

Lab 7

LCD Interface with PIC Microcontroller

Objectives

1. To know how LCD Works.
2. To realize how PIC16F84A microcontroller deals with LCD.
3. To get familiar with interfacing LCD display to PIC16F84A and show words.

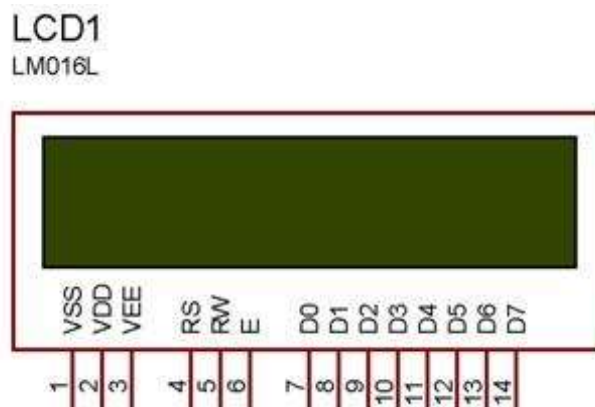
Tools

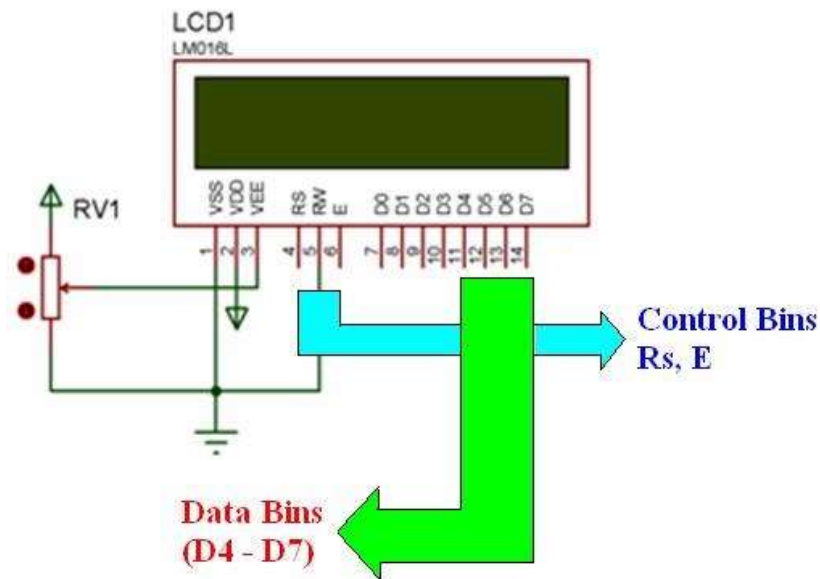
PIC16F84A microcontroller, LCD Display LM016L, MIKROC software, PROTEUS software, USB Programmer.

Theory

LCD

LCDs (liquid crystal display) are widely used devices that come in different forms that differ in size and shapes and many other features. However almost all LCDs conform to a standard interface specification. In our lab we will consider LM016L LCD with size 2*16 (32 characters) that has a simple interface as shown in the figure.





✚ D0-D7 is the data bus and is used to pass commands and characters to the LCD. Data can be transferred to and from the display either as a single 8-bit byte or two 4-bit nibbles. In the later case only the upper four data lines (D4-D7) are used. This 4-bit mode is beneficial when using a microcontroller with few input/output pins available.

✚ VSS = Ground (0V)

✚ VDD= VCC (4.5 V – 5V)

✚ VEE= Used to alter the control contrast of the display. Ideally, it should be connected to variable power supply.

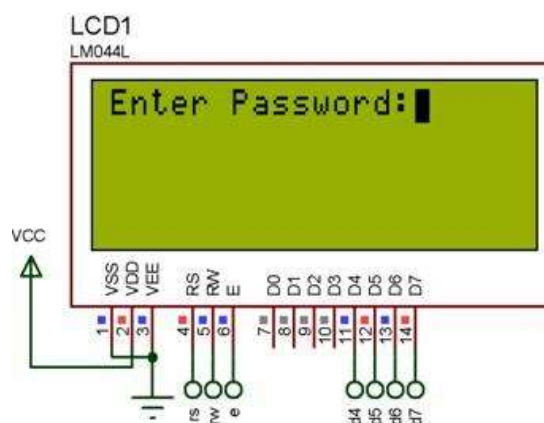
✚ RS (Register Select): when this line is low, data bytes transferred to the display are treated as commands. By setting it to high data is treated as characters.

✚ E: Starts the transfer of data to or from the LCD on falling edge

✚ R/W: This line is used to choose whether to write to or to read from the LCD.

✚ Since we will write to the LCD, and not read we will connect R/W to the ground, and the above figure will be as shown

Lab Work



Hints about the program

- 1) To simplify the work, Use the **PIC16F877A**, because it has more I/O Pins.
- 2) To initialize the LCD use the function `lcd_Init` as follow

void Lcd_Init(unsigned short *port);

Example: if we write the following code:

`Lcd_Init();` then

D7 → portb.7

D6 → portb.6

D5 → portb.5

D4 → portb.4

E → portb.3

RS → portb.2

RW → portb.0

- 3) To write a text use the function
void Lcd_Out_Cp(char *text);

Example: write the text Hello in the LCD

`Lcd_Out_Cp("Hello");`

- 7) To write in a specified location use the function
void Lcd_Out(unsigned short row, unsigned short col, char *text);
Example: write the text "Correct Password" in row 2 and column 1
`Lcd_Out(2, 1, "Correct Password");`

- 8) To print a character on the LCD use the function
void Lcd_Chr_Cp(char character);
So this function can be used to print a character on the LCD at current cursor position. Both variables and literals can be passed as character.
Examples
To print the character 1 `Lcd_Chr_Cp('1');`
Also you can use the ASCII code for 1 `Lcd_Chr_Cp(0X31);`

- 9) To clear the LCD use the function
void Lcd_Cmd(unsigned short command);
This function Sends commands to LCD. You can pass one of the predefined commands to the function.
Example: `Lcd_Cmd(Lcd_Clear)` clears the LCD.

- 10) To make a delay use the function
void Delay_ms(const time_in_ms);
Example: `Delay_ms(1000);` makes 1 sec delay.

- 11) To move text to the right use this function
Lcd_Cmd(_LCD_SHIFT_RIGHT);

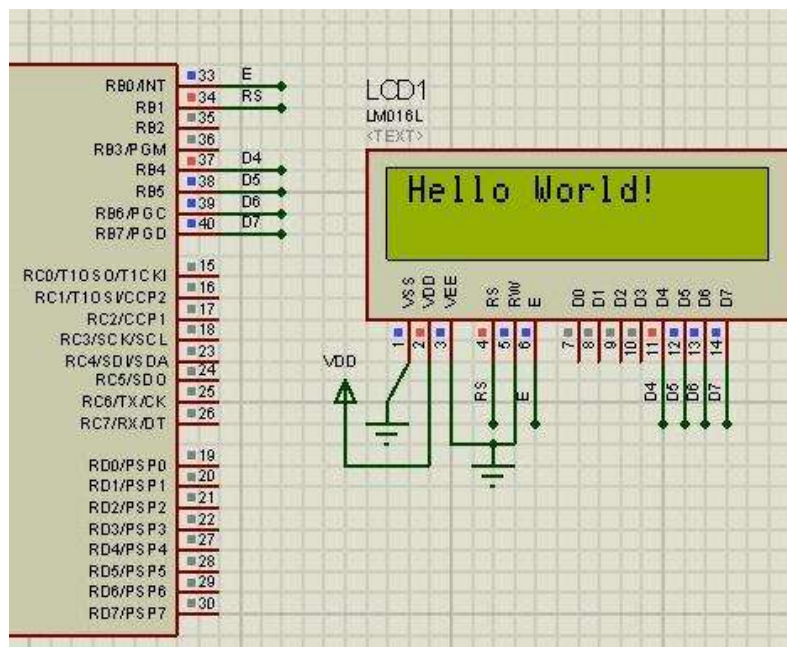
- 12) To move text to the left use this function
Lcd_Cmd(_LCD_SHIFT_LEFT);

13) For more information about these functions, refer to the help of MikroC.

Procedure

Part 1: Write a sentence

- Write a C program to clear LCD and Turn off the Cursor then display “PIC Microcontroller” for 5 seconds then clear LCD
- Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated
- Program a PIC 16F84A using the QL2006 programmer.
- Build the circuit using the programmed PIC 16F84A and then observe its operation. Demonstrate the circuits operation to the instructor.



Part 2: Write and Move Words on LCD

- Write a C program to clear LCD and Turn off the Cursor
- Display “Welcome to PIC Microcontroller” on LCD and move the words to the right 16 times then back to the left 16 times.
- Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated
- Program a PIC 16F84A using the QL2006 programmer.
- Build the circuit using the programmed PIC 16F84A and then observe its operation. Demonstrate the circuits operation to the instructor.

Part 3

- Present your results in a lab report including a copy of the source code.