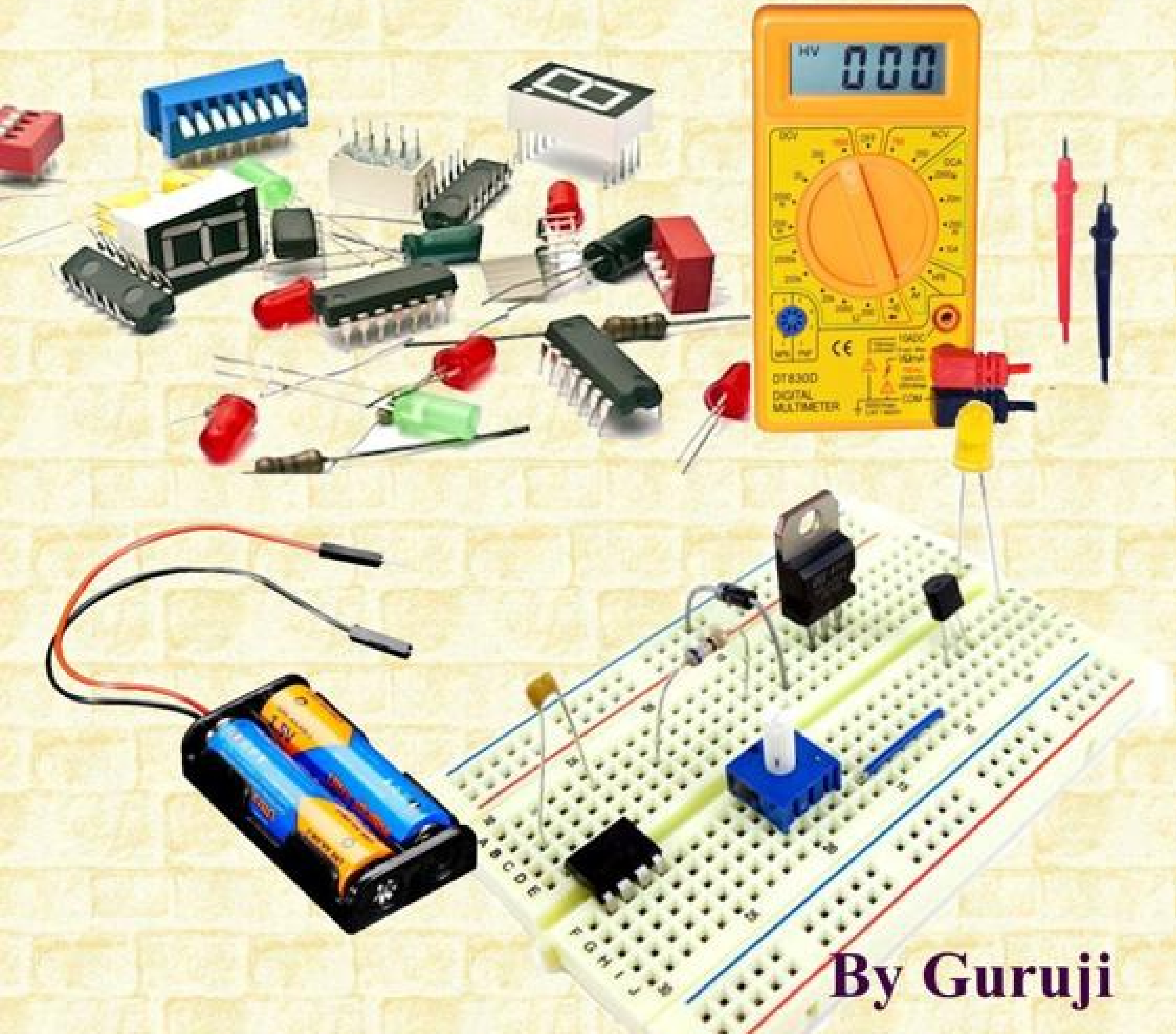
Infrared Sensor Using Opamp IC LM324



By Guruji

Mini Electronic Projects Series

Infrared Sensor Using Opamp IC LM324

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About this book

The Mini Electronics Projects Series – This series helpful to build projects, learn electronic circuits, and to understand their real-world applications.

This eBook guides you to build the 'Infrared Sensor Using Opamp IC LM324'.

The eBook is a great price offer to you and this eBook provides a practical hands-on learning experience to the engineers, technicians, students, and hobbyists who are curious and eager to learn and make an electronic project on their own. The project in the eBook explains all the project relevant topics in a simple and in a descriptive manner for you. In addition, lots of electronic project-building stuff included in this eBook which makes it easier for you to build an electronic project.

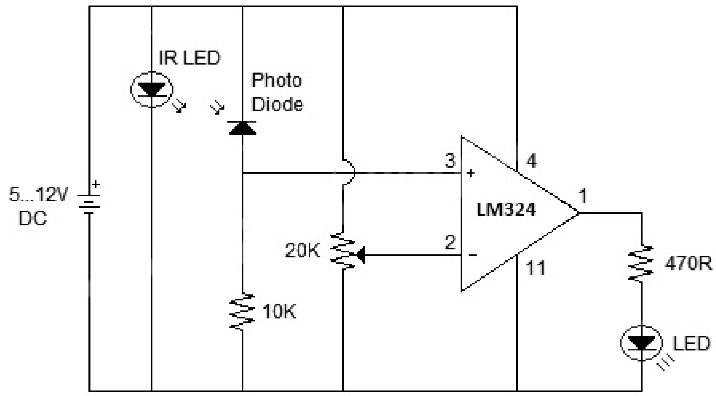
By building these electronics projects boost your skills and analytic power rapidly to a great level and has been used in thousands of applications and is extremely popular.

This eBook includes circuit diagrams, circuit description, parts list, actual photos of electronic components, their pin configurations and polarity, color codes of components, and component's value conversion tables.

BONUS: To support your project building work and to boost your knowledge, bonus materials such as understanding circuit diagrams, the anatomy of the breadboard, how a breadboard and circuit work, and practice circuits on a breadboard with actual photos and detailed explanation also included.

Contents

1. Circuit Diagram



2. Circuit Explanation

The circuit will show visual indication by activated an LED when an object is placed in front of the IR LED and photodiode. IR sensors (Infrared sensors) are used in many electronic devices nowadays, like on TV, DVDs, and many other appliances. Apart from these appliances they are also used in movement detectors, IR sensing water taps, hand dryers, robots, vehicles, etc.

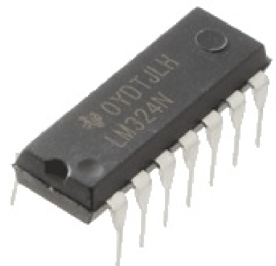
Every IR sensor is consisting of three main things in its circuit, which are IR transmitting LED, Photodiode to receive the IR signal, and the signal amplification circuit. The circuit can be used as an obstacle detector by placing both the IR transmitter LED and photodiode side by side. When an obstacle comes in front of them the IR rays reflect through that obstacle and received by the photodiode due to which the output 1 of the LM324 goes high and the LED will become activated.

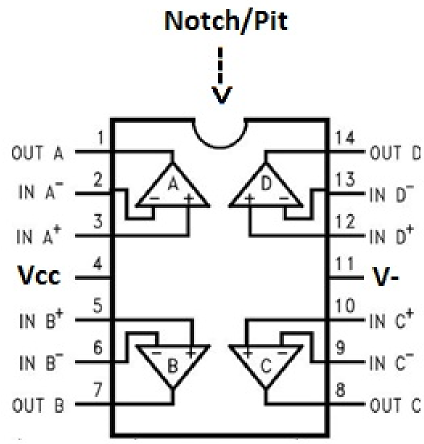
IR sensors actually consist of an infrared transmitter LED and a photodiode and the IR LED continuously emits the infrared signals that can be detected by the photodiode. There are two procedures from which the infrared signals can be detected one is directly or in front of each other and the second is by reflection.

3. Parts

1x Photodiode
1x IR (Infrared) LED
1x Red LED (lIght Emitting Diode)
1x IC LM324, quad opamp
1x POT (Potentiometer) 20k
1x Resistor 470E (yellow violet brown gold) 5% tolerance, 1/4 Watt
1x Resistor 10k (brown black orange gold) 5% tolerance, 1/4 Watt
1x DC power supply/battery any voltage between 5 Volts to 12 Volts

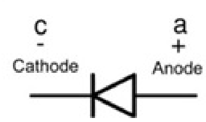
4. Pin Configurations

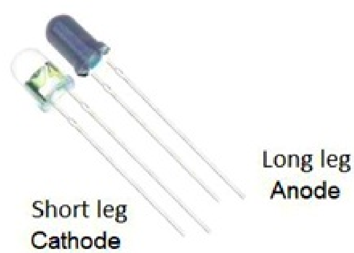




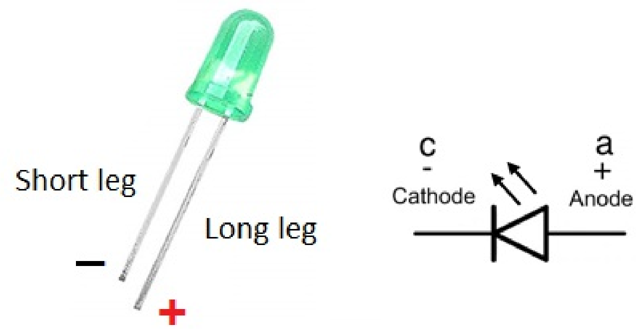
LM324 Quad Opamp

Infrared Diode

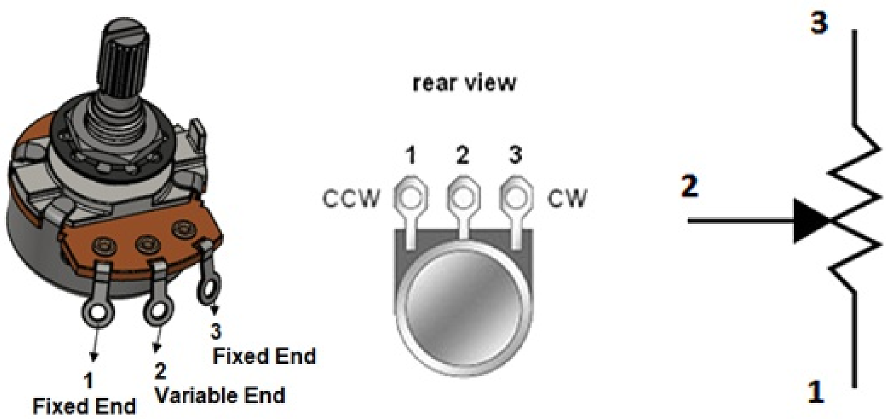




IR (Infrared) Transmitter LED
IR (Infrared) Receiver Diode



Light Emitting Diode (LED)



Potentiometer (POT)

Bonus

A. Understanding Circuit/Schematic Diagrams

Name Designators and Values

One of the biggest keys to being schematic-literate is being able to recognize which components are which. The component symbols tell half the story, but each symbol should be paired with both a name and value to complete it.

Names and Values

The electrical and electronic component's values help us to define exactly which type of a component is. For schematic components like resistors, capacitors, and inductors the value tells us how many ohms, farads, or henries they have. For other components, like integrated circuits, the value may just be the name of the chip. The crystal oscillator component value printed on their body the oscillating frequency as their component values. Basically, the value of a component in a schematic diagram calls out its most important characteristic.

The component name is usually a combination of one or more letters and followed by a number. The letter part of the name identifies the type of component -- R's for resistors, C's for capacitors, U's for integrated circuits, etc. Each component name on a schematic should be unique; if you have multiple resistors in a circuit, for example, they should be named R1, R2, R3, etc. The component's name helps us to refer to a specific point in the schematic diagram.

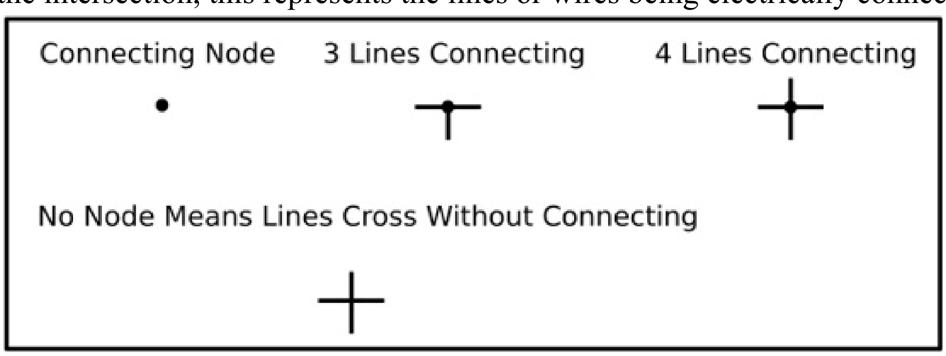
The prefixes of the component names are globally standardized and following by global component manufacturers. For some components, such as resistors and capacitors the prefix is just the first letter of the component. The other name prefixes are not so literal; inductors, for example, are L's (because the current has already taken. Here's a quick table of common components and their name prefixes:

Name Identifier	Component
R	Resistors
C	Capacitors
L	Inductors
S	Switches
D	Diodes
Q	Transistors
U	Integrated Circuits
Y	Crystals and Oscillators

Although these are the "standardized" names for component symbols, they're not universally followed for many reasons. You might see integrated circuits prefixed with IC instead of U, for example, or crystals labeled as 'xtals' instead of Y's. It is better to use your judgment in identifying which component is which. The symbol of the component should usually convey enough information to users.

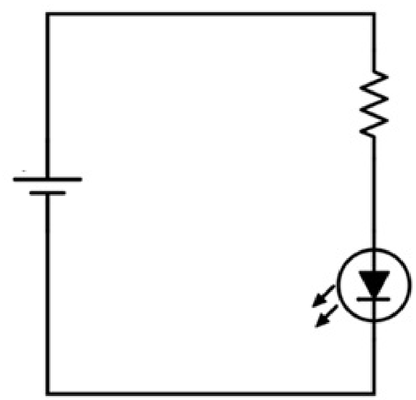
Circuit Diagram Connections

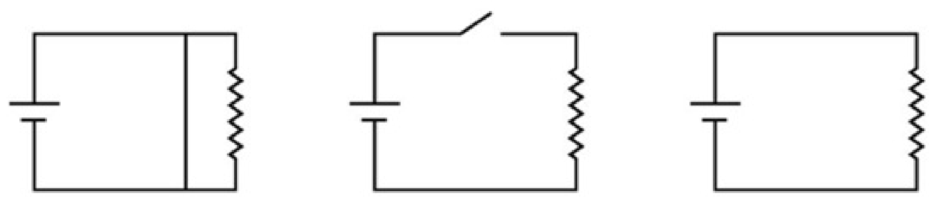
Circuit diagrams or schematic diagrams show electrical connections of wires or conductors by using a node as shown in the image below. A node is simply a filled circle or dot in a schematic diagram. When three or more lines touch each other or cross each other and a node is placed at the intersection, this represents the lines or wires being electrically connected at that point.



If wires or lines cross each other and there is no node, as shown at the bottom of the above image, the wires are not electrically connected. In this case, the wires are crossing each other without connecting like two insulated wires placed one on top of the other.

Example Circuit Diagram





Short circuit Open circuit Closed circuit

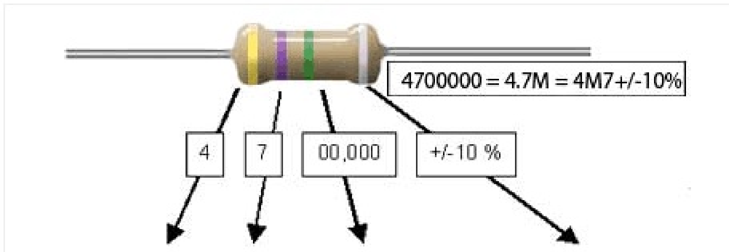
Some Circuit Diagram Rules

The following is general circuit diagram rules:

- Wires or lines in circuit diagrams are usually horizontal or vertical. In some cases, a diagonal line may be used which is placed at 45 degrees.
- Component symbols in a circuit diagram are usually placed horizontally or vertically. On is very rare occasions a component may be placed at 45 degrees, but only for a very good reason.
- Circuit diagrams are drawn as simply and neatly as possible. This means that the physical implementation of the circuit may look different from the circuit diagram, but they are electrically the same.
- Lines connecting components can be thought of as insulated wires in most cases, with only the ends of the wires being bare conductors for electrical connection.
- When lines cross each other in a circuit diagram, they can be thought of as two insulated wires crossing if there is no node where the wires intersect or cross each other.
- Three lines intersecting at a point with a node at the intersection means that the three wires are electrically connected. This connection can be thought of as three insulated wires bared at the point of intersection and soldered together.
- Two wires that cross each other with a node at the intersection of the crossing point means that the wires are electrically connected.

B. Resistor Colour Code

Resistor Colour Code



Band	1	2	3	4
Meaning	1^{st} Digit	2^{nd} Digit	(No. of zeros)	Tolerance % (No band +/- 20%)
Silver			.00 (divide by 100)	+/-10%
Gold			.0 (divide by 10)	+/-5%
Black	0	0	No Zeros	
Brown	1	1	0	+/-1%
Red	2	2	00	+/-2%
Orange	3	3	,000	
Yellow	4	4	0,000	
Green	5	5	00,000	+/-0.5%
Blue	6	6	,000,000	+/-0.25%
Violet	7	7	0,000,000	+/-0.1%
Grey	8	8		+/-0.05%
White	9	9		

C. Capacitor Conversion Table

Capacitor Conversion Table

Microfarads (uF)	Nanofarads (nF)	Picofarads (pF)
0.000001	0.001	1
0.00001	0.01	10
0.0001	0.1	100
0.001	1	1000
0.01	10	10000
0.1	100	100000
1	1000	1000000
10	10000	10000000
100	100000	100000000

Some Examples of Capacitor Letter Codes

Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
10	0.01	0.00001	100
15	0.015	0.000015	150
22	0.022	0.000022	220
33	0.033	0.000033	330
47	0.047	0.000047	470
100	0.1	0.0001	101

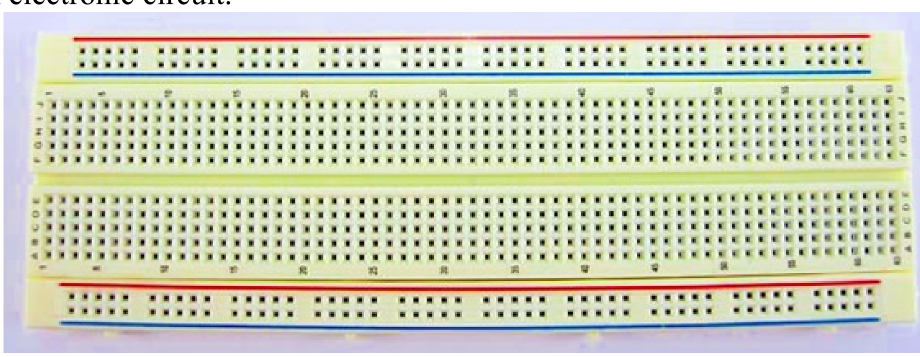
Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
4700	4.7	0.0047	472
5000	5.0	0.005	502
5600	5.6	0.0056	562
6800	6.8	0.0068	682
10000	10	0.01	103
15000	15	0.015	153

Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
220	0.22	0.00022	221
330	0.33	0.00033	331
470	0.47	0.00047	471
560	0.56	0.00056	561
680	0.68	0.00068	681
750	0.75	0.00075	751

Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
100000	100	0.1	104
150000	150	0.15	154
200000	200	0.2	254
220000	220	0.22	224
330000	330	0.33	334
470000	470	0.47	474

D. Anatomy of Breadboard

A breadboard is a rectangular plastic board with a bunch of tiny holes made in it. These holes let you easily insert electronic components to prototype (meaning to build and test an early version of) an electronic circuit.



The connections are not permanent, so it is easy to remove a component if you make a mistake, or just start over and do a new project. This makes breadboards great for beginners who are new to electronics.

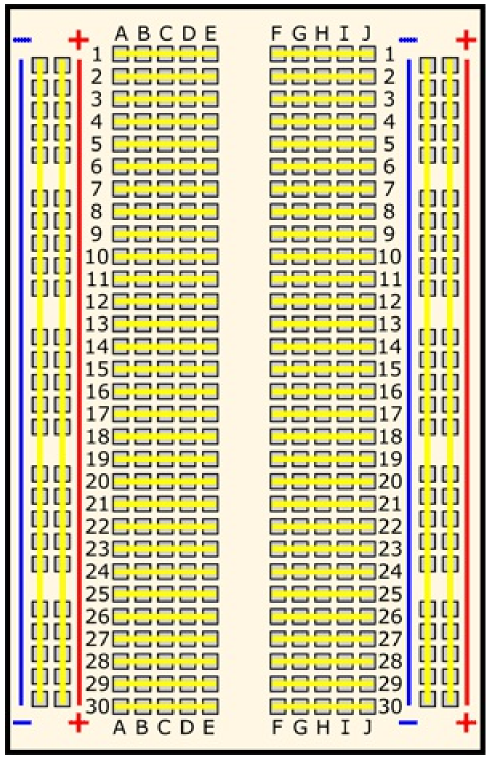
Inside a breadboard

The leads can fit into the breadboard because the inside of a breadboard is made up of rows of tiny metal clips. This is what the clips look like when they are removed from a breadboard.

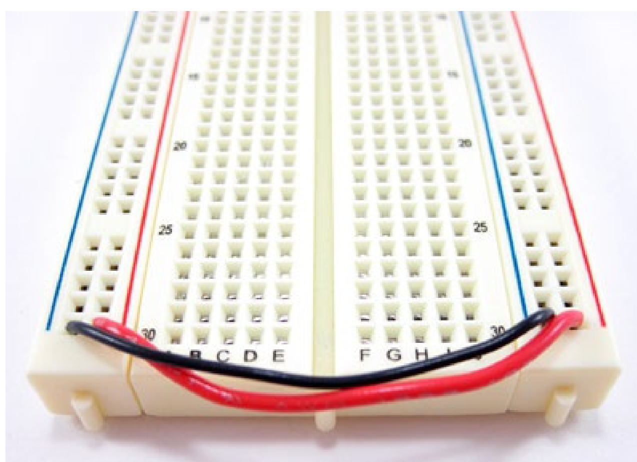
A row of five breadboard spring clips
When you press a component's lead into a breadboard hole, one of these clips grabs onto it.

How are the holes connected?

Remember that the inside of the breadboard is made up of sets of five metal clips. This means that each set of five holes forming a half-row (columns A–E or columns F–J) is electrically connected. For example, that means hole A1 is electrically connected to holes B1, C1, D1, and E1. It is not connected to hole A2, because that hole is in a different row, with a separate set of metal clips. It is also not connected to holes F1, G1, H1, I1, or J1, because they are on the other "half" of the breadboard—the clips are not connected across the gap in the middle (to learn about the gap in the middle of the breadboard, see the Advanced section). Unlike all the main breadboard rows, which are connected in sets of five holes, the buses typically run the entire length of the breadboard (but there are some exceptions). This image shows which holes are electrically connected in a typical half-sized breadboard, highlighted in yellow lines.



Buses on opposite sides of the breadboard are not connected to each other. Typically, to make power and ground available on both sides of the breadboard, you would connect the buses with jumper wires, like this. Make sure to connect positive to positive and negative to negative (see the section on buses if you need a reminder about which color is which).



E. Practice Circuit on a Breadboard

This tutorial shows you how to build a very simple circuit which lights up a single Light Emitting Diode (LED).

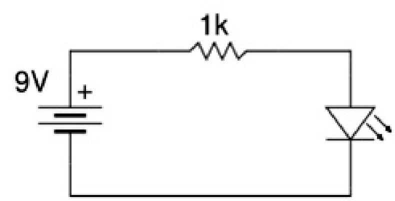
You will learn:

- About resistors
- About LEDs

- How to read a circuit diagram
- How to build a circuit on breadboard

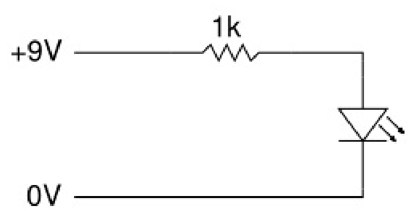
Parts Required:
- 1x Resistor 1k (brown black red gold)
- 1x LED (Light Emitting Diode)
- 1x Breadboard
- Few breadboard connecting/link wires
- 1x 9V Battery
- 1x battery snap/link for 9V battery

Reading the Circuit Diagram
The circuit diagram (also known as a schematic diagram) is shown below:

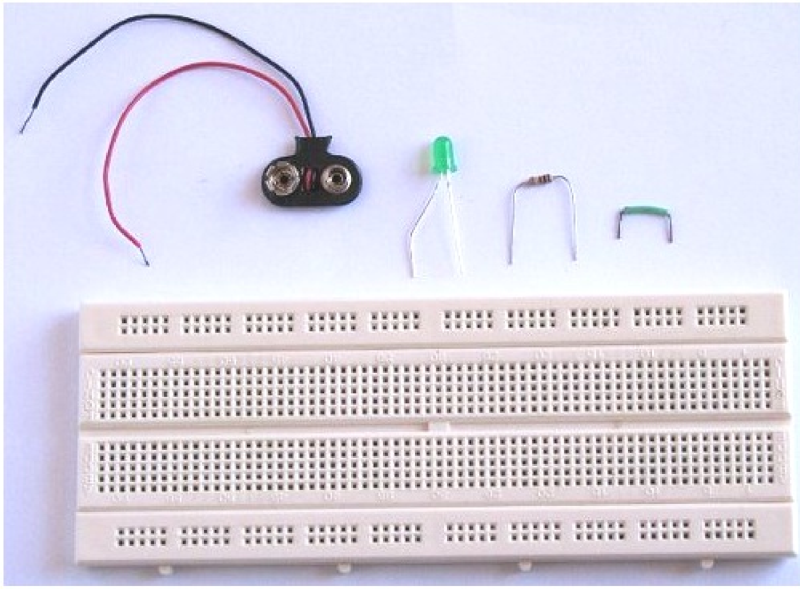


This circuit diagram tells us (clockwise from the battery): Connect the positive terminal of the battery (red battery clip lead) to the 1 kilo-ohm resistor. Connect the other lead of the resistor to the anode of the LED. Connect the cathode of the LED to the negative terminal of the battery (black battery clip lead).

Often the battery or power source is not shown in the circuit diagram. It will be represented by text that will show what voltage must be connected across the circuit. This diagram shows the alternate circuit:



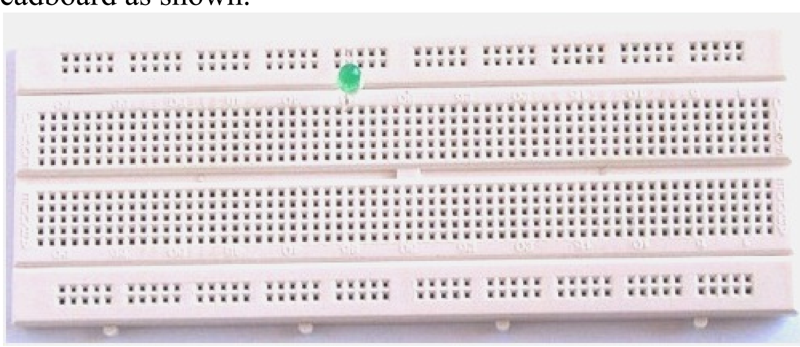
Building the Circuit
Get the parts and tools ready:



Watch video clip on CD. It will show you what you will be doing – step by step instructions.

Step 1: Insert the LED into the Breadboard

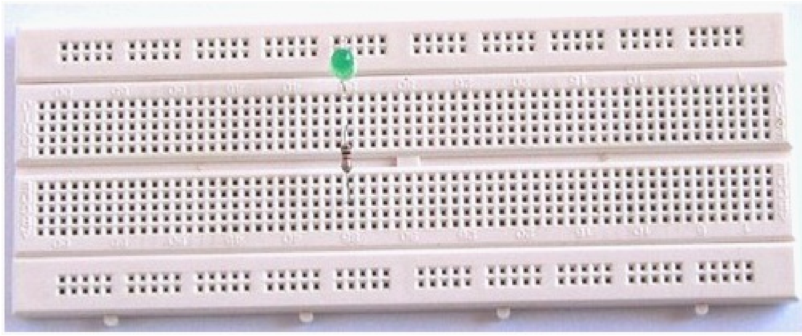
Start by bending the longest lead of the LED as shown in the previous photo. Plug the longer lead (anode) of the LED into the top rail of the breadboard and the other lead into a hole in the main part of the breadboard as shown.



Step 2: Insert the Resistor into the Breadboard

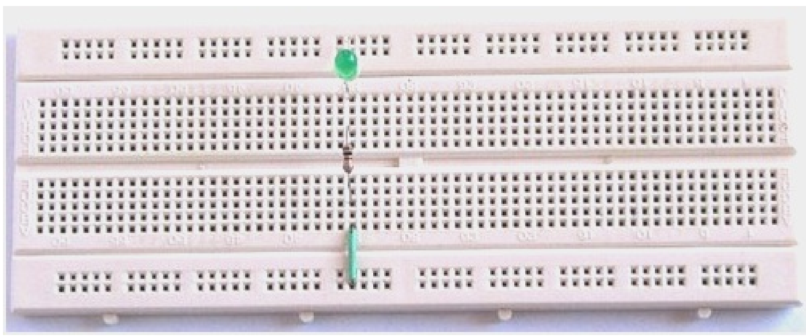
Use the side cutters to remove a 1k resistor from the string of resistors if they are taped together. Cut the resistor lead as near to the tape as possible. Don't try to remove the tape as this will leave a sticky mess at the end of the resistor lead which will then end up in your breadboard.

Bend the leads of the resistor as shown in the photo below. Plug one of the resistor leads into a hole directly below the cathode lead of the LED and the other lead into a hole below the middle channel of the breadboard. This connects the LED cathode to one of the resistor leads. It does not matter which way around the resistor is plugged into the breadboard.



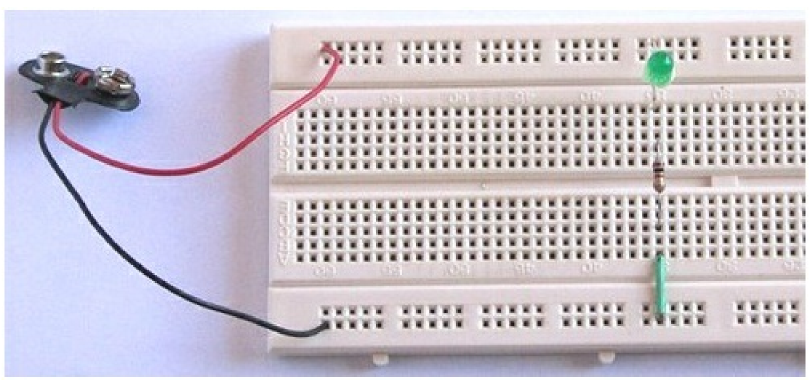
Step 3: Insert the Wire Link into the Breadboard

Insert a wire connector into a hole directly below the resistor lead and into the bottom rail of the breadboard.



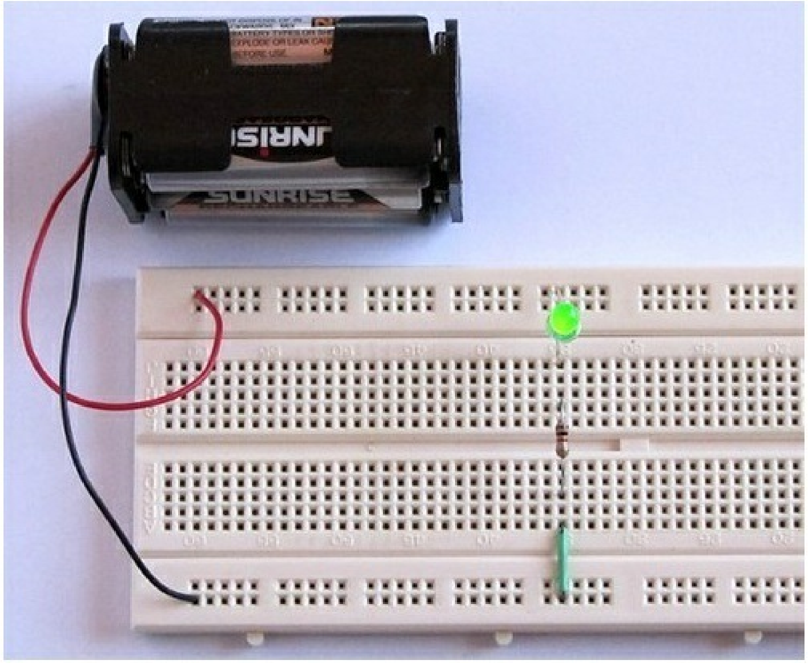
Step 4: Insert the Battery Clip into the Breadboard

Plug the red (positive) wire of the battery clip into the top rail of the breadboard. Plug the black (negative) wire of the battery clip into the bottom rail of the breadboard.

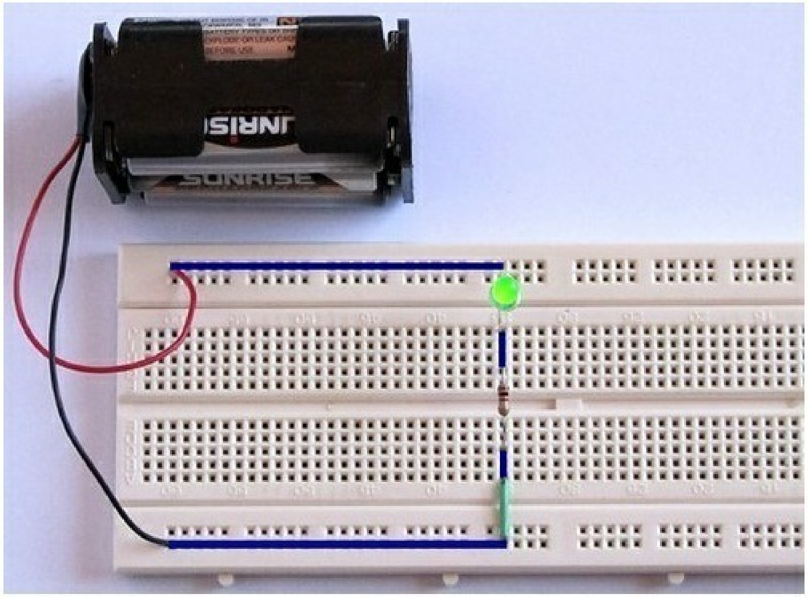


Step 5: Plug the battery into the Battery Clip

Finally, plug the battery into the battery clip to power up the circuit and switch the LED on. Make sure to connect the battery clip to the battery the right way around. The opposite type of the connector on the battery clip must be connected to the battery terminals, i.e. the battery and battery clip each have a pair of terminals they will only connect to each other one way. If you try to connect them the wrong way, they won't clip together, but they will put reverse polarity on the circuit for a moment which may destroy the circuit, so be sure to connect the battery the right way around the first time.



The following photo shows the circuit built in this tutorial with the connecting strips of the breadboard that are used by the circuit in blue.



The red lead from the battery is joined to the LED via the top horizontal strip of the breadboard. The LED connects to the resistor using a top vertical strip. The resistor is not shorted out because it jumps across the middle insulated channel of the breadboard to a vertical connecting strip below. The wire link connects the bottom resistor lead to the bottom horizontal connecting strip which is then connected to the black lead of the battery.

END