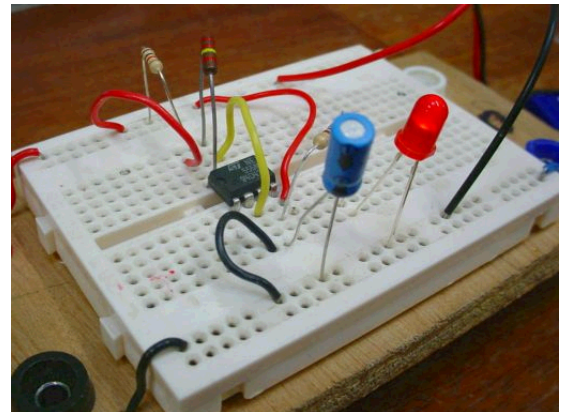


Building Circuits on Breadboards

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.

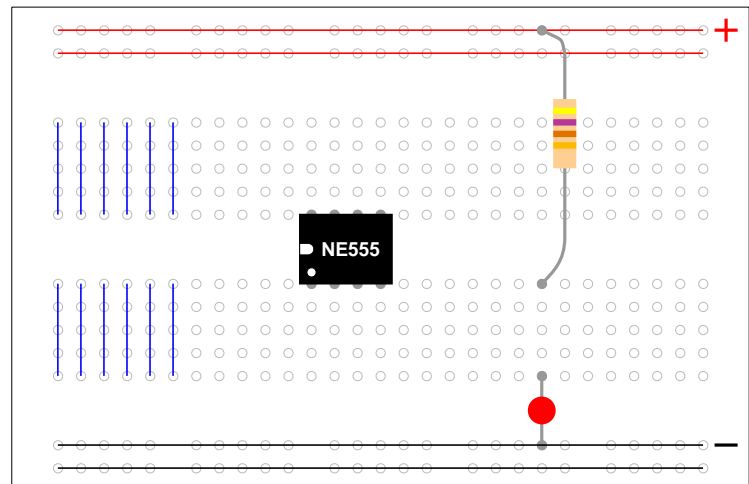
The photograph shows a circuit on a typical small breadboard which is suitable for beginners building simple circuits with one or two ICs (chips).



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).

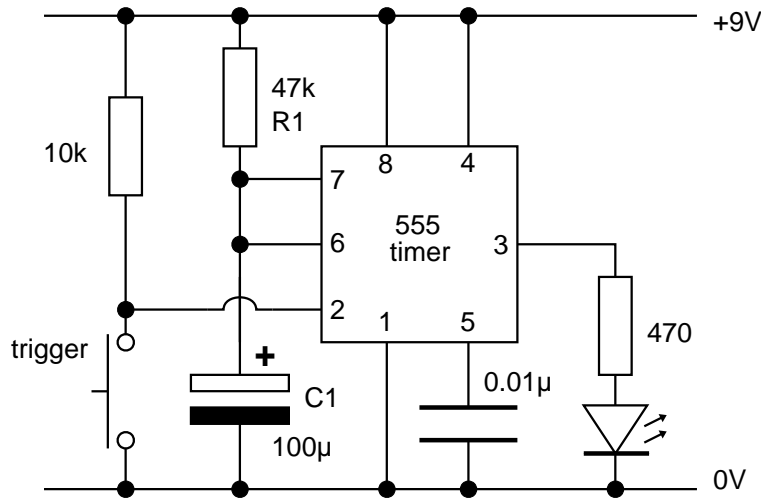
The other holes are linked **vertically** in blocks of 5 with no link across the centre. Notice how there are separate blocks of connections to each pin of ICs.

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

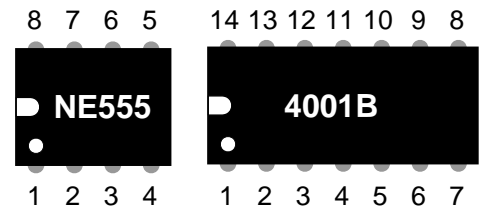
The best way to explain this is by example, so the process of building this 555 timer circuit on breadboard is listed step-by-step on the next page.

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.

$$\text{Time Period, } T = 1.1 \times R1 \times C1$$

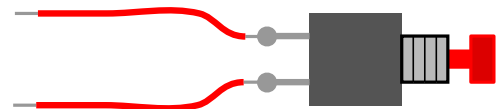
IC pin numbers

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

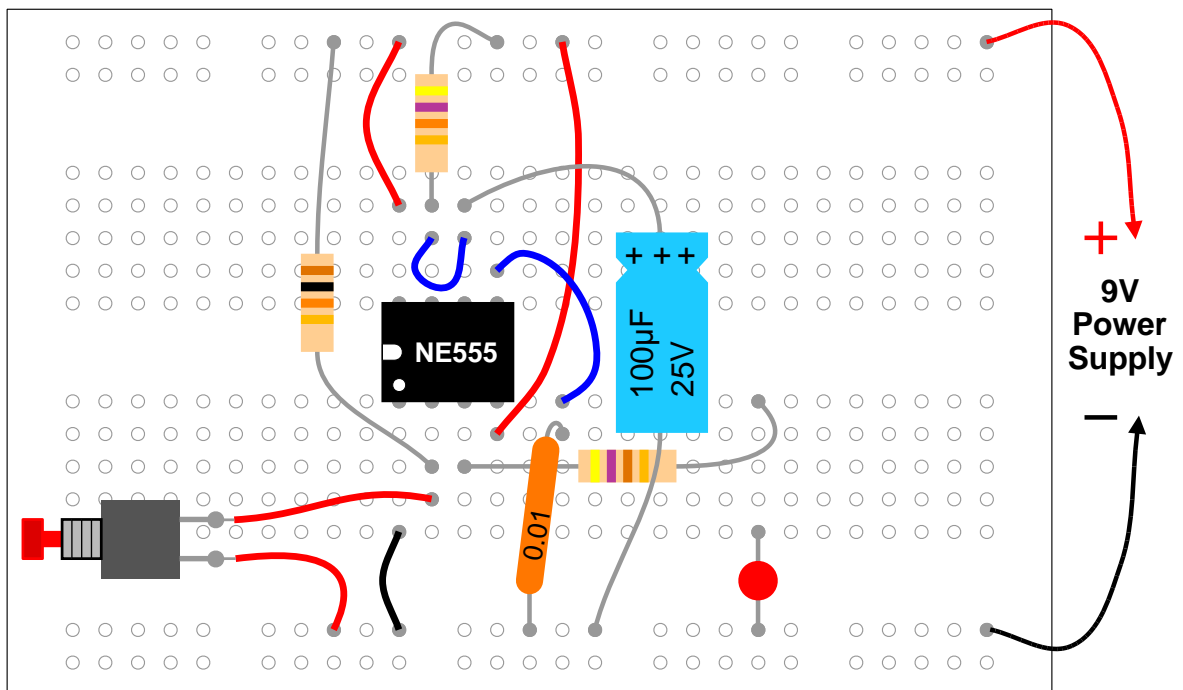
Begin by carefully insert the 555 IC in the centre of the breadboard with its notch or dot to the left. Then deal with each pin of the 555:

- 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 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