Simple Electricity

Gears and Gadgets – Svoronos

Important Definitions

A/C – Alternating Current (from wall, 120volts in the US)

D/C – Direct Current (from batteries, USB, 'wall wart' chargers, voltage varies)

Positive (+) – Point from where current flows

Negative (-) – Point to where electricity flows

Ground (-) or (green wire)

- in A/C applications, the third prong, or green wire

- in D/C applications, any point that connects to negative (-)

Resistance - (R) in formulas

- measured in Ohms (Ω)

- the degree to which a substance opposes electric current

Voltage – (V) in formulas

- measured in Volts (V)

- a measure of electromotive force

Amperes – (I) in formulas

- measured in amps (A -mostly A/C) and milliamps (mA -mostly D/C)

- the strength of electric current

- also measures the capacity of batteries in milliamp hours (mAh)

Load – the part of a circuit using the electricity. (LEDs, motors, etc.)

Circuit – an electrical application, where current moves from positive, through a load to negative or ground.

Switch – A device to control the flow of electric power. (On/Off or variable)

Alternating Current

- Typically 110-120V

- Very dangerous

- There are no dedicated positive or negative wires. They both *alternate* from positive to negative 60 times a second (this alternating wave is measured in Hertz – Hz)

- Most large appliances run on A/C power

Direct Current

- Voltage can range from miniscule (millivolts mV – one thousandth of a volt) to massive (Kilovolts kV – one thousand volts)

- for our purposes, we will use between 1.5-12V

- has dedicated Positive and Negative wires

- all portable electronics run on D/C power

Simple Circuits

All circuits we will be working on will be D/C circuits; being safer, easier to work with and lower voltage (meaning less power to shock you)

All circuits require 3 basic components:

1. Positive and negative voltage (wires on battery holders)
2. A load to run the power through (that is properly rated for the voltage provided)
3. An unbroken conduit to direct the power from positive to negative (wires, circuit boards, switches)

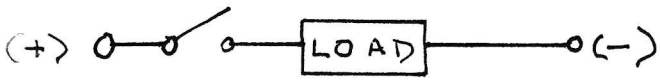
The Simplest Circuit

Power travels from + to –

through a load.

Simple with Switch

Same configuration, however now a switch interferes with the flow of current. Switch can be placed either before or after the load.



Loads in series (Series Circuit)

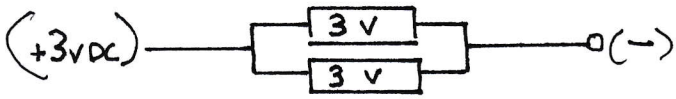
Loads can be configured in *Series*- from one to the next, where power flows through one to reach the next.

The voltage needed to power the circuit is the sum of the voltage necessary to run each load. i.e. Two 1.5v LEDs wired in series, require 3v to power.

Loads in parallel (Parallel Circuit)

Parallel circuits provides power to to multiple loads, independent of each other. Power does not have to flow through one to reach the next.

The voltage needed remains the same for each load. i.e. Two 1.5v LEDs, only require 1.5v when wired in parallel.



Batteries in Series and Parallel

Batteries, like loads, can be connected in series or parrallel to manipulate their output voltage and amperage.

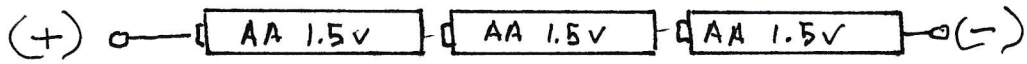
Every battery has a positive and negative terminal (+ is the 'button top' of AA batteries, - is the flat end.)

Series Batteries

Batteries connected in series, have their voltages *added together*. While the amperage *remains the same.*

To connect batteries in series; link the battery terminals positive to negative, positive to negative, and so on until the desired voltage is reached.

Example: three AA batteries (1.5v each, 1000mA) connected in series, will produce a total voltage of 4.5v at 1000mA.



Parallel Batteries

Batteries connected in parallel, *remain the same voltage, but add their amperages.*

To connect batteries in parallel; link all the positive terminals together to form one positive connection, then to the same with the negative terminals.

Example: three AA batteries (1.5v each) connected in parallel, will still output 1.5v, but at 3000mA.