Using internal current excitation and built in voltage reference

V_{REF} = 2.048 V; 5ppm/°C drift; Long term drift 1000h = 110ppm

I_{DAC} = 100uA; 50 ppm/°C drift

$R_{RTD(37°C)}$ = 1143.9Ω, resistance of PT1000 on 37.00°C

$V_{ADC} = V_{REF}\frac{\mathrm{CODE}}{2^n}$, ADC conversion formula

$$V_{ADC} = R_{RTD} * I_{REF}$$

$$R_{RTD} * I_{DAC} = V_{REF}\frac{\mathrm{CODE}}{2^n}$$

$$R_{RTD} = \frac{V_{REF}}{I_{DAC}} * \frac{\mathrm{CODE}}{2^n}$$

If we analyze scenario where PT1000 temperature remains the same (37.00°C) but ambient temperature where electronics is located rises +20°C then $V_{REF+20°\mathrm{C}}$ and $I_{DAC+20°\mathrm{C}}$ because of temperature drift will be:

$$V_{REF+20°\mathrm{C}} = \mathrm{V}_{REF} \pm \mathrm{V}_{REF} * 5ppm * 20 = \mathrm{V}_{REF} \pm \mathrm{V}_{REF} * 0.0001 = \mathrm{V}_{REF}(1 \pm 0.0001)$$

$$I_{DAC+20°\mathrm{C}} = I_{DAC} \pm I_{DAC} * 50ppm * 20 = I_{DAC} \pm I_{DAC} * 0.001 = I_{DAC}(1 \pm 0.001)$$

Measured code at ambient temperature +20°C will be:

$$CODE_{+20°\mathrm{C}} = \frac{V_{ADC} * 2^n}{V_{REF+20°\mathrm{C}}} = \frac{I_{DAC+20°\mathrm{C}} * \mathrm{R_{RTD(37°C)}} * 2^n}{V_{REF+20°\mathrm{C}}}$$

Because we don't know the ambient temperature and during calculation we will consider standard values of I_{DAC} and V_{REF} calculated $R_{RTD+20°\mathrm{C}}$ on rised ambient electronics temperature of +20°C will be:

$$\mathrm{R_{RTD+20°C}} = \frac{\mathrm{V_{REF}}}{\mathrm{I_{DAC}}} * \frac{\mathrm{CODE_{+20°C}}}{2^\mathrm{n}} = \frac{\mathrm{V_{REF}}}{\mathrm{I_{DAC}}} * \frac{\mathrm{I_{DAC+20°C}} * \mathrm{R_{RTD(37°C)}} * 2^\mathrm{n}}{\mathrm{V_{REF+20°C}} * 2^\mathrm{n}}$$

If we calculate extreme condition where $\mathrm{I_{DAC+20°C}} = I_{DAC}(1 + 0.001)$ and $\mathrm{V_{REF+20°C}} = \mathrm{V}_{REF}(1 - 0.0001)$

$$\mathrm{R_{RTD+20°C}} = \frac{\mathrm{V_{REF}}}{\mathrm{I_{DAC}}} * \frac{I_{DAC}(1 + 0.001) * \mathrm{R_{RTD(37°C)}} * 2^\mathrm{n}}{V_{REF}(1 - 0.0001) * 2^\mathrm{n}} = \mathrm{R_{RTD(37°C)}}\frac{1.001}{0.9999} = 1145.16$$

Which gives us measured temperature of 37.33°C which is error of +0.33°C

Using ratiometric measurement

R_{REF} with temperature drift of $\pm$ 5ppm and long term drift 0.04% 10 000h at 70°C

$$R_{RTD} = R_{REF} * \frac{\mathrm{CODE}}{2^n}$$

If we analyze same scenario where PT1000 temperature remains the same (37.00°C) but ambient temperature where electronics is located rises +20°C then R_{REF} because of temperature drift will be:

$$R_{REF+20°C} = R_{REF} \pm R_{REF} * 5ppm * 20 = \mathrm{R}_{REF}(1 \pm 0.0001)$$

Measured code will be

$$CODE_{+20°C} = \frac{R_{RTD} * 2^n}{R_{REF+20°C}}$$

Because we don't know the ambient temperature and during calculation we will consider standard values of R_{REF}, calculated $R_{RTD+20°C}$ on rised ambient electronics temperature of +20°C will be:

$$R_{RTD+20°C} = R_{REF} * \frac{CODE_{+20°C}}{2^n} = R_{RTD} * \frac{R_{REF}}{R_{REF+20°C}} = R_{RTD} * \frac{R_{REF}}{\mathrm{R}_{REF}(1 \pm 0.0001)}$$
$$= R_{RTD} \frac{1}{1 \pm 0.0001}$$

$R_{RTD+20°C}$ = 1143.79Ω

Which gives us measured temperature of 36.97°C which is error of +0.03°C which is 10 times lower error than previous measurement