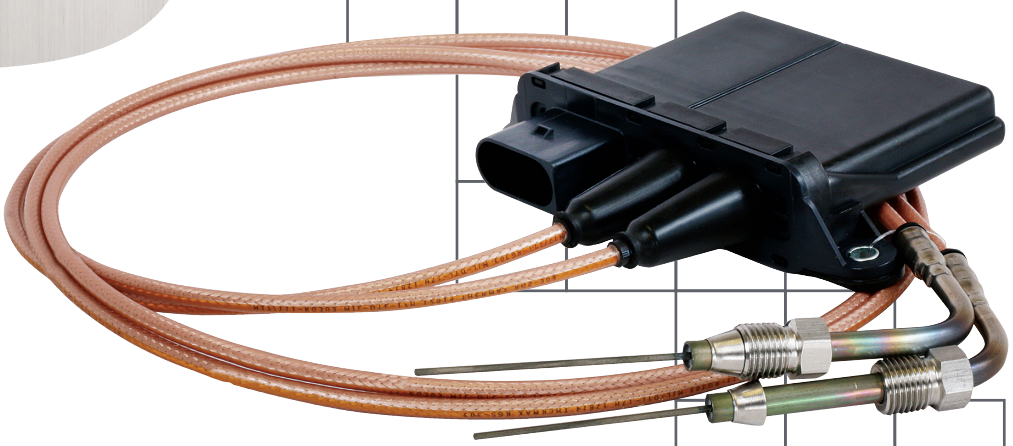
RF Sensors for Particulate Filters

Sense



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Product Overview

CTS's RF Sensor is a fully-integrated particulate filter sensor and control unit, capable of directly controlling filter operation and diagnosing system faults and failure modes. The sensor measures the soot and ash levels in a particulate filter and optimizes filter control to reduce engine fuel consumption while extending the life of the filter. A single sensor also takes real-time measurements of the filter state and detects emission system malfunctions to meet on-board diagnostic (OBD) requirements.

CTS's sensor uses low-power radio frequencies (RF) to transmit and receive signals through the filter. Soot and ash accumulation levels, as well as filter failure symptoms, can be measured by the change in the RF signal response. The sensor provides additional flexibility to engine and aftertreatment system designers when attempting to meet increasingly stringent emissions regulations and fuel efficiency standards.

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CAUTION
HIGH
TRAILER

RF Sensors for Particulate Filters

Applications

The CTS RF sensor is uniquely designed for on-vehicle sensing and control of diesel particulate filters (DPF) and gasoline particulate filters (GPF). On-highway applications of the sensor include passenger cars, trucks, buses, and vocational vehicles. Off-highway applications include construction and agricultural equipment, rail, marine, and power generation.

System Benefits: Filter Controls

Real-time measurements and feedback control based on filter soot and ash levels enable the following benefits for OEM and retrofit applications:

- Reduced engine fuel consumption through optimized regeneration intervals and duration
- Decreased warranty claims via more precise feedback and control of particulate filter operation
- Lower maintenance costs by measuring ash directly and cleaning the particulate filter only when needed
- Extended component life by minimizing high temperature regenerations
- Reduced system costs by utilizing smaller or less-expensive filters via improved sensing
- Faster development times by decreasing the resources needed for particulate filter calibration
- Decreased oil dilution through shorter and fewer overall regenerations

Specific benefits and system advantages depend on a number of factors, including baseline application, aftertreatment architecture, and control strategy.

System Benefits: Filter Diagnostics

Real-time monitoring of engine and particulate filter operation on the vehicle enable advanced diagnostics capabilities including:

- Early fault detection of engine-out conditions such as high soot or ash emissions, indicative of upstream malfunctions to prevent and protect the particulate filter from failures
- Continuous monitoring of the particulate filter state over all operating conditions — even with the engine off
- Detection of particulate filter failures resulting in reduced trapping efficiency
- Measurement of spatial variations in filter loading or failures to detect non-uniform soot and ash accumulation
- Bulk measurement of 100% of the exhaust stream

Filter diagnostic and control functions are provided by a single sensor, greatly simplifying particulate filter implementation.

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RF Sensor Specifications

RF control unit with integrated microcontroller, RF transmit and detect functions, sensor diagnostics, and vehicle communications.

Antennas for RF signal transmission and detection are passive devices consisting only of stainless steel (Inconel) rods well-suited for harsh environments.

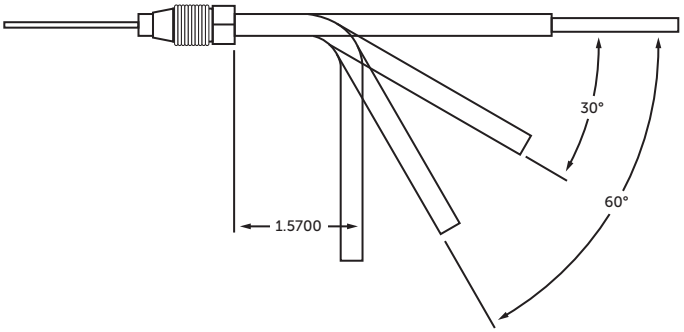
The antenna geometry and bend angle are customized to fit application packaging requirements.

Sensor Operating Specifications

Measurement Update Rate	0.1 Hz Typical, > 1 Hz for Customer-Specific Applications
Operating Frequency Range	0.4 to 2.5 GHz
Soot Measurement Accuracy	±0.5 g/L Typical, Based on Customer Calibration Accuracy
Ash Measurement Accuracy	Based on Customer Calibration Accuracy
Measurement Method	Magnitude and Phase

Electrical

Supply Voltage Range	6.5V to 36V
Max Current at 25°C	500 mA
Communication Method	CAN J1939



Mechanical

Mass	Sensor Module: 175g Max, Antenna: 125g Max Each, Based on 2m Cable
Antenna	125g Max Each, Based on 2m Cable
Connector	Hirschmann, 4 Pin Inline [1]
Envelope (Sensor Module)	131 x 107 x 27.3 mm
Mounting Features	Three Bolt, M5X0.8, ISO Class 4.6
Antenna Body Length	150 mm Max
Cable Length	Customer Specified
Number of Antennas	2
Antenna Mounting	M12 x 1.25

Durability/Environmental

Storage Temp. Range	–55°C to 125°C
Operational Temp. Range (Sensor Module)	ISO 16750-4, 5.1.1.2 and 5.1.2.2, –40°C to 125°C
Operational Temp. Range (Antenna)	ISO 16750-4, 5.1.1.2 and 5.1.2.2, –40°C to 650°C; Peak 900°C [2]
Operational Temp. Range (Cable)	–40°C to 200°C

[1] For other connector options, contact CTS Engineering

[2] For higher temperature operating requirements, contact CTS Engineering

[3] Requires non-conducting filter

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