

LESSON 18

Additional resistance w/LEDs**Watch video
Lesson 18**

In an electronic circuit, each component in the circuit 'drops' a certain amount of voltage.

For example, a red LED usually drops 2 volts at 18 mAmps. We say that there is a '**voltage drop**' across the LED of 2 volts.

The additional resistor in the circuit has to drop the balance of the 9 volts.

For example, if we use a 9-volt battery to power the circuit, and the voltage drop across the LED is 2 volts, then the additional resistor must provide a voltage drop of 7 volts.

Using Ohm's Law then, we calculate the value of the additional resistor with the following version of the Ohm's Law formula.



Practice Quiz

$$R_{\text{ADD}} = E_{\text{RES}} / I_{\text{LED}}$$

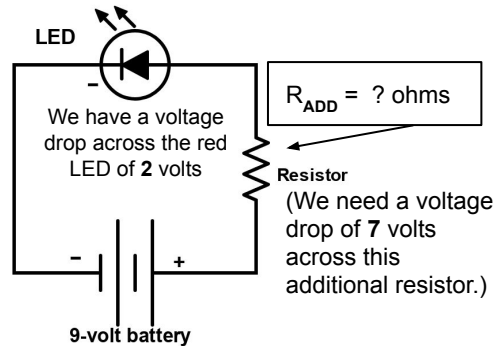
R_{ADD} = value in ohms of the additional resistor

E_{RES} = voltage drop across the additional resistor = with a 9v battery = 7 V

I_{LED} = current needed by the LED = red LEDs need **0.018 Amps** to operate

The schematic below shows a red LED in series with a 9-volt battery and an additional resistance.

Here is the schematic of the circuit:



$$R_{\text{ADD}} = E_{\text{RES}} / I_{\text{LED}}$$

Put the numbers into the formula:

$$R_{\text{ADD}} = 7 / 0.018 = 389 \text{ ohms}$$

What about if you use a different voltage, other than 9 volts, to power the red LED?

Here are some examples:

Suppose you use a **5-volt** power supply. Put (5 volts - 2 volts) into the formula as follows:

$$R_{\text{ADD}} = E_{\text{RES}} / I_{\text{LED}}$$

$$R_{\text{ADD}} = (3 / 0.018)$$

With 5V

$$R_{\text{ADD}} = 167 \text{ ohms}$$

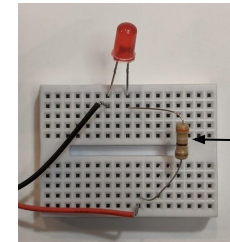
Now, suppose you have **6-volts** to power the circuit. Put (6 volts - 2 volts) into the formula.

$$R_{\text{ADD}} = E_{\text{RES}} / I_{\text{LED}}$$

$$R_{\text{ADD}} = (4 / 0.018)$$

With 6V

$$R_{\text{ADD}} = 222 \text{ ohms}$$



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Answer these questions

Activity Page

Additional resistance
with LEDs

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(1) If you have a red LED and you have a 12 volt power source, how much additional resistance do you need so that the LED will light up and not burn out?

_____ Ohms

(2) Draw a schematic showing the circuit with the red LED, the additional resistor and 12-volt power source.

Use the multicell battery symbol for your 12-volt power supply.

Label the resistor with the value you calculated in question #1.

#1. Res = $10/.018 = 556$ ohms

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