**Queensborough Community College**

The City University of New York

**Department of Engineering Technology**

**ET 110 – Introduction to Circuit Analysis Laboratory**

**Lab#3**

**Voltage and Current Measurements**

**Inspector: Prof. Wu**

**Date 9/9/16**

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* **State the objective of today’s lab**

1. Build a circuit to measure the current and voltage through each of the resistors
2. Using the DMM to measure the actual value of the resistors
3. Measured the current through each resistor
4. Measured the voltage through each resistor
5. Measured the voltage at a node with respect to ground
6. Measured the voltage between two points
7. Measured the voltage rises and voltage drops

* **List all component used for Lab 3**
* Resistors 100Ω, 330Ω, 47Ω, 470Ω and 220Ω
* A 9V battery
* DMM
* Jump wire
* **Lab Experimental result**
* **Table 3.1**

|  |  |  |
| --- | --- | --- |
| **Elements** | **Given Value (include unit)** | **Measured Value (include unit)** |
|  | 100Ω (brown, black, brown, gold) | 100.1Ω |
|  | 330Ω (Orange, orange, brown, gold) | 328.0Ω |
|  | 47Ω (yellow, blue, black, gold) | 48.0Ω |
|  | 470Ω (yellow, blue, brown, gold) | 471.0Ω |
|  | 220Ω (red, red, brown, gold) | 220.0Ω |
| Voltage Source | 9V | 9.1V |

* **Table 3.2**

|  |  |  |
| --- | --- | --- |
| **Elements** | **Measured Value (include unit)** | **Predicted Value** |
|  | 26.6mA |  |
|  | 17.6mA |  |
|  | 17.6mA |  |
|  | 9.4mA | 9.25mA |
|  | 9.5mA |  |
|  | 26.5mA | 26.18mA |

* **Table 3.3**

|  |  |  |  |
| --- | --- | --- | --- |
| **Voltage label** | **Voltage Magnitude** | **Polarity** | **Label and voltage as it would be written** |
|  | 9V | + |  |
|  | 2.7V | + |  |
|  | 5.6V | + |  |
|  | 820.0mV | + |  |
|  | 4.4V | + |  |
|  | 2.1V | + |  |

* **Table 3.4**

|  |  |  |  |
| --- | --- | --- | --- |
| Node | Measure Voltage | Expected Voltage | Voltage written as |
| A | 9.2V | +9V |  |
| B | 6.5V |  |  |
| C | 820.0mV | +0.8V |  |
| D | 2.1V |  |  |

* **Table 3.5**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Voltage to be measured** | **Measured Value** | **Expected Value** | **Written as** | **Voltage at 1st point minus voltage at 2nd point** | **Comment** |
|  | 2.7V |  |  |  | + sign indicates A is higher in voltage than B |
|  | -2.6V | -2.6V |  |  | - sign indicates B is lower in voltage than A |
|  | 5.6V | +5.6V |  |  | + sign indicates B is higher in voltage than C |
|  | -5.6V |  |  |  | - sign indicates C is lower in voltage than B |
|  | -4.4V |  |  |  | - sign indicates D is lower in voltage than B |
|  | -8.2V |  |  |  | - sign indicates C is lower in voltage than A |
|  | 8.2V |  |  |  | + sign indicates A is higher in voltage than C |

* **Table 3.6**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **From point** | **To point** | **Calculation** | **Rise or drop** | **+ for rise -for drop** | **Magnitude of voltage** | **This is the same as (compare to Table 3.5 measured value)** |
| A | C |  | Drop | - | 8.2V |  |
| D | B |  | Rise | + | 4.4V |  |
| GND | C |  | Rise | + | 820.0mV |  |
| D | GND |  | Drop | - | 2.1V |  |
| C | B |  | Rise | + | 5.7V |  |

* **Question**

1. There are three jacks on DMM from left to right, they are labeled as COM (max 500V), VΩMA (max 200mA), and A (max 10A). The black lead is always plugged in COM, and red lead is plugged in VΩMA when measuring the voltage, resistance, and current (which less than 200mA), however, when the current is greater than 200mA, the red lead should be plugged into the jack which labeled in A.
2. The DMM is placed across the component.
3. The black lead is going to clip the circuit ground which we use the jump wire in the negative line on the breadboard. And red lead is going to hook the terminal from the component.
4. In this circuit, all the points are positive with respect to the ground because the battery’s negative terminal takes to be a reference (ground).
5. No. In an energized circuit, all voltage measurements are done across elements or from on point to another. So we can measure the voltage direct in the circuit without involving the “break” a wire.
6. Yes. Because if we do not involve the “break” a wire during the measurement, we just know there is current in the energized circuit, but we are not able to observe how many the current is being transferred.
7. The current flow in Figure 3.1 is a series-parallel circuit, so the current will be allocation after current go through the resistor and it is a *dc* circuit, the polarity of the voltage is always being the same flow which is from positive to the negative.

* **Conclusion**

In today’s lab, I have learned how to measure the current and voltage in an energized circuit. The theory to use for the current or voltage measurement is different. By measured current, we have to involve the ‘break’ wire, otherwise, we are not able to measure it. On the other hand, the voltage measurement must be done across the component or from one point to another. During the experiment, I had a problem to measure the current through the battery. My DVM cannot get the result for it. I had double checked the build of the circuit and the connection, but I still not able to get the result out. I had to borrow the classmate DVM to measure the current through the battery. Fortunately, it was working this time and I got the answer for it. In addition, I am also aware of the different with the subscript notation between the voltage between the two point and the voltage rises and drops. Furthermore, I realize the circuit which we used on lab is a dc parallel circuit. So the current will distribute after the current through the , and the flow will be always from the positive polarity to the negative polarity.