

EBLOCKS[®]

Sensor board & modules



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About this document

This document concerns the E-blocks EB090 sensor board and all associated sensor modules (EBM002 - EBM021).

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2. Disclaimer

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

3. Product support

For further information, please visit the Matrix website which contains many learning resources, examples and support. 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 product better.
- Example files and programs.
- Ways to get technical support for your product, either via the forums or by contacting us directly.

General information

This range of sensor modules are primarily designed for use with the e-block EB090 sensor carrier board. They can however also be easily used in other projects due to the use of standard 0.1" pitch connectors.

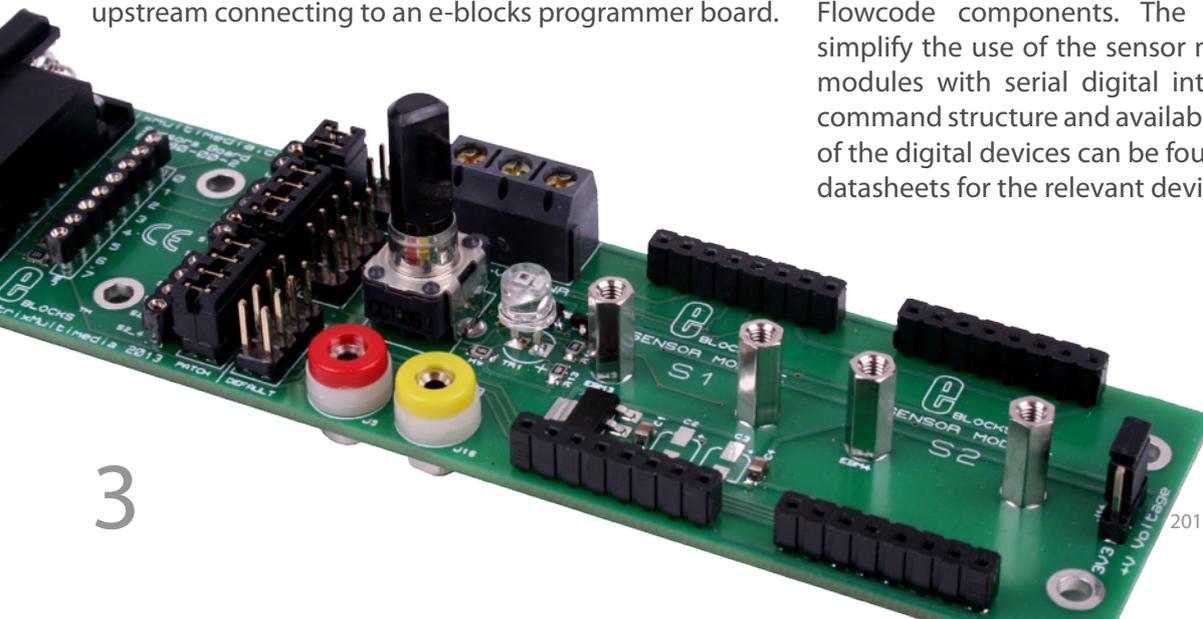
All the boards share a common pin-out structure and can be mounted in either socket 1 or socket 2 of the carrier board. They can be inserted either way round as the carrier board repeats the same connections on opposing sockets.

The e-block carrier board provides ease of connection of the various signals of the sensor modules via the jumper selectors to the 9 way D connector for upstream connecting to an e-blocks programmer board.

Depending upon the application and the process port connected to, the jumper settings may need changing from their default position to use the patch wiring system.

Sensor modules are designed to work with 3.3v or 5v systems (on the +V terminal), but please ensure that the voltage selector (J14) on the EB090 E-block is set correctly. Some of the sensor modules also require a power supply to the VPWR connector. This is usually supplied from the programmer board VPWR output and is nominally 9v to 12v (positive DC relative to GND).

Software to drive the sensor modules is available as Flowcode components. The Flowcode components simplify the use of the sensor modules, particularly the modules with serial digital interfaces. In addition the command structure and available internal register values of the digital devices can be found in the manufacturers' datasheets for the relevant devices.



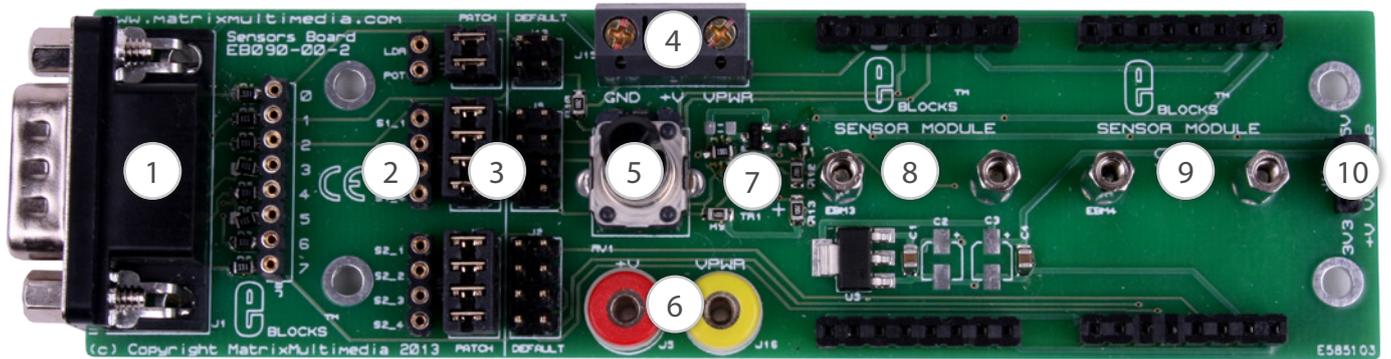
EB090 - Sensor board

The sensor board allows you to connect a range of digital or analogue sensors to any of the I/O ports on the E-blocks upstream boards. In addition to the onboard photodiode and variable resistor, the board has two sockets for use with a range of sensor modules, ranging from simple temperature sensors to digital compass and gyroscopes.

1. Features

- E-blocks compatible
- Extensive range of plug in sensor modules
- Onboard potentiometer
- Downstream D-type connector
- Compatible with most I/O ports in the E-blocks range
- Easy to develop programming code using Flowcode icons
- Vernier sensor module available to extend the range of external sensors

Board layout



1. 9-way D-type plug
2. Patch system
3. Patch selection jumpers
4. Power screw terminals (+V = Processor interface voltage, VPWR = Power supply, nominally 9V)
5. Potentiometer
6. Power sockets (2mm)
7. Light sensor
8. Sensor module socket 1
9. Sensor module socket 2 (Sensor modules can be inserted either way round)
10. Processor interface voltage selector

Circuit description

The circuit consists of four main devices. The board has a photodiode to enable quick analogue light measurements. RV1 is a potentiometer that can provide a varying analogue voltage. This can be used to quickly simulate any sensor input. There are two sockets, having identical pairs of receptacles that accommodate one or two sensor modules from the available range. J4 is used to connect all analogue sensors. There is also a screw terminal that is included on all E-blocks that allows you to connect +V and GND to the system. Additionally the Vpwr connector provides for higher voltage for some sensor boards.

1. Patch system

The sensor board, like all E-blocks, is designed with flexibility in mind. Therefore the sensor board can be used with any upstream processor board. To facilitate this, a patch system has been used on the board. This patch system allows the user to either select the default setting of the board (generally used for PICmicro® microcontrollers where - on many devices - the lowest 5 bits on port A and all A/D inputs) or to wire the connector to any pin of the D-type connector that they require

using individual wires.

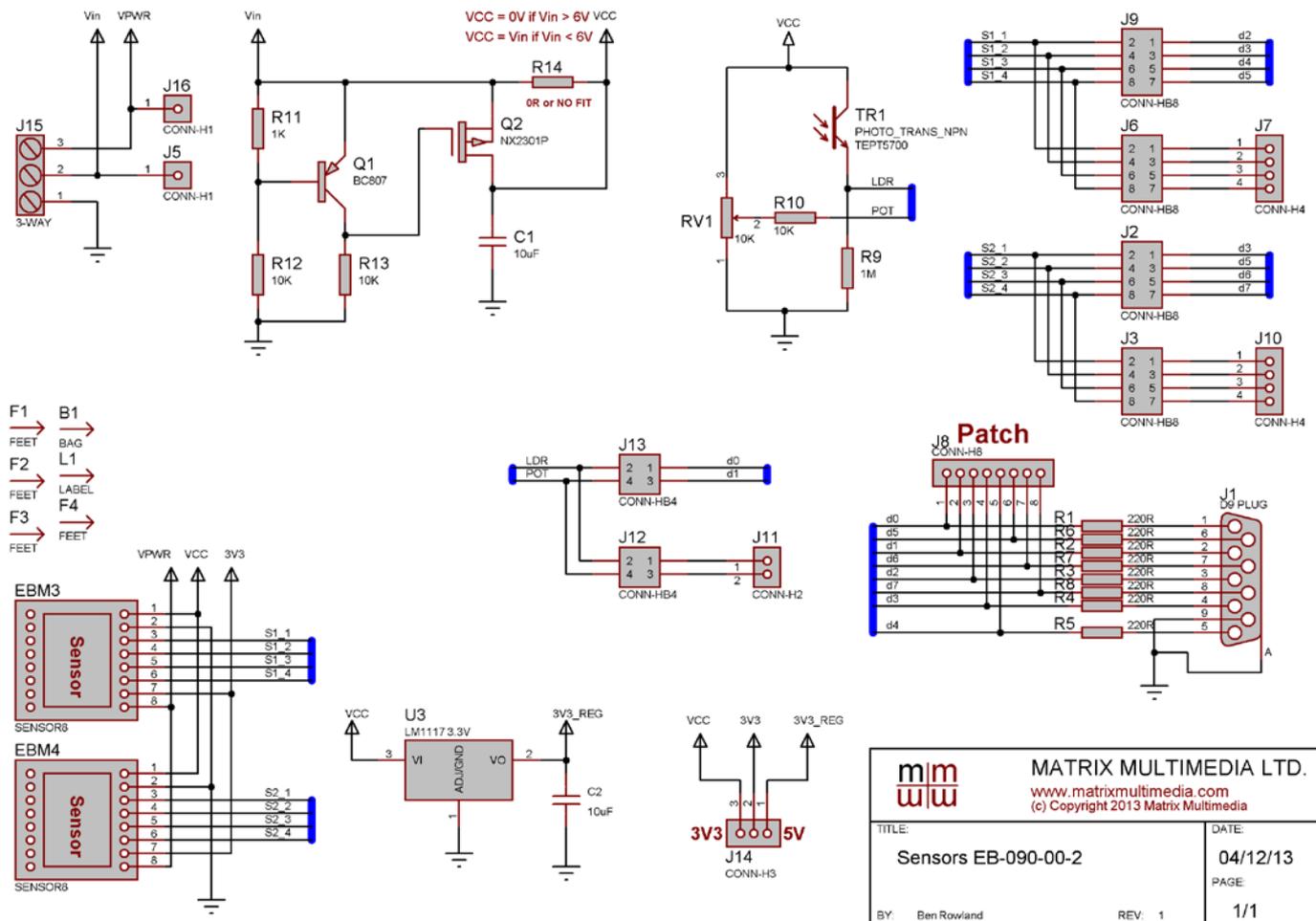
2. Default settings

To use the default setting of the sensor board, the jumper links should be placed on header pins J5. This is labelled "DEFAULT" on the actual PCB. The following table shows the connections for the default jumper setting.

D type (J1)	Main board	Socket 1	Socket 2
Bit 0	Phototransistor		
Bit 1	Potentiometer		
Bit 2		S1_1	
Bit 3		S1_2	S2_1
Bit 4		S1_3	
Bit 5		S1_4	S2_2
Bit 6			S2_3
Bit 7			S2_4

3. 3.3V operation

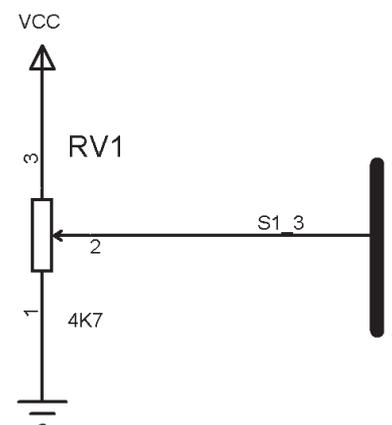
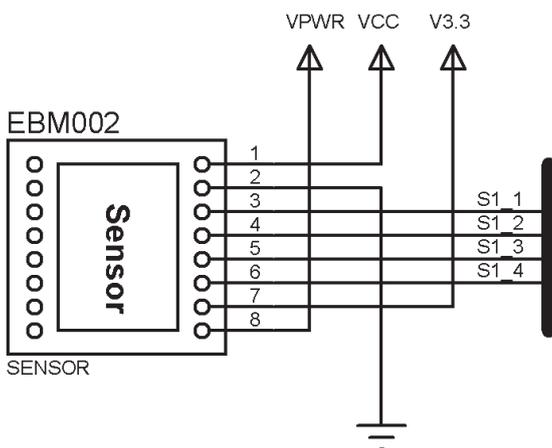
The photodiode and variable resistor will operate satisfactorily when the voltage supplied to the board is 3.3V.



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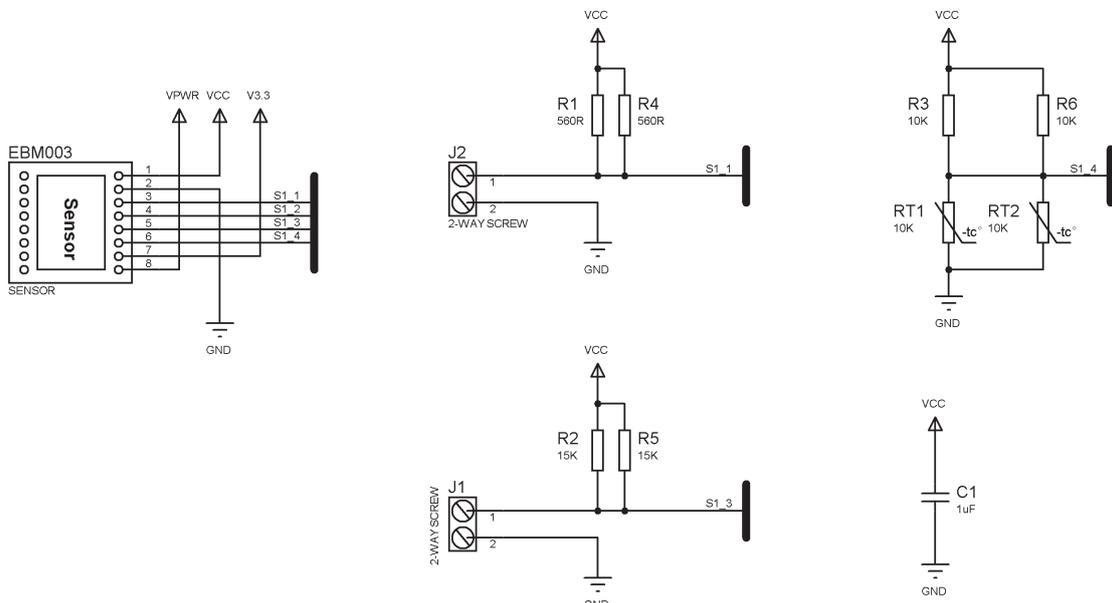
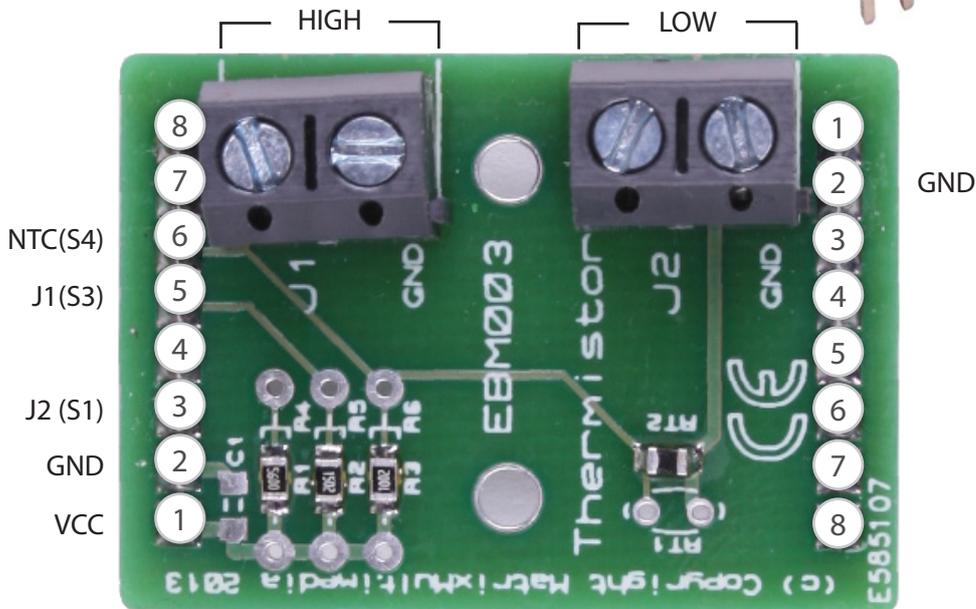
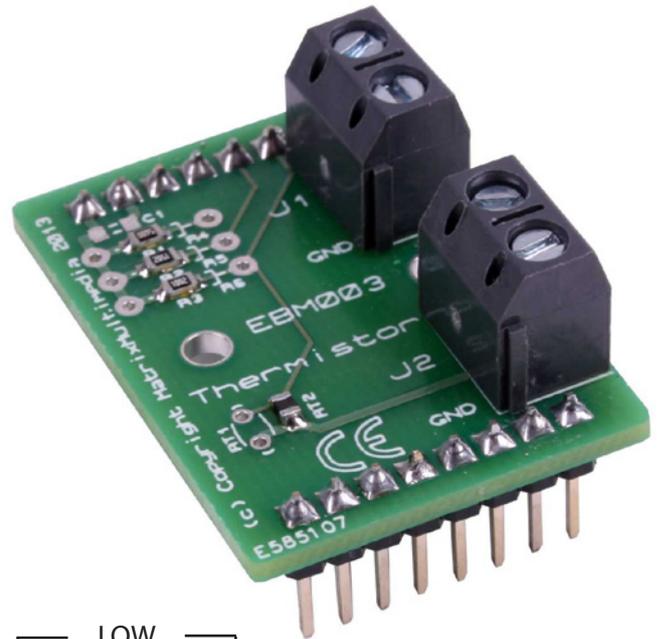
EBM002 - Potentiometer

This board consists of a standard shaft rotary potentiometer that provides a linear voltage output ranging between the microcontroller power rails. This can be connected to an Analogue to Digital input of the microcontroller in order to provide a control value.



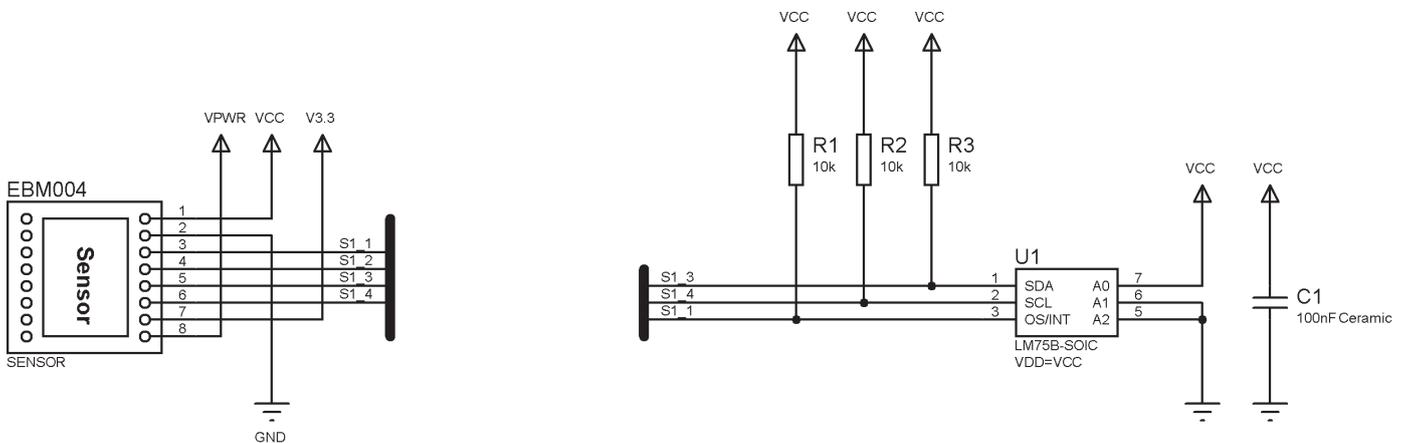
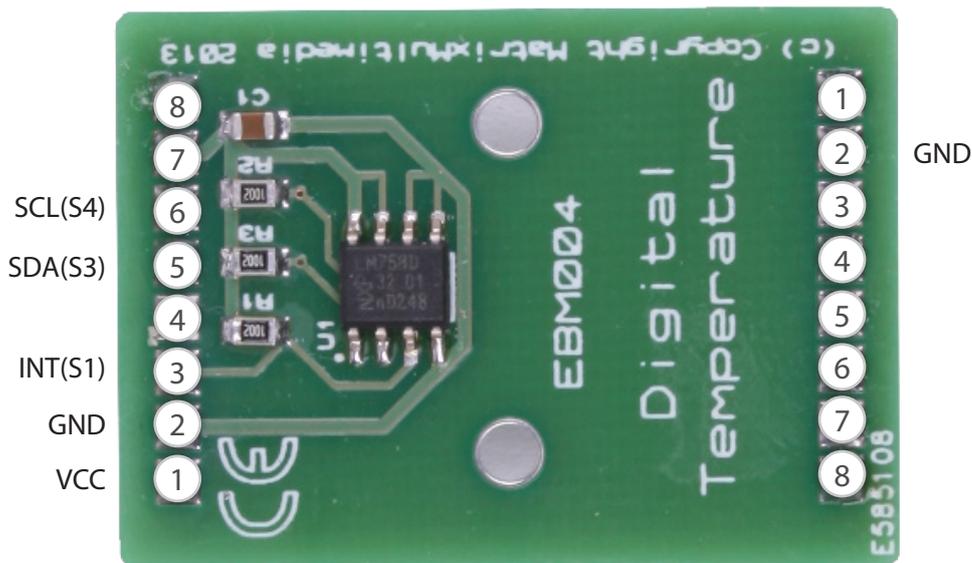
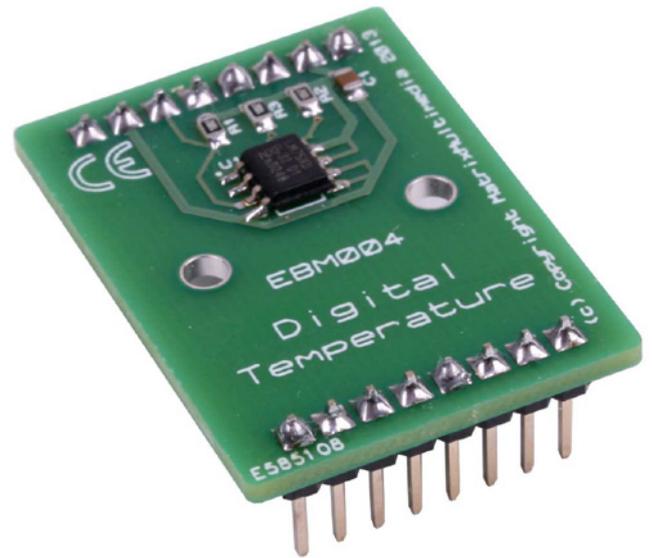
EBM003 - Thermistor

The Thermistor board provides for the measuring of up to three temperature points using thermistors and resistor potential divider circuits, such that temperature measurements can be determined based on the voltages read into Analogue to Digital convertors of the microcontroller. The board provides one on-board 10K NTC (Negative Temperature Coefficient) thermistor together with two screw terminal connection pairs to enable the wiring of up to two external thermistor temperature probes. Connector J1 provides a 15K ohm pull-up resistor and J2 provides a 560 ohm pull-up resistor so as to match to a range of NTC or PTC thermistor probes.



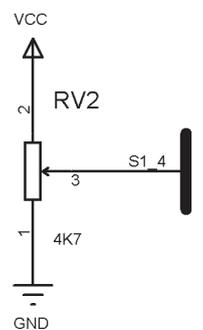
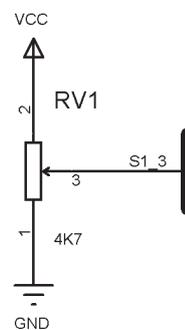
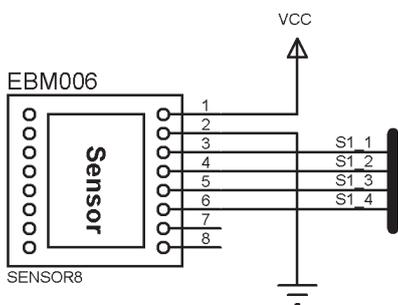
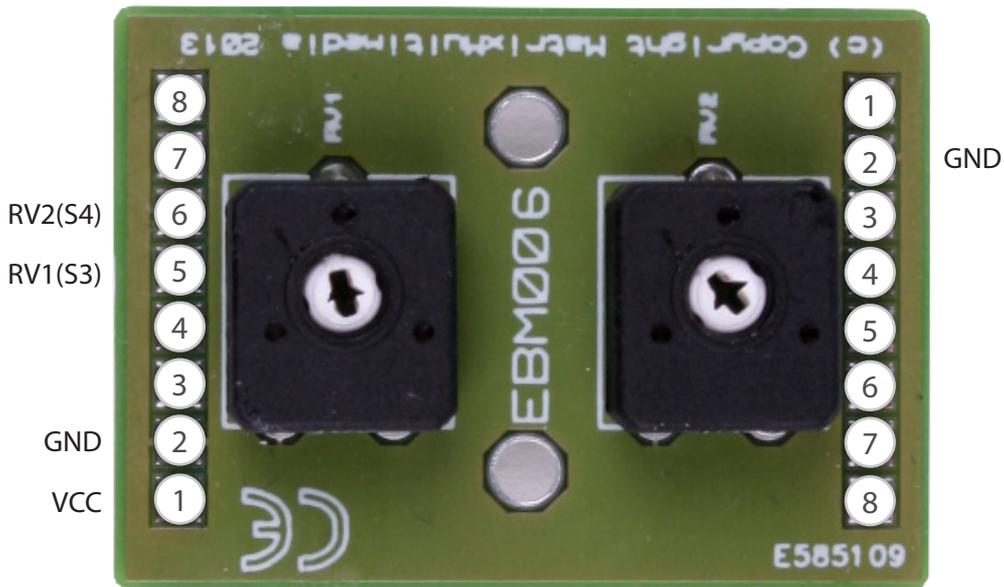
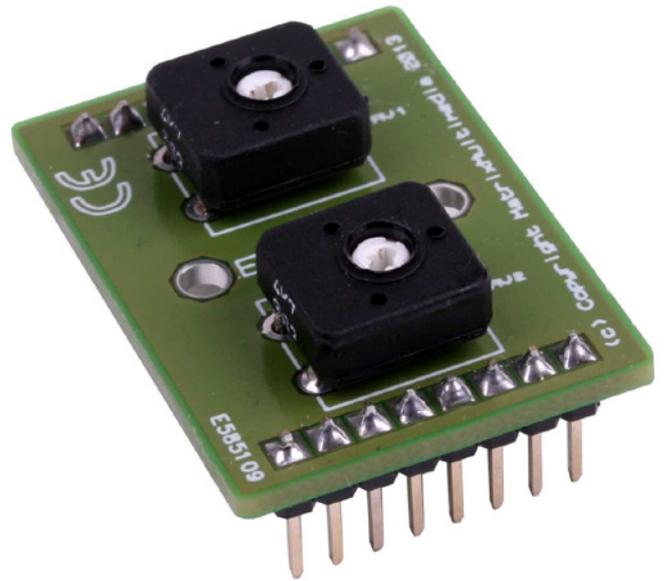
EBM004 - Digital Temperature

This board contains a LM75B Digital Temperature sensor that returns the temperature from an 11 bit ADC via an I²C two wire interface to the microcontroller. Temperature resolutions of 0.125°C can be achieved with an accuracy of up to ±2°C



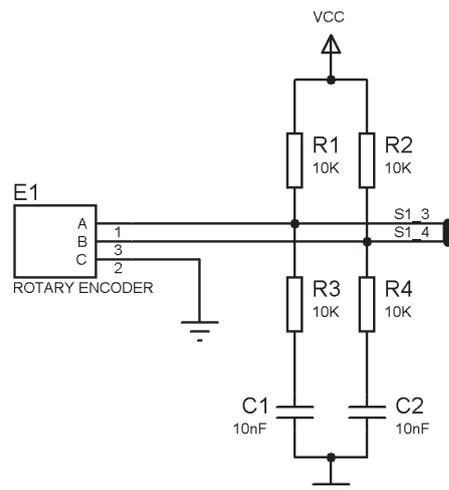
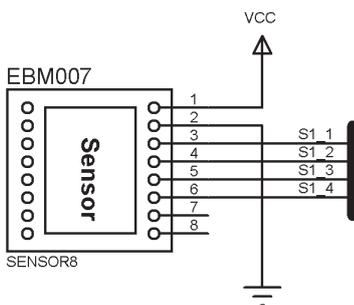
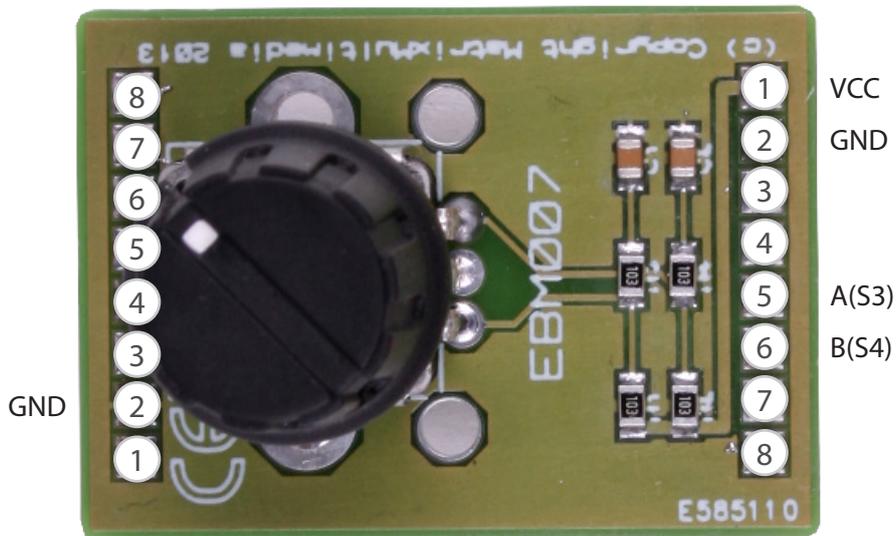
EBM006 - Dual Trimmer

This board provides two screwdriver slotted pre-set rotary potentiometers. These output a linear voltage ranging between the microcontroller power rails, such that they can be connected to Analogue to Digital inputs of the microcontroller in order to provide, for example, calibration or other control values.



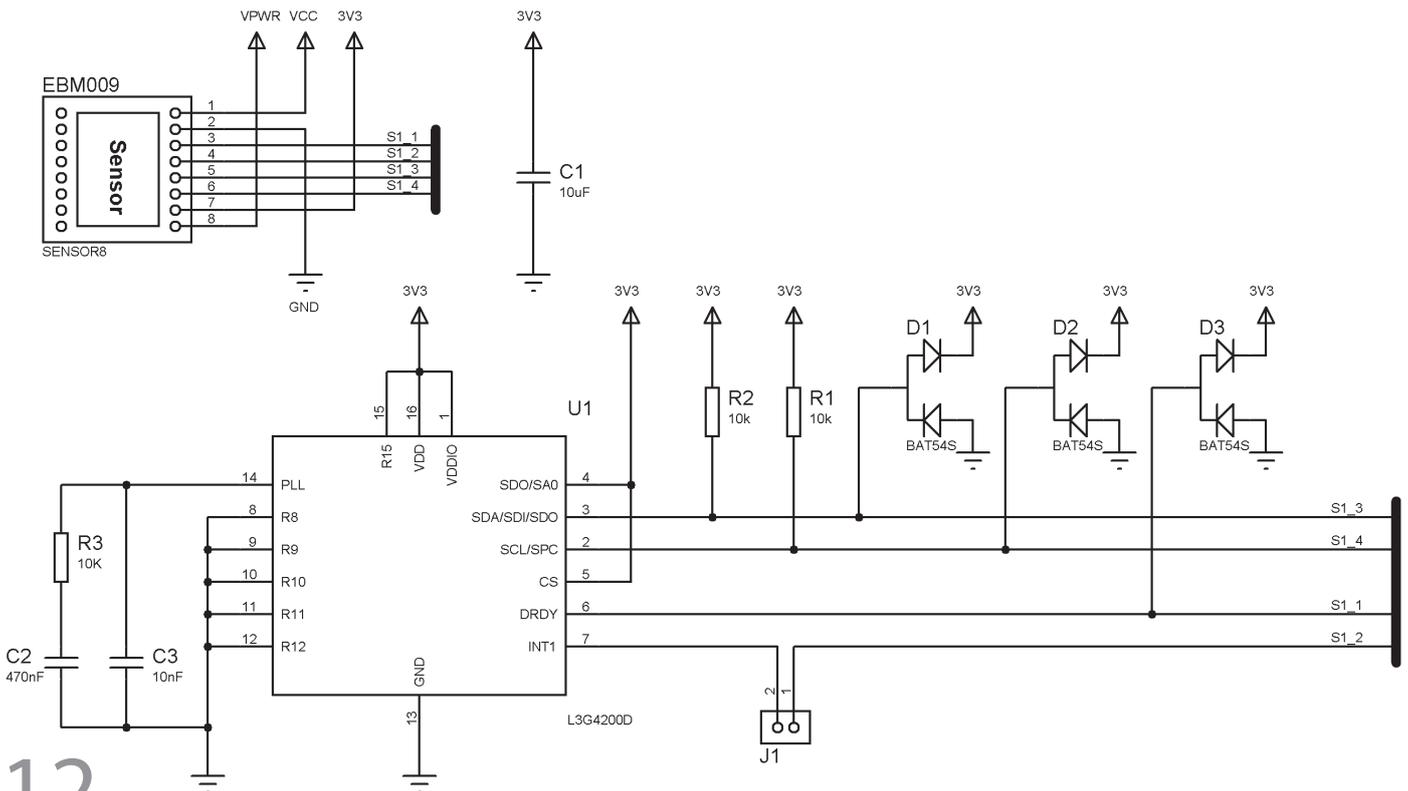
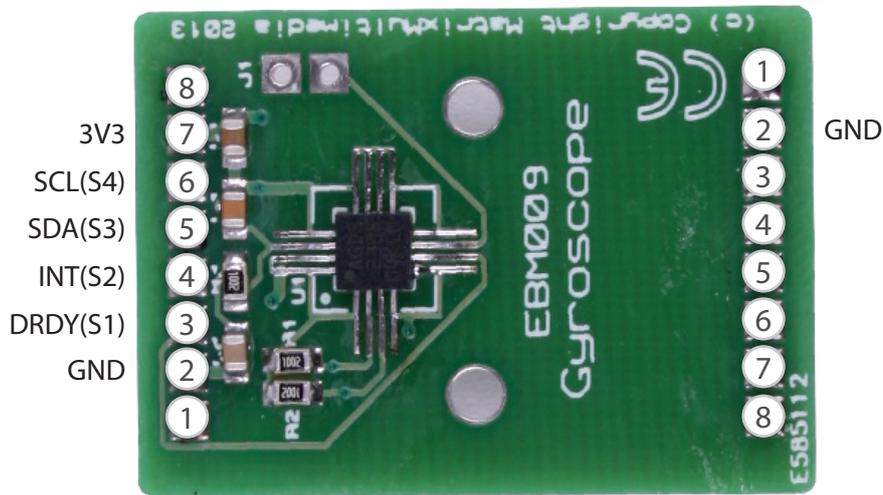
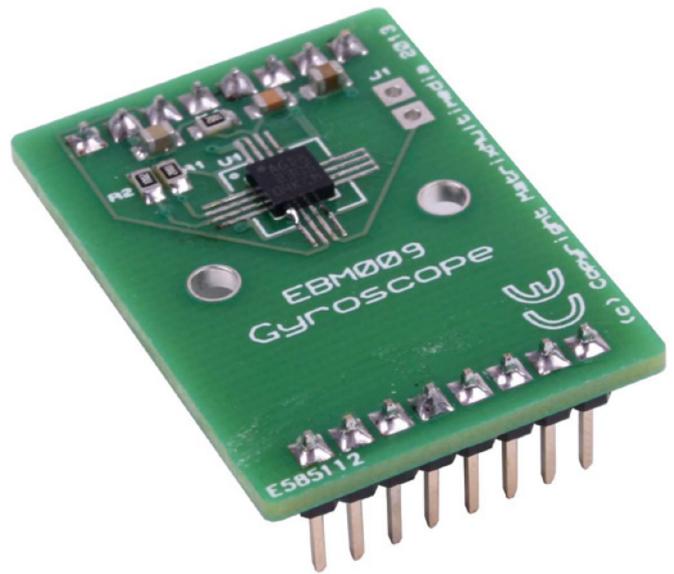
EBM007 - Rotary Encoder

Provides a rotary encoder with dual digital outputs that provide rotation and direction information. When connected to two digital inputs of a microcontroller a "digital pot" can be implemented to convert to digital values.



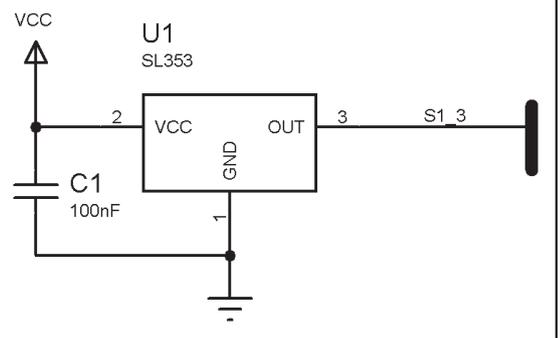
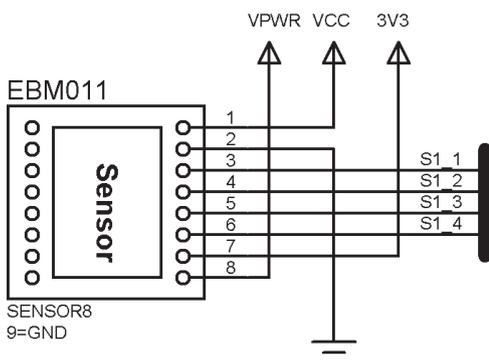
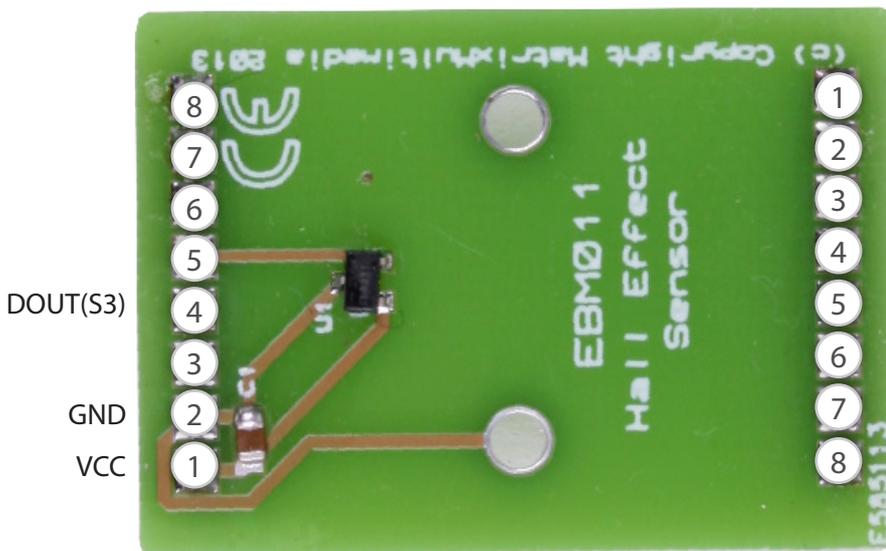
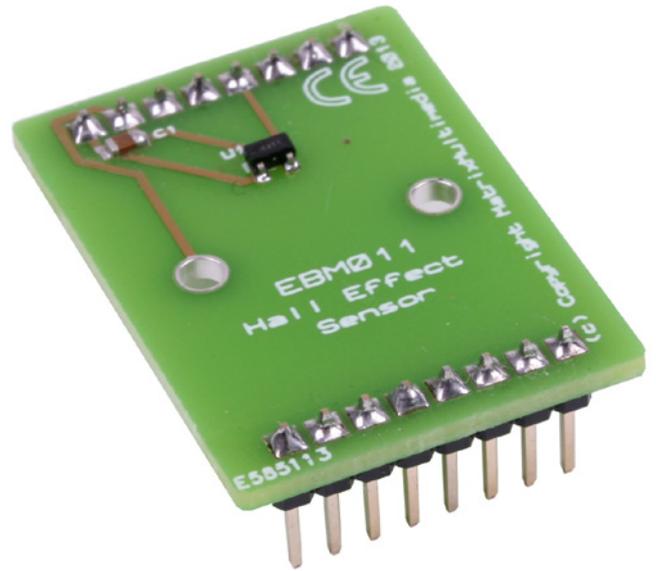
EBM009 - Gyroscope

This board contains an L3G4200D three axis digital gyroscope. Pitch, Roll and Yaw parameter values are read via an I²C interface



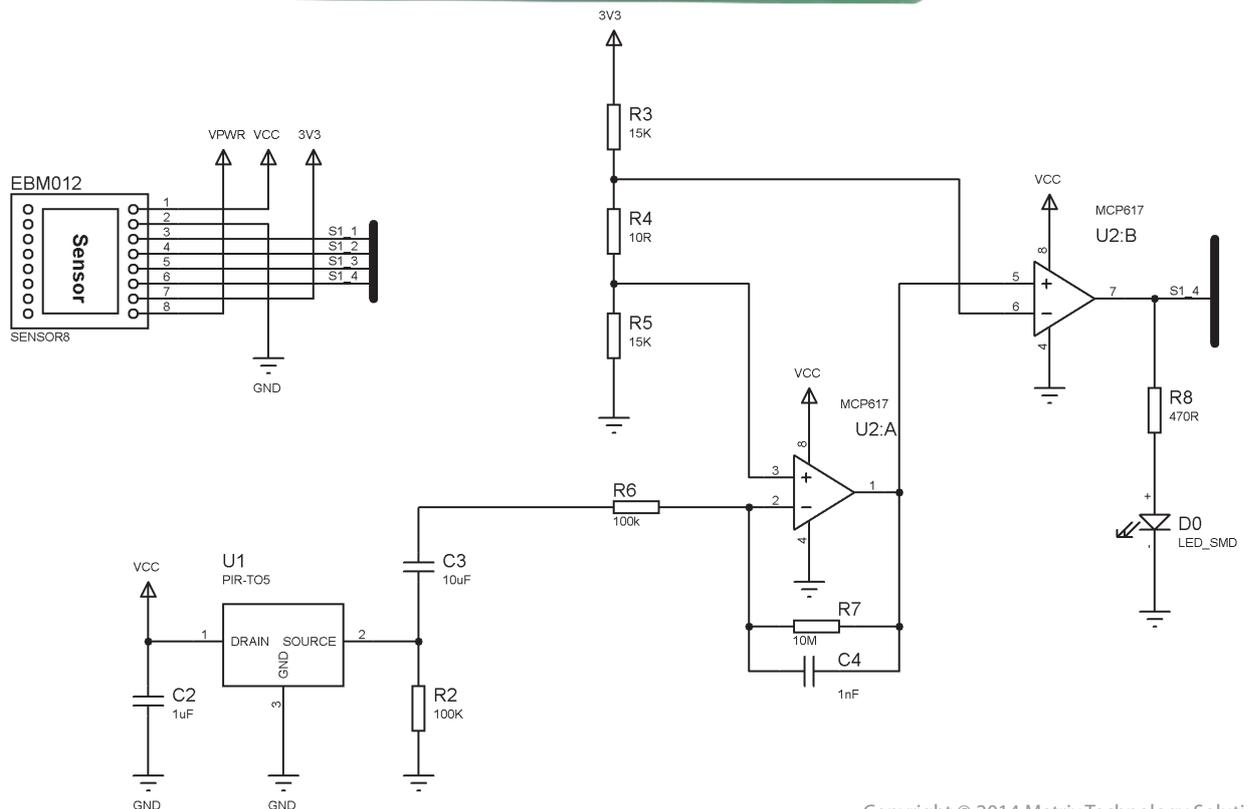
EBM011 - Hall Effect

The board has a Hall Effect sensor that gives a digital output in the presence of a magnetic field (in the region of 60 Gauss) from a permanent magnet or electromagnet, either North or South pole.



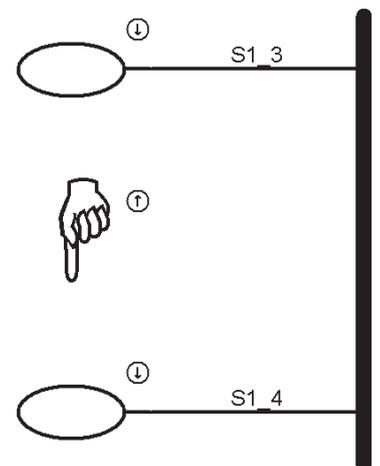
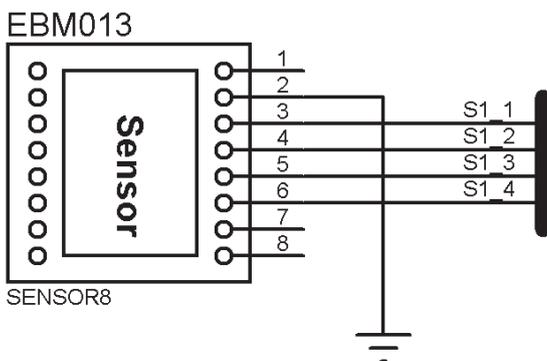
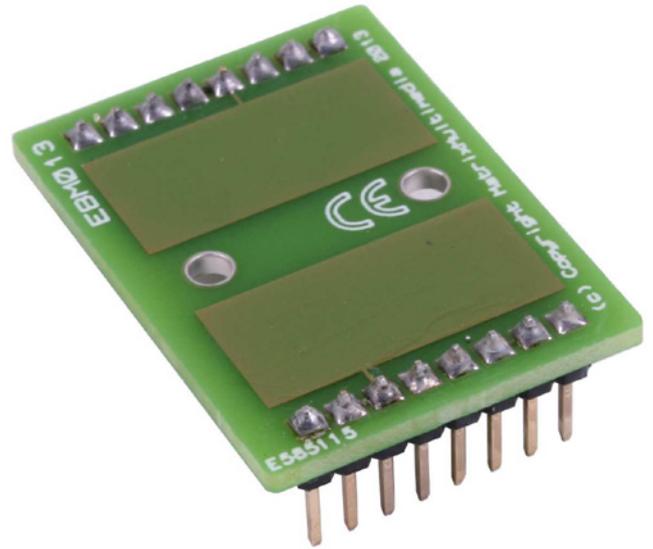
EBM012 - PIR

This Passive Infrared sensor gives a digital output and illuminates an on-board LED when a heat source movement is detected.



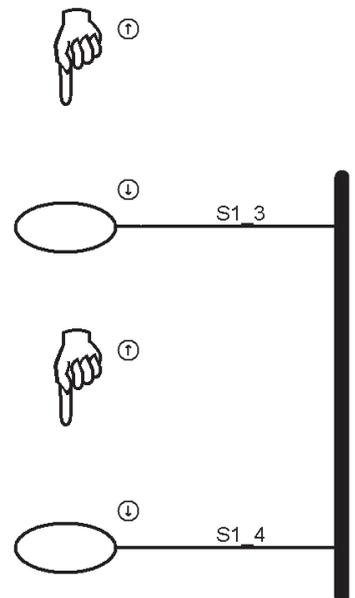
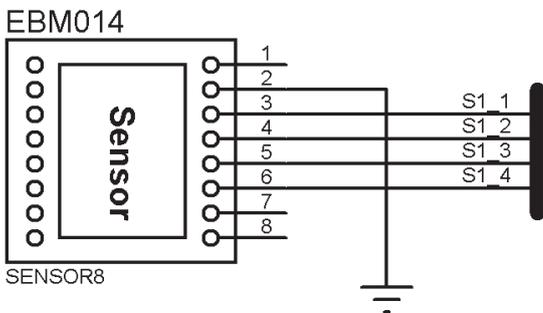
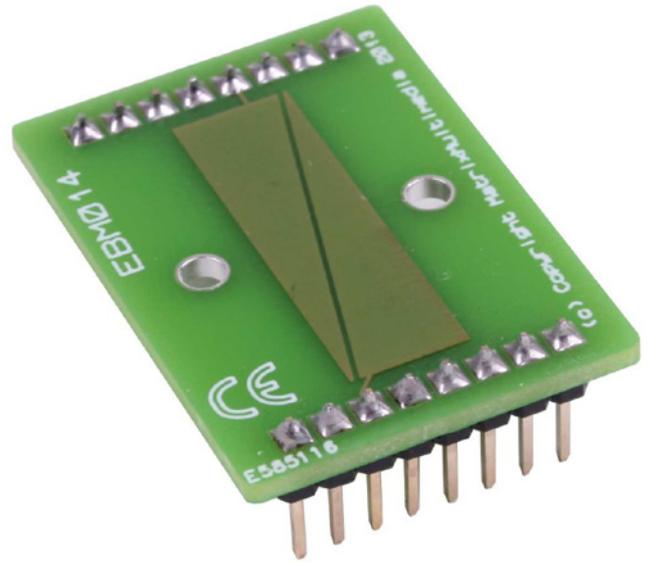
EBM013 - Touch Pads

This board provides two touch areas for use with capacitive sensing. Hence two digital touch switches can be implemented.



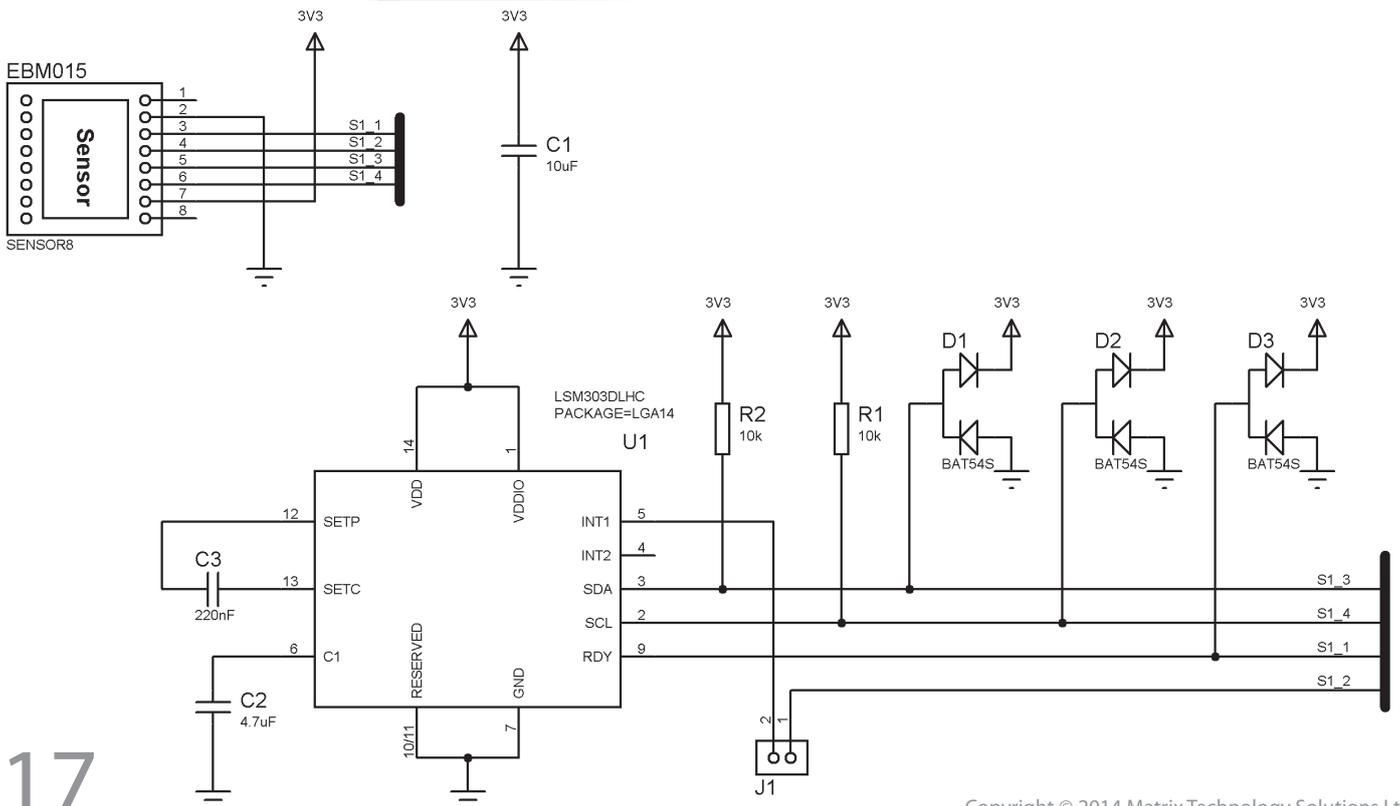
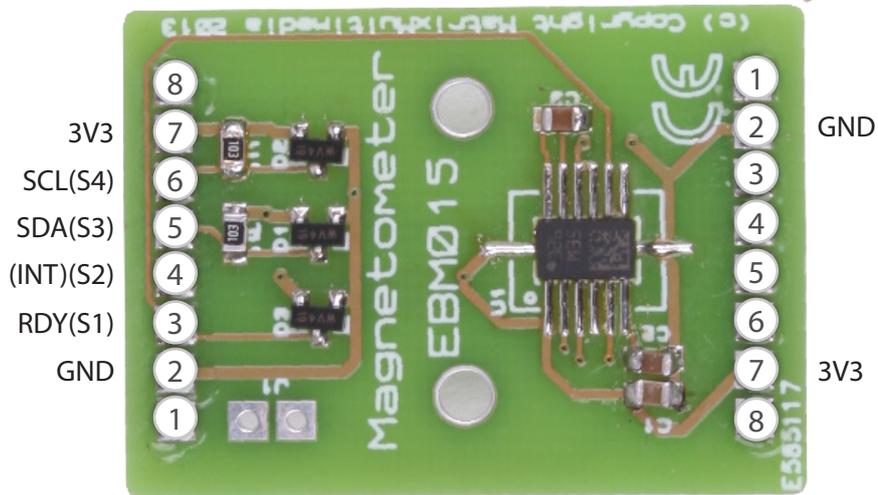
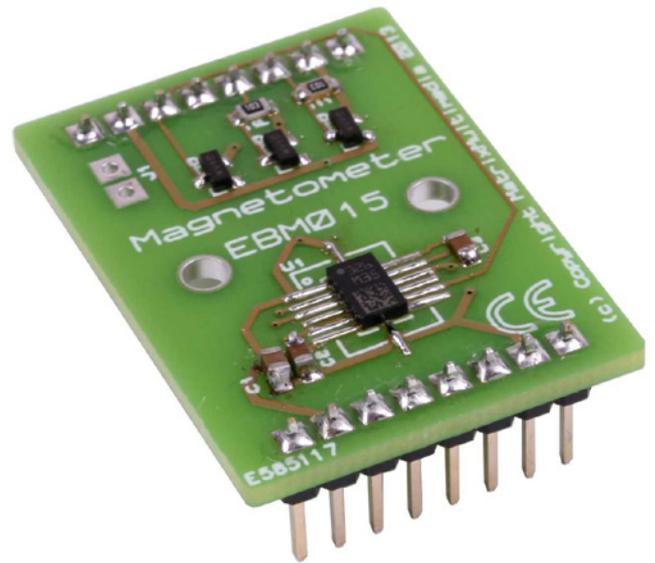
EBM014 - Touch Slider

This board provides a touch area for use with capacitive sensing. A sliding variable value can be determined from the relative touch position along the slider.



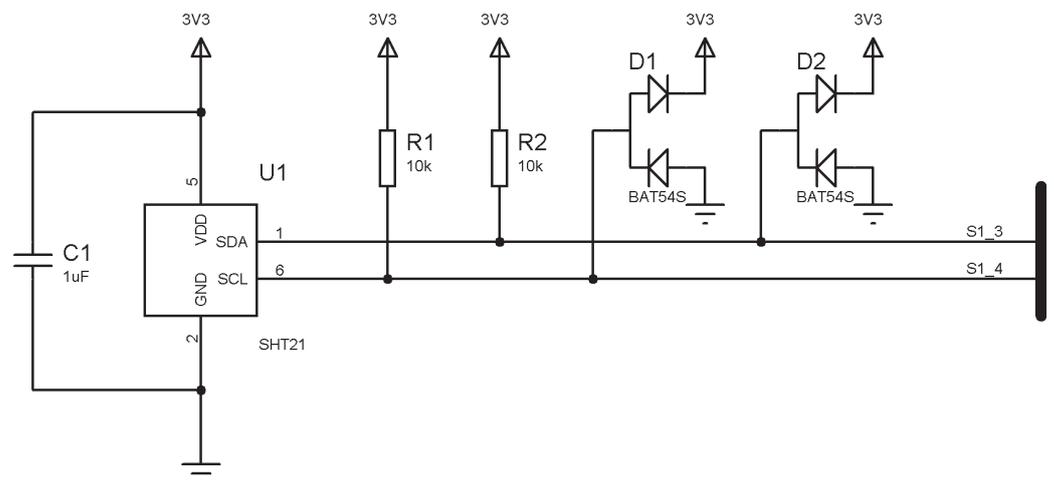
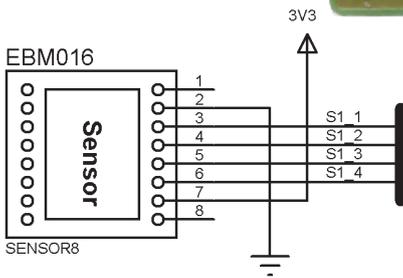
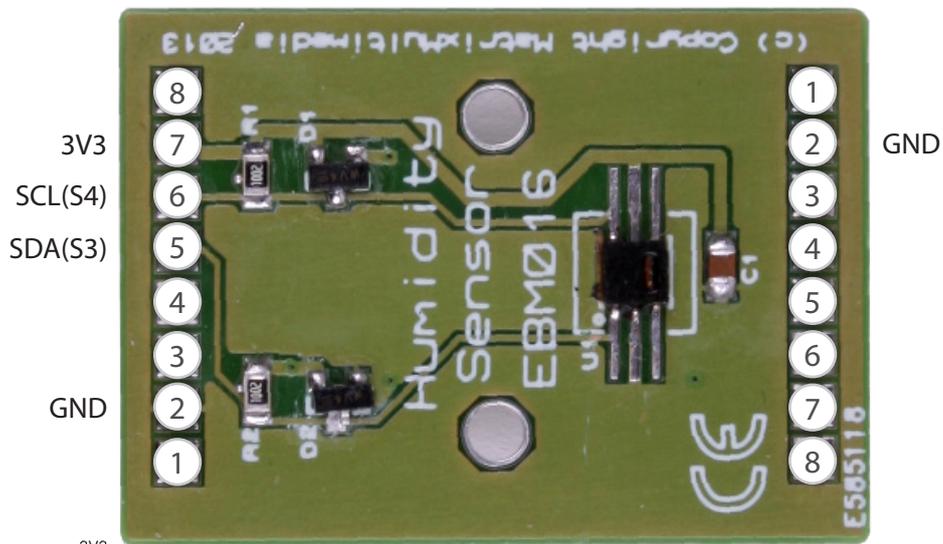
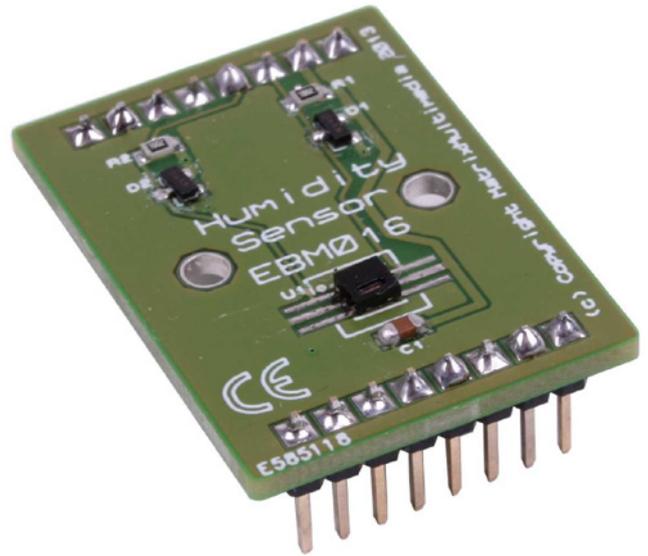
EBM015 - Magnetometer

This board provides an LSM303DLHC sensor device which contains both a digital 3D accelerometer and a 3D magnetometer. All information is available via an I²C interface, such that a high performance e-compass with numerous applications can be implemented.



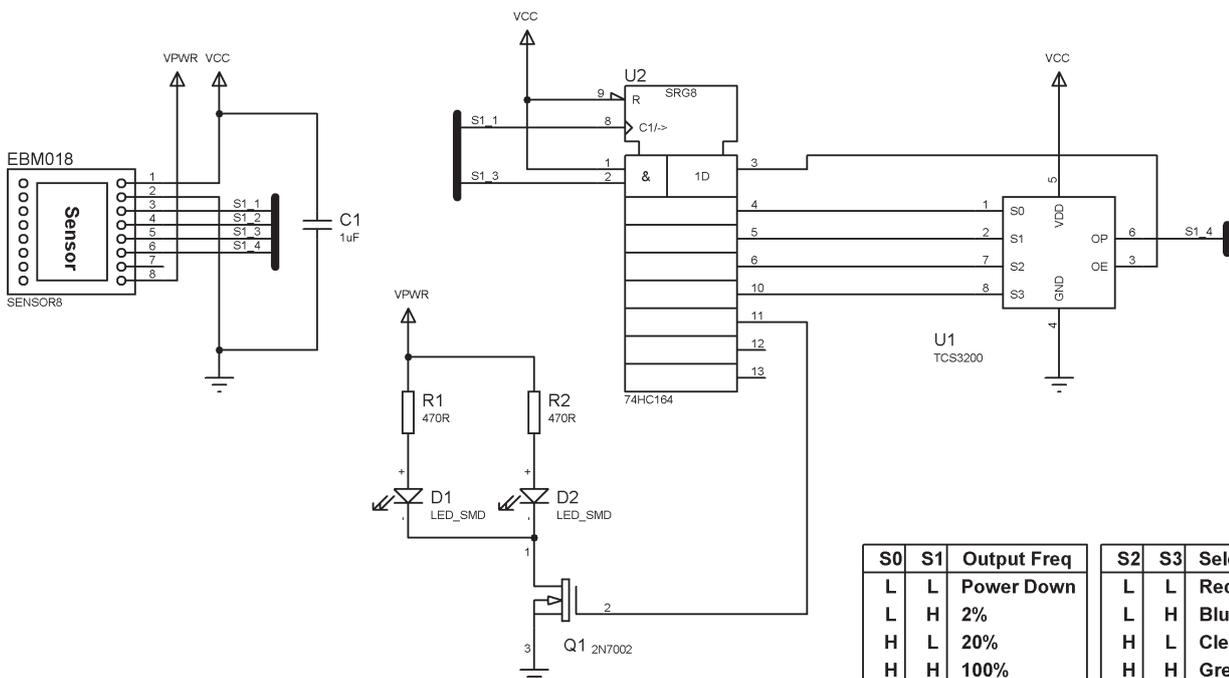
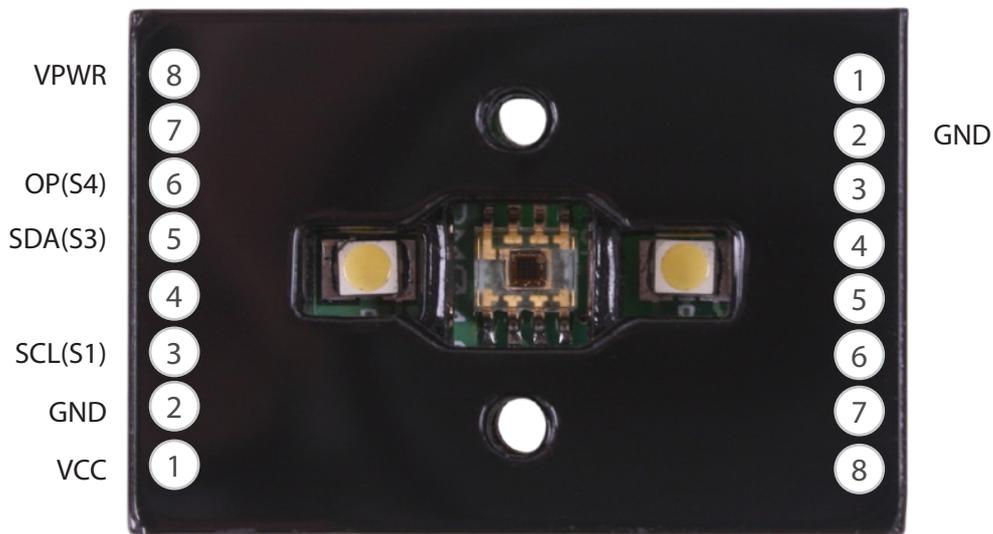
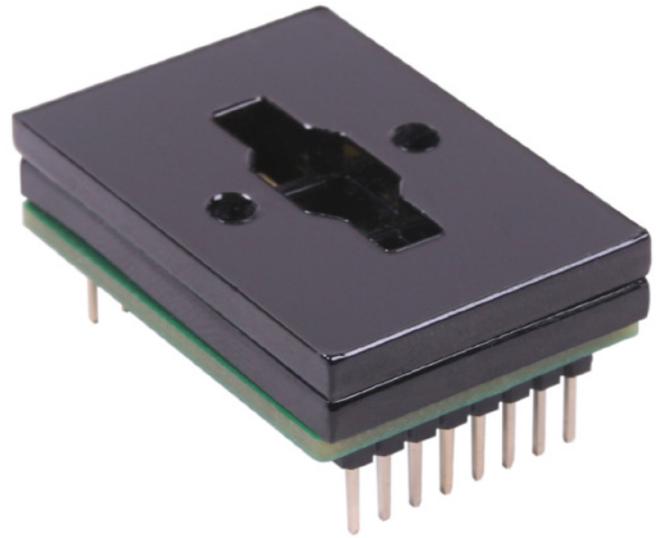
EBM016 - Humidity

This board uses the SHT21 Humidity sensor and provides both digital relative humidity and temperature information via an I²C interface



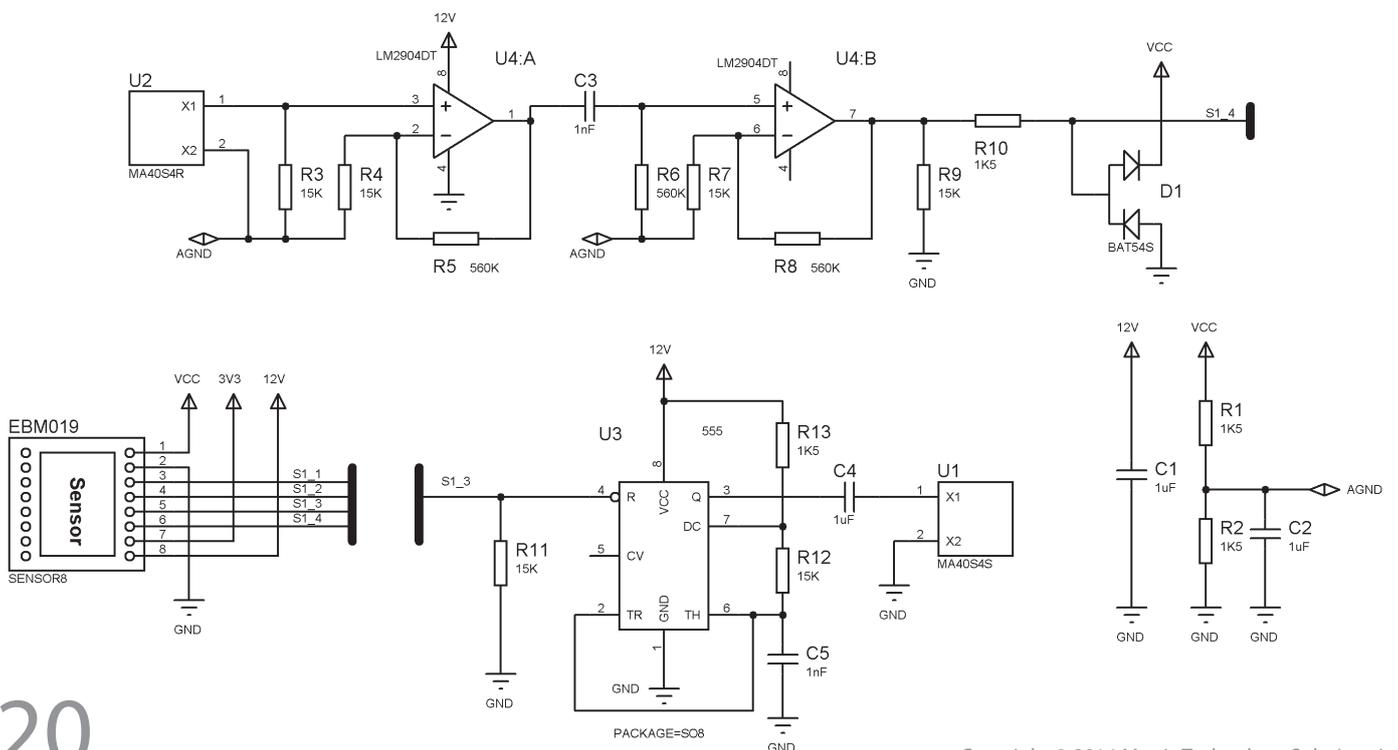
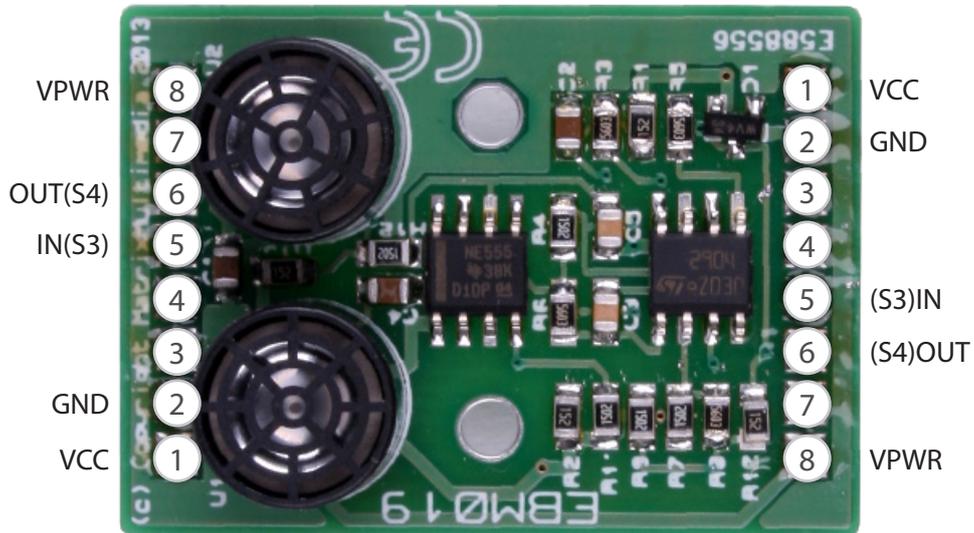
EBM018 - Colour Sensor

The colour sensor provides a digital conversion of incident light intensity in separate values for Red, Green and Blue components. Reflected light can also be measured via use of the on-board white light LED illuminators.



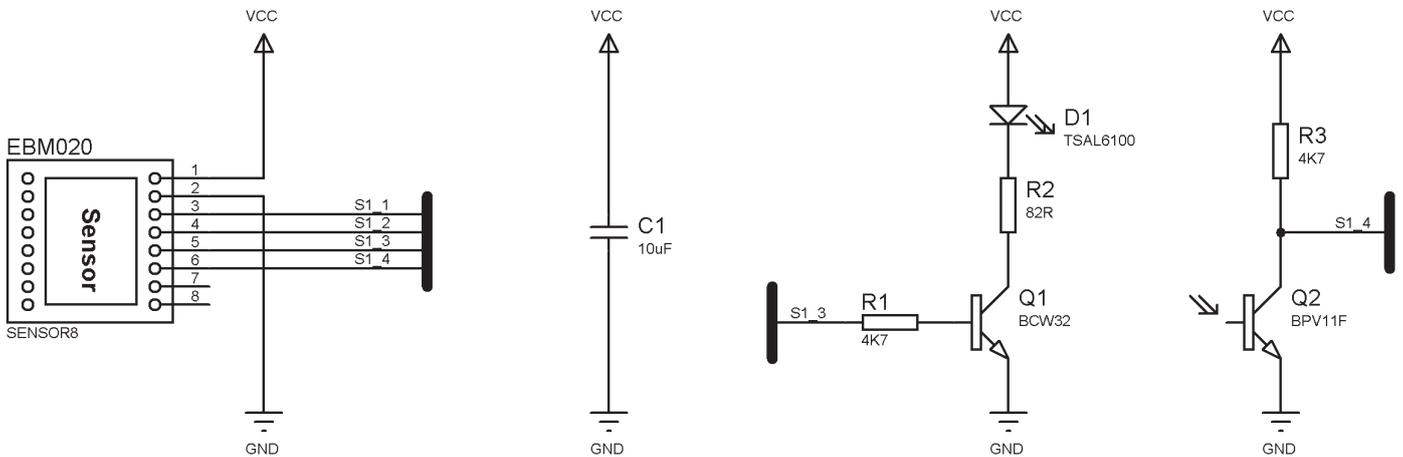
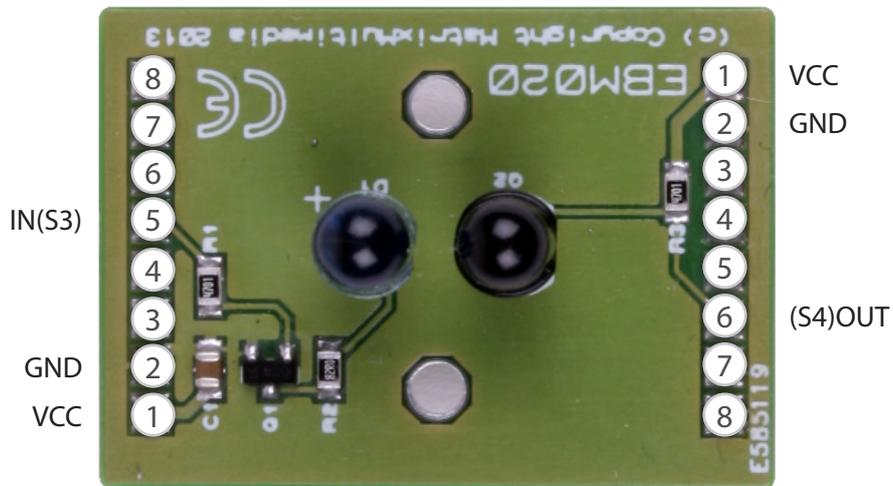
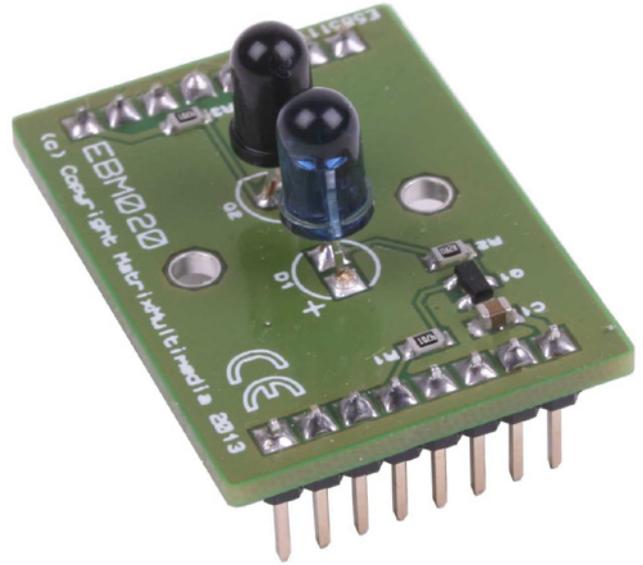
EBM019 - Ultrasonic Distance

This board has both an ultrasonic transmitter and receiver. The transmitter is driven by an on-board 40KHz oscillator which is enabled by the host microprocessor. The receiving sensor signal is amplified and provided as an analogue signal to be processed by a single channel ADC of the microprocessor. By measuring the time delay between enabling a transmit pulse and receiving an echo the distance of objects in a range of around 3cm to 3m can be determined.



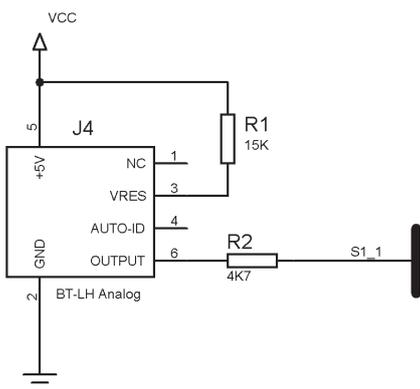
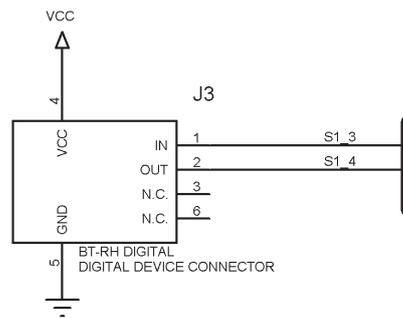
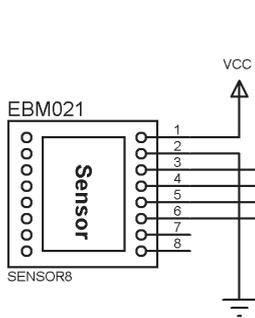
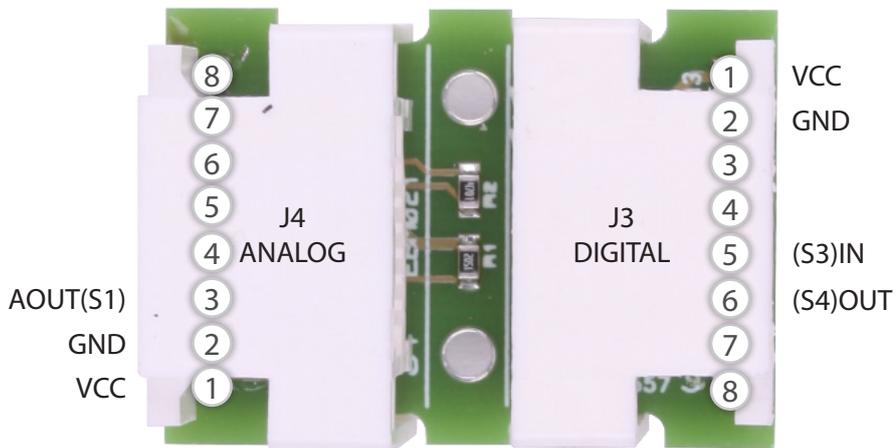
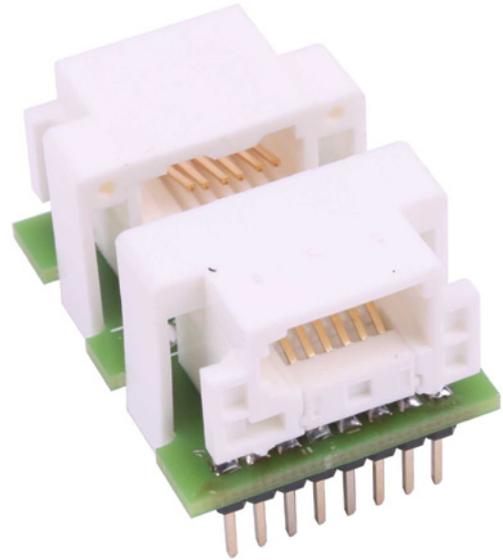
EBM020 - Infrared

The Infrared sensor board contains both an IR transmitter and receiver. The transmitter is enabled via a digital control signal and the receiver provides an analogue output. By enabling the transmitter and reading the variable voltage output of the receiver it is possible to measure the distance of a reflecting object in the region of 1cm to 10cm.



EBM021 - Vernier Socket

The Vernier Socket module allows the connection of a wide range of digital and analogue sensors, ranging from external temperature probes to heart rate monitors.





Matrix Technology Solutions Ltd.
The Factory
33 Gibbet Street
Halifax, HX1 5BA, UK

t: +44 (0)1422 252380
e: sales@matrixtsl.com

www.matrixtsl.com

EB090
EBM002 - EBM021