

# ET 095G Programming Exercise 5: Liquid Crystal Displays

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## 1 Background and Learning Goals

In many embedded system applications information needs to be shown to the user. LCDs have become a common way for visualizing information in embedded systems, as they are very versatile. In this exercise you will learn how to visualize information in different formats on a pixel display. After this exercise, you should be able to:

- include external libraries to mbed programs.
- display text data on the C12832 LCD.
- display bitmaps on the C12832 LCD.
- visualize data on the C12832 LCD.

## 2 Preparation

All required information for this exercise can be found in chapter 8 of the course book. You can find further information on mbed and its API functions at <https://docs.mbed.com> as well as the documentation of the C12832 library.

## 3 Evaluation and Presentation

For evaluation, submit a functioning .bin file and the main.cpp file of your program for each of the subtasks. The main file should be well commented. For submission, use the respective inbox for this exercise on the moodle course page.

## 4 Tasks

### 4.1 Sub-task 1: Display texts

Using the C12832 library, create a simple voltmeter application. Use one of the application board's potentiometers as the input and display the voltage periodically on the display.

### 4.2 Sub-task 2: Display bitmaps

Write a program that displays a small figure as bitmap on the display. The figure should initially be located at (0,0), but its position should be controllable with the boards joystick (moving pixel by pixel in the joysticks direction). Make sure that the figure is not allowed to leave the display area. Note: Design the figure in your liking, however it should not be taller than 20 pixels (so it has some room to move around).

### 4.3 Sub-task 3: Display graphs

Write a program that displays a temperature graph on the LCD. The graph should include x- and y-axes, as well as min and max value for the y-axis. In an interval of your liking (e.g., 10 seconds) add the current temperature as a single pixel to your graph. Once the graph has filled the axis area, clear the graph and start over again. Note: Selecting the y-axis length and the temperature range in a smart way can simplify your life.