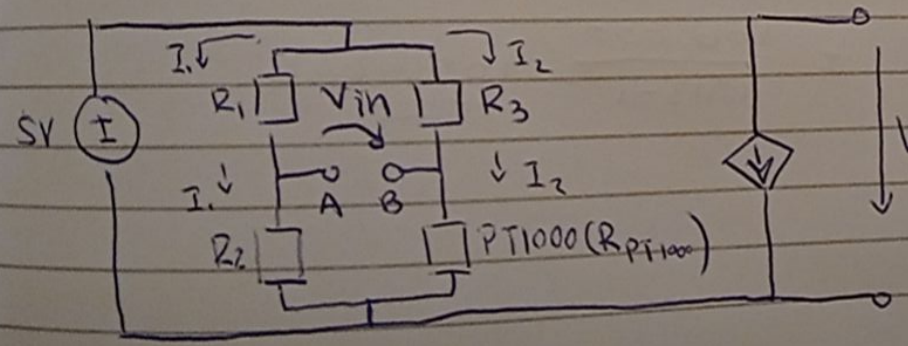
HW - 02

Design PT1000 based thermometer, containing the AD623 instrumentation amplifier. The operating temp is -50°C to 400°C. The output voltage is 0...2.5V. The supply voltage is 5V.

- Find resistor value in the bridge
- Find amplifier gain to comply output voltage requirements
- Use AD623 datasheet to find value of gain control resistor (see datasheet for details).



$V_{R1} = V_{R3}$
$V_{R2} = V_{PT1000}$

$$\frac{V_{R1}}{V_{R2}} = \frac{V_{R3}}{V_{PT1000}}$$

$$\frac{I_1 R_1}{I_1 R_2} = \frac{I_2 R_3}{I_2 R_{PT1000}}$$

$$\frac{R_1}{R_2} = \frac{R_3}{R_{PT1000}}$$

At $-50°C$, $R_{PT1000} = 803.10\,\Omega$

If $V_{in} = 0$, then $R_{PT1000} = R_1 = R_2 = R_3$

Assume $R_1 = R_2 = R_3 = 800\,\Omega$, the resistor value

$$V_A = V_{sup} \cdot \frac{R_{PT1000}}{R_{PT1000} + R_2} = 5 \cdot \frac{803.10}{803.10 + 800} = 2.505\ V$$

$$V_B = V_{sup} \cdot \frac{R_3}{R_1 + R_3} = 5 \cdot \frac{800}{800 + 800} = 2.5\ V$$

$$V_{in} = 2.505 - 2.5 = 0.005\ V$$

At $400°C$, $R_{PT1000} = 2470.90\,\Omega$

$$V_A = 5 \cdot \frac{2470.90}{2470.9 + 800} = 3.777\ V$$

$$V_B = 5 \cdot \frac{800}{800 + 800} = 2.5\ V$$

$$V_{in} = 3.777 - 2.5 = 1.277\ V \approx 1.3\ V$$

- $V_{out} = 2.5\ V$ at $400°C$

$$\therefore G = \frac{V_{out}}{V_{in}} = \frac{2.5}{1.3} = 1.923$$

- $$R_G = \frac{100\,000}{G - 1} = \frac{100\,000}{1.923 - 1} = 108342\,\Omega$$