**Lab 2: Calculation of Internal Resistances of Voltmeter, Ammeter and Scope**

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EEE 117L Section 05

2pm – 4:50pm

**Procedure:**

1. Set up our circuit with a 430k Ohm resistor and the voltmeter or ammeter in parallel to the resistor.
2. Measure values of resistance (True value) of the resistors being used, this is measured through the DMM use of the Ohmmeter.
3. Calculate the voltage across the 430k Ohm resistor to calculate the internal resistance of the source through voltage division
4. Repeat the process for the ammeter and voltmeter to calculate the internal resistance of the ammeter. (Find Ohm’s law related variables to properly calculate the resistance being observed)
5. Calculate theoretical values through voltage division, current division to see how close/accurate our measured results are to our calculated results.

**Analysis:**

During our lab experiments we were using a simple circuit with a resistor of a measured value of 426K Ohms, our voltage source was placed to 5.998 V. The percentage error here is .009 so hour theoretical and measured values should be in a range of about -.009 percent of what we calculate. We used one circuit to measure both the source internal resistance, ammeter internal resistance and the voltmeter internal resistance. The circuit was the source in series with our 430K “labeled” resistor. Attached in parallel to the resistor was our voltmeter, we used this to calculate the voltage drop within the internal resistance to the node directly after the source (where the source and the resistor meet). From there we were able to calculate the current running through the 430k “labeled” resistor and then calculate a theoretical value for the internal resistance of .142 Ohms. The internal resistance is very small because it needs to dissipate as little of the voltage across the internal resistance as possible to deliver a close to accurate input voltage. After we calculated this we did a current divider across the voltmeter and the resistor to obtain the theoretical value of the voltmeters internal resistance, we measure a miniscule current going through the voltmeter, .00019 x 10^-3 A, across the voltmeter. This resulted in a very large resistance of almost 31 MOhms. We then did the current division, switching places in the circuit with the voltmeter, across the ammeter to determine the amperage across the ammeter and noticed that the resistance was fairly low, our calculated value was 5 Ohms which in theory makes sense. The voltmeter has a very high resistance to impede on the current of the circuit so that way the voltage potential can be measured while the ammeter has a relatively low resistance so the current can flow relatively unimpeded.

**Data:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Internal Resistance of: | | Power Source | VM | AM |
|  |  | .142 Ohms | 31568000 Ohms | 5 Ohms |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Voltage: | 5.998V |  |  |  |
| Amps: | .01407 A | Total |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Resistors: | Labeled | Measured |  |  |
| R\_1: | 430k\_Ohm | .426k\_Ohm |  |  |
| R\_1A: | 0.01388 A | <- Measured |  |  |
|  |  |  |  |  |
|  |  | 0.00019 | mA |  |
| R\_VM = | 5.998/.00019 | |  |  |

**Conclusion:**

We learned that using these instruments gives us a number relatively close to our calculations, as concluded from the other lab, while also proving again the theory of KVL and KCL. Our current dividers and voltage dividers were able to give us calculated values close to our measured ones. Also this further proves the circuit analysis theories that we’ve been taught in our courses. There needs to be some sort of resistance to provide the correct voltage and current across circuit elements. We were also able to conclude how a voltmeter and a ammeter so accurately measure values across circuit elements, it is due to the internal resistance of the components themselves.