Current, Ohms and Amps

Electricity is a form of energy. It is generated by millions of free-flowing electrons whose movement through a conductor create energy from motion like water flowing through a garden hose. When you do things like play video games, watch TV, surf the internet and turn on lights you are using electricity.

There are two basic types of electricity: Direct Current and Alternating Current. This tutorial deals with DC current only.

Direct Current (DC) is the type of current that is supplied from such sources as batteries, solar cells and wall transformers. All handheld electronic devices and toys operate on some form of Direct Current. Direct Current flows in only one direction with current (or electrons) flowing from the positive terminal to the negative terminal.

Generically, Alternating Current (AC) is the type of current that is delivered to you home and businesses and is available from the wall outlet in your room. Technically, AC power is an electric current whose magnitude and direction vary (or alternates) cyclically.

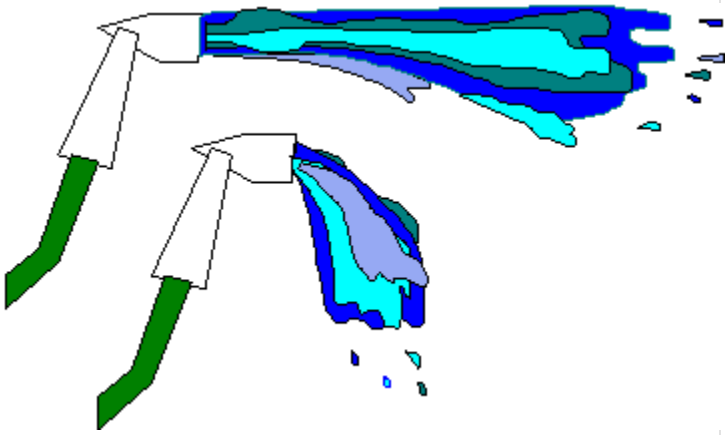
It is possible to convert AC current to DC current by using a **rectifier**. DC current can be converted to AC current by using an inverter. Some of you may have an inverter for use in your car that you plug into the accessory jack to be able to run some type of AC powered device while driving.

An interesting note is that you can use a permanent magnet motor (look on the label) as a generator to generate DC Voltage. Connect the terminals of a permanent magnet motor to a small lamp or voltage meter and spin the motor shaft. The light will light up or the voltage meter will register a voltage. Video: **Generating electricity with a permanent magnet motor**.

Another type of electricity is Static Electricity. Static electricity is usually caused by two different materials rubbing together. While the materials are rubbing together, electrons are pulled from the surface of one material and deposited on the surface of the second material. Many of you may have "discovered" static electricity when you walked on a carpet and were shocked when you touched a piece of metal. A static

"shock" is a sudden movement of electrons when the surface of a negatively charged material touches a positively charged conductor.

Voltage: Voltage is the electrical pressure (force) that causes the flow of electricity. If we equate the flow of electricity in a wire with the flow of water in a pipe (or hose) then voltage would be like water pressure. In the picture to the right the amount of water exiting each hose is the same but the pressure is different. Water pressure is measured in PSI (Pounds per Square Inch). Voltage is measured in Volts.



The amount of water exiting each nozzle is the same. However, the water pressure is different.

Voltage can be measured with a Multimeter (or Voltage Ohm Meter). Video: **Using a Multimeter to measure volts**

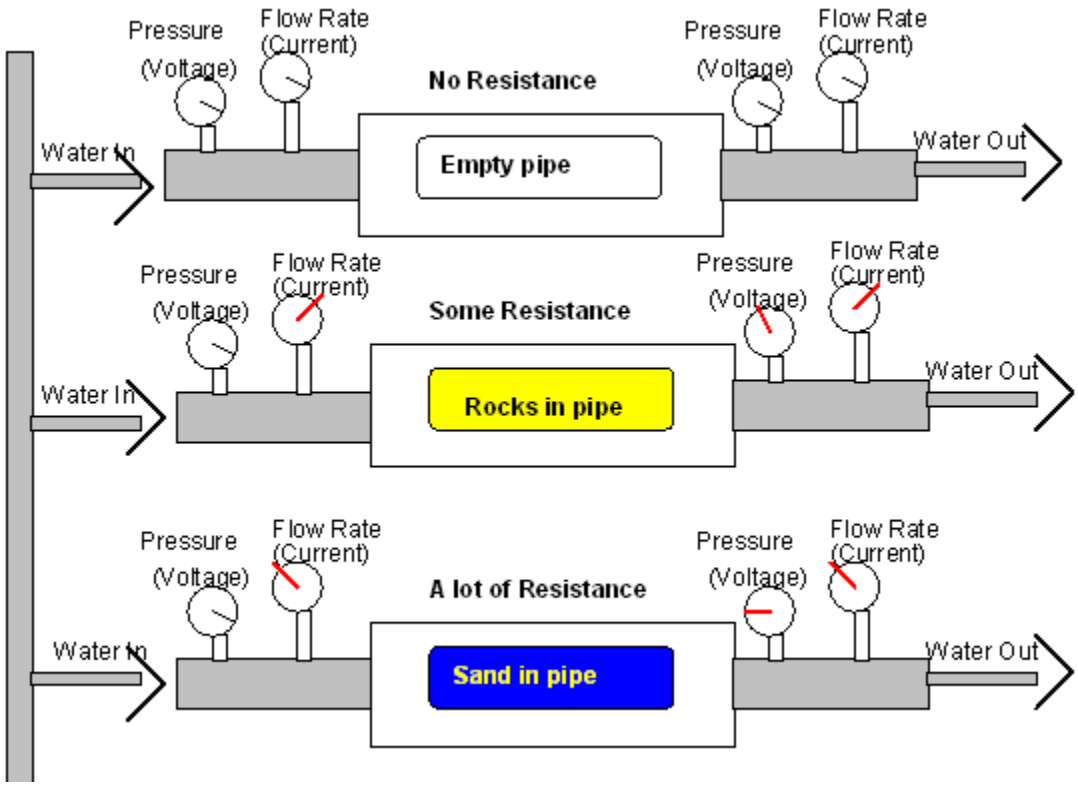
Current: Current is the amount (quantity) of electricity flowing through a circuit. Equating electricity and water then current would be the amount of water that is flowing through a hose. In the picture to the right the water pressure in the house hydrant and the fire hydrant are the same but more water (current) is exiting the fire hydrant. Water current is measured in GPM (Gallons per Minute). Electrical current is measured in Amps. Amps can be measured with a multimeter. Video: **Using a multimeter to meaure amps**.

The water out of your tap and the water out of a fire hydrant are at the same pressure There is just a lot more water coming out of the fire hydrant. Current is like the amount of water flowing

An important point to remember is that a load will only use as much current as it needs to operate. In the video example of reading amps using a multimeter the motor

is using .22 amps when the multimeter is first connected. When the motor is made to work harder by pinching the motor shaft the amp reading jumps as high as 1.08 amps. A load (in this case a motor) will try to draw (or use) as much current from the power source as it needs to operate – even if the wire and source are not capable of handling that amount.

Resistance: When electrons flow in a circuit they encounter some friction (or resistance.) Resistance limits the flow of electricity. Some conductors (like electrical wire) have very low resistance to the flow of electricity. Other things (like rubber) do not allow the flow of electricity at all. Resistance is measured in OHMs. An important thing to remember about resistance is that as the amount of current flowing through a conductor increases the resistance of the wire also increases. This resistance generates heat. This is why it is very important that you use the correct size wire for the voltage and current of your load. Think about what happens when you restrict the flow of water through a water hose by crimping the end of it. The hose expands as the pressure builds up inside the hose. Trying to force to much current through a wire creates the same problem and that energy build up generates heat which could melt the insulation on the wire. The diagram below demonstrates electrical resistance using the analogy of wire flowing in a pipe.



In the empty water pipe there is little resistance so the water pressure (voltage) and water flow rate (current) are the same on each side. With rocks in the pipe there is some resistance to the flow of water and the water pressure (voltage) and the water flow rate (current) are less. With sand in the pipe there is a lot of resistance to the flow of water and the water pressure (voltage) and water flow rate (current) are reduced even further.

Source: http://tech.texasdi.org/currenthohmsamps