doesn’t depend on the voltage.
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- An **ohmic device** is one for which the ratio between voltage and current is constant; i.e. it doesn’t depend on the voltage.

- A **non-ohmic device** is one for which the ratio between voltage and current is *not* constant; i.e. it depends on the voltage.
The power used by any element in a circuit is given by
\[ P = I \times V \]
For a resistor, Ohm's law states
\[ V = I \times R \]
and so
\[ P = I \times (IR) \]
or
\[ P = I^2 R \]
Alternatively
\[ P = V R \]
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Power is measured in Watts, (W), although sometimes you may see VA; why?
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1. **Terminology:** resistance *of*, voltage *across* (or voltage *between*), current *through*
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2. Voltage is always measured by a meter in parallel with the device being measured.
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6. \[ P = I \times V = I^2R = \frac{V^2}{R} \]