Lab 1: Simple Circuits and Debugging Techniques

ECE218-L01

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Lab Date: 1 Feb 21

Due Date: 8 Feb 21

Introduction

Purpose

Design and create basic circuits to learn debugging techniques.

Scope

To measure and record the voltages across the resistors and state of the LEDs.

Theory

Theoretical Basis

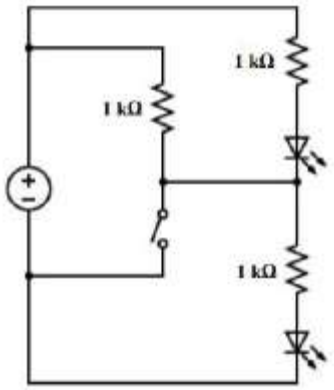
Most of the circuits have the same basic input-output circuit structure with the output circuit used to test if the input circuit is working properly.

Preliminary Work

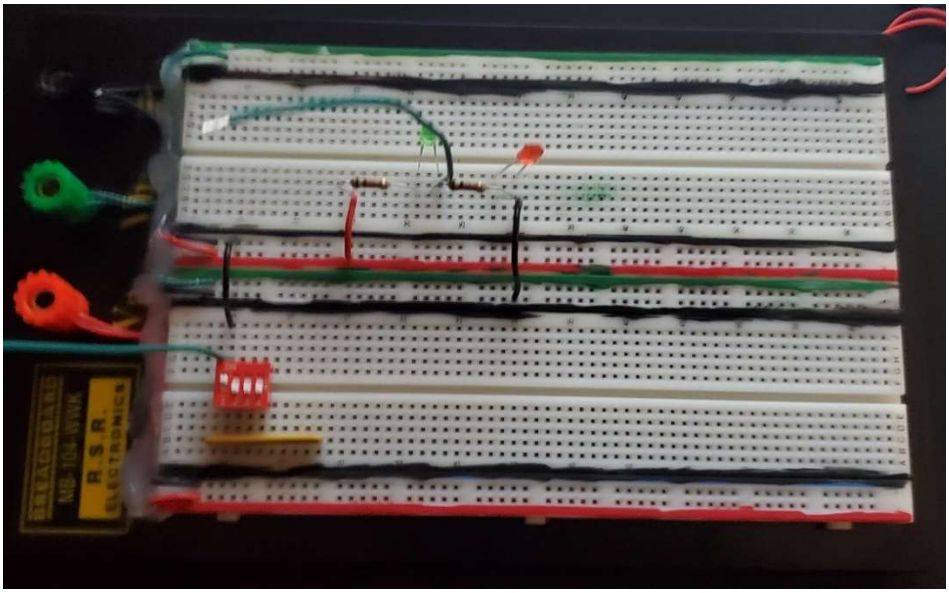
1. For the input circuit, what is the voltage at the node mentioned as "input node" when the switch is open, and the supply voltage is 10V instead of 5V?
   - When the switch is open the voltage at node “input node” is 10V.
2. With the same voltage of 10V, for the input circuit, what is the voltage at the node mentioned as "input node" when the switch is closed?
   - When the switch is closed the voltage at the node “input node” is 0V.
3. What is the current flowing through the resistor R=1kΩ in the input circuit when the supply voltage is 5V (give the answer for both switch open and switch closed condition)?
   - Open switch (I): (0V)/ (1000Ω) = 0A
   - Closed switch (I): (5V)/ (1000Ω) = 0.005A

Experimental Procedure

Schematics (Circuit Diagram)



Breadboard



Equipment:

- copper wire
- 1kΩ resistor array
- 2 1kΩ resistors
- DIP SPST switch
- red LED
- green LED

Procedure

1. Set up circuit depicted in the circuit diagram on the breadboard
2. Connect breadboard to desktop voltage source and set to 5V
3. With the switch closed measure and record the voltage from the output node to the negative terminal
4. Repeat step 3 with the switch open
5. For each resistor and LED measure and record the voltage from the positive to the negative end of each element with the switch closed
6. Repeat step 5 with the switch open
7. Record which LED is lit when the switch is open and closed

Results

Input Circuit

Switch	Input Point Voltage	
	Handheld Multimeter	Desktop Multimeter
Open	4.99	5.01
Closed	0.01	0.0

Output Circuit

Device	Voltages					
Desktop Multimeter	Input	LED Green	LED Red	Resistor 1	Resistor 2	Led Lit
	V_{CC}	0	1.82	0	3.18	Red
	GND	2.48	0	2.52	0	Green
Handheld Multimeter	Input	LED Green	LED Red	Resistor 1	Resistor 2	Led Lit
	V_{CC}	0	1.81	0	3.18	Red
	GND	2.49	0	2.52	0	Green

V_{CC} Input:

Current through LED Green:

I=V/R=0V/1000Ω=0A

Current through LED Red:

I=1.82V/1000Ω=0.000182A=1.82mA

GND Input:

Current through LED Green:

I=2.49V/1000Ω=0.00249A=2.49mA

Current through LED Red:

I=0V/1000Ω=0A

Interpretation

The results of the experiment are exactly as excepted. When the switch was closed the output-node was connected directly to the ground, so the voltage was 0 and the green LED was lit, when the switch was open however, the node was connected to the power supply and had a higher voltage, and the red LED was lit. A possible source of error could have been resistance in the wires which could have decreased measured voltages.

Conclusion

We can conclude that it is possible to create a simple circuit to view its output using LEDs.