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

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.
### Supported ASCII Characters

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

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**User’s Defined Characters**

Other than the standard ASCII characters, users 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**

- 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]
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]\n
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]
```
<table>
<thead>
<tr>
<th>Output Value</th>
<th>I3</th>
<th>I2</th>
<th>I1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>1</td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>2</td>
<td>LOW</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>3</td>
<td>LOW</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td>4</td>
<td>HIGH</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>5</td>
<td>HIGH</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>6</td>
<td>HIGH</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>7</td>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

**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

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

- **Operating Temperature**: 0°C to 50°C
- **Storage Temperature**: -10°C to 60°C
- **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
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Mechanical Dimension

Available Accessories

Character Size

Aluminum Mounting Kit

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Mounting Kit Dimension (mm)
Thickness 1.5mm

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