

Structural Health & Process Monitoring Outdoor AE & Sensor Fusion System

Monitoring System for Structural Health

The Sensor Highway II System™ is an Acoustic Emission (AE) monitoring system with up to 16 high-speed channels and 16 standard parametric input channels (expandable to over 100). The system is designed for unattended and remote monitoring use in *Structural Health Monitoring* management and condition monitoring applications. It is rated for outdoor use and comes equipped in a rugged weather proof NEMA 4 enclosure.

Your Application Solution

The key feature of the Sensor Highway II System™ is its highly flexible sensor fusion interface for input and processing, using a variety of sensors. The system is able to accept AE sensors (using the standard "phantom power" coaxial connection for powering external preamplifiers), ICP (Amplified) accelerometers, and various other sensors with current and voltage outputs. This interface is accomplished through the use of standard industrial, DIN Rail Mounted Signal Conditioning Modules, with options for Proximity Probes, Tachometers, Pressure Transducers, Load Cells, Thermocouples, Environmental Sensors, Strain Gages, Wireless Sensors *and more*.

Key Features:

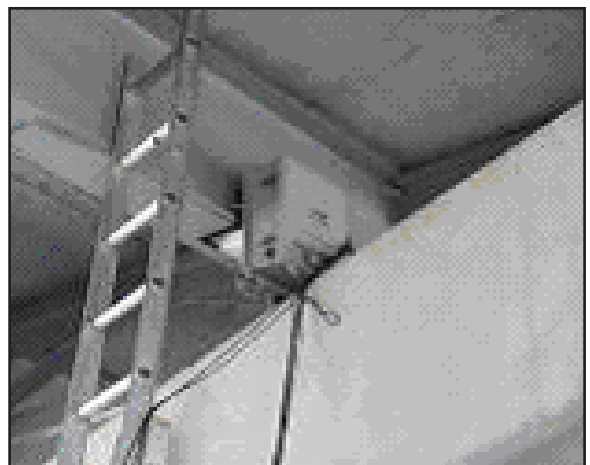
- ◆ Scalable for large factory use, allowing for multiple units to be placed near the machinery or structures that are being monitored.
- ◆ Designed for outdoor environments, with a minimum power dissipation and a temperature range of (-35° -70° C) without the need for heaters or air conditioners.
- ◆ Direct On-Board Terminal Block connections and DIN rail mounts for external sensor inputs.
- ◆ Various communication interfaces available for data communication and remote control including Ethernet, Wireless, Cellular Modem and Satellite.
- ◆ Scalable system for connecting up additional units in the field and time synchronization options between remote units.
- ◆ RS-232/485, 4-20mA, -108 - +106 input for sensors



The Sensor Highway II™ has several interfaces available for data communication and remote control. The principal interface is the built-in Ethernet 10/100BT port (or optional wireless Ethernet). Other available interfaces include: cellular modem and wireless.

The AE Sensor Highway II™ System is designed to:

- ◆ Monitor the effectiveness of repairs/retrofit.
- ◆ Determine if pre-existing/known defects are active.
- ◆ Monitor "hidden areas" where visual inspection is difficult or impossible.
- ◆ Determine if high stressed areas show flaw-like activity.
- ◆ Wire break monitoring on suspension cable and cable stay bridges.



Optional Application Solutions

Data Collection (SH-II DC) System

The most basic and lowest cost system is the *SH-II DC System*, capable of remote acquisition and storage (short term) of sensor data, with some basic signal processing and alarm screening capabilities.

This *SH-II DC System* is for situations where remote analysis is desirable and is usually associated with a monitoring contract. Data is usually downloaded via a remote interface (Ethernet, Cell Modem, etc.) and analyzed. Optionally, an Internet web access site option is available for customer status monitoring, activity, trend monitoring and customer data visualization.

Networked" Sensor Highway System (SH-II N)

The *SH-II-N System* is a SH-II-DC with 2 extra features including - a built-in, multiport Ethernet hub and linking the multiple Sensor Highway Systems to a base station computer. In order to carry out location analysis a time synchronization input for synchronizing the AE time-of-test measurements between units is available.

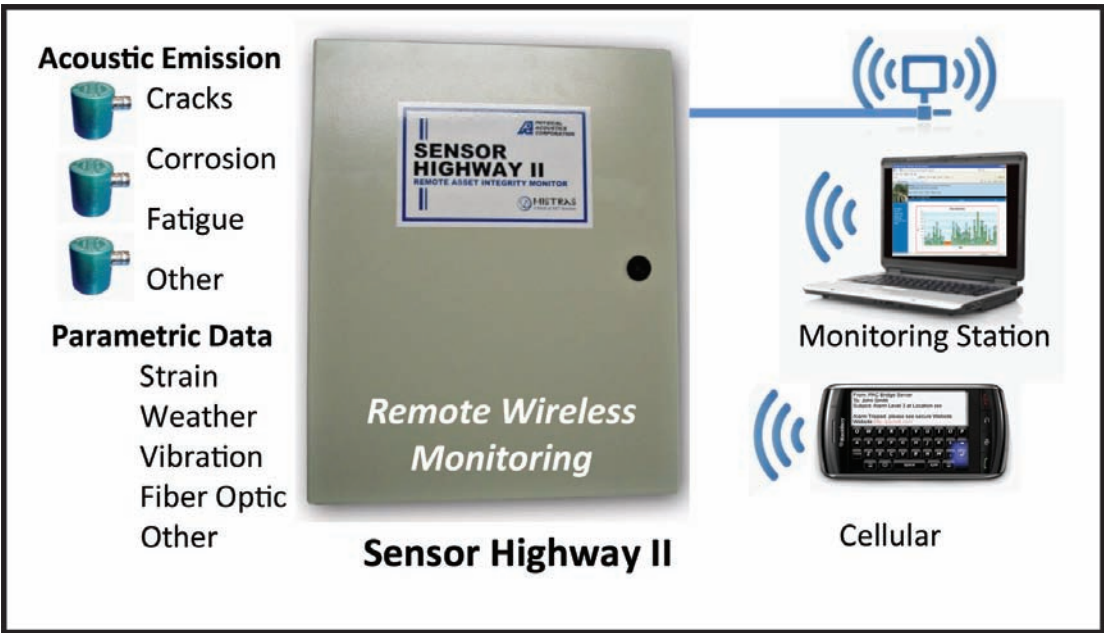
The BaseStation computer is available as either an outdoor unit for remote monitoring (in an outdoor enclosure without keyboard, mouse or display) or an indoor PC based system with full user interface.



Smart Remote Sensor Highway (SH-II SRM)

The *SH-II SRM System* performs all the tasks of data collection, full signal processing (including location determination, clustering capabilities), analysis and alarming for standalone, surveillance monitoring, 24 hours a day, all within the Sensor Highway, SH-II SRM unit.

This extra capability is achieved by incorporating a more powerful, industrial temperature range CPU inside the unit, running Windows XP and AEwin with all its features and capabilities. It is truly stand-alone and capable of making complex, on-line asset integrity decisions while interfacing through the user, the internet or to a control room.



Software Options & Features

Sensor Highway II™ Standard Built-in Software Features

Basic, built-in features common to all Sensor Highway Systems include:

- **Data Acquisition** - Full AE feature and waveform data acquisition to a data file, with ability to be downloaded through Ethernet connection.
- **Status and Trending Capabilities** - Ability to generate timed STA files for individual and web page based system status reporting and trending.
- **AE System Set-up & Control** - Client program to remotely setup the system, generating a layout (set-up) file that can be uploaded to the Sensor Highway.
- **Data File Upload and Download** - Available through an FTP server with a Windows Explorer interface for transferring files between the remote computer and the Sensor Highway.
- **Alarm Capability** - Built-in alarms, based on Hit/Event activity or feature based (not location or cluster based, this is available on the SH-II-SRM).
- **Communications** - Ethernet networking built-in for walk-up, plug-in operation and remote Ethernet/Internet communications
- **AE Software Analysis Compatibilities** - Fully compatible with AEwin for Sensor Highway II (AEwinSH). Remote user must have AEwinSH installed on analysis workstation to analyze AE data files downloaded from the Sensor Highway System.

Network Sensor Highway II™ Software Features

In addition to the built-in software features, there is an Ethernet hub inside each SH-II-N unit, which allows a networked, multiple unit, Sensor Highway System to be connected together and controlled by a single Sensor Highway BaseStation.

Depending on Options and time synchronization between SH-II-N units and the AEwinSH-N software, a large, single location group can be setup, allowing large structures to be monitored by one AEwin software program.



Smart Remote Sensor Highway II™ Software Features

The SH-II-SRM is a standalone on-line monitoring, remote AE system capable of operating our high performance, AEwin software internally, in real time. In addition to its basic capabilities, the SH-II-SRM has the following extensive capabilities:

- On-line data collection and signal processing.
- Communication of alarm and status information over the internet.
- Ability to handle many different types of source location in real time.
- Clustering of location data and ability to alarm on clusters and cluster rate.
- Comprehensive alarm detection capability.
- Remote Internet communications over the Ethernet and WiFi, cellular or telephone modem for remote monitoring and control.

In addition, the AEwin Base Station computer software can process alarms from the Sensor Highway units.

Main Board Specifications

Power Requirements:	85-260 VAC or 9-28 VDC
Power Consumption:	12W + sensor requirements (16 channel configuration), for DC, 25W for SRM
Digital Signal Processing:	Yes, via 2 - 4 million gate custom programmed FPGA
Digital I/O:	8 Digital Inputs, & 8 Digital Outputs, standard
Number of AE/Vib Modules	0-4

Parametrics (16 standard)

On-Board Single-Ended inputs:	10kSPS, 16 bit, +/-10V input, qty: 12
On Board Differential inputs:	10kSPS, 16 bit, +/-10V input, programmable gain, offset and excitation voltage, qty: 4
Optional Parametric:	2 SPI Interfaces for 16 additional parametric inputs RS-232 Input for additional digital parametrics

4-Channel AE/Vibration Module Specifications

Number of Channels:	4
High Pass Filters:	1Hz, 10Hz, 10kHz, 100kHz Analog
Low Pass Filter (Analog):	1MHz, 6th order Analog
Low Pass Filters (Digital):	100Hz, 1kHz, 10kHz, 100kHz, 300kHz, 400kHz
Bandwidth:	1Hz- 1MHz
ADC:	20MSPS, 18-bit
AE Sensor Power:	Phantom Power, Selectable 5V, 12V, 28V
Preamp Gain Range	26dB/40dB

CPU Board Specifications For “SH-II DC” and “SH-II N” Models

Network:	Ethernet 10/100 BT
USB:	2 Full Speed USB Host, 1 Full Speed USB Device
Serial:	One RS-232, One RS-485
IDE:	Full size 40-pin connector
Processor:	200 MHz, ARM920T Core
Memory:	Flash: 64 Mbytes SDRAM: 128 Mbytes Compact Flash Interface

CPU Board Specifications For “SH-II SRM Model

Network:	Ethernet 10/100 BT
USB:	2 High Speed 2.0
IDE:	44-pin 2.5" Drive
Processor:	ULV Pentium M or Celeron M
Memory:	1 GByte
CF:	4 GByte Standard

System Physical Specifications

Standard Enclosure:	Steel, NEMA 4, IP-66 (Indoor/Outdoor)
Weight:	< 25 lbs. w/enclosure
Size:	20" x 16" x 6"
Operating Temperature:	-31° - 158° F (-35° - 70° C)
Storage Temperature:	-40° - 167° F (-40° - 75° C)

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