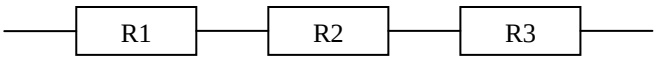
Kitronik Ltd – How to calculate resistors in series and parallel

Resistors in series

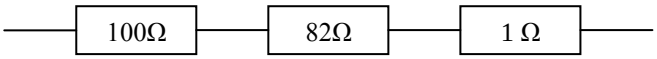
When resistors are connected one after each other this is called connecting in series. This is shown below.



To calculate the total overall resistance of a number of resistors connected in this way you add up the individual resistances. This is gives the following formula:

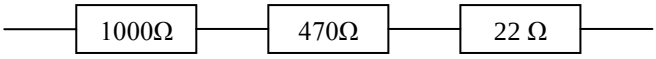
$Rtotal = R1 + R2 + R3$ and so on

Example: To calculate the total resistance for these three resistors in series



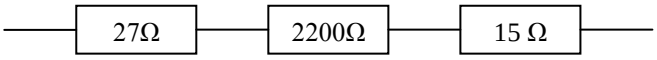
$$\begin{aligned} Rtotal &= R1 + R2 + R3 \\ &= 100\ \Omega + 82\ \Omega + 1\ \Omega \\ &= 183\ \Omega \end{aligned}$$

Task 1: Calculate the total resistance of the following resistor in series



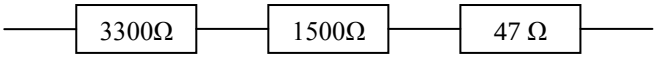
Rtotal = ……...

= ……...



Rtotal = ……...

= ……...

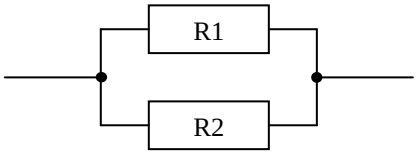


Rtotal = ……...

= ……...

Resistors in parallel

When resistors are connected across each other (side by side) this is called connecting in parallel. This is shown below.

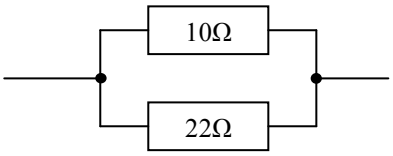


Two resistors in parallel

To calculate the total overall resistance of a of two resistors connected in this way you can use the following formula:

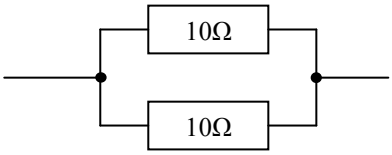
$$Rtotal = \frac{R1 \times R2}{R1 + R2}$$

Example: To calculate the total resistance for these two resistors in parallel

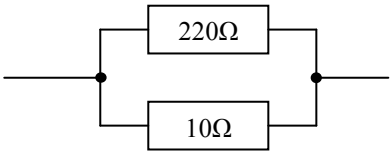


$$Rtotal = \frac{R1 \times R2}{R1 + R2} = \frac{10\Omega \times 22\Omega}{10\Omega + 22\Omega} = \frac{220\Omega}{32\Omega} = \mathbf{6.87\Omega}$$

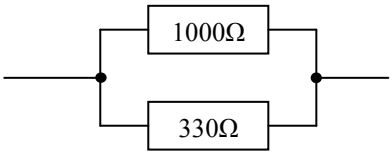
Task 2: Calculate the total resistance of the following resistors in parallel



$$Rtotal = \frac{\ldots\ldots\ldots \times \ldots\ldots\ldots}{\ldots\ldots\ldots + \ldots\ldots\ldots} = \frac{\ldots\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$

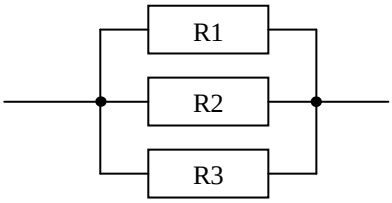


$$Rtotal = \frac{\ldots\ldots\ldots \times \ldots\ldots\ldots}{\ldots\ldots\ldots + \ldots\ldots\ldots} = \frac{\ldots\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$



$$Rtotal = \frac{\ldots\ldots\ldots \times \ldots\ldots\ldots}{\ldots\ldots\ldots + \ldots\ldots\ldots} = \frac{\ldots\ldots\ldots\ldots\ldots}{\ldots\ldots\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$

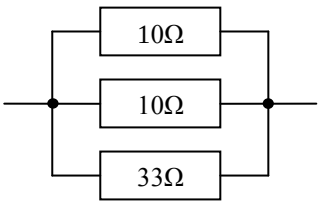
Three or more resistors in parallel



To calculate the total overall resistance of a number of three or more resistors connected in this way you can use the following formula:

$$\frac{1}{Rtotal} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \text{and so on}$$

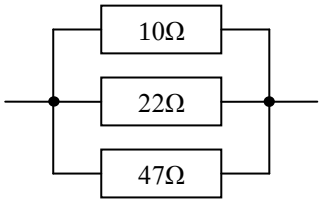
Example: To calculate the total resistance for these three resistors in parallel



$$\frac{1}{Rtotal} = \frac{1}{10\Omega} + \frac{1}{10\Omega} + \frac{1}{33\Omega} = 0.1\Omega + 0.1\Omega + 0.03\Omega = \mathbf{0.23\Omega}$$

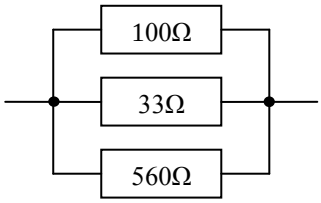
$$Rtotal = \frac{1}{0.23\Omega} = \mathbf{4.35\ \Omega}$$

Task 3: Calculate the total resistance of the following resistors in parallel



$$\frac{1}{Rtotal} = \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} = \ldots\ldots + \ldots\ldots + \ldots\ldots = \ldots\ldots\ldots$$

$$Rtotal = \frac{1}{\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$



$$\frac{1}{Rtotal} = \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} + \frac{1}{\ldots\ldots\ldots} = \ldots\ldots + \ldots\ldots + \ldots\ldots = \ldots\ldots\ldots$$

$$Rtotal = \frac{1}{\ldots\ldots\ldots} = \ldots\ldots\ldots\ldots$$

Answers

Task 1

1 = 1492 Ω
2 = 2242 Ω
3 = 4847 Ω

Task 2

1 = 5 Ω
2 = 9.57 Ω
3 = 248.12 Ω

Task 3

1 = 5.95 Ω
2 = 23.76 Ω