**Queensborough Community College**

The City University of New York

**Department of Engineering Technology**

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

**Lab#5**

**Short Circuits, Open Circuits, Switches & Relays**

**Inspector: Prof. Wu**

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**State the Objective of Lab #5**

* Introduction Short circuits and Open Circuits
* Identify the bread board nodes
* Learn the N/O, N/C, SPST, SPDT, DPDT switches application.
* Measured voltages from the Short or Open Circuits by using different type of the switches.

**Components’ list**

* Power Supply =9V
* DMM
* Protoboard
* Jumper wires
* N/O, N/C, SPST, SPDT, DPDT switches
* Lamps, Red and Green LED.
* Resistors 470Ω and 560Ω.

**Experimental**

* **Part 1- Open and Short Circuit**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Circuit Element** | **DMM reading** | **Resistance Value** | **Is it an open or short circuit?** | **Continuity indication (Yes/No)** |
| **Short piece of wire** | **0.165Ω** | **165mΩ** | **Short** | **Yes** |
| **Wire Disconnected from meter lead** | **OL** | **-** | **Open** | **No** |
| Table 5.1 Short Circuit & Open Circuit Measurements | | | | |

* **Part 2 – Protoboard connections**

|  |  |
| --- | --- |
| **Test Node** | **Are they connected?** |
| A5 to A6 | No |
| D10 to F10 | No |
| C20 to D20 | Yes |
| F50 to I50 | Yes |
| +10 to +20 | Yes |
| +30 to -30 | No |
| Table 5.1- Protoboard connections | |

|  |  |  |
| --- | --- | --- |
| **Description** | **Number nodes** | **Number of connection in a node** |
| Power supply nodes: Each long red or blue line | 2 | 50 |
| Basic nodes: short line (on each side of the indentation) | 63 | 5 |
| Table 5.2 – Protoboard Description | | |

* **Part 3 – Switches**

|  |  |
| --- | --- |
| **Switch Position** | **Short or Open?** |
| ON | Short |
| OFF | Open |
| Table 5.2 – On/Off Switch Operation | |

|  |  |
| --- | --- |
| **Switch Position** | **Short or Open** |
| 1 | Open |
| 2 | Short |
| Table 5.3 -SPDT Switch Operation | |

* **Part 4 – Application of Momentary Contact Switches**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Figure 5.4a**  **Push to make** | **Expected**  **Voltage Across Switch** | **Measured Voltage Across Switch** | **Expected**  **Voltage Across Bulbs** | **Measured**  **Voltage Across Bulbs** |
| Pushbutton not depressed | 9V  (Bulbs are off) | 8.99V | 0V  (Bulbs are off) | 0V |
| Pushbutton depressed | 0V  (Bulbs are on) | 480µV | 9V  (Bulbs are on) | 8.98V |
| Table 5.4a- Switch & Bulbs Voltages N/O Pushbutton Switch | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Figure 5.4b**  **Push to break** | **Expected**  **Voltage Across Switch** | **Measured Voltage Across Switch** | **Expected**  **Voltage Across Bulbs** | **Measured**  **Voltage Across Bulbs** |
| Pushbutton not depressed | 0V  (Bulbs are on) | 0V | 9V  (Bulbs are on) | 8.98V |
| Pushbutton depressed | 9V  (Bulbs are off) | 8.98V | 0V  (Bulbs are off) | 0V |
| Table 5.4b- Switch & Bulbs Voltages N/C Pushbutton Switch | | | | |

* **Part 5 – Application of ON/OFF Switches**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Figure 5.5**  **Push to make** | **Expected**  **Voltage Across Switch** | **Measured Voltage Across Switch** | **Expected**  **Voltage Across Bulbs** | **Measured**  **Voltage Across Bulbs** |
| Switch in the OFF position | 9V  (Bulbs are off) | 8.99V | 0V  (Bulbs are off) | 0V |
| Switch in the ON position | 0V  (Bulbs are on) | 240µV | 9V  (Bulbs are on) | 8.98V |
| Table 5.5- Switch & Bulbs Voltages for on/off Switch | | | | |

* **Part 6 Application of a Two-way Switch (SPDT)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Switch Position** | **Green LED**  **(on or off)** | **Red LED**  **(on or off)** | **(Include Unit)** | **(Include Unit)** |
| 1 | On | Off | 6.99V | 0V |
| 2 | Off | On | 0V | 6.84V |
| Table 5.6 – Control of 2 circuits with a SPDT switch | | | | |

* **Part 7 – Relays**

|  |  |  |
| --- | --- | --- |
| **Pushbutton Switch** | **Red LED (On or Off)** | **Green LED (On or Off)** |
| Not Depressed | On | Off |
| Depressed | Off | On |
| Table 5.7 - Control of 2 Separate Circuits with a SPDT Relay | | |

The answers for the table 5.7 are my predicted. Because we didn’t do it on lab.

**Questions**

1. A path that carries a very small resistance is a short circuit.
2. The open circuit is the opposite way of the short circuit that owns exceedingly high resistance.
3. Basically, there is nothing wrong with a short circuit, if it supposes in that position. However, the short circuits cause a trouble only when it has been damaged in such a way that it becomes shorted. Thus, the short circuit is turned to an open circuit.
4. According to the lab, when an ohmmeter placed across a short circuit, the ohmmeter will present a minuscule variable number on the display.
5. According to the lab, when an ohmmeter placed across an open circuit, the ohmmeter will give an immensely large number on the LED screen.
6. According to the lab, when the short circuit tests for the continuity, a noise will be made. On the other hand, when the open circuit tests, it only shows the word “OPEN” one the display.
7. Switches are devices that are used to control circuits. They can turn electronic or electrical devices on or off and enable circuits to perform the various task.
8. The N/C pushbutton switch is a normally connected switch if you don’t push the button it is a short circuit. When you push the button it turns to open circuit. The N/O pushbutton is a normally open switch which is the opposite operation of the N/C pushbutton. When you push the button it turns to a short circuit, and when you release the button it goes back to the open circuit.
9. “break before make” means the break to the first contact can be accomplished before the contact to the second through path is made.
10. The SPST has on the pole and one through which means there is a terminal of the switch is permanently connected to the traveling arm. In addition, the other terminal of the switch is in contact with the traveling arm during a “make” and is not in contact during a “break”. However, the momentary contact switch is the both side terminals are either in contact or not in contact the traveling arm at all.
11. The another name for the SPDT switch is a Two-way Switch.

**Conclusion**

In this lab, we were learning the short and open circuits. And used that knowledge to understand how the momentary contact switches, SPST, SPDT, and DPDT switches working on the circuit. Basically, the switches allowed us to control the circuits. In fact, the switch uses a pole and throw to connect the circuit. The pole is the permanently connected to the traveling arm. And throw can connect one or more circuits during it makes contact with the circuit or not. During the lab, we also identify the indication for the short and open circuit ran a continuity test. When it is a short circuit a noisy would be an attempt. What I didn’t want to hear any more. Base on my experience in this lab, it is really important you understand how the breadboard works for you. That means you need to know the correct way to connect the node and branches by jumper wire in the network. Otherwise, you will not be able to get the right circuit. And your measurements would give you a hard time to find voltages in the lab. I also got misunderstanding when I measured voltage across the bulbs. I only thought I need to do one of the bulbs instead of the both of them.