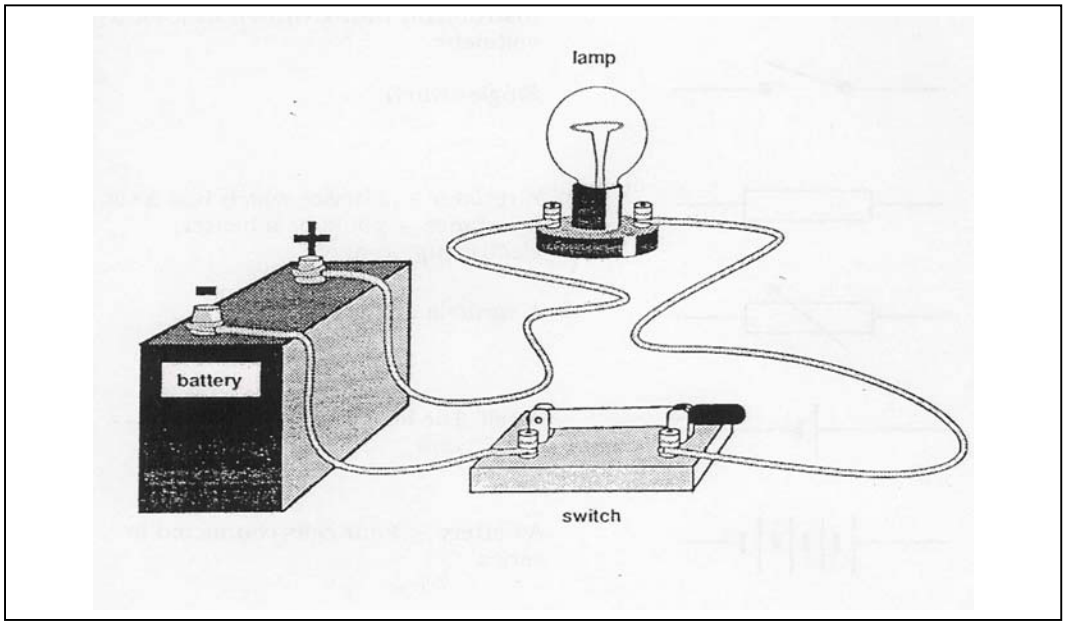
Simple Electrical Circuits

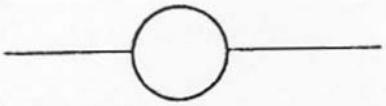
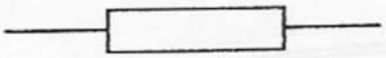
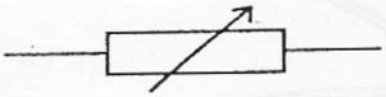
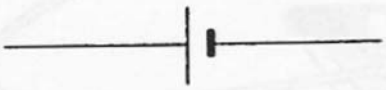
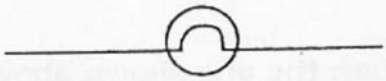
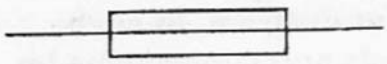
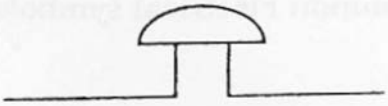
Introduction to Simple Circuits



Most electrical circuits are more complicated than the one shown above. As most electrical circuits are more complicated than this it would be too difficult and time consuming to draw them this way. So instead we represent electrical circuits by means of a circuit diagram. In such diagrams real objects are represented by symbols and connections by single lines.

The table on the following page shows some common electrical symbols. Some of which you will use in this module

Common Electrical Symbols Symbol

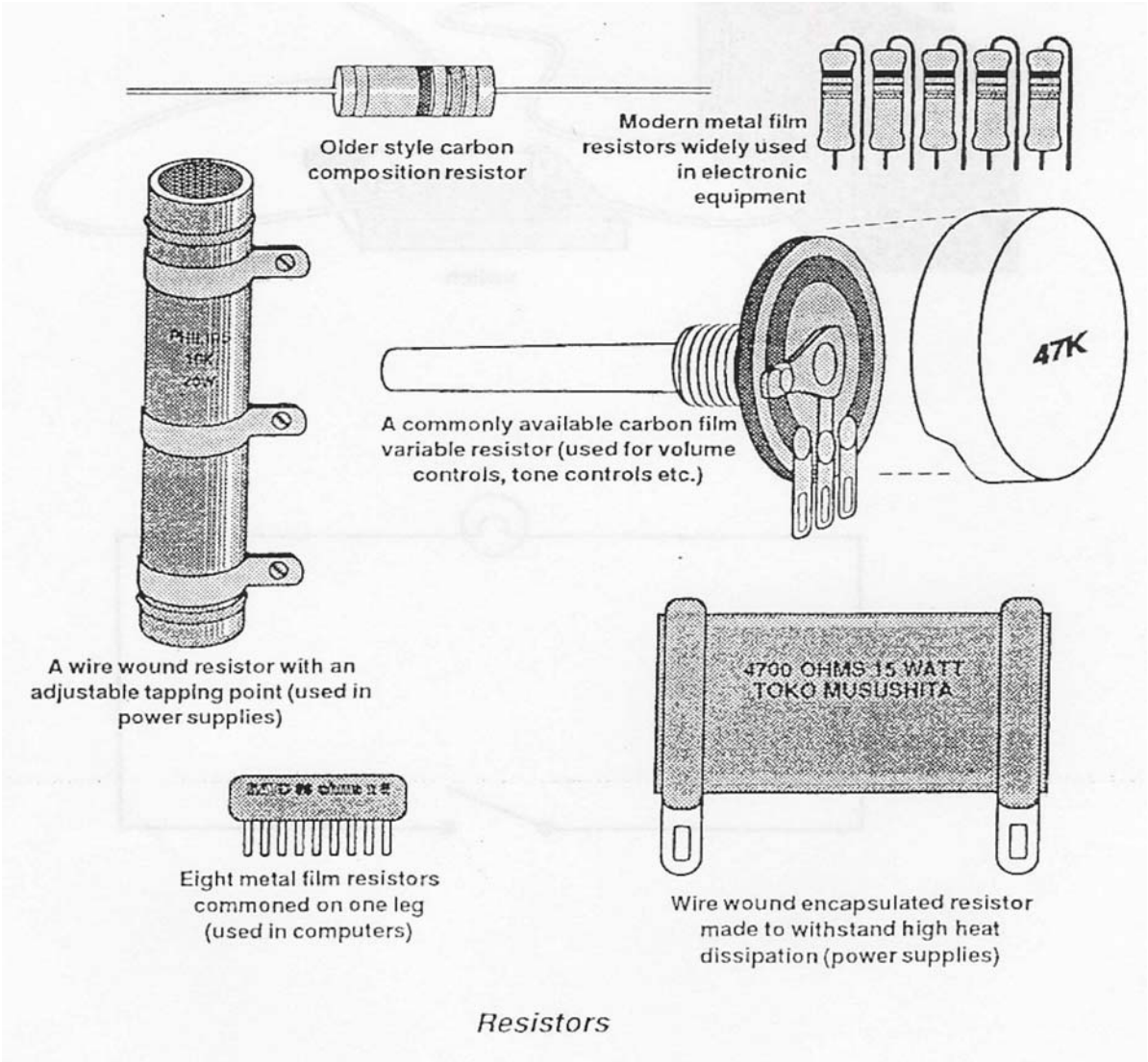
Symbol	Description
	Instrument with A written in it for an ammeter (current measuring instrument) with V written in it for a voltmeter
	Single switch
	A resistor — a device which has a set resistance — could be a heater, electric jug, iron, etc..
	A variable resistor
	A cell. The long line is the positive connection
	A battery — Four cells connected in series
	A lamp — an ordinary household type
	A fuse or circuit breaker
	An electric bell

Resistance

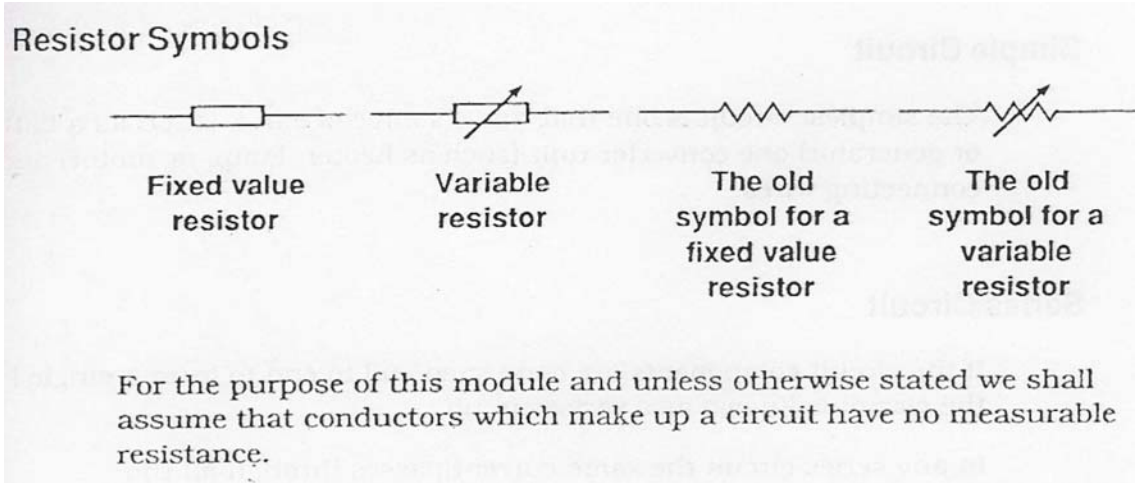
The resistance of the electrical devices in a circuit determine in part the value of the current in the circuit.

The total resistance of the electrical devices and the connecting wires in a circuit determine the value of the circuit current. If it is desired to reduce the current, additional resistance can be added by connecting into the circuit, devices called resistors which are designed to have a specific resistance value.

Although resistors come in many shapes and forms, as shown below, there are two symbols to represent them on circuit diagrams.



Resistors



For the purpose of this module and unless otherwise stated we shall assume that conductors which make up a circuit have no measurable resistance.

Simple Circuit

The simplest circuit is one that has a source of e.m.f (such as a battery or generator) one converter unit (such as heater, lamp, or motor) and connecting wires.

Series Circuit

If the circuit components are connected end to end to form a single loop the circuit is known as a series circuit.

In any series circuit the same current passes through all the components

Remember that current is the movement of electrons through a circuit. So like several hoses connected together in one long line (and neglecting friction) water can only come out of one end at the same rate that it entered at the other.

Voltage Drop

In any electrical circuit containing conversion devices there is a drop in voltage across the device when current is passing (like a drop in potential from head of water to a hose).

The voltage drops around any circuit always add up to the e.m.f of the supply. If the device is a resistor then the relationship between the voltage drop across it. Its resistance and its current was discovered by the German scientist Dr G.S. Ohm and stated in the law which bears his name.

Ohms Law

Under constant physical conditions the voltage drop across a resistor is directly proportional to its current and the formula is V=IR.

Where V = voltage drop across the resistor (volts)

I = resistor current (amps)

R = resistance of the resistor (ohms).

Example:

- What is the voltage drop across an earth continuity conductor of resistance I .2 ohm when its current is 25 amps.

$$V = IR$$

$$= 25x1.2$$

$$= 3OV$$

This formula can be transposed so that if the voltage drop is given as well as the resistance, the current can be calculated from I = V/R

Example:

- The resistance of an immersion heater is 20 ohms. What is the current it would draw from a 240-volt supply?

$$I = V/H$$

$$= 240/20$$

$$= 12A$$

Similarly, if the current and the voltage drop are known, the resistance can be calculated from R = V/I

Example:

- Calculate the resistance of a soldering iron element if it draws a current of O.SA from a 250 volt supply?

$$R = V/I$$

$$= 250/0.5$$

$$= 500\ \Omega$$