



# Interfacing LCD 16x2 in 4-bit mode with PIC18F4550

## Introduction

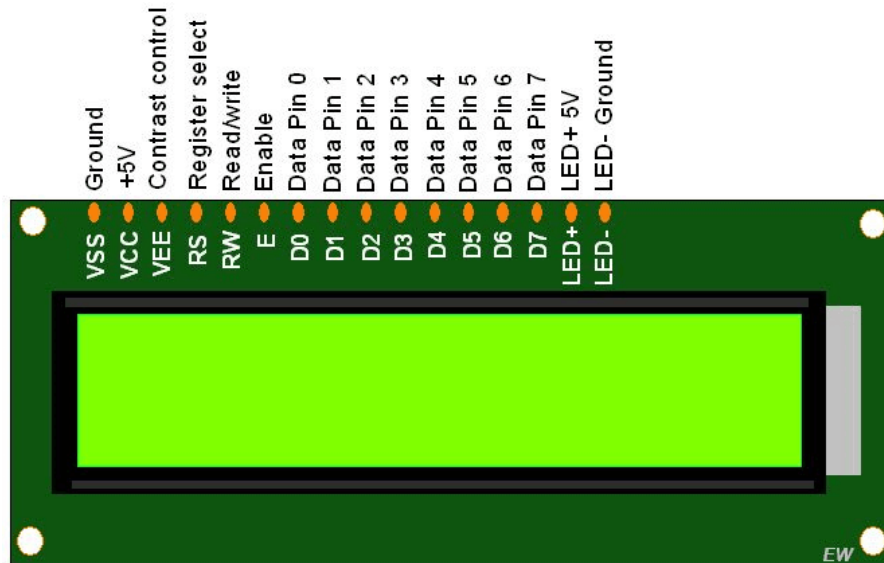
LCDs (Liquid Crystal Displays) are used for displaying status or parameters in embedded systems.

LCD 16x2 is a 16 pin device which has 8 data pins (D0-D7) and 3 control pins (RS, RW, EN). The remaining 5 pins are for supply and backlight for the LCD.

The control pins help us configure the LCD in command mode or data mode. They also help configure read mode or write mode and also when to read or write.

LCD 16x2 can be used in 4-bit mode or 8-bit mode depending on the requirement of the application. In order to use it, we need to send certain commands to the LCD in command mode and once the LCD is configured according to our need, we can send the required data in data mode.

For more information about LCD 16x2 and how to use it, refer to the topic LCD 16x2 display module (<http://electronicwings.com/sensors-modules/lcd-16x2-display-module>) in the sensors and modules section.



LCD16x2 Pinout

## LCD 16x2 4-bit Mode

- In 4-bit mode, data/command is sent in a 4-bit (nibble) format.
- To do this 1st send Higher 4-bit and then send lower 4-bit of data/command.
- Only 4 data (D4 - D7) pins of 16x2 of LCD are connected to the microcontroller and other control pins i.e. RS (Register select), RW (Read/write), E (Enable) are connected to other GPIO Pins of the controller.

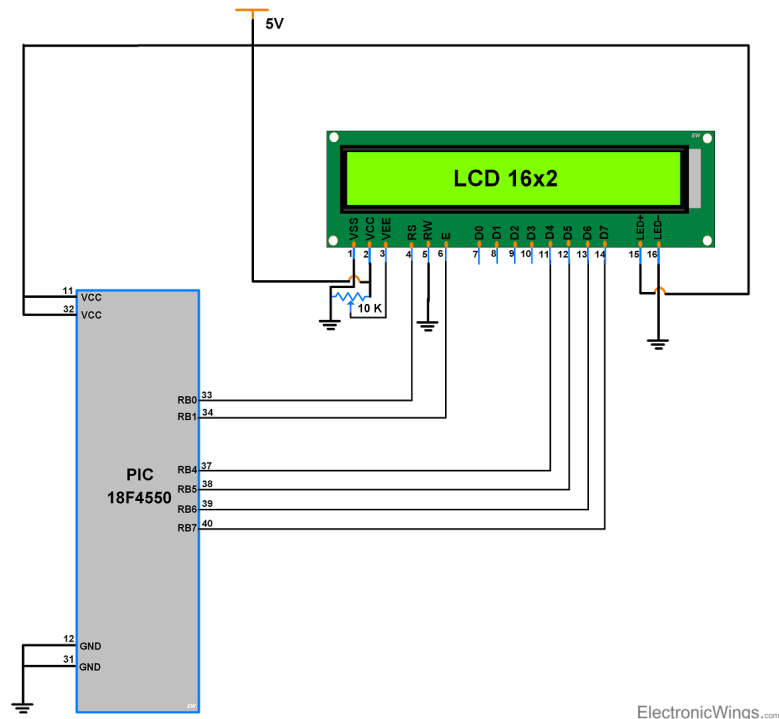


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## Interfacing Diagram



LCD16x2 Interfacing in 4-bit Mode with PIC18F4550

## Programming LCD16x2 with PIC18F4550

### Initialization

1. Wait for 15ms, Power-on initialization time for LCD16x2.
2. Send 0x02 command which initializes LCD 16x2 in 4-bit mode.
3. Send 0x28 command which configures LCD in 2-line, 4-bit mode, and 5x8 dots.
4. Send any Display ON command (0x0E, 0x0C)
5. Send 0x06 command (increment cursor)

```
void LCD_Init()
{
    LCD_Port = 0;           /*PORT as Output Port*/
    MSdelay(15);           /* 15 ms, Power-On delay*/
    LCD_Command(0x02);     /*send for initialization of LCD with nibble method */
    LCD_Command(0x28);     /*use 2 line and initialize 5*7 matrix in (4-bit mode)*/
    LCD_Command(0x01);     /*clear display screen*/
    LCD_Command(0x0c);     /*display on cursor off*/
    LCD_Command(0x06);     /*increment cursor (shift cursor to right)*/
}
```

Now we successfully initialized LCD & it is ready to accept data in 4-bit mode to display.

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### Command write function

1. First Send Higher nibble of command.
2. Make RS pin low, RS=0 (command reg.)
3. Make RW pin low, RW=0 (write operation) or connect it to ground.
4. Give High to Low pulse at Enable (E).
5. Send lower nibble of command.
6. Give High to Low pulse at Enable (E).

```
void LCD_Command(unsigned char cmd)
{
    ldata = (ldata & 0x0f) | (0xF0 & cmd); /*Send higher nibble of con
    RS = 0; /*Command Register is selected i.e.RS=0*/
    EN = 1; /*High-to-low pulse on Enable pin to latch data*/
    NOP();
    EN = 0;
    MSdelay(1);
    ldata = (ldata & 0x0f) | (cmd<<4); /*Send lower nibble of command to
    EN = 1;
    NOP();
    EN = 0;
    MSdelay(3);
}
```

### Data write function

1. First Send a Higher nibble of data.
2. Make RS pin high, RS=1 (data reg.)
3. Make RW pin low, RW=0 (write operation) or connect it to ground.
4. Give High to Low pulse at Enable (E).
5. Send lower nibble of data.
6. Give High to Low pulse at Enable (E).

```
void LCD_Char(unsigned char dat)
{
    ldata = (ldata & 0x0f) | (0xF0 & dat); /*Send higher nibble of da
    RS = 1; /*Data Register is selected*/
    EN = 1; /*High-to-low pulse on Enable pin to latch data*/
    NOP();
    EN = 0;
    MSdelay(1);
    ldata = (ldata & 0x0f) | (dat<<4); /*Send lower nibble of data to POR
    EN = 1; /*High-to-low pulse on Enable pin to latch data*/
    NOP();
    EN = 0;
    MSdelay(3);
}
```



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## 16x2 LCD 4bit mode program for PIC18F4550

```

Project (/projects)
~/projects/contests/16x2_lcd_4bit_mode_program_for_pic18f4550.c
~/projects/contests/16x2_lcd_4bit_mode_program_for_pic18f4550.c
LCD_Command(0x0c); /*display on cursor off*/
LCD_Command(0x06); /*increment cursor (shift cursor to right)*/
}

void LCD_Command(unsigned char cmd)
{
    ldata = (ldata & 0x0f) | (0xF0 & cmd); /*Send higher nibble of c
    RS = 0; /*Command Register is selected i.e.RS=0*/
    EN = 1; /*High-to-low pulse on Enable pin to latch data*/
    NOP();
    EN = 0;
    MSdelay(1);
    ldata = (ldata & 0x0f) | (cmd<<4); /*Send lower nibble of command
    EN = 1;
    NOP();
    EN = 0;
    MSdelay(3);
}

void LCD_Char(unsigned char dat)
{
    ldata = (ldata & 0x0f) | (0xF0 & dat); /*Send higher nibble of

```

Components Used

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**PICKit 4 MPLAB**  
PICKit 4 MPLAB X 1

[https://www.mouser.in/ProductDetail/Microchip-Technology/PG164140?qs=r5DSvIrkXmLKDuYNJImLWw%3D%3D&utm\\_source=electronicswings&utm\\_medium=display&utm\\_campaign=mouser-componentslisting&utm\\_content=0x0](https://www.mouser.in/ProductDetail/Microchip-Technology/PG164140?qs=r5DSvIrkXmLKDuYNJImLWw%3D%3D&utm_source=electronicswings&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

[Datasheet \(/components/pickit-4-mplab/1/datasheet\)](/components/pickit-4-mplab/1/datasheet)

**PIC18f4550**  
PIC18f4550 X 1

[https://www.mouser.in/ProductDetail/Microchip-Technology/PIC18F4550-I-P?qs=oKK8NaWdAJs8nLDXBGwMXw%3D%3D&utm\\_source=electronicswing&utm\\_medium=display&utm\\_campaign=mouser-componentslisting&utm\\_content=0x0](https://www.mouser.in/ProductDetail/Microchip-Technology/PIC18F4550-I-P?qs=oKK8NaWdAJs8nLDXBGwMXw%3D%3D&utm_source=electronicswing&utm_medium=display&utm_campaign=mouser-componentslisting&utm_content=0x0)

[Datasheet \(/components/pic18f4550/1/datasheet\)](/components/pic18f4550/1/datasheet)

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## Components Used

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LCD16x2 Display

LCD16x2 Display

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<div><div></div><div>PIC18F4550 LCD 16x2 4bit Mode</div></div>	<div>Dow (/api/download/platform-attachment/48) d</div>
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