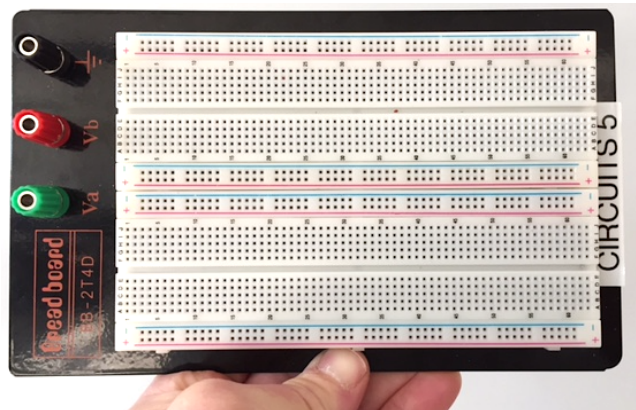


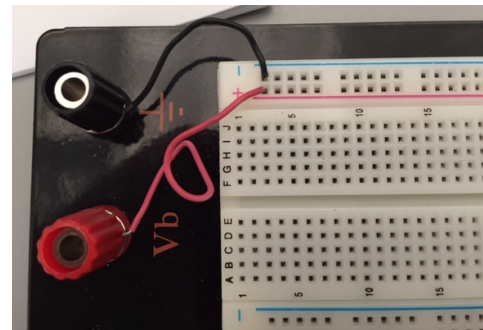
Solderless Breadboards

Your solderless breadboard is a mini version of the one shown at the right. Both boards operate in identical fashion. You will use a solderless breadboard to build and test circuits by temporarily connecting components together. The **solderless breadboard** shown at the right is a plastic-covered board with many holes into which you can insert the leads of components. Underneath the plastic cover are strips of metal that connect some of the holes to each other. By inserting component leads into the proper holes, you connect the components to each other without having to solder them together.



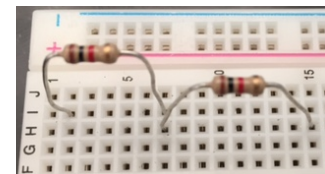
The holes in the breadboard are arranged in rows and columns. All holes in the + (red) and - (blue) rows are tied together the entire width of the breadboard. However, the rows are not connected to each other. These are commonly used for signals like **Power** and **Ground** that may have many connections to your circuit.

The holes in between the + and - rows are connected vertically in groups of five holes by a metal strip beneath the breadboard's plastic cover, but those five holes are not connected to any of the other holes on the breadboard.



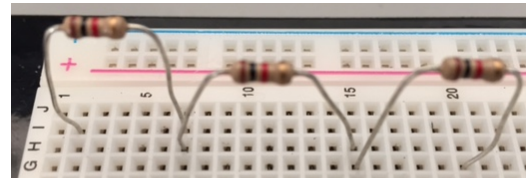
Connecting Two Components in Series

The picture at the right shows two resistors on a breadboard. Notice that each resistor has one lead (or "leg") inserted into a hole in column 7 thus connecting the two resistors to each other at this point. Notice that the resistor's other leads are **not** connected together. When two resistors are connected in this particular way, they are said to be **connected in series**. In the same way, we could connect two capacitors in series, or two inductors in series, or a capacitor and a resistor in series, and so forth.



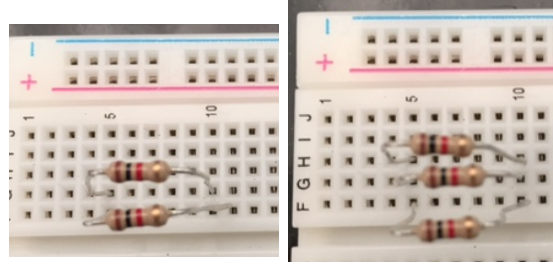
Connecting More than Two Components in Series

The picture at the right shows **three** resistors connected in series. The first and second resistors are connected because they each have a lead inserted into column 7. The second and third resistors are connected because they each have a lead inserted into column 15.



Connecting Two Components in Parallel

The two resistors shown at the immediate right are **connected in parallel**. Notice that the left-hand leads of the resistors are connected to each other in column 5 and the right-hand leads are connected together in column 10. To measure the total resistance, R_T , of these two resistors, you would touch one of the ohmmeter's test leads to either resistor's left-hand leads and the other test lead to either of the resistor's right-hand leads.



Connecting More than Two Components in Parallel

Extending the idea of two resistors in parallel, we can connect three, four, or more resistors in parallel. The picture at the far right above shows three resistors connected in parallel.

4-Band-Code

2%, 5%, 10% 560kΩ ± 5%

COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	±0.5% (D)
Blue	6	6	6	1MΩ	±0.25% (C)
Violet	7	7	7	10MΩ	±0.10% (B)
Grey	8	8	8		±0.05%
White	9	9	9		
Gold				0.1	± 5% (J)
Silver				0.01	± 10% (K)

5-Band-Code

0.1%, 0.25%, 0.5%, 1% 237Ω ± 1%