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ECGR 2155-Section L02

University of North Carolina at Charlotte
Department of Electrical and Computer Engineering

Laboratory Experiment Number#1 Instrumentation Tutorial

Laboratory Experiment Report#1

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1 Objectives:

There are many instruments in the lab to be used by students in the ECE undergraduate program. Students are required to know how to build circuits from circuit diagrams and use the instruments in the lab to be able to measure different circuit elements. During the first lab session of the semester, it is imperative to acclimate students to the process of using the different lab instruments. The first laboratory session explored the operation and use of common lab instruments, e.g., the dc power supply, multimeter, signal generator and oscilloscope. The purpose of Experiment 1 is to learn about and use the equipment in the lab with the intent of using it for future labs.

2 Equipment List:

- Banana Leads
- $1k\Omega$ Resistor - mounted on a U channel
- Agilent U8031A DC Power Supply
- Agilent 34461A Digital Multimeter
- Agilent 33500B Arbitrary Function Generator
- Agilent DSO-X-2002A Digital Storage Oscilloscope

3 Relevant Theory/Background Information

Multiple instruments are used during the experiment. The DC power supply supplies voltage values set by the experimenter to the circuit board. The digital multimeter measures three basic electrical quantities; current, resistance, and voltage (AC and DC). The arbitrary function generator generates a sine wave- arbitrary function generators can also produce eight other waveforms; square, ramp, line, pulse, triangle, noise, PRBS, and DC. An oscilloscope graphically displays varying voltage signals and shows how voltage changes over time. Ohm's law is a basic circuit theory concept. According to Ohm's law $V = IR$ where V is voltage, I is current, and R is the resistance value. Ohm's law is applied during this experiment. According to Ohm's law, no voltage can appear across a short circuit- as a connection between two nodes, a short circuit provides no resistance. As the value for resistance is equal to 0, the equation is as follows $V = I * R$ and thus there is zero voltage. Ohm's

law can also explain the directly proportional relationship between voltage and current.

4 Experimental Data/Analysis

A DC power supply is used to set up a current limit of 0.3A, the current limit protects the lab equipment in case of unintentional short circuits. A digital multimeter (DMM) is then used to measure different values of a circuit; voltage, resistance, and current. Although the values of the circuit were predetermined and preset, the measured values differed (refer to table 1 for more details). The preset values of the experiment saw the resistance at $1k\Omega$, the voltage at $10V$, and the current at $0.3A$.
The measured values were as follows:
$\frac{9.99826V}{0.00991201A} \approx 1008.702\Omega \approx 1k\Omega \approx 0.986k\Omega$
Where...
The calculated value = 1008.702Ω
The actual value = $1k\Omega$
The measured value = $0.986k\Omega$
The oscilloscope is then used to measure a specified voltage and the function generator is used to generate a specified waveform.

5 Conclusion

During the experiment, the values of the resistors recorded in the post lab differed from the measured values during the experiment. Possible deviations in measurements can be attributed to any imperfections in the voltage being provided by the power supply, the make of the resistor, and the multimeter. The resistor being used in the lab ($1k\Omega$) already had a given tolerance level of ± 5 indicated by the gold band. Some of the power given by the power supply could have been dissipated through the connections to the circuit, explaining why the measured resistance values were always slightly less than the given values.
To conclude, experiement one was an introduction to the course acclimating students to the instruments used during the lab. Through measuring different circuit elements, students can see the variances between measured and given values.

6 Tables

Table 1:

Nominal Resistance	$1k\Omega$
Measured Resistance	$0.986k\Omega$
Measured Voltage across the Resistor	$9.99826V$
Measured Current through the Resistor	$9.91201MA$

7 References

Experiment 1 - Instrumentation Tutorial. University of North Carolina at Charlotte, Department of Electrical and Computer Engineering. https://ece.charlotte.edu/sites/ece.charlotte.edu/files/media/ecgr2155-experiment-1-instrumentation-tutorial.pdf.