

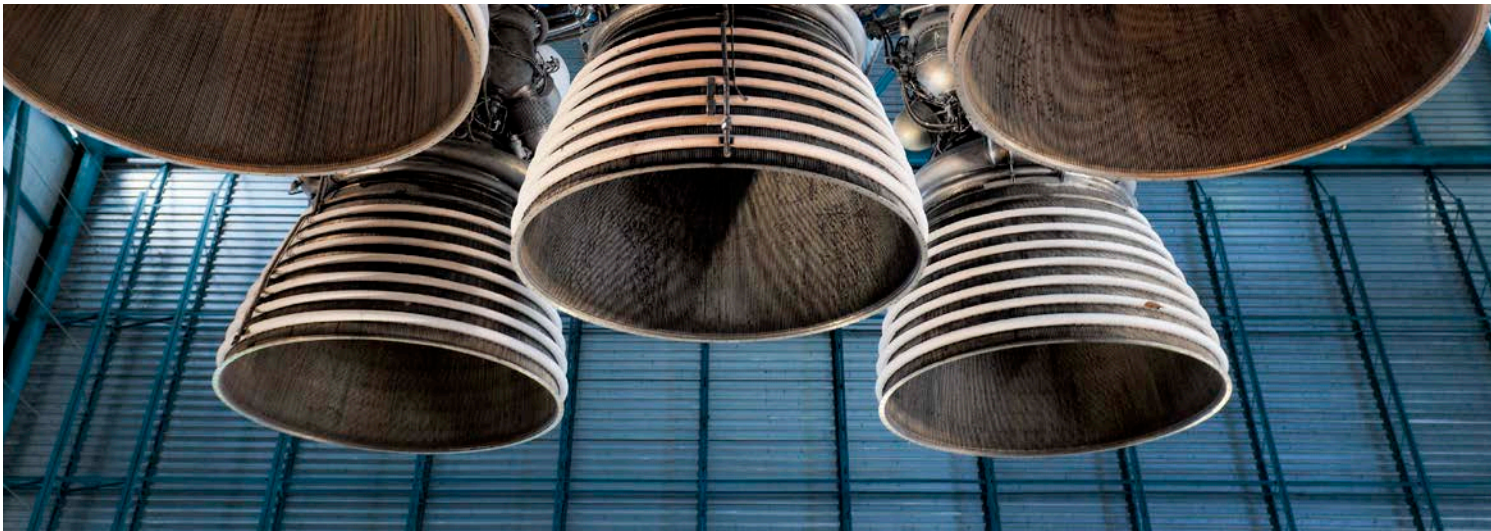


HIGH TEMPERATURE ACCELEROMETERS FOR GAS TURBINES & HELICOPTERS

 **PCB PIEZOTRONICS**
AN AMPHENOL COMPANY

 **ENDEVCO**
AN AMPHENOL COMPANY

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VIBRATION TESTING IN SEVERE THERMAL ENVIRONMENTS

Featuring UHT-12™ Ultra High Temperature
Sensing Element

Vibration testing of aircraft gas turbine engines, industrial turbines, rocket propulsion systems, and exhaust systems requires accelerometers that are designed to withstand very high temperature environments. PCB's accelerometers for testing and monitoring of turbomachinery are manufactured from tough low mass materials such as titanium and Inconel, and are hermetically sealed.

This brochure contains a sample of our stock and standard high temperature instrumentation, including those that feature our UHT-12™ high temperature crystal for operation to 1400 °F (760 °C). We also offer sensors that are matched precisely to the requirements of engine manufacturers to ensure successful measurement.

VIBRATION TESTING IN SEVERE THERMAL ENVIRONMENTS

Temperature Range: -100 to +1400 °F (-73 to +760 °C)

ICP® & Charge Output

Case and Ground Isolation

RTCA/DO-160 & MIL STD-810 Qualification Available

UHT-12™ Crystal

APPLICATIONS

Test & Monitor Vibration of Gas Turbine Engines

Turbocharger and Exhaust System Testing

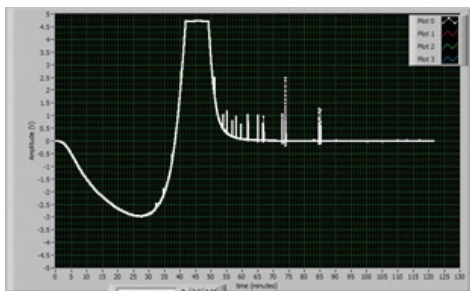
Engine Balancing

WHAT IS UHT-12™?

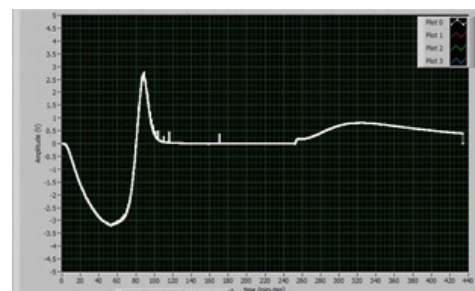
PCB® offers specially designed and tested ICP® accelerometers for conducting vibration and shock measurements under demanding environmental conditions of up to 356 °F (180 °C). These sensors combine proven quartz and ceramic shear sensing technology with specialized, built-in microelectronic signal conditioning circuitry to achieve dependable operation in extreme temperatures and through repetitive temperature cycling.

Charge output accelerometers from PCB® use piezo-ceramic sensing elements that output an electrostatic charge signal proportional to the applied acceleration. These sensors can operate at extremely high temperatures (up to 1400 °F/ 760 °C) because they do not contain the built-in signal conditioning electronics that limit the temperature range of ICP® accelerometers.

UHT-12™ technology reduces the effects of temperature variation. Pyroelectricity phenomenon may occur during large temperature fluctuations, generating “spikes” and disrupting behavior of the accelerometer and the test results. Accelerometers made with UHT-12™ technology have an improved data quality.



WITHOUT UHT-12™



WITH UHT-12™

APPLICATIONS

Vibration testing of automotive exhaust, turbocharger and engine systems requires accelerometers that are designed to withstand very high temperatures.

HIGHLIGHTS

Absence of pyroelectric noise spikes up to 1400 °F (760 °C)

Sensitivity that remains more consistent over a wide temperature change

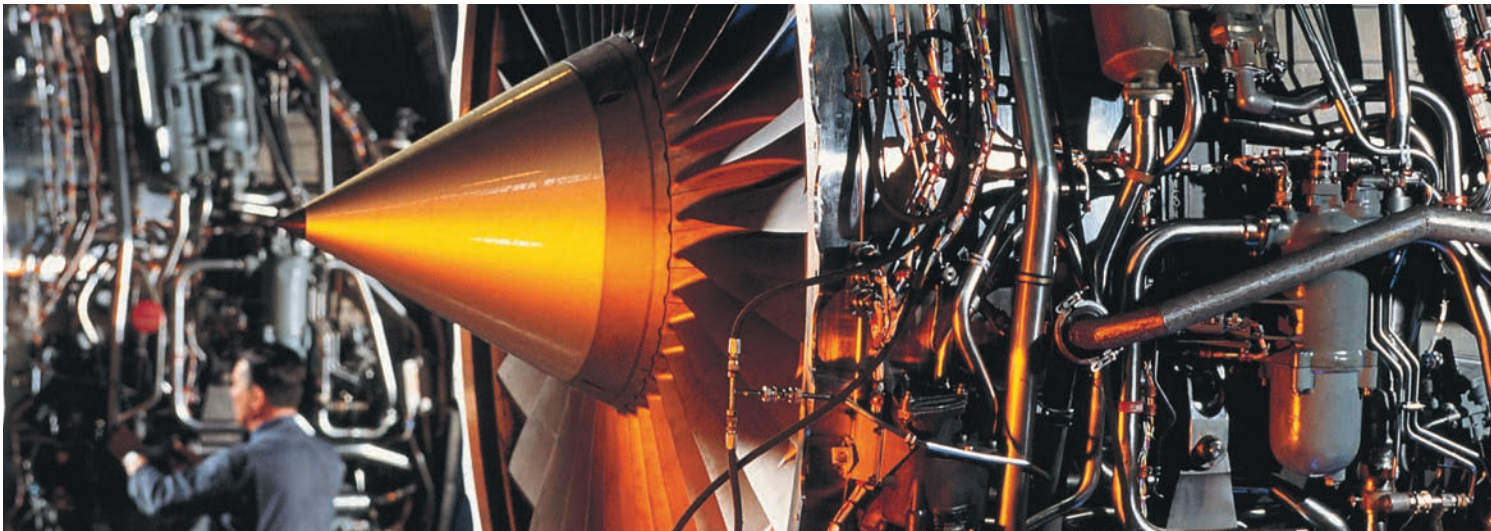
Shear mode crystals isolated from base strain & transverse measurement errors

Proprietary crystal technology comes sealed in a hermetic package and has proven reliable performance in hundreds of automotive powertrain NVH installations for research and monitoring

PCB® ACCELEROMETERS ARE AVAILABLE TO 1400 °F (760 °C)

ICP® accelerometers available in single and triaxial versions to 356°F/180°C

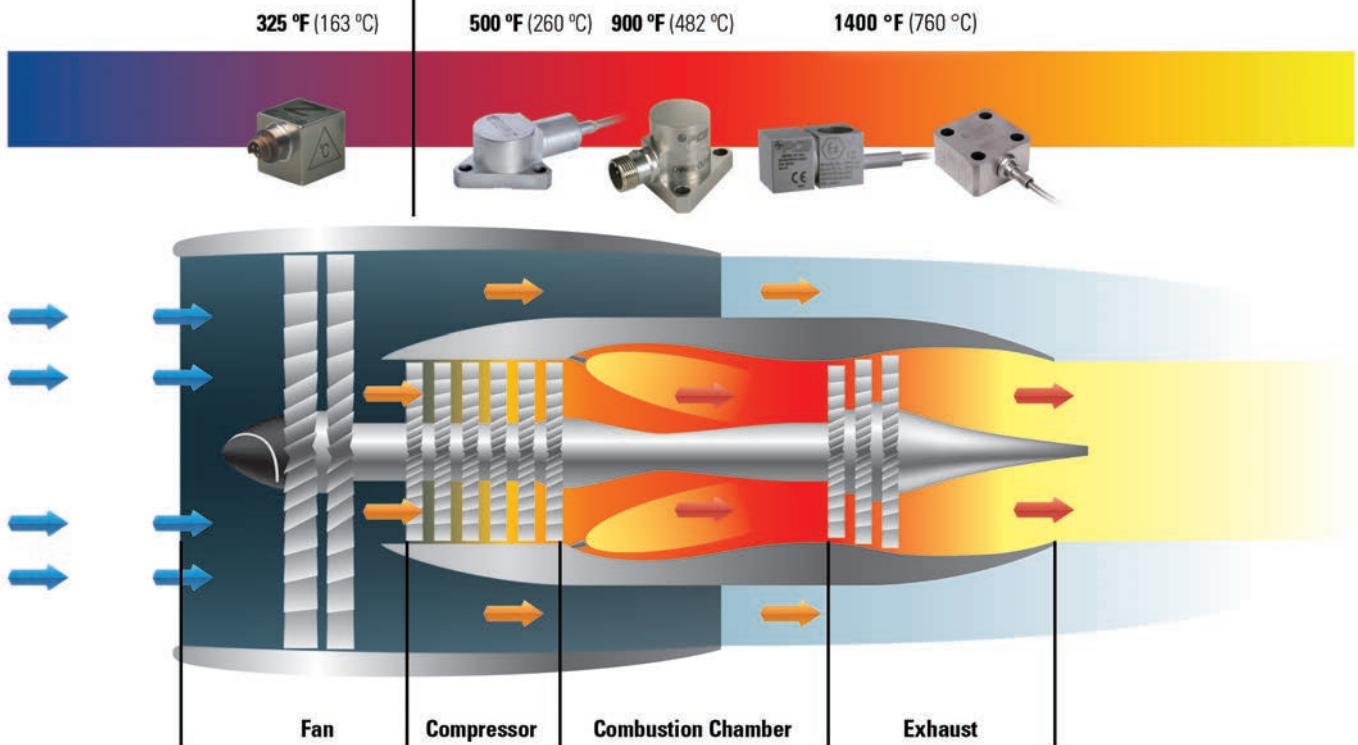
Charge output accelerometers for testing or continuous monitoring cover temperature ranges to 1400 °F (760 °C)



PCB® High Temperature Accelerometers are Available to 1400 °F (760 °C)

ICP® Accelerometers available in single and triaxial versions to 325 °F (163 °C)

Charge output accelerometers for testing or continuous monitoring cover temperature ranges to 1400 °F (760 °C)



FAN AREA AND COMPONENT TESTING

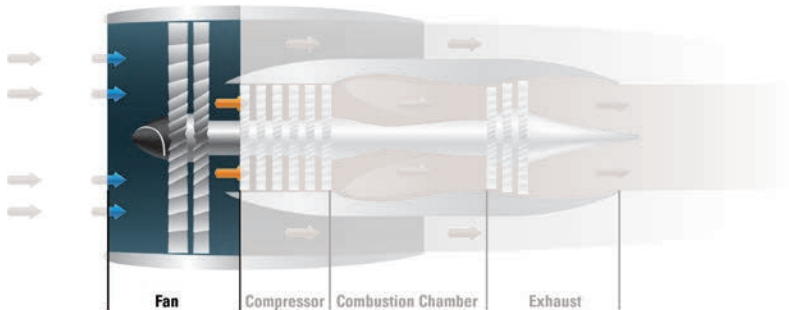
HIGHLIGHTS

Robust titanium housings
Measuring range up to 1000 g

Frequency from 2 to 10k Hz
Low weight starting at only 1 gram

ICP® ACCELEROMETERS TO 356 °F (180 °C)

The fan area of a turbine engine requires test accelerometers capable of withstanding not only high temperatures but also severe vibration. With small size and low mass, ICP® accelerometers below are recommended for ESS and HALT/HASS testing of engine components.



ESS MINI QUARTZ SHEAR ICP® ACCELEROMETER

MODEL 320C15 & 320C18

Temperature: -100 to +325 °F
(-73 to +163 °C)

Sensitivity: 10 mV/g

Measuring range: 500 g

Weight: 1.7 to 2 grams



TRIAxIAL LIGHTWEIGHT MINIATURE ICP® ACCELEROMETER

MODEL HT356B01 & HTJ356B01

Temperature: -65 to +356 °F
(-54 to +180 °C)

Sensitivity: 5 mV/g

Measuring range: 1000 g

Weight: 1 gram

HTJ356B01 is ground isolated



UHT-12™ ICP® TRIAXIAL ACCELEROMETER

MODEL 339B32

Temperature: -65 to +325 °F
(-54 to +163 °C)

Sensitivity: 10 mV/g

Measuring range: 500 g

Weight: 3.6 grams

UHT-12™ sensing technology



UHT-12™ ICP® TRIAXIAL ACCELEROMETER

MODEL 339B31

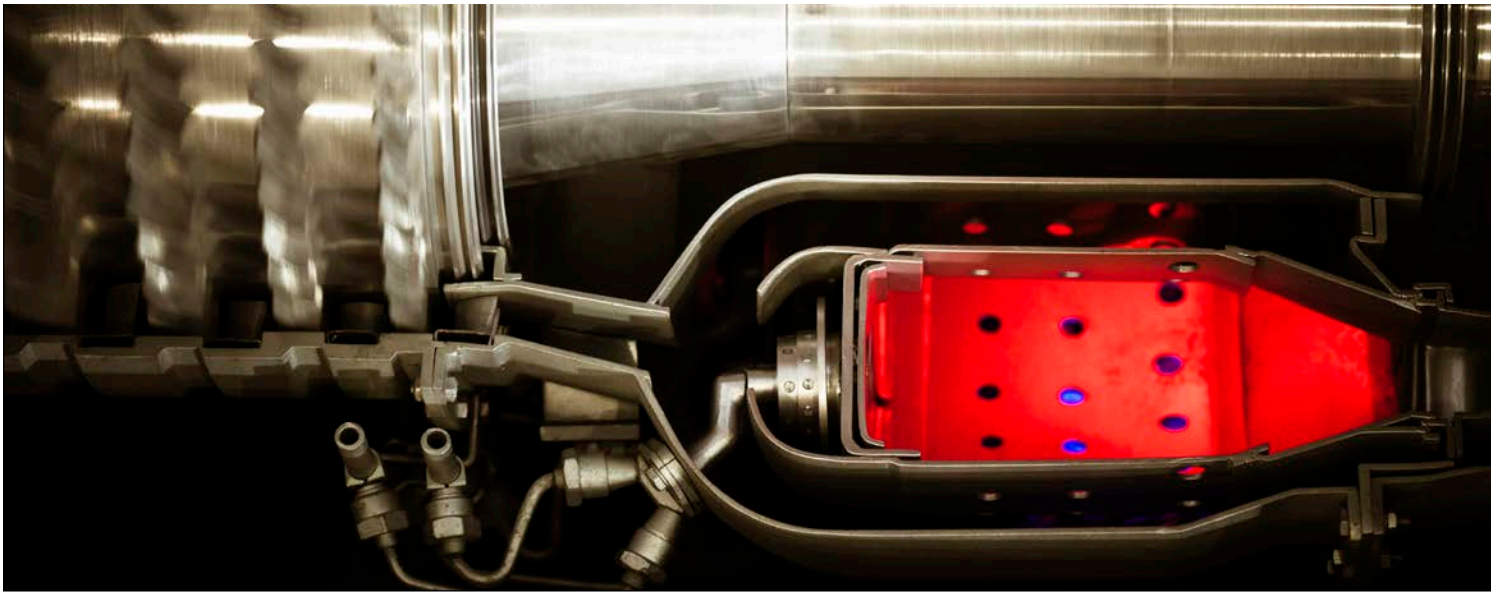
Sensitivity: (± 10%) 10 mV/g

Measurement Range: ±500 g pk

Frequency Range: (±5%) 2 - 8000 Hz

Temperature Range: (Operating) -65 to +356 °F (-54 to +180 °C)

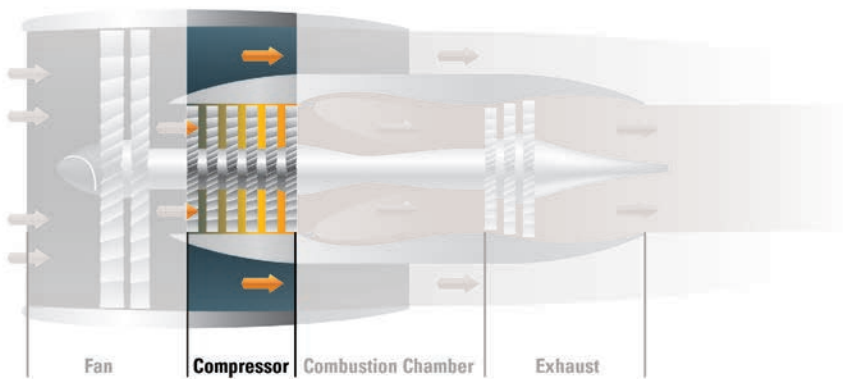
Weight: 4.2 grams



COMPRESSOR AREA AND COMPONENT TESTING

CHARGE OUTPUT ACCELEROMETERS TO 900 °F (482 °C)

The compressor area of a turbine engine requires an accelerometer capable of higher temperatures. The charge accelerometers listed below are ideal for the application and feature hermetically sealed titanium housings, smaller size and high frequency range.



HIGHLIGHTS

- Robust housings, hermetically sealed
- Measuring range to 2300 g
- Frequency to 12k Hz
- Miniature models from 2 grams



MINIATURE TRIAXIAL CHARGE OUTPUT ACCELEROMETER

MODEL 356A70 & 356A71

Temperature: -94 to +490 °F
(-70 to +254 °C)

Sensitivity: 2.7 to 10 pC/g

Measuring range: 1500 g

Weight: 8 grams



MINIATURE RING-STYLE CHARGE OUTPUT ACCELEROMETER

MODEL 357B06

Temperature: -65 to +500 °F
(-54 to +260 °C)

Sensitivity: 5 pC/g

Measuring range: 500 g

Weight: 2.3 grams



HIGH TEMPERATURE MINIATURE CHARGE OUTPUT ACCELEROMETER

MODEL 357B11

Temperature: -95 to +500 °F
(-71 to +260 °C)

Sensitivity: 3 pC/g

Measuring range: 2300 g

Weight: 2 grams



CHARGE OUTPUT TRIAXIAL ACCELEROMETER WITH UHT-12™

MODEL EX356A73

Temperature: -67 to +900 °F
(-55 to +482 °C)

Sensitivity: 3.2 pC/g

Measuring range: ±500 g

Weight: 150 grams



UHT-12™ HIGH TEMPERATURE CHARGE OUTPUT ACCELEROMETER

MODEL 357A63

Temperature: -65 to +900 °F
(-54 to +482 °C)

Sensitivity: 0.53 pC/g

Measuring range: ±5000 g

Weight: 8.7 grams



HIGH TEMPERATURE CHARGE OUTPUT ACCELEROMETER

MODEL 357B69

Temperature: -65 to +900 °F
(-54 to +482 °C)

Sensitivity: 3.5 pC/g

Measuring range: ±500 g

Weight: 16.0 grams

CE



MINIATURE CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 7240C

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 3 pC/g

Measuring range: 5000 g pk

Weight: 4.8 grams

CE



MINIATURE CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 2220E

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 3 pC/g

Measuring range: 5000 g pk

Weight: 3.1 grams

CE



MINIATURE CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 2230E

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 2.8 pC/g

Measuring range: 2000 g pk

Weight: 17 grams

CE



CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 2221F

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 10 pC/g

Measuring range: 2000 g pk

Weight: 11 grams

CE



TRIAxIAL CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 2230EM1

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 3 pC/g

Measuring range: 2000 g pk

Weight: 17 grams

CE



CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 7201-10

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 10 pC/g

Measuring range: 2000 g pk

Weight: 18 grams

CE



CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 7221A

Temperature: -67 to +500 °F
(-55 to +260 °C)

Sensitivity: 10 pC/g

Measuring range: 2000 g pk

Weight: 0.37 grams

CE



CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 7703A-50

Temperature: -67 to +550 °F
(-55 to +288 °C)

Sensitivity: 300 pC/g

Measuring range: 2000 g pk

Weight: 25 grams

CE



CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 7704A-50

Temperature: -67 to +550 °F
(-55 to +288 °C)

Sensitivity: 50 pC/g

Measuring range: 2000 g pk

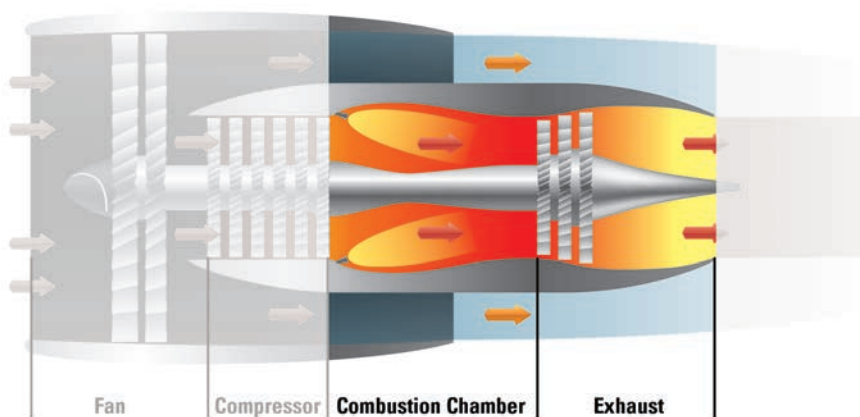
Weight: 0.9 grams



COMBUSTOR AND EXHAUST TESTING

CHARGE OUTPUT ACCELEROMETERS UP TO 1400 °F (760 °C)

Testing the combustor and exhaust of turbine engines requires an ultra-high temperature sensor. The confined space demands accelerometer compactness. These sensors are designed specifically for the testing and development of turbine combustors and exhaust systems and feature integral hardline cables.

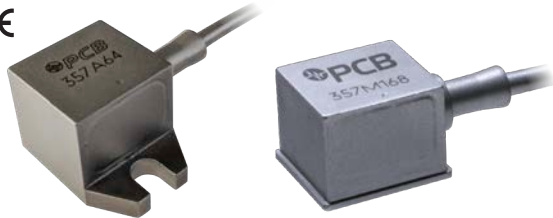


HIGHLIGHTS

- Compact and electrically isolated
- Temperature range to 1400 °F (760 °C)
- Insensitive to extreme variations in temperature with UHT-12™ element



CE



**CHARGE OUTPUT
ACCELEROMETER WITH UHT-12™**

MODEL 357A64 & 357M168

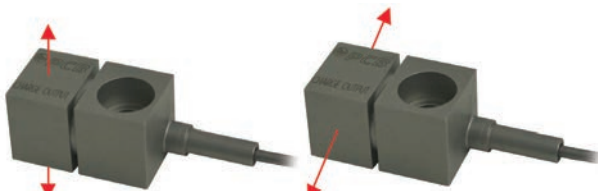
Sensitivity: 1.15 pC/g

Measurement Range: ± 1000 g

Signal Type: Single-ended

Connector: 10-32 jack

CE



MODEL EX357E90

MODEL EX357E91

**CHARGE OUTPUT
ACCELEROMETER WITH UHT-12™**

SERIES EX357A9X & EX357E9X

EX357E90/91 Sensitivity: 5.0 pC/g

EX357E92/93 Sensitivity: 2.3 pC/g

EX357A94/95 Sensitivity: 3.3 pC/g

Measurement Range: ± 1000 g

Signal Type: Single-ended (EX357E9X), differential (EX357A9X)

Connector: 10-32 jack (EX357E9X), 7/16-27 2-pin (EX357A9X)

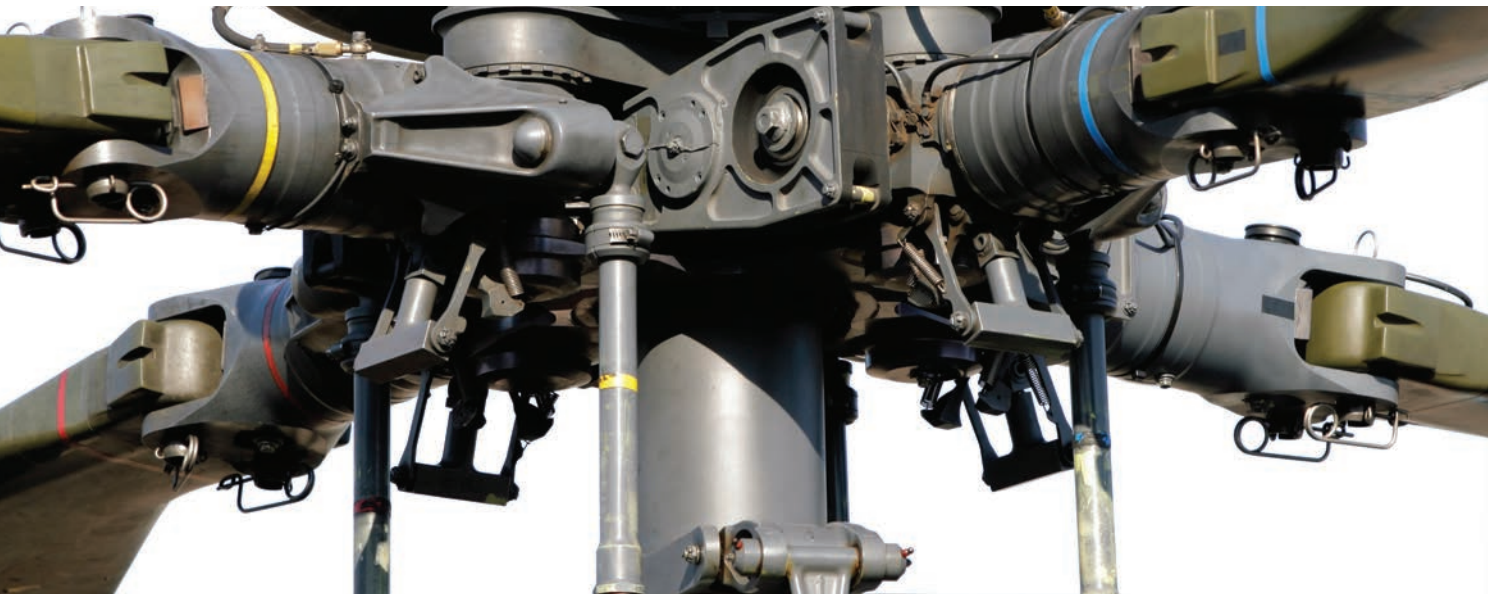


MODELS EX357E92 & EX357A94



MODELS EX357E93 & EX357A95

Arrows Depict Sensitive Axis



LONG TERM VIBRATION MONITORING AND HUMS

DIFFERENTIAL ACCELEROMETERS FOR TURBINE ENGINE MONITORING

Charge mode accelerometers with high temperature differential output are ideal for monitoring of turbines and HUMS applications on helicopters.



UHT-12™ HIGH TEMPERATURE ACCELEROMETER

SERIES EX600B1X

Temperature: -65 to 900 °F
(-54 to 482 °C)

Sensitivity: 10 to 100 mV/g

Measurement Range: ±50 to 500 g

Hazardous location approvals

UHT-12™ sensing technology



HIGH TEMPERATURE CHARGE OUTPUT ACCELEROMETER WITH UHT-12™

MODEL 357A100

Temperature: -65 to 900 °F
(-54 to 482 °C)

Sensitivity: 5.0 pC/g

Measuring Range: ±200 g

UHT-12™ sensing technology



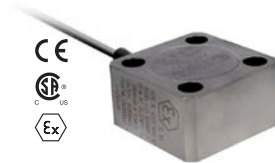
CHARGE OUTPUT ACCELEROMETER

SERIES 357C7X

Temperature: -65 to 900 °F
(-54 to 482 °C)

Sensitivity: 10 to 100 pC/g

Measurement Range: 300 to 1000 g



HIGH TEMPERATURE ACCELEROMETER WITH UHT-12™

MODEL EX611A20

Temperature: -165 to 1200 °F
(-109 to 650 °C)

Measurement Range: ±200 g

Featuring shear mode sensing element

Hazardous location approvals

UHT-12™ sensing technology



DIFFERENTIAL CHARGE OUTPUT ACCELEROMETER

ENDEVCO MODEL 6222S

Temperature: -65 to 500 °F
(-54 to 260 °C)

Sensitivity: 20 pC/g

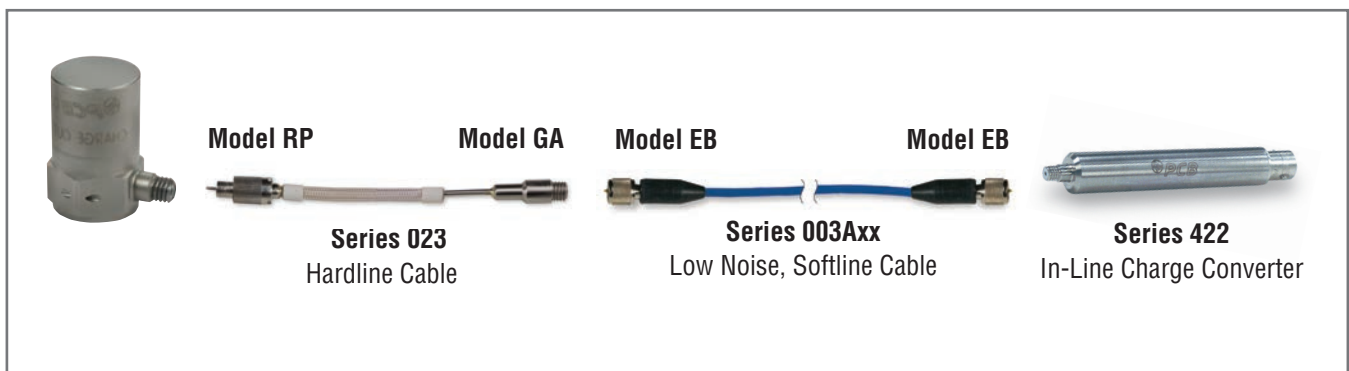
Measuring Range: ±500 g

Weight: 60 grams



ACCESSORIES

HIGH TEMPERATURE, SINGLE-ENDED, CHARGE OUTPUT SYSTEM CONFIGURATION



RECOMMENDED OUTPUT CABLES





CHARGE CONVERTERS

In-line ICP® charge converters serve to convert high impedance charge mode piezoelectric sensor signals into low impedance voltage signals for input into readout, recording, and analysis instruments. Powered by ICP® sensor signal conditioners, series 422 converters are placed between the sensor and signal conditioner. They can also connect directly to a DAQ system or readout device if the system includes ICP® power.



REMOTE CHARGE CONVERTER

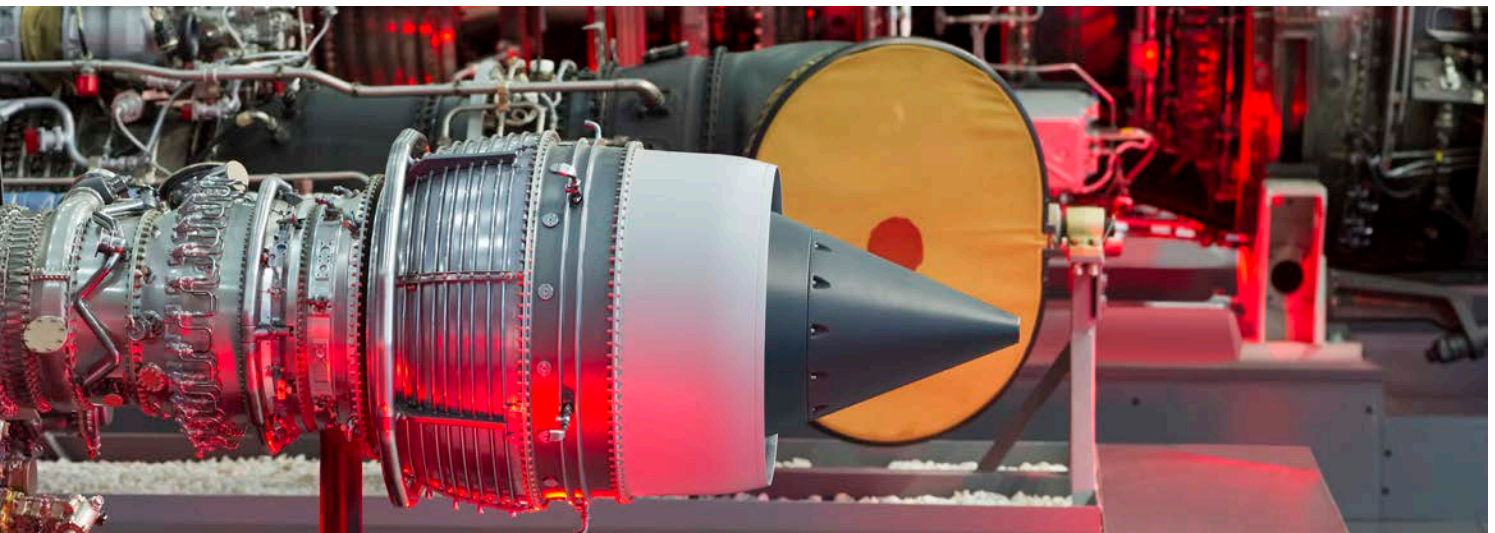
ENDEVCO MODEL 2771CM2-1



REMOTE CHARGE CONVERTER

SERIES 422EXX

Model	Sensitivity	Input Range	Low Frequency (-5%)
2771CM2-1	1 mV/pC	5000 pC	3 Hz
422E38	0.1 mV/pC	25000 pC	5 Hz
422E35	1 mV/pC	2500 pC	5 Hz
422E36	10 mV/pC	250 pC	5 Hz
422E39	1 mV/pC	2500 pC	5 Hz



DIFFERENTIAL CHARGE OUTPUT SYSTEM COMPONENTS



Model GN
Hardline Accelerometer Mating
Socket Connector 900 °F (482 °C)



Model 013
2-Conductor Hardline Cable
1200 °F (650 °C)



Model GP
Hardline 7/16-27 2-pin Connector
900 °F (482 °C)



Model ET
Softline Accelerometer Mating
Socket Connector 400 °F (204 °C)



Model 045
2-Conductor Softline
FEP Cable 500 °F (260 °C)



Model JD
2-pin connector mate to 2777A



Endevco Model 2777A
Differential Charge Converter



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AD-UHT12-0224