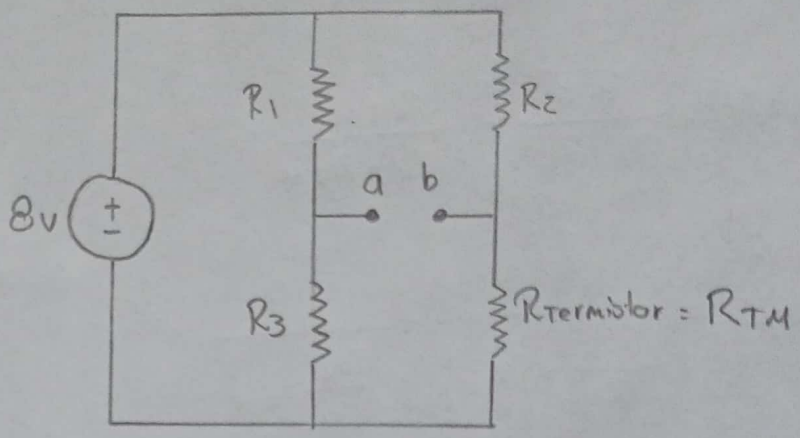
"Diseño de Circuito de acondicionamiento para NTC"

Características.

Alcance de entrada = 0°C a 100°C
Alcance de salida de 0v a 1v
Voltaje de alimentación = 8v



Termistor a 25°C = 10KΩ
Termistor a 0°C = 27.6KΩ
Termistor a 100°C = 1.16KΩ

$$Vab = Vi\left[\frac{R3}{R1+R3} - \frac{RTM}{R2+RTM}\right] \rightarrow Ec.\ (1)$$

* Condición donde: Termistor a 0°C = 27.6KΩ

$Vab = Vsal = 0v$

$$Vab = Vi\left[\frac{R3}{R1+R3} - \frac{RTM}{R2+RTM}\right]$$

$$\frac{Vab}{Vi} = \frac{0v}{8v} = 0 = \frac{R3}{R1+R3} - \frac{RTM}{R2+RTM}$$

$$\frac{R3}{R1+R3} = \frac{RTM}{R2+RTM}$$

$$R3+R2+\cancel{R3\,RTM} = RTM\,R1 + \cancel{RTM\,R3}$$

$$R3\,R2 = RTM\,R1$$

$$\frac{R2}{RTM} = \frac{R1}{R3} \rightarrow \text{Ecuación de equilibrio } (2)$$

Sustituyendo 27.6KΩ en Ec (2)

$$\frac{R2}{27.6K\Omega} = \frac{R1}{R3}$$

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* Condición donde: Termistor a 100°C = 1.16 kΩ

ahora $V_{ab} = V_{sal} = 1V$

$$\frac{V_{ab}}{V_i} = \frac{1V}{8V} = \frac{R\,R_3}{R_1+R_3} - \frac{R_{TM}}{R_2 - R_{TM}}$$

$$0.125 = \frac{R_3}{R_1+R_3} - \frac{R_{TM}}{R_2+R_{TM}}$$

$$0.125 = \frac{1}{\frac{R_2}{R_3}+1} - \frac{1}{\frac{R_2}{R_{TM}}+1}$$ → Ecuación (3)

ahora $\frac{R_1}{R_3} = \frac{R_{TM}}{R(0°C)}$ → de la ecuación (2)

Sustituyendo en ecuación (3)

$$0.125 = \frac{1}{\frac{R_2}{R(0°C)}+1} - \frac{1}{\frac{R_2}{R(100°C)}+1}$$

$$0.125 = \frac{1}{\frac{R_2}{27.6k\Omega}+1} - \frac{1}{\frac{R_2}{1.16k\Omega}+1}$$ → (*)

Despejando R_2 de (*)

$$\left(\frac{27600}{27600}\right)\frac{1}{\frac{R_2}{27600}+1} - \frac{1}{\frac{R_2}{1160}+1}\left(\frac{1160}{1160}\right) = 0.125$$

$$\frac{27600}{R_2+27600} - \frac{1160}{R_2+1160} = 0.125$$

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$$(R_2+27600)(R_2+1160)\left[\frac{27600}{R_2+27600}-\frac{1160}{R_2+1160}=0.125\right]$$

$$10(27600(R_2+1160)-1160(R_2+27600)=0.125(R_2+27600)(R_2+1160)$$

$$276000(R_2+1160)-11600(R_2+27600)=1.25(R_2+27600)(R_2+1160)$$

$$27600R_2+320160000-11600R_2-320160000=1.25[R_2^2+27600R_2+1160R_2+32016000]$$

$$264400R_2=1.25R^2+28760R_2+32016000$$

$$=1.25R^2-235640R_2+32016000$$

ahora

$$X=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$R_2=\frac{235640\pm\sqrt{(235640)^2-1600800000}}{2.5}=\frac{235640+235300.0841}{2.5}=188376.0337$$

$$R_2=\frac{255640-235300.0841}{2.5}=135.9663$$

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Soluciones para R_2

$R_2 = 135.9663\ \Omega$

$R_2 = 188.3760\ K\Omega$

Como: $\frac{R_2}{R(0°C)} > 1$

Tenemos

$$\frac{188.3760\ K\Omega}{27.6\ K\Omega} = 6.8252 > 1$$

$$\frac{R_2}{R(0°C)} = \frac{R_1}{R_3} = 6.8252$$

$R_1 = (6.8252)(R_3)$

Proponiendo valores comerciales para $R_3 = 1K\Omega$

$R_1 = (6.8252)\ 1K\Omega$

$R_1 = 6.8252\ K\Omega$

$\therefore R_1 = 6.8252\ K\Omega$

$R_2 = 188.3760\ K\Omega$

$R_3 = 1K\Omega$

a valores comerciales →

$R_1 = 6.8\ K\Omega$

$R_2 = 180K\Omega$

$R_3 = 1K\Omega$

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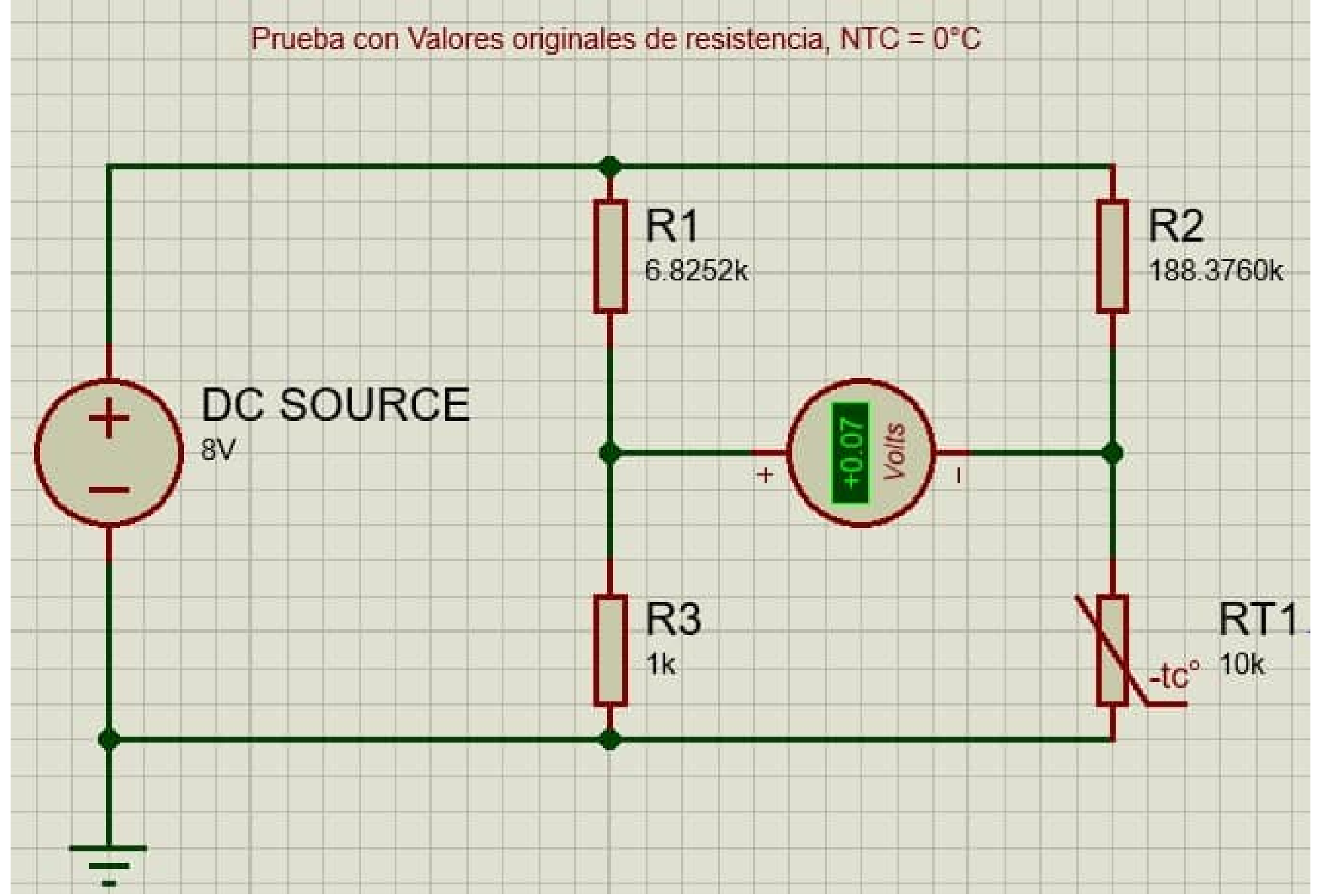

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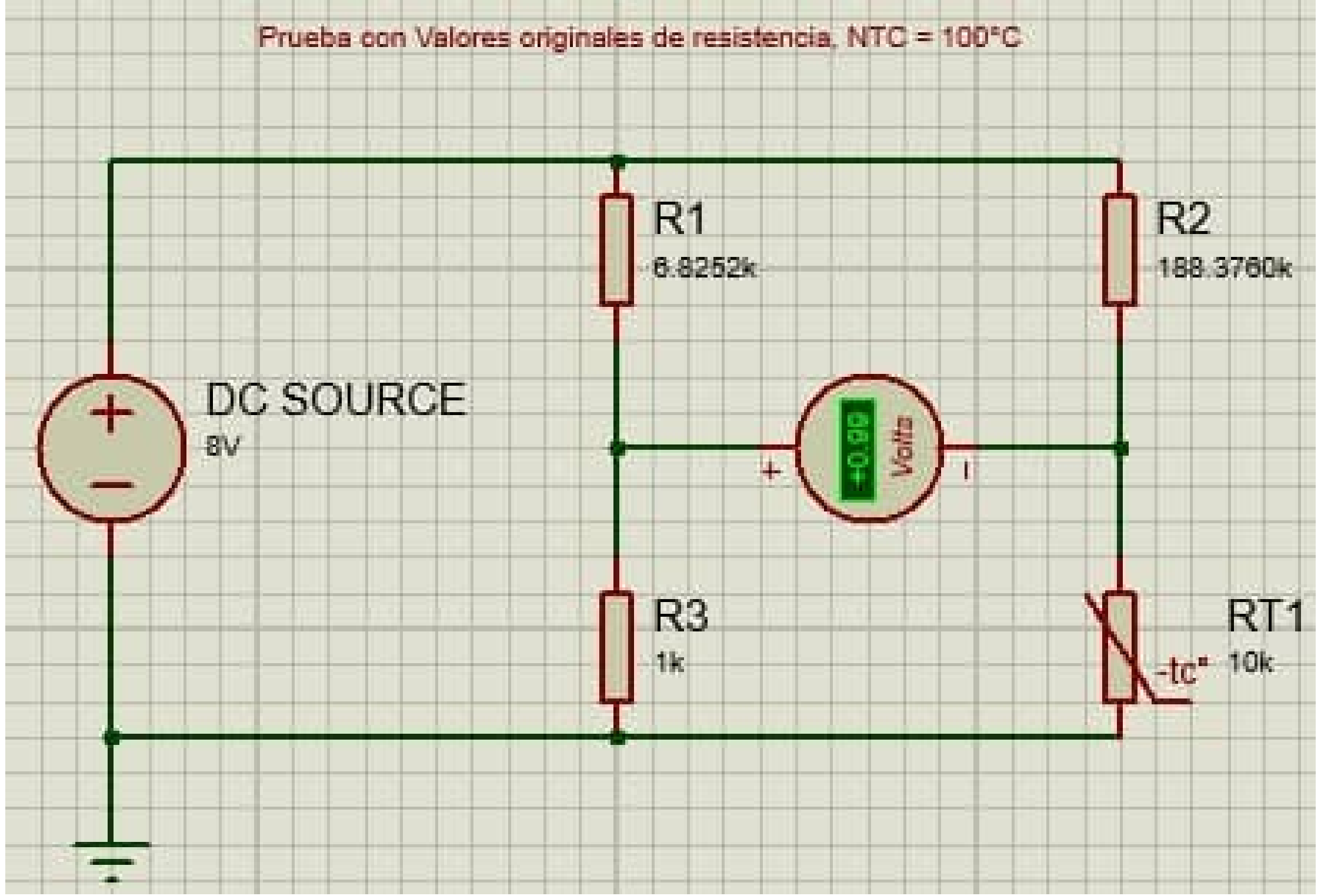

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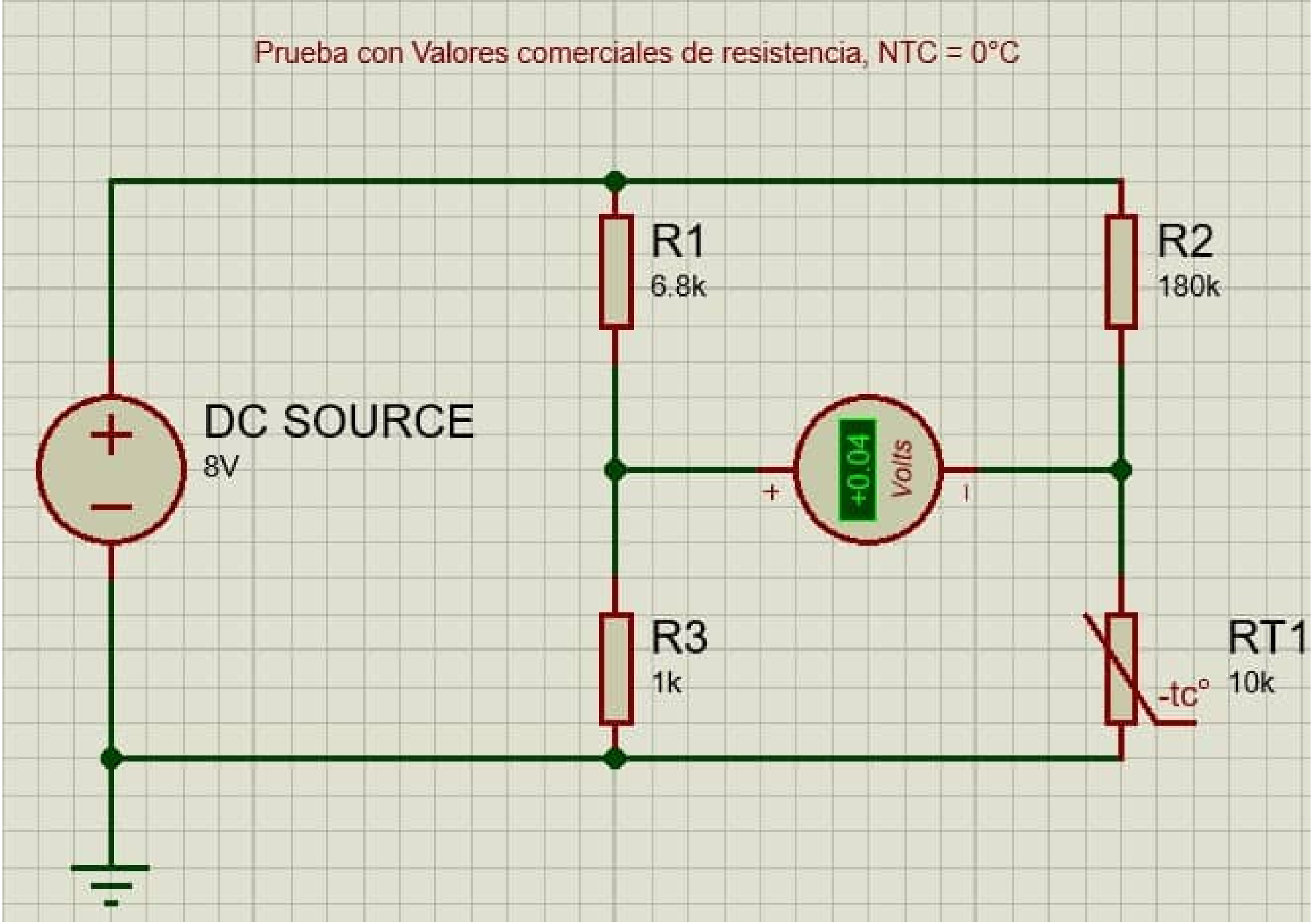

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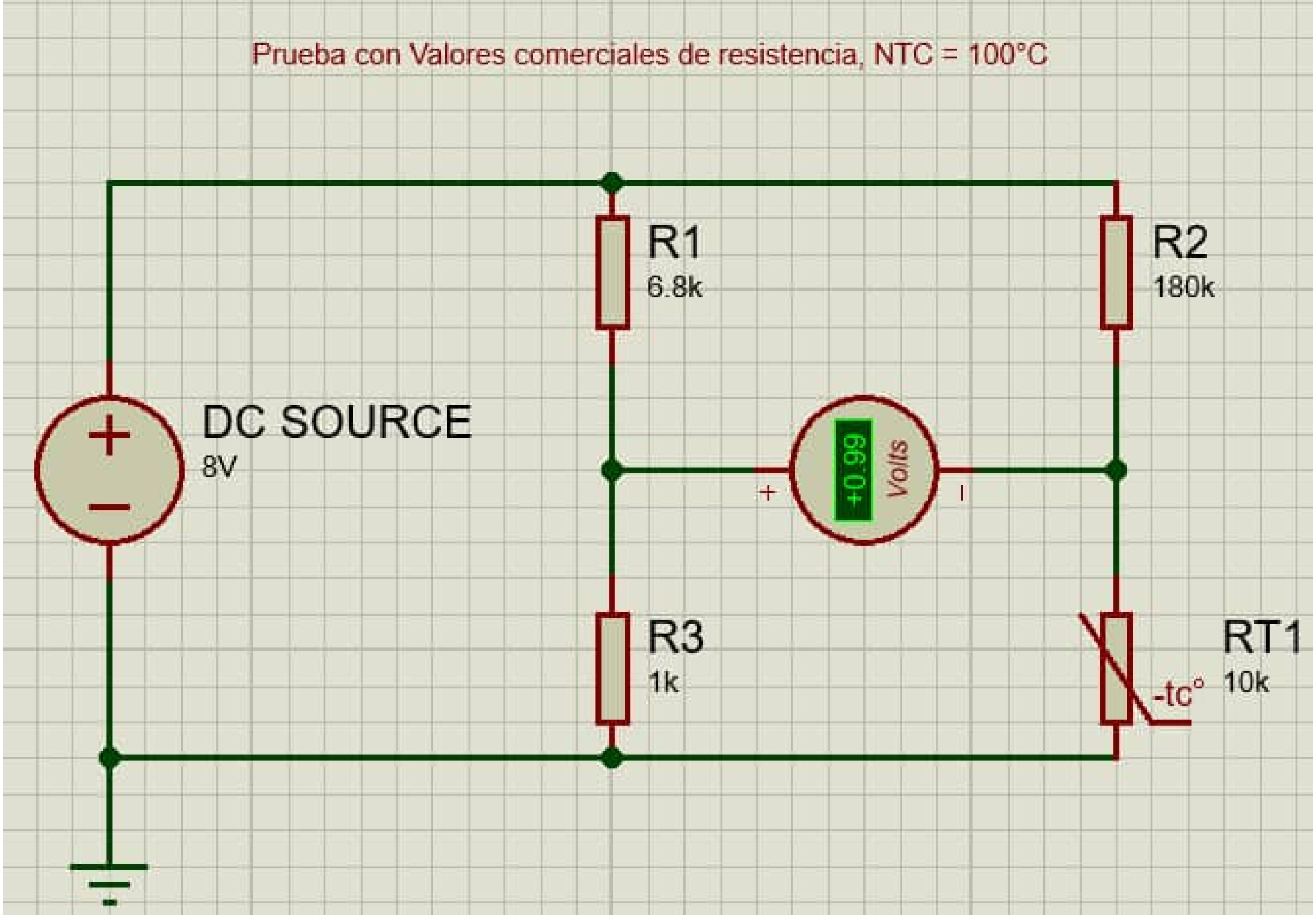

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