APPLICATION NOTE

CAS DATALOGGERS

Vibration Monitoring of a Gas Turbine in a Refinery

DAQ System Provides Effective Condition Monitoring

CAS DataLoggers has provided the vibration monitoring solution for a refinery relying on a gas turbine-driven generator to provide power for the facility. Continuous vibration monitoring is critical not only to protect against catastrophic failures but also for condition monitoring to allow users to schedule downtime for maintenance and avoid power interruptions which cause costly processing delays. The facility uses an older generator which has begun to develop vibrations in its shafts and bearings, which can lead to fatigue failures. Turbine failure could be due to bearing wear, damage to turbine blades or a number of other factors, so effective fault diagnosis requires analyzing data collected during critical windows surrounding the failure. Therefore technicians needed to setup condition monitoring of vibration signals of the engine's bearings and shafts during normal operation. Users also needed to acquire process data from the turbine including temperature, pressure, flow rates and RPM. Additionally, the generator's manufacturer wanted access to all this data to monitor it remotely for preventative maintenance purposes.

Installation

The refinery installed a Delphin Expert Vibro Data Acquisition and Control System sourced from CAS DataLoggers into their control cabinet adjacent to the turbine. The system's compact design and screw terminal connections made installation easy.

The Expert Vibro's 8 synchronous analog inputs allow for direct connection for piezoelectric accelerometers and displacement sensors at sampling rates of up to 50kHz per channel. The system also features 4 analog outputs and 8 digital outputs for connection to controllers. Integrated comparators for Keyphasor® sensors and 4 digital inputs are also included to enable flexible triggering. All channels are galvanically isolated to prevent transverse distortions.

The DAQ system's 24-Bit A/D converter ensures that measurements are taken with a high level of precision. The data logger is also equipped with a high-performance, dual-core FPGA processor based on ARM technology providing it with enormous reserves of power for online computations and analysis, including the ability to perform real-time FFT calculations. Meanwhile the Expert Vibro's touchscreen display shows users configuration and measurement data.

Usage

The Delphin is connected to the control room's PLC to continuously acquire pressure vibrations as well as temperature, flow rate and RPM data from the turbine. In this way the Delphin performs comprehensive condition monitoring for the gas turbine across every value of interest utilizing not only vibration data but also process data such as bearing temperatures. The Expert Vibro system has its own internal data storage capability (32 GB/1 billion point memory), making it especially reliable for this application. The system memory can record raw time signals as well as frequency spectra and characteristic values (Peak-Peak, Gap).

Users then connected the Expert Vibro datalogger's LAN interface to a LAN port giving them the ability to access and evaluate measurement data from any authorized PC on the refinery's network. Analysis of online/offline measurement data is performed from a desktop PC thanks to the Delphin's Profisignal Vibro module, a vibration analysis software module which provides full signal processing.

This modular signal processing system offers users a range of preprocessing functions. Users can select signal filters such as high, low, or bandpass with rectifiers, integrators, differentiators or decimators to configure a preprocessing sequence. Multiple sequences are able to run in parallel in order to evaluate an input signal for maximum versatility.

Simultaneously, the Delphin system sends all the data online via the refinery's wired Ethernet network. This enables the generator's manufacturer to view all the data offsite, providing the refinery with more reliable fault detection and faster response times.

Turbine control is provided by the control room's PLC. In the event of a failure, the PLC will initiate a shutdown command. As soon as the turbine receives the signal to shut off, there's a critical window both before the triggering event and as the turbine slowly spins down. Whenever this event occurs, the Expert Vibro automatically buffers the data from the last 10 minutes in memory before the alarm occurred, so that users can then record that buffer to the system's non-volatile storage. In this way users can analyze the data in the Delphin software for effective turbine failure diagnostic purposes.

The Delphin system functions as a subsystem of the PLC with access to all of its measurement and alarming data. The Expert Vibro also automatically sends users warnings and alarm conditions via their choice of text messages or emails.

Vibration Analysis Sofware

The Expert Vibro utilizes Delphin ProfiSignal analysis software for data acquisition, vibration analysis, visualization and automation. By using the Vibro option, users can portray online and offline FFT, cascade, time-signal and orbit diagrams, and monitor and evaluate both vibration and process data.

ProfiSignal is easy to learn and is modular and scalable. Measurement data is monitored on the fly and digital outputs which can react within milliseconds in the event of limit value violations can interface with shutdown circuitry. Characteristic values or raw time signals from any of the analog inputs can be output to 2 analog outputs to interface with other equipment.

Time signal processing and characteristic curve computations take place directly within the hardware's DSP. Users can access and analyze both online and archived data at any time by simply selecting their desired time range from the current visualization. ProfiSignal also offers users diagrams with a range of analysis functions, while customized documentation can be created with a report generator.

Benefits

The Expert Vibro DAQ system acts as the brain of this application as it measures, monitors and records the vibration and process data fully independent of a host PC. Other vibration monitoring systems require multiple pieces of equipment at a higher cost, but here a single system is providing real time monitoring, local data storage, alarming, and analysis. This data may then be manually evaluated at regular intervals or used with the alarm management option for automated and direct warnings and alarms to the appropriate personnel. With Delphin, system installation and familiarization with ProfiSignal were both quickly accomplished so that users were soon logging and processing their data.

The intelligent data logger records even the smallest irregularity in the data so non-periodic signals can now be precisely analyzed for effective fault diagnostics. This gives users a look at real time conditions of the gas turbine, making the refinery's generator--and its power—much more reliable, significantly reducing expensive processing delays due to undiagnosed problems when a turbine fails. Prior to installation and the real-time data collection and buffering, it used to take days for engineers to diagnose a problem. This also avoids unnecessary damage to the generator over time. Additionally, with Delphin's remote monitoring capability, the data is viewable not only locally but also remotely for the manufacturer to view online as additional diagnostic support.

For further information on the Delphin Expert Vibro DAQ System, vibration monitoring, or to find the ideal solution for your application-specific needs, contact a CAS Data Logger Application Specialist at **(800) 956-4437** or www.DataLoggerInc.com.