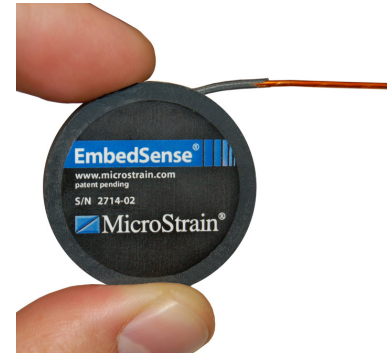


# EmbedSense®

## Wireless Sensor



### Introduction

**EmbedSense®** Wireless Sensor nodes are tiny, passive wireless sensor and data acquisition modules that are small enough to be embedded in a product, enabling the next generation of smart structures and materials.

Batteries are completely eliminated, which means that the embedded sensors and **EmbedSense®** node can be queried for the life of the structure. Because they can tolerate extreme *g* levels and high temperatures, sensor measurements can be made in applications where previously no data could be obtained.

The node uses an inductive link to receive power from an external coil and to return digital strain, temperature and unique ID information. A reader coil is energized by an AC electromagnetic field from a 125 kHz signal supplied by the reader unit. The **EmbedSense®** node picks up this energy and uses it to power its data acquisition circuits. Communication is accomplished by the node shifting the tuning of its internal antenna from a reflective state to an absorptive state, in accordance with data to be sent to the reader. The reader sees these shifts as amplitude modulation (AM) on the power signal and converts the AM to a recovered data stream and passes it on to the computer. When the reader sends a command to the module, it frequency modulates (FM) the power signal with command data, which is detected by the node.

**EmbedSense®** nodes can read data from multiple types of sensors, including semiconductor temperature sensors, thermocouples, strain gauges, pressure sensors, and load cells.

### Features & Benefits

- small size is ideally suited for embedded applications
- no batteries to maintain, hence nodes can operate for the life of the structure or machine
- wide operating temperature from -40 °C to +125 °C
- 30 Hz sample rate
- configuration available for high inertial loads, up to 50,000 *g*
- low cost
- requires no physical connection
- communicates through non-conductive materials
- provides high-resolution measurements

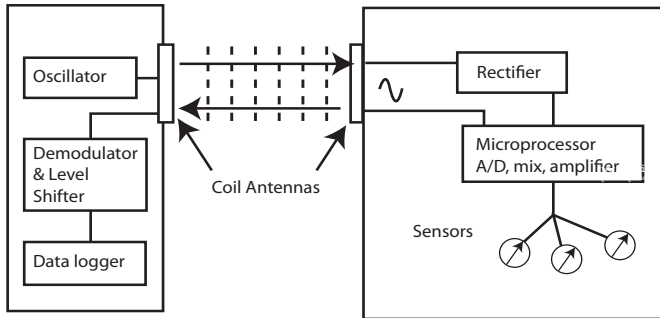
### Applications

- smart structures, materials and machines
- intelligent medical implants
- monitoring turbines and other high-speed rotational equipment
- embedded process control
- temperature monitoring of composite panels during autoclave cure process
- monitoring physical parameters inside sealed containers





## EmbedSense® Block Diagram

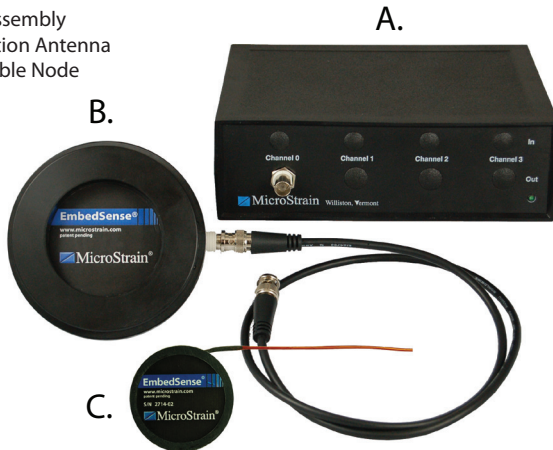


Power, interrogation & data acquisition unit

EmbedSense™ sensing node

The **EmbedSense®** system includes:

- A. Reader Assembly
- B. Interrogation Antenna
- C. Embeddable Node



## Specifications

Number input channels	2 Channels, 1 differential input and 1 internal temperature sensor (Other configurations available as custom options)
Input amplifier	Instrumentation amp, 110 dB CMRR, standard gain 250, factory options from 1 to 1000
Bridge excitation	3 VDC, regulated to 0.1%, up to 3 mA at 3 VDC available
Sensor types	piezoresistive bonded foil & semiconductor strain gauges, pressure/load/torque transducers, thermocouples
Analog to digital (A/D) converter	16 bit resolution successive approximation type (standard), other configurations available as custom options
Identification (ID)	user programmable, 16 bits
Update rates	30 Hz/channel w/ 125 kHz operating freq, 16 bit A/D (Other configurations available as custom options)
Communication method	switched reactance, pulse code modulated serial (RS-232), clocked synchronous
Coil-to-coil separation	sensor dependent; 37 mm minimum, 50 mm typical
EmbedSense® power	200 µA at 3 VDC, not including bridge excitation
Operating temperatures	-40 °C to +125 °C
Operating G levels	independently tested to 50,000 g
Dimensions	reader assembly: 200 mm (length) x 160 mm (width) x 67 mm (height) interrogation antenna: 115 mm (diameter) x 40 mm (height) embeddable node: 36 mm (diameter) x 7 mm (height)
Weight	reader assembly: 567 g interrogation antenna: 221 g embeddable node: 17 g starter kit including reader assembly, interrogation antenna, 2 embeddable nodes, cables and power supply: 1910 g



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Patent Pending