

Department of Electrical and Computer Engineering

Breadboards, Resistor Color Codes, & Accuracy

The Breadboard

A breadboard is a device used to facilitate the building and testing of circuits. The breadboard allows pre-stripped wires to be connected between power supplies, resistors, and other components easily and without making any permanent connections. Testing and modifying a circuit is made easier by using a breadboard. Figure 12 below illustrates the layout of a breadboard. A typical breadboard looks like an array of holes that are internally connected. The breadboards in this lab contain busses for connecting various power levels and reference points. The breadboard depicted in Figure 12 has eight (8) busses of 25 points each. These busses are labeled by the red and blue lines shown on the breadboard across the top and across the bottom. Each bus has 25 tie points that are shorted together but insulated from all other points on the breadboard. For example, all points in the upper right red bus are electrically connected but insulated from any other tie points on the board. That is, if +5V is tied to any point on this bus, all other points in this bus are also at +5V. In addition to the eight power busses, the breadboard has a number of five-point tie points that run perpendicular to the power busses. These five-point tie points are arranged in pairs that are separated by a recessed channel that runs across the length of the breadboard in the middle. These pairs are, of course, electrically insulated. Also, the spacing between adjacent tie points corresponds to the standard spacing between commonly used integrated circuits (ICs). This allows such devices to be interconnected easily to power supplies and components. In Figure 12, the five-point tie points are labeled with numbers that run from 1 to 64 (but for space reasons only the odd numbers are displayed on the board). All five points in any column (column 5, for example in the picture below) are electrically connected but insulated from all other points on the board. Circuits are constructed on the breadboard by connecting components and wires between tie points. Note the examples in the picture.

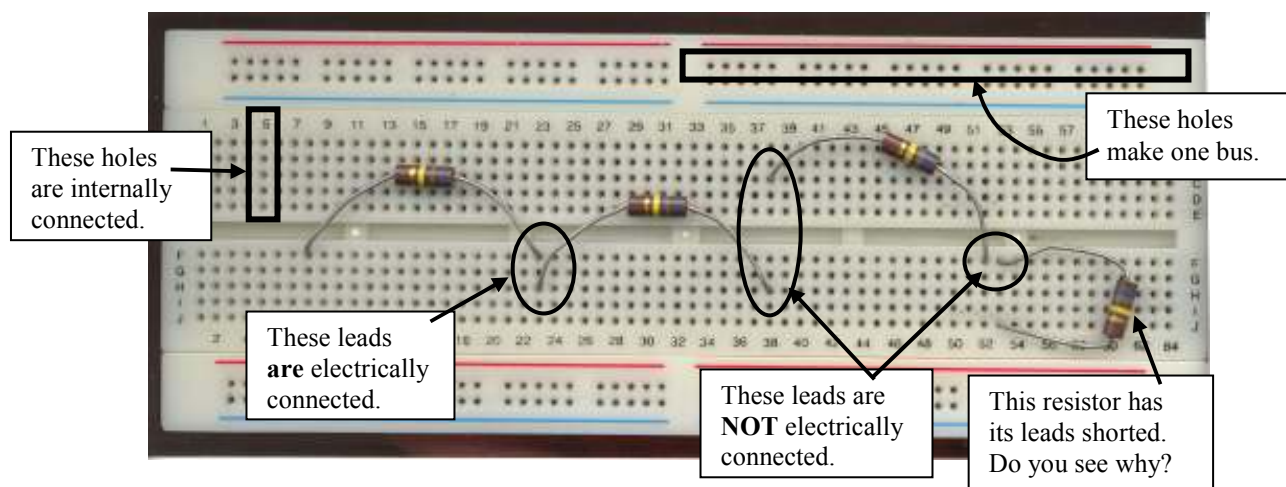


Figure 12. The Breadboard

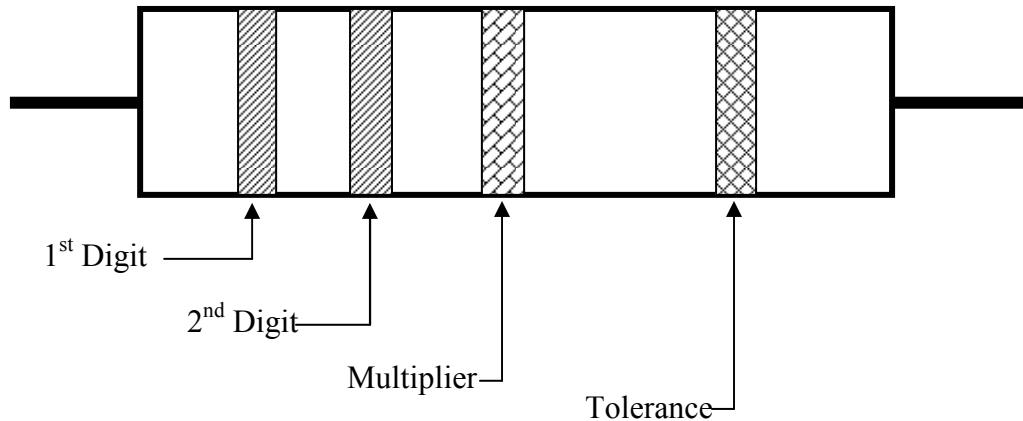
Resistor Color Codes

The nominal value of a resistor can be determined by examining the colored bars stamped on the resistor by the manufacturer. The exact resistance value must be determined using an ohmmeter. Table 3 contains the standard resistor color code. Example: Suppose that a resistor has the following stripes – yellow, violet, red and gold. Then it is a $47 \times 100 \Omega$ (or $4.7 \text{ K}\Omega$) resistor with a 5% tolerance.

Table 3 Resistor Color Code

Color	1 st Digit	2 nd Digit	Multiplier
Black	0	0	1
Brown	1	1	10
Red	2	2	100
Orange	3	3	1,000
Yellow	4	4	10,000
Green	5	5	100,000
Blue	6	6	1,000,000
Violet	7	7	10,000,000
Gray	8	8	100,000,000
White	9	9	1,000,000,000
Gold	-	-	0.1
Silver	-	-	0.01

Tolerance (4th Band)	
Gold	$\pm 5 \%$
Silver	$\pm 10 \%$
No Band	$\pm 20 \%$



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