Experiment 1 — Resistor Color Code and Use of the Ohmmeter

EL 111 - DC Fundamentals

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Objectives:

1. For the student to interpret and record the ohmic value of a resistor when given a color-coded resistor.
2. For the student to measure the ohmic value of a resistor using an analog ohmmeter.
3. For the student to measure the ohmic value of a resistor using a digital multimeter.
4. For the student to determine whether a resistor is within its coded tolerance.

Equipment:

- Resistors: 20 assorted color-coded resistors, provided in a tray
- Meter: Agilent 34401A Digital Multimeter which can be used to measure:

  voltage (unit is volts, abbreviation is V),
  current (unit is amps, milliamps, microamps, abbreviations are A, mA, μA),
  resistance (unit is ohms, kilo-ohms, megohms, abbreviations are Ω, kΩ, MΩ)

REFER TO THE HANDOUT ON LABORATORY EQUIPMENT FOR DETAILED EQUIPMENT INFORMATION

Information:

Your instructor will explain the resistor color code, the use of a digital multimeter, and will do a sample measurement and entering of measured data in of the table on page 2. Also, the initial adjustments on an analog ohmmeter, and how to measure resistance using an analog ohmmeter, will be demonstrated. The analog ohmmeter information is for historical purposes only; you'll use a digital multimeter for this lab experiment.

Note that you should always adjust the multimeter to obtain as many significant digits as possible. For example, 3.27 kΩ (with its three significant figures) is better than 3.3 kΩ (two significant figures).

Procedure: Take a resistor from the sample tray provided.

B. Record its **COLOR CODE** in column 1 of the table.

C. Determine, using a color code chart, its **Coded Resistance**, in units of ohms (the symbol for which is Ω). Write this coded resistance in column 2.

D. Determine, using the color code chart, the **Tolerance** (in percent) of the resistor, and record this tolerance in column 3.

E. Using the **Coded Resistance** and the **Tolerance**, find the **Maximum Coded Resistance**, and record this value in column 4.

F. Using the **Coded Resistance** and the **Tolerance**, find the **Minimum Coded Resistance**, and record this value in column 5.

G. Using the digital multimeter, set to the **Ohms** function, measure the resistance of the resistor. Note that you should always adjust the multimeter to obtain as many significant digits as possible. Record the **Measured Resistance** (using proper Ω, kΩ or MΩ notation) in column 6. The symbol **k** = kilo = 1,000; the symbol **M** = mega = 1,000,000.

H. By comparing the measured resistance with the maximum and minimum coded resistances, decide if the resistor is within tolerance. Record the result (YES or NO) in column 7.

Refer to Table 1. Study carefully the example given in the first row.

A resistor with a color-code of **"Red-Violet-Orange-Silver"** would have a **color-coded value of 27 kΩ**.

The color-coded tolerance would be ±10%, and 10% of 27 kΩ is 2.7 kΩ.

This means the resistor should have an actual measured value within the range of (27 kΩ – 2.7 kΩ = 24.3 kΩ) and (27 kΩ + 2.7 kΩ = 29.7 kΩ). So, any resistor with a color code of **Red-Violet-Orange-Silver** should have an actual value that lies within the range of 24.3 kΩ and 29.7 kΩ. Mathematically, we would say that for the measured resistor to be within tolerance:

$$24.3k\Omega \leq Rmeasured \leq 29.7k\Omega$$

Since this sample resistor measures 25.1 kΩ, it **IS** within its color-coded tolerance.

Procedure Continued: Now, repeat steps A through H (on page 1), for 19 other resistors. Choose resistors so that you get several from each of the possible third band colors (gold, black, brown, red, orange, yellow, green).

NOTE: The "basic" unit for resistance of your ohmmeter is the kilo-ohm (kΩ). Pay VERY careful attention to the UPPER RIGHT region of the DMM (see picture to the right) for ALL ohmmeter readings.

IF the Ω LED is lit, the **unit of your measured R is** Ω, NOT kΩ.

IF the MΩ LED is lit, the **unit of your measured R is MΩ**, NOT kΩ.

MΩ = meg-ohm = 10^6 ohm = 1,000,000 ohm.

LABORATORY REPORT:

As part of the regular laboratory report, write a brief set of procedures explaining how to measure resistance with a digital multimeter, including how to interpret the display so that the correct unit of measurement is associated with the numerical value.

Resistor's ColorCode *(Record four color bands)*	Coded Resistance (Ω)	Tolerance (%)	Maximum Coded Resistance (Ω)	Minimum Coded Resistance (Ω)	Measured Resistance (Ω)	Is the Resistor Within Tolerance?
Red-Violet-Orange-Silver	27Ω	10%	27k+2.7k = **29.7kΩ**	27k-2.7k=**24.3kΩ**	25.1 kΩ	YES**

**YES because: 24.3 kΩ ≤ 25.1kΩ≤29.7kΩ

Student's Name: _____ **Date(s) Performed:**_____