Combustion Pressure Monitoring System

By Douglas Dieruff, Applications Engineer

Products Used:

LabWindows®/CVI, DAQ, and Modbus

The Challenge

Provide a reliable and economical system for continuously monitoring turbine combustion pressure.

The Solution

The combustion pressure monitoring system consists of PC based DAQ interfaces controlled by LabWindows/CVI.

Abstract

A major power utility requires a system to monitor the pressure frequencies present in the combustion chamber of a combined cycle turbine. The system must report status to the power plant control system and alert the control room operator in the event of an alarm condition.

The Combustion Pressure Monitoring System

A standard PC running Windows 95 is the platform for this system. The PC contains an E series MIO interface. This system has been installed using both AT and PCI MIO interfaces.

The MIO interface provides differential analog inputs for voltage signals transmitted by pressure transducers connected to each turbine combustion chamber.

Turbine configurations vary from plant to plant, as do the plant configurations. The Combustion Pressure Monitoring System design allows the monitoring of the maximum number of differential channels available on the MIO interface. With an MIO-64E-3, the system is capable of monitoring up to 32 combustion chambers. The system also allows the inputs to be grouped by turbine, allowing one computer to monitor several turbines.

The voltage from each pressure transducer is digitized, and the power spectrum of the waveform is generated. The resulting spectrum is analyzed to determine the frequency of peak resonance in the combustion chamber. The operator may specify alarm thresholds for different frequency bands, which, if exceeded will alert the control room operator.

Software for the test system is divided into several functional areas: configuration management, report generation, and normal operation.

Configuration management allows the operator to adjust the operating parameters of the system. The pressure transducers have manufacturer calibration data that must be entered whenever a transducer is changed. The frequency bands and alarm thresholds may be modified. The local recording of pressure data and alarm events may be disabled.

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Report generation allows the operator to print data from an individual transducer or for a group of transducers. Report formats include pressure spectrum plots and peak summary forms.
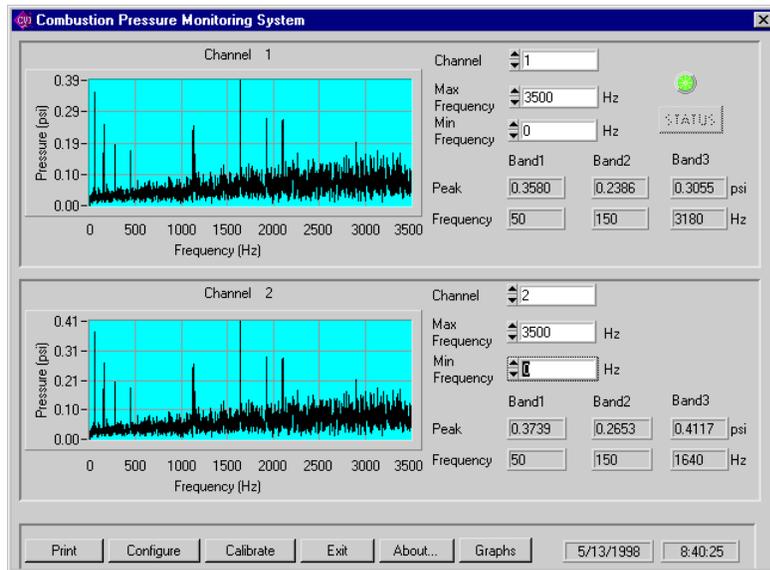

Figure 1, Combustion Pressure Monitor System

During normal operation the system displays a screen similar to the one shown in Figure 1. This form allows the operator to display the data for two transducers. This screen allows the operator to change the display frequencies to expand a region of interest in the spectrum. An additional display screen presents a summary of all transducers.

In addition to the local user interface, the Combustion Pressure Monitoring System interfaces to the plant control system using the Modbus protocol defined by AEG Schneider Automation. Sending the entire spectrum for each transducer is not possible with this interface. Rather than sending only alarm conditions to the control room, the system sends the peak pressure in each user defined frequency band. This allows the plant control system to provide useful information to the plant operator and perform its own alarm tests.

Results

The original installation of the Pressure Monitoring System has been in continuous operation for over one year. In that time it has provided valuable information allowing the customer to extend the interval between planned outages for maintenance. The customer has been satisfied with the operation of the original system to the point that additional systems have been installed at other plants.

Authors Note:

The above article was written in 1996. In the intervening time, the system has evolved through several generations. Current features include enhanced data displays, Modbus TCP/IP communication, and the ability to remotely view information.

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