# Jeff's guide to electronics, programming, and interfacing.

## Key Ideas in Electronics

**circuit** a closed path through which charge can flow, if pushed
**current** the rate of charge flow, measured in **amps** (or milliamps, etc.)
**voltage** the amount of energy per unit charge, measured in **volts**
**resistance** how much the circuit hinders the flow of charge, measured in **ohms**

Water analogy: if charge is like water, then a circuit is like water pipes in a city or your house. Current is like the flow rate of water (water trickling, or gushing?) Voltage is like water pressure – the more pressure (or rather, pressure difference), the more water will flow. And resistance is caused by what hinders the flow of water: narrow pipes or gunk coating the insides of the pipes.

Voltages can be used to store or transmit information, in either an **analog** way (the voltage can vary smoothly, taking on any value, like 3.4 V, 0.7 V, 4.0492 V) or **digital** (the voltage can take on only two values LOW (usually zero volts or **ground**) and HIGH (usually 5 V). A **bit** is a single digital voltage, with LOW representing the number 0 and HIGH representing the number 1. All information can ultimately be reduced to 1's and 0's. Eight bits together form a **byte**, a thousand bytes is a **kilobyte** (kB), a million bytes is a **megabyte** (1 MB = 1000 kB), and a billion bytes is a **gigabyte** (1 GB = 1000 MB).

## Key Ideas in Programming

**processor** a very complex electronic circuit that accepts commands and data (both in the form of bytes) and generates output (also in the form of bytes). The particular processor we are using is called an **Arduino**.
**command** a single line of code that does one small, specific thing, written in a particular **language**.
**program** a sequence of commands, run by a processor to accomplish some complex task (also called a "**sketch**" in the Arduino world)
**block** of code more than one command, but less than an entire program
**variable** a named piece of data.
Variables come in different **types**, such as integers, decimals, characters and strings of characters.
**control structures** commands that determine how and when certain blocks of code are executed
**if-then**: executing (once) a block of code only when some **condition** is true
**loops**: repeating a block of code, either forever (an **infinite loop**), a set number of times (a **for-next loop**) or while some **condition** is true (a **while loop**).
**output** sending information from the processor to the some other device, usually as either an analog or digital voltage signal
**input** information coming to the processor, as either an analog or digital voltage signal

## The Most Common Electronic Devices (see SIK Guide p.11 for drawings)

**battery** uses chemical reactions to give energy to charge, pushing it through a circuit
**generator** uses magnetic fields and mechanical motion to give energy to charge, pushing it through a circuit
**resistor** adds a specific amount of resistance to a circuit (the amount indicated by color-coded stripes)
**diode** allows current to flow in only one direction, like the one-way valves in your heart
**LED** (light-emitting diode) a diode designed to glow when current flows through it
**capacitor** stores charge
**switch** connects and disconnects wires, controlling whether current can flow or not
**potentiometer** a resistor whose resistance value can be changes, usually by rotating a dial or shaft
**photoresistor** a resistor whose resistance changes with how much light hits it; a light sensor