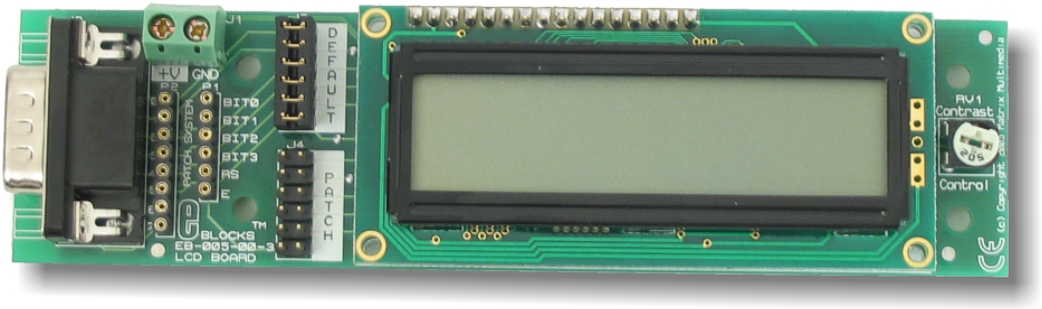
LCD board datasheet
EB005-00-3



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Appendix 1 Circuit Diagram

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1. About this document

This document concerns the E-blocks LCD board code EB005 version 3.

The order code for this product is EB005.

1. Trademarks and copyright

PIC and PICmicro are registered trademarks of Arizona Microchip Inc.
E-blocks is a trademark of Matrix Multimedia Limited.

2. Other sources of information

There are various other documents and sources that you may find useful:

Getting started with E-Blocks.pdf

This describes the E-blocks system and how it can be used to develop complete systems for learning electronics and for PICmicro programming.

PPP Help file

This describes the PPP software and its functionality. PPP software is used for transferring hex code to a PICmicro microcontroller.

C and assembly strategies

Not provided for this product.

3. Disclaimer

The information in this document is correct at the time of going to press. Matrix Multimedia reserves the right to change specifications from time to time. This product is for development purposes only and should not be used for any life-critical application.

4. Technical support

If you have any problems operating this product then please refer to the troubleshooting section of this document first. You will find the latest software updates, FAQs and other information on our web site: www.matrixmultimedia.com . If you still have problems please email us at: support@matrixmultimedia.co.uk.

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2. General information

This is an LCD Display designed for E-blocks which can be used as a flexible display for development use and for projects. The display is a 16 character, 2-line alphanumeric LCD device which connects to an upstream E-block board via a single 9-way D-type connector. The LCD display requires data in a serial format on 5 data inputs. Programming details and a full character set are provided.

1. Features

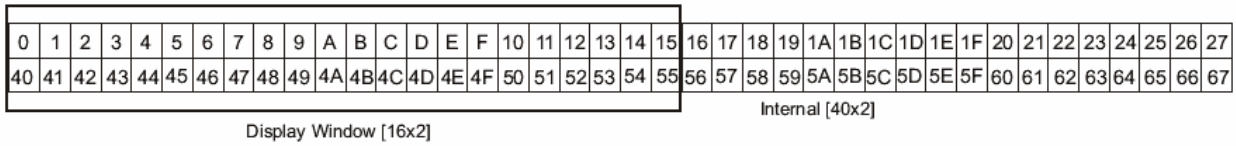
- E-blocks compatible
- Compatible with most I/O ports in the E-Block range (requires 5 I/O lines via 9 way D-type connector)
- Compatible with Flowcode
- 3.3 Voltage compatible

2. Block schematic

Not provided.

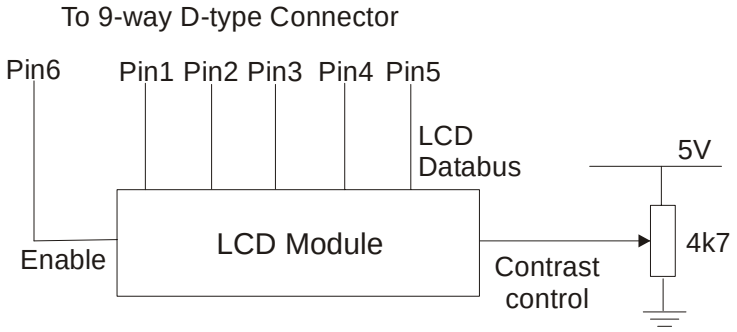
3. Programming guide

The LCD is a 16 character x 2 lines module. Internally it is 40 characters x 2 lines. Line 1 ranges from H'00' to H'27' and Line 2 ranges from H'40' to H'67'.



The LCD Module uses a Samsung KS0066U controller, which is similar to the Hitachi HD44780 controller.

The upstream board uses pins 1 - 6 on the 9-way D-type connector (when DEFAULT link option is chosen) to program the LCD, as shown in the circuit diagram below. When the LCD board is turned on, data can only be sent to it after 30ms, this is the time taken for the LCD to initialize [as it clears all the RAM and sets up the Entry Mode].



LCD Block Diagram

To send a command to the LCD, data must be sent in two steps, the MSB followed by the LSB [byte is data on pins 1 - 4]. As each byte is sent to the LCD, B5 must be go high then low, for the LCD to acknowledge the byte. After the second byte has been acknowledged the LCD executes the command. The upstream board must wait for at least the length of the execution time for that command, before the next command can be sent. A timing diagram of this process is shown below.

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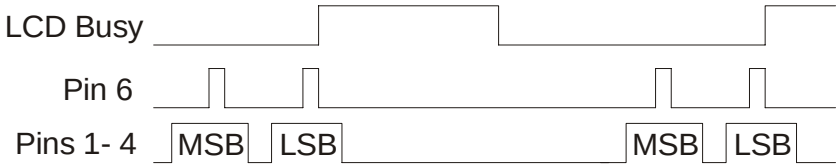
Timing Diagram



The first command to be sent to the LCD must be 'Function Set' [to setup the LCD], this is usually followed by 'Display Control' and then 'Clear Display'. According to 'Entry Mode Set' after each character is sent to the LCD, the position of the cursor changes [by default it is incremented].

LCD Instruction Set

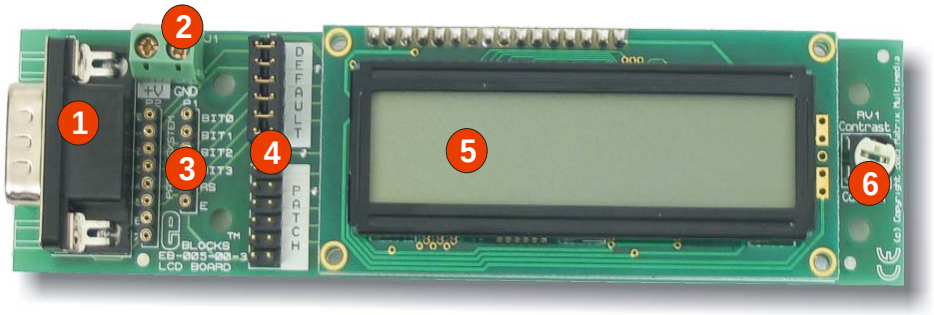
Instruction	Code								Description	Execution Time
MSB / LSB	B4	B3	B2	B1	B0					
Clear Display	0	0	0	0	0	0	0	0	1	Clear all display data. Set DDRAM address to 0. Move cursor to home position. Entry mode set to increment.	1.53 ms
Return Home	0	0	0	0	0	0	0	1	X	Set DDRAM address to 0. Move cursor to home position.	1.53 ms
Entry Mode Set	0	0	0	0	0	0	1	I/D	SH	Sets cursor move direction (I/D), specifies to shift the display (S). These operations are performed during data read/write.	39 us
Display Control	0	0	0	0	0	1	D	C	B	D is Display ON/OFF bit, C is Cursor ON/OFF bit. B is Blink Cursor ON/OFF bit.	39 us
Cursor/Display Shift	0	0	0	0	1	S/C	R/L	X	X	Sets cursor-move or display-shift (S/C), shift direction (R/L). DDRAM contents remains unchanged.	39 us
Function Set	0	0	0	1	0	1	0	X	X	Configuration data for setting up LCD. [Send First]	39 us
Set CGRAM Address	0	0	1	A5	A4	A3	A2	A1	A0	Sets the CGRAM address. CGRAM data is sent and received after this setting.	39 us
Set DDRAM Address	0	1	A6	A5	A4	A3	A2	A1	A0	Sets the DDRAM address. DDRAM data is sent and received after this setting.	39 us
Write Data to RAM	1	D7	D6	D5	D4	D3	D2	D1	D0	Writes data to CGRAM or DDRAM.	43 us

DDRAM is Display Data RAM
DDRAM address is location of cursor
CGRAM is Character Generator RAM
X is Don t Care

Bit Name	0	1
I/D	Decrement cursor position	Increment cursor position
SH	No display shift	Display shift
D	Display off	Display on
C	Cursor off	Cursor on
B	Cursor blink off	Cursor blink on
S/C	Move cursor	Shift display
R/L	Shift left	Shift right

LCD Character Set

3. Board layout



EB005-74-1.cdr

1) 9-way downstream D-type connector
2) Power screw terminals
3) Patch connectors
4) Connection selection blocks
5) LCD display
6) Contrast potentiometer

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4. Testing this product

The following program will test the circuit. The test file can be downloaded from www.matrixmultimedia.com.

1. System Setup

Multi-programmer board with

EB006 Options	Setting
Power supply	External, 14V
PICmicro device	16F88
SW1 (Fast/Slow)	Don't care
SW2 (RC/Xtal)	Xtal
Xtal frequency	19.6608MHz
Port A	
Port B	LCD board EB005
Port C	
Port D	
Port E	
Test program	LCD_hex.hex

EB005 Options	Setting
Patch jumper setting	DEFAULT

2. Test Procedure

1) Wire power to all boards.
2) Configure system and board options as above.
3) Download the test program to the Multiprogrammer
4) The LCD.hex program will place a counter on to the LCD Board. You may need to adjust the contrast potentiometer.

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5. Circuit description

1. Circuit details

The 5 data lines are fed from the 9 way D-type connector to two 6 way jumper blocks. The DEFAULT jumper block makes connections between the lowest 5 bits on the D-type and the display.

There are occasions where you may want a different connection set up – for example when using a PIC16F88 in Low Voltage Program mode, bit B3 of the PICmicro microcontroller will be reserved for the programming of the chip, and can not be used as a general purpose input output pin. In this case you will need to move the 6 way jumper block to the PATCH setting and use small jumper wires to make up the connections you require between the LCD display and the upstream board. This scenario may also occur when sharing an E-blocks port with more than one downstream device.

The contrast on the device is controlled by the potentiometer RV1.

2. 3.3V operation

This board operates from upstream boards with a 3.3V supply..

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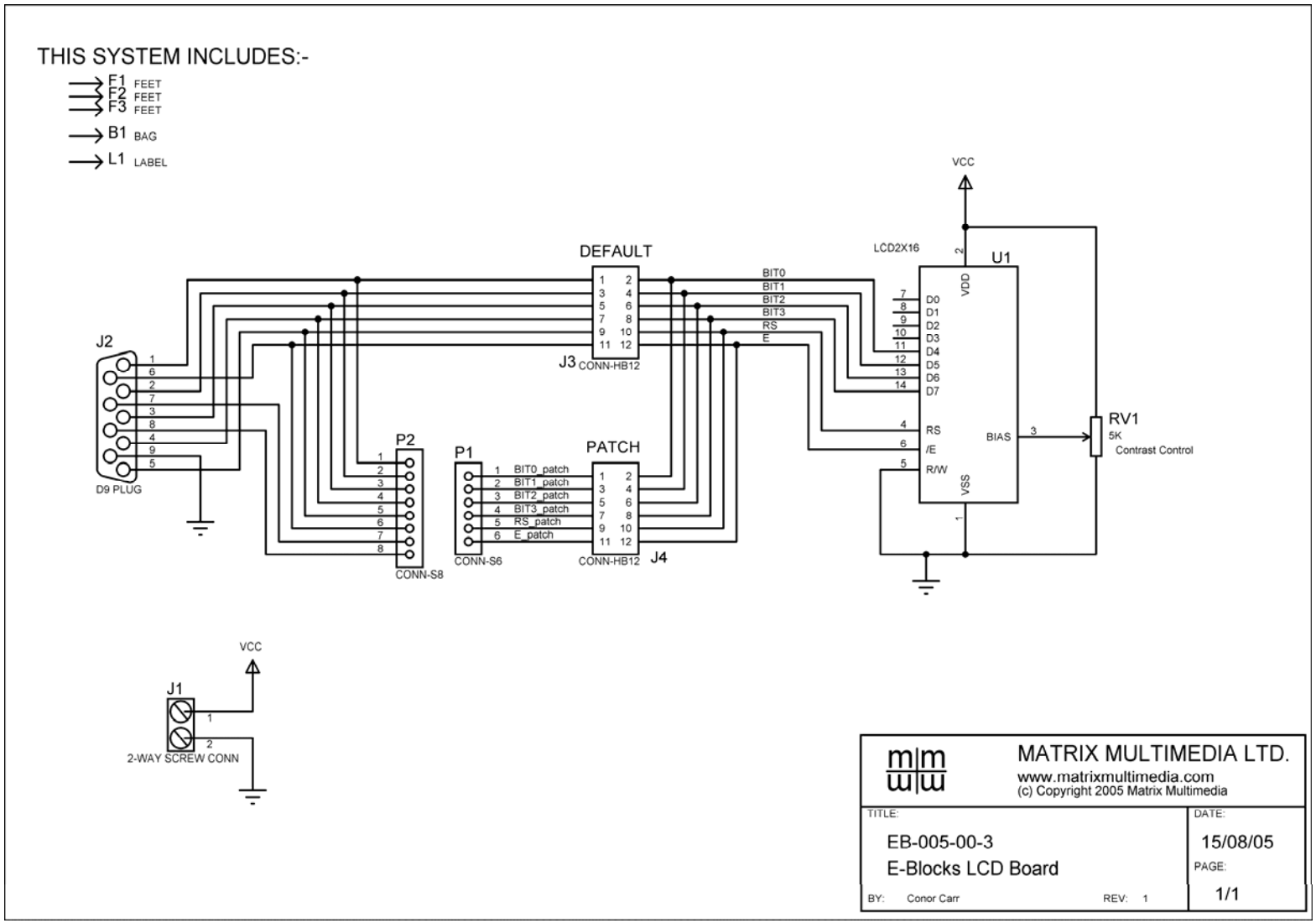
Appendix 1 – Circuit diagram