

# ENGINE



Erasmus+

TEACHING ONLINE ELECTRONICS, MICROCONTROLLERS AND PROGRAMMING  
IN HIGHER EDUCATION

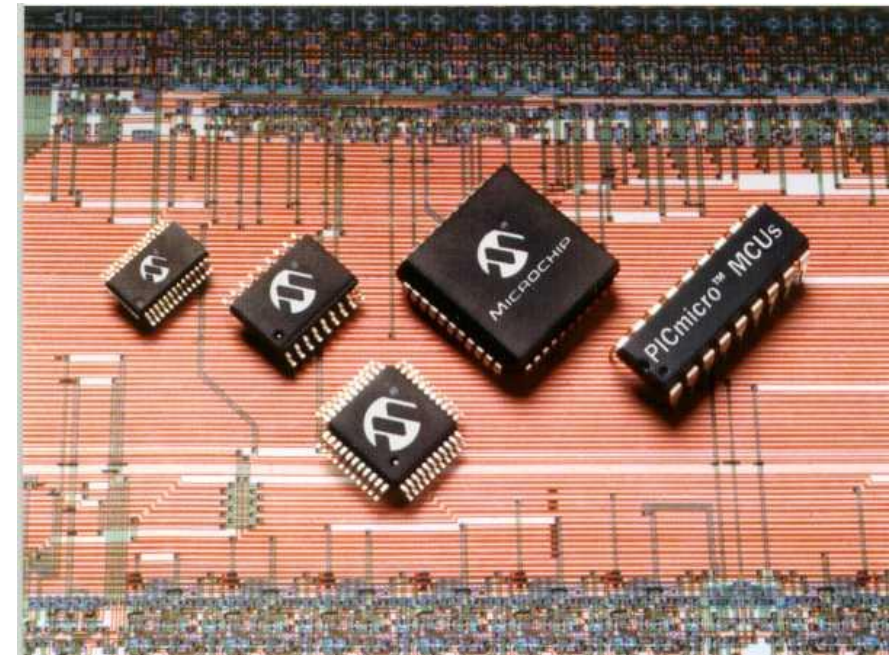
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## Module\_2-4. LCD 16x2

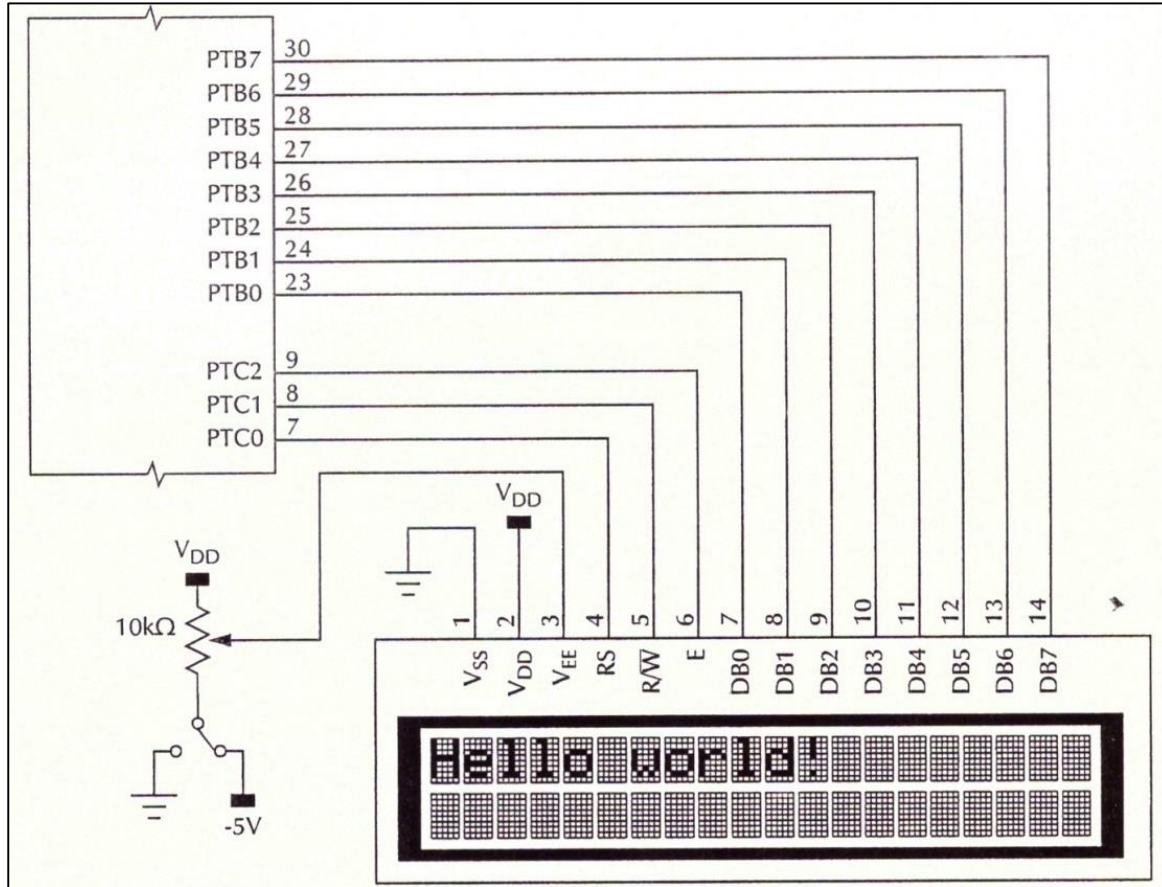
*PIC18F4550 with Proteus Simulation*

# Contents

- LCD 16x2 pinout
- LCD commands
- ASCII
- Example



# Module\_2-4. LCD 16x2 Pinout

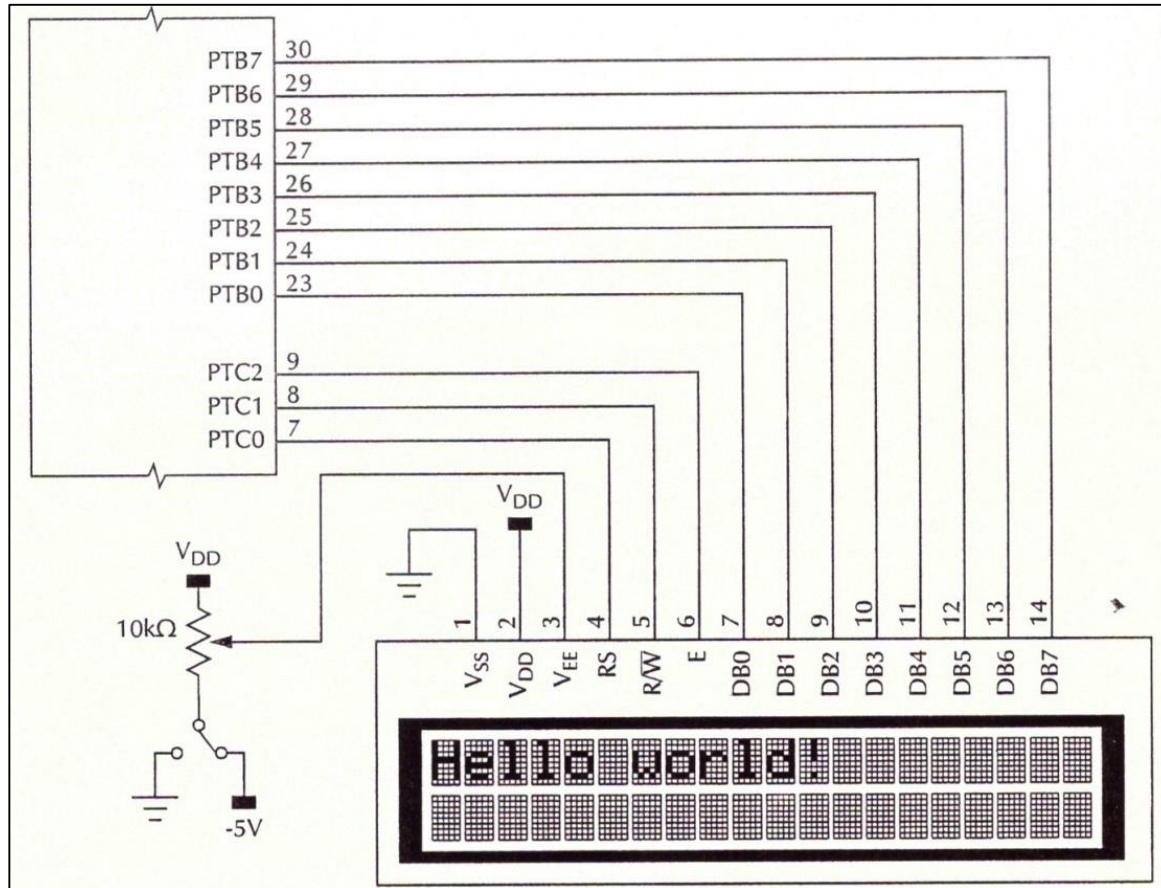


LCD connections

Pin	Type	Description
RS	Control	Register Select 1 => Data 0 => Command
R/ $\hat{W}$	Control	Read / Write 0 => Write to register 1 => Read from register
E	Control	Enable
D0-D7	Data	Bidirectional data bus

LCD pinout

# Module\_2-4. LCD 16x2 Pinout



LCD connections

Pay attention to the connection of the LCD to the microcontroller.

We can use any output pin of any PORT.

# *Module\_2-4. LCD 16x2 Commands*

**To send a command to the LCD, we need RS=1**

Instructions/commands for the LCD to do an action, such as:

1. Clear the screen
2. Prepare to write in a position on a particular line
3. Rotate the text left or right
4. Show (or not) the cursor

For each command there is a binary code which is sent via the pins D0-D7 to LCD

**How do we send a character to appear on the LCD?**

We send an 8-bit code number that corresponds to the specific character

This number is sent through the pins D0-D7

*The code number is the ASCII character code*

# Module\_2-4. LCD 16x2

## ASCII

ASCII: American Standard Code for Information Interchange

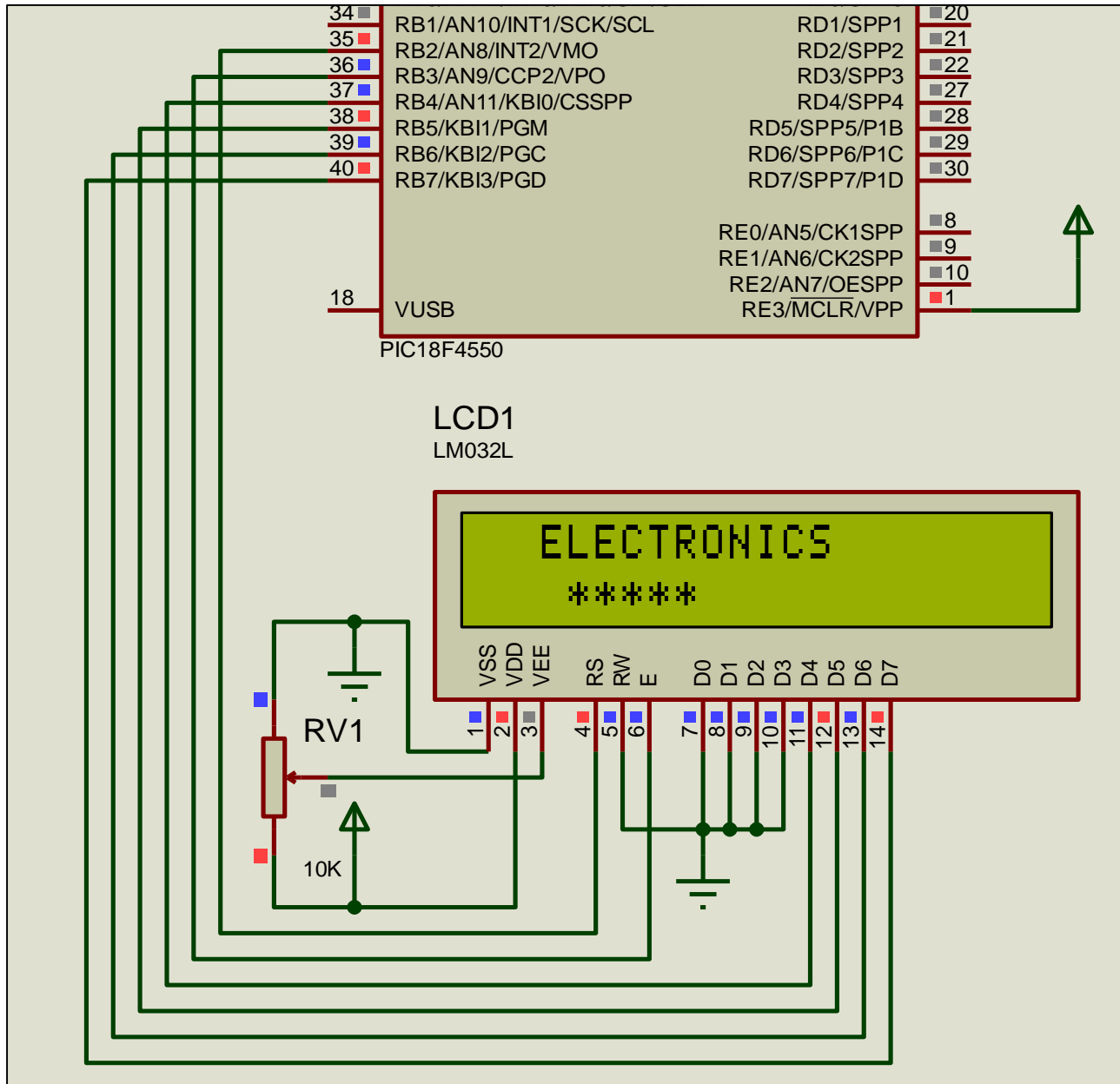
A character mapping to numbers is the ASCII code that matches the letters of the Latin alphabet, ten-digit numbers, and some other special symbols to 8-bit numbers.

Digit	ASCII code
0	0x30
1	0x31
2	0x32
3	0x33
4	0x34
5	0x35
6	0x36
7	0x37
8	0x38
9	0x39

Letter	ASCII code
A	0X41
B	0X42
C	0X43
D	0X44
E	0X45
F	0X46
G	0X47
H	0X48
I	0X49
J	0X4A
K	0X4B
L	0X4C
M	0X4D

Letter	ASCII code
N	0X4E
O	0X4F
P	0X50
Q	0X51
R	0X52
S	0X53
T	0X54
U	0X55
V	0X56
W	0X57
X	0X58
Y	0X59
Z	0X5A

# Module\_2-4. LCD 16x2 Example



The purpose of this example is to display a message on the LCD 16x2.

# Module\_2-4. LCD 16x2

## Example

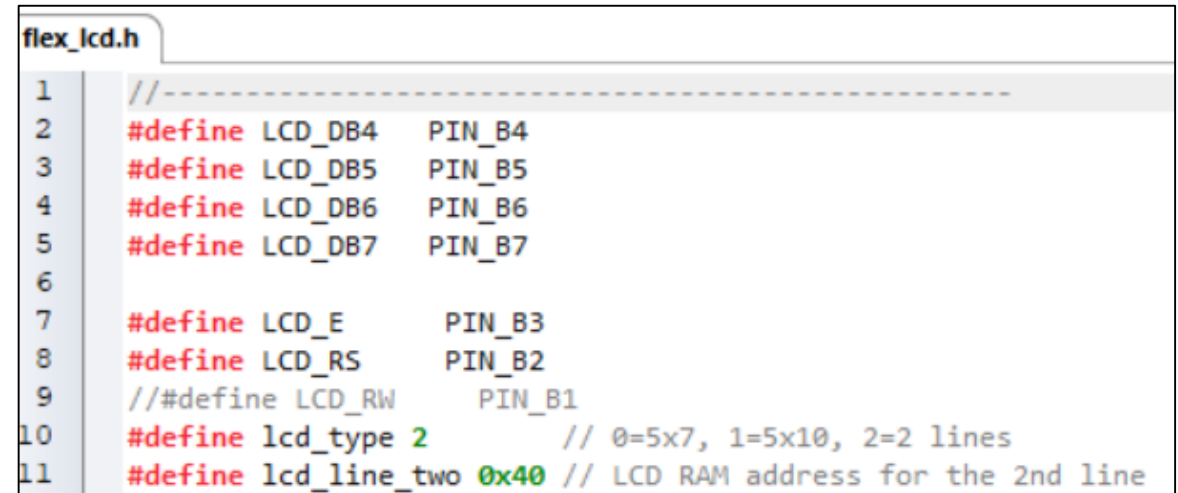
```
#include <main.h> // the file main.h with the
    // initial settings is included.
    // This file must be placed in the same
    // folder with the project.
    // Also the 18F4550.h file must exist
    // in the same folder with the project

#include <flex_lcd.h> // The h file of the lcd driver
    // should be in the same folder where we will save our program.
    // The #define LCD_DB4 PIN_B4 etc statements in flex_lcd.c
    // should be checked and possibly modified.
    // These statements determine the pins of the microcontroller
    // that are connected to LCD 16x2.

#byte PORTB =0xF81 // We attribute to the memory position 0xF81 the name PORTB.
    // This means that we define a 8 bit variable whose value
    // will be stored to the memory position F81h.
    // The memory position F81h is the PORTD data register.

void main(){
    lcd_init();    // Initialization routine
    lcd_putc("\f"); // Clear display
    lcd_gotoxy(3,1); // The cursor moves to the third position of the first line
    lcd_putc("ELECTRONICS"); // print the message on the LCD
    lcd_gotoxy(4,2); // he cursor moves to the fourth position of the second line
    lcd_putc("*****"); // print the message on the LCD

    while(TRUE){;} //The main program does nothing. Eternal loop
}
```



```
flex_lcd.h
1 //-----
2 #define LCD_DB4 PIN_B4
3 #define LCD_DB5 PIN_B5
4 #define LCD_DB6 PIN_B6
5 #define LCD_DB7 PIN_B7
6
7 #define LCD_E PIN_B3
8 #define LCD_RS PIN_B2
9 // #define LCD_RW PIN_B1
10 #define lcd_type 2 // 0=5x7, 1=5x10, 2=2 lines
11 #define lcd_line_two 0x40 // LCD RAM address for the 2nd line
```

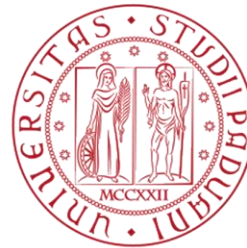


## ENGINE Partnership

- Warsaw University of Technology (PL) - *coordinator*
- IHU - International Hellenic University (GR)
- EDUMOTIVA - European Lab for Educational Technology (GR)
- University of Padova (IT)
- University of Applied Sciences in Tarnow (PL)



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