Investigating Electronics

PROTOTYPE BOARD

The board, which you will use for your investigations, is called a **PROTOTYPE BOARD**. Components are simply pressed into holes in the board which make a physical contact with an electrical conductive strip within the board. The strips have been drawn as lines in Fig.1 to show which holes are connected together. Lines B, C, D, E, F are joined vertically in strips of 5. Similarly lines G, H, I, J, and K.

Lines A and L are horizontal strips running the length of the board.

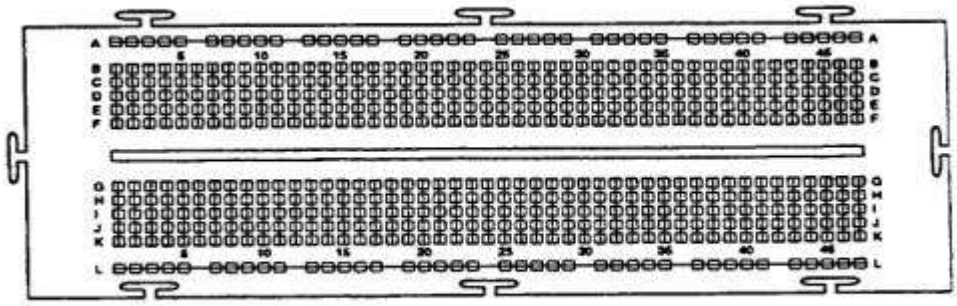
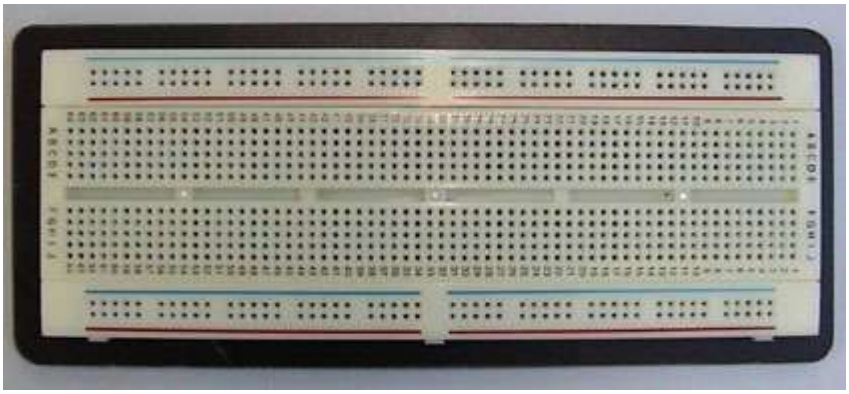


Fig. 1

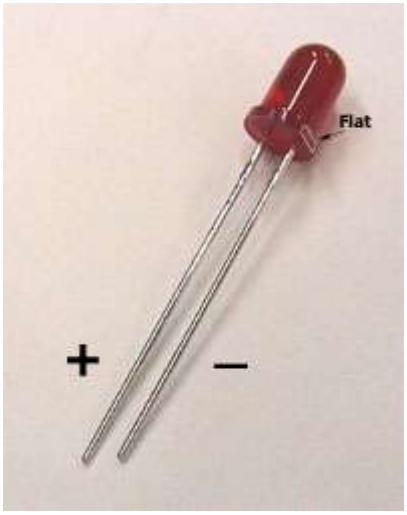
(BEWARE some boards have two lines at the top and two at the bottom with **breaks** in the middle)!



Prototype Board

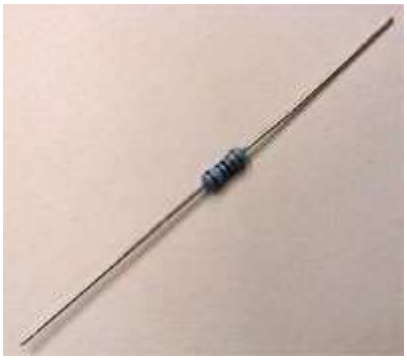
LIGHT EMITTING DIODES

The trouble with electricity is that you can never see it, you can only see its effects, e.g., a light bulb or a motor switched ON. This is where **LIGHT EMITTING DIODES** are useful. As the name indicates light emitting diodes give off light and are useful to tell if a circuit is working, or not as the case may be.



Light Emitting Diode

It is important that whenever you construct a circuit using a light emitting diode that you use a **RESISTOR** with it (see Fig. 3 below), unless that is, the LED has a resistor built in to it. RESISTORS restrict the flow of electric **CURRENT** and in this way protect components like an LED. Think of current as water flowing along a pipe, the greater the flow, the greater the current. Resistors behave as if someone is squeezing the pipe and restricting the flow of current.



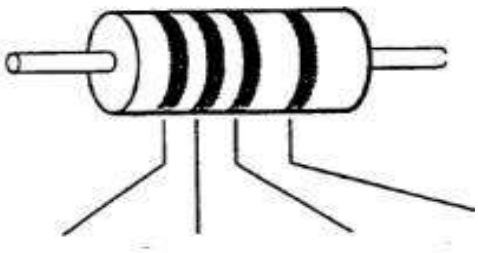
Resistor

RESISTANCE is measured in **OHMS** and electrical **CURRENT** is measured in **AMPS**. Whereas Ohms are usually measured in large

numbers (i.e., sometimes millions of Ohms known as megohms), electrical current is usually measured in small quantities (i.e., one thousandth of an Amp is known as a milliamp).

In order to know the value or size of a resistor, a **RESISTOR COLOUR CODE** is used. Around each resistor there are coloured bands which are read from left to right. Position the resistor such that the group of three or four bands at on end are on the left. In the case of a **FOUR** band resistor (as shown in Fig.2) the first band is the first digit, the second band is the second digit and the third band is the number of zeros. If you have **FIVE** band resistor (as in photograph of resistor above), then the first band is the first digit, the second band is the second digit, the third band is the third digit and the fourth band is the number of zeros. The band on its own to the right is known as the **TOLERANCE** band and tells you how accurate the resistance is.

Fig.2



Colour	Band 1	Band 2	Band 3	Tolerance
Black	0	0		
Brown	1	1	Xl0	
Red	2	2	X100	
Orange	3	3	X1,000	
Yellow	4	4	X10,000	
Green	5	5	X100,000	
Blue	6	6	X1,000,000	
Violet	7	7	X10,000,000	
Grey	8	8		
White	9	9		±10%
Silver				±5%
Gold				

Connect up the following circuit:-

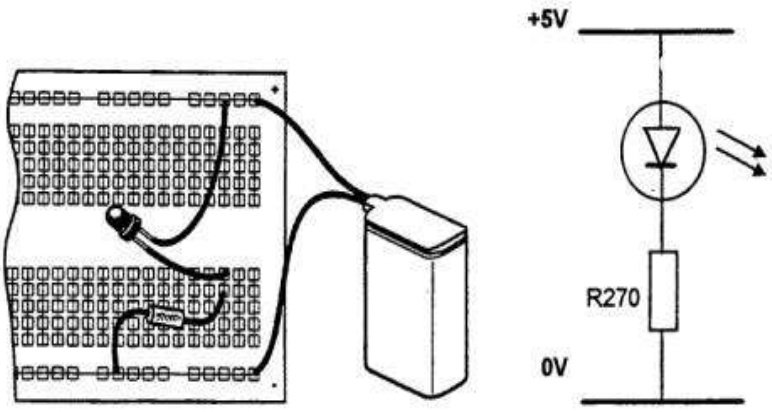
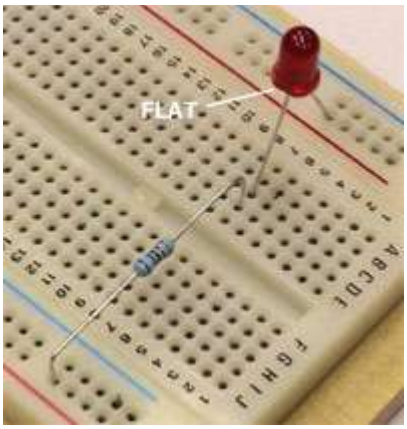


Fig.3



The drawing on the top right of Fig 3 is called a **CIRCUIT DIAGRAM**. Note the **SYMBOLS** for both an LED and a resistor. As these components follow one after the other they are said to be in **SERIES**. The two long horizontal lines represent what are called the **TOP** and **BOTTOM RAILS** respectively. You have to learn how to convert these circuit diagrams in to actual circuits, as shown on the top left of Fig.3 and in the photograph.

NB - Note the flat on the LED and the bar which the arrow is pointing too, in the symbol for an LED. They are one and the same. This will be very important when constructing circuits to make sure that the LED is in the correct position.

The junction between the diode and the resistor can be in the top half or the bottom half of the board. This does not matter as long as they are in the same vertical strip of 5 holes.

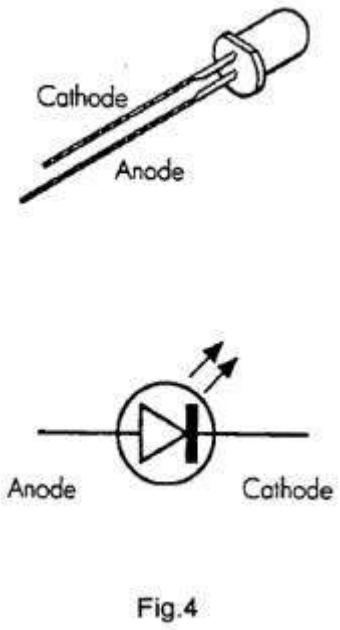


Fig.4

An LED can be thought of as a **ONE- WAY VALVE.** From your circuit you have constructed, can you see why? It only allows **CURRENT** to flow (i.e., work) when the longer leg known as the **ANODE** is towards the **POSITIVE** top rail and the **CATHODE** (notice flat on the red plastic case in Fig.4) is pointing towards the **NEGATIVE** bottom rail.

VARIABLE RESISTOR

The resistor you have used so far had a single value, e.g. 270 Ohms. This is known as a fixed resistor. With a **VARIABLE RESISTOR** you can alter resistance. The variable resistor in Fig.5 is adjusted using a small screwdriver in the slot in the wiper.

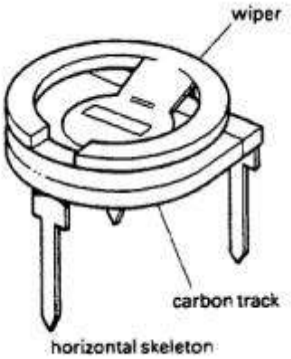


Fig.5

Add a variable resistor to your circuit as shown below in Fig.6. Use the leg on its as one connection and either one of the other two as the other.

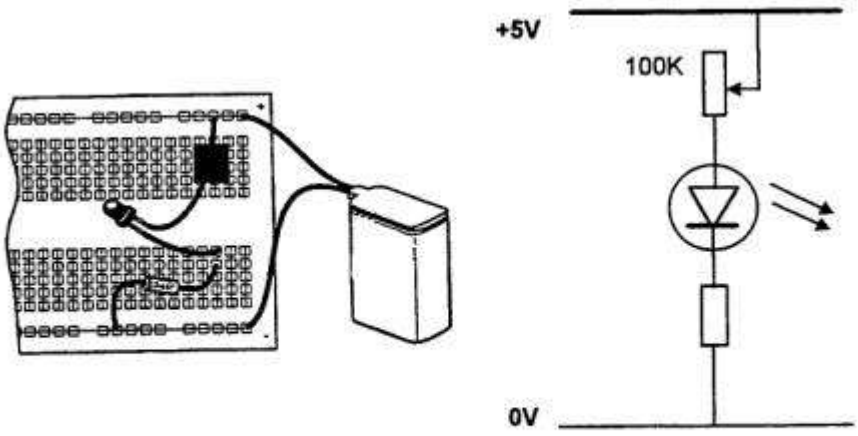
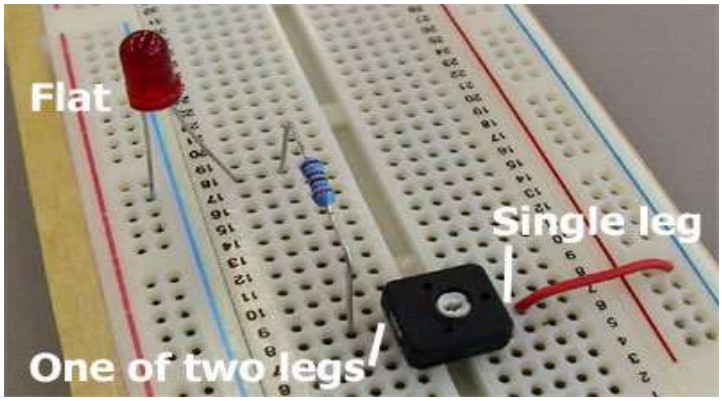


Fig.6



Place a small screwdriver in the slot on the top of the variable

resistor and turn it.

What happens to the LED?

A **RESISTOR** controls the amount of **CURRENT** flowing through it. It is this quantity of current, which drives the LED. If the current is insufficient, i.e., the resistance is to great and the LED WILL NOT LIGHT. Insufficient resistance and the LED will 'blow' (stop working and need to be thrown away). It is essential that a fixed resistor is always used in **SERIES** with the LED (unless as has already been said such a resistor is built into the LED). In so doing you will protect the life of the LED.

LED's IN SERIES

Construct the following circuit: -

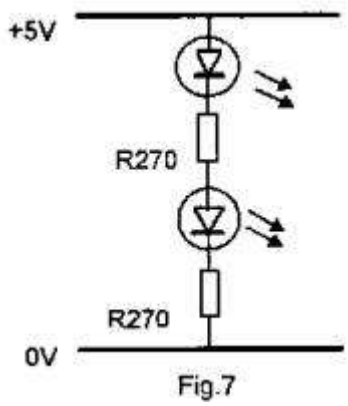
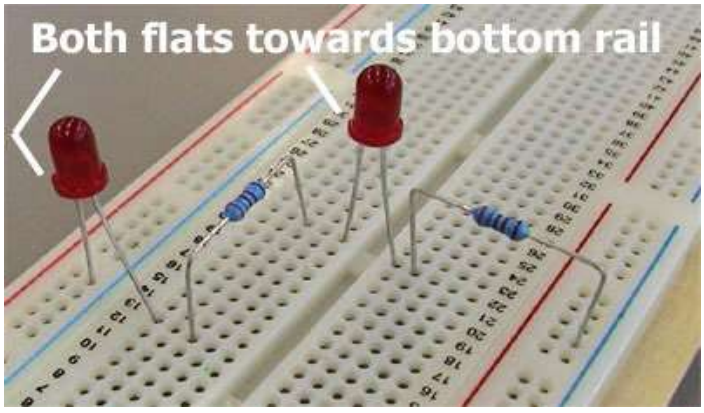


Fig.7



The LED's are said to be in **SERIES** i.e., they follow one after the other.

Notice that in the photograph how to use a strip of five holes to join the components together. Do not put both legs of the same component in the same strip of five vertical holes or else you will 'short circuit' the component, i.e., the electricity will NOT flow up and over the component (as there will be no potential difference across the legs).

Take out one LED. What happens to the other LED?

LED's IN PARALLEL

Construct the following circuit: -

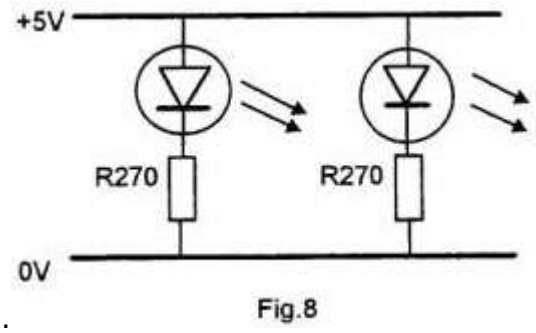
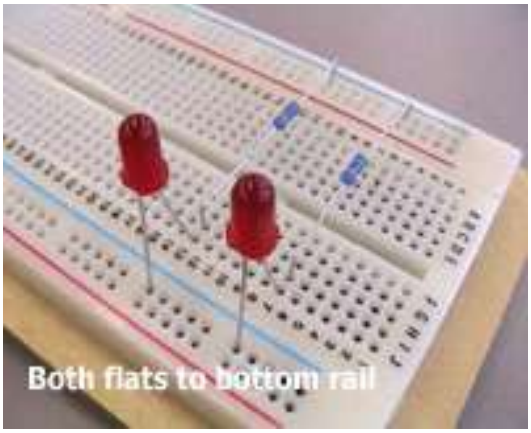


Fig.8



In this arrangement, the LED's each have their own power supply and are said to be in **PARALLEL.**