SC1602 16x2 Characters Serial LCD Module Rev 1.2

Introduction

SC1602 is an intelligence LCD module designed to ease project development that require LCD display. SC1602 is a dot matrix LCD module with serial interface board. The serial interface board receives and interprets serial data and output the data to the LCD module accordingly.

With RS232 and TTL inputs, it can be use with any controller with serial port. (Computers, microcontrollers, microprocessors etc.)

Fig 1: SC1602YG

Two options are available:

Fig 2 – SC1602YG 16x2 Characters, Yellow Green LED Backlight

Fig 2 – SC1602B – 16x2 Characters, White Characters On Blue Backlight

Features:

- Programmable baud rate 9600bps or 19200bps.
- RS232 or TTL serial interface.
- Simple serial command – clear screen, line feed, clear row, clear column etc.
- 85 bytes UART receive buffers.
- 11 Screens non volatile memory storage.
- Programmable backlight brightness level.
- Programmable backlight auto off.
- Text scrolling without host intervention.
- Horizontal graph drawing.
- 8 user's defined characters.
- 2 analog inputs ; 0-10V and 0-20mA
- 3 General Purpose Inputs
- 3 General Purpose Outputs.
- Free application software with custom characters generator.
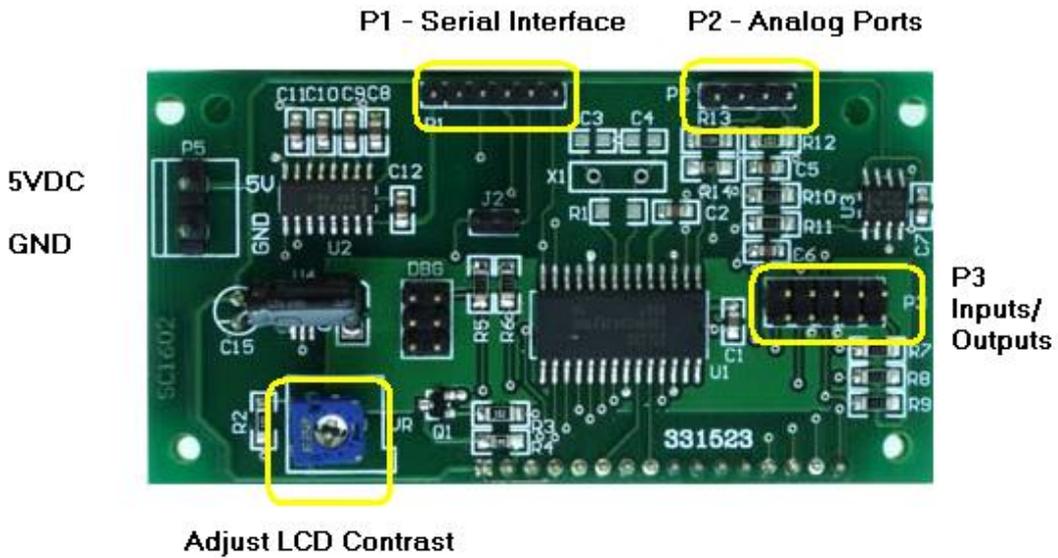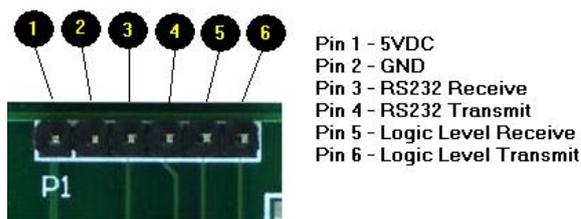
Hardware Connection

Fig 4 – SC1602 Connectors

Power Supply

5VDC connected through P5 or Pin 1 and Pin 2 of P1.
Warning! Check Power Supply Polarity before turning on the power.

P1 Serial Interface

Pin 1 - 5VDC
Pin 2 - GND
Pin 3 - RS232 Receive
Pin 4 - RS232 Transmit
Pin 5 - Logic Level Receive
Pin 6 - Logic Level Transmit

Warning! Do not Connect RS232 to TTL Pins.   Fig 5 – Serial Port Header

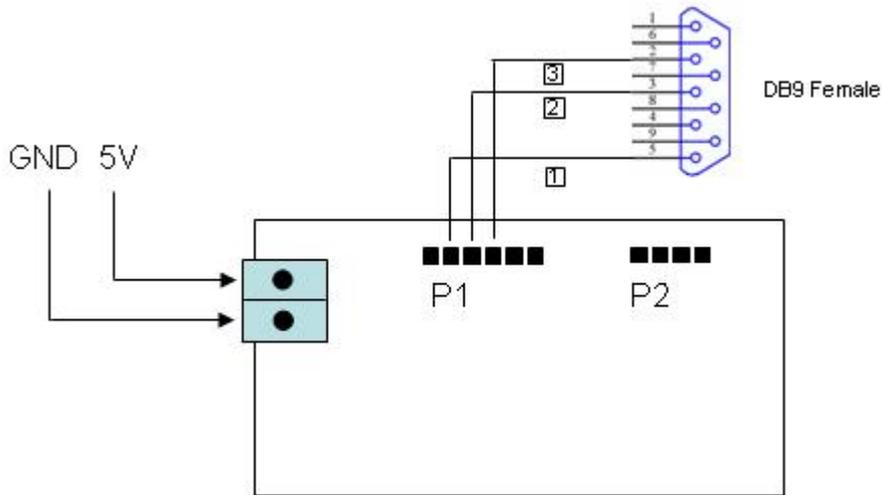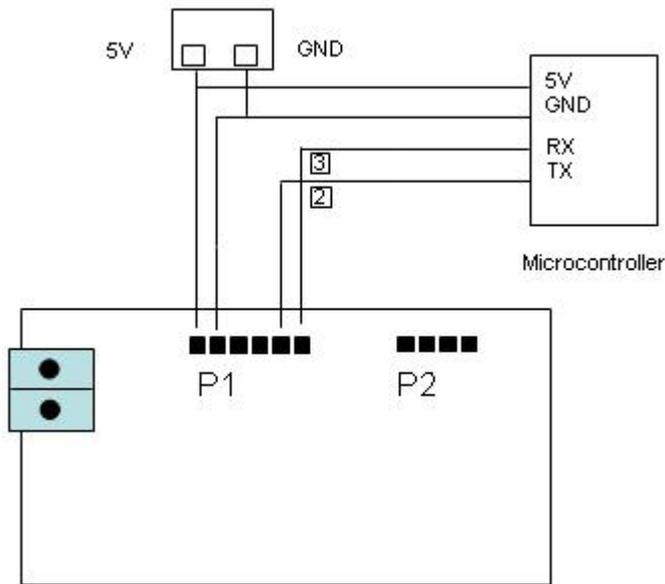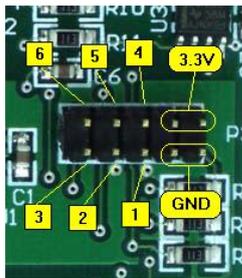Fig 6 - RS232 Interface with DB9 Female Connector

Fig 7 - TTL interface with microcontroller

Note: Connection 3 is not required if the inputs and analog ports are not used.

P3 General Purpose I/Os

1 - INPUT 1
2 - INPUT 2
3 - INPUT 3
4 - OUTPUT 3
5 - OUTPUT 2
6 - OUTPUT 1

Fig 8 – P3 Header

Inputs MAX 3.3V, 20mA
Outputs 3.3V, 20mA

P2 Analog Input Ports

Pin 1 - 5VDC
Pin 2 - GND
Pin 3 - Analog Port 1
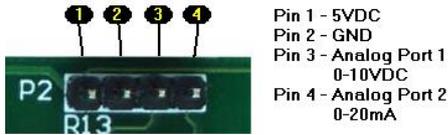   0-10VDC
Pin 4 - Analog Port 2
        0-20mA

Fig 9 – P2 Header

Communication

All communication is through UART (Universal Asynchronous Receiver Transmitter) Data format is 8 data bits, no parity and 1 stop bit.

Baud rate is programmable: 9600bps* or 19200bps

   * Default value

Sending ASCII characters to the serial LCD will result in text display on the LCD screen.

Example: Send ASCII text "LCD Demo"

ASCII code in Hexadecimal [0x4C][0x43][0x44][0x20][0x44][0x65][0x6D][0x6F]

The position of the first character depends on the current cursor position.

If the text is more than 16 characters, it will wrap to the next row.

Fig 10 – ASCII character sets

Control Characters

Backspace **0x08** Move Cursor one position to the left and delete the character
Cursor Home **0x0B** Send Cursor to row 0, column 0 LCD screen unchanged
Next Line **0x0C** Move Cursor to the beginning of next line.
Clear LCD **0x0D** Clear LCD display and Send cursor to row 0, column 0
Cursor Left **0x0E** Move cursor one position to the left
Cursor Right **0x0F** Move cursor one position to the right

User's Defined Characters

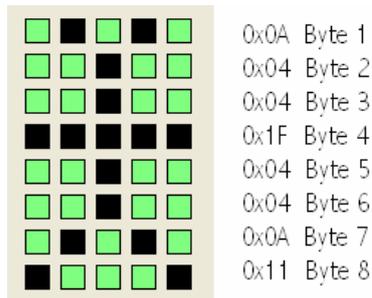User's can define up to 8 characters. Each character consists of 8 bytes of data.

0x0A Byte 1
0x04 Byte 2
0x04 Byte 3
0x1F Byte 4
0x04 Byte 5
0x04 Byte 6
0x0A Byte 7
0x11 Byte 8

Fig 11 – User's Defined Character Bitmap

To load user's define characters use command

[0xFE][0x64][64 Bytes of Character Bitmap]

Followed by

[0xFE][0x08]

After which user can display the defined characters by sending

0x00 for User's Defined Character 0
0x01 for User's Defined Character 1
0x02 for User's Defined Character 2
0x03 for User's Defined Character 3
0x04 for User's Defined Character 4
0x05 for User's Defined Character 5
0x06 for User's Defined Character 6
0x07 for User's Defined Character 7

Cursor Control

There are two types of cursor : the underline cursor and the block blinking cursor.

Show underline cursor

[0xFE][0x01]

Show block blinking cursor

[0xFE][0x02]

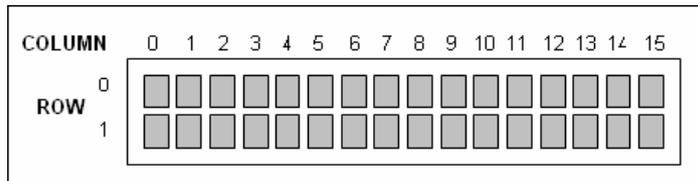Hide Cursor

[0xFE][0x03]

Cursor Position Control

Fig 12 – row and column position definition

You can move the cursor to any position by command

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

Delete selected row

[0xFE][0x2D][row]

After this command, cursor points to the beginning of the next line.

Delete selected column

[0xFE][0x2E][column]

After this command, cursor points to the next column

LCD Backlight Control

Turn On

[0xFE][0x06]

Turn Off

[0xFE][0x07]

Backlight will turn off automatically after some time. By default 255 seconds.

You can adjust this interval by command

[0xFE][0x29][interval]

Where interval is max 255 seconds and min 1 second.

Note: Setting the interval to 0 will disabled the auto backlight off feature.

Backlight brightness can be adjusted by command

[0xFE][0x28][brightness level]

Where brightness level is max 250 and min 50

Startup Screen

Start up screen is the screen that the LCD will display every time you power up the device. It will be displayed for 3s. During this interval the backlight will be turned on.

By default, start up screen is not defined and nothing displayed on power up.

User can defined the startup screen by command

[0xFE][0xC8]["row 0 text"][0x0D]["row 1 text"][0xFF]

User's Defined Screens

User can define up to 10 screens by easy retrieval.

For example, it you need to display

"LINE 1 Custom"
"Screen Demo"

Instead of sending "LINE 1 Custom" [0x0C] "Screen Demo" every time you can predefine the screen and store it onto the SC1602 memory for easy retrieval.

To define the screen

[0xFF][PAGE]["row 0 text"][0x0D]["row 1 text"][0xFF]

PAGE = 0xC9   Page 1
PAGE = 0xCA   Page 2
PAGE = 0xCB   Page 3
PAGE = 0xCC   Page 4
PAGE = 0xCD   Page 5
PAGE = 0xCE   Page 6
PAGE = 0xCF   Page 7
PAGE = 0xD0   Page 8
PAGE = 0xD1   Page 9
PAGE = 0xD2   Page 10

To display saved page

Send [0x0D]   to clear the display

Then

Send [0xFE][0x2A][spage] to display the saved screen.

Spage = 0 to 10 where spage 0 is the startup Page

Changing the baud rate

Set baud rate to 9600bps

[0xFE][0x1E]

Set baud rate to 19200bps

[0xFE][0x1F]

LCD will display the baud rate every time you change it. It will be displayed for 1.5s.

Remember Settings

This command will memorize all settings done on to the non volatile memory and will be loaded on the next startup.

[0xFE][0x20]

User's settings include: Backlight Brightness, Auto Off Interval, Baud Rate, Users defined characters ,start up screen and predefined screens.

Text Scrolling

You can display up to 40 characters per line using the text scrolling mode.
Left to right or right to left scroll is selectable.

Scroll left to right

[0xFE][0xD3]["row 0 text"][0x0D]["row 1 text"][0xFF]

Scroll right to left

[0xFE][0xD4]["row 0 text"][0x0D]["row 1 text"][0xFF]

You must exit the scroll mode by clear LCD command [0x0D] before issuing any other command.

Horizontal Graph

This command enables you to draw horizontal bar graph on the LCD easily.

Step 1:   Initialize Horizontal Graph Utility
               [0xFE][0x04]

Step 2:   Move the cursor to start position

Step 3:   Draw left to right graph
               [0xFE][0x2B][length]

               Or

               Draw right to left graph
               [0xFE][0x2C][length]

Fig 13 – Horizontal Bar Graph

Bar graph on Fig 13 is drawn with command

[0xFE][0x04]   Initialize Bar Graph Utility
[0xFE][0x32][0x00][0x03]   Move cursor to row 0,column 3
[0xFE][0x2B][0x1B]   Draw left to right bar graph of length 27

Note: Maximum length is 80
       User's Defined Characters is unavailable when bar graph is in use.

Setting The General Purpose Outputs

Command

[0xFE][0x2F][OUTPUT]

OUTPUT	OUT3	OUT2	OUT1
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

Table 1 – General Purpose Output

High Logic Level 3.3V
Low Logic Level 0V

Reading General Purpose Inputs Port

3 TTL level inputs available for external connection.
Input Ports is polled every 500ms and its status updated in the internal memory.
This status can be requested by Read Inputs Command [0xFE][0x0A]

SC1602 will response by transmitting the input port status byte (INPUT)

INPUT	INPUT3	INPUT2	INPUT1
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

Table 2 – General Purpose Inputs

Analog Input Ports

Two available:

0 to 10VDC and 0-20mA
Both are 10bits resolution

To read 0-10V port value

[0xFE][0x0B]

Response from SC1602 [0xFA][MSB][LSB]

To read 0-20mA port value

[0xFE][0x0C]

Response from SC1602 [0xFC][MSB][LSB]

Command Summary

FUNCTION	CODE Hexadecimal	CODE Decimal
Turn on underline cursor	[0xFE][0x01]	[254][1]
Turn on blinking cursor	[0xFE][0x02]	[254][2]
Hide cursor	[0xFE][0x03]	[254][3]
Set cursor position	[0xFE][0x32][row][column]	[254][50][row][column]
Set Backlight brightness level	[0xFE][0x28][level]	[254][40][level]
Turn on backlight	[0xFE][0x06]	[254][6]
Turn off backlight	[0xFE][0x07]	[254][7]
Set auto off interval	[0xFE][0x29][INTERVAL]	[254][41][INTERVAL]
Text Scrolling Mode Setting	[0xFE][smode][LINE1 TEXT] [0x0D][LINE2 TEXT][0xFF]	[254][smode][LINE1 TEXT][13][LINE2 TEXT][255]
Save Screen Into Memory	[0xFE][page][LINE1 TEXT] [0x0D][LINE2 TEXT][0xFF]	[254][page] [LINE1 TEXT][13][LINE2 TEXT][255]
Display Saved Screen	[0xFE][0x2A][spage]	[254][42][spage]
Initialize Horizontal Graph Draw	[0xFE][0x04]	[254][4]
Draw Left to Right Graph	[0xFE][0x2B][length]	[254][43][length]
Draw Right to Left Graph	[0xFE][0x2C][length]	[254][44][length]
Defines User's Characters	[0xFE][0x64][64 bytes Data]	[254][100][64 Bytes Data]
Load User's Defined Characters	[0xFE][0x08]	[254][8]
Clear row	[0xFE][0x2D][row]	[254][45][row]
Clear column	[0xFE][0x2E][column]	[254][46][column]
Set General Purpose Outputs	[0xFE][0x2F][output]	[254][47][output]
Read General Purpose Inputs	[0xFE][0x0A]	[254][10]
Read 0-10V Analog Port	[0xFE][0x0B]	[254][11]
Read 0-20mA Analog Port	[0xFE][0x0D]	[254][13]
Set baud to 9600bps	[0xFE][0x1E]	[254][30]
Set baud to 19200bps	[0xFE][0x1F]	[254][31]
Remember settings	[0xFE][0x20]	[254][32]
Display Defined Character 0	0x00	0
Display Defined Character 1	0x01	1

Display Defined Character 2	0x02	2
Display Defined Character 3	0x03	3
Display Defined Character 4	0x04	4
Display Defined Character 5	0x05	5
Display Defined Character 6	0x06	6
Display Defined Character 7	0x07	7
Backspace	0x08	8
Send Cursor Home	0x0B	11
Move Cursor to next line	0x0C	12
Clear LCD	0x0D	13
Move Cursor one position left	0x0E	14
Move Cursor one position right	0x0F	15

Electrical Specification

Power Supply: 4.8-5.5V @ 10mA (Backlight Off)
                                    4.8-5.5V @ 100mA (Backlight On)
Operating Temperature: 0°C to 50°C
Storage Temperature: -20°C to 60°C
Voltage level on TTL inputs:
RXD: 5.5V max
General Purpose Inputs: 3.9V max
Voltage level TTL outputs:
TXD & General Purpose: 3.3V typical 20mA max
0-10V Analog Inputs: 12V max , 0V min
0-20mA Analog Inputs: 50mA max, 0mA min
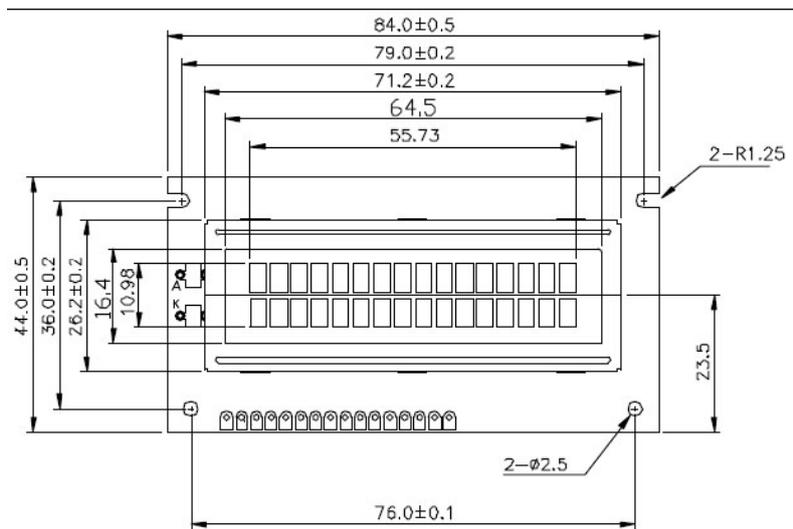
Mechanical Dimension
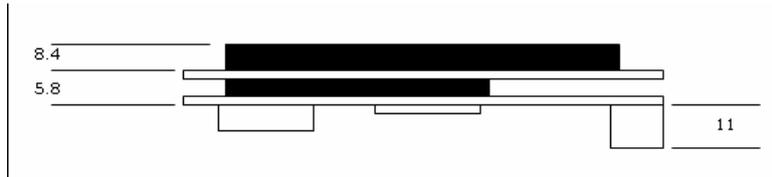

Fig 14 – Front view Dimension in mm

Fig 15 – Side view Dimension in mm

SC1602App Software

This application software is available free of charge on
www.siliconcraft.net/download.htm

It is created by Silicon Craft to test and configure SC1602 with computer serial port connection.
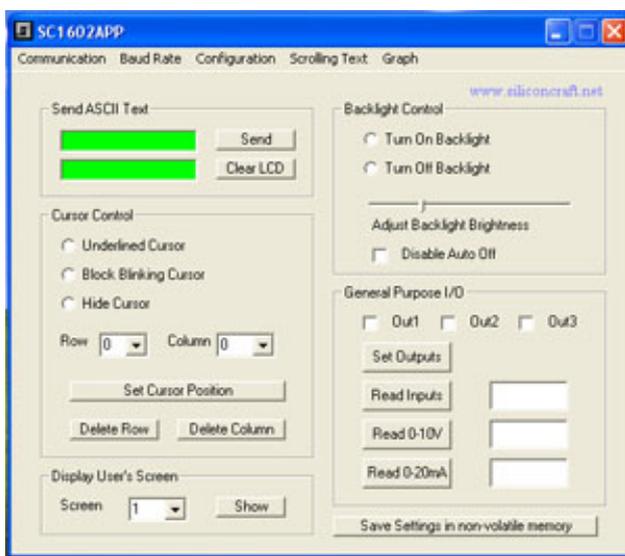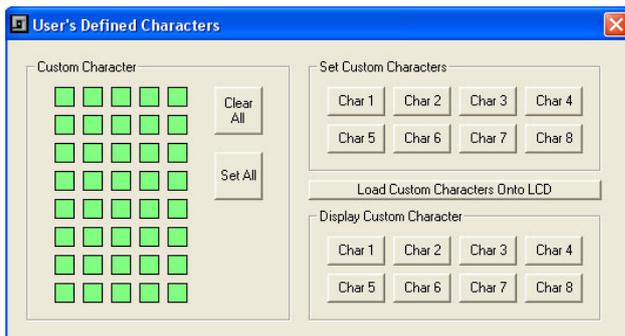

Fig 16 – SC1602App Screenshot

Fig 17 – SC1602App User's defined characters generator