Signal Conditioning Circuit for RTD

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***Abstract*—RTD sensor resistances and temperature coefficients are relatively small. The signal acquired from it requires signal conditioning to quantify the parameters precisely and accurately .Signal conditioning is the part of data acquisition that establishes interface to a sensor. In this process, analog signal is being manipulated in such a way that it meets the requirements for further processing. In this we are designing two circuits with instrumentational and differential amplifier. We are designing signal conditioning circuit for RTD such that for 25 C it gives 0V and for 100 C it gives 5V. and for 0 C it gives 0V and for 100C it gives 5V**

Keywords—component, formatting, style, styling, insert (*key words****)***

I. INTRODUCTION (*HEADING 1*)

Temperature is the widely used physical parameter in the process industries. Various elements, such as Resistance Temperature Detectors (RTDs), thermistors, thermocouples and diodes are used for the measurement of temperature. Platinum RTD Pt100 is having 100 Ω resistance at 0°C temperature. The temperature range of RTD is -200 °C to 850 °C having total variation in resistance of 18.52 Ω to 390.48 Ω. The resistance of the RTD (or any resistor) can be determined by passing a known current through it; the resistance is then calculated using Ohms Law. The RTD element requires a current excitation. If the magnitude of the current source is too high, the element will dissipate power and start to self-heat. Consequently, care should be taken to ensure that less than or equal to1 mA of current is used to excite the RTD element. There is a need for designing and developing a basic signal conditioning module that can be temperature sensor. Signal conditioning is the part of a data acquisition system that interfaces to a sensor and converts the output signal from a sensor into linear voltage that can be measured by a data acquisition computer.

II. II PROPOSED METHODOLGY

Resistance thermometers, also called Resistive Temperature Detectors (RTD), are sensors used to measure temperature using the principle that the resistance of a metal changes with temperature. As the temperature of the metal increases, the metal's resistance to the flow of electricity increases. Similarly, as the temperature of the RTD resistance element increases, the electrical resistance measured in ohms increases. Platinum is the most commonly used metal for RTD elements due to its stability and wide temperature usage.

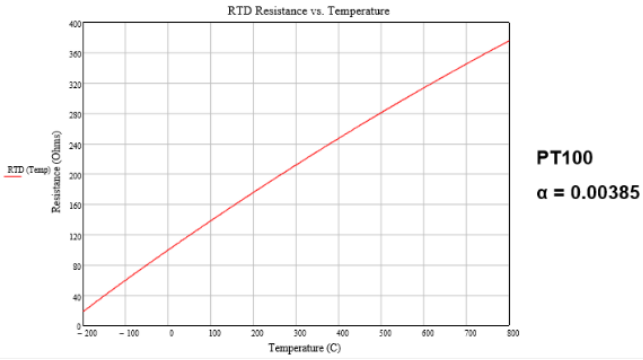
Below graph shows resistance vales for different temperatures

The formula for Rt at temperature T is

Rt = Ro(1 + 0.00385 × T)

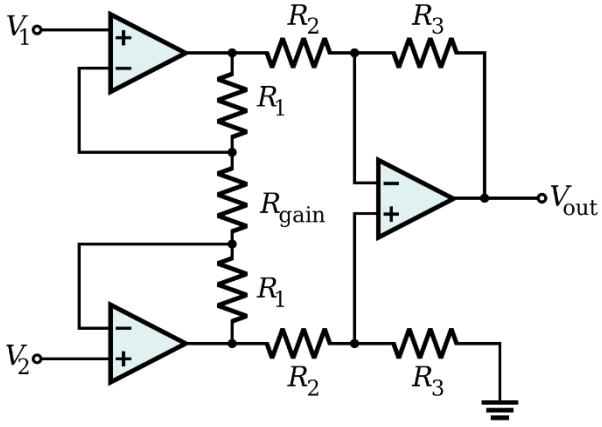
R_{25} = 109.5

R_{100} = 148.5



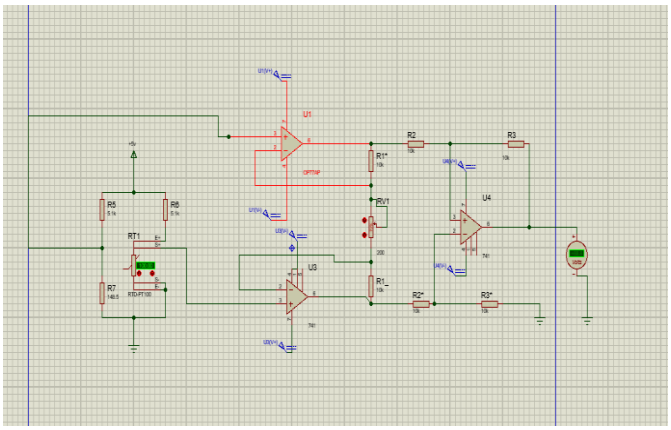
In this project we are using Instrumentation amplifier. The gain formula for it is $Av = (1 + \frac{2R1}{Rg})\frac{R2}{R3}$.

After calculating the value of gain and Rg are 138.732 and 148.75.

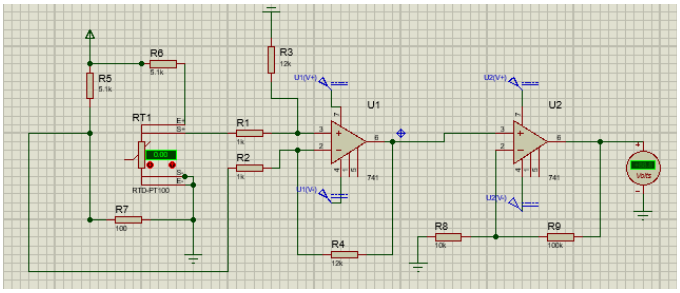


III. IMPLEMENTATION DETAILS & RESULTS

RTD, Potentiometer resistors and 741opamp are used in this circuit. These are some of the screenshots of the circuit we designed in PROTEUS 8.11 software. Here RTD sensor is used as input signal in Wheatstone bridge configuration. Here are some of the screenshots of the circuit.



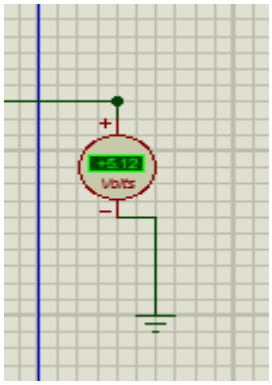
Signal Conditioning Circuit using Instrumentation amplifier



Signal conditioning circuit using differential amplifer.

For 25 C we obtained 0.24V

For 100C we obtained 5.11 V.



IV. Conclusion and Future Scope

The Signal conditioning circuit for the given problem is designed with the help of instrumentation amplifier. Instrumentation amplifier is used as signal conditioning circuit. The gain can be varied as per the given input. Here we designed a circuit such that for 25 C we get 0V and for 100 C we get 5V

Here we have got some errors. Calibration errors can be minimized by compensating offset voltage of Opamp.

References

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