1284 | Wireless Multichannel AE Node

The 1284 Wireless Multichannel AE Node is a scalable Acoustic Emission (AE) instrument with sensor fusion capabilities, allowing integration of AE data and up to six parametric inputs including one strain gauge. The system was originally designed for bridge and civil infrastructure applications, but its scalability and modularity are suitable for a variety of monitoring applications such as: storage tanks, vessels, aircraft, turbines, and more.

Acoustic Emission is one of the most comprehensive bridge testing methods today, but it has been constrained to hardwired systems due to the power consumption of systems capable of rapid processing of high bandwidth sensor data on multiple channels. MISTRAS has invested heavily into wireless technology for Acoustic Emission and structural health monitoring and is fully committed to ongoing development in growing and improving our technology and product line.

MISTRAS’ family of Wireless AE systems are designed to be low power and can be battery operated, providing the opportunity of monitoring critical areas in structures found in remote locations where power is not available, where the deployment of a hardwired AE system is not economically feasible, or when a system with small foot print is necessary for the application on hand.

The 1284 wireless AE node is a low power multichannel AE system that communicates to a base station module wirelessly, using a wireless data transmission standard that satisfies the unique needs of low-cost, low-power, wireless sensor networks. The 1284 is an instrument capable of waveform recording, saving data into an onboard SD card and uses wireless communication to transfer the recorded data to a base station or analysis computer. Wireless data transmission from the instrument to a base station helps reduce installation time and costs, by keeping the instrument close to the sensors, and by reducing the need for long cables. The 1284 node can be battery operated or powered from a solar panel or energy harvester.

Each 1284 AE Wireless Node is a complete micro-computer that can be used to monitor an area of concern. The 1284 has a NEMA-4 enclosure rated for outdoor use, and wide temperature operation so there are few environmental restrictions for its placement. The 1284 (and its antenna) is placed at a location where there will be a minimum of RF wave-path blockages between the node and the base station unit. Typically the range can be anywhere between 40 meters to 500 meters, depending on the surrounding structures. The base station module is connected to a computer via the USB bus and the user can directly monitor and control a test at the AE base station computer. The 1284 AE wireless node can be deployed with and without maintaining continuous communication with the base station, depending on the application.

Power consumption of the unit depends on the Acoustic Emission activity being detected, the rate at which external parametrics, particularly the strain gauge channel, are recorded, and whether the captured data is being transferred to the base station or just saved into the SD card. To optimize the system performance, user definable front end filters are available; these are used to limit the data that is actually saved and transmitted. Limiting data recording given the characteristics of an application help streamline data post processing and alarming.

In order to minimize power consumption and prolong battery life, MISTRAS’ family of AE wireless products not only deploy low power sensors (Alpha type or PK-I type), but also customize the unit’s frequency range during manufacturing depending on the application and sensor to be used.

Applications
- Continuous storage tank monitoring
- Leak monitoring in different vessel types
- Continuous monitoring of aircraft composite structures during flight
- Monitoring of critical regions on wind turbine blades during operation
- Bridge health monitoring
1284 | Wireless Multichannel AE Node

Wireless control of the 1284 system is done via a proprietary software — AEwin for Wireless-4 — which is based on MISTRAS’ signature Acoustic Emission software AEwin. AEwin for Wireless-4 allows users to analyze collected data, as well as start and stop the test or monitoring activities, start and stop data transfer to the base station, and provide the user interface to set the AE activity location and classification filters to optimize data acquisition.

The functional design of the instrument allows for longer periods of monitoring using battery power in conjunction with an energy harvester; or for short monitoring periods (3-6 months) on just battery power to identify AE baseline response and/or to gather AE signals including waveforms necessary to characterize the response and/or to gather AE signals including waveforms necessary to characterize the behavior and response of a critical location during in-service loads.

The 1284 or 4-channel wireless node provides alarm capability based on user defined filters obtained after review of AE data captured from baseline response and damage detection, as well as other system parameters like strain, pH, temperature and other quantities recorded by the instrument.

The 1284 wireless node can be used for active monitoring by pulsing the AE sensors connected to the instrument in an independent fashion, and capturing the transmitted signals with the adjacent sensors. This type of test (Auto Sensor Test or AST) is commonly used to verify sensors installation over time, or determine if changes in the area covered by the sensors has occurred over time.

**INSTRUMENT CHARACTERISTICS:**
- Compatible with batteries and alternative energy sources
- Low power consumption thanks to Field Programmable Gate Array (FPGA) design
- Wireless data transmission using 900 MHz RF module, allowing maximum reach and minimum power consumption
- Fusion of up to 11 sensor platforms including a single strain gauge, 4 AE channels and 6 parametrics
- Easily deployable, given its small size and wireless transmission to a base station using ISM RF band
- Internal storage via SD card
- User defined data filtering options that combine AE features and system parameters
- Customized alarms provide instant notification and data transfer upon reaching user-defined damage thresholds
- Power saving options based on parametric data collected

**INSTRUMENT CAPABILITIES:**
- Four AE channels, 6 parametric inputs and 1 strain gauge module
- Waveform capture on SD card
- 250 kHz low pass and 20 kHz high pass filters for AE acquisition
- AST on user demand to test the channels, or to perform tomography studies in a region of interest
- User defined AE feature filtering and waveform acquisition filter
- Up to 10 hits/sec per channel, when waveform saving is enabled with wireless transmission
- Up to 80 hits/sec per channel, without waveform saving and w/ wireless transmission
- User defined Sleep-Wake up mode based on parametric input values
- User defined front end filtering capability based on parametric and AE features
- Data file transmission when the node is not in acquisition mode
- Full watch mode capability (connect and disconnect remotely without stopping acquisition)
- Dedicated parametric for measuring battery voltage, which can be used in assessing charging when connected to an energy harvester

**POSSIBLE APPLICATIONS**
The node was designed as an easily deployable system for small but critical area monitoring — particularly to monitor the evolution of cracks discovered during routine inspections, and to assess the behavior of a critical bridge components such as a girder.

**FLOOR BEAM TO GIRDER CONNECTION (LINEAR LOCATION)**
- One sensor used for detection of AE sources from known discontinuity (e.g. crack)
- 3 sensors used as “guard” sensors
- The purpose of the guard sensor is to graphically filter out AE noises sources that occur outside the area of interest
- If the AE source passes the “guard” sensor before passing the AE sensor (S1 or S2), the data is still collected but graphically ignored by the location algorithm

**GIRDER WEB CRACK (2D PLANAR LOCATION)**
- Set the four sensors in a distribution to monitor the crack
- Strain gauge or displacement sensor can be connected to the parametric input
- Calculate speed of the medium and set up location filters or linear or 2d location
- Track AE signals from the source over time

**SPECIFICATIONS:**

| AE Channels | 4 |
| Bandwidth | 20 kHz – 250 kHz |
| Sensor | PKXXI or Passive Sensor (IL-XX-LP preamp) |
| Parametric channels | 6 |
| Strain Gauges | 1 |
| Nodes per base station | 1 |
| Interface Data Rate | 57.6 Kbps (5.7 Kbytes/sec) |
| AE Data Sets rate | 80 Hits/sec |
| Power consumption | 30 mAmps (1hit/ch/s, 1 parametric, no strain-gauge, 12V power supply, wireless on), 3mAmps (sleep mode) 80 ma (10hit/ch/s, waveforms on, no strain gauge or parametrics, 12V power supply, wireless on) |

Visit our website for an office near you
www.mistrasgroup.com