Experiment No. 8: Resistor Color Coding

1. Objective

The objective of this experiment is to determine the value of resistors from their EIA (Electronic Industries Association) color code and measure the resistance using ohmmeter.

2. Apparatus

- Resistors of various color bands
- Digital Multi-meter

3. Theory

An electronic color code is used to indicate the values or ratings of electronic components, usually for resistors, but also for capacitors, inductors, diodes and others. A basic resistor with color bands is shown in Figure 8.1. The standard color code marking consists of four bands around the body of the resistor. The colors and their numerical values are given in the resistor color chart; Table 8.1. The color of the first band indicates the first significant figure of the resistance value. The second band indicates the second significant value. The color of the third band indicates the multiplier that follows the first two significant figures. If the third band is gold or silver then the third band indicates the fractional value of the first two significant figures as shown in the Table 8.1.

The fourth band indicates the percent tolerance of the resistance. Percent tolerance is the amount the resistance may vary from the value indicated by the color code. Because the resistors are mass produced, variations in materials will affect their resistance. Tolerances are usually given as plus or minus of the nominal, or color-code value.

Example:

Brown	1
Red	2
Orange	10^3
Gold	5%

The value of the resistor will be written as,

$$R = 12K\Omega \pm 5\%$$

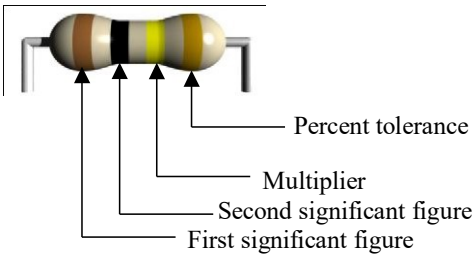

Figure 8.1: Color Code for 4 Band Resistors

Table: 8.1 Color Values for 4 Band Resistors

Color	1st Digit(First band)	2nd digit(Second band	Multiplier (Third band)	% Tolerance (Fourth band)
Black	0	0	0	-
Brown	1	1	10^1	-
Red	2	2	10^2	-
Orange	3	3	10^3	-
Yellow	4	4	10^4	-
Green	5	5	10^5	0.5
Blue	6	6	10^6	-
Violet	7	7	10^7	-
Gray	8	8	10^8	-
White	9	9	10^9	-
Gold	-	-	10^{-1}	5
Silver	-	-	10^{-2}	10
No color	-	-	-	20

High precision resistors have five bands and 6 bands. For the 5 band resistors as shown in the Figure 8.2 the first three bands indicate the first three significant figures (digits) of the resistance; the fourth band indicates the multiplier; the fifth band is the percent tolerance as given in the Table 8.2.

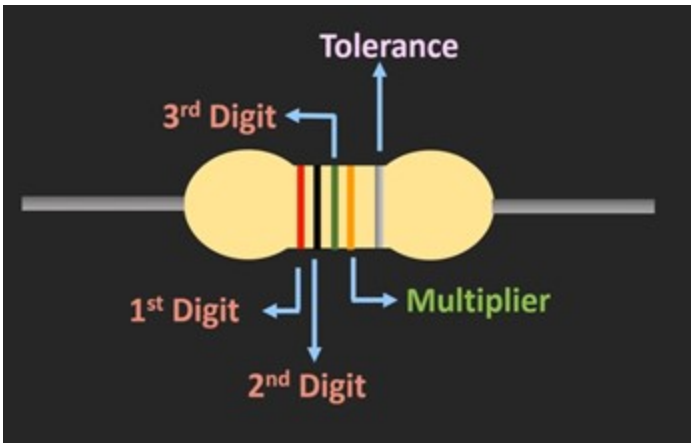

Figure 8.2: Color Code for 5 Band Resistors

Table: 8.2 Color Values for 5 Band Resistors

Color	1st Digit (First band)	2nd digit (Second band	3rd digit (Third band)	Multiplier (Third band)	% Tolerance (Fourth band)
Black	0	0	0	0	-
Brown	1	1	1	10^1	-
Red	2	2	2	10^2	-
Orange	3	3	3	10^3	-
Yellow	4	4	4	10^4	-
Green	5	5	5	10^5	0.5
Blue	6	6	6	10^6	-
Violet	7	7	7	10^7	-
Gray	8	8	8	10^8	-
White	9	9	9	10^9	-
Gold	-	-	-	10^{-1}	5
Silver	-	-	-	10^{-2}	10
No color	-	-	-	-	20

For the 6 band resistors as shown in the Figure 8.3 the first three bands indicate the first three significant figures (digits) of the resistance; the fourth band indicates the multiplier; the fifth band is the percent tolerance and sixth band indicates the temperature coefficient of resistor as given in the Table 8.3.

Percent tolerance for these resistors ranges from 0.1 percent to 2 percent. 6 band resistors are used for military purposes.

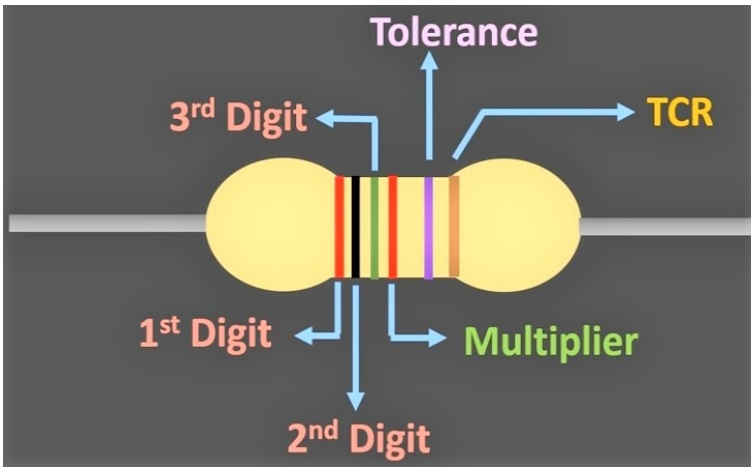

Figure 8.3: Color Code for 6 Band Resistors

Table: 8.3 Color Values for 6 Band Resistors

Color	1st Digit (First band)	2nd digit (Second band	3rd digit (Third band)	Multiplier (Fourth band)	% Tolerance (Fifth band)	TCR(ppm/k) (Sixth band)
Black	0	0	0	0	-	
Brown	1	1	1	10^1	-	100
Red	2	2	2	10^2	-	50
Orange	3	3	3	10^3	-	15
Yellow	4	4	4	10^4	-	25
Green	5	5	5	10^5	0.5	
Blue	6	6	6	10^6	-	10
Violet	7	7	7	10^7	-	5
Gray	8	8	8	10^8	-	
White	9	9	9	10^9	-	
Gold	-	-	-	10^{-1}	5	
Silver	-	-	-	10^{-2}	10	
No color	-	-	-	-	20	

4. Procedure

1. You are given with resistors of various values and tolerances. Examine each one and determine its resistance and tolerance according to its color code. Record the coded resistance value, and tolerance in Table 8.4.
2. Using the coded resistance value as a guide, select an appropriate meter range by rotating the multi-range selector switch to Ohms, and measure the resistance of each of the resistors. Record your reading under "measured value" in Table 8.4.
3. Measure and record the resistance of a short length of hookup wire given to you.
   R = _____Ω.
4. Select one of the resistors in step 1 and connect the wire given in step 3 across it. By connecting the wire across the leads of resistor, the resistance has been short circuited. Measure the resistance across the resistor-hookup wire connection.

   R = _____ Ω.

Table 8.4: Observations

Resistors	First color band	Second color band	Third color band	Fourth color band	Tolerance %	Coded value Ω	Measured value Ω
1							
2							
3							
4							
5							

Table 8.5: Lab Task

Resistors	Coded value Ω	Tolerance %	First color band	Second color band	Third color band	Fourth color band
1	1000	10				
2	12	10				
3	41000	5				
4	100	10				
5	56000	20				

5. Lab Task:

What are the colors of the bands for each of the following carbon resistors having coded values and tolerances given in Table 8.5?

6. Conclusions