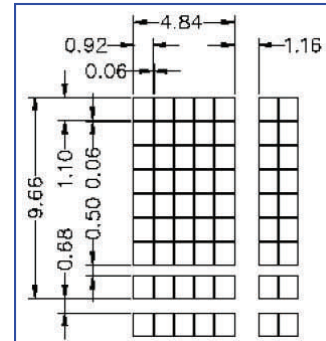


Large Viewing Area 99mm x 24mm



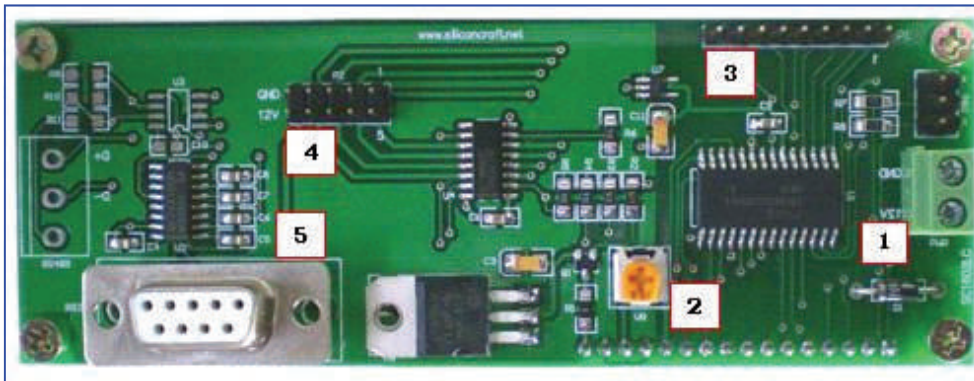
Large Character Size

4.84mm x 9.66mm

Features

- 16x2 Large Characters LCD
- RS232 Interface
- Simple Serial Command
- Wide Range Voltage Operation (9-15V)
- 8 User's Defined Characters
- 10 User's Defined Text Line
- Buffered received bytes eliminates delay requirement
- 4x4 Keypad Input Or 8 pulled up inputs (programmable)
- 8 Open Drain Output
- LCD Backlight with Brightness Control
- Programmable baud rate 9600 or 19200

Hardware Connection (Back View)



- | | |
|---------------------------------|---------------------------|
| 1. Power Supply (12V Nominal) | 4. Open Drain Output Port |
| 2. LCD Contrast Adjust | 5. DB9 RS232 Connector |
| 3. Keypad / Inputs Port | |

Communication

Communication with SC1602LC is through RS232 at 9600 bps and 8 data bits, no parity and 1 stop bit protocol. (9600,8,N,1). The baud rate can be changed to 19200 bps with serial command explained later.

9600 bps will be the default baud rate

Displaying Text

SC1602LC will display characters it received from its RS232 port.

All supported characters is listed below

167-164 163-160	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
CG RAM (1)			0	1	A	P	Y	P				-	9	3	0	P
(2)		!	1	A	Q	a	9									
(3)		"	2	B	R	b	r									
(4)		#	3	C	S	c	s									
(5)		\$	4	D	T	d	t									
(6)		%	5	E	U	e	u									
(7)		&	6	F	V	f	v									
(8)		'	7	G	W	g	w									
(1)		(	8	H	X	h	x									
(2)		)	9	I	Y	i	y									
(3)		*	:	J	Z	j	z									
(4)		+	;	K	[	k	[
(5)		,	<	L	]	l]									
(6)		-	=	M	^	m	>									
(7)		.	>	N	_	n	*									
(8)		/	?	O	_	o	*									

Examples :

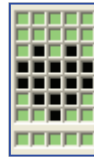
Display ASCII character " 1 "

Send hexadecimal 0x31

Display special character " Ω "

Send hexadecimal 0xF4

User's Defined Characters



	Hex	Decimal
Row 1	0x00	0
Row 2	0x00	0
Row 3	0x0A	10
Row 4	0x1F	31
Row 5	0x1F	31
Row 6	0x0E	14
Row 7	0x04	4
Row 8	0x00	0

SC1602LC allows user's to define 8 characters to be added to the character set listed above. Each character is a 5x8 pixels matrix with each row represented by a byte of data.

Thus, each character consists of 8 bytes of bitmap data

The defined characters need to be loaded to the LCD memory first before they can be used.

Transmit decimal 0 to 7 to display custom character 1 to 8 respectively.

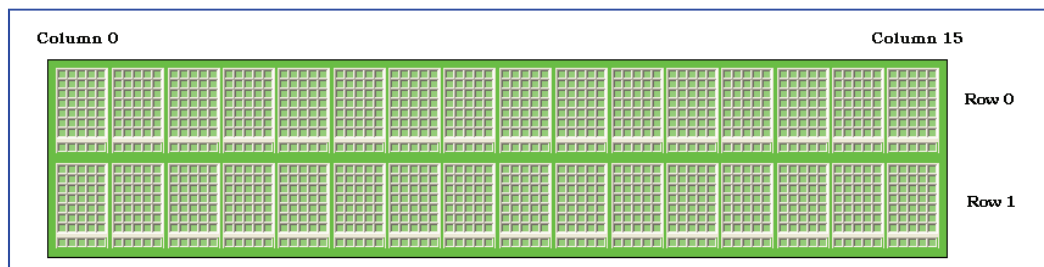
Bitmap Data Example

Control Characters / Code Summary

<u>Function</u>	<u>Code (in decimal)</u>
Insert Custom Character	0 to 7
Backspace	8
Send Cursor Home	11
Move Cursor to the next row	12
Clear display and send cursor home	13
Move Cursor one position left	14
Move Cursor one position right	15
Turn On Underline Under	254,1
Turn On Block Blinking Cursor	254,2
Hide Cursor	254,3
Turn On Backlight	254,6
Turn Off Backlight	254,7
Load User's Characters	254,8
Disable Keypad	254,9
Enable Keypad	254,10
Turn On All Outputs	254,12
Turn Off All Outputs	254,13

<u>Function</u>	<u>Code (in decimal)</u>
Read Inputs	254,14
Set Inputs Port As Keypad Port	254,15
Set Inputs Port As Pulled Up Inputs	254,16
Change LCD baud rate to 9600	254,30
Change LCD baud rate to 19200	254,31
Save settings to non volatile memory	254,32
Change Backlight Brightness	254,40, [brightness]
Clear Selected row	254,45, [selected row]
Clear Selected column	254,46, [selected column]
Move cursor position	254,50, [row],[column]
Turn On/Off Individual Output	254,51,[Port ID] , [On or Off]
Show user's defined text	254,52, [Text ID] , [row]
User's predefine text	254, [Text ID], [16 Characters]
Define user's characters	254, 100 , [64 Bytes Bitmap Data]

Cursor Control



Cursor is the indicator of the current position where the next character to be displayed.

Cursor may be visible or hidden. On power up, cursor is hidden by default.

To turn on visible cursor, send command “254, 1” for underline type cursor or “254,2” for block blinking type of cursor.

Cursor can be hidden at anytime by sending command “254,3”

To move cursor to the beginning of next row , send control character “12” (in decimal). Note : cursor is move to row 0 if current cursor position is at row 1.

To move cursor home (row 0, column 0) , send control character “11” (in decimal)

Cursor can be move to any position on screen by command “254,50,[row],[column]

where row is 0 or 1 and column is 0 to 15

Backlight Control

The LCD is illuminated by a Yellow Green LED light guide.

The backlight is turned on upon power up. To turn it off send command “254,7” . To turn it back on, send command “254,6”.

Brightness can be control with command “254,40, [brightness level]” where 0 is the minimum and 250 is maximum.

Open Drain Output Ports

The module has 8 open drain outputs which can be individually controlled. Each output is capable of sinking 100mA of continuous on current.

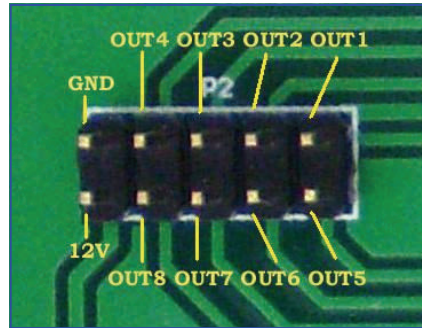
It is controlled by command

“ 254,51, [Port ID], [On/Off]”

Where Port ID is 0 (decimal) for OUT1 and 7 (decimal) for OUT8

On/Off is “H” (ASCII) to turn it on and “L” (ASCII) to turn it off.

Output port is accessible via 5x2 pin header P2



Input Port

9 pins input port on P1 can be configured as 4x4 keypad inputs or 8 channels pulled up inputs.

Keypad Mode (Default)

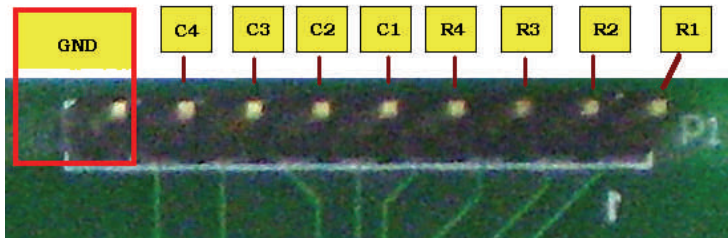
In this mode, two bytes will be transmitted each time a keypress is detected. Keypad is scan every 250ms

Keypad can be disabled with command “254,9” . When disabled no data will be transmitted when keypress detected.

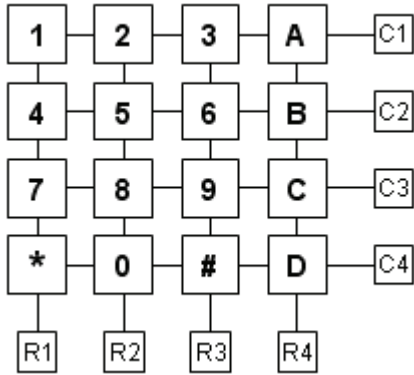
Keypad is enabled by command “254,10”. Keypad is enabled by default.

Pulled Up Input Mode

In this mode , input pins is scan every 250ms and it status updated. Input status can be retrieved with command “254,14” . LCD will response by transmitting two bytes indicating the status of inputs.



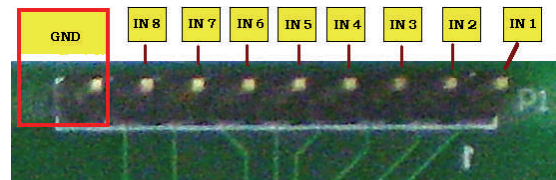
Header P1 Keypad Mode Connection



Keypad Return Code	
Key	Return Code (HEX)
1	0xFE , 0xFF
2	0xFB , 0xFF
3	0xF7 , 0xFF
A	0xFD , 0xFF
4	0xEF , 0xFF
5	0xBF , 0xFF
6	0x7F , 0xFF
B	0xDF , 0xFF
7	0xFF , 0xFE
8	0xFF , 0xFB
9	0xFF , 0xF7
C	0xFF , 0xFD
*	0xFF , 0xEF
0	0xFF , 0xBF
#	0xFF , 0x7F
D	0xFF , 0xDF

Input mode return two bytes [STATUS 0] , [STATUS 1]

Where lower nibble of STATUS 0 indicates IN1 to IN4 and lower nibble of STATUS 1 indicates IN5 to IN8



Header P1 Input Mode Connection

User's Predefined Text

10 memory locations is available to store commonly used text.

Each is 16 characters wide.

Text stored in these memory locations can be recalled and displayed on the LCD with command

[0xFE] [0x34] [text location] [row to be displayed]

Where [text location] is which text to be displayed

101 to 110. [row to be displayed] is 0 or 1 depending on which row you want the text to be displayed.

Example:

Text Stored in memory location 101 is "SC1602LC Test". To display this, instead of sending the text string, you can display the text by sending command

[0xFE] [0x34] [0x65] [0x00] to have "SC1602LC Test" displayed on row 0

Changing the baud rate

By default , SC1602LC baud rate is set at 9600 bps. To change it to 19200 bps send command "254,31"

To set it back to 9600 bps, send command "254,30"

LCD will display "Baud Changed" each time the baud rate is changed.

Changes are immediate, thus make sure the baud rate of the host controller is change too before sending command to the LCD.

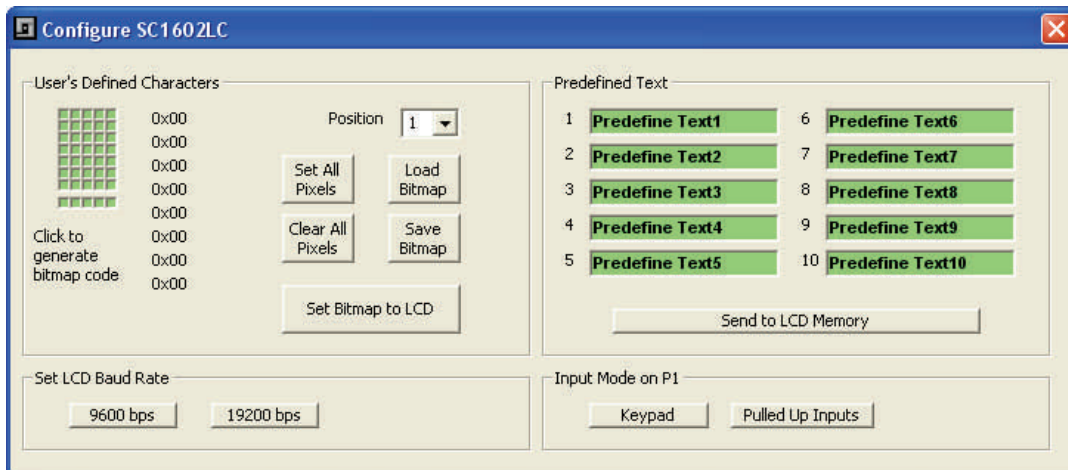
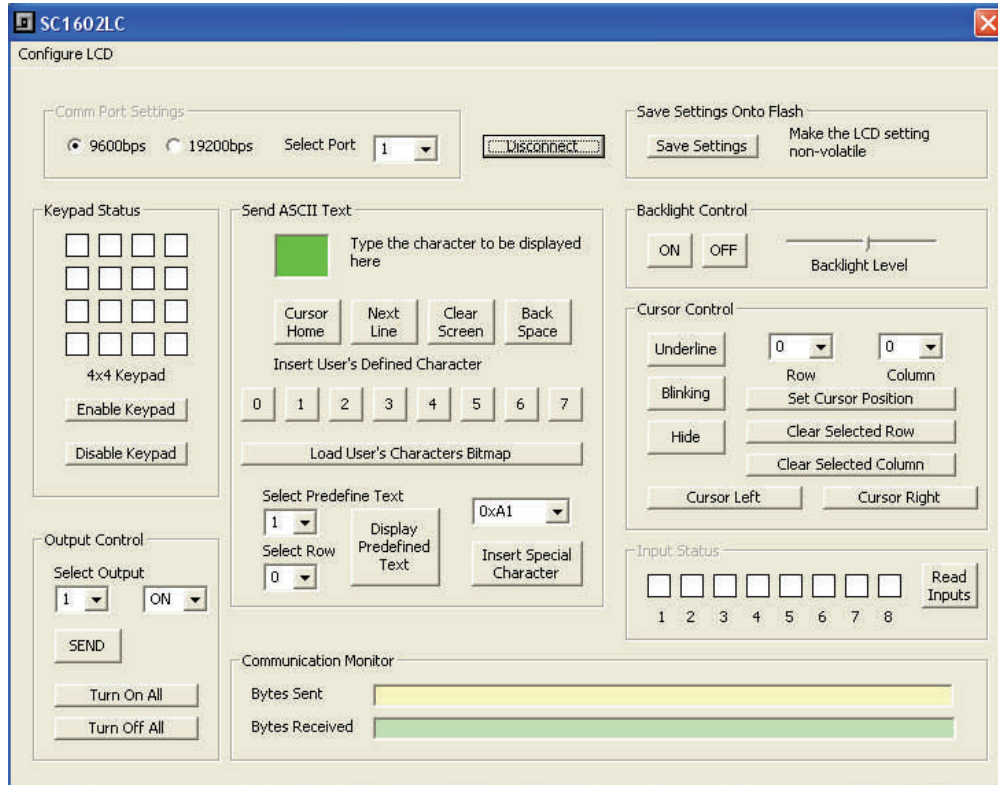
Make setting non-volatile

LCD configurations : baud rate , backlight brightness , input mode , user's characters , predefine text can be make non-volatile (retain after power down) by sending command " 254 , 32 "

LCD will display " Settings Saved" when this is done.

SC1602LCApp Software

This software can be downloaded from www.siliconcraft.net/download to test and configure SC1602LC



Electrical Specification

- Power Supply : 9 - 15VDC (Nominal 12VDC)
- Current Consumption : 15mA (Backlight Off) , 120mA (Backlight On)
- Operation Temperature Range : 0° C to 70° C
- Storage Temperature Range : - 20° C to 85° C
- LCD Type : STN
- Backlight : Yellow Green LED Light Guide
- Maximum sink current on each open drain output : 100mA
- Maximum voltage on each open drain output : 33V

Mechanical Dimension (mm)

