

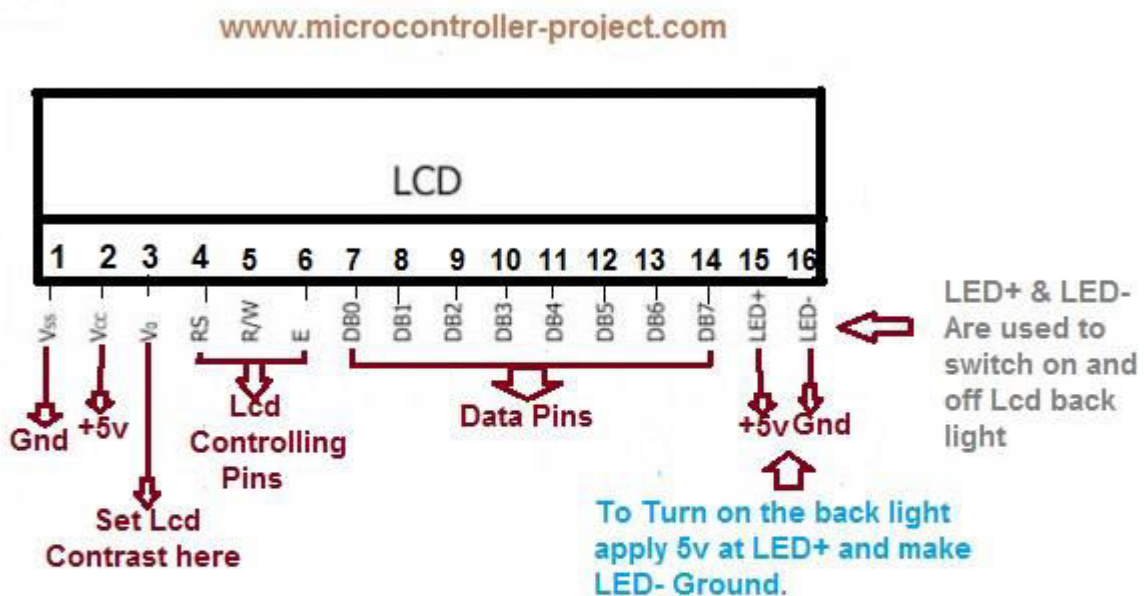
# Character LCD Pinout and Working

In this Tutorial I am going to explain the pinout and working of Character Lcds. Character Lcds comes out in many sizes for example 8x1, 8x2, 8x4, 20x1, 20x2, 20x4, 24x1, 24x2, 24x4, 32x1, 32x2, 40x1, 40x2, 40x4. In these MxN Lcds, M represents number of Columns & N represents number of Rows.

## Pinout

All these Lcds have 14 or 16 pins , except 40x4 and above it. 40x4 will be explained later in the tutorial.

In these 14 pins, 8 are data pins(From DB-0 to DB-9). 3 are Control Pins RS(Register Select), R/W(Read-Write) & En(Enable). 2 Power Pins vcc(+5v) vss(Gnd) and 1 contrast pin(V0). If lcd contains 16 pins than the extra 2 pins are LED+ and LED-.



**All the Character Lcds 8x1, 8x2, 8x4, 20x1, 20x2, 20x4, 24x1, 24x2, 24x4, 32x1, 32x2, 40x1, 40x2 are of same Pinout Given above.**

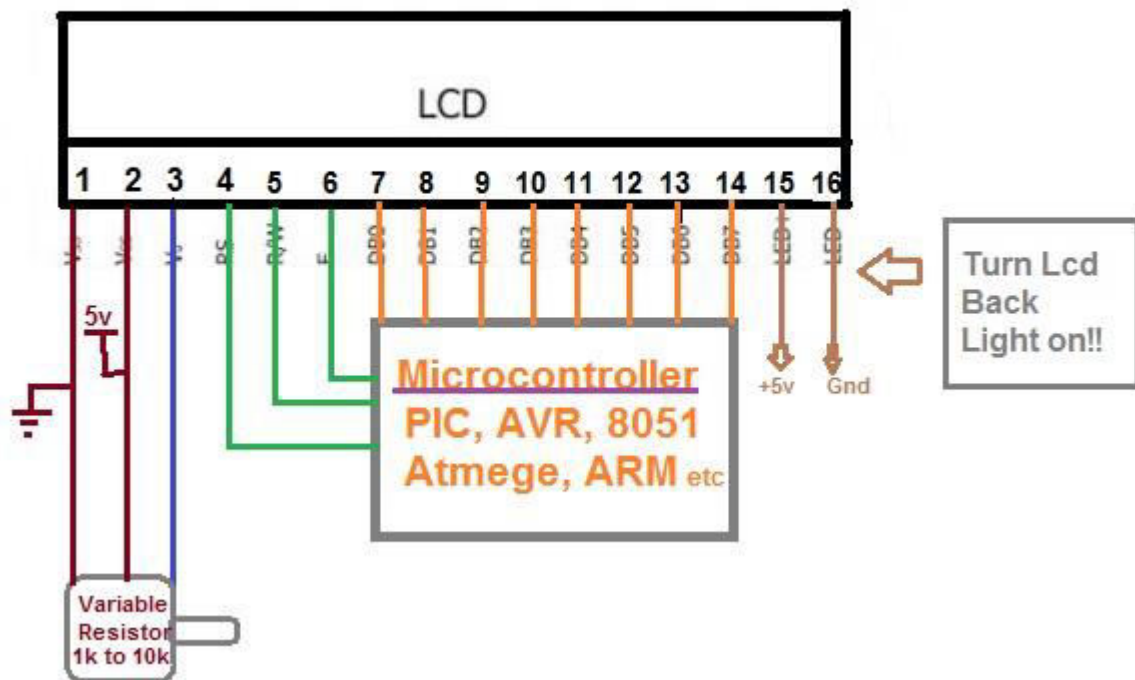
Lcds that have pins arranged in two lines like header, their pinout is given below. Female header pinout is given below.



Functions of the pins were explained later in the post.

## Now how to make connections with lcd?

You can use directly this lcd with your computer. Send data from Computer and display it on lcd. For this task you need some extra hardware installed with your lcd. You can also interface these character lcds with microcontrollers. Send data from microcontroller to lcd and make this data to display on lcd using lcd controlling pins.



## 40x4 Lcd and dimensions greater than this size has Different Pinout than others. Why???

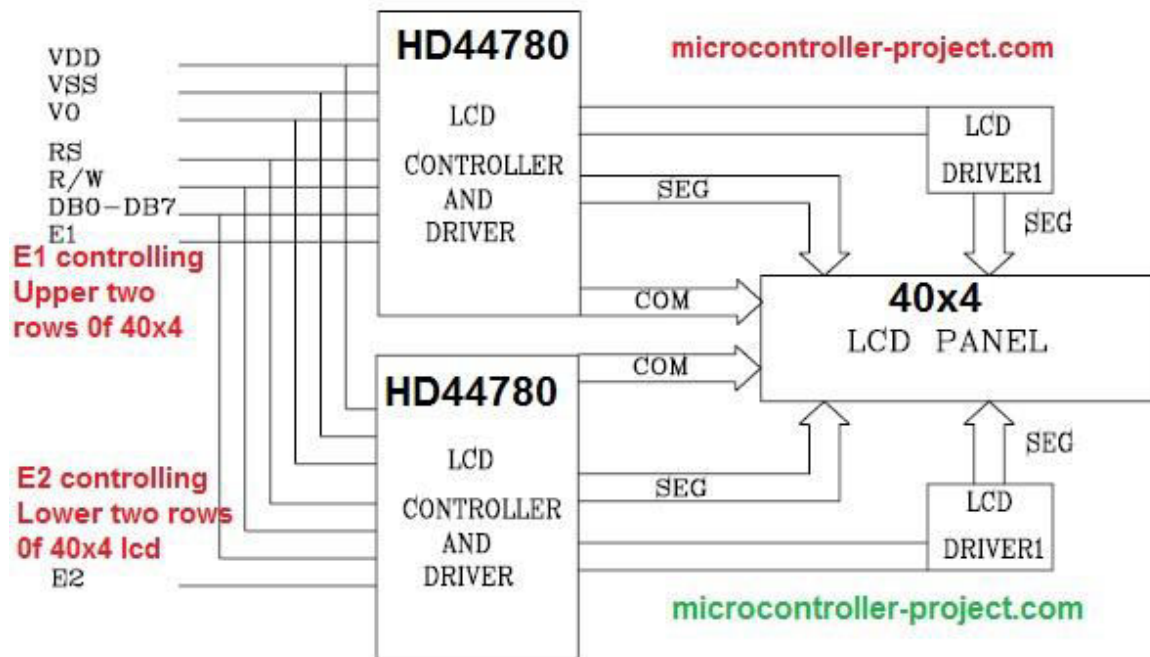
Mostly character Lcds contains HD44780U controller in them. HD44780 was developed by Hitachi.

A single HD44780 can handle up to 80 characters. In 40x4 Lcd display total characters are  $40 \times 4 = 160$ . So to control 160 characters we need two HD44780 controllers. To work with two HD44780 controllers we need an extra pin to energize the second controller.

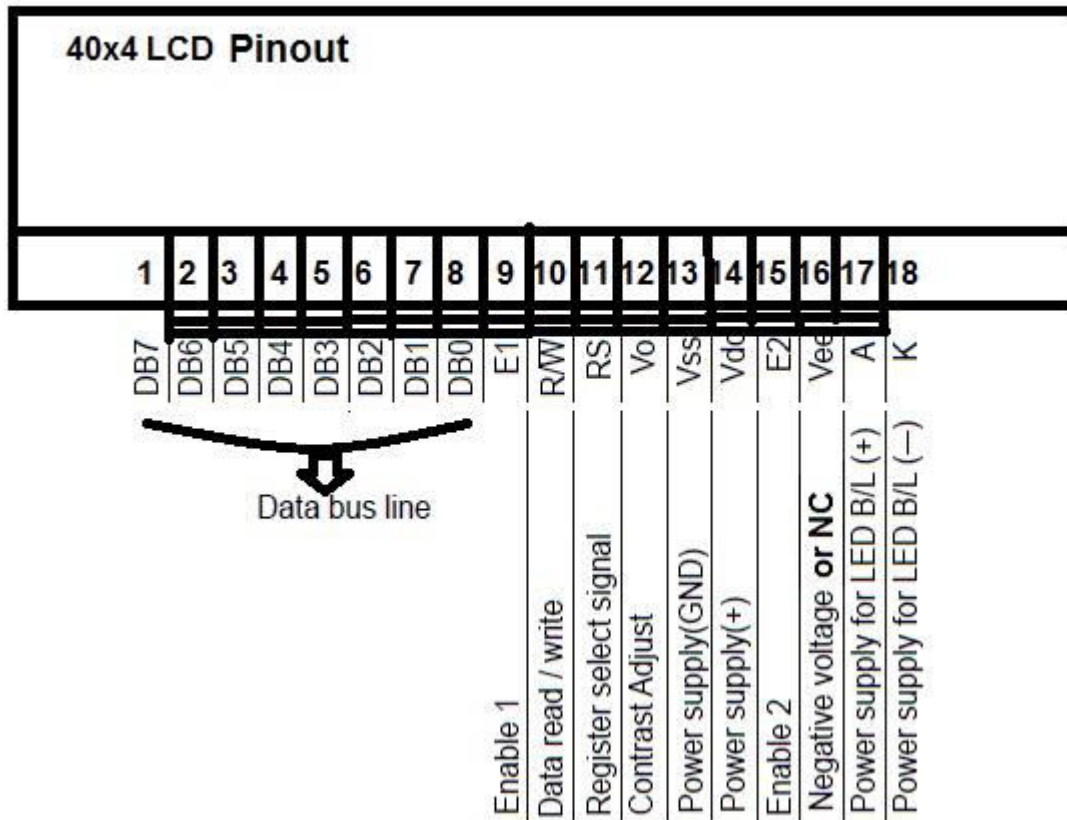
The only difference in 40x4 display and sizes greater than this is two extra pins. NC and an extra En pin.

- NC -> Is simply no connection. Leave it untouched or apply negative voltage.
- E1 & E2 -> E1 controls (Enables) the upper two rows of 40x4 character Lcd. E2 controls (Enables) the Lower 2 rows of 40x4 display.

Take a simple Look on the diagram from the datasheet.



40x4 Lcd Pinout



If Lcd comes in Header package Pinout will be.

**If 18 pin Header**

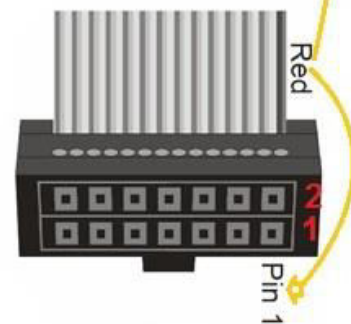
**16-Pin header**

LED-	NC	VDD-VCC	V0	R/W	DB8	DB6	DB4	DB2
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18	16	14	12	10	8	6	4	2
17	15	13	11	9	7	5	3	1

LED+	E2	Vss	RS	E1	DB7	DB5	DB3	DB1
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**Pinout of 40x4 lcd and sizes above this..**



# LCD Working and Pin Functions

## DB0-DB7

These are eight bit data pins. We send our data and command to lcd using these lines.

## R/W(Read-Write)

This pin selects if we want to read or write some instruction (Data-Command) to lcd.

- If R/W=0 Write operation is selected.
- If R/W=1 Read operation is selected.

## En(Enable)

This pin is a push to data. Generally it remains low. But when we want to display data to execute command we make this pin high for some milli seconds and then back again low.

**Note:** 40x4 and sizes greater than it has two enable pins E1 and E2.

## RS(Register Select)

This pin selects the lcd register.Each character lcd has two Registers Data and Command.

### Data Register

To display data on lcd we have to select data register of lcd. Send data to data register. Now To make this data appear on lcd we made En(Enable) pin high.

- If RS=1 Data Register is selected.

### Command Register

Before using lcd we have to set some parameters for lcd. Like the font size of data that is going to appear on lcd. Cursor Blinking or Still.

- If RS=0 Command register is selected.

Standard commands and their functions are given below.

No.	Instruction	Hex	Decimal
1	Function Set: 8-bit, 1 Line, 5x7 Dots	0x30	48
2	Function Set: 8-bit, 2 Line, 5x7 Dots	0x38	56
3	Function Set: 4-bit, 1 Line, 5x7 Dots	0x20	32
4	Function Set: 4-bit, 2 Line, 5x7 Dots	0x28	40
5	Entry Mode	0x06	6
6	Display off Cursor off (clearing display without clearing DDRAM content)	0x08	8
7	Display on Cursor on	0x0E	14
8	Display on Cursor off	0x0C	12
9	Display on Cursor blinking	0x0F	15
10	Shift entire display left	0x18	24
12	Shift entire display right	0x1C	30
13	Move cursor left by one character	0x10	16
14	Move cursor right by one character	0x14	20
15	Clear Display (also clear DDRAM content)	0x01	1
16	Set DDRAM address or cursor position on display	0x80+add	128+add

## Vo

Vo sets the contrast for lcd. Attach a variable resistor , potentiometer to this pin and set the exact contrast which makes the text visible to naked eye.

## LED+ & LED-

To display the back light of lcd. Supply +5v to LED+ and ground LED-.

## Vss & Vdd



Made Vss pin ground and apply +5v to vdd to switch on the lcd.

**You can use lcd in 4-bit as well as 8-bit mode. To learn about 4-bit and 8-bit mode take the tutorial below.**

<http://www.microcontroller-project.com/lcd-in-4-bit-mode-and-8-bit-mode.html>

**Demo Codes and projects are available in the projects and Lcd Interfacing Section of the site.**

<http://www.microcontroller-project.com/lcd-interfacing>

<http://www.microcontroller-project.com/projects.html>

<http://www.microcontroller-project.com/name-on-lcd-with-8051-microcontroller.html>