Department of Computer Engineering
Faculty of Engineering, University of Peradeniya

CO321 Embedded Systems - 2020

Using Character LCD with AVR

Introduction

Liquid Crystal Display (LCD)

LCDs can be used to display anything. Although there are many types of LCDs in the market, the ones that are commonly used for embedded systems, robotics, etc. are of character LCD and graphical LCD. In this lab, only character LCDs will be discussed.

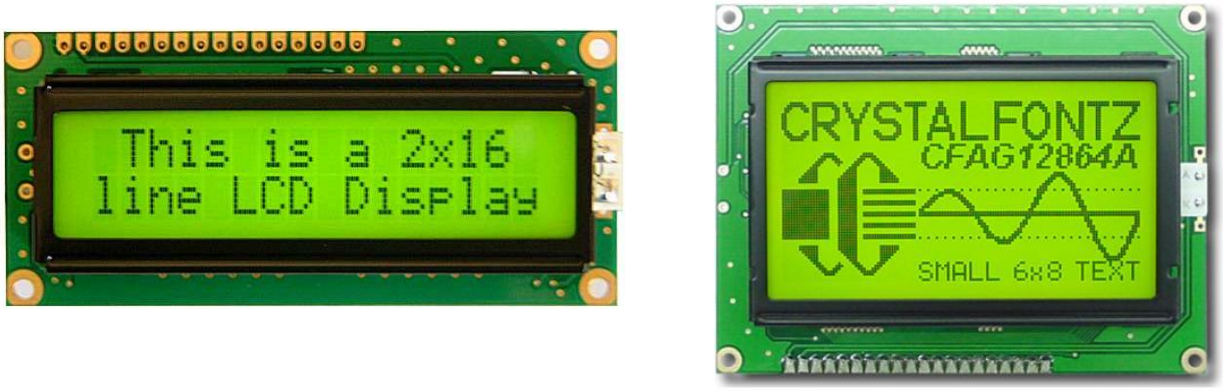

Figure 1: Character LCD and a graphic LCD

HD44780 LCD

This is by far the most famous character LCD that is available (figure 2). It is a 16×2 LCD module i.e. it has 16 columns and 2 rows for display. Each character is displayed in a 7×5 pixel matrix.
There two modes of operation: 8 bit mode and 4 bit mode.

- In 8 bit mode, 8 bits are sent to the LCD from the microcontroller.
- In 4 bit mode, 4 bits are sent to the LCD from the microcontroller.

Operation of the LCD

Table 1: Pins on the HD44780 and their meaning

Pin	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; the best way is to use variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.	Vo / VEE
4	Selects command register when low, and data register when high	RS (Register Select)
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction we make it high en=1 for some milliseconds. After this we again make it ground that is, en=0.	Enable
7-14	Data pins	D0-D7
15	Backlight VCC (5V)	Led+
16	Backlight Ground (0V)	Led-

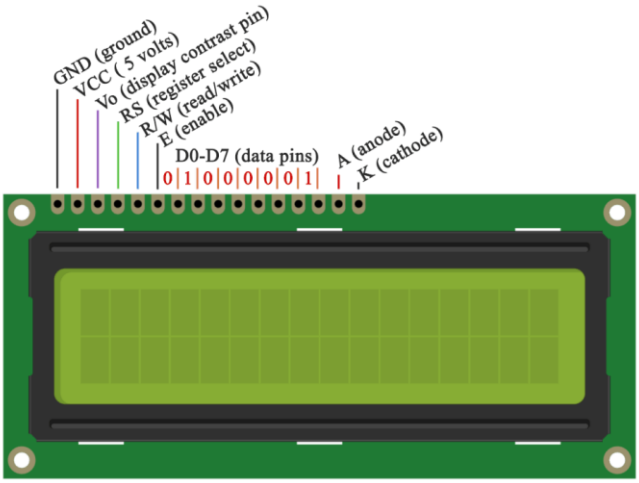

Figure 2: Pin Connections in HD44780

Connecting the LCD to ATMEGA328p

Configuring the LCD is a very tedious job. Hence, for this exercise, we are using the following library by Peter Fleury (code is in the course page). You can have a look at the source code and see for yourself the how complex it is.

Description of LCD library: http://homepage.hispeed.ch/peterfleury/doxygen/avr-gcc-libraries/group__pfleury__lcd.html

The connections to the ATMEGA328p is described in the lcd.h. However, you can change them according to your need. The following figure is such an example.

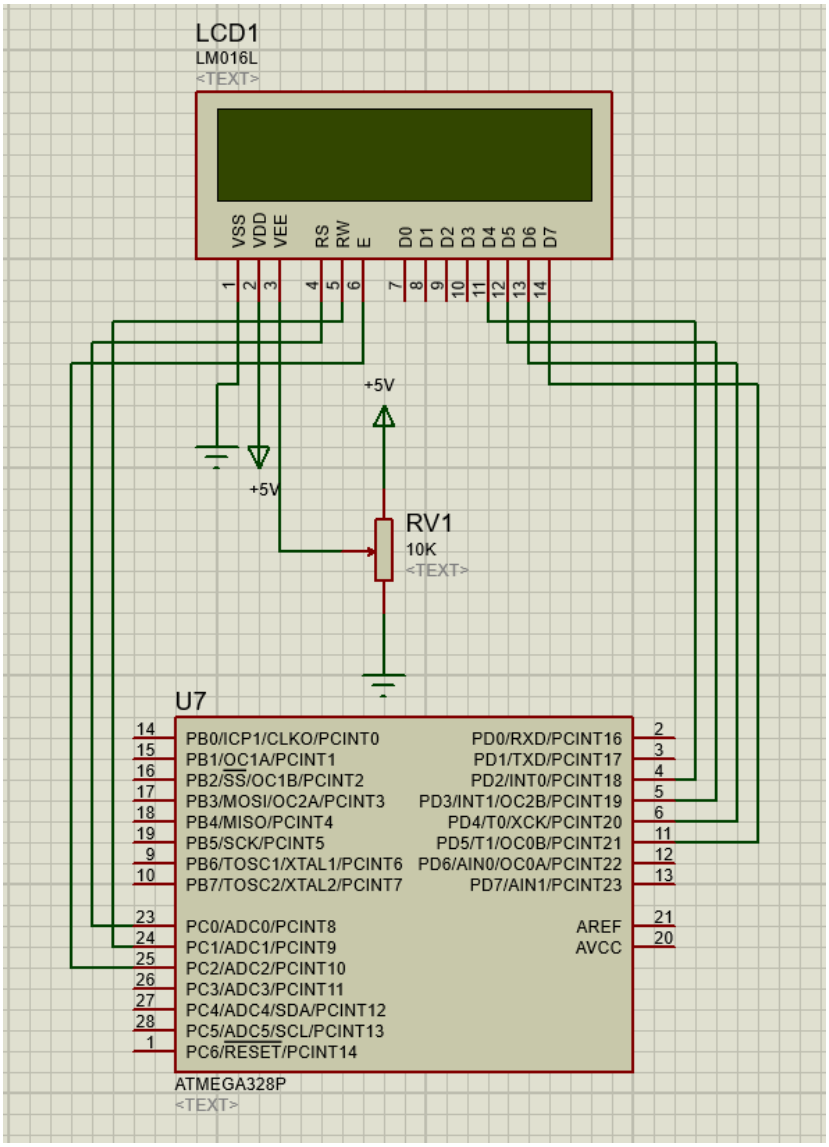

Figure 3: Connection diagram

Programming the LCD

There are many steps one needs to follow when programming the LCD. However, as mentioned earlier, doing this from scratch is hard and time taking. Therefore, we'll only look at how to use the library.

A sample code is provided in the course page (test_lcd.c)