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**SC1602A—16x2 Characters RS232 LCD Display**
User's Manual

SC1602A is an intelligence LCD Module designed to ease project development that requires a LCD display.
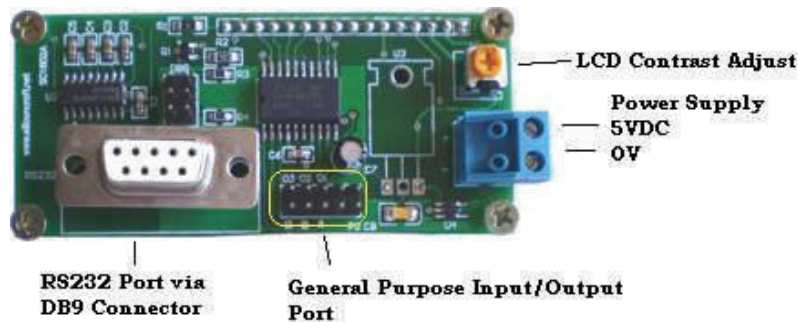
It receives serial data via the RS232 port and display the data accordingly.

Available in Blue and Yellow Green LED Backlight.

Standard version works on 5V DC supply.
Wide input version has a onboard voltage regulator that accept 9 to 15VDC input.
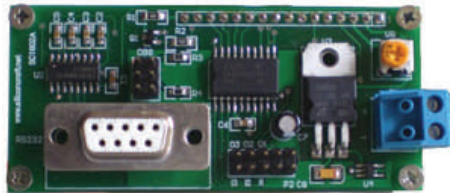
Hardware Connection

SC1602A Back View

Communication

RS232 connection to the host. 8 Data bits, No parity, 1 Stop bit.
Baud rate is programmable : 9600bps * or 19200 bps
85 bytes Receive Buffer eliminates the need of delay between command.

* Factory Default

Displaying ASCII texts

SC1602A displays whatever ASCII characters it receives from the RS232 port.

Sending " LCD DEMO" to the LCD to display "LCD Demo" on the screen.

If the number of characters send is more than 16, it will wrap to the next line.

Supported characters is listed below.

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Upper 4 Bits / Lower 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111
xxxx0000	CG RAM (1)			0	@	P	`	p
xxxx0001	(2)		!	1	A	Q	a	q
xxxx0010	(3)		"	2	B	R	b	r
xxxx0011	(4)		#	3	C	S	c	s
xxxx0100	(5)		$	4	D	T	d	t
xxxx0101	(6)		%	5	E	U	e	u
xxxx0110	(7)		&	6	F	V	f	v
xxxx0111	(8)		'	7	G	W	g	w
xxxx1000	(1)		(	8	H	X	h	x
xxxx1001	(2)		)	9	I	Y	i	y
xxxx1010	(3)		*	:	J	Z	j	z
xxxx1011	(4)		+	;	K	[	k	{
xxxx1100	(5)		,	<	L	¥	l	ǀ
xxxx1101	(6)		-	=	M	]	m	}
xxxx1110	(7)		.	>	N	^	n	→
xxxx1111	(8)		/	?	O	_	o	←

Supported ASCII Characters

Control Characters

HEX	Decimal	Function
0x08	8	Backspace (Move Cursor one position to the left and delete the character)
0x0B	11	Cursor Home (Move Cursor to Row 0,Column 0 LCD screen unchanged)
0x0C	12	Next Line (Move Cursor to the beginning of the next line)
0x0D	13	Clear Screen (Clear and move cursor to Row 0,Column 0)
0x0E	14	Move cursor one position to the left
0x0F	15	Move cursor one position to the right

User's Defined Characters

Other than the standard ASCII characters, user's can define up to 8 characters stored in the non-volatile memory.
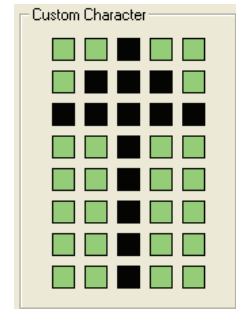
Each character consists of 8 bytes of bitmap data.

For example:

Up arrow symbol on the right is represented by 8 bytes bitmap

0x04 0x0E 0x1F 0x04 0x04 0x04 0x04 0x04

To use the custom characters, first define the characters by sending command

[0xFE] [0x64] [64 bytes of bitmap data]

Then load the characters by command

[0xFE] [0x08]

User can display the custom characters by sending

HEX   DEC

HEX	DEC	
0x00	0	Custom Character 1
0x01	1	Custom Character 2
0x02	2	Custom Character 3
0x03	3	Custom Character 4
0x04	4	Custom Character 5
0x05	5	Custom Character 6
0x06	6	Custom Character 7
0x07	7	Custom Character 8

Cursor Control

By default, cursor is hidden. To show cursor send command

[0xFE][0x01]   for underlined cursor

[0xFE][0x02]   for block blinking cursor

To hide the cursor send command [0xFE][0x03]

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Cursor can be move to any position by Command

[0xFE] [0x32][row number][column number]

Row/Column Delete

Text on row of column can be independently deleted

[0xFE][0x2D][row number]   to delete desire row

[0xFE][0x2E][column number] to delete desire column

Cursor points to the next row/column after these command

LCD backlight control

Turn On   [0xFE][0x06]
Turn Off   [0xFE][0x07]
Set brightness   [0xFE][0x28][level]   where level is 0 to 254

Backlight is turn on upon power up. Brightness level is set at 155 by default

Startup Screen

The LCD can be programmed to display a startup screen every time it powered up.
If the startup screen is not defined, the LCD is blank upon power up. This is factory default.

To define startup screen use command:

[0xFE][0xC8][row 0 text][0x0D][row 2 text][0xFF]

Row 0 and Row 1 text must be 16 characters max.

To erase startup screen send command

[0xFE][0x15]

Defined startup screen can be recalled and put on screen at any time by command

[0xFE][0x16]

Horizontal Bar Graph

Bar graph as illustrated on the right is can be easily drawn by the horizontal bar graph command.
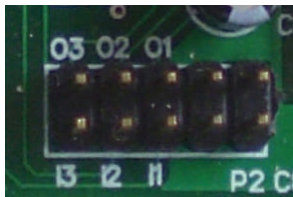
To draw a horizontal graph:
1.   Invoke the graph utility by command [0xFE][0x04]
2.   Move the cursor to the start location
3.   Draw the graph
       [0xFE][0x2B][length]   to draw the graph from left to right
       Or
       [0xFE][0x2C][length]   to draw the graph from right to left

Note that maximum graph length is 80 and minimum 1

Graph utility and custom characters cannot be used at the same time.

General Purpose Input/Output Port

3 Inputs and 3 Outputs is available onboard via P2 header

Input port is marked as I1,I2,I3
Output port is marked as O1,O2,O3

Inputs are internally pulled up.

To read its status ; send command

[0xFE][0x0A]

LCD response with [input] byte where the 3 LSB bit is I1,I2,I3 status

Outputs is 3.3V high level and 0V low level with maximum current of 20mA each.

Output is set with command

[0xFE][0x2F][output]

Output Value	I3	I2	I1
0	LOW	LOW	LOW
1	LOW	LOW	HIGH
2	LOW	HIGH	LOW
3	LOW	HIGH	HIGH
4	HIGH	LOW	LOW
5	HIGH	LOW	HIGH
6	HIGH	HIGH	LOW
7	HIGH	HIGH	HIGH

Changing the baud rate

Set to 9600 bps   [0xFE][0x1E]
Set to 19200 bps   [0xFE][0x1F]

Remember Setting

Changes to the baud rate, LCD backlight level, custom characters bitmap and startup screen can be stored in the non-volatile memory by command

[0xFE][0x14]

Settings will revert to the previous settings if this command is not send after all changes is made.

Application Software

SC1602A-App Software is available on www.siliconcraft.net/download.htm
For testing and setting the LCD module.

Supported OS : Windows 98, XP , Vista

Command Summary

Function	Code (HEX)	Code (Decimal)
Underlined Cursor	0xFE 0x01	254, 1
Block Blinking Cursor	0xFE 0x02	254, 2
Hide Cursor	0xFE 0x03	254, 3
Invoke Graph Utility	0xFE 0x04	254, 4
Backlight On	0xFE 0x06	254, 6
Backlight Off	0xFE 0x07	254, 7
Load Custom Characters	0xFE 0x08	254, 8
Read Inputs	0xFE 0x0A	254, 10
Remember Settings	0xFE 0x14	254, 20
Erase Startup Screen	0xFE 0x15	254, 21
Show Startup Screen	0xFE 0x16	254, 22
Set baud 9600	0xFE 0x1E	254, 30
Set baud 19200	0xFE 0x1F	254, 31
Set Backlight Brightness	0xFE 0x28 [level]	254, 40, [level]
Left to Right Graph	0xFE 0x2B [length]	254, 43, [length]
Right to Left Graph	0xFE 0x2C [length]	254, 44, [length]
Clear Row	0xFE 0x2D [row number]	254, 45, [row number]
Clear Column	0xFE 0x2E [column number]	254, 46, [column number]
Set Output	0xFE 0x2F [output]	254, 47, [output]
Set Cursor Position	0xFE 0x32 [row] [column]	254, 50, [row], [column]
Define Startup Screen	0xFE 0xC8 [row 0 text] 0x0D [row 1 text] 0xFF	254,200,[row 0 text],13,[row 1 text], 255

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Specifications

Operating Temperature	0ºC to 50ºC
Storage Temperature	-10ºC to 60ºC
Operating Relative Humidity	90% max non-condensing

Operating Voltage (Standard)	min 4.5V	typ. 5V	max 5.5V
Operating Voltage (Wide Input)	min 9.0V	typ. 12V	max 15V

Supply Current (Standard)	10mA (backlight off)
	80mA (backlight On)

Supply Current (Wide Input)	20mA (backlight off)
	30mA (backlight on)

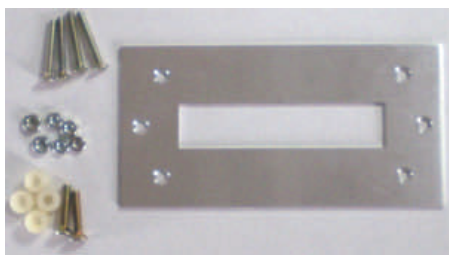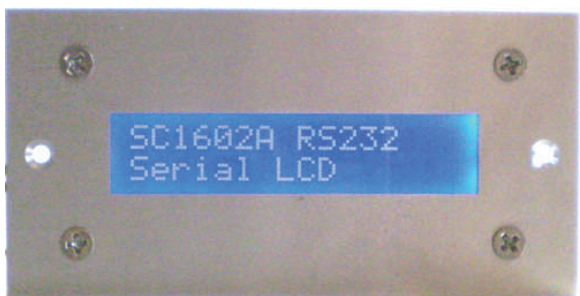|	
LCD Viewing Direction	6 o'clock
Number of Characters	16 x 2
Character Size	2.95mm x 4.35mm
Module Size	80mm x 36mm x 32mm
Viewing Area	65mm x 15mm

SC1602A Side View

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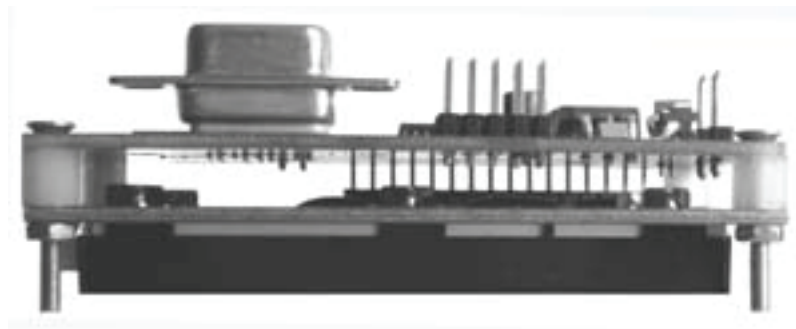
Mechanical Dimension
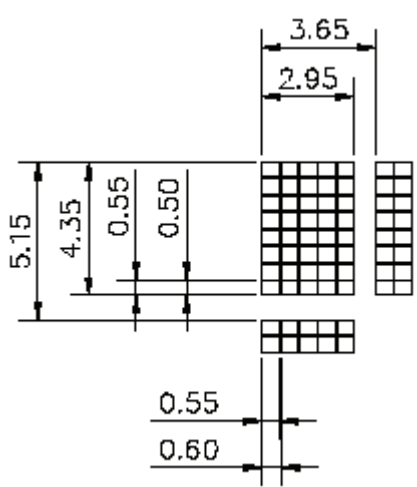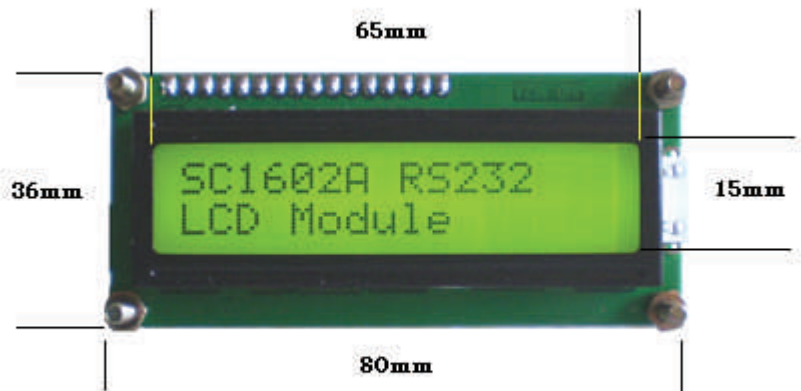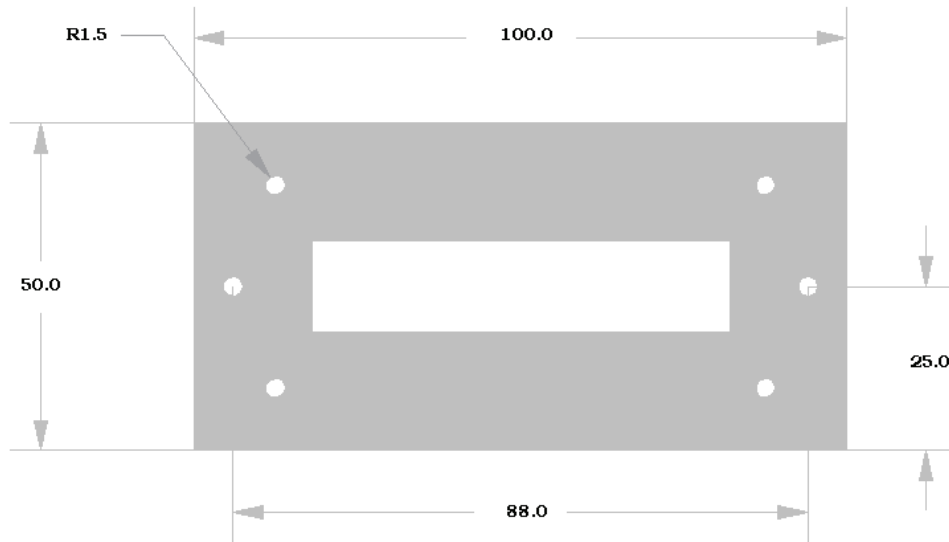

Available Accessories

Character Size

Aluminum Mounting Kit

Mounting Kit Dimension (mm)
Thickness 1.5mm