CoE 115 Lab 2A: LCD Interfacing

February 2019

Objectives

- To construct an LCD interface to the PIC microcontroller
- To initialize the successfully the LCD module
- To display a character of choice

Overview

The dot-matrix character LCD display module allows users to output data in a more understandable and readable format with the use of text and other characters. All display functions can be controlled by instructions given to the LCD module through proper interfacing from the outside, in our case, the PIC microcontroller. The LCD module has different operating modes which can be set up during initialization. Writing and reading data to and from the module is allowed depending on the signals fed to its pins as listed below:

- **E (Enable)** – dictates if an operation will start or stop. (INPUT)
- **R/W (Read or Write)** – dictates the direction of data flow. (INPUT)
- **RS (Register Select)** – determines if the input to the LCD corresponds to a command or to a data value. (INPUT)
- **D7 to D4 (Data Lines [7:4])** – corresponds to the upper half of a byte. The only lines used when operating in 4-bit mode. (INPUT/OUTPUT)
- **D3 to D0 (Data Lines [3:0])** – corresponds to the lower half of a byte. These are not used when operating in 4-bit mode. (INPUT/OUTPUT)

Display

Each 5x8 pixel character is controlled by an address in the Display Data RAM (DDRAM) of the LCD module. A value in the DDRAM corresponds to either a predetermined character or a custom character saved in the Character Generator RAM (CGRAM). The character table can be seen at Table 5.3 of the LCD Dot Matrix User Manual.

Initialization

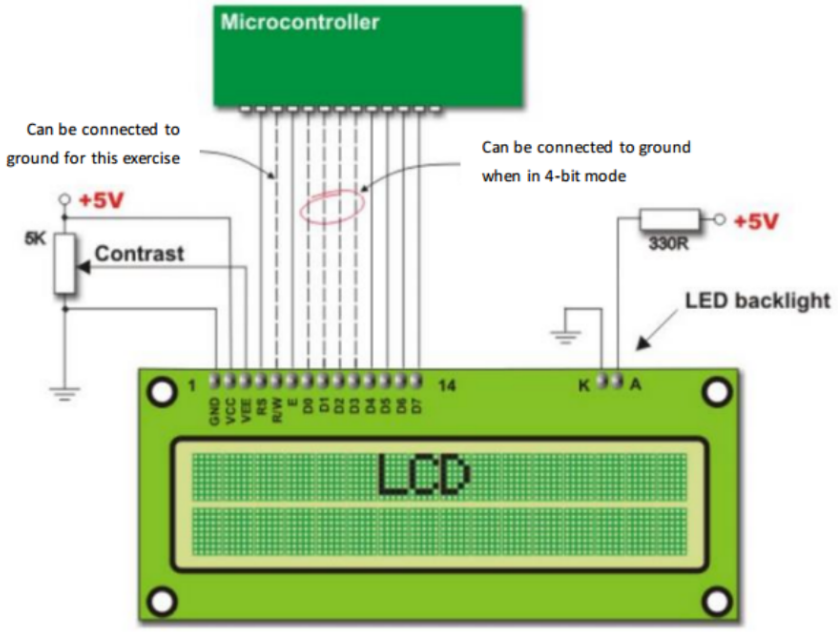
For this exercise we will use the following modes of the LCD:

- 4-bit mode
- 2-line display
- 16-character through 40-character
- Blinking cursor

Section 2.2.2 (Software Initialization) of the manual shows the sequence on how to initialize the LCD for 4-bit operation. Timing requirements in the sequence should be strictly followed. Refer to Table 3.1 of the manual for the list of instructions and their corresponding execution times. Since 4-bit mode will be used, note that the upper 4 bits D[7:4] should be sent first before the remaining last 4 bits D[3:0].

Hardware Connections:

- D[7:4] should be connected to RB[3:0]
- D[3:0] should be connected to ground
- R/W pin should be connected to ground RS pin should be connected to RB[4]
- E pin should be connected to RB[5]



Initialize the LCD as indicated in the Initialization section of this document (15 points). Implement the following subroutines in your code:

- delay100us
- delay4_1ms
- delay15ms
- lcd_send4bits
- lcd_send8bits

Display an alphanumeric character anywhere in your LCD (5 points).