Series-Parallel Circuits

*Air Washington Electronics ~ Direct Current Lab*

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Overview

In this lab, students are asked to build a series-parallel circuit using both Multisim and a breadboard, based on a schematic. Calculations and measurements will be taken and analyzed. Using a Multisim file, a fault will be introduced and analyzed. Utilizing the circuit on the breadboard, a fault will be induced and analyzed.

## Requirements

To meet all requirements for this lab, you must complete all activities, questions, critical thinking activities and questions, and observations and conclusions.

## Course Objectives

* Demonstrate proper measurement techniques for voltage, current and resistance.
* Demonstrate proper operating techniques and evaluate for proper operation the following list of test equipment: DC Power Supply and Digital Multimeter
* Demonstrate acceptable techniques to construct circuits from schematic drawings on solderless and/or solder type breadboards.
* Demonstrate ability to document a breadboard circuit, schematic, pictorial layouts, predict circuit operation, test circuit operation and compare test results.

## Module Objectives

* Build a series-parallel circuit per schematic and take/analyze measurements.
* Analyze and compare values between calculated and measured values.
* Choose resistors needed to meet stated specifications using standard ±5% resistor values.
* Predict and support circuit response to specific changes and faults.

## Activities & Assessments

1. Series-parallel Circuit (Breadboard)
2. Series-parallel Circuit (Multisim)

# 1: Series-Parallel Circuit (Multisim)

### Components & Equipment Needed

* Multisim program
* Multisim file S-P circuit.ms12

### Schematic

**R11**

**R5**

**R3**1



**R7**

**R6**

**R4**

**R2**

### Procedure

**Step 1:**  Using Multisim, build the circuit shown in the schematic.

**Step 2:**  Take measurements and perform calculations as required in the table below.

**Step 3:** Open the Multisim file labeled S-P circuit.ms12 in the Canvas module for Series-Parallel circuits.

**Step 4:**  Take measurements and perform calculations as required in the table below.

### Measurements

|  |  |  |  |
| --- | --- | --- | --- |
|  | Multisim Value | File S-P circuit.ms12 value | % Difference |
| VR1 |  |  |  |
| VR2 |  |  |  |
| VR3 |  |  |  |
| VR4 |  |  |  |
| VR5 |  |  |  |
| VR6 |  |  |  |
| VR7 |  |  |  |
| IR2 |  |  |  |
| IR4 |  |  |  |
| IR7 |  |  |  |
| ITotal |  |  |  |
| RT |  |  |  |

### Questions

1. What is the faulty component and what is the fault? Please explain.
2. In the table above there is no space to record IR1, IR3, IR5, or IR6 . Why do you think this is?

# 2: Series-Parallel Circuit (Breadboard)

### Components & Equipment Needed

* Breadboard
* Jumper Wires
* Resistors: 330 Ω, 390 Ω, 560 Ω, 910 Ω, 1.1 kΩ (2), 1.5 kΩ
* Schematic from Activity 1.
* DC Power Supply

### Procedure

Step 1: Build the schematic shown in Acitivity 1.

Step 2: Take measurements and perform calculations as required in the table below.

Step 3: Simulate an open circuit by removing R4.

Step 4: Take measurements and perform calculations as required in the table below.

Step 5: Simulate a short circuit by replacing R4 with a jumper.

Step 6: Take measurements and perform calculations as required in the table below.

### Measurements

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Breadboard Values** | **R4 Open** | **R4 Short** |
| VR1 |  |  |  |
| VR2 |  |  |  |
| VR3 |  |  |  |
| VR4 |  |  |  |
| VR5 |  |  |  |
| VR6 |  |  |  |
| VR7 |  |  |  |
| IR2 |  |  |  |
| IR4 |  |  |  |
| IR7 |  |  |  |
| ITotal |  |  |  |
| RT |  |  |  |

### Questions

1. Do the values for R4 Open and R4 Short match the values you expected? Explain.