HIGH TEMPERATURE ACCELEROMETERS FOR GAS TURBINES & HELICOPTERS
VIBRATION TESTING IN SEVERE THERMAL ENVIRONMENTS

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, featuring the UHT-12™ high temperature crystal for operation to 1200 °F (650 °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 +1200 °F (-73 to +650 °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
UHT-12™ is a new crystal designed for more accurate, lower noise measurements during large temperature variations. 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. See plots below.

**HIGHLIGHTS**

- Proprietary crystal technology sealed in a hermetic package provides long-term reliability.
- No pyroelectric output provides accurate low-frequency measurements.
- Reduced thermal noise spikes eliminate false alarms during monitoring.
- More consistent sensitivity over a wide temperature change provides greater accuracy.
- Shear mode crystals prevent base strain and transverse measurement errors.

The UHT-12™ family of accelerometers include Model 320C52, Model 357B63, Model EX356A73, Series 339, EX357A9X, EX357E9X, and EX611. Other products such as Series 115 and 176 combustion pressure sensors are also available.
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 1200 °F (650 °C)

**PCB® High Temperature Accelerometers are Available to 1200 °F (650 °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 1200 °F (650 °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 339A31 & 339B32
- Temperature: -65 to +325 °F (-54 to +163 °C)
- Sensitivity: 10 mV/g
- Measuring range: 500 g
- Weight: 3.6 to 5.5 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
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 357B63
- Temperature: -65 to +1000 °F
  (-54 to +538 °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
COMBUSTOR AND EXHAUST TESTING

CHARGE OUTPUT ACCELEROMETERS TO 1200 °F (650 °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 1200 °F (650 °C)
-Insensitive to extreme variations in temperature with UHT-12™ element
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

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)
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 EX60081X

- 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 ACCELEROMETER WITH UHT-12™
MODEL EX611A20
- Temperature: -165 to 1200 ºF (-109 to 650 ºC)
- Measurement Range: ±200 g
- Featuring shear mode sensing element
- Hazardous location approvals
- UHT-12™ sensing technology

CHARGE OUTPUT ACCELEROMETER SERIES 357C7X
- Temperature: -65 to 900 ºF (-54 to 482 ºC)
- Sensitivity: 10 to 100 pC/g
- Measuring Range: 300 to 1000 g
- UHT-12™ sensing technology

HIGH TEMPERATURE CHARGE OUTPUT ACCELEROMETER WITH UHT-12™
MODEL 357A100
- Temperature: -65 to 900 ºF (-54 to 482 ºC)
- Sensitivity: 5.0 pC/g
- Measuring Range: ±200 g
- UHT-12™ sensing technology
ACCESSORIES

HIGH TEMPERATURE, SINGLE-ENDED, CHARGE OUTPUT SYSTEM CONFIGURATION

(RECOMMENDED OUTPUT CABLES)

(xx = Cable length in feet)
SINGLE-ENDED IN-LINE CHARGE CONVERTERS

- Condition signals from charge output piezoelectric sensors
- Convert high impedance charge signals into low impedance voltage signals
- Operate with ICP® sensor signal conditioners or readout devices with an ICP® sensor input
- Maintain fixed charge conversion regardless of input capacitance

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensitivity</th>
<th>Input Range</th>
<th>Low Frequency (-5%)</th>
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<tbody>
<tr>
<td>422E38</td>
<td>0.1 mV/pC</td>
<td>25000 pC</td>
<td>5 Hz</td>
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<tr>
<td>422E35</td>
<td>1 mV/pC</td>
<td>2500 pC</td>
<td>5 Hz</td>
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<tr>
<td>422E36</td>
<td>10 mV/pC</td>
<td>250 pC</td>
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<tr>
<td>422E39</td>
<td>1 mV/pC</td>
<td>2500 pC</td>
<td>5 Hz</td>
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</table>
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 500 °F (260 °C)

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

Model JD 2-pin connector
mate to 495B10

Series 495B10 Differential
Charge Amplifier
# COMPLETE HIGH TEMPERATURE ACCELEROMETER LISTING

<table>
<thead>
<tr>
<th>Temp</th>
<th>Model</th>
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<td>≥ 325 to &lt; 500 °F</td>
<td>357C10</td>
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<td>(162 ºC to &lt; 260 ºC)</td>
<td>357C10/NC</td>
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<tr>
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<td>320C15</td>
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<td>320C18</td>
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<td>HT356A43</td>
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<td>HT356A44</td>
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<tr>
<td>≥ 500 to &lt; 1200 °F</td>
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<td>(≥ 260 ºC to &lt; 650 ºC)</td>
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<td>357B61/NC</td>
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<tr>
<td>≥ 1200 °F</td>
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<td>(≥ 650 ºC)</td>
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<td>EX611A20*</td>
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*UHT-12™ sensing technology
MTS Sensors, a division of MTS Systems Corporation (NASDAQ: MTSC), vastly expanded its range of products and solutions after MTS acquired PCB Piezotronics, Inc. in July, 2016. PCB Piezotronics, Inc. is a wholly owned subsidiary of MTS Systems Corporation. Additional information on MTS can be found at www.mts.com.

PCB Piezotronics, Inc. is a designer and manufacturer of microphones, vibration, pressure, force, torque, load, and strain sensors, as well as the pioneer of ICP® technology used by design engineers and predictive maintenance professionals worldwide for test, measurement, monitoring, and control requirements in automotive, aerospace, industrial, R&D, military, educational, commercial, OEM applications, and more. With a worldwide customer support team, 24-hour SensorLineSM, and a global distribution network, PCB® is committed to Total Customer Satisfaction. Visit www.pcb.com for more information. PCB Piezotronics, Inc. is a wholly owned subsidiary of MTS Systems Corporation. Additional information on MTS can be found at www.mts.com.

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