

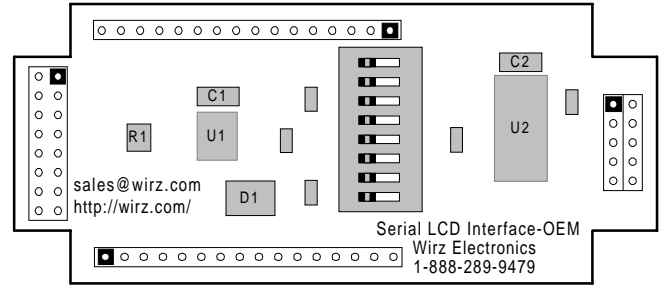
## Serial LCD Interface - OEM

### General Description

The Wirz Electronics' SLI-OEM is the lowest cost and most flexible Serial LCD Interface on the market today. It is designed to provide a simple and fast interface to a Hitachi 44780 based LCD while still retaining the ability to interface with all the special functions of the 44780, including custom character generation and cursor movement.

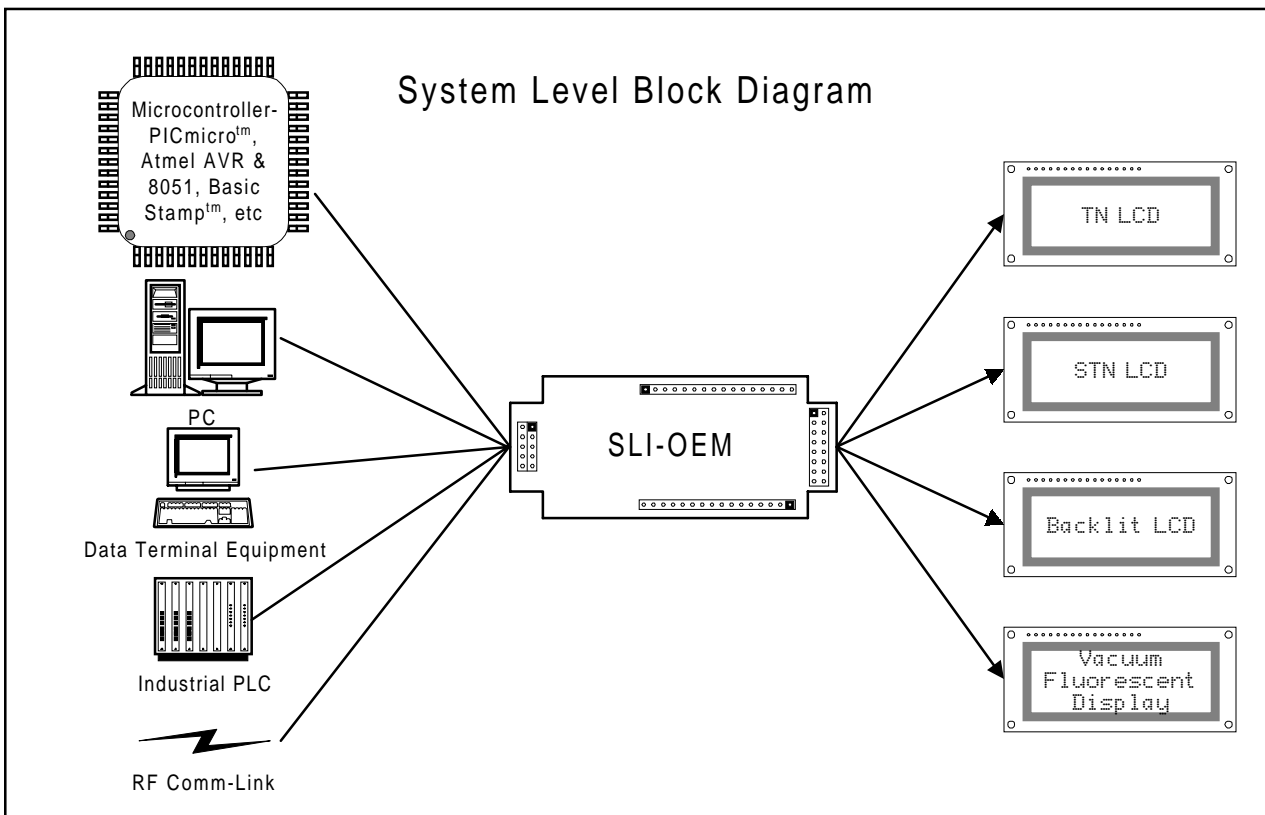
For LCDs with multiple line interfaces, scrolling is automatically provided, thus reducing the development time and memory required to provide this function in the system controller. The asynchronous serial input supports positive or negative TTL and CMOS, as well as RS232 logic levels.

SLI-OEM is a completely assembled module that is manufactured in modern ISO 9002 certified SMT facilities. The customer can purchase our module and add the LCD of their choice. Custom units can also be built to the customer's specifications for volume applications.



### Features

- \* Asynchronous Serial Input
- \* Full DIP switch configuration
- \* 8 data speeds: 110 to 19,200 bps
- \* Sixteen byte character buffer
- \* RS232 and TTL compatible with data polarity detection on power-up
- \* Allows direct control of the LCD functions
- \* Complete access to LCD mounting holes
- \* Designed for all alphanumeric HD44780 controlled LCDs and VFDs
- \* Many different LCD sizes supported:
  - One line LCDs: 1 x 8, 10, 16, 20, 24, 30, 32 & 40
  - Two line LCDs with scrolling: 2 x 8, 10, 16, 20, 24, 30, 32 & 40
  - Four line by 20 LCDs with scrolling



## Specifications

Section	Characteristic	Symbol	Min	Typ	Max	Units
Power Supply	Positive Supply	V <sub>CC</sub>	4.5	5	5.5	V
	Supply Current 1	I <sub>CC</sub>		2.7		mA
Backlight Supply	Backlight Current 2	I <sub>B</sub>			1500	mA
Serial Input	Input Current	I <sub>S</sub>	0.001		1.4	mA
	Bit Rate		110		19,200	bps
	Bit Rate Error				+/-1	%
	Character Buffer			16		characters
Positive Logic (TTL or Inverted RS232) 3	Logic Low		-13		1.1	V
	Logic High		2		13	V
Negative Logic (RS232) 3	Logic Low		2		13	V
	Logic High		-13		1.1	V
Miscellaneous	Power Up Delay	t <sub>P</sub>		30		mS
	Operating Temperature 4	T <sub>A</sub>	0°		50°	C
	Storage Temperature 4	T <sub>S</sub>	0°		50°	C

- 1) Does not include LCD current.
- 2) The actual current draw of the backlighting is dependent on the particular LCD used. This figure reflects the maximum current handling capability of the module.
- 3) The serial input data polarity is detected on device power up.
- 4) The LCD is typically the limiting factor on temperature specifications.

## Connections

### J1

Pin#	Function	Pin#	Function
1	V+	2	Vcc
3	V-	4	Gnd
5	N/C	6	Serial Input
7	V-	8	Gnd
9	V+	10	Vcc

### J2, J3, and J4

Pin#	Function	Pin#	Function
1	Gnd	2	+5V
3	LCD Contrast	4	R/S
5	R/W	6	E
7	Data Bit 0	8	Data Bit 1
9	Data Bit 2	10	Data Bit 3
11	Data Bit 4	12	Data Bit 5
13	Data Bit 6	14	Data Bit 7
15	V+	16	V-

\* V+ and V- of J1 are directly connected to J2, J3, and J4 for powering backlit LCDs. The pins are not connected to the SLI circuitry.

## Dip Switch Settings

LCD Rows	SW1	SW2
1 Row	1	1
1 Row Split	0	1
2 Rows	1	0
4 Rows	0	0

LCD Columns	SW3	SW4	SW5
8	1	1	1
10	0	1	1
16	1	0	1
20	0	0	1
24	1	1	0
30	0	1	0
32	1	0	0
40	0	0	0

Data Rate	SW6	SW7	SW8
110 bps	1	1	1
300 bps	0	1	1
600 bps	1	0	1
1,200 bps	0	0	1
2,400 bps	1	1	0
4,800 bps	0	1	0
9,600 bps	1	0	0
19,200 bps	0	0	0

Example Setting: 4 Row by 20  
Character LCD running at 2,400 bps



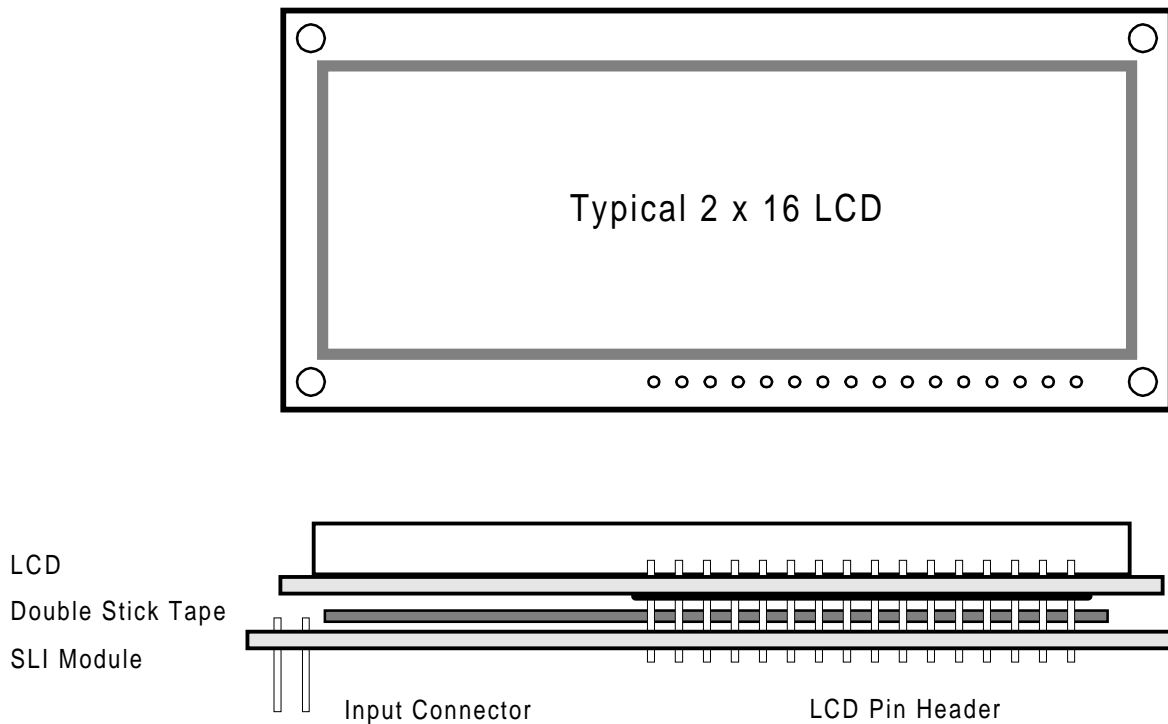
## LCD Mounting

The LCD is mounted to the SLI module using an unshrouded pin header. The header has .025" (.64 mm) square posts on .1" (2.54 mm) centers. Most LCD's require one of 4 header configurations: 1 row by 14 pins, 1 row by 16 pins, 2 rows by 7 pins, or 2 rows by 8 pins. The SLI-OEM supports all four configurations. The SLI module is additionally designed to allow full access to most LCD mounting holes.

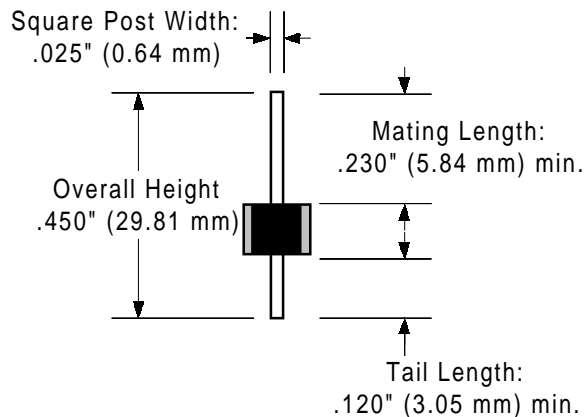
LCD's with 2 x 7 and 2 x 8 header sizes should be mounted at J2. LCD's with 1 x 14 or 1 x 16 headers should be mounted at either J3 or J4 depending on the header's location. The important consideration is to match pin #1 of SLI with pin #1 of the LCD. Pin #1 is denoted with a square pad on SLI.

The SLI-OEM and the LCD are mounted solder side to solder side. The pin header forms the mechanical and electrical connection between the two. A piece of double sided tape should also be placed between the SLI and the LCD for further mechanical strength.

### Mounted LCD (Not to Scale)



### Suggested Pin Header Post (Not to Scale)



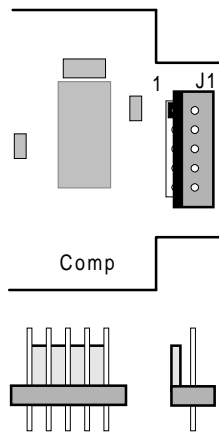
The Mating Length and Tail Length are suggested minimum values. The Mating Length should be selected based on the thickness of the tape used.

## J1 Input Connector Selection

The SLI supports several different types of input connectors depending on the user's needs. By supporting multiple connector types, the SLI allows selection of the most effective solution for a particular application. Many backlit LCD's can be powered through the LCD pins 15 & 16. A 2 x 5 connector should be used with this type of LCD. With other LCD types, and those that are not backlit, either a 1 x 5 or 2 x 5 connector may be selected.

### 1 x 5 Configuration

The 1 x 5 connector provides the most cost effective solution in many cases. When using a discrete wire connector, it is important to install all 5 terminals even when wires are not connected to each terminal. The extra connectors provide mechanical locking strength to the connection.

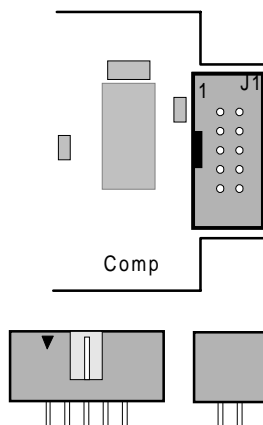


J1 (1 x 5 Connector)

Pin#	Function
2	Vcc
4	Gnd
6	Serial Input
8	Gnd
10	Vcc

### 2 x 5 Configuration

A 2 x 5 configuration has the advantage that connectors are available for both ribbon cables and discrete wires. 2 x 5 connectors may also have more holding friction and be available with locking tabs, thus providing a more secure connection.



J1 (2 x 5 Connector)

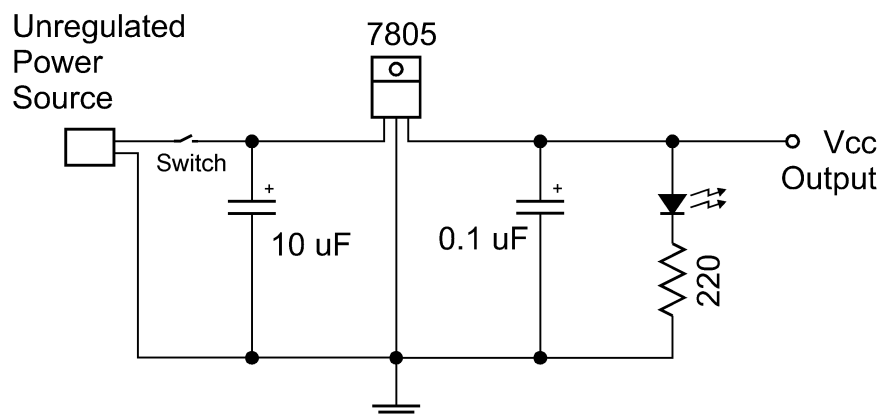
Pin#	Function	Pin#	Function
1	V+	2	Vcc
3	V-	4	Gnd
5	N/C	6	Serial Input
7	V-	8	Gnd
9	V+	10	Vcc

## Electrical Connection:

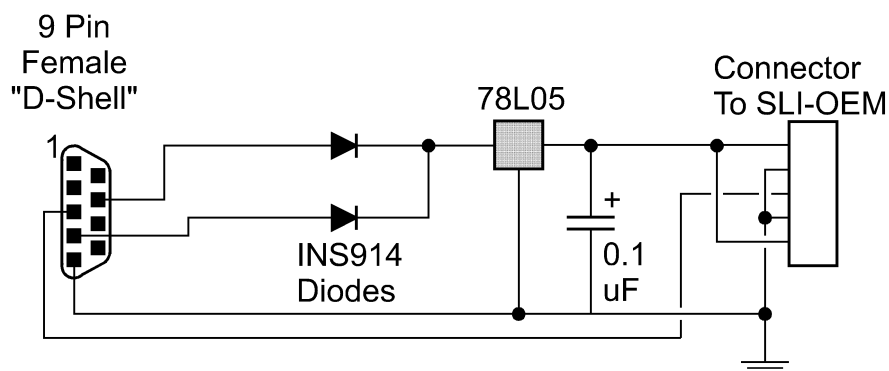
The SLI-OEM requires a 5 V regulated power supply. Below are two example power supply schemes. The first uses a 7805, 1 amp linear regulator with an unregulated power source. This circuit would have ample current handling capability to supply SLI and a backlit LCD.

The second circuit shows how the SLI-OEM can be powered from standard serial port. Most serial ports will have enough current handling capacity to power SLI and a nonbacklit LCD. However, laptops and some desktop PC's may not be able to supply enough current.

### **Typical Power Circuit**



### **Powering the SLI-OEM from a Serial Port**



## Contrast Control

The contrast of the LCD must be adjusted using the potentiometer R1. The required contrast setting varies from manufacturer to manufacturer and can even vary within the same batch of LCD's. The contrast should be set by turning R1 fully clockwise, and then slowly turning it counter clockwise until the desired level is obtained.

## Direct LCD Control

Commands can be sent directly to the HD44780 controller by first sending a 0x0FE or 254d character to the SLI. The next command will be passed directly to the HD44780 as an instruction (not data to be displayed). 0x0FE or 254d should never be sent to the SLI as data.

This method of sending control data to the SLI must be used with caution. The commands are not parsed, and the internal variables in the SLI controlling the behavior of the LCD (i.e. scrolling, backspacing, etc.) are not always updated. This may lead to unexpected results after sending data.

Before moving the cursor explicitly, it is recommended that either a Form Feed or Carriage Return is sent to the SLI to ensure that any subsequent data writes do not cause an inadvertent scroll of the display.

A detailed table of the instructions can be found in the Hitachi HD44780 data sheet. A few examples are listed in the next section.

### Example Direct LCD Control Operations

Move the Cursor to the First Line:

Send 0x0FE

Send 0x080 ; Add 0 - 39 to put cursor at different columns of the line

Move the Cursor to the Second Line:

Send 0x0FE

Send 0x0C0 ; Add 0 - 39 to put cursor at different columns of the line

Clear the Screen:

Send 0x0FE

Send 0x001

<u>Instruction</u>	<u>Bits</u>	<u>Comment</u>
Clear Display	0000 0001	Sending a Form Feed (0x0C) will do exactly the same command. The internal SLI cursor position will be updated.
Return Home	0000 001x	Sending this instruction will also update the internal SLI cursor position.
Entry Mode Set	0000 01IS	Sets the cursor move direction and specifies whether or not to shift the display. This command should not be used because it may cause the internal SLI characters to be incorrect.

<u>Instruction</u>	<u>Bits</u>	<u>Comments</u>
Display Control	0000 1DCB	Turns on/off the LCD display and cursor. The cursor display can be changed, but it is not recommended that the LCD Display ever be shut off.
Curs/Disp Shift	0001 SRxx	Allows moving the cursor and shifting the display without changing the LCD display RAM contents. Although the cursor position is updated this command is not recommended.
Function Set	001D Nfxx	Initializes the display and sets the interface length. This command is not recommended.
Set CG RAM Addr	01pp pppp	Allows the user to start writing at a specific location in CG RAM. After this command, a "Set DD Addr" command should be executed.
Set DD RAM Addr	1ppp pppp	Allows the user to move the cursor anywhere on the LCD. The internal SLI cursor position is updated after this command. Note that the top line starts at 0 and the bottom line starts at address 0x040. Up to 40 characters on each line can be written.

## User-Definable Characters

The SLI-OEM provides for up to 8 user defined characters. Each of these characters can be displayed on the screen using Hex Codes 0x00 through 0x007. They are actually infrequently used ASCII Control Characters.

Each character is setup as an 8 x 5 pixel box, requiring 8 bytes of data in the CG RAM Area. Each byte is a row in the box. The top most row being the lowest address. Accessing the CG RAM from DD RAM, which contains the Hex/ASCII Codes for each character, is accomplished by moving the cursor into the CG RAM area by the instruction 0b001xxxxxx. "xxxxxx" is the address within the CG RAM. The address of the 8 Row Bytes in CG RAM starts at 8x the character address. If the Character Graphic RAM is being written to and the Escape, CR, LF, FF, & BS commands are sent. The SLI may behave unpredictably. OR'ing 0x020 to all the CG data writes guarantees this will never happen.

For example, to make custom character 0x02 a "\", which isn't in the LCD Character Set, the following sequence of instructions would be sent:

```

Send( 254 ) ; Move the Cursor into the CG RAM Area
Send( 0x040 plus 8 plus 8 = 0x050 ); for Character 2
Send( 0x010 OR 0x020 = 0x030 ) ; Slash: X _ _ _ _
Send( 0x010 OR 0x020 = 0x030 ) ; X _ _ _ _
Send( 0x008 OR 0x020 = 0x028 ) ; _ X _ _ _
Send( 0x004 OR 0x020 = 0x024 ) ; _ _ X _ _
Send( 0x002 OR 0x020 = 0x022 ) ; _ _ _ X _
Send( 0x001 OR 0x020 = 0x021 ) ; _ _ _ _ X
Send( 0x001 OR 0x020 = 0x021 ) ; _ _ _ _ X
Send( 0x000 OR 0x020 = 0x020 ) ; _ _ _ _ _
Send( 254 ) ; Move Cursor Back to Start of DD RAM Area
Send( 0x080 )

```

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