

Ch 7 Parallel Circuits

Notes

In the previous unit we learned that *voltage, current, and resistance* obey certain fundamental laws.

In this unit we will learn

- Parallel circuits have a different set of fundamental laws.
- Circuit problems are solved in a step-by-step process.
- Three different ways to solve for total resistance.

In a parallel circuit the loads are connected across the two conductors that lead to the power source.

- The loads operate independently.
- The loads and their wires are called branches.

Loads connected in parallel may be drawn in many ways.

VOLTAGE IN PARALLEL

- *All branches* of a parallel circuit have the same voltage across them.

CURRENT IN PARALLEL

- Kirchhoff's law of current says that all the current that goes into a point leaves that point.
- The **total current** delivered to a parallel circuit is equal to the sum of the branch currents.

RESISTANCES IN PARALLEL

- If you have three unequal resistance values the total resistance in parallel can be found by using the following formula.

If you have two resistances of unequal value use this formula.

If all the resistances are of equal value use this formula.

Power in a Parallel Circuit

- The **total power** in a parallel circuit is equal to the sum of all the individual powers in the circuit.
- The formula is written:
● $P_t = P_1 + P_2 + P_3 \dots$

Troubleshooting Parallel Circuits

- In a parallel circuit the voltage is the same every-where in the circuit.
- Checking voltage drops is not a very good method for finding a bad load.
- Using the volt meter to find a bad load works well for series circuits, but we should use the Ohmmeter to find a bad load in a parallel circuit.

BATTERIES IN PARALLEL

- Cells are put in parallel to get more current than be obtained from a single cell.
- The total voltage of the combination is equal to the voltage of each cell.
- The total current of the combination is equal to the sum of the individual cells currents.

Using an Ohmmeter to troubleshoot a parallel circuit

- Use the ohmmeter to compare the measured value of R_t (total resistance) to the calculated value of R_t

• *What is the calculated total resistance*

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• *What is the calculated total resistance? **33.33 Ω***

• **Now compare the measured amount to the calculated values..**

• **If there is difference in the values it is problem tell us that there is a lose connection at one of our resistors.**

Using an Ohmmeter to troubleshoot a parallel circuit

- The ohmmeter can provide a quick idea about the condition of the circuit.
- *An infinity reading would indicate an open circuit.*
- *A reading of zero resistance would indicate a short of the entire circuit.*
- *If we got some but not all to the resistance it would indicate that **one or more of the resistances are shorted.***

Using the Ammeter to troubleshoot

- Another method of troubleshooting uses current readings taken for total current and at each load.
- *First, the total current for this circuit is **calculated**, and then calculate the current at each load.*
- Then compare the calculations to the meter readings.
- **A open load would draw no current.**

Ammeter measuring Total Current

- Lets calculate the current.
- Because all the resistances are the same we should use the Ammeter measuring Total Current
- Do not forget to open the circuit before it starts branching out. (splitting to go to R1 and R2), so you can get the meter in series to the loads.

Ammeter measuring an individual load

Ammeter for load R2

- The current can be calculated at R2 by using the formula $I_2 = E_2/R_2$
- $I_2 = 12 \text{ v}/40 \Omega$
- $I_2 = .300 \text{ A}$
- $I_2 = 300 \text{ mA}$

Summary

- Voltage is the same in all parts of a parallel circuit. ($E_t = E_1 = E_2 = E_3$)
- Current spreads out among the loads.
- *All the current that flows into a point will exit that point.*
- The sum of the individual currents will equal the total current. ($I_t = I_1 + I_2 + I_3$)
- R_t will always be lower than the smallest resistance.
- 3 different formulas to calculate Total Resistance