# SENSORS FOR ROAD LOAD MEASUREMENTS

Including **ENDEVCO** sensors, electronics, and cables

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PCB PIEZOTRONICS
AN AMPHENOL COMPANY

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# ROAD LOAD MEASUREMENTS

Road load data is essential for analyzing the design, reliability, and structural integrity of vehicle components. Road load tests measure the transient and steady-state inputs of a vehicle as it operates over a road surface or test track, taking into account all projected vehicle and driving parameters such as mass, inertia, air and rolling resistance, road characteristics, engine loads, and vehicle speed.

Sensors for road load data acquisition (RLDA) must be robust and reliable to survive the shock, heat, humidity, and contamination associated with various measurement locations on the vehicle and test track. PCB's line of rugged sensors for RLDA offer features such as hermetic titanium sealing, gas damping and overload protection, to provide a high level of confidence in data acquired during even the most aggressive road events.

PCB products are designed and manufactured in our state-of-the-art facilities. Through our global distribution network and Total Customer Satisfaction guarantee, you can rely on us to deliver products and solutions for your demanding requirements.

## COMMON APPLICATIONS:

- Spindle force and motion testing
- Fluid pressure tests in shock, brake and steering systems
- Stress profiles on components
- Durability validation
- Modal analysis

## SENSOR TYPES:

- Triaxial and single-axis VC MEMS accelerometers
- Load cells and strain sensors
- Triaxial ICP® accelerometers and force sensors
- ICP® quartz force rings
- Angular rate and 6 degrees of freedom (6DoF) sensors

# LOW-FREQUENCY APPLICATIONS VC MEMS ACCELEROMETERS

PCB® series 3711F, 3713F, 3741F, and 3743G variable capacitance MEMS (VC MEMS) accelerometers are used to measure low frequency motion down to near zero hertz. These accelerometers are used in durability applications with low frequency and amplitude requirements. Each series includes a full scale measurement range from ±2g to ±200g and features low spectral noise with high resolution. DC response sensors feature gas-damped silicon MEMS sensing elements for uniform, repeatable performance and high frequency overload protection.

## SINGLE-ENDED VC MEMS ACCELEROMETERS

SERIES 3711F & 3713F

- Sensitivity: 6.75 to 675 mV/g
- Measurement Range: ±2 g pk to ±200
- Frequency Range: from 0 to 1.5k Hz (±5%)
- Case isolated, hermetically sealed titanium housing
- Available with integral cable or multi-pin, threaded electrical connector

## DIFFERENTIAL OUTPUT, SINGLE AXIS VC MEMS ACCELEROMETERS

SERIES 3741F

- Sensitivity: 13.5 to 1350 mV/g
- Measurement Range: ±2 to ±200 g pk
- Frequency Range: from 0 to 1.5k Hz (±5%)
- Ground isolated, hard-anodized aluminum housing
- Integral, 4-conductor shielded cable

## DIFFERENTIAL OUTPUT, TRIAXIAL VC MEMS ACCELEROMETERS

SERIES 3743G

- Sensitivity: 13.5 to 1350 mV/g
- Measurement Range: ±2 to ±200 g pk
- Frequency Range: from 0 to 250 Hz to 0 to 1.5k Hz (±5 %)
- Case isolated, hermetically sealed titanium housing
- M8x1 8-pin connector (3743G11) / IP67 connection (3743G12)

# RIDE QUALITY TRIAXIAL ICP® ACCELEROMETERS

Hybrid and electric vehicles present unique road load testing challenges due to vehicle complexity and potential for problems with electrical isolation. RLDA issues related to the addition of new electrical devices, gear whine, and vehicle resonances increase the number of areas and components to be tested. PCB's broad line of accelerometers are engineered to meet these challenges with ground and case isolation. These accelerometers are ideal for use in strong electrical fields generated by electric and hybrid vehicle systems. Electrical isolation reduces noise in these fields and eliminates ground loops.

## GROUND ISOLATED TEDS TRIAXIAL ACCELEROMETER

MODELS J356A43, J356A44, J356A45

- Sensitivity: 10 mV/g, 50 mV/g, and 100 mV/g
- Measurement Range: ±500, ±100, & ±50 g pk
- Frequency Range: 0.7 to 7k Hz (±5%)
- 1/4 - 28 4-pin connector
- Ground Isolated with Titanium shell, 5 sided

## MINIATURE TRIAXIAL ICP® ACCELEROMETER

MODEL J356A03

- Sensitivity: 10 mV/g
- Measurement Range: ±500 g pk
- Frequency Range: 2 to 8k Hz (±5%)
- Integral Cable to 1/4-28 4-Pin Connector
- Ground Isolated with Titanium shell, 3 sided

## HIGH SENSITIVITY ICP® TRIAXIAL ACCELEROMETER

MODEL 356A15 & 356A16

- Sensitivity: 100 mV/g
- Measurement Range: ±50 g pk
- Frequency Range: 2 to 5k Hz & 0.5 to 5k Hz (±5 %)
- 1/4-28 4-Pin Connector
- Versions in Titanium or Anodized Aluminum

## CASE ISOLATED HIGH SENSITIVITY TRIAXIAL ICP® ACCELEROMETER

MODEL 354B04 & 354B05

- Sensitivity: 10 and 100 mV/g
- Measurement Range: ±500 & ±50 g pk
- Frequency Range: 0.6 to 10k Hz (±5 %)
- 1/4-28 4-Pin Connector
- Case Isolated, thru-hole mounted

## UHT-12™ TRIAXIAL ICP® ACCELEROMETER

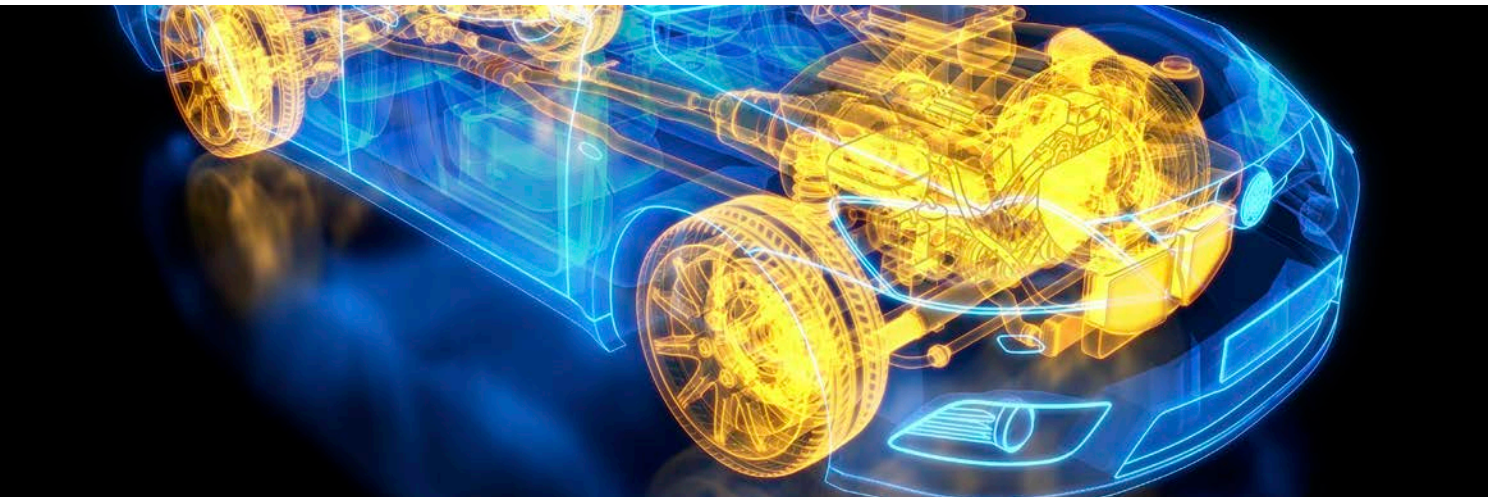
MODEL HT339C31

- Sensitivity: 10 mV/g
- Measurement Range: ±500 g pk
- Frequency Range: 2 to 8k Hz (±5%)
- 1/4-28 4-Pin Connector
- UHT-12™ element for low noise over thermal range

## FILTERED LTC TRIAXIAL ICP® ACCELEROMETER

MODELS TLD339A36 & TLD339A37

- Sensitivity: 10 mV/g & 100 mV/g
- Measurement Range: ±500 & ±50 g pk
- Frequency Range: 2 to 5k Hz & 0.3 to 4k Hz (±5%)
- 1/4-28 4-Pin Connector
- Low Temperature Coefficient



# ENDEVCO ANGULAR RATE SENSOR & 6DOF

## ANGULAR RATE AND 6 DOF SENSORS

The Endevco® Model 7310A is an angular rate sensor that utilizes unique silicon MEMS gyroscope technologies with custom electronics and packaging to provide reliable sensing performance even under excessive shock and vibration environments. This angular rate sensor is designed specifically for automotive testing and other system designs requiring accurate measurement of angular velocity.

The Model 7360A is a six degrees of freedom (6DoF) sensor that provides analog output for three axes of linear acceleration and three axes of angular rate in a compact, roughly one inch cube package. A sensor with analog output offers the advantage of being able to troubleshoot the data to its source and examine the output compared to its time history.

With this new 6DoF sensor, professionals in automotive development are now able to measure linear and rotational dynamics that previously required multiple sensors and much more space.

### ANGULAR RATE SENSOR
MODEL 7310A

- 7 Angular Rate Ranges from 100 to 18K deg/sec
- Up to 2000 Hz bandwidth
- Lightweight, mass less than 3 grams

### TRIAXIAL ANGULAR RATE SENSOR
MODEL 7330

- Ranges of 100, 500, 1500, 6K, 8K, 12K and 18K deg/sec
- Up to 2000 Hz bandwidth
- Weighs less than 10 grams


### SIX DEGREE OF FREEDOM SENSOR
MODEL 7360

- 6 Angular Rate ranges from 100 to 18K deg/sec
- 5 Linear Acceleration ranges from ±2 to ±500 g
- Shock limit 5000 g

# COMPONENT STRESS PROFILING LOAD CELLS & STRAIN SENSORS

PCB load cells and strain sensors are suitable for a wide range of measurement applications, including stress profiles on components. Selecting the right load cell and strain seniors is important as it helps to measure a variety of quantities including indirectly determine stress, torque, pressure, vibration, weight and deflection.  This ensures that the equipment and material can withstand the stress they will be subjected to in regular basis.

## LOW PROFILE LOAD CELLS

MODELS 1203-01A / 03A / 05A

- Sensitivity: 2 / 2 / 3 mV/V
- Measurement Range: 500 / 2000 / 10,000 lb
- Overload Limit: 2.224 / 8.896 / 44.48 kN
- Non-Linearity: 750 / 3000 / 15,000 lb
- Excitation Voltage: -65 to +200 °F (-54 to +93 °C)


## STRAIN SENSOR

MODEL 740B02

- Sensitivity: 50 mV/με
- Measurement Range: 100 pk με
- Frequency Range: 0.5 to 100k Hz
- Temperature Range: -65 to +250 °F (-53 to +121 °C)

# DURABILITY VALIDATION FORCE SENSORS

Charge mode versions of each of these models are also available.

ICP® force sensors incorporate a built-in MOSFET microelectronic amplifier. This serves to convert the high impedance charge output into a low impedance voltage signal for analysis or recording. Quartz, piezoelectric force rings from PCB® output a high integrity signal under compressive force in cyclical loading applications. Force rings possess extreme stiffness and accuracy, making them ideal for measuring microsecond duration events common to metal forming equipment (crimp, bend, stake, or stamp), drop test, and product testing applications.


## TRIAXIAL ICP® FORCE SENSOR
MODEL 260A01 & 260A02

Sensitivity: 2.5 mV/lb

Measurement Range: 1000 lb

Low Frequency Response: 0.01 Hz (-5 %)

Upper Frequency Limit: 90 kHz


## TRIAXIAL ICP® FORCE SENSOR
MODEL 260A03

Sensitivity: 0.25 mV/lb

Measurement Range: 10,000 lb

Low Frequency Response: 0.01 Hz (-5 %)

Upper Frequency Limit: 39K Hz


## ICP® QUARTZ FORCE RING
MODEL 201B04 & 201B05

Sensitivity: 5 mV/lb & 1 mV/lb

Measurement Range: 1000 lb & 5000 lb

Low Frequency Response: 0.001 Hz & 0.0003 Hz (-5 %)

Maximum Static Force: 6000 lb & 8000 lb


## ICP® QUARTZ FORCE RING
MODEL 202B

Sensitivity: 0.50 mV/lb

Measurement Range: 10,000 lb

Low Frequency Response: 0.0003 Hz (-5 %)

Maximum Static Force: 15,000 lb


## ICP® QUARTZ FORCE RING
MODEL 203B

Sensitivity: 0.25 mV/lb

Measurement Range: 20,000 lb

Low Frequency Response: 0.0003 Hz (-5 %)

Maximum Static Force: 25,000 lb


## ICP® QUARTZ FORCE RING
MODEL 204C

Sensitivity: 0.12 mV/lb

Measurement Range: 40,000 lb

Low Frequency Response: 0.0003 Hz (-5 %)

Maximum Static Force: 50,000 lb

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