



ELECTRIC & HYBRID VEHICLE TESTING & DEVELOPMENT

 **PCB PIEZOTRONICS**
AN AMPHENOL COMPANY

 **ENDEVCO**
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ACOUSTICS

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.



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 μ Pa
- Cost effective
- TEDS
- Intrinsically safe (for battery testing) and high temperature versions available



1/2" LOW NOISE ICP® MICROPHONE SYSTEM

MODEL 378A04

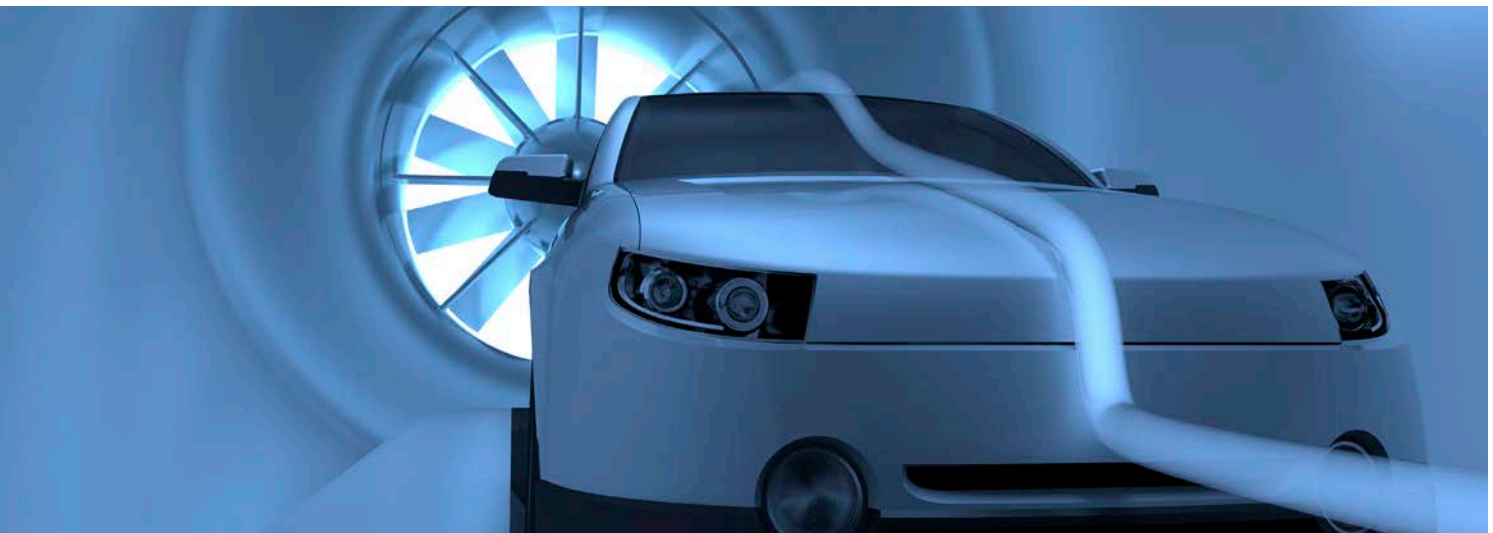
- Prepolarized (industry's first)
- Frequency Range: 10 Hz - 16 kHz
- Less than 6.5 dBA noise floor
- High sensitivity, 450 mV/Pa
- TEDS
- Ideal for anechoic chamber applications



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

General noise reduction

Vehicle and powertrain noise, vibration and harshness (NVH)

Automotive component and system performance



1/2" WATER AND DUST RESISTANT ICP® MICROPHONE SYSTEM

MODEL 130A24

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

SERIES 130F

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

MODEL 130B40

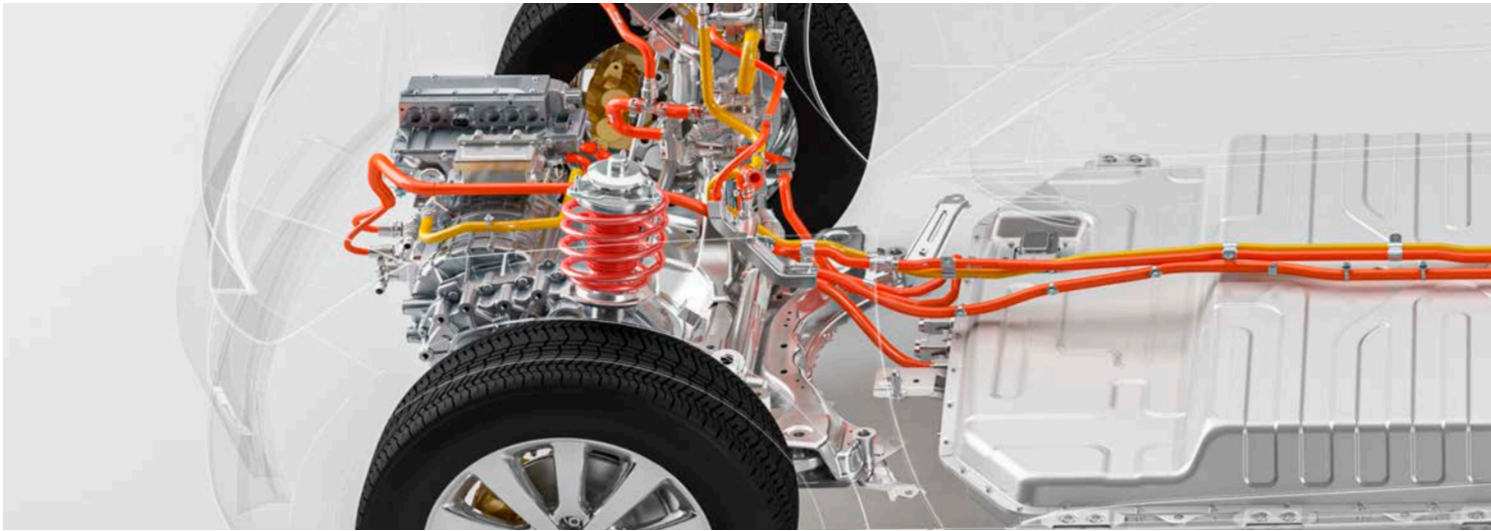
Low profile 1/8" (3 mm) microphone system

Dynamic Range: 150 dB before clipping

Water and dust resistant grid cap

Integral 5 ft cable

Adhesive mounting for flush mounted applications



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.

VIBRATION



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

MODEL 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

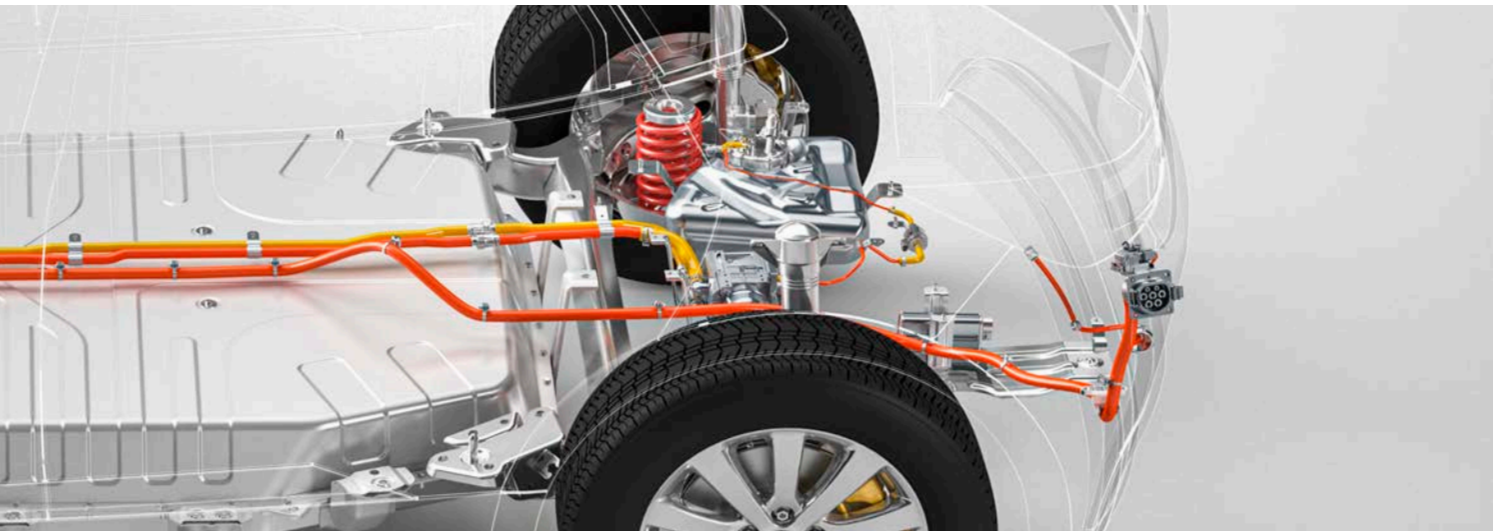
MODEL 356A02

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: ($\pm 5\%$) 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



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)



INTRINSICALLY SAFE ACCELEROMETER

MODEL EX639A91

- Sensitivity: 100 mV/g
- Measurement Range: ± 50 g pk
- Frequency Range: 0.5 to 13000 Hz
- Electrical Connector: 4-Pin, M12
- Intrinsically safe for EV battery testing



CASE ISOLATED HIGH SENSITIVITY TRIAXIAL ICP® ACCELEROMETER

MODELS 354B04 & 354B05

- Sensitivity: 10 and 100 mV/g
- Frequency Range ($\pm 5\%$): 0.4 to 10000 Hz
- Weight: 0.51 oz (14.5 gm)
- Thru-hole mounting



HIGH SENSITIVITY ICP® ACCELEROMETER

MODEL 352C33

- Frequency Range: ($\pm 5\%$) 0.5 to 10 kHz
- Sensitivity: 100 mV/g
- 10-32 side connector
- Ground isolation model available



VIBRATION

PCB® series 3711F, 3713F, 3741F, and 3743F DC response sensors are used to measure low frequency motion down to zero hertz. Each series includes a full scale measurement range from $\pm 2g$ to $\pm 200g$ and features low spectral noise with high resolution. The units feature capacitive, silicon MEMS sensing elements for uniform, repeatable performance and offer high frequency overload protection.



MEMS DC ACCELEROMETERS

MODEL 3711F

Sensitivities: ($\pm 3\%$) 6.75 mV/g to 675 mV/g

Measurement Range: $\pm 2 g$ pk
($\pm 19.6 m/s^2$ pk) to $\pm 200 g$ pk
($\pm 1962 m/s^2$ pk)

Frequency Range: ($\pm 5\%$)
0 to 250 Hz to 0 to 1500 Hz



TRIAXIAL MEMS DC ACCELEROMETERS

MODEL 3713F

Sensitivities: ($\pm 3\%$) 6.75 mV/g to 675 mV/g

Measurement Range: $\pm 2 g$ pk
($\pm 19.6 m/s^2$ pk) to $\pm 200 g$ pk
($\pm 1962 m/s^2$ pk)

Frequency Range: ($\pm 5\%$)
0 to 250 Hz to 0 to 1500 Hz



DIFFERENTIAL MEMS DC ACCELEROMETERS

MODEL 3741F

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

Measurement Range: $\pm 2 g$ pk
($\pm 19.6 m/s^2$ pk) to $\pm 200 g$ pk
($\pm 1962 m/s^2$ pk)

Frequency Range: ($\pm 5\%$)
0 to 250 Hz to 0 to 1500 Hz



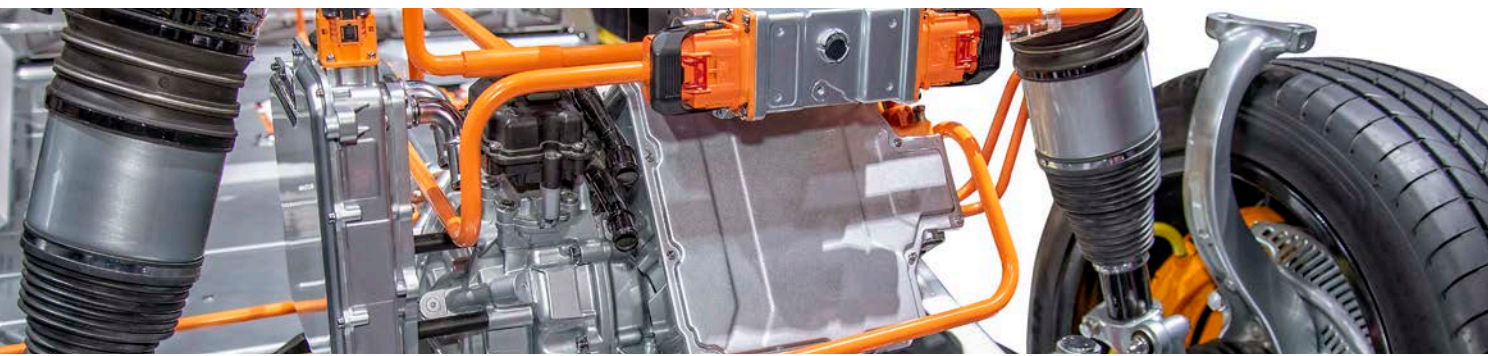
DIFFERENTIAL, TRIAXIAL MEMS DC ACCELEROMETERS

SERIES 3743F

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

Measurement Range: $\pm 2 g$ pk
($\pm 19.6 m/s^2$ pk) to $\pm 200 g$ pk
($\pm 1962 m/s^2$ pk)

Frequency Range: ($\pm 10\%$)
0 to 2500 Hz to 0 to 1500 Hz



VIBRATION ACCESSORIES

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.



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



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



NF CABLE
4-CONDUCTOR TERMINATION

Connector Style: Triple Splice

Connector Style: BNC

Connection Type: Plug (male pin)

Temperature Range: -40 to +176 °F (-40 to +80 °C)

Grounded shield



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

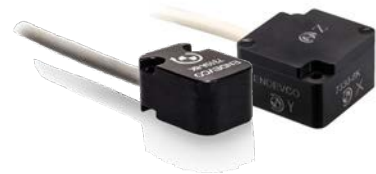
- DC response and wide bandwidth
- Undamped - meets NHTSA SA572-S4
- Mechanical stops
- Passenger safety testing



PIEZORESISTIVE TRIAXIAL ACCELEROMETER

MODEL 7268C

- 500 and 2000 g ranges
- DC response
- 12 wire integral cable
- Original equipment for WorldSID ATD



ANGULAR RATE SENSOR

MODELS 7310A & 7330

- Ranges of 100, 500, 1500, 6K, 8K, 12K and 18K deg/sec
- Up to 2000 Hz bandwidth
- Weights less than 3 grams (7310A)
- Weights less than 10 grams (7330)
- 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 ACCELEROMETER

MODEL 758H

- High sensitivity, 0.3 mV/g
- Multi-mode gas damping
- Mountable on x, y, or z axis



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



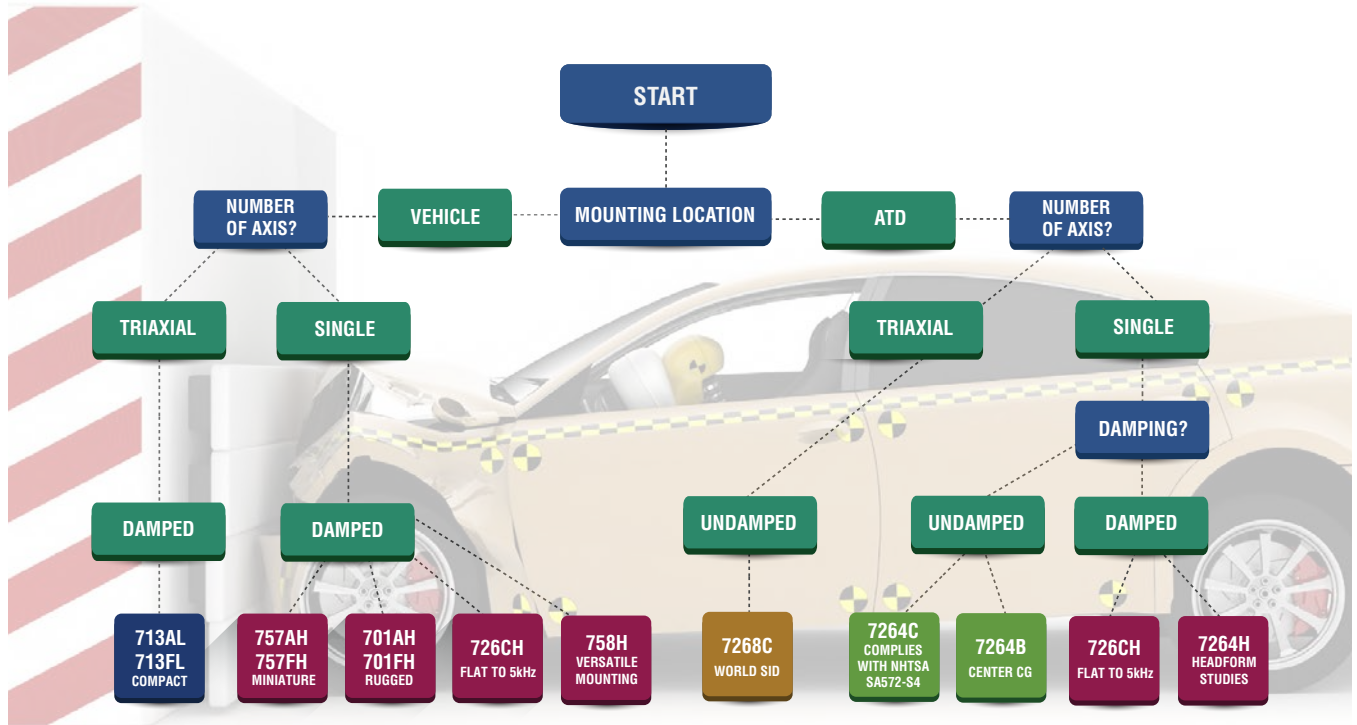
PIEZORESISTIVE PRESSURE TRANSDUCER

MODEL 8530BM37

- 200, 500, 1000, 2000 psia ranges
- Detachable cable
- ABS studies



ENDEVCO AUTO SAFETY SELECTION CHART



- Damped triax
- Damped single axis
- Undamped triax
- Undamped single axis

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