



TRAIN CONTROL SYSTEMS  
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$$I = \frac{E}{R} \quad R = \frac{E}{I} \quad E = IR$$

$$P = I^2 R \quad P = IE$$

$P = \text{Watts } w$

$E = \text{Volts } v$

$I = \text{Amps } a$

$R = \text{Ohms } \Omega$

# Examples for the aspiring electrician

## Finding Resistor Value for 1.5v 15mA bulb

$$\begin{aligned}\text{Track Voltage} &= 13\text{v} \\ \text{Bulb Voltage} &= \frac{-1.5\text{v}}{11.5\text{v}}\end{aligned}$$

$$15 \text{ mA} = .015\text{a}$$

$$R = \frac{11.5\text{v}}{.015\text{a}} = 767\Omega$$

Choose closest resistor value i.e. 780Ω

## Finding Resistor Value for 1.5v 30mA bulb

$$\begin{aligned}\text{Track Voltage} &= 13\text{v} \\ \text{Bulb Voltage} &= \frac{-1.5\text{v}}{11.5\text{v}}\end{aligned}$$

$$30 \text{ mA} = .030\text{a}$$

$$R = \frac{11.5\text{v}}{.030\text{a}} = 383\Omega$$

Choose closest resistor value i.e. 390Ω

## Finding Resistor Value for a 2v 20mA LED

$$\begin{aligned}\text{Track Voltage} &= 15\text{v} \\ \text{LED Voltage} &= \frac{-2\text{v}}{13\text{v}}\end{aligned}$$

$$20 \text{ mA} = .020\text{a}$$

(use a value of .015a to protect the LED)

$$R = \frac{13\text{v}}{.015\text{a}} = 867\Omega$$

Choose closest resistor value i.e. 910Ω