

## HOW TO FIND THE RESISTANCE OF LOADS WIRED IN PARALLEL.

What you are looking for is the total resistance value of a parallel circuit. You can then compare this value to what the circuit would be like if only one single load was wired in series. We call this the parallel circuits' "equivalent resistance value".

Each load wired in parallel provides an ADDITIONAL path for current because it ADDS its conductance value to the circuit.

**CONDUCTANCE and RESISTANCE.** They are each others' opposite or **RECIPROCAL**.

If one is high, the other will be low.

High resistance would mean little current flow, low conductance.

High conductance would mean high current flow, low resistance.

1Ω of resistance would provide a conductance value of 1.000.  $1 \div 1 = 1.000$

1/2Ω or .500Ω of resistance would provide a conductance value of 2.000.  $1 \div .500 = 2.000$

2Ω of resistance would provide a conductance value of .500.  $1 \div 2 = .500$

The more resistance, the less conductance. The more conductance, the less resistance.

If we had a parallel circuit containing three loads, one 5Ω, 10Ω, and 30Ω, the total resistance they would bring to the circuit would be the same as a 3Ω resistor would if it were wired in series. Since our parallel branch IS the entire parallel circuit, the total resistance of the entire circuit is 3 ohms. If this parallel branch was wired in series with other loads, it would contribute 3 ohms of resistance to the ENTIRE circuit.

Lets see how we arrived at that 3Ω equivalent resistance value.

We used a math formula known as the "RECIPROCAL FORMULA" for finding equivalent resistance of loads wired in parallel.

**THIS IS THE FORMULA:**

$$\frac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \text{ etc.}} = \frac{1}{\text{Total circuit conductance}} = \text{Total equivalent resistance of the parallel circuit or branch.}$$

R1, R2, R3, etc., simply mean that you have identified each load that is wired in parallel with a number so we know what load we are referring to.

When working with the formula:

1. Do all the math on the bottom of the long horizontal line first, this gives us a total value of conductance for all the loads that are wired in parallel with each other.

2. Once you know the value of conductance for each load wired in parallel, simple ADD their values (each load wired in parallel provides an ADDITIONAL path for current).

3. Next, divide that total into 1 (above the long horizontal line), the answer you get will be the total resistance of the parallel circuit or branch. This value could be compared or is equivalent to the resistance that a single resistor wired in series would offer to the circuit.

Lets do the math.

$$\frac{1}{\frac{1}{5} + \frac{1}{10} + \frac{1}{30}} = \frac{1}{.200 + .100 + .033} = \frac{1}{.333} = 3.00\Omega \text{ Equivalent Resistance}$$

Individual conductance      Total conductance

The TOTAL resistance of any parallel circuit is ALWAYS EQUAL TO OR LESS than the resistance of the lowest branch.

Once the total resistance is known, and knowing total voltage applied, total current can be calculated.

Engineering needs these values to determine what size in-line, maxi, mini fuse, etc. is needed to protect a circuit.