SENSORS FOR EXPLOSION, FIREARMS & IMPACT TESTING

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

PCB PIEZOTRONICS
AN AMPHENOL COMPANY

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EXPLOSION, FIREARMS & IMPACT TESTING

SENSORS FOR HIGH ENERGY MEASUREMENTS

From mining sites to military proving grounds, engineers count on PCB® and Endevco® sensors to measure the powerful forces produced by explosions, impacts, and high-shock events. These sensors are essential tools for collecting reliable data during the development, testing, and validation of structures, vehicles, and systems exposed to extreme dynamic conditions.

Designed for survivability and precision, our accelerometers and pressure sensors capture critical measurements from fast-rise, high-G shock events and complex pressure waveforms. Their rugged construction and consistent performance make them a trusted choice across industries where data integrity matters most.

Inside this catalog, you'll find a selection of our most widely used sensors for blast, ballistic, and impact testing-each engineered to support structural analysis, system qualification, and mission-critical research. For detailed specifications, visit www.pcb.com or www.endevco.com and search by model series. To speak with an expert about your specific test needs, contact an Application Engineer at 866-816-8892 or email us at sales@pcb.com.

CIVILIAN APPLICATIONS INCLUDE:

- Mining
- Construction
- Demolition
- Pyrotechnics

DEFENSE APPLICATIONS INCLUDE:

- Aerial Bombs
- Mines
- Torpedoes
- Breeching Operations
- Ballistics
- Tactical Missiles
- Firearms

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PIEZORESISTIVE ACCELEROMETERS

Piezoresistive high-G shock accelerometers are available in both undamped and lightly damped models to provide high-reliability shock and vibration measurements in extreme environments. With available measurement ranges from 2,000 to 200,000 g, these accelerometers feature rugged piezoresistive MEMS sensing elements. Our in-house MEMS manufacturing techniques allow us to offer a product with compact size, high sensitivity, and exceptional overrange, while ensuring the repeatability and reliability required for mission critical applications. Product variations include single axis or triaxial configurations and screw, stud, and surface mounting options.

PCB® and Endevco® manufacture leading-edge shock accelerometer designs that are contributing to the improved measurement of severe mechanical shock. Our piezoresistive accelerometers are DC responding to avoid integration errors which is critical to the quality of your low frequency measurements. Piezoelectric ICP® accelerometers offer a very high signal output (+/- 5 volts full scale) and the ease of two-wire electrical connectivity. Our technical experts can help you determine the optimal accelerometer for your measurement application. A brief summary of the technologies available are provided inside this brochure.

HIGHLIGHTS

- Multiple mounting configurations
- Minimal zero shift after shock
- High survivability in overrange environments
- DC response for long duration transient events
- Ranges up to 200,000 g
- Undamped for broad frequency response or damped for exceptional survivability
- Miniature SMT versions for embedded applications

APPLICATIONS

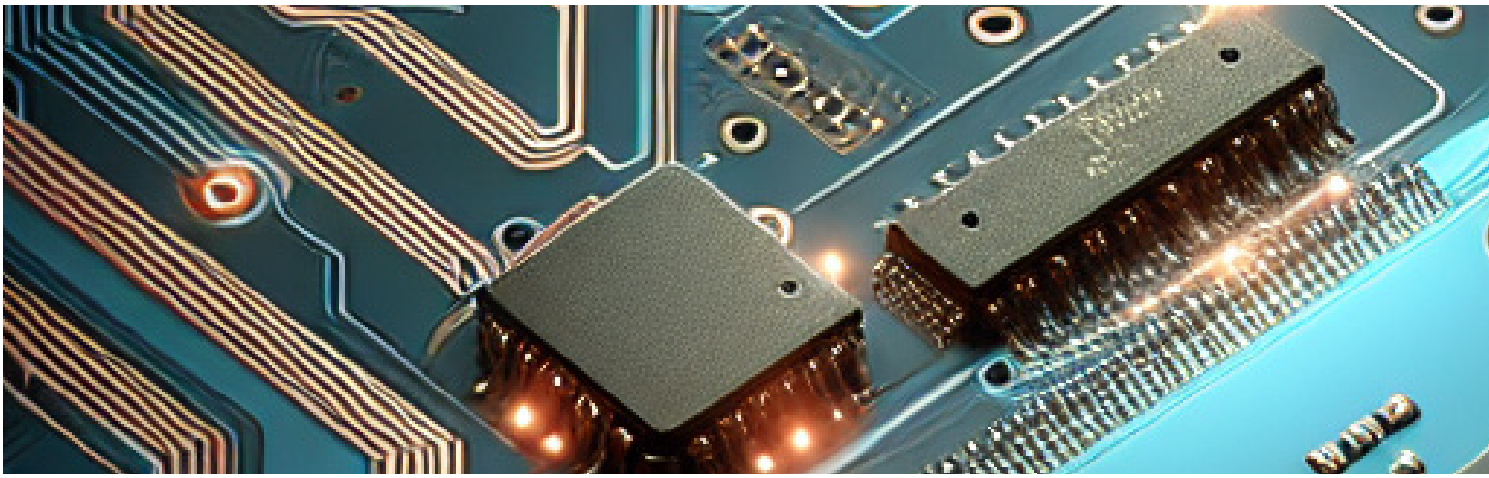
- Mechanical shock testing
- Shock wave monitoring
- Drop and impact testing
- Portable electronic device testing
- High-shock data recorders
- Near and far-field pyroshock testing
- Weapons and rocket testing
- Fuze/safe and arm

DAMPED PIEZORESISTIVE ACCELEROMETERS

Damped MEMS high-amplitude shock accelerometers represent state-of-the-art industry technology for miniature, high amplitude, DC response acceleration sensors. This series is capable of measuring long duration transient motion, as well as responding to and surviving extremely fast rise times, typical of a high-G shock event as found in explosive, gun and impact testing.

SPECIFICATIONS		
Model Number	**Endevco 2262B**	**Endevco 7280AM4**
Description	High Sensitivity Multi-mode damping Rugged to 10000 g shocks	Extremely rugged Lightly damped
Range (g)	±1000 / ±2000 / ±6000	±2000 / ±20000 / ±60000
Sensitivity (uV/V/g)	0.45 / 0.3 / 0.015	30 / 1.6 / .5
Frequency response (kHz)	0 to 3000	0-5 / 0-10 / 0-13
Shock limit (g pk)	10000	10000 / 80000 / 240000
Temperature Range - Operating	-67 to 257 °F -55 to 125 °C	-67 to +250 °F -55 to +121 °C
Dimensions (in(mm))	0.935 x 0.625 x 0.79 23.68 x 15.88 x 20.1	0.312 HEX 7.92
Weight (gm)	22	2.1
Excitation voltage (V)	10	10
Mounting method	10-32 detachable stud	1/4-28 UNF-3A stud

SPECIFICATIONS			
Model Number	**Endevco 7280AM7**	**Endevco 7280A**	**Endevco 7284A**
Description	Extremely rugged Lightly damped Low noise cable	Extremely rugged Lightly damped Low power consumption	Thru hole mount Lightly damped
Range (g)	±2000 g / ±20000 g / ±60000	±2000 g / ±20000 g / ±60000	±2000 g /±20000 / ±60000
Sensitivity (uV/V/g)	30 / 1.6 / .5	30 / 1.6 / .5	30 / 1.6 / .5
Frequency response (kHz)	0-5 / 0-10 / 0-13	0-5 / 0-10 / 0-13	0-10 / 0-10 / 0-20
Shock limit (g pk)	10000 / 80000 / 240000	10000 / 80000 / 240000	10000 / 60000 / 180000
Temperature Range - Operating	-67 to 250 °F -55 to +121 °C	-67 to 250 °F -55 to +121 °C	-67 to +250 °F -55 to +121 °C
Dimensions (in(mm))	0.56 x 0.35 x 0.16 (14.2 x 8.90 x 4.06)	0.56 x 0.35 x 0.16 (14.2 x 8.90 x 4.06)	0.56 x .304 x .245 (14.22 x 7.72 x 6.22)
Weight (gm)	4	4	3.6
Excitation voltage (V)	10	10	5
Mounting method	4-40 screws	4-40 screws	4-40 screws



PIEZOELECTRIC ACCELEROMETERS

SERIES 660 (TO-5 PACKAGE) LOW COST, EMBEDDABLE ACCELEROMETERS

Series 660 accelerometers are ideal for continuous vibration monitoring in high-volume and commercial OEM applications.

The Series 660 low cost accelerometers offer an affordable solution for vibration and shock measurements in high-volume and commercial OEM applications. The units are particularly well suited for shock and impact detection of packages or components, as well as bearing and gear mesh vibration measurements in predictive maintenance and condition monitoring requirements. The compact designs may be imbedded into machinery at the OEM level to provide value-added monitoring protection.

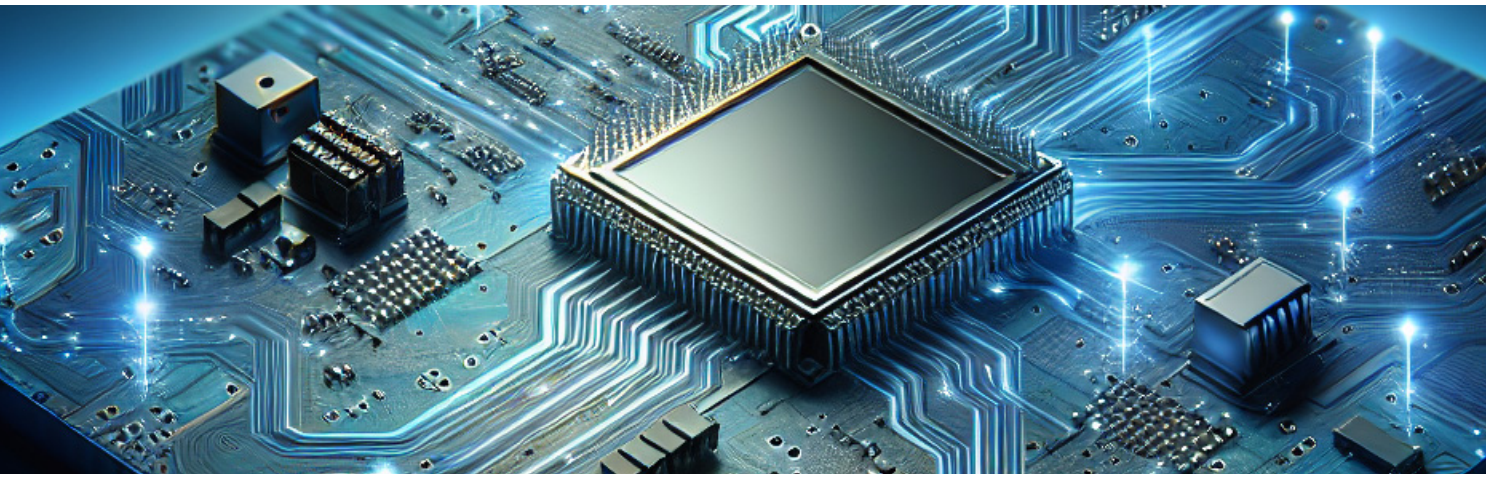
The units employ field-proven, solid-state, piezoelectric sensing elements for durability and broadband performance. Choose from either charge mode types, which achieve high operating temperatures or voltage mode ICP® types, with built-in signal conditioning microelectronics, for simplified operation and connectivity to data acquisition and vibration monitoring instrumentation.

HIGHLIGHTS:

- Choice of standard TO-5 or TO-8 transistor-style packages
- Choice of charge mode piezoelectric, voltage mode ICP®, and 3-wire low power varieties
- Mountable via adhesive or soldering and choice of either integral cable or solder pin electrical connections
- Variety of sensitivities to accommodate a wide variety of applications
- Broad bandwidth, high shock survivability, wide operating temperature range, high resolution, and large dynamic range

OPTIONS:

- Low Output Bias Voltage
- High Temperature Operation to 365 °F (185 °C)
- High Range (less sensitivity)
- Temperature Output Signal



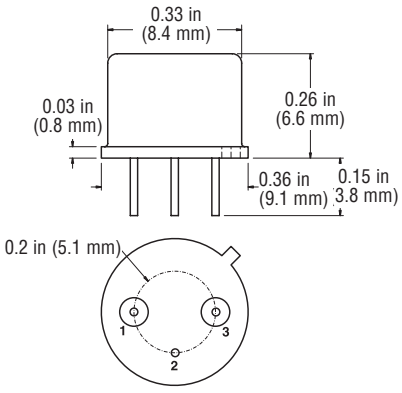
PELLET TYPE ACCELEROMETER

LOW PROFILE T-05, MODEL 66103LPZ1

3-wire voltage output
(power, signal, ground)

Sensitivity: (±20%) 10 mV/g

Low power consumption



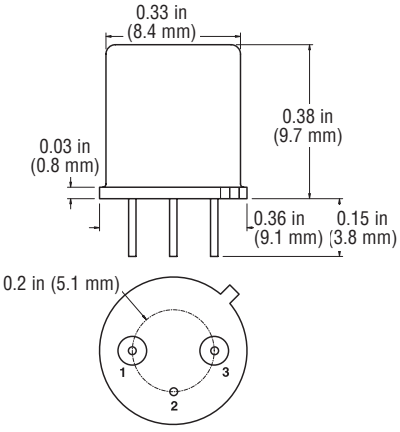
PELLET TYPE ACCELEROMETER

STANDARD T-05, MODEL 66292CNZ1

2-wire charge output
(signal, ground)

Sensitivity: (±20%) 11 pC/g

Power supply not required



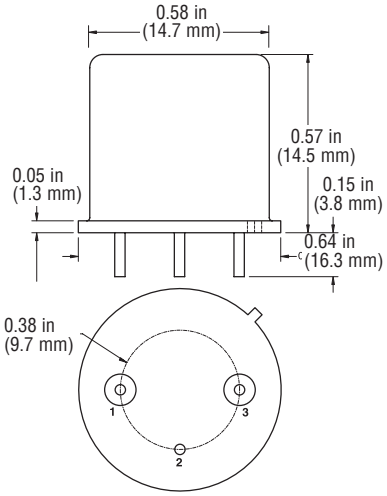
PELLET TYPE ACCELEROMETER

STANDARD T-08, MODEL 66332APZ1

2-wire ICP® power
(power/signal, ground)
current regulated power

Sensitivity: (±20%) 1,000 mV/g

High resolution



HIGH AMPLITUDE ICP® SHOCK ACCELEROMETERS

Piezoelectric ICP® accelerometers afford a very high signal output (+/- 5 volts full scale) and the ease of two-wire electrical connectivity. Their inherent ruggedness enables them to be severely over ranged without damage. The addition of internal mechanical isolation minimizes the high frequency stress that would otherwise be encountered by their ceramic sensing elements. This mechanical isolation, coupled with an internal 2-pole electrical filter, built into the ICP® circuitry, tailors the overall accelerometer response to assure data quality to frequencies as high as 10 kHz. Depending on the specific model, accelerations in excess of 50 kg can be successfully measured. These modern designs, with their internal elastomeric isolation materials are verified through calibration to remain dynamically linear and are enabling piezoelectric accelerometers to operate in increasingly severe acceleration environments.




SPECIFICATIONS				
Model Number	**PCB 350C23**	**PCB 350C24**	**PCB 350D02**	**PCB 350B01**
Description	Single Axis Integral Cable Mechanically Isolated	Single Axis Integral Cable Mechanically Isolated	Single Axis Integral Cable Mechanically Isolated	Single Axis Integral Cable Mechanically Isolated
Range (g)	±10000 g pk	±5000 g pk	±50000 g pk	±100000 g pk
Sensitivity (mV/g)	0.5	1.0	0.1	0.05
Frequency response (Hz)	0.4 - 10000	0.4 - 10000	4 - 10000	4 - 10000
Shock limit (g pk)	±50000	±50000	±150000	±150000
Temperature Range (Operating)	-10 to +150 °F -23 to +66 °C	-10 to +150 °F -23 to +66 °C	-10 to +150 °F -23 to +66 °C	-10 to +150 °F -23 to +66 °C
Dimensions (in(mm))	0.375 x 0.88 9.5 x 22.4	0.375 x 0.88 9.5 x 22.4	0.375 x 0.87 9.5 x 22.1	0.375 x 1.04 9.5 x 26.5
Weight (gm)	5.4	5.4	4.5	5.5
Excitation voltage (V)	20 - 30	20 - 30	20 - 30	20 - 30
Mounting method	1/4-28 UNF-3A stud	1/4-28 UNF-3A stud	1/4-28 UNF-3A stud	1/4-28 UNF-3A stud

HIGH AMPLITUDE ICP® SHOCK ACCELEROMETERS

Depending on the specific model, accelerations in excess of 50 kg can be successfully measured. These modern designs, with their internal elastomeric isolation materials are verified through calibration to remain dynamically linear and are enabling piezoelectric accelerometers to operate in increasingly severe acceleration environments.




SPECIFICATIONS				
Model Number	**PCB 350B41**	**PCB 350B42**	**PCB 350B43**	**PCB 350B44**
Description	Triaxial Hermetically Sealed Mechanically Isolated	Triaxial Hermetically Sealed Mechanically Isolated	Triaxial Hermetically Sealed Mechanically Isolated	Triaxial Hermetically Sealed Mechanically Isolated
Range (g)	±100000	±50000	±10000	±5000
Sensitivity (mV/g)	0.05	0.1	0.5	1.0
Frequency response (Hz)	4 - 10000	4 - 10000	0.4 - 10000	0.4 - 10000
Shock limit (g pk)	± 150,000	± 150,000	±50000	±50000
Temperature Range (Operating)	-10 to +150 °F -23 to +66 °C	-10 to +150 °F -23 to +66 °C	-10 to +150 °F -23 to +66 °C	-10 to +150 °F -23 to +66 °C
Dimensions (in(mm))	1.02 x 1.02 x 1.02 (26.0 x 26.0 x 26.0)	1.02 x 1.02 x 1.02 (26.0 x 26.0 x 26.0)	1.02 x 1.02 x 1.02 (26.0 x 26.0 x 26.0)	1.02 x 1.02 x 1.02 (26.0 x 26.0 x 26.0)
Weight (gm)	27	27	27	27
Excitation voltage (V)	20 - 30	20 - 30	20 - 30	20 - 30
Mounting method	Through Hole, 1/4-28 x .87 screw	Through Hole, 1/4-28 x .87 screw	Through Hole, 1/4-28 x .87 screw	Through Hole, 1/4-28 x .87 screw

PRESSURE PRODUCTS FOR BLAST TESTING

MEASURING EXPLOSIONS AND PROPELLANT BURNS

Pressure sensors with quartz, ceramic and tourmaline sensing elements are used for a wide variety of shock wave, blast and explosive testing. Typical applications include measurement of shock and blast waves, combustion or detonation in closed bombs, projectile velocity, free field or underwater explosive testing, and squib lot acceptance testing. All of these applications require high frequency response and durability, ability to drive long cables, and operate in adverse environments.

In applications involving long input cables to data acquisition systems, care must be exercised to assure the measurement system has adequate frequency response. Capacitance associated with the long cables can act as a low pass filter. Sensor output voltage, cable capacitance and constant current are factors to be considered. More current is required to drive higher voltages over longer cables. PCB® signal conditioners can be easily field-adjusted up to 20 mA to drive long cables. Selecting a sensor to provide about 1 V full scale for the expected pressure to be measured, rather than 5V, will provide 5 times greater frequency response for a given current and cable length.

Most of the sensors listed in this section incorporate acceleration-compensating sensing elements with integral electronics, which provide a frequency-tailored, non-resonant response. Frequency tailored sensors have microsecond rise time and suppressed resonance to faithfully follow shock wave events without the characteristic “ringing” common in other sensors.

APPLICATIONS:

- Air Blast Measurement
- Underwater Explosion Measurement
- Peak and Total Impulse
- Explosive Research and Structural Loading
- Shock Tube or Closed Bomb Testing
- Wave Velocity and/or Time of Arrival Determinations
- Explosive Component (e.g., Squib) Lot Acceptance

SERIES 113B - HIGH FREQUENCY, GENERAL PURPOSE PRESSURE SENSORS

PCB® Series 113B dynamic pressure sensors set the standard for extremely fast, micro-second response and a wide amplitude and frequency range that allows them to excel in high-frequency applications where minimum sensor diameter is required. Typical applications include combustion studies, explosive component testing (e.g. detonators, explosive bolts), airbag testing, and measurement of air blast shock waves resulting from explosions.

HIGHLIGHTS:

- Fast rise time ≤ 1 µsec from quartz element
- Ultra-high resonant frequency of ≥ 500 kHz
- Frequency-tailored output without the “ringing” characteristic of most other sensors
- Internal acceleration compensation minimizes shock and vibration sensitivity

MOUNTING ADAPTOR

MODELS 061A01, 061A10, 062A01

- Model 061A01: 3/8-24
- Model 061A10: M10
- Model 062A01: 1/8-NPT

MOUNTING ADAPTOR

MODEL 061A59

- 3/8-24 Delrin, ground isolated, up to 500 psi

HIGH FREQUENCY ICP® PRESSURE SENSOR								
Model Number	**113B28**	**113B27**	**113B21**	**113B26**	**113B24**	**113B22**	**113B23**	**113B03**
Sensitivity	100 mV/psi (14.5 mV/kPa)	50 mV/psi (7.25 mV/kPa)	25 mV/psi (3.6 mV/kPa)	10 mV/psi (1.45 mV/kPa)	5 mV/psi (0.725 mV/kPa)	1 mV/psi (0.145 mV/kPa)	0.5 mV/psi (0.073 mV/kPa)	0.44 pC/psi (0.064 pC/kPa)
Measurement Range (±5 Volt Output)	50 psi (345 kPa)	100 psi (690 kPa)	200 kpsi (1380 kPa)	500 psi (3450 kPa)	1 kpsi (6895 kPa)	5 kpsi (34475 kPa)	10 kpsi (68950 kPa)	15 kpsi (103420 kPa)
Low Frequency Response	0.5 Hz	0.5 Hz	0.5 Hz	0.01 Hz	0.005 Hz	0.001 Hz	0.0005 Hz	—

SERIES 102B - GROUND ISOLATED VERSION OF THE SERIES 113B

These sensors offer all the features and benefits of the Series 113B, with the added advantage of electrically isolating their output from the ground to help prevent ground loop issues. Additionally, this series can be equipped with an optional ablative coating (Prefix: CA) to protect the diaphragm from thermal shock in flash-temperature applications.

HIGHLIGHTS:

Ultra-high frequency > 500 kHz

Fast rise time < 1 µsec

Peak pressure and total impulse

APPLICATIONS:

Shock Tubes and Closed Bombs

Time-of-arrival Measurements

Explosion, Blast, and Shock Wave

HIGH FREQUENCY ICP® PRESSURE SENSOR							
Model Number	**102B**	**102B03**	**102B04**	**102B06**	**102B15**	**102B16**	**102B18**
Sensitivity	1 mV/psi (0.145 mV/kPa)	0.5 mV/psi (0.073 mV/kPa) /	5 mV/psi (0.725 mV/kPa)	10 mV/psi (1.45 mV/kPa)	25 mV/psi (3.6 mV/kPa)	50 mV/psi (7.25 mV/kPa)	100 mV/psi (14.5 mV/kPa)
Measurement Range (±5 Volt Output)	5 kpsi (34475 kPa)	10 kpsi (68950 kPa)	1 kpsi (6895 kPa)	500 psi (3450 kPa)	200 psi (1380 kPa)	100 psi (690 kPa)	50 psi (345 kPa)
Low Frequency Response	0.001 Hz	0.0005 Hz	0.0005 Hz	0.01 Hz	0.5 Hz	0.5 Hz	0.5 Hz

SERIES 8500 - PIEZORESISTIVE PRESSURE TRANSDUCERS

With designs suitable for blast pressure measurements, these pressure sensors feature quick response times and high output for excellent signal-to-noise ratio. They measure both static and dynamic pressure. Our miniature pressure sensors measure structural loading by shock waves resulting from blast explosions. For harsh environments where there is particle impingement and thermal shock, an optional version is available with a protective screen and a black silicone grease coating which further reduces photoflash sensitivity and provides an effective thermal barrier for short duration high temperature service. Please contact us for available model numbers.

PIEZORESISTIVE PRESSURE TRANSDUCER

ENDEVCO MODEL 8510B

Output type: Voltage (MEMS)

Reference type: Gage

Full scale: 200/500/2000 psi (29/72.6/290 kPa)

Order “Mx” option for thermal shock protection

PIEZORESISTIVE PRESSURE TRANSDUCER

ENDEVCO MODEL 8511AM8

Output type: Voltage (MEMS)

Reference type: Gage

Full scale: 5000/10000/20000 psi (726/1451/2903 kPa)

PIEZORESISTIVE PRESSURE TRANSDUCER

ENDEVCO MODEL 8530C

Output type: Voltage (MEMS)

Reference type: Absolute

Full scale: 50/100 psi (7./ 14.5 kPa)

PIEZORESISTIVE PRESSURE TRANSDUCER

ENDEVCO MODEL 8530BM37

Output type: Voltage (MEMS)

Reference type: Absolute

Full scale: 200/500/1000/2000 psia (29/72.6/145/290 kPa)

PIEZORESISTIVE PRESSURE TRANSDUCER

ENDEVCO MODEL 8530CM37

Output type: Voltage (MEMS)

Reference type: Absolute

Full scale: 15/50/100 psia (2.2/7.3/14.5 kPa)

SERIES 106B - ICP® HIGH INTENSITY, ACOUSTIC PRESSURE SENSORS

The Model 106B and 106B50 are high-sensitivity, acceleration-compensated ICP® quartz pressure sensors designed for measuring intense acoustic phenomena. This series is widely utilized for monitoring acoustic fields in operational launch vehicles and their payloads. The 106 Series covers a range from acoustic pressures below 80 dB to several psi. These sensors use piezoelectric technology similar to that found in PCB's full line of hermetically sealed dynamic pressure sensors, which can measure pressure fluctuations from acoustic levels to tens of thousands of psi, with frequencies ranging from near DC to tens of kHz. Their ability to detect only pressure fluctuations above a specified frequency, even in high static pressure environments, makes them uniquely suited for applications such as combustion instability monitoring.

CE

HIGH SENSITIVITY, ICP® ACOUSTIC PRESSURE SENSOR

MODEL 106B52

Sensitivity (±15%): 5000 mV/psi (725 mV/kPa)

Measurement Range: 1 psi (6.89 kPa)

Low Frequency Response (-5%): 2.5 Hz

CE

HIGH SENSITIVITY, ICP® ACOUSTIC PRESSURE SENSOR

MODEL 106B50

Sensitivity (±15%): 500 mV/psi (72.5 mV/kPa)

Measurement Range: 5 psi (34.45 kPa)

Low Frequency Response (-5%): 0.5 Hz

CE

HIGH SENSITIVITY, ICP® ACOUSTIC PRESSURE SENSOR

MODEL 106B

Sensitivity (±15%): 300 mV/psi (43.5 mV/psi)

Measurement Range: 8.0 psi (55.1 kPa)

Low Frequency Response (-5%): 0.5 Hz

MODEL 132B38 - ICP® TIME-OF-ARRIVAL MICRO-PRESSURE SENSOR

Model 132B38 is well suited for short wavelength acoustic and shock wave measurements associated with high-frequency projectile detection systems. . Incorporating a 1mm square sensing element and integral microelectronics in a 3mm housing, Model 132B38 has a very high sensitivity and microsecond response capable of identifying the bow and stern wave from a passing projectile. An internal 8 kHz high-pass filter eliminates low-frequency inputs.

Sensitivity: 140 mV/psi (20.3 mV/kPa)

Measurement Range: 50 psi (345 kPa)

Low Frequency Response (-5%): 11 kHz

MODEL 134A24 - TOURMALINE PRESSURE BAR

Model 134A24 is a unique non-resonant sensor is designed for instantaneous, reflected (face-on) shock wave pressure measurements in dry environments. A shock wave pressure impacting the very thin tourmaline crystal which operates into a silver alloyed “pressure bar”, eliminates sensor structure response. The sensor has a 0.2-microsecond rise time. The sensor diaphragm end is coated with a conductive silver epoxy.

Sensitivity: 5 mv/psi to 0.25 mV/psi
(0.73 mV/kPa to 0.04 mV/kPa)

Measurement Range: 1000 psi to 20 kpsi
(6895 kPa to 137900 kPa)

Low Frequency Response (-5%): 0.25 kHz

MODEL 113B55 - ICP® FREE-FIELD EXPLOSION BLAST PRESSURE ‘LOLLIPOP’ SENSOR

Model 113B55 ‘lollipop’ configuration helps make blast measurement by allowing blast waves to travel across its surface from any elevation, in tight places where a pencil probe won’t fit. It is designed for a broad range of explosion, blast, and shock wave testing applications including measuring blast pressure in free-field or closed bunker arenas to obtain peak pressure, total impulse, shock wave and time-of-arrival measurements that are used to study blast effects on structures, vehicles, and humans.

Sensitivity: 10 mV/psi (1.45 mV/kPa)

Measurement Range: 500 psi (3448 kPa)

Low Frequency Response (-5%): 0.05 Hz

SERIES 137 - ICP® FREE-FIELD BLAST PRESSURE "PENCIL" PROBE

Series 137 incorporates acceleration-compensated quartz elements and integral microelectronics for long cabledriving, improved stability and low thermal sensitivity.

MODEL 137B2XB (BNC CONNECTOR)

MODEL 137B2XA (10-32 CONNECTOR WITH PROTECTIVE COVER)

MODEL 137B25 (4-PIN CONNECTOR WITH 2-CHANNEL OUTPUT)

HIGHLIGHTS:

Pressure ranges from 25 to 1,000 psi (173 to 6,895 kPa)

Rise time ≤ 6.5 µsec (incident)

Resonant frequency ≥ 400 kHz

The 137 series is available in single and dual-sensing element housings

137B32 features an active sensor in the front and placebo in the rear

137B29B is high sensitivity with exceptional resolution (0.002 psi) for low pressure measurements

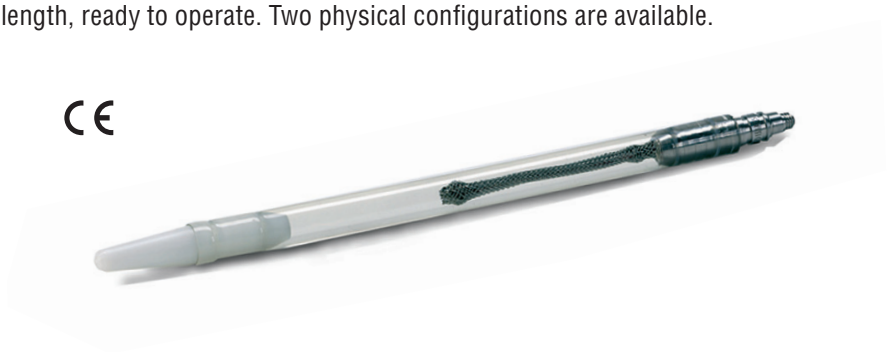
FREE-FIELD ICP® BLAST PRESSURE PROBE					
Model Number	**137B21B**	**137B22B**	**137B23B**	**137B24B**	**137B29B**
Measurement Range	1 kpsi [3] 6895 kPa [3]	500 psi 3447 kPa	50 psi 345 kPa	250 psi 1724 kPa	25 psi 173 kPa
Useful Overrange	—	1 kpsi [1] 6895 kPa [1]	100 psi [1] 690 kPa [1]	500 psi [1] 3447 kPa [1]	50 psi [1] 345 kPa [1]
Sensitivity	1 mV/psi 0.145 mV/kPa	10 mV/psi 1.45 mV/kPa	100 mV/psi 14.5 mV/kPa	20 mV/psi 2.9 mV/kPa	200 mV/psi 29 mV/kPa
Maximum Pressure	5 kpsi 34,475 kPa	5 kpsi 34,474 kPa	1 kpsi 6895 kPa	5 kpsi 34,474 kPa	1 kpsi 6895 kPa
Resolution	8.5 mpsi 0.059 kPa	1 mpsi 0.007 kPa	10 mpsi 0.069 kPa	0.7 mpsi 0.005 kPa	2 mpsi 0.01 kPa
Resonant Frequency	> 400 kHz	> 400 kHz	> 400 kHz	> 400 kHz	> 300 kHz
Rise Time (Incident)	< 4 µsec	< 4 µsec	< 4 µsec	< 4 µsec	< 6.5 µsec
Non-linearity	< 1 % [2]	< 1 % [2]	< 1 % [2]	< 1 % [2]	< 1 % [2]
Temperature Range	-100 to +275 °F -73 to +135 °C	-100 to +275 °F -73 to +135 °C	-100 to +275 °F -73 to +135 °C	-100 to +275 °F -73 to +135 °C	-100 to +275 °F -73 to +135 °C
Discharge Time Constant(at room temp)	> 0.2 sec	> 0.2 sec	> 0.2 sec	> 0.2 sec	> 0.2 sec
Electrical Connector	BNC Coaxial Jack	BNC Coaxial Jack	BNC Coaxial Jack	BNC Coaxial Jack	BNC Coaxial Jack
Housing Material	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Diaphragm Material	Invar	Invar	Invar	Invar	Invar
Sealing	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Additional Accessories					
Mating Cable Connectors	—	—	AC	—	AC
Recommended Stock Cables (29 pF/ft, 95 pF/m)	002ACXXXAC	002ACXXXAC	002ACXXXAC	002ACXXXAC	002ACXXXAC
Dual Output Cable	010AYXXXQM	010AYXXXQM	010AYXXXQM	010AYXXXQM	—
Additional Versions					
10-32 Coaxial Jack Connector with Protective Cover	137B21A	137B22A	137B23A	137B24A	—
Placebo, BNC Jack Only	137BPBO	137BPBO	137BPBO	137BPBO	137BPBO
Two-Sensor Pencil Probe	137B28	137B27	137B25	137B26	—
Active Sensor in front, Placebo in rear	—	—	—	137B32	—
Notes					
[1] For +10 volt output, minimum 24 VDC supply voltage required. Negative 10 volt output may be limited by output bias. [2] Zero-based, least-squares, straight line method. [3] For +/- 1V output.					

SERIES 138 - ICP® TOURMALINE UNDERWATER BLAST SENSOR

Series 138 Sensors measure shock wave pressures associated with underwater explosion testing. The sensors are structured with a volumetrically sensitive tourmaline crystal, suspended and sealed in an insulating, oil-filled vinyl tube. They have integral microelectronics. These underwater shock wave sensors provide a clean, non-resonant, high-voltage output through long cables in adverse underwater environments. They can be supplied with a sealed cable of appropriate length, ready to operate. Two physical configurations are available.

HIGHLIGHTS:

- ICP® underwater blast explosion pressure probes
- Ranges from 1000 to 50k psi (6894 to 344,740 kPa)
- Rise time < 1.5 µsec
- Resonant frequency > 1M Hz



UNDERWATER TOURMALINE BLAST SENSORS FOR PEAK, OVERPRESSURE AND HIGH-PRESSURE BUBBLE ENERGY MEASUREMENTS			
SERIES 138A MODEL NUMBERING SYSTEM			
1) Connector Type			
Default	10-32 Coaxial Jack		
W	Attached Waterproof Cable		
	2A) ICP® Output Pressure Range and Tube Length / Configuration		
	138A01	Measurement Range: 1000 psi (6895 kPa) with 7.6 in.(193 mm) Length and Sinker Hole for Vertical Mounting	
	138A02	Measurement Range: 1000 psi (6895 kPa) with 4.7 in. (120 mm) Length for Horizontal Mounting	
	138A05	Measurement Range: 5000 psi (34475 kPa) with 7.6 in.(193 mm) Length and Sinker Hole for Vertical Mounting	
	138A06	Measurement Range: 5000 psi (34475 kPa) with 4.7 in. (120 mm) Length for Horizontal Mounting	
	138A10	Measurement Range: 10 kpsi (68950 kPa) with 7.6 in.(193 mm) Length and Sinker Hole for Vertical Mounting	
	138A11	Measurement Range: 10 kpsi (68950 kPa) with 4.7 in. (120 mm) Length for Horizontal Mounting	
	138A25	Measurement Range: 25 kpsi (172375 kPa) with 7.6 in.(193 mm) Length and Sinker Hole for Vertical Mounting	
	138A26	Measurement Range: 25 kpsi (172375 kPa) with 4.7 in. (120 mm) Length for Horizontal Mounting	
	138A50	Measurement Range: 50 kpsi (344750 kPa) with 7.6 in. (193 mm) Length and Sinker Hole for Vertical Mounting	
	138A51	Measurement Range: 50 kpsi (344750 kPa) with 4.7 in. (120 mm) Length for Horizontal Mounting	
	2B) Charge Output Pressure Range and Tube Length / Configuration		
	138A	Measurement Range: 25 kpsi (172375 kPa) with 7.6 in.(193 mm) Length and Sinker Hole for Vertical Mounting	
	138A24	Measurement Range: 25 kpsi (172375 kPa) with 4.7 in. (120 mm) Length for Horizontal Mounting	
		3) Attached Model 038 Cable Length (add only if ordering the W option)	
		/038CYxxxAC	Specify total length xxx in feet. Cable is terminated with BNC plug connector
		/M038CYxxxAC	Specify total length xxx in meters. Cable is terminated with BNC plug connector
Example			
W	**138A05**	/038CY300AC	Attached 300 ft. 038 cable, 5000 psi measurement range, 7.6 in. length, sinker hole, BNC plug termination

PRESSURE PRODUCTS FOR BALLISTIC TESTING

BALLISTIC PRESSURE SENSORS

For over forty years, PCB® has provided high-frequency, durable quartz ballistic pressure sensors in both charge and ICP® voltage mode designs. The Series 109 ICP® ballistic pressure sensors are acceleration-compensated and feature a ceramic-coated integral diaphragm to minimize thermal shock caused by burning propellants. Additionally, this series includes a floating clamp nut that reduces strain sensitivity on the sensor body due to mounting torque. The integrated ICP® electronics are designed to withstand shock, making them ideal for gun test applications. Series 119 charge output versions also available.

In the early 1970s, PCB® collaborated with members of the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) to develop a reliable and durable standard test method for sporting arms ammunition. Pressure sensors were needed for integration into a standardized test method for rapid-fire ammunition production testing. This approach utilized a sensor with a precisely machined curved diaphragm, enabling direct pressure measurement through the shell case. As a result of this innovation, the conformal sensor was adopted as a SAAMI/ANSI "National Standard" for ammunition testing.

Series 117B conformal pressure sensors provide accurate gun chamber pressure measurements by directly interfacing with an unmodified shell case. Designed with a machined diaphragm that sits flush with the specific chamber diameter, these sensors ensure that the measurement process remains unchanged. Unlike other methods, conformal sensors eliminate the need for drilled cartridges or maintenance of gas passages. Known for their durability and stability, these sensors can withstand thousands of rounds. Because a single sensor often outlasts multiple barrels, ammunition batch qualification testing can be completed without the risk of sensor failure during the process.

Every PCB® sensor comes with NIST traceable calibration. To ensure pre-calibration stabilization, all ballistic pressure sensors undergo high-pressure hydraulic cycling, with most also being test-fired at the PCB® ballistic firing range. Additionally, PCB® offers the Model 905C high-pressure static calibration system for on-site use in ballistic laboratories. We also provide side-by-side dynamic and static comparison calibration services for both PCB® and competitor ballistic sensors.

APPLICATIONS:

- Ammunition and Gun Testing
- Explosives Testing
- Closed Bombs
- Recoil Mechanisms
- Ultra High-frequency Detonation

SERIES 109 - ICP® BALLISTIC SENSORS

PCB® offers a complete line of high pressure ballistic sensors with integral electronics. They operate from a PCB® constant-current signal conditioner and provide a high-voltage, low-impedance output. ICP® sensors are well suited for applications involving long cables and operation in dirty factory or field environments.

These sensors incorporate a captivated floating clamp nut and a more stable structure for improved accuracy, reliability, and lower thermal transient sensitivity. They are structured with quartz sensing elements, built-in microelectronics, and an integral machined ceramic-coated diaphragm for greater durability, overrange capability, high-frequency response, and improved linearity.

Series 109 are acceleration-compensated ICP® sensors for high-energy, high-frequency applications, such as detonation, closed bomb combustion, and explosive blast measurements under extreme shock conditions.

CE

HIGH PRESSURE ICP® BALLISTIC PRESSURE SENSOR

MODEL 109D12

Sensitivity (±15%): 0.07 mV/psi (0.010 mV/kPa)

Measurement Range: 100000 psi (689000 kPa)

Resonant Frequency: ≥ 400 kHz

Maximum Pressure: 125000 psi (862000 kPa)

SERIES 119 - CHARGE MADE BALLISTIC SENSORS

Charge Mode Pressure Sensors are well suited for high-pressure ballistics, detonation, and explosive research and test applications.

These sensors incorporate stable quartz-sensing elements, a durable-machined ceramic-coated integral diaphragm and floating clamp nut.

Series 119 are unique, acceleration-compensated, high resolution ballistic sensors designed for high-pressure, high-energy ballistics, detonation, and explosive applications under high-shock conditions, such as those that might be encountered in howitzer and liquid-propellant weapons.

HIGH PRESSURE BALLISTIC PRESSURE SENSOR

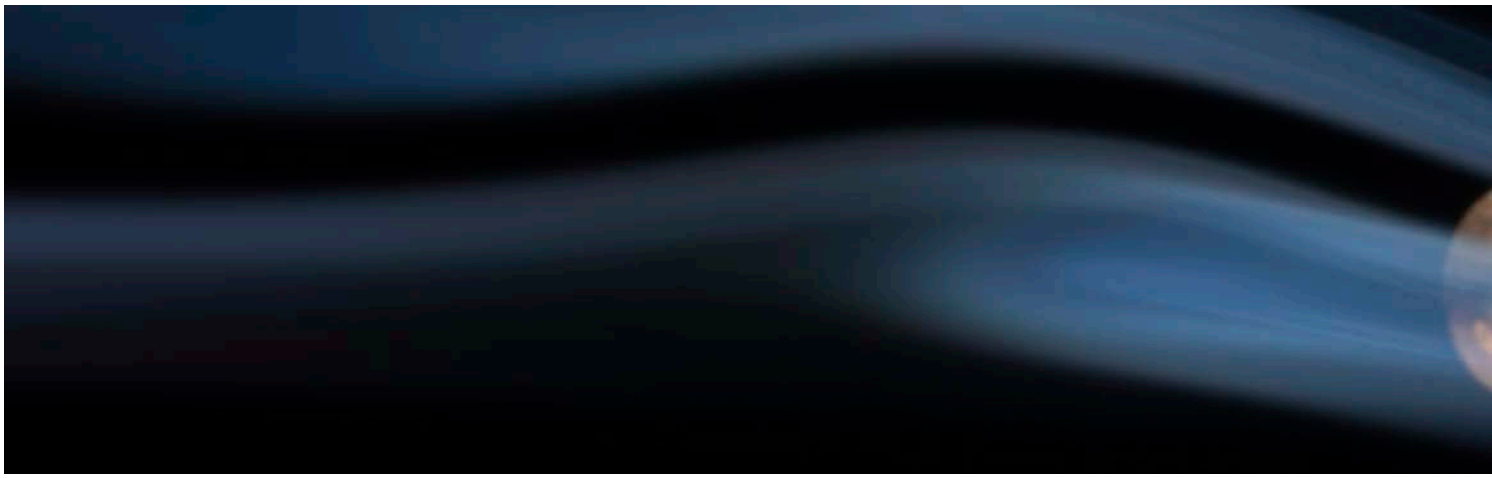
MODEL 119C12

Sensitivity (±15%): 0.25 pC/psi (0.036 pC/kPa)

Measurement Range: 0 to 100000 psi (0 to 689000 kPa)

Resonant Frequency: ≥ 400 kHz

Maximum Pressure: 125000 psi (862000 kPa)



SERIES 117B - CHARGE MODE CONFORMAL BALLISTIC SENSORS

Conformal ballistic sensors measure true gun chamber pressure directly through the cartridge case. The diaphragm of the conformal sensor is contoured to match a specific chamber diameter. An alignment guide and spacers help the user to install the sensor flush with the gun chamber walls.

The conformal ballistic sensor, when correctly installed, has a proven life expectancy of hundreds of thousands of rounds, outlasting many test barrels. Rapid-fire testing is possible since there are no cartridges to drill and align, no diaphragm ablatives to apply, and no gas passages to clean. The conformal sensor does not affect operation of the test barrel, nor change the measurement process.

Developed in cooperation with members of SAAMI to provide an accurate rapid-fire electronic production test method to replace the mechanical “copper crusher,” the conformal sensor has experienced 20 years of proven performance.

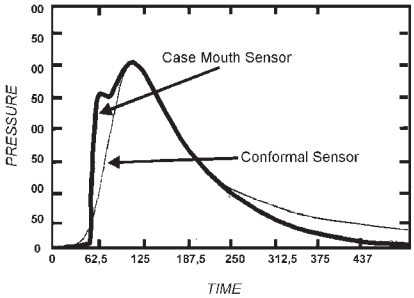
Conformal calibration through an unfired, unmodified empty cartridge shell case with PCB® Series 090B Calibration Adaptor accounts for the effects of the cartridge case. Output from the conformal sensor is compatible with any charge amplifier. The PCB® Model 443A53 Digital Peak Holding System with a charge amplifier and auto-reset peak meter facilitates rapid-fire testing of production ammunition.

The two machined flats near the connector end, an alignment guide, and a captive retaining nut facilitate installation. The nut automatically extracts the sensor when it is unscrewed. Series 090B Calibration Adaptor permits static calibration of the Model 117B Sensor, with pressures to be applied to the empty cartridge case. Spacer set is supplied to facilitate flush installation of the sensor.

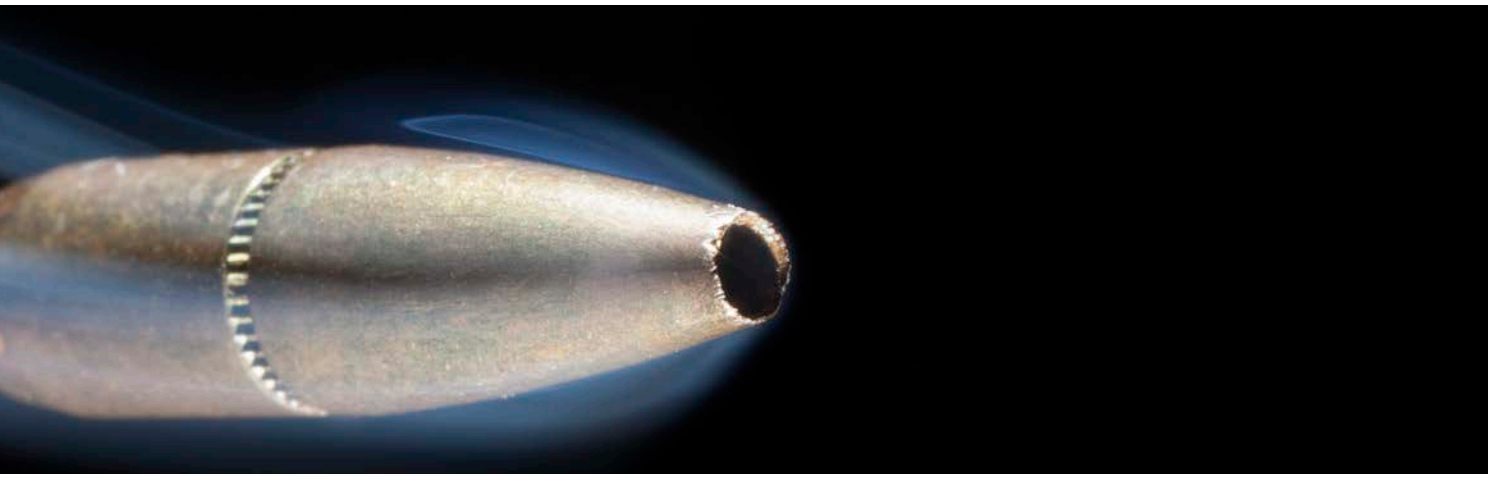
HIGHLIGHTS:

- Proven long life
- Outlasts life of many barrels
- ANSI/SAAMI standards Z299 test method
- Allows rapid-fire testing
- No drilled cases or recessed passages
- Cost effective

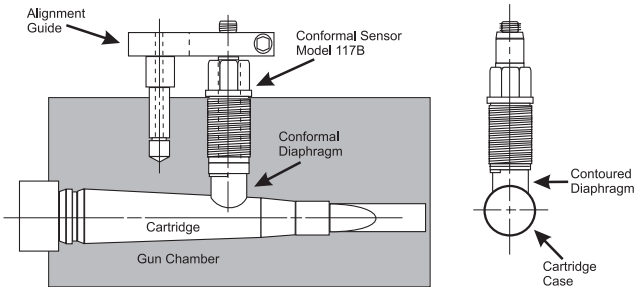
Conformal vs. Standard Case Mouth Installation



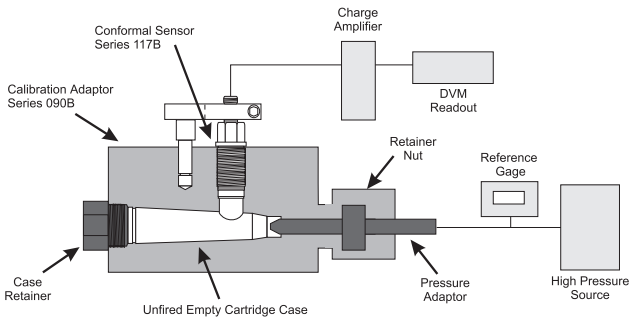
MODEL 117B



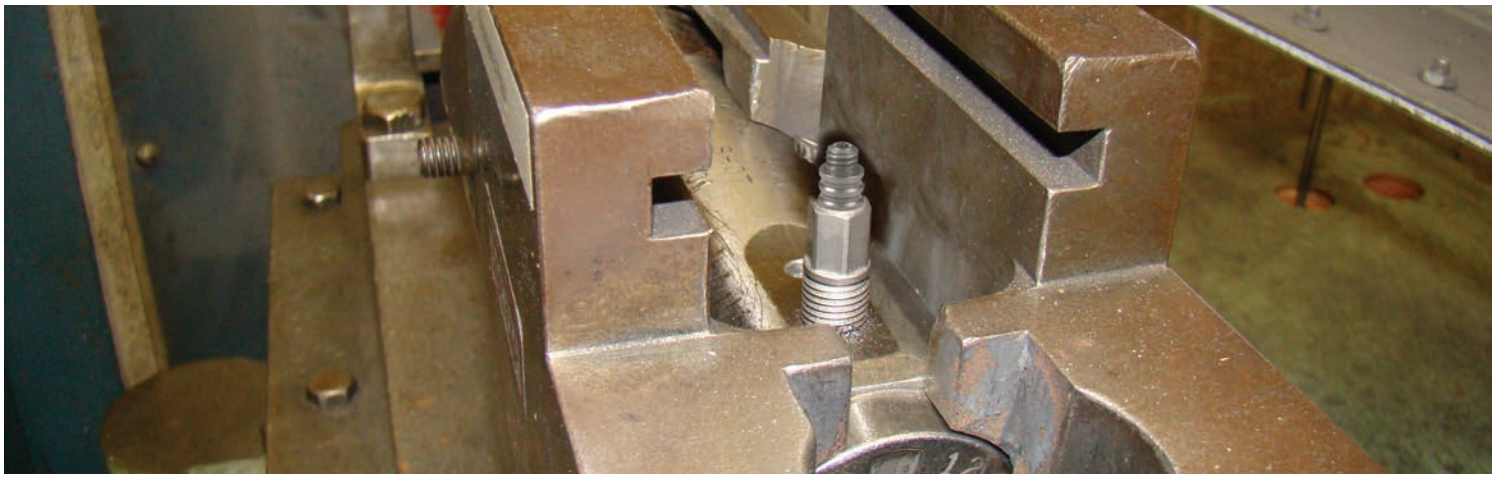
Typical Conformal Sensor Installation in Universal Receiver



Typical Conformal Calibration Adaptor System



BALLISTIC PRESSURE SENSORS SMALL ARMS TESTING		
	Conformal Gages	
	Contact factory for proper model number to match the caliber of ammunition under test	
Model Number	**117B Small Caliber**	**117B Large Caliber**
Measurement Range	35 kpsi 241 kPa	60 kpsi 414 kPa
Sensitivity	0.110 pC/psi 0.016 pC/kPa	0.140 pC/psi 0.021 pC/kPa
Maximum Pressure	40 kpsi 275 kPa	80 kpsi 552 kPa
Resolution	2 psi 14 kPa	2 psi 14 kPa
Resonant Frequency	> 300 kHz	> 300 kHz
Rise Time (Reflected)	<2 µsec	< 2 µsec
Non-linearity	<2 % [1]	< 2 % [1]
Acceleration Sensitivity	<0.02 psi/g <0.014 psi/(m/s²)	<0.02 psi/g <0.014 psi/(m/s²)
Temperature Range	-100 to +400 °F -73 to +204 °C	-100 to +400 °F -73 to +204 °C
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack
Housing Material	17-4SS	17-4SS
Diaphragm Material	17-4SS	17-4SS
Additional Accessories		
Conformal Calibration Adaptors	090B	090B
Brass Calibration	Contact factory for assistance, requires customer supplied brass casings and conformal adaptor	
Mating Cable Connectors	EB	EB
Recommended Stock Cables	003	003
Notes		
[1] Zero-based, least-squares, straight line method.		



MODEL 118A07 - CHARGE MODE SHOT SHELL SENSOR

For production testing of shotshell ammunition per SAAMI recommendations, this upgraded sensor measures chamber pressure through the case wall of an unmodified cartridge. The number of rounds capability has increased due to a recently modified design.

The Model 118A07 is a charge mode ballistics transducer with welded diaphragm and a rugged quartz element of proven reliability ideally suited for shotgun shells. The transducer's welded diaphragm provides better transient thermal characteristics, important for ballistics applications. The rugged piezoelectric element utilizes synthetic quartz crystals to convert instantaneous pressure changes to an analogous electrostatic charge. Chamber pressure is sensed by the transducer as the round is fired. The transducer also serves as a replacement for other diaphragm-type gauges.

For production testing of shotshell ammunition per SAAMI recommendations, this upgraded sensor measures chamber pressure through the case wall of an unmodified cartridge. The number of rounds capability has increased due to a recently modified design.

In addition to ballistics testing, the Model 118A07 can be used for hydraulic and pneumatic test applications.

BALLISTIC SHOT SHELL PRESSURE SENSOR

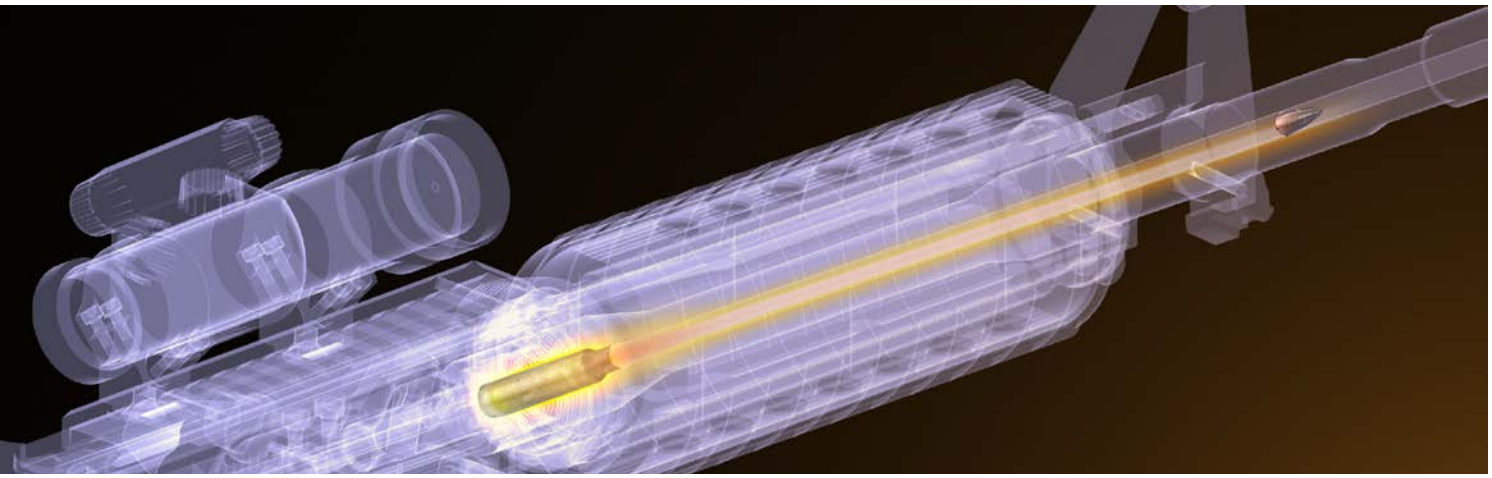
MODEL 118A07

Sensitivity (±15%): 0.28 pC/psi (0.041 pC/kPa)

Measurement Range: 15000 psi (103400 kPa)

Resonant Frequency: ≥ 175 kHz

Maximum Pressure: 35000 psi (241316 kPa)



FORCE & STRAIN PRODUCTS FOR STRUCTURAL IMPACT

IMPACT FORCE SENSORS

Quartz, piezoelectric force, and strain sensors are durable measurement devices, which possess exceptional characteristics for the measurement of dynamic force.

ICP® QUARTZ FORCE RING FOR PERFORMANCE APPLICATIONS

SERIES 201B

Sensitivity (±15%): 50 to 1 mV/lb (11240 to 224.8 mV/kN)

Measurement Range: 10 to 5000 lb (0.4448 to 22.24 kN)

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

GENERAL PURPOSE QUARTZ FORCE SENSORS

SERIES 208C

Sensitivity (±15%): 500 - 1 mV/lb (112.41 to 0.2248 mV/N)

Measurement Range: 10 - 5000 lb (44.5 to 22.24 kN)

Low Frequency Response (-5%): 0.0003 to 0.01 Hz

APPLICATIONS:

Firearm Recoil Testing

Drop Testing

Fracture Testing

Materials Testing

Penetration Testing

Dynamic Tension & Compression

Impact & Repetitive Applications

REUSABLE PIEZOELECTRIC ICP® STRAIN SENSORS

FOR DYNAMIC TESTING OF AIRCRAFT, DEFENSE VEHICLES AND COMPONENTS

Reusable ICP® Piezoelectric strain sensors can be used in modal analysis to assess structural integrity of aircraft during ground vibration testing and flight testing to determine high stress levels. They may also be used for measurement of strain-displacement relationships and load predictions.

Often used to supplement accelerometers, the small size of Series 740 strain sensors minimizes interference with aerodynamic properties of aircraft for flight test measurements. For applications where low strain levels occur, series 740 piezoelectric ICP® strain sensors generate output ten thousand times larger than the output of a resistive strain gauge. Its high sensitivity provides up to ±5 volts output at ±100 micro-strain.

This product is CE-marking compliant to European Union EMC Directive, based upon conformance testing to the following European norms:

EN 50081-1: 1992 Emissions

EN 50082-1: 1992 Immunity

HIGHLIGHTS:

Measures small strain on top of large static loads

Provides high resolution and wide dynamic range

Designed with low profile and integral cable

Contains built-in microelectronic circuitry

Detects wave propagation for material velocity characterization

TYPICAL APPLICATIONS :

Ground Vibration Testing

Modal Analysis

Transfer Path Analysis

Active Vibration Control

Photo Courtesy of Siemens and Belgian Defense

MODEL 740B02 - DYNAMIC ICP® STRAIN SENSORS

An epoxy-bonded Model 740B02 Strain Sensor provides a control signal for an actively damped flexible robot manipulator, illustrated above. The electronic controller, with vibration feedback from the strain sensor, provides a signal to the amplifier, such that vibration amplitude is minimized. The active control system permits rapid settling time for a step rotation of the manipulator arm.

The sensor mounts fast and easy to painted metals, composites, plastics and other materials in the field with gel-type super glue, and may be reused multiple times or reapplied if alignment is not correct on the first application. Removal is simplified with a debonding agent and supplied removal tool. The strain sensor is also supplied with a calibration certificate.

Structured with a quartz sensing element and microelectronic circuitry in a low-profile titanium housing, this sensor is ideal for high-resolution measurements of dynamic strain. This unit is compatible with PCB's ICP® Sensor signal conditioners and is capable of driving long cables.

CE

ICP® PIEZOELECTRIC STRAIN SENSOR

MODEL 740B02

- Sensitivity (±20%): 50 mV/με
- Measurement Range: 100 pk με
- Frequency Range: 0.5 to 100000 Hz
- Maximum Pressure: 125 kpsi (862000 kPa)

CE

ICP® PIEZOELECTRIC STRAIN SENSOR

MODEL 740M04

- Sensitivity (±20%): 5 mV/με
- Measurement Range: 900 pk με
- Frequency Range: 0.5 to 100000 Hz
- Maximum Pressure: 125 kpsi (862000 kPa)

PLACEBO TRANSDUCERS

For any testing in which the environmental operating conditions of a transducer vary with time and/or location, several requirements must be fulfilled before measurement uncertainty analysis is justified. Included among the requirements are good measurement system design practices, such as adequate low- and high-frequency response and data-sampling rates, appropriate anti-aliasing filter selection, proper grounding and shielding, and much more.

In addition to these requirements, data validation must be performed to establish that each transducer responds only to the environmental stimulus for which it is intended. For piezoelectric and piezoresistive transducers, “placebo” (IEST-RP-DTE011.1) transducers enable data validation to be accomplished. The referenced IEST standard defines a placebo transducer as ‘identical to a “live” unit in every parameter except for mechanical sensitivities.’ The placebo transducer should respond only to extraneous “environmental factors.” Ideally, its output would be zero. Any signal output from it would indicate that signals from the “live” transducers could be corrupted.

Every transducer responds to its environment in every way it can. For example, accelerometer specifications include their response to thermal, acoustic, strain, and radiation stimuli, to name a few. While accelerometers must have their response to acoustic pressure specified, pressure transducers must have their response to acceleration specified. Thus, one transducer’s desired response becomes another’s undesired response.

These undesired responses can cause a change in transducer sensitivity or can result in additive, spurious signals at the transducer’s output attributable to thermoelectric, electromagnetic, triboelectric and other self-generating noise phenomena. Since the test or instrumentation engineer has the best understanding of the test environment, he/she becomes responsible for data validation. The transducer manufacturer can assist by supplying “placebo” transducers to support this validation process.

Model 137B32

Endevco Model 7280A-Z

Model 102BPBO

Model 350B21PBO

Model 113B22PBO

Model 356A32PBO

Model 354C03PBO

Model 356A33PBO

Other models available upon special request. Contact your local Sales Representative for more information.

DYNAMIC PRESSURE CALIBRATION SYSTEMS

To service the wide range of pressure events measured by dynamic pressure sensors, The Modal Shop offers systems that calibrate sensors designed for atmospheric blast experiments, gas turbine exhaust fluctuations, internal combustion engine measurements, ammunition brass calibrations, and hydraulic or fuel line measurements. These systems have been proven in tens of thousands of factory calibrations performed at PCB Piezotronics, and this rich metrology heritage is leveraged with a digital hardware and software platform that is shared with the Precision Sensor Calibration Workstation Model 9155D.

By combining PCB's factory calibration hardware with The Modal Shop system software and expertise, pressure calibration systems meet the needs of the most discerning user. These turnkey systems reproduce the factory calibration techniques of pressure sensors for customers with the added advantage of a single point for product support and Total Customer Satisfaction.

HIGHLIGHTS:

- Assures accurate, traceable calibrations
- Integrated system includes all necessary components
- Windows® PC supplies familiar, intuitive user interface
- Set up tests, acquire data, save results and print reports quickly with precision and automation
- Define pass/fail criteria for each test and automatically recall them from the internal database

PRESSURE SENSOR CALIBRATION SYSTEMS					
PRESSURE	**MAX RANGE psi (MPa)**	**MEASUREMENT TECHNIQUE**	**UNCERTAINTY**	**TURNKEY WORKSTATION**	**9155D MODULAR OPTION**
Low Pressure	150 (1)	Dynamic Step	±1.5 %	K9903C	9155D-903
Medium Pressure	1 000 (6.9)	Dynamic Step	±1.5 %	K9907C	9155D-907
High Pressure	15 000 (103)	Dynamic Impulse	±4.1 %	K9913C	9155D-913
Ultra-High pressure	80 000 (550)	Dynamic Step	±2.0 %	K9905D+AUTO	

LOW PRESSURE CALIBRATION SYSTEM

MODEL K9903C

- Maximum pressure: 1 MPa (150 psi)
- Pneumatic calibration media
- 'Step' pressure input

MEDIUM PRESSURE CALIBRATION SYSTEM

MODEL K9907C

- Maximum pressure: 6.9 MPa (1000 psi)
- Compressed air or industrial helium media
- 'Step' pressure input

HIGH PRESSURE CALIBRATION SYSTEM

MODEL K9913C

- Maximum pressure: 103 MPa (15000 psi)
- Silicon oil media
- 'Impulse' pressure input

To service the wide range of pressure events measured by dynamic pressure sensors, The Modal Shop offers systems that calibrate sensors designed for atmospheric blast experiments, gas turbine exhaust fluctuations, internal combustion engine measurements, ammunition brass calibrations, and hydraulic or fuel line measurements. These systems have been proven in tens of thousands of factory calibrations performed at PCB Piezotronics, and this rich metrology heritage is leveraged with a digital hardware and software platform that is shared with the Precision Sensor Calibration Workstation Model 9155D.

By combining PCB's factory calibration hardware with The Modal Shop system software and expertise, pressure calibration systems meet the needs of the most discerning user. These turnkey systems reproduce the factory calibration techniques of pressure sensors for customers with the added advantage of a single point for product support and Total Customer Satisfaction.

ULTRA HIGH PRESSURE CALIBRATION SYSTEM

MODEL K9905D

- Maximum pressure: 550 MPa (80000 psi)
- Hydraulic calibration media
- 'Step' pressure input
- Quasi-static method available for ballistics sensors and brass calibration
- SAAMI standard brass calibration

INSTRUMENTED SHOCK TUBE

MODEL K9901C

- Enables high frequency resonant frequency measurement
- High speed time of arrival measurements
- Operates with compressed air or inert gas
- Max burst pressure 9.6 MPa (1400 psi)

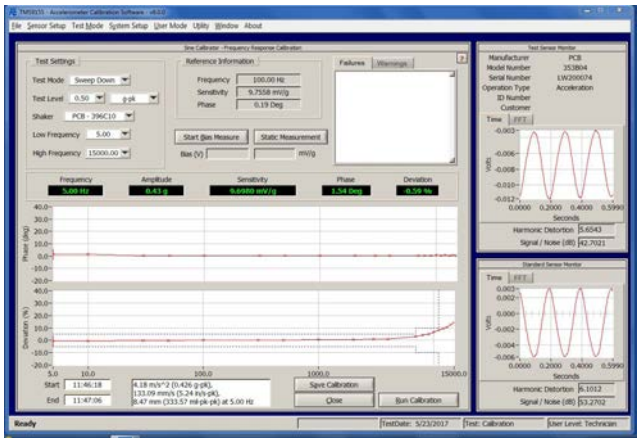
MODEL 9155D - ACCELEROMETER CALIBRATION WORKSTATION

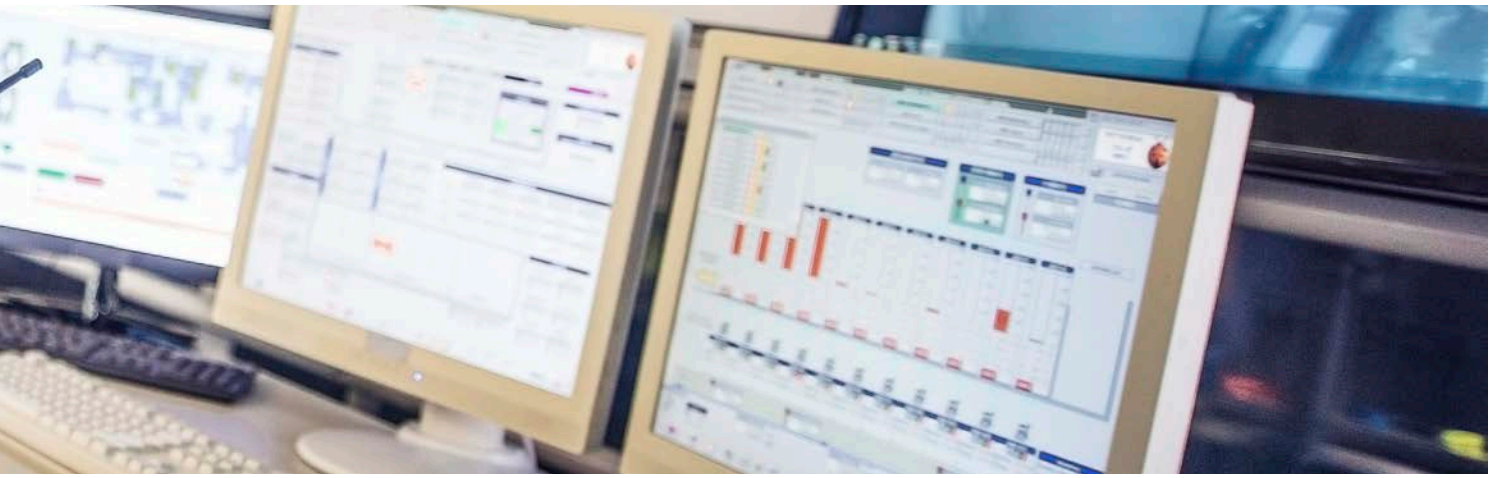
The Accelerometer Calibration Workstation Model 9155D is a turnkey solution that provides all the necessary components out of the box. Principal components include a Windows® PC Controller, software, printer and 24-bit data acquisition card. System options allow custom configuration of the modular system with a variety of shakers and shock towers, accelerometer signal conditioning, test software modules and mounting accessories.

The system often includes the 9155D-830 or 9155D-831 air bearing shaker. With our air bearing shakers, customers benefit from two things: PCB's R&D investment in precision metrology and years of experience on PCB's accelerometer production line. The real world experience these shakers have in our factory results in a mature design that has been 'hardened' for durability and optimized for usability.

HIGHLIGHTS:

- Wide frequency range of 0.1 Hz to 20 kHz
- Resonant frequency testing up to 50 kHz
- Drastically reduces uncertainty by virtually eliminating transverse motion
- Integral quartz ICP® reference for long-term stability
- Lorentz force coil enables rapid centering of sensors with varying mass



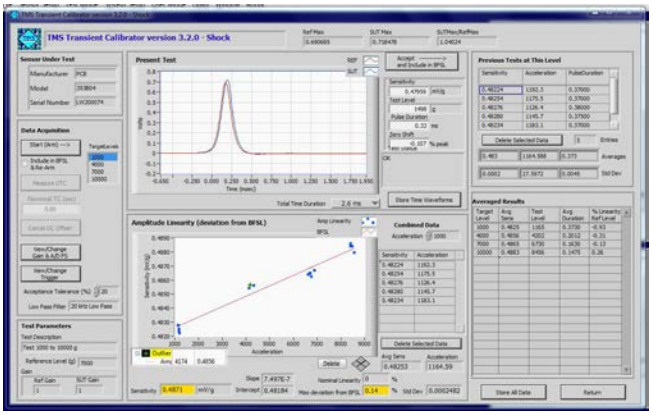


MODEL K9525C - SHOCK ACCELEROMETER CALIBRATION WORKSTATION

The PneuShockTM Model K9525C is a turnkey calibration solution for shock accelerometers. Shocks pulses are created at accelerations from 20 g to 10000 g using a pneumatically operated projectile to strike an anvil and excite the sensor. By controlling both the level and the duration of the air pressure applied, the user gains greater control and consistency of the impacts. PneuShock provides verification and linearity check. We also offer Model 9155D-525 as an optional module for the 9155D Accelerometer Calibration Workstation.

HIGHLIGHTS:

- Amplitude linearity calibration of shock and crash sensors from 20 g to 10000 g, per ISO 16062-22
- Controlled and consistent impacts using state-of-the-art pneumatically
- Easy refinement of impulse shape and frequency content using a wide variety of impact anvils
- Superior impact control through drive pressure and duration control



SPECIALIZED INSTRUMENTATION

LARSON DAVIS
A PCB DIVISION

SPARTAN SERIES FIREARM NOISE SOUND LEVEL METER

Many firearm examiners are tasked with determining whether installation of a suppressor on a firearm results in a “perceptible” reduction of the sound pressure level of a gun. The Larson Davis Spartan 821IH-QPR provides this functionality utilizing an easy-to use handheld platform. Included BLE technology allows for easy measurement control using the LD Atlas mobile app or included software. Meters may also be connected via USB-C.

With the included ¼” prepolarized pressure microphone, Spartan 821IH-QPR is capable of reading levels up to 183 dB, easily capturing levels typically associated with gunfire testing. Included G4 LD Utility software provides automatic wireless or USB data download, and convenient data storage options.

HIGHLIGHTS

- Measure up to 183 dB
- Class 1 Sound Level Meter
- 48 kHz sampling rate
- Simple setup for gunfire testing applications
- Easy-to-navigate, responsive, touch display
- Long battery life, up to 40 hours
- Bluetooth BLE 4.1 wireless communication
- Full control with LD Atlas mobile app
- Dosimetry option included for noise exposure measurements

MODEL SPARTAN 821IH-QPR

MODEL 444A53 - BALLISTIC PEAK PRESSURE MONITORING SYSTEM

The Model 444A53 is a modular-style signal conditioner that combines a dual-mode amplifier module (443B102), a peak voltage monitoring module (444A152), and an AC power supply module (441A101) into one, integrated device. The unit connects directly with an ICP® or charge output pressure sensor, normalizes sensor sensitivity, and displays peak transient measurement signals in voltage or pressure units.

Unlike a digitizing peak detector, which is limited in accuracy by the sampling rate, the 444A152 peak monitoring module captures the true peak voltage of the transient event. Additionally, the module incorporates a 20 kHz low pass filter, offers reset capability between events, and delivers an analog output signal to profile the entire pressure event.

This device is ideal for barrel chamber pressure testing, lot testing of ammunition, and cartridge load studies. Two alternative versions (Models 444A51 and 444A52) eliminate the dual mode amplifier module and are intended for direct connection to ICP® pressure sensors, any direct voltage input, or for existing systems that already utilize a separate charge amplifier.

SPECIFICATIONS	
Model	**444A53**
Performance	
Channels	1
Input Sensor Type (selectable)	ICP®, charge, voltage
Input Sensitivity Adjustment (normalization)	0.001 to 9999 (pC or mV per unit)
Excitation Supplied (ICP® mode)	24 VDC @ 0 to 20 mA
Voltage Gain (ICP® or voltage mode)	0.1 to 1000
Charge Converter (charge mode)	0.1 to 10000 mV/pC
Charge Input Limit	100000 pC
Drift (long DTC mode)	<0.03 pC/sec
Discharge Time Constant (selectable)	0.18, 1.8, 10, 100, 1000, >100000 sec
Peak / DVM Display	4-digit LCD
Peak Voltage Display Range (infinite hold)	± 10 V
Accuracy	± 1%
Display Mode	Peak, DVM, Bias Test (for ICP® sensors)
Rise Time	<1 µsec
Low Pass Filter	20 kHz
Peak Reset	Manual, Remote, or Auto (1 to 99 sec)
Environmental	
Temperature Range	+32 to +120 °F 0 to +50 °C
Electrical	
Power Required	100 to 240 VAC, 50 to 60 Hz
Relays (2 Form C each with HI or LOW setpoint)	1 A @ 30 VDC, 1/2 A @ 125 VAC
Physical	
Size (h x w x d)	6.2 x 6.06 x 10.2 in 157.5 x 153.9 x 259.1 mm
Electrical Connectors (input, peak/DVM output, analog output, remote reset)	BNC Jack

SIGNAL CONDITIONING & CONVERTERS

PCB® SIGNAL CONDITIONING

LINE POWERED BRIDGE/ DIFFERENTIAL/ICP® SIGNAL CONDITIONER
MODEL 483C28

Sensor Input Type(s): ICP®, Voltage, Bridge/Differential

Channels: 8

Frequency Range (-5%): 0.05 to 100000 Hz

LINE POWERED, ICP® SIGNAL CONDITIONER
MODEL 482C05

Sensor Input Type(s): ICP®

Channels: 4

Frequency Range (-5%): 0.1 to >1000 kHz

LINE POWERED, ICP® SIGNAL CONDITIONER
MODEL 483C05

Sensor Input Type(s): ICP®

Channels: 8

Frequency Range (-5%): 0.1 to >1000 kHz

LINE POWERED CHARGE/ICP® SIGNAL CONDITIONER
MODELS 482C64 & 482C16

Sensor Input Type(s): ICP®, Voltage, Charge

Channels: 4

Frequency Range (-5%): 0.05 to 100000 Hz

LINE POWERED BRIDGE/ DIFFERENTIAL/ICP® SIGNAL CONDITIONER
MODEL 482C27

Sensor Input Type(s): ICP®, Voltage, Bridge/Differential

Channels: 4

Frequency Range (-5%): 0.05 to 100000 Hz

ICP® SIGNAL CONDITIONER, BATTERY POWERED
MODEL 480C02

Sensor Input Type(s): ICP®, Voltage

Channels: 1

Voltage Gain (±1%): 1:1

DUAL MODE CHARGE AMPLIFIER
MODELS 443B02

1-channel system, dual-mode charge amplifier system, line powered

SERIES 402 – IMPEDANCE CONVERTERS AND IN-LINE VOLTAGE FOLLOWER AMPLIFIERS

Series 402A in-line voltage follower amplifiers are designed to convert high-impedance charge output signals from sensors into low-impedance voltage signals. Functionally similar to Series 422E charge converters, they are ideal for applications that require high-frequency response up to 1 MHz, as well as for situations where the sensor's output (in pC/unit) exceeds the input range limits of the Series 422E.

The voltage sensitivity (V) of a system using a charge output sensor, low-noise cable, and voltage follower amplifier is given by the formula V = Q / C, where Q is the sensor's charge sensitivity in coulombs and C is the total system capacitance in farads.

System capacitance is the combined value of the sensor's capacitance, the capacitance of the connecting cable, and the input capacitance of the voltage amplifier. When selecting an amplifier, choose one with an input capacitance that delivers the desired sensitivity while ensuring the total output voltage (range × sensitivity) stays within the ±10V limit. Note that voltage follower amplifiers preserve the polarity of the measurement signal; they do not invert it.

SERIES 422 IN LINE ICP® POWERED CHARGE CONVERTERS

IN-LINE VOLTAGE FOLLOWER AMPLIFIER
MODEL 402A

Input Capacitance: < 8.0 pF

Discharge Time Constant:
1.0 second

Frequency Response (± 5%):
0.5 to 1M Hz

IN-LINE VOLTAGE FOLLOWER AMPLIFIER
MODEL 402A02

Input Capacitance: 100 ± 10% pF

Discharge Time Constant:
10 second

Frequency Response (± 5%):
0.05 to 1M Hz

IN-LINE VOLTAGE FOLLOWER AMPLIFIER
MODEL 402A03

Input Capacitance: 1000 ± 10% pF

Discharge Time Constant:
100 second

Frequency Response (± 5%):
0.005 to 1M Hz

IN-LINE CHARGE CONVERTER
MODEL 422E35

Sensitivity (±2%): 1 mV/pC

Output Voltage: ±2.5 V

Temperature Range:
-65 to +250 °F (-54 to +121 °C)

IN-LINE CHARGE CONVERTER
MODEL 422E36

Sensitivity (±2%): 10 mV/pC

Output Voltage: ±2.5 V

Temperature Range:
-65 to +250 °F (-54 to +121 °C)

IN-LINE CHARGE CONVERTER
MODEL 422E51 / 422E52

Sensitivity:
(±5.0%): 100 mV/pC
(±2.5%): 10 mV/pC

Output Voltage: ±5.0 V

Temperature Range (Operating):
-65 to +250 °F(-54 to +121 °C)

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