



OEM100 AND OEM1000 MODULES

VERSION 1.5

Hardware Manual

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Sensicast Systems, Inc.
220-3 Reservoir Street
Needham, MA 02494
Phone 781.453.2555
support@sensicast.com

Part # 1390 – OEM100 and OEM1000 Module Hardware Manual

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In the interest of product improvement, information and specifications herein are subject to change without notice.

FCC Statement

The OEM100 and OEM1000 equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference; and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by Sensicast could void the user's authority to operate this equipment.

FCC RF Radiation Exposure Statement: To comply with FCC's RF exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of 20 cm from all persons and must not be co-located or operated in conjunction with any other antenna or transmitter.

FCC Labeling

The module is labeled with its own FCC ID number (RNB-OEM100 or RNB-OEM1000). If this number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label with the following wording: "Contains FCC ID:RNB-OEM100" or "Contains FCC ID:RNB-OEM1000"

OEM Responsibility to the FCC Rules and Regulations

The OEM100 and OEM1000 modules have been certified per FCC part 15 rules for integration into products without further testing or certification. To fulfill the FCC certification requirements the OEM using the OEM100 or OEM1000 module must ensure that the information provided on the OEM100 or OEM1000 Label is placed on the outside of the final product. The OEM100 or OEM1000 module is labeled with its own FCC ID number (RNB-OEM100 or RNB-OEM1000). If this FCC ID number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label with the following wording: "Contains FCC ID:RNB-OEM100" or "Contains FCC ID:RNB-OEM1000".

The OEM of the OEM100 or OEM1000 Module must only use the approved antenna, which has been certified with this module.

The OEM of the OEM100 or OEM1000 Module must test their final product configuration to comply with Unintentional Radiator Limits before declaring FCC compliance per part 15 of the FCC rules.

Industry Canada Statement per Section 4.0 of RSP-100

The term IC: before the certification / registration number only signifies that Industry Canada technical specifications were met.

Section 7.1.5 of RSS-GEN

Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation.

Section 2.6 of RSS-102

This mobile transmitter with its antenna complies with Industry Canada RF Exposure Limits for General Population / Uncontrolled Exposure.

Introduction

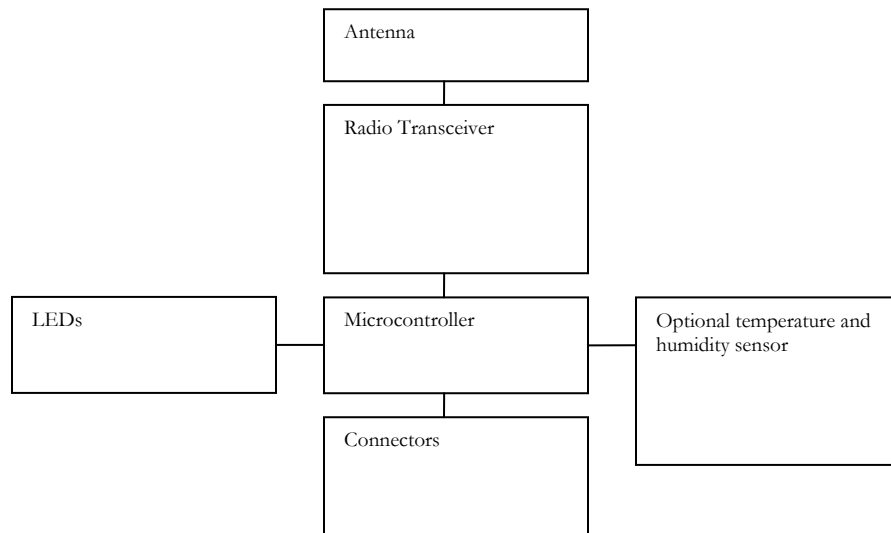
This design guide is intended to provide a good understanding of the functionality of the OEM100 or OEM1000 module. The intended audience is the engineer responsible for integrating the OEM module into a product.

Description and Specifications

The OEM100 or OEM1000 is a component of the Sensicast H900 Wireless Sensor Network Platform – a completely self-configuring, self-healing, power managed sensor network. Powered by SensiNet, Sensicast's proprietary mesh networking software, the OEM100/OEM1000 is the most reliable mesh networking radio module on the market today. It has a range of over 1000 feet (outdoors) (1 mile OEM1000) and 300 feet (indoors, non-line of site) (1000 feet OEM1000). Furthermore, SensiNet uses frequency diverse radio algorithms to ensure reliable, clear channel communication even in the most harsh radio environments.

In addition, off-the-shelf H900 infrastructure hardware and software for constructing and maintaining your mesh network is available from Sensicast.

Block diagram



Antenna

There is a board mounted antenna on the device. For best performance, care should be taken to keep metal components away from the antenna.

Radio Transceiver

The radio is under control of the OEM100/OEM1000's microcontroller and is contained inside the metal shield.

Microcontroller

The SensiNet software, including the sensor API, runs on this microcontroller. It includes onboard flash memory, RAM, and analog and digital I/O and a 32Khz real time clock.

LEDs

There are three LEDs: red, yellow and green that are firmware controlled.

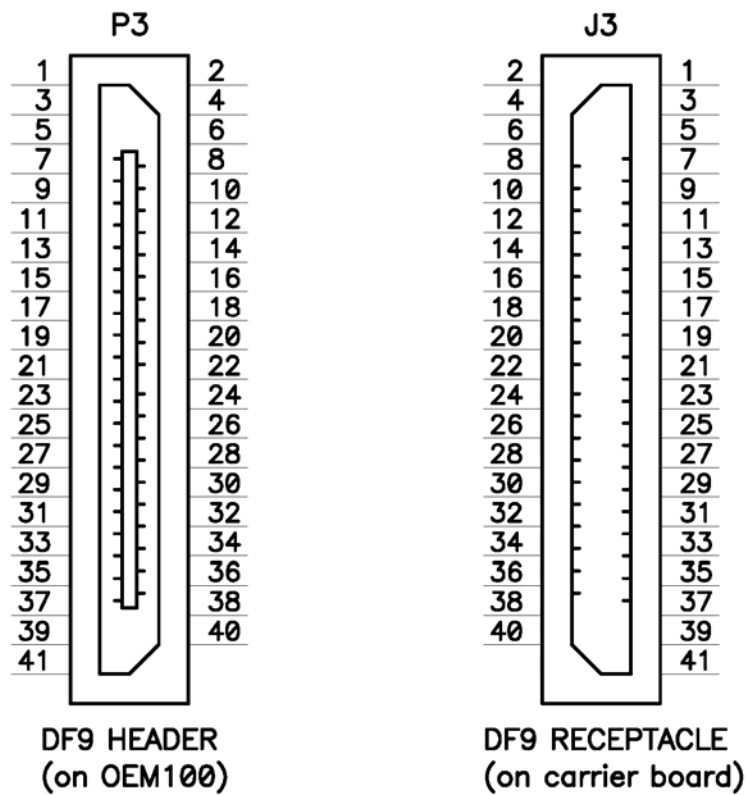
Optional temperature and humidity sensor

The OEM100/OEM1000 can be preloaded with a temperature and humidity sensor. Please contact Sensicast for temperature and humidity specifications.

Connectors

The primary interconnection is P3, the 41 position board to board, header (Hirose p/n DF9A-41P-1V(20); mates with: Hirose p/n DF9A-41S-1V(20)) on the bottom of the assembly.

Optionally, power can be brought to the board through P5, a two position, right angle wire to board, header (JST p/n S2B-PH-K-S, mate: JST p/n PHR-2). Here is a schematic drawing of P3 and a list of signal descriptions for both connectors:



J3 Pin	OEM module Signal	Type	OEM module Description
1	GND	Ground	Ground
2	GND	Ground	Ground
3	VCC	Power	Power
4	VCC	Power	Power
5	GND	Ground	Ground
6	DIG2/EXTINT2	I/O	General I/O / external interrupt
7	SPARE1	I/O	General I/O
8	DIG1/EXTINT1	I/O	General I/O / external interrupt
9	SPARE0	I/O	General I/O
10	DIG0/EXTINT0	Input	Initialization

11	AN1	Input	Analog In
12	SDA	I/O	Two-wire interface data
13	AN0	Input	Analog In
14	DIG3/CNT3	I/O	General I/O / external interrupt / counter in
15	GND	Ground	Ground
16	RTS	Output	UART RTS
17	RESET#	Input	Reset (active low)
18	CTS	Input	UART CTS
19	TCK	Input	JTAG programming
20	SCK	I/O	Two-wire interface clock
21	TMS	Input	JTAG programming
22	SPARE1	I/O	General I/O
23	TDI	Input	JTAG programming
24			Reserved
25	TDO	Output	JTAG programming
26			Reserved
27			Reserved
28	TXD1	Output	UART transmit data
29			Reserved
30	RXD1	Input	UART RX
31			Reserved
32			Reserved
33			Reserved
34	FLAG0	Output	Initialization
35			Reserved
36			Reserved
37			Reserved
38	VSUPPLY	Power	Power
39	VSUPPLY	Power	Power
40	GND	Ground	Ground
41	GND	Ground	Ground

J5 Pin	OEM module Signal	Type	OEM module Description
1	VSUPPLY	Power	Power
2	GND	Ground	Ground

Functional descriptions

Power: The module is powered by a DC power source from 2.0V to 3.3V. The absolute maximum voltage that should be applied is 3.6V. VCC and VSUPPLY are connected through a zero ohm resistor on the module. The power plane is attached directly to VCC. P3 can carry 100mA per pin; P5 can carry 500mA per pin. The OEM1000 module transmits at a much higher power than the OEM100, care should be taken to ensure that enough current is available when the node transmits.

Ground: These are attached to the ground plane of the module. P3 can carry 100mA per pin; P5 can carry 500mA per pin.

General I/O: These are bidirectional, CMOS level, digital signals running between VCC and GND.

General I/O / external interrupt: These are bidirectional, CMOS level, digital signals running between VCC and GND. They can also be configured as external, hardware interrupts.

General I/O / external interrupt / counter in: This is a bidirectional, CMOS level, digital signal running between VCC and GND. It can be configured as external, hardware interrupt or as an input to a counter.

Analog In: These are analog inputs.

Initialization: These pins are digital inputs and outputs used during the initialization of the module.

Two-wire interface: Both SDA and SCK have 10K ohm pull-ups to VCC. The module acts as the master on the bus.

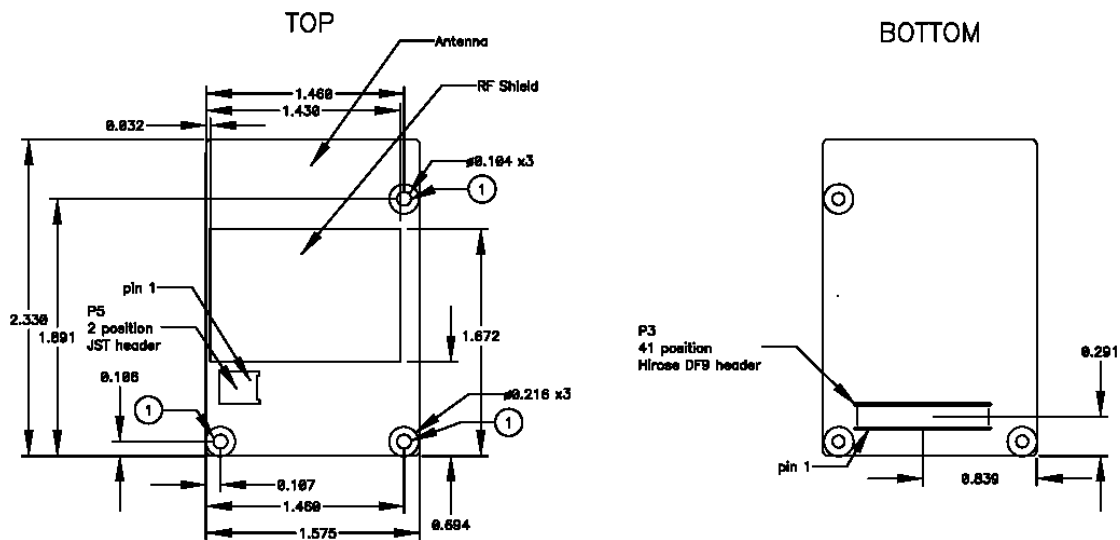
UART: Two wire (RX/TX) or four wire (RX/TX/CTS/RTS) logic level interface. Runs at 9600 baud, 8 data bits, no parity, 1 stop bit.

Reset: An active low signal (RESET#) to reset the microcontroller. Used during debug and test of the module.

JTAG Programming: These provide a four wire interface into JTAG controller on the modules microcontroller. These are used during debug and test of the module.

Mechanical interface

(all dimensions in inches unless otherwise noted)

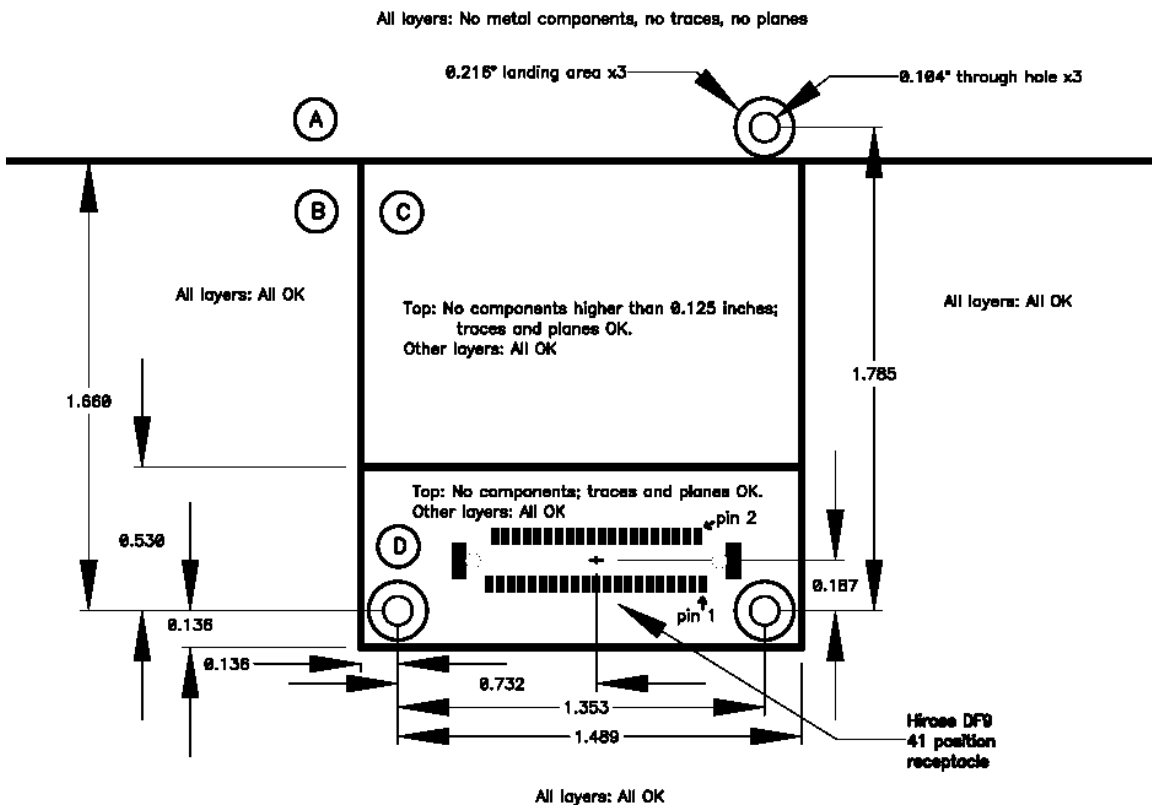


Top side module height: max 0.250"

Bottom side module height: max 0.169"

The OEM100/OEM1000 is a printed circuit board (PCB) assembly with two connectors (P3 and P5) and three mounting holes. The primary interconnection is P3, the 41 position board to board, connector on the bottom of the assembly. When loaded into its mating connector on a carrier board, the bottom of the OEM's PCB will be 4.3mm (0.169 inches) from the top of that carrier board. The mounting holes are designed to accommodate 4mm tall, board to board, plastic, stacking posts also on the bottom side (e.g. Richco p/n MDLSP1-04M-01). Alternatively, #2, nylon fasteners may be used.

Recommended PCB Layout



The OEM module occupies 2.35" by 1.58" and is designed to plug into a PCB mounted, 41 position, Hirose DF9 receptacle (Hirose p/n DF9A-41S-1V(20)). Please refer to Hirose's documentation for more information about this connector. There are three mounting holes designed to accommodate 4mm plastic stacking posts (Richco p/n MDLSP1-04M-01).

There are four distinct areas of the carrier board PCB:

- (A) This is reserved for the OEM's radio signals, and this area should be kept clear of all metal components including traces and planes. Note, this zone extended above and below the PCB.
- (B) In this area there are no restrictions on component placement or height.
- (C) On the top layer, components should be limited to $0.125''$ in height to fit below the OEM module. On all other layers there are no restrictions.
- (D) On the top layer, the only component should be the Hirose receptacle. On all other layers there are no restrictions.

Product Labeling Information

Please see important FCC labeling information at the beginning of this manual.

Each module is programmed with a unique address. This address is printed on the barcode label on the back of the module. In most applications it is helpful to reproduce this label on the outside of the final product packaging.

Technical Specifications

Radio frequency	902-928MHz Frequency Hopping Spread Spectrum
Radio power	+10dBm (10mW) nominal

Battery life	Up to 3 years with a 2/3A Lithium battery using a 2 minute report interval (sensor dependent)
Range	Up to 1000' (outdoors, line of sight) (1 mile OEM1000) Up to 300' (typical indoor conditions) (1000 feet OEM1000)
Connector options	Two (2) analog input lines Six (6) digital I/O lines Two wire interface bus UART (TX, RX, RTS and CTS)
Duty cycle	Remotely user-adjustable (default 3 minutes)
Antenna	Board mounted, omni-directional antenna included
LEDs	3 diagnostic LEDs (red, yellow and green)

Appendix A

Developer's Kit Adapter Board

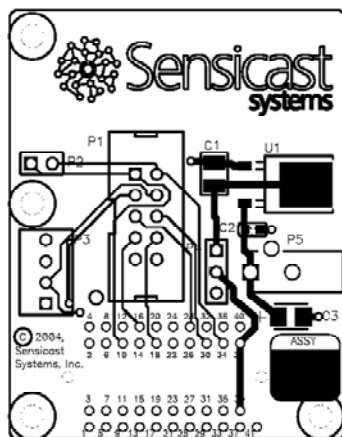
Optionally a Sensicast Developer's Kit Adapter Board (P/N 1408) can be used as to ease prototyping with the OEM module. There are four .104" diameter mounting holes that correspond to the mounting holes of the OEM module. The board has a Hirose receptacle that mates with the OEM module's 41 position header. Each signal is brought to a test point arranged on a 2mm grid.

Some of the more commonly used signals are brought to three other connectors (P1, P2 and P3) for ease of integration with a microcontroller based target board. A multicolor ribbon cable the mates with P1 is also provided. There is a 3.3V regulator that allows the user to power the OEM module from an AC power adapter. Here is a drawing of the adapter board and a description of the connectors and their signals

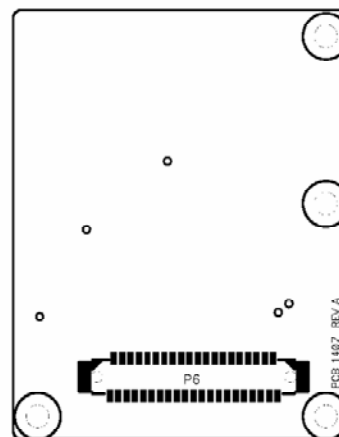
If the optional target developer's board is being used, the I2C and jumper wires included are compatible with P2 and P3.

Developer's Kit Adapter Board

FRONT



BACK



P1 - 10 position (2x5) 0.1 inch pitch ribbon cable connector			
pin	signal	description	Ribbon cable color
1	INT_S2R	Interrupt line from sensor to radio module, active on rising edge	Brown
2	INT_R2S	Interrupt line from radio module to sensor, active on rising edge	Red
3	SCL	Two wire interface, serial clock	Orange
4	SDA	Two wire interface, serial data	Yellow
5	TXD	UART (3V logic level), radio module transmit data	Green
6	RXD	UART (3V logic level), radio module receive data	Blue
7	RTS	UART (3V logic level), radio module ready to send	Violet
8	CTS	UART (3V logic level), radio module clear to send	Gray
9	EXT_VCC	Power source for radio module (2.0V to 3.6V)	White
10	GND	Ground	Black

P2 – 2 position 0.1 inch pitch header		
pin	signal	description
1	INT_S2R	Interrupt line from sensor to radio module, active on rising edge
2	INT_R2S	Interrupt line from radio module to sensor, active on rising edge

P3 - 4 position (2x2) 0.1 inch pitch ribbon cable connector		
pin	signal	description
1	SCL	Two wire interface, serial clock
2	SDA	Two wire interface, serial data
3	EXT_VCC	Power source for radio module (2.0V to 3.6V)
4	GND	Ground

P4 - 3 position 0.1 inch pitch jumper	
Short pins	Function
1 and 2	Power from on board 3.3V regulator
2 and 3	Power from P1 or P3

P5 – barrel connector jack	
Outer	ground
Center	+5V

P6 - 41 position Hirose DF9 receptacle (bottom)	See above description of signals
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