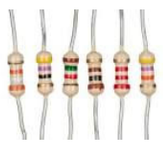
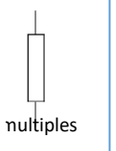
Electronic Systems – These are systems that utilise discrete components to control events.

The **voltage** at any point in the circuit is the electrical pressure trying to cause the **current** to flow.
The units of voltage and current are **Volts** (V) and **Amps** (A) respectively.
The relationship between voltage and current is explained by **Ohm's Law**
Voltage = Current x Resistance (**V=IR**)
Voltage (**V**olts) = Electrical Pressure
Current (**A**mps) = flowing electricity
Resistance (Ohms) = constraint on flow

Resistance is measured in Ohms (Ω)
1 kΩ = 1000Ω (see standard form table for others.

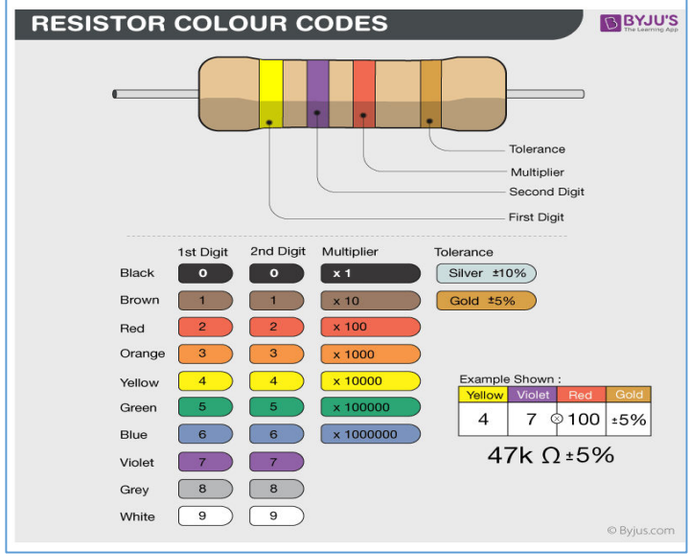
Resistors
Resistors are the components that provide resistance in the circuit which controls the current flow. They are only available in certain stock (**preferred)** values. multiples of 10 on the following numbers.
1.0,1.2,1.5,1.8,2.2,2.7,3.3,3.9,4.37,5.6,6.8,8.2, ie 270Ω and 330Ω are common values to use with an **LED.**



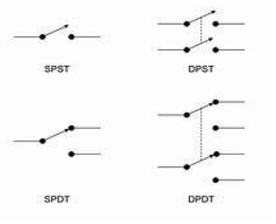


To work out the value of a resistor you need to read the 4 coloured bands on its outside.
The 1st and 2nd colours are numbers, the 3rd is a multiplier and band 4 is the **tolerance** of the resistor.

Combining resistors
Because they only come in certain values you often have to use resistor is series or parallel to get the exact value you want.
In **series:** $R_T = R_1 + R_2 + ... + R_n$
In **parallel:** $1/R_T = 1/R_1 + 1/R_2 + ... + 1/R_n$



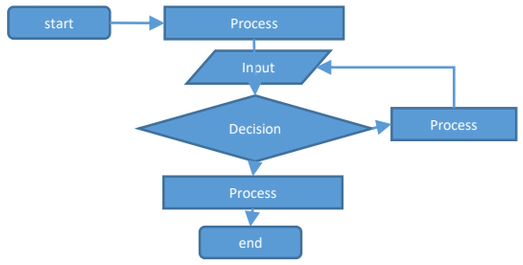
Switches
A switch can be either on or off in varying configurations. They can be either latches, or push to make/breaks.
A **tilt switch** is on when upright and off when tilted
A **reed switch** has a thin ferrous wire which is activated by a magnet in close proximity.



Standard Form
When writing very large or small numbers.
You could use it for 1mA = 0.001A or 10 kΩ = 10,000Ω

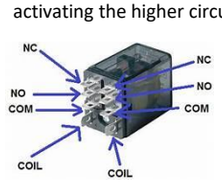
In Words	Digits	Standard Form	Prefix (symbol)
trillion	1,000,000,000,000	1×10^{12}	Tera (T)
billion	1,000,000,000	1×10^{9}	Giga (G)
million	1,000,000	1×10^{6}	Mega (M)
thousand	1,000	1×10^{3}	Kilo (k)
unit	**1**		
hundredth	0.01	1×10^{-2}	Centi (c)
thousandth	0.001	1×10^{-3}	Milli (m)
millionth	0.000 001	1×10^{-6}	Micro (µ)
billionth	0.000 000 001	1×10^{-9}	Nano (n)
trillionth	0.000 000 000 001	1×10^{-12}	Pico (p)

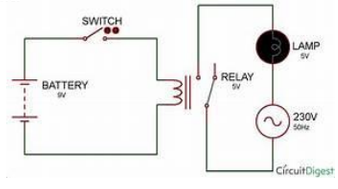
Flowcharts
A flow chart is a way of explaining your systems, it helps you to understand what you want your system to do before you construct or program it. The most important part of the system is the feedback from the decision processes back to an earlier part of the system.
The diagram below shows a simple flowchart



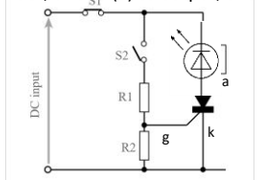
Switch Circuits

Relay
A component to allow control of a high voltage/current from a low voltage/current circuit. The relay acts as a switch activating the higher circuit.

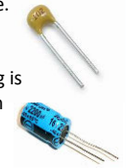




Thyristor
Similar to a MOSFET but as a switch, gate (g) to potential divider, anode (a) to output, and cathode (k) to 0V.

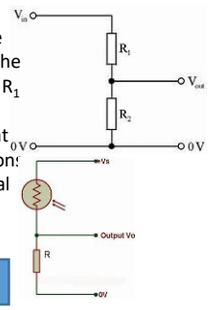


Capacitors
A capacitor is a device for temporally storing charge. Its units are **Farads** (F) Below 1µF they are normally non-polarised and made of Ceramic in a disc shape Above 1µF these are Normally barrel shaped one leg is longer than the other (+ve) and the –ve is marked on the case.

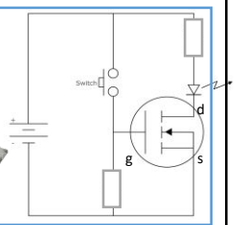


Potential Divider
These are used with sensors to adjust the output voltage, for example if you want the voltage to increase you put the sensor at R_1 and to decrease then at R_2 the other Resistor is often a **variable** resistor so that the circuit can be adjusted to the condition. The example shows an LDR with the signal being increased as there is more light.

$V_{out} = V_{in} \times (R_2 / (R_1 + R_2))$

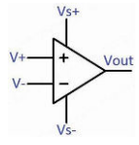


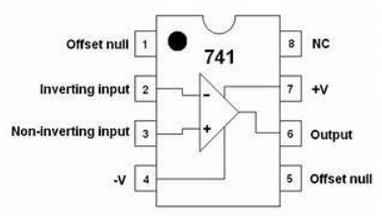
Transistor (MOSFET) Used to amplify a signal so the signal can be used as a switch for a transducer, The pins: gate (g) to potential divider, drain (d) to output and source (s) to 0V.



Darlington Pair
When 2 thyristors are used together to double the amplification of the circuit.

Operational Amplifier (Op Amp)
A amplifier that is loaded onto a chip. It has far more **gain** than the other systems.





Systems Diagrams
A system diagram consists of 3 basic elements

Input → Process → Output

By breaking down a system the designer can focus on different elements one at a time, concentrating on the information that flows between each part.
Each part is called a **subsystem.** Each subsystem will output either a **digital** (0/1) or **analogue** (variable) **signal**.
Systems and sub-systems can be combined to produce complicated operation.

Voltage
Volts (V)
Potential difference
Current
Amps (A)
Ohm's Law
Resistance
Resistor
Preferred Value
Tolerance
System
Subsystem
Input
Process
Output
Digital
Analogue
Signal
transducer

Voltage is often referred to as **Potential Difference** (PD) in physics

Design and Technology

Title: Electronic Systems part 1

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