Combustion Monitoring

The primary purpose of a stationary gas turbine is to generate power, and diagnostics will only be implemented when it is necessary for reliable power production. However, monitoring of the combustion process and related phenomena in large gas turbines is still limited. Combustion monitoring is being increasingly recognized as a **necessary component** for **safely operating** ultra low-NOx gas turbines.

Key features of Combustion Monitoring

- EZY-CM **connects** the **sensory components** and provides TMOS SCADA to process the evaluated data.
- Combustion Monitoring will collect the **raw-measurements**, and performs various **mathematical operations** such as FFT analysis and bandwidth calculation.
- **Real-time feedback** of the combustor to **adjust** the **fuel regulation system**.
- It enables the operator to **optimize** the exhaust **emission continuously**.

The primary purpose of Combustion Monitoring

- To raise the alarm, if the acoustics in a specified band is too high.
- To monitor the relation of data provided by the turbine control and the combustion dynamics.
- To calculate an auto-tuning mechanism for the installed hardware.
- To prevent the turbine from substantial damage.

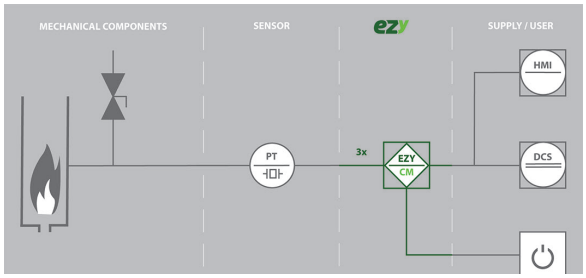
Why is Combustion Monitoring so important

- Combustion instabilities deteriorate the engine performance and reliability and increase the frequency of required service.
- Combustion instability can cause flashback, flame blowout due to an increase in the LBO limit mixture ratio, starting problems, damage to combustor hardware, switchover problems, High Cycle Fatigue (HCF) of hot gas path components, and Foreign Object Damage (FOD) to turbine components.
- In the worst case, a system failure can occur due to extensive structural damage and loss of control.

Typical Installation on Site

- The sensor is mounted in a stainless steel block. The whole unit is fixed by using assembly bolt holes from the combuster.
- The sensor block provides a second adapting connector (NPT 1/2") to support the original tuning pipes.
- This can be used as reference measurement points during sensor validation.

Functional Drawing



In relation to the functional drawing, please find detailed information and examples below.

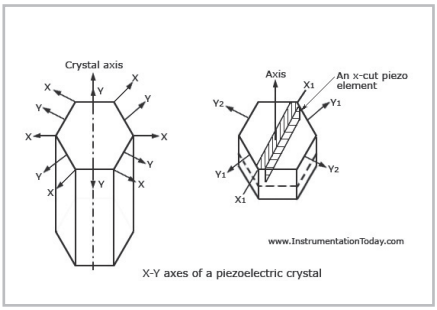
Sensor (Accessories)

Dynamic Combustion Sensors

Dynamic combustion sensors are typically mounted on modern heavy-duty gas turbines for intermittent measurement and burner tuning, only when required due to cost-saving and other maintenance needs. After a major overhaul, it is common practice to perform an adjustment during the commission stage. For these intermittent tuning requirements, a permanent monitoring system may not be required. Modern DLN combustors are equipped with the possibility of remote monitoring, diagnostic and tuning. Some models use the on-line dynamic pressure transducers for issuing alarms if acoustic amplitudes exceed a preset limit, thus preventing damage to structural components.

Piezo-Electric Transducers

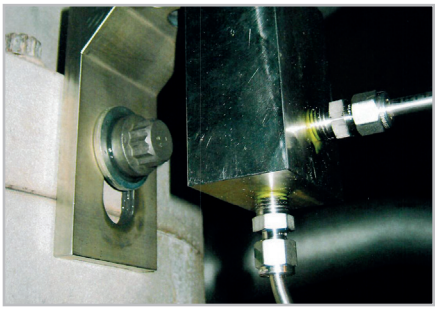
The primary diagnostic tool for combustion chambers of large gas turbines is the dynamic pressure sensor (piezo-electric transducer). So far only piezo-electric transducers are used for mounting on the gas turbine with casing temperatures of about 400 °C and pressures of 15bar - electric transducers are ceramic crystals that produce a charge separation pro-portional to the applied pressure variation. The signal crystals are made of either compression mode quartz crystals preloaded in a rigid housing, tourmaline crystals, or human-made polycrystalline ceramic. These crystals are mounted in such a way that acceleration effects can be compensated for.



The remnant sensitivity to acceleration is minimal and can be ignored in gas turbine applications. These designs give microsecond response times and monitoring frequencies in the hundreds of kHz. Only dynamic pressure can be monitored with piezo-electric transducers.

Signal

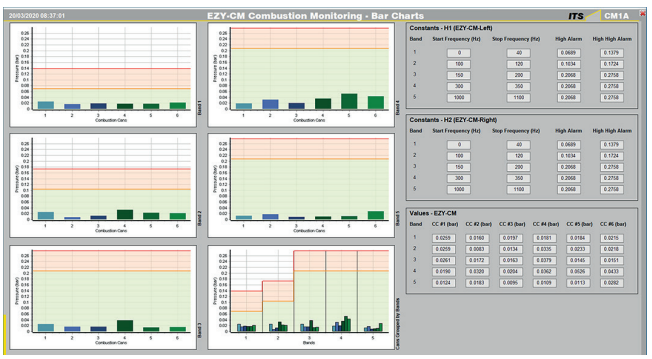
These crystals can withstand high temperatures, and their connections are integrated to maintain the high-temperature properties over a length of several meters. High-temperature measurements of the dynamic pressure are possible up to 700 °C. The sensitivity of these transducers is a function of the size and the properties of the piezo-electric crystal. Both mineral and synthetic crystals are used. For gas turbine applications the piezo-electric transducers have advantages over the piezo-resistive sensors in that they are more resilient in a high-temperature environment, and also possess a robust integrated construction of the sensor head.

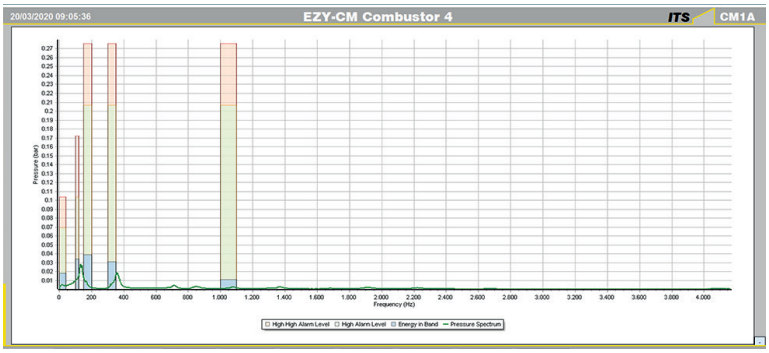


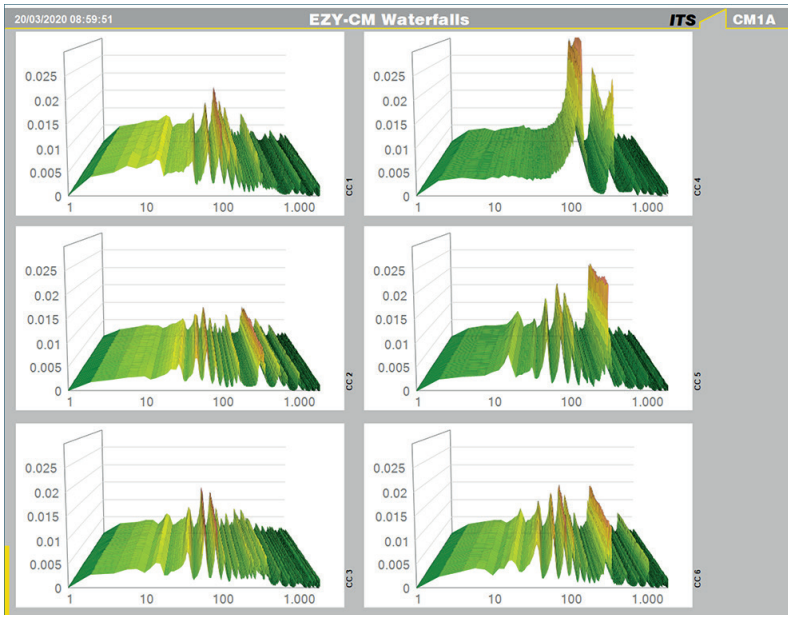
EZY Device CM

Combustion Monitoring Example Screens

The following subsections provide brief descriptions of the sensors and associated instrumentation for data acquisition, analysis, and display.







CM Waterfalls

FFT analysis in a historical representation - better overview.

GO BEYOND

EZY Family devices allow you to analyze your data down to the moment, enabling a range of new possibilities to monitor and manage your utility.

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