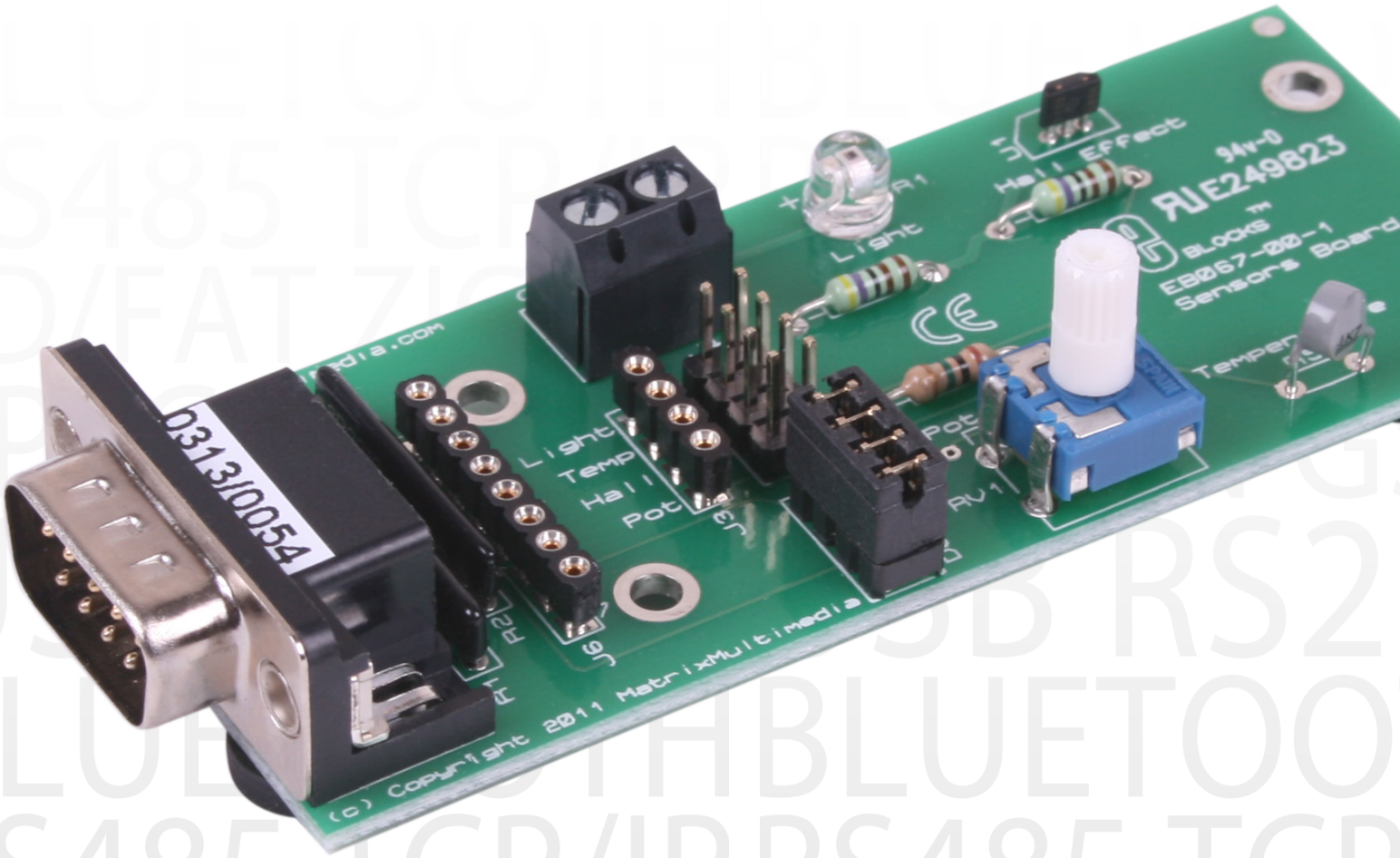
MATRIX

eBLOCKS®

Sensors board



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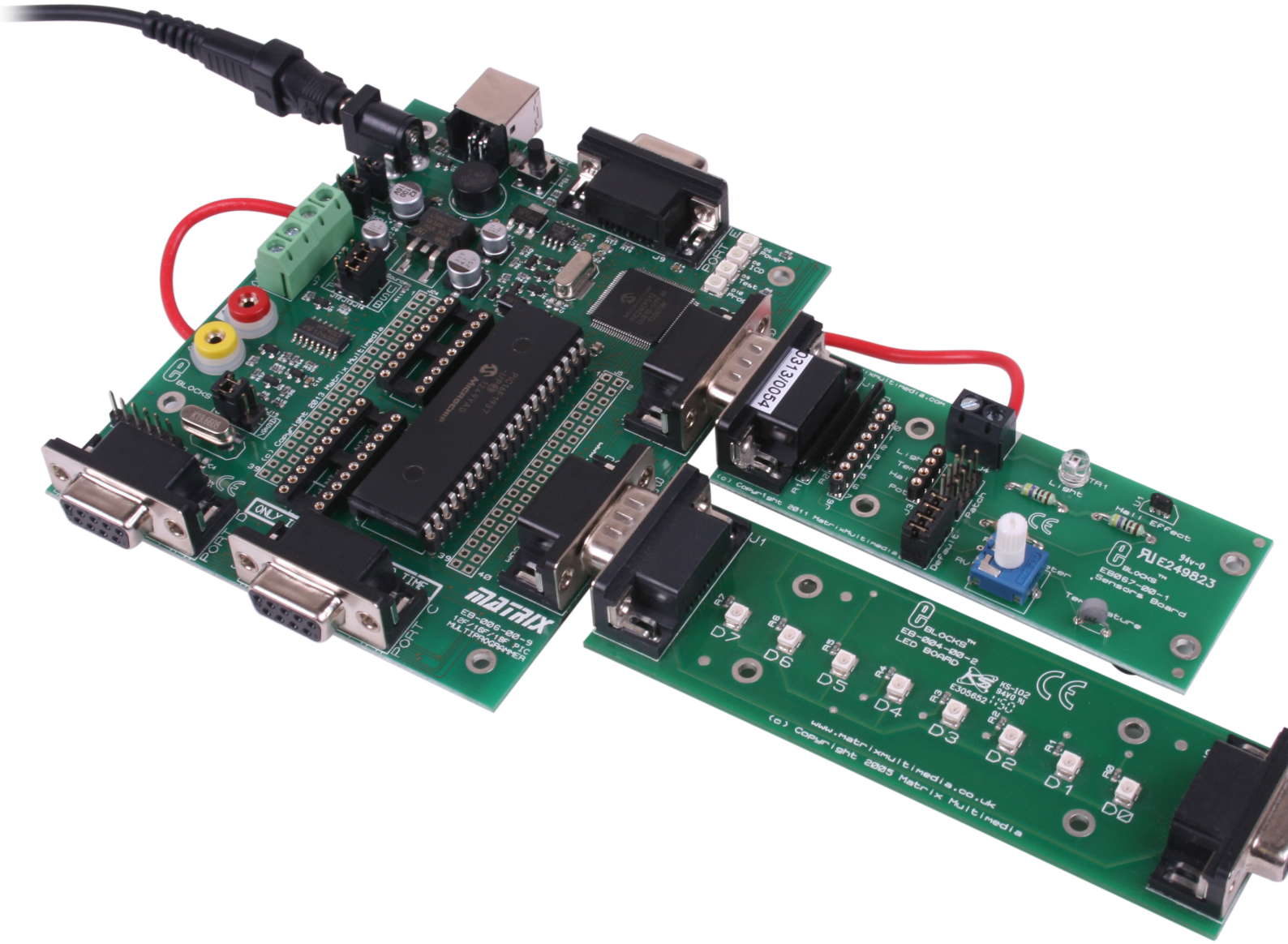


About this document

This document concerns the EB067 E-blocks sensors board.

1. Trademarks and copyright

PIC and PICmicro are registered trademarks of Arizona Microchip Inc. E-blocks is a trademark of Matrix Technology Solutions Ltd.

2. Disclaimer

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

3. Testing this product

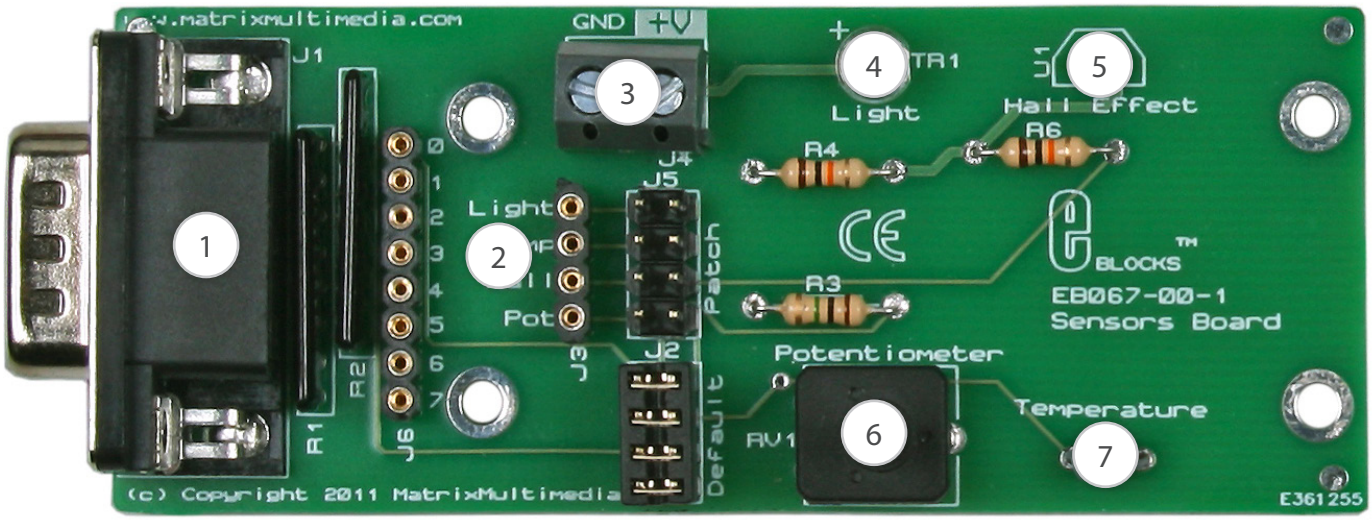
It is advisable to test the product upon receiving it to ensure it works correctly. Matrix TSL provides test procedures for all E-blocks, which can be found in the Support section of the website.

4. Product support

If you require support for this product then please visit the Matrix TSL 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. Patch system
3. +5V input voltage screw terminal
4. Phototransistor light level sensor
5. Hall effect magnetic field sensor
6. Potentiometer rotation sensor
7. NTC thermistor temperature sensor

General information

Sensors make up a large percentage of microcontroller applications as they allow for real world measurements to take place thus feeding data about the surrounding environment to allow decisions to be made. The E-block sensors board incorporates 4 distinct types of analogue sensor into an easy to use package allowing for experimentation or practical exercises to be achieved. Each of the sensors return a reading as an analogue voltage which can be between 0v and 5v.

1. Features

- Phototransistor - light level sensor
- NTC thermistor - temperature sensor
- Hall effect - magnetic field sensor
- Potentiometer - rotation sensor
- E-blocks compatible.

Testing this product

The following instructions describe the test procedure for the EB067-00-1 Sensors board.

1. System Setup

Multi-programmer board (EB-006) with:

EB006 Options	Setting
Power supply	External, 14V
PICmicro device	16F877A
SW1 (Fast/Slow)	Don't care
SW2 (RC/Xtal)	Xtal
Xtal frequency	19.6608MHz
Port A	Sensors Board EB067
Port B	LCD Board EB005
Port C	
Port D	
Port E	
Test program	Sensors.HEX

2. Test procedure

- Connect EB067-00-1 (Sensors board) to PORTB of the Multiprogrammer.
- Connect USB cable to computer.
- Ensure 13.5V power supply is working correctly.
- Connect a wire from the +V screw terminal of the Multi-programmer to 5V terminal of Sensors board.
- Open mLoader.
- In mLoader open file Sensors.HEX.
- In mLoader click on "Send" icon. A pop up window will inform you of status. If status is ok a "Program Sent And Verified" window will be observed on the screen
- Reading for each sensor will appear on the screen of the LCD board.
- Use your hand to cast a shadow on the light sensor and check the value on the LCD is changing accordingly.
- Move a magnet past the hall effect sensor and check the value on the LCD is changing accordingly.
- Rotate the potentiometer and check the value on the LCD is changing accordingly.
- Hold the temperature sensor and check the value on the LCD is changing accordingly.

If all the sensors are returning values that are changing as the surrounding conditions change then the sensors board has passed testing.

Circuit description

The EB067 Sensors board circuit diagram can be seen on page 6.
The circuit for the Sensors board can be broken up into 5 distinct sections.

1. The patch system

The patch system is designed to allow you to connect any of the sensors to any of the pins on the downstream E-blocks port connector.

The jumper setting marked default connects the sensors up to specific I/O on the E-blocks port.

Sensor	Connection
Light Sensor	Bit 0
Temperature Sensor	Bit 1
Hall Effect Sensor	Bit 2
Potentiometer	Bit 3

The jumper setting marked patch allows you to use single core wire to allow for any sensor configuration to be achieved.

2. The light sensor

The light sensor circuitry uses a TEPT5700 phototransistor to detect the amount of light level present in the surrounding environment. As the amount of light present increases the voltage across the potential divider circuit increases.

3. The hall effect sensor

The hall effect sensor uses a A1301UA-T sensor to detect variations in the surrounding magnetic field. The output voltage from the sensor should be around 2.5V when no magnetic fields are present. Introducing a magnetic field to either side of the sensor allows the voltage to rise and fall in proportion to the applied magnetic field strength.

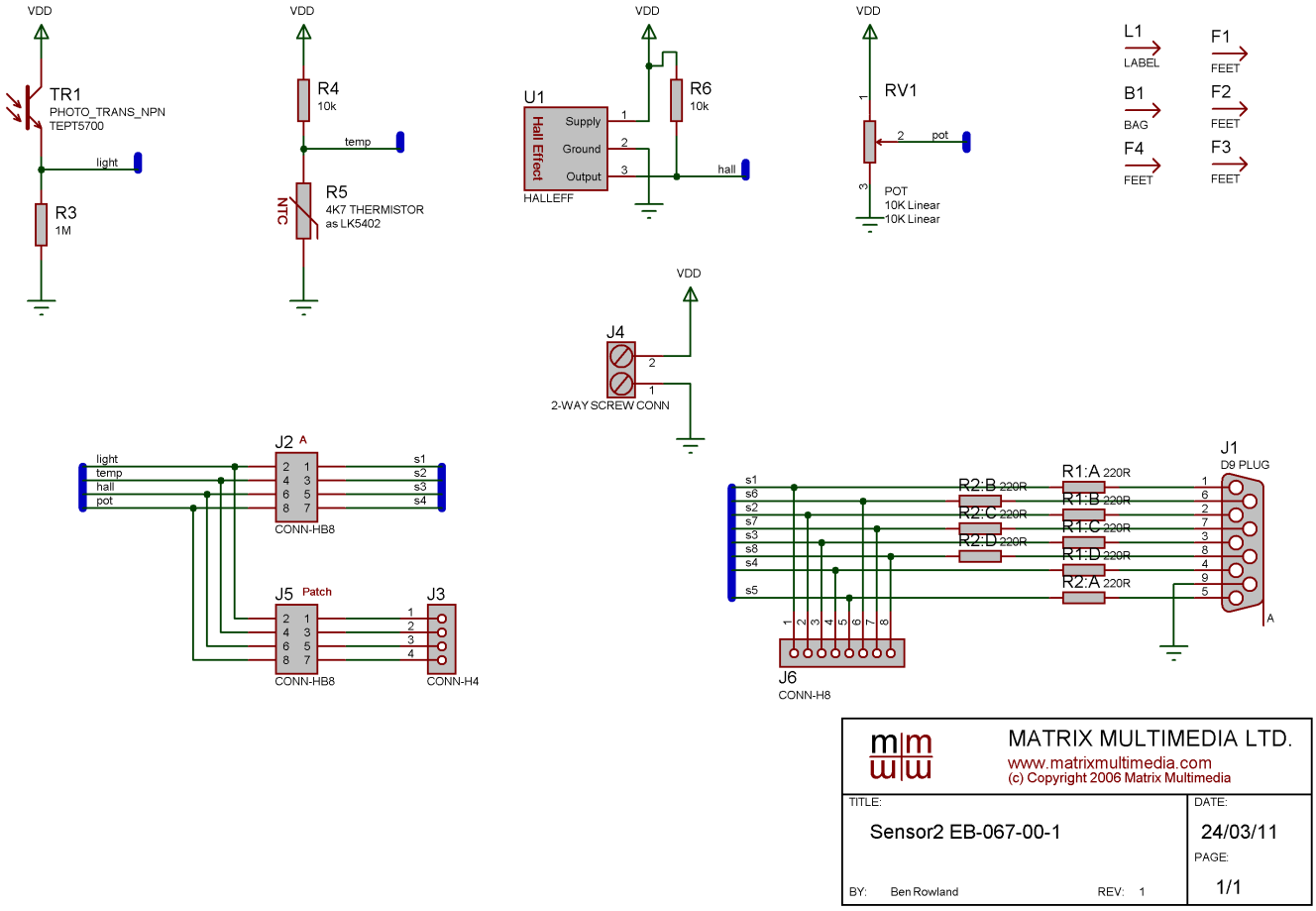
4. The temperature sensor

The temperature sensor uses a B57164K472J 4.7K negative coefficient type thermistor to detect the temperature present in the surrounding environment. The output of the thermistor is not linear so there are mainly two methods employed in order to collect a meaningful reading from the sensor. The first method involves a complex calculation that is performed by the microcontroller each time the temperature output voltage is read. This method can be a bit complicated to achieve as the calculation involves floating point numbers and complex functions such as log and exponent. A second simpler way of achieving the same result is to perform the calculations first on a PC and record output temperature for every reading possible from the sensor. Storing these pre-calculated values into an array on the microcontroller allows the microcontroller to find the answer without having to ever perform the complex calculation. An example of this second type of sensor reading is available on the Matrix Technology Solutions website along with the board test file.

5. The rotation sensor

The rotation sensor is simply a variable resistor that creates a potential divider between 0v and 5v. Turning the potentiometer adjusts the ratio of the potential divider circuit, which in turn controls the voltage going to the microcontroller.

Circuit diagram



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