

How To Calculate Total Resistance in Series and Parallel Circuits

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Quick answer

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That rundown encompasses such people as electrical and electronics engineers, technicians, electricians, and circuit designers, to cite just a few.

The possession of such knowledge will put you in a strong position to design circuits that are efficient, safe, and functional. So, let's take you through the essentials of this topic.

What Is the Difference Between Series and Parallel Circuits?

The basic distinctions between series and parallel circuits can be described as follows:

- A series circuit involves components being connected end-to-end, forming a single path for current flow. As a result, the same current flows through every component in a series circuit. In the event, however, of one component failing, the entire circuit would be broken.
- A parallel circuit entails components being connected across separate branches, allowing current to flow through multiple paths. While some current flows through each branch of a parallel circuit, it splits at junctions where branches occur. If one component fails in a parallel circuit, the others can continue to function.

The Steps of Figuring Out Total Resistance in A Series Circuit

A series connection involves the placement of resistors one after the other along a single path. With the current flowing through every resistor in line, their individual resistances add up.

Calculating the total resistance of a series circuit, then, is straightforward. You will simply need to identify the resistance value of each resistor in the series circuit in ohms, followed by adding together all the resistance values to arrive at the total resistance, or R_{total} .

This formula can be expressed as $R_{total} = R_1 + R_2 + R_3 \dots + R_n$, where R_1 , R_2 , R_n , and so on are the resistances of the individual resistors.

So, to give an example of how this calculation would work, if you have three resistors in series with values of 10 ohms (R_1), 20 ohms (R_2), and 30 ohms (R_3), this would be $10 + 20 + 30 = 60$ ohms as the total resistance.

The Steps of Figuring Out Total Resistance in a Parallel Circuit

Resistors being connected "in parallel" means they are arranged so that both ends of each resistor are connected to the same two points in a circuit. A parallel circuit's total resistance is less than the resistance of any individual branch.

To determine the total resistance (R_{total}) of such a circuit, then, you can use the formula $1/R_{total} = 1/R_1 + 1/R_2 + 1/R_3 + \dots + 1/R_n$. Again, R_1 , R_2 , and so on, are the resistances of the individual resistors numbered to n .

The steps, then, are as follows: identify the resistance value of each resistor in the parallel circuit in ohms, before calculating the reciprocal ($1/R$) for each resistor. Sum the reciprocals, and take the reciprocal of the sum to determine R_{total} .

To set out an example, let's imagine you have three resistors in parallel, with values of 10 ohms (R_1), 20 ohms (R_2), and 40 ohms (R_3).

Calculating the reciprocals would give you $1/10 = 0.1S$ (siemens), $1/20 = 0.05S$, and $1/40 = 0.025S$ respectively. Adding together the reciprocals would give you $R_{total} = 0.1 + 0.05 + 0.025 = 0.175S$.

You would then be able to take the reciprocal, this calculation being expressed as $R_{total} = 1/0.175$, which would work out as approximately 5.71 ohms for the total resistance.

What Else Should You Know About Calculating Total Resistance in Series and Parallel Circuits?

If the circuit for which you are trying to figure out the total resistance has both series and parallel configurations, you will need to calculate the equivalent resistance of each parallel section of the circuit, before adding the values for any series resistors. This will then give you a total resistance reading.

Parallel and series resistor calculators are available on various websites, and can be greatly helpful for verifying the accuracy of your manual workings out. The electrical component supplier RS is among the many sources of such tools, making it straightforward to calculate total resistance in a circuit online.

References

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