# NetMedia 2x16 Serial LCD Display Module V1.5


**Table of Contents:**

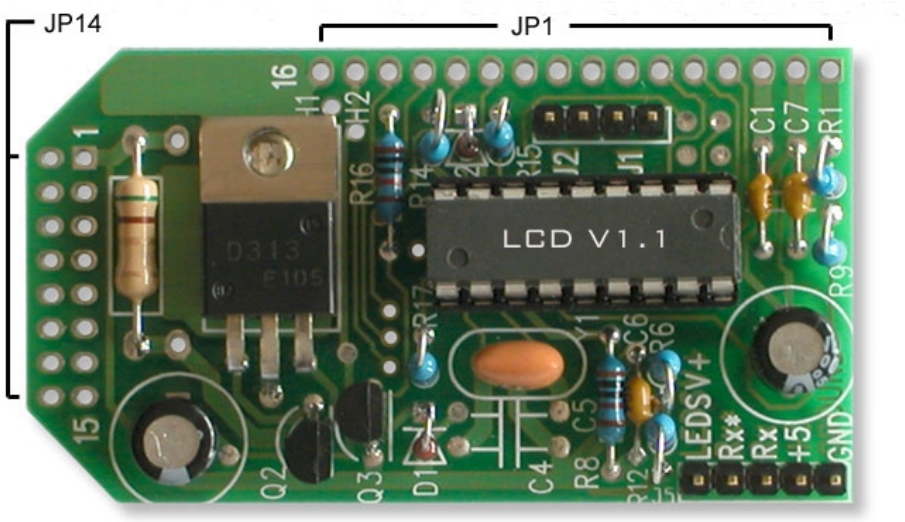


**Warranty**
NetMedia, Inc. warrants this product against defects in materials and workmanship for a period of 90 days from purchase date. Repaired/replaced products will be returned via standard shipping. Expedited return shipping is available at customer's expense. Any product that has been abused, modified or had its polarity reversed is not covered under warranty. Our technicians check all returns. Items damaged by customer abuse/misuse will not be warranted and will only be returned at the customer's request and expense.

Extended warranties are available for large volume OEM customers. Please contact a NetMedia sales representative for more information.

## Pinout

Power and communications connections are made via header J5. Jumper connections J1 and J2 are used to set the modules baud rate and display type. Connection JP1 connects the serial module to the LCD, header JP14 is for 2x8 pin style LCD modules.




| J5 Pins | Description | Notes |
|---|---|---|
| GND | Power Ground | **Reversing Polarity voids warranty!** |
| +5 | Power + 5 supply | Tie to +5vdc 15mA+ supply |
| RX | Serial Input | RS232 or logic level (if used leave RX* disconnected) |
| RX* | Serial Input (Inverted) | RS232 or logic level (if used leave RX disconnected) |
| LEDSV+ | Backlight Power | Tie to 5-14vdc 100mA+ supply |

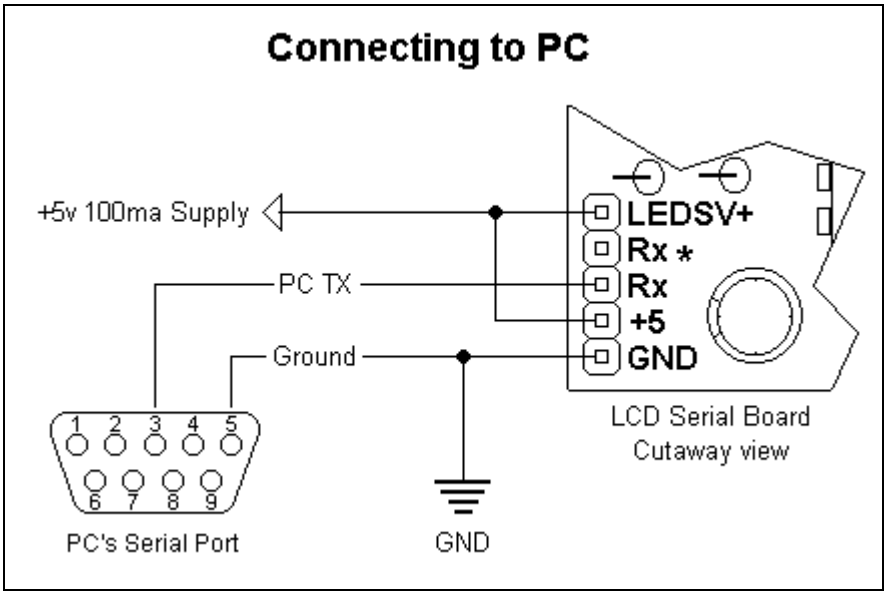
**Note:** Always disconnect power before changing jumper positions!

| Jumpers J1 & J2 | Description | |
|---|---|---|
| J1 | J1 On = 9600 Baud, J1 Off = 2400 Baud | Factory setting = J1 On |
| J2 | ****Not Used**** | Factory setting = J2 On |

| JP1/JP14 Pins 1 - 8 | Description | JP1/JP14 Pins 9 -16 | Description |
|---|---|---|---|
| Pin1 | Ground | Pin9 | D2 (Not Used) |
| Pin2 | VCC (+5) | Pin10 | D3 (Not Used) |
| Pin3 | Contrast | Pin11 | D4 |
| Pin4 | Data/Command (R/S) | Pin12 | D5 |
| Pin5 | Read/Write (W) | Pin13 | D6 |
| Pin6 | Enable (E1) | Pin14 | D7 |
| Pin7 | D0 (Not Used) | Pin15 | VCC (LEDSV+) |
| Pin8 | D1 (Not Used) | Pin16 | Ground |

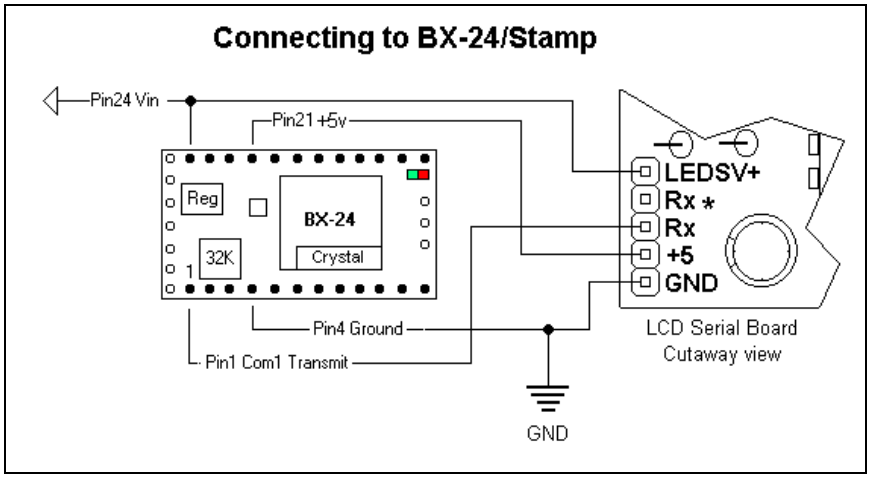
## Interfacing

The diagrams below show two common methods for interfacing the 2x16 LCD.




**Connection LEDSV+ is 5-14vdc.**

**Note: Never connect LEDSV+ to +5 on the BX-24! The BX-24 +5 regulator cannot supply enough current to power the LCD backlight and will overheat.**



## LCD Control Codes

| Description | Keyboard Code | ASCII or Decimal value |
|---|---|---|
| Display custom character 0-7 | Ctrl-@ -Through- Ctrl-G | 0 - 7 |
| Back Space | Ctrl-H | 8 |
| Horizontal Tab | Ctrl-I | 9 |
| New Line | Ctrl-J | 10 |
| Vertical Tab | Ctrl-K | 11 |
| Form Feed (Clear Screen) | Ctrl-L | 12 |
| Carriage Return | Ctrl-M | 13 |
| Reset Controller | Ctrl-N | 14 |
| Set Geometry | Ctrl-O | 15 |
| Set Tab Size | Ctrl-P | 16 |
| Set Cursor Position | Ctrl-Q | 17 |
| *Not Used | ***** | ** |
| Set Contrast | Ctrl-S | 19 |
| Set Backlight | Ctrl-T | 20 |
| Command Escape | Ctrl-U | 21 |
| Data Escape | Ctrl-V | 22 |
| Raw Data Escape | Ctrl-W | 23 |
| *Not Used | ***** | ** |
| Display an ASCII Character | None | 22 - 255 |

**Back Space** **Ctrl-H**

Causes the cursor to move back once space. The cursor will wrap from the first column of a line to the last column of a previous line. Sending backspace when at the home position causes the cursor to wrap to the last character position of the last line.

**Horizontal Tab** **Ctrl-I**

Causes the cursor to move forward to the next tab position. If the cursor is near the end of the line and no more tab positions are on the line, then the cursor will advance to the next line. The LCD Controller is initial set up with tab positions at every 4'th column. To set the tab position at a different column use the "Set Tab Size" command.

**New Line** **Ctrl-J**

Causes the cursor to advance to column 1 of the next line. If the cursor is on the last line, it will wrap to the home position.

**Vertical Tab** **Ctrl-K**

Causes the cursor to advance to the next line, but stay on the same column. If the cursor is on the last line of the screen, it will wrap to the first line of the screen.

**Form Feed** **Ctrl-L**

Causes the screen to be cleared and the cursor positioned to the home position. The form feed command takes some time to complete. It may take up to 2ms to complete. Since the LCD Controller has a finite amount of internal buffer space (16 bytes) for storing commands and data before sending to the LCD, you may overrun the internal buffer when sending multiple form feed commands in succession followed by other data.

**Carriage Return** **Ctrl-M**
Causes the cursor to go to column 1 of the current line

**Reset Controller** **Ctrl-N**

Resets the LCD controller as if it had been just power on. This command will also cause the hardware jumpers to be reread, so you can use it if you want to change baud rate or display size. This command takes about 1 second to complete.

**Set Geometry** **Ctrl-O**

Defines the layout (or geometry of the LCD). This command needs to issued before any other commands if the LCD is not a 20 character by 4 line LCD. You need to send 5 addition bytes after sending a "Set Geometry" command.

Example:

| | |
|---|---|
| 15,20,0x80, 0xC0,0x94,0xD4 | Standard 20 column by 4 line display |
| 15,16,0x80, 0xC0,0x94,0xD4 | Standard 16 column by 4 line display |
| 15,16,0x80, 0xC0,0x80,0x80 | Standard 16 column by 2 line display |

If the display is less than 4 lines then you still need to send the line 1 starting address for the unused starting addresses. See the appendix for the typical layout of various LCD modules.

**Set Tab Size** **Ctrl-P**

Sets the size of a tab. You need to send a byte that is the negative of the tab size. The default tab size is 4. The tab size should be a power of 2 (i.e. 0, 1, 2, 4, 8, 16)

**Set Cursor Position** **Ctrl-Q**

Sets the cursor position. The following 2 bytes specify the zero based row and column of the cursor position. The bytes need to be within the display range. Sending bytes outside the display range will position the cursor to unpredictable locations.

**Set Contrast** **Ctrl-S**

Sets the display contrast. The byte following the "Set Contrast" command will set the display contrast. A contrast of 0 is no contrast and a contrast of 255 is full contrast. The contrast is automatically set to 50% at power up.

**Set Backlight** **Ctrl-T**

Sets the display backlight brightness. The byte following the "Set Brightness" command will set the display brightness. A brightness level of 0 will turn off the backlight completely. A brightness level of 255 is full brightness. The brightness is set to 80% after power up.

**Command Escape** **Ctrl-U**

The following byte is sent to the LCD controller as a raw LCD controller command. See the appendix for a list of commands that the LCD controller supports. You will mostly use this command to define custom characters and to set the cursor shape and visibility.

**Data Escape** **Ctrl-V**

The following byte is treated as data. This command is used to send bytes that would normally be interpreted as commands. Some LCD displays (in particular the European font LCDs) have characters in the same range as the commands of the LCD controller. This command allows these characters to be sent. After data is output to the LCD controller, the cursor is updated properly.

**Raw Data Escape** **Ctrl-W**

The following byte is treated as raw data. This command is used to send bytes that are used for the creation of custom characters. No attempt is made to advance the cursor since this would interfere with custom character creation.

## Creating Custom Characters

The LCD 2 X 16 contains eight users definable characters. Each custom character is created by sending the following sequence of bytes.

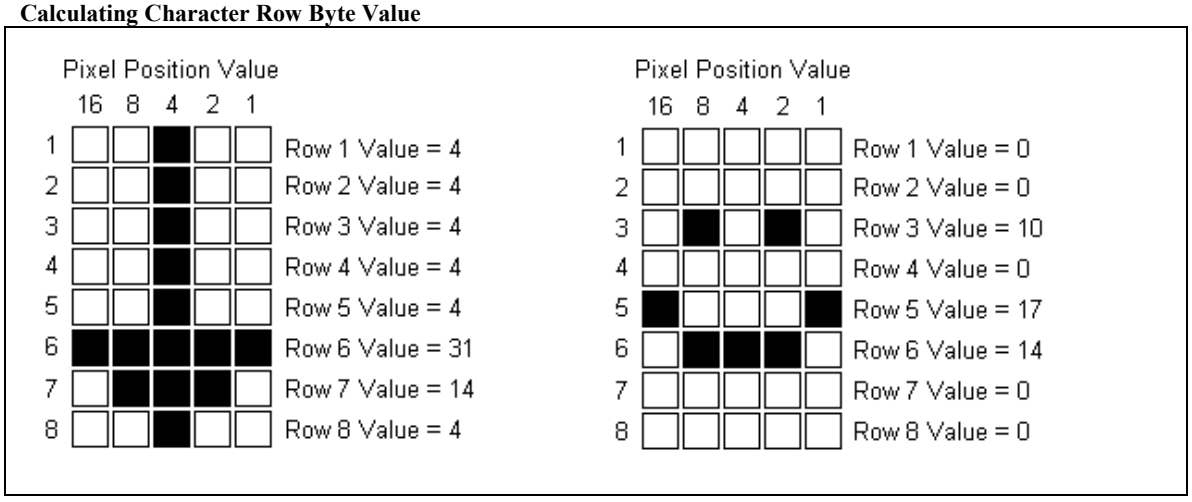
Chr(21) , Storage Address , ( Chr(23) , Character row byte) X 8

The RAM Storage address is the location where the character will be stored.

**Character RAM Addresses**

| Character Number | Character RAM storage address |
|---|---|
| 0 | 64 (Dec) |
| 1 | 72 (Dec) |
| 2 | 80 (Dec) |
| 3 | 88 (Dec) |
| 4 | 96 (Dec) |
| 5 | 104 (Dec) |
| 6 | 112 (Dec) |
| 7 | 120 (Dec) |

**Calculating Character Row Byte Value**




Custom Character BasicX Code Example:

```
' Load Down Arrow as char 0
Call PutQueueStr(Com3Out,Chr(21) & Chr(64) & Chr(23) & Chr(4) & Chr(23) & Chr(4) & Chr(23) & Chr(4) &
Chr(23) & Chr(4)& Chr(23) & Chr(4) & Chr(23) & Chr(31) & Chr(23) & Chr(14) & Chr(23) & Chr(4))

‘ Print char 0 (new down arrow)
Call PutQueueStr(Com3Out,Chr(0))
```

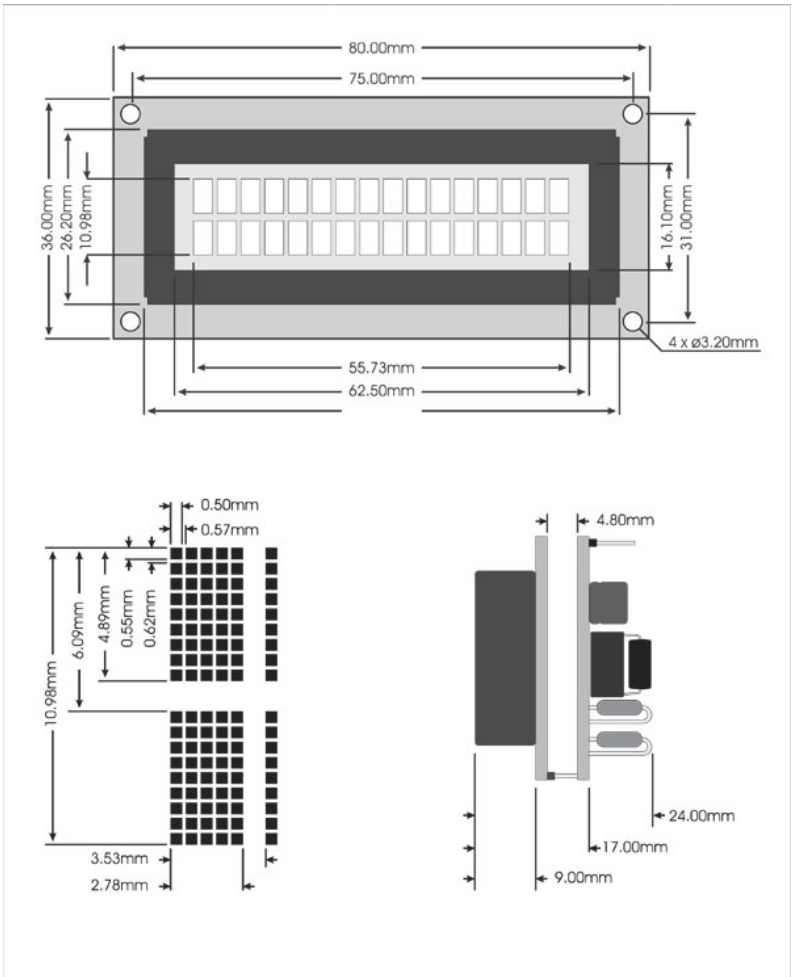
## BasicX-24 Example Program

```
' This program turns on the LCD 2X16 backlight and displays
' a “Hello World” message.

' Connections:
' LCD Gnd    to BasicX-24 Pin23
' LCD +5      to BasicX-24
' LCD LEDSV+ to BasicX-24 Pin24 or 5-12Vdc 150mA + supply
' LCD RX   to BasicX-24 Pin 5

' Define Com3 buffer sizes
Dim Com3In(1 to 15) As Byte
Dim Com3Out(1 to 40) As Byte

' Define the LCD control constants we will use
Const BackLite As Byte = 20
Const Clear_LCD As Byte = 12
Const Set_Cursor As Byte = 17

'*************************************************************
Sub Main()

' Wait 1/2 second after power up for LCD to stabilize
Call Sleep(256)
' Open Com3 Buffers
Call OpenQueue(Com3In, 15)
Call OpenQueue(Com3Out, 40)
' Set Com3 to Inverted Logic, 8 Data Bits, No Parity, Pin12 TX, 0 = NO RX pin
Call DefineCom3(0, 5, bx1000_1000)
' Open Com3
Call OpenCom(3, 9600, Com3In, Com3Out)
' Run greeting subroutine
Call Greeting

Do          'We are done. Sit here and do nothing
Loop

End Sub

'*************************************************************
Sub Greeting()

' Set backlight to full brightness
Call PutQueueStr(Com3Out,Chr(BackLite) & Chr(255))
' Send Clear LCD command and  first 1/2 of message "Hello World!"
Call PutQueueStr(Com3Out,Chr(Clear_LCD) & "  Hello World!")
' Move cursor to Row 2 column 4
Call PutQueueStr(Com3Out,Chr(Set_cursor) & Chr(1) & Chr(3))
' Display the rest of the message "I'm Alive!"
Call PutQueueStr(Com3Out,"I'm Alive!")
End Sub                  ' Return
```

**2x16 Specifications**

Power ……4.9-5.2 Vdc @15mA (No Backlight),  135mA (Full Backlight)
Serial Input……8N1, 9600 or 2400 Baud, RS232 or TTL/CMOS level
Maximum Operating Temperature…….0° - 50° C

## Dimensions





10940 N. Stallard Place
Tucson, AZ 85737
(520) 544-4567