

# Series-Parallel Circuits

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*Air Washington Electronics ~ Direct Current Lab*



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# Series-Parallel Circuits

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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  $\pm 5\%$  resistor values.
- Predict and support circuit response to specific changes and faults.

## Activities & Assessments

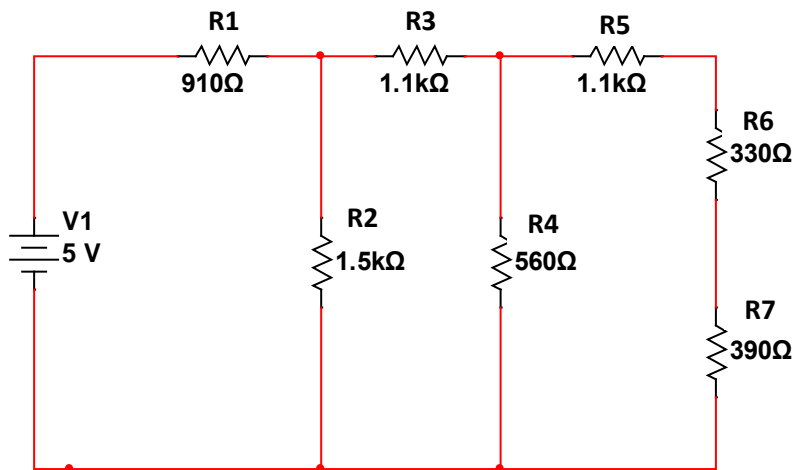
1. Series-parallel Circuit (Breadboard)
2. Series-parallel Circuit (Multisim)

## 1: Series-Parallel Circuit (Multisim)

### Components & Equipment Needed

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

### Schematic



### 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.

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### Measurements

	Multisim Value	File S-P circuit.ms12 value	% Difference
$V_{R1}$			
$V_{R2}$			
$V_{R3}$			
$V_{R4}$			
$V_{R5}$			
$V_{R6}$			
$V_{R7}$			
$I_{R2}$			
$I_{R4}$			
$I_{R7}$			
$I_{Total}$			
$R_T$			

### 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  $I_{R1}$ ,  $I_{R3}$ ,  $I_{R5}$ , or  $I_{R6}$ . Why do you think this is?

## 2: Series-Parallel Circuit (Breadboard)

### Components & Equipment Needed

- Breadboard
- Jumper Wires
- Resistors: 330  $\Omega$ , 390  $\Omega$ , 560  $\Omega$ , 910  $\Omega$ , 1.1 k $\Omega$  (2), 1.5 k $\Omega$
- Schematic from Activity 1.
- DC Power Supply

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### Procedure

- Step 1: Build the schematic shown in Activity 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
$V_{R1}$			
$V_{R2}$			
$V_{R3}$			
$V_{R4}$			
$V_{R5}$			
$V_{R6}$			
$V_{R7}$			
$I_{R2}$			
$I_{R4}$			
$I_{R7}$			
$I_{Total}$			
$R_T$			

### Questions

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