

Model CDMS 7FA Fiber Optic Combustion Dynamics Monitoring System



DavidsonSensors™ provide the safest and most cost-effective instrumentation for use in harsh industrial applications.

This product data sheet describes Davidson Model CDMS 7FA, a fiber-optic based combustion dynamics monitoring system. This system is designed for use in General Electric 7E, 7F, 9E, and 9F gas turbines and does not require any modifications to the engines.

Performance Specifications

Frequency Response

2 Hz to 5 kHz +/- 0.4 dB

Pressure Sensitivity

250 mV per psi (nominal)

Dynamic Pressure Range

+/-10 psi

Static Pressure Limit

1000 psi

Acceleration Sensitivity

< 0.001 psi per g

Thermal Stability

Calibrated for operation at 800° F;
1% per 100° F variance

Thermal Sensitivity

Insensitive to Transient Thermal Events

Transducer Temperature Limit

1000° F

Background

Dynamic instabilities that occur during the combustion process can severely damage an engine. Combustion dynamics monitoring systems can be used to tune the engine and maintain dynamic stability, minimize emissions, and detect problems. Early detection of combustion instabilities can enable the operators to avoid catastrophic damage to the engines. The result is high operating efficiency, low emissions, and new insight into the health of the engines.

Davidson offers fully integrated combustion dynamics monitoring systems. These integrated systems include all of the transducers, cabling, and signal conditioning equipment required for a combustion dynamics monitoring system.

Davidson fiber optic transducers can tolerate temperatures up to 1000° F. The transducers have flexible probes that allow them to be installed directly on the combustor casing at an existing port where they penetrate through the casing and through an existing hole in the inner liner. This direct-coupled method provides the greatest fidelity in the signal and eliminates the need for electronic transducers, charge amplifiers, "infinite" length tubes, and associated purging systems.

The result of this direct measurement is higher fidelity and higher quality signal with lower installation and maintenance costs. Davidson combustion dynamics monitoring systems are the best value for combustion dynamics monitoring.

System Configuration

The CDMS 7/9 system consists of the following major subsystems:

- Pressure Transducers (one per combustor)
- Fiber Optic Cables and Junction Box
- Signal Conditioner
- Spectrum Analyzer and System / Display

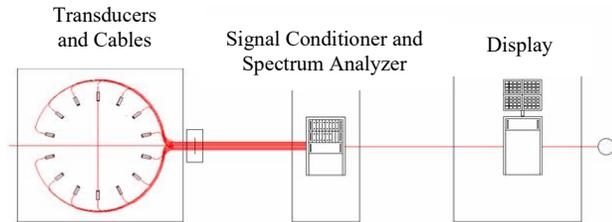


Figure 1 – CDMS 7/9 System Schematic

Subsystem Details

Transducers - Davidson fiber optic pressure pulsation transducers are designed for installation through the turbine casing where the existing acoustic waveguides are installed. The transducer design allows the sensor to be positioned flush with the OD of the liner. The transducer probe is flexible to accommodate movement of the liner relative to the casing.



Figure 2 – GT1200-7FA Transducer

The dynamic pressure sensor is located at the tip of the transducer and is made of a superalloy diaphragm. The sensor functions as an optical interferometer. The diaphragm is protected by a thermal radiation shield and the sensors is completely enclosed behind the diaphragm inside

the transducer housing. The transducer has an armored pigtail cable 4' long.

Cables – The tactical cables connect the transducers to the junction box and range in length from 40' to 50' depending on the location of the junction box. The tactical cables are rated for 550° F. The first four feet of the tactical cable is sheathed in stiff wound stainless steel armor for thermal and mechanical protection. The home run cable connects the tactical cable to the signal conditioner. The home run cable is rated for 180° F.

Fiber Optic Signal Conditioner – The fiber optic signal conditioner transmits light to each of the transducers via a separate optical fiber.

The light is modulated by the sensor at the tip of the transducer and is reflected to the signal conditioner where it is converted to an optical signal into a electronic signal.

The electronic signal is processed by a high-speed micro-processor that converts the signal into pressure readings at up to 80kHz and provides an analog output signal, i.e., +/- 5 Volts, proportional to the pressure.

CDMS Monitoring System and Software - The CDMS monitoring system consists of an industrial rackmount computer and a 19" LCD. The computer receives the electrical signals from the signal conditioner and displays the signals according to a variety of options to be defined during the training session prior to installation.

The combustion monitoring software allows the user to configure the display to provide a visual representation of the engine, to set thresholds for alerts and warnings, and to enter calibration constants for the transducers.

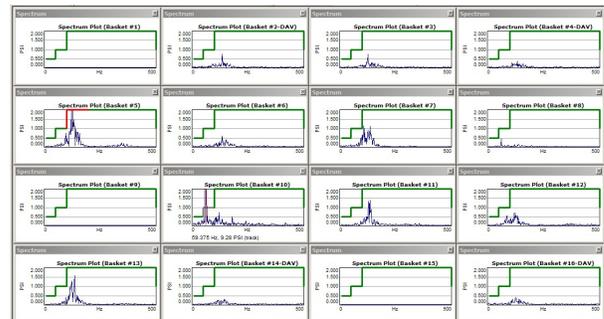


Figure 3 – Sixteen Channel CDMS Display

Installation and Training

Davidson provides turnkey installation, commissioning, and training for the system operators. Consider the following when developing a plan for installation of a CDMS:

- A pre-site conference call should be conducted to walk through the installation identifying the need for penetrations, permits, power, special needs, etc.
- The turbine must be shut down and cool at the time the transducers are installed.
- Electrical power needs to be available at the location of the monitoring system and the fiber optic signal conditioners.
- For planning purposes, assume that installation and commissioning can be accomplished by two technicians in three days.

Testing and Calibration

Standard test and calibration includes the following:

Each transducer is calibrated at the factory at ambient temperature at 0.5 psi dynamic pressure.

Documentation

A calibration data sheets will be provided for each transducer upon request.

An operator's manual is provided with each system.

Safety (Transducer with Cable)

Intrinsically-safe and suitable for use in:

Class I, Division 1, Groups B, C, and D
Class II, Division 1, Groups E, F, and G
Class III, Division 1

Ordering Data – Complete System

Model Number	CDMS 7FA
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Options

10 -Channel Fiber Optic Signal Conditioner for 7E	DSC1400-10
14 -Channel Fiber Optic Signal Conditioner for 7F 9E	DSC1400-14
18 -Channel Fiber Optic Signal Conditioner for 9F	DSC1400-18

Spares

Four Channel Card	DSC1400M4
Tactical Cable	Tactical 40
Pressure Transducer	GT1400 Frame 7

U.S. Patent 8,125,646 and other Patents Pending

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