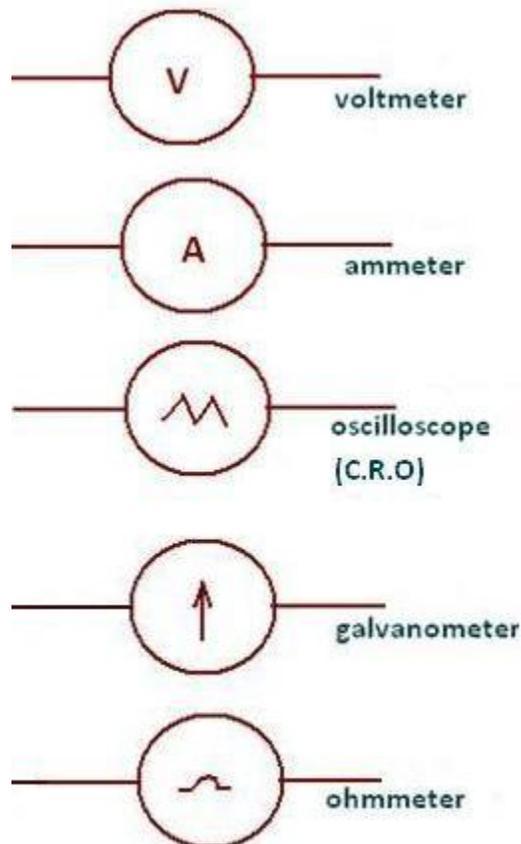


BASIC ELECTRONIC COMPONENTS - II

METERS

- ♣ A **voltmeter** is used to measure voltage.
- ♣ An **ammeter** is used to measure current.
- ♣ A galvanometer is a device used to detect whether current is flowing in a circuit or not.
- ♣ An **ohmmeter** is used to measure resistance. Most multimeters have an ohmmeter setting.
- ♣ An **oscilloscope** is used to display the shape of electrical signals and it can be used to measure their voltage and time period.

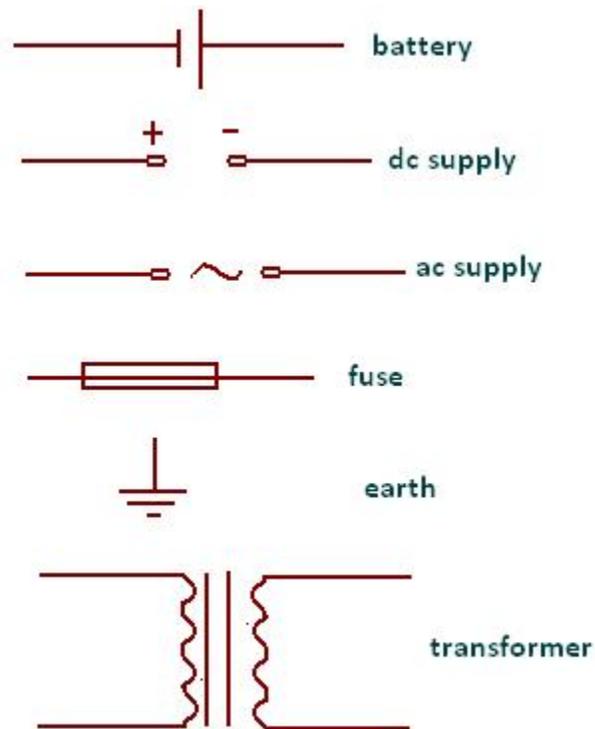


POWER SUPPLIES

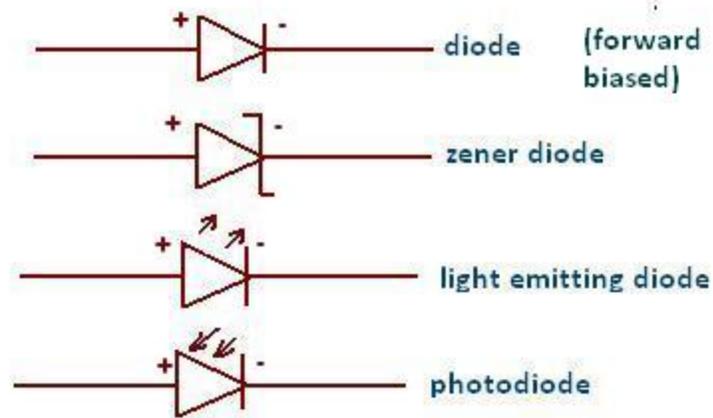
- ♣ Cells & batteries are used.

- ♣ Supply is provided directly from power line. It can be Alternative Current (AC) or Direct Current(DC).
- ♣ **Fuse:** A safety device which will 'blow' (melt) if the current flowing through it exceeds a specified value.
- ♣ **Ground:** A connection to earth. For electronic circuits this is the 0V (zero volt) of the power supply (but for mains electricity and some radio circuits it means '**earthing**').
- ♣ **Transformer:** Two coils of wire linked by an iron core. Transformers are used to step up (increase) and step down (decrease) AC voltages. Energy is transferred between the coils by the magnetic field in the core. There is no electrical connection present between the coils.

The circuit symbols are shown below.



DIODES



Diodes allow electricity to flow in only one direction. The arrow of the circuit symbol shows the direction in which the current can flow. Diodes are the electrical version of a 'valve' and early diodes were actually called valves.

- ♣ **Forward Voltage Drop:** Electricity uses up a little energy pushing its way through the diode like a person opening a door with a spring attached to it. This means that there is a small voltage across a conducting diode, it is called the forward voltage drop and is about 0.7V for all normal diodes which are made from silicon. The forward voltage drop of a diode is almost constant and is independent of the value of the the current passing through the diode so they have a very steep characteristic (current-voltage graph).
- ♣ **Reverse Voltage:** When a reverse voltage is applied a perfect diode does not conduct, but all real diodes leak a very tiny current of a few μAs or less. This can be ignored in most circuits because it will be very much smaller than the current flowing in the forward direction. However, all diodes have a maximum reverse voltage (usually 50V or more) and if this is exceeded the diode will fail and pass a large current in the reverse direction, this is called **breakdown**.

Ordinary diodes can be split into two types: **Signal diodes** which pass small currents of 100mA or less and **Rectifier diodes** which can pass large currents. In addition there are LEDs and Zener diodes.

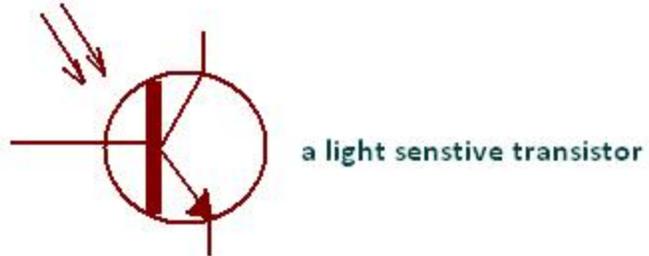
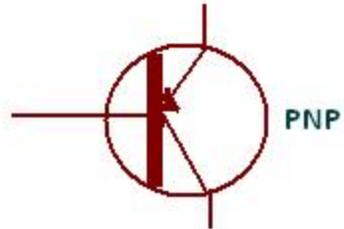
Zener diodes are used to maintain a fixed voltage. They are designed to operate in 'breakdown' region in a reliable and non-destructive way so that they can be used in reverse state to maintain

a fixed voltage across their terminals. A resistor is attached in series with zener diode to limit the current.

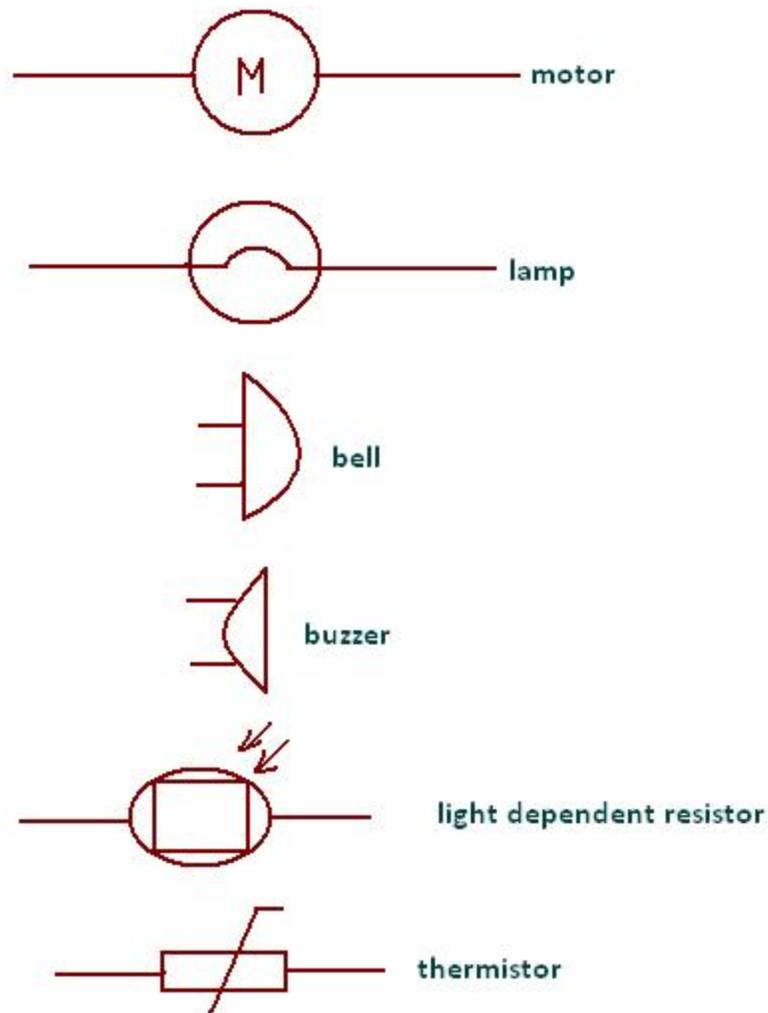
TRANSISTORS

- ♣ Transistors amplify current, for example they can be used to amplify the small output current from a logic IC so that it can operate a lamp, relay or other high current device. In many circuits a resistor is used to convert the changing current to a changing voltage, hence the transistor is used to amplify voltage.
- ♣ A transistor may be used as a switch (either fully on with maximum current, or fully off with no current) and as an amplifier (if it is always partly on i.e. some current is passing through it).
- ♣ The amount of current amplification is called the current gain, symbol h_{FE} .
- ♣ **Types:** There are two types of standard transistors, NPN and PNP, with different circuit symbols. The letters refer to the layers of semiconductor material used to make the transistor. Most transistors used today are NPN because this is the easiest type to make from silicon. The leads are labeled base (B), collector (C) and emitter (E). These terms refer to the internal operation of a transistor but they are not much help in understanding how a transistor is used, so just treat them as labels.
- ♣ **Additional Information-**> A Darlington pair is two transistors connected together to give a very high current gain. In addition to standard (bipolar junction) transistors, there are field-effect transistors which are usually referred to as FETs.
- ♣ **Connecting Transistors:** they have three leads which must be connected the correct way round. Please take care of this because a wrongly connected transistor may be damaged instantly when you switch it on.





OTHER CIRCUIT ELEMENTS



A transducer is a device which converts a signal from one form to another.

- ♣ An LDR is an **input transducer** (sensor) which converts brightness/intensity (light) to resistance. It is made from cadmium sulphide (CdS) and the resistance decreases as the brightness of light falling on the LDR increases.
- ♣ A **thermistor** is an input transducer (sensor) which converts temperature (heat) to resistance. Almost all thermistors have a negative temperature coefficient (NTC) which means their resistance decreases as their temperature increases. It is possible to make thermistors with a positive temperature coefficient (resistance increases as temperature increases) but these are rarely used. Always assume NTC if no information is given.

- ♣ **Buzzers:** These devices are output transducers converting electrical energy to sound. They contain an internal oscillator to produce the sound which is set at about 400Hz for buzzers and about 3kHz for beepers.



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