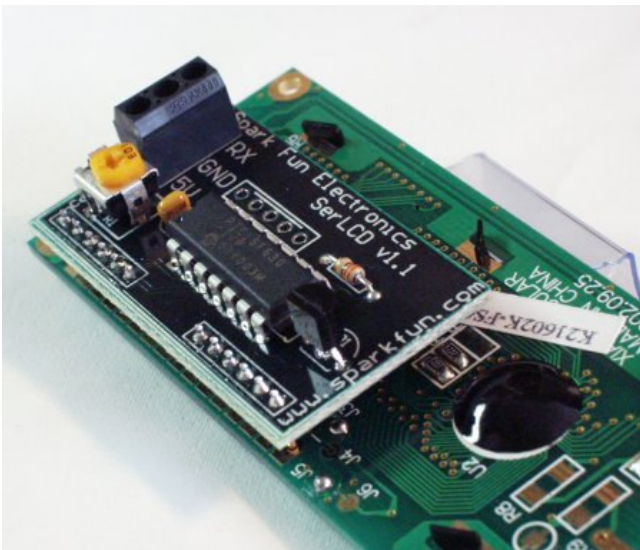## SerLCD
Serial Enabled LCD
2/20/2004

1 Overview

The SerLCD is a simple and cost effective solution for interfacing to Liquid Crystal Displays (LCDs) based on the HD44780 controller. The SerLCD module takes incoming 9600bps TTL level signals and displays those characters on the LCD screen. Only three wires - 5V, GND, and Signal - are needed to interface to the LCD.

Please report typos, inaccuracies, and especially unclear explanations to us at spark@sparkfun.com. Suggestions for improvements are welcome and greatly valued.

2 Interface Specifications

All transmissions occur at 9600bps with 8 bits of data, 1 start bit, 1 stop bit, and no parity.

The SerLCD is controlled using actual ASCII characters. This means that if you pass the ASCII character 'r' to the module, an 'r' will be displayed on the LCD at the next cursor position. There are only two exceptions to this. These are the command characters decimal 254 (0xFE) and 124 (0x7C).

3 Configuration

All settings are stored on onboard EEPROM and loaded during power up.

3.1 Backlight

The SerLCD v1.1 comes with the ability to control whether the backlight is on or off.

To control the backlight, transmit the special command - 124 (0x7C). Follow this command with either 1 (0x01) to turn on the backlight, or 2 (0x02) to turn the backlight off. The current status of the backlight is saved to EEPROM after each change.

3.2 LCD Type Setup

The SerLCD v1.1 firmware includes settings to interface to the following types of LCDs : 2x16, 2x20, 4x16, and 4x20.

LCD Type	
20 Characters Wide	3
16 Characters Wide	4
4 Lines	5
2 Lines	6

If you purchased the SerLCD soldered to an LCD, it has already been configured to work with that specific LCD. You should not have to configure anything.

If you purchased the SerLCD module by itself, you will have to tell the module what type of LCD it is going to be, or is currently, attached to.

To control what type of LCD the SerLCD module is attached to, transmit the special command - 124 (0x7C). Follow this command with either 3, 4, 5, or 6. These commands set the LCD character width and number of lines. These settings are used to correctly wrap the cursor to keep it within the viewable screen. The type of LCD is saved to EEPROM after each change.

3.3 Extended LCD Commands

The HD44780 LCD controller is very common. The extended commands for this chip include but are not limited to:

HD44780 Commands	
Clear Display	0x01
Move cursor right one	0x14
Move cursor left one	0x10
Scroll right	0x1C
Scroll left	0x18
Turn visual display on	0x0C
Turn visual display off	0x08
Underline cursor on	0x0E
Underline cursor off	0x0C
Blinking box cursor on	0x0D
Blinking box cursor off	0x0C
Set cursor position	0x80 +

Please refer to the HD44780 datasheet for more information.

Clear display and set cursor position are the two commands that effect the SerLCD the most. By sending these commands to the SerLCD the cursor position gets changed. This change is tracked by the firmware and cursor wrapping is performed normally. A cursor move to outside the viewable area is possible and the cursor position variable will be updated accurately.

The viewable area cursor positions are as follows for almost all HD44780 based LCDs:

16 Character Displays	
Line Number	Viewable Cursor Positions
1	0-15
2	64-79
3	16-31
4	80-95

20 Character Displays	
Line Number	Viewable Cursor Position
1	0-19
2	64-83
3	20-39
4	84-103

To perform a cursor move, a series of steps must occur:

1. You will need to determine the correct decimal position to move to. For example, the viewable position three on the second line of a 16 character display is 66.

2. Set bit 7 (the highest bit) of that decimal number to '1'. Position 66 + 128 = 194.

3. Now transmit the special character 254 to tell the SerLCD you want to send a command.

4. Finally, transmit the number 194. The cursor is now sitting in the third position of the second line.

4 Hardware

4.1 Vcc and Current Draw

The SerLCD v1.1 should only be powered by 5V DC. Higher than 5.5V will cause damage to the PIC, LCD, and backlight (if attached).

The SerLCD uses 3mA with the backlight turned off and ~60mA with the backlight activated.

4.2   Contrast Control

The SerLCD v1.1 comes equipped with a 10k potentiometer to control the contrast of the LCD. This is set by the manufacturer during testing and may need correcting for your specific module. Temperature and supply voltage can effect the contrast of the LCD.

4.3   Hi-Current Control

The SerLCD v1.1 uses a general purpose, 800mA NPN transistor to control the Backlight. If you purchased the SerLCD module, you may use this pin as a general purpose, high power control pin. If you issue the backlight on/off command to the SerLCD, pin 15 (next to the last pin below the transistor) will turn on/off. Pin 16 (last pin below the transistor) is connected to ground.