

**ZEPHYR**

*More Than Just Play*

# Blix™

## E-CIRCUITS SOUND



**LIGHT AND  
SOUND**



**SAFE AND  
INTUITIVE**



**SUPER  
BUZZER**



**EASY  
CONNECT**



AGE  
**6-14**

**12**  
EXPERIMENTS

**18**  
COMPONENTS

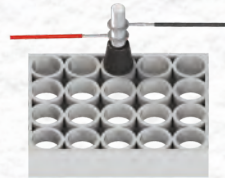
## How To Connect



Fix connecting tower  
on the baseboard



Slide loops of wires you  
want to connect



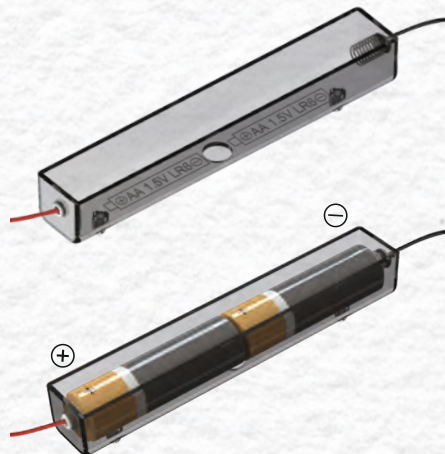
Connection  
completed!

## Useful Tips

- Most circuit problems are due to incorrect assembly, so always double check that your circuit exactly matches the diagram.
- Always connect the battery in the end, after you have connected all the other components properly and check all the connections before turning on a circuit. This ensures that no component is damaged if the circuit is accidentally connected in a wrong manner.

## Safety Guidelines

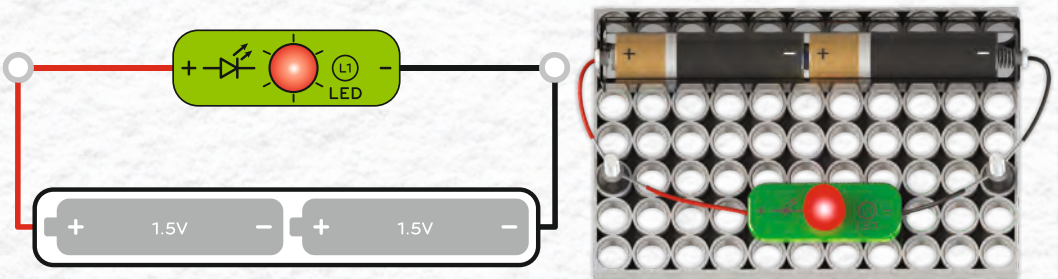
1. Do not mix old and new batteries.
2. Do not mix alkaline, standard (Carbon-Zinc) or rechargeable (Nickel-Cadmium) batteries.
3. Batteries are to be inserted by matching (+) and (-) polarity markings as shown in the image.
4. Non-rechargeable batteries are not to be charged.
5. Rechargeable batteries are to be removed before being charged.
6. Exhausted batteries are to be removed from kit.
7. The supply terminals are not to be short-circuited.
8. The kit is not intended for children under 6 years old.
9. Remove batteries before cleaning any part of the kit.
10. Never leave a circuit unattended while batteries are installed.
11. Never connect additional batteries or any other power sources to your circuits.



Add 2 x 1.5 V "AA" size batteries

## Let's Make Our First Circuit!

- Attach the LED, Battery Box (WITHOUT batteries) & Connecting Towers to the Base Board.
- Connect the Red wire of the battery to the Red wire of the LED with the help of the Connecting Towers. Do the same for the Black wire.
- Double check with this image and connect EXACTLY as shown:



- Now insert the Batteries in the Box as indicated in the image. See the LED light up?
- Congratulations! You have just made your first circuit!

### Did not work?

- Don't worry, it is common in electronics for things not to work because of tiny errors. Just check if all the wires are firmly connected & are connected as per the directions above. Also make sure the batteries are new and are inserted correctly in the box. Your circuit should work now!

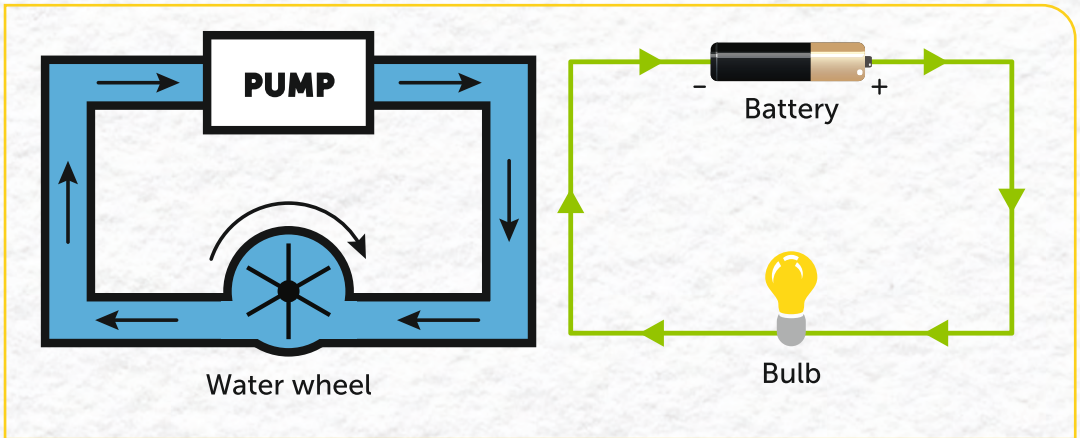
### Keep in mind!

- Remember all the steps that we followed here to make and check the circuit. These will be very helpful in making the other circuits in this book work quickly!
- Once you are confident and are able to make connections properly in the first go, you can connect the battery box with batteries from the start. But for the first few circuits, follow above steps to ensure no component gets damaged.

# What Is An Electric Circuit?

An electric circuit is like a path for electricity. A circuit is completed when two terminals ("+" & "-") of a battery are connected through a wire or any other conducting material. When this happens, the electricity starts flowing from "+" to "-" terminal of the battery.

You can think of the battery as a water pump and the wire like a water pipe. The battery pumps electricity into the wire from one terminal to the other.



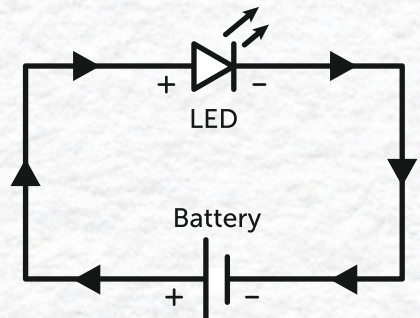
Thus battery is the "power source" that is required in every electric circuit. The components connected in the circuit make use of this power. For example a bulb glows by using power from the battery just in the same way as a water wheel will rotate by using the power of a water pump!

## Just remember this!

- If you want to check whether a circuit is complete or not, look for a continuous path from the '+' to the '-' terminal of a battery!

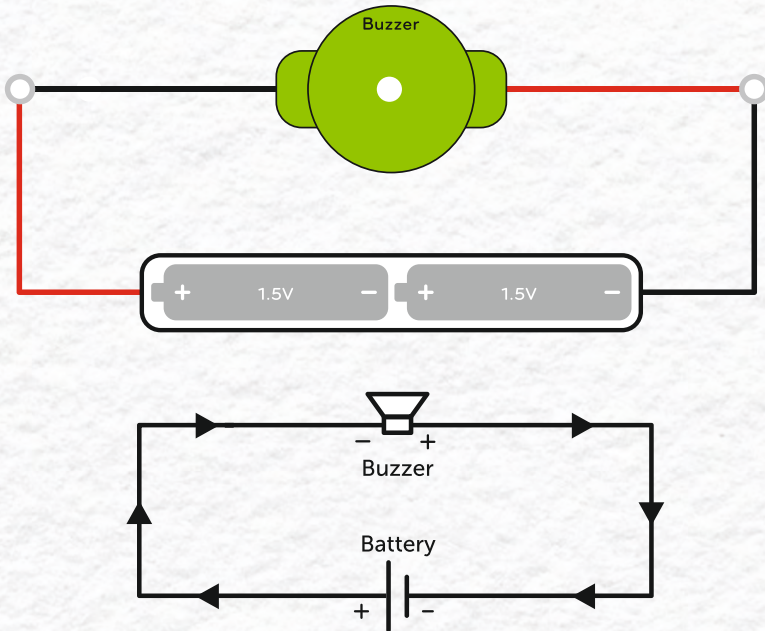
## Circuit Diagrams!

- Engineers use "Circuit Symbols" to represent circuits in a concise way. The diagrams made using these symbols are called "Circuit Diagrams".
- Can you identify the components from this diagram?
- Can you now relate the previous circuit to the water diagram and this circuit diagram?



## Buzzer In Reverse!

- Connect the Buzzer & Battery Box as shown here. Notice that the Buzzer is connected in an opposite way this time, with its black wire connected to battery's red wire and red wire connected to black!
- Then insert the batteries in the box.

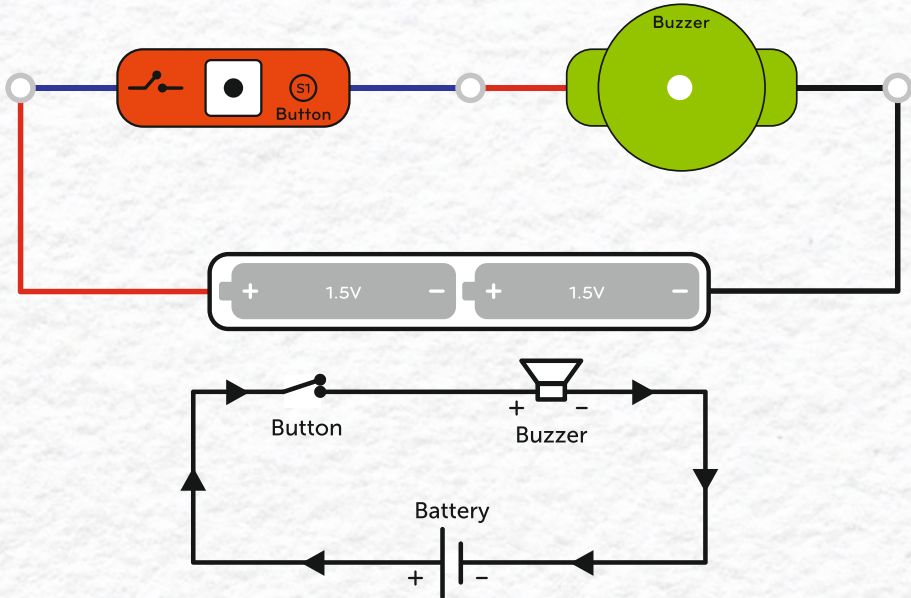


- Did the Buzzer beep this time? That's because Buzzer is a “polar” component!

## Red, Black & Blue!

- The + & - signs on the components (denoted by red & black wires) are actually referred to as “Polarities”. This means that the component is not uniform and will behave differently when connected in one way & differently in the other!
- So, when we connected the Buzzer in reverse, it did not beep, because it works only in the forward direction! The components with blue wires are non-polar and can work in any direction!

- Connect the Push Button Switch & Buzzer as shown.
- Then connect the battery.



- Press the Button to hear the buzz like a car horn. Tap it for some super fun!
- Did you figure out how the connections worked here to complete the circuit? How did the Button magically make & break the circuit?

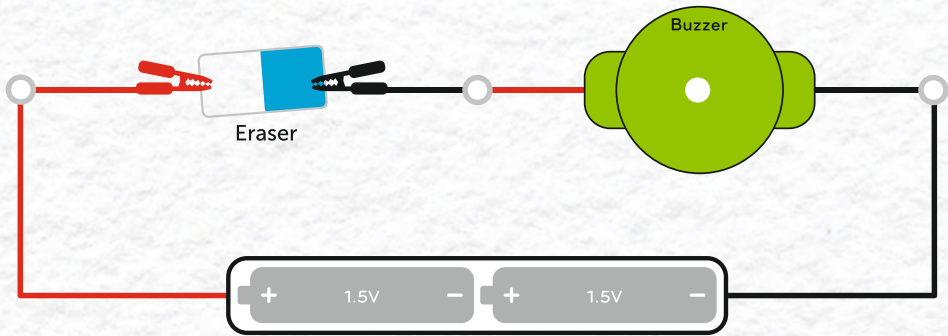
### Open & closed circuits

For a circuit to be complete there should be a continuous path for electricity from one battery terminal to the other. Even if one terminal is disconnected, the circuit will be incomplete and called an "Open Circuit". A completed circuit is called a "Closed Circuit".

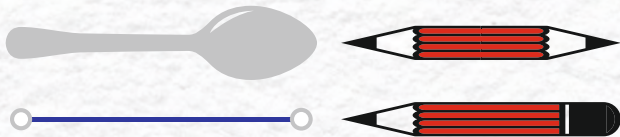
A Push Button Switch helps you open & close circuits with ease by connecting & disconnecting the terminals. Think of it just like a water tap!

## Conductor Tester

- Connect the Clip Wire and Buzzer as shown.
- Then connect the battery.
- Try connecting different things like spoons, erasers, pencils, pencil sharpened from both ends, wire, wire's outer covering etc. between the 2 clips.



Also try connecting these objects between the clips



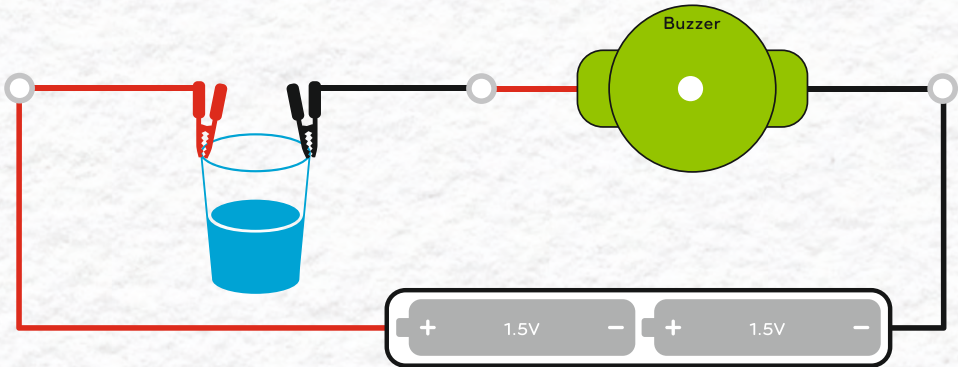
- What did you observe? Did the Buzzer beep for all the materials?

## Conductors & Insulators

- Conductors are materials that allow electricity to pass easily whereas Insulators don't. So, when you connected a conductor between the clips, the circuit got completed but for an insulator it remained open and so, the Buzzer didn't beep!
- In general, metals like iron, copper, gold etc. are conductors whereas non-metals like wood, rubber, plastic etc. are insulators.

## Water Overflow Alarm!

- Connect the Buzzer, Clip Wires and the Battery as shown.
- Now attach the Clips to a NON-METALLIC glass as shown.
- Slowly start pouring TAP WATER into the glass.



As soon as the water reaches the top, the Buzzer will beep, alerting that the glass is full. Your very own Water Overflow Alarm is ready!

But can you tell why this happens? This is because tap water generally contains a few minerals that allow small amounts of electricity to pass through. This means that when tap water comes in contact with the Clips, it “closes” the circuit and cause the Buzzer to beep!

Now you would have understood why one should not touch electric appliances or switches with wet hands, to prevent us from getting a shock!

Add some salt in the water to make it a better conductor & notice the volume of the buzzer.

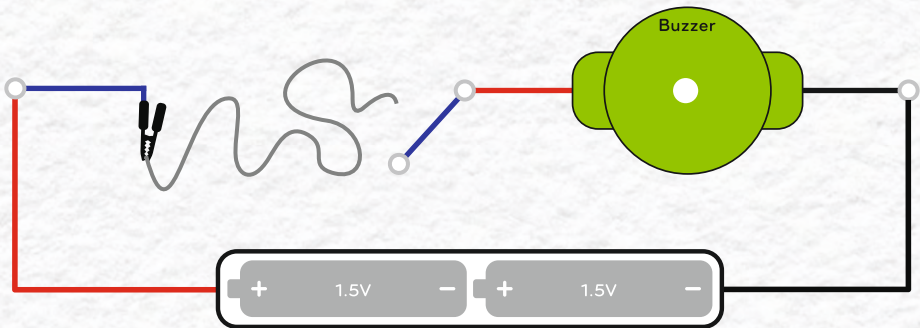
What would happen if we used RO filtered water instead of tap water?

What would happen if we used a metallic glass here?

## Twisted Wire Game!

Let's make a super-cool game using the concept of conductors & open-close circuits, that you can play with your friends at a party!

- Connect the Battery, Clip Wire, Jumper Wire and Buzzer as shown.
- Clamp one end of Electric Wire by the Clip and tape the Clip with Baseboard.
- Bend the Electric Wire in the shape of your choice such that it doesn't touch itself anywhere and its open end is accessible.

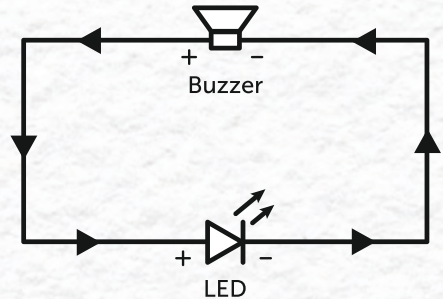
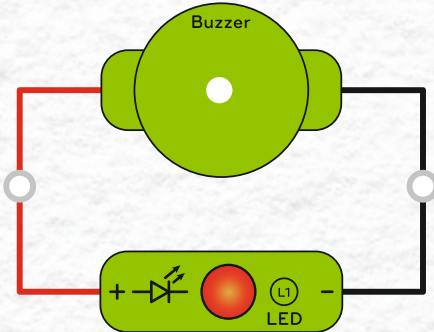


- Now it is time to challenge your friends! Ask them to start sliding the loop of the Jumper Wire from the open end of the Electric Wire till its other end.
- Now you know that if the loop of the Jumper Wire touches the Electric Wire at any point, it will close the circuit and the Buzzer will beep!
- The one who slides it till the end without touching the Electric Wire wins!

## Piezo-electricity



- This is a really magical project. We are NOT going to connect a battery and yet, the LED will glow!
- Connect the Buzzer & LED on your Baseboard as shown.



- Now tap on the Buzzer with a pen/pencil. Tap continuously as fast as you can.
- Did you see the LED turn on for some time? This is Piezo-Electricity in action!

## Piezo-electricity

Interestingly, Piezo Buzzers work in two ways. Just like they produce vibrations/pressure differences when electricity is passed, the vibrations made on the Buzzer can also in turn generate electricity! This phenomenon is known as "Piezo-Electricity".

Buzzer can generate very little electricity in this manner but a lot of research is going on to generate large amounts of electricity through similar technology by using the walking movement of people and the movement of cars!

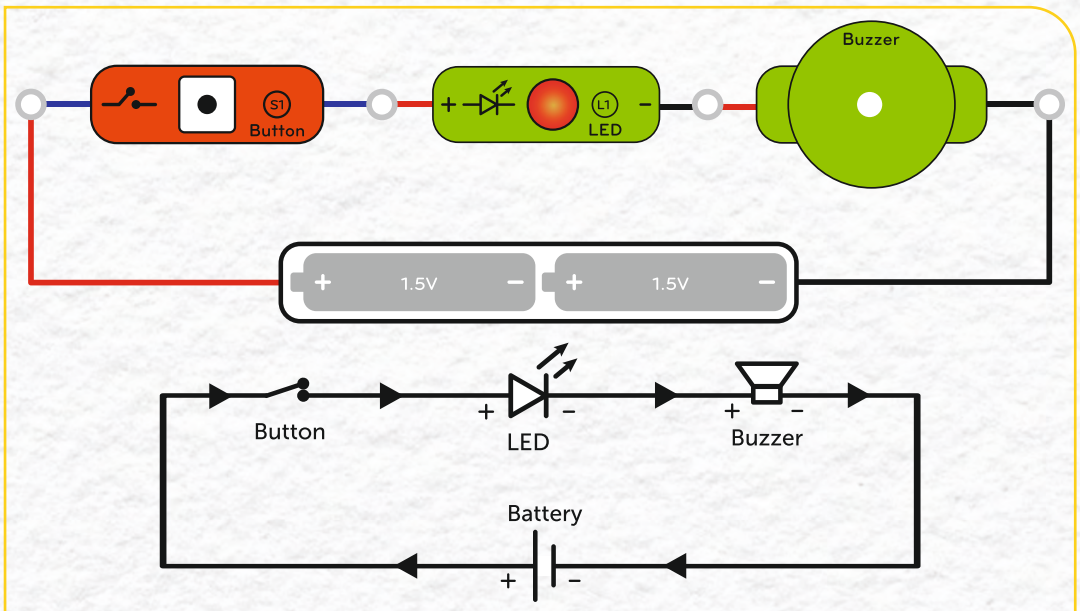
## Did you notice?

The connections of the buzzer were similar to that of a battery this time. The red wire of the buzzer was connected to the red wire of the LED and vice-versa for black. This is because the buzzer wasn't using electricity this time but instead producing it!

## The Party Doorbell!

Let's make a Doorbell that can alert you even if you're in a complete party mode!

- Connect the Push Button Switch, Buzzer and LED as shown.
- Now connect the Battery.
- Press the Button for super fun!



- Now this Doorbell will alert you not only by sound but also via light! So, even if you're not able to hear the sound due to loud music around you or in case you have earphones plugged-in, the light will still be able to alert you!
- You would have seen such doorbells in homes as well, where a bulb glows along with a ringing bell.
- Did you notice that we were able to control BOTH the LED & Buzzer with the same Button? That's because they were connected in "Series"!

### Series Connections

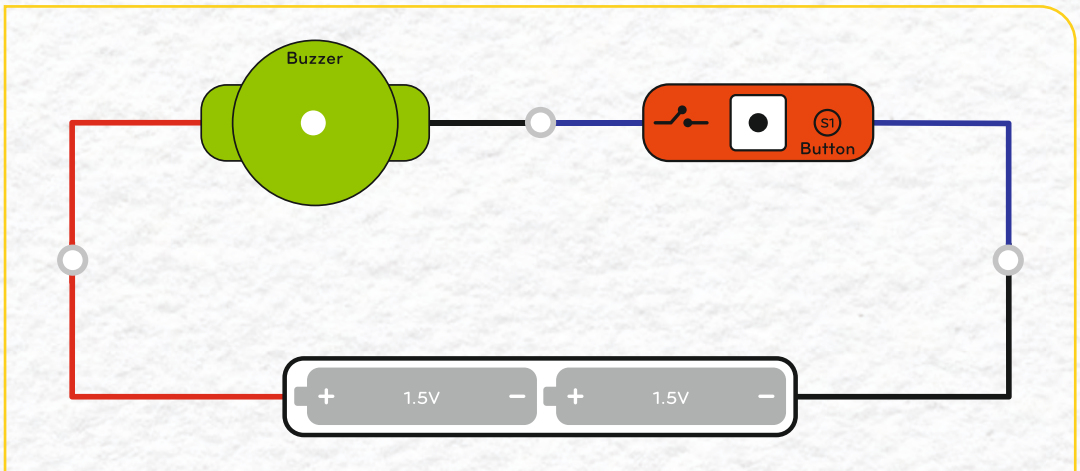
- In electronics, Series connection means that components are connected one after the other in a line such that electricity has only one path to flow. If any one component is removed, the circuit gets opened and no electricity can flow!
- So, when the Button is pressed, both the LED & Buzzer get powered because electricity has only one path and that path is controlled by the Button!

Morse Codes are a very popular signalling technique and were used to send messages through a Telegraph. Besides this technique is also widely used when sending emergency messages like SOS through flash lights or big horns. They are also used by spies to send secret messages!

The messages are sent in the form of "dots" & "dashes". For example, the emergency message, SOS (Save Our Souls) would be written in Morse Codes as: ... --- ... where "." can be represented by turning light/sound ON for a short amount of time, "-" can be represented by turning light/sound ON for a long amount of time and the white spaces mean silence/pause.

Now let's play a small Morse Code Game!

- Connect the Button, Buzzer & Battery as shown.



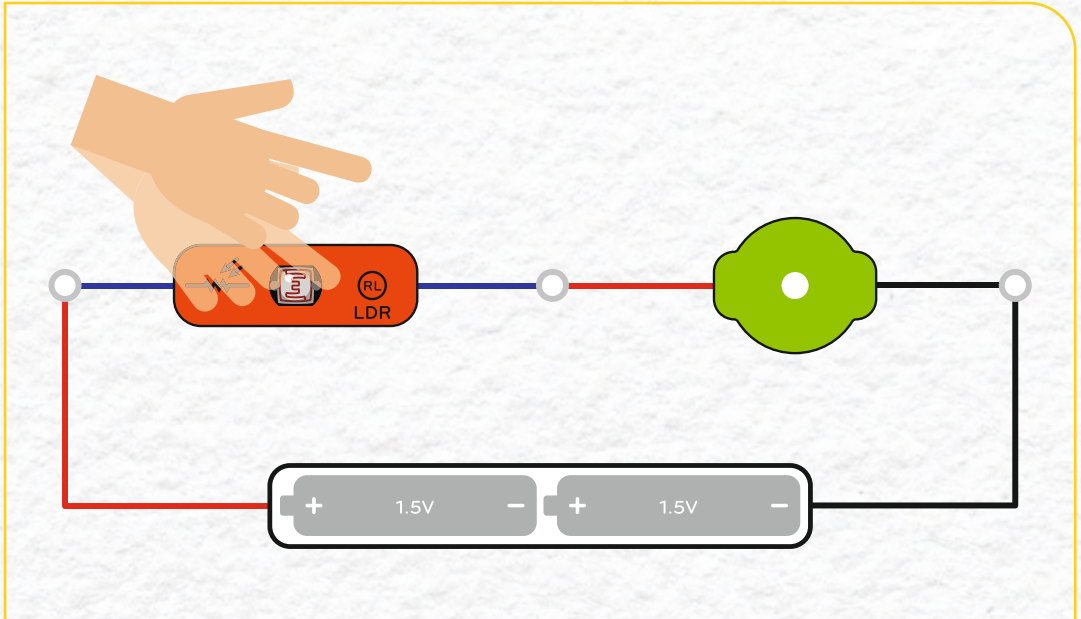
A ·—	G —·	M —	S ...	Y —·—	4 ....—
B —...	H ....	N —·	T —	Z —··	5 .....
C —·—	I ..	O —	U ..—	0 ———	6 —···
D —·	J ·—	P ·—·	V ···	1 ·—	7 —···
E ·	K —·	Q —·—	W ·—	2 ···—	8 —··
F ··—	L ···	R ··	X —··	3 ...—	9 ———

Use the above chart to code & decode your message.

- Here you will send the Morse Coded messages using the Button and your friend will decode them by listening to the Buzzer beeps.
- Refer to the codes for each character from the table. Remember "·" means a short beep and "—" means a long beep!

## Light Theremin!

- Make sure that you are in a well lit up place. Avoid a dark room for this project.
- Connect the LDR, Buzzer & Battery as shown.
- Now try to block the light falling on the LDR by moving your hand near to it. Then move your hand away from the LDR. Hear the volume change?



- Move your hand from one side of the LDR to the other very fast and also go on changing the distance from the LDR as shown. Do you hear crazy sounds?
- A Theremin is exactly such an instrument that's played by waving hands in the air! You just made your own Light Theremin!
- But how did this awesome phenomenon happen? All thanks to the LDR!

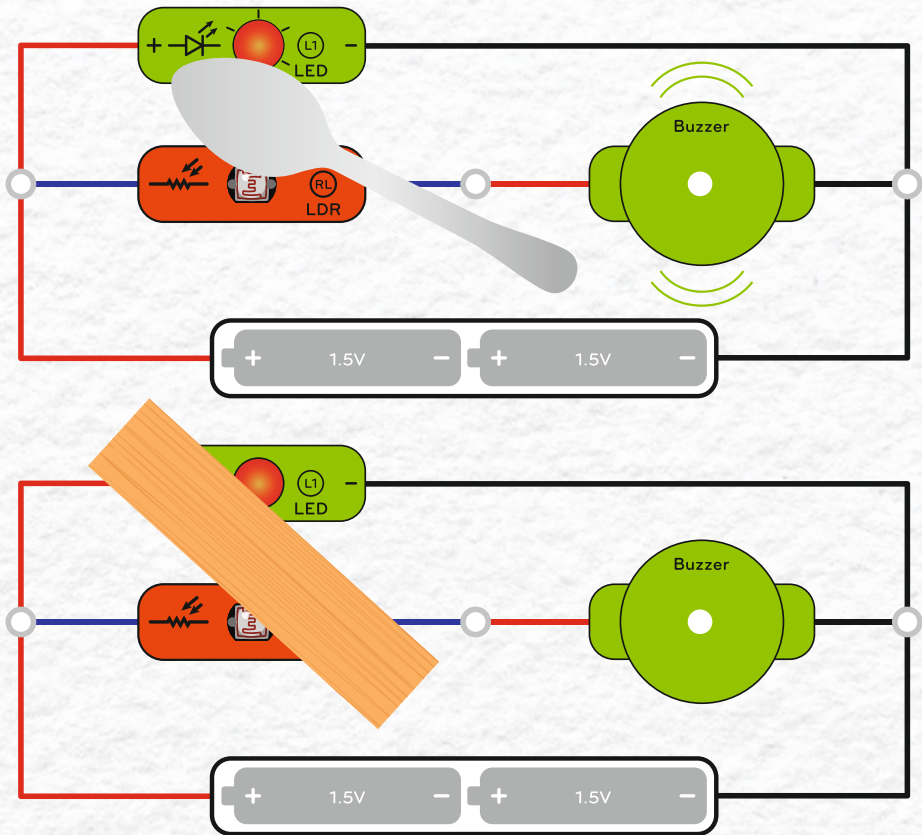
## Light Dependent Resistor

Yes, that's LDR's full name! As the name suggests, it's a component which "resists" electricity based on the light that falls onto it! If more light falls on it, its resistance goes down and if it's dark around, its resistance goes up! That's why, when you blocked light, LDR reduced the electricity flowing into the Buzzer by resisting it more, thus making it sound feeble!

LDRs are used widely as light sensors in applications like automated street lights, automatic car headlights, mobile phone's light sensor etc.

## Reflection Detector

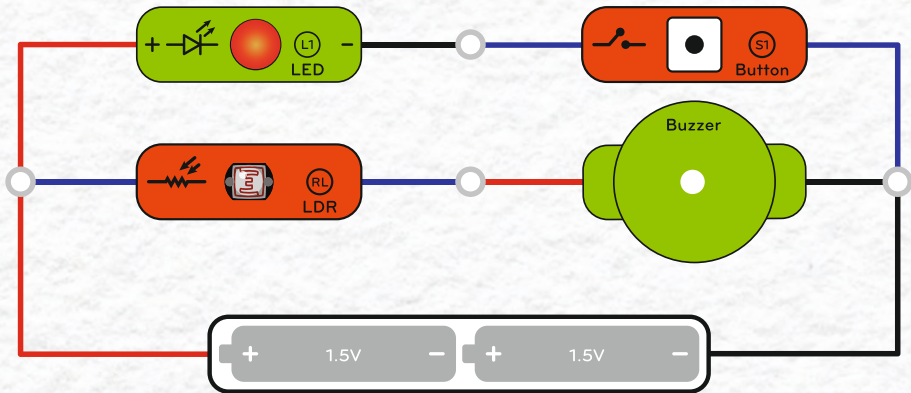
- Connect the LED, Button, LDR, Buzzer & Battery and place them as shown.
- Move to a slightly dark area before running this circuit.
- Tap the Button and you'll see that as the LED blinks, the Buzzer also beeps!



- Does it beep when you bring a non-shiny object like wood, plastic or cloth near the pair?
- When light from the LED reflects and falls on the LDR, it triggers the connected Buzzer similar to the Light Theremin. So, if light falls on the LDR, the Buzzer will beep else it will not!
- This same concept is used in a phone's proximity sensor, coin slot machines & people counting sensors, where one needs to detect whether any object has passed through a particular point or not!

## Optical Communication

- Connect the LED, Button, LDR, Buzzer & Battery and place them as shown.
- Move to a slightly dark area before running this circuit.
- Tap the Button and you'll see that as the LED blinks, the Buzzer also beeps!



But the Button isn't connected to the Buzzer. So how does this happen? Button controls the LED and when the LED's light falls on the LDR, the buzzer beeps! This is Optical Communication! You are sending data in form of light pulses!

## Optical Communication

Today, a lot of digital communication, especially the internet communication, happens optically through the Optical Fibre Cables and Laser lights. The Lasers send out streams of data in form of 1s & 0s by blinking On & Off. The receiver has sensors, similar to an LDR that sense the pulses of light and convert them back to data. TV remote controls also transmit data by blinking Infrared LEDs!

Humans also wink to communicate optically sometimes ;-)

## Thank You!

Hope you enjoyed playing and learning with this kit. We bet that you'll be able to see things differently now and understand how they work. You should definitely try to break open old gadgets & toys and learn more about them. Also, try searching the internet and learn more about the concepts or projects that appeal to you the most! Keep making your own cool projects with this kit!



**E - CIRCUITS**  
**SO-UND**



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