Circuit Components

With some of the electrical theory out of the way, you are now ready to take a look at the basic electronic components that are used in circuits. There are quite a few different ones, but the following are the most common ones that you will come across.

Resistors

An electronic circuit will contain lots of resistors. They are used to limit the flow of current and are available in all sorts of shapes and sizes and a wide range of values and tolerances. There are also different types such as carbon, metal film, and wirewound. Which type is used depends on its specific purpose in the circuit.

Resistors come in all shapes and sizes depending on their application. In general, small resistors are for very low wattage applications, whilst larger resistors are often used in high-current applications where they may get hot and so have to dissipate the heat.

The resistor color code

Because resistors are often very small it would be difficult to mark their value and tolerance on the casing. Such markings might also become burned off after prolonged use, as circuits generate heat. Instead, small resistors are commonly identified by colored bands. The four-band and the five-band resistor color codes are shown below, together with an example of each.

COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1%
Red	2	2	2	100Ω	± 2%
Orange	3	3	3	1kΩ	
Yellow	4	4	4	10kΩ	
Green	5	5	5	100kΩ	± 0.5%
Blue	6	6	6	1MΩ	± 0.25%
Violet	7	7	7	10MΩ	± 0.10%
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1	± 5%
Silver				0.01	± 10%

The more you use the resistor color code table, the easier it becomes to remember the bands and their values.

The four-band is the most common as it is used for wide tolerance (and hence cheaper) resistors found in many circuits. The five-band code is used where very accurate resistance values are needed.

Note that the bands for the value are grouped together on the left, whilst the tolerance color is spaced apart at the other end. To read the value of a resistor with four colored bands just do this:

1. With the resistor the right way round, note the first color and look up the value in the 1st band column (e.g. Red = 2)
2. Note the second color and look up its value in the 2nd band column (e.g. Blue = 6, so the significant value is 26)
3. Note the third color, look up its value in the Multiplier band column and multiply the significant value with this figure (e.g. Yellow = 10 kΩ, so 26 x 10 kΩ = 260 kΩ)
4. Note the fourth band color and look its value up in the Tolerance band column to get the full resistor value (e.g. Gold = ±5%, giving the resistor's value of 260 kΩ ±5%)

Always check the value of a resistor with a multimeter set to the Ohm's range before using it in a circuit. Humans can make mistakes when reading a color, as can a manufacturer when labeling a resistor!

Capacitors

A capacitor is a device for storing energy in the form of an electrical charge, like a battery or cell, but stores a much smaller charge and can be charged or discharged almost instantly. Capacitors have many uses, such as in power supplies or tuned circuits.

Diodes

A diode is an electronic device that allows current to flow in one direction only, like a one-way valve but with no moving parts. There are various types of diodes with specific functions such as controlling a voltage level or emitting a colored light (LED).

Power sources

Electronic circuits require a power source to provide the electrical energy for them to work. Batteries are often used to provide a simple power source, but when carrying out repairs or practical experiments it is more common to use a stabilized power supply.

This type of mains-driven power supply provides an accurate voltage that can be set by the user. There is often a means of limiting the current that the unit will supply, and protection circuitry to effectively turn off its output if the circuit it is powering malfunctions.

Take care when working with large-value capacitors in case they are still charged. Always ensure they are fully discharged before attempting any work in that part of a circuit. The last thing you want is for the stored energy to discharge through another component with disastrous results, or worse, through YOU!