DE ANZA COLEGE – PHYSICS 4B LAB – FALL 2024

Lab 1 – Measuring Resistance

TITLE

Measuring Resistance

OBJECTIVE

1. To understand the quantity of resistance for a material.
2. Learn how to use a VOM, DMM, and HP-DMM to the resistance of a resistor.
3. Learn how to use a color-code table to determine the resistance of a resistor.

THEORY

1. Current is the rate of flow of charge per unit time.

$$I = \frac{\mathrm{d}q}{\mathrm{d}t}$$

2. Units for current is Ampere **A** where 1 A = 1 C / s with **C** being 1 Coulomb SI unit for charge.
3. Resistance is the measure of a material's opposition against the flow of charge in a material.
4. In electrical or electronic circuits we identify three types of material:
    a. Conductors – they have extremely low resistance and are used to bring electrical current from point A to point B. Limiting factors are:
        i. Length of the conductor
        ii. Amount of current flowing through the conductor
        iii. Ambient temperature
    b. Insulators – they have very high resistance and are designed to prevent current flow under any circumstances. Their operational limits are:
        i. Every insulator is rated for a certain voltage differential.
    c. Resistors – they have a finite amount of resistance. Depending on the voltage, a certain amount of current will flow. They can be used to either
        i. Limit the flow of current given a voltage differential
        ii. Create a certain voltage differential across terminals for a given amount of current
5. Common resistors are made of carbon and nichrome.
6. For a resistor in the normal operating range, we expect a linear behavior where the ratio of current to voltage is constant.

$$R = \frac{V}{I}$$

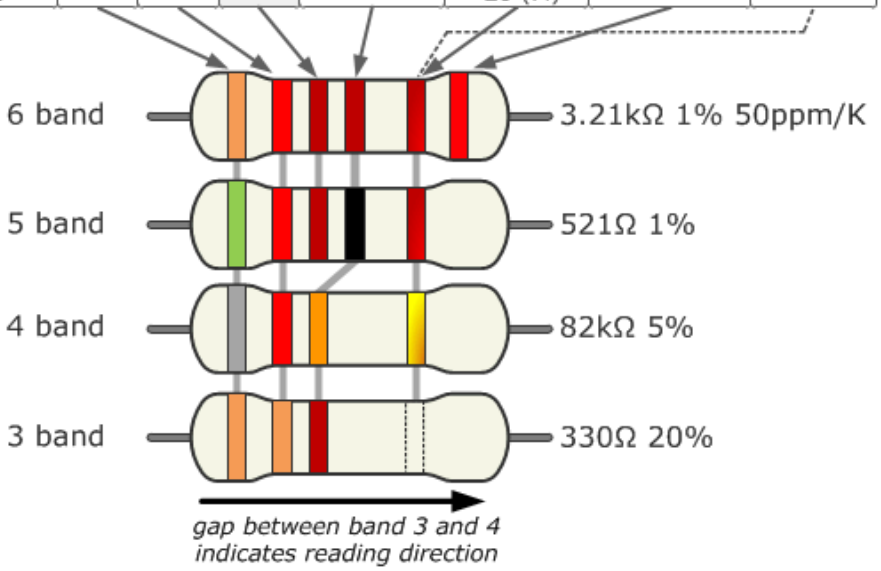
7. The SI unit for resistance is Ω

APPARATUS

1. VOM, DMM, HP-DMM
2. 3 different resistors
3. 2 leads, 2 alligator clips

PROCEDURE

Color	Signficant figures			Multiply	Tolerance (%)	Temp. Coeff. (ppm/K)	Fail Rate (%)
black	0	0	0	x 1		250 (U)	
brown	1	1	1	x 10	1 (F)	100 (S)	1
red	2	2	2	x 100	2 (G)	50 (R)	0.1
orange	3	3	3	x 1K		15 (P)	0.01
yellow	4	4	4	x 10K		25 (Q)	0.001
green	5	5	5	x 100K	0.5 (D)	20 (Z)	
blue	6	6	6	x 1M	0.25 (C)	10 (Z)	
violet	7	7	7	x 10M	0.1 (B)	5 (M)	
grey	8	8	8	x 100M	0.05 (A)	1(K)	
white	9	9	9	x 1G			
gold			3th digit only for 5 and 6 bands	x 0.1	5 (J)		
silver				x 0.01	10 (K)		
none					20 (M)		



1. Determine the resistance of all 3 resistors using the color-code table above
2. Measure the resistance of all 3 resistors using the VOM, DMM, HP-DMM (refer to the Classic 4B Lab Manual)
3. Compare the measured resistance values to color code table values (calculate % error) and also determine if they are within the stated tolerance as per the color code table.