ELECTRIC & HYBRID VEHICLE TESTING & DEVELOPMENT
Noise sources are distinct between electric vehicles and conventional vehicles due to their different types of power. Electric vehicles have systems that contribute differently to the interior and exterior noise levels and quality. PCB offers a wide array of microphones specifically designed to meet many different exacting applications.

**ACOUSTICS**

**1/2" FREE-FIELD ICP® MICROPHONE SYSTEM**
MODEL 378B02
- Sensitivity: 50 mV/Pa
- Frequency Range: 3.75 Hz – 20 kHz
- Dynamic Range: 137 dB re 20 µPa
- Cost effective
- TEDS
- Intrinsically safe (for battery testing) and high temperature versions available

**1/2" LOW NOISE ICP® MICROPHONE SYSTEM**
MODEL 378A04
- Prepolarized (industry’s first)
- Frequency Range: 10 Hz - 16 kHz
- Less than 6.5 dBA noise floor
- High sensitivity, 450 mV/Pa
- TEDS
- Ideal for anechoic chamber applications

**1/2" PREPOLARIZED RANDOM INCIDENCE MICROPHONE**
MODEL 378C20
- Sensitivity: 50 mV/Pa
- Frequency Range: 3.75 Hz – 16 kHz
- Dynamic range: 16 dB(A) – 137 dB
- Excellent for vehicle interior sound measurements
**APPLICATIONS INCLUDE:**

- Cabin noise testing
- Wind noise testing
- Powertrain development
- Noise source location
- Sound system performance
- Vehicle and powertrain noise, vibration and harshness (NVH)
- Automotive component and system performance

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**1/2” WATER AND DUST RESISTANT ICP® MICROPHONE SYSTEM**

- ICP® water resistant array
- IP55 rated
- Frequency Range: 20 Hz to 16 kHz
- IP55 Rated for harsh environments
- Cost effective
- Harsh testing environment applications

**1/4” FREE-FIELD ICP® ARRAY MICROPHONE SYSTEM**

- Low noise floor: 24 dBA
- Frequency Range: 10 Hz to 20 kHz (+/- 4 dB)
- Integral preamplifier & SMB jack connector
- TEDS
- High channel count applications

**SURFACE MICROPHONE**

- Low profile 1/8” (3 mm) microphone system
- Dynamic Range: 150 dB before clipping
- Water and dust resistant grid cap
- Integral 5 ft cable
- Adhesive mounting for flush mounted applications
VIBRATION

Hybrid and electric vehicles present NVH testing challenges due to vehicle complexity and potential for problems with electrical isolation. NVH issues related to the addition of new electrical devices, gear whine, and vehicle resonances increase the number of NVH areas to be tested. Our broad line of accelerometers is engineered to meet these challenges, by incorporating ground and case isolation. Electrically isolated accelerometers help avoid measurement errors and poor test data that can result when ground loops and stray electrical signals are present during testing.

HIGH SENSITIVITY ICP® TRIAXIAL ACCELEROMETER MODELS 356A15
- Sensitivity: 100 mV/g
- Measurement Range: ±50 g pk
- Frequency Range: 5 to 5000 Hz
- Electrical Connector: 1/4-28 4-Pin

TRIAXIAL, GENERAL PURPOSE ICP® ACCELEROMETER MODELS 356A25
- Sensitivity: 25 mV/g
- Measurement Range: ±200 g pk
- Frequency Range: 1 to 5000 Hz
- Electrical Connector: 1/4-28 4-Pin

TRIAXIAL, GENERAL PURPOSE ICP® ACCELEROMETER MODELS 356A02
- Sensitivity: 10 mV/g
- Measurement Range: ±500 g pk
- Frequency Range: 1 to 5000 Hz
- Electrical Connector 1/4-28 4-pin
**GROUND ISOLATED TEDS TRIAXIAL ACCELEROMETER**
MODELS J356A43, J356A44, J356A45
- Ground isolated
- Frequency Range: (±5%) 0.7 to 7 kHz
- 1/4 - 28 4-pin connector
- TEDS IEEE 1451.4 enabled
- Available in sensitivities 10 mV/g, 50 mV/g, and 100 mV/g

**GROUND ISOLATED TRIAXIAL HIGH SENSITIVITY ICP® ACCELEROMETER**
MODEL 354C03
- Ground isolated
- Frequency Range: (±5 %) 0.5 to 2 kHz
- Sensitivity: 100 mV/g
- Thru-hole mounting

**MINIATURE TRIAXIAL ICP® ACCELEROMETER**
SERIES 356A03
- Sensitivity: 10 mV/g
- Measurement Range: ±500 g pk
- Frequency Range: 2 to 8000 Hz (y or z axis) 2 to 5000 Hz (x axis)
- Small 0.25 (6.4 mm) adhesive mount cube
- Ground isolation model available

**MINIATURE CERAMIC SHEAR ICP® ACCELEROMETER**
MODEL 352A24
- Sensitivity: 100 mV/g
- Measurement Range: ±50 g pk
- Frequency Range: 1.0 to 8000 Hz
- Miniature, lightweight (0.8 gm)

**MINIATURE TRIAXIAL ICP® ACCELEROMETER**
SERIES 356A03
- Sensitivity: 10 mV/g
- Measurement Range: ±500 g pk
- Frequency Range: 2 to 8000 Hz (y or z axis) 2 to 5000 Hz (x axis)
- Small 0.25 (6.4 mm) adhesive mount cube
- Ground isolation model available

**MINIATURE CERAMIC SHEAR ICP® ACCELEROMETER**
MODEL 352A24
- Sensitivity: 100 mV/g
- Measurement Range: ±50 g pk
- Frequency Range: 1.0 to 8000 Hz
- Miniature, lightweight (0.8 gm)
PCB® series 3711F, 3713F, 3741F MEMS DC response sensors are used to measure low frequency motion down to zero hertz. These accelerometers are used in applications such as road load data acquisition (RLDA), drivability, ride and handling, and vehicle performance testing. Each series includes a full scale measurement range from ± 2g to ± 200g and features low spectral noise with high resolution.

**VIBRATION**

Single axis 3711F and triaxial 3713F series DC response sensors feature gas-damped silicon MEMS sensing elements. The MEMS element(s) are hermetically sealed in a titanium housing to withstand harsh environments. These sensors are insensitive to both base strain and transverse acceleration effects and provide a single ended output. A proprietary temperature compensation circuit is included for stable performance over the entire operational temperature range.

Our differential output single axis 3741F DC response sensors feature gas-damped silicon MEMS sensing elements configured for a differential output signal and provide common-mode noise rejection. They have a low profile design and are packaged in an anodized aluminum housing.

**MEMS DC ACCELEROMETERS**
- **MODEL 3711F**
  - Sensitivities: (± 3%) 6.75 mV/g to 675mV/g
  - Measurement Range: ±2 g pk (±19.6 m/s² pk) to ±200 g pk (±1962 m/s² pk)
  - Frequency Range: (±5%) 0 to 250 Hz to 0 to 1500 Hz

**TRIAXIAL MEMS DC ACCELEROMETERS**
- **MODEL 3713F**
  - Sensitivities: (± 3%) 6.75 mV/g to 675mV/g
  - Measurement Range: ±2 g pk (±19.6 m/s² pk) to ±200 g pk (±1962 m/s² pk)
  - Frequency Range: (±5%) 0 to 250 Hz to 0 to 1500 Hz

**DIFFERENTIAL MEMS DC ACCELEROMETERS**
- **MODEL 3741F**
  - Sensitivities: (± 3%) 13.5 mV/g to 1350mV/g
  - Measurement Range: ±2 g pk (±19.6 m/s² pk) to ±200 g pk (±1962 m/s² pk)
  - Frequency Range: (±5%) 0 to 250 Hz to 0 to 1500 Hz
PCB® offers a wide selection of signal conditioners, accessories, and cables that complement our sensors for testing electric vehicles, hybrid electric vehicles, and fuel cell vehicles. See our website for the complete offering of these products.

VIBRATION ACCESSORIES

**4-CONDUCTOR, SHIELDED, FEP CABLE**
MODEL 010GXX
- Used with triaxial ICP® accelerometers
- 4 conductor, shielded, FEP jacket
- 1/4-28, 4-socket plug to 3 BNC plugs

**NF CABLE**
SERIES 003CXX
- Connector Style: Triple Splice
- Connector Style: BNC
- Connection Type: Plug (male pin)
- Temperature Range: -40 to +176 °F (-40 to +80 °C)
- Grounded shield

**4-CONDUCTOR, SHIELDED, FEP CABLE**
MODEL 034WXX
- Used with triaxial ICP® accelerometers
- 4 conductor, shielded, FEP jacket
- IP68 Rated 1/4-28, 4-socket plug to 3 BNC plugs

**4-CONDUCTOR, SHIELDED, POLYURETHANE CABLE**
MODEL 078WXX
- Used with triaxial ICP® accelerometers
- 4 conductor, shielded, flexible polyurethane jacket
- IP68 Rated 1/4-28, 4-socket plug to 3 BNC plugs

**ICP® SIGNAL CONDITIONER**
MODEL 483C15
- 8 individual channels
- ICP® and voltage sensor input
- Selectable gain of x1, x10, x100

**LOW-NOISE COAXIAL CABLE**
SERIES 003CXX
- Used with single axis ICP® accelerometers
- Low-noise coaxial cable
- 10-32 coaxial plug to BNC plug
High-precision, DC responding Endevco piezoresistive accelerometers are widely specified for vehicle safety testing due to their high-output, low mass designs and compact size for mounting within difficult-to-reach areas. Their survivability, miniature size and DC response measurement capabilities offer solutions for a diverse set of automobile testing requirements.

**AUTO SAFETY SENSORS**

**UNDAMPED PIEZORESISTIVE ACCELEROMETER**
MODEL 7264C
- DC response and wide bandwidth
- Undamped - meets NHTSA SA572-S4
- Mechanical stops
- Passenger safety testing

**PIEZORESISTIVE TRIAXIAL ACCELEROMETER**
MODEL 7268C
- 500 and 2000 g ranges
- DC response
- 12 wire integral cable
- Original equipment for WorldSID ATD

**ANGULAR RATE SENSOR**
MODEL 7310A
- Ranges of 100, 500, 1500, 6K, 8K, 12K and 18K deg/sec
- Up to 2000 Hz bandwidth
- Weighs less than 3 grams
- Operates with 5 to 16 V input
**APPLICATIONS INCLUDE:**

- Anthropomorphic test devices (ATD) - DC accelerometers and angular rate sensors meeting J211/J2570/ISO6487, NHTSA SA572 designed for use inside various dummies
- On-vehicle crash test - Rugged accelerometers with a wide variety of form factors for use in on-vehicle crash environments
- SLED testing - DC accelerometers designed specifically for sled track test environment
- Pedestrian safety testing - Highly damped accelerometers meeting EuroNCAP directives, suitable for installing inside headform
- ABS/Airbag Testing - Miniature pressure transducers with broad frequency response, perfect for airbag design and tests
- Side impact testing - Small pressure sensors that fit inside doors and other tight locations

**PIEZORESISTIVE ACCELEROMETER**

**MODEL 726CH**
- High sensitivity 600mV FSO
- Multi-mode damping
- DC response and wide bandwidth
- In-dummy application

**PIEZORESISTIVE ACCELEROMETER**

**MODEL 701AH - 701FH**
- High sensitivity, 0.3 mV/g
- Multi-mode gas damping
- Flat frequency response
- Rugged housing and cable with 28 AWG conductors

**PIEZORESISTIVE ACCELEROMETER**

**MODEL 757AH - 757FH**
- High sensitivity, 0.3 mV/g
- Multi-mode gas damping
- Crash and shock testing
- Miniature for tight spaces
- Survives up to 10,000 g shock
TRIAXIAL PIEZORESISTIVE ACCELEROMETER
MODEL 713 - 713F
■ High sensitivity, 0.3 mV/g
■ Multi-mode damping
■ Compact package, eliminates mounting block

DAMPED PIEZORESISTIVE ACCELEROMETER
MODEL 7264H
■ DC response and wide bandwidth
■ Multi-mode damping
■ High sensitivity
■ Passenger safety testing

PIEZORESISTIVE PRESSURE TRANSDUCER
MODEL 8510B
■ 200, 500, 2000 psig ranges
■ Airbag testing
■ Rugged, miniature

PIEZORESISTIVE PRESSURE TRANSDUCER
MODEL 8530C
■ 15, 50 and 100 psia ranges
■ Side impact testing
■ Absolute reference

PIEZORESISTIVE PRESSURE TRANSDUCER
MODEL 8530BM37
■ 200, 500, 1000, 2000 psia ranges
■ Detachable cable
■ ABS studies
ENDEVCO AUTO SAFETY SELECTION CHART

START

NUMBER OF AXIS?

VEHICLE

MOUNTING LOCATION

ATD

NUMBER OF AXIS?

TRIAXIAL

SINGLE

DAMPED

DAMPED

UNDAMPED

UNDAMPED

DAMPED

713
713F
COMPACT

757AH
757FH
MINIATURE

701AH
701FH
ROUGGED

726CH
FLAT TO SID

758H
VERSATILE MOUNTING

7268C
WORLD SID

7264C
COMPLIES WITH NHTSA SAND92-54

7264B
CENTER CG

726CH
FLAT TO SANK

7264H
HEADFORM STUDIES

Damped triax
Damped single axis
Undamped triax
Undamped single axis