

Model CDMS 7/9 Fiber Optic Combustion Dynamics Monitoring System



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

This product data sheet describes Model CDMS 7/9 fiber optic 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 10 kHz +/- 0.4 dB

Pressure Sensitivity

100 mV per psi (nominal)

Pressure Range

+/-10 psi

Static Pressure Limit

1000 psi

Acceleration Sensitivity

< 0.001 psi per g

Thermal Stability

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

Thermal Sensitivity

Insensitive to Transient Thermal Events

Transducer Temperature Limit

1200° F (GT1400); 1000° F (GT1200)

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 a more reliable 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
- Dynamic Monitoring System / Display

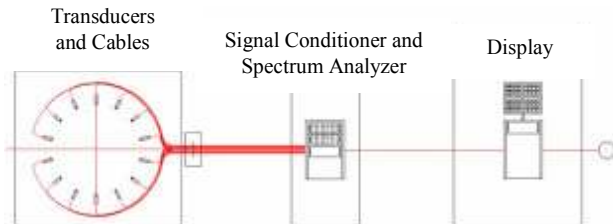


Figure 1 – CDMS 7/9 System Schematic

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 liner and the transducer housing is flexible to accommodate movement of the liner relative to the casing.



Figure 2 – GT1200-7FA Transducer

The sensor is located at the tip of the transducer and has a superalloy diaphragm that functions as an optical interferometer. The diaphragm is protected by a thermal radiation shield and the sensing element is completely enclosed behind the diaphragm in the transducer housing.

The transducers have forty (40) feet of fiber optic cable rated for 550° F. The fiber optic cable is sheathed in ¼" diameter stainless steel armor for mechanical protection. The cables are terminated with ST connectors.

Fiber Optic Signal Conditioner – The fiber optic signal conditioner transmits light to each of the transducers via a separate fiber optic cable. The light is modulated by the sensor at the tip of the transducers and reflected back to the signal conditioner where it is converted from an optical signal into an electronic signal. The electronic signal is processed by a high speed micro-processor that converts the signal into pressure readings at 15 kHz and provides an analog output signal, i.e. +/- 5 Volts, proportional to the pressure. The result is unprecedented measurement reliability, accuracy, and frequency response in harsh industrial environments.

Dynamic Monitoring System / Display - The monitoring system consists of an industrial rackmount computer and a 19" LCD display for each turbine. The computer receives the signals from the transducers and displays the signals according to a variety of options to be defined during the training session prior to installation. Setup normally entails a computer configuration with a TCP/IP address that can be connected to the plant network and provides Virtual Network Computing (VNC) access for external users.

The monitoring software consists of the following:

- **Basic Combustion Measurements** - This package provides the basic combustion analysis software and 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.
- **Criteria Trending** - This package provides the trend analysis software and allows the user to detect long term changes in the frequency spectrum of each combustor.
- **MODBUS Interface** - This package provides an interface and necessary software.

Installation, Commissioning, 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 shutdown 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 two work 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

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

Other Applications

For information about other Davidson products, see www.davidson-instruments.com

Guide to Configuring a Fiber Optic Sensing System

For information to assist you in planning a fiber optic sensing system, see

www.davidson-instruments.com

Ordering Data

Model Number	CDMS 7/9
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Options

10 -Channel Fiber Optic Signal Conditioner 7E	DSC1400-10
14 -Channel Fiber Optic Signal Conditioner 7F 9E	DSC1400-14
18 -Channel Fiber Optic Signal Conditioner 9F	DSC1400-18
10 Channel Dynamic Monitoring System	SA-1210
14 Channel Dynamic Monitoring System	SA-1214
18 Channel Dynamic Monitoring System	SA-1218

Spares

Pressure Transducer	GT1200 Frame 7
Pressure Transducer	GT1400 Frame 9
Two Channel Card for Fiber Optic Signal Conditioner	DSC1400M2
Four Channel Card for Fiber Optic Signal Conditioner	DSC1400M4
Signal Conditioner Chassis	DSC1400BP
Power Supply/ Communications Card	DSC1400PC

U.S. Patents 5,202,939; 5,392,117; U.S. Patent Pending

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