DLP-MAV-LCD1
LEAD FREE

LCD / MICROCONTROLLER MODULE

The DLP-MAV-LCD1 combines a 2x16-character backlit LCD display with a TI MSP430 microcontroller to form a MAVRK-supported display module. The MSP430 is preprogrammed with basic functionality for driving the LCD display via either the MAVRK platform or a simple, 5-pin TTL serial interface.

FEATURES:

- Simple ASCII Command Set
- Requires 3.0-3.3V Supply
- LED Backlight
- 5-Switch Joystick (Left, Right, Up, Down and Select)
- Can Be Used Standalone or with the MAVRK Platform

1.0 GENERAL DESCRIPTION

The DLP-MAV-LCD1 provides the MAVRK platform with a means of displaying data that does not require a connected host PC.

To send data from the host processor on the MAVRK platform via the 2-wire TTL serial interface, the host firmware sends the data to be displayed using the format described below in Section 3.

When the 5-switch joystick is operated, the DLP-MAV-LCD1 issues switch closure information to the host processor using the MAVRK platform protocol. This protocol consists of a printable ASCII format using a synchronization character "^", and a termination character "~". (This protocol is further described in Section 3.)

The DLP-MAV-LCD1 is ready to accept commands immediately upon power up. (Initial baud rate and serial parameters are outlined in Section 3.)

2.0 MAVRK QUICK START GUIDE

This guide requires the use of a MAVRK platform (purchased separately).

1. Connect the DLP-MAV-LCD1 module to one of the four LTE positions on the MAVRK platform via the connector on the bottom side of the DLP-MAV-LCD1 module:
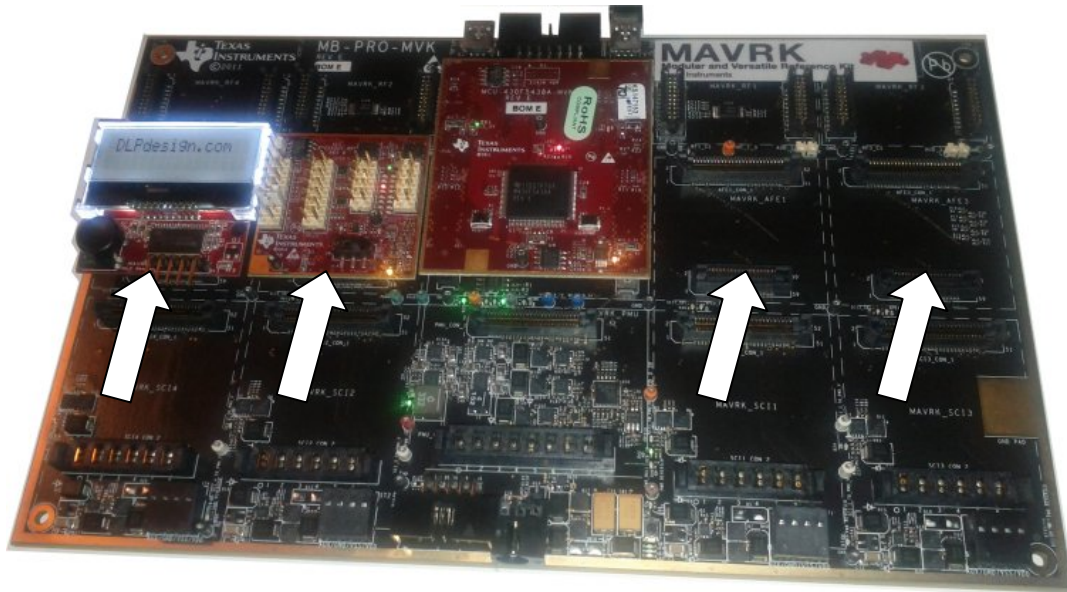

Figure 1: MAVRK Board with DLP-MAV-LCD1 Installed in Position AFE #4

2. Install the firmware as described on the MAVRK wiki pages: **http://processors.wiki.ti.com/index.php/MAVRK_Introduction**, specifically the "How do I get started with MAVRK?" section. Begin by creating a SVN folder at C:\svn.

3. Once installed, locate the project:

   C:\svn\mavrk\mavrk_embedded\Modular_EVM_Projects\System_Demo_Projects\MSP430F5438-MVK_UART_Passthrough

4. Open the project in Code Composer 5.1 or later.

5. Find the file "MSP430F5438_UART_Passthrough_main.c", then edit the following lines in the function main():

   //   mvk_Configure_UART_Passthrough (MAVRK_UART_RF, MAVRK_UART_TUSB);
   //   mvk_Configure_UART_Passthrough (MAVRK_UART_TUSB, MAVRK_UART_RF);

6. Add the following lines in the function main() under the ones you just commented out above:

   mvk_Configure_UART_Passthrough (*MAVRK_UART_P1P2*, *MAVRK_UART_TUSB*);
   mvk_Configure_UART_Passthrough (*MAVRK_UART_TUSB*, *MAVRK_UART_P1P2*);

7. Rebuild the project, and reload the MAVRK platform with your new flash.

8. Now you can connect the USB cable to the MAVRK debug port and open a terminal interface (ex: HyperTerminal) to the MAVRK platform using the following settings: Baud: 460800, N, 8, 1.

9. Once connected, actuating the joystick will result in data being displayed that indicates which joystick button was pressed. The terminal window may also be used to send commands and data characters to the LCD.

The DLP-MAV-LCD1 module is shipped preprogrammed with firmware for either communicating directly with the MAVRK platform or for operation in standalone mode via the 5-pin header.

Figure 2: DLP-MAV-LCD1 Module Ready to Start Right Out of the Box

Figure 2 will be displayed for 5 seconds, and then the display will be clear as shown in Figure 3:
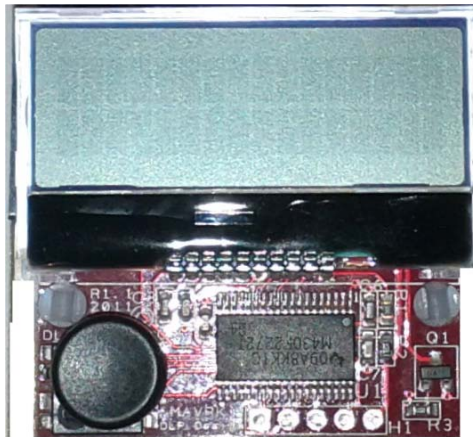

Figure 3: Clear (After 5 Seconds)

At this point, the DLP-MAV-LCD1 is ready for use. (Note that the unit will appear non-responsive on the MAVRK platform until you build and load your new MAVRK platform flash file as described in Section 2.)

Alternatively, you can communicate directly with the unit in standalone mode. Troubleshooting information will also be available on the MAVRK wiki pages referenced above.

3.0 COMMAND AND DATA SET

The command and data set syntax communicates via a two-wire serial TTL interface:

Parameter	Value
Baud Rate	460800
Data	8 Bit
Parity	None
Stop Bit	1
Flow Control	None

Table 1: Sample Data and Commands

Changing the Baud Rate via the Menu:

Figure 4: Splash Screen on Power Up

Changing the baud rate may be accomplished; however, you must press Select (joystick straight down) to initiate the Baud Rate Menu. (Note that this must be done during the first 5 seconds when the splash screen shown above is displayed.)
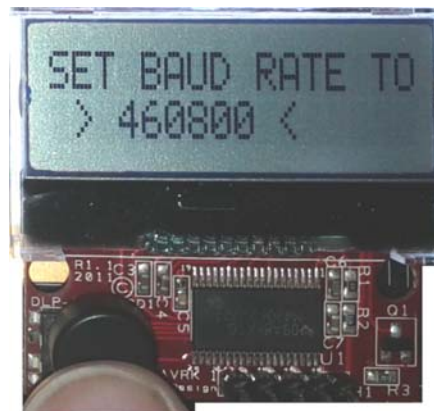

Figure 5: Baud Rate Menu

Once Select has been pressed, the Baud Rate Menu (see Figure 5) will be displayed.

From this Baud Rate Menu, press the up or down buttons on the toggle to increase or decrease the baud rate. (Standard baud rates are detailed in Table 3 below.)
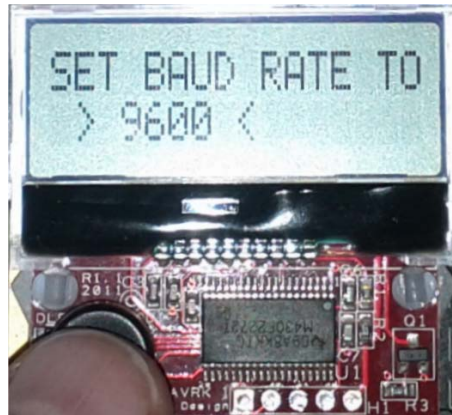

Figure 6: Baud Rate 9600

You may now press the Select button once your baud rate is displayed. This saves the selected baud rate into flash. On subsequent power ups, the following screen will be displayed indicating the saved baud rate:

Figure 7: Power Up Splash Screen

Changing the Baud Rate via the Terminal Emulator:

To change the baud rate, first set the baud rate of the terminal to 460800 as described above. Then send the command ^b9600~, at which point the new baud rate will immediately be in effect. (You will have to change your terminal to 9600 immediately to continue processing any further commands.)

The TTL interface requires the specific formatting described below for all message traffic to and from the LCD:

Function	Synchronization Characters	Command or Data Buffer	Termination Character	Example
Sending Data	^d	Hello World	~	^dHello World~
Sending Commands	^c	01	~	^c01~
Sending a New Baud Rate	^b	9600	~	^b9600~
Receiving Keys	^k	U	~	^kU~

Table 2: Data and Commands Syntax

Command	Sent Text	Baud Rate
1200	^b1200~	1200
2400	^b2400~	2400
4800	^b4800~	4800
9600	^b9600~	9600
14400	^b14400~	14400
19200	^b19200~	19200
38400	^b38400~	38400
57600	^b57600~	57600
115200	^b115200~	115200
230400	^b230400~	230400
460800	^b460800~	460800 (Default)
921600	^b921600~	921600

Table 3: Standard Baud Rates

Data that exceeds the 16 character lines will be truncated based on the length of the display. Both the top and bottom LCD lines require separate data commands.

Joystick	Received Text	Description
Up	^kU~	Key Up was Pressed
Down	^kD~	Key Down was Pressed
Left	^kL~	Key Left was Pressed
Right	^kR~	Key Right was Pressed
Select	^kS~	Key Select (Center Down) was Pressed

Table 4: Key Definitions

Keys will be sent to the connected terminal with de-bounce. If you hold the key down longer than 500mS, it will repeat.

Command	Sent Text	Description
80	^c80~	Cursor Location to Row 1/Column 1 (see Table 6)
C0	^cC0~	Cursor Location to Row 2/Column 1 (see Table 6)
F1	^cF1~	Turn the LCD Backlight On
F0	^cF0~	Turn the LCD Backlight Off
E1	^cE1~	Turn Echo On
E0	^cE0~	Turn Echo Off (Default)
01	^c01~	Clears the Screen
02	^c02~	Return Home
08	^c08~	Display OFF Cursor OFF Cursor Position OFF
09	^c09~	Display OFF Cursor OFF Cursor Position ON
0A	^c0A~	Display OFF Cursor ON Cursor Position OFF
0B	^c0B~	Display OFF Cursor ON Cursor Position ON
0C	^c0C~	Display ON Cursor OFF Cursor Position OFF
0D	^c0D~	Display ON Cursor OFF Cursor Position ON
0E	^c0E~	Display ON Cursor ON Cursor Position OFF
0F	^c0F~	Display ON Cursor ON Cursor Position ON
7x	^c70~	Set Contrast Value to x Where x is 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E or F

Table 5: Commands Definition

The table below describes the Cursor Location Commands for each on-screen position based on the row and column required. Once each command has been issued, the next data command will start writing text from this location and will automatically increment to the next location based upon the length of the text string:

Row	Column	Command	Example
1	1	80	^c80~
1	2	81	^c81~
1	3	82	^c82~
1	4	83	^c83~
1	5	84	^c84~
1	6	85	^c85~
1	7	86	^c86~
1	8	87	^c87~
1	9	88	^c88~
1	10	89	^c89~
1	11	8A	^c8A~
1	12	8B	^c8B~
1	13	8C	^c8C~
1	14	8D	^c8D~
1	15	8E	^c8E~
1	16	8F	^c8F~
2	1	C0	^cC0~
2	2	C1	^cC1~
2	3	C2	^cC2~
2	4	C3	^cC3~
2	5	C4	^cC4~
2	6	C5	^cC5~
2	7	C6	^cC6~
2	8	C7	^cC7~
2	9	C8	^cC8~
2	10	C9	^cC9~
2	11	CA	^cCA~
2	12	CB	^cCB~
2	13	CC	^cCC~
2	14	CD	^cCD~
2	15	CE	^cCE~
2	16	CF	^cCF~

Table 6: Cursor Location Definitions

The table below describes sample strings sent to the DLP-MAV-LCD1 to include clearing the screen and positioning the cursor prior to writing text:

Data	Example	Description
Hello	^dHello~	Displays "Hello"
Testing 123	^d Testing 123~	Displays " Testing 123" (note that the spaces are valid)
Beyond the Maximum Text Length of 16	^dBeyond the Maximum Text Length of 16~	The Data is Ignored
Line 1 Here	^c01~^c80~^dLine 1 Here~	Clears the Screen, Goes to Row 1/ Column 1 and Displays "Line 1 Here"
Line 2 Here	^c01~^cc0~^dLine 2 Here~	Clears the Screen, Goes to Row 2/ Column 1 and Displays "Line 2 Here"

Table 7: Sample Commands

4.0 STANDALONE MODE

Alternatively, when used in standalone mode, the DLP-MAV-LCD1 board may be powered externally and communicated with utilizing the 5-pin, TTL serial header described below:
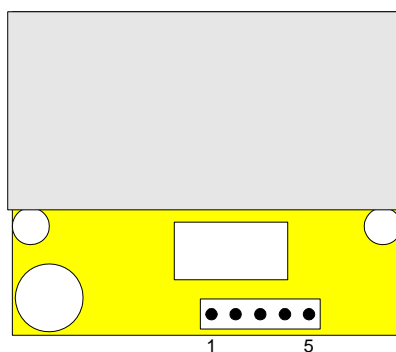

Figure 8: DLP-MAV-LCD1 Standalone Pins

Pin #	Description
1	**FROM EXTERNAL HOST (In)** – TTL serial from host processor
2	**TO EXTERNAL HOST (Out)** – TTL serial to host processor
3	**GROUND**
4	**RESET (In)** – Pull to ground to reset MSP430 on DLP-MAV-LCD1
5	**3.0 - 3.3V (In)** – Power supply for module

Table 8: TTL 5-Pin Header Descriptions

5.0 MECHANICAL DRAWINGS

Both inches and (millimeters) in parentheses are shown below for each measurement:
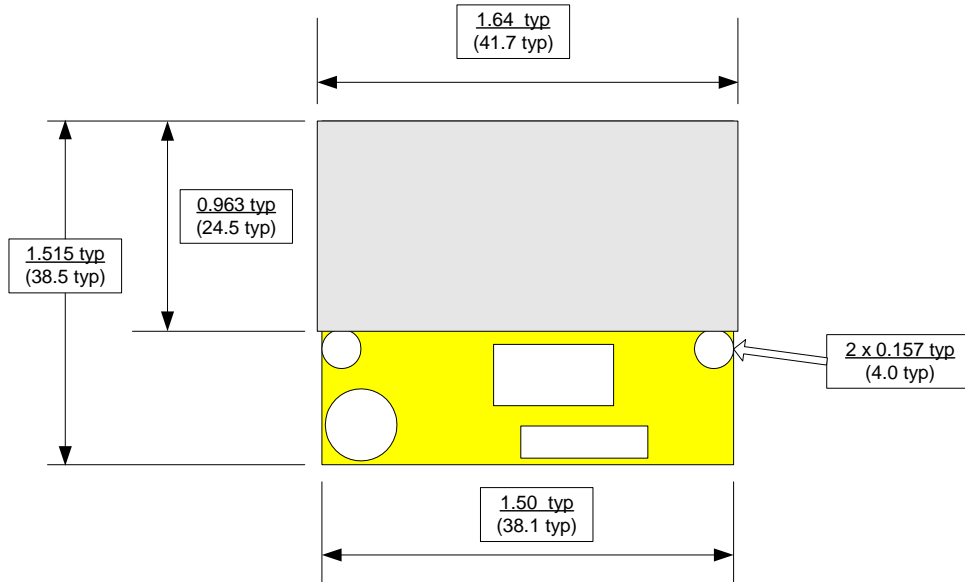

Figure 9: DLP-MAV-LCD1 Dimensions

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7.0 CONTACT INFORMATION

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