When An Alternate Energy Source Fails, What Do You Do?

Many completed projects for roads, bridges, highways, trains, power facilities such as solar, wind and other machinery are in place and operating. But when neighbors complain about high noise levels or the facility fails, help must be on the way. The first task is to get measurement data on the facility in its operating mode.

However, data is often difficult to obtain and financially prohibitive. But confidence levels and a "fix-it" plan cannot be started without it. This first step is to understand the facility's health as well as community issues. Fortunately, portable electronic equipment can be used to yield highly valuable information.

How is this done? Sensors are directly connected to modular measurement devices that are synchronized to take operating data at a precise instance. This understanding of the time relationship of noise components, vibration instabilities, and strain at particular points and frequency levels, can lead to useful information for solving operating problems.

The key to getting to the point of developing a strategy for fixing field problems lies in getting precise synchronized data from sensors in the

field. Being able to easily transport modular measurement equipment with connection to a simple portable PC USB port makes it highly affordable and quick to acquire precise data.

A Real-World Case Where Measurement Data Can Help

Recently, the town of Falmouth, MA was faced with neighbor complaints. The wind turbine noise was driving them crazy. So the town was forced to close down one of its wind turbines after a study confirmed what neighbors had complained about - too much noise.

The Department of Environmental Protection was called in to check out the noise of the Wind 1 turbine at Falmouth's wastewater facility. After monitoring the sound from five different locations, the agency determined that the noise was more than the state-mandated level of 10 dB above ambient noise levels. In fact, it was running very high at 30-40dB. So, the Wind 1 turbine was put offline.

While many wind turbines run without incident, other communities have similar complaints. As a result, the state is now considering new regulations that require potential noise issues to be reviewed before wind turbines are built.

Other states and governments face similar issues. To provide information to decision makers and help resolve these issues, it is imperative that accurate data is collected to characterize the noise levels and other system parameters.

Understanding the Problem Requires Fact Finding

How can measurement data help? Understanding any problem requires fact finding.

In the wind turbine example, sensors, such as strain gages, load-cells, vibration sensors, and tachometers can all be used to help characterize the system.

What is the noise level? Is a turbine blade unbalanced? What other factors may be at *play?*

Here is an approach that gets to the heart of the problem. Microphones with an IEPE input can be used to determine the noise level that the turbine produces. Strain gages, load cells, pressure transducers, and torque sensors, can be used to measure different stresses, such as the flex of the blades under different conditions to determine if a blade is unbalanced. Tachometers can be used to measure the wind speed of an anemometer.

Connection of the sensors directly to the modular instrumentation eliminates any signal conditioning issues. This allows fast and easy data gathering.

By synchronizing all of the measurement data from all the sensor inputs, users can truly understand what is happening to the system at any given moment, and diagnose operating problems.

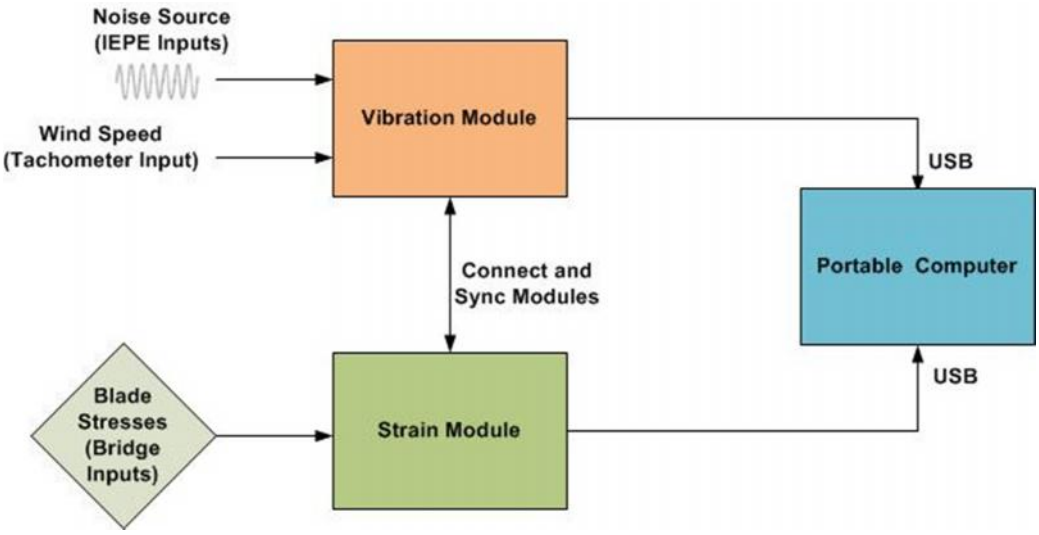
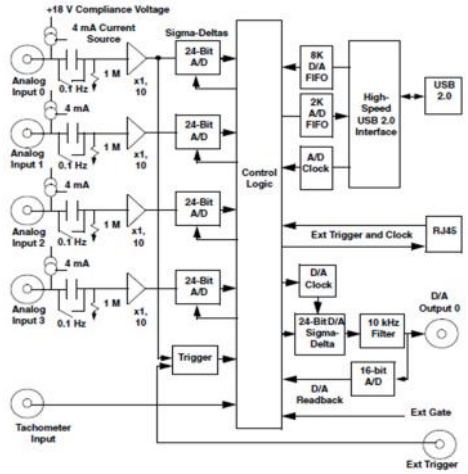
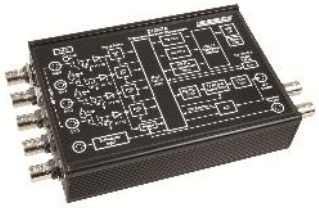


Figure 1. *Synchronizing multiple sensors and devices allows users to capture vibration, strain, and tachometer signals all correlated precisely in time – critical for diagnosing operating issues.*

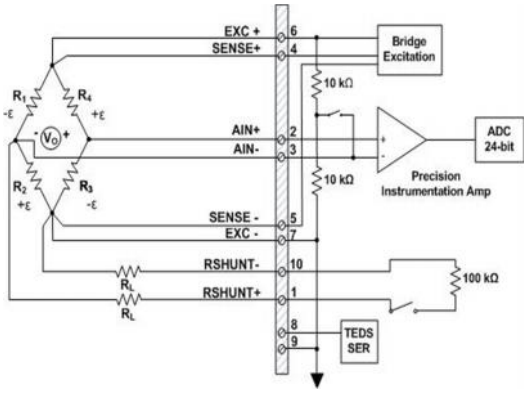
Vibration Module



For vibration measurement, use a device that accommodates direct connection of IEPE inputs and provides the proper current and coupling requirements like the DT9837 Series from Data Translation.



Strain Module



For strain measurements, use a device that supports the required bridge configurations with bridge completion, proper excitation, and Transducer Electronic Data Sheet (TEDS) smart sensor compatibility like the DT9838 from Data Translation.

But Software Really Points Out What's Going On

The integration of all the sensor data requires a software application that allows users to configure multiple sensor types easily, but is powerful enough to acquire, view, and analyze the data from multiple sensor types simultaneously.

Single-channel FFT (Fast Fourier Transforms) operations and two-channel FFT operations, like Frequency Response Functions, Cross-Spectrum, Power Spectral Density, Coherence, and Coherent Output Power operations, are required features for effective data analysis.

Data logging and export capability to Excel are also important features to consider.

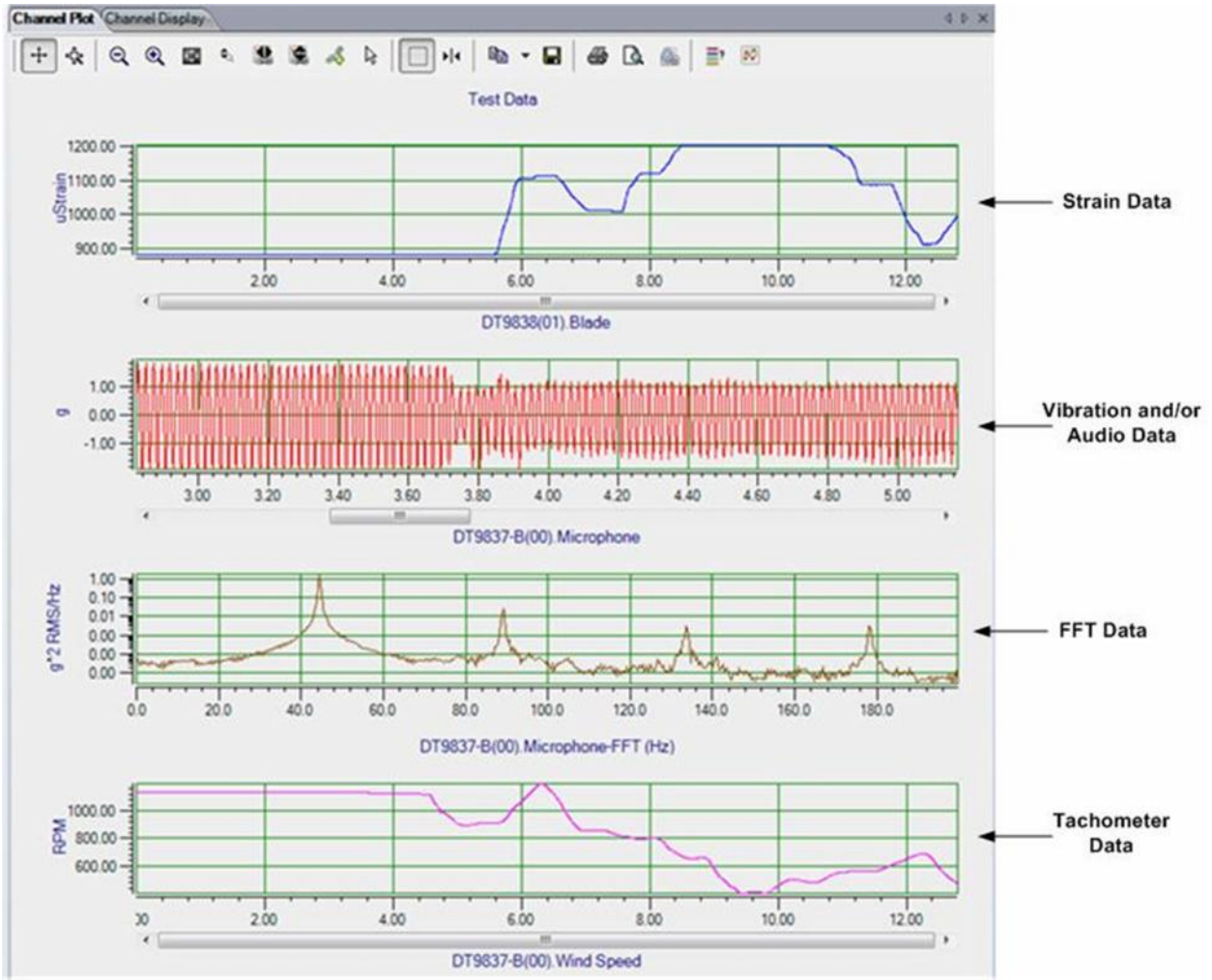


Figure 2. Easy configuration of multiple sensor types allows one to acquire and view vibration, strain, and tachometer data together.

Good Data Can Satisfy Neighbors and Officials

With new technologies, feelings of hostility are often present but eventually give way to acceptance. Communities need good measurement data to help them understand the issues. Modular measurement equipment can be transported easily and connected at the site. This makes it affordable and easy to acquire good data. Properly equipped to handle neighborhood complaints, officials have a better basis for resolving issues.