Lab#9: Temperature measurement

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Objectives:

- Measure the temperature using a TMP61 PTC thermistor.
- Measure the temperature using the TC1047A temperature to voltage converter.

Material: Explorer 16-32 and resistors.

To hand in:

This document on Teams.
Your code on GitHub – see previous labs.

Lab Work

In the first part of the lab, you are going to measure the temperature using a TMP61 PTC thermistor.

In the second part of the lab, you are going to measure the temperature using the TC1047A temperature to voltage converter.

GitHub

Make sure you are logged into GitHub. Copy-paste the following URL to accept an invitation for this lab:

https://classroom.github.com/a/RfnDbSio

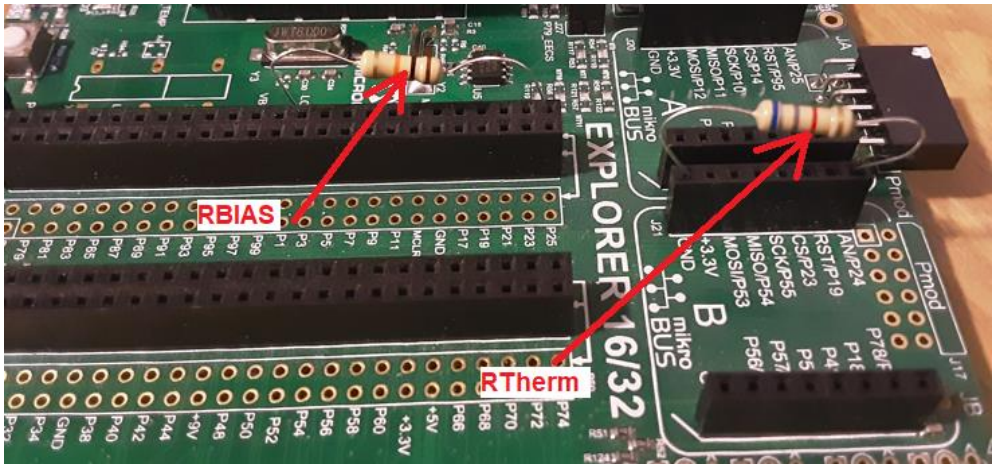
You will get a private new repository for this lab:

https://github.com/Embedded-OS-Vanier/temperature_measurement-your_name

Part1 - TMP61 PTC thermistor

You must use analog input AN1 (pin24) to read Vtemp.

RBias and Rtherm make a voltage divider by connecting RBias between +3.3V and P24
And Rtherm between GND and P24 – see picture.



Resistors

Since we don't have a TMP61 PTC thermistor, the thermistor will be replaced by normal resistors.

Three resistor values will be used to simulate the thermistor: R1, R2 and R3.

Using an ohmmeter, fill the following table by measuring the resistance for the following nominal values:

	RBias	R1	R2	R3
Nominal resistance (Ω)	10kΩ	6.8kΩ	8.2kΩ	12kΩ
Measured value (Ω)	9.85kΩ	6.7kΩ	8.07kΩ	12.03kΩ
Temperature (°C)	N/A	-35°C	-7°C	57°C

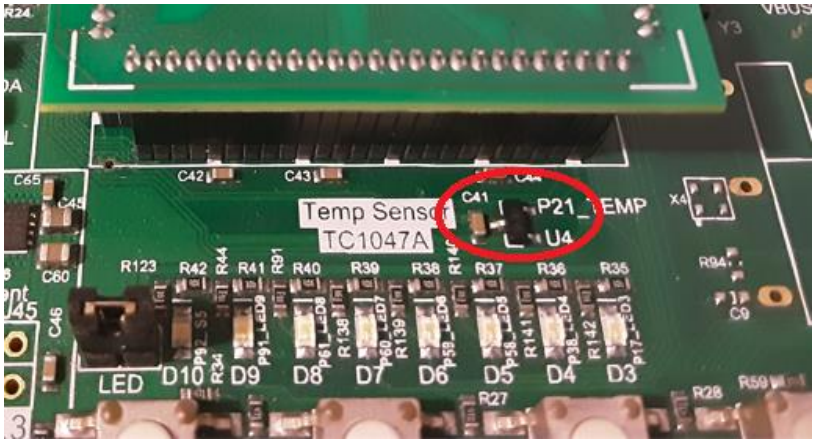
Coding

In the main loop, the thermistor temperature must be displayed on the LCD every second.

You must give a demo for all 3 resistors.

Part2- TC1047A temperature to voltage converter

Reading the schematics, find out the analog pin that connects the converter.



Coding

In the main loop, the sensor temperature must be displayed on the LCD every second.

You must give a demo.

After lab questions:

1- Explain what you learned in this lab. What went wrong and what did you learn from your mistakes.

- Not many mistakes were encountered. Aside from common syntax errors and logical errors, the one error that was persistent happened during the first part of the lab with the TMP61. Basically, the for loop implemented to derive the measured temperature from the LUT was wrong. Instead of looking to the Rtherm values stored in the LUT, the loop would iterate and compare with the temperature values stored in the LUT.

  The takeaway here is to be careful when using loops to iterate through LUTs to obtain certain values.

2- Comment the results for Part1.

- The obtained results match closely with the TMP61 temperature graph. For an Rtherm value of around 6.8kΩ, the measured temperature was -35°C. For an Rtherm value of around 8.2kΩ, the measured temperature was -7°C. Finally, for an Rtherm value of around 12kΩ, the measured temperature was 57°C.

  Basically, the higher the Rtherm value is, the higher the measured temperature will be (and vice versa). Refer to screenshot below.

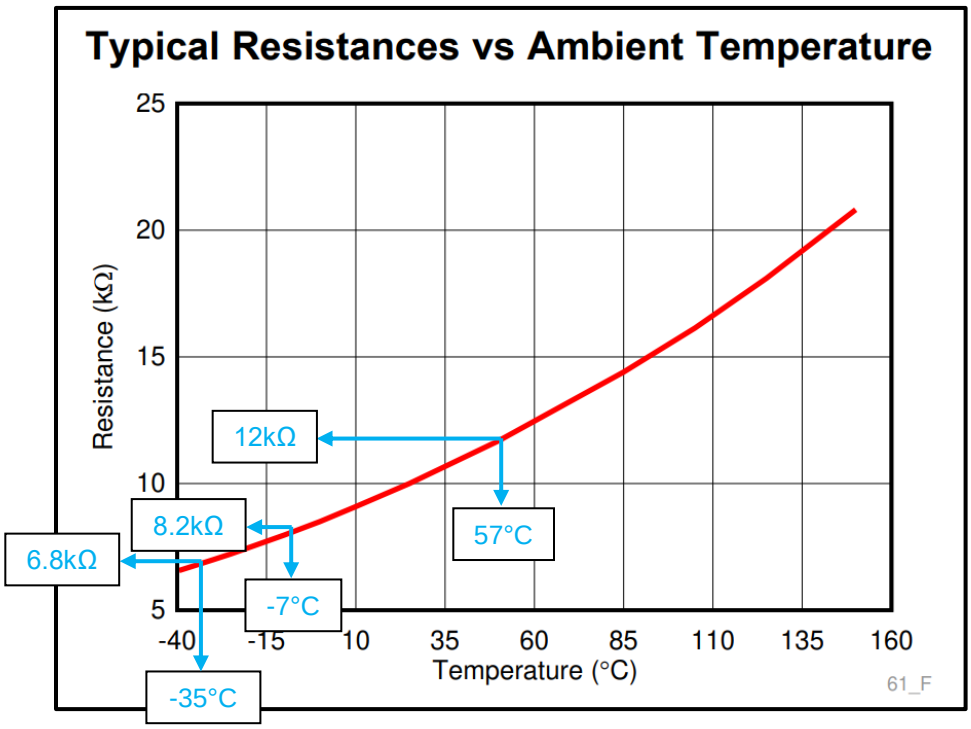


Figure 1. Screenshot above shows TMP61 non-linear PTC graph. Source: TMP61 datasheet from Microchip INC.

3- Comment the results for Part2.

- Although no results were recorded for part 2, in general, the results viewed were as expected. For a Vout of around 0.7V, the measured temperature was 23°C. Further manipulating the TC1074A shows that when Vout drops, the temperature drops as well. On the other hand, when Vout increases, the temperature increases.

  Basically, the higher the Vout value is, the higher the measured temperature will be (and vice versa). Refer to screenshot below.

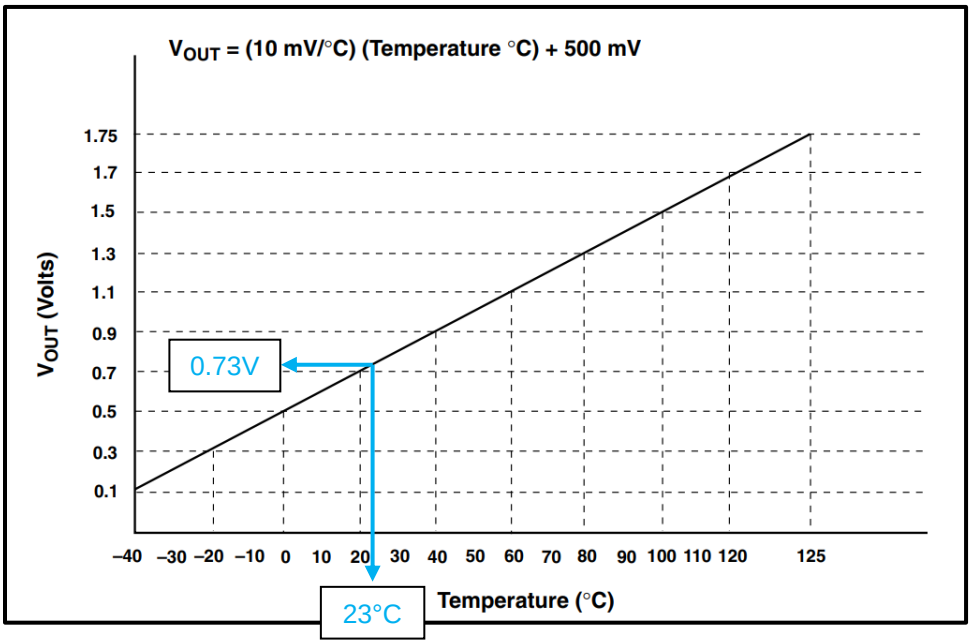


Figure 2. Screenshot above shows TC1074A linear PTC graph. Source: TC1074A datasheet from Microchip INC.