



OEM200 MODULE

VERSION 1.0

Hardware Manual

HARDWARE MANUAL

OEM200 Module

VERSION 1.0

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

Part # 2390 – OEM200 Module Hardware Manual

Copyright ©2005 Sensicast Systems, Inc. All rights reserved.

Sensicast® and SensiNet™ are trademarks of Sensicast Systems, Inc. in the United States and/or other countries. All other trademarks are property of their respective owners.

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

FCC Statement

The A2400 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: The module complies with FCC's RF exposure requirements and the module 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-OEM200). 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-OEM200"

FCC 20cm RF Exposure 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 at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Introduction

This design guide is intended to provide a good understanding of the functionality of the OEM200 module. The intended audience is the engineer responsible for integrating the OEM200 into a product.

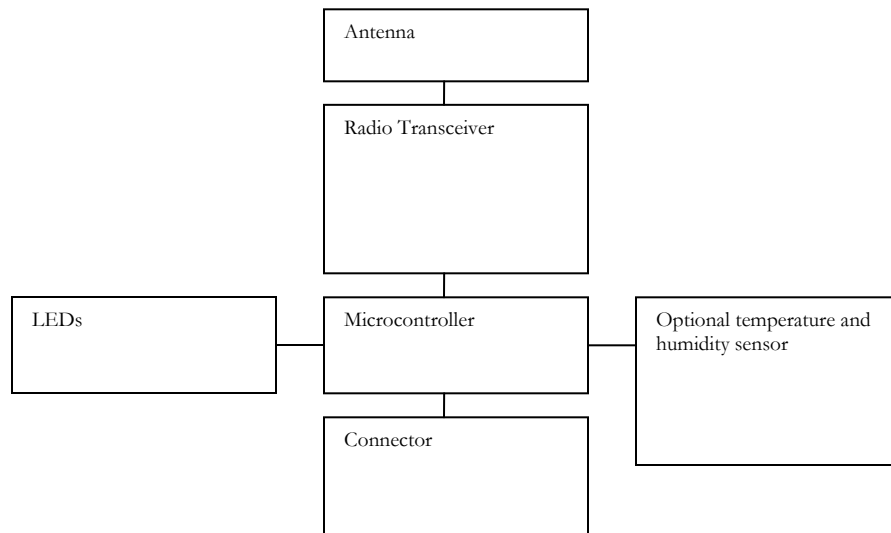
Description and Specifications

The OEM200 is a component of the Sensicast A2400 Wireless Sensor Network Platform – a completely self-configuring, self-healing, power managed sensor network.

Powered by SensiNet (Sensicast proprietary mesh networking software), the OEM200 is the most reliable mesh networking radio module on the market today. With its external radio amplification stage, it has a range of over 1000 feet (outdoors) and 230 feet (indoors, non-line of site). 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 A2400 infrastructure hardware and SensiMesh® Gateway software for constructing and maintaining your mesh network is available from Sensicast.

Block diagram



Antenna

There is a PCB “Inverted F” antenna on the device. For best performance, care should be taken to keep metal components away from this section of the PCB. The PCB will also support an external antenna connector at J2. However, please note that this product is only FCC certified with the existing embedded antenna. If a user application requires an external antenna, re-submission with the specific external antenna is required for FCC approval. For more details, please contact Sensicast.

Radio Transceiver

The radio is under control of the OEM200’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.

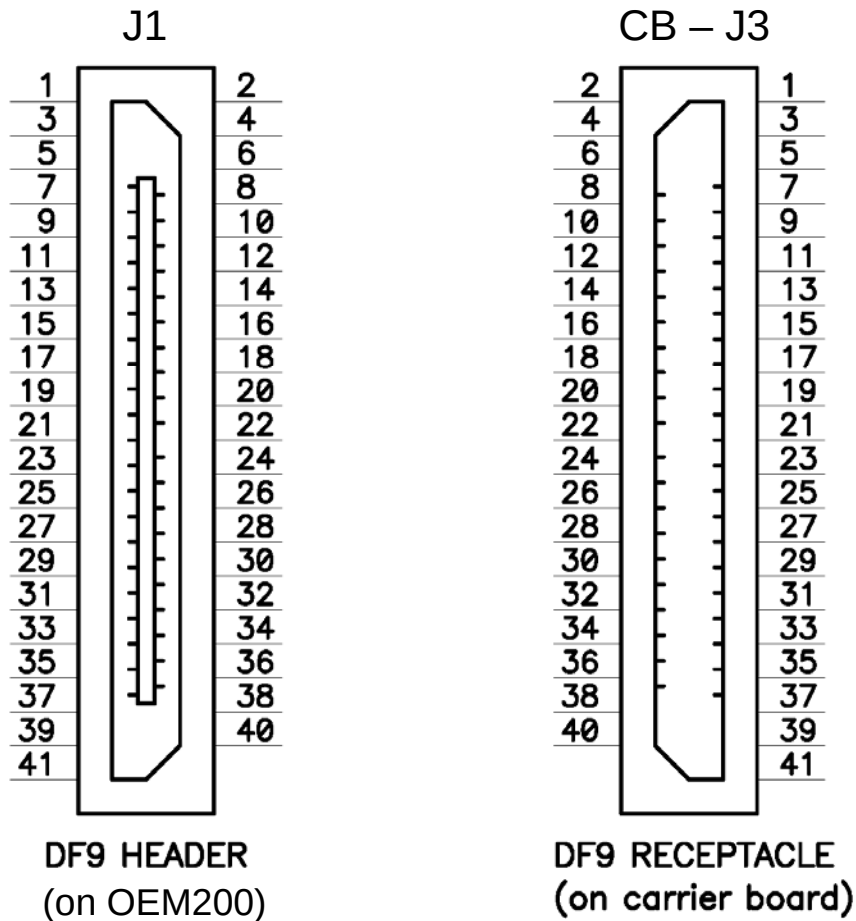
Optional temperature and humidity sensor

The OEM200 can be preloaded with a temperature and humidity sensor at U7. Please contact Sensicast for temperature and humidity specifications.

Connectors

The primary interconnection is J1, 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. (Please note that this header is common between the OEM200 and OEM100).

Optionally, power can be brought to the board through J3, 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 J1 and a list of signal descriptions for both connectors:



J1 Pin	OEM200 Signal	OEM200 Description
1	GND	Ground
2	GND	Ground
3	VCC	Power
4	VCC	Power

5	GND	Ground
6	PD2/RXD1/INT2 [DIG2/EXTINT2]	General I/O / External interrupt
7	PC0/SPARE1	General I/O ; end node (OEM200) only
8	PE6/T3/INT6 [DIG1/RTCLK/EXTINT1]	Radio Amp Indicator (Tx) – Output
9	PC1/SPARE0	General I/O ; end node (OEM200) only
10	PE5/OC3C/INT5 [DIG0/EXTINT0]	General I/O / External interrupt
11	PF1/ADC1	Analog In
12	PD1/SDA/INT1	I2C_DATA
13	PF0/ADC0	Analog In
14	PD6/T1	General I/O / Counter In
15	GND	Ground
16	PE2/SCK0/AIN0	RTS
17	RESET#	Atmel reset Input
18	PE3/OC3A/AIN1	CTS/16 bit PWM out
19	PF4/ADC4/TCK	Module programming
20	PD0/SCL/INT0	I2C_SCK I/O
21	PF5/ADC5/TMS	Module programming
22	PC2/SPARE2	General I/O ; end node (OEM200) only
23	PF7/ADC7/TDI	Module programming
24	PF7_ATTEN	[PIC_ICSPMCLR#] through a 10K resistor / Carrier Board Reset Output
25	PF6/ADC6/TDO	Module programming
26	PF6_ATTEN	[PIC_ICSPPGM] through a 10K resistor
27	PD7/T2_ATTEN	no connect (input through 10K resistor)
28	PE1/TXDO/PD0	UART TX
29	PF5_ATTEN	[PIC_ICSPCLK] through a 10K resistor
30	PE0/RXD0/PDI	UART RX
31	PD4/ICP1[BOOST_ENABLE]	Boost Enable Request Output
32	PF4_ATTEN	[PIC_ICSPDAT] through a 10K resistor
33	PD0/SCL/INT0	no connect (bit bang-able SPI)
34	PB4/OC0	Status line/ RS485 Enable
35	PD1/SDA/INT1	no connect (bit bang-able SPI)
36	PE2/SCK0/AIN0	no connect (bit bang-able SPI)
37	PE3/OC3A/AIN1	no connect (bit bang-able SPI)
38	VSUPPLY	Power
39	VSUPPLY	Power
40	GND	Ground
41	GND	Ground

J3 Pin	OEM200 Signal	Type	OEM200 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 0 Ω resistor on the module. The power plane is attached directly to VCC. J1 can carry 100mA per pin; J3 can carry 500mA per pin.

Ground: These are attached to the ground plane of the module. J1 can carry 100mA per pin; J3 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 Ω pull-ups to VCC. The module acts as the master on the bus.

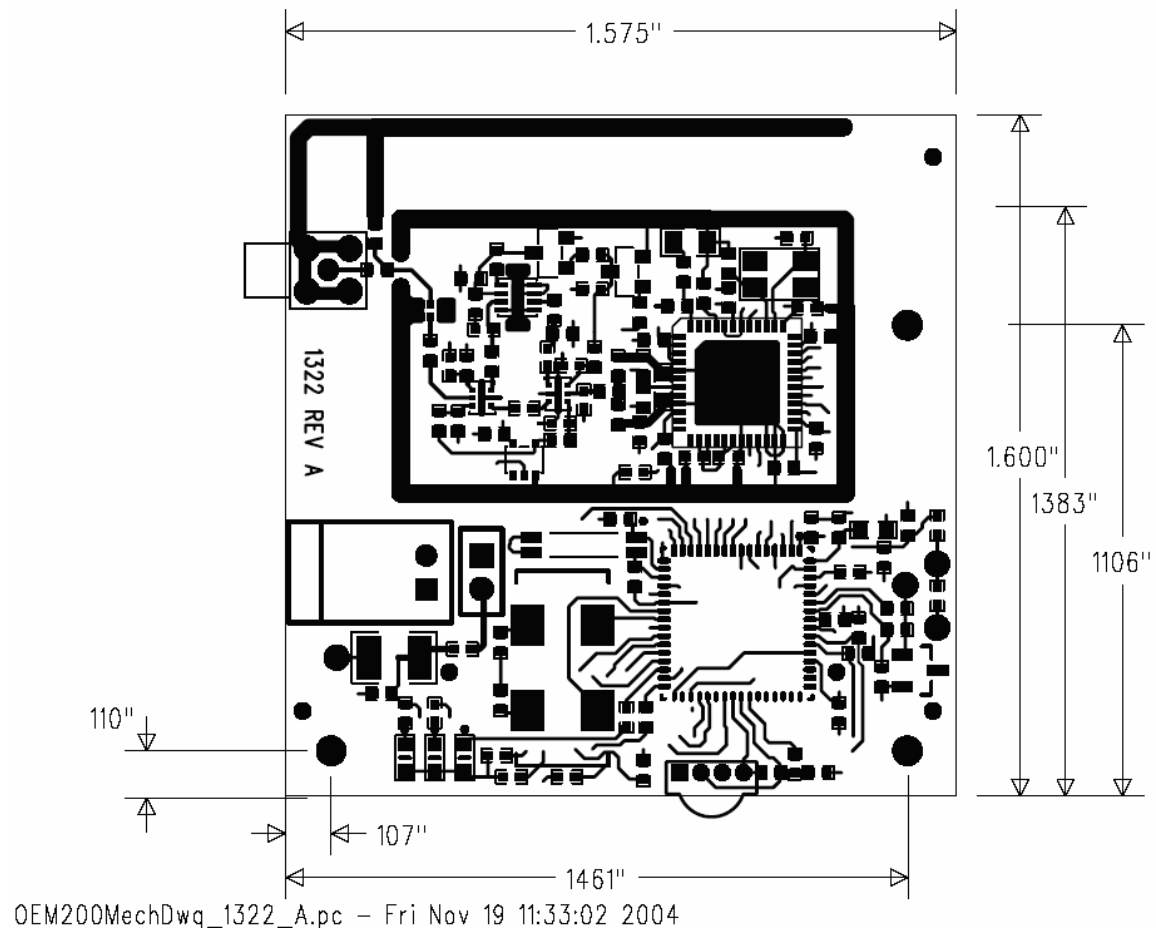
UART: Two-wire (RX/TX) or four-wire (RX/TX/CTS/RTS) logic level interface. Runs at 9600 baud, 8 data bits, no parity, 1 stop bit.

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 module's 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 0.255"

Bottom side module height: max 0.149"

The OEM200 is a printed circuit board (PCB) assembly with two connectors (J1 and J3) and three mounting holes. The primary interconnection is J1, 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 OEM100'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.

[illegible]

There are four distinct areas of the carrier board PCB:

- ## Product Labeling Information

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	2.4GHz Frequency Hopping Spread Spectrum
Radio power	+15dBm (32mW) nominal
Battery life	Up to 3 years with a 2/3A Lithium battery using a 5 minute report interval (sensor dependent)
Range	Up to 1000' (outdoors, line of sight) Up to 230' (typical indoor conditions)
Connector options	Two (2) analog input lines Six (6) digital I/O lines Two-wire interface bus UART (TX, RX, RTS and CTS)
Antenna	PCB "Inverted F" antenna included
LEDs	3 diagnostic LEDs (red, yellow and green)

Appendix A

Developer's Kit Adapter Board

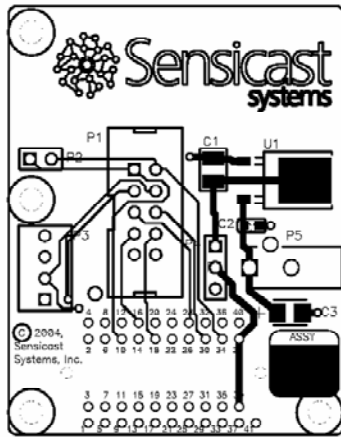
Optionally a Senciscast Developer's Kit Adapter Board (P/N 1408) can be used to ease prototyping with the OEM100/200. There are .104" diameter mounting holes that correspond to the mounting holes of the OEM100/200. The board has a Hirose receptacle that mates with the OEM100's 41 position header. Each 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 J1 is also provided. There is a 3.3V regulator that allows the user to power the OEM100/200 from an AC power adapter. Here is a drawing of the adapter board and a description of the connectors and their signals

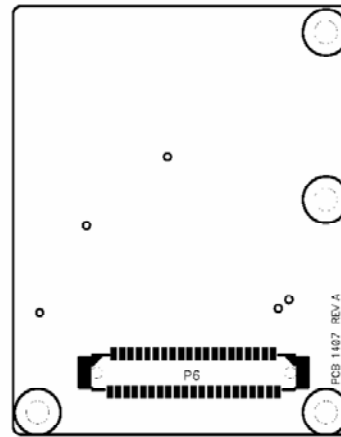
If the optional target developer's board is being used, the I2C and jumper wires included are compatible with P2 and P3.

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
--	----------------------------------

|

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	16.00	(dBm)
Maximum peak output power at antenna input terminal:	39.811	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2400	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.007920	(mW/cm^2)
Maximum allowable antenna gain:	21.0	(dBi)
Margin of Compliance at 20 cm =	21.0	dB

Note: Only enter values in yellow boxes.