MATRIX

eBLOCKS®

LCD board

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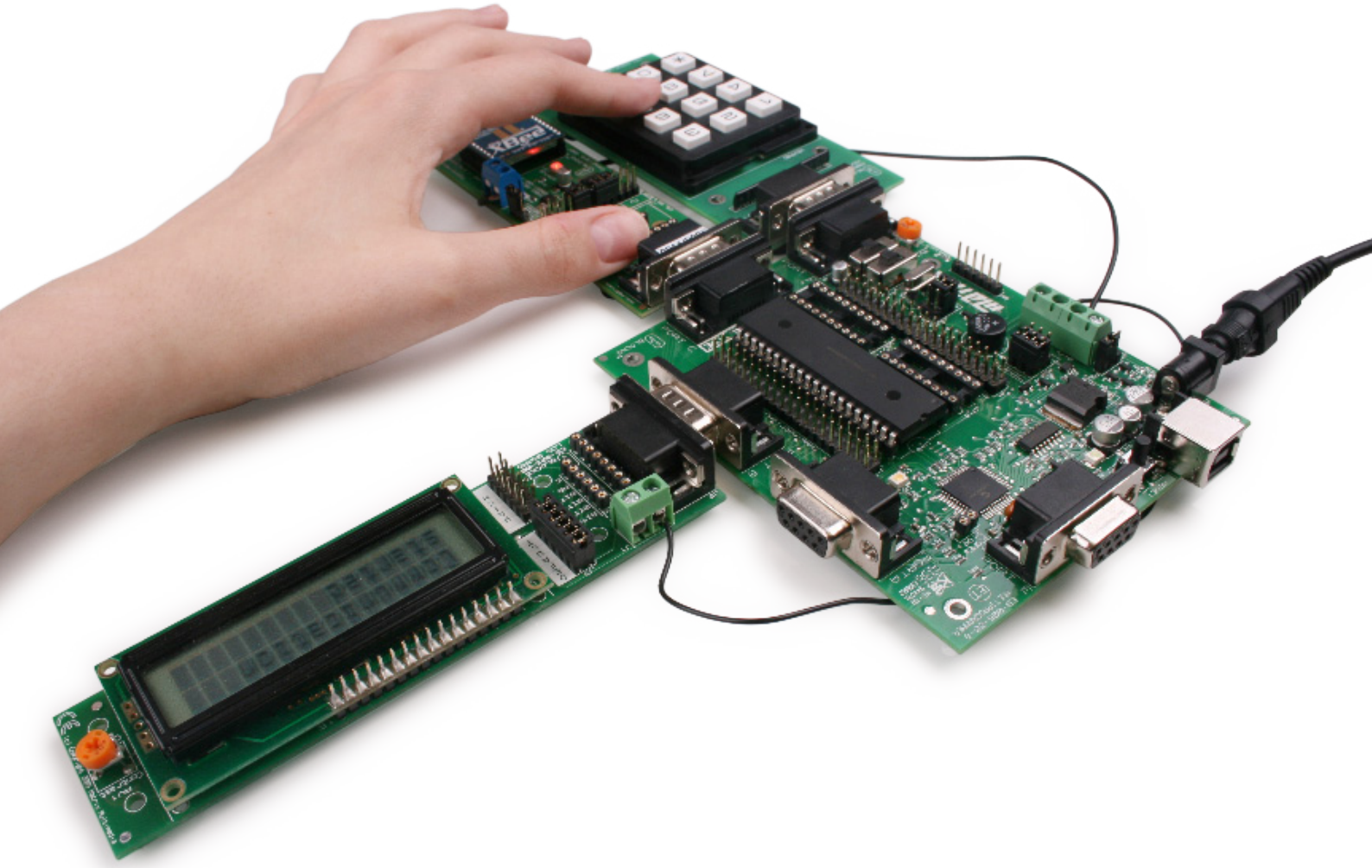

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About this document

This document concerns the EB005 E-blocks LCD board.

1. Trademarks and copyright

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2. Disclaimer

The information provided within this document is correct at the time of going to press. Matrix TSL reserves the right to change specifications from time to time.

3. Testing this product

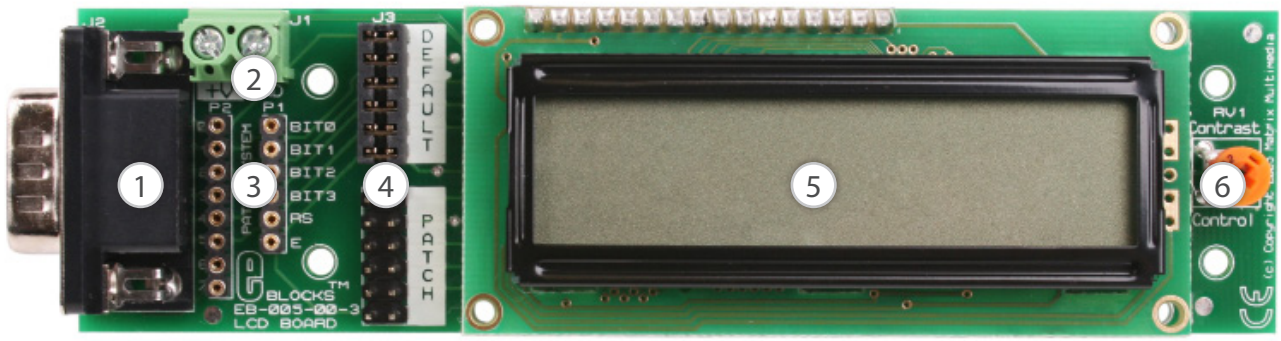
It is advisable to test the product upon receiving it to ensure it works correctly. Matrix provides test procedures for all E-blocks, which can be found in the Support section of the website.

4. Product support

If you require support for this product then please visit the Matrix website, which contains many learning resources for the E-blocks series. On our website you will find:

- How to get started with E-blocks - if you are new to E-blocks and wish to learn how to use them from the beginning there are resources available to help.
- Relevant software and hardware that allow you to use your E-blocks product better.
- Example files and programs.
- Ways to get technical support for your product, either via the forums or by contacting us directly.

Board layout



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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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-blocks 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 for H'00' to H'27' and Line 2 ranges from H'40' to H'67'.

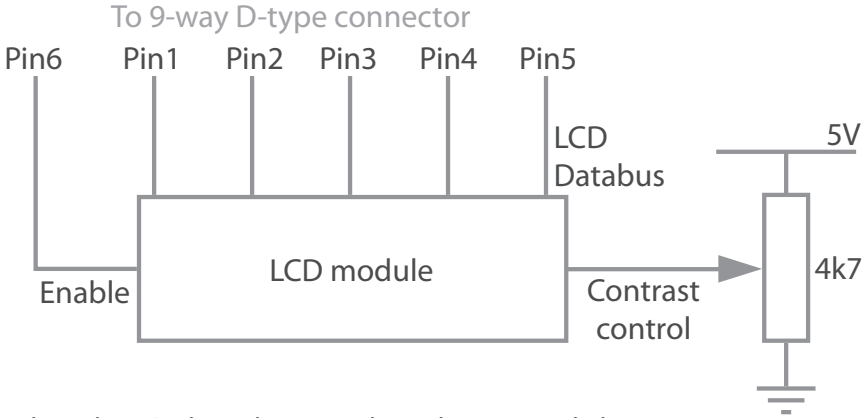
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

Display window [16 x 2]

Internal [40 x 2]

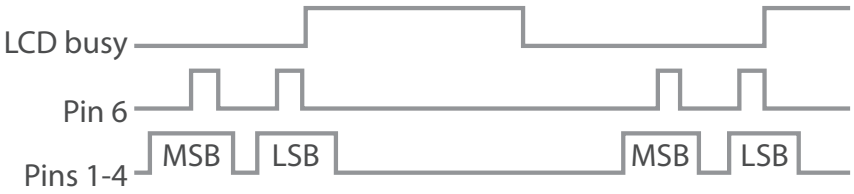
The LCD module uses a Samsung KS0066U controller, which is similar to the Hitachi HD44780 controller.

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).

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 go high then low, for the LCD to acknoledge 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.



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).

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

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

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Circuit description

The EB005 LCD circuit can be observed on page 7.

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 cannot 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

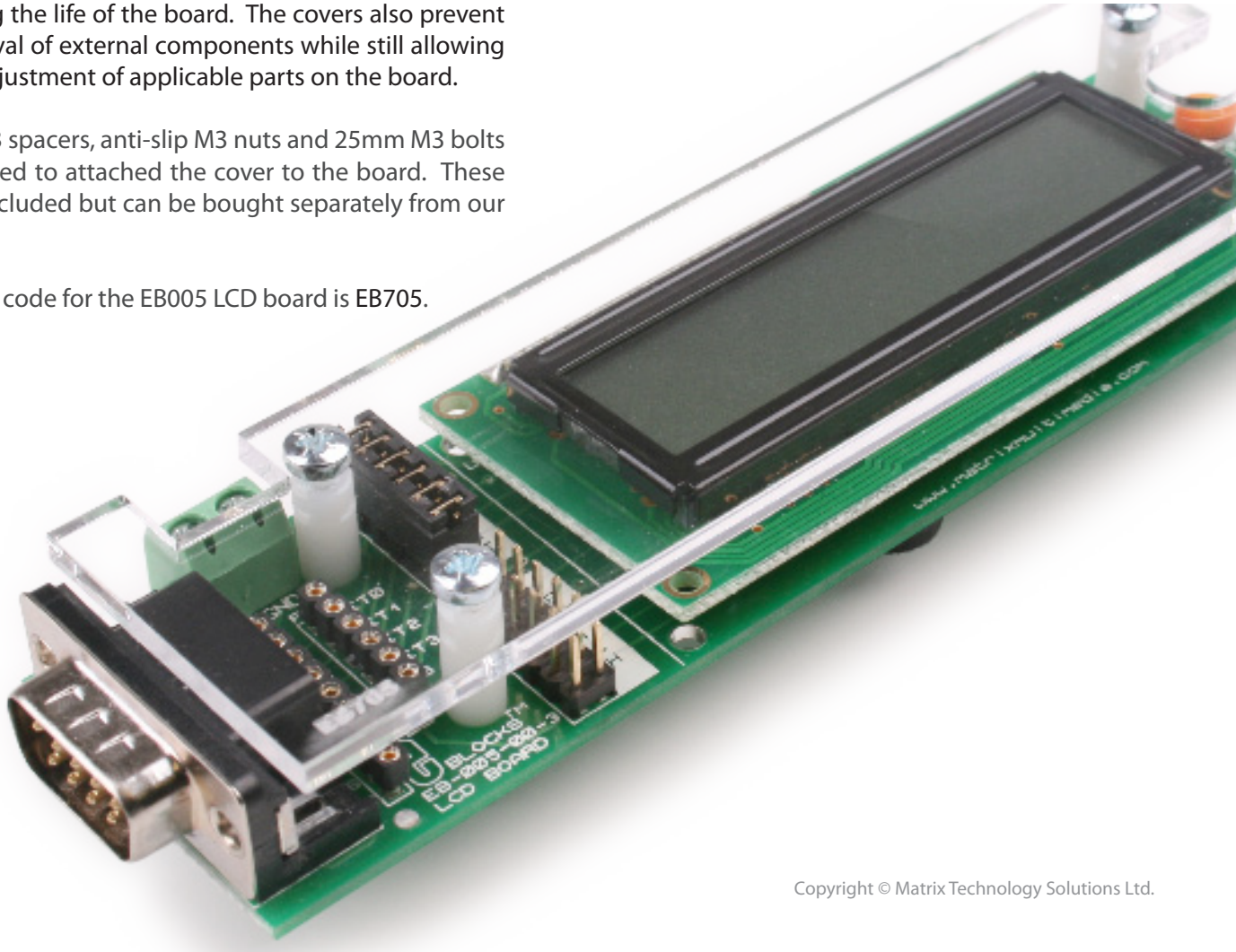
This board operates from upstream boards with a 3.3V supply.

Protective cover

Most of the boards in the E-blocks range can be fitted with a plastic cover as an optional extra. These covers are there to protect your E-blocks board therefore extending the life of the board. The covers also prevent the removal of external components while still allowing for the adjustment of applicable parts on the board.

12mm M3 spacers, anti-slip M3 nuts and 25mm M3 bolts can be used to attached the cover to the board. These are not included but can be bought separately from our website.

The order code for the EB005 LCD board is EB705.



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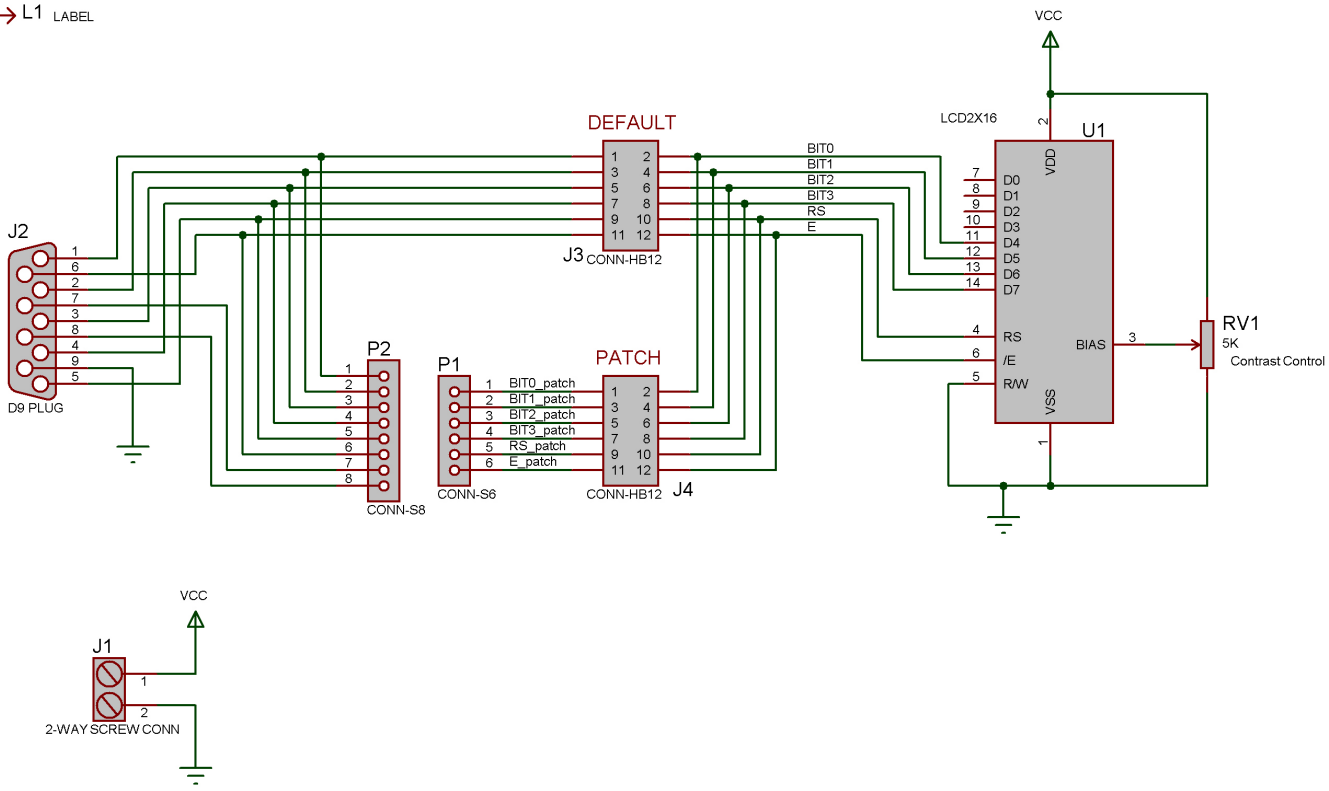
Circuit diagram

THIS SYSTEM INCLUDES:-

- F1 FEET
- F2 FEET
- F3 FEET
- B1 BAG
- L1 LABEL



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