

ECE 476/676 - Homework #8

Text Files, Temperature Sensors, BME280 Sensor

What is the thermal time constant of a DS18B20 Sensor?

Determine the differential equation relating air temperature and measured air temperature with a DS18B20 sensor.

Software

1) Write a Python program which

- Waits until you press GP15 (start of data collection)
- Once pressed, it starts reading temperature
 - Data consists of temperature readings from a DS18B20 sensor
 - One data point every 1 second
 - For 60 seconds (can vary)
 - Data is saved as a text file on your Pico board
 - Different names for each data run

Data Collection

2) Let your temperature sensor come to equilibrium (let it sit out for about a minute). Once temperature is stable, change the temperature:

- Place the sensor inside your refrigerator, or
- Place the sensor inside your freezer, or
- Place the sensor outside your window

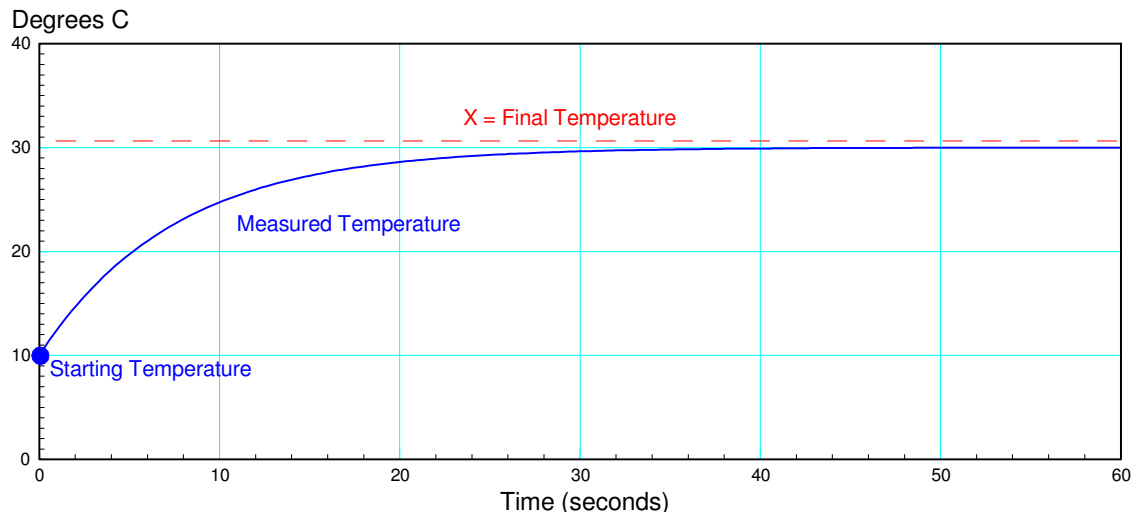
Start collecting data for one minute

3) Repeat three times

- Creating three different data files
- Plot your data vs. time

Data Analysis

Ideally, the measured temperature should be exponential in nature:



4) Determine the thermal time constant for each of the three recordings:

$$ay' + y = x$$

$$y(t) = y_0 + (x - y_0)(1 - \exp(-t/a))$$

where 'a' is the thermal time constant in seconds.

5) From your data, find the 90% confidence interval for the thermal time constant of your temperature sensor.