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# ECE 10A Lab 1 Report

**Introduction:** This lab is intended to familiarize students with operating resistors by conducting tests like measuring the resistance, examining the relationship between the voltage and current in the resistors, and checking the validity of Ohm's law to determine resistance.

**Results:**
**Step 1:**

| Resistor | Measurement (R = 100 Ω) | Measurement (R = 1 kΩ) |
|---|---|---|
| 1 | 100.73 | 1.006 |
| 2 | 100.48 | 0.9997 |
| 3 | 100.59 | 1.000 |
| 4 | 100.92 | 0.9998 |
| 5 | 100.63 | 0.9968 |
| 6 | 100.57 | 1.004 |
| 7 | 100.67 | 0.9979 |
| 8 | 100.74 | 0.9996 |
| 9 | 100.89 | 1.007 |
| 10 | 100.59 | 1.002 |
| μ | 100.681 | 1.00128 |
| σ | 0.1409 | 0.0032 |
| σ/μ | 0.0014 | 0.0032 |

Table 1. Resistor measurements

**Step 2:**
Finding the standard deviation normalized to the mean (σ/μ) helps determine the measure of variability in our results. This is important because determining the precision of data can be used in quality control assessments. **[RP1]**

**Step 3:**

| $V_{in}$ (V) | $I_{out}$ (mA) |
|---|---|
| 0.0 | 0.000 |
| 0.5 | 0.500 |
| 1.0 | 1.001 |
| 1.5 | 1.501 |
| 2.0 | 2.001 |
| 2.5 | 2.502 |
| 3.0 | 3.002 |
| 3.5 | 3.501 |
| 4.0 | 4.002 |
| 4.5 | 4.502 |
| 5.0 | 5.003 |

Table 2. $I_{out}$ vs. $V_{in}$ 1kΩ resistor.

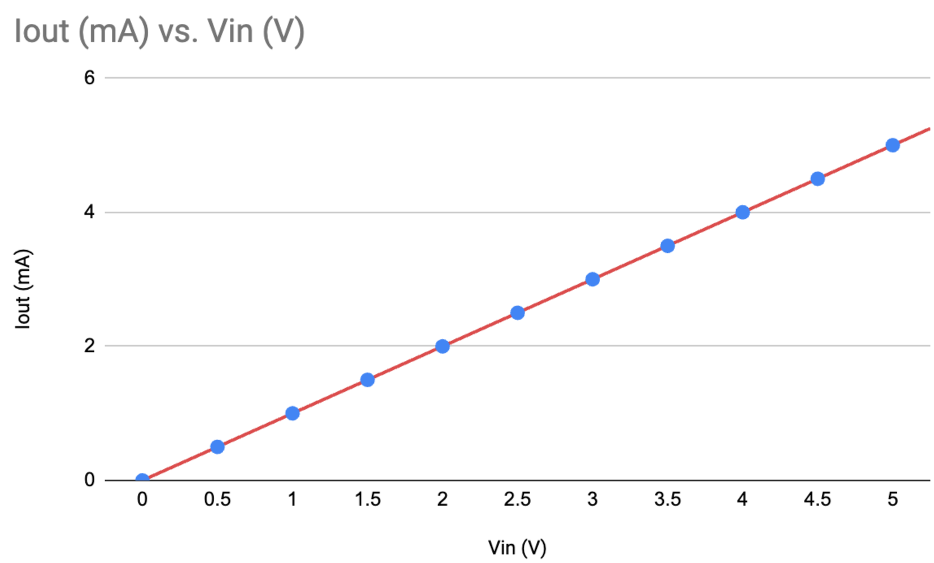



Figure 1. $I_{out}$ vs. $V_{in}$ 1kΩ resistor. **[RP2]**

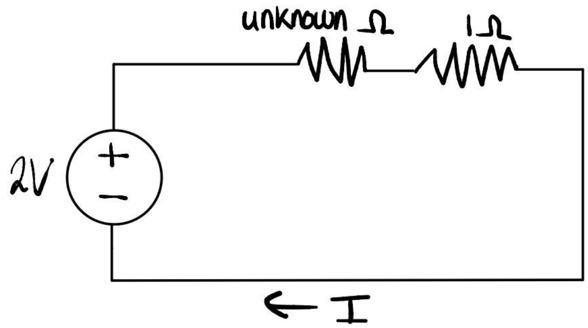
**Step 4:** **[RP3]**

**4.1.** The $I_{out}$-$V_{in}$ characteristics are linear.

**4.2.** The slope of the graph represents the conductance, in mhos. Which is just 1/R.

**4.3.** The line of best fit estimates the resistance to be approximately 1kΩ.

**Step 5:**
**5.1.** **[RP4]**




**5.2.** $V_{out} = V_{in}\left[\frac{R_{unknown}}{R_{1\Omega} + R_{unknown}}\right]$ **[RP5]**

**5.3.**

| Resistor | Measurement (R = 100 Ω) | Measurement (R = 1 kΩ) |
|---|---|---|
| 1 | 97.75 | 0.89775 |
| 2 | 95.57 | 1.12275 |
| 3 | 96.87 | 1.04426 |
| 4 | 94.78 | 1.05339 |
| 5 | 98.21 | 1.07750 |
| 6 | 92.76 | 0.89510 |
| 7 | 86.73 | 1.10563 |
| 8 | 85.54 | 1.08774 |
| 9 | 90.08 | 1.09965 |
| 10 | 91.45 | 0.91623 |
| μ | 92.974 | 1.03000 |
| σ | 4.4771 | 0.0908 |
| σ/μ | 0.0482 | 0.0882 |

Table 3. Calculated resistance values. **[RP6]**

**5.4.** Our modified technique was less accurate than the actual digital multimeter measurements. When we measure the resistance using the multimeter we obtained means of 100.681Ω and 1.00128kΩ and normalized standard deviations of 0.0014Ω and 0.0032kΩ for the 100Ω and 1kΩ resistors respectively. When we implemented our modified technique we got means of 2.974Ω and 1.03kΩ and normalized standard deviations of 0.0482Ω and 0.0882kΩ for the 100Ω and 1kΩ resistors respectively. In both resistors our modified technqiue's calculated resistance data proved to be less accurate than the multimeter. This can be seen through our normalized standard deviation values. **[RP7]**

**Conclusion:**

Following our observations made throughout the lab, we can conclude that using the digital multimeter to directly measure the resistors is more accurate and precise than measuring it indirectly using the voltage divider circuit and formula. We came to this conclusion based on the standard deviation of the data we collected for the voltage divider circuit, which had a larger mean and standard deviation than that of the exact measurements. The data collected from measuring the current of the 1kΩ resistor with varying voltages shows that the relationship between the current and voltage is linear, and that the slope of the graph represents the conductance, or the reciprocal of resistance.