Electric Circuits Lab. 1
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Experiment No.1

Resistor Color Code and Measurement of Resistance

1. Introduction

1.1 Objective:

The aim of this experiment is to learn how to use the multimeter and how to calculate the value of the resistor.

1.2 Components:

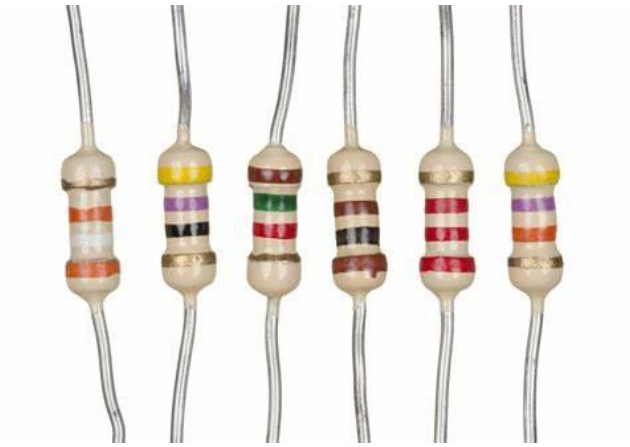
- Set of Resistors;
- Multimeter.

1.3 Theory

1.3.1. Resistor:

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

The main purpose of resistor is to reduce the current flow and to lower the voltage in any particular portion of the circuit. It is made of copper wires which are coiled around a ceramic rod and the outer part of the resistor is coated with an insulating paint.



Tolerance: Tolerance indicates how much the measured value of its **actual resistance** is different from its **theoretical value**, and it is calculated using percentages.

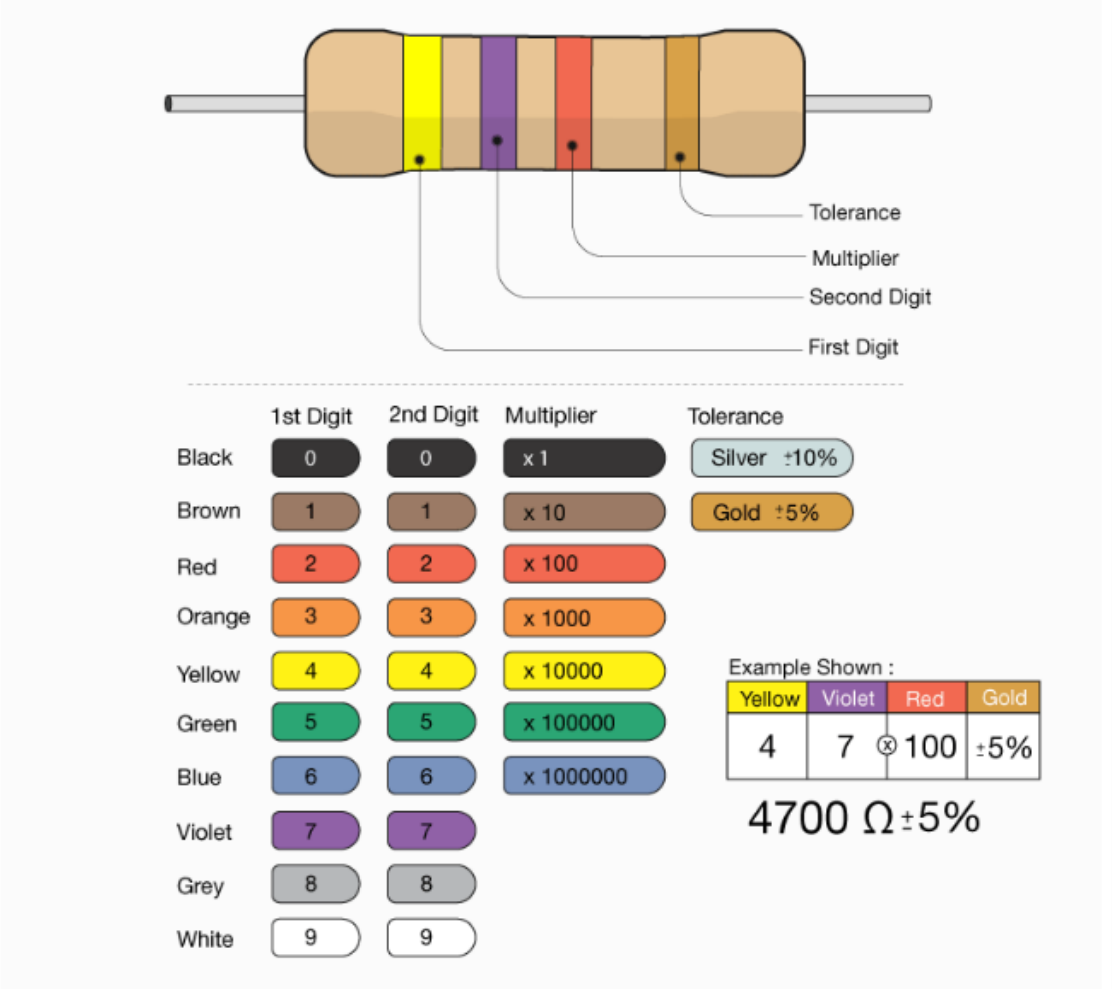
Resistor Colour Table:

Colour	Digit	Multiplier	Tolerance
Black	0	1	
Browen	1	10	±1%
Red	2	100	±2%
Orange	3	1000	
Yellow	4	10000	
Green	5	100000	±0.5%
Blue	6	1000000	±0.25%
Violet	7	10000000	±0.1%
Grey	8		±0.05%
white	9		
Gold		0.1	±5%
Silver		0.01	±10%

How to Read Resistor Colour Code?

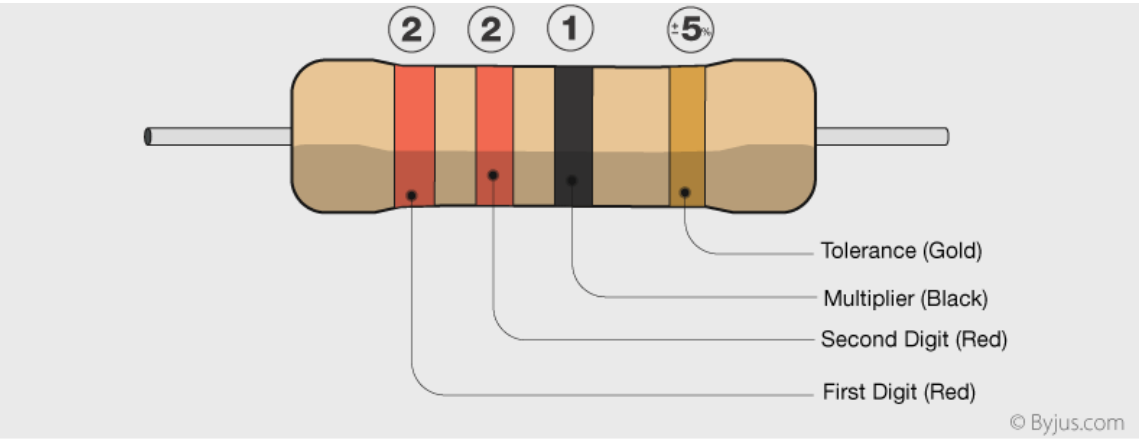
- To read them, hold the resistor such that the tolerance band is on your right. Thetolerance band is usually gold or silver in colour and is placed a little further away from the other bands.
- Starting from your left, note down all the colours of the bands and write them down in sequence.
- Next, use the table given below to see which digits they represent.
- The band just next to the tolerance band is the multiplier band. So if the colour of this band is Red (representing 2), the value given is 10^2.

Example 1:



Example 2:

After learning about resistance colour codes, let us learn how to find resistor colour codes with an example. Here's an example to get you started:



The band colours for resistor colour code in the order:

Band colours in order	***RED***	***RED***	***BLACK***	***GOLD***
Digit representation	2	2	$10^0 = 1$	±5%
Value	22 Ω ±5 %			

The tolerance values represent by how much the resistance can vary from its mean value in terms of percentage. A gold band represents the lowest variation, so be sure to buy these at the electronics store. The value of the given resistance is: 22 Ω ± 5%. The tolerance of the resistor can be calculated as follows:

Tolerance=Value of resistor × value of tolerance band

= 22 Ω × 5% = 1.1 Ω

This means that the 22 Ω resistor with a tolerance value of 1.1 Ω could range from the actual value as much as 23.1 Ω to as little as 20.9 Ω. It is important to note that the band next to the tolerance band represents the multiplier. All the bands to the left of this band represent thE significent digits. There can be more than two such bands.

1.3.2. Digital Multimeter:

A digital multimeter is a test tool used to measure two or more electrical values—principally voltage (volts), current (amps) and resistance (ohms). It is a standard diagnostic tool for technicians in the electrical/electronic industries.

Digital multimeters long ago replaced needle-based analog meters due to their ability to measure with greater accuracy, reliability and increased impedance. Fluke introduced its first digital multimeter in 1977.

How to use a multimeter

Digital multimeters combine the testing capabilities of single-task meters—the voltmeter (for measuring volts), ammeter (amps) and ohmmeter (ohms). Often, they include several additional specialized features or advanced options. Technicians with specific needs, therefore, can seek out a model targeted to meet their needs.

The face of a multimeter typically includes four components:

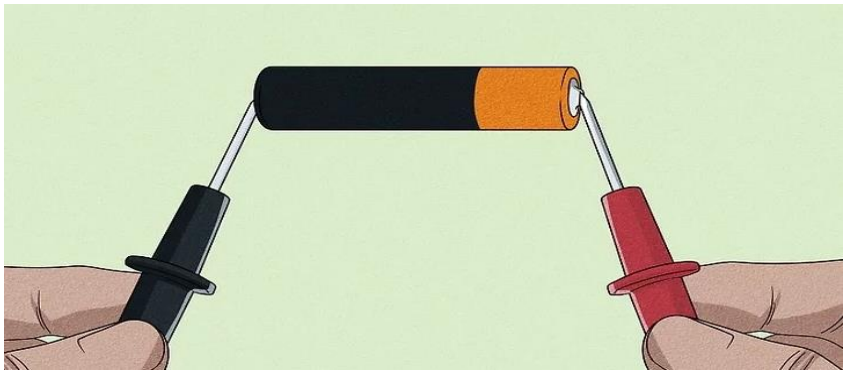
- Display: Where measurement readouts can be viewed.
- Buttons: For selecting various functions; the options vary by model.
- Dial (or rotary switch): For selecting primary measurement values (volts, amps, ohms).
- Input jacks: Where test leads are inserted.

Test leads are flexible, insulated wires (red for positive, black for negative) that plug into the DMM. They serve as the conductor from the item being tested to the multimeter. The probe tips on each lead are used for testing circuits.

Measuring Voltage

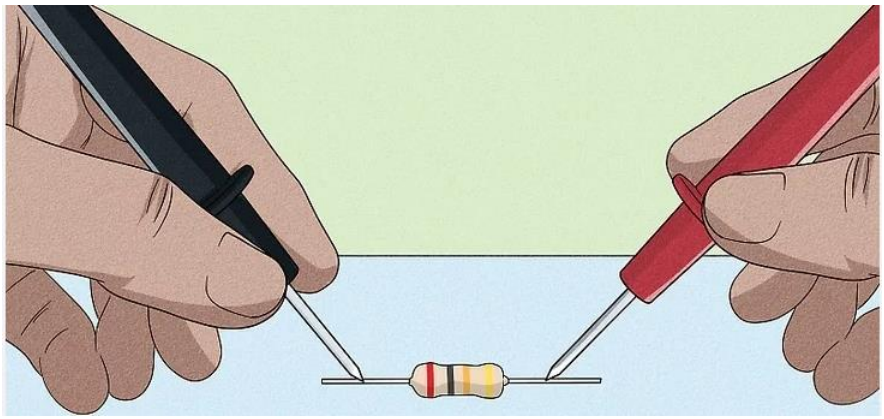
1- Plug the test leads into the COM and V terminals. Always plug the black test lead into the terminal that's labeled "COM" for "Common." Always plug the red test lead into the terminal labeled "V" for "Voltage," since this is what you're testing.
2- Move the dial to the voltage setting for AC or DC voltage. Turn the dial to V~, or the V with a wave sign next to it, if you're measuring AC voltage. Switch the dial to V⎓, or the V with a horizontal line next to it, to measure DC voltage.
3- Set the voltage range to a higher voltage than what's expected. If you set the voltage range too low, you won't get an accurate reading. Look at the numbers on the dial and choose the setting that's closest to the expected voltage of what you're measuring, while still being above that voltage.
4- Touch the probes to both sides of a load or power source. Put the tip of the black probe on the negative lead of a battery or into the right side of a wall socket, for

example. Put the red probe on the positive end of a battery or into the positive side of a wall socket, for instance



Measuring Resistance:

1- Insert the black test lead in COM and the red test lead in the Ω terminal. Stick the black test lead's plug into the COM terminal. The red test lead's plug goes into the terminal labeled Ω, which is the symbol for ohms.
2- Set the dial to a number on the multimeter's resistance scale. Look for the Ω symbol on your multimeter's dial area. Twist the dial to a number close to the expected resistance in this section. If you aren't sure what the expected resistance is, set it to a number at the top of the scale.
3- Place the probes on the resistor and read the resistance. Touch the tips of the probes onto each end of the resistor. Look at the multimeter's digital screen to see the reading, which tells you the amount of resistance in ohms



2. Experiment procedure:

1- Choose randomly three different resistors.

2- Read the resisters value by using resistor colour code method.

3- Using the multimeter, read the resistors value (Measured value).

4- Write down all the measured and calculated values on the table below.

Deviation = | ((R measured – R nominal)/ R nominal) | × 100%

Table 1

Color Code Bands	Nominal	Tolerance	Minimum	Maximum	Measured	Deviation
1-						
2-						
3-						

3. Discussion:

1. What are the uses and main specifications of resistors in electrical circuits?
2. What is meant by color codes and tolerance values of resistors?
3. Determine and record the nominal value, tolerance and the minimum and maximum acceptable values of resistors shown in the following figure.

Color Code Bands	Nominal	Tolerance	Minimum	Maximum
1-				
2-				
3-				
4-				
5-				
6-				

4. Record four band resistor colors gave to its value in below:

Value	Four Band Resistor Color Codes
1- 390 ± 10 %	
2- 680 ± 5 %	
3- 1.5k ± 20 %	
4- 10k ± 5 %	
5- 820k ± 10 %	
6- 2.2M ± 10 %	

5. What is the function of multimeter?