Technical Basics

ONE OF THE KEY differences between radio amateurs and other users of radio is that amateurs are interested in how radio works. Other users don't care much about how it works, as long as it does.

When mobile handheld phones first became available, the users wondered why they did not work out in the depths of the countryside, in a valley or in a tunnel. The fact that these telephones used radio, and radio waves could not penetrate tunnels or the basements of large buildings, was not understood.

At the Foundation level, most of the training is about how to use a radio with only a little emphasis on the technicalities. Training for the higher licence classes includes more of the technical theory of electronics and radio.

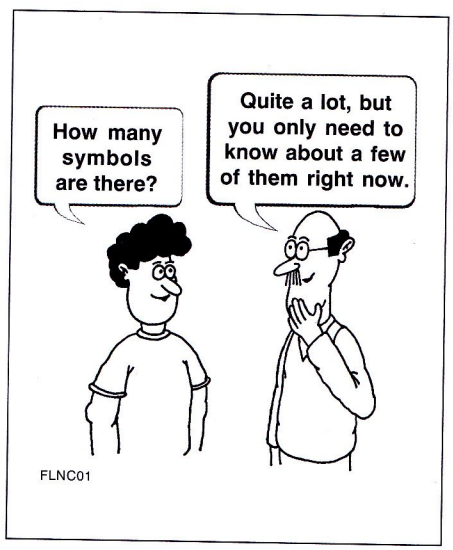
Units & Symbols

Current (symbol 'I')

The current is a measure of how much electricity is flowing. The unit of measurement is the Amp (A).

The current is actually made up of millions of small particles called electrons, which are electrically charged and move round the circuit 'carrying' the electricity.

These electrons need enough room to move and if a larger current is expected to flow, a larger diameter wire is used. A bedside lamp may have a relatively thin wire, but an electric kettle will have a thicker one because it will take more current.



Potential Difference (symbol 'V')

It is the current, the moving electrons that carry the electrical energy around a circuit. The electrons get their energy from the battery or power supply. As the electrons pass through something such as a bulb, motor or a radio they transfer some of their energy to it. The energy that is transferred can make the bulb light up, the motor spin round or the radio make a sound.

The electrons have more energy when they enter a device such as a bulb than when they leave it. The Potential Difference across the device shows this difference in energy and is the energy being transferred to it. Very often it is simply called the 'Voltage'.

Potential Difference is measured in a unit called a 'Volt'. If we measure more Volts across a device it means the flow of electrons (the Current) is transferring more energy to that device.

A 4-cell battery has a potential difference of 6V. It will give the electrons four times as much energy as a single cell (1.5V) and will cause the electrons to flow more quickly.

Caution! If we use the mains to supply energy to a piece of equipment the Potential Difference is 230 Volts. This is quite enough energy to kill you or cause you serious injury.

Large and Small Units

The unit of length is the metre. A tall person might be almost 2 metres tall and a 8 year old child may be 1 metre tall.

A ruler is usually 30cm long. The 'c' stands for 'centi' and the 'm' for 'metre'. One centimetre is one hundredth of a metre. There are 100 centimetres in a metre. If 1 centimetre is 1/100 of a metre, this can also be written as 0·01 of a metre. The ruler is 30 times this length so it is $30 \times 0{\cdot}01 = 0{\cdot}3$ metre long.

The millimetre is even smaller, 10 times smaller than the centimetre. There are 1000 millimetres in a metre, so each millimetre is 0·001 of a metre.

Distances are often much greater than a metre and are often measured in kilometres. The kilometre is 1000 metres. From London to Edinburgh is 411 kilometres, often written as 411km. In metres it would be 411,000 metres. It would also be 411,000,000 millimetres!

In the scientific world it is common to use either very large or very small units. To avoid needing lots of zeros, the measurements are given in a suitable sized unit. The ones needed for the Foundation licence are the **milli**, the **kilo** and the **Mega**.

The **milli** is one thousandth, 1/1000 or 0·001. The abbreviation is 'm'.

A small current is 5 milliamps or 5mA. That would be 0·005A.

A small voltage might be 350mV, or 0·35V.

A single cell battery is 1500mV, which should be written as 1·5V.

The **kilo** is one thousand times or 1,000. The abbreviation is 'k'.

A distance of 45,000 metres should be written as 45km.

A high voltage of 2,300V should be written as 2·3kV.

The **mega** is 1,000 times bigger than a kilo, or 1,000,000 times bigger than the basic unit. The abbreviation is 'M'. Don't confuse this with 'm'.

A flash of lightning may be 4,000,000V, or 4MV. It may also cause a momentary current of 8,000 Amps, or 8kA to flow.

Electrical circuits

AN ELECTRIC CIRCUIT is the name given to the way electrical devices are connected. By connecting a battery and a light bulb we make a circuit consisting of the battery, the bulb and two pieces of wire to make the connections.

This is easiest to describe using a drawing and to help with that we will need to know how to draw a battery and a bulb so they will be recognised. This is done by using standard symbols. The standard symbol for a battery is shown in **Fig 1**.

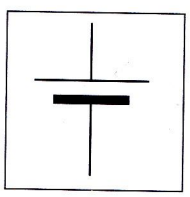


Fig 1: The circuit symbol for a single cell. The longer side is the positive connection.