

Breadboard Basics and Connections

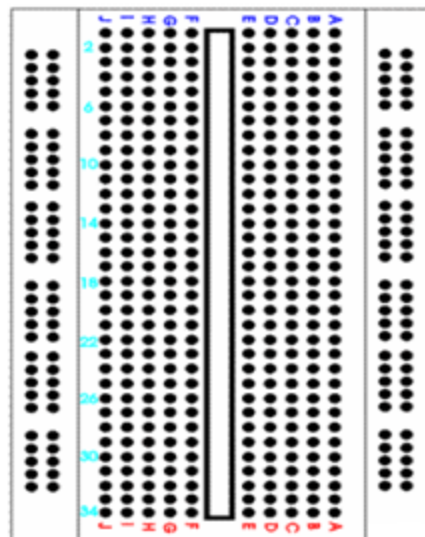
What is Breadboard?

A breadboard is a circuit board that is used to make temporary circuits. It is a device having electronics and test circuit designs. The electronic elements inside the electronic circuits can be interchanged by inserting the terminals and leads into holes and later connecting it with the help of appropriate wires. The device has stripes of metal below the board that connects the holes placed on the top of the board. The connections of the breadboard are mostly temporary and the elements can further be reassembled and reused without any damage. Breadboards are generally used in electrical engineering. Engineers make use of breadboards in order to test different products made by them. Using breadboard is the most efficient way of testing and also they are cost effective. They can be reused again and again for the purpose of testing. Today, starting from tiny analog, digital circuits to big complicated CPU's everything can be tested with the help of this.

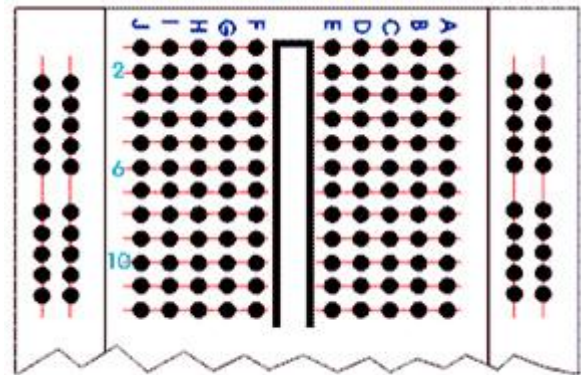
Breadboards earlier were made of copper wires or terminal strips. These days it is made up of white plastic and is a breadboard that can be plugged. Breadboards are solderless and they are made of two kinds of strips i.e. terminal and bus strips. Terminal strips help in holding the electronic elements while the bus strip is used to power electric power to all the electronic components. You can find manufacturers selling solderless breadboards very easily, some manufactures sell the bust and terminal strips separately and some sell it together.

Breadboard Basics:

A breadboard is a circuit which if of a temporary nature used for the purpose of testing and prototyping circuits. It is easy to prototype circuits with the help of breadboards because it is fast and easy. Breadboards are generally used to test circuits. As this device have holes in it. In order to form a circuit, wires are inserted simply inside the holes. An advantage of using a breadboard is that the positions of the wires can be changed if they are placed in a wrong order. In the below diagram you can see alphabets are used in order to identify vertical columns and numbers are used in order to identify vertical columns.



In the below diagram you can see both the vertical columns and horizontal to be connected internally. As soon as the power



Breadboard Diagram 2

is turned on, the current flows through these internal connections.

In the below diagram you can see how a resistor of 380 ohm and a LED are set up on the breadboard. A 9 volt battery is eventually attached to the LED light. Replace the current resistor with a resistor having 680 ohm you can see the resistance to be greater and the LED light to be dimmer.

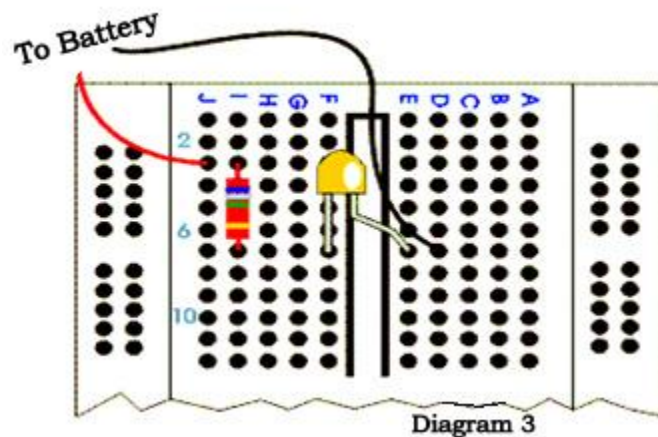
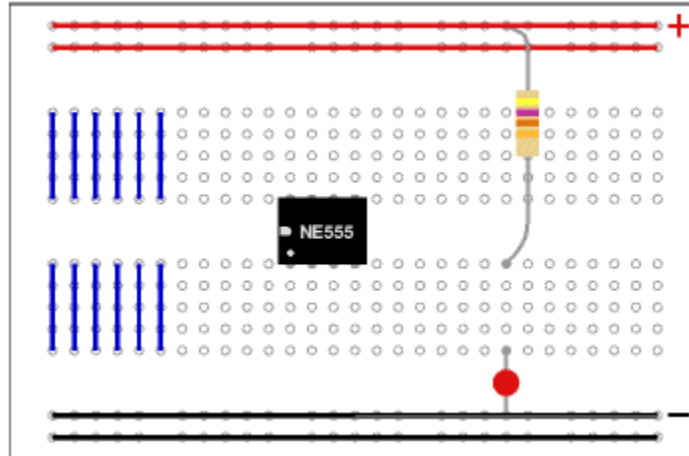


Diagram 3

Breadboard Connections:

A breadboard as mentioned before is used to make temporary circuit for testing and other purposes. The advantage of using a breadboard for testing is that connection can be changed if they are wrong. Also the parts of the circuit do not get damaged and can easily be reused. A breadboard generally consists of lots of holes so that wires can easily be pushed in. testing for almost every electronic projects starts from the breadboard. The breadboard has many tiny sockets like holes arranged in a 0.1 grid. The leads that most elements have can easily be pushed inside these holes. The ICs are pushed inside across to the gap with their dot on the left. Standard wires cannot be used for breadboard as they get damaged easily and hence they require single core plastic coated wires that have 0.6mm diameter. Standard wires if used can also lead to damage of the board.



The above diagram shows how the holes of a breadboard are connected. The bottom and the top rows are connected horizontally across as the red and the black line denotes. The power supply is connected to both the black and red rows. The other rows are connected in a vertical manner which consists of five rows each without any links to the across the centre. In this way there are separate blocks of connections to each of the ICs pin. Now this was the connection in a small breadboard.

In case of large breadboards, there are breaks half way in the top and the bottom rows of the power supply. It is always better to link across the gap before you start building circuit. If you do not link it then that part of the circuit will not have any power supply.

Virtual Breadboard:

The virtual breadboard is generally used to test and design embedded software that is in a high level interactive circuit. It is used for prototyping the hardware from these designs. People find the virtual breadboard easier to utilize than the normal ones because it has a high approach. Also it is faster in its working and helps in testing new ideas and circuit variations.

Virtual breadboards are usually used in place of real breadboards because they are fast in working. Also it is fast in performing experiments and testing electronic embedded applications. Many experimenters prefer using virtual boards for experiments than real boards as its functioning is easy. The virtual board is popular in many universities around the world since the 1990s.

A virtual breadboard is also called as VBB and makes use of [microcontrollers](http://www.electronicshub.org/microcontrollers) featuring Makeable breadboard designs. A virtual breadboard helps in making your projects easier and helps you do your experiments in a simple way. There are different versions of VBB that are available which users can use according to their need. It is always better to use a virtual breadboard than a real one as the virtual ones are more reliable. So if you are in a hurry and want immediate results it is advised that you make use of VBB.

On the whole, using a breadboard is very easy and as it gives immediate results everyone prefers using it for testing different gadgets and electronic products.

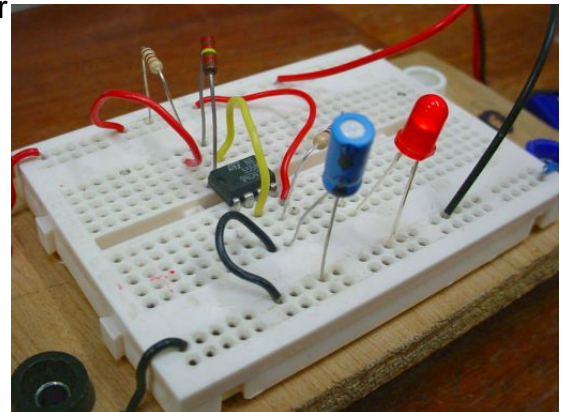
Source: <http://www.electronicshub.org/breadboard-basics-and-connections/>

Building Circuits on Breadboards

Uses of Breadboards

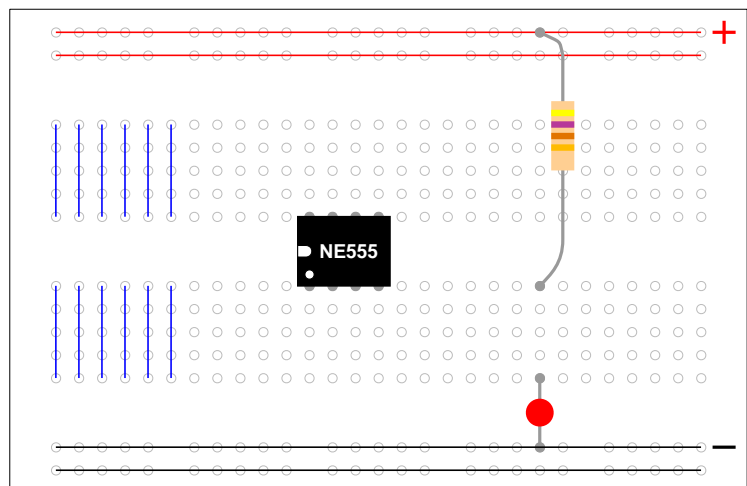
A breadboard is used to make up **temporary circuits** for testing or to try out an idea. No soldering is required so it is easy to change connections and replace components. Parts will not be damaged so they will be available to re-use afterwards.

The photograph shows a circuit on a typical small breadboard which is suitable for beginners building simple circuits with one or two ICs (chips).



Connections on Breadboards

Breadboards have many tiny sockets (called 'holes') arranged on a 0.1" grid. The leads of most components can be pushed straight into the holes. ICs are inserted across the central gap with their notch or dot to the left. Wire links can be made with single-core plastic-coated wire of 0.6mm diameter (the standard size). Stranded wire is **not** suitable because it will crumple when pushed into a hole and it may damage the board if strands break off.



The diagram shows how the breadboard holes are connected.

The top and bottom rows are linked **horizontally** all the way across. The power supply is connected to these rows, + at the top and 0V (zero volts) at the bottom. I suggest using the upper row of the bottom pair for 0V, then you can use the lower row for the negative supply with circuits requiring a dual supply (e.g. +9V, 0V, -9V).

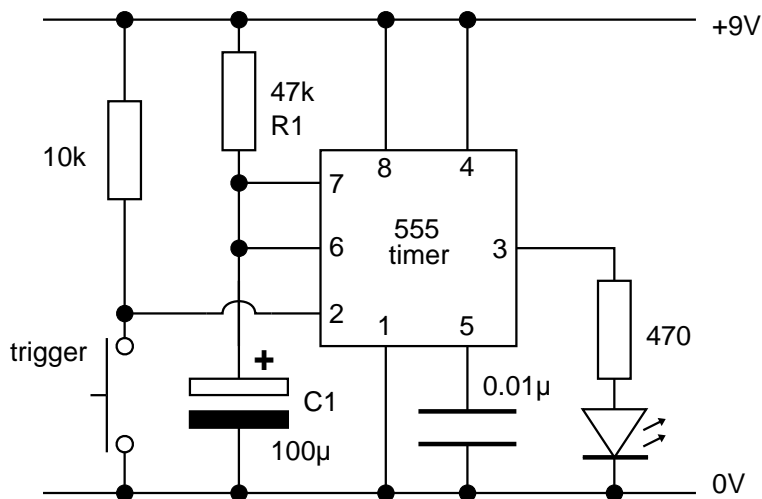
The other holes are linked **vertically** in blocks of 5 with no link across the centre. Notice how there are separate blocks of connections to each pin of ICs.

Large Breadboards

On larger breadboards there may be a break halfway along the top and bottom power supply rows. It is a good idea to link across the gap before you start to build a circuit, otherwise you may forget and part of your circuit will have no power!

Building a Circuit on Breadboard

Converting a circuit diagram to a breadboard layout is not straightforward because the arrangement of components on breadboard will look quite different from the circuit diagram. When putting parts on breadboard you must concentrate on their **connections**, not their positions on the circuit diagram. The IC (chip) is a good starting point so place it in the centre of the breadboard and work round it pin by pin, putting in all the connections and components for each pin in turn.



Monostable Circuit Diagram

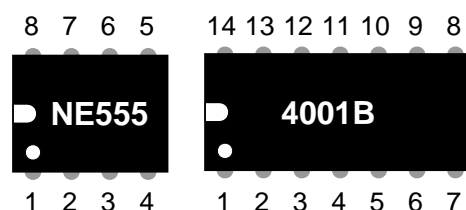
The best way to explain this is by example, so the process of building this 555 timer circuit on breadboard is listed step-by-step on the next page.

The circuit is a monostable which means it will turn on the LED for about 5 seconds when the 'trigger' button is pressed. The time period is determined by R1 and C1 and you may wish to try changing their values. R1 should be in the range 1kΩ to 1MΩ.

Time Period, $T = 1.1 \times R1 \times C1$

IC pin numbers

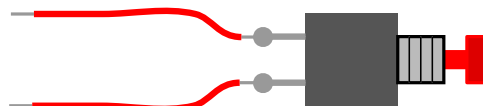
IC pins are numbered anti-clockwise around the IC starting in the bottom left-hand corner, near the notch or dot. The diagram shows the numbering for 8-pin and 14-pin ICs, but the principle is the same for all sizes.



Components without suitable leads

Some components such as switches and variable resistors do not have suitable leads of their own so you must solder some on yourself. Use **single-core** plastic-coated wire of 0.6mm diameter (the standard size).

Stranded wire is not suitable because it will crumple when pushed into a hole and it may damage the board if strands break off.



Building the example circuit

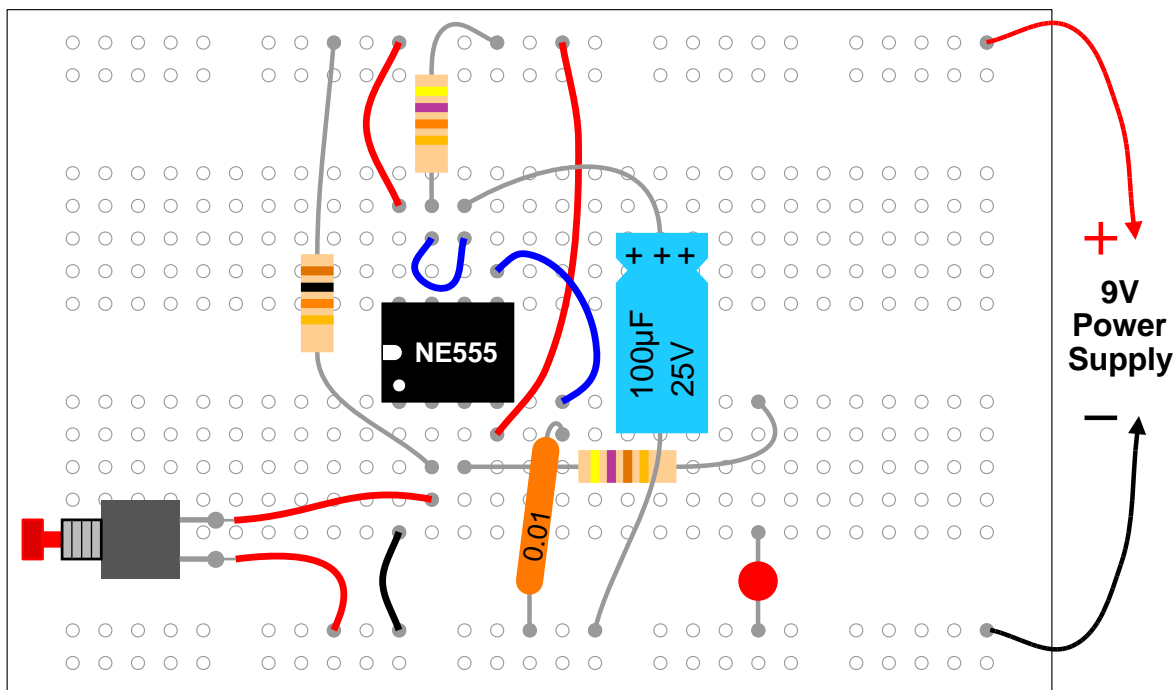
Begin by carefully insert the 555 IC in the centre of the breadboard with its notch or dot to the left. Then deal with each pin of the 555:

- Pin 1: Connect a wire (black) to 0V.
- Pin 2: Connect the 10k resistor to +9V.
Connect a push switch to 0V (you will need to solder leads onto the switch)
- Pin 3: Connect the 470 resistor to an used block of 5 holes, then...
Connect an LED (any colour) from that block to 0V (short lead to 0V).
- Pin 4: Connect a wire (red) to +9V.
- Pin 5: Connect the 0.01 μ F capacitor to 0V.
You will probably find that its leads are too short to connect directly, so put in a wire link to an unused block of holes and connect to that.
- Pin 6: Connect the 100 μ F capacitor to 0V (+ lead to pin 6).
Connect a wire (blue) to pin 7.
- Pin 7: Connect the 47k resistor to +9V.
Check: there should be a wire already connected to pin 6.
- Pin 8: Connect a wire (red) to +9V.

Finally...

- Check all the connections carefully.
- Check that parts are the correct way round (LED and 100 μ F capacitor).
- **Check that no leads are touching** (unless they connect to the same block).
- Connect the breadboard to a 9V supply and press the push switch to test the circuit.

If your circuit does not work disconnect (or switch off) the power supply and very carefully re-check every connection against the circuit diagram on the previous page.



Monostable Circuit on Breadboard