

# LED: LIGHT EMITTING DIODE



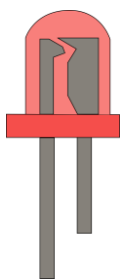
The [light-emitting diode](#) (LED) is an versatile piece of technology that has revolutionised the way we use lighting. LED light is a solid state light as there are no gases, no filaments and no moving parts to fatigue.

LEDs are mostly used for two things: **illumination** (shines light onto something) and **indication** (to point something out).

The LED was invented by Oleg Losev, James R. Biard, Nick Holonyak and were first produced in 1968.

The development of blue LEDs enabled bright and energy saving white light. It proved a challenge. The Nobel Prize in Physics in 2014 was awarded jointly to Isamu Akasaki, Hiroshi Amano & Shijo Nakamura for their work on the blue LED.

The energy emission of LEDs can be altered by utilizing materials with different band gaps. This produces different coloured LEDs which can be used in a wide range of applications.



LEDs have only two wires. One wire is the **anode** (positive) and another is the **cathode** (negative). LEDs only work in one direction. One goes to the positive voltage and the other goes to the negative voltage.

## Advantages of using LEDs

- LEDs produce no ultraviolet radiation and little heat so they can be used to display art work.
- LED lights consume less power than any other bulbs which leads to lower running cost. Achieving the same

light output, the power consumption of an LED is only 1/8 of that for the incandescent lamp, and 1/2 of that for the fluorescent lamp.

- The light source is small in size and can be combined for high power applications when needed.
- LED displays offer advantages such as high brightness, dynamic visual display, high reliability, low energy consumption, long service life, display content diversity, high durability, and low maintenance costs. LED display screens have been widely adapted in various fields.
- Lights up instantly, can be dimmed or strobed
- Difficult to damage & break as they are made with epoxy lenses not glass.
- They can actually be recycled as they do not contain hazardous substances and are manufactured without hazardous substances.

## Disadvantages of using LEDs

- In cold climates, LED arrays do not generate enough heat to keep themselves free of snow in the winter.
- Cost - In general, the brighter the LED the more expensive it is. LED light bulbs use a circuit board and incorporate electronic components.

## FURTHER INVESTIGATION:

🔍 Search for examples of the way LEDs are used. Divide into categories e.g. illumination/indication; applications – in the home, community, automotive. Record information in a meaningful way.

🔍 Research unusual uses for LEDs. Brainstorm how you could change an object to incorporate LEDs. Would this

object be improved by the use of LEDs? Make a hypothesis. Experiment.



## LED PROJECTS



Scorpio Technology has four kits using LEDs. The **Wind-up Torch** (WINDT) uses 3 bright LEDs. The most popular is the **LED Touch Lamp** (LEDTLK) which uses LED strips. It is turned on & off by touching a metal plate or part of the light.

The most innovative LED project is the **Single LED torch** which uses a Balun and wound enamelled copper wire to increase the voltage of a single AA battery to power a LED. (which requires 3.2V to operate). When it fits into an Eclipse Mints tin! *(Featured in our September 2015 newsletter)*

The **LED Touch Lamp** kit gives the student opportunities to design and create a lamp using a large range of materials and manufacturing methods.

Materials can be reused from other sources leading into investigation of renewable resources and other environmental issues.

When designing your LED Touch Lamp (or any project) we suggest students use Design Process steps.

## DESIGN BRIEF

- What is the problem? How did others solve the problem? What are the constraints?
- Brainstorm to create solutions for the problem. Choose the best idea.

- Plan your project by producing a number of sketches of different designs. Choose the best design. Produce detailed drawings and plans showing measurements, processes to be used, parts and materials required.
- Create the project. Test it out.
- Determine if changes need to be made. Modify design to improve aspects e.g. function, appearance. Test it out again.
- Repeat steps until project is completed.

## MANUFACTURE

Every lamp design will be different. The appearance will also be determined by the manufacturing method used. The kit allows students to use traditional hand tools as well as a 3D Printer or milling machine. Modern technology may not improve a design but it will make it different.

Level:	Intermediate kit
Type:	Electrical, Electronic, PCB
Scorpio Code:	<b>LEDTLK</b>
Cost:	\$25.50 ea
(NB: Check current price on website catalogue)	



Mary Lou Cook

## REFERENCES:

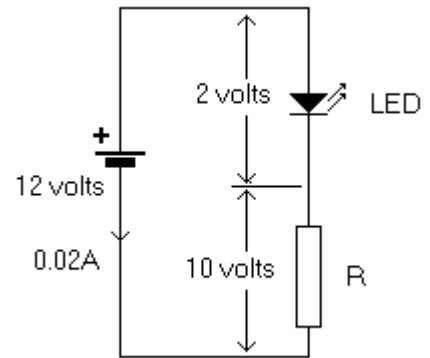
- <http://www.slideshare.net/rbelectronics/the-led-revolution>
- <http://rocketproduction.com/blog/nine-super-creative-uses-of-led-lights-to-get-you-thinking/>
- <http://www.slideshare.net/adtronics123/advantages-uses-of-led-lighting>
- <http://blog.energenie4u.co.uk/tech-gadgets/weird-and-wonderful-ways-to-use-led-lights/>
- <http://www.wisegeek.com/what-are-common-uses-of-led-technology.htm>



SCORPIO TECHNOLOGY Vic Pty Ltd  
17 Inverell Ave, Mt. Waverley Vic 3149  
[www.scorpiontechnology.com.au](http://www.scorpiontechnology.com.au)

## USING LED's

The light emitting diode (LED) is commonly used as an indicator. It can show when the power is on, act as a warning indicator, or be part of trendy jewellery etc. It needs to be fed from a DC supply, with the anode positive and the cathode negative, as shown in the diagram.



To calculate the value of the series resistor we need to know the diode forward voltage and current and its connections. The necessary data can be obtained from a catalogue or data book. In our example it is 2 volts and 20mA (0.02 amps). The cathode lead is the one nearest a "flat" on the body. Since the voltage across the diode is 2 volts and the battery voltage is 12 volts, then the voltage across the resistor is  $12 - 2 = 10$  volts.

The diode is in series with the resistor, so the current through then both is the same, 0.02 amps. We now know the voltage across, and the current through the resistor. From Ohm's Law we can now calculate the value of the resistor.

$$\text{Resistance} = \text{Volts divided by Amps} = V/I = 10/0.02 = 500 \text{ ohms.}$$

Since this is not a standard value you would use the next highest value resistor of 560 ohm, resistor as this application is not critical of values.

<p>Diagram of an LED showing identification methods: Flag, Flat, Short Leg, Cathode, and Anode.</p>	<p>Circuit symbol for an LED.</p>	<p><b>LIGHT EMITTING DIODE (LED)</b></p> <p>LED's are commonly used as indicators to show whether something is turned on or adjusted properly. The stereo light used on FM radios is an example of a LED being used show when the station is tuned properly.</p> <p>LED's use three methods to mark the negative lead.</p> <ol style="list-style-type: none"> <li>1. The FLAG (the larger of the connections inside the body). This can be seen when you hold the LED up to the light.</li> <li>2. The shortest leg.</li> <li>3. A flat on the ridge around the base of the LED.</li> </ol> <p><u>NOTE:</u> Not all LED's use methods 2 &amp; 3. All types use method 1.</p>
---	-----------------------------------	--