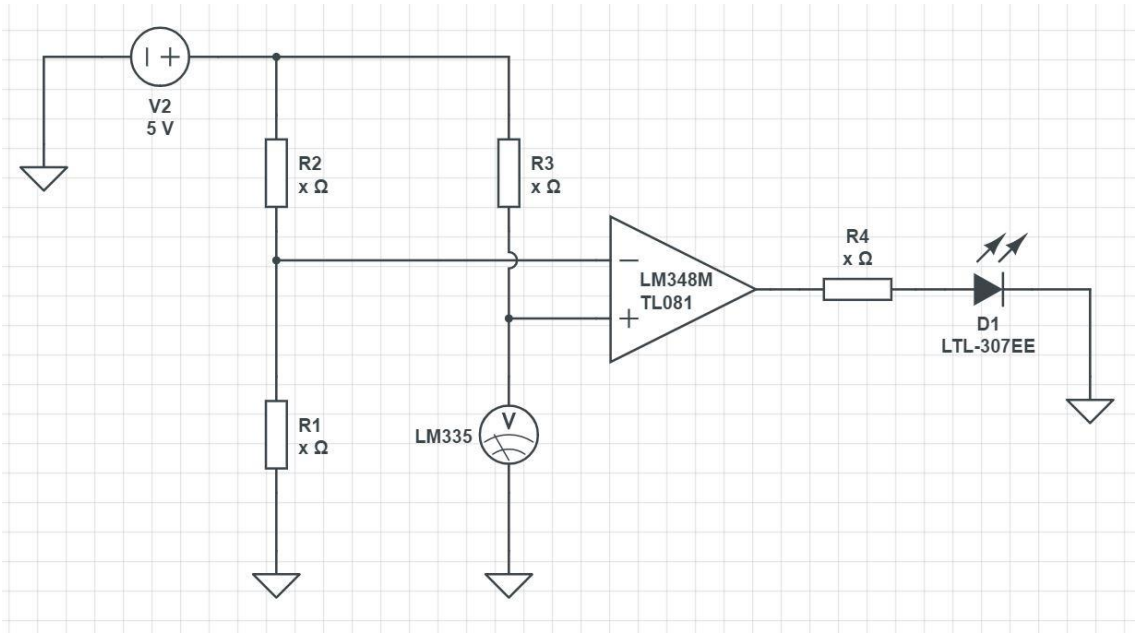
1 Introduction

A model of a functional circuit was created. The purpose is to measure temperature level using a temperature sensor (LM335) to detect the temperature and then compare the target temperatures versus the targeted voltage range using operational amplifiers (LM348M) as comparators.

2 Calculating the circuit values

2.1 Calculation



It is assumed that the current on the left line of the circuit is 5mA. In the real circuit targeted value of Ua is 2.482V and the resistors value was initiated as 510Ω, so it determines the actual current in the circuit as $\mathrm{I} = \frac{U_a}{R_1} = 4.87\ mA$, which is an approximation of our initial assumption of 5mA.

Then by using voltage division Ua can be calculated as shown as above. R1 is set at 510Ω**.** R2 was calculated using the formula $R_2 = \frac{(U \times R_1)}{U_a} - R_1$.

Then by applying this method every section of the resistor values was calculate.

For example in the real circuit, the targeted voltage for the yellow LED is 3.082V.

$\boldsymbol{R_9 + R_2 + R_1 = \frac{3.082}{I}}$. Combining the limited choices in the resistor values to be R_9= 20Ω, R_2 = 100Ω.

The second formula in the picture shows how the resistor values were calculated for the LED part of the circuit according to the 15mA limit of the LED components.
U_{LED} is the voltage drop of the LEDs.

For example, in the real circuit, $R_6 + R_{13} + R_{14} = \frac{(5-1.8)V}{0.015A} = 213\Omega$.

But since options for the resistor values were limited, R_6 = R_{13} = 100Ω and R_{14} = 20Ω were chosen for the circuit.
The current limit for LEDs is between 15mA - 20mA. 20mA is the limit, but it is not recommended as it may damage the LED over time.