# DX160 SERIAL GRAPHIC 128x64 LCD

1. Overview

The DX160 allows simple interfacing with your project using just 3 wires. It can be used with any micro controller or connected to PC using its serial interface. This display is very compact and is ideal for hand-held and/or portable applications. Also, its pixels are square - circles appear as true circles instead of an ellipse.

- **8 rows of 32 characters (total 256)** in small font mode.
- **8 rows of 21 characters (total 168)** in large font mode.
- Easy to use - simple ASCII commands.
- Display up to 5 full screen bitmaps per second.
- Only 3 lines needed - 5V power, ground and signal input.
- Compact size - 3.0in. wide by 2.1in. tall. (0.58in. thick)
- Software selectable baud rates from 4,800 to 115,200. Standard RS-232 or TTL level signals.
- Software controlled LED backlight.
- Available in **Yellow/Green** transflective or **White/Blue** transmissive.

2. Connection

Connect the DX160 to a regulated 5 volt power supply at the +5V and GND positions on the rear of the display (4-position terminal block). Please ensure that the correct polarity is observed and that the power supply is within 4.75 to 5.25 volts. Exceeding 5.25 volts may damage the display.
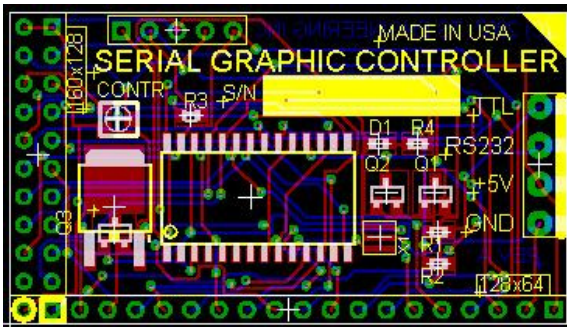
To connect it directly to a micro controller, connect the position marked TTL to the MCU's TX pin. The MCU's UART should be set to **57600,n,8,1** (57,600 baud, no parity, 8 data bits & 1 stop bit).

Connection to PC is done using the terminal marked RS232. The PC's serial port output should be set to **57600,n,8,1** (57,600 baud, no parity, 8 data bits, 1 stop bit).

3. Text & Setup Commands

The baud rate is set at **57600,n,8,1** when the display is received from the factory. To change the baud rate, send **ASCII[190] - ASCII[195]** according to the table below, eg. sending **ASCII[194]** will set the baud rate to 9600. The baud rate is stored in non-volatile memory on the display controller and will remain (even if the display is turned off) until it is changed.

To restore the factory default baud rate, temporarily connect the TTL terminal to GND before powering up the display.

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ASCII	FUNCTION (TEXT)
180	Selects large 5x8 font (max. 21 characters/row)
181	Selects small 3x6 font (max. 32 characters/row)
185	Toggle backlight ON/OFF
186	Clear Display, set column and row to position 1
187	Toggle splash screen at display boot-up
190-195	Set communication to 115200, 57600, 38400, 19200, 9600 or 4800
COL+135	Set new column position (1 to 21 or 1-32)
ROW+126	Set new row position (1 to 8), column set to 1

To clear the display, send **ASCII[186].** Upon clearing the display, the current text position will be at row 1, column 1.

When text is written to the screen, it is displayed at the current position. The current position is updated as each character is displayed. If the text extends beyond the end of the line, it will automatically wrap to the next line. When the text reaches the bottom-right corner, it will automatically wrap to the top-left of the display.

Text strings are limited to 80 characters and must be terminated with ASCII[255].

To set the current position to any row (1 to 8) send **ASCII[row+127]** to the display. To set the current position to any column (1 to 21 for large fonts and 1-32 for small fonts) send **ASCII[column+135]** to the display. Any text sent after either of these commands, will be displayed **STARTING** at the current position.

The commands **ASCII[180]** and **ASCII[181]** select either the large font mode (default at power up) or the small font mode. The large 5x8 font will display up to 21 characters per row. The smaller 3x6 font is useful when more characters need to be displayed (32 characters/row up to a total of 256 characters). Both sizes can display up to 8 rows.

NOTE THAT ONLY UPPER CASE CHARACTERS AVAILABLE WHEN USING THE SMALL FONT.

The backlight can be toggled ON or OFF by sending **ASCII[185]** to the display. If the backlight is ON, it is turned OFF and vice versa.

The DX160 will display a splash screen when it is powered up. It can be disabled by sending **ASCII[187]** to the display. To enable the splash screen send **ASCII[187]** again.

4. Graphic Commands

The DX160 is capable of displaying 128x64 pixel graphics and is defined as follows:

0,0 **(x1,y1)** **127,63** **(x2,y2)**	Top left corner is 0,0 and bottom right is 127,63. There are 128 pixels (0-127) on the horizontal axis and 64 pixels (0-63) on the vertical axis.

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The following graphic commands are available:

ASCII	PARAMETERS	FUNCTION (GRAPHICS)
1	x1,y1,x2,y2,color*	Draws a filled box from x1,y1 to x2,y2.
2	x1,y1,x2,y2,color*	Draws a rectangle from x1,y1 to x2,y2.
3	x1,y1,r,color*	Draws a circle centered at x1,y1 with a radius of r.
4	x1,y1,x2,y2,color*	Draws a line from x1,y1 to x2,y2.
5	x1,y1,color*	Draws a dot (pixel) at x1,y1.

* Color = 0 for white, 1 for black and 2 for "smart" (invert each pixel).
To send graphic commands, enclose them with ASCII [200].

Graphic command examples:

ASCII[200], [2], [10], [10], [80], [35], [1], [200]
Sending this sequence of ASCII codes to the display will draw a black rectangle from 10,10 to 80,35.

ASCII[200], [3], [63], [31], [12], [2], [200]
This will draw a circle at the center of the screen with a radius of 12 pixels. The pixels will be "smart", where there is a black pixel on the screen it will draw a clear pixel and vice versa.

IMPORTANT: Please note that the display requires a small amount of time to perform the above graphic commands and a small delay has to be inserted between consecutive graphic commands. This delay is dependent upon the specific graphic command and the selected baud rate (slower baud rates will require longer delays). Required delays are typically 20-50mS. Drawing filled boxes take the longest amount of time and may require a delay of 150mS or more depending on the size of the filled box.

To display a full screen (128x64) bitmap, send **ASCII[200], [6], [200]** followed by a 1,024 byte bitmap file. The display is defined as 8 rows (0-7) of 128 bytes (0-127) for the display of bitmaps. Send bytes 0-127 of row 0 followed by bytes 0-127 of row 1 etc. to display a bitmap. The total size of the bitmap file must be exactly 1,024 bytes to work correctly. The selected baud rate will determine how quickly a bitmap is displayed. At 57,600 baud, it takes about 220mS to display a full screen bitmap (about 4-5 screens per second can be displayed). It is recommended that a delay of 50-200mS be inserted between sending consecutive bitmaps depending upon the selected baud rate.

5. Specifications

Size: 3.0in. x 2.1in. X 0.58in. (75mm x 53mm x 14.5mm)
Power: 5V (+/- 5%) regulated supply. **** Do Not Exceed ****
                15mA - backlight off, 60mA (100mA for yellow LED) - backlight on.
Baud Rates: 4,800-115,200 - no parity, 8 data bits, 1 stop bit.

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