



SENSORS FOR ROAD LOAD MEASUREMENTS

 **PCB PIEZOTRONICS**
AN AMPHENOL COMPANY

 **ENDEVCO**
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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 DC 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 DC RESPONSE ACCELEROMETERS



SINGLE-ENDED MEMS ACCELEROMETERS

SERIES 3711F & 3713F

Measurement Ranges: ± 2 g pk to ± 200 g pk

Frequency response from 0 Hz up to 2500 Hz ($\pm 10\%$)

Hermetically sealed, titanium housing

Available with integral cable or multipin, threaded electrical connector

Available in single-axis or triaxial configurations



DIFFERENTIAL OUTPUT, SINGLE-ENDED MEMS ACCELEROMETERS

SERIES 3741F

Sensitivities: 13.5 mV/g to 1350 mV/g ($\pm 3\%$)

Measurement Ranges: ± 2 g pk to ± 200 g pk

Frequency response from 0 Hz up to 2500 Hz ($\pm 10\%$)

Hard-anodized aluminum housing

Integral, 4-conductor shielded cable



DIFFERENTIAL OUTPUT, TRIAXIAL MEMS DC ACCELEROMETERS

SERIES 3743F

Sensitivities: 13.5 mV/g to 1350 mV/g ($\pm 3\%$)

Measurement Ranges: ± 2 g pk to ± 200 g pk

Frequency response from 0 Hz up to 2500 Hz ($\pm 10\%$)

Hermetically sealed titanium housing

9-Pin threaded electrical connector

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

Frequency Range: 0.4 to 10000 Hz
(±10%)

Measurement Range: ±500, ±100,
and ±50 g pk

1/4 - 28 4-pin connector

Ground Isolated with Titanium shell,
5 sided



CASE ISOLATED HIGH SENSITIVITY TRIAXIAL ICP® ACCELEROMETER

MODEL 354B04 & 354B05

Sensitivity: 10 and 100 mV/g

Frequency Range: 0.6 to 10000 Hz
(±5 %)

Measurement Range: ±500
and ±50 g pk

1/4-28 4-Pin Connector

Case Isolated, thru-hole mounted



MINIATURE TRIAXIAL ICP® ACCELEROMETER

MODEL J356A03

Sensitivity: 10 mV/g Measurement

Frequency Range: 2 to 8000 Hz (±5%)

Measurement Range: ±500 g pk

Integral Cable to 1/4-28 4-Pin
Connector

Ground Isolated with Titanium shell,
3 sided



UHT-12™ TRIAXIAL ICP® ACCELEROMETER

MODEL 339B31

Sensitivity: 10 mV/g

Frequency Range: 1.5 to 11000 Hz
(±10%)

Measurement Range: ±500 g pk

1/4-28 4-Pin Connector

UHT-12™ element for low noise
over thermal range



HIGH SENSITIVITY ICP® TRIAxIAL ACCELEROMETER

MODEL 356A15 & 356A16

Sensitivity: 100 mV/g

Frequency Range: 1.4 to 6000 Hz
(±10 %)

Measurement Range: ±50 g pk

1/4-28 4-Pin Connector

Versions in Titanium or Anodized
Aluminum



FILTERED LTC TRIAXIAL ICP® ACCELEROMETER

MODELS TLD339A36 & TLD339A37

Sensitivity: 10 mV/g & 100 mV/g

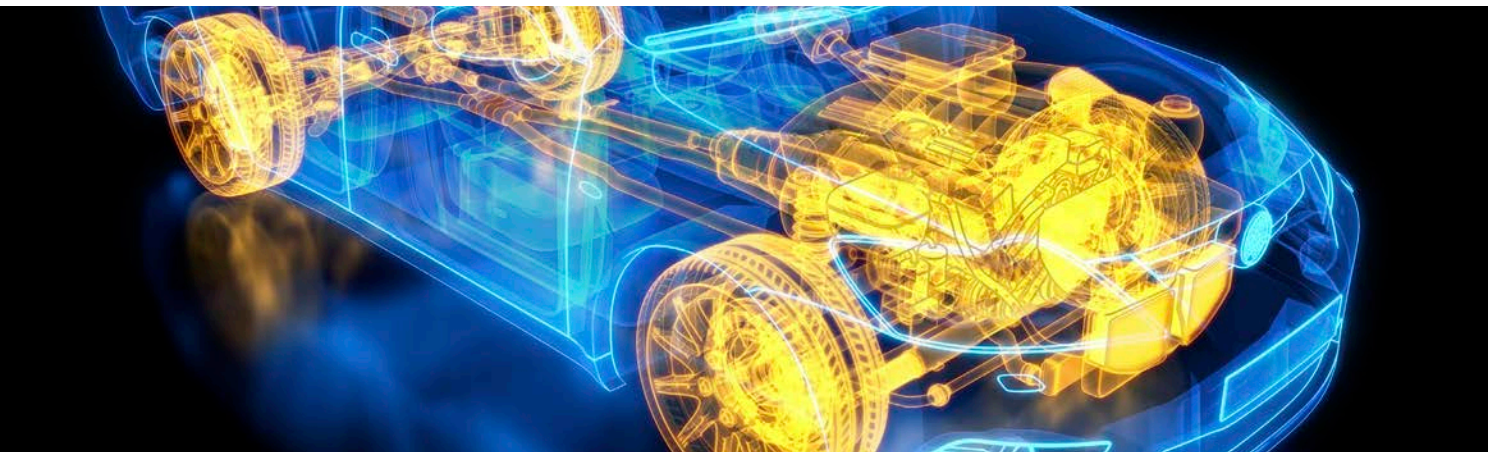
Frequency Range: 2 to 5000 Hz and
0.3 to 4000 Hz (±5%)

Measurement Range: ±500
and ±50 g pk

1/4-28 4-Pin Connector

Low Temperature Coefficient

Integral low-pass filter limits
signal saturation



ENDEVCO ANGULAR RATE SENSOR AND 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 and provides reliable sensing performance even under excessive shock and vibration environments. This angular rate sensor is designed specifically for automotive safety 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



ANGULAR RATE SENSOR
MODEL 7330

7 Angular Rate Ranges from 100 to 18K deg/sec

Up to 2000 Hz bandwidth

Lightweight, mass less than 10 grams



SIX DEGREE OF FREEDOM SENSOR
MODEL 7360A

5 Linear Acceleration ranges from ± 2 to ± 500 g

6 Angular Rate ranges from 100 to 18K deg/sec

Shock limit 5000 g



COMPONENT STRESS PROFILING LOAD CELLS & STRAIN SENSORS



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/ $\mu\epsilon$

Measurement Range: 100 pk $\mu\epsilon$

Frequency Range: 0.5 to 100,000 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.



TRIAxIAL, ICP® FORCE SENSOR
MODELS 260A01 & 260A02

Measurement Range (z axis):
1000 lb (4.45 kN) & 1000 lb (4.45 kN)

Measurement Range (x or y axis):
500 lb (2.22 kN) & 1000 lb (4.45 kN)

Sensitivity (z axis):
2.5 mV/lb (0.56 mV/N)

Sensitivity (x or y axis):
10 mV/lb (2.25 mV/N) &
5 mV/lb (1.12 mV/N)

Weight: 26 gm & 45 gm



TRIAxIAL, ICP® FORCE SENSOR
MODEL 260A03

Measurement Range (z axis):
10,000 lb (44.48 kN)

Measurement Range (x or y axis):
4000 lb (17.79 kN)

Sensitivity (z axis):
0.25 mV/lb (0.06 mV/N)

Sensitivity (x or y axis):
1.25 mV/lb (0.28 mV/N)

Weight: 271 gm



ICP® QUARTZ FORCE RING
MODEL 201B04 & 201B05

Measurement Range (Compression):
1000 lb (4.448 kN) &
5000 lb (22.24 kN)

Sensitivity: 5 mV/lb (1124 mV/kN)
& 1 mV/lb (224.8 mV/kN)

Maximum Static Force
(Compression): 6000 lb (26.69 kN)
& (Compression): 8000 lb (35.59 kN)

Weight: 10 gm



ICP® QUARTZ FORCE RING
MODEL 202B

Measurement Range (Compression):
10 klb (44.48 kN)

Sensitivity: 0.50 mV/lb
(112.4 mV/kN)

Maximum Static Force
(Compression): 15 klb (66.72 kN)

Weight: 19 gm



ICP® QUARTZ FORCE RING
MODEL 203B

Measurement Range (Compression):
20 klb (88.96 kN)

Sensitivity: 0.25 mV/lb (56.2 mV/kN)

Maximum Static Force
(Compression): 25 klb (111.2 kN)

Weight: 38 gm



ICP® QUARTZ FORCE RING
MODEL 204C

Measurement Range (Compression):
40 klb (177.92 kN)

Sensitivity: 0.12 mV/lb (27 mV/kN)

Maximum Static Force
(Compression): 50 klb (222.4 kN)

Weight: 57 gm



3425 Walden Avenue, Depew, NY 14043 USA

pcb.com | info@pcb.com | 800 828 8840 | +1 716 684 0001



10869 NC Highway 903, Halifax, NC 27839 USA

endevco.com | sales@endevco.com | 866 363 3826

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