MultiSensor

Digital measuring unit including an *accelerometer*, *gyroscope*, *magnetometer*, *barometer* and *thermometer*.

Output: Bluetooth, UART, I²C.

Features

- 16-bit I²C output interface
- Float, two decimal – for XBee modules
- UART & Bluetooth output interface 115200 b/s
- 6 user IO pins brought out to header
- 72 × 49 × 10 mm size
- 68 × 40 mm center PCB mounting holes: 0.118″ diameter
- Supply voltage: 3.3 V (UART) and 5–6 V (DC)
- Possible use with battery
  (is designed under the place EEMB LP852040 3.7 V, 700 mAh)
- Operating temperature range: –40 ... +85 °C
- *Magnetometer*: ±8 gauss (field range), 2 milligauss (resolution)
- *Accelerometer*: ±16 *g* (range), 4 mg/LSB (scale factor)
- *Gyroscope*: ±2000 dps (measurement range), 70 mdps/digit (sensitivity)
- *Barometer & temperature*: 300 ... 1100 hPa (pressure range), 0 ... +65 °C (temperature range)

Applications

- Gaming and virtual reality input devices
- Motion control with MMI (man-machine interface)
- Appliances and robotics

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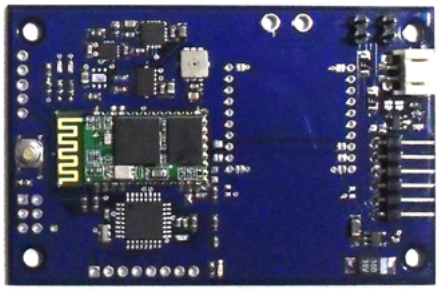
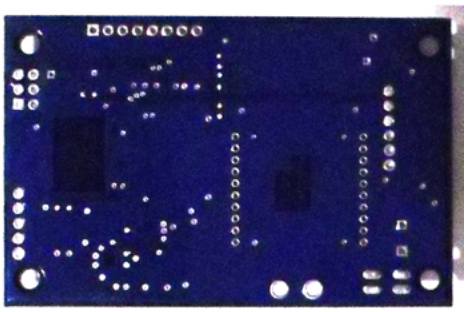
digital module with 4 sensors:
- 3-axis magnetometer;
- 3-axis accelerometer;
- 3-axis gyroscope;
- barometer and thermometer

Top View



Bottom View



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Specification

Characteristics	Conditions	Min	Typ	Max	Units
	Magnetometer HMC5883L				
Field Range	Full scale (FS)	-8		+8	gauss
Mag Dynamic Range	3-bit gain control	±1		±8	gauss
Field Resolution	Standard Deviation 100 samples		2		milligauss
Linearity	±2.0 gauss input range			0.1	±% FS
Hysteresis	±2.0 gauss input range		±25		ppm
Turn-on Time	Ready for I²C commands Analog Circuit Ready for Measurements		200 50		µs ms
Output Rate (ODR)	Continuous Measurement Mode	0.75		75	Hz
	Accelerometer ADXL345				
Measurement Range	Each axis		±16		*g*
Sensitivity	±16 g, 10-bit resolution	29	32	35	LSB/*g*
Sensitivity Deviation from Ideal	±16 g, 10-bit resolution	28.6	31.2	34.5	mg/LSB
Output Data Rate (ODR)	User selectable	0.1		3200	Hz
	Gyroscope L3G4200D				
Measurement range	User-selectable		±2000		dps
Sensitivity	FS = 2000 dps		70		mdps/digit
Sensitivity change vs. temperature	From -40 °C to +85 °C		±2		%
Digital zero-rate level	FS = 2000 dps		±75		dps
Output Data Rate (ODR)			200		Hz
	Barometer BMP085				
Pressure Range		300		1100	hPa
RMS noise expressed in pressure			0.03		hPa
RMS noise expressed in altitude			0.25		m
Pressure	Absolute accuracy p = 700 ... 1100 hPa, T = 0 ... +65 °C			±2.5	hPa
Temperature	Absolute accuracy p = 700 ... 1100 hPa, T = 0 ... +65 °C			±2	°C

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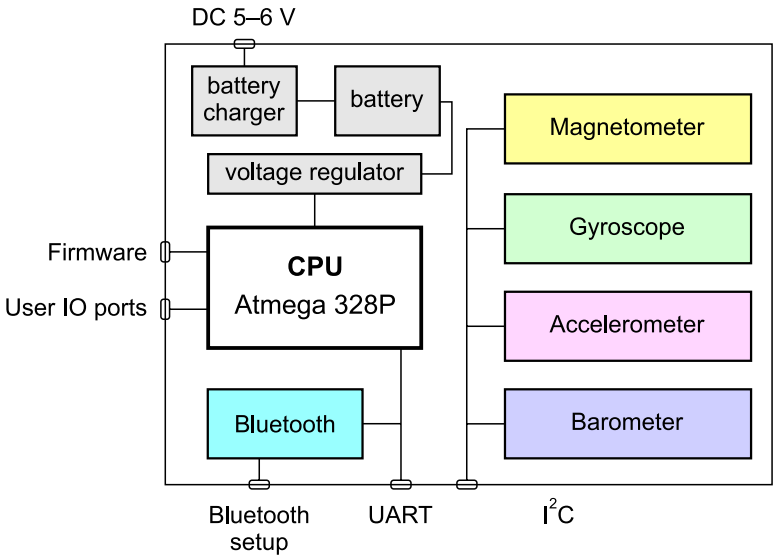
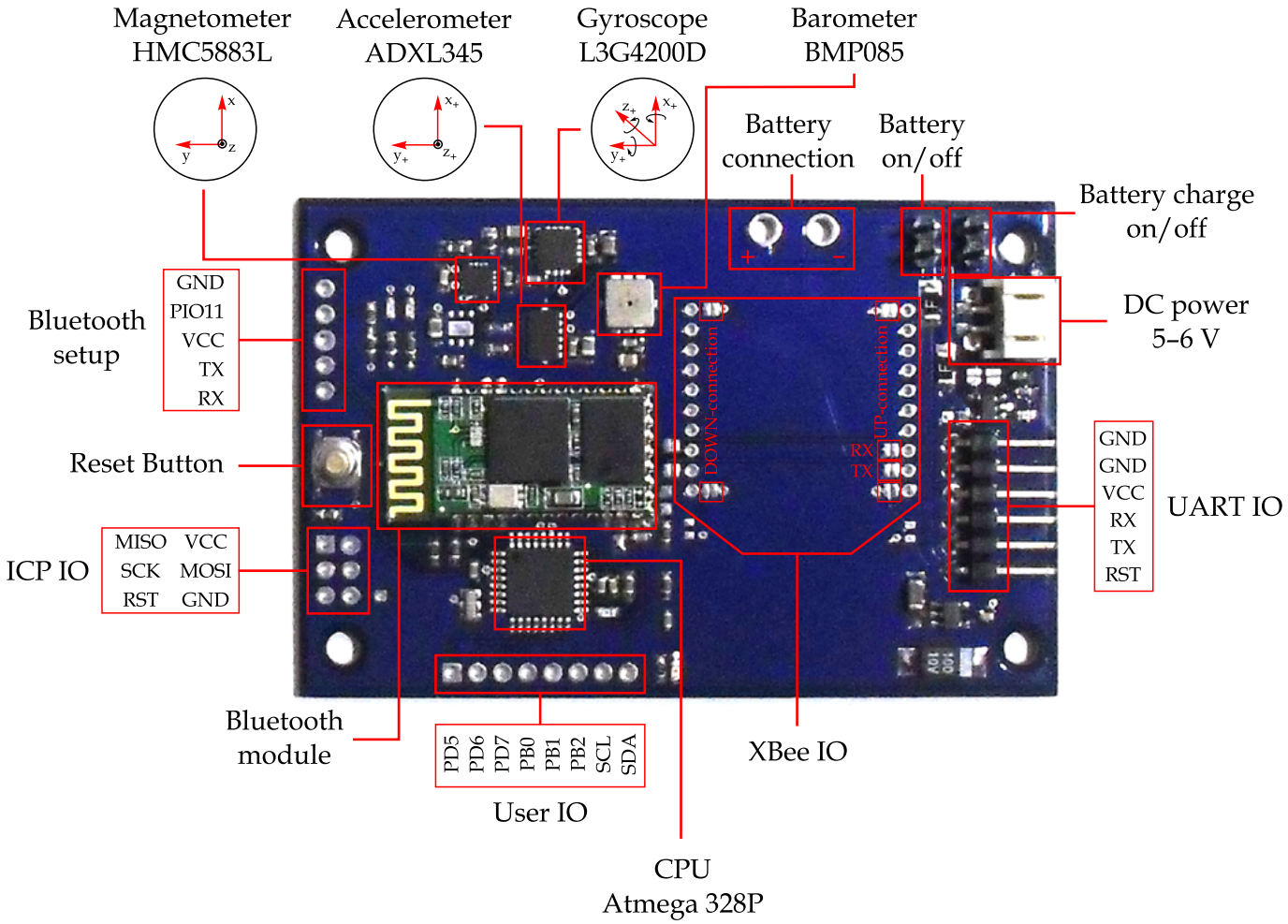
Block Diagram



Advanced Detailed Specification



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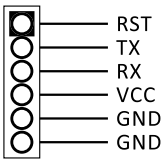
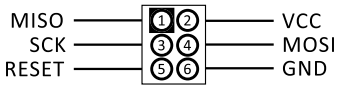
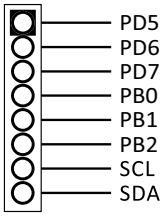
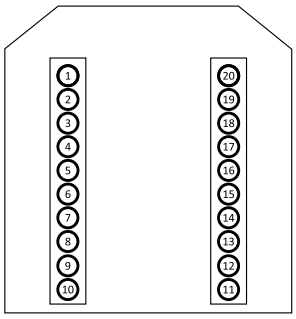
PIN configuration

Pin	Name	Descriptions
		UART – serial IO
1	RST	Reset pin
2	TX	Transmitted Data
3	RX	Received Data
4	VCC	Power Supply (3.3 V)
5	GND	Supply Ground
6	GND	Supply Ground
		ICP IO
1	MISO	Master input, slave output (output from slave)
2	VCC	Power Supply (3.3 V)
3	SCK	Serial clock (output from master)
4	MOSI	Master output, slave input (output from master)
5	RESET	Reset pin
6	GND	Supply Ground
		User IO
1	PD5 (9)	8-bit bi-directional I/O port with internal pull-up resistors
2	PD6 (10)	
3	PD7 (11)	
4	PB0 (12)	
5	PB1 (13)	
6	PB2 (14)	
7	SCL	2-wire Serial Bus Clock Line
8	SDA	2-wire Serial Bus Data Input/Output Line
		XBee IO
1-20		Through Hole XBee Headers









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Output Data

Line of the output has the following format:

The prefix block «!ANG»

- Roll (*double*), degree
- Pitch (*double*), degree
- Yaw (*double*), degree

The prefix block «!SEN»

- Accelerometer X (*double*), mg
- Accelerometer Y (*double*), mg
- Accelerometer Z (*double*), mg
- Gyroscope X (*double*), dps
- Gyroscope Y (*double*), dps
- Gyroscope Z (*double*), dps
- Magnetometer X (*int*), milligauss
- Magnetometer Y (*int*), milligauss
- Magnetometer Z (*int*), milligauss
- Compass heading (Tilt compensated Magnetic fields XY) (*double*)
- Temperature ·10 (*int*), °C
- Pressure (*int*), Pa

The prefix block «!RAW» (sensors data)

- Accelerometer X Raw (*int*), mg
- Accelerometer Y Raw (*int*), mg
- Accelerometer Z Raw (*int*), mg
- Gyroscope X Raw (*int*), dps
- Gyroscope Y Raw (*int*), dps
- Gyroscope Z Raw (*int*), dps
- Magnetometer X Raw (*int*), milligauss
- Magnetometer Y Raw (*int*), milligauss
- Magnetometer Z Raw (*int*), milligauss

Separating of indications is character «,».

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Software

The demo application is written in Microsoft C #. Net.Freymwork 4.0. It shows the basic parameters passed device collects information from 4 sensors. Besides the expected performance of sensors in their values, the device also transmits readings angles: pitch, roll and yaw. The application logged minimum, current and maximum readings, which has an opportunity to correct.

The connection is made by means of parallel connections through UART or when connected via Bluetooth.

The device name when connecting bluetooth: «M-SENSOR». Password for pairing: «1234».