PCB PIEZOTRONICS INC.

VIBRATION DIVISION

PRODUCT CATALOG

VIB-300E

SENSORS FOR ACCELERATION, SHOCK, VIBRATION,
AND ACOUSTIC MEASUREMENTS

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PCB Piezotronics, Inc. — Vibration Division

The Vibration Division of PCB Piezotronics, Inc. is pleased to provide this catalog as a selection guide of our broad spectrum of standard products. Within this publication are sensors, accessories, and signal conditioning equipment which have been specifically designed for the detection, measurement, and control of acceleration, motion, shock, and vibration. New to this catalog are Acoustic Products, comprised of microphones, preamplifiers, and power supplies for conducting precision sound measurements, and acoustic array measurements and mapping.

Piezoelectric and capacitive sensing technologies are the fundamental sensing principles for the precision measurement devices offered. The capabilities within these technologies permit a broad range of sensor designs, which support a variety of measurement tasks. Applications for these products span from monitoring the slightest seismic motions of the earth to capturing the shock acceleration of violent, explosive impacts.

PCB Piezotronics, Inc. has been a supplier of precision sensors for acceleration, pressure and force measurements since 1967. Unmatched customer service, state-of-the-art manufacturing capabilities, and worldwide distribution have contributed to our steady growth and success. Customers from industrial, governmental, educational, aerospace, automotive, medical, and R&D disciplines have relied on PCB to deliver products and solutions for many demanding requirements.

Lockheed Martin — utilizes a variety of accelerometers for flight and ground vibration testing

General Motors Proving Ground — uses accelerometers for modal and vehicular road-response vibration studies

Honda — uses accelerometers for engine NVH and modal studies

EADS/Airbus — uses PCB accelerometers for flight testing

Boeing — uses accelerometers for simulated pyroshock testing

Renault — uses accelerometers for engine and wheel dynamometer testing

DaimlerChrysler — tests vibration of engine compartment areas in luxury automobiles

Ford — uses TEDS based accelerometers and microphones for squeak and rattle testing

The Vibration Division of PCB Piezotronics, Inc. is an integrated team created to address the specific sensor needs of those involved with the measurement of acceleration, motion, shock, vibration, and acoustics. Together, the Design, Engineering, Sales, Customer Service and Marketing personnel within the Vibration Division team draw upon the vast manufacturing resources within PCB to continually provide new, more powerful sensing solutions. Please do not hesitate to call upon us to assist with your measurement requirements and provide our guarantee of **Total Customer Satisfaction.**

Accuracy of Information: PCB has made a reasonable effort to ensure that the specifications contained in this catalog were correct at the time of printing. In the interest of continuous product improvement, PCB reserves the right to change product specifications without notice at any time. Dimensions and specifications in this catalog may be approximate and for reference purposes only. Before installing sensors, machining any surfaces, or tapping any holes, visit our Web site at www.pcb.com, or contact a PCB application specialist to obtain a current installation drawing and the latest product specifications.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

Total Customer Satisfaction Guaranteed

Vibration Division Product Catalog
VIB-300E-1104

PCB Piezotronics, Inc. — Vibration Division
Services and Qualifications

Total Customer Satisfaction

PCB® Piezotronics guarantees Total Customer Satisfaction. If, at any time, for any reason, you are not completely satisfied with any PCB product, PCB will repair, replace, or exchange it at no charge. You may also choose to have your purchase price refunded.

☎ Toll-Free Customer Service ☎ 888-684-0013

The Vibration Division of PCB Piezotronics offers a direct, toll-free telephone number for customer use. Feel free to call to discuss application requirements, request product literature, request price quotations, place orders, inquire about order status, expedite orders, troubleshoot equipment, or arrange for returns. International customers are invited to call 716-684-0001. In addition, we can be reached by e-mail at vibration@pcb.com. Our fax number is: 716-685-3886. We look forward to hearing from you.

24-hour SensorLine℠

PCB offers to all customers, at no charge, 24-hour emergency phone support. This service makes product or application support available to our customers, day or night, seven days per week. To reach a PCB SensorLine℠ customer service representative, call 716-684-0001.

Web site - www.pcb.com

Detailed product information is featured on PCB's web site — www.pcb.com. The web site also offers customers educational and technical information, as well as the latest product releases. Additionally, industrial sensors are featured with the ability to place an on-line order at www.imi-sensors.com. You may also wish to contact us via our general e-mail address at: info@pcb.com.

ISO 9001 Certification

PCB Piezotronics, Inc. is registered by Underwriters Laboratories, Inc. as an ISO 9001 facility and maintains a quality assurance system dedicated to resolving any concern to ensure Total Customer Satisfaction. PCB also conforms to the former MIL-STD-45662 and MIL-Q-9858.

ISO 9001 and ISO 10012-1 Compliant Calibration Facility

All Vibration Division accelerometers are calibrated with full traceability to NIST (National Institute of Standards & Technology) and PTB to ensure conformance to published specifications. Certificates of calibration are furnished that include actual measured data. Calibration systems utilized are kept in full compliance with ISO 9001 and ISO 10012-1 standards. Calibration methods are accredited by A2LA to ISO 17025 standards.

Delivery Policy

PCB is committed to making every effort possible to accommodate all delivery requests. Our extensive in-house production capabilities permit us to manufacture most products to order in a timely fashion. In the event that a specific model is unavailable in the time frame that you need, we can usually offer a comparable unit, for sale or loan, to satisfy your urgent requirements. Many products are available, from stock, for immediate shipment. Standard cable assemblies and accessory hardware items are always stocked for immediate shipment and PCB never requires a minimum order amount. If you have urgent requirements, call a factory representative and every effort will be made to fulfill your needs.

Custom Products

PCB prides itself on being able to respond to customers' needs. Heavy investment in machinery, capabilities, and personnel allow us to design, test, and manufacture products for specialized applications. Please contact a PCB customer service representative to discuss your special needs.

CE Marking CE

Many PCB Products are designed, tested, and qualified to bear CE marking in accordance with applicable European Union Directives. Products that conform to this qualification are so indicated by the CE logo.

Warranty

Instrumentation provided by PCB is covered by a limited warranty against defective material and workmanship for a period of one year. Contact PCB for a complete statement of our warranty.

Popular Products

Products in this catalog that are identified by the popular product symbol ( ) are the suggested choice when several products could fulfill the requirements of the application. If uncertainty arises with which product to select, pick one of the popular products. These products are typically either in stock, or in production, which ensures their availability in a timely manner. For critical needs, call to discuss your requirements with a customer service representative. Every effort will be made to accommodate rush or unique requirements.

Numerical Model Number Index

This index provides page references for accelerometers, microphones, signal conditioners, and test equipment. For cables, mounting hardware, and accessory items, please check the appropriate sections listed in the table of contents.

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Vibration Division Catalog Contents

PRODUCTS

APPENDIX

Model Number Information

Model Number Definitions — Model number designations for PCB accelerometers and microphones have been developed in such a way as to group sensors with like characteristics into a common "Series". Although there has never been any rigid definition for all portions or components of the model numbers, the series designation has become a common, frequently used reference. The following definitions may help you to categorize accelerometers or assist with locating information about specific models of interest.

Series 130 — Array microphone, low cost

Series 300 — This is a system designator that typically identifies a complete set of equipment including accelerometer, cables, and signal conditioner.

Series 301 — Calibration reference standard accelerometer

Series 302* — ICP® quartz compression, inverted

Series 303* — ICP® quartz compression, miniature

Series 305* — ICP® quartz compression shock

Series 306* — ICP® quartz compression triaxial

Series 307* — ICP® quartz compression, high performance

Series 308* — ICP® quartz compression, general purpose

Series 309* — ICP® quartz compression, high frequency

Series 312* — Charge output quartz compression

Series 320 — ICP® quartz shear, high temperature or "HALT, HASS, ESS"

Series 321* — OEM, low cost

Series 328* — ICP® quartz compression, industrial

Series 333 — Structural test / array accelerometers

Series 336* — Flexural mode

Series 337* — Shear mode, industrial

Series 338 — OEM, low profile and low cost

Series 339* — ICP® quartz shear, triaxial

Series 340 — Metric design

Series 342* — ICP® quartz compression Isolator® mode

Series 346* — ICP® quartz compression triaxial Isolator® mode

Series 348* — High sensitivity Isolator® quartz compression mode

Series 350 — Shock accelerometers

Series 351 — ICP® quartz shear, cryogenic temperature

Series 352 — ICP® ceramic shear

Series 353 — ICP® quartz shear

Series 354 — ICP® triaxial ring

Series 355 — ICP® ceramic shear ring

Series 356 — ICP® ceramic shear triaxial

Series 357 — Charge output ceramic shear

Series 359* — ICP® quartz shear, high temperature

Series 3701 — Capacitive, DC response

Series 3703 — Capacitive, DC response, triaxial

Series 377 — Precision microphone

Series 3801 — Capacitive, DC response, low-cost

Series 393 — ICP® seismic

Series 394 — Calibration reference standard system

* Designates that model series is obsolete or no longer promoted. Contact a factory representative for a suitable alternate unit.

About Excluded Models — This Vibration Division catalog reflects the most current technology and most frequently requested products. Many specialty options and custom products are not included in this publication.

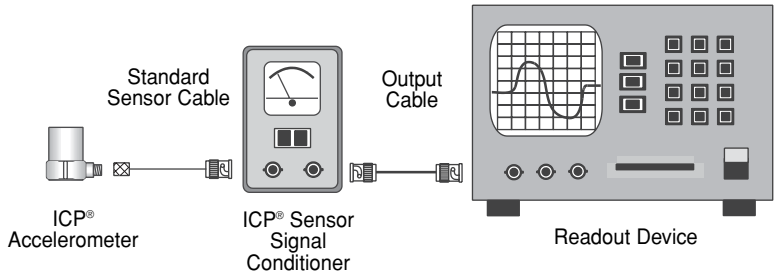
For example, PCB manufactures Flight-Tested accelerometers that have passed various flight qualification tests by one or more commercial and/or government aerospace companies. They are, therefore, recommended for a variety of airborne applications. Also absent from this catalog are compression mode accelerometers. Many customers still request these units and are invited to continue to do so; however, for the purposes of this catalog, PCB is restricting the catalog scope to those products that offer the most current technology, best performance, a broad representation of popular features, and excellent value.

Customers are encouraged to make known their special requests, particularly for products that have served faithfully in the past. Consult a Vibration Division factory application engineer for assistance in handling specialty or custom applications.

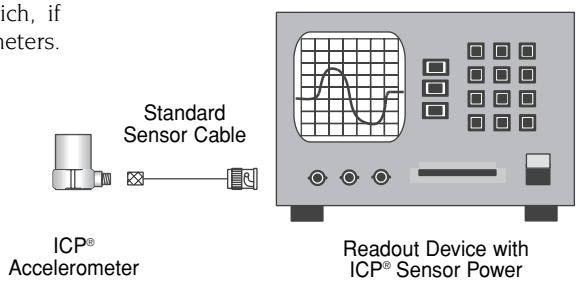
Typical Acceleration Measurement Systems

Accelerometers in this catalog fall within three distinct functional categories: ICP®, Charge, and Capacitive. Each type possesses certain features and benefits that make it better suited for specific applications. A typical measurement system consists of an accelerometer, a signal conditioner, a readout or recording device, and signal cables to facilitate interconnection. Make certain that all components of the measurement system are taken into consideration to enable proper and successful implementation. Once an accelerometer is selected, consult the following typical system configurations to ensure that necessary ancillary equipment is not overlooked.

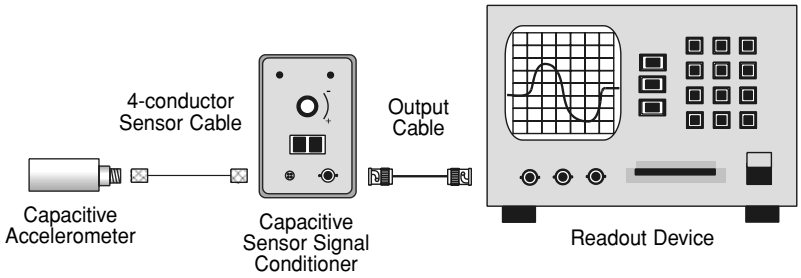
ICP® Accelerometers — These piezoelectric sensors contain built-in signal conditioning electronics and require proper excitation power to operate, typically a 2 to 20 mA constant-current-regulated DC voltage of 18 to 30 VDC. PCB's signal conditioners for ICP® sensors include fault LEDs or a bias monitoring meter to aid in sensor troubleshooting.



Some readout devices provide ICP® sensor excitation which, if properly utilized, permits direct connection to ICP® accelerometers.

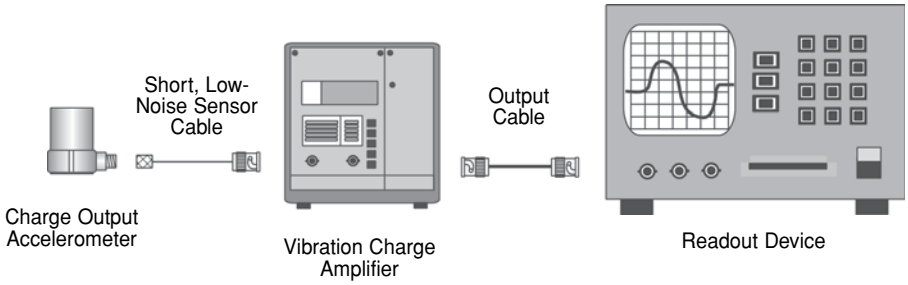


Capacitive Accelerometers — These sensors contain built-in signal conditioning electronics and require proper excitation power to operate. The typical 16 to 28 VDC is provided by a separate signal conditioning power supply. An added feature of PCB's capacitive sensor signal conditioners is their offset adjustment, which serves to null any DC voltage offset inherent to the sensor.

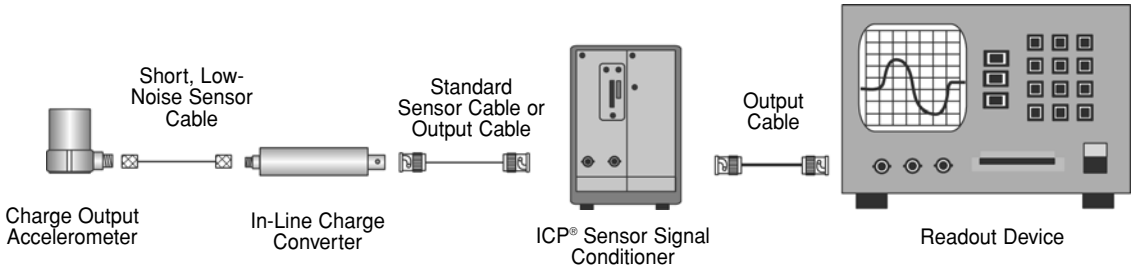


Typical Acceleration Measurement Systems

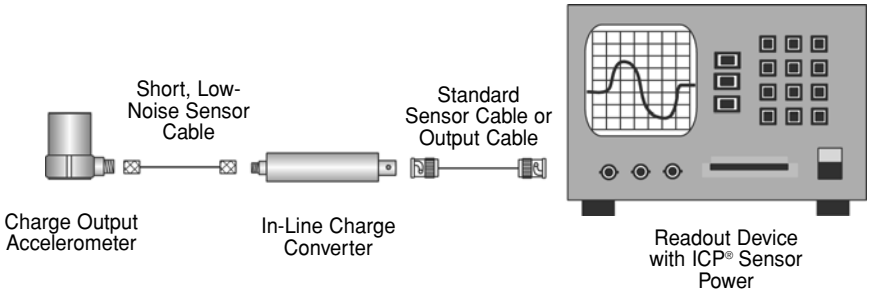
Charge Output Accelerometers — These piezoelectric sensors do not contain built-in electronics and require conditioning of the high-impedance charge signal by conversion to a low-impedance voltage signal for input to a readout device. Conversion is typically accomplished with a laboratory-style charge amplifier. Additional charge amplifier features include sensitivity normalization, filtering, and gain. Note that the use of special low-noise cable is required for the high-impedance portion of the signal path.



A fixed in-line charge converter may be utilized to simplify setup or to make use of an existing ICP® sensor signal conditioner.



Similar to an ICP® sensor system, a readout device with ICP® sensor power eliminates the need for a separate signal conditioner to power the in-line charge converter.

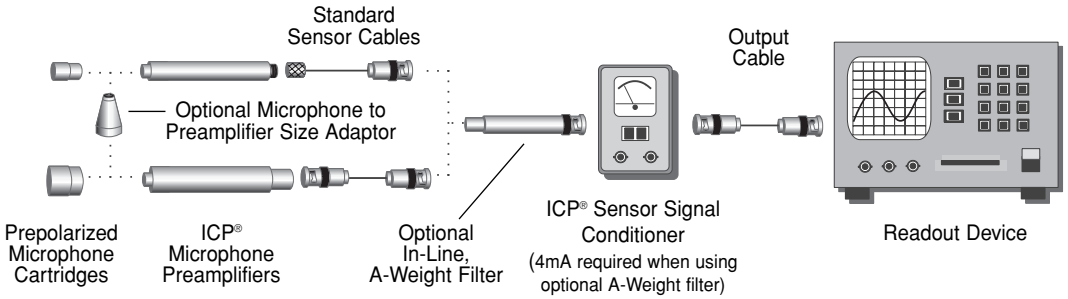


Spare Cables - Sensor cables are vulnerable to failure due to their persistent exposure to the shock and vibration being measured. Care should be taken to properly secure the cable and strain-relive the connections to extend cable life. It is always good practice to order spare cables, to avoid test interruption, in the event of a cable failure.

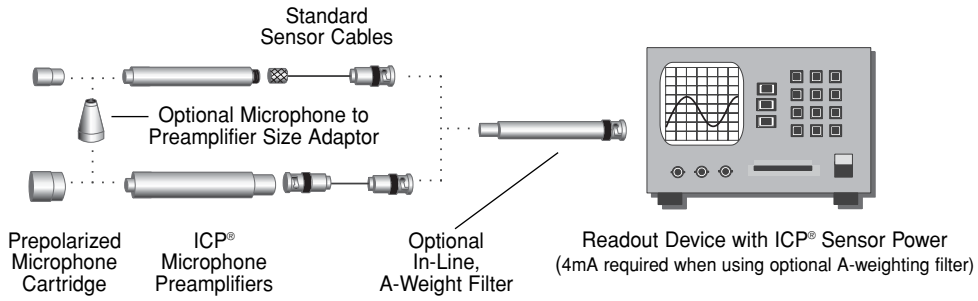
Typical Acoustic Measurement Systems

Microphones in this catalog fall within three distinct functional categories: Prepolarized, Externally Polarized, and Array. Each type possesses certain features and benefits that make it better suited for specific applications. A typical measurement system consists of a microphone cartridge, a preamplifier, a signal conditioner, a readout or recording device, and signal cables to facilitate interconnection. Make certain that all components of the measurement system are taken into consideration to enable proper and successful implementation. Once a microphone cartridge is selected, consult the following typical system configurations to ensure that necessary ancillary equipment is not overlooked.

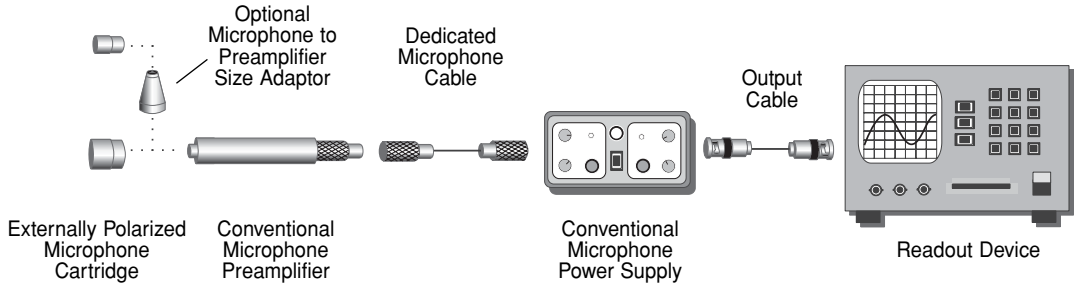
Prepolarized Microphones — These precision condenser microphones operate with ICP® microphone preamplifiers for reduced system cost. Constant-current ICP® sensor signal conditioners provide the necessary excitation power. Signal conditioners with a the ability to deliver 4 mA excitation are recommended if an in-line filter is added to the measurement chain. Prepolarized microphones may also be connected to conventional microphone preamplifiers and power supplies when additional dynamic range is desired.



Some readout devices provide ICP® sensor excitation which, if properly utilized, permits direct connection to ICP® microphone preamplifiers.

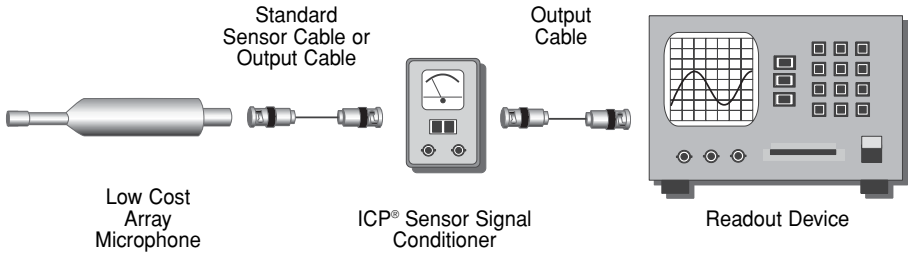


Externally Polarized Microphones — These precision condenser microphones operate with conventional microphone preamplifiers and power supplies, which provide the necessary polarization voltage and bias level for proper operation. This approach yields the widest dynamic range and best overall performance for precision acoustic measurements, however, at a system cost that is considerably higher than that for prepolarized microphones.

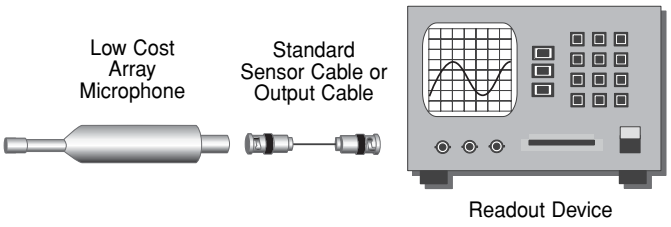


Typical Acoustic Measurement Systems

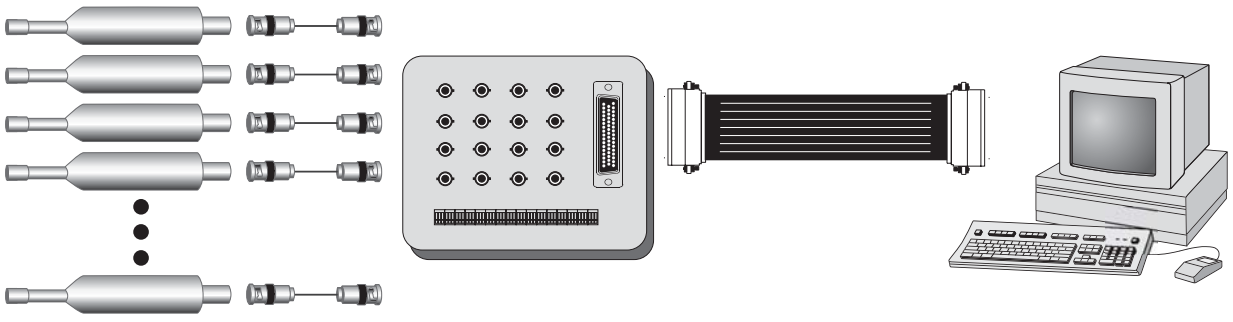
Array Microphones — These low cost microphones utilize built-in preamplifiers, which operate from constant-current ICP® sensor signal conditioners. The low cost microphone element and reduced signal conditioning requirements, which also keeps costs to a minimum, makes these microphones an affordable choice for multi-channel acoustic measurements. Note that array microphone cartridges are available separately for use with an attachable array microphone preamplifier. This approach may be desirable when there is a risk of cartridge damage.



Some readout devices provide ICP® sensor excitation which, if properly utilized, permits direct connection to array microphones.



For multi-channel installations, the use of a patch panel can help organize cables, reduce tangles, and keep cable costs to a minimum.



Accelerometer Selection Guide
English Measurement Units

Quartz Shear ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	353B11	5 mV/g	0.7 to 18k Hz	± 1000 g pk	0.01 g rms	-65 to +250 °F	side 5-44	2 gm	1.2, 1.7
	353B12	5 mV/g	0.7 to 20k Hz	± 1000 g pk	0.01 g rms	-65 to +250 °F	top 5-44	1.5 gm	1.2, 1.7
	353B13	5 mV/g	0.7 to 20k Hz	± 1000 g pk	0.01 g rms	-65 to +250 °F	top cable	1.7 gm	1.3, 1.7
	353B14	5 mV/g	0.7 to 18k Hz	± 1000 g pk	0.01 g rms	-65 to +250 °F	top 10-32	1.8 gm	1.3, 1.7
●	353B15	10 mV/g	0.7 to 18k Hz	± 500 g pk	0.005 g rms	-65 to +250 °F	side 5-44	2 gm	1.2, 1.8
●	353B16	10 mV/g	0.7 to 20k Hz	± 500 g pk	0.005 g rms	-65 to +250 °F	top 5-44	1.5 gm	1.2, 1.8
●	353B17	10 mV/g	0.7 to 20k Hz	± 500 g pk	0.005 g rms	-65 to +250 °F	top cable	1.7 gm	1.3, 1.8
●	353B18	10 mV/g	0.7 to 18k Hz	± 500 g pk	0.005 g rms	-65 to +250 °F	top 10-32	1.8 gm	1.3, 1.8
●	353B03	10 mV/g	0.7 to 11k Hz	± 500 g pk	0.003 g rms	-65 to +250 °F	side 10-32	10.5 gm	1.4, 1.9
●	353B04	10 mV/g	0.7 to 11k Hz	± 500 g pk	0.003 g rms	-65 to +250 °F	top 10-32	10.5 gm	1.4, 1.9
	355B34	10 mV/g	2 to 5000 Hz [1]	± 500 g pk	0.001 g rms	-65 to +250 °F	side 10-32	11 gm	1.6, 1.11
	353B01	20 mV/g	0.7 to 10k Hz	± 250 g pk	0.005 g rms	-65 to +250 °F	side 10-32	10 gm	1.4, 1.9
	353B02	20 mV/g	0.7 to 10 k Hz	± 250 g pk	0.005 g rms	-65 to +250 °F	top 10-32	10 gm	1.4, 1.9
	353B31	50 mV/g	0.7 to 8000 Hz	± 100 g pk	0.001 g rms	-65 to +250 °F	side 10-32	20 gm	1.5, 1.10
	353B32	50 mV/g	0.7 to 8000 Hz	± 100 g pk	0.001 g rms	-65 to +250 °F	top 10-32	20 gm	1.5, 1.10
●	353B33	100 mV/g	0.7 to 6500 Hz	± 50 g pk	0.0005 g rms	-65 to +250 °F	side 10-32	27 gm	1.5, 1.10
	353B34	100 mV/g	0.7 to 7000 Hz	± 50 g pk	0.0005 g rms	-65 to +250 °F	top 10-32	27 gm	1.5, 1.10
	355B33	100 mV/g	2 to 5000 Hz [1]	± 50 g pk	0.0005 g rms	-65 to +250 °F	side 10-32	11 gm	1.6, 1.11

NOTE: [1] Frequency range specified is ± 5%

High Resolution Ceramic Shear ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	352B01	1 mV/g	1 to 20k Hz	± 5000 g pk	0.02 g rms	-65 to +250 °F	top 10-32	0.7 gm		1.16, 1.26
	352A25	2.5 mV/g	0.7 to 13k Hz	± 2000 g pk	0.01 g rms	-65 to +250 °F	side 3-56	0.6 gm	ti. teardrop	1.15, 1.25
●	352C23	5 mV/g	1.5 to 15k Hz	± 1000 g pk	0.003 g rms	-65 to +250 °F	side 3-56	0.2 gm	al. teardrop	1.14, 1.24
●	352C22	10 mV/g	0.7 to 13k Hz	± 500 g pk	0.002 g rms	-65 to +250 °F	side 3-56	0.5 gm	al. teardrop	1.14, 1.24
●	352A21	10 mV/g	0.7 to 13k Hz	± 500 g pk	0.002 g rms	-65 to +250 °F	side 3-56	0.6 gm	ti. teardrop	1.14, 1.24
●	352B10	10 mV/g	1 to 17k Hz	± 500 g pk	0.003 g rms	-65 to +250 °F	top cable	0.7 gm		1.16, 1.26
	352C15	10 mV/g	0.7 to 18k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	side 5-44	2 gm		1.17, 1.26
	352C16	10 mV/g	0.7 to 16k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	top 5-44	2 gm		1.17, 1.26
	352C17	10 mV/g	0.7 to 18k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	top cable	2 gm		1.18, 1.27
	352C18	10 mV/g	0.7 to 18k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	top 10-32	2 gm		1.18, 1.27
	355B12	10 mV/g	0.6 to 15k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	side 5-44	2.3 gm	through-hole	1.20, 1.31
	352C41	10 mV/g	0.3 to 15k Hz	± 500 g pk	0.0008 g rms	-65 to +250 °F	top 10-32	2.8 gm		1.19, 1.27
●	352C43	10 mV/g	0.5 to 10k Hz	± 500 g pk	0.0008 g rms	-65 to +250 °F	top 10-32	3 gm		1.19, 1.28
●	352C03	10 mV/g	0.3 to 15k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	side 10-32	5.8 gm		1.22, 1.32
	352C04	10 mV/g	0.3 to 15k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	top 10-32	5.8 gm		1.22, 1.32
	352A60	10 mV/g	5 to 60k Hz [1]	± 50 g pk	0.002 g rms	-65 to +250 °F	top 5-44	6 gm	highest frequency	1.18, 1.28
	355B02	10 mV/g	0.6 to 12k Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	side 10-32	10 gm	through-hole	1.21, 1.31
●	352A24	100 mV/g	0.8 to 10k Hz	± 50 g pk	0.0002 g rms	-65 to +250 °F	side 3-56	0.8 gm	al. teardrop	1.15, 1.25
	338C04	100 mV/g	0.35 to 10k Hz	± 50 g pk	0.00018 g rms	-65 to +200 °F	side 10-32	4 gm	low profile	1.20, 1.30
●	352C33	100 mV/g	0.3 to 15k Hz	± 50 g pk	0.00015 g rms	-65 to +200 °F	side 10-32	5.8 gm	general purpose	1.22, 1.33
●	352C34	100 mV/g	0.3 to 15k Hz	± 50 g pk	0.00015 g rms	-65 to +200 °F	top 10-32	6.6 gm	general purpose	1.22, 1.33
	352C42	100 mV/g	0.3 to 15k Hz	± 50 g pk	0.0005 g rms	-65 to +250 °F	top 10-32	2.8 gm		1.19, 1.27
	352C44	100 mV/g	0.5 to 10k Hz	± 50 g pk	0.0005 g rms	-65 to +250 °F	top 10-32	3 gm		1.19, 1.28
●	352C65	100 mV/g	0.3 to 12k Hz	± 50 g pk	0.00016 g rms	-65 to +200 °F	side 5-44	2 gm		1.16, 1.29
●	352C66	100 mV/g	0.3 to 12k Hz	± 50 g pk	0.00016 g rms	-65 to +200 °F	top 5-44	2 gm		1.17, 1.29
●	352C67	100 mV/g	0.3 to 12k Hz	± 50 g pk	0.00016 g rms	-65 to +200 °F	top cable	2 gm		1.17, 1.29
●	352C68	100 mV/g	0.3 to 12k Hz	± 50 g pk	0.00016 g rms	-65 to +200 °F	top 10-32	2 gm		1.18, 1.29
	355B03	100 mV/g	0.6 to 12k Hz	± 50 g pk	0.0001 g rms	-65 to +250 °F	side 10-32	10 gm	through-hole	1.21, 1.31
	355B04	1000 mV/g	0.6 to 12k Hz	± 5 g pk	0.0001 g rms	-65 to +200 °F	side 10-32	11.2 gm	through-hole	1.21, 1.31
	352B	1000 mV/g	3 to 10k Hz	± 5 g pk	0.00004 g rms	-65 to +200 °F	top 10-32	35 gm	high resolution	1.23, 1.32

NOTE: [1] Frequency range specified is ± 3 dB

Accelerometer Selection Guide
English Measurement Units

Low Amplitude Seismic ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
●	393B05	10 V/g	0.5 to 750 Hz	± 0.5 g pk	0.000004 g rms	0 to +176 °F	top 10-32	50 gm		1.74, 1.77
	393B04	1000 mV/g	0.25 to 750 Hz	± 5 g pk	0.000003 g rms	0 to +176 °F	top 10-21	50 gm		1.74, 1.76
●	393A03	1000 mV/g	0.3 to 4000 Hz	± 5 g pk	0.00001 g rms	-65 to +250 °F	MIL-C-5015	210 gm		1.74, 1.76
	393C	1000 mV/g	0.01 to 1200 Hz	± 2.5 g pk	0.0001 g rms	-65 to +200 °F	side 10-32	1000 gm	quartz	1.75, 1.76
	393B12	10 V/g	0.1 to 2000 Hz	± 0.5 g pk	0.000008 g rms	-50 to +180 °F	MIL-C-5015	210 gm		1.75, 1.77
	393B31	10 V/g	0.07 to 300 Hz	± 0.5 g pk	0.000001 g rms	0 to +150 °F	MIL-C-5015	635 gm		1.75, 1.77

Triaxial ICP® and Charge Output Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	356A70	2.7 pC/g	to 7000 Hz	± 500 g pk	N/A	-95 to +490 °F	side 5-44	7.9 gm	charge mode	1.40, 1.47
	356A71	10 pC/g	to 7000 Hz	± 500 g pk	N/A	-95 to +490 °F	side 10-32	22.7 gm	charge mode	1.40, 1.47
	356B10	1.0 mV/g	2 to 10k Hz [1]	± 5000 g pk	0.03 g rms	-65 to +250 °F	side cable	4 gm		1.36, 1.43
	356B20	1.0 mV/g	2 to 10k Hz [1]	± 5000 g pk	0.03 g rms	-65 to +250 °F	4-pin	4 gm		1.37, 1.43
	356A01	5 mV/g	2 to 8000 Hz [1]	± 1000 g pk	0.003 g rms	-65 to +250 °F	side cable	1 gm	0.25 in cube	1.36, 1.43
	356A24	10 mV/g	0.5 to 12k Hz	± 500 g pk	0.002 g rms	-65 to +250 °F	4-pin	3.1 gm	low profile	1.37, 1.44
●	356A61	10 mV/g	2 to 5000 Hz [1]	± 500 g pk	0.008 g rms	-65 to +250 °F	side cable	4 gm	filtered	1.42, 1.49
	356B11	10 mV/g	2 to 10k Hz [1]	± 500 g pk	0.002 g rms	-65 to +250 °F	side cable	4 gm	0.4 in cube	1.36, 1.43
●	356B21	10 mV/g	2 to 10k Hz [1]	± 500 g pk	0.002 g rms	-65 to +250 °F	4-pin	4 gm	0.4 in cube	1.37, 1.44
	354C10	10 mV/g	2 to 8000 Hz [1]	± 500 g pk	0.003 g rms	-65 to +250 °F	side cable	5 gm	through-hole	1.39, 1.46
●	356A33	10 mV/g	2 to 10k Hz [1]	± 500 g pk	0.003 g rms	-65 to +250 °F	4-pin	5.3 gm		1.38, 1.44
●	356A63	10 mV/g	2 to 5000 Hz [1]	± 500 g pk	0.008 g rms	-65 to +250 °F	4-pin	5.3 gm	filtered	1.42, 1.49
	356A66	10 mV/g	2 to 4000 Hz [1]	± 500 g pk	0.002 g rms	-65 to +325 °F	4-pin	9 gm	filtered	1.42, 1.49
●	356A02	10 mV/g	0.5 to 6000 Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	4-pin	10.5 gm	0.55 in cube	1.38, 1.45
	354C02	10 mV/g	0.3 to 4000 Hz	± 500 g pk	0.0005 g rms	-65 to +250 °F	4-pin	15.5 gm	13/16 through-hole	1.39, 1.46
	356A25	25 mV/g	0.5 to 6500 Hz	± 200 g pk	0.0002 g rms	-65 to +250 °F	4-pin	10.5 gm	0.55 in cube	1.38, 1.45
●	356A32	100 mV/g	0.7 to 5000 Hz	± 50 g pk	0.0003 g rms	-65 to +250 °F	4-pin	5.4 gm		1.37, 1.44
	356A16	100 mV/g	0.3 to 6000 Hz	± 50 g pk	0.0001 g rms	-65 to +176 °F	4-pin	7.4 gm	0.55 in aluminum	1.41, 1.48
	354C03	100 mV/g	0.3 to 4000 Hz	± 50 g pk	0.0002 g rms	-65 to +200 °F	4-pin	15.5 gm	13/16 through-hole	1.40, 1.46
●	356A15	100 mV/g	1 to 6500 Hz	± 50 g pk	0.0002 g rms	-65 to +250 °F	4-pin	10.5 gm	0.55 in cube	1.39, 1.45
	356A17	500 mV/g	0.3 to 4000 Hz	± 10 g pk	0.00006 g rms	-65 to +176 °F	4-pin	9.3 gm	0.55 in aluminum	1.41, 1.48
●	356B18	1000 mV/g	0.3 to 5000 Hz	± 5 g pk	0.00006 g rms	-20 to +170 °F	4-pin	25 gm	0.8 in aluminum	1.41, 1.48

NOTE: [1] Frequency range specified is ± 5%

High Amplitude ICP® and Charge Output Shock Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	350A96	0.065 pC/g	15k Hz	± 100k g pk	N/A	0 to +150 °F	top 10-32	13 gm	charge mode	1.55, 1.59
	350B21	0.05 mV/g	1 to 10k Hz	± 100k g pk	0.3 g rms	-65 to +200 °F	side cable	4.4 gm	ceramic	1.52, 1.57
●	350B02	0.1 mV/g	4 to 10k Hz	± 50k g pk	0.5 g rms	0 to +150 °F	top cable	4.25 gm	ceramic	1.52, 1.56
	350B03	0.5 mV/g	0.4 to 10k Hz	± 10k g pk	0.04 g rms	0 to +150 °F	top 10-32	4.5 gm	ceramic	1.53, 1.56
	350B23	0.5 mV/g	0.4 to 10k Hz	± 10k g pk	0.04 g rms	0 to +150 °F	top cable	4.5 gm	ceramic	1.52, 1.57
	350A13	0.5 mV/g	0.4 to 7500 Hz [2]	± 10k g pk	0.06 g rms	-65 to +250 °F	top 10-32	17.9 gm	quartz	1.54, 1.58
	350B04	1 mV/g	0.4 to 10k Hz	± 5000 g pk	0.02 g rms	0 to +150 °F	top 10-32	4.5 gm	ceramic	1.53, 1.56
	350A14	1 mV/g	0.4 to 7500 Hz [2]	± 5000 g pk	0.02 g rms	-65 to +250 °F	top 10-32	17.9 gm	quartz	1.54, 1.58

NOTE: [2] Frequency range specified is ± 10%

Extended Temperature / ESS ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	320C18	10 mV/g	1.5 to 18k Hz	± 500 g pk	0.01 g rms	-100 to +325 °F	top 10-32	1.7 gm	1.80, 1.84
	320C15	10 mV/g	1.5 to 18k Hz	± 500 g pk	0.005 g rms	-100 to +325 °F	side 5-44	2 gm	1.80, 1.84
	300A12	10 mV/g	10 to 10k Hz [1]	± 250 g pk	0.002 g rms	-100 to +500 °F	top 10-32	5.4 gm	1.83, 1.88
	320C20	10 mV/g	1.5 to 10k Hz	± 500 g pk	0.006 g rms	-100 to +325 °F	top 10-32	6.5 gm	1.83, 1.87
	352B30	10 mV/g	10 to 6000 Hz	± 500 g pk	0.004 g rms	-65 to +250 °F	top 10-32	7 gm	1.83, 1.87
	320C03	10 mV/g	0.7 to 9000 Hz	± 500 g pk	0.005 g rms	-100 to +325 °F	side 10-32	10.5 gm	1.80, 1.84
	320C33	100 mV/g	0.7 to 6000 Hz	± 50 g pk	0.0003 g rms	-100 to +325 °F	side 10-32	20 gm	1.81, 1.84

NOTE: [1] Frequency range specified is ± 5%

Low Temperature / Cryogenic ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	351B11	5 mV/g	0.7 to 15k Hz	± 300 g pk	0.001 g rms	-320 to +250 °F	side 5-44	2 gm	1.81, 1.85
	351B14	5 mV/g	0.7 to 10k Hz	± 300 g pk	0.001 g rms	-320 to +250 °F	top 10-32	1.8 gm	1.81, 1.85
	351B03	10 mV/g	0.7 to 9000 Hz	± 150 g pk	0.003 g rms	-320 to +250 °F	side 10-32	10.5 gm	1.82, 1.85
	351B31	50 mV/g	0.7 to 7000 Hz	± 30 g pk	0.001 g rms	-320 to +250 °F	side 10-32	20 gm	1.82, 1.86
	351B41	100 mV/g	0.7 to 3500 Hz	± 15 g pk	0.0002 g rms	-320 to +250 °F	side 10-32	40 gm	1.82, 1.86

Charge Output Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	357A08	0.3 pC/g	20k Hz	± 1000 g pk	dependent upon signal conditioner used	-100 to +350 °F	side 3-56	0.16 gm	al. teardrop	1.62, 1.68
	357A09	1.5 pC/g	13k Hz	± 500 g pk		-100 to +350 °F	side 3-56	0.6 gm	ti. teardrop	1.62, 1.68
	357C10	1.7 pC/g	13k Hz	± 500 g pk		-100 to +350 °F	side 3-56	0.45 gm	al. teardrop	1.62, 1.69
✪	357B11	3 pC/g	16k Hz	± 2300 g pk		-95 to +490 °F	side 5-44	2 gm		1.63, 1.69
	357B14	3 pC/g	16k Hz	± 2300 g pk		-95 to +500 °F	top 10-32	2 gm		1.63, 1.69
	357A06	5 pC/g	15k Hz	± 500 g pk		-65 to +350 °F	side 5-44	2.3 gm	through-hole	1.63, 1.68
	357B03	10 pC/g	12k Hz	± 2000 g pk		-95 to +490 °F	side 10-32	10.9 gm		1.64, 1.70
	357B04	10 pC/g	12k Hz	± 2000 g pk		-95 to +490 °F	top 10-32	10.9 gm		1.64, 1.70
✪	357B61	10 pC/g	5000 Hz [1]	± 3000 g pk		-65 to +900 °F	side 10-32	30 gm		1.66, 1.72
	357B71	10 pC/g	2000 Hz [1]	± 500 g pk		-65 to +900 °F	2 pin	100 gm	differential	1.66, 1.72
	357A05	17 pC/g	12k Hz	± 500 g pk		-65 to +350 °F	side 10-32	12 gm	through-hole	1.64, 1.70
	357B21	30 pC/g	7500 Hz	± 1500 g pk		-95 to +490 °F	side 10-32	20.7 gm		1.65, 1.70
	357B22	30 pC/g	7500 Hz	± 1500 g pk		-95 to +490 °F	top 10-32	20.7 gm		1.65, 1.71
	357B72	50 pC/g	2000 Hz [1]	± 500 g pk		-65 to +900 °F	2 pin	120 gm	differential	1.66, 1.72
	357B33	100 pC/g	3500 Hz	± 150 g pk		-95 to +490 °F	side 10-32	45.4 gm		1.65, 1.71
	357B34	100 pC/g	3500 Hz	± 150 g pk		-95 to +490 °F	top 10-32	45.4 gm		1.65, 1.71
	357B73	100 pC/g	2000 Hz [1]	± 500 g pk		-65 to +900 °F	2 pin	130 gm	differential	1.67, 1.72

NOTE: [1] Frequency range specified is ± 5%

Accelerometer Selection Guide
English Measurement Units

ICP® Structural Test / Array Accelerometers										
POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
✪	333B	100 mV/g	2 to 1000 Hz	± 50 g pk	0.00007 g rms	0 to +150 °F	base 3-pin	5.6 gm	economy/array	1.90, 1.93
	333B30	100 mV/g	0.5 to 3000 Hz	± 50 g pk	0.00015 g rms	0 to +150 °F	side 10-32	4 gm		1.90, 1.93
	333B31	100 mV/g	0.5 to 3000 Hz	± 50 g pk	0.00015 g rms	0 to +150 °F	top 10-32	4 gm	general/array	1.90, 1.93
✪	333B32	100 mV/g	0.5 to 3000 Hz	± 50 g pk	0.00015 g rms	0 to +150 °F	side 10-32	4 gm	cubic	1.90, 1.93
	333B40	500 mV/g	0.5 to 3000 Hz	± 10 g pk	0.00005 g rms	0 to +150 °F	side 10-32	7.5 gm		1.91, 1.94
	333B42	500 mV/g	0.5 to 3000 Hz	± 10 g pk	0.00005 g rms	0 to +150 °F	side 10-32	7.5 gm	cubic	1.91, 1.94
	333B50	1000 mV/g	0.5 to 3000 Hz	± 5 g pk	0.00005 g rms	0 to +150 °F	side 10-32	7.5 gm		1.91, 1.94
	333B52	1000 mV/g	0.5 to 3000 Hz	± 5 g pk	0.00005 g rms	0 to +150 °F	side 10-32	6.8 gm	cubic	1.91, 1.94

Metric ICP® and Charge Output Accelerometers									
POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	340A75	3 pC/g	16k Hz	± 22.5 m/s² pk	N/A	-70 to +260° C	side M3	2 gm	1.105, 1.107
	340A76	3 pC/g	16k Hz	± 22.5 m/s² pk	N/A	-70 to +260° C	top M3	2 gm	1.105, 1.107
	340A50	2.7 pC/g	10k Hz	± 1000 g pk	N/A	-94 to +500 °F	side M3	11 gm	1.105, 1.108
	340A15	9.8 mV/g	0.7 to 18k Hz	± 500 g pk	0.0006 g rms	-67 to +257 °F	side M3	2 gm	1.104, 1.106
	340A16	9.8 mV/g	0.7 to 18k Hz	± 500 g pk	0.0006 g rms	-67 to +257 °F	top M3	2 gm	1.104, 1.106
	340A65	98.1 mV/g	0.3 to 12k Hz	± 50 g pk	0.00016 g rms	-67 to +203 °F	side M3	2 gm	1.104, 1.106
	340A66	98.1 mV/g	0.3 to 12k Hz	± 50 g pk	0.00016 g rms	-67 to +203 °F	top M3	2 gm	1.104, 1.106

Quartz Shear ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	353B11	0.51 mV/(m/s²)	0.7 to 18k Hz	± 9800 m/s² pk	0.1 m/s² rms	-54 to +121 °C	side 5-44	2 gm	1.2, 1.7
	353B12	0.51 mV/(m/s²)	0.7 to 20k Hz	± 9800 m/s² pk	0.1 m/s² rms	-54 to +121 °C	top 5-44	1.5 gm	1.2, 1.7
	353B13	0.51 mV/(m/s²)	0.7 to 20k Hz	± 9800 m/s² pk	0.1 m/s² rms	-54 to +121 °C	top cable	1.7 gm	1.3, 1.7
	353B14	0.51 mV/(m/s²)	0.7 to 18k Hz	± 9800 m/s² pk	0.1 m/s² rms	-54 to +121 °C	top 10-32	1.8 gm	1.3, 1.7
✪	353B15	1.02 mV/(m/s²)	0.7 to 18k Hz	± 4900 m/s² pk	0.05 m/s² rms	-54 to +121 °C	side 5-44	2 gm	1.2, 1.8
✪	353B16	1.02 mV/(m/s²)	0.7 to 20k Hz	± 4900 m/s² pk	0.05 m/s² rms	-54 to +121 °C	top 5-44	1.5 gm	1.2, 1.8
✪	353B17	1.02 mV/(m/s²)	0.7 to 20k Hz	± 4900 m/s² pk	0.05 m/s² rms	-54 to +121 °C	top cable	1.7 gm	1.3, 1.8
✪	353B18	1.02 mV/(m/s²)	0.7 to 18k Hz	± 4900 m/s² pk	0.05 m/s² rms	-54 to +121 °C	top 10-32	1.8 gm	1.3, 1.8
✪	353B03	1.02 mV/(m/s²)	0.7 to 11k Hz	± 4900 m/s² pk	0.03 m/s² rms	-54 to +121 °C	side 10-32	10.5 gm	1.4, 1.9
✪	353B04	1.02 mV/(m/s²)	0.7 to 11k Hz	± 4900 m/s² pk	0.03 m/s² rms	-54 to +121 °C	top 10-32	10.5 gm	1.4, 1.9
	355B34	1.02 mV/(m/s²)	2 to 5000 Hz [1]	± 4900 m/s² pk	0.01 m/s² rms	-54 to +121 °C	side 10-32	11 gm	1.6, 1.11
	353B01	2.04 mV/(m/s²)	0.7 to 10k Hz	± 2450 m/s² pk	0.05 m/s² rms	-54 to +121 °C	side 10-32	10 gm	1.4, 1.9
	353B02	2.04 mV/(m/s²)	0.7 to 10 k Hz	± 2450 m/s² pk	0.05 m/s² rms	-54 to +121 °C	top 10-32	10 gm	1.4, 1.9
	353B31	5.10 mV/(m/s²)	0.7 to 8000 Hz	± 980 m/s² pk	0.01 m/s² rms	-54 to +121 °C	side 10-32	20 gm	1.5, 1.10
	353B32	5.10 mV/(m/s²)	0.7 to 8000 Hz	± 980 m/s² pk	0.01 m/s² rms	-54 to +121 °C	top 10-32	20 gm	1.5, 1.10
✪	353B33	10.19 mV/(m/s²)	0.7 to 6500 Hz	± 490 m/s² pk	0.005 m/s² rms	-54 to +121 °C	side 10-32	27 gm	1.5, 1.10
	353B34	10.19 mV/(m/s²)	0.7 to 7000 Hz	± 490 m/s² pk	0.005 m/s² rms	-54 to +121 °C	top 10-32	27 gm	1.5, 1.10
	355B33	10.19 mV/(m/s²)	2 to 5000 Hz [1]	± 490 m/s² pk	0.005 m/s² rms	-54 to +121 °C	side 10-32	11 gm	1.6, 1.11

NOTE: [1] Frequency range specified is ± 5%

High Resolution Ceramic Shear ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	352B01	0.1 mV/(m/s²)	1 to 20k Hz	± 49k m/s² pk	0.2 m/s² rms	-53 to +121 °C	top 10-32	0.7 gm		1.16, 1.26
	352A25	0.25 mV/(m/s²)	0.7 to 13k Hz	± 19.6k m/s² pk	0.1 m/s² rms	-53 to +121 °C	side 3-56	0.6 gm	ti. teardrop	1.15, 1.25
✪	352C23	0.5 mV/(m/s²)	1.5 to 15k Hz	± 9800 m/s² pk	0.03 m/s² rms	-53 to +121 °C	side 3-56	0.2 gm	al. teardrop	1.14, 1.24
✪	352C22	1.02 mV/(m/s²)	0.7 to 13k Hz	± 4900 m/s² pk	0.02 m/s² rms	-53 to +121 °C	side 3-56	0.5 gm	al. teardrop	1.14, 1.24
✪	352A21	1.02 mV/(m/s²)	0.7 to 13k Hz	± 4900 m/s² pk	0.02 m/s² rms	-53 to +121 °C	side 3-56	0.6 gm	ti. teardrop	1.14, 1.24
✪	352B10	1.02 mV/(m/s²)	1 to 17k Hz	± 4900 m/s² pk	0.03 m/s² rms	-53 to +121 °C	top cable	0.7 gm		1.16, 1.26
	352C15	1.02 mV/(m/s²)	0.7 to 18k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	side 5-44	2 gm		1.17, 1.26
	352C16	1.02 mV/(m/s²)	0.7 to 16k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	top 5-44	2 gm		1.17, 1.26
	352C17	1.02 mV/(m/s²)	0.7 to 18k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	top cable	2 gm		1.18, 1.27
	352C18	1.02 mV/(m/s²)	0.7 to 18k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	top 10-32	2 gm		1.18, 1.27
	355B12	1.02 mV/(m/s²)	0.6 to 15k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	side 5-44	2.3 gm	through-hole	1.20, 1.31
	352C41	1.02 mV/(m/s²)	0.3 to 15k Hz	± 4900 m/s² pk	0.008 m/s² rms	-53 to +121 °C	top 10-32	2.8 gm		1.19, 1.27
✪	352C43	1.02 mV/(m/s²)	0.5 to 10k Hz	± 4900 m/s² pk	0.008 m/s² rms	-53 to +121 °C	top 10-32	3 gm		1.19, 1.28
✪	352C03	1.02 mV/(m/s²)	0.3 to 15k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	side 10-32	5.8 gm		1.22, 1.32
	352C04	1.02 mV/(m/s²)	0.3 to 15k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	top 10-32	5.8 gm		1.22, 1.32
	352A60	1.02 mV/(m/s²)	5 to 60k Hz [1]	± 490 m/s² pk	0.02 m/s² rms	-53 to +121 °C	top 5-44	6 gm	highest frequency	1.18, 1.28
	355B02	1.02 mV/(m/s²)	0.6 to 12k Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	side 10-32	10 gm	through-hole	1.21, 1.31
✪	352A24	10.19 mV/(m/s²)	0.8 to 10k Hz	± 490 m/s² pk	0.002 m/s² rms	-53 to +121 °C	side 3-56	0.8 gm	al. teardrop	1.15, 1.25
	338C04	10.19 mV/(m/s²)	0.35 to 10k Hz	± 490 m/s² pk	0.0018 m/s² rms	-53 to +93 °C	side 10-32	4 gm	low profile	1.20, 1.30
✪	352C33	10.19 mV/(m/s²)	0.3 to 15k Hz	± 490 m/s² pk	0.0015 m/s² rms	-53 to +93 °C	side 10-32	5.8 gm	general purpose	1.22, 1.33
✪	352C34	10.19 mV/(m/s²)	0.3 to 15k Hz	± 490 m/s² pk	0.0015 m/s² rms	-53 to +93 °C	top 10-32	6.6 gm	general purpose	1.22, 1.33
	352C42	10.19 mV/(m/s²)	0.3 to 15k Hz	± 490 m/s² pk	0.005 m/s² rms	-53 to +121 °C	top 10-32	2.8 gm		1.19, 1.27
	352C44	10.19 mV/(m/s²)	0.5 to 10k Hz	± 490 m/s² pk	0.005 m/s² rms	-53 to +121 °C	top 10-32	3 gm		1.19, 1.28
✪	352C65	10.19 mV/(m/s²)	0.3 to 12k Hz	± 490 m/s² pk	0.0015 m/s² rms	-53 to +93 °C	side 5-44	2 gm		1.16, 1.29
✪	352C66	10.19 mV/(m/s²)	0.3 to 12k Hz	± 490 m/s² pk	0.0015 m/s² rms	-53 to +93 °C	top 5-44	2 gm		1.17, 1.29
✪	352C67	10.19 mV/(m/s²)	0.3 to 12k Hz	± 490 m/s² pk	0.0015 m/s² rms	-53 to +93 °C	top cable	2 gm		1.17, 1.29
✪	352C68	10.19 mV/(m/s²)	0.3 to 12k Hz	± 490 m/s² pk	0.0015 m/s² rms	-53 to +93 °C	top 10-32	2 gm		1.18, 1.29
	355B03	10.19 mV/(m/s²)	0.6 to 12k Hz	± 490 m/s² pk	0.0009 m/s² rms	-53 to +121 °C	side 10-32	10 gm	through-hole	1.21, 1.31
	355B04	101.9 mV/(m/s²)	0.6 to 12k Hz	± 49 m/s² pk	0.001 m/s² rms	-53 to +93 °C	side 10-32	11.2 gm	through-hole	1.21, 1.31
	352B	101.9 mV/(m/s²)	3 to 10k Hz	± 49 m/s² pk	0.0008 m/s² rms	-53 to +93 °C	top 10-32	35 gm	high resolution	1.23, 1.32

NOTE: [1] Frequency range specified is ± 3 dB

Accelerometer Selection Guide
Metric Measurement Units

Low Amplitude Seismic ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
●	393B05	1.02 V/(m/s²)	0.5 to 750 Hz	± 4.9 m/s² pk	0.00004 m/s² rms	-18 to +80 °C	top 10-32	50 gm		1.74, 1.77
	393B04	102 mV/(m/s²)	0.25 to 750 Hz	± 49 m/s² pk	0.00003 m/s² rms	-18 to +80 °C	top 10-21	50 gm		1.74, 1.76
●	393A03	102 mV/(m/s²)	0.3 to 4000 Hz	± 49 m/s² pk	0.0001 m/s² rms	-53 to +121 °C	MIL-C-5015	210 gm		1.74, 1.76
	393C	102 mV/(m/s²)	0.01 to 1200 Hz	± 24.5 m/s² pk	0.001 m/s² rms	-53 to +93 °C	side 10-32	1000 gm	quartz	1.75, 1.76
	393B12	1.02 V/(m/s²)	0.1 to 2000 Hz	± 4.9 m/s² pk	0.00008 m/s² rms	-45 to +82 °C	MIL-C-5015	210 gm		1.75, 1.77
	393B31	1.02 V/(m/s²)	0.07 to 300 Hz	± 4.9 m/s² pk	0.000009 m/s² rms	-18 to +65 °C	MIL-C-5015	635 gm		1.75, 1.77

Triaxial ICP® and Charge Output Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	356A70	0.28 pC/(m/s²)	to 7000 Hz	± 4900 m/s² pk	N/A	-70 to +254 °C	side 5-44	7.9 gm	charge mode	1.40, 1.47
	356A71	1.02 pC/(m/s²)	to 7000 Hz	± 4900 m/s² pk	N/A	-70 to +254 °C	side 10-32	22.7 gm	charge mode	1.40, 1.47
	356B10	0.1 mV/(m/s²)	2 to 10k Hz [1]	± 49k m/s² pk	0.29 m/s² rms	-53 to +121 °C	side cable	4 gm		1.36, 1.43
	356B20	0.1 mV/(m/s²)	2 to 10k Hz [1]	± 49k m/s² pk	0.29 m/s² rms	-53 to +121 °C	4-pin	4 gm		1.37, 1.43
	356A01	0.5 mV/(m/s²)	2 to 8000 Hz [1]	± 9800 m/s² pk	0.03 m/s² rms	-53 to +121 °C	side cable	1 gm	6.35 mm cube	1.36, 1.43
	356A24	1.02 mV/(m/s²)	0.5 to 12k Hz	± 4900 m/s² pk	0.02 m/s² rms	-53 to +121 °C	4-pin	3.1 gm	low profile	1.37, 1.44
●	356A61	1.02 mV/(m/s²)	2 to 5000 Hz [1]	± 4900 m/s² pk	0.08 m/s² rms	-53 to +121 °C	side cable	4 gm	filtered	1.42, 1.49
	356B11	1.02 mV/(m/s²)	2 to 10k Hz [1]	± 4900 m/s² pk	0.03 m/s² rms	-53 to +121 °C	side cable	4 gm	10.2 mm cube	1.36, 1.43
●	356B21	1.02 mV/(m/s²)	2 to 10k Hz [1]	± 4900 m/s² pk	0.03 m/s² rms	-53 to +121 °C	4-pin	4 gm	10.2 mm cube	1.37, 1.44
	354C10	1.02 mV/(m/s²)	2 to 8000 Hz [1]	± 4900 m/s² pk	0.03 m/s² rms	-53 to +121 °C	side cable	5 gm	through-hole	1.39, 1.46
●	356A33	1.02 mV/(m/s²)	2 to 10k Hz [1]	± 4900 m/s² pk	0.03 m/s² rms	-53 to +121 °C	4-pin	5.3 gm		1.38, 1.44
●	356A63	1.02 mV/(m/s²)	2 to 5000 Hz [1]	± 4900 m/s² pk	0.08 m/s² rms	-53 to +121 °C	4-pin	5.3 gm	filtered	1.42, 1.49
	356A66	1.02 mV/(m/s²)	2 to 4000 Hz [1]	± 4900 m/s² pk	0.02 m/s² rms	-53 to +163 °C	4-pin	9 gm	filtered	1.42, 1.49
●	356A02	1.02 mV/(m/s²)	0.5 to 6000 Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	4-pin	10.5 gm	14 mm cube	1.38, 1.45
	354C02	1.02 mV/(m/s²)	0.3 to 4000 Hz	± 4900 m/s² pk	0.005 m/s² rms	-53 to +121 °C	4-pin	15.5 gm	13/16 through-hole	1.39, 1.46
	356A25	2.6 mV/(m/s²)	0.5 to 6500 Hz	± 1960 m/s² pk	0.002 m/s² rms	-53 to +121 °C	4-pin	10.5 gm	14 mm cube	1.38, 1.45
●	356A32	10.19 mV/(m/s²)	0.7 to 5000 Hz	± 490 m/s² pk	0.003 m/s² rms	-53 to +121 °C	4-pin	5.4 gm		1.37, 1.44
	356A16	10.19 mV/(m/s²)	0.3 to 6000 Hz	± 490 m/s² pk	0.001 m/s² rms	-53 to +80 °C	4-pin	7.4 gm	14 mm aluminum	1.41, 1.48
	354C03	10.19 mV/(m/s²)	0.3 to 4000 Hz	± 490 m/s² pk	0.002 m/s² rms	-53 to +93 °C	4-pin	15.5 gm	13/16 through-hole	1.40, 1.46
●	356A15	10.19 mV/(m/s²)	1 to 6500 Hz	± 490 m/s² pk	0.002 m/s² rms	-53 to +121 °C	4-pin	10.5 gm	14 mm cube	1.39, 1.45
	356A17	51 mV/(m/s²)	0.3 to 4000 Hz	± 98 m/s² pk	0.0006 m/s² rms	-53 to +80 °C	4-pin	9.3 gm	14 mm aluminum	1.41, 1.48
●	356B18	102 mV/(m/s²)	0.3 to 5000 Hz	± 49 m/s² pk	0.0005 m/s² rms	-29 to +77 °C	4-pin	25 gm	20.3 mm aluminum	1.41, 1.48

NOTE: [1] Frequency range specified is ± 5%

High Amplitude ICP® and Charge Output Shock Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	350A96	0.007 pC/(m/s²)	15k Hz	± 980k m/s² pk	N/A	-18 to +66 °C	top 10-32	13 gm	charge mode	1.55, 1.59
	350B21	0.005 mV/(m/s²)	1 to 10k Hz	± 980k m/s² pk	2.9 m/s² rms	-53 to +93 °C	side cable	4.4 gm	ceramic	1.52, 1.57
●	350B02	0.01 mV/(m/s²)	4 to 10k Hz	± 490k m/s² pk	4.9 m/s² rms	-18 to +66 °C	top cable	4.25 gm	ceramic	1.52, 1.56
	350B03	0.05 mV/(m/s²)	0.4 to 10k Hz	± 98k m/s² pk	0.39 m/s² rms	-18 to +66 °C	top 10-32	4.5 gm	ceramic	1.53, 1.56
	350B23	0.05 mV/(m/s²)	0.4 to 10k Hz	± 98k m/s² pk	0.39 m/s² rms	-18 to +66 °C	top cable	4.5 gm	ceramic	1.52, 1.57
	350A13	0.05 mV/(m/s²)	0.4 to 7500 Hz [2]	± 98k m/s² pk	0.59 m/s² rms	-53 to +121 °C	top 10-32	17.9 gm	quartz	1.54, 1.58
	350B04	0.10 mV/(m/s²)	0.4 to 10k Hz	± 49k m/s² pk	0.20 m/s² rms	-18 to +66 °C	top 10-32	4.5 gm	ceramic	1.53, 1.56
	350A14	0.10 mV/(m/s²)	0.4 to 7500 Hz [2]	± 49k m/s² pk	0.20 m/s² rms	-53 to +121 °C	top 10-32	17.9 gm	quartz	1.54, 1.58

NOTE: [2] Frequency range specified is ± 10%

Extended Temperature / ESS ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	320C18	1.02 mV/(m/s²)	1.5 to 18k Hz	± 4900 m/s² pk	0.05 m/s² rms	-73 to +163 °C	top 10-32	1.7 gm	1.80, 1.84
	320C15	1.02 mV/(m/s²)	1.5 to 18k Hz	± 4900 m/s² pk	0.05 m/s² rms	-73 to +163 °C	side 5-44	2 gm	1.80, 1.84
	300A12	1.02 mV/(m/s²)	10 to 10k Hz [1]	± 2450 m/s² pk	0.02 m/s² rms	-73 to +260 °C	top 10-32	5.4 gm	1.83, 1.88
	320C20	1.02 mV/(m/s²)	1.5 to 10k Hz	± 4900 m/s² pk	0.06 m/s² rms	-73 to +163 °C	top 10-32	6.5 gm	1.83, 1.87
	352B30	1.02 mV/(m/s²)	10 to 6000 Hz	± 4900 m/s² pk	0.04 m/s² rms	-53 to +121 °C	top 10-32	7 gm	1.83, 1.87
	320C03	1.02 mV/(m/s²)	0.7 to 9000 Hz	± 4900 m/s² pk	0.05 m/s² rms	-73 to +163 °C	side 10-32	10.5 gm	1.80, 1.84
	320C33	10.2 mV/(m/s²)	0.7 to 6000 Hz	± 490 m/s² pk	0.003 m/s² rms	-73 to +163 °C	side 10-32	20 gm	1.81, 1.84

NOTE: [1] Frequency range specified is ± 5%

Low Temperature / Cryogenic ICP® Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	351B11	0.51 mV/(m/s²)	0.7 to 15k Hz	± 2942 m/s² pk	0.1 m/s² rms	-196 to +121 °C	side 5-44	2 gm	1.81, 1.85
	351B14	0.51 mV/(m/s²)	0.7 to 10k Hz	± 2942 m/s² pk	0.1 m/s² rms	-196 to +121 °C	top 10-32	1.8 gm	1.81, 1.85
	351B03	1.02 mV/(m/s²)	0.7 to 9000 Hz	± 1472 m/s² pk	0.1 m/s² rms	-196 to +121 °C	side 10-32	10.5 gm	1.82, 1.85
	351B31	5.10 mV/(m/s²)	0.7 to 7000 Hz	± 294 m/s² pk	0.02 m/s² rms	-196 to +121 °C	side 10-32	20 gm	1.82, 1.86
	351B41	10.2 mV/(m/s²)	0.7 to 3500 Hz	± 147 m/s² pk	0.005 m/s² rms	-196 to +121 °C	side 10-32	40 gm	1.82, 1.86

Charge Output Accelerometers

POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
	357A08	0.03 pC/(m/s²)	20k Hz	± 9800 m/s² pk	dependent upon signal conditioner used	-73 to +177 °C	side 3-56	0.16 gm	al. teardrop	1.62, 1.68
	357A09	0.17 pC/(m/s²)	13k Hz	± 4900 m/s² pk		-73 to +177 °C	side 3-56	0.6 gm	ti. teardrop	1.62, 1.68
	357C10	0.17 pC/(m/s²)	13k Hz	± 4900 m/s² pk		-73 to +177 °C	side 3-56	0.45 gm	al. teardrop	1.62, 1.69
◆	357B11	0.31 pC/(m/s²)	16k Hz	± 22.5k m/s² pk		-71 to +260 °C	side 5-44	2 gm		1.63, 1.69
	357B14	0.31 pC/(m/s²)	16k Hz	± 22.5k m/s² pk		-71 to +260 °C	top 10-32	2 gm		1.63, 1.69
	357A06	0.51 pC/(m/s²)	15k Hz	± 4900 m/s² pk		-53 to +177 °C	side 5-44	2.3 gm	through-hole	1.63, 1.68
	357B03	1.02 pC/(m/s²)	12k Hz	± 19k m/s² pk		-71 to +260 °C	side 10-32	10.9 gm		1.64, 1.70
	357B04	1.02 pC/(m/s²)	12k Hz	± 19k m/s² pk		-71 to +260 °C	top 10-32	10.9 gm		1.64, 1.70
◆	357B61	1.02 pC/(m/s²)	5000 Hz [1]	± 29k m/s² pk		-54 to +482 °C	side 10-32	30 gm		1.66, 1.72
	357B71	1.02 pC/(m/s²)	2000 Hz [1]	± 4900 m/s² pk		-54 to +482 °C	2 pin	100 gm	differential	1.66, 1.72
	357A05	1.7 pC/(m/s²)	12k Hz	± 4900 m/s² pk		-53 to +177 °C	side 10-32	12 gm	through-hole	1.64, 1.70
	357B21	3.1 pC/(m/s²)	7500 Hz	± 14.7k m/s² pk		-71 to +260 °C	side 10-32	20.7 gm		1.65, 1.70
	357B22	3.1 pC/(m/s²)	7500 Hz	± 14.7k m/s² pk		-71 to +260 °C	top 10-32	20.7 gm		1.65, 1.71
	357B72	5.1 pC/(m/s²)	2000 Hz [1]	± 4900 m/s² pk		-54 to +482 °C	2 pin	120 gm	differential	1.66, 1.72
	357B33	10.2 pC/(m/s²)	3500 Hz	± 1470 m/s² pk		-71 to +260 °C	side 10-32	45.4 gm		1.65, 1.71
	357B34	10.2 pC/(m/s²)	3500 Hz	± 1470 m/s² pk		-71 to +260 °C	top 10-32	45.4 gm		1.65, 1.71
	357B73	10.2 pC/(m/s²)	2000 Hz [1]	± 4900 m/s² pk		-54 to +482 °C	2 pin	130 gm	differential	1.67, 1.72

NOTE: [1] Frequency range specified is ± 5%

Accelerometer Selection Guide
Metric Measurement Units

ICP® Structural Test / Array Accelerometers										
POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	COMMENT	PAGE
●	333B	10.19 mV/(m/s²)	2 to 1000 Hz	± 490 m/s² pk	0.0007 m/s² rms	-18 to +66 °C	base 3-pin	5.6 gm	economy/array	1.90, 1.93
	333B30	10.19 mV/(m/s²)	0.5 to 3000 Hz	± 490 m/s² pk	0.0015 m/s² rms	-18 to +66 °C	side 10-32	4 gm		1.90, 1.93
	333B31	10.19 mV/(m/s²)	0.5 to 3000 Hz	± 490 m/s² pk	0.0015 m/s² rms	-18 to +66 °C	top 10-32	4 gm	general/array	1.90, 1.93
●	333B32	10.19 mV/(m/s²)	0.5 to 3000 Hz	± 490 m/s² pk	0.0015 m/s² rms	-18 to +66 °C	side 10-32	4 gm	cubic	1.90, 1.93
	333B40	51 mV/(m/s²)	0.5 to 3000 Hz	± 98 m/s² pk	0.0005 m/s² rms	-18 to +66 °C	side 10-32	7.5 gm		1.91, 1.94
	333B42	51 mV/(m/s²)	0.5 to 3000 Hz	± 98 m/s² pk	0.0005 m/s² rms	-18 to +66 °C	side 10-32	7.5 gm	cubic	1.91, 1.94
	333B50	102 mV/(m/s²)	0.5 to 3000 Hz	± 49 m/s² pk	0.0005 m/s² rms	-18 to +66 °C	side 10-32	7.5 gm		1.91, 1.94
	333B52	102 mV/(m/s²)	0.5 to 3000 Hz	± 49 m/s² pk	0.0005 m/s² rms	-18 to +66 °C	side 10-32	6.8 gm	cubic	1.91, 1.94

Metric ICP® and Charge Output Accelerometers									
POPULAR PRODUCT	MODEL	SENSITIVITY	FREQUENCY RANGE (± 10%)	AMPLITUDE RANGE	RESOLUTION	TEMPERATURE RANGE	CONNECTOR	WEIGHT	PAGE
	340A75	0.3 pC/m/s²	16k Hz	± 22.5 m/s² pk	N/A	-70 to +260° C	side M3	2 gm	1.105, 1.107
	340A76	0.3 pC/m/s²	16k Hz	± 22.5 m/s² pk	N/A	-70 to +260° C	top M3	2 gm	1.105, 1.107
	340A50	0.28 pC/(m/s²)	10k Hz	± 9,800 m/s² pk	N/A	-70 to +260° C	side M3	11 gm	1.105, 1.108
	340A15	1.0 mV/(m/s²)	0.7 to 18k Hz	± 4,900 m/s² pk	0.006 m/s² rms	-55 to +125° C	side M3	2 gm	1.104, 1.106
	340A16	1.0 mV/(m/s²)	0.7 to 18k Hz	± 4,900 m/s² pk	0.006 m/s² rms	-55 to +125° C	top M3	2 gm	1.104, 1.106
	340A65	10.0 mV/(m/s²)	0.3 to 12k Hz	± 490 m/s² pk	0.0016 m/s² rms	-55 to +95° C	side M3	2 gm	1.104, 1.106
	340A66	10.0 mV/(m/s²)	0.3 to 12k Hz	± 490 m/s² pk	0.0016 m/s² rms	-55 to +95° C	top M3	2 gm	1.104, 1.106

Standard Options for Accelerometers

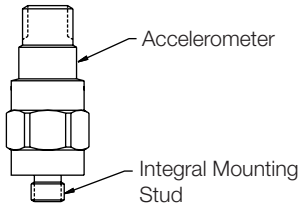
How to Specify an Option

It is often desirable to incorporate various options in an accelerometer to enhance or improve its performance for a given application. To designate an option for a specific model, first check to insure that it is available by finding the option prefix letter in the model's specification chart. The prefix letter is then inserted in front of the model number to designate the option, e.g., J353B16. More than one option may be designated, e.g., JM353B16. The following descriptions address the impact any option may have on specifications and performance. If in doubt about the compatibility of any option for the accelerometer model of interest, or the effects any option may introduce for your application, call a factory application engineer for assistance.

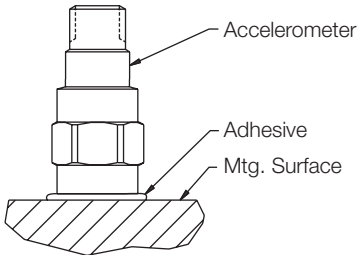
Option "A" — Adhesive Mount (e.g., A353B18)

Many applications require the sensor to be attached without modification of the test specimen by drilling and tapping a mounting hole. This is best accomplished by adhesive mounting with Petro Wax, hot glue, or other adhesive. Most units are supplied with an adhesive mounting pad to facilitate this approach, however, for miniature sensors, with integral mounting studs, the use of the adhesive mounting base may not be desirable due to space limitations.

This option designates the removal of the integral stud so that the sensor has a smooth and flat bottom for direct adhesive mounting. Note that the frequency response will not be as high as with stud mounting and that higher frequency response will be achieved with stiffer adhesives.



Standard Accelerometer with Integral Mounting Stud



Direct Adhesive Mounting (stud removed)

Option "B" — Low Output Bias Voltage (e.g., B353B01)

A factory adjustment to the built-in microelectronic circuitry reduces the output bias voltage to approximately 4.5 to 6.5 VDC. This permits the accelerometer to operate from a reduced, minimum excitation voltage of 9 VDC. This may be desirable when incorporating an accelerometer into an OEM system and the voltage available for excitation is limited. Also, some data collectors or readout devices that incorporate excitation power may provide only a lower voltage than is normally recommended. The low bias option limits the amplitude range of the accelerometer to ± 3 volts output. For example, a 100 mV/g accelerometer is therefore limited to a ± 30 g amplitude range.

Standard Options for Accelerometers

Option "EX" — Intrinsically Safe (e.g., EX337F04)

Certain industrial style accelerometers are available with Cenelec approval for use in hazardous, explosive environments. This option provides the Cenelec approval for such use and stipulates that appropriate signal conditioning, including an intrinsic safety barrier, is utilized with the sensor.

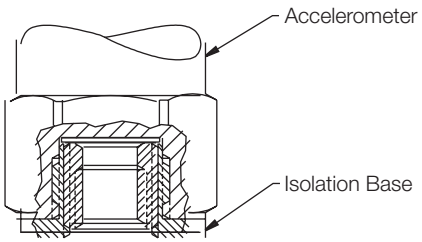
Option "HT" — High Temperature Operation (e.g., HT356A02)

An adjustment to the built-in microelectronic circuitry permits sensor operation to temperatures that exceed the standard specified temperature range. Typically, the low frequency range will be somewhat compromised. Check with the factory to determine the allowable high temperature capability for a specific model and the impact this option will have on low frequency range.

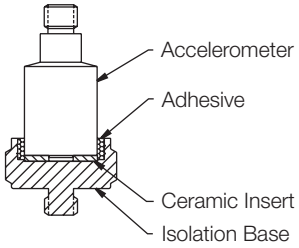
Option "J" — Ground Isolation (e.g., J353B01)

The ground isolation option provides an electrical isolation of > 10^8 ohms between the accelerometer and the test structure. This electrical isolation is achieved by manufacturing the accelerometer with a custom isolation base integral with the bottom of the sensor. Typically, ground isolation is used when testing electric motors or other objects that produce large amounts of electrical noise. Isolating the sensor from the test object also reduces noise induced by electrical ground loops. Attaching the ground isolation base to the accelerometer reduces the upper frequency range slightly.

Typical Integral Ground Isolation Base

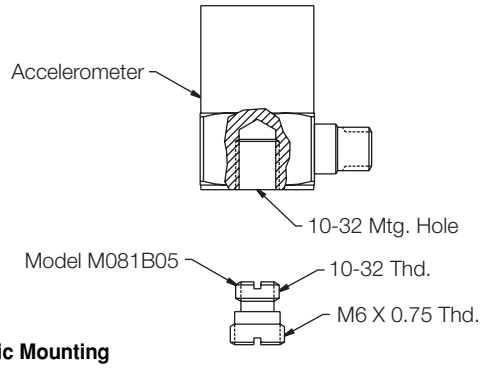


Integral Ground Isolation Base for Miniature Accelerometers



Option "M" — Metric Mounting Thread (e.g., M353B15)

This option is used for applications requiring a metric thread for installation. On models for which a separate mounting stud is provided, this option supplies an adapter stud (typically, 10-32 to M6) with a metric installation thread. For models that incorporate an integral mounting stud, the optional unit includes an integral metric threaded stud. Models that have through-hole mounting are furnished with appropriately sized, metric-threaded cap screws. There are no compromises to any specification when installing with a metric thread. Note: many models are supplied with both English and Metric mounting hardware as standard.



Metric Mounting

Standard Options for Accelerometers

Option "N" — Negative Polarity Element (e.g., N333B31)

For phase matching during multi-channel, modal analysis applications, it may be necessary to reverse the polarity of the output signal, to correspond to the sensor's mounting orientation. Certain array type accelerometers may be mounted by screwing their electrical connector onto a designated receptacle mounting base or directly to the structure by inverting the sensor and adhesively mounting it. When inverted and mounted directly, the negative output polarity is recommended. This option provides a negative polarity ICP® sensor without compromise to any other specification.

Option "P" — Positive Polarity Element (e.g., P357B03)

When the phase of the output signal is important, especially for timing and multi-channel applications, it may be necessary to reverse the polarity of the output signal to correspond to the inverting characteristics of the signal conditioner being used. Most charge amplifiers invert the measurement signal and would typically be used with charge mode accelerometers having a negative signal polarity. In cases where the signal conditioner is a non-inverting device, it may be desirable to use a positive polarity sensor. This option provides a positive polarity charge mode sensor without compromise to any other specification.

Option "Q" — Extended Low Frequency (e.g., Q353B01)

Accurate measurements below 1 Hz can often be achieved by factory modification of the internal microelectronics of the sensor. By increasing the value of the electronics' discharge time constant (see glossary for definition), it is possible to obtain an extended low-end frequency response. For most sensors the DTC is extended to 10 seconds, which provides -5% @ 0.05 Hz. For some smaller sensors the DTC is extended to 5 seconds, which provides -5% @ 0.1 Hz.

For accurate low-frequency measurements, be certain the signal conditioner is DC coupled. For practical reasons, lower sensitivity sensors (≤ 50 mV/g) with extended low frequency are recommended only for long-duration shock pulse measurements associated with package or drop testing.

Option "T" — Transducer Electronic Data Sheet (TEDS) (e.g., T333B32)

The "TEDS" option provides an accelerometer with an on-board digital memory. This memory stores valuable information such as sensor model number, serial number, sensitivity value, last calibration date, etc. Via command from an appropriately outfitted signal conditioner, the sensor is digitally addressed and the information in the memory is downloaded. The information is then utilized by the data acquisition system to aid in automating such tasks as coordinate mapping and data bookkeeping. This plug-and-play capability is in accordance with the international standard defined by IEEE P1451.4

This technique saves time and reduces error caused by human interface leading to improved test efficiency and accuracy. Applications such as multi-channel modal analysis and route data collection are a natural fit for this technology. Look for the TEDS graphic which identifies sensors in this catalog that are capable of this feature.

TEDS CIRCUITRY COMPATIBLE

For some sensors, the tapped mounting hole may be sacrificed to accommodate the additional circuitry, making these adhesive mounted only.

Standard Options for Accelerometers

Option "TLA" — TEDS with LMS Free Format (e.g., TLA333B32)

This "TEDS" option variation provides an information template, within the accelerometer's on-board memory, that conforms to the "Free" format that is supported by LMS data acquisition equipment. This option is otherwise identical to Option "T" described on the previous page.

Option "TLB" — TEDS with LMS Automotive Format (e.g., TLB333B32)

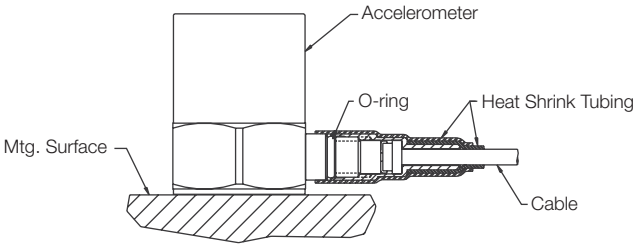
This "TEDS" option variation provides an information template, within the accelerometer's on-board memory, that conforms to the "Automotive" format that is supported by LMS data acquisition equipment. This option is otherwise identical to Option "T" described on the previous page.

Option "TLC" — TEDS with LMS Aeronautical Format (e.g., TLC333B32)

This "TEDS" option variation provides an information template, within the accelerometer's on-board memory, that conforms to the "Aeronautical" format that is supported by LMS data acquisition equipment. This option is otherwise identical to Option "T" described on the previous page.

Option "W" — Water Resistant Connection (e.g., W353B01/002C10)

The water resistant option provides a cable directly attached and sealed to the sensor's electrical connector with O-rings and heat-shrink tubing. This helps secure and seal the cable to the sensor, provides strain relief, and protects the integrity of the connection. This sealing guards against contamination from dirt and fluids and permits short-term underwater use. Use the option letter "W" as a prefix to the model number. Then add a slash (/) after the model number, followed by the type of cable, length, and appropriate connectors. (See cables/accessories section for a description of cables and connectors). Example above is a Model 353B01 connected to a 10 ft Model 002C10 cable via a standard 10-32 coaxial plug. The cable itself terminates in a BNC plug. Designate a metric length by adding an "M" in front of the cable type, e.g., W353B01/M002C03 designates a 3-meter cable length.



Water-Resistant Cable Attachment

Precision Quartz Shear ICP® Accelerometers

- **Routine vibration measurements**
- **Product testing**
- **Structural testing**
- **Testing in adverse environments**
- **Impulse response measurements**
- **Vibration control**

The Quartz Shear ICP® Accelerometer was developed by PCB in 1987. This effort was in response to demand for a small, lightweight, high-precision vibration sensor capable of stable operation in thermally active, harsh environments. The design capitalizes on the unique capabilities of quartz, built-in microelectronic signal conditioning circuitry, shear mode sensing geometry, lightweight titanium, and laser-welded construction. Now, a full range of quartz shear ICP® accelerometers are available to accomplish a wide variety of measurement tasks. Each model exhibits an impressive resume' of features and benefits, including the following:

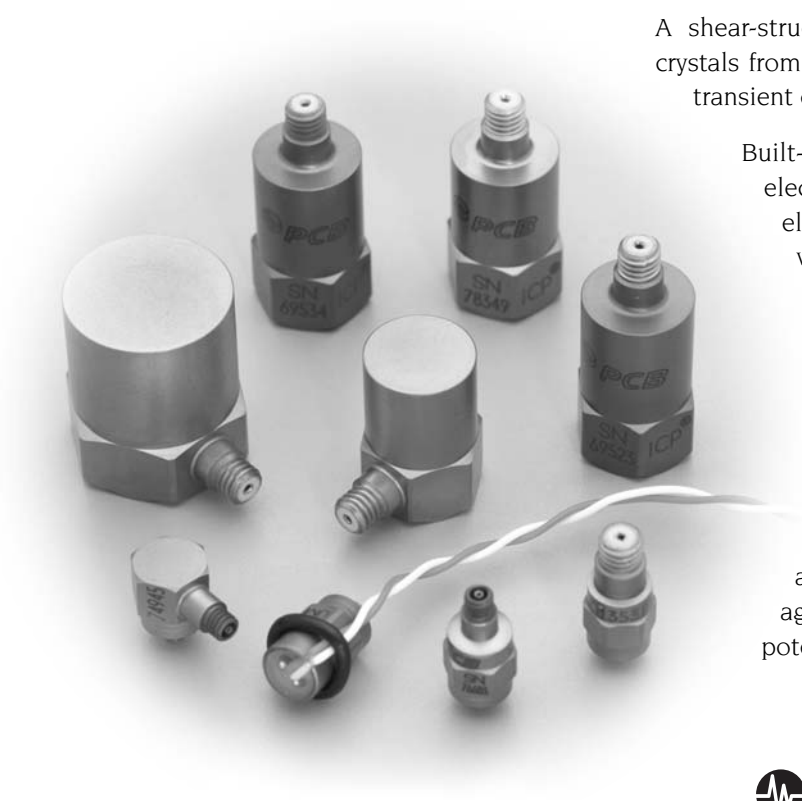
Quartz sensing crystals offer the most stable operation over time with virtually no shift in sensitivity, no output due to temperature change, and no change in performance even after overloads. Measurement accuracy is improved while eliminating the need for frequent recalibration.

A shear-structured sensing element isolates the sensing crystals from strain effects caused by base bending, thermal transient compression, and expansion forces.

Built-in signal conditioning circuitry converts the electrostatic charge signal from the quartz sensing element to a directly useable, low-impedance, voltage output signal proportional to input acceleration.

Titanium housings provide lightweight construction for maximum frequency range and to minimize mass loading of the test specimen. Titanium also provides excellent protection against many corrosives.

Hermetically sealed, laser-welded construction and glass-fused electrical connectors safeguard against the influx of moisture, oils, or other potential contaminants.



PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Precision Quartz Shear ICP® Accelerometers

MINIATURE
(*complete specifications are featured on pages* 1.7 *to* 1.8)

Miniature quartz ICP® accelerometers are especially well suited for applications demanding high frequency range, small size, and light weight.

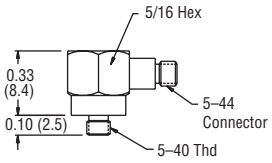
- printed circuit boards
- card cages and chassis
- package and drop testing
- brackets
- thin panels
- cams

Model 353B15 — Side connector provides low profile, simplifies cable routing and strain relief.

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 2 gram (0.07 oz) weight
- 500 g (4900 m/s²) range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

Actual Size

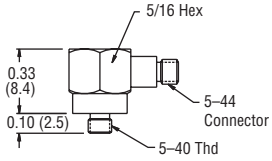


Model 353B11 — Side connector provides low profile, simplifies cable routing and strain relief

- 5 mV/g [0.51 mV/(m/s²)] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 2 gram (0.07 oz) weight
- 1000 g (9800 m/s²) range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

Actual Size

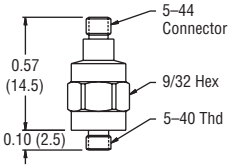


Model 353B16 — Lighter weight, higher frequency range, installs with small footprint

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 20 kHz frequency range
- 1.5 gram (0.05 oz) weight
- 500 g (4900 m/s²) range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

Actual Size

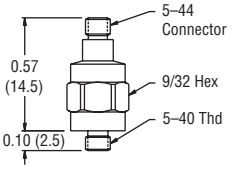


Model 353B12 — Lighter weight, higher frequency range, installs with small footprint

- 5 mV/g [0.51mV/(m/s²)] sensitivity
- 0.7 Hz to 20 kHz frequency range
- 1.5 gram (0.05 oz) weight
- 1000 g (9800 m/s²) range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

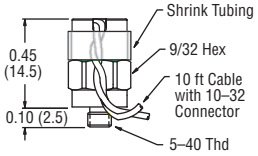
MINIATURE *Precision Quartz Shear* ICP® *Accelerometers (continued)*

Model 353B17 — Installs with small footprint, low in profile

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 20 kHz frequency range
- 1.7 gram (0.06 oz) weight
- 500 g (4900 m/s²) range
- Field repairable, integral cable

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

Actual Size

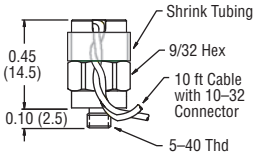


Model 353B13 — Installs with small footprint, low in profile

- 5 mV/g [0.51 mV/(m/s²)] sensitivity
- 0.7 Hz to 20 kHz frequency range
- 1.7 gram (0.06 oz) weight
- 1000 g (9800 m/s²) range
- Field repairable, integral cable

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

Actual Size



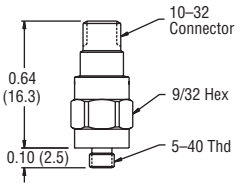
Model 353B18 — 10-32 connector joins to cables common to most accelerometers

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 1.8 gram (0.06 oz) weight
- 500 g (4900 m/s²) range

Recommended cables and accessories ❷❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

CE

Actual Size



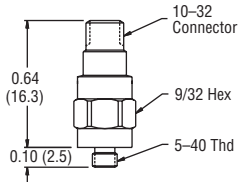
Model 353B14 — 10-32 connector joins to cables common to most accelerometers

- 5 mV/g [0.51 mV/(m/s²)] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 1.8 gram (0.06 oz) weight
- 1000 g (9800 m/s²) range

Recommended cables and accessories ❷❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, B, J, M, Q, W — see pages xvii to xx for option information

CE

Actual Size



Precision Quartz Shear ICP® Accelerometers

GENERAL PURPOSE
(*complete specifications are featured on pages* 1.9 *to* 1.10)

For routine vibration and low-amplitude shock applications.

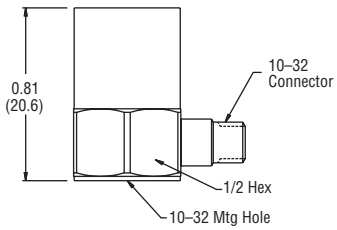
- product qualifications studies
- structural response tests
- vehicle studies
- vibration control

Model 353B03 — Side connector simplifies cable routing and strain relief

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 11 kHz frequency range
- 10.5 gram (0.38 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size

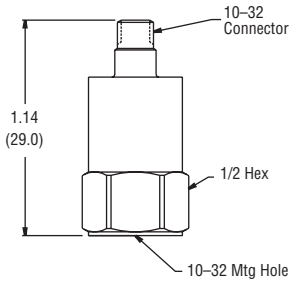


Model 353B04 — Top connector installs with small footprint

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 11 kHz frequency range
- 10.5 gram (0.38 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size

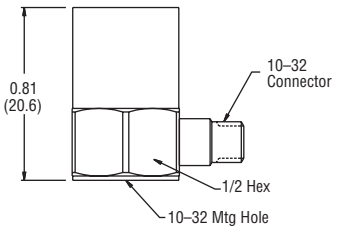


Model 353B01 — Side connector simplifies cable routing and strain relief

- 20 mV/g [2.04 mV/(m/s²)] sensitivity
- 0.7 Hz to 10 kHz frequency range
- 10 gram (0.35 oz) weight
- ± 250 g (2450 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size

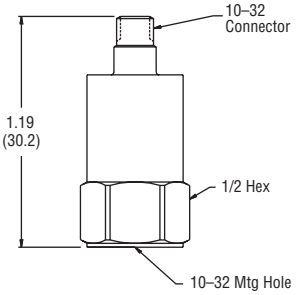


Model 353B02 — Top connector installs with small footprint

- 20 mV/g [2.04 mV/(m/s²)] sensitivity
- 0.7 Hz to 10 kHz frequency range
- 10 gram (0.35 oz) weight
- ± 250 g (2450 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

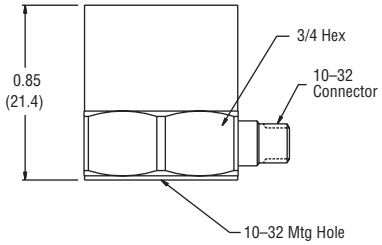
GENERAL PURPOSE *Precision Quartz Shear* ICP® *Accelerometers (continued)*

Model 353B31 — Side connector simplifies cable routing and strain relief

- 50 mV/g [5.1 mV/(m/s²)] sensitivity
- 0.7 Hz to 8000 Hz frequency range
- 20 gram (0.7 oz) weight
- ± 100 g (980 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size

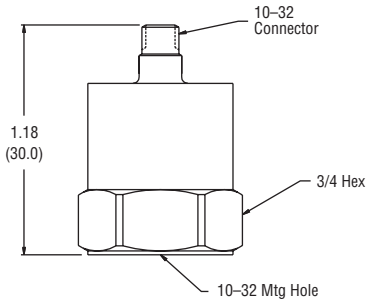


Model 353B32 — Top connector installs with small footprint

- 50 mV/g [5.1 mV/(m/s²)] sensitivity
- 0.7 Hz to 8000 Hz frequency range
- 20 gram (0.7 oz) weight
- ± 100 g (980 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size

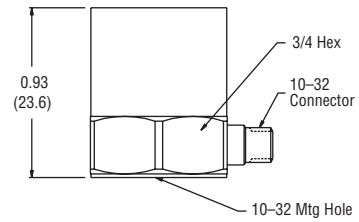


Model 353B33 — Side connector simplifies cable routing and strain relief

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.7 Hz to 6500 Hz frequency range
- 27 gram (0.95 oz) weight
- ± 50 g (490 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size

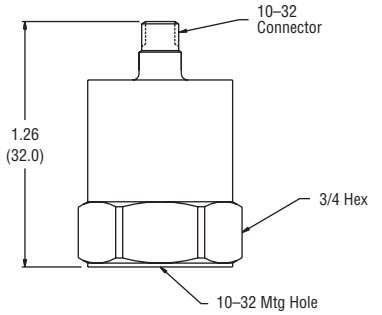


Model 353B34 — Top connector installs with small footprint

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.7 Hz to 7000 Hz frequency range
- 27 gram (0.95 oz) weight
- ± 50 g (490 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: B, J, Q, W — see pages xvii to xx for option information

Actual Size



Precision Quartz Shear ICP® Accelerometers

THROUGH HOLE
(*complete specifications are featured on page* 1.11)

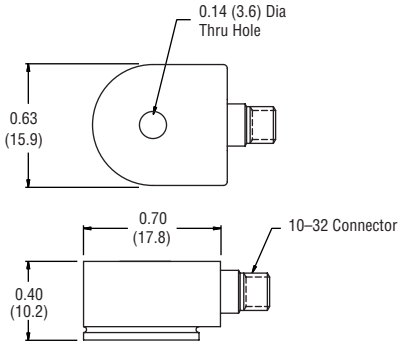
Through hole mounting configurations install conveniently, with a through bolt, may be rotated to achieve desired orientation of their electrical connection, and are low in profile, which permits use in tight installations.

Model 355B33 — High sensitivity, thermally stable

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 1 Hz to 10 kHz frequency range
- 11 gram (0.39 oz) weight
- 50 g (490 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T — see pages xvii to xx for option information

Actual Size

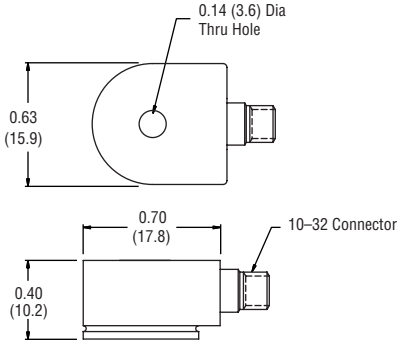


Model 355B34 — High amplitude, thermally stable

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 1 Hz to 7000 Hz frequency range
- 11 gram (0.39 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

Precision Quartz Shear ICP® Accelerometers

Miniature Precision Quartz Shear ICP® Accelerometers								
Model Number [1]	**353B11**		**353B12**		**353B13**		**353B14**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	5 mV/g	0.51 mV/(m/s²)	5 mV/g	0.51 mV/(m/s²)	5 mV/g	0.51 mV/(m/s²)	5 mV/g	0.51 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 1000 g pk	± 9800 m/s² pk	± 1000 g pk	± 9800 m/s² pk	± 1000 g pk	± 9800 m/s² pk	± 1000 g pk	± 9800 m/s² pk
Frequency Range (± 5%)	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz
Frequency Range (± 10%)	0.7 to 18k Hz	0.7 to 18k Hz	0.7 to 20k Hz	0.7 to 20k Hz	0.7 to 20k Hz	0.7 to 20k Hz	0.7 to 18k Hz	0.7 to 18k Hz
Resonant Frequency	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz
Broadband Resolution (1 to 10k Hz)	0.01 g rms	0.1 m/s² rms	0.01 g rms	0.1 m/s² rms	0.01 g rms	0.1 m/s² rms	0.01 g rms	0.1 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical								
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Weight	0.07 oz	2.0 gm	0.05 oz	1.5 gm	0.06 oz	1.7 gm	0.06 oz	1.8 gm
Size (Hex × Height)	5/16 in × 0.43 in	5/16 in × 10.9 mm	9/32 in × 0.58 in	9/32 in × 14.7 mm	9/32 in × 0.49 in	9/32 in × 12.4 mm	9/32 in × 0.74 in	9/32 × 18.8 mm
Electrical Connection	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	Integral Cable	Integral Cable	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Side	Side	Top	Top
Cable Termination	N/A	N/A	N/A	N/A	10-32 Coaxial Plug	10-32 Coaxial Plug	N/A	N/A
Cable Length	N/A	N/A	N/A	N/A	10 ft	3.0 m	N/A	N/A
Cable Type [3]	N/A	N/A	N/A	N/A	031AD010EB	031AD010EB	N/A	N/A
Mounting Thread	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Adhesive Mounting Base	080A15		080A15		080A15		080A15	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A30		080A30		080A30		080A30	
Triaxial Mounting Adaptor	080B16		080B16		080B16		080B16	
Mating Cable Connectors	AF, AG		AF, AG		AL		EB, AH, AK, AW	
Connector Adaptor	N/A		N/A		070A02		N/A	
Recommended Stock Cables	003, 018		003, 018		N/A		002, 002	
Options [5]								
Available Options	A, B, J, M, Q, W		A, B, J, M, Q, W		A, B, J, M, Q, W		A, B, J, M, Q, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See pages xvii to xx for option information.

Precision Quartz Shear ICP® Accelerometers

Miniature Precision Quartz Shear ICP® Accelerometer Specifications								
Model Number [1]	**353B15**		**353B16**		**353B17**		**353B18**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz
Frequency Range (± 10%)	0.7 to 18k Hz	0.7 to 18k Hz	0.7 to 20k Hz	0.7 to 20k Hz	0.7 to 20k Hz	0.7 to 20k Hz	0.7 to 18k Hz	0.7 to 18k Hz
Resonant Frequency	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz	≥ 70 kHz
Broadband Resolution (1 to 10k Hz)	0.005 g rms	0.05 m/s² rms	0.005 g rms	0.05 m/s² rms	0.005 g rms	0.05 m/s² rms	0.005 g rms	0.05 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical								
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Weight	0.07 oz	2.0 gm	0.05 oz	1.5 gm	0.06 oz	1.7 gm	0.06 oz	1.8 gm
Size (Hex × Height)	5/16 in × 0.43 in	5/16 in × 10.9 mm	9/32 in × 0.67 in	9/32 in × 17.0 mm	9/32 in × 0.49 in	9/32 in × 12.4 mm	9/32 in × 0.74 in	9/32 in × 18.8 mm
Electrical Connection	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	Integral Cable	Integral Cable	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Top	Top	Top	Top
Cable Termination	N/A	N/A	N/A	N/A	10-32 Coaxial Plug	10-32 Coaxial Plug	N/A	N/A
Cable Length	N/A	N/A	N/A	N/A	10 ft	3 m	N/A	N/A
Cable Type [3]	N/A	N/A	N/A	N/A	031AD010EB	031AD010EB	N/A	N/A
Mounting Thread	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Adhesive Mounting Base	080A15		080A15		080A15		080A15	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A30		080A30		080A30		080A30	
Triaxial Mounting Adaptor	080B16		080B16		080B16		080B16	
Mating Cable Connectors	AF, AG		AF, AG		AL		EB, AH, AK, AW	
Connector Adaptor	N/A		N/A		070A02		N/A	
Recommended Stock Cables	003, 018		003, 018		N/A		002, 002	
Options [5]								
Available Options	A, B, J, M, Q, W		A, B, J, M, Q, W		A, B, J, M, Q, W		A, B, J, M, Q, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Precision Quartz Shear ICP® Accelerometers

General Purpose Precision Quartz Shear ICP® Accelerometer Specifications								
Model Number [1]	**353B01**		**353B02**		**353B03**		**353B04**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	20 mV/g	2.04 mV/(m/s²)	20 mV/g	2.04 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%
Measurement Range	± 250 g pk	± 2450 m/s² pk	± 250 g pk	± 2450 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	1 to 7000 Hz	1 to 7000 Hz	1 to 7000 Hz	1 to 7000 Hz	1 to 7000 Hz	1 to 7000 Hz	1 to 7000 Hz	1 to 7000 Hz
Frequency Range (± 10%)	0.7 to 10k Hz	0.7 to 10k Hz	0.7 to 10k Hz	0.7 to 10k Hz	0.7 to 11k Hz	0.7 to 11k Hz	0.7 to 11k Hz	0.7 to 11k Hz
Resonant Frequency	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz
Broadband Resolution (1 to 10k Hz)	0.005 g rms	0.05 m/s² rms	0.005 g rms	0.05 m/s² rms	0.003 g rms	0.03 m/s² rms	0.003 g rms	0.03 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical								
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	1/2 in × 0.81 in	1/2 in × 20.6 mm	1/2 in × 1.19 in	1/2 in × 30.2 mm	1/2 in × 0.81 in	1/2 in × 20.6 mm	1/2 in × 1.14 in	1/2 in × 29.0 mm
Weight	0.35 oz	10 gm	0.35 oz	10 gm	0.38 oz	10.5 gm	0.38 oz	10.5 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Side	Side	Top	Top
Mounting Thread	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Adhesive Mounting Base	080A		080A		080A		080A	
Mounting Stud	081B05		081B05		081B05		081B05	
Metric Mounting Stud	M081B05		M081B05		M081B05		M081B05	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A27		080A27		080A27		080A27	
Triaxial Mounting Adaptor	080B10		080B10		080B10		080B10	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW	
Recommended Stock Cables	002, 003		002, 003		002, 003		002, 003	
Options [5]								
Available Options	B, J, Q, W		B, J, Q, W		B, J, Q, W		B, J, Q, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Precision Quartz Shear ICP® Accelerometers

General Purpose Precision Quartz Shear ICP® Accelerometer Specifications								
Model Number [1]	**353B31**		**353B32**		**353B33**		**353B34**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	50 mV/g	5.10 mV/(m/s²)	50 mV/g	5.10 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%
Measurement Range	± 100 g pk	± 980 m/s² pk	± 100 g pk	± 980 m/s² pk	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	1 to 5000 Hz	1 to 5000 Hz	1 to 5000 Hz	1 to 5000 Hz	1 to 4000 Hz	1 to 4000 Hz	1 to 4000 Hz	1 to 4000 Hz
Frequency Range (± 10%)	0.7 to 8000 Hz	0.7 to 8000 Hz	0.7 to 8000 Hz	0.7 to 8000 Hz	0.7 to 6500 Hz	0.7 to 6500 Hz	0.7 to 7000 Hz	0.7 to 7000 Hz
Resonant Frequency	≥ 30 kHz	≥ 30 kHz	≥ 28 kHz	≥ 28 kHz	≥ 22 kHz	≥ 22 kHz	≥ 22 kHz	≥ 22 kHz
Broadband Resolution (1 to 10k Hz)	0.001 g rms	0.01 m/s² rms	0.001 g rms	0.01 m/s² rms	0.0005 g rms	0.005 m/s² rms	0.0005 g rms	0.005 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98000 m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	7.5 to 11.5 VDC	7.5 to 11.5 VDC	7.5 to 11.5 VDC	7.5 to 11.5 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical								
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	3/4 in × 0.85 in	3/4 in × 21.6 mm	3/4 in × 1.18 in	3/4 in × 29.9 mm	3/4 in × 0.93 in	3/4 in × 23.6 mm	3/4 in × 1.26 in	3/4 in × 32.0 mm
Weight	0.7 oz	20 gm	0.7 oz	20 gm	0.95 oz	27 gm	0.95 oz	27 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Side	Side	Top	Top
Mounting Thread	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Adhesive Mounting Base	080A12		080A12		080A12		080A12	
Mounting Stud	081B05		081B05		081B05		081B05	
Metric Mounting Stud	M081B05		M081B05		M081B05		M081B05	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A27		080A27		080A27		080A27	
Triaxial Mounting Adaptor	080B11		080B11		080B11		080B11	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW	
Recommended Stock Cables	002, 003		002, 003		002, 003		002, 003	
Options [5]								
Available Options	B, J, Q, W		B, J, Q, W		B, J, Q, W		B, J, Q, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Through Hole Precision Quartz Shear ICP® Accelerometer Specifications				
Model Number [1]	**355B33**		**355B34**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 50 g pk	± 490 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	2 to 5000 Hz	2 to 5000 Hz	2 to 5000 Hz	2 to 5000 Hz
Frequency Range (± 10%)	1 to 10k Hz	1 to 10k Hz	1 to 7000 Hz	1 to 7000 Hz
Resonant Frequency	≥ 25 kHz	≥ 25 kHz	≥ 25 kHz	≥ 25 kHz
Broadband Resolution (1 to 10k Hz)	0.0005 g rms	0.005 m/s² rms	0.001 g rms	0.01 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental				
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical				
Excitation Voltage	22 to 30 VDC	22 to 30 VDC	19 to 30 VDC	19 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	11 to 14 VDC	11 to 14 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Electrical Isolation (Base)	> 10^8 ohms	> 10^8 ohms	> 10^8 ohms	> 10^8 ohms
Physical				
Sensing Element	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.40 in × 0.70 in × 0.63 in 10.2 mm × 17.8 mm × 15.9 mm		0.40 in × 0.70 in × 0.63 in 10.2 mm × 17.8 mm × 15.9 mm	
Weight	0.39 oz	11 gm	0.39 oz	11 gm
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side
Mounting	Through Hole	Through Hole	Through Hole	Through Hole
Supplied Accessories [3]				
Petro Wax	080A109		080A109	
Cap Screw	081A45		081A45	
Allen wrench	039A22		039A22	
NIST Calibration [4]	ACS-1		ACS-1	
Additional Accessories [3]				
Mating Cable Connectors	EB, EJ, AH, AK, AW		EB, EJ, AH, AK, AW	
Recommended Stock Cables	002, 003		002, 003	
Mounting Adaptor	080M260		080M260	
Options [5]				
Available Options	T		T	

NOTES: [1] See note regarding accuracy of information on inside front cover.

[2] Zero-based, least-squares, straight line method.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

PCB accelerometers are meticulously assembled by skilled technicians.

PCB accelerometers are used for modal studies of airframes as well as ground vibration testing and flight testing.

Dimensions shown are in inches (millimeters).

Ceramic Shear ICP® Accelerometers

- **Low amplitude vibration measurements**
- **High frequency vibrations**
- **Minimized mass loading effects**
- **Space restricted installations**
- **Low profile accelerometers**
- **Ring shaped accelerometers**

Structured with highly sensitive piezoceramic sensing elements, Ceramic Shear ICP® Accelerometers have an excellent signal-to-noise ratio, high measurement resolution, and are ideal for conducting low-level vibration measurements. Due to their inherent higher sensitivity, a ceramic ICP® accelerometer can be assembled with a smaller mass than comparable quartz units, resulting in a sensor with lighter weight, higher frequency response, and lower noise.

To further reduce the mass of the sensors, all ceramic shear accelerometers are housed in either tough, lightweight, laser-welded, hermetically sealed, titanium or aluminum housings. By minimizing the mass of the sensor, mass loading effects are reduced, which maximizes the accuracy of the data obtained.

These sensors use shear-mode designs that minimize extraneous signals caused by base bending and other strain effects, such as thermal transient compression, and expansion forces.

Through the use of built-in electronics, these ICP® accelerometers are powered by low-cost, constant-current, signal conditioners. Sensor power and signal output are simultaneously carried on a two-wire pair. The low-impedance voltage output signal results in reduced electrical noise while long cable runs are permitted when necessary.

A wide assortment of ceramic shear ICP® accelerometers are offered to meet a variety of measurement requirements.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Ceramic Shear ICP® Accelerometers

TEARDROP
(*complete specifications are featured on pages* 1.24 *to* 1.25)

Teardrop style accelerometers are very small and lightweight, exhibit minimum mass loading effects and install adhesively into tight locations.

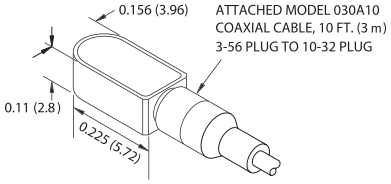
- circuit boards
- brackets
- components
- small assemblies

Model 352C23 — PCB's smallest ICP® accelerometer with coaxial connector

- 5 mV/g [0.51 mV/(m/s²)] sensitivity
- 1.5 Hz to 15 kHz frequency range
- 0.2 gram (0.007 oz) weight
- 1000 g (9800 m/s2) amplitude range
- Adhesive mount
- Electrically ground isolated
- Mating cable provided

Recommended cables and accessories ③❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

2× Actual Size

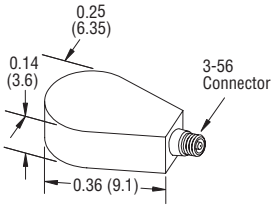


Model 352A21 — Robust titanium construction

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 13 kHz frequency range
- 0.6 gram (0.02 oz) weight
- 500 g (4900 m/s² amplitude range
- Adhesive mount
- Mating cable provided

Recommended cables and accessories ③❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

2× Actual Size

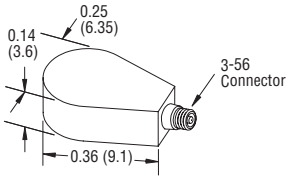


Model 352C22 — Lightweight, anodized, aluminum construction

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 13 kHz frequency range
- 0.5 gram (0.17 oz) weight
- 500 g (4900 m/s²) amplitude range
- Adhesive mount
- Electrically ground isolated
- Mating cable provided

Recommended cables and accessories ③❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

2× Actual Size



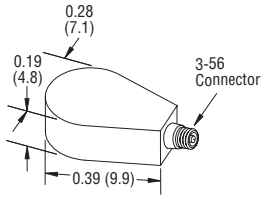
Dimensions shown are in inches (millimeters).

TEARDROP *Ceramic Shear* ICP® *Accelerometers (continued)*

Model 352A24 — Lightweight, high-sensitivity, anodized, aluminum construction

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.8 Hz to 10 kHz frequency range
- 0.8 gram (0.03 oz) weight
- 50 g (490 m/s²) amplitude range
- Adhesive mount
- Electrically ground isolated
- Mating cable provided

2× Actual Size

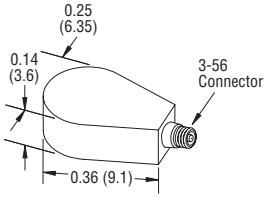


Recommended cables and accessories ③❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

Model 352A25 — Robust titanium construction, higher measurement range

- 2.5 mV/g [0.25 mV/(m/s²)] sensitivity
- 0.7 Hz to 13 kHz frequency range
- 0.6 gram (0.02 oz) weight
- 2000 g (19.6k m/s²) amplitude range
- Adhesive mount
- Mating cable provided

2× Actual Size



Recommended cables and accessories ③❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

Ceramic Shear ICP® Accelerometers

MINIATURE
(*complete specifications are featured on pages* 1.26 *to* 1.29))

Miniature accelerometers are especially well suited for applications demanding high frequency range, small size, and light weight.

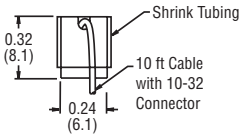
- NVH studies
- printed circuit boards
- card cages and chassis
- brackets
- thin panels
- shrouds
- conduits
- bearings

Model 352B10 — Lightweight, hermetically-sealed, titanium construction, adhesively installs with small footprint and achieves very high frequency range

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 1 Hz to 17 kHz frequency range
- 0.7 gram (0.03 oz) weight
- 500 g (4900 m/s²) amplitude range
- Adhesive mount

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: W — see pages xvii to xx for option information

Actual Size

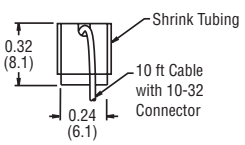


Model 352B01 — Lightweight, hermetically-sealed, titanium construction, adhesively installs with small footprint and achieves very high frequency range

- 1 mV/g [0.1 mV/(m/s²)] sensitivity
- 1 Hz to 20 kHz frequency range
- 0.7 gram (0.03 oz) weight
- 5000 g (49k m/s²) amplitude range
- Adhesive mount

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

Actual Size

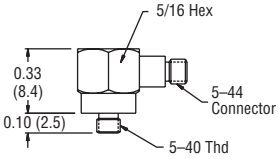


Model 352C65 — Side connector provides low profile, simplifies cable routing and strain relief

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 2 gram (0.07 oz) weight
- 50 g (490 m/s²) amplitude range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J, M, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

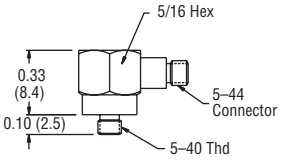
MINIATURE *Ceramic Shear* ICP® *Accelerometers (continued)*

Model 352C15 — Side connector provides low profile, simplifies cable routing and strain relief

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 2 gram (0.07 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

Actual Size

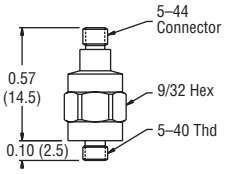


Model 352C66 — Installs with small footprint

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 2 gram (0.07 oz) weight
- 50 g (490 m/s²) amplitude range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J, M, W — see pages xvii to xx for option information

Actual Size

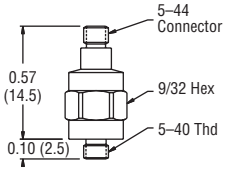


Model 352C16 — Installs with small footprint

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 16 kHz frequency range
- 2 gram (0.07 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

Actual Size

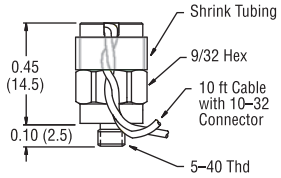


Model 352C67 — Installs with small footprint, low profile

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 2 gram (0.07 oz) weight
- 50 g (490 m/s²) amplitude range
- Field repairable, integral cable

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J, M, W — see pages xvii to xx for option information

Actual Size



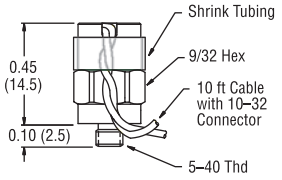
MINIATURE *Ceramic Shear* ICP® *Accelerometers (continued)*

Model 352C17 — Installs with small footprint, low profile

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 16 kHz frequency range
- 2 gram (0.07 oz) weight
- 500 g (4900 m/s²) amplitude range
- Field repairable, integral cable

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

Actual Size



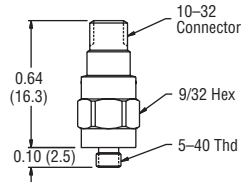
❶ **Model 352C68** — 10-32 connector joins to cables common to most accelerometers

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 2 gram (0.07 oz) weight
- 50 g (490 m/s²) amplitude range

Recommended cables and accessories ❷❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J, M, W — see pages xvii to xx for option information

CE

Actual Size



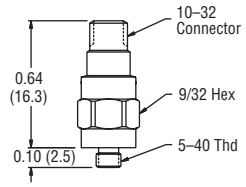
Model 352C18 — 10-32 connector joins to cables common to most accelerometers

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.07 Hz to 18 kHz frequency range
- 2 gram (0.07 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ❷❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

CE

Actual Size



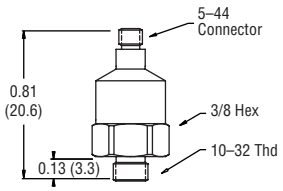
Model 352A60 — Achieves extremely high frequencies

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 5 Hz to 60 kHz frequency range (± 3 dB)
- 6 gram (0.21 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ❶❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

CE

Actual Size



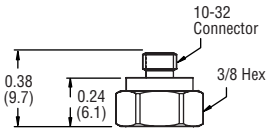
Dimensions shown are in inches (millimeters).

MINIATURE *Ceramic Shear* ICP® *Accelerometers (continued)*

Model 352C41 — Lightweight, adhesive mount, ideal for structural testing

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.3 Hz to 15 kHz frequency range
- 2.8 gram (0.10 oz) weight
- 500 g (4900 m/s²) amplitude range
- Adhesive mount

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

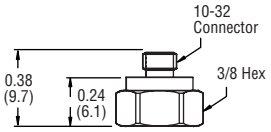


Actual Size

Model 352C42 — Lightweight, adhesive mount, ideal for structural testing

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 15 kHz frequency range
- 2.8 gram (0.10 oz) weight
- 50 g (490 m/s²) amplitude range
- Adhesive mount

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

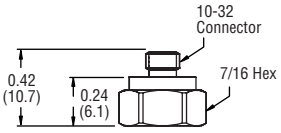


Actual Size

Model 352C43 — Lightweight, adhesive mount, ideal for structural testing

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.5 Hz to 10 kHz frequency range
- 3 gram (0.10 oz) weight
- 500 g (4900 m/s²) amplitude range
- Adhesive mount
- Electrically ground isolated

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

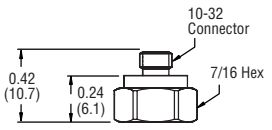


Actual Size

Model 352C44 — Lightweight, adhesive mount, ideal for structural testing

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.5 Hz to 10 kHz frequency range
- 3 gram (0.1 oz) weight
- 50 g (490 m/s²) amplitude range
- Adhesive mount
- Electrically ground isolated

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT — see pages xvii to xx for option information



Actual Size

Ceramic Shear ICP® Accelerometers

MINIATURE *Ceramic Shear* ICP® *Accelerometers (continued)*

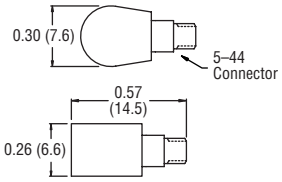
Model 352A56 — Smallest, TEDS compliant, single-axis accelerometer

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.5 Hz to 10 kHz frequency range (± 5%)
- 1.8 gram (0.06 oz) weight
- 50 g (490 m/s²) amplitude range
- Adhesive mount
- TEDS compliant

TEDS CIRCUITRY COMPATIBLE

CE

Actual Size



Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: TLA, TLB,TLC — see pages xvii to xx for option information

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LOW PROFILE (*complete specifications are featured on page* 1.30)

Low profile sensors offer specific advantages in space restricted installations or when it is necessary to minimize aerodynamic drag.

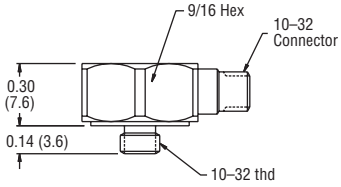
- wind tunnels
- road tests
- flight test

Model 338C04 — Low profile, high sensitivity

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 4.6 gram (0.16 oz) weight
- 50 g (490 m/s²) amplitude range

CE

Actual Size



Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, M, W — see pages xvii to xx for option information

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THROUGH HOLE (*complete specifications are featured on page* 1.31)

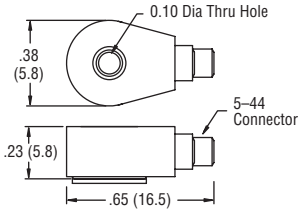
Through hole mounting configurations install conveniently, with a through bolt, may be rotated to achieve desired orientation of their electrical connection, and are low in profile, which permits use in tight installations.

Model 355B12 — PCB's smallest through hole mount accelerometer

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.6 Hz to 15 kHz frequency range
- 2.3 gram (0.08 oz) weight
- 500 g (4900 m/s²) amplitude range
- Electrically ground isolated

CE

Actual Size



Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Dimensions shown are in inches (millimeters).

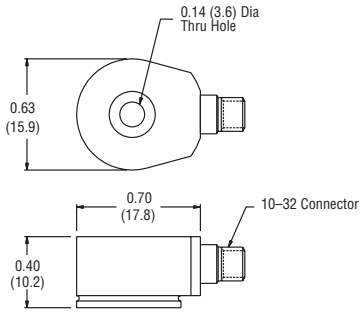
THROUGH HOLE *Ceramic Shear* ICP® *Accelerometers (continued)*

Model 355B02 — HIgh range

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.6 Hz to 12 kHz frequency range
- 10 gram (0.35 oz) weight
- 500 g (4900 m/s²) amplitude range
- Electrically ground isolated

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, M, W — see pages xvii to xx for option information

Actual Size

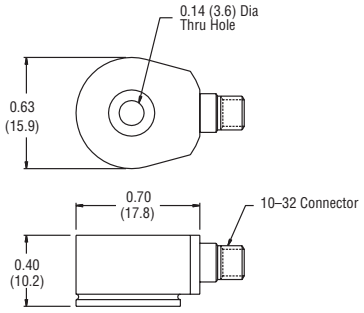


Model 355B03 — General purpose

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.6 Hz to 12 kHz frequency range
- 10 gram (0.35 oz) weight
- 50 g (490 m/s²) amplitude range
- Electrically ground isolated

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, M, W — see pages xvii to xx for option information

Actual Size

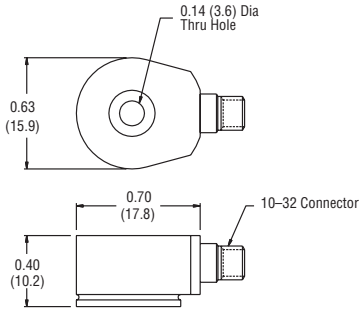


Model 355B04 — High sensitivity

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.6 Hz to 12 kHz frequency range
- 11.2 gram (0.4 oz) weight
- 5 g (49 m/s²) amplitude range
- Electrically ground isolated

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M, W — see pages xvii to xx for option information

Actual Size



Ceramic Shear ICP® Accelerometers

HIGH RESOLUTION
(*complete specifications are featured on pages* 1.32 *to* 1.33)

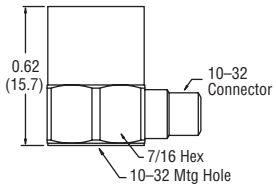
High resolution accelerometers possess excellent signal-to-noise ratios for conducting very low amplitude vibration and motion measurements.

Model 352C33 — Good choice for general purpose vibration and low amplitude shock measurements

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 15 kHz frequency range
- 5.8 gram (0.20 oz) weight
- 50 g (490 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, T, W — see pages xvii to xx for option information

Actual Size

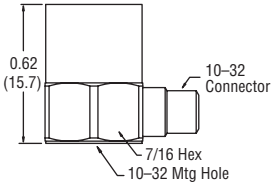


Model 352C03 — Good choice for high amplitude vibration and medium amplitude shock measurements

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.3 Hz to 15 kHz frequency range
- 5.8 gram (0.20 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, T, W — see pages xvii to xx for option information

Actual Size

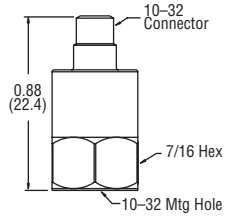


Model 352C34 — Good choice for general purpose vibration and low amplitude shock measurements

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 15 kHz frequency range
- 5.8 gram (0.20oz) weight
- 50 g (490 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, T, W — see pages xvii to xx for option information

Actual Size

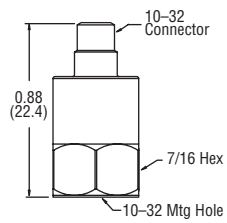


Model 352C04 — Good choice for high amplitude vibration and medium amplitude shock measurements

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.3 Hz to 15 kHz frequency range
- 5.8 gram (0.20 oz) weight
- 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, T, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

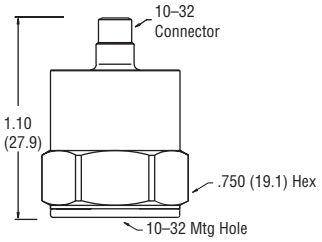
HIGH RESOLUTION *Ceramic Shear* ICP® *Accelerometers (continued)*

Model 352B — Provides high sensitivity, good resolution, and high frequency in a small size

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 1 Hz to 15 kHz frequency range
- 25 gram (0.9 oz) weight
- 5 g (49 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

Ceramic Shear ICP® Accelerometers

Teardrop Ceramic Shear ICP® Accelerometer Specifications						
Model Number [1]	**352A21**		**352C22**		**352C23**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	5 mV/g	0.51 mV/(m/s²)
Sensitivity Tolerance	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 1000 g pk	± 9800 m/s² pk
Frequency Range (± 5%)	1.0 to 10k Hz	1.0 to 10k Hz	1.0 to 10k Hz	1.0 to 10k Hz	2.0 to 10k Hz	2.0 to 10k Hz
Frequency Range (± 10%)	0.7 to 13k Hz	0.7 to 13k Hz	0.7 to 13k Hz	0.7 to 13k Hz	1.5 to 15k Hz	1.5 to 15k Hz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 70 kHz	≥ 70 kHz
Broadband Resolution (1 to 10k Hz)	0.002 g rms	0.02 m/s² rms	0.002 g rms	0.02 m/s² rms	0.003 g rms	0.03 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC
Discharge Time Constant	1.0 to 3.5 sec	1.0 to 3.5 sec	1.0 to 3.5 sec	1.0 to 3.5 sec	0.1 to 1.0 sec	0.1 to 1.0 sec
Electrical Isolation (Base)	N/A	N/A	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum
Sealing	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Size (Height × Length × Width)	0.14 in × 0.45 in × 0.25 in (3.6 mm × 11.4 mm × 6.4 mm)		0.14 in × 0.45 in × 0.25 in (3.6 mm × 11.4 mm × 6.4 mm)		0.11 in × 0.34 in × 0.16 in (2.8 mm × 8.6 mm × 4.1 mm)	
Weight	0.02 oz	0.6 gm	0.017 oz	0.5 gm	0.007 oz	0.2 gm
Electrical Connection	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side
Mounting	Adhesive	Adhesive	Adhesive	Adhesive	Adhesive	Adhesive
Supplied Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Quick Bonding Gel	—		—		—	
Removal Tool	039A27		039A27		039A26	
Cable	030A10		030A10		030A10	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1	
Additional Accessories [3]						
Mating Cable Connectors	EK		EK		EK	
Recommended Stock Cables	030		030		030	
Options [5]						
Available Options	NA		NA		NA	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Teardrop Ceramic Shear ICP® Accelerometer Specifications				
Model Number [1]	**352A24**		**352A25**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)	2.5 mV/g	0.25 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 15%	± 15%
Measurement Range	± 50 g pk	± 490 m/s² pk	± 2000 g pk	± 19.6k m/s² pk
Frequency Range (± 5%)	1.0 to 8000 Hz	1.0 to 8000 Hz	1.0 to 10k Hz	1.0 to 10k Hz
Frequency Range (± 10%)	0.8 to 10k Hz	0.8 to 10k Hz	0.7 to 13k Hz	0.7 to 13k Hz
Resonant Frequency	≥ 30 kHz	≥ 30 kHz	≥ 80 kHz	≥ 80 kHz
Broadband Resolution (1 to 10k Hz)	0.0002 g rms	0.002 m/s² rms	0.01 g rms	0.1 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental				
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical				
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	7 to 11 VDC	7 to 11 VDC
Discharge Time Constant	0.4 to 1.5 sec	0.4 to 1.5 sec	1.0 to 3.5 sec	1.0 to 3.5 sec
Electrical Isolation (Base)	> 10^8 ohms	> 10^8 ohms	N/A	N/A
Physical				
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Anodized Aluminum	Anodized Aluminum	Titanium	Titanium
Sealing	Epoxy	Epoxy	Epoxy	Epoxy
Size (Height × Length × Width)	0.19 in × 0.48 in × 0.28 in (4.8 mm × 12.2 mm × 7.1 mm)		0.14 in × 0.45 in × 0.25 in (3.6 mm × 11.4 mm × 6.4 mm)	
Weight	0.03 oz	0.8 gm	0.02 oz	0.6 gm
Electrical Connection	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side
Mounting	Adhesive	Adhesive	Adhesive	Adhesive
Supplied Accessories [3]				
Petro Wax	080A109		080A109	
Quick Bonding Gel	—		080A90	
Removal Tool	039A28		039A27	
Cable	030A10		030A10	
NIST Calibration [4]	ACS-1		ACS-1	
Additional Accessories [3]				
Mating Cable Connectors	EK		EK	
Recommended Stock Cables	030		030	
Options [5]				
Available Options	NA		NA	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Ceramic Shear ICP® Accelerometers

Miniature Ceramic Shear ICP® Accelerometer Specifications								
Model Number [1]	**352B01**		**352B10**		**352C15**		**352C16**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	1 mV/g	0.1 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 15%	± 15%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 5000 g pk	± 49k m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	2 to 10k Hz	2 to 10k Hz	2 to 10k Hz	2 to 10k Hz	1 to 12k Hz	1 to 12k Hz	1 to 12k Hz	1 to 12k Hz
Frequency Range (± 10%)	1 to 20k Hz	1 to 20k Hz	1 to 17k Hz	1 to 17k Hz	0.7 to 18k Hz	0.7 to 18k Hz	0.7 to 16k Hz	0.7 to 16k Hz
Resonant Frequency	≥ 65 kHz	≥ 65 kHz	≥ 65 kHz	≥ 65 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz
Broadband Resolution (1 to 10k Hz)	0.02 g rms	0.2 m/s² rms	0.003 g rms	0.03 m/s² rms	0.0005 g rms	0.005 m/s² rms	0.0005 g rms	0.005 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.3 to 1.0 sec	0.3 to 1.0 sec	0.3 to 1.0 sec	0.3 to 1.0 sec	0.4 to 1.2 sec	0.4 to 1.2 sec	0.4 to 1.2 sec	0.4 to 1.2 sec
Electrical Isolation	N/A	N/A	N/A	N/A	Optional	Optional	Optional	Optional
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	0.32 in × 0.24 in [8] (8.1 mm × 6.1 mm) [8]		0.32 in × 0.24 in [8] (8.1 mm × 6.1 mm) [8]		5/16 in × 0.43 in (5/16 in × 10.9 mm)		9/32 in × 0.67 in (9/32 in × 17.0 mm)	
Weight	0.03 oz	0.7 gm	0.03 oz	0.7 gm	0.07 oz	2.0 gm	0.07 oz	2.0 gm
Electrical Connection	Integral Cable [7]	Integral Cable [7]	Integral Cable [7]	Integral Cable [7]	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top	Side	Side	Top	Top
Cable Termination	10-32 Coaxial Plug	10-32 Coaxial Plug	10-32 Coaxial Plug	10-32 Coaxial Plug	N/A	N/A	N/A	N/A
Cable Length	10 ft	3 m	10 ft	3 m	N/A	N/A	N/A	N/A
Cable Type [3]	030AD010EB	030AD010EB	030AD010EB	030AD010EB	N/A	N/A	N/A	N/A
Mounting Thread	Adhesive	Adhesive	Adhesive	Adhesive	5-40 Male	5-40 Male	5-40 Male	5-40 Male
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Quick Bonding Gel	080A90		080A90		—		—	
Adhesive Mounting Base	—		—		080A15		080A15	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	N/A		N/A		080A30		080A30	
Triaxial Mounting Adaptor	N/A		N/A		080B16		080B16	
Mating Cable Connectors	AL		AL		AF, AG		AF, AG	
Connector Adaptor	070A02		070A02		N/A		N/A	
Recommended Stock Cables	N/A		N/A		003, 018		003, 018	
Options [5]								
Available Options	N/A		W		A, J, M, W		A, J, M, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[7] Supplied with cable attached to solder pins on sensor. [8] Height × Diameter.

Dimensions shown are in inches (millimeters).

Miniature Ceramic Shear ICP® Accelerometer Specifications								
Model Number [1]	**352C17**		**352C18**		**352C41**		**352C42**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	1 to 12k Hz	1 to 12k Hz	1 to 12k Hz	1 to 12k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz
Frequency Range (± 10%)	0.7 to 16k Hz	0.7 to 16k Hz	0.7 to 18k Hz	0.7 to 18k Hz	0.3 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 30 kHz	≥ 30 kHz	≥ 30 kHz	≥ 30 kHz
Broadband Resolution (1 to 10k Hz)	0.0005 g rms	0.005 m/s² rms	0.0005 g rms	0.005 m/s² rms	0.0008 g rms	0.008 m/s² rms	0.0005 g rms	0.005 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC
Discharge Time Constant	0.4 to 1.2 sec	0.4 to 1.2 sec	0.4 to 1.2 sec	0.4 to 1.2 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Electrical Isolation	Optional	Optional	Optional	Optional	N/A	N/A	N/A	N/A
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	9/32 in × 0.67 in	9/32 in × 17.0 mm	9/32 in × 0.74 in	9/32 in × 18.8 mm	3/8 in × 0.38 in	3/8 in × 9.7 mm	3/8 in × 0.38 in	3/8 in × 9.7 mm
Weight	0.07 oz	2.0 gm	0.07 oz	2.0 gm	0.10 oz	2.8 gm	0.10 oz	2.8 gm
Electrical Connection	Integral Cable [7]	Integral Cable [7]	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top	Top	Top	Top	Top
Cable Termination	10-32 Coaxial Plug	10-32 Coaxial Plug	N/A	N/A	N/A	N/A	N/A	N/A
Cable Length	10 ft	3 m	N/A	N/A	N/A	N/A	N/A	N/A
Cable Type [3]	031AD010EB	031AD010EB	N/A	N/A	N/A	N/A	N/A	N/A
Mounting Thread	5-40 Male	5-40 Male	5-40 Male	5-40 Male	Adhesive	Adhesive	Adhesive	Adhesive
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Quick Bonding Gel	—		—		080A90		080A90	
Adhesive Mounting Base	080A15		080A15		—		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A30		080A30		N/A		N/A	
Triaxial Mounting Adaptor	080B16		080B16		N/A		N/A	
Mating Cable Connectors	AL		EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW	
Connector Adaptor	070A02		N/A		N/A		N/A	
Recommended Stock Cables	N/A		002, 003		002, 003		002, 003	
Options [5]								
Available Options	A, J, M, W		A, J, M, W		N/A		N/A	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[7] Supplied with cable attached to solder pins on sensor.

Ceramic Shear ICP® Accelerometers

Miniature Ceramic Shear ICP® Accelerometer Specifications								
Model Number [1]	**352C43**		**352C44**		**352A56**		**352A60**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 15%	± 15%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	1 to 8000 Hz	1 to 8000 Hz	1 to 8000 Hz	1 to 8000 Hz	0.5 to 10k Hz	0.5 to 10k Hz	N/A	N/A
Frequency Range (± 10%)	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	N/A	N/A	5 to 60k Hz [6]	5 to 60k Hz [6]
Resonant Frequency	≥ 30 kHz	≥ 30 kHz	≥ 30 kHz	≥ 30 kHz	≥ 45 kHz	≥ 45 kHz	≥ 95 kHz	≥ 95 kHz
Broadband Resolution (1 to 10k Hz)	0.0008 g rms	0.008 m/s² rms	0.0005 g rms	0.0005 g rms	0.0006 g rms	0.006 m/s² rms	0.002 g rms	0.02 m/s² rms
Non-Linearity [2]	≤ 1 %	≤1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
TEDS Compliant	N/A	N/A	N/A	N/A	Yes	Yes	N/A	N/A
Environmental								
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to 250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	20 to 30 VDC	20 to 30 VDC	22 to 30 VDC	22 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 600 ohms	≤ 600 ohms	≤ 200 ohms	≤ 200 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC	8.5 to 14.5 VDC	8.5 to 14.5 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 1.5 sec	0.5 to 1.5 sec	0.02 to 0.06 sec	0.02 to 0.06 sec
Electrical Isolation	$>10^8$ ohms	$>10^8$ ohms	$>10^8$ ohms	$>10^8$ ohms	N/A	N/A	N/A	N/A
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Stainless Steel	Stainless Steel
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	7/16 in × 0.42 in	7/16 in × 10.7 mm	7/16 in × 0.42 in	7/16 in × 10.7 mm	0.26 × 0.57 × 0.30 in [7]	6.6 × 14.5 × 7.6 mm [7]	3/8 in × 0.81 in	3/8 in × 20.6 mm
Weight	0.10 oz	3.0 gm	0.10 oz	3.0 gm	0.06 oz	1.8 gm	0.21 oz	6 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top	Side	Side	Top	Top
Cable Termination	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cable Length	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cable Type [3]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mounting Thread	Adhesive	Adhesive	Adhesive	Adhesive	Adhesive	Adhesive	10-32 Male	10-32 Male
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		—	
Quick Bonding Gel	080A90		080A90		—		—	
Removal Tool	—		—		039A31		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	N/A		N/A		N/A		N/A	
Triaxial Mounting Adaptor	N/A		N/A		N/A		N/A	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW		AF, AG		AF, AG	
Connector Adaptor	N/A		N/A		N/A		N/A	
Recommended Stock Cables	002, 003		002, 003		003, 018		003, 018	
Options [5]								
Available Options	N/A		HT		TLA, TLB, TLC		N/A	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Frequency Range ± 3 dB. [7] Height × Length × Width.

Dimensions shown are in inches (millimeters).

Ceramic Shear ICP® Accelerometers

Miniature Ceramic Shear ICP® Accelerometer Specifications								
Model Number [1]	**352C65**		**352C66**		**352C67**		**352C68**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz
Frequency Range (± 10%)	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz
Broadband Resolution (1 to 10k Hz)	0.00016 g rms	0.0015 m/s² rms	0.00016 g rms	0.0015 m/s² rms	0.00016 g rms	0.0015 m/s² rms	0.00016 g rms	0.0015 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +200 °F	-54 to +93 °C	-65 to +200 °F	-54 to +93 °C	-65 to +200 °F	-54 to +93 °C	-65 to +200 °F	-53 to +93 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec
Electrical Isolation	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	5/16 in × 0.42 in	5/16 in × 10.7 mm	9/32 in × 0.66 in	9/32 in × 16.8 mm	9/32 in × 0.54 in	9/32 in × 13.7 mm	9/32 in × 0.73 in	9/32 in × 18.5 mm
Weight	0.07 oz	2.0 gm	0.07 oz	2.0 gm	0.07 oz	2.0 gm	0.07 oz	2.0 gm
Electrical Connection	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	Integral Cable [7]	Integral Cable [7]	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Top	Top	Top	Top
Cable Termination	N/A	N/A	N/A	N/A	10-32 Coaxial Plug	10-32 Coaxial Plug	N/A	N/A
Cable Length	N/A	N/A	N/A	N/A	10 ft	3 m	N/A	N/A
Cable Type [3]	N/A	N/A	N/A	N/A	031AD010EB	031AD010EB	N/A	N/A
Mounting Thread	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male	5-40 Male
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Quick Bonding Gel	—		—		—		—	
Adhesive Mounting Base	080A15		080A15		080A15		080A16	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A30		080A30		080A30		080A30	
Triaxial Mounting Adaptor	080B16		080B16		080B16		080B16	
Mating Cable Connectors	AF, AG		AF, AG		AL		EB, AH, AK, AW	
Connector Adaptor	N/A		N/A		070A02		N/A	
Recommended Stock Cables	003, 018		003, 018		N/A		002, 003	
Options [5]								
Available Options	A, HT, J, M, W		A, HT, J, M, W		A, HT, J, M, W		A, HT, J, M, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Frequency Range ± 3 dB.

Low Profile Ceramic Shear ICP® Accelerometer Specifications		
Model Number [1]	**338C04**	
Performance	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%
Measurement Range	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	0.5 to 10k Hz	0.5 to 10k Hz
Frequency Range (± 10%)	0.3 to 12k Hz	0.3 to 12k Hz
Resonant Frequency	≥ 35 kHz	≥ 35 kHz
Broadband Resolution (1 to 10k Hz)	0.00018 g rms	0.0018 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%
Environmental		
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +200 °F	-53 to +93 °C
Electrical		
Excitation Voltage	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 300 ohms	≤ 300 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.8 to 2.4 sec	0.8 to 2.4 sec
Physical		
Sensing Element	Ceramic	Ceramic
Sensing Geometry	Shear	Shear
Housing Material	Titanium	Titanium
Sealing	Hermetic	Hermetic
Size (Hex × Height)	9/16 in × 0.30 in	9/16 × 7.6 mm
Weight	0.16 oz	4.6 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side
Mounting Thread	10-32 Male	10-32 Male
Supplied Accessories [3]		
Petro Wax	080A109	
Adhesive Mounting Base	080A12	
NIST Calibration [4]	ACS-1	
Additional Accessories [3]		
Magnetic Mounting Base	N/A	
Triaxial Mounting Adaptor	080B10	
Mating Cable Connectors	EB, AH, AK, AW	
Recommended Stock Cables	018, 002, 003	
Options [5]		
Available Options	A, M, W	

NOTES:

[1] See note regarding accuracy of information on inside front cover.

[2] Zero-based, least-squares, straight line method.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Ceramic Shear ICP® Accelerometers

Through Hole Ceramic Shear ICP® Accelerometer Specifications								
Model Number [1]	**355B02**		**355B03**		**355B04**		**355B12**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	1000 mV/g	102 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 50 g pk	± 490 m/s² pk	± 5 g pk	± 49 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 10k Hz	1 to 8000 Hz	1 to 8000 Hz	1 to 10k Hz	1 to 10k Hz
Frequency Range (± 10%)	0.6 to 12k Hz	0.6 to 12k Hz	0.6 to 12k Hz	0.6 to 12k Hz	0.6 to 12k Hz	0.6 to 12k Hz	0.6 to 15k Hz [6]	0.6 to 15k Hz [6]
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 30 kHz	≥ 30 kHz	≥ 50 kHz	≥ 50 kHz
Broadband Resolution (1 to 10k Hz)	0.0005 g rms	0.005 m/s² rms	0.0001 g rms	0.0009 m/s² rms	0.0001 g rms	0.001 m/s² rms	0.0005 g rms	0.005 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +200 °F	-54 to +93 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 4 mA	2 to 4 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 200 ohms	≤ 200 ohms	≤ 1000 ohms	≤ 1000 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	7 to 13 VDC	7 to 13 VDC	7 to 13 VDC	7 to 13 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Electrical Isolation (Base)	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms [7]	>10^8 ohms [7]
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.40 in × 0.95 in × 0.63 in (10.2 mm × 24.1 mm × 16.0 mm)		0.40 in × 0.95 in × 0.63 in (10.2 mm × 24.1 mm × 16.0 mm)		0.40 in × 0.95 in × 0.63 in (10.2 mm × 24.1 mm × 16.0 mm)		0.23 in × 0.65 in × 0.38 in (5.84 mm × 16.4 mm × 9.6 mm)	
Weight	0.35 oz	10 gm	0.35 oz	10 gm	0.4 oz	11.2 gm	0.08 oz	2.3 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side	Side	Side
Mounting	Through Hole	Through Hole	Through Hole	Through Hole	Through Hole	Through Hole	Through Hole	Through Hole
Supplied Accessories [3]								
Petro Wax	080A019		080A019		080A019		—	
Cap Screw	081A45		081A45		081A45		081A36 [8]	
Allen Wrench	039A22		039A22		039A22		039A20	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	N/A		N/A		N/A		N/A	
Triaxial Mounting Adaptor	N/A		N/A		N/A		N/A	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW		AF, AG	
Recommended Stock Cables	002, 003		002, 003		002, 003		018, 002, 003	
Options [5]								
Available Options	A, M, W		A, M, W		M, W		M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Approximately 13 kHz with off ground washer. [7] Only when using off ground washer. [8] Includes off ground washer.

Ceramic Shear ICP® Accelerometers

High Resolution Ceramic Shear ICP® Accelerometer Specifications						
Model Number [1]	**352B**		**352C03**		**352C04**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	1000 mV/g	102 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 5%	± 5%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 5 g pk	± 49 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	2 to 10k Hz	2 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz
Frequency Range (± 10%)	1 to 15k Hz	1 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz
Resonant Frequency	≥ 25 kHz	≥ 25 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz
Broadband Resolution (1 to 10k Hz)	0.00008 g rms	0.0008 m/s² rms	0.0005 g rms	0.005 m/s² rms	0.0005 g rms	0.005 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit	± 1000 g pk	± 9800 m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range	-65 to +200 °F	-54 to +93 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical						
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 500 ohms	≤ 500 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 14 VDC	8 to 14 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC
Discharge Time Constant	0.1 to 0.6 sec	0.1 to 0.6 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	3/4 in × 1.10 in	3/4 × 27.9 mm	7/16 in × 0.62 in	7/16 in × 15.7 mm	7/16 in × 0.88 in	7/16 in × 22.4 mm
Weight	0.9 oz	25 gm	0.20 oz	5.8 gm	0.20 oz	5.8 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Side	Side	Top	Top
Mounting	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Adhesive Mounting Base	080A12		080A		080A	
Mounting Stud	081B05		081B05		081B05	
Metric Mounting Stud	M081B05		M081B05		M081B05	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1	
Additional Accessories [3]						
Magnetic Mounting Base	080A27		080A27		080A27	
Triaxial Mounting Adaptor	080B11		080B10		080B10	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW		EB, AH, AK, AW	
Recommended Stock Cables	002, 003		002, 003		002, 003	
Options [5]						
Available Options	J, W		J, T, W		J, T, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

High Resolution Ceramic Shear ICP® Accelerometer Specifications				
Model Number [1]	**352C33**		**352C34**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz
Frequency Range (± 10%)	0.3 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz	0.3 to 15k Hz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz
Broadband Resolution (1 to 10k Hz)	0.00015 g rms	0.0015 m/s² rms	0.00015 g rms	0.0015 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental				
Overload Limit	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range	-65 to +200 °F	-54 to +93 °C	-65 to +200 °F	-54 to +93 °C
Electrical				
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC
Discharge Time Constant	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec
Physical				
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	7/16 in × 0.62 in	7/16 in × 15.7 mm	7/16 in × 0.88 in	7/16 in × 22.4 mm
Weight	0.20 oz	5.8 gm	0.20 oz	5.8 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top
Mounting	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]				
Petro Wax	080A109		080A109	
Adhesive Mounting Base	080A		080A	
Mounting Stud	081B05		081B05	
Metric Mounting Stud	M081B05		M081B05	
NIST Calibration [4]	ACS-1		ACS-1	
Additional Accessories [3]				
Magnetic Mounting Base	080A27		080A27	
Triaxial Mounting Adaptor	080B10		080B10	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW	
Recommended Stock Cables	002, 003		002, 003	
Options [5]				
Available Options	J, T, W		J, T, W	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

PCB accelerometers are used extensively throughout the automotive and aerospace industries to qualify designs, improve performance, and test structural integrity.

Dimensions shown are in inches (millimeters).

ICP® and Charge Output Triaxial Accelerometers

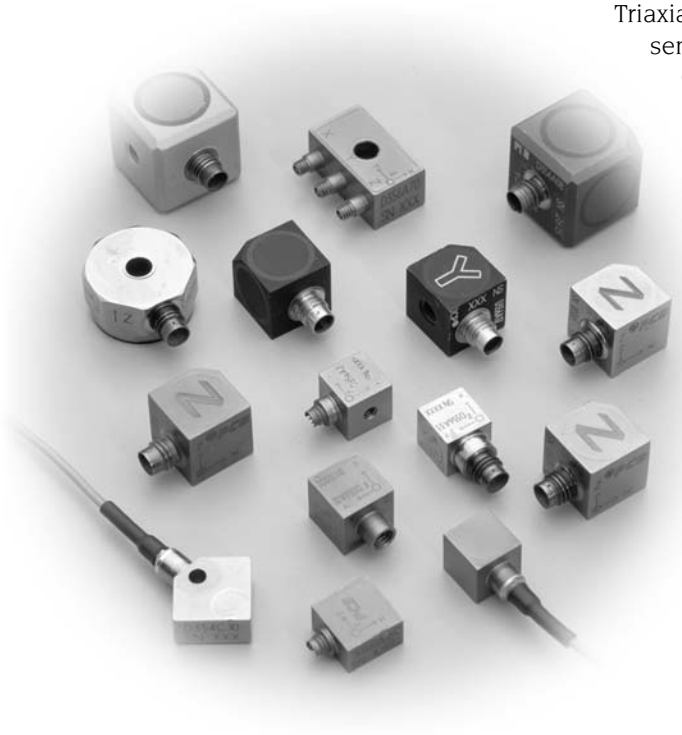
- **Simultaneous x, y, and z axis measurements**
- **Engine vibration and NVH studies**
- **Modal analysis**
- **Road response tests**
- **Vehicle testing**
- **Flight testing**
- **Package testing**
- **Squeak and rattle**

PCB's triaxial accelerometers simultaneously measure vibration or shock in three orthogonal directions. They are structured with three independent sensing elements oriented for response to motion along the x, y, and z axes. The elements are protected inside a precision-machined, laser-welded metallic housing.

Triaxial ICP® accelerometers feature built-in microelectronic signal conditioning circuitry which provides clean, low-impedance voltage output signals capable of being transmitted over long cable lengths. Multi-conductor cable assemblies offer simple, single-point hook-up to the triaxial accelerometer and ease cable routing on and around the test specimen. Multi-channel signal conditioners are available for powering triaxial ICP® accelerometers and interfacing their measurement signals to readout, recording, and analysis instrumentation.

Charge output triaxial accelerometers are capable of operation to 490 °F (254 °C), permitting measurements in extreme environments and with existing charge amplified systems.

Triaxial accelerometers are available in a variety of sizes and sensitivities to suit specific application requirements. Choose miniature, lightweight units for high-frequency response, minimized mass loading, and installation in space restricted locations. Low profile designs are ideal for on-road or wind tunnel testing of exterior body panels. Through-hole mount units simplify axis and electrical connector orientation while controlling cable routing along the test specimen. Structural analysis units exhibit excellent phase response characteristics and are constructed of aluminum to yield the lowest mass for minimized mass loading effects. Filtered output units avoid high frequency overload as may be encountered with engine NVH and drive train measurements.



PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Triaxial Accelerometers

MINIATURE *Triaxial* ICP® *Accelerometers*
(*complete specifications are featured on pages* 1.43 *to* 1.44)

Miniature triaxial accelerometers are especially well suited for applications demanding high frequency range, small size, and light weight.

- printed circuit boards
- thin panels
- structural testing
- modal analysis
- brackets
- moving vehicles
- NVH
- wind tunnel testing

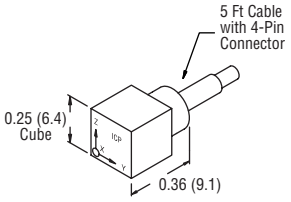
Model 356A01 — Smallest, cube shaped, triaxial accelerometer with integral cable

- 5 mV/g [0.5 mV/(m/s²)] sensitivity
- 2 Hz to 8000 Hz frequency range (± 5%)
- 1 gram (0.04 oz) weight
- ± 1000 g (9810 m/s²) amplitude range
- Adhesive mount

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT — see pages xvii to xx for option information

CE

Actual Size



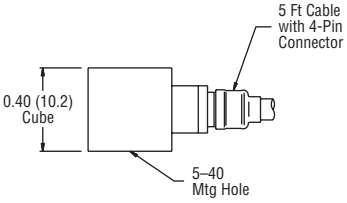
Model 356B10 — High-range, cube shaped, triaxial accelerometer with integral cable

- 1.0 mV/g [0.1 mV/(m/s²)] sensitivity
- 2 Hz to 10 kHz frequency range (± 5%)
- 4 gram (0.14 oz) weight
- ± 5000 g (49k m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

CE

Actual Size



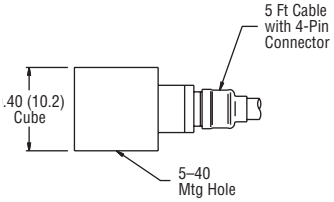
Model 356B11 — General purpose, cube shaped, triaxial accelerometer with integral cable

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 10 kHz frequency range (± 5%)
- 4 gram (0.14 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J, W — see pages xvii to xx for option information

CE

Actual Size



Dimensions shown are in inches (millimeters).

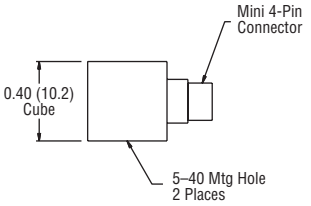
MINIATURE *Triaxial* ICP® *Accelerometers (continued)*

Model 356B20 — High-range, cube shaped, triaxial accelerometer with 4-pin connector

- 1 mV/g [0.1 mV/(m/s²)] sensitivity
- 2 Hz to 10 kHz frequency range (± 5%)
- 4 gram (0.14 oz) weight
- ± 5000 g (49k m/s²) amplitude range
- Mating cable assembly provided

Recommended cables and accessories ⑤ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT — see pages xvii to xx for option information

Actual Size

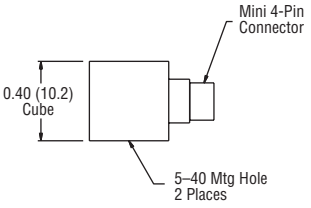


Model 356B21 — General purpose, cube-shaped, triaxial accelerometer with 4-pin connector

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 10 kHz frequency range (± 5%)
- 4 gram (0.14 oz) weight
- ± 500 g (4900 m/s²) amplitude range
- Mating cable assembly provided

Recommended cables and accessories ⑤ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J — see pages xvii to xx for option information

Actual Size



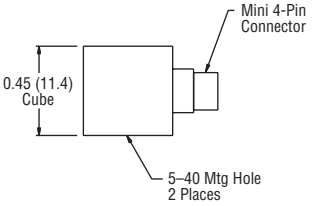
Model 356A32 — Smallest, 100 mV/g triaxial accelerometer with 4-pin connector

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.7 Hz to 5000 Hz frequency range
- 5.4 gram (0.19 oz) weight
- ± 50 g (491 m/s²) amplitude range
- Mating cable assembly provided

TEDS CIRCUITRY COMPATIBLE

Recommended cables and accessories ⑤ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

Actual Size

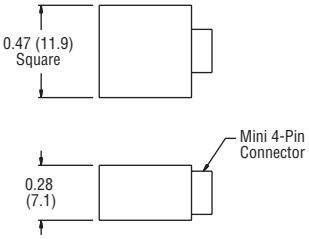


Model 356A24 — Lowest profile, lightweight, triaxial accelerometer with 4-pin connector

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.5 Hz to 12 kHz frequency range
- 3.1 gram (0.11 oz) weight
- ± 500 g (4900 m/s²) amplitude range
- Adhesive mount
- Mating cable assembly provided

Recommended cables and accessories ⑤ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT, J — see pages xvii to xx for option information

Actual Size



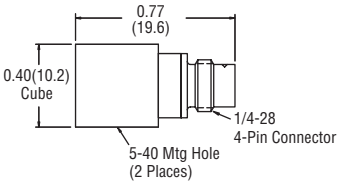
MINIATURE *Triaxial* ICP® *Accelerometers (continued)*

Model 356A33 — General-purpose, cube-shaped, triaxial accelerometer with rugged 4-pin connector

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 10 kHz frequency range (± 5%)
- 5.3 gram (0.19 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ④ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT — see pages xvii to xx for option information

Actual Size



GENERAL PURPOSE *Triaxial* ICP® *Accelerometers*
(*complete specifications are featured on page* 1.45)

For routine, triaxial shock and vibration measurements.

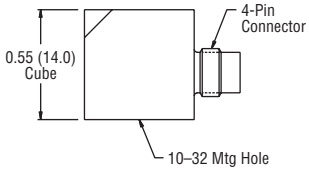
- package drop testing
- automotive studies
- motors and pumps
- household appliances

Model 356A02 — High range

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.5 Hz to 6000 Hz frequency range
- 10.5 gram (0.37 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT, T, TLA, TLB, TLC — see pages xvii to xx for option information

Actual Size

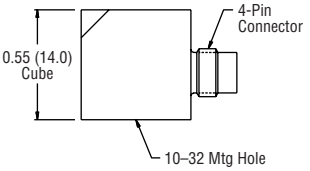


Model 356A25 — Mid range

- 25 mV/g [2.6 mV/(m/s²)] sensitivity
- 0.5 Hz to 6500 Hz frequency range
- 10.5 gram (0.37 oz) weight
- ± 200 g (1960 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

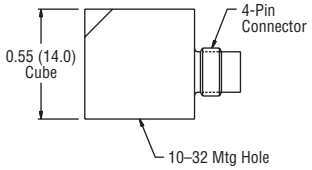
GENERAL PURPOSE *Triaxial* ICP® *Accelerometers (continued)*

Model 356A15 — Low noise

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 1.4 Hz to 6500 Hz frequency range
- 10.5 gram (0.37 oz) weight
- ± 50 g range (490 m/s²) amplitude range

TEDS CIRCUITRY COMPATIBLE

Actual Size



Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, J, T, TLA, TLB, TLC — see pages xvii to xx for option information

THROUGH HOLE *Triaxial* ICP® *Accelerometers*

(*complete specifications are featured on page* 1.46)

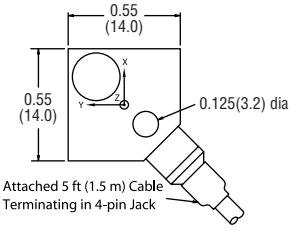
For general purpose or industrial use. Through hole mounting simplifies axis and connector orientation.

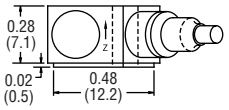
- package drop testing
- automotive studies
- motors and pumps
- household appliances

Model 354C10 — Low profile

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 8000 Hz frequency range (± 5%)
- 5 gram (0.18 oz) weight
- ± 500 g range (4900 m/s²) amplitude range
- Ground isolated

Actual Size





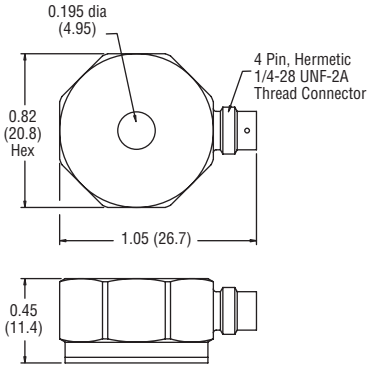
Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Model 354C02 — General purpose

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.3 Hz to 4000 Hz frequency range
- 15.5 gram (0.55 oz) weight
- ± 500 g range (4900 m/s²) amplitude range
- Ground isolated

TEDS CIRCUITRY COMPATIBLE

Actual Size



Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, HT, M, T, W — see pages xvii to xx for option information

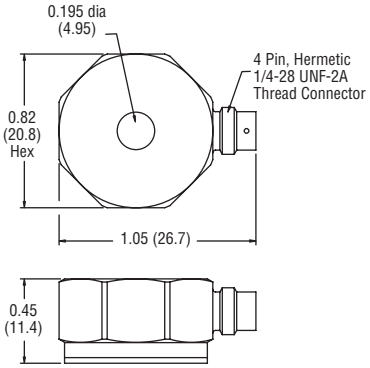
THROUGH HOLE *Triaxial* ICP® *Accelerometers (continued)*

Model 354C03 — Low noise

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 4000 Hz frequency range
- 15.5 gram (0.55 oz) weight
- ± 50 g (490 m/s²) amplitude range
- Ground isolated

TEDS CIRCUITRY COMPATIBLE

Actual Size



Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, M, T, W — see pages xvii to xx for option information

HIGH TEMPERATURE *Triaxial Charge-Output Piezoelectric Accelerometers*

(*complete specifications are featured on page* 1.47)

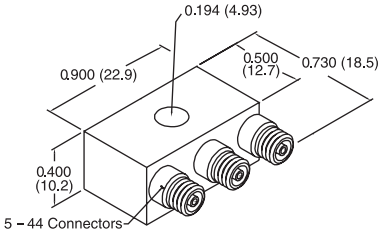
High temperature, charge-output, triaxial accelerometers deliver high-impedance measurement signals directly from their piezoelectric sensing elements. No internal circuitry is used, which permits operation to extreme temperatures.

- motors
- engines
- turbines
- steam pipes
- exhaust systems

Model 356A70 — Miniature, through-hole mount

- 2.7 pC/g [0.28 pC/(m/s²)] sensitivity
- 7000 Hz frequency range
- 7.9 gram (0.28 oz) weight
- ± 500 g (4900 m/s²) amplitude range
- -94 to +490 °F (-70 to +254 °C) temperature range

Actual Size

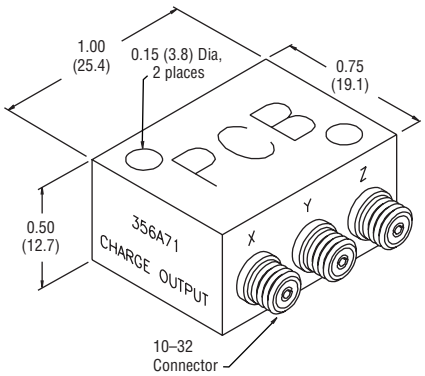


Recommended cables and accessories ① — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: M, P — see pages xvii to xx for option information

Model 356A71 — High sensitivity

- 10 pC/g [1.02 pC/(m/s²)] sensitivity
- 7000 Hz frequency range
- 22.7 gram (0.8 oz) weight
- ± 500 g (4900 m/s²) amplitude range
- -94 to +490 °F (-70 to +254 °C) temperature range

Actual Size



Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: M, P — see pages xvii to xx for option information

Dimensions shown are in inches (millimeters).

STRUCTURAL ANALYSIS ICP® ACCELEROMETERS

(*complete specifications are featured on page* 1.48)

Triaxial accelerometers for structural analysis are constructed of aluminum for lowest mass and exhibit excellent phase response and measurement resolution.

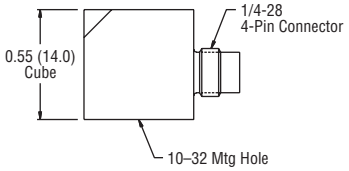
- modal analysis
- NVH
- structural testing
- vibration isolation
- optics
- micromachining

Model 356A16 — General purpose

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.3 Hz to 6000 Hz frequency range
- 7.4 gram (0.26 oz) weight
- ± 50 g (490 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, T — see pages xvii to xx for option information

Actual Size

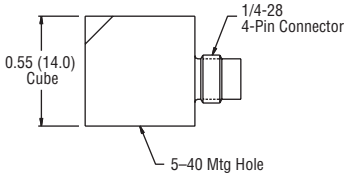


Model 356A17 — Mid range

- 500 mV/g [51 mV/(m/s²)] sensitivity
- 0.3 Hz to 4000 Hz frequency range
- 9.3 gram (0.33 oz) weight
- ± 10 g range (98 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J — see pages xvii to xx for option information

Actual Size

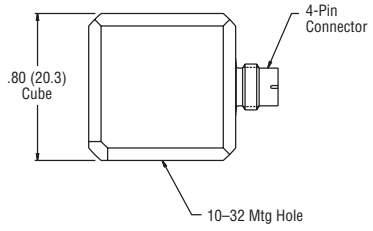


Model 356B18 — High sensitivity

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.3 Hz to 5000 Hz frequency range
- 25 gram (0.88 oz) lightweight aluminum housing
- ± 5 g range (49 m/s²) amplitude range
- 50 µg (0.5µm/s²) resolution

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, T — see pages xvii to xx for option information

Actual Size



Triaxial Accelerometers

FILTERED OUTPUT SIGNAL

(*complete specifications are featured on page* 1.49)

These triaxial ICP® accelerometers contain built in electrical filters to help prevent overloads due to excessive high frequency excitation.

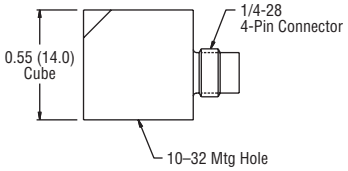
- engine NVH
- drive train studies

Model 356A66 — General purpose

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 4000 Hz frequency range (± 5%)
- 9 gram (0.32 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT, T, TLA, TLB, TLC — see pages xvii to xx for option information

Actual Size

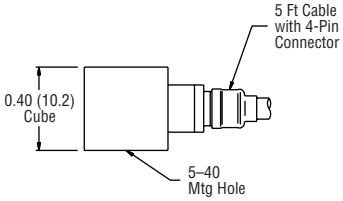


Model 356A61 — Integral cable, light weight

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 5000 Hz frequency range (± 5%)
- 4 gram (0.14 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

Actual Size

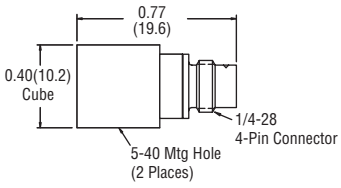


Model 356A63 — Rugged 4-pin connector

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 2 Hz to 5000 Hz frequency range (± 5%)
- 5.3 gram (0.19 oz) weight
- ± 500 g (4900 m/s²) amplitude range

Recommended cables and accessories ④❹ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: HT — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

Miniature Triaxial ICP® Accelerometer Specifications

Model Number [1]	356A01		356B10		356B11		356B20	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	5 mV/g	0.5 mV/(m/s²)	1.0 mV/g	0.1 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	1.0 mV/g	0.1 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 20%	± 20%	± 10%	± 10%	± 20%	± 20%
Measurement Range	± 1000 g pk	± 9810 m/s² pk	± 5000 g pk	± 49k m/s² pk	± 500 g pk	± 4900 m/s² pk	± 5000 g pk	± 49k m/s² pk
Frequency Range (± 5%) (Y & Z - axis)	2 to 8000 Hz	2 to 8000 Hz	2 to 10k Hz	2 to 10k Hz	2 to 10k Hz	2 to 10k Hz	2 to 10k Hz	2 to 10k Hz
Frequency Range (± 5%) (X-axis)	2 to 7000 Hz	2 to 7000 Hz	2 to 7000 Hz	2 to 7000 Hz	2 to 7000 Hz	2 to 7000 Hz	2 to 7000 Hz	2 to 7000 Hz
Frequency Range (± 5%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Frequency Range (± 10%)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 55 kHz	≥ 55 kHz	≥ 55 kHz	≥ 55 kHz	≥ 55 kHz	≥ 55 kHz
Broadband Resolution (1 to 10k Hz)	0.003 g rms	0.03 m/s² rms	0.03 g rms	0.29 m/s² rms	0.003 g rms	0.03 m/s² rms	0.03 g rms	0.29 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 2.5%	≤ 2.5%	≤ 1%	≤ 1%	≤ 2.5%	≤ 2.5%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 7000 g pk	± 68.6k m/s² pk	± 10k g pk	± 98k m/s² pk	± 7000 g pk	± 68.6k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC
Discharge Time Constant	0.3 to 1.0 sec	0.3 to 1.0 sec	2.5 to 4.5 sec	2.5 to 4.5 sec	0.3 to 1.0 sec	0.3 to 1.0 sec	1.5 to 3.0 sec	1.5 to 3.0 sec
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.25 in × 0.25 in × 0.25 in (6.35 mm × 6.35 mm × 6.35 mm)		0.4 in × 0.4 in × 0.4 in (10.2 mm × 10.2 mm × 10.2 mm)		0.4 in × 0.4 in × 0.4 in (10.2 mm × 10.2 mm × 10.2 mm)		0.4 in × 0.4 in × 0.4 in (10.2 mm x 10.2 mm x 10.2 mm)	
Weight	0.04 oz	1 gm	0.14 oz	4 gm	0.14 oz	4 gm	0.14 oz	4 gm
Electrical Connection	Integral Cable [6]	Integral Cable [6]	Integral Cable [6]	Integral Cable [6]	Integral Cable [6]	Integral Cable [6]	8-36 4-Pin Jack	8-36 4-Pin Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side	Side	Side
Cable Termination	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	N/A	N/A
Cable Length	5 ft	1.5 m	5 ft	1.5 m	5 ft	1.5 m	N/A	N/A
Cable Type [3]	034AD005CA	034AD005CA	034AD005CA	034AD005CA	034AD005CA	034AD005CA	N/A	N/A
Mounting Thread	Adhesive	Adhesive	5-40 Female	5-40 Female	5-40 Female	5-40 Female	5-40 Female	5-40 Female
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Quick Bonding Gel	080A90		—		—		—	
Adhesive Mounting Base	—		080A15		080A15		080A15	
Mounting Stud	—		081A27		081A27		081A27	
Metric Mounting Stud	—		M081A27		M081A27		M081A27	
Cable	034G05		034G05		034G05		034K10	
High G Shock Calibration [4]	—		ACS-14		—		ACS-14	
NIST Calibration [4]	ACS-1T		ACS-1T		ACS-1T		ACS-1T	
Additional Accessories [3]								
Magnetic Mounting Base	N/A		080A30		080A30		080A30	
Removal Tool	—		039A08		039A08		039A08	
Mating Cable Connectors	AY		AY		AY		EH	
Recommended Stock Cables	010, 034		010, 034		010, 034		034	
Options [5]								
Available Options	HT		N/A		A, HT, J, W		HT	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method. [3] See section 4 in this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information. [6] Supplied with cable attached to solder pins on sensor.

Dimensions shown are in inches (millimeters).

Triaxial Accelerometers

Miniature Triaxial ICP® Accelerometer Specifications								
Model Number [1]	**356B21**		**356A24**		**356A32**		**356A33**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 15%	± 15%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4905 m/s² pk	± 500 g pk	± 4905 m/s² pk	± 50 g pk	± 491 m/s² pk	±500 g pk	±4905 m/s² pk
Frequency Range (± 5%) (Y & Z - axis)	2 to 10k Hz	2 to 10k Hz	N/A	N/A	N/A	N/A	2 to 10k Hz	2 to 10k Hz
Frequency Range (± 5%) (X-axis)	2 to 7000 Hz	2 to 7000 Hz	N/A	N/A	N/A	N/A	2 to 7000 Hz	2 to 7000 Hz
Frequency Range (± 5%)	N/A	N/A	1 to 9000 Hz	1 to 9000 Hz	1.0 to 4000 Hz	1.0 to 4000 Hz	N/A	N/A
Frequency Range (± 10%)	N/A	N/A	0.5 to 12k Hz	0.5 to 12k Hz	0.7 to 5000 Hz	0.7 to 5000 Hz	N/A	N/A
Resonant Frequency	≥ 55 kHz	≥ 55 kHz	≥ 45 kHz	≥ 45 kHz	≥ 25 kHz	≥ 25 kHz	≥ 55 kHz	≥ 55 kHz
Broadband Resolution (1 to 10k Hz)	0.003 g rms	0.03 m/s² rms	0.002 g rms	0.02 m/s² rms	0.0003 g rms	0.003 m/s² rms	0.003 g rms	0.03 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 5000 g pk	± 49k m/s² pk	±10k g pk	±98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	22 to 30 VDC	22 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 16 VDC	7 to 16 VDC	7 to 11 VDC	7 to 11 VDC
Discharge Time Constant	0.3 to 1.0 sec	0.3 to 1.0 sec	1.0 to 3.5 sec	1.0 to 3.5 sec	0.5 to 1.5 sec	0.5 to 1.5 sec	0.3 to 1.0 sec	0.3 to 1.0 sec
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.4 in × 0.4 in × 0.4 in (10.2 mm × 10.2 mm × 10.2 mm)		0.28 in × 0.47 in × 0.47 in (7.0 mm × 12.0 mm × 12.0 mm)		0.45 in × 0.45 in × 0.45 in (11.4 mm × 11.4 mm × 11.4 mm)		0.4 in × 0.77 in × 0.4 in (10.2 mm × 19.6 mm × 10.2 mm)	
Weight	0.14 oz	4 gm	0.11 oz	3.1 gm	0.19 oz	5.4 gm	0.19 oz	5.3 gm
Electrical Connection	8-36 4-Pin Jack	8-36 4-Pin Jack	8-36 4-Pin Jack	8-36 4-Pin Jack	8-36 4-Pin Jack	8-36 4-Pin Jack	1/4-28 4-Pin	1/4-28 4-Pin
Electrical Connection Position	Side	Side	Side	Side	Side	Side	Side	Side
Cable Termination	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cable Length	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cable Type [3]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mounting Thread	5-40 Female	5-40 Female	Adhesive	Adhesive	5-40 Female	5-40 Female	5-40 Female	5-40 Female
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Quick Bonding Gel	—		080A90		—		—	
Adhesive Mounting Base	080A15		—		080A15		080A15	
Mounting Stud	081A27		—		081A27		081A27	
Metric Mounting Stud	M081A27		—		M081A27		M081A27	
Cable	034K10		034K10		034K10		—	
NIST Calibration [4]	ACS-1T		ACS-1T		ACS-1T		ACS-1T	
Additional Accessories [3]								
Magnetic Mounting Base	080A30		N/A		080A30		N/A	
Removal Tool	039A08		—		039A09		039A08	
Mating Cable Connectors	EH		EH		EH		AY	
Recommended Stock Cables	036		038		040		034	
Options [5]								
Available Options	A, HT, J		HT, J		T, TLA, TLB, TLC		HT	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

General Purpose Triaxial ICP® Accelerometer Specifications						
Model Number [1]	**356A02**		**356A15**		**356A25**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	25 mV/g	2.6 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 50 g pk	± 490 m/s² pk	± 200 g pk	± 1960 m/s² pk
Frequency Range (± 5%)	1 to 5000 Hz	1 to 5000 Hz	2 to 5000 Hz	2 to 5000 Hz	1 to 5000 Hz	1 to 5000 Hz
Frequency Range (± 10%)	0.5 to 6000 Hz	0.5 to 6000 Hz	1.4 to 6500 Hz	1.4 to 6500 Hz	0.5 to 6500 Hz	0.5 to 6500 Hz
Resonant Frequency	≥ 25 kHz	≥ 25 kHz	≥ 25 kHz	≥ 25 kHz	≥ 25 kHz	≥ 25 kHz
Broadband Resolution (1 to 10k Hz)	0.0005 g rms	0.005 m/s² rms	0.0002 g rms	0.002 m/s² rms	0.0002 g rms	0.002 m/s² rms
Non-Linearity [2]	≤ 1 % [6]	≤ 1 % [6]	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental						
Overload Limit (Shock)	± 7000 g pk	± 68.6k m/s² pk	± 7000 g pk	± 68.6k m/s² pk	± 7000 g pk	± 68.6k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical						
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	0.2 to 0.8 sec	0.2 to 0.8 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.55 in × 0.80 in × 0.55 in (14.0 mm × 20.3 mm × 14.0 mm)		0.55 in × 0.80 in × 0.55 in (14.0 mm × 20.3 mm × 14.0 mm)		0.55 in × 0.80 in × 0.55 in (14.0 mm × 20.3 mm x 14.0 mm)	
Weight	0.37 oz	10.5 gm	0.37 oz	10.5 gm	0.37 oz	10.5 gm
Electrical Connection	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side
Cable Termination	N/A	N/A	N/A	N/A	N/A	N/A
Cable Length	N/A	N/A	N/A	N/A	N/A	N/A
Cable Type [3]	N/A	N/A	N/A	N/A	N/A	N/A
Mounting Thread	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Quick Bonding Gel	080A90		080A90		—	
Adhesive Mounting Base	080A12		080A12		080A12	
Mounting Stud	081B05		081B05		081B05	
Metric Mounting Stud	M081B05		M081B05		—	
NIST Calibration [4]	ACS-1T		ACS-1T		ACS-1T	
Additional Accessories [3]						
Magnetic Mounting Base	080A27		080A27		080A27	
Removal Tool	039A10		039A10		039A10	
Mating Cable Connectors	AY		AY		AY	
Recommended Stock Cables	034, 010		034, 010		034, 010	
Options [5]						
Available Options	HT, T, TLA, TLB, TLC		A, HT, J, T, TLA, TLB, TLC		M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] ≤ 1% to 400g and ≤ 2% to 500g.

Through Hole Triaxial ICP® Accelerometer Specifications						
Model Number [1]	**354C02**		**354C03**		**354C10**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4905 m/s² pk	± 50 g pk	± 490 m/s² pk	± 500 g pk	± 4905 m/s² pk
Frequency Range (± 5%)	0.5 to 2000 Hz	0.5 to 2000 Hz	0.5 to 2000 Hz	0.5 to 2000 Hz	2 to 8000 Hz	2 to 8000 Hz
Frequency Range (± 10%)	0.3 to 4000 Hz	0.3 to 4000 Hz	0.3 to 4000 Hz	0.3 to 4000 Hz	N/A	N/A
Resonant Frequency	≥ 12 kHz	≥ 12 kHz	≥ 12 kHz	≥ 12 kHz	≥ 40 kHz	≥ 40 kHz
Broadband Resolution (1 to 10k Hz)	0.0005 g rms	0.005 m/s² rms	0.0002 g rms	0.002 m/s² rms	0.003 g rms	0.03 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental						
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-53 to +93 °C	-65 to +250 °F	-54 to +121 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 300 ohms	≤ 300 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	7 to 11 VDC	7 to 11 VDC
Discharge Time Constant	0.8 to 2.0 sec	0.8 to 2.0 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.3 to 1.0 sec	0.3 to 1.0 sec
Electrical Isolation	>10⁸ ohms	>10⁸ ohms	>10⁸ ohms	>10⁸ ohms	>10⁸ ohms	>10⁸ ohms
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	13/16 × 0.45 in (13/16 × 11.4 mm)		13/16 × 0.45 in (13/16 × 11.4 mm)		0.30 in × 0.55 in × 0.55 in [6] (7.6 mm × 14.0 mm × 14.0 mm) [6]	
Weight	0.55 oz	15.5 gm	0.55 oz	15.5 gm	0.18 oz	5.0 gm
Electrical Connection	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	Integral Cable	Integral Cable
Electrical Connection Position	Side	Side	Side	Side	Side	Side
Cable Termination	N/A	N/A	N/A	N/A	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack
Cable Length	N/A	N/A	N/A	N/A	5 ft	1.5 m
Cable Type [3]	N/A	N/A	N/A	N/A	034AD005CA	034AD005CA
Mounting Thread	Through Hole	Through Hole	Through Hole	Through Hole	Through Hole	Through Hole
Supplied Accessories [3]						
Petro Wax	080A109		080A109		—	
Allen Wrench	039A23		039A23		039A21	
Cap Screw	081A60		081A60		081A93	
Cable	—		—		034G05	
NIST Calibration [4]	ACS-IT		ACS-IT		ACS-1T	
Additional Accessories [3]						
Magnetic Mounting Base	080M162		080M162		N/A	
Mating Cable Connectors	AY		AY		AY	
Recommended Stock Cables	010, 034		010, 034		034	
Options [5]						
Available Options	A, HT, M, T, W		A, M, T, W		M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Size (Height × Length × Width).

Dimensions shown are in inches (millimeters).

High Temperature Charge Output Triaxial Accelerometer Specifications				
Model Number [1]	**356A70**		**356A71**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	2.7 pC/g	0.28 pC/(m/s²)	10 pC/g	1.02 pC/(m/s²)
Sensitivity Tolerance	± 15%	± 15%	± 15%	± 15%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%) [6]	5000 Hz	5000 Hz	5000 Hz	5000 Hz
Frequency Range (± 10%) [6]	7000 Hz	7000 Hz	7000 Hz	7000 Hz
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	≥ 25 kHz	≥ 25 kHz
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental				
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-94 to +490 °F	-70 to +254 °C	-94 to +490 °F	-70 to +254 °C
Electrical				
Capacitance	240 pF	240 pF	690 pF	690 pF
Insulation Resistance (at 70° F [21° C])	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms
Insulation Resistance (at 490° F [254° C])	$>10^{8}$ ohms	$>10^{8}$ ohms	$>10^{8}$ ohms	$>10^{8}$ ohms
Output Polarity	Negative	Negative	Negative	Negative
Physical				
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.73 in × 0.90 in × 0.40 in (18.5 mm × 22.9 mm × 10.2 mm)		0.96 in × 1.00 in × 0.50 in (24.4 mm × 25.4 mm × 12.7 mm)	
Weight	0.28 oz	7.9 gm	0.8 oz	22.7 gm
Electrical Connection	5-44 Coaxial Jack	5-44 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side
Mounting	Through Hole	Through Hole	Through Hole	Through Hole
Supplied Accessories [3]				
Allen Wrench	039A23		039A22	
Quick Bonding Gel	080A90		080A90	
Mounting Stud	081A46		081A94	
Adhesive Mounting Base	—		080A70	
NIST Calibration [4]	ACS-1T		ACS-1T	
Additional Accessories [3]				
Mating Cable Connectors	AF, AG		EB, AH, AK, AW	
Recommended Stock Cables	003		003	
Options [5]				
Available Options	M, P		M, P	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Low frequency response is determined by external signal conditioning electronics.

Structural Analysis Triaxial ICP® Accelerometer Specifications						
Model Number [1]	**356A16**		**356A17**		**356B18**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)	500 mV/g	51 mV/(m/s²)	1000 mV/g	102 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 50 g pk	± 490 m/s² pk	± 10 g pk	± 98 m/s² pk	± 5 g pk	± 49 m/s² pk
Frequency Range (± 5%)	0.5 to 5000 Hz	0.5 to 5000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz
Frequency Range (± 10%)	0.3 to 6000 Hz	0.3 to 6000 Hz	0.3 to 4000 Hz	0.3 to 4000 Hz	0.3 to 5000 Hz	0.3 to 5000 Hz
Resonant Frequency	≥ 25 kHz	≥ 25 kHz	≥ 14 kHz	≥ 14 kHz	≥ 20 kHz	≥ 20 kHz
Phase Response (± 5 °)	1.0 to 5000 Hz	1.0 to 5000 Hz	2 to 4000 Hz	2 to 4000 Hz	2 to 8000 Hz	2 to 8000 Hz
Broadband Resolution (1 to 10k Hz)	0.0001 g rms	0.001 m/s² rms	0.00006 g rms	0.0006 m/s² rms	0.00005 g rms	0.0005 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental						
Overload Limit (Shock)	± 7000 g pk	± 68.6k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +176 °F	-54 to +80 °C	-65 to +176 °F	-54 to +80 °C	-20 to +170 °F	-29 to +77 °C
Electrical						
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 300 ohms	≤ 300 ohms	≤ 250 ohms	≤ 250 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	1.0 to 3.0 sec	1.0 to 3.0 sec	0.8 to 2.0 sec	0.8 to 2.0 sec	1.0 to 3.0 sec	1.0 to 3.0 sec
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum	Anodized Aluminum
Sealing	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Size (Hex × Height)	0.55 in × 0.80 in × 0.55 in (14.0 mm × 20.3 mm × 14.0 mm)		0.55 in × 0.80 in × 0.55 in (14.0 mm × 20.3 mm × 14.0 mm)		0.80 in × 1.03 in × 0.80 in (20.3 mm × 26.1 mm × 20.3 mm)	
Weight	0.26 oz	7.4 gm	0.33 oz	9.3 gm	0.88 oz	25 gm
Electrical Connection	1/4-28 4-Pin	1/4-28 4-Pin	1/4-28 4-Pin	1/4-28 4-Pin	1/4-28 4-Pin	1/4-28 4-Pin
Electrical Connection Position	Side	Side	Side	Side	Side	Side
Mounting Thread	10-32 Female	10-32 Female	5-40 Female	5-40 Female	10-32 Female	10-32 Female
Supplied Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Adhesive Mounting Base	080A12		080A145		080A68	
Mounting Stud	081B05		081A27		081B05	
Metric Mounting Stud	M081B05		M081A27		—	
NIST Calibration [4]	ACS-1T		ACS-1T		ACS-1T	
Additional Accessories [3]						
Magnetic Mounting Base	N/A		N/A		080A27	
Removal Tool	039A10		039A10		—	
Mating Cable Connectors	AY		AY		AY	
Recommended Stock Cables	034		034		010, 034	
Options [5]						
Available Options	A, T		A, J		A, J, M, T	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Filtered Output Triaxial ICP® Accelerometer Specifications						
Model Number [1]	**356A61**		**356A63**		**356A66**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 15%	± 15%	± 15%	± 15%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (± 5%)	2 to 5000 Hz [7]	2 to 5000 Hz [7]	2 to 5000 Hz [7]	2 to 5000 Hz [7]	2 to 4000 Hz [8] [9]	2 to 4000 Hz [8] [9]
Resonant Frequency	≥ 55 kHz	≥ 55 kHz	≥ 55 kHz	≥ 55 kHz	≥ 35 kHz	≥ 35 kHz
Broadband Resolution (1 to 10k Hz)	0.008 g rms	0.08 m/s² rms	0.008 g rms	0.08 m/s² rms	0.002 g rms	0.02 m/s² rms
Non-Linearity [2]	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental						
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 7000 g pk	± 68.6k m/s² pk
Temperature Range (Operating)	-65 to +325 °F	-54 to +163 °C	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 11 VDC	7 to 14 VDC	7 to 14 VDC
Discharge Time Constant	0.3 to 1.0 sec	0.3 to 1.0 sec	0.3 to 1.0 sec	0.3 to 1.0 sec	0.1 to 1.0 sec	0.1 to 1.0 sec
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Length × Width × Height)	0.4 in × 0.4 in × 0.4 in (10.2 mm × 10.2 mm × 10.2 mm)		0.40 in × 0.77 in × 0.40 in (10.2 mm × 19.6 mm × 10.2 mm)		0.55 in × 0.80 in × 0.55 in (14.0 mm × 20.3 mm × 14.0 mm)	
Weight	0.14 oz	4.0 gm	0.19 oz	5.3 gm	0.32 oz	9.0 gm
Electrical Connection	Integral Cable [6]	Integral Cable [6]	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side
Cable Termination	1/4-28 4-Pin Jack	1/4-28 4-Pin Jack	N/A	N/A	N/A	N/A
Cable Length	5.0 ft	1.5 m	N/A	N/A	N/A	N/A
Cable Type [3]	034AD005CA	034AD005CA	N/A	N/A	N/A	N/A
Mounting Thread	5-40 Female	5-40 Female	5-40 Female	5-40 Female	10-32 Female	10-32 Female
Supplied Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Adhesive Mounting Base	080A15		080A15		080A12	
Quick Bonding Gel	—		—		080A90	
Mounting Stud	081A27		081A27		081B05	
Metric Mounting Stud	M081A27		M081A27		—	
Cable	034G05		—		—	
NIST Calibration [4]	ACS-1T		ACS-1T		ACS-1T	
Additional Accessories [3]						
Removal Tool	039A08		039A08		039A10	
Mating Cable Connectors	AY		AY		AY	
Recommended Stock Cables	034		034		034	
Options [5]						
Available Options	N/A		HT		HT, T, TLA, TLB, TLC	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Supplied with cable attached to solder pins on sensor. [7] All axes filtered to provide -5% between 4,000 and 6,000 Hz.
[8] Upper frequency response is ± 500 Hz from the specified value. [9] X-axis frequency response is limited due to mounting method.

PCB accelerometers are used for testing the structural integrity of space vehicles as well as payload response to simulated environments to ensure survivability and mission success.

Dimensions shown are in inches (millimeters).

Shock Accelerometers

- **Aerospace vehicle separations**
- **Pile driver monitoring**
- **Simulated pyroshock events**
- **Recoil and penetration**
- **Impact press monitoring**
- **Explosive studies**
- **Shaker impact monitoring**

Shock accelerometers are specifically designed to withstand and measure extreme, high-amplitude, short-duration, transient accelerations. Such accelerations characteristically exceed the 1000 g boundary imposed on other typical accelerometer designs. Shock acceleration events may reach 100,000 g or more with pulse durations of less than 10 microseconds. The extremely fast transient and volatile nature of a shock event imposes special demands on the design of a shock accelerometer.

PCB shock accelerometers represent extensive research in materials, assembly techniques, and testing techniques to insure survivability and faithful representation of the shock event. An automated Hopkinson Bar Calibration Station is utilized to evaluate shock sensor performance by simulating actual, high amplitude measurement conditions. This investment allows PCB to assess and improve upon individual sensor characteristics, such as zero shift, ringing, and non-linearity.

Shear mode quartz and ceramic sensing elements are used in shock accelerometer designs to minimize the effects of base strain and thermal transients. Ceramic elements yield a smaller, lighter weight sensor with higher amplitude range and frequency limits. Quartz elements offer a wider operating temperature thereby allowing for a more general purpose measurement device. Built-in signal conditioning circuitry permit ICP® sensors to operate from constant-current signal conditioners for reliable operation and simplicity of use. The addition of mechanical and electrical filtering, in some designs, assists in resonance suppression to eliminate high-frequency "ringing" in the output signal.

A general purpose charge mode unit is available for systems employing external charge amplifiers and where adjustability through a wide measurement range is desired, such as with near- and far-field pyroshock testing.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

HIGH FREQUENCY ICP® *Shock Accelerometers*

(*complete specifications are featured on pages* 1.56 *to* 1.57)

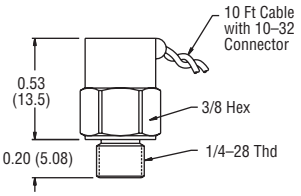
High frequency ICP® shock accelerometers utilize ceramic sensing elements and lightweight, titanium construction. Most incorporate electrical and mechanical filtering to virtually eliminate zero shift.

- metal-to-metal impacts
- simulated pyroshock tests
- pile driver monitoring
- projectile impacts

Model 350B21 — PCB's highest amplitude range shock accelerometer, unfiltered

- ± 100k g (980k m/s²) amplitude range
- 0.05 mV/g [0.005 mV/(m/s²)] sensitivity
- 1 Hz to 10 kHz frequency range (± 1 dB)
- 4.4 gram (0.15 oz) weight
- Electrical case isolation
- Integral cable
- ≥ 200 kHz unfiltered mounted resonance
- Titanium construction

Actual Size

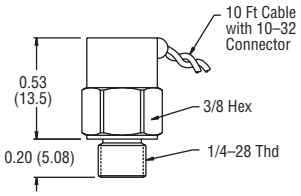


Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Model 350B02 — General purpose, high amplitude

- ± 50k g (490k m/s²) amplitude range
- 0.1 mV/g [0.01 mV/(m/s²)] sensitivity
- 4 Hz to 10 kHz frequency range (± 1 dB)
- 4.2 gram (0.15 oz) weight
- Electrical case isolation
- Integral cable
- Mechanically and electrically filtered
- Titanium construction

Actual Size

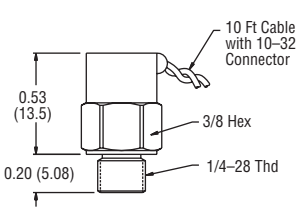


Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Model 350B23 — High sensitivity, with electrical isolation

- ± 10k g (98k m/s²) amplitude range
- 0.5 mV/g [0.05 mV/(m/s²)] sensitivity
- 0.4 Hz to 10 kHz frequency range (± 1 dB)
- 4.5 gram (0.16 oz) weight
- Electrical case isolation
- Integral cable
- Mechanically and electrically filtered
- Titanium construction

Actual Size



Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Dimensions shown are in inches (millimeters).

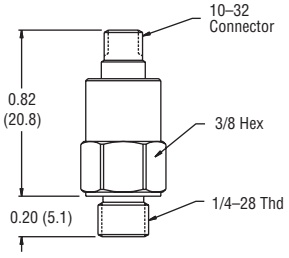
HIGH FREQUENCY ICP® *Shock Accelerometers (continued)*

Model 350B03 — General purpose, low amplitude

- ± 10k g (98k m/s²) amplitude range
- 0.5 mV/g [0.05 mV/(m/s²)] sensitivity
- 0.4 Hz to 10 kHz frequency range (± 1 dB)
- 4.5 gram (0.16 oz) weight
- Mechanically and electrically filtered
- Titanium construction

Recommended cables and accessories ❷, ❸, ②, ⑧ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size

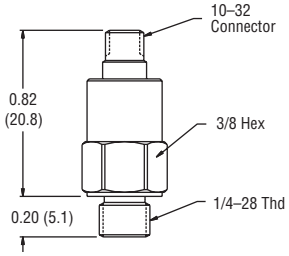


Model 350B04 — Low amplitude range, high sensitivity

- ± 5000 g (49k m/s²) amplitude range
- 1 mV/g [0.1 mV/(m/s²)] sensitivity
- 0.4 Hz to 10 kHz frequency range (± 1 dB)
- 4.5 gram (0.16 oz) weight
- Mechanically and electrically filtered
- Titanium construction

Recommended cables and accessories ❷, ❸, ②, ⑧ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size



GENERAL PURPOSE ICP® *Shock Accelerometers*

(*complete specifications are featured on page* 1.58)

General purpose ICP® shock accelerometers utilize quartz sensing elements and stainless steel housings for durability and wide operating temperature range to +250 °F (121 °C).

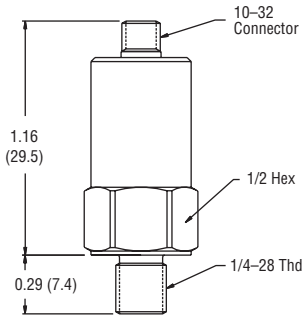
- pile driver monitoring
- package and drop testing
- payload survivability

Model 350A13 — Longer duration events, higher amplitude

- ± 10k g (98k m/s²) amplitude range
- 0.5 mV/g [0.051 mV/(m/s²)] sensitivity
- 0.4 Hz to 7500 Hz frequency range
- 17.9 gram (0.63 oz) weight
- Electrically filtered
- Stainless steel construction

Recommended cables and accessories ❷, ❸, ②, ⑧ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size

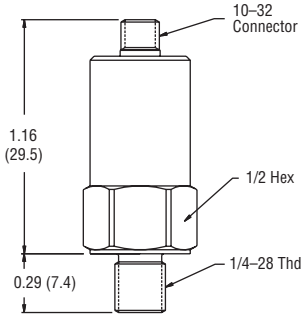


Model 350A14 — Longer duration events and integration

- ± 5000 g (49k m/s²) amplitude range
- 1 mV/g [0.102 mV/(m/s²)] sensitivity
- 0.4 Hz to 7500 Hz frequency range
- 17.9 gram (0.63 oz) weight
- Electrically filtered
- Stainless steel construction

Recommended cables and accessories ❷, ❸, ②, ⑧ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

CHARGE OUTPUT S*hock Accelerometer*

(*complete specifications are featured on page* 1.59)

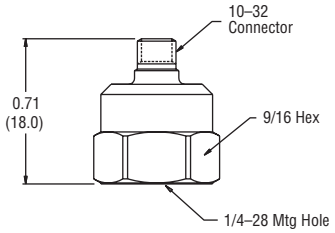
Charge output shock accelerometers provide flexibility of set-up to accommodate a wide range of test requirements when used with adjustable charge amplifiers.

- near and far-field pyroshock testing
- charge amplified systems

Model 350A96 — High amplitude range, high resonance

- ± 100k g (980k m/s²) amplitude range
- 0.065 pC/g [0.007 pC/(m/s²)] sensitivity
- 15 kHz upper frequency range (± 1 dB)
- 13 gram (0.46 oz) weight
- Stainless steel construction
- Mating cable provided

Actual Size



Recommended cables and accessories ②, ❸ — see page 4.2

Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3

Options: P — see pages xvii to xx for option information

Shock Accelerometers

High Frequency ICP® Shock Accelerometer Specifications						
Model Number [1]	**350B02**		**350B03**		**350B04**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	0.1 mV/g	0.01 mV/(m/s²)	0.5 mV/g	0.05 mV/(m/s²)	1.0 mV/g	0.10 mV/(m/s²)
Sensitivity Tolerance	± 30%	± 30%	± 30%	± 30%	± 30%	± 30%
Measurement Range	± 50k g pk	± 490k m/s² pk	± 10k g pk	± 98k m/s² pk	± 5000 g pk	± 49k m/s² pk
Frequency Range (± 1 dB)	4 to 10k Hz	4 to 10k Hz	0.4 to 10k Hz	0.4 to 10k Hz	0.4 to 10k Hz	0.4 to 10k Hz
Frequency Range (-3 dB) [6]	2 to 25k Hz	2 to 25k Hz	0.2 to 25k Hz	0.2 to 25k Hz	0.2 to 25k Hz	0.2 to 25k Hz
Electrical Filter Corner Frequency (-3 dB) [7]	13 kHz	13 kHz	13 kHz	13 kHz	13 kHz	13 kHz
Mechanical Filter Resonant Frequency [8]	23 kHz	23 kHz	23 kHz	23 kHz	23 kHz	23 kHz
Resonant Frequency	≥ 100 kHz	≥ 100 kHz	≥ 100 kHz	≥ 100 kHz	≥ 100 kHz	≥ 100 kHz
Broadband Resolution (1 to 10k Hz)	0.5 g rms	4.9 m/s² rms	0.04 g rms	0.39 m/s² rms	0.02 g rms	0.20 m/s² rms
Non-Linearity (per 10k g)	≤ 2.5%	≤ 2.5%	≤ 2.0%	≤ 2.0%	≤ 2.0%	≤ 2.0%
Transverse Sensitivity	≤ 7%	≤ 7%	≤ 7%	≤ 7%	≤ 7%	≤ 7%
Environmental						
Overload Limit (Shock)	± 150k g pk	± 1471k m/s² pk	± 50k g pk	± 490k m/s² pk	± 50k g pk	± 490k m/s² pk
Temperature Range (Operating)	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C
Electrical						
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC	8 to 14 VDC
Discharge Time Constant	0.10 sec	0.10 sec	1.0 to 2.0 sec	1.0 to 2.0 sec	1.0 to 2.0 sec	1.0 to 2.0 sec
Electrical Isolation (Case)	>10^6 ohms	>10^6 ohms	N/A	N/A	N/A	N/A
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	3/8 in × 0.75 in	3/8 in × 19.1 mm	3/8 in × 1.02 in	3/8 in × 25.9 mm	0.375 in × 1.02 in	9.5 mm × 25.9 mm
Weight	0.15 oz	4.2 gm	0.16 oz	4.5 gm	0.16 oz	4.5 gm
Electrical Connection	Integral Cable	Integral Cable	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top	Top	Top
Cable Termination	10-32 Coaxial Plug	10-32 Coaxial Plug	N/A	N/A	N/A	N/A
Cable Length	10 ft	3.05 m	N/A	N/A	N/A	N/A
Cable Type	031AD010EB	031AD010EB	N/A	N/A	N/A	N/A
Mounting Thread	1/4-28 Male	1/4-28 Male	1/4-28 Male	1/4-28 Male	1/4-28 Male	1/4-28 Male
Supplied Accessories [3]						
NIST Calibration [4]	ACS-22		ACS-22		ACS-22	
Additional Accessories [3]						
Triaxial Mounting Adaptor	080A180		080A180		080A180	
Metric Triaxial Mounting Adaptor	M080A180		M080A180		M080A180	
Adhesive Mounting Base	080M217		080M217		080M217	
Metric Adhesive Mounting Base	M080M217		M080M217		M080M217	
Mating Cable Connectors	AL		EB		EB	
Connector Adaptor	070A02		N/A		N/A	
Recommended Stock Cables	N/A		003		003	
Options [5]						
Available Options	M		M		M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See page xvii to xx for option information. [6] Typical corner frequency for coupled electrical and mechanical filters.
[7] Electrical filter is a second order filter. [8] Amplitude at resonance is +9 dB.

Dimensions shown are in inches (millimeters).

High Frequency ICP® Shock Accelerometer Specifications				
Model Number [1]	**350B21**		**350B23**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	0.05 mV/g	0.005 mV/(m/s²)	0.5 mV/g	0.05 mV/(m/s²)
Sensitivity Tolerance	± 30%	± 30%	± 30%	± 30%
Measurement Range	± 100k g pk	± 980k m/s² pk	± 10k g pk	± 98k m/s² pk
Frequency Range (± 1 dB)	1 to 10k Hz	1 to 10k Hz	0.4 to 10k Hz	0.4 to 10k Hz
Frequency Range (-3 dB) [6]	N/A	N/A	0.2 to 25k Hz	0.2 to 25k Hz
Frequency Range (± 3 dB)	0.5 to 35k Hz	0.5 to 35k Hz	N/A	N/A
Electrical Filter Corner Frequency (-3 dB) [7]	N/A	N/A	13 kHz	13 kHz
Mechanical Filter Resonant Frequency [8]	N/A	N/A	23 kHz	23 kHz
Resonant Frequency	≥ 200 kHz	≥ 200 kHz	≥ 100 kHz	≥ 100 kHz
Broadband Resolution (1 to 10k Hz)	0.3 g rms	2.9 m/s² rms	0.04 g rms	0.39 m/s² rms
Non-Linearity (per 10k g)	≤ 0.5%	≤ 0.5%	≤ 2.0%	≤ 2.0%
Transverse Sensitivity	≤ 7%	≤ 7%	≤ 7%	≤ 7%
Environmental				
Overload Limit (Shock)	± 200k g pk	± 1961k m/s² pk	± 50k g pk	± 490k m/s² pk
Temperature Range (Operating)	-65 to +200 °F	-54 to +93 °C	0 to +150 °F	-18 to +66 °C
Electrical				
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 200 ohms	≤ 200 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 14 VDC	8 to 14 VDC
Discharge Time Constant	0.5 to 0.7 sec	0.5 to 0.7 sec	1.0 to 2.0 sec	1.0 to 2.0 sec
Electrical Isolation (Case)	>10⁸ ohms	>10⁸ ohms	>10⁶ ohms	>10⁶ ohms
Physical				
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	3/8 in × 0.73 in	3/8 in x 18.5 mm	3/8 in × 0.75 in	3/8 in × 19.1 mm
Weight	0.15 oz	4.4 gm	0.16 oz	4.5 gm
Electrical Connection	Integral Cable	Integral Cable	Integral Cable	Integral Cable
Electrical Connection Position	Side	Side	Top	Top
Cable Termination	10-32 Coaxial Plug	10-32 Coaxial Plug	10-32 Coaxial Plug	10-32 Coaxial Plug
Cable Length	10 ft	3.05 m	10 ft	3.05 m
Cable Type	031AD010EB	031AD010EB	031AD010EB	031AD010EB
Mounting Thread	1/4-28 Male	1/4-28 Male	1/4-28 Male	1/4-28 Male
Supplied Accessories [3]				
NIST Calibration [4]	ACS-22		ACS-22	
Additional Accessories [3]				
Triaxial Mounting Adaptor	080A180		080A180	
Metric Triaxial Mounting Adaptor	M080A180		M080A180	
Adhesive Mounting Base	080M217		080M217	
Metric Adhesive Mounting Base	M080M217		M080M217	
Mating Cable Connectors	AL		AL	
Connector Adaptor	070A02		070A02	
Recommended Stock Cables	N/A		N/A	
Options [5]				
Available Options	M		M	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information. [6] Typical corner frequency for coupled electrical and mechanical filters.
[7] Electrical filter is a second order filter. [8] Amplitude at resonance is +9 dB.

Dimensions shown are in inches (millimeters).

General Purpose ICP® Shock Accelerometer Specifications				
Model Number [1]	**350A13**		**350A14**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	0.5 mV/g	0.05 mV/(m/s²)	1.0 mV/g	0.102 mV/(m/s²)
Sensitivity Tolerance	± 15%	± 15%	± 15%	± 15%
Measurement Range	± 10k g pk	± 98k m/s² pk	± 5000 g pk	± 49k m/s² pk
Frequency Range (± 10%)	0.4 to 7500 Hz	0.4 to 7500 Hz	0.4 to 7500 Hz	0.4 to 7500 Hz
Electrical Filter Cutoff Frequency (-10 %) [2]	≥ 7500 Hz	≥ 7500 Hz	≥ 7500 Hz	≥ 7500 Hz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz
Broadband Resolution (1 to 10k Hz)	0.06 g rms	0.59 m/s² rms	0.02 g rms	0.20 m/s² rms
Non-Linearity	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity	≤ 5%	≤ 5%	≤ 5%	≤ 5%
Environmental				
Overload Limit (Shock)	± 30k g pk	± 294k m/s² pk	± 30k g pk	± 294k m/s² pk
Temperature Range (Operating)	-65 to +250 °F	-54 to +121 °C	-65 to +250 °F	-54 to +121 °C
Electrical				
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	≥ 1.8 sec	≥ 1.8 sec	≥ 1.8 sec	≥ 1.8 sec
Physical				
Sensing Element	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Weight	0.63 oz	17.9 gm	0.63 oz	17.9 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top
Mounting Thread	1/4-28 Male	1/4-28 Male	1/4-28 Male	1/4-28 Male
Supplied Accessories [3]				
NIST Calibration [4]	ACS-22		ACS-22	
Additional Accessories [3]				
Mating Cable Connectors	EB, AW		EB, AW	
Recommended Stock Cables	002, 003, 031		002, 003, 031	
Options [5]				
Available Options	M		M	

NOTES:

[1] See note regarding accuracy of information on inside front cover.

[2] Electrical filter is a first order low pass filter.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Charge Output Shock Accelerometer Specifications		
Model Number [1]	**350A96**	
Performance	**English**	**SI**
Sensitivity	0.065 pC/g	0.007 pC/(m/s2)
Sensitivity Tolerance	± 20%	± 20%
Measurement Range	± 100k g	± 980k m/s^2
Frequency Range (± 1 dB) [6]	15 kHz	15 kHz
Resonant Frequency	120 kHz	120 kHz
Non-Linearity (per 10k g)	<0.5%	<0.5%
Transverse Sensitivity	≤ 5%	≤ 5%
Environmental		
Overload Limit (Shock)	± 200k g pk	± 1961k m/s^2 pk
Temperature Range (Operating)	0 to +150 °F	-18 to +66 °C
Electrical		
Capacitance	125 pF	125 pF
Insulation Resistance	$>10^{10}$ ohms	$>10^{10}$ ohms
Output Polarity	Negative	Negative
Physical		
Sensing Element	Ceramic	Ceramic
Sensing Geometry	Shear	Shear
Housing Material	Stainless Steel	Stainless Steel
Sealing	Hermetic	Hermetic
Size (Hex × Height)	9/16 in × 0.71 in	9/16 in × 18 mm
Weight	0.46 oz	13 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top
Mounting Thread	1/4-28 Female	1/4-28 Female
Supplied Accessories [3]		
Mounting Stud	081A96	
Metric Mounting Stud	M081A96	
Cable	003A10	
NIST Calibration [4]	ACS-22	
Additional Accessories [3]		
Mating Cable Connectors	EB, AW	
Recommended Stock Cables	003	
Options [5]		
Available Options	P	

NOTES:

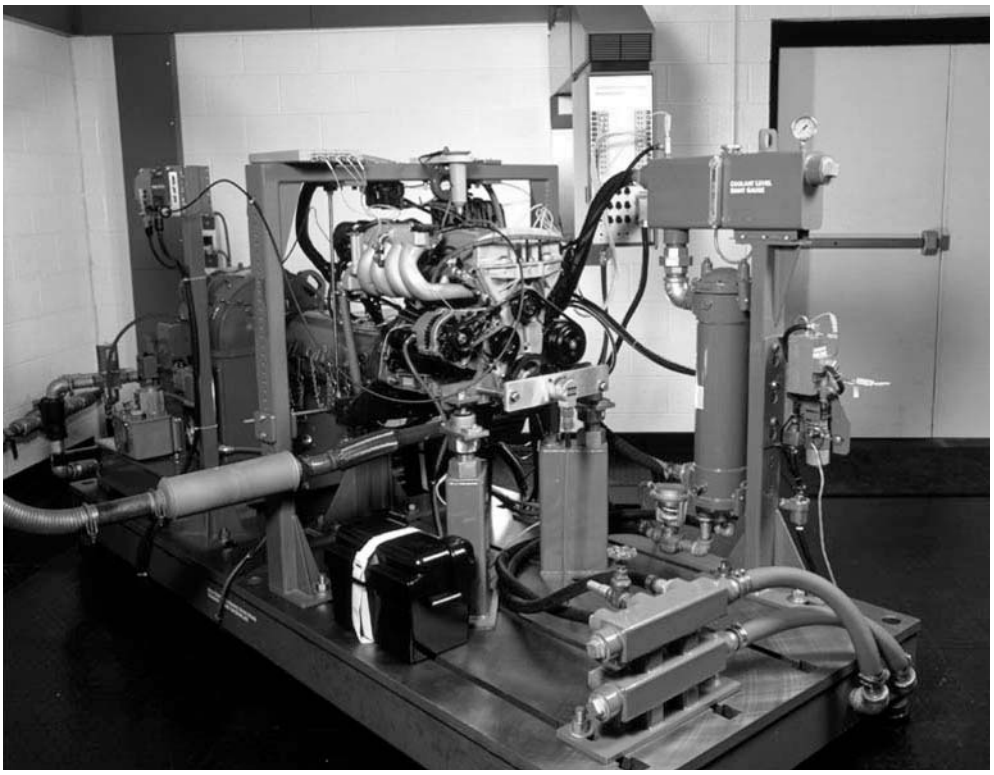
[1] See note regarding accuracy of information on inside front cover.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

[6] Low frequency response is determined by external signal conditioning electronics.



Charge output and extreme environment quartz shear ICP® accelerometers are used in applications where temperature extremes preclude the use of ordinary ICP® accelerometers.

Dimensions shown are in inches (millimeters).

Charge Output Accelerometers

- **Interface with existing charge amplifiers**
- **High temperature vibration measurements**
- **Engine compartment studies**
- **Exhaust component vibration tests**
- **Steam turbine testing**
- **Jet engine vibration analysis**

PCB's charge output accelerometers utilize piezo-ceramic sensing elements, in shear mode configurations, to directly output an electrostatic charge signal that is proportional to applied acceleration.

Ceramic shear sensing elements generate strong charge output signals, while reducing the effects of thermal transients, base strain, and transverse motion. Also, the use of laser-welded, lightweight, titanium housings provide a hermetic seal and help to minimize mass loading effects.

Charge output accelerometers do not contain built-in, signal conditioning electronics. As a result, external signal conditioning is required to interface their generated measurement signals to readout or recording instruments. The sensor's charge output signals can be conditioned with either a laboratory-style, adjustable charge amplifier or, for an economical approach, with an in-line, fixed charge converter.

Since there are no electronics built into charge output accelerometers, they may operate and survive exposure to very high temperatures (to 900 °F (482 °C) for some models). In addition, charge output accelerometers are used for thermal cycling requirements or to take advantage of existing charge amplifier signal conditioning equipment.

It is important to note that measurement resolution and low-frequency response for charge output, acceleration sensing systems are dependent upon the noise floor and discharge time constant characteristics of the signal conditioning and readout devices used.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

Charge Output Accelerometers

MINIATURE
(*complete specifications are featured on pages* 1.68 *to* 1.69)

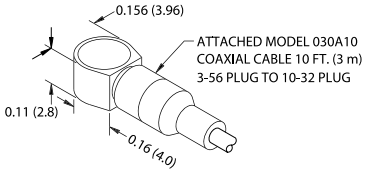
Miniature charge output accelerometers are especially well suited for applications demanding high frequency range, small size, light weight and elevated operating temperatures. Use with charge amplifiers and in-line charge converters.

- high temperature testing
- thermal stress screening
- small component qualifications
- high speed machinery analysis
- engine brackets
- motor housing

Model 357A08 — PCB's smallest accelerometer

- 0.3 pC/g [0.03 pC/(m/s²)] sensitivity
- 20 kHz upper frequency range
- 0.16 gram (0.006 oz) weight
- -100 to +350 °F (-73 to +177 °C) temperature range
- Adhesive mount
- Mating cable provided
- Electrically ground isolated
- Lightweight aluminum housing

2x Actual Size

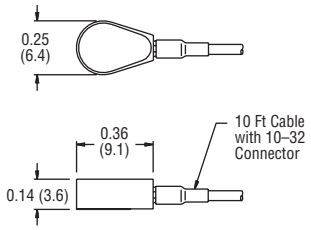


Recommended cables and accessories ③❸ — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: P — see pages xvii to xx for option information

Model 357C10 — Lightweight aluminum housing

- 1.7 pC/g [0.17 pC/(m/s²)] sensitivity
- 13 kHz upper frequency range
- 0.45 gram (0.016 oz) weight
- -100 to +350 °F (-73 to +177 °C) temperature range
- Adhesive mount
- Mating cable provided
- Electrically ground isolated

2x Actual Size

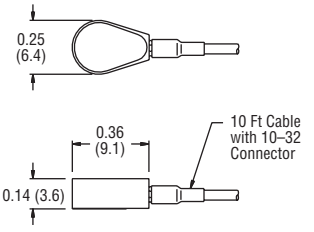


Recommended cables and accessories ③❸ — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: P — see pages xvii to xx for option information

Model 357A09 — Robust titanium housing

- 1.7 pC/g [0.17 pC/(m/s²)] sensitivity
- 13 kHz upper frequency range
- 0.6 gram (0.02 oz) weight
- -100 to +350 °F (-73 to +177 °C) temperature range
- Adhesive mount
- Mating cable provided

2x Actual Size



Recommended cables and accessories ③❸ — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: P — see pages xvii to xx for option information

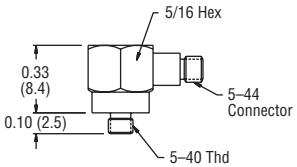
Dimensions shown are in inches (millimeters).

MINIATURE *Charge Output Accelerometers (continued)*

Model 357B11 — Side connector provides low profile, simplifies cable routing and strain relief

- 3 pC/g [0.31 pC/(m/s²)] sensitivity
- 16 kHz upper frequency range
- 2 gram (0.071 oz) weight
- -95 to +500 °F (-71 to +260°C) temperature range

Actual Size



Recommended cables and accessories ① — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, P, W — see pages xvii to xx for option information

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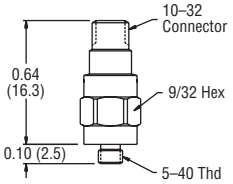
Model 357B14 — 10-32 connector joins to cables common to most accelerometers

- 3 pC/g [0.31 pC/(m/s²)] sensitivity
- 16 kHz upper frequency range
- 2 gram (0.071 oz) weight
- -95 to +500 °F (-71 to +260°C) temperature range

Actual Size



Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, P, W — see pages xvii to xx for option information

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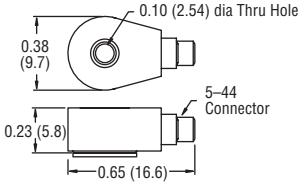
Model 357A06 — Through-hole mounting simplifies connector orientation

- 5 pC/g [0.51 pC/(m/s²)] sensitivity
- 15 kHz upper frequency range
- 2.3 gram (0.08 oz) weight
- -65 to +350 °F (-54 to +177 °C) temperature range
- Electrically ground isolated

Actual Size



Recommended cables and accessories ① — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: M, P — see pages xvii to xx for option information

Charge Output Accelerometers

GENERAL PURPOSE
(*complete specifications are featured on pages* 1.70 *to* 1.71)

For routine vibration and low-amplitude shock applications, especially at elevated operating temperatures. Use with charge amplifiers or in-line charge converters.

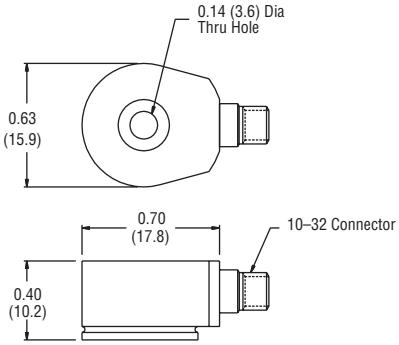
- engines
- turbines
- exhaust systems
- furnace blowers
- turbochargers
- steam handling equipment

Model 357A05 — Through-hole mounting simplifies connector orientation

- 17 pC/g [1.7 pC/(m/s²)] sensitivity
- 12 kHz upper frequency range
- 10 gram (0.35 oz) weight
- -65 to +350 °F (-54 to +177 °C) temperature range
- Electrically ground isolated

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: A, M, P, W — see pages xvii to xx for option information

Actual Size

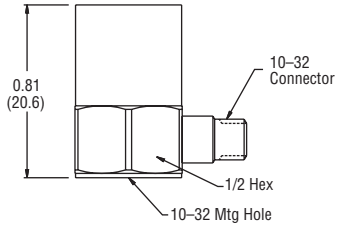


Model 357B03 — General purpose for shaker control, side connector for simplified cable routing

- 10 pC/g [1.02 pC/(m/s²)] sensitivity
- 12 kHz upper frequency range
- 11 gram (0.39 oz) weight
- -95 to +500 °F (-71 to +260 °C) temperature range

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: J, P, W — see pages xvii to xx for option information

Actual Size

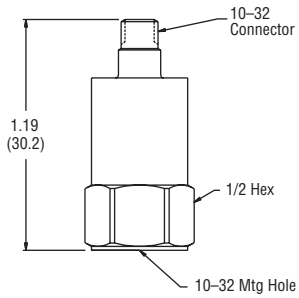


Model 357B04 — General purpose for shaker control

- 10 pC/g [1.02 pC/(m/s²)] sensitivity
- 12 kHz upper frequency range
- 11 gram (0.39 oz) weight
- -95 to +500 °F (-71 to +260 °C) temperature range

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: J, P, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

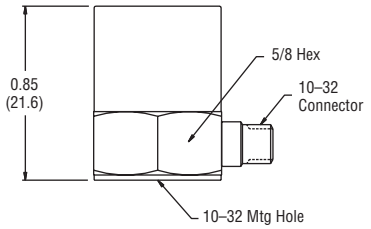
GENERAL PURPOSE *Charge Output Accelerometers (continued)*

Model 357B21 — Side connector simplifies cable routing

- 30 pC/g [3.1 pC/(m/s²)] sensitivity
- 7500 Hz upper frequency range
- 21 gram (0.73 oz) weight
- -95 to +500 °F (-71 to +260 °C) temperature range

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: J, P, W — see pages xvii to xx for option information

Actual Size

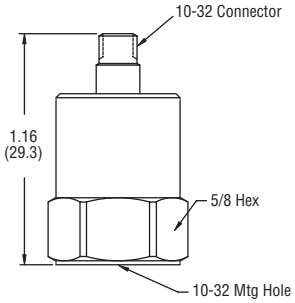


Model 357B22 — Top connector installs with narrower footprint

- 30 pC/g [3.1 pC/(m/s²)] sensitivity
- 7500 Hz upper frequency range
- 21 gram (0.73 oz) weight
- -95 to +500 °F (-71 to +260 °C) temperature range

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: J, P, W — see pages xvii to xx for option information

Actual Size

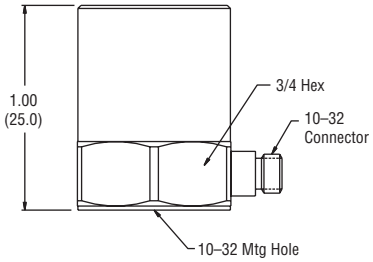


Model 357B33 — High sensitivity for low level measurements, side connector simplifies cable routing

- 100 pC/g [10.2 pC/(m/s²)] sensitivity
- 3500 Hz upper frequency range
- 45 gram (1.6 oz) weight
- -95 to +500 °F (-71 to +260 °C) temperature range

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: J, P, W — see pages xvii to xx for option information

Actual Size

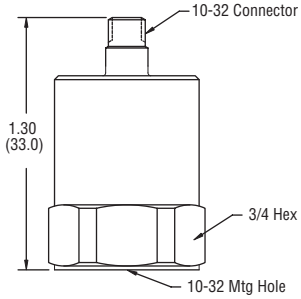


Model 357B34 — High sensitivity for low level measurements

- 100 pC/g [10.2 pC/(m/s²)] sensitivity
- 3500 Hz upper frequency range
- 45.4 gram (1.6 oz) weight
- -95 to +500 °F (-71 to +260 °C) temperature range

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: J, P, W — see pages xvii to xx for option information

Actual Size



Charge Output Accelerometers

HIGH TEMPERATURE
(*complete specifications are featured on page* 1.72)

These accelerometers utilize special materials that enable them to operate continuously to 900° F (482° C). Both single-ended and differential designs are offered.

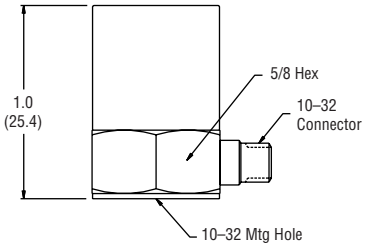
- engines
- compressors
- furnaces
- turbomachinery
- rockets

Model 357B61 — Single-ended for lighter weight and laboratory testing

- 10 pC/g [1.02 pC/(m/s²)] sensitivity
- 5000 Hz upper frequency range
- 30 gram (1.1 oz) weight
- -65 to +900 °F (-54 to +482 °C) temperature range
- Mating cable assembly provided

Recommended cables and accessories ② — see page 4.2
Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or, an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: P — see pages xvii to xx for option information

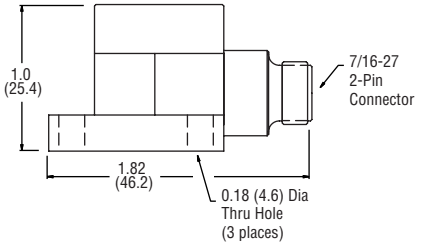
Actual Size



Model 357B71 — Differential for engines and turbomachinery

- 10 pC/g [1.02 pC/(m/s²)] sensitivity
- 2000 Hz upper frequency range
- 100 gram (3.6 oz) weight
- -65 to +900 °F (-54 to +482 °C) temperature range

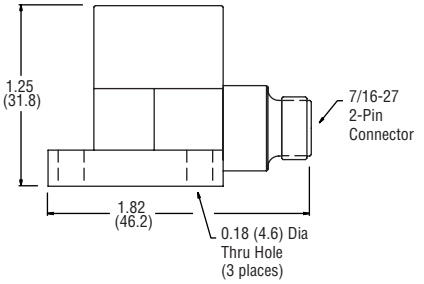
Recommended cables and accessories: Series 013 cable — see page 4.4
Options: none



Model 357B72 — Differential for engines and turbomachinery

- 50 pC/g [5.1 pC/(m/s²)] sensitivity
- 2000 Hz upper frequency range
- 120 gram (4.3 oz) weight
- -65 to +900 °F (-54 to +482 °C) temperature range

Recommended cables and accessories: Series 013 cable — see page 4.4
Options: none



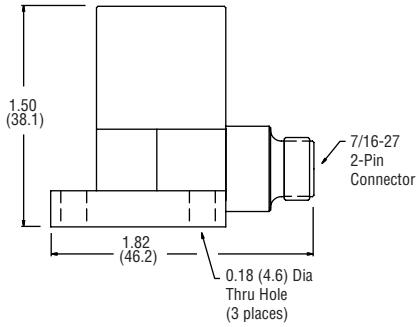
Dimensions shown are in inches (millimeters).

HIGH TEMPERATURE *Charge* Output *Accelerometers* (*continued*)

Model 357B73 — High sensitivity, differential for engines

- 100 pC/g [10.2 pC/(m/s²)] sensitivity
- 2000 Hz upper frequency range
- 130 gram (4.6 oz) weight
- -65 to +900 °F (-54 to +482 °C) temperature range

Recommended cables and accessories: Series 013 cable — see page 4.4
Options: none



Miniature Charge Output Accelerometer Specifications						
Model Number [1]	**357A06**		**357A08**		**357A09**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	5 pC/g	0.51 pC/(m/s²)	0.3 pC/g	0.03 pC/(m/s²)	1.7 pC/g	0.17 pC/(m/s²)
Sensitivity Tolerance	± 20%	± 20%	± 20%	± 20%	± 20%	± 20%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 1000 g pk	± 9800 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (+5%) [6]	10 kHz	10 kHz	12 kHz	12 kHz	10 kHz	10 kHz
Frequency Range (+10%) [6]	15 kHz [7]	15 kHz [7]	20 kHz	20 kHz	13 kHz	13 kHz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 70 kHz	≥ 70 kHz	≥ 50 kHz	≥ 50 kHz
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-65 to +350 °F	-54 to +177 °C	-100 to +350 °F	-73 to +177 °C	-100 to +350 °F	-73 to +177 °C
Electrical						
Capacitance	700 pF	700 pF	120 pF	120 pF	310 pF	310 pF
Insulation Resistance (at 70° F [21°C])	$>10^{11}$ ohms	$>10^{11}$ ohms	$>10^{10}$ ohms	$>10^{10}$ ohms	$>10^{10}$ ohms	$>10^{10}$ ohms
Electrical Isolation (Base)	$>10^{8}$ ohms [8]	$>10^{8}$ ohms [8]	$>10^{8}$ ohms	$>10^{8}$ ohms	N/A	N/A
Output Polarity	Negative	Negative	Negative	Negative	Negative	Negative
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Anodized Aluminum	Anodized Aluminum	Titanium	Titanium
Sealing	Hermetic	Hermetic	Epoxy	Epoxy	Epoxy	Epoxy
Size (Height × Length × Width)	0.23 in × .65 in × 0.38 in 5.8 mm × 16.4 mm × 9.6 mm		0.11 in × 0.16 in × 0.27 in 2.8 mm × 4.1 mm × 6.9 mm		0.14 in × 0.45 in × 0.25 in 3.6 mm × 11.4 mm × 6.4 mm	
Weight	0.08 oz	2.3 gm	0.006 oz	0.16 gm	0.02 oz	0.6 gm
Electrical Connection	5-44 Coaxial Jack	5-44 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack	3-56 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side
Mounting	Through Hole	Through Hole	Adhesive	Adhesive	Adhesive	Adhesive
Supplied Accessories [3]						
Petro Wax	—		080A109		080A109	
Removal Tool	—		039A29		039A27	
Cap Screw	081A36		—		—	
Allen Wrench	039A20		—		—	
Cable	—		030A10		030A10	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1	
Additional Accessories [3]						
Adhesive Mounting Base	N/A		N/A		N/A	
Magnetic Mounting Base	N/A		N/A		N/A	
Triaxial Mounting Adaptor	N/A		080A194		N/A	
Mating Cable Connectors	AF, AG		EK		EK	
Recommended Stock Cables	003		030		030	
Options [5]						
Available Options	M, P		P		P	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Low frequency response is determined by external signal conditioning electronics. [7] 2 kHz less when used with off ground washer. [8] Only when using off ground washer.

Dimensions shown are in inches (millimeters).

Miniature Charge Output Accelerometer Specifications						
Model Number [1]	**357C10**		**357B11**		**357B14**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	1.7 pC/g	0.17 pC/(m/s²)	3.0 pC/g	0.31 pC/(m/s²)	3 pC/g	0.31 pC/(m/s²)
Sensitivity Tolerance	± 20%	± 20%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 2300 g pk	± 22.6k m/s² pk	± 2300 g pk	± 22.6k m/s² pk
Frequency Range (+5%) [6]	10 kHz	10 kHz	12 kHz	12 kHz	12 kHz	12 kHz
Frequency Range (+10%) [6]	13 kHz	13 kHz	16 kHz	16 kHz	16 kHz	16 kHz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-100 to +350 °F	-73 to +177 °C	-95 to +500 °F	-71 to +260 °C	-95 to +500 °F	-71 to +260 °C
Electrical						
Capacitance	310 pF	310 pF	340 pF	340 pF	340 pF	340 pF
Insulation Resistance (at 70° F [21°C])	$>10^{10}$ ohms	$>10^{10}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms
Electrical Isolation (Base)	$>10^{8}$ ohms	$>10^{8}$ ohms	N/A	N/A	N/A	N/A
Output Polarity	Negative	Negative	Negative	Negative	Negative	Negative
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Anodized Aluminum	Anodized Aluminum	Titanium	Titanium	Titanium	Titanium
Sealing	Epoxy	Epoxy	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.14 in × 0.45 in × 0.25 in 3.6 mm × 11.4 mm × 6.4 mm		9/32 in × 0.33 in [9] 9/32 in × 8.4 mm [9]		9/32 in × 0.64 in [9] 9/32 in × 16.3 mm [9]	
Weight	0.016 oz	0.45 gm	0.071 oz	2.0 gm	0.071 oz	2.0 gm
Electrical Connection	3-56 Coaxial Jack	3-56 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Top	Top
Mounting	Adhesive	Adhesive	5-40 Male	5-40 Male	5-40 Male	5-40 Male
Supplied Accessories [3]						
Petro Wax	080A109		—		—	
Removal Tool	039A27		—		—	
Cap Screw	—		—		—	
Allen Wrench	—		—		—	
Cable	030A10		—		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1	
Additional Accessories [3]						
Adhesive Mounting Base	N/A		080A15		080A15	
Magnetic Mounting Base	N/A		080A30		080A30	
Triaxial Mounting Adaptor	N/A		080B16		080B17	
Mating Cable Connectors	EK		AG		EB, AH, AK	
Recommended Stock Cables	030		003		003	
Options [5]						
Available Options	P		A, J, M, P, W		A, J, M, P, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. 4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information.[6] Low frequency response is determined by external signal conditioning electronics.
[9] Hex × Height.

Charge Output Accelerometers

General Purpose Charge Output Accelerometer Specifications								
Model Number [1]	**357B03**		**357B04**		**357A05**		**357B21**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 pC/g	1.02 pC/(m/s²)	10 pC/g	1.02 pC/(m/s²)	17 pC/g	1.7 pC/(m/s²)	30 pC/g	3.1 pC/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 15%	± 15%	± 10%	± 10%
Measurement Range	± 2000 g pk	± 19k m/s² pk	± 2000 g pk	± 19k m/s² pk	± 500 g pk	± 4900 m/s² pk	± 1500 g pk	± 14.7k m/s² pk
Frequency Range (+5%) [6]	9 kHz	9 kHz	9 kHz	9 kHz	10 kHz	10 kHz	6 kHz	6 kHz
Frequency Range (+10%) [6]	12 kHz	12 kHz	12 kHz	12 kHz	12 kHz	12 kHz	7.5 kHz	7.5 kHz
Resonant Frequency	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 38 kHz	≥ 35 kHz	≥ 35 kHz	≥ 25 kHz	≥ 25 kHz
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 21k g pk	± 205k m/s² pk	± 21k g pk	± 205k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 6000 g pk	± 58.8k m/s² pk
Temperature Range (Operating)	-95 to +500 °F	-71 to +260 °C	-95 to +500 °F	-71 to +260 °C	-65 to +350 °F	-54 to +177 °C	-95 to +500 °F	-71 to +260 °C
Electrical								
Capacitance	750 pF	750 pF	750 pF	750 pF	1400 pF	1400 pF	750 pF	750 pF
Insulation Resistance (at 70° F [21°C])	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{11}$ ohms	$>10^{11}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms
Output Polarity	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	1/2 in × 0.81 in	1/2 in × 20.6 mm	1/2 in × 1.19 in	1/2 in × 30.2 mm	0.40 in × 0.95 in × 0.63 in [7]	10.2 mm × 24.1 mm × 16.0 mm [7]	5/8 in × 0.85 in	5/8 in × 21.6 mm
Weight	0.39 oz	11 gm	0.39 oz	11 gm	0.35 oz	10 gm	0.73 oz	21 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Side	Side	Side	Side
Mounting	10-32 Female	10-32 Female	10-32 Female	10-32 Female	Through Hole	Through Hole	10-32 Female	10-32 Female
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Mounting Stud	081B05		081B05		—		081B05	
Metric Mounting Stud	M081B05		M081B05		—		M081B05	
Cap Screw	—		—		081A45		—	
Allen Wrench	—		—		039A22		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Adhesive Mounting Base	080A		080A		N/A		080A12	
Magnetic Mounting Base	080A27		080A27		N/A		080A27	
Triaxial Mounting Adaptor	080B10		080B10		N/A		080B11	
Mating Cable Connectors	EB, EJ, AH, AK		EB, EJ, AH, AK		EB, EJ, AH, AK		EB, EJ, AH, AK	
Recommended Stock Cables	003		003		003		003	
Options [5]								
Available Options	J, P, W		J, P, W		A, M, P, W		J, P, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Low frequency response is determined by external signal conditioning electronics. [7] Height × Length × Width.

Dimensions shown are in inches (millimeters).

General Purpose Charge Output Accelerometer Specifications						
Model Number [1]	**357B22**		**357B33**		**357B34**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	30 pC/g	3.1 pC/(m/s²)	100 pC/g	10.2 pC/(m/s²)	100 pC/g	10.2 pC/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 1500 g pk	± 14.7k m/s² pk	± 150 g pk	± 1470 m/s² pk	± 150 g pk	± 1470 m/s² pk
Frequency Range (+5%) [6]	6 kHz	6 kHz	3 kHz	3 kHz	3 kHz	3 kHz
Frequency Range (+10%) [6]	7.5 kHz	7.5 kHz	3.5 kHz	3.5 kHz	3.5 kHz	3.5 kHz
Resonant Frequency	≥ 25 kHz	≥ 25 kHz	≥ 13 kHz	≥ 13 kHz	≥ 13 kHz	≥ 13 kHz
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 6000 g pk	± 58.8k m/s² pk	± 2000 g pk	± 19.6k m/s² pk	± 2000 g pk	± 19.6k m/s² pk
Temperature Range (Operating)	-95 to +500 °F	-71 to +260 °C	-95 to +500 °F	-71 to +260 °C	-95 to +500 °F	-71 to +260 °C
Electrical						
Capacitance	750 pF	750 pF	750 pF	750 pF	750 pF	750 pF
Insulation Resistance (at 70° F [21°C])	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms	$>10^{12}$ ohms
Output Polarity	Negative	Negative	Negative	Negative	Negative	Negative
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	5/8 in × 1.16 in	5/8 in × 29.3 mm	3/4 in × 1.00 in	3/4 in × 25.4 mm	3/4 in × 1.30 in	3/4 in × 33.0 mm
Weight	0.73 oz	21 gm	1.60 oz	45 gm	1.60 oz	45.4 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Side	Side	Top	Top
Mounting	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Mounting Stud	081B05		081B05		081B05	
Metric Mounting Stud	M081B05		M081B05		M081B05	
Cap Screw	—		—		—	
Allen Wrench	—		—		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1	
Additional Accessories [3]						
Adhesive Mounting Base	080A12		080A12		080A12	
Magnetic Mounting Base	080A27		080A27		080A27	
Triaxial Mounting Adaptor	080B11		080B11		080B11	
Mating Cable Connectors	EB, EJ, AH, AK		EB, EJ, AH, AK		EB, EJ, AH, AK	
Recommended Stock Cables	003		003		003	
Options [5]						
Available Options	J, P, W		J, P, W		J, P, W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Low frequency response is determined by external signal conditioning electronics.

Charge Output Accelerometers

High Temperature Charge Output Accelerometer Specifications								
Model Number [1]	**357B61**		**357B71**		**357B72**		**357B73**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 pC/g	1.02 pC/(m/s²)	10 pC/g	1.02 pC/(m/s²)	50 pC/g	5.1 pC/(m/s²)	100 pC/g	10.2 pC/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 5%	± 5%	± 5%	± 5%	± 5%	± 5%
Measurement Range	± 3000 g pk	± 29k m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk
Frequency Range (+5%) [6]	5 kHz	5 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz
Frequency Range (+10%) [6]	—	—	—	—	—	—	—	—
Resonant Frequency	≥ 27 kHz	≥ 27 kHz	≥ 16 kHz	≥ 16 kHz	≥ 10 kHz	≥ 10 kHz	≥ 8 kHz	≥ 8 kHz
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 3 %	≤ 3 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 1000 g pk	± 9810 m/s² pk	± 1000 g pk	± 9810 m/s² pk	± 1000 g pk	± 9810 m/s² pk
Temperature Range (Operating)	-65 to +900 °F	-54 to +482 °C	-65 to +900 °F	-54 to +482 °C	-65 to +900 °F	-54 to +482 °C	-65 to +900 °F	-54 to +482 °C
Electrical								
Capacitance	650 pF	650 pF	220 pF	220 pF	1000 pF	1000 pF	1500 pF	1500 pF
Insulation Resistance (70° F [21°C])	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms	>10^8 ohms
Insulation Resistance (900 °F ± 15 °F [482 °C ± 10 °C])	>10^5	>10^5	—	—	—	—	—	—
Output Polarity	Negative	Negative	Differential	Differential	Differential	Differential	Differential	Differential
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Compression	Compression	Compression	Compression	Compression	Compression	Compression	Compression
Housing Material	Inconel	Inconel	Inconel	Inconel	Inconel	Inconel	Inconel	Inconel
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	5/8 in × 1.0 in	5/8 in × 25.4 mm	1.0 in × 1.82 in [7]	25.4 × 46.2 mm [7]	1.25 in × 1.82 in [7]	31.8 × 46.2 mm [7]	1.5 in × 1.82 in [7]	38.1 × 46.2 mm [7]
Weight	1.1 oz	30 gm	3.6 oz	100 gm	4.3 oz	120 gm	4.6 oz	130 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	7/16-27 2-Pin	7/16-27 2-Pin	7/16-27 2-Pin	7/16-27 2-Pin	7/16-27 2-Pin	7/16-27 2-Pin
Electrical Connection Position	Side	Side	Side	Side	Side	Side	Side	Side
Mounting	10-32 Female	10-32 Female	Through Holes [8]	Through Holes [8]	Through Holes [8]	Through Holes [8]	Through Holes [8]	Through Holes [8]
Supplied Accessories [3]								
Mounting Stud	081B05		—		—		—	
Metric Mounting Stud	M081B05		—		—		—	
Cap Screw	—		081A99 (3 ea.)		081A99 (3 ea.)		081A99 (3 ea.)	
Hardline Cable	023A10		—		—		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Mating Cable Connectors	EB, EJ, AH, AK		ET, GN		ET, GN		ET, GN	
Recommended Stock Cables	003		013, 020		013, 020		013, 020	
Options [5]								
Available Options	P		N/A		N/A		N/A	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information. [6] Low frequency response is determined by external signal conditioning electronics.
[7] Height × Width. [8] Triangular base with three mounting holes.

Dimensions shown are in inches (millimeters).

Seismic ICP® Accelerometers

- **Building vibration monitoring**
- **Earthquake detection**
- **Structural testing of bridges**
- **Floor vibration monitoring**
- **Geological formation studies**
- **Foundation vibration monitoring**

Seismic accelerometers are specifically designed to enable the detection of ultra-low-level, low-frequency vibrations associated with very large structures, foundations, and earth tremors. These sensors typically possess exceptional measurement resolution as the result of a comparatively larger size, which furnishes a stronger output signal and a lower noise floor.

Both ceramic and quartz sensing elements are utilized in seismic accelerometer designs. The Model 393C, with quartz sensing element, offers the best low-frequency response. Ceramic element styles with built-in, low-noise, signal conditioning circuitry offer the greatest measurement resolution. For best measurement clarity, seismic accelerometers should be used with a unity gain, battery-powered signal conditioner.

Several versions offer rugged, laser-welded, stainless steel housings with durable military-style connectors. Electrical case isolation, hermetic sealing, RF, EMI, ESD, and overload protection all ensure tolerance against environmental influences and mishandling.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

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Seismic ICP® Accelerometers

SEISMIC ICP® ACCELEROMETERS
(*complete specifications are featured on page* 1.76 *to* 1.77)

Seismic ICP® accelerometers are characterized by a low noise floor, high output signal, and low frequency response. They are also larger in size and weight.

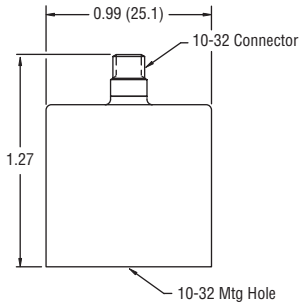
- building vibration
- floor and foundation vibration
- large machinery
- heavy equipment
- site surveys

Model 393B04 — Low noise, wide amplitude range

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.05 Hz to 750 Hz frequency range
- 50 gram (1.8 oz) weight
- 3 µg (30 µm/s² resolution)

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

1/2x Actual Size

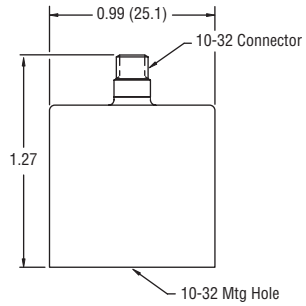


Model 393B05 — High output signal in a small package size

- 10 V/g [1.02 V/(m/s²)] sensitivity
- 0.5 Hz to 750 Hz frequency range
- 50 gram (1.8 oz) weight
- 4 µg (40 µm/s² resolution)

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

1/2x Actual Size

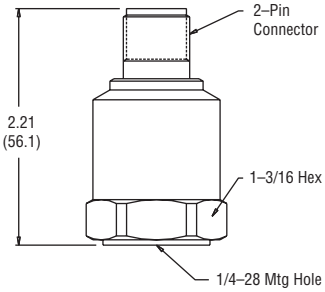


Model 393A03 — General purpose, rugged

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.3 to 4000 Hz frequency range
- 210 gram (7.4 oz) weight
- 10 µg (100 µm/s²) resolution
- 5000 g (49k m/s²) shock survivability
- Electrical case isolation

Recommended cables and accessories ⑦ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

1/2x Actual Size



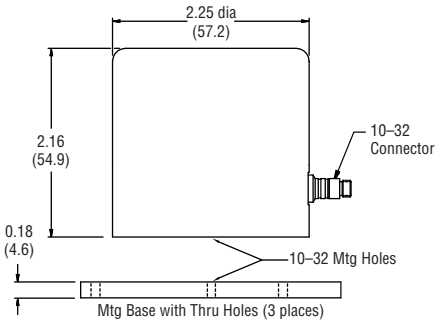
Dimensions shown are in inches (millimeters).

SEISMIC ICP® ACCELEROMETERS (*continued*)

Model 393C — Quartz sensing element provides stable, low-frequency measurement capability

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.01 to 1200 Hz frequency range
- 885 gram (31.2 oz) weight
- 100 µg (1mm/s²) resolution
- Electrical ground isolation

Recommended cables and accessories ②❷ — see page 4.
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

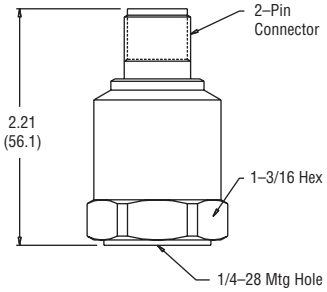


1/2x Actual Size

Model 393B12 — High output signal in a relatively small package size

- 10 V/g [1.02 V/(m/s²)] sensitivity
- 0.1 to 2000 Hz frequency range
- 210 gram (7.4 oz) weight
- 8 µg (80 µm/s²) resolution
- 5000 g shock survivability
- Electrical case isolation

Recommended cables and accessories ⑦ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

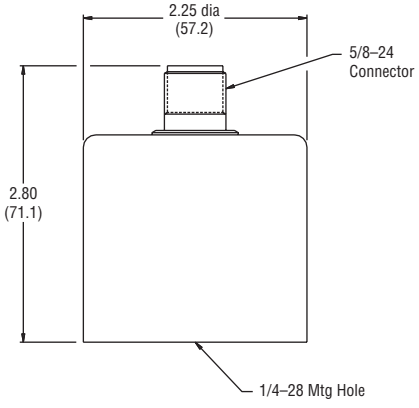


1/2x Actual Size

Model 393B31 — Best resolution seismic accelerometer

- 10 V/g [1.02 V/(m/s²)] sensitivity
- 0.07 to 300 Hz frequency range
- 635 gram (22.4 oz) weight
- 1 µg (9 µm/s²) rms resolution
- Electrical case isolation

Recommended cables and accessories ⑦ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information



1/2x Actual Size

Seismic ICP® Accelerometers

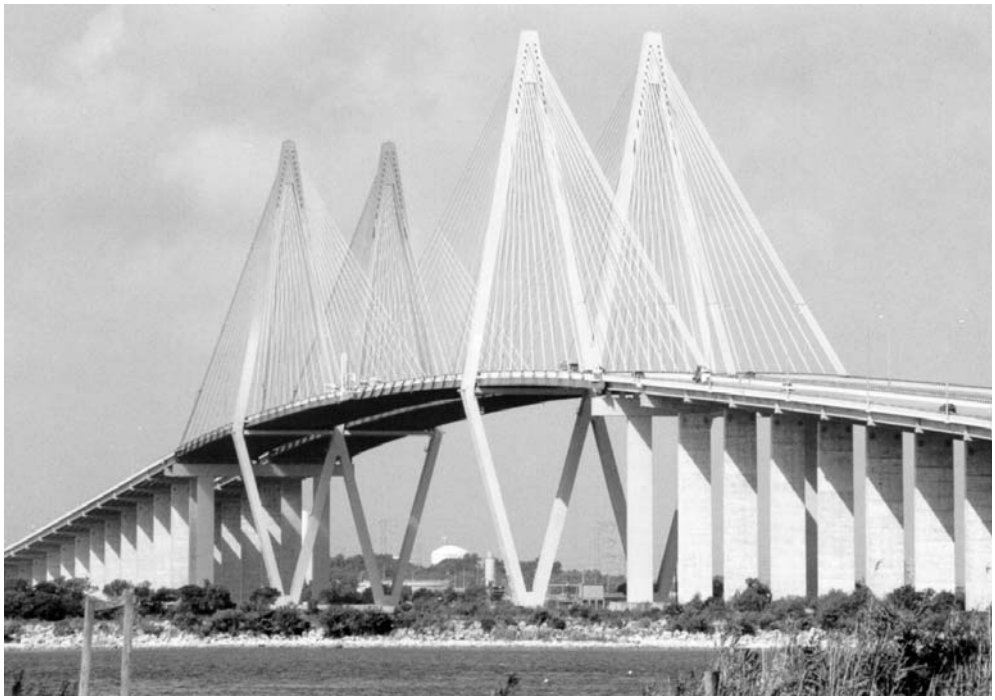
Seismic ICP® Accelerometer Specifications						
Model Number [1]	**393C**		**393A03**		**393B04**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	1000 mV/g	102 mV/(m/s²)	1000 mV/g	102 mV/(m/s²)	1000 mV/g	102 mV/(m/s²)
Sensitivity Tolerance	± 15%	± 15%	± 5%	± 5%	± 10%	± 10%
Measurement Range	2.5 g pk	24.5 m/s² pk	± 5 g pk	± 49 m/s² pk	± 5 g pk	± 49 m/s² pk
Frequency Range (± 5%)	0.025 to 800 Hz	0.025 to 800 Hz	0.5 to 2000 Hz	0.5 to 2000 Hz	0.06 to 450 Hz	0.06 to 450 Hz
Frequency Range (± 10%)	0.01 to 1200 Hz	0.01 to 1200 Hz	0.3 to 4000 Hz	0.3 to 4000 Hz	0.05 to 750 Hz	0.05 to 750 Hz
Resonant Frequency	≥ 3.5 kHz	≥ 3.5 kHz	≥ 10 kHz	≥ 10 kHz	≥ 2500 Hz	≥ 2500 Hz
Broadband Resolution (1 to 10k Hz)	0.0001 g rms	0.001 m/s² rms	0.00001 g rms	0.0001 m/s² rms	0.000003 g rms	0.00003 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 100 g pk	± 981 m/s² pk	± 5000 g pk	± 49k m/s² pk	± 300 g pk	± 2950 m/s² pk
Temperature Range (Operating)	-65 to +200 °F	-54 to +93 °C	-65 to +250 °F	-54 to +121 °C	0 to +176 °F	-18 to +80 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 10 mA	2 to 10 mA
Output Impedance	<100 ohms	<100 ohms	<250 ohms	<250 ohms	<500 ohms	<500 ohms
Output Bias Voltage	3 to 4.5 VDC	3 to 4.5 VDC	8 to 12 VDC	8 to 12 VDC	7 to 12 VDC	7 to 12 VDC
Discharge Time Constant	≥ 20 sec	≥ 20 sec	1 to 3 sec	1 to 3 sec	5 to 15 sec	5 to 15 sec
Electrical Isolation (Case)	≥ 10^8 ohms [7]	≥ 10^8 ohms [7]	≥ 10^8 ohms	≥ 10^8 ohms	N/A	N/A
Physical						
Sensing Element	Quartz	Quartz	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Compression	Compression	Shear	Shear	Flexural	Flexural
Housing Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Weight	31.2 oz	885 gm	7.4 oz	210 gm	1.8 oz	50 gm
Size (Diameter × Height)	2.25 in × 2.16 in	57.2 mm × 54.9 mm	1 3/16 in × 2.19 in [6]	1 3/16 in × 55.6 mm [6]	0.99 in × 1.22 in	25 mm × 31 mm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	2-Pin MIL-C-5015	2-Pin MIL-C-5015	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Top	Top
Mounting Thread	10-32 Female	10-32 Female	1/4-28 Female	1/4-28 Female	10-32 Female	10-32 Female
Supplied Accessories [3]						
Petro Wax	080A109		—		—	
Mounting Base	080A88		—		—	
Mounting Stud	081B05		081B20		081B05	
Metric Mounting Stud	M081B05		M081B20		—	
Protective Thermal Jacket	—		085A31		—	
NIST Calibration [4]	ACS-1, ACS-4		ACS-1, ACS-4		ACS-1, ACS-4	
Additional Accessories [3]						
Magnetic Mounting Base	080A21		080A54		N/A	
Triaxial Mounting Adaptor	080M16		080A57		N/A	
Mating Cable Connectors	EB, AH, AK, AW		AE, AM, AP		EB, AH, AK, AW	
Recommended Stock Cables	002, 003		N/A		002, 003	
Options [5]						
Available Options	N/A		N/A		M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information. [6] Hex × Height. [7] Base Isolation.

Dimensions shown are in inches (millimeters).

Seismic ICP® Accelerometer Specifications						
Model Number [1]	**393B05**		**393B12**		**393B31**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 V/g	1.02 V/(m/s²)	10.0 V/g	1.02 V/(m/s²)	10.0 V/g	1.02 V/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 5%	± 5%
Measurement Range	0.5 g pk	4.9 m/s² pk	0.5 g pk	4.9 m/s² pk	0.5 g pk	4.9 m/s² pk
Frequency Range (± 5%)	0.6 to 450 Hz	0.6 to 450 Hz	0.15 to 1000 Hz	0.15 to 1000 Hz	0.1 to 200 Hz	0.1 to 200 Hz
Frequency Range (± 10%)	0.5 to 750 Hz	0.5 to 750 Hz	0.10 to 2000 Hz	0.10 to 2000 Hz	0.07 to 300 Hz	0.07 to 300 Hz
Resonant Frequency	≥ 2.5 kHz	≥ 2.5 kHz	≥ 10 kHz	≥ 10 kHz	≥ 700 Hz	≥ 700 Hz
Broadband Resolution (1 to 10k Hz)	0.000004 g rms	0.00004 m/s² rms	0.000008 g rms	0.00008 m/s² rms	0.000001 g rms	0.000009 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 7 %	≤ 7 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 300 g pk	± 2950 m/s² pk	± 5000 g pk	± 49k m/s² pk	± 40 g pk	± 392 m/s² pk
Temperature Range (Operating)	0 to +176 °F	-18 to +80 °C	-50 to +180 °F	-45 to +82 °C	0 to +150 °F	-18 to +65 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	24 to 28 VDC	24 to 28 VDC
Constant Current Excitation	2 to 10 mA	2 to 10 mA	2 to 20 mA	2 to 20 mA	2 to 10 mA	2 to 10 mA
Output Impedance	<500 ohms	<500 ohms	<1000 ohms	<1000 ohms	≤ 500 ohms	≤ 500 ohms
Output Bias Voltage	7 to 12 VDC	7 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 14 VDC	8 to 14 VDC
Discharge Time Constant	0.5 to 2.0 sec	0.5 to 2.0 sec	≥ 3.5 sec	≥ 3.5 sec	≥ 5 sec	≥ 5 sec
Electrical Isolation (Case)	N/A	N/A	≥ 10^8 ohms	≥ 10^8 ohms	≥ 10^8 ohms	≥ 10^8 ohms
Physical						
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Flexural	Flexural	Shear	Shear	Flexural	Flexural
Housing Material	Titanium	Titanium	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Weight	1.8 oz	50 gm	7.4 oz	210 gm	22.4 oz	635 gm
Size (Diameter × Height)	0.99 in × 1.22 in	25 mm × 31 mm	1 3/16 in × 2 3/16 in [6]	1 3/16 in × 55.6 mm [6]	2 1/4 in × 2.8 in [6]	2 1/4 in × 71.1 mm [6]
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	2-Pin MIL-C-5015	2-Pin MIL-C-5015	2-Pin MIL-C-5015	2-Pin MIL-C-5015
Electrical Connection Position	Top	Top	Top	Top	Top	Top
Mounting Thread	10-32 Female	10-32 Female	1/4-28 Female	1/4-28 Female	1/4-28 Female	1/4-28 Female
Supplied Accessories [3]						
Petro Wax	—		—		—	
Mounting Base	—		—		—	
Mounting Stud	081B05		081B20		081B20	
Protective Thermal Jacket	—		085A31		—	
NIST Calibration [4]	ACS-1		ACS-1, ACS-4		ACS-4	
Additional Accessories [3]						
Magnetic Mounting Base	N/A		080A54		N/A	
Triaxial Mounting Adaptor	N/A		080A57		080M189	
Mating Cable Connectors	EB, AH, AK, AW		AE, AM, AP		AE, AM, AP	
Recommended Stock Cables	002, 003		N/A		N/A	
Options [5]						
Available Options	M		M		M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information. [6] Hex × Height.

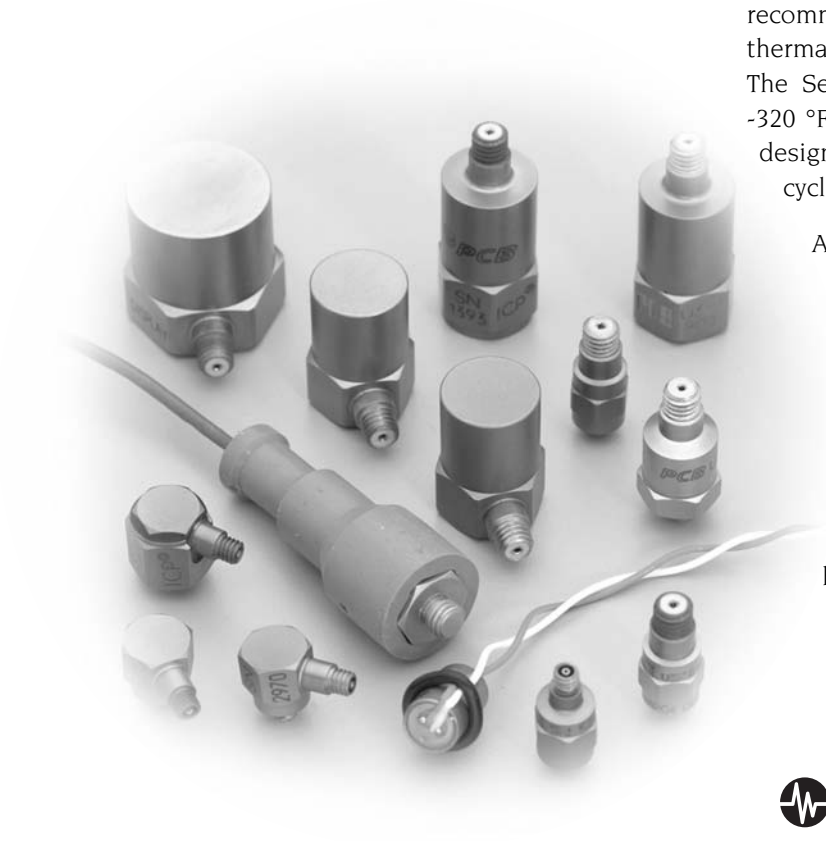


Seismic accelerometers are utilized on large civil structures, such as buildings and bridges, to monitor their motion in response to such effects as wind, traffic, and earthquakes.

Dimensions shown are in inches (millimeters).

Extreme Environment ICP® Accelerometers

- **High temperature**
- **Cryogenic temperature**
- **HALT, HASS, ESS**
- **Thermal stress screening**
- **Environmental testing**
- **Combined environmental chambers**



PCB offers specially designed and tested ICP® and charge output accelerometers for conducting vibration and shock measurements under demanding environmental conditions. These sensors combine proven quartz, and ceramic shear sensing technology with specialized, built-in, microelectronic signal conditioning circuitry to achieve dependable operation to extreme temperatures and through repetitive temperature cycling. Laser-welded, hermetically sealed, light-weight titanium or stainless-steel housings offer further protection from the environment. Most units operate from conventional, constant-current signal conditioners, permitting reliable operation and simplicity of use.

Three distinct series of accelerometers are offered for extreme environments. The Series 320 is recommended for high temperature applications and thermal cycling requirements from -100 to +325 °F. The Series 351 addresses cryogenic applications to -320 °F. Accelerometers for HALT, HASS, and ESS are designed and tested for operation in rapid, thermal cycling, vibration test applications.

A variety of sizes and configurations are available in each series to accommodate unique application requirements.

Prior to shipment, each sensor undergoes a battery of tests to ensure survivability for its intended use. Such tests include temperature soak at cryogenic or elevated temperatures, temperature cycling, and exposure to highly accelerated screening procedures with hydraulically actuated shakers.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

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Extreme Environment Accelerometers

HIGH TEMPERATURE ICP® ACCELEROMETERS
(*complete specifications are featured on page* 1.84)

High temperature ICP® accelerometers are specially designed and tested to survive temperature extremes beyond the range of standard ICP® accelerometers.

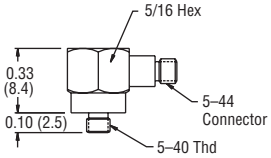
- engine testing
- turbine testing
- high-temperature testing

Model 320C15 — Miniature, low profile

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 1.5 Hz to 18 kHz frequency range
- 2 gram (0.07 oz) weight
- -100 to +325 °F (-73 to +163 °C) temperature range
- ± 500 g (± 4900 m/s²) amplitude range
- Quartz shear sensing element

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

Actual Size

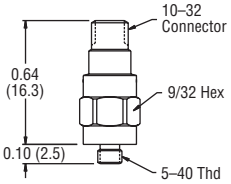


Model 320C18 — 10-32 connector joins to cables common to most accelerometers

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 1.5 Hz to 18 kHz frequency range
- 1.7 gram (0.06 oz) weight
- -100 to +325 °F (-73 to +163 °C) temperature range
- ± 500 g (± 4900 m/s²) amplitude range
- Quartz shear sensing element

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

Actual Size

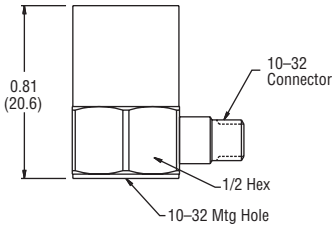


Model 320C03 — General purpose

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 9000 Hz frequency range
- 10.5 gram (0.38 oz) weight
- -100 to +325 °F (-73 to +163 °C) temperature range
- ± 500 g (± 4900 m/s²) amplitude range
- Quartz shear sensing element

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, W — see pages xvii to xx for option information

Actual Size



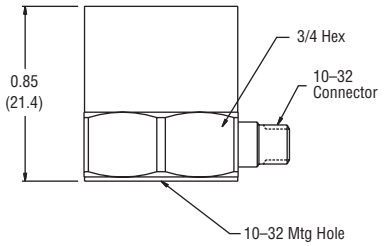
Dimensions shown are in inches (millimeters).

HIGH TEMPERATURE ICP® ACCELEROMETERS (*continued*)

Model 320C33 — High sensitivity

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.7 Hz to 6000 Hz frequency range
- 20 gram (0.7 oz) weight
- -100 to +325 °F (-73 to +163 °C) temperature range
- ± 50 g (± 490 m/s²) amplitude range
- Quartz shear sensing element

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J, W — see pages xvii to xx for option information



Actual Size

CRYOGENIC ICP® ACCELEROMETERS

(*complete specifications are featured on pages* 1.85 *to* 1.86)

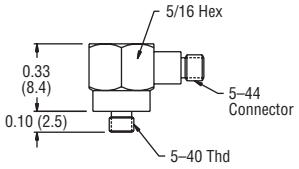
Cryogenic ICP® accelerometers are especially well suited for applications requiring operation to extremely low temperatures.

- cryogenic pumps
- rocket motors
- refrigerant handling

Model 351B11 — Miniature, low profile

- 5 mV/g [0.51 mV/(m/s²)] sensitivity
- 0.7 Hz to 15 kHz frequency range
- 2 gram (0.07 oz) weight
- -320 to +250 °F (-196 to +121 °C) temperature range
- ± 300 g (± 2942 m/s²) amplitude range

Recommended cables and accessories ①❶ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M, W — see pages xvii to xx for option information

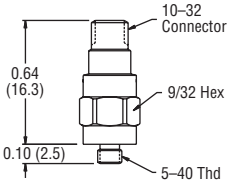


Actual Size

Model 351B14 — 10-32 connector joins to cables common to most accelerometers

- 5 mV/g [0.51 mV/(m/s²)] sensitivity
- 0.7 Hz to 10 kHz frequency range
- 1.8 gram (0.06 oz) weight
- -320 to +250 °F (-196 to +121 °C) temperature range
- ± 300 g (± 2942 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: A, J, M — see pages xvii to xx for option information



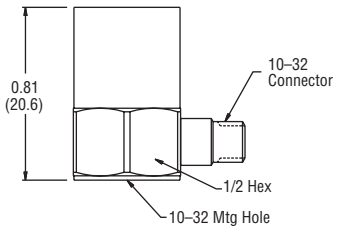
Actual Size

CRYOGENIC ICP® ACCELEROMETERS (*continued*)

Model 351B03 — General purpose

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 9000 Hz frequency range
- 10.5 gram (0.38 oz) weight
- -320 to +250 °F (-196 to +121 °C) temperature range
- ± 150 g (± 1472 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J — see pages xvii to xx for option information

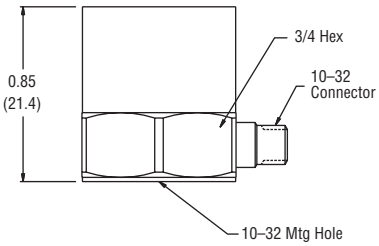


Actual Size

Model 351B31 — High sensitivity

- 50 mV/g [5.1 mV/(m/s²)] sensitivity
- 0.7 Hz to 7 kHz frequency range
- 20 gram (0.7 oz) weight
- -320 to +250 °F (-196 to +121 °C) temperature range
- ± 30 g (± 294 m/s²) amplitude range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J — see pages xvii to xx for option information

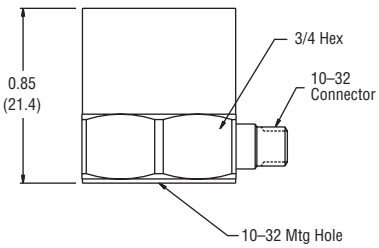


Actual Size

Model 351B41 — High sensitivity, high resolution

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.7 Hz to 3500 Hz frequency range
- 40 gram (1.4 oz) weight
- -320 to +250 °F (-196 to +121 °C) temperature range
- ± 15 g (± 147 m/s²) amplitude range
- 0.0005 g (0.005 m/s²) resolution

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: J — see pages xvii to xx for option information



Actual Size

Dimensions shown are in inches (millimeters).

Extreme Environment Accelerometers

HALT, HASS, ESS ACCELEROMETERS

(*complete specifications are featured on pages* 1.87 *to* 1.88)

HALT, HASS, and ESS accelerometers are specifically designed and tested to endure the extreme and rapid thermal and vibration cycles encountered in pneumatically actuated vibration tables used for accelerated life testing and stress screening.

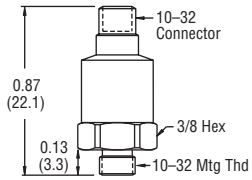
- avionics
- servo controls
- circuit boards
- motors
- life support apparatus
- consumer electronics
- machinery monitoring
- vibration control

Model 352B30 — Built-in, low-pass filter suppresses overloads

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 10 Hz to 6000 Hz frequency range
- 7 gram (0.25 oz) weight
- ± 500 g (± 4900 m/s²) amplitude range
- -65 to +250 °F (-54 to +121 °C) temperature range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size

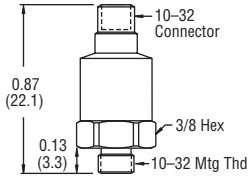


Model 320C20 — Filtered, high frequency, high temperature, stable sensing element

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 1.5 Hz to 10 kHz frequency range
- 6.5 gram (0.23 oz) weight
- ± 500 g (± 4900 m/s²) amplitude range
- -100 to +325 °F (-73 to +163 °C) temperature range

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: M — see pages xvii to xx for option information

Actual Size



Model 300A12 — System, including high temperature, charge output accelerometer, in-line charge converter, and high temperature interconnect cable

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 10 Hz to 10 kHz frequency range
- 5.4 gram (0.19 oz) weight
- ± 250 g (± 2450 m/s²) amplitude range
- -100 to +500 °F (-73 to +260 °C) temperature range

Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

Dimensions shown are in inches (millimeters).

Extreme Environment Accelerometers

High Temperature ICP® Accelerometer Specifications								
Model Number [1]	**320C03**		**320C15**		**320C18**		**320C33**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	1 to 6000 Hz	1 to 6000 Hz	2.0 to 10k Hz	2.0 to 10k Hz	2.0 to 10k Hz	2.0 to 10k Hz	1 to 4000 Hz	1 to 4000 Hz
Frequency Range (± 10%)	0.7 to 9000 Hz	0.7 to 9000 Hz	1.5 to 18k Hz	1.5 to 18k Hz	1.5 to 18k Hz	1.5 to 18k Hz	0.7 to 6000 Hz	0.7 to 6000 Hz
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	≥ 60 kHz	≥ 60 kHz	≥ 60 kHz	≥ 60 kHz	≥ 22 kHz	≥ 22 kHz
Broadband Resolution (1 to 10k Hz)	0.005 g rms	0.05 m/s² rms	0.005 g rms	0.05 m/s² rms	0.005 g rms	0.05 m/s² rms	0.0003 g rms	0.003 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 2000 g pk	± 19.6k m/s² pk
Temperature Range (Operating)	-100 to +325 °F	-73 to +163 °C	-100 to +325 °F	-73 to +163 °C	-100 to +325 °F	-73 to +163 °C	-100 to +325 °F	-73 to +163 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.5 to 1.0 sec	0.5 to 1.0 sec	0.25 to 1.0 sec	0.25 to 1.0 sec	0.25 to 1.0 sec	0.25 to 1.0 sec	0.5 to 1.5 sec	0.5 to 1.5 sec
Physical								
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic
Size (Hex × Height)	1/2 in × 0.81 in	1/2 in × 20.6 mm	5/16 in × 0.43 in	5/16 in × 10.9 mm	9/32 in × 0.74 in	9/32 in × 18.8 mm	3/4 in × 0.85 in	3/4 in × 21.6 mm
Weight	0.38 oz	10.5 gm	0.07 oz	2.0 gm	0.06 oz	1.7 gm	0.7 oz	20 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	5-44 Coaxial	5-44 Coaxial	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Top	Top	Side	Side
Mounting Thread	10-32 Female	10-32 Female	5-40 Male	5-40 Male	5-40 Male	5-40 Male	10-32 Female	10-32 Female
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		—	
Adhesive Mounting Base	—		080A15		080A15		080A12	
Mounting Stud	081B05		—		—		081B05	
Metric Mounting Stud	M081B05		—		—		M081B05	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Magnetic Mounting Base	080A27		080A30		080A30		080A27	
Triaxial Mounting Adaptor	080B10		080B16		080B16		080B11	
Mating Cable Connectors	AH, AK, AW, EB, EJ		AF, AG		AH, AK, AW, EB, EJ		AH, AK, AW, EB, EJ	
Recommended Stock Cables	002, 003		002, 003		002, 003		002, 003	
Options [5]								
Available Options	J, W		A, J, M, W		A, J, M, W		J. W	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Extreme Environment Accelerometers

Cryogenic ICP® Accelerometer Specifications						
Model Number [1]	**351B03**		**351B11**		**351B14**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	5 mV/g	0.51 mV/(m/s²)	5 mV/g	0.51 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	±150 g pk	±1472 m/s² pk	± 300 g pk	± 2942 m/s² pk	± 300 g pk	± 2942 m/s² pk
Frequency Range (± 5%)	1 to 6000 Hz	1 to 6000 Hz	1 to 10k Hz	1 to 10k Hz	1 to 8k Hz	1 to 8k Hz
Frequency Range (± 10%)	0.7 to 9000 Hz	0.7 to 9000 Hz	0.7 to 15k Hz	0.7 to 15k Hz	0.7 to 10k Hz	0.7 to 10k Hz
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	≥ 40 kHz	≥ 40 kHz	≥ 40 kHz	≥ 40 kHz
Broadband Resolution (1 to 10k Hz)	0.01 g rms	0.1 m/s² rms	0.01 g rms	0.1 m/s² rms	0.01 g rms	0.1 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental						
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-320 to +250 °F	-196 to +121 °C	-320 to +250 °F	-196 to +121 °C	-320 to +250 °F	-196 to +121 °C
Electrical						
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	3 to 10 VDC	3 to 10 VDC	3 to 10 VDC	3 to 10 VDC	3 to 10 VDC	3 to 10 VDC
Discharge Time Constant	>0.5 sec	>0.5 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical						
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic
Size (Hex × Height)	1/2 in × 0.81 in	1/2 in × 20.6 mm	5/16 in × 0.43 in	5/16 in × 10.9 mm	9/32 in × 0.74 in	9/32 in × 18.8 mm
Weight	0.38 oz	10.5 gm	0.07 oz	2 gm	0.06 oz	1.8 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	5-44 Coaxial Jack	5-44 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Top	Top
Mounting Thread	10-32 Female	10-32 Female	5-40 Male	5-40 Male	5-40 Male	5-40 Male
Supplied Accessories [3]						
Mounting Stud	081B05		—		—	
Metric Mounting Stud	M081B05		—		—	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1	
Additional Accessories [3]						
Petro Wax	080A109		080A109		080A109	
Adhesive Mounting Base	080A		080A15		080A15	
Magnetic Mounting Base	080A27		080A30		080A30	
Triaxial Mounting Adaptor	080B10		080B16		080B16	
Mating Cable Connectors	EB, AH, AK, AW		AF, AG		EB, AH, AK, AW	
Recommended Stock Cables	003		003		003	
Options [5]						
Available Options	J		A, J, M, W		A, J, M	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.

Cryogenic ICP® Accelerometer Specifications				
Model Number [1]	**351B31**		**351B41**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	50 mV/g	5.10 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 30 g pk	± 294 m/s² pk	±15 g pk	±147 m/s² pk
Frequency Range (± 5%)	1 to 4000 Hz	1 to 4000 Hz	1 to 2000 Hz	1 to 2000 Hz
Frequency Range (± 10%)	0.7 to 7000 Hz	0.7 to 7000 Hz	0.7 to 3500 Hz	0.7 to 3500 Hz
Resonant Frequency	≥ 22 kHz	≥ 22 kHz	≥ 15 kHz	≥ 15 kHz
Broadband Resolution (1 to 10k Hz)	0.002 g rms	0.02 m/s² rms	0.0005 g rms	0.005 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental				
Overload Limit (Shock)	± 2000 g pk	± 19.6k m/s² pk	±1000 g pk	±9810 m/s² pk
Temperature Range (Operating)	-320 to +250 °F	-196 to +121 °C	-320 to +250 °F	-196 to +121 °C
Electrical				
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	3 to 10 VDC	3 to 10 VDC	3 to 10 VDC	3 to 10 VDC
Discharge Time Constant	>0.5 sec	>0.5 sec	>0.5 sec	>0.5 sec
Physical				
Sensing Element	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium
Sealing	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic
Size (Hex × Height)	3/4 in × 0.85 in	3/4 in × 21.6 mm	3/4 in × 0.85 in	3/4 in × 21.6 mm
Weight	0.7 oz	20 gm	1.4 oz	40 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side
Mounting Thread	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]				
Mounting Stud	081B05		081B05	
Metric Mounting Stud	M081B05		M081B05	
NIST Calibration [4]	ACS-1		ACS-1	
Additional Accessories [3]				
Petro Wax	080A109		080A109	
Adhesive Mounting Base	080A12		080A12	
Magnetic Mounting Base	080A27		080A27	
Triaxial Mounting Adaptor	080B11		080B11	
Mating Cable Connectors	EB, AH, AK, AW		EB, AH, AK, AW	
Recommended Stock Cables	003		003	
Options [5]				
Available Options	J		J	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

HALT, HASS, ESS ICP® Accelerometer Specifications				
Model Number [1]	**320C20**		**352B30**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	10 mV/g	1.02 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 500 g pk	± 4905 m/s² pk
Frequency Range (± 5%)	2.0 to 5000 Hz	2.0 to 5000 Hz	15 to 4500 Hz	15 to 4500 Hz
Frequency Range (± 10%)	1.5 to 10k Hz	1.5 to 10k Hz	10 to 6000 Hz	10 to 6000 Hz
Resonant Frequency	≥ 60 kHz	≥ 60 kHz	≥ 65 kHz	≥ 65 kHz
Broadband Resolution (1 to 10k Hz)	0.006 g rms	0.06 m/s² rms	0.004 g rms	0.04 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental				
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-100 to +325 °F	-73 to +163 °C	-65 to +250 °F	-54 to +121 °C
Electrical				
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.25 to 1.0 sec	0.25 to 1.0 sec	<0.1 sec	<0.1 sec
Physical				
Sensing Element	Quartz	Quartz	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Stainless Steel	Stainless Steel
Sealing	Welded Hermetic	Welded Hermetic	Welded Hermetic	Welded Hermetic
Size (Hex × Height)	3/8 in × 0.87 in	3/8 in × 22.1 mm	3/8 in × 0.87 in	3/8 in × 22 mm
Weight	0.23 oz	6.5 gm	0.25 oz	7 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top
Mounting Thread	10-32 Male	10-32 Male	10-32 Male	10-32 Male
Supplied Accessories [3]				
Petro Wax	080A109		080A109	
Adhesive Mounting Base	080A		080A	
Mounting Stud	—		—	
Metric Mounting Stud	—		—	
NIST Calibration [4]	ACS-1		ACS- 1	
Additional Accessories [3]				
Magnetic Mounting Base	N/A		N/A	
Triaxial Mounting Adaptor	080A17		080A17	
Mating Cable Connectors	EB, EJ		EB, EJ	
Recommended Stock Cables	002, 003		002, 003	
Options [5]				
Available Options	M		M	

NOTES: [1] See note regarding accuracy of information on inside front cover.

[2] Zero-based, least-squares, straight line method.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

Extreme Environment Accelerometers

HALT, HASS, ESS Charge Output Accelerometer Specifications						
	Kit Specifications		Component Specifications			
Model Number [1]	**300A12**		**357M50**		**422M136**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	10 mV/g	1.02 mV/(m/s²)	0.4 pC/g	0.04 pC/(m/s²)	N/A	N/A
Sensitivity Tolerance	± 20%	± 20%	± 15%	± 15%	N/A	N/A
Measurement Range	± 250 g pk	± 2450 m/s² pk	± 500 g pk	± 4900 m/s² pk	± 2.5 V	± 2.5 V
Frequency Range (± 5%)	10 to 10k Hz	10 to 10k Hz	10 kHz [6]	10 kHz [6]	N/A	N/A
Low Frequency Cutoff (-5%)	N/A	N/A	N/A	N/A	10 Hz	10 Hz
Resonant Frequency	≥ 60 kHz	≥ 60 kHz	≥ 60 kHz	≥ 60 kHz	N/A	N/A
Broadband Resolution (1 to 10k Hz)	0.002 g rms	0.02 m/s² rms	N/A	N/A	N/A	N/A
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	N/A	N/A
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	N/A	N/A
Environmental						
Overload Limit (Shock)	± 3000 g pk	± 29k m/s² pk	± 3000 g pk	± 29k m/s² pk	± 1000 g pk	± 9800 m/s² pk
Temperature Range (Operating)	-100 to +500 °F	-73 to +260 °C	-100 to +500 °F	-73 to +260 °C	-65 to +250 °F	-54 to +121 °C
Electrical						
Input Range (± 2%)	N/A	N/A	N/A	N/A	± 100 pC	± 100 pC
Charge Sensitivity (± 2% at 100 Hz)	N/A	N/A	N/A	N/A	25 mV/pC	25 mV/pC
Broadband Noise (1 to 10k Hz)	N/A	N/A	N/A	N/A	20 µV	20 µV
Excitation Voltage	18 to 28 VDC	18 to 28 VDC	N/A	N/A	18 to 28 VDC	18 to 28 VDC
Constant Current Excitation	2.2 to 20 mA	2.2 to 20 mA	N/A	N/A	2.2 to 20 mA	2.2 to 20 mA
Output Impedance	< 10 ohms	< 10 ohms	N/A	N/A	< 10 ohms	< 10 ohms
Bias Voltage	8 to 12 VDC	8 to 12 VDC	N/A	N/A	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.05 sec	0.05 sec	N/A	N/A	0.05 sec	0.05 sec
Capacitance	N/A	N/A	125 pF	125 pF	N/A	N/A
Insulation Resistance (at 70° F [21°C])	N/A	N/A	> 10^{12} ohms	> 10^{12} ohms	N/A	N/A
Insulation Resistance (at 500° F [260°C])	N/A	N/A	> 10^{8} ohms	> 10^{8} ohms	N/A	N/A
Output Polarity	Positive	Positive	Negative	Negative	N/A	N/A
Output Related to Input	N/A	N/A	N/A	N/A	Inverted	Inverted
Physical						
Sensing Element	N/A	N/A	Ceramic	Ceramic	N/A	N/A
Sensing Geometry	N/A	N/A	Shear	Shear	N/A	N/A
Housing Material	N/A	N/A	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	N/A	N/A	Hermetic	Hermetic	Epoxy	Epoxy
Weight	N/A	N/A	0.19 oz	5.4 gm	1.1 oz	31.2 gm
Size (Hex × Height)	N/A	N/A	3/8 in × 0.87 in	3/8 in × 22 mm	3.4 in × 0.5 in [7]	86.4 mm × 12.7 mm [7]
Electrical Connection (Output)	N/A	N/A	10-32 Coaxial Jack	10-32 Coaxial Jack	BNC Jack	BNC Jack
Electrical Connection (Input)	N/A	N/A	N/A	N/A	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	N/A	N/A	Top	Top	N/A	N/A
Mounting Thread	N/A	N/A	10-32 Male	10-32 Male	N/A	N/A
Supplied Accessories [3]						
Charge Mode Accelerometer	357M50		—		—	
Charge Converter	422M136		—		—	
Cable	16950-01		—		—	
NIST Calibration [4]	ACS-1		ACS-1		—	
Options [5]						
Available Options	N/A		N/A		N/A	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Low frequency response is determined by external signal conditioning electronics. [7] Length x Diameter.

Dimensions shown are in inches (millimeters).

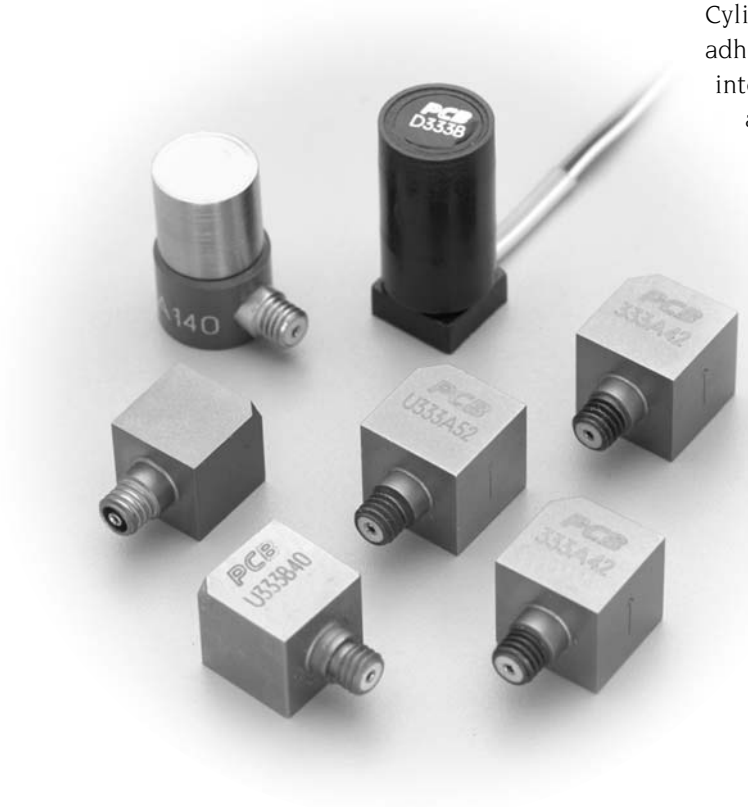
Structural Test / Array Accelerometers

- **Structural vibration testing**
- **Multi-channel modal analysis**
- **Automotive NVH analysis**
- **"Body-in-white" testing**
- **Aircraft GVT's**

The Series 333 ICP® accelerometers, and their accessories, have been specifically designed to address the needs of multi-point modal and structural test measurement applications. This equipment has been developed in conjunction with the world renowned University of Cincinnati Structural Dynamics Research Laboratory and proven in real-world testing situations.

All accelerometers feature high-output, piezoceramic sensing elements for strong output signal levels when measuring lower-amplitude input vibrations. All reduce mass-loading effects by employing ultra-lightweight casing materials. All exhibit minimal phase deviation, an important consideration for mode shape analysis. Within this family exists a variety of packages, mounting, and output cabling options to accommodate virtually any testing situation. Cubic style sensors offer convenience in installation by permitting adhesive mounting on any face. Cylindrical style packages install using convenient adhesive mounting pads and can also be easily configured into biaxial or triaxial sensor arrays with mounting adaptors. Optional "TEDS" circuitry offers "smart sensing" solutions for automating sensor performance bookkeeping and structure coordinate mapping. See section 5 of this catalog for more information about TEDS.

Mounting pads, multi-conductor signal cables, and patch panels all help to control and organize the cable bundles of sensor arrays. This helps to minimize set-up time and potential errors that are often the result of cable tangles encountered during multi-channel structural testing.



PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Structural Test / Array Accelerometers

MODAL ARRAY ICP® ACCELEROMETERS

(*complete specifications are featured on pages* 1.93 *to* 1.94)

Modal array accelerometers are specifically designed for structural testing and multi-point modal analysis. Shear mode sensing elements are utilized to provide stable, low frequency measurements. Their intelligent mounting schemes utilize adhesive mounting pads for simplified, temporary installations and patch panels to eliminate cable tangles. Installation, set-up and channel identification is accomplished more expediently.

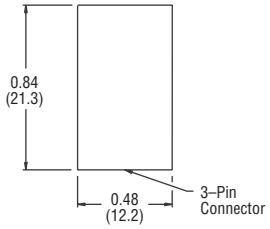
- multi-channel modal analysis
- low cost sensor arrays

Model 333B — 3-pin, snap-in, socket connector mounts to adhesively installed pad

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 2 Hz to 1000 Hz frequency range
- 5.6 gram (0.2 oz) weight
- 3-pin socket connector mount
- 0.00007 g (0.0007 m/s²) resolution
- Lightweight, low-cost polymer housing

Recommended cables and accessories ❼❾ — see pages 4.2 and 4.18
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

Actual Size

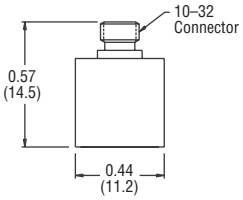


Model 333B31 — Installs upright with adhesive or inverted via interfacing adaptor pad

- 100 mV/g (10.2 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 4 gram (0.14 oz) weight
- 0.00015 g (0.0015 m/s²) resolution
- Titanium housing

Recommended cables and accessories ❷❽❿ — see pages 4.2 and 4.18
Select an ICP® sensor signal conditioner from those featured in section 3
Options: N, T — see pages xvii to xx for option information

Actual Size

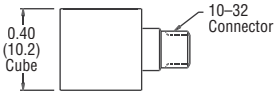


Model 333B32 — Convenient cubic shape offers versatile mounting options

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 4 gram (0.14 oz) weight
- Adhesive mount

Recommended cables and accessories ❷❷ — see pages 4.2 and 4.19
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

Actual Size

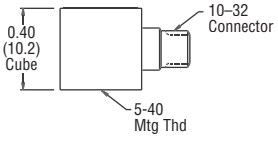


Model 333B30 — Convenient cubic shape offers versatile mounting options

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 4 gram (0.14 oz) weight
- Stud mount

Recommended cables and accessories ❷❷ — see pages 4.2 and 4.19
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

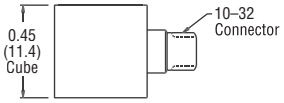
MODAL ARRAY (*continued*)

Model 333B42 — Convenient cubic shape offers versatile mounting options

- 500 mV/g [51 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 7.5 gram (0.26 oz) weight
- Adhesive mount

TEDS CIRCUITRY COMPATIBLE

Actual Size



Recommended cables and accessories ②❷ — see pages 4.2 and 4.19
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

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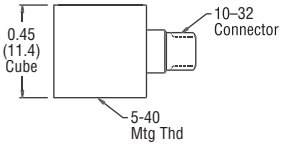
Model 333B40 — Convenient cubic shape offers versatile mounting options

- 500 mV/g [51 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 7.5 gram (0.26 oz) weight
- Stud mount

TEDS CIRCUITRY COMPATIBLE

Actual Size



Recommended cables and accessories ②❷ — see pages 4.2 and 4.19
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

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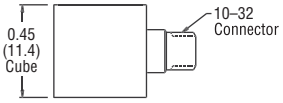
Model 333B52 — Convenient cubic shape offers versatile mounting options

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 7.5 gram (0.26 oz) weight
- Adhesive mount

TEDS CIRCUITRY COMPATIBLE

Actual Size



Recommended cables and accessories ②❷ — see pages 4.2 and 4.19
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

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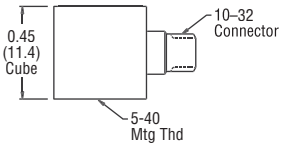
Model 333B50 — Convenient cubic shape offers versatile mounting options

- 1000 mV/g [102 mV/(m/s²)] sensitivity
- 0.5 Hz to 3000 Hz frequency range
- 7.5 gram (0.26 oz) weight
- Stud mount

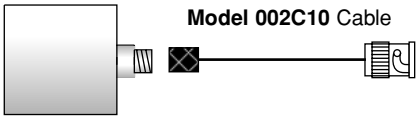
TEDS CIRCUITRY COMPATIBLE

Actual Size



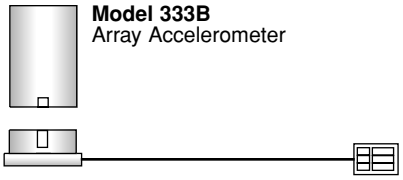
Recommended cables and accessories ②❷ — see pages 4.2 and 4.19
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T, TLA, TLB, TLC — see pages xvii to xx for option information

Modal Array Vibration Sensing Systems



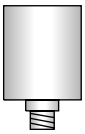
Model 002C10 Cable

Model 333B30, 333B40, 333B50
Single Axis Cubic Accelerometer



Model 333B
Array Accelerometer

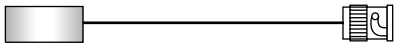
Model 080B37 25 ft. length
Model 080B38 50 ft. length
Model 080B40 10 ft. length
Adhesive pad with integral cable terminated with IDC connector



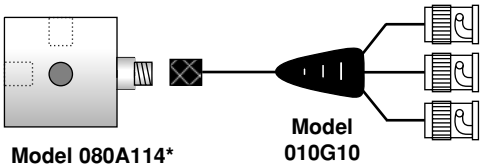
Model 333B31
Single Axis Array Accelerometer

Model 002C10 Cable

Model 080A140*
Adhesive Pad with 10-32 electrical connector



Model 080A115*
Adhesive Pad with integral 10 ft. cable

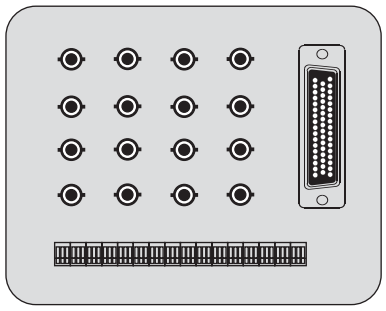


Model 080A114*
Triaxial Adapter

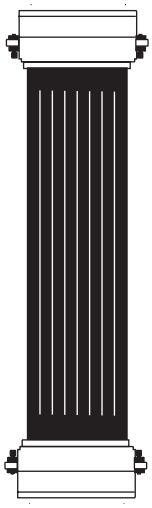
Model 010G10
Cable

*U.S. Patent No. 4,905,518

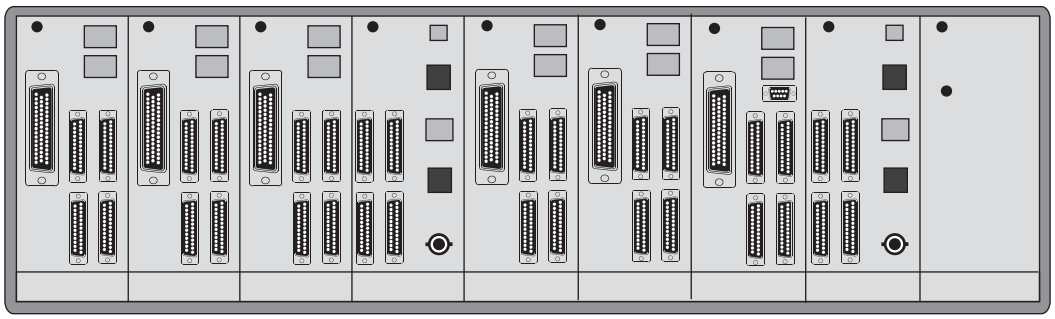
See Patch Panels on p. 4.15



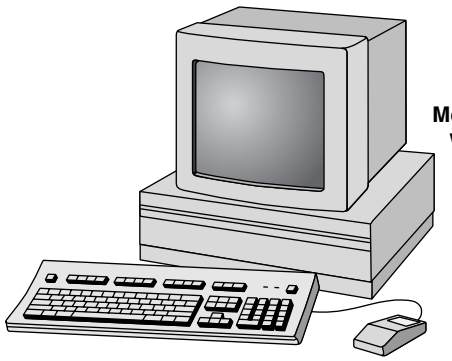
Model 070C29 Patch Panel
(16) BNC and (16) IDC inputs
(1) DB50 output



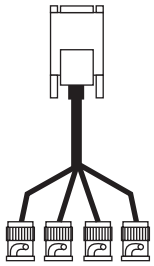
Model 009H25
Shielded Cable
DB50 to DB50
25 ft. length



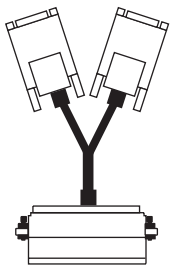
Series 440
Modular Signal Conditioner
with Bank Switching
(request brochure for details)



Data Acquisition or Modal Analysis Workstation



Model 009L"xx"
4 ch. output cable
VXI to (4) BNC plugs



Model 009P"xx"
8 ch. output cable
(2) VXI to DB50

Model 009S"xx"
4 ch. output cable
VXI to VXI

Dimensions shown are in inches (millimeters).

Modal Array ICP® Accelerometer Specifications								
Model Number [1]	**333B**		**333B30**		**333B31**		**333B32**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Sensitivity Tolerance	± 20%	± 20%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 50 g pk	± 490 m/s² pk	±50 g pk	±490 m/s² pk	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	2 to 1000 Hz	2 to 1000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz
Resonant Frequency	≥ 5 kHz	≥ 5 kHz	≥ 40 kHz	≥ 40 kHz	≥ 40 kHz	≥ 40 kHz	≥ 40 kHz	≥ 40 kHz
Phase Response (±5 °)	2 to 1000 Hz	2 to 1000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz
Broadband Resolution (1 to 10k Hz)	0.00007 g rms	0.0007 m/s² rms	0.00015 g rms	0.0015 m/s² rms	0.00015 g rms	0.0015 m/s² rms	0.00015 g rms	0.0015 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 3500 g pk	± 34k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	0 to 150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC
Discharge Time Constant	0.7 to 1.3 sec	0.7 to 1.3 sec	1.0 to 3.0 sec	1.0 to 3.0 sec	1.0 to 3.0 sec	1.0 to 3.0 sec	1.0 to 3.0 sec	1.0 to 3.0 sec
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Polymer	Polymer	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.84 in × 0.48 in [7] 21.4 mm × 12.2 mm [7]		0.40 in × 0.63 in × 0.40 in 10.2 mm × 16.0 mm × 10.2 mm		0.57 in × 0.44 in [7] 14.5 mm × 11.2 mm [7]		0.40 in × 0.63 in × 0.40 in 10.2 mm × 16.0 mm × 10.2 mm	
Weight	0.2 oz	5.6 gm	0.14 oz	4.0 gm	0.14 oz	4.0 gm	0.14 oz	4.0 gm
Electrical Connection	3-Pin Socket [6]	3-Pin Socket [6]	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Bottom	Bottom	Side	Side	Top	Top	Side	Side
Mounting	Plug-In [6]	Plug-In [6]	5-40 Female	5-40 Female	Adhesive	Adhesive	Adhesive	Adhesive
Supplied Accessories [3]								
Petro Wax	—		080A109		080A109		080A109	
Quick Bonding Gel	—		080A90		080A90		080A90	
Adhesive Mounting Base	—		080A25		—		—	
Mounting Stud	—		081A27		—		—	
Metric Mounting Stud	—		M081A27		—		—	
NIST Calibration [4]	ACS-2		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Adhesive Mounting Base	080B37, 080B38, 080B40		N/A		080A115, 080A140		N/A	
Triaxial Mounting Adaptor	080B55, 080A141		N/A		080A114		N/A	
Removal Tool	—		039A08		—		039A08	
Mating Cable Connectors	Contact Factory		AH, AK, AW, EB		AH, AK, AW, EB		AH, AK, AW, EB	
Recommended Stock Cables	Contact Factory		002		002		002	
Options [5]								
Available Options	T, TLA, TLB, TLC		T, TLA, TLB, TLC		N, T		T, TLA, TLB, TLC	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information. [6] Accelerometer plugs into an optional adhesive mounting socket. [7] Height × Diameter.

Dimensions shown are in inches (millimeters).

Structural Test / Array Accelerometers

Modal Array ICP® Accelerometer Specifications								
Model Number [1]	**333B40**		**333B42**		**333B50**		**333B52**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity	500 mV/g	51.0 mV/(m/s²)	500 mV/g	51.0 mV/(m/s²)	1000 mV/g	102 mV/(m/s²)	1000 mV/g	102 mV/(m/s²)
Sensitivity Tolerance	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%	± 10%
Measurement Range	± 10 g pk	± 98 m/s² pk	± 10 g pk	± 98 m/s² pk	±5 g pk	±49 m/s² pk	± 5 g pk	± 49 m/s² pk
Frequency Range (± 5%)	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz	0.5 to 3000 Hz
Resonant Frequency	≥ 20 kHz	≥ 20 kHz	≥ 20 kHz	≥ 20 kHz	≥ 20 kHz	≥ 20 kHz	≥ 20 kHz	≥ 20 kHz
Phase Response (±5 °)	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz	2 to 3000 Hz
Broadband Resolution (1 to 10k Hz)	0.00005 g rms	0.0005 m/s² rms	0.00005 g rms	0.0005 m/s² rms	0.00005 g rms	0.0005 m/s² rms	0.00005 g rms	0.0005 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk	± 5000 g pk	± 49k m/s² pk	±4000 g pk	± 39k m/s² pk	± 4000 g pk	± 39k m/s² pk
Temperature Range (Operating)	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C	0 to +150 °F	-18 to +66 °C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 200 ohms	≤ 500 ohms	≤ 500 ohms	≤ 500 ohms	≤ 500 ohms
Output Bias Voltage	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC	7 to 12 VDC
Discharge Time Constant	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec	1.0 to 2.5 sec
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Height × Length × Width)	0.45 in × 0.68 in × 0.45 in 11.4 mm × 17.3 mm × 11.4 mm		0.45 in × 0.68 in × 0.45 in 11.4 mm × 17.3 mm × 11.4 mm		0.45 in × 0.68 in × 0.45 in 11.4 mm × 17.3 mm × 11.4 mm		0.45 in × 0.68 in × 0.45 in 11.4 mm × 17.3 mm × 11.4 mm	
Weight	0.26 oz	7.5 gm	0.26 oz	7.5 gm	0.26 oz	7.5 gm	0.26 oz	7.5 gm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Side	Side	Side	Side	Side	Side	Side	Side
Mounting	5-40 Female	5-40 Female	Adhesive	Adhesive	5-40 Female	5-40 Female	Adhesive	Adhesive
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Quick Bonding Gel	080A90		080A90		080A90		080A90	
Adhesive Mounting Base	080A25		N/A		080A25		N/A	
Mounting Stud	081A27		N/A		081A27		N/A	
Metric Mounting Stud	M081A27		N/A		M081A27		N/A	
NIST Calibration [4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Adhesive Mounting Base	N/A		N/A		N/A		N/A	
Triaxial Mounting Adaptor	N/A		N/A		N/A		N/A	
Removal Tool	039A09		039A09		039A09		039A09	
Mating Cable Connectors	AH, AK, AW, EB		AH, AK, AW, EB		AH, AK, AW, EB		AH, AK, AW, EB	
Recommended Stock Cables	002		002		002		002	
Options [5]								
Available Options	T, TLA, TLB, TLC		T, TLA, TLB, TLC		T, TLA, TLB, TLC		T, TLA, TLB, TLC	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information. [4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information.

Dimensions shown are in inches (millimeters).

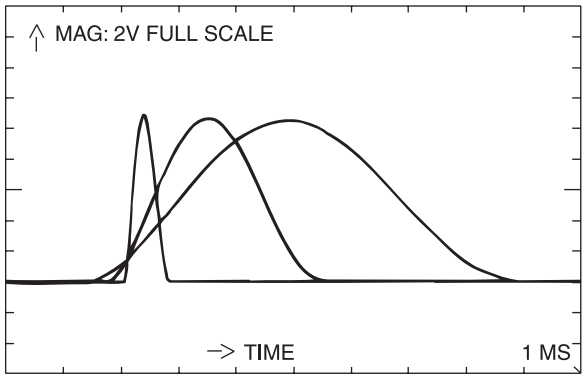
Modally Tuned® ICP® Impact Hammers and Hammer Kits

- **Modal analysis**
- **Structural testing**
- **Impulse and response**
- **Resonance determination**
- **Laboratory design test evaluation**
- **Civil structure health determination**

PCB's Modally Tuned® impact hammers are easy-to-use solutions for delivering impulse forces into test specimens and providing electrical measurement signals of the amplitude and frequency content of the applied force. Response accelerometers then measure the resultant motion of the test specimen for such requirements as resonance detection, modal analysis, transfer characteristics, and structural health determination.

Available hammer kits include response accelerometers, signal conditioners, and all the accessories needed to begin testing with FFT analyzers or data acquisition workstations. The variety of hammer kits are comprised of matched components which are tuned for testing structures within certain size and weight categorizations.

A selection of tips are included with each hammer which, along with an extender mass, allow the hammer to be tailored to deliver the desired frequency content of the impulse force waveform the structure under test.



History of time-varying signals from different hammer structures (different extenders and tips)

These Modally Tuned® impact hammers have been proven over thousands of requirements in such applications as automotive design, bridge health assessment, and aerospace vehicle development. Their design has been refined, through the selection of their materials of construction, to deliver consistent, accurate results. This "modal tuning" of the hammer structure eliminates hammer resonances from corrupting the test data resulting in more accurate test results.

PCB's Modally Tuned® impact hammer kit received the IR-100 award as recognition by Industrial Research & Development magazine as one of the most significant technical products of 1983. Since then, hammer kits have continually been improved upon where today, all kits include state-of-the-art, shear-mode ICP® accelerometers which deliver unmatched performance and value.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Modally Tuned ICP® Impact Hammers
and Hammer Kits

Modally Tuned® ICP® Impact Hammers are available separately or as complete Hammer Kits which include response accelerometers, signal conditioners, all cables, and accessories needed to begin testing with your FFT analyzer or data acquisition system. Kits may be custom configured to suit specific application requirements and component substitutions are possible. Hammer Kits represent exceptional value, as their cost is less than that of the components if ordered separately. Do not hesitate to call to discuss your specific application or a hammer kit custom tailored to your requirements.

Typical Hammer Kits

KIT MODEL NUMBER		GK291D80	GK291D01	GK291D02	GK291D	GK291D04	GK291D05	GK291D20	GK291D50
Supplied Kit Components									
Impact Hammer	model	086D80	086C01	086C02	086C03	086C04	086D05	086D20	086D50
Accelerometer #1	model	352B10	352B10	352B10	352B10	352B10	353B33	353B33	353B33
for details see pages	page #	1.16	1.16	1.16	1.16	1.16	1.5	1.5	1.5
Accelerometer #2	model	352C68	352C68	352C68	352C68	352C68	352B	352B	393A03
for details see pages	page #	1.18	1.18	1.18	1.18	1.18	1.23	1.23	1.74
Signal Conditioner (2 ea.)	model	480E09	480E09	480E09	480E09	480E09	480E09	480E09	480E09
for details see pages	page #	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
Hammer Cable	model	integral	003D10	003D10	003D10	003D10	003D10	003D20	003D20
Accelerometer Cable (2 ea.)	model	003C10	003C10	003C10	003C10	003C10	003C20	003C20	003C20
Accelerometer Cable (2 ea.)	model	—	—	—	—	—	—	—	012E20
Cable Adaptor	model	070A02 (2 ea.)	070A02	070A02	070A02	070A02	—	—	—
Output Cable (2 ea.)	model	003D03	003D03	003D03	003D03	003D03	003D03	003D03	003D03

Dimensions shown are in inches (millimeters).

Modally Tuned ICP® Impact Hammers
and Hammer Kits

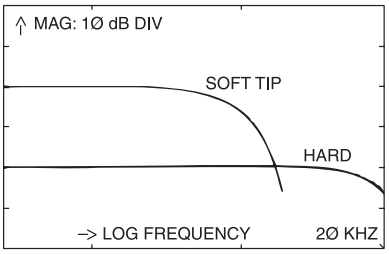
MODALLY TUNED® ICP® IMPACT HAMMERS
(*complete specifications are featured on page* 1.100 - 1.102)

Hammer model selection involves determining the size and mass of the hammer, which will provide the force amplitude and frequency content required for proper excitation of the structure under test. Each hammer's corresponding frequency response plots indicate the frequency content of the force impulse that can be achieved using the variety of supplied tips. An extender mass, supplied with most hammers, allows further tuning by concentrating more energy at lower frequencies.

Model 086D80 — Mini pencil sized, test very light structures such as compressor blades, disk drives, sheet metal parts, and printed circuit boards at medium to very high frequencies

- 100 mV/lbf (22.5 mV/N) sensitivity
- 20 kHz frequency range
- 50 lbf (220 N) amplitude range
- 0.10 oz (2.9 gm) hammer mass
- 0.25 inch (6.3 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

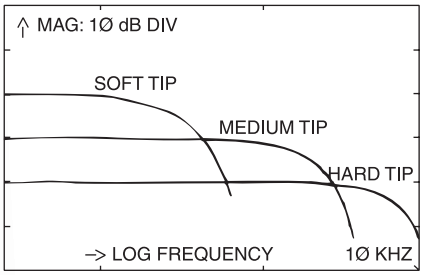


Model 086C01 — Lightweight aluminum head, tests light to medium structures such as lightly damped panels and frames at medium to high frequencies

- 50 mV/lbf (11.2 mV/N) sensitivity
- 9500 Hz frequency range
- 100 lbf (440 N) amplitude range
- 0.23 lb (0.1 kg) hammer mass
- 0.6 inch (1.57 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T — see pages xvii to xx for option information

(shown with cable attached)

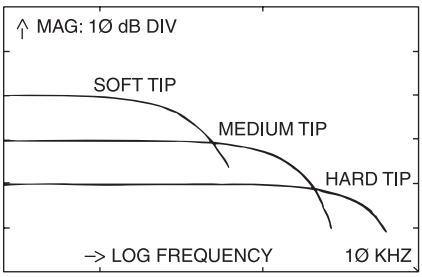


Model 086C03 — General purpose, tests medium structures such as car frames, engines and machine parts at low to medium frequencies

- 10 mV/lbf (2.25 mV/N) sensitivity
- 8000 Hz frequency range
- 500 lbf (2200 N) amplitude range
- 0.34 lb (0.16 kg) hammer mass
- 0.62 inch (1.57 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

(shown with cable attached)



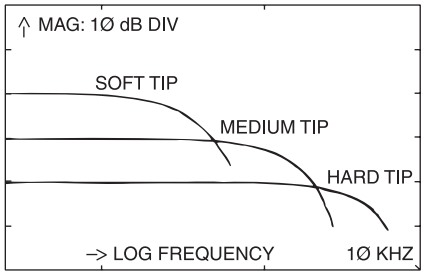
Modally Tuned ICP® Impact Hammers
and Hammer Kits

Model 086C02 — General purpose, high sensitivity

- 50 mV/lbf (11.2 mV/N) sensitivity
- 8000 Hz frequency range
- 100 lbf (440 N) amplitude range
- 0.34 lb (0.16 kg) hammer mass
- 0.62 inch (1.57 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

(shown with cable attached)

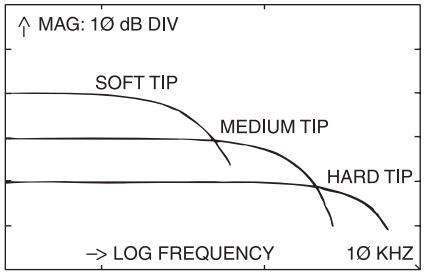


Model 086C04 — General purpose, low sensitivity

- 5 mV/lbf (1.1 mV/N) sensitivity
- 8000 Hz frequency range
- 1000 lbf (4400 N) amplitude range
- 0.34 lb (0.16 kg) hammer mass
- 0.62 inch (1.57 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

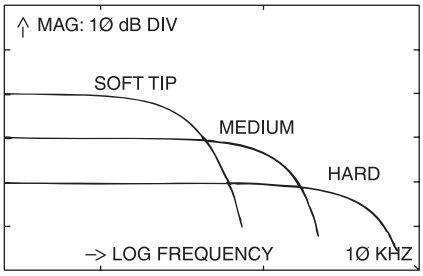
(shown with cable attached)



Model 086D05 — Tests medium to heavy structures such as machine tools, light trucks, at low to medium frequencies

- 1 mV/lbf (0.23 mV/N) sensitivity
- 5000 Hz frequency range
- 5000 lbf (22k N) amplitude range
- 0.7 lb (0.32 kg) hammer mass
- 1 inch (2.5 cm) head diameter

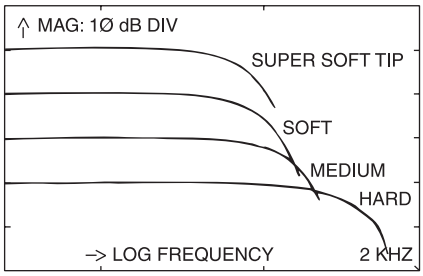
Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none



Model 086D20 — Small sledge, tests medium to heavy structures such as tool foundations and storage tanks at low to medium frequencies

- 1 mV/lbf (0.23 mV/N) sensitivity
- 1000 Hz frequency range
- 5000 lbf (22k N) amplitude range
- 2.4 lb (1.1 kg) hammer mass
- 2 inch (5.1 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T — see pages xvii to xx for option information

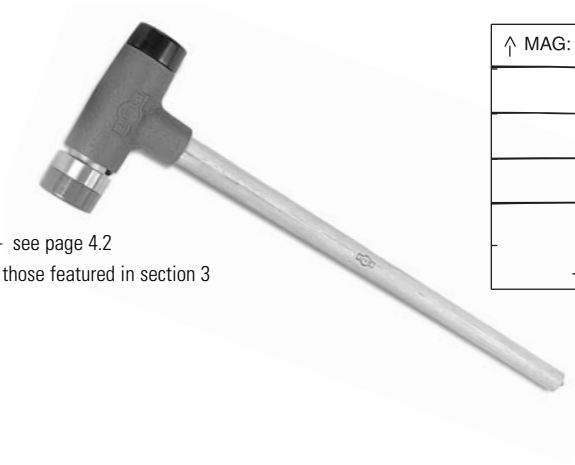


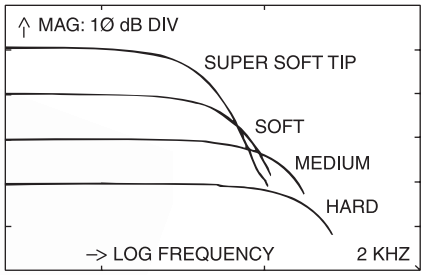
Dimensions shown are in inches (millimeters).

Model 086D50 — Large sledge, tests very heavy structures such as buildings, locomotives, ships, and foundations at low to very low frequencies

- 1 mV/lbf (0.23 mV/N) sensitivity
- 750 Hz frequency range
- 5000 lbf (22k N) amplitude range
- 12.1 lb (5.5 kg) hammer mass
- 3 inch (7.6 cm) head diameter

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none





Modally Tuned ICP® Impact Hammers
and Hammer Kits

Modally Tuned ICP® Impact Hammer and Hammer Kit Specifications						
Model Number [1]	**086C01**		**086C02**		**086C03**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity (± 15%)	50 mV/lbf	11.2 mV/N	50 mV/lbf	11.2 mV/N	10 mV/lbf	2.25 mV/N
Measurement Range	± 100 lbf pk	± 440 N pk	± 100 lbf pk	± 440 N pk	± 500 lbf pk	± 2200 N pk
Frequency Range for Hard Tip (-10 dB) [2][6]	9.5 kHz	9.5 kHz	8 kHz	8 kHz	8 kHz	8 kHz
Frequency Range for Medium Tip (-10 dB) [2][6]	2.5 kHz	2.5 kHz	2.5 kHz	2.5 kHz	2.5 kHz	2.5 kHz
Frequency Range for Soft Tip (-10 dB) [2][6]	750 Hz	750 Hz	750 Hz	750 Hz	750 Hz	750 Hz
Frequency Range for Super Soft Tip (-10 dB) [2][6]	600 Hz	600 Hz	600 Hz	600 Hz	600 Hz	600 Hz
Resonant Frequency	≥ 35 kHz	≥ 35 kHz	≥ 22 kHz	≥ 22 kHz	≥ 22 kHz	≥ 22 kHz
Non-Linearity	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance [2]	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant [2]	≥ 500 sec	≥ 500 sec	≥ 500 sec	≥ 500 sec	≥ 2000 sec	≥ 2000 sec
Physical						
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sealing	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Hammer Mass	0.23 lb	0.10 kg	0.34 lb	0.16 kg	0.34 lb	0.16 kg
Head Diameter	0.62 in	1.57 cm	0.62 in	1.57 cm	0.62 in	1.57 cm
Tip Diameter	0.25 in	0.63 cm	0.25 in	0.63 cm	0.25 in	0.63 cm
Hammer Length	8.5 in	21.6 cm	8.5 in	21.6 cm	8.5 in	21.6 cm
Electrical Connection	BNC Jack	BNC Jack	BNC Jack	BNC Jack	BNC Jack	BNC Jack
Electrical Connection Position	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle
Extender Mass Weight	0.9 oz	25 gm	2.6 oz	75 gm	2.6 oz	75 gm
Supplied Accessories [3]						
Mounting Stud	081B05		081B05		081B05	
Aluminum Extender	084A06		084A08		084A08	
Hard Tip	084B03		084B03		084B03	
Medium Tip	084B04		084B04		084B04	
Soft Tip	084B05		084B05		084B05	
Super Soft Tip	084B11		084B11		084B11	
Tip Insert (4 each)	085A07		085A07		085A07	
Tip Insert (4 each)	085A08		085A08		085A08	
Tip Cover (4 each)	085A10		085A10		085A10	
NIST Calibration [4]	HCS-2		HCS-2		HCS-2	
Additional Accessories [3]						
Extender Mass	N/A		N/A		N/A	
Options [5]						
Available Options	T		N/A		N/A	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Typical. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Dependent upon stiffness of test structure. Values shown are from hitting a stiff steel mass without extender mass attached.

Dimensions shown are in inches (millimeters).

Modally Tuned ICP® Impact Hammers
and Hammer Kits

Modally Tuned ICP® Impact Hammers								
Model Number [1]	**086C04**		**086D05**		**086D20**		**086D50**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity (± 15%)	5 mV/lbf	1.1 mV/N	1 mV/lbf	0.23 mV/N	1 mV/lbf	0.23 mV/N	1 mV/lbf	0.23 mV/N
Measurement Range	± 1000 lbf pk	± 4400 N pk	± 5000 lbf pk	± 22k N pk	± 5000 lbf pk	± 22k N pk	± 5000 lbf pk	± 22k N pk
Frequency Range for Hard Tip (-10 dB) [2][6]	8 kHz	8 kHz	5 kHz	5 kHz	1 kHz	1 kHz	750 Hz	750 Hz
Frequency Range for Medium Tip (-10 dB) [2][6]	2.5 kHz	2.5 kHz	1.7 kHz	1.7 kHz	700 Hz	700 Hz	650 Hz	650 Hz
Frequency Range for Soft Tip (-10 dB) [2][6]	750 Hz	750 Hz	250 Hz	250 Hz	450 Hz	450 Hz	350 Hz	350 Hz
Frequency Range for Super Soft Tip (-10 dB) [2][6]	600 Hz	600 Hz	150 Hz	150 Hz	400 Hz	400 Hz	250 Hz	250 Hz
Resonant Frequency	≥ 22 kHz	≥ 22 kHz	≥ 22 kHz	≥ 22 kHz	≥ 12 kHz	≥ 12 kHz	≥ 5 kHz	≥ 5 kHz
Non-Linearity	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance [2]	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<100 ohms	<100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant [2]	≥ 2000 sec	≥ 2000 sec	≥ 2000 sec	≥ 2000 sec	≥ 2000 sec	≥ 2000 sec	≥ 2000 sec	≥ 2000 sec
Physical								
Sensing Element	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz	Quartz
Sealing	Epoxy	Epoxy	Epoxy	Epoxy	Hermetic	Hermetic	Hermetic	Hermetic
Hammer Mass	0.34 lb	0.16 kg	0.70 lb	0.32 kg	2.4 lb	1.1 kg	12.1 lb	5.5 kg
Head Diameter	0.62 in	1.57 cm	1.0 in	2.5 cm	2.0 in	5.1 cm	3.0 in	7.6 cm
Tip Diameter	0.25 in	0.63 cm	0.25 in	0.63 cm	2.0 in	5.1 cm	3.0 in	7.6 cm
Hammer Length	8.5 in	21.6 cm	9.0 in	22.7 cm	14.5 in	37 cm	35 in	89 cm
Electrical Connection	BNC Jack	BNC Jack	BNC Jack	BNC Jack	BNC Jack	BNC Jack	BNC Jack	BNC Jack
Electrical Connection Position	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle	Bottom of Handle
Extender Mass Weight	2.6 oz	75 gm	7.0 oz	200 gm				
Supplied Accessories [3]								
Mounting Stud	081B05		081B05		—		—	
Extender Mass	084A08		084A09		—		—	
Hard Tip	084B03		084B03		084A63		084A33	
Medium Tip	084B04		084B04		084A62		084A32	
Soft Tip	084B05		084B05		084A61		084A31	
Super Soft Tip	084B11		084A50		084A60		084A30	
Tip Adaptor	—		084A51		—		—	
Tip Insert (4 each)	085A07, 085A08		085A08		—		—	
Tip Cover (4 each)	085A10		085A10		—		—	
NIST Calibration [4]	HCS-2		HCS-2		HCS-2		HCS-2	
Additional Accessories [3]								
Extender Mass	N/A		N/A		084A16		N/A	
Options [5]								
Available Options	N/A		N/A		T		N/A	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Typical. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See page xvii to xx for option information.
[6] Dependent upon stiffness of test structure. Values shown are from hitting a stiff steel mass without extender mass attached.

086D80 Modally Tuned ICP® Impact Hammer		
Model Number [1]	**086D80**	
Performance	**English**	**SI**
Sensitivity (± 15%)	100 mV/lb	22.5 mV/N
Measurement Range	± 50 lb pk	± 220 N pk
Frequency Range for Hard Tip (-10 dB) [2][5][7]	20 kHz	20 kHz
Resonant Frequency	≥ 100 kHz	≥ 100 kHz
Non-Linearity) [1]	≤ 1 %	≤ 1 %
Electrical		
Excitation Voltage	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA
Output Impedance	<100 ohms	<100 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant [2]	≥ 100 sec	≥ 100 sec
Physical		
Sensing Element	Quartz	Quartz
Sealing	Epoxy	Epoxy
Hammer Mass	0.10 oz [6], 0.22 oz [7]	2.9 gm [6], 6.2 gm [7]
Head Diameter	0.25 in	6.3 cm
Tip Diameter	0.10 in	2.5 cm
Hammer Length	4.00 in	101.6 cm
Electrical Connection [7]	5-44 Coaxial	5-44 Coaxial
Electrical Connection Position	Bottom of Handle	Bottom of Handle
Cable Type [3][6]	035 Twisted Pair	035 Twisted Pair
Cable Length [3][6]	10 ft	3.05 m
Extender Mass Weight	0.044 oz	1.25 gm
Supplied Accessories [3]		
Kit Case	001A20	
Miniature coaxial cable	018G10	
Petro Wax	080A109	
Extender Mass	084A13	
Plastic Handle Assembly	084A14	
Aluminum Handle	084A17	
Vinyl Impact Cap	084A28	
NIST Calibration [4]	HCS-2	

NOTES:

[1] See note regarding accuracy of information on inside front cover.

[2] Typical.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] Dependent upon stiffness of test structure. Values shown are from hitting a stiff steel mass without extender mass attached.

[6] With plastic handle attached.

[7] With aluminum handle attached. When using the aluminum handle, the extender mass must be used.

Dimensions shown are in inches (millimeters).

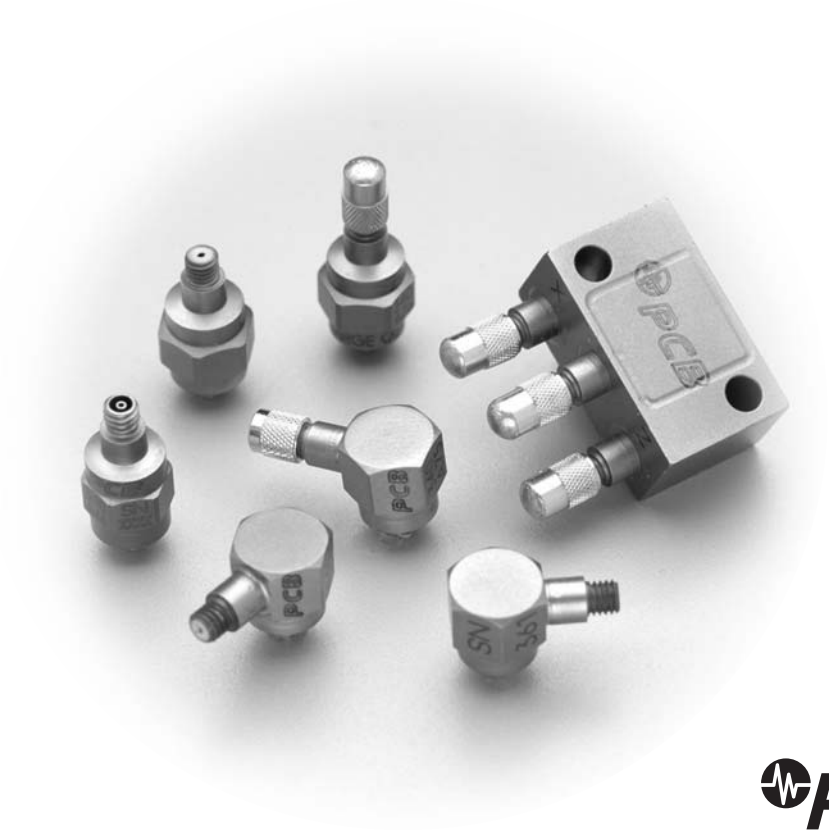
Metric ICP® and Charge Output Accelerometers

- **Metric mounting threads**
- **Metric hex sizes**
- **Directly replaceable with alternate manufacturer's units**
- **M3 coaxial electrical connectors**
- **Metric standardized sensitivities with 159.2 Hz reference frequency calibration**

Metric accelerometers are offered for use when it is convenient to have sensors with metric features and mechanical dimensions. Each installs with metric mounting threads, utilizes metric threaded electrical connectors, and may utilize a metric hex for its housing.

Sensitivities are standardized about metric values. Both ICP® and charge output types are offered. A triaxial charge output unit is also featured.

Additional metric designed accelerometers can be provided for unique or specialized applications.



PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Metric ICP® and Charge Output Accelerometers

METRIC ICP® ACCELEROMETERS
(*complete specifications are featured on page* 1.106)

Miniature ICP® accelerometers are especially well suited for applications demanding high frequency range, small size, and light weight.

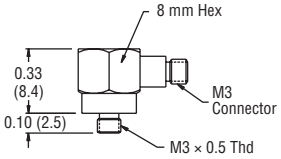
- NVH studies
- printed circuit boards
- card cages and chassis
- brackets
- thin panels
- shrouds
- conduits
- bearings

Model 340A15 — Side connector provides low profile, simplifies cable routing and strain relief

- 1.0 mV/(m/s²) [9.8 mV/g] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 2.0 gram (0.07 oz) weight
- 4900 m/s² (500 g) amplitude range

Select an ICP® sensor signal conditioner from those featured in section 3
Options: A. J, W — see pages xvii to xx for option information

Actual Size

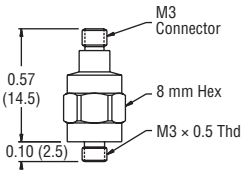


Model 340A16 — Installs with small footprint

- 1.0 mV/(m/s²) [9.8 mV/g] sensitivity
- 0.7 Hz to 18 kHz frequency range
- 2.0 gram (0.07 oz) weight
- 4900 m/s² (500 g) amplitude range

Select an ICP® sensor signal conditioner from those featured in section 3
Options: A. J, W — see pages xvii to xx for option information

Actual Size

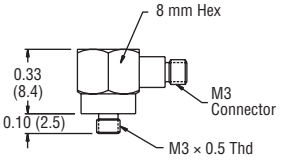


Model 340A65 — Side connector provides low profile, simplifies cable routing and strain relief

- 10.0 mV/(m/s²) [98.1 mV/g] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 2.0 gram (0.07 oz) weight
- 490 m/s² (50 g) amplitude range

Select an ICP® sensor signal conditioner from those featured in section 3
Options: A. J, W — see pages xvii to xx for option information

Actual Size

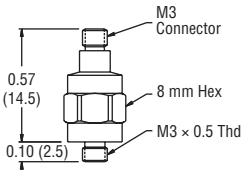


Model 340A66 — Installs with small footprint

- 10.0 mV/(m/s²) [98.1 mV/g] sensitivity
- 0.3 Hz to 12 kHz frequency range
- 2.0 gram (0.07 oz) weight
- 490 m/s² (50 g) amplitude range

Select an ICP® sensor signal conditioner from those featured in section 3
Options: A. J, W — see pages xvii to xx for option information

Actual Size



Dimensions shown are in inches (millimeters).

Metric ICP® and Charge Output Accelerometers

METRIC CHARGE OUTPUT ACCELEROMETERS

(*complete specifications are featured on page* 1.107)

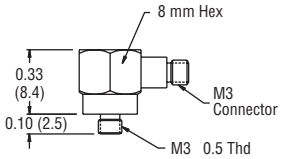
Miniature charge output accelerometers are especially well suited for applications demanding high frequency range, small size, light weight, and elevated operating temperatures. Use with charge amplifiers and in-line charge converters.

- high temperature testing
- thermal stress screening
- small component qualifications
- high speed machinery analysis
- engine brackets
- motor housing

Model 340A75 — Side connector provides low profile, simplifies cable routing and strain relief

- 0.3 pc/(m/s²) [2.9 pC/g] sensitivity
- 16 kHz frequency range
- 2.0 gram (0.07 oz) weight
- 22,600 m/s² (2300 g) amplitude range
- -70 to +260 °C (-91 to +500 °F) temperature range

Actual Size

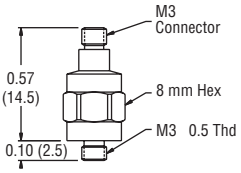


Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: A. J — see pages xvii to xx for option information

Model 340A76 — Installs with small footprint

- 0.3 pc/(m/s²) [2.9 pC/g] sensitivity
- 16 kHz frequency range
- 2.0 gram (0.07 oz) weight
- 22,600 m/s² (2300 g) amplitude range
- -70 to +260 °C (-91 to +500 °F) temperature range

Actual Size



Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: A. J — see pages xvii to xx for option information

METRIC TRIAXIAL ACCELEROMETER

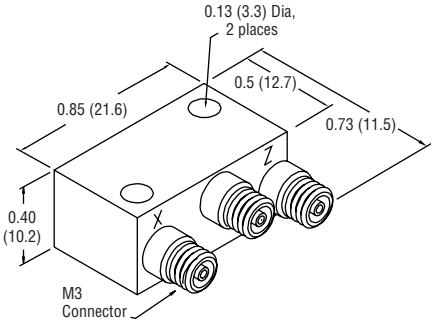
(*complete specifications are featured on page* 1.108)

Triaxial accelerometers provide simultaneous measurements in three orthogonal directions. Charge output styles offer the ability for high temperature operation.

- motors
- steam pipes
- turbines
- engines
- exhaust systems

Model 340A50 — High temperature, charge output operation

- 0.28 pc/(m/s²) [2.7 pC/g] sensitivity
- 10 kHz frequency range
- 11.0 gram (0.39 oz) weight
- 9800 m/s² (1000 g) amplitude range
- -70 to +260 °C (-94 to +500 °F) temperature range



Actual Size

Select Model 443B01 Dual Mode Vibration Amplifier (page 3.5), or,
an in-line charge converter (page 3.8) with an ICP® sensor signal conditioner from those featured in section 3
Options: A. J — see pages xvii to xx for option information

Metric ICP® and Charge Output Accelerometers

Metric ICP® Accelerometer Specifications								
Model Number [1]	**340A15**		**340A16**		**340A65**		**340A66**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Sensitivity (± 10 %)	9.8 mV/g	1.0 mV/(m/s²)	9.8 mV/g	1.0 mV/(m/s²)	98.1 mV/g	10.0 mV/(m/s²)	98.1 mV/g	10.0 mV/(m/s²)
Measurement Range	± 500 g pk	± 4,900 m/s² pk	± 500 g pk	± 4,900 m/s² pk	± 50 g pk	± 490 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	1 to 12k Hz	1 to 12k Hz	1 to 12k Hz	1 to 12k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz	0.5 to 10k Hz
Frequency Range (± 10%)	0.7 to 18k Hz	0.7 to 18k Hz	0.7 to 18k Hz	0.7 to 18k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz	0.3 to 12k Hz
Frequency Range (± 3 dB)	0.35 to 25k Hz	0.35 to 25k Hz	0.35 to 25k Hz	0.35 to 25k Hz	0.2 to 20k Hz	0.2 to 20k Hz	0.2 to 20k Hz	0.2 to 20k Hz
Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz	≥ 35 kHz
Broadband Resolution (1 to 10k Hz) [2]	0.0006 g rms	0.006 m/s² rms	0.0006 g rms	0.006 m/s² rms	0.00016 g rms	0.0016 m/s² rms	0.00016 g rms	0.0016 m/s² rms
Non-Linearity [6]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1%	≤ 1%	≤ 1%	≤ 1%	≤ 1%
Transverse Sensitivity [7]	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental								
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk	± 5k g pk	± 49k m/s² pk	± 5k g pk	± 49k m/s² pk
Temperature Range (Operating)	-67 to +257° F	-55 to +125° C	-67 to +257° F	-55 to +125° C	-67 to +203° F	-55 to +95° C	-67 to +203° F	-55 to +95° C
Electrical								
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms	≤ 300 ohms
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Discharge Time Constant	0.4 to 1.2 sec	0.4 to 1.2 sec	0.4 to 1.2 sec	0.4 to 1.2 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec	0.8 to 2.4 sec
Physical								
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	0.31 × 0.43 in	8.0 × 10.9 mm	0.31 in × 0.66 in	8.0 × 16.8 mm	0.31 × 0.43 in	8.0 × 10.9 mm	0.31 × 0.66 in	8.0 × 16.8 mm
Weight	0.07 oz	2.0 gm	0.07 oz	2.0 gm	0.07 oz	2.0 gm	0.07 oz	2.0 gm
Electrical Connection	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top	Side	Side	Top	Top
Mounting Thread	M3 × 0.50 Male	M3 × 0.50 Male	M3 × 0.50 Male	M3 × 0.50 Male	M3 × 0.50 Male	M3 × 0.50 Male	M3 × 0.50 Male	M3 × 0.50 Male
Mounting Torque	8 to 12 in-lb	90 to 135 N-cm	8 to 12 in-lb	90 to 135 N-cm	8 to 12 in-lb	90 to 135 N-cm	8 to 12 in-lb	90 to 135 N-cm
Supplied Accessories [3]								
Petro Wax	080A109		080A109		080A109		080A109	
Adhesive Mounting Base	M080A15		M080A15		M080A15		M080A15	
NIST Calibration[4]	ACS-1		ACS-1		ACS-1		ACS-1	
Additional Accessories [3]								
Mating Cable Connectors	EP		EP		EP		EP	
Recommended Stock Cables	002, 003, 018		002, 003, 018		002, 003, 018		002, 003, 018	
Options [5]								
Available Options	A[8], J, W		A[8], J, W		A[8], J, W		A[8], J, W	

NOTES:

[1] See note regarding accuracy of information on inside front cover.

[2] Typical.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

[6] Zero-based, least-squares, straight line method.

[7] Transverse sensitivity is typically <= 3%.

[8] Mounting stud removed, adhesive mounting base not required.

Dimensions shown are in inches (millimeters).

Metric Charge Output Accelerometer Specifications				
Model Number [1]	**340A75**		**340A76**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity (± 15%)	2.9 pC/g	0.3 pC/m/s²	2.9 pC/g	0.3 pC/m/s²
Measurement Range	± 2300 g pk	± 22.6k m/s² pk	± 2300 g pk	± 22.6k m/s² pk
Frequency Range (+ 5%) [7]	12 kHz	12 kHz	12 kHz	12 kHz
Frequency Range (+ 10%) [7]	16 kHz	16 kHz	16 kHz	16 kHz
Frequency Range (+3 dB) [7]	26 kHz	26 kHz	26 kHz	26 kHz
Mounted Resonant Frequency	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz	≥ 50 kHz
Non-Linearity (1000 g [9800 m/s²]) [6]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Non-Linearity (2300 g, [22.6k m/s²]) [6]	≤ 2.3 %	≤ 2.3 %	≤ 2.3 %	≤ 2.3 %
Transverse Sensitivity	<5%	<5%	<5%	<5%
Environmental				
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk	± 10k g pk	± 98k m/s² pk
Temperature Range (Operating)	-94 to +500° F	-70 to +260° C	-94 to +500° F	-70 to +260° C
Electrical				
Capacitance [2]	380 pF	380 pF	380 pF	380 pF
Insulation Resistance (at 70 °F[(21 °C] [2]	> 10^{12} ohms	> 10^{12} ohms	> 10^{12} ohms	> 10^{12} ohms
Insulation Resistance (at 500 °F [260° F] [2]	> 10^{8} ohms	> 10^{8} ohms	> 10^{8} ohms	> 10^{8} ohms
Output Polarity	Negative	Negative	Negative	Negative
Physical				
Sensing Element	Ceramic	Ceramic	Ceramic	Ceramic
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Titanium	Titanium	Titanium	Titanium
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Size (Hex × Height)	0.31 × 0.43 in	8.0 × 10.9 mm	0.31 in × 0.66 in	8.0 × 17.0 mm
Weight	0.07 oz	2.0 gm	0.07 oz	2.0 gm
Electrical Connection	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack	M3 Coaxial Jack
Electrical Connection Position	Side	Side	Top	Top
Mounting Thread	M3 × 0.5 Male	M3 × 0.5 Male	M3 × 0.5 Male	M3 × 0.5 Male
Supplied Accessories [3]				
Petro Wax	080A109		080A109	
Adhesive Mounting Base	M080A15		M080A15	
NIST Calibration [4]	ACS-1		ACS-1	
Additional Accessories [3]				
Mating Cable Connectors	EP		EP	
Recommended Stock Cables	003		003	
Options [5]				
Available Options	A, J		A, J	

NOTES:

[1] See note regarding accuracy of information on inside front cover.

[2] Typical.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See page xvii to xx for option information.

[6] Zero-based, least-squares, straight line method.

[7] Low frequency response is determined by external signal conditioning electronics.

Metric Triaxial Charge Accelerometer Specifications		
Model Number [1]	**340A50**	
Performance	**English**	**SI**
Sensitivity (± 15 %)	2.7 pC/g	0.28 pC/(m/s²)
Measurement Range	± 1000 g pk	± 9800 m/s² pk
Frequency Range (± 5 %)	8 kHz	8 kHz
Frequency Range (± 10 %)	10 kHz	10 kHz
Resonant Frequency	≥ 25 kHz	≥ 25 kHz
Non-Linearity [6]	≤ 1 %	≤ 1%
Transverse Sensitivity	≤ 5 %	≤ 5 %
Environmental		
Overload Limit (Shock)	± 5000 g pk	± 49k m/s² pk
Temperature Range (Operating)	-94 to +500° F	-70 to +260° C
Electrical		
Capacitance [2]	240 pF	240 pF
Insulation Resistance (at 70 °F[(21 °C] [2]	> 10^{12} ohms	> 10^{12} ohms
Insulation Resistance (at 500 °F [260° F] [2]	> 10^{8} ohms	> 10^{8} ohms
Output Polarity [8]	Negative	Negative
Physical		
Sensing Element	Ceramic	Ceramic
Sensing Geometry	Shear	Shear
Housing Material	Titanium	Titanium
Sealing	Hermetic	Hermetic
Size (Height × Length × Width)	0.85 × 0.5 × 0.4 in	21.6 × 12.7 × 10.2 mm
Weight	0.39 oz	11.0 gm
Electrical Connection	M3 Coaxial Jack	M3 Coaxial Jack
Mounting Thread	M3 x 0.50 Male	M3 x 0.50 Male
Mounting Torque	4.0 to 5.0 in-lb	45 to 55 N-cm
Supplied Accessories		
Petro Wax	080A109	
Quick Bonding Gel	080A90	
Removal Tool	039A25	
Adhesive Mounting Base	080A147	
Mounting Screw	081A95	
Allen Wrench	M039A22	
NIST Calibration	ACS-1T	
Additional Accessories [3]		
Mating Cable Connectors	EP	
Recommended Stock Cables	003	
Options [5]		
Available Options	P [8]	

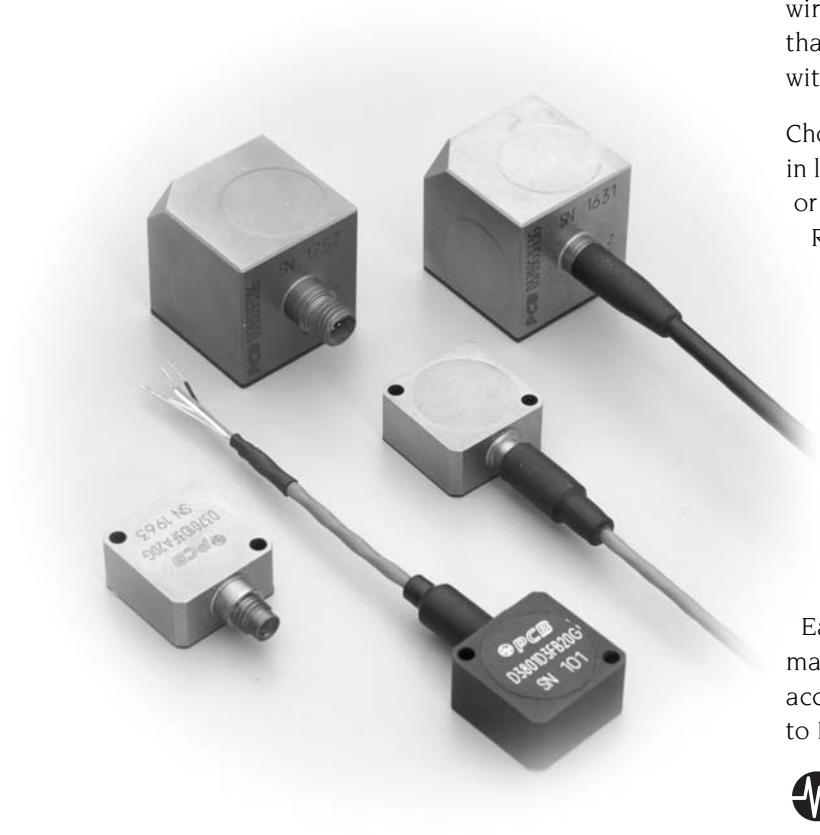
NOTES:

[1] See note regarding accuracy of information on inside front cover.
[2] Typical. [3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information.
[5] See page xvii to xx for option information.
[6] Zero-based, least-squares, straight line method.
[7] Low frequency response is determined by external signal conditioning electronics. [8] Acceleration from structure into sensor base.

Dimensions shown are in inches (millimeters).

Capacitive Accelerometers

- **Uniform acceleration measurement**
- **Low-frequency vibration analysis**
- **Automotive ride quality assessment**
- **Modal analysis**
- **Robotics**
- **Elevator ride quality**
- **Tilt measurement**



Single axis and triaxial capacitive accelerometers measure low-level, low-frequency vibration and uniform, static acceleration. They possess true DC frequency response capability. Capacitive accelerometers utilize the properties of an opposed-plate capacitor. When influenced by acceleration, a displaced spring-mass creates a proportional capacitance shift.

PCB's capacitive accelerometers offer many advantages. They are durable and utilize a multi-pin connector, or integral cable, for a single-point hook-up. Pneumatic damping provides resistance to overloads, insensitivity to thermal transients, and resonance suppression. By design, they are inherently insensitive to base strain, transverse motion, and electromagnetic influences. The three-wire system delivers a low-impedance output signal that can be transmitted over long cable lengths, without degradation of signal quality.

Choose from either the precision Series 3700 housed in lightweight, hermetically-sealed titanium housings, or the low cost Series 3800 with injection-molded Ryton housings. Both types offer a selection of models that offer a variety of full-scale ranges, sensitivities, and measurement resolutions.

The units require DC voltage excitation, however, built in voltage regulators eliminate the need for expensive, regulated power sources. A variety of powering options are offered for fixed or portable operation and adapt the units to benchtop power supplies, automotive batteries, or laptop PC data acquisition power sources.

Each unit is fabricated in PCB's ISO-9001 approved manufacturing facility and supplied with an A2LA-accredited certificate of calibration traceable to N.I.S.T.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

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Capacitive Accelerometers

PRECISION CAPACITIVE ACCELEROMETERS

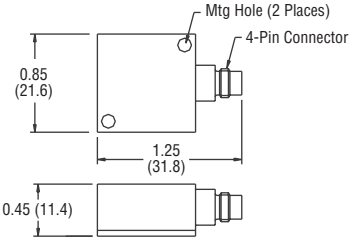
(*complete specifications are featured on page* 1.112)

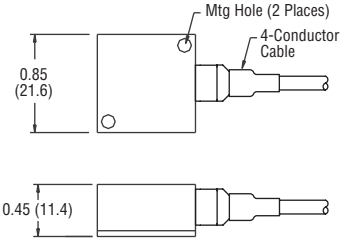
Precision capacitive accelerometers offer true, DC frequency response capability for laboratory or field testing applications.

- ride quality assessments
- stabilization control
- structural testing
- tilt measurements

Series 3701 — Precision, single-axis capacitive accelerometers with 4-pin connector or integral cable

- Choice of four different measurement ranges
  - ± 3 g (29.4 m/s²) 0 to 150 Hz
  - ± 20 g (196 m/s²) 0 to 500 Hz
  - ± 50 g (490 m/s²) 0 to 600 Hz
  - ± 200 g (1961 m/s²) 0 to 1000 Hz
- Choice of three different voltage excitation ranges
  5 to 30 VDC, 10 to 30 VDC, 16 to 30 VDC
- Lightweight, hermetically-sealed, titanium housings
- Operating temperature range -40 to +185 °F (-40 to +85 °C)

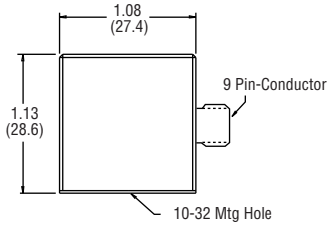


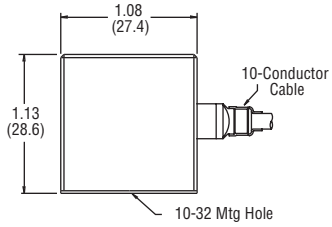


Recommended cables and accessories ❻ — see pages 1.115 to 1.116, and page 4.2
Select a capacitive sensor signal conditioner from those shown on page 1.115
Options: HT — see pages xvii to xx for option information
See model configuration matrix on next page

Series 3703 — Precision, triaxial capacitive accelerometers with 4-pin connector or integral cable

- Choice of four different measurement ranges
  - ± 3 g (29.4 m/s²) 0 to 150 Hz
  - ± 20 g (196 m/s²) 0 to 500 Hz
  - ± 50 g (490 m/s²) 0 to 600 Hz
  - ± 200 g (1961 m/s²) 0 to 1000 Hz
- Choice of three different voltage excitation ranges
  5 to 30 VDC, 10 to 30 VDC, 16 to 30 VDC
- Lightweight, hermetically-sealed, titanium housings
- Operating temperature range -40 to +185 °F (-40 to +85 °C)





Recommended cables and accessories: Model 037P10 — see page 1.116
Select a capacitive sensor signal conditioner from those shown on page 1.115
Options: HT — see pages xvii to xx for option information
See model configuration matrix on next page

Dimensions shown are in inches (millimeters).

Model Numbering System for Precision Capacitive Accelerometers

1.) Series (add "HT" prefix for optional high temperature operation)	2.) Full scale output	3.) Excitation voltage	4.) Electrical connection	5.) Measurement Range	6.) Integral cable length (add only if selecting integral cable other than standard 10 ft. (3,0 m.) length)	7.) Cable termination (add only if selecting integral cable with other than pigtail connection)	
3701							Single axis capacitive accelerometer
3703							Triaxial capacitive accelerometer
	D						± 2 volt (Required for use with 20 g and 200 g units. Required for 3 g and 50 g units specified for 5 to 30 VDC excitation voltage)
	G						± 3 volt (Required for use with 3 g and 50 g units) [1]
		1					5 to 30 VDC (May be used with 5 VDC power supplies or 9 VDC batteries) [1]
		2					10 to 30 VDC (May be used with 12 VDC automotive or marine batteries)
		3					16 to 30 VDC (May be used with PCB signal conditioners and other laboratory power supplies)
			FA				4-pin hermetic jack (For use with single axis sensors)
			FB				010 Series 4-conductor integral cable (For use with single axis sensors)
			FD				9-pin hermetic jack (For use with triaxial sensors)
			FE				037 Series 10-conductor integral cable (For use with triaxial sensors)
				3G			± 3 g measurement range corresponding to 1000 mV/g sensitivity and ± 3 volts full scale output [1]
				20G			± 20 g measurement range corresponding to 100 mV/g sensitivity and ± 2 volts full scale output
				50G			± 50 g measurement range corresponding to 60 mV/g sensitivity and ± 3 volts full scale output [1]
				200G			± 200 g measurement range corresponding to 10 mV/g sensitivity and ± 2 volts full scale output
					/XXX		Specify XXX as desired cable length in feet (or meters, if ordering metric version) insert "M" prefix to cable length
						AY	4-pin plug (For use with single axis sensors)
						EN	9-pin plug (For use with triaxial sensors)

Examples:

HT3703	D	1	FD	20G			Triaxial Sensor: 100 mV/g, 20 g range, ± 2 volt FS output, 9-pin connector, operates from 5 to 30 VDC power and to 250 °F (121 °C)
3701	G	3	FB	3G	/5	AY	Single Axis Sensor: 1000 mV/g, 3 g range, ± 3 volt FS output, with 5 foot integral 010 series cable terminating with 4-pin plug operates from 16 to 30 VDC power

Note: [1] When ordering ±3 g or ±50 g range sensors requiring 5 to 30 VDC excitation voltages, full-scale output code "D" (±2 volt) must be specified. The sensitivity for these sensors will be set at 700 mV/g and 40 mV/g respectively.

Series 3701 (Single Axis) and 3703 (Triaxial) Precision Capacitive Accelerometer Specifications

Individual Specifications [1] (based upon selected configuration from the model numbering system matrix)

Voltage Sensitivity (± 5%)		Measurement Range		Frequency Range		Resonant Frequency	Broadband Resolution [6] 0.5 to 100 Hz	
English	SI	English	SI	(± 5%)	(± 10%)		English	SI
10 mV/g	1.02 mV/(m/s^2)	200 g	1961 m/s^2	0 to 800 Hz	0 to 1000 Hz	≥ 2500 Hz	600 µg rms	5880 µm/s^2 rms
60 mV/g [7]	6.12 mV/(m/s^2) [7]	50 g	490 m/s^2	0 to 450 Hz	0 to 600 Hz	≥ 1500 Hz	120 µg rms	1176 µm/s^2 rms
100 mV/g	10.2 mV/(m/s^2)	20 g	196 m/s^2	0 to 300 Hz	0 to 500 Hz	≥ 900 Hz	80 µg rms	785 µm/s^2 rms
1000 mV/g [7]	102.0 mV/(m/s^2) [7]	3 g	29.4 m/s^2	0 to 100 Hz	0 to 150 Hz	≥ 400 Hz	30 µg rms	294 µm/s^2 rms

Series 3701 (Single Axis) and 3703 (Triaxial) Accelerometer Specifications

Common Specifications [1]

Performance		English	SI
Non-Linearity [2]		≤ 1%	
Transverse Sensitivity		≤ 3%	
Environmental			
Overload Limit (Shock)		3000 g pk	29k m/s2 pk
Temperature Range (Operating)		-40 to +185 °F	-40 to +85 °C
	with "HT" Option	-40 to +250 °F	-40 to +121 °C
Temperature Range (Storage)		-85 °F to +250 °F	-65 °C to +121 °C
Electrical			
Excitation Voltage		16 to 30 VDC, 10 to 30 VDC, or 5 to 30 VDC	
Typical Current Consumption		≤ 10 mA per axis	
Output Impedance		50 ohms	
Electrical Isolation (Base)		> 10^8 ohms	
Physical			
Housing Material		Titanium	Titanium
Sealing		Hermetic	Hermetic
Size (Height x Length x Width)	Single Axis	0.45 × 0.85 × 0.85 in	11.4 × 21.6 × 21.6 mm
	Triaxial	1.1 in cube	28 mm cube
Weight	Single Axis	0.62 oz	17.5 gm
	Triaxial	2.7 oz	78.1 gm
Electrical Connector	Single Axis	4-Pin Jack or Series 010 Integral Cable	
	Triaxial	9-Pin Jack or Series 037 Integral Cable	
Mounting	Single Axis	Through Hole	
	Triaxial	10-32 Female	
Supplied Accessories [3]			
Easy Mount Clip	Single Axis	080A152	
Adhesive Mounting Base	Triaxial	080A190	
Mounting Screws	Single Axis	081A64 (2 ea.)	
Metric Mounting Screws	Single Axis	M081A64 (2 ea.)	
Mounting Stud	Triaxial	081A05	
Metric Mounting Stud	Triaxial	M081A05	
NIST Calibration [4]	Single Axis	ACS-11	
NIST Calibration [4]	Triaxial	ACS-11T	
Options [5]			
Available Options		HT (operation from -40 to +250 °F (-40 to +121 °C))	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See pages xvii to xx for option information.
[6] For 16 to 30 VDC excitation version. [7] For ± 3 g (29.4 m/s^2) and ± 50 g (490 m/s^2) versions with 5 to 30 VDC excitation, sensitivity will be 700 mV/g (71.4 mV/(m/s^2)) and 40 mV/g (4.1 mV/(m/s^2)) respectively.

Dimensions shown are in inches (millimeters).

Series 3801 Single Axis Low-Cost Capacitive Accelerometer Specifications

Individual Specifications [1] (based upon selected configuration from the model numbering system matrix)

Voltage Sensitivity (± 10%)		Measurement Range		Frequency Range		Resonant Frequency	Broadband Resolution [6] 0.5 to 100 Hz	
English	SI	English	SI	(± 5%)	(± 10%)		English	SI
10 mV/g	1.02 mV/(m/s^2)	200 g	1960 m/s^2	0 to 600 Hz	0 to 800 Hz	≥ 2000 Hz	600 µg rms	5880 µm/s^2 rms
60 mV/g [7]	6.12 mV/(m/s^2)	50 g	490 m/s^2	0 to 350 Hz	0 to 500 Hz	≥ 1200 Hz	180 µg rms	1764 µm/s^2 rms
100 mV/g	10.2 mV/(m/s^2)	20 g	196 m/s^2	0 to 200 Hz	0 to 400 Hz	≥ 800 Hz	120 µg rms	1176 µm/s^2 rms
1000 mV/g [7]	102.0 mV/(m/s^2)	3 g	29.4 m/s^2	0 to 80 Hz	0 to 100 Hz	≥ 350 Hz	60 µg rms	588 µm/s^2 rms

Series 3801 Single Axis Capacitive Accelerometer Specifications

Common Specifications [1]

Performance	English	SI
Non-Linearity [2]	≤ 2%	
Transverse Sensitivity	≤ 5%	
Environmental		
Overload Limit (Shock)	3000 g pk	29k m/s2 pk
Temperature Range (Operating)	-40 to +185 °F	-40 to +85 °C
with "HT" Option	-40 to +250 °F	-40 to +121 °C
Temperature Range (Storage)	-85 °F to +250 °F	-65 °C to +121 °C
Temperature Coefficient of Sensitivity	≤ 0.005% / °F	≤ 0.009% / °C
Electrical		
Excitation Voltage	16 to 30 VDC or 5 to 30 VDC	
Typical Current Consumption	≤ 10 mA	
Output Impedance	50 ohms	
Electrical Isolation (Base)	> 10^8 ohms	
Physical		
Housing Material	Polymer	Polymer
Sealing	Epoxy	Epoxy
Size (Height x Length x Width)	0.5 × 0.85 × 0.85 in	12.7 × 21.6 × 21.6 mm
Weight	0.62 oz	17.5 gm
Electrical Connector	Series 010 Integral Cable	
Mounting	Through Hole	
Supplied Accessories [3]		
Easy Mount Clip	080A152	
Mounting Screws	081A98 (2 ea.)	
Metric Mounting Screws	M081A98 (2 ea.)	
NIST Calibration [4]	ACS-11	
Options [5]		
Available Options	HT (operation from -40 to +250 °F (-40 to +121 °C))	

NOTES: [1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 for calibration information. [5] See pages xvii to xx for option information.
[6] For 16 to 30 VDC excitation version. [7] For ± 3 g (29.4 m/s^2) and ± 50 g (490 m/s^2) versions with 5 to 30 VDC excitation, sensitivity will be 700 mV/g (71.4 mV/(m/s^2)) and 40 mV/g (4.1 mV/(m/s^2)) respectively.

Capacitive Accelerometers

LOW COST CAPACITIVE ACCELEROMETERS

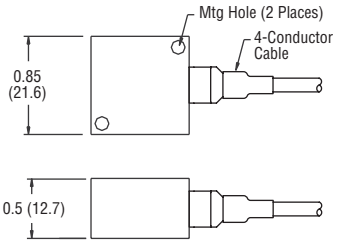
(*complete specifications are featured on page* 1.113)

Low cost capacitive accelerometers offer true, DC frequency response capability for laboratory testing applications.

- modal analysis
- stabilization control
- structural testing
- tilt measurements

Series 3801 — Low cost, single-axis capacitive accelerometers with integral cable

- Choice of four different measurement ranges
  - ± 3 g (29.4 m/s²) 0 to 100 Hz
  - ± 20 g (196 m/s²) 0 to 400 Hz
  - ± 50 g (490 m/s²) 0 to 500 Hz
  - ± 200 g (1961 m/s²) 0 to 800 Hz
- Choice of two different voltage excitation ranges
  5 to 30 VDC, 16 to 30 VDC
- Lightweight, injection-molded, Ryton housings
- Operating temperature range -40 to +185 °F (-40 to +85 °C)



Select a capacitive sensor signal conditioner from those shown on page 1.115
Options: HT — see pages xvii to xx for option information
See model configuration matrix below

Model Numbering System for Low Cost Capacitive Accelerometers

1). Series (Add 'HT' prefix for High Operating Temperature Option — e.g., HT3801D3FB20G)	2). Full Scale Output	3). Excitation Voltage	4). Electrical Connection	5). Measurement Range	6). Integral Cable Length (Add only if selecting integral cable with other than standard 10 ft (3 m) length)	7). Cable Termination (Add only if selecting integral cable with other than pigtail connection)	
3801	Low cost, single axis capacitive accelerometer						
	D	± 2 volt (Required for use with all 20 g and 200 g units. Required for 3 g and 50 g units specified for 5 to 30 VDC excitation voltage)					
	G	± 3 volt (Required for use with 3 g and 50 g units specified for 16 to 30 VDC excitation voltage) [1]					
		1	5 to 30 VDC (May be used with PCB signal conditioners, other laboratory power supplies, 9 VDC batteries or 12 VDC batteries) [1]				
		3	16 to 30 VDC (May be used with PCB signal conditioners or other laboratory power supplies)				
			FB	010 Series 4-conductor integral cable			
				3G	± 3 g measurement range corresponding to 1000 mV/g sensitivity and ± 3 volts full scale output [1]		
				20G	± 20 g measurement range corresponding to 100 mV/g sensitivity and ± 2 volts full scale output		
				50G	± 50 g measurement range corresponding to 60 mV/g sensitivity and ± 3 volts full scale output [1]		
				200G	± 200 g measurement range corresponding to 10 mV/g sensitivity and ± 2 volts full scale output		
					/XXX	Specify XXX as desired cable length in feet (or meters, if ordering metric version insert "M" prefix to cable length)	
						AY	4-pin threaded plug, Microtech style
						GE	6-pin bayonet plug, MS-3111F-10-6P style

Example							
3801	G	3	FB	3G	/5	AY	Single Axis Sensor: 1000 mV/g, 3 g range, ± 3 volt FS output, with 5 foot integral 010 series cable terminating with 4-pin plug, operates from 16 to 30 VDC power

Note: [1] When ordering ± 3 g or ± 50 g range sensors requiring 5 to 30 VDC excitation voltages, full-scale output code 'D' (± 2 volt) must be specified. The sensitivity for these sensors will be set at 700 mV/g and 40 mV/g, respectively.

Dimensions shown are in inches (millimeters).

CAPACITIVE SENSOR SIGNAL CONDITIONERS

PCB's capacitive accelerometers contain a built-in voltage regulator that permits them to operate from virtually any conventional power supply. The signal conditioners offered provide the added benefit of a offset adjustment for nulling the inherent zero offset voltage.

Model 478A01 — Single channel, battery-powered, capacitive sensor signal conditioner

- Single channel
- Unity gain
- Powered by three 9 VDC batteries (optional AC adaptor, Model 488A03)
- DC offset null adjustment
- 4-pin input jack
- BNC output jack

Model 478A05 — Three-channel, line powered, capacitive sensor signal conditioner

- Three channels
- Unity gain
- Universal line powered (100 to 240 VAC, 50 to 60 Hz)
- DC offset null adjustment
- Input terminal strip
- Three BNC output jacks
- Optional DC power pack, Model 488B07

Model 445B01 — Single channel, line powered, modular-style, capacitive sensor signal conditioner

- Single channel
- Selectable gain ×1, ×10, ×100
- Universal line powered (100 to 240 VAC, 50 to 60 Hz)
- DC offset null adjustment
- 4-pin input jack
- BNC output jack

Model 478A16 — pre-configured, multi-channel, rack-mountable, capacitive sensor signal conditioner

- 16 channels per rack
- Unity gain
- Universal line powered (100 to 240 VAC, 50 to 60 Hz)
- DC offset null adjustment for each channel
- 4-pin input jack
- BNC output jack
- Optional Model 478A17 features expandable architecture with selectable gain, filtering, output channel switching, DC voltage operation, RS-232 computer control, and more

Dimensions shown are in inches (millimeters).

ACCESSORIES FOR CAPACITIVE ACCELEROMETERS

Model 080A152 — Easy-mount clip

- Installs via adhesive, double-sided tape, or screw
- Sensor "snaps" in and out of place
- Adapts a single sensor for triaxial or multi-point successive measurements
- Compatible with all Series 3701 capacitive accelerometers

Model 080A153 — Triaxial mounting block (plastic)

- Adapts Series 3701 capacitive accelerometers for triaxial measurements
- Includes three Model 080A152 Easy-mount clips
- Easy-mount clips install onto block, sensors snap in and out of clips
- Alternate Model 080A151 features anodized aluminum construction

---

Model 010D10 — 10 ft (3 m) cable for single axis capacitive accelerometers

- 4-conductor, shielded cable
- 4-socket plug on each end
- Alternate lengths available — 5 ft (1.5 m), 20 ft (6.1 m), 30 ft (9.1 m)
- Alternate model with 4-socket plug to pigtail termination (10 ft (3 m)) — Model 010P10

Model 037P10 — 10 ft (3 m) cable for triaxial capacitive accelerometers

- 9-conductor, shielded cable
- 9-socket plug to pigtail termination
- Alternate lengths available — 5 ft (1.5 m), 20 ft (6.1 m), 30 ft (9.1 m)
- Alternate model with three, 4-socket plug terminations — Model 037A10

Model 488B07 — DC voltage power pack for Model 478B05 signal conditioner

- Permits portable, battery-powered operation of Model 478B05
- Operates from four 9 VDC batteries

Miscellaneous

- **Model 081A64** screw assembly with 4-40 thread for mounting Series 3701
- **Model M081A64** screw assembly with M2.5 × 0.45 thread for mounting Series 3701
- **Model 081A98** screw assembly with 4-40 thread for mounting Series 3801
- **Model M081A98** screw assembly with M2.5 × 0.45 thread for mounting Series 3801
- **Model 081A05** 10-32 thread to 10-32 thread stud for mounting Series 3703
- **Model M081A05** 10-32 thread to M6 × 0.75 thread adaptor stud for mounting Series 3703
- **Model 080A190** 1-1/4 hex × 0.25 in stainless steel, adhesive mounting base for Series 3703
- **Model 080A154** anodized aluminum adhesive mounting base for Series 3701

Dimensions shown are in inches (millimeters).

Special Purpose Sensors

- **Low cost / OEM sensors**
- **Dynamic strain measurements**
- **Whole-body vibrations**
- **Mechanical impedance**

PCB has many accelerometers specifically tailored for a multitude of applications. These range in scope from single-copy, exclusive-use devices to sensors of which thousands are produced to satisfy special application requirements. An extensive commitment of resources for the design, development, manufacture, and test of sensors, instrumentation, and accessories allows PCB to respond to customer's needs by producing accelerometers suited for unique or specific tasks.

For many requirements, the use of an available standard option may be all that is necessary to configure a compatible sensor. Available standard options are listed in the specification tables for most units in this catalog. A description of standard options begins on page *xvii*. Special options may range from additional qualification testing or calibration to a complete re-configuration or design from scratch. Whether the application is routine or out-of-the-ordinary, PCB has the resources to address specialized needs.

The models offered in this section are only a minor representation of available special purpose accelerometers. PCB welcomes requests for instrumentation tailored to satisfy any unique test requirements.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

Special Purpose Sensors

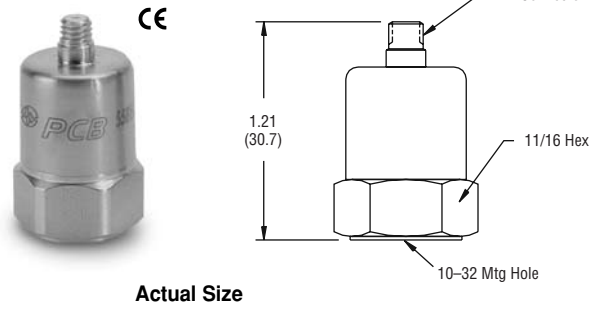
ECONOMY / OEM
(*complete specifications are featured on page* 1.121)

- value-added resale
- limited budged circumstances

Model 338B34 — Low sensitivity, low cost, ICP® accelerometer

- 10 mV/g [1.02 mV/(m/s²)] sensitivity
- 0.7 Hz to 3000 frequency range
- 34 gram (1.2 oz) weight
- Single point calibration
- Stainless steel housing

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: W — see pages xvii to xx for option information

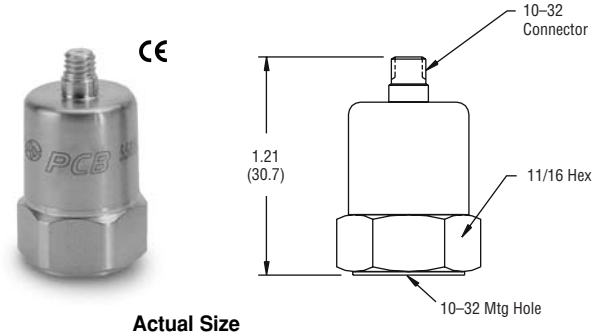


Actual Size

Model 338B35 — High sensitivity, low cost, ICP® accelerometer

- 100 mV/g (10.2 mV/(m/s²)] sensitivity
- 0.7 Hz to 3000 frequency range
- 34 gram (1.2 oz) weight
- Single point calibration
- Stainless steel housing

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: W — see pages xvii to xx for option information



Actual Size

DYNAMIC STRAIN
(*complete specifications are featured on page* 1.122)

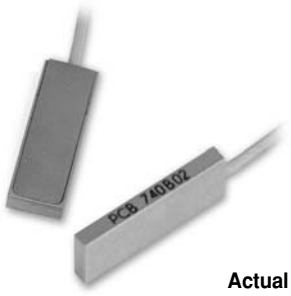
The dynamic, ICP® strain sensor utilizes a quartz sensing element in a durable, titanium housing. The device adhesively attaches to the test specimen and is re-usable.

- composite materials testing
- noise path analysis
- active vibration control
- machinery monitoring

Model 740B02 — Dynamic ICP® Strain Sensor

- 50 mV/με sensitivity
- 0.5 Hz to 100 kHz frequency range
- 0.5 gram (0.02 oz) weight
- 0.6 nε resolution
- Integral 10 ft (3 m) cable with 10–32 coaxial plug termination

Recommended cables and accessories ❸ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none



Actual Size

Dimensions shown are in inches (millimeters).

TRIAXIAL ICP® SEAT PAD ACCELEROMETER

(*complete specifications are featured on page* 1.122)

The triaxial seat pad accelerometer measures whole body vibration influences associated with vehicle operation. The unit houses a triaxial accelerometer within a molded, rubber pad that can be placed under a seated person, beneath a weighted test object, or strapped onto the body.

- operator comfort studies
- construction vehicle exposure vibration
- seat design studies
- seat mounting, suspension, bracket and damping tests

Model 356B40 — Triaxial ICP® seat pad accelerometer

- 100 mV/g [10.2 mV/(m/s²)] sensitivity
- 0.5 to 1000 Hz frequency range
- 180 gram (6.3 oz) weight
- 4-pin connector
- Supplied with Model 010G05 interface cable 5 ft (1.5 m) length

Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

HUMAN VIBRATION MEASUREMENTS

The Human Vibration Meter utilizes accelerometer inputs to provide vibration severity measurements relative to human exposure to vibration. The unit is directly compatible with the model 356B40 shown above, as well as any other single axis or triaxial ICP® accelerometer.

- hand-arm vibration
- whole-body vibration
- operator comfort studies

Model 381A20

- Data logging of rms, peak, and vector sum values
- RS-232 computer interface
- Programmable AC and DC outputs

Dimensions shown are in inches (millimeters).

ICP® MECHANICAL IMPEDANCE SENSOR

(*complete specifications are featured on page* 1.123)

The mechanical impedance sensor simultaneously measures an applied, driving-point force and response acceleration of a test structure for determining parameters such as mechanical mobility and mechanical impedance. The unit consists of a precision, shear mode accelerometer and a quartz force sensor in a common housing. Installation is primarily facilitated at the structural excitation points, in series with a stinger and vibratory shaker.

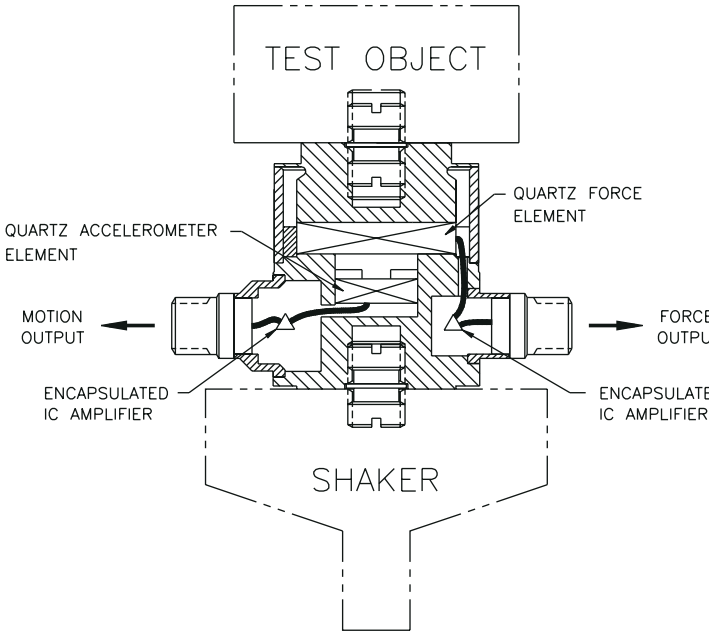
- structural testing
- modal analysis

Model 288D01 — Driving point, mechanical impedance sensor

- 100 mV/g [10.2 mV/(m/s²)] acceleration sensitivity
- 100 mV/lb [22.4 mV/N] force sensitivity
- 0.7 to 7000 Hz frequency range
- 19.2 gram (0.68 oz) weight

Recommended cables and accessories ❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: none

Actual Size



Dimensions shown are in inches (millimeters).

Economy / OEM ICP® Accelerometer Specifications				
Model Number [1]	**338B34**		**338B35**	
Performance	**English**	**SI**	**English**	**SI**
Sensitivity (± 15%)	10 mV/g	1.02 mV/(m/s²)	100 mV/g	10.2 mV/(m/s²)
Measurement Range	± 500 g pk	± 4900 m/s² pk	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	1 to 2000 Hz	1 to 2000 Hz	1 to 2000 Hz	1 to 2000 Hz
Frequency Range (± 10%)	0.7 to 3000 Hz	0.7 to 3000 Hz	0.7 to 3000 Hz	0.7 to 3000 Hz
Resonant Frequency	≥ 12 kHz	≥ 12 kHz	≥ 12 kHz	≥ 12 kHz
Broadband Resolution (1 to 10k Hz)	0.01 g rms	0.10 m/s² rms	0.001 g rms	0.01 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %	≤ 5 %	≤ 5 %
Environmental				
Overload Limit (Shock)	± 2000 g pk	± 19.6k m/s² pk	± 2000 g pk	± 19.6k m/s² pk
Temperature Range (Operating)	-65 to +250° F	-54 to +121° C	-65 to +250° F	-54 to +121° C
Electrical				
Excitation Voltage	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Impedance	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms	≤ 100 ohms
Output Bias Voltage	7.5 to 11.5 VDC	7.5 to 11.5 VDC	7.5 to 11.5 VDC	7.5 to 11.5 VDC
Discharge Time Constant	>3.0 sec	>3.0 sec	0.5 to 2.0 sec	0.5 to 2.0 sec
Physical				
Sensing Element	Quartz	Quartz	Quartz	Quartz
Sensing Geometry	Shear	Shear	Shear	Shear
Housing Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	Hermetic	Hermetic	Hermetic	Hermetic
Weight	1.2 oz	34 gm	1.2 oz	34 gm
Size (Hex × Height)	11/16 × 1.2 in	17.5 × 30.5 mm	11/16 × 1.2 in	17.5 × 30.5 mm
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Electrical Connection Position	Top	Top	Top	Top
Mounting Thread	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Supplied Accessories [3]				
NIST Calibration [4]	ACS-2		ACS-2	
Additional Accessories [3]				
Adhesive Mounting Base	080A12		080A12	
Quick Bonding Gel	080A90		080A90	
Mounting Stud	081B05		081B05	
Metric Mounting Stud	M081B05		M081B05	
Mating Cable Connectors	EB, EJ, AH, AK, AW		EB, EJ, AH, AK, AW	
Recommended Stock Cables	002, 003		002, 003	
Options [5]				
Available Options	W		W	

NOTES: [1] See note regarding accuracy of information on inside front cover.

[2] Zero-based, least-squares, straight line method.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 for calibration information.

[5] See pages xvii to xx for option information.

Dynamic ICP® Strain Sensor Specifications

Model Number [1]	740B02	
Performance	**English**	**SI**
Sensitivity (± 20 %) [6]	50 mV/με	50 mV/με
Measurement Range	100 pk με	100 pk με
Frequency Range [7]	0.5 to 100k Hz	0.5 to 100k Hz
Broadband Resolution (1 to 10k Hz)	0.6 nε	0.6 nε
Non-Linearity [4]	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %
Environmental		
Overload Limit (Shock)	± 10k g pk	± 98k m/s² pk
Operating Temperature Range	-65 to +250° F	-54 to +121° C
Acceleration Sensitivity [5]	0.001 με/g	0.0001 με/(m/s²)
Electrical		
Excitation Voltage	20 to 30 VDC	20 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA
Output Bias Voltage	9 to 13 VDC	9 to 13 VDC
Discharge Time Constant	1 to 3 sec	1 to 3 sec
Physical		
Sensing Element	Quartz	Quartz
Housing Material	Titanium	Titanium
Sealing	Epoxy	Epoxy
Weight	0.02 oz	0.5 gm
Size (Width × Length × Height)	0.2 × 0.6 × 0.07 in	5.1 × 15.2 × 1.8 mm
Electrical Connection	Integral Cable	Integral Cable
Cable Length	10 ft	3 m
Cable Termination	10-32 Coaxial Plug	10-32 Coaxial Plug
Cable Type	030 Coaxial	030 Coaxial
Mounting	Adhesive	Adhesive
Supplied Accessories [3]		
Removal Tool	039A07	
Quick Bonding Gel	080A90	
Additional Accessories [3]		
Connector Adaptor	070A02	

NOTES:

[1] See note regarding accuracy of information on inside front cover.
[3] See section 4 of this catalog for cable and accessory information.
[4] Zero-based, least-squares, straight line method.
[5] Measured perpendicular to sensing axis.
[6] Calibrated on steel bar.
[7] Based on cable drive of 100 ft at 30 pF/ft, 20 mA excitation.

Triaxial ICP® Seat Pad Accelerometer Specifications

Model Number [1]	356B40	
Performance	**English**	**SI**
Sensitivity (± 10%)	100 mV/g	10.2 mV/(m/s²)
Measurement Range	± 10 g pk	± 98 m/s² pk
Frequency Range (± 5 %)	0.5 to 1000 Hz	0.5 to 1000 Hz
Resonant Frequency	≥ 27 kHz	≥ 27 kHz
Broadband Resolution (1 to 10k Hz)	0.0002 g rms	0.002 m/s² rms
Non-Linearity [2]	≤ 1 %	≤ 1 %
Transverse Sensitivity	≤ 5 %	≤ 5 %
Environmental		
Overload Limit (Shock)	± 2000 g pk	± 19.6k m/s² pk
Operating Temperature Range	+14 to +122° F	-10 to +50° C
Temperature Response	<0.10 %/°F	<0.17 %/°C
Electrical		
Excitation Voltage	6 to 30 VDC	6 to 30 VDC
Constant Current Excitation	0.3 to 10 mA	0.3 to 10 mA
Output Impedance	≤ 500 ohms	≤ 500 ohms
Output Bias Voltage	2.8 to 4.2 VDC	2.8 to 4.2 VDC
Discharge Time Constant	1 to 3 sec	1 to 3 sec
Physical		
Sensing Element	Ceramic	Ceramic
Sensing Geometry	Shear	Shear
Housing Material	Titanium	Titanium
Sealing	Hermetic	Hermetic
Weight	6.3 oz	180 gm
Size (Diameter × Width)	7.87 × 0.472 in	200 × 12 mm
Electrical Connection	1/4-28 4-Pin	1/4-28 4-Pin
Electrical Connection Position	Side	Side
Mounting Thread	10-32 Female	10-32 Female
Supplied Accessories [3]		
Cable	010G05	
Allen Wrench	039B23	
NIST Calibration [4]	ACS-17	

NOTES:

[1] See note regarding accuracy of information on inside front cover.
[2] Zero-based, least-squares, straight line method.
[3] See section 4 of this catalog for cable and accessory information.
[4] See page 1.130 calibration information.

Dimensions shown are in inches (millimeters).

ICP® Mechanical Impedance Sensor Specifications		
Model Number [1]	**288D01**	
Performance-Acceleration	**English**	**SI**
Sensitivity (± 10%)	100 mV/g	10.2 mV/(m/s²)
Measurement Range (for ± 5V output)	± 50 g pk	± 490 m/s² pk
Frequency Range (± 5%)	1 to 5000 Hz	1 to 5000 Hz
Frequency Range (± 10%)	0.7 to 7000 Hz	0.7 to 7000 Hz
Mounted Resonant Frequency	≥ 20 kHz	≥ 20 kHz
Phase Response (± 5° at 70 °F, 21 °C)	4 to 5000 Hz	4 to 5000 Hz
Broadband Resolution (1 Hz to 10 kHz)	0.002 g rms	0.02 m/s² rms
Discharge Time Constant	0.5 to 1.5 sec	0.5 to 1.5 sec
Transverse Sensitivity	≤ 5%	≤ 5%
Overload Limit (Shock)	± 3000 g pk	± 29.4k m/s² pk
Output	Polarity	Positive
Sensing Element	Ceramic/Shear	Ceramic/Shear
Performance-Force		
Sensitivity (± 10%)	100 mV/lb	22.4 mV/N
Measurement Range (for ± 5V output)	± 50 lb pk	± 222.4 N pk
Resonant Frequency (unmounted- no load)	>40 kHz	>40 kHz
Broadband Resolution	0.002 lb	0.0089 N
Discharge Time Constant	≥ 60 sec.	≥ 60 sec.
Maximum Force	500 lb	2224 N
Output (compression force)	Polarity	Positive
End Plate Mass	0.16 oz	4.8 gm
Sensing Element	Quartz/Compression	Quartz/Compression
Common Specifications		
Non-Linearity [6]	≤ 1%	≤ 1%
Operating Temperature Range	0 to +200° F	-18 to +95° C
Excitation Voltage	18 to 30 VDC	18 to 30 VDC
Excitation Constant Current	2 to 20 mA	2 to 20 mA
Output Bias	8 to 14 VDC	8 to 14 VDC
Output Impedance	<250 ohms	<250 ohms
Housing Material	Titanium	Titanium
Sealing	Hermetic	Hermetic
Weight	0.68 oz	19.2 gm
Size (Hex × Height)	0.687 × 0.820 in	17.5 × 20.83 mm
Electrical Connection	10-32 Coaxial	10-32 Coaxial
Mounting Thread (both ends)	10-32 Female	10-32 Female
Supplied Accessories [3]		
Mounting Stud	081B05	
Adhesive Mounting Base	080A	
NIST Calibration [4]	ACS-1, ACS-4, FCS-1	
Additional Accessories [3]		
Mating Cable Connectors	EB, EJ, AH, AW	
Recommended Stock Cables	002, 003	
Options [5]		
Available Options	M, T	

NOTES:

[1] See note regarding accuracy of information on inside front cover.

[2] Zero-based, least-squares, straight line method.

[3] See section 4 of this catalog for cable and accessory information.

[4] See page 1.130 calibration information.

[5] See pages xvii to xx for option information.

PCB's machining capabilities allow full control of the production of precision parts to insure quality and timely delivery. Capabilities including dual spindle CNC lathes, wire EDM machines, and injection molding machines fabricate in excess of 100,000 parts per month to exacting standards.

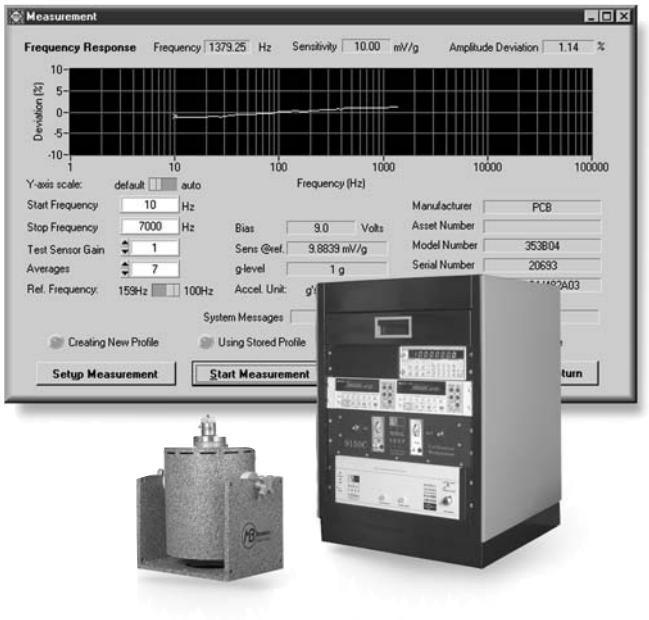
Dimensions shown are in inches (millimeters).

Calibration Equipment and Services

- **Handheld shakers**
- **Reference standard accelerometers**
- **Vibration calibration workstations**
- **High amplitude shock calibrator**
- **Calibration services**
- **Special testing services**

PCB strives to provide the most accurate and complete calibration and testing services in the industry. Considerable investment in equipment, NIST traceability, A2LA accreditation, and conformance to industry and ISO standards ensure that delivered equipment will perform in accordance with its specifications. Page 1.130 to 1.131 highlight some of the performance verification reports or, "calibration certificates", which are included with most sensors.

Additional testing services are available which help qualify accelerometers for use in particular applications. Such tests include: amplitude response to extended low and high frequencies, transverse sensitivity through 360°, effects of elevated or reduced temperatures, high amplitude shock response, exposure to high pressures, and leak testing. Page 1.132 identifies PCB's model numbers associated with additional testing services available for many new sensors, or existing units which may be sent in for service.



Also available from PCB are a variety of test instruments which permit users to conduct their own accelerometer performance verification tests. It is often advantageous to conduct routine calibrations on-site to maintain conformance to quality assurance standards and avoid the delay and inconvenience of being without equipment that is returned for such services. The following pages highlight some of the more popular available items ranging from basic handheld shakers and reference standard accelerometers to complete calibration workstations.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

Calibration Equipment and Services

PORTABLE 1g HANDHELD SHAKER

The Model 394C06 handheld shaker is a small, self-contained, battery powered, vibration exciter specifically designed to conveniently verify accelerometer and vibration system performance. It accepts sensors weighing up to 210 grams* in weight and delivers a controlled, 1 g mechanical excitation. Conduct on-the-spot sensor sensitivity checks, identify channels for multi-point data acquisition, perform end-to-end system troubleshooting, and confirm system gain settings.

**total weight including mounting hardware and cable influence*

Model 394C06

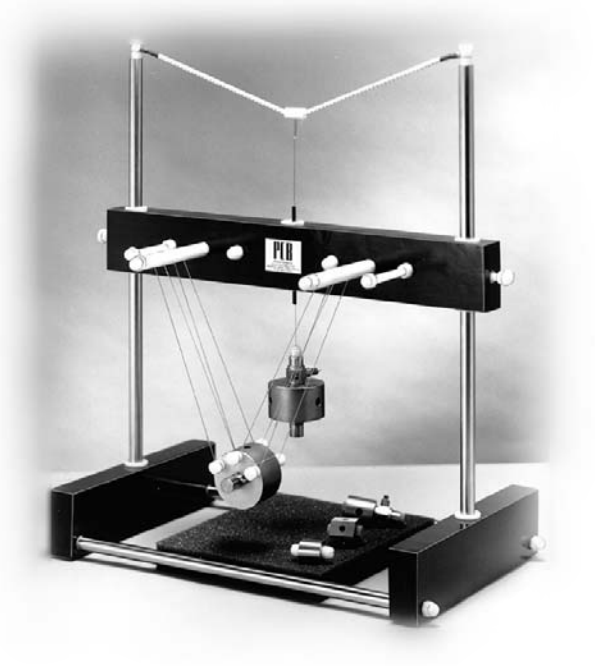
- Provides mechanical excitation at 1 g rms or 1 g pk
- Fixed, 159.2 Hz frequency
- Powered by four "AA" alkaline batteries (included)
- Automatic shut-off or continuous operation
- Mechanical stops protect from overload
- Optional AC power adaptor (Model 073A16)
- Optional **Model M394C06** offers 10 m/sec^2 excitation

Model 394C06

GRAVIMETRIC CALIBRATION FIXTURE

Model 9961C gravimetric calibration fixture is a convenient mechanism for calibrating accelerometers, force sensors, and impact hammers over a low to mid frequency range. Using Earth's gravity as a reference, accelerometers and force sensors are "drop" calibrated using the vertical suspension. Impact hammers are "ratio" calibrated utilizing the pendulous suspension, known mass, and calibrated reference accelerometer, in accordance with Newton's second law, F=ma. The fixture includes an adjustable frame, vertical and pendulous suspensions and calibrated test masses. The system is an economical, educational, and versatile tool for building confidence in sensor performance.

- Calibrates accelerometers, impact hammers and force sensors
- References measurements to Earth's gravity
- Utilizes "drop" and "ratio" techniques
- Applies Newton's law F=ma
- Builds confidence in sensor performance
- Provides educational insight of sensor behavior



Model 9961C

Dimensions shown are in inches (millimeters).

BACK-TO-BACK COMPARISON CALIBRATION STANDARDS

Back-to-back comparison calibration standard accelerometers permit NIST traceable calibration of accelerometers, and other vibration sensors, by the reference comparison method. The back-to-back reference calibration accelerometer is mounted to a mechanical exciter and the sensor to be calibrated is installed onto its surface. The output signals from the reference standard and transducer under test (TUT) are compared, permitting sensitivity, frequency response and phase response verification of the tested unit. Frequency and amplitude inputs to the exciter can be varied to suit the desired test parameters. Included are interconnect cables and a dedicated signal conditioner for use with the reference standard to insure a precise sensitivity at a common reference frequency. Also provided are a variety of mounting studs and an NIST traceable calibration certificate. Readout instruments, shakers, and their controllers are not included. A complete, turnkey system, Model 9150C, is offered on the next page.

Model 394A10

- 100 mV/g sensitivity
- 0.5 to 10 kHz (± 5%) frequency range
- 85 to264 VAC, 47 to 440 Hz powered
- 1/4-28 threaded, test sensor mounting hole

Model 394A11

- 100 mV/g sensitivity
- 0.5 Hz to 10 kHz (± 5%) frequency range
- 85 to 264 VAC, 47 to 440 Hz powered
- optional battery powered
- 10-32 threaded, test sensor mounting hole
- CE compliant

Models 394A10, 394A11

System Model	394A10	394A11
Included Components:		
Sensor Model	301A10	301A11
Sensor Cable (10 ft.)	002C10	003C10
Signal Conditioner	482A23	482A23
Output Cable (3 ft.)	012A03	003D03

Dimensions shown are in inches (millimeters).

Calibration Equipment and Services

ACCELERATION CALIBRATION WORKSTATION

Model 9150C is a complete, fully integrated, turnkey calibration system which performs automated, NIST or PTB-traceable calibration of ICP®, charge mode, piezoresistive and capacitive vibration sensors.

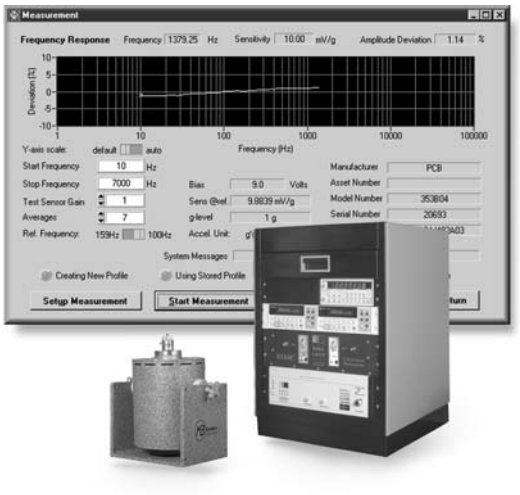
All system components operate under control of the supplied PC workstation running a programmed LabWindows application. A function generator delivers a frequency sweep which drives the shaker / exciter, while a pair of digital multi-meters monitor the output generated from the reference standard sensor and transducer under test (TUT). By comparison method, the associated reference sensitivity and amplitude response of the TUT is determined. Resultant data may then be viewed, printed and saved electronically.

The system features components selected for high precision and cost effectiveness and requires only a desktop computer and minimal floor space. The LabWindows program allows user-customization of calibration routines, data display, and calibration certificates. A typical calibration session takes only a few minutes. In-house calibration saves time, money and inconvenience and, in most cases, return on investment for this system will be justified within just two years.

The Modal Shop (A PCB Group Co.), provides sales and technical support for the model 9150C calibration workstation. Contact The Modal Shop toll-free at 800-860-4867 or visit www.modalshop.com.

Model 9150C

- Fast, automated accelerometer calibrations
- Fully integrated, turnkey system
- NIST or PTB traceability
- PC workstation and LabWindows platform
- Comma Separated Variable output to database



Model 9150C

MODEL 9150C	
Vibration Calibration System:	
Frequency Range	5 to 15 000 Hz
Acceleration Levels	1 g (9,8 m/s2) to 10 g (98,0 m/s2)
Reference Frequencies	100 and 159 Hz
Maximum Displacement	1 inch (2,54 cm)
Total Estimated Accuracy: (1)	
5 to 2 000 Hz	1.8 %
2 000 to 10 000 Hz	2.7 %
Included System Components:	
PC compatible computer with monitor and printer	
GPIB controller card	
LabWindows software	
Instrumentation cabinet	
Function generator	
Power amplifier	
50 lb. electrodynamic shaker	
(2) Digital multi-meters	
Model 394A10 reference standard accelerometer system	
Model 482B06 TUT signal conditioner	
Model 352A78 check accelerometer	
(3) Series 422E in-line charge converters	
Accessory kit (mounting studs, adhesives, cables, etc.)	
Hardware and software instruction manuals	
Available options:	
PCB modular series signal conditioners (CE compliant)	
Low frequency, air-bearing shaker	
System set-up and training	

NOTE: 1. System accuracy for NIST traceable calibration; can also be ordered with PTB traceable calibration.

Dimensions shown are in inches (millimeters).

HOPKINSON BAR FOR HIGH G ACCELEROMETER CALIBRATION SYSTEM

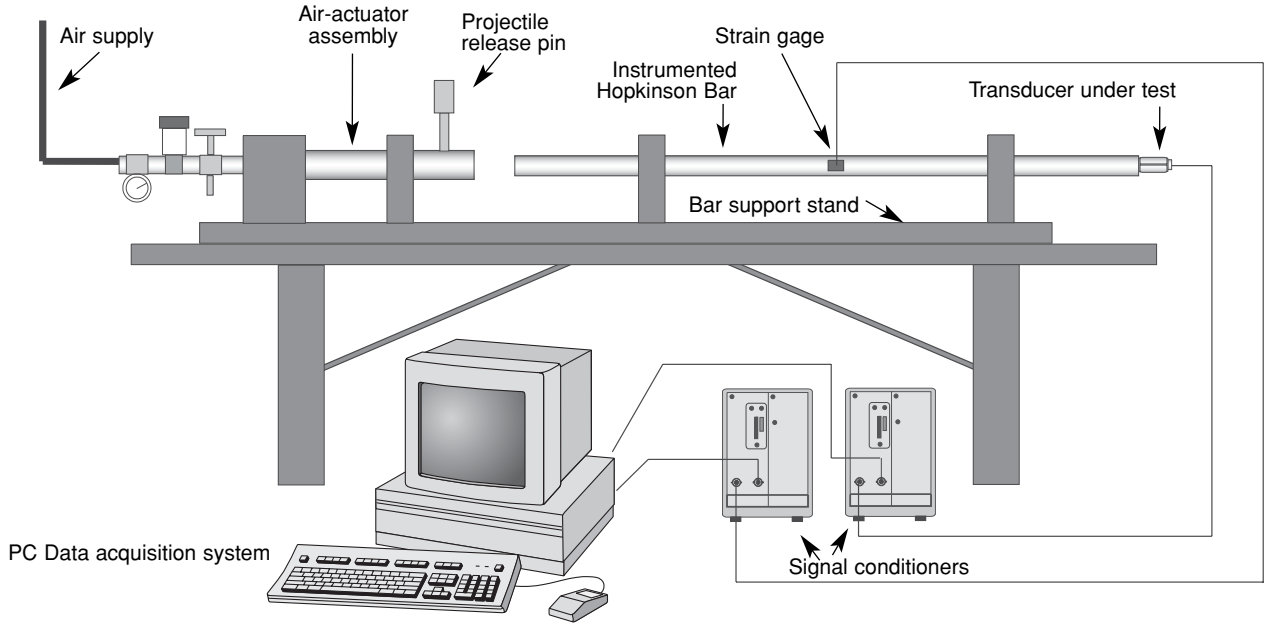
Model 925A01 is a fully automated system for calibrating and verifying high g range shock accelerometers, and for testing of small, lightweight specimens, at acceleration levels from 1,000 to 100,000 g. A triggered lifting pin releases a specially shaped, air-driven, plastic or metal projectile, which impacts one end of the Hopkinson Bar. This action generates a compression wave, which imparts a high-amplitude acceleration to a test accelerometer, or specimen that is mounted on the opposite end of the bar. As a reference, a pair of strain gauges is bonded to the middle of the bar and measures the propagation of the compression wave. Automated data collection is performed by a high speed, 5 MHz, PC data acquisition workstation. Software running under National Instruments Labview processes and analyzes the reference and test measurement signals. The system verifies accelerometer performance characteristics such as sensitivity, frequency response, zero shift, linearity, and survivability.

MODEL 925A01	
Shock Calibration System:	
Acceleration Levels	
(plastic projectile)	1,000 to 10,000 g
(metal projectile)	10,000 to 100,000 g
Pulse Duration	
(plastic projectile)	150 to 200 µsec
(metal projectile)	30 to 40 µsec
Air pressure required	2 to 20 psi
Velocity to Test Specimen (max)	50 ft/sec
Calibration Uncertainty	± 5%
Maximum Test Specimen Mass	15 gm
Hopkinson Bar	
(size)	0.75 " dia. x 80 " length
(material)	6AL-4V Titanium
Included System Components:	
Instrumented Hopkinson Bar with steel base	
Air-actuator assembly with triggered release pin	
Set of (4) projectiles	
Table top bar support	
Windows PC data acquisition system	
National Instruments Labview software	
Signal conditioners	
Air-supply equipment	

See next page for typical calibration results.

Model 925A01

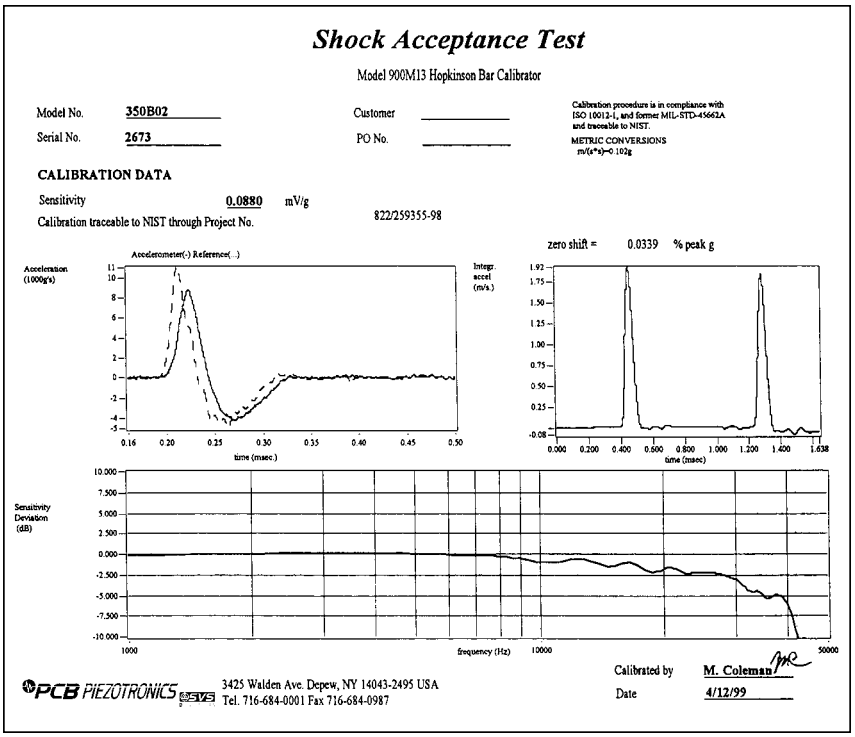
- Sensitivity calibration from 1,000 to 100,000 g
- Frequency response verification
- Tests for zero shift and non-linearity
- Durable, reusable impact projectiles
- Automated data acquisition and analysis
- Complete with PC workstation and Labview Software



Dimensions shown are in inches (millimeters).

CALIBRATION PROCEDURES

PCB's calibration laboratory is accredited by A2LA to ISO 17025. PCB's calibration procedures are in compliance with ISO standard 10012-1:1992 - Quality assurance requirements for measuring equipment, Part 1 - Metrological confirmation system for measuring equipment and the former MIL-STD-45662A. In addition, calibration reference standard accelerometers are maintained with traceability to NIST over 44 frequency data points and all other equipment utilized for calibration purposes is maintained with current NIST traceability. PCB is committed to providing customers with the most accurate, reliable calibration data through maintaining state-of-the-art equipment and reference traceability, conforming to industry standards and procedures, and ensuring conformity through quality assurance.

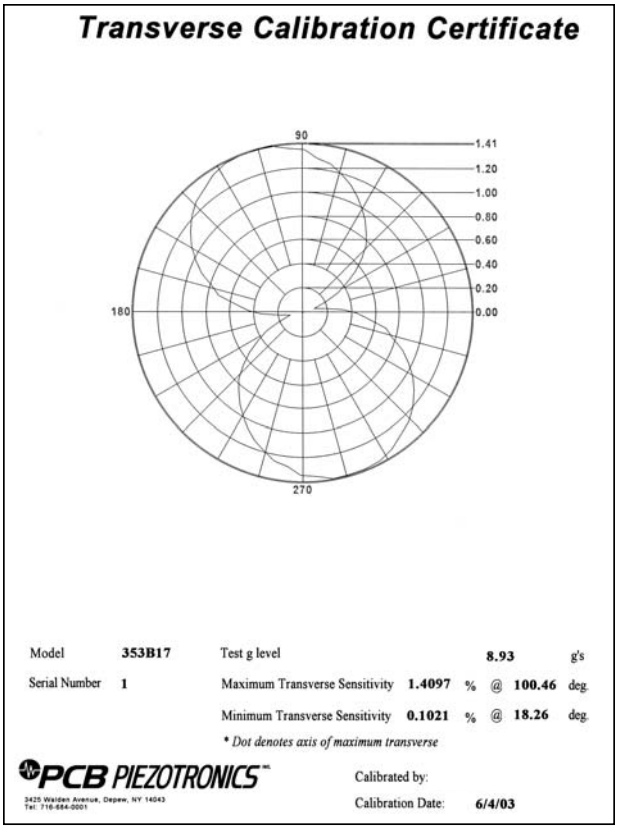


Typical results obtained with the Model 925A01 Hopkinson Bar Calibration System

CALIBRATION CERTIFICATE

For each tested accelerometer, measured data is supplied on the calibration certificate to support its performance characteristics. Automated, computer controlled calibration procedures test individual frequency data points over the test accelerometer's usable range and provide a continuous plot of the unit's frequency response. Additional tests determine the axial sensitivity, maximum transverse sensitivity, resonant frequency, output bias level or insulation resistance and the discharge time constant value (which establishes the low frequency limit) or sensing element capacitance.

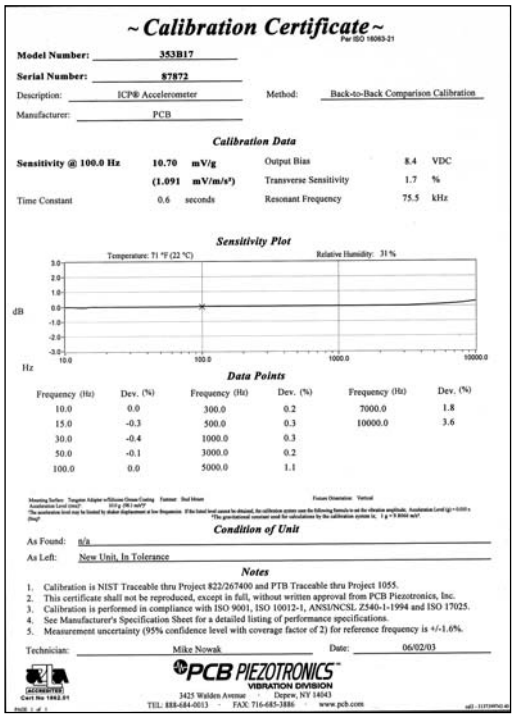
Typical transverse sensitivity calibration (ATS-7)



Dimensions shown are in inches (millimeters).

PERFORMANCE CONCERNS

Calibration of an accelerometer determines its ability to perform within published specifications. It is important to be aware that measurement or environmental influences, beyond specified limits, can cause corruption of accelerometer performance and acquired data. Low frequency range, for an accelerometer, is defined by the high-pass, filtering effect of the discharge time constant of the signal conditioning circuitry. This circuitry is built into ICP® sensors or is external to charge mode sensors. High frequency range is established by the mechanical gain associated with the natural resonance of the accelerometer, which is characterized as a single-degree-of-freedom, second-order, mechanical system. Exposing an accelerometer to frequencies above specified limits may cause excitation of its natural resonance resulting in erroneous or corrupted data. Other environmental influences, such as base strain, thermal transients, EMI, and RFI, can affect accuracy or cause erroneous outputs. Best measurement practices require an understanding of the environment in which the sensor is to be used so that errors can be accounted for. Often, additional testing of an accelerometer, with respect to the undesired influence, will help to quantify its behavior so that measurement data is better understood. Some testing services that are available from the Vibration Division are shown on the next page.



~ Calibration Certificate ~

Model Number: 353B17
Serial Number: 87872
Description: ICP® Accelerometer
Method: Back-to-Back Comparison Calibration
Manufacturer: PCB

Calibration Data

Sensitivity @ 100.0 Hz	10.70 mV/g	Output Bias	8.4	VDC
	(1.091 mV/m/s²)	Transverse Sensitivity	1.7	%
Time Constant	0.6 seconds	Resonant Frequency	75.5	kHz

Sensitivity Plot

Temperature: 71 °F (22 °C) Relative Humidity: 31 %

dB: 3.0, 2.0, 1.0, 0.0, -1.0, -2.0, -3.0
Hz: 10.0, 100.0, 1000.0, 10000.0

Data Points

Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)	Frequency (Hz)	Dev. (%)
10.0	0.0	300.0	0.2	7000.0	1.8
15.0	-0.3	500.0	0.3	10000.0	3.6
30.0	-0.4	1000.0	0.3		
50.0	-0.1	3000.0	0.2		
100.0	0.0	5000.0	1.1		

Condition of Unit

As Found: n/a
As Left: New Unit, In Tolerance

Notes

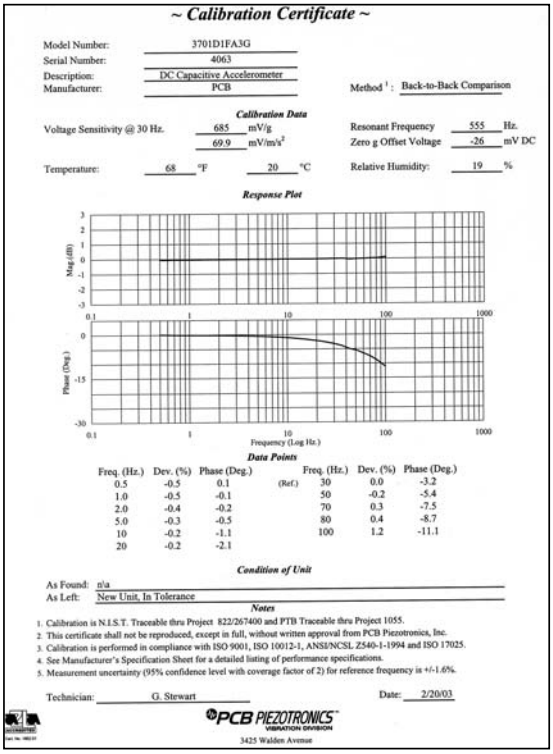
1. Calibration is NIST Traceable thru Project 822/267400 and PTB Traceable thru Project 1055.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for reference frequency is +/-1.6%.

Technician: Mike Nowak Date: 06/02/03

PCB PIEZOTRONICS VIBRATION DIVISION
3425 Walden Avenue · Depew, NY 14043
TEL: 888-684-0013 · FAX: 716-685-3886 · www.pcb.com

A typical ICP® accelerometer calibration certificate (ACS-1)

A calibration certificate for extended low frequency testing (ACS-4)



~ Calibration Certificate ~

Model Number: 3701D1FA3G
Serial Number: 4063
Description: DC Capacitive Accelerometer
Manufacturer: PCB
Method [1]: Back-to-Back Comparison

Calibration Data

Voltage Sensitivity @ 30 Hz: 685 mV/g (69.9 mV/m/s²)
Resonant Frequency: 555 Hz.
Zero g Offset Voltage: -26 mV DC
Temperature: 68 °F 20 °C
Relative Humidity: 19 %

Response Plot

Mag (dB): 3, 2, 1, 0, -1, -2, -3
Phase (Deg.): 0, -15, -30
0.1, 1, 10, 100, 1000
Frequency (Log Hz.)

Data Points

Freq. (Hz.)	Dev. (%)	Phase (Deg.)		Freq. (Hz.)	Dev. (%)	Phase (Deg.)
0.5	-0.5	0.1	(Ref.)	30	0.0	-3.2
1.0	-0.5	-0.1		50	-0.2	-5.4
2.0	-0.4	-0.2		70	0.3	-7.5
5.0	-0.3	-0.5		80	0.4	-8.7
10	-0.2	-1.1		100	1.2	-11.1
20	-0.2	-2.1				

Condition of Unit

As Found: n/a
As Left: New Unit, In Tolerance

Notes

1. Calibration is N.I.S.T. Traceable thru Project 822/267400 and PTB Traceable thru Project 1055.
2. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
3. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
4. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
5. Measurement uncertainty (95% confidence level with coverage factor of 2) for reference frequency is +/-1.6%.

Technician: G. Stewart Date: 2/20/03

PCB PIEZOTRONICS VIBRATION DIVISION
3425 Walden Avenue

Dimensions shown are in inches (millimeters).

CALIBRATION AND TESTING

Calibration of an accelerometer typically involves a series of tests which are intended to verify its performance and adherence to its specifications. Results of this testing are provided on a report or "Calibration Certificate". See pages 1.130 and 1.131 for examples of typical PCB calibration certificates.

Routine calibration of PCB's accelerometers includes an amplitude response test from 10 Hz to the specified 5% upper frequency range (ACS-1), a transverse sensitivity test and a test to determine the unit's discharge time constant. Seismic accelerometers receive an additional low frequency response test down to 0.5 Hz (ACS-4). Shock accelerometers receive and additional high amplitude shock test (ACS-14). Certain low cost accelerometers are tested at only one reference frequency point (ACS-2).

PCB's calibration laboratory is accredited by A2LA to ISO 17025. To insure testing accuracy, PCB calibrations are traceable to NIST and in accordance with ISO standards and industry procedures. It is important to note that PCB maintains traceability to NIST for 44 discrete frequency points for the primary standards used for reference acceleration comparison. PCB also maintains traceability to NIST for all test instrumentation utilized during calibration.

The following is a partial list of calibration and testing services that are available for your existing PCB accelerometers or to complement the testing supplied with a new sensor.

Calibration services for piezoelectric accelerometers not manufactured by PCB are also available. Please contact the Vibration Division for further information regarding such services for non-PCB accelerometers.

Calibration and Testing Services

Code	Description
ACS-1	Single axis amplitude response calibration from 10 Hz to upper 5% frequency range, NIST traceable
ACS-1T	Triaxial amplitude response calibration from 10 Hz to upper 5% frequency range, NIST traceable
ACS-2	Single axis one point @ 100 Hz amplitude response calibration, NIST traceable
ACS-2T	Triaxial one point @ 100 Hz amplitude response calibration, NIST traceable
ACS-3	Single axis phase calibration from 10 Hz to upper 5% frequency range
ACS-3T	Triaxial phase calibration from 10 Hz to upper 5% frequency range
ACS-4	Single axis low frequency phase and amplitude response calibration from 0.5 to 10 Hz
ACS-4T	Triaxial low frequency phase and amplitude response calibration from 0.5 to 10 Hz
ACS-5	Single axis extended frequency, amplitude response cal. from upper 5% frequency to 15 kHz, NIST traceable
ACS-5T	Triaxial extended frequency, amplitude response cal. from upper 5% frequency to 15 kHz, NIST traceable
ACS-6	Single axis high frequency, amplitude response calibration from 15 kHz to 20 kHz
ACS-6T	Triaxial high frequency, amplitude response calibration from 15 kHz to 20 kHz
ACS-7	Single axis high frequency, amplitude response calibration from 100 Hz to 50 kHz for units up to 12 grams
ACS-8	Single axis high frequency, amplitude response calibration from 100 Hz to 100 kHz for units up to 3 grams
ACS-11	Single axis amplitude response calibration of 370 series capacitive accelerometers from 0.5 Hz to upper 5% frequency
ACS-14	High G shock accelerometer calibration using Hopkinson bar, to 100,000 g
ATS-1	High temperature sensitivity test, provides coefficient at one selected temp. from +71 to +400 °F, single axis
ATS-1A	Additional temperature test points from +71 to +400 °F, single axis
ATS-2	High temperature sensitivity test, provides coefficient at one selected temp. from +401 to +650 °F, single axis
ATS-2A	Additional temperature test points from +401 to +650 °F, single axis
ATS-3	Low temperature sensitivity test, provides coefficient at one selected temp. from +69 to -320 °F, single axis
ATS-3A	Additional temperature test points from +69 to -320 °F, single axis
ATS-4	Gross leak test
ATS-5	Helium leak test for hermeticity
ATS-6	Hyrdostatic pressure test — cable/sensor assembly in water environment to 3000 psi for 30 minutes
ATS-7	360 ° transverse sensitivity test with polar plot

Dimensions shown are in inches (millimeters).

Acoustic Products

- **Sound power testing**
- **Engine noise analysis**
- **Environmental noise analysis**
- **Near-field acoustic holography**
- **Building noise studies**
- **Acoustic chamber testing**
- **Sound pressure mapping**

The Vibration Division provides acoustic measurement products to support the efforts of the sound and vibration measurement community. The product focus is on microphones and preamplifiers that operate from ICP® sensor power, which may already be available in the S&V lab for use with ICP® accelerometers. This approach can represent a significant cost savings compared to the use of conventional, externally-polarized microphones, preamplifiers, and power supplies.

Included are high-accuracy prepolarized microphone cartridges, which operate with ICP® microphone pre-amplifiers, and array microphones with integral or separate ICP® microphone preamplifiers. In addition, a selection of conventional, high-accuracy, externally-polarized microphones, preamplifiers, power supplies, calibration devices, and accessories are offered.

1/8, 1/4, 1/2 and 1 inch diameter precision microphones with free-field, random incidence, or pressure responses are included in the Vibration Division acoustic line. The lower cost array microphones are featured in 1/4 inch diameter with free field response.

Whether you are new to acoustic measurements or a veteran acoustician, the Vibration Division can support your requirements with quality products, backed by a Total Customer Satisfaction guarantee.

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PRECISION CONDENSER MICROPHONE CARTRIDGES

(*complete specifications are featured on pages* 2.11 *to* 2.12)

Precision condenser microphone cartridges are offered in both externally polarized and prepolarized versions.

Prepolarized versions offer the advantage of operation with an ICP® microphone preamplifier for reduced system cost. Free-field, random incidence, and pressure responses are offered in a variety of standard microphone sizes.

■ precision acoustic measurements

Model 377A50 — Externally polarized with pressure response

- 1/8 inch diameter with pressure response
- 200 V polarization voltage
- 1 mV/Pa sensitivity
- 6.5 Hz to 140 kHz frequency range
- 178 dB sound pressure limit
- 40 dB noise floor

Compatible with ICP® microphone preamplifiers — see page 2.13

Model 377A01 — Prepolarized with free-field response

- 1/4 inch diameter with free-field response
- Prepolarized
- 4 mV/Pa sensitivity
- 4 Hz to 80 kHz frequency range
- 166 dB sound pressure limit
- 30 dB (A) noise floor

Compatible with ICP® microphone preamplifiers — see page 2.13

Available with matched TEDS ICP® preamplifier as Model 378A01 — see page 2.13

Model 377A10 — Prepolarized with pressure response

- 1/4 inch diameter with pressure response
- Prepolarized
- 1.6 mV/Pa sensitivity
- 4 Hz to 70 kHz frequency range
- 170 dB sound pressure limit
- 34 dB (A) noise floor

Compatible with ICP® microphone preamplifiers — see page 2.13

Available with matched TEDS ICP® preamplifier as Model 378A10 — see page 2.13

Model 377A02 — Prepolarized with free-field response

- 1/2 inch diameter with free-field response
- Prepolarized
- 50 mV/Pa sensitivity
- 3.15 Hz to 20 kHz frequency range
- 148 dB sound pressure limit
- 14.5 dB (A) noise floor

Compatible with ICP® microphone preamplifiers — see page 2.13

Available with matched TEDS ICP® preamplifier as Model 378A02 — see page 2.13

Dimensions shown are in inches (millimeters).

Model 377A03 — Prepolarized with free-field or random incidence response

- 1/2 inch diameter with free-field response
- Prepolarized
- 50 mV/Pa sensitivity
- 6.5 Hz to 12.5 kHz frequency range
- >146 dB sound pressure limit
- 15 dB (A) noise floor
- Supplied with Model 079A01 random incidence adaptor

Compatible with ICP® microphone preamplifiers — see page 2.13

Available with matched TEDS ICP® preamplifier as Model 378A03 — see page 2.13

Model 377A11 — Prepolarized with pressure response

- 1/2 inch diameter with pressure response
- Prepolarized
- 50 mV/Pa sensitivity
- 3.15 Hz to 10 kHz frequency range
- 148 dB sound pressure limit
- 16 dB noise floor

Compatible with ICP® microphone preamplifiers — see page 2.13

Available with matched TEDS ICP® preamplifier as Model 378A11 — see page 2.13

Model 377A20 — Prepolarized with random incidence response

- 1/2 inch diameter with random incidence response
- Prepolarized
- 50 mV/Pa sensitivity
- 3.15 Hz to 12.5 kHz frequency range
- 148 dB sound pressure limit
- 16 dB noise floor

Compatible with ICP® microphone preamplifiers — see page 2.13

Available with matched TEDS ICP® preamplifier as Model 378A20— see page 2.13

Model 377A40 — Externally polarized with free-field response

- 1/2 inch diameter with free field response
- 200 V polarization voltage
- 14.5 mV/Pa sensitivity
- 3.15 Hz to 40 kHz frequency range
- >160 dB sound pressure limit
- 20 dB (A) noise floor

Compatible with conventional microphone preamplifiers — see page 2.13

Model 377A41 — Externally polarized with free-field response

- 1/2 inch diameter with free field response
- 200 V polarization voltage
- 44.5 mV/Pa sensitivity
- 3.15 Hz to 20 kHz frequency range
- >146 dB sound pressure limit
- 15 dB (A) noise floor

Compatible with conventional microphone preamplifiers — see page 2.13

Model 377A42 — Externally polarized with free-field response

- 1 inch diameter with free field response
- 200 V polarization voltage
- 48 mV/Pa sensitivity
- 2.6 Hz to 20 kHz frequency range
- 146 dB sound pressure limit
- 10 dB (A) noise floor

Compatible with conventional microphone preamplifiers — see page 2.13

Model 377A53 — Externally polarized with pressure response

- 1 inch diameter with pressure response
- 200 V polarization voltage
- 45 mV/Pa sensitivity
- 2.6 Hz to 8000 Hz frequency range
- 146 dB sound pressure limit
- 10 dB (A) noise floor

Compatible with conventional microphone preamplifiers — see page 2.13

Model 377A25 — Externally polarized microphone probe, with integral cable and 7-pin LEMO plug termination

- 166 dB sound pressure limit

Model 377A26 — Prepolarized microphone probe, with BNC jack output connector

- 160 dB sound pressure limit

Common features:

- Operates in harsh or inaccessible locations
- 1 mm diameter probe
- 3 mV/Pa sensitivity
- 1 Hz to 20 kHz frequency range
- 40 dB noise floor

Dimensions shown are in inches (millimeters).

PREAMPLIFIERS FOR PRECISION MICROPHONE CARTRIDGES

(*complete specifications are featured on page* 2.13)

ICP® microphone preamplifiers operate from ICP® sensor signal conditioners and are used to condition the output signal of prepolarized precision microphone cartridges for reduced system cost. Conventional microphone preamplifiers operate from precision microphone power supplies, which provide the necessary polarization voltage for the precision microphone cartridge.

Model 426B03 — ICP® preamplifier for 1/4 inch, prepolarized, precision microphone cartridges

This ICP® preamplifier interfaces with 1/4 inch, prepolarized microphone cartridges. It requires constant current (2 to 20 mA) excitation, which is provided by an ICP® sensor signal conditioner. Many FFT analyzers and data acquisition instruments also incorporate ICP® sensor power for direct connection to this preamplifier. This model includes TEDS circuitry.

Model 426D01 — ICP® preamplifier for 1/2 inch, prepolarized, precision microphone cartridges

This ICP® preamplifier interfaces with 1/2 inch, prepolarized microphone cartridges. It requires constant current (2 to 20 mA) excitation, which is provided by an ICP® sensor signal conditioner. Many FFT analyzers and data acquisition instruments also incorporate ICP® sensor power for direct connection to this preamplifier. This model includes TEDS circuitry.

Model 426A30 — Conventional preamplifier for 1/2 inch, externally polarized, precision microphone cartridges

This conventional preamplifier interfaces with 1/2 inch precision microphone cartridges and is compatible with microphones as defined in the international standard IEC 61094. It requires power from a precision microphone power supply. This preamplifier can also be used with prepolarized, precision microphone cartridges.

PRECISION MICROPHONE POWER SUPPLY

A precision microphone power supply is required for externally polarized precision microphone cartridges and conventional microphone preamplifiers. The supplied power provides the necessary polarization voltage for the microphone cartridge and excitation voltage for the preamplifier.

- precision acoustic measurements
- externally polarized condenser microphones
- conventional precision microphone preamplifiers

Model 480A25 — Precision microphone power supply

- 0 to 50 dB gain
- Delivers 0 and 200 V polarization
- A weighted, C weighted, and flat output signals
- 7-pin LEMO input connector
- Powered by internal batteries or supplied AC adaptor

Dimensions shown are in inches (millimeters).

ARRAY MICROPHONES WITH INTEGRAL PREAMPLIFIER

(*complete specifications are featured on page* 2.14)

Array microphones provide a cost effective method for large channel count sound pressure measurements. Each requires ICP® sensor power for excitation.

- sound pressure mapping
- acoustic mode analysis
- near-field acoustic holography
- vibro-acoustic testing

Model 130D21 — Free-field response, 10-32 coaxial jack connector

- 1/4 inch diameter with free-field response
- Prepolarized with integral preamplifier
- 45 mV/Pa sensitivity
- 10 Hz to 15 kHz frequency range
- >122 dB sound pressure limit
- <40 dB noise floor

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T

Model 130D20 — Free-field response, BNC jack connector

- 1/4 inch diameter with free-field response
- Prepolarized with integral preamplifier
- 45 mV/Pa sensitivity
- 10 Hz to 15 kHz frequency range
- >122 dB sound pressure limit
- <40 dB noise floor

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T

Dimensions shown are in inches (millimeters).

ARRAY MICROPHONE CARTRIDGE

(*complete specifications are featured on page* 2.14)

The array microphone cartridge operates in conjunction with one of its dedicated preamplifiers shown below. It is useful for severe applications where there is potential for microphone damage, as it can be easily replaced and the preamplifier reused.

Model 130D10 — used in conjunction with an array microphone preamplifier

- 1/4 inch diameter with free-field response
- Prepolarized, requires array microphone ICP® preamplifier
- 45 mV/Pa sensitivity (with preamplifier)
- 10 Hz to 15 kHz frequency range
- >122 dB sound pressure limit
- <40 dB noise floor

Compatible with array microphone preamplifiers — see below

PREAMPLIFIERS FOR USE WITH ARRAY MICROPHONE CARTRIDGE

(*complete specifications are featured on page* 2.14)

Array microphone preamplifiers operate from ICP® sensor power and are used exclusively with the array microphone cartridge shown above.

Model 130P10 — with BNC jack connector

- Accepts 1/4 inch array microphone cartridge
- 10 Hz to 30 kHz frequency range
- Operates from ICP® sensor signal conditioner
- BNC jack connector

Recommended cables and accessories ⑥ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T

Model 130P11 — with 10-32 coaxial jack connector, 2.1 in (53.4 mm) length

Model 130P22 — with 10-32 coaxial jack connector, 4.1 in (104.1 mm) length

- Accepts 1/4 inch array microphone cartridge
- 10 Hz to 30 kHz frequency range
- Operates from ICP® sensor signal conditioner
- 10-32 coaxial jack connector

Recommended cables and accessories ②❷ — see page 4.2
Select an ICP® sensor signal conditioner from those featured in section 3
Options: T

Acoustic Products

CALIBRATORS AND ACCESSORIES

Acoustic calibrators build confidence in measurements and their use leads to more accurate results. Field verification of microphone performance can compensate for such variables as temperature, humidity, and barometric pressure.

- Easy to use
- Meet IEC and ANSI standards

Model 394A40 — Pistonphone

The 394A40 pistonphone is a precision, high-level sound source for the calibration of 1/2 inch or 1/4 inch microphones. It produces a constant sound pressure level of 114 dB at 250 Hz. It complies with the requirements of IEC 942 (1988) Class 1 and is PTB approved. The unit operates from 4-AA batteries.

Model CAL200 — Acoustic Calibrator

The CAL200 is a precision sound pressure level calibrator for use with 1/2 inch microphones. An optional Model 079A04 adaptor permits use with 1/4 inch microphones. The unit is capable of either 94 dB or 114 dB at 1000 Hz. It conforms to both ANSI SI.40-1984 and IEC 942 (1988) Class 1 standards.

Model 079A04 — Adaptor for attaching a 1/4 inch microphone to the CAL200 acoustic calibrator

Dimensions shown are in inches (millimeters).

ACOUSTIC MEASUREMENT ACCESSORIES

- filters
- adaptors
- cables
- wind screens

Model 426B02 — In-line "A-weighting" filter

This in-line A-weighting filter is powered by constant current excitation and is compatible with ICP® microphone preamplifiers. When using this filter, however, a minimum of 4 mA excitation current is required of the ICP® sensor signal conditioner or readout device, which incorporates ICP® sensor power.

Model 079A03 — Adaptor for attaching a 1/2 inch microphone cartridge to a 1/4 inch microphone preamplifier

Model 079A25 — Adaptor for attaching a 1 inch microphone cartridge to a 1/2 inch microphone preamplifier

Model 079A02 — Adaptor for attaching a 1/4 inch microphone cartridge to a 1/2 inch microphone preamplifier

Model 079A26 — Adaptor for attaching a 1/8 inch microphone cartridge to a 1/4 inch microphone preamplifier

Model 079A10 — Holder for 1/4 inch microphone preamplifiers

Model 079A11 — Holder for 1/2 inch microphone preamplifiers

Model 079A01 — Random incidence adaptor for Model 377A03 1/2 inch free-field microphone

Dimensions shown are in inches (millimeters).

Model 079A20 — Nose cone for 1/4 inch microphones

Model 079A21 — Nose cone for 1/2 inch microphones

Model 079A23 — Swivel head adaptor for 1/2 inch and 1/4 inch microphones

Model 079A18 — Flexible microphone clamp

Model 079A06 — Windscreen for 1/2 inch microphones

Model 079A07 — Windscreen for 1/4 inch microphones

Model 011A10 — Microphone cable, 10 ft. length. 7-pin Lemo plug and jack connectors

Dimensions shown are in inches (millimeters).

Precision Microphone Cartridge Specifications								
Model Number [1]	**377A01**		**377A02**		**377A03**		**377A10**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Microphone Diameter	1/4 in	1/4 in	1/2 in	1/2 in	1/2 in	1/2 in	1/4 in	1/4 in
Response	Free-Field	Free-Field	Free-Field	Free-Field	Free-Field [3]	Free-Field [3]	Pressure	Pressure
Open Circuit Sensitivity (at 250 Hz)	4 mV/Pa	4 mV/Pa	50 mV/Pa	50 mV/Pa	50 mV/Pa	50 mV/Pa	1.6 mV/Pa	1.6 mV/Pa
Frequency Response (± 2 dB)	4 to 80k Hz	4 to 80k Hz	3.15 to 20k Hz	3.15 to 20k Hz	6.5 to 12.5k Hz	6.5 to 12.5k Hz	4 to 70k Hz	4 to 70k Hz
Dynamic Range (3% Distortion Limit) [5][6]	166 dB	166 dB	148 dB	148 dB	146 dB	146 dB	170 dB	170 dB
Noise Floor [5]	30 dB (A)	30 dB (A)	14.5 dB (A)	14.5 dB (A)	15 dB (A)	15 dB (A)	34 dB (A)	34 dB (A)
Environmental								
Temperature Range (Operating)	-40 to +250 °F	-40 to +121 °C	-40 to +302 °F	-40 to +150 °C	-40 to +176 °F	-40 to +80 °C	-40 to +302 °F	-40 to +150 °C
Electrical								
Polarization Voltage	0 V [2]	0 V [2]	0 V [2]	0 V [2]	0 V [2]	0 V [2]	0 V [2]	0 V [2]
Physical								
Diameter (with Grid)	0.27 in	6.9 mm	0.52 in	13.2 mm	0.52 in	13.2 mm	0.27 in	6.9 mm
Height (with Grid)	0.41 in	10.5 mm	0.64 in	16.2 mm	0.68 in	17.3 mm	0.41 in	10.5 mm
Weight	0.07 oz	2 gm	0.25 oz	7 gm	0.32 oz	9 gm	0.07 oz	2 gm
Preamplifier Connection	0.2244 in - 60 UNS	5.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS	0.2244 in - 60 UNS	5.7 mm - 60 UNS

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Prepolarized [3] Supplied with Model 079A01 Random Incidence Adaptor [5] re 20µPa [6] Maximum dynamic range is based on the physical characteristics of the microphone. The actual range may be lower, depending on the type of preamplifier used and the voltage supplied. Please refer to the technical notes section for information on calculating the maximum range for a specific microphone and preamplifier combination.

Precision Microphone Cartridge Specifications								
Model Number [1]	**377A11**		**377A20**		**377A40**		**377A41**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**	**English**	**SI**
Microphone Diameter	1/2 in	1/2 in	1/2 in	1/2 in	1/2 in	1/2 in	1/2 in	1/2 in
Response	Pressure [4]	Pressure [4]	Random Incidence	Random Incidence	Free-Field	Free-Field	Free-Field	Free-Field
Open Circuit Sensitivity (at 250 Hz)	50 mV/Pa	50 mV/Pa	50 mV/Pa	50 mV/Pa	14.5 mV/Pa	14.5 mV/Pa	44.5 mV/Pa	44.5 mV/Pa
Frequency Response (± 2 dB)	3.15 to 10k Hz	3.15 to 10k Hz	3.15 to 12.5k Hz	3.15 to 12.5k Hz	3.15 to 40k Hz	3.15 to 40k Hz	3.15 to 20k Hz	3.15 to 20k Hz
Dynamic Range (3% Distortion Limit) [5][6]	148 dB	148 dB	148 dB	148 dB	160 dB	160 dB	146 dB	146 dB
Noise Floor [5]	16 dB	16 dB	16 dB	16 dB	20 dB (A)	20 dB (A)	15 dB (A)	15 dB (A)
Environmental								
Temperature Range (Operating)	-40 to +302 °F	-40 to +150 °C	-40 to +302 °F	-40 to +150 °C	-40 to +302 °F	-40 to +150 °C	-40 to +302 °F	-40 to +150 °C
Electrical								
Polarization Voltage	0 V [2]	0 V [2]	0 V [2]	0 V [2]	200 V	200 V	200 V	200 V
Physical								
Diameter (with Grid)	0.52 in	13.2 mm	0.52 in	13.2 mm	0.52 in	13.2 mm	0.52 in	13.2 mm
Height (with Grid)	0.64 in	16.2 mm	0.64 in	16.2 mm	0.5 in	12.7 mm	0.54 in	16.3 mm
Weight	0.32 oz	9 gm	0.32 oz	9 gm	0.32 oz	9 gm	0.32 oz	9 gm
Preamplifier Connection	0.4606 in - 60 UNS	11.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Prepolarized [4] Can also be used as a Random Incidence Microphone [5] re 20µPa [6] Maximum dynamic range is based on the physical characteristics of the microphone. The actual range may be lower, depending on the type of preamplifier used and the voltage supplied. Please refer to the technical notes section for information on calculating the maximum range for a specific microphone and preamplifier combination.

Dimensions shown are in inches (millimeters).

Precision Microphone Cartridge Specifications						
Model Number [1]	**377A42**		**377A50**		**377A53**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Microphone Diameter	1 in	1 in	1/8 in	1/8 in	1 in	1 in
Response	Free-Field	Free-Field	Pressure	Pressure	Pressure	Pressure
Open Circuit Sensitivity (at 250 Hz)	48 mV/Pa	48 mV/Pa	1 mV/Pa	1 mV/Pa	45 mV/Pa	45 mV/Pa
Frequency Response (± 2 dB)	2.6 to 20k Hz	2.6 to 20k Hz	6.5 to 140k Hz	6.5 to 140k Hz	2.6 to 8000 Hz	2.6 to 8000 Hz
Dynamic Range (3% Distortion Limit) [5][6]	146 dB	146 dB	178 dB	178 dB	146 dB	146 dB
Noise Floor [5]	10 dB(A)	10 dB(A)	40 dB	40 dB	10 dB(A)	10 dB(A)
Environmental						
Temperature Range (Operating)	-40 to +302 °F	-40 to +150 °C	-40 to +302 °F	-40 to +150 °C	-40 to +302 °F	-40 to +150 °C
Electrical						
Polarization Voltage	200 V	200 V	200 V	200 V	200 V	200 V
Physical						
Diameter (with Grid)	0.936 in	2.77 mm	0.18 in	3.5 mm	0.936 in	2.77 mm
Height (with Grid)	0.748 in	19 mm	0.26 in	6.7 mm	0.748 in	19 mm
Weight	1.09 oz	31 gm	0.053 oz	1.5 gm	1.09 oz	31 gm
Preamplifier Connection	0.9098 in - 60 UNS	23.11 mm - 60 UNS	N/A	M3 x 0.2	0.9098 in - 60 UNS	23.11 mm - 60 UNS

NOTES: [1] See note regarding accuracy of information on inside front cover. [5] re 20µPa [6] Maximum dynamic range is based on the physical characteristics of the microphone. The actual range may be lower, depending on the type of preamplifier used and the voltage supplied. Please refer to the technical notes section for information on calculating the maximum range for a specific microphone and preamplifier combination.

Microphone Probe Specifications				
Model Number [1]	**377A25**		**377A26**	
Performance	**English**	**SI**	**English**	**SI**
Microphone Diameter	1 mm Probe	1 mm Probe	1 mm Probe	1 mm Probe
Response	Probe	Probe	Probe	Probe
Open Circuit Sensitivity (at 250Hz)	3 mV/Pa	3 mV/Pa	3 mV/Pa	3 mV/Pa
Frequency Response (+/- 3 dB)	1 to 20k Hz	1 to 20k Hz	1 to 20k Hz	1 to 20k Hz
Dynamic Range (3% Distortion Limit) [2][4]	166 dB	166 dB	160 dB	160 dB
Noise Floor [2]	40 dB	40 dB	40 dB	40 dB
Environmental				
Temperature Range (Operating)	-13 to +158 °F	-25 to +70 °C	-13 to +158 °F	-25 to +70 °C
Temperature Range Probe Tip	-13 to 1472 °F	-25 to 800 °C	-13 to 1472 °F	-25 to 800 °C
Electrical				
Excitation Voltage (Single Supply)	28 to 120 V	28 to 120 V	N/A	N/A
Excitation Voltage (Double Supply)	± 14 to ± 60 V	± 14 to ± 60 V	N/A	N/A
Constant Current Voltage	N/A	N/A	2 to 20 mA [3]	2 to 20 mA [3]
Physical				
Case Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Probe Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Diameter	0.5 in	12.7 mm	0.5 in	12.7 mm
Length	3.3 in	83.8 mm	3.3 in	83.8 mm
Probe Tube Outside Diameter	0.049 in	1.25 mm	0.049 in	1.25 mm
Probe Tube Inside Diameter	0.039 in	1 mm	0.039 in	1 mm
Weight	1.4 oz	40 gm	1.4 oz	40 gm
Electrical Connector	Integral Cable	Integral Cable	BNC	BNC
Cable Termination	7-pin Lemo Plug	7-pin Lemo Plug	N/A	N/A
Cable Length	9.8 ft	3 m	N/A	N/A

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] re 20µPa [3] Powered by ICP® Sensor Power Supplies [4] Maximum dynamic range is based on the physical characteristics of the microphone. The actual range may be lower, depending on the type of preamplifier used and the voltage supplied. Please refer to the technical notes section for information on calculating the maximum range for a specific microphone and preamplifier combination.

Dimensions shown are in inches (millimeters).

TEDS Microphone Assemblies [2]						
Model Number [1]	**378A01**	**378A02**	**378A03**	**378A10**	**378A11**	**378A20**
Supplied Components						
Prepolarized microphone cartridge	377A01	377A02	377A03	377A10	377A11	377A20
Cartridge size	1/4 in	1/2 in	1/2 in	1/4 in	1/2 in	1/2 in
Response	Free-Field	Free-Field	Free-Field [3]	Pressure	Pressure	Random Incidence
TEDS ICP® preamplifier	426B03	426D01	426D01	426B03	426D01	426D01

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] All assemblies are furnished with factory programmed TEDS
[3] Supplied with Model 079A01 random incidence adaptor

Preamplifiers for Precision Microphone Cartridge Specifications						
Model Number [1]	**426B03**		**426A30**		**426D01**	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Microphone Diameter	1/4 in	1/4 in	1/2 in	1/2 in	1/2 in	1/2 in
Gain	-0.15 dB	-0.15 dB	-0.25 dB	-0.25 dB	-0.08 dB	-0.08 dB
Frequency Response	3.15 to 126 kHz [2]	3.15 to 126 kHz [2]	16 to 100k Hz [3]	16 to 100k Hz [3]	8 to 50k Hz [4]	8 to 50k Hz [4]
Electrical Noise (Flat 20 Hz to 20kHz)	<5.6 µV	<5.6 µV	<7 µV	<7 µV	<8 µV	<8 µV
Electrical Noise (A-Weight)	<3.2 µV	<3.2 µV	<4.5 µV	<4.5 µV	<5 µV	<5 µV
TEDS Compliant	Yes	Yes	N/A	N/A	Yes	Yes
Environmental						
Temperature Range (Operating)	-40 to +149 °F	-40 to +65 °C	-40 to 185 °F	-40 to +85 °C	-40 to 149 °F	-40 to +65 °C
Electrical						
Excitation Voltage	20 to 32 VDC	20 to 32 VDC	Dual ± 10 to ± 18 VDC Single 20 to 150V	Dual ± 10 to ± 18 VDC Single 20 to 150V	20 to 32 VDC	20 to 32 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	N/A	N/A	2 to 20 mA	2 to 20 mA
Output Bias Voltage						
Capacitance	0.2 pF	0.2 pF	0.5 pF	0.5 pF	0.15 pF	0.15 pF
Input Impedance	2×10^{10} ohms	2×10^{10} ohms	10^{10} ohms	10^{10} ohms	10^{10} ohms	10^{10} ohms
Output Impedance	<50 ohms	<50 ohms	<50 ohms	<50 ohms	<50 ohms	<50 ohms
Output Voltage - Maximum (+/- V pK)	8	8	28 Vpp	28 Vpp	8	8
Physical						
Case Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Diameter	0.25 in	6.33 mm	0.5 in	12.7 mm	0.5 in	12.7 mm
Height	1.74 in	44.2 mm	5.2 in	132 mm	3.18 in	80.7 mm
Weight	0.2 oz	6 gm				
Electrical Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	7 Pin LEMO	7 Pin LEMO	BNC Jack	BNC Jack
Mounting Thread (Microphone to Preamplifier)	0.2244 in -60 UNS	5.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS	0.4606 in - 60 UNS	11.7 mm - 60 UNS

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Frequency Response at +/- 0.2 dB [3] Frequency Response at +/- 0.15 dB
[4] Frequency Response at +/- 0.1 dB

Array Microphone Specifications

Model Number [1]	130D10		130D20		130D21	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Microphone Diameter	1/4 in	1/4 in	1/4 in	1/4 in	1/4 in	1/4 in
Response	Free-Field	Free-Field	Free-Field	Free-Field	Free-Field	Free-Field
Open Circuit Sensitivity (at 250Hz)	45 mV/Pa	45 mV/Pa	45 mV/Pa	45 mV/Pa	45 mV/Pa	45 mV/Pa
Frequency Response (± 2 dB) [6]	10 to 15k Hz	10 to 15k Hz	10 to 15k Hz	10 to 15k Hz	10 to 15k Hz	10 to 15k Hz
Dynamic Range (3% Distortion Limit)	122 dB	122 dB	122 dB	122 dB	122 dB	122 dB
Noise Floor [4]	40 dB	40 dB	40 dB	40 dB	40 dB	40 dB
Environmental						
Temperature Range (Operating)	+14 to +122 °F	-10 to +50 °C	+14 to +122 °F	-10 to +50 °C	+14 to +122 °F	-10 to +50 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Voltage	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Polarization Voltage	0 V [2]	0 V [2]	0 V [2]	0 V [2]	0 V [2]	0 V [2]
Physical						
Case Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Preamplifier Diameter	0.275 in [3]	6.99 mm [3]	0.5 in	12.7 mm	0.22 in	5.5 mm
Height with Grid	1.02 in	25.9 mm	2.67 in	68 mm	3.2 in	81.8 mm
Weight	0.11 oz	3 gm	0.66 oz	18.5 gm	0.19 oz	5.4 gm
Output Connection	10-32 Coaxial Jack	10-32 Coaxial Jack	BNC Jack	BNC Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Options [5]						
Available Options	N/A		T		T	

NOTES: [1] See note regarding accuracy of information on inside front cover. [2] Prepolarized [3] Preamplifier sold separately. Maximum microphone diameter specifications substituted [4] re 20µPa [5] See pages xvii to xx for option information. [6] Typical.

Preamplifiers for Array Microphone Cartridge Specifications

Model Number [1]	130P10		130P11		130P22	
Performance	**English**	**SI**	**English**	**SI**	**English**	**SI**
Microphone Diameter	1/4 in	1/4 in	1/4 in	1/4 in	1/4 in	1/4 in
Frequency Response (+/- 0.05 dB)	10 to 30k Hz	10 to 30k Hz	10 to 30k Hz	10 to 30k Hz	10 to 30k Hz	10 to 30k Hz
Electrical Noise (Flat 20 Hz to 20kHz)	<20 µV	<20 µV	<10 µV	<10 µV	<10 µV	<10 µV
Electrical Noise (A-Weight)	<7 µV	<7 µV	<7 µV	<7 µV	<7 µV	<7 µV
Environmental						
Temperature Range (Operating)	+14 to +122 °F	-10 to +50 °C	+14 to +122 °F	-10 to +50 °C	+14 to +122 °F	-10 to +50 °C
Electrical						
Excitation Voltage	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC	18 to 30 VDC
Constant Current Excitation	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA	2 to 20 mA
Output Bias Voltage	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC	8 to 12 VDC
Output Voltage - Maximum (+/- VpK)	<10 ohms	<10 ohms	<10 ohms	<10 ohms	<10 ohms	<10 ohms
Physical						
Case Material	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Diameter	0.5 in	12.7 mm	0.22 in	5.5 mm	0.22 in	5.5 mm
Length	1.7 in	43.2 mm	2.1 in	53.3 mm	4.1 in	104.1 mm
Weight	0.71 oz	20 gm	0.13 oz	3.7 gm	0.25 oz	7.1 gm
Electrical Connection	BNC Jack	BNC Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack	10-32 Coaxial Jack
Mounting Thread (Microphone to Preamplifier)	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female	10-32 Female
Options [5]						
Available Options	T		T		T	

NOTES: [1] See note regarding accuracy of information on inside front cover. [5] See pages xvii to xx for option information.

Dimensions shown are in inches (millimeters).

Signal Conditioners

- **Battery powered signal conditioners**
- **Line powered signal conditioners**
- **Modular signal conditioners**
- **Vibration meters**
- **Charge converters**
- **Sensor simulators**
- **Signal conditioner kits**

Model 443B01
Dual-Mode Vibration Amplifier
for use with both charge and ICP® accelerometers

PCB PIEZOTRONICS INC.
VIBRATION DIVISION

PCB 716-684-0001 **Vibration Division toll-free** 888-684-0013 **Fax** 716-685-3886 **E-mail** vibration@pcb.com **Web site** www.pcb.com

Battery-Powered Signal Conditioners

BATTERY-POWERED ICP® SENSOR SIGNAL CONDITIONERS

Battery-powered signal conditioners offer portable, convenient methods for powering ICP® sensors and conditioning their output signals for transmittal to readout and recording instruments. These units operate, and are supplied, with standard 9 volt alkaline batteries. Each features a color coded input circuit checkout meter to alert of proper sensor turn-on or input fault due to open or short circuit connections. Optional rechargeable versions are equipped with ni-cad batteries and supplied with an AC powered recharger unit.

Model 480C02
Unity gain, low noise, high frequency

Model 480E09
Gain x1, x10, x100

CE

Model 480B10
Integrating: acceleration, velocity, displacement

Model 480B21
3 channel, triaxial, gain x1, x10, x100

Battery-Powered Signal Conditioners				
Model Numbers	**480C02**	**480E09**	**480B10**	**480B21**
Style	Basic	Gain	Integrating, accel, vel., displ.	Triaxial, with gain
Channels	1 channel	1 channel	1 channel	3 channels
Sensor excitation	27 volt, 2 mA	27 volt, 2 mA	18 volt, 2 mA	27 volt, 3 mA
Gain	unity	×1, ×10, ×100	unity	×1, ×10, ×100
Low frequency response (-5%) [1]	0.05 Hz	0.15 Hz	0.07 (a), 8 (v), 15 (d)	0.15 Hz
High frequency response (-5%)	500 kHz	100 kHz	100 (a), 10(v), 1 (d) kHz	100 kHz
Broadband noise (at unity gain)	3.25 µV rms	3.25 µV rms	N/A	3.54 µV rms
Battery (qty) type	(3) 9 V	(3) 9 V	(2) 9 V	(3) 9 V
Average battery life	100 hour	50 hour	30 hour	33 hour
Input/output connectors	BNC/BNC	BNC/BNC	BNC/BNC	4-pin, BNC/BNC
External DC powerable	yes	yes	no	yes
DC power input jack	3.5 mm	3.5 mm	—	6-pin mini DIN
Size (height × width × depth)	4.0 × 2.9 × 1.5 in 101.6 × 73.7 × 38.1 mm	4.0 × 2.9 × 1.5 in 101.6 × 73.7 × 38.1 mm	4.0 × 2.9 × 1.5 in 101.6 × 73.7 × 38.1 mm	7.5 × 5.0 × 2.0 in 190.5 × 127 × 50.8 mm
Weight	10.5 oz (298 gm)	12 oz (340.2 gm)	9.75 oz (276.4 gm)	17.6 oz (499 gm)
Optional Models				
10-32 input/output connectors	480C	480E06	N/A	N/A
Rechargeable (supplied with ni-cad batteries and AC powered recharger unit)	R480C02	R480E09	R480B10	N/A
Optional Accessories				
AC powered recharger unit with (3) 9 V ni-cad batteries	488A02	488A02	488A02	N/A
AC power supply	488A03	488A03	—	488A10
Ultralife lithium batteries (3)	400A81	400A81	—	400A81

NOTE: [1] Achieved with readout device having a 1 megohm input impedance.

Dimensions shown are in inches (millimeters).

LINE-POWERED ICP® SENSOR SIGNAL CONDITIONERS

Line-powered signal conditioners offer benchtop methods for powering ICP® sensors in the laboratory and conditioning their output signals for transmittal to readout and recording instruments. Each features a color coded input circuit checkout meter to alert of proper sensor turn-on or input fault due to open or short circuit connections. AC and DC powerable units can operate either with the supplied AC powered transformer or optional external battery pack. AC/DC coupled outputs offer the ability to achieve true DC frequency response in order to accurately condition very low frequency vibrations or long duration shock pulses.

Model 482A21
Unity gain, low noise, AC and DC powerable

Model 482A22
4 channel, unity gain, low noise, AC and DC powerable

Model 482B06
Basic, unity gain

Model 482B11
Gain x1, x10, x100

Model 484B06
Low frequency, unity gain, AC/DC coupled output

Model 484B11
Low frequency, gain x1, x10, x100, AC/DC coupled output

Line-Powered Signal Conditioners

Model Numbers	482A21	482A22	482B06	482B11	484B06	484B11
Style	Low noise AC and DC power	Low noise AC and DC power	Basic	Gain	Low frequency AC/DC coupled	Low frequency with gain
Channels	1 channel	4 channels	1 channel	1 channel	1 channel	1 channel
Sensor excitation [1]	26 volt, 2 to 20 mA	26 volt, 2 to 20 mA	24 volt, 2 to 20 mA	24 volt, 2 to 20 mA	24 volt, 2 to 20 mA	24 volt, 2 to 20 mA
Gain	unity	unity	unity	×1, ×10, ×100	unity	×1, ×10, ×100
Low frequency response (-5%)	< 0.1 Hz [2]	< 0.1 Hz [2]	< 0.05 Hz	0.17 Hz	DC	DC
High frequency response (-5%)	> 1000 kHz	> 1000 kHz	1000 kHz	200 kHz	200 kHz	200 kHz
Broadband noise (at unity gain)	< 3.25 µV rms	< 3.25 µV rms	< 3.64 µV rms	700 µV	28.8 µV rms	10 µV rms
Power required	36 VDC 120 mA [3]	36VDC 120 mA [3]	115 VAC 50 to 400 Hz	115 VAC 50 to 400 Hz	115 VAC 50 to 400 Hz	115 VAC 50 to 400 Hz
Input/output connectors	BNC/BNC	BNC/BNC	BNC/BNC	BNC/BNC	BNC/BNC	BNC/BNC
External DC powerable	yes	yes	no	no	no	no
DC power input jack	DIN	DIN	—	—	—	—
Size (height × width × depth)	6.3 × 2.4 × 11 in 160 × 61 × 279 mm	6.3 × 2.4 × 11 in 160 × 61 × 279 mm	4.3 × 1.8 × 6 in 109.2 × 45.7 × 152.4 mm	4.3 × 1.8 × 6 in 109.2 × 45.7 × 152.4 mm	4.3 × 1.8 × 6 in 109.2 × 45.7 × 152.4 mm	4.3 × 1.8 × 6 in 109.2 × 45.7 × 152.4 mm
Weight	24.2 oz (685 gm)	26.7 oz (756 gm)	19.2 oz (544 gm)	32 oz (907.2 gm)	32 oz (907.2 gm)	32 oz (907.2 gm)
Optional Models						
10-32 input/output connectors	N/A	N/A	N/A	N/A	484B	484B10
210 to 250 VAC powerable	standard	standard	F482B06	F482B11	F484B06	F484B11
Options						
External 36 VDC battery pack	488B07	488B07	N/A	N/A	N/A	N/A

NOTES: [1] Current is factory set at 4 mA but is user adjustable between 2 and 20 mA.
[2] Achieved with readout device having a 1 megohm input impedance.
[3] Supplied with Model 488A04 AC power adaptor (100 to 240 VAC, 50 to 60 Hz input; 36 VDC 120 mA output).

Dimensions shown are in inches (millimeters).

Line-Powered Signal Conditioners

MULTI-CHANNEL, LINE-POWERED ICP® SENSOR SIGNAL CONDITIONERS WITH GAIN

These full-featured, multi-channel, line-powered signal conditioners offer push-button, selectable gain for each channel and optional output switching to simplify data acquisition. Each features a bank of LED's on each channel to indicate gain setting, input overload, and input fault due to open or short circuit connections. In addition to the channel specific BNC's, the optional switched output units offer additional output BNC's that carry the signals of the switch-selected channel.

Model 482A16
4 channel,
gain x1, x10, x100

Model 482A18
8 channel
gain x1, x10, x100
8 to 1 output
switching

Full-Featured, Line-Powered Signal Conditioners with Gain		
Model Numbers	**482A16**	**482A20**
Style	Full Feature with gain	Full Feature with gain
Channels	4 channels	8 channels
Sensor excitation [1]	24 volt, 2 to 20 mA	24 volt, 2 to 20 mA
Gain (each channel)	×1, ×10, ×100	×1, ×10, ×100
Low frequency response (-5%)	0.225 Hz [2]	0.225 Hz [2]
High frequency response (-5%)	100 kHz	100 kHz
Broadband noise (at unity gain)	9.1 µV rms	9.1 µV rms
Power required	90 to 130 VAC 50 to 400 Hz	90 to 130 VAC 50 to 400 Hz
Input/output connectors	BNC/BNC	BNC/BNC
Size (height × width × depth)	6.3 × 2.9 × 9.7 in 160 × 73.7 × 246.4 mm	6.3 × 4.0 × 9.7 in 160 × 101.6 × 246.4 mm
Weight	32 oz (907.2 gm)	97.6 oz (2767 gm)
Optional Models		
4 to 1 output switching	482A17	482A19 [3]
8 to 1 output switching	N/A	482A18
210 to 250 VAC powerable	F482A16	F482A20

NOTES: [1] Current is factory set at 4 mA but is user adjustable between 2 and 20 mA.
[2] Achieved with readout device having a 1 megohm input impedance.
[3] Model 482A19 offers dual 4 to 1 output switching and is ideally suited for use with two channel analyzers.

DC POWER CONDITIONERS

Models 485B and **485B12** serve to regulate available current from any conventional DC power supply or battery source to a constant value between 2 and 20 mA as required by ICP® sensors. In addition, the units decouple the sensor's output bias voltage from the measurement signal to enable zero based measurements with any readout device.

Model 485B features a 10-32 coaxial jack input connector, while Model 485B12 features a BNC jack input connector. Both units feature BNC jack output connectors.

Model 485B

Model 485B12

Dimensions shown are in inches (millimeters).

Modular Style Signal Conditioners

MODULAR STYLE SIGNAL CONDITIONERS

Modular signal conditioners are comprised of selected signal conditioning modules, and an AC power supply module, assembled into a 2-, 3-, 5-, or 9-slot chassis. Available modules condition ICP®, charge, or capacitive sensor signals. The common chassis backplane architecture permits mixing and matching of modules to achieve the desired number of channels and signal conditioning features. Preconfigured models offer ease of ordering units possessing the most commonly requested features. Request the "Series 440 Modular Signal Conditioners" brochure for full details of available items.

Modular Signal Conditioner Systems

Preconfigured Modular Style Signal Conditioners

Model 442B02
Single channel, gain x1, x10, x100 for ICP® sensors

Model 442C04
4 channel, gain x1, x10, x100 for ICP® sensors

Model 442B06
Single channel, gain x1, x10, x100 AC and DC coupling for ICP® sensors

Model 443B01
Dual-Mode Vibration Amplifier for charge and ICP® sensors

Modular Style Signal Conditioners				
Model Numbers	**442B02**	**442C04**	**442B06**	**443B01**
Style	ICP Sensor with gain	ICP Sensor with gain	ICP Sensor AC/DC coupling	Charge Mode and ICP Sensor
Channels	1 channel	4 channels	1 channel	1 channel
Sensor excitation [1]	24 volt, 1 to 20 mA	25.5 volt, 0.5 to 20 mA	24 volt, 1 to 20 mA	24 volt, 2 to 20 mA [2]
Gain (each channel)	×1, ×10, ×100	×1, ×10, ×100	×1, ×10, ×100	0.1 to 1000
Charge sensitivity	N/A	N/A	N/A	0.0001 to 10 volts/pC
Low frequency response	0.05 Hz (-5%) [3]	0.05 Hz (-5%) [3]	DC	0.2/2 Hz (-10%) [4]
High frequency response (-5%)	100 kHz	100 kHz	100 kHz	0.1, 1, 3, 10, 100 kHz [5]
Broadband noise (at unity gain)	9.5 µV rms	9.98 µV rms	9.11 µV rms	9 µV rms
Power required	100 to 240 VAC 50 to 60 Hz	100 to 240 VAC 50 to 60 Hz	100 to 240 VAC 50 to 60 Hz	100 to 240 VAC 50 to 60 Hz
Input/output connectors	BNC/BNC	BNC/BNC	BNC/BNC	BNC/BNC
Size (height × width × depth)	6.2 × 4.25 × 10.2 in 157.5 × 108 × 259.1 mm	6.2 × 4.25 × 10.2 in 157.5 × 108 × 259.1 mm	6.2 × 4.25 × 10.2 in 157.5 × 108 × 259.1 mm	6.2 × 6.05 × 10.2 in 157.5 × 153.7 × 259.1 mm
Weight	70.7 oz (2 kg)	70.7 oz (2 kg)	70.7 oz (2 kg)	168.6 oz (4.78 kg)

NOTES: [1] Current is factory set at 4 mA but is user adjustable up to 20 mA.
[2] Excitation is disabled for charge mode sensor input.
[3] Achieved with readout device having a 1 megohm input impedance.
[4] Adjusted by Discharge Time Constant selection.
[5] Adjusted by Low Pass Filter selection.

Dimensions shown are in inches (millimeters).

Multi-Channel Signal Conditioners

MULTI-CHANNEL SIGNAL CONDITIONERS

Multi-channel rack mount signal conditioners contain 8 or 16 channels of simultaneous signal conditioning and can be configured for multiple unit, daisy-linking with computerized set-up and control. The building block style architecture permits factory configuration to include characteristics which best tailor a unit for the specific application and data acquisition requirements. Optional features include ICP® sensor excitation, LED indicators for input fault monitoring and overload detection, programmable gain, autoranging, filtering, output switching, integration, IEEE-488, RS-232, and RS-485 interface, and keypad control with LCD display. Units are available to condition signals from ICP sensors, charge mode sensors or can be set up to accept voltage input signals from other types of sensors. Request the "Series 481 Multi-Channel Signal Conditioners" brochure for full details of available items.

Series 481A30
8 channel signal conditioners

Series 481A
16 channel signal conditioners

USB POWERED, TWO CHANNEL, ICP® SENSOR POWER CONDITIONER

Model 485B36 power conditioner provides current-regulated, ICP® sensor power for two sensor input channels. The unit operates from power obtained from a computer's USB (Universal Serial Bus) port. Additionally, the sensor bias voltage is decoupled from the measurement signals, which are output via a 3.5 mm stereo jack. Other features include: unity gain, 19.5 VDC @ 4.5 mA sensor excitation power, 50 kHz upper frequency range, BNC jack input connectors, and compact size. The device is ideal for use in portable measurement applications such as ride control, road testing, and cabin noise.

Model 485B36
2 channel, ICP® sensor power conditioner

Dimensions shown are in inches (millimeters).

MODEL 381A05 HANDHELD VIBRATION METER KIT

The Model 381A05 Vibration Meter Kit provides an easy, yet effective method for conducting overall vibration measurements. The kit is designed for general purpose use, product testing, or bearing, gearbox, and spindle vibration monitoring.

The kit is supplied with headphones for audible monitoring, a precision quartz ICP® accelerometer, a cable assembly, a high-strength mounting magnet, and a convenient storage case. The portable, lightweight, battery-powered meter provides both overall acceleration and velocity measurements.

Ideal for measuring the vibration severity of fans, motors, and pumps, it also verifies the DC bias voltage of ICP® accelerometers for troubleshooting sensors, cables, and system integrity.

Model 381A05
Handheld Vibration Meter Kit

Model 381A05 Handheld Vibration Meter Kit

Performance		English	SI
Accelerometer Sensitivity	(± 5%)	100 mV/g	10.2 mV/(m/s²)
Accelerometer Frequency Response	(± 5%)	1 to 4000 Hz	1 to 4000 Hz
	(± 10%)	0.7 to 7000 Hz	0.7 to 7000 Hz
	(± 3 dB)	0.35 to 12k Hz	0.35 to 12k Hz
Meter Frequency Response (acceleration ± 3 dB)		5 to 50k Hz	5 to 50k Hz
	(velocity +10%, -20%)	1 to 1000 Hz	1 to 1000 Hz
Meter Display Range	(acceleration)	0.01 to 19.9 g rms	N/A
	(velocity)	0.001 to 1.999 in/sec rms	N/A
Meter Resolution		± 2 counts	± 2 counts
Accuracy		± 3%	± 3%
Electrical			
Power Required (one battery)		9 VDC	9 VDC
Battery Life (alkaline)		10 hours	10 hours
Battery Life (rechargeable)		3 hours	3 hours
Environmental			
Temperature Range	(accelerometer)	-65 to +250 °F	-54 to +121 °C
	(meter)	+32 to +122 °F	0 to +50 °C
Physical			
Sensor	(size, hex × height)	7/8 in × 1.9 in	7/8 in × 48.3 mm
	(weight)	2.8 oz	80 gm
	(mounting thread)	10-32 female	10-32 female
Meter	(size, h × w × d)	5.9 × 3.15 × 1.2 in	150 × 80 × 30 mm
	(weight, with battery)	9.1 oz	258 gm
	(input connector)	BNC jack	BNC jack
	(headphone connector)	1/8" stereo jack	1/8" stereo jack

Supplied Components	
Model 487A20 Handheld Vibration Meter	Model 070A47 Headphones
Model 353B34 Quartz ICP® Accelerometer	Model 080A27 Magnetic Mounting Base
Model 003C10 Cable	NIST Traceable Calibration Certificate

Options

Model M381A05 — Metric Unit Display
Model R381A05 — Rechargeable Version: includes Model 073M12 External Charger and Model 073A09 Ni-Cad battery replaces alkaline battery.

TRUE G RMS VIBRATION MONITOR

Model 487B07 provides ICP® sensor excitation and accepts input from either a 10 or 100 mV/g accelerometer. Overall vibration levels within a frequency range of 2 to 10,000 Hz are displayed on an analog meter whose full scale range is adjustable to 1, 4, 10 or 40 g rms. High and low set points activate rear panel relays to alarm of upset conditions. An analog output for waveform analysis and a DC output for recording are included. 105 to 125 VAC, 50 to 400 Hz powered.

Model 487B07

PORTABLE G RMS VIBRATION METER

Model 487C08 provides ICP® sensor excitation and accepts input from a 100 mV/g accelerometer. Overall vibration levels within a frequency range of 5 to 10,000 Hz are displayed on an analog meter whose full scale range is adjustable to 0.25, 2.5 or 25 g rms. An analog output for waveform analysis is included. Battery powered by two standard 9 volt batteries. Ni-cad batteries with recharger option and kit configuration including accelerometer and mounting accessories are also available.

Model 487C08

Dimensions shown are in inches (millimeters).

IN-LINE CHARGE CONVERTERS

Series 422E charge converters serve to convert charge mode sensor signals to low impedance voltage signals, for transmission over long cables, and interface to data acquisition equipment. They are low in noise, powered by standard ICP® sensor signal conditioners, and install in-line between the sensor and signal conditioner.

Models 422E35 and 422E36 are specifically designed to operate with sensors that operate at extreme, elevated temperatures, >400 °F (204 °C).

Series 422E

Charge Converters for Use with Charge Mode Sensors

Charge Converter Models	422E11	422E12	422E13	422E35 [2]	422E36 [2]
Gain	100 mV/pC ± 5%	10 mV/pC ± 2%	1 mV/pC ± 2%	1 mV/pC ± 2%	10 mV/pC ± 2%
Input range ± 2%	± 25 pC	± 250 pC	± 2500 pC	± 2500 pC	± 250 pC
Output voltage range	± 2.5 volts	± 2.5 volts	± 2.5 volts	± 2.5 volts	± 2.5 volts
Frequency response (± 5%) [1]	5 to 110k Hz	5 to 100k Hz	5 to 100k Hz	5 to 100k Hz	5 to 100k Hz
Broadband noise	60 µV rms	20 µV rms	11 µV rms	10.02 µV rms	71.0 µV rms
Power required	18 to 28 VDC	18 to 28 VDC	18 to 28 VDC	18 to 28 VDC	18 to 28 VDC
Constant current required	2.2 to 20 mA	2.2 to 20 mA	2.2 to 20 mA	2.2 to 20 mA	2.2 to 20 mA
Input connector	10-32 jack	10-32 jack	10-32 jack	10-32 jack	10-32 jack
Output connector	BNC jack	BNC jack	BNC jack	BNC jack	BNC jack
Size (length × diameter)	3.4 × 0.5 in 85.1 × 12.7 mm	3.4 × 0.5 in 85.1 × 12.7 mm	3.4 × 0.5 in 85.1 × 12.7 mm	3.4 × 0.5 in 85.1 × 12.7 mm	3.4 × 0.5 in 85.1 × 12.7 mm
Weight	1.1 oz (31.2 gm)	1.1 oz (31.2 gm)	1.1 oz (31.2 gm)	1.1 oz (31.2 gm)	1.1 oz (31.2 gm)
Optional Models					
0.5 Hz (-5%) low frequency	422E01	422E02	422E03	—	—
BNC plug output connector	—	—	—	422E35/C	422E36/C
10-32 jack output connector	—	—	—	422E35/A	422E36/A
TEDS addressable, on-board EEPROM	—	—	—	T422E35	T422E36

NOTE: [1] High frequency achieved at 20mA excitation. [2] Specifically designed for use with sensors that operate at extreme, elevated temperatures, >400 °F (204 °C).

ICP® SENSOR SIMULATOR

Model 492B

Model 492B ICP® sensor simulator installs in place of an ICP® sensor and serves to verify signal conditioning settings, cable integrity, and tune long lines for optimum system performance. By use of an internal oscillator, the unit delivers a 100 Hz sine or square wave at a selectable peak to peak voltage. External test signals from a function generator may also be inserted. This portable unit is battery powered.

ICP® SENSOR SIMULATOR

Model 401A04

Model 401A04 ICP® sensor simulator installs in place of an ICP® sensor and accepts test signals from a voltage function generator. The unit serves to verify signal conditioning settings, cable integrity, and tune long lines for optimum system performance. This unit requires power from an ICP® sensor signal conditioner.

STEP FUNCTION GENERATOR

Model 492B03

Model 492B03 generates a rapid charge or voltage step function from zero to a selected peak value between either 0 and 100,000 pC or 0 and 10 volts DC. The unit is useful for setting trigger points in recording equipment and verifying charge amplifier and data acquisition equipment setup. This unit is battery powered and portable.

Dimensions shown are in inches (millimeters).

TEDS READ/WRITE PDA

Model 400A75 is a fully-functional Palm™ m105 PDA with software, adaptor, and sensor cable, which permits upload and download of TEDS data. The unit provides read and write capability to the on board memory circuitry contained within a TEDS sensor, or in-line TEDS memory modules.

TEDS functionality permits data storage within a non-volatile EEPROM memory circuit to store information such as model number, serial number, sensitivity, location, and orientation. The standard TEDS protocol complies with IEEE P1451.4, which facilitates automated bookkeeping and measurement system setup to speed testing and reduce errors.

IN-LINE TEDS MEMORY MODULES

Models 070A70 and **070A71** are TEDS memory modules, which can be added in-line with standard ICP® sensors, to construct a sensor system with TEDS functionality.

Both units are identical except for their electrical connectors. Model 070A70 features a BNC jack input connector and a BNC plug output connector, whereas Model 070A71 features 10-32 coaxial jack input and output connectors.

ICP® sensor excitation is passed through the units to the sensor. Under reverse bias, the memory circuitry is activated for read and write capability per IEEE P1451.4.

TEDS functionality permits data storage within a non-volatile EEPROM memory circuit to store information such as model number, serial number, sensitivity, location, and orientation. The standard TEDS protocol complies with IEEE P1451.4, which facilitates automated bookkeeping and measurement system setup to speed testing and reduce errors.

Model 070A70

Model 070A71

Dimensions shown are in inches (millimeters).

Sensor Signal Conditioning Kits

SIGNAL CONDITIONER AND SENSOR KITS

To simplify ordering, predefined kits are available which supplement the ICP® sensor of choice with appropriate cables, accessories and a selected signal conditioner. Kits are designated with a letter code which, when assigned as a prefix to the sensor model number, defines the complete kit including sensor, input and output cables, signal conditioner, accessories, and storage case.

Ordering by kit designation simplifies the ordering process and insures that the correct cables are included for proper connectivity. In addition, the kit represents a better value since the cost of the components purchased separately would exceed the cost of the kit and also, up to 50 ft. of sensor cable can be specified at no additional charge.

Choose the prefix letter code corresponding to the signal conditioner desired from the table below. The letter code designates a complete kit when assigned as a prefix to the sensor model, e.g., GK353B33.

A typical sensor kit including signal conditioner, interconnect cables and storage case

Letter Designations for Signal Conditioners

Prefix	SIGNAL CONDITIONER		FEATURES
Kits with Battery Powered Signal Conditioners:			
K	480C02	(see page 3.2)	Basic, unity gain
KR	R480C02	(see page 3.2)	Basic, unity gain, with rechargeable batteries and recharger
GK	480E09	(see page 3.2)	Gain ×1, ×10, ×100
GKR	R480E09	(see page 3.2)	Gain ×1, ×10, ×100, with rechargeable batteries and recharger
Kits with 105 to 125 VAC Line Powered Signal Conditioners:			
KL	482B06	(see page 3.3)	Basic, unity gain
GKL	482B11	(see page 3.3)	Gain ×1, ×10, ×100
DKL	484B06	(see page 3.3)	Unity gain, AC/DC coupling
GDKL	484B11	(see page 3.3)	Gain ×1, ×10, ×100, AC/DC coupling
Kits with 210 to 250 VAC Line Powered Signal Conditioners:			
FKL	F482B06	(see page 3.3)	Basic, unity gain
FGKL	F482B11	(see page 3.3)	Gain ×1, ×10, ×100
FDKL	F484B06	(see page 3.3)	Unity gain, AC/DC coupling
FGDKL	F484B11	(see page 3.3)	Gain ×1, ×10, ×100, AC/DC coupling

NOTES: All kits include Model 002C10 sensor cable (10 ft.) and Model 012A03 output cable (3 ft.) unless:
a) a longer sensor cable is specified (up to 50 ft. available at no additional charge).
-or-
b) if the sensor has an integral cable (in which case the kit will include Model 070A02 adaptor (10-32 jack to BNC plug) instead of a sensor cable).

A signal conditioner kit may also be purchased separately, without a sensor. To achieve this, specify the kit prefix designator in association with the signal conditioner model number, e.g., GK480E09.

In addition to the signal conditioner, these kits include the vinyl storage case, the standard 10 ft. input cable, Model 002C10, and 3 ft. output cable, Model 012A03. Longer input cables, to 50 ft. may be specified at no additional charge.

Dimensions shown are in inches (millimeters).

Cable Assemblies and Connector Adaptors

- **Custom cable ordering guide**
- **Cable connector descriptions**
- **Cable specifications and stock cable assemblies**
- **Multi-conductor cables**
- **Patch panels**
- **Connector adaptors**

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Recommended Cables and Accessories

RECOMMENDED, POPULAR CABLES AND ACCESSORIES

Within the product sections of this catalog, code numbers are provided for most models, which refer to the most popular cable and / or accessory choices for that model. A code number can refer to more than one choice for the model.

The key below provides the cross reference for the code numbers. Detailed specifications, descriptions, and photographs for the cable and accessory models are offered on the following pages.

Code	Model Number	Description
❶	018C10	Lightweight 10 ft. (3 m) cable assembly, 5-44 coaxial plug to BNC plug
❶	002P10	General purpose 10 ft. (3 m) cable assembly, 5-44 coaxial plug to BNC plug
①	003P10	Low noise 10 ft. (3 m) cable assembly, 5-44 coaxial plug to BNC plug
❷	002C10	General purpose 10 ft. (3 m) cable assembly, 10-32 coaxial plug to BNC plug
②	003C10	Low noise 10 ft. (3 m) cable assembly, 10-32 coaxial plug to BNC plug
❸	070A02	Adaptor, 10-32 coaxial jack to BNC plug
③	030A10	Miniature, low noise 10 ft. (3 m) cable assembly, 3-56 coaxial plug to 10-32 coaxial plug
❹	010G10	General purpose 10 ft. (3 m) triaxial accelerometer cable assembly, 1/4-28 thread, 4-pin plug to (3) BNC plugs
④	034G10	Lightweight 10 ft. (3 m) triaxial accelerometer cable assembly, 1/4-28 thread, 4-pin plug to (3) BNC plugs
❺	010D10	General purpose 10 ft. (3 m) triaxial accelerometer cable assembly, 1/4-28 thread 4-pin plug, to 1/4-28 thread 4-pin plug (also used for single axis capacitive accelerometers)
⑤	034K10	Lightweight 10 ft. (3 m) triaxial accelerometer cable assembly, 8-36 thread, mini 4-pin plug to (3) BNC plugs
❻	059AN010AC	Industrial 10 ft. (3 m) triaxial accelerometer cable assembly, 4-pin MIL plug to (3) BNC plugs
⑥	003D10	Low noise 10 ft (3 m) cable assembly, BNC plug to BNC plug
⑥	003D20	Low noise 20 ft (6.1 m) cable assembly, BNC plug to BNC plug
❼	080B37	Adhesive pad for 333B with 25 ft (7.6 m) integral cable, terminating with IDC connector
❼	080B38	Adhesive pad for 333B with 50 ft (15.2 m) integral cable, terminating with IDC connector
❼	080B40	Adhesive pad for 333B with 10 ft (3 m) integral cable, terminating with IDC connector
⑦	024R10	Industrial 10 ft (3 m) cable assembly, 2-socket MIL connector to BNC plug
❽	080A115	Adhesive pad for 333B31 with 10 ft (3 m) integral cable, terminating with BNC plug
❽	080A140	Adhesive pad for 333B31 with 10-32 plug receptacle and 10-32 jack output connector
⑧	031A10	Lightweight 10 ft (3m) twisted cable pair, 10-32 coaxial plug to 10-32 coaxial plug
❾	080B55	Triaxial mounting block for 333B, 0.812 in (20.6 mm)
❾	080A141	Triaxial mounting block for 333B, 1.125 in (28.6 mm)
❿	080A114	Triaxial mounting block for 333B31, 0.9 in (22.9 mm)

Dimensions shown are in inches (millimeters).

CUSTOM CABLE ASSEMBLIES

Many standard cable assemblies are offered on the following pages, however, in the event that a standard cable assembly will not fulfill the requirements of the application, the ability to configure a custom cable assembly is offered. Start by insuring compatibility of the connector type with the cable type desired from the chart below and then configure the custom cable model number from the steps on the next page.

CABLE - CONNECTOR COMPATIBILITY MATRIX

The following table provides compatibility information for cables and cable connectors. A "✓" denotes compatibility of the connector type shown in the rows going down the table with the cable type of the intersecting column going across the table.

Some assembled cable types, particularly for triaxial accelerometers, are spliced assemblies which may join two different types of cables. For example, an 010 series cable, with 4 conductors (x, y, z, and common ground) and 4-pin connector installed on the sensor end may be spliced to three individual coaxial cables with a BNC coaxial termination connector installed on the signal conditioner end. Such possibilities are indicated with a "*" which denotes that a cable assembly is possible, through a spliced interface to an appropriate cable. Some of these types of spliced assemblies are available as standard configurations on subsequent pages.

Cable	002	003	005	006	010	012	013	018	020	023	030	031	032	034	037	038	059
Connector																	
AB	✓	✓	✓	✓	*	✓		✓			✓	✓	✓	*		✓	
AC	✓	✓	✓	✓	*	✓		✓			✓	✓	✓	*		✓	
AD	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
AE						✓			✓								
AF	✓	✓	✓	✓				✓			✓						
AG	✓	✓	✓	✓				✓			✓						
AH	✓	✓	✓	✓	*			✓			✓		✓	*			
AK	✓	✓	✓	✓	*			✓					✓	*			
AL	✓	✓	✓	✓	*			✓					✓	*			
AM	✓	✓	✓	✓		✓										✓	
AQ																	
AR																	
AW												✓					
AY					✓									✓			
CA					✓									✓			
EB	✓	✓	✓	✓	*							✓		*			
EH														✓			
EJ	✓	✓	✓	✓	*			✓			✓		✓	*			
EK											✓						
EN															✓		
EP	✓	✓	✓	✓				✓			✓						
ET									✓								
FZ										✓							
GA										✓							
GN							✓										
GP							✓										

"✓" denotes compatibility of the connector type shown in the rows going down the table with the cable type of the intersecting column going across the table.

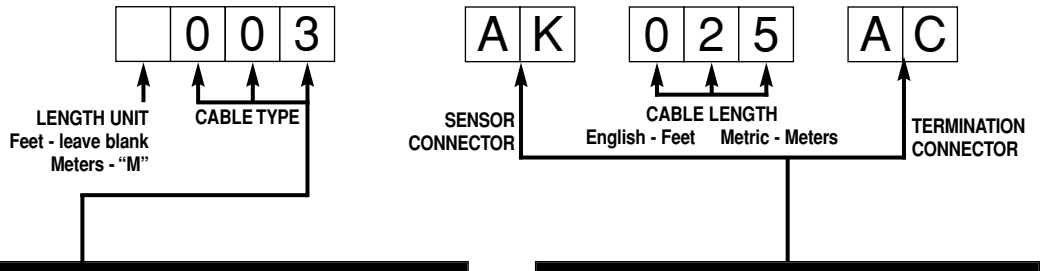
"*" denotes that a cable assembly is possible, through a spliced interface to an appropriate cable.

Custom Cable Assemblies

HOW TO CONFIGURE CUSTOM CABLE MODELS:

1. Choose the cable length format desired, either English (ft) or Metric (m) unit lengths.
2. Choose the desired raw cable type (see pages 4.6 to 4.13 for complete cable specifications).
3. Choose desired sensor connector type (see page 4.5 for connector photographs).
4. Determine the cable length required in English (ft) or Metric (m) unit lengths.
5. Choose desired termination connector type (see page 4.5 for connector photographs).

Example:
Model 003AK025AC defines a 25 ft, low-noise cable with right angle 10-32 plug sensor connector, BNC plug termination connector.



RAW CABLE TYPES

	COAXIAL CABLE		DIAMETER		MAX. TEMP.	
002	General purpose, white Teflon jacket		0.075 in	1.9 mm	400°F	204°C
003	Low noise, blue Teflon jacket	CE	0.079 in	2.0 mm	500°F	260°C
005	Ruggedized 002 type, general purpose		0.2 in	5.08 mm	275°F	135°C
006	Ruggedized 003 type, low noise	CE	0.2 in	5.08 mm	275°F	135°C
012	RG-58/U, black vinyl jacket	CE	0.193 in	4.90 mm	176°F	80°C
018	Lightweight, black PVC jacket		0.051 in	1.3 mm	221°F	105°C
030	Low noise, mini, blue Teflon jacket	CE	0.043 in	1.1 mm	500°F	260°C
038	Low noise, blue polyurethane jacket	CE	0.119 in	3.02 mm	250°F	121°C
	TWISTED/SHIELDED PAIR CABLE					
020	High temperature, red Teflon jacket	CE	0.157 in	3.99 mm	392°F	200°C
032	Lightweight, Teflon jacket		0.085 in	2.16 mm	392°F	200°C
	TWISTED PAIR CABLE					
031	Red / white Teflon jacket		*0.03 in	*0.8 mm	392°F	200°C
	SHIELDED 4-CONDUCTOR CABLE					
010	General purpose, Teflon jacket	CE	0.1 in	2.54 mm	392°F	200°C
034	Lightweight, Teflon jacket	CE	0.07 in	1.77 mm	392°F	200°C
059	Industrial, black polyurethane jacket	CE	0.25 in	6.35 mm	250°F	121°C
	HARDLINE CABLE					
013	Hardline, 2-conductor, Inconel jacket		0.125 in	3.20 mm	1200 °F	650 °C
023	Hardline, coaxial, 304L SS jacket		0.059 in	1.5 mm	1200 °F	650 °C
	MISCELLANEOUS CABLE					
037	10-cond. shielded, black poly jacket		0.024 in	0.610 mm	250°F	121°C

* diameter of each conductor

The combination of cables and connectors listed are only recommended configurations; other configurations may be available. Consult PCB before ordering.

CE designates that cable maintains CE conformance

CONNECTOR TYPES

	COAXIAL CABLE CONNECTORS
EB	10-32 Coaxial Plug (straight)
EJ	10-32 Coaxial Plug (straight, o-ring seal, spring loaded)
AH	10-32 Coaxial Plug (straight, with wire locking hex)
AK	10-32 Coaxial Plug (right angle)
AW	10-32 Coaxial Plug / Solder Adaptor (user repairable)
FZ	10-32 Coaxial Plug (for hardline cable)
AL	10-32 Coaxial Jack (straight)
GA	10-32 Coaxial Jack (for hardline cable)
AG	5-44 Coaxial Plug (straight)
AF	5-44 Coaxial Plug (right angle)
EK	3-56 Coaxial Plug
EP	M3 Coaxial Plug
AC	BNC Plug
AB	BNC Jack
	MULTI-LEAD CONNECTORS (FOR TRIAXIAL SENSORS)
AY	4-Socket Plug, 1/4-28 Thread (for triaxial sensors)
CA	4-Pin Jack, 1/4-28 Thread (for triaxial sensors)
EH	4-Pin Mini Plug, 8-36 Thread (for triaxial sensors)
EN	9-Pin Plug (for triaxial capacitive accelerometers))
	MISCELLANEOUS CONNECTORS
GN	2-Socket Plug, 7/16-27 Thread (high temperature)
ET	2-Socket Plug, 7/16-27 Thread
GP	2-Pin Jack, 7/16-27 Thread (high temperature)
AM	2-Socket MS3106 Plug
AE	2-Socket MS3106 Plug (with environmental boot)
AD	Pigtail (leads stripped and tinned)

Dimensions shown are in inches (millimeters).

Cable Connector Descriptions

AB **BNC Jack**
Max Temp 212 °F (100 °C)

AC **BNC Plug**
Max Temp 212 °F (100 °C)

AD **Pigtail (leads stripped and tinned)**
Max Temp 490 °F (254 °C)*

AE **2-Socket MS3106 Plug (with environmental boot)**
Max Temp 325 °F (163 °C)

AF **5-44 Coaxial Plug (right angle)**
Max Temp 325 °F (163 °C)

AG **5-44 Coaxial Plug (straight)**
Max Temp 490 °F (254 °C)

AH **10-32 Coaxial Plug (straight, with wire locking hex)**
Max Temp 490 °F (254 °C)

AK **10-32 Coaxial Plug (right angle)**
Max Temp 490 °F (254 °C)

AL **10-32 Coaxial Jack (straight)**
Max Temp 325 °F (163 °C)

AM **2-Socket MS3106 Plug**
Max Temp 325 °F (163 °C)

AW **10-32 Coaxial Plug / Solder Adaptor (user repairable)**
Max Temp 490 °F (254 °C)*

AY **4-Socket Plug, 1/4-28 Thread (for triaxial sensors)**
Max Temp 325 °F (163 °C)

CA **4-Pin Jack, 1/4-28 Thread (for triaxial sensors)**
Max Temp 350 °F (177 °C)

EB **10-32 Coaxial Plug (straight)**
Max Temp 490 °F (254 °C)

EH **4-Socket Mini Plug, 8-36 Thread (for triaxial sensors)**
Max Temp 490 °F (254 °C)

EJ **10-32 Coaxial Plug (straight, o-ring seal, spring loaded)**
Max Temp 490 °F (254 °C)

EK **3-56 Coaxial Plug**
Max Temp 350 °F (177 °C)

EN **9-Socket Plug (for triaxial capacitive accelerometers)**
Max Temp 325 °F (163 °C)

EP **M3 Coaxial Plug**
Max Temp 490 °F (254 °C)

ET **2-Socket Plug, 7/16-27 Thread**
Max Temp 325 °F (163 °C)

FZ **10-32 Coaxial Plug (for hardline cable)**
Max Temp 900 °F (482 °C)

GA **10-32 Coaxial Jack (for hardline cable)**
Max Temp 500 °F (260 °C)

GN **2-Socket Plug, 7/16-27 Thread (high temperature)**
Max Temp 900 °F (482 °C)

GP **2-Pin Jack, 7/16-27 Thread (high temperature)**
Max Temp 900 °F (482 °C)

***Max Temp may be less depending upon cable application.**

Cable Specifications and Standard Models

CABLE SPECIFICATIONS AND STANDARD CABLE MODELS

The following tables provide specifications and configuration diagrams for the variety of available cable types. Where applicable, standard cable assembly model numbers are provided. Standard models can be less costly than custom cables and available for overnight shipment. For alternate cable lengths or custom model numbering, follow the guidelines provided on page 4.4. If there is an urgent need, please let us know. Most cables can be fabricated and shipped within 24 hours.

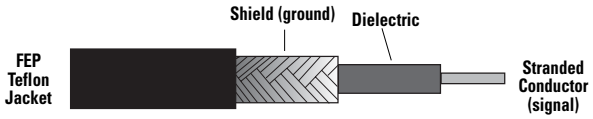
Series 002 Standard Coaxial Cable

Usage

General purpose use with ICP® sensors and low impedance voltage signals.

Outer Jacket	Extruded FEP Teflon (waterproof), white	
Diameter	0.075 in	1.9 mm
Capacitance	29 pF/ft	95 pF/m
Temperature Range	-130 to 400 °F	-90 to 204 °C
Impedance	50 ohm	

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)	
002C03	3 ft	0.9 m	 10-32 Coaxial Plug (EB) — BNC Plug (AC)
002C05	5 ft	1.5 m	
002C10	10 ft	3.0 m	
002C20	20 ft	6.1 m	
002C30	30 ft	9.1 m	
002C50	50 ft	15.2 m	
002A03	3 ft	0.9 m	 10-32 Coaxial Plug (EB) — 10-32 Coaxial Plug (EB)
002A05	5 ft	1.5 m	
002A10	10 ft	3.0 m	
002A20	20 ft	6.1 m	
002A30	30 ft	9.1 m	
002A50	50 ft	15.2 m	
002B01	1 ft	0.3 m	 10-32 Coaxial Plug (EB) — BNC Jack (AB)
002B03	3 ft	0.9 m	
002T03	3 ft	0.9 m	 BNC Plug (AC) — BNC Plug (AC)
002T10	10 ft	3.0 m	
002T20	20 ft	6.1 m	
002P03	3 ft	0.9 m	 5-44 Coaxial Plug (AG) — BNC Plug (AC)
002P05	5 ft	1.5 m	
002P10	10 ft	3.0 m	
002P20	20 ft	6.1 m	
002P30	30 ft	9.1 m	

Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

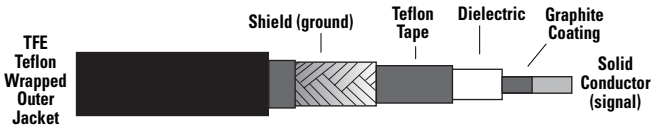
Series 003 Low-Noise Coaxial Cable

Usage

General purpose and high temperature use with charge mode sensors, high impedance signals, ICP® sensors, and low impedance voltage signals. Maintains CE conformance.

Outer Jacket	Wrapped TFE Teflon, blue	
Diameter	0.079 in	2.0 mm
Capacitance	29 to 32 pF/ft	95 to 105 pF/m
Temperature Range	-130 to 500 °F	-90 to 260 °C
Impedance	50 ohm	

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)	
003C03	3 ft	0.9 m	 10-32 Coaxial Plug (EB) — BNC Plug (AC)
003C05	5 ft	1.5 m	
003C10	10 ft	3.0 m	
003C20	20 ft	6.1 m	
003C30	30 ft	9.1 m	
003A01	1 ft	0.3 m	 10-32 Coaxial Plug (EB) — 10-32 Coaxial Plug (EB)
003A03	3 ft	0.9 m	
003A05	5 ft	1.5 m	
003A10	10 ft	3.0 m	
003A20	20 ft	6.1 m	
003A30	30 ft	9.1 m	
003B01	1 ft	0.3 m	 10-32 Coaxial Plug (EB) — BNC Jack (AB)
003B03	3 ft	0.9 m	
003D03	3 ft	0.9 m	 BNC Plug (AC) — BNC Plug (AC)
003D10	10 ft	3.0 m	
003D20	20 ft	6.1 m	
003P03	3 ft	0.9 m	 5-44 Coaxial Plug (AG) — BNC Plug (AC)
003P05	5 ft	1.5 m	
003P10	10 ft	3.0 m	
003P20	20 ft	6.1 m	
003P30	30 ft	9.1 m	

Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

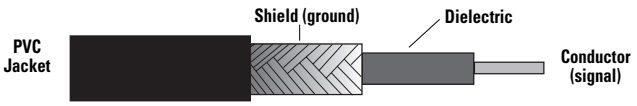
Series 018 Lightweight Coaxial Cable

Usage

General purpose use with ICP® sensors and low impedance voltage signals. Recommended for use with miniature sensors to reduce cable strain.

Outer Jacket	PVC, black	
Diameter	0.051 in	1.3 mm
Capacitance	55 pF/ft	180 pF/m
Temperature Range	-22 to 221 °F	-30 to 105 °C
Impedance	32 ohm	

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
018C03	3 ft	0.9 m
018C05	5 ft	1.5 m
018C10	10 ft	3.0 m
018C20	20 ft	6.1 m
018C30	30 ft	9.1 m

5-44 Coaxial Plug (AG) BNC Plug (AC)

018G03	3 ft	0.9 m
018G05	5 ft	1.5 m
018G10	10 ft	3.0 m
018G20	20 ft	6.1 m
018G30	30 ft	9.1 m

5-44 Coaxial Plug (AG) 10-32 Coaxial Plug (EB)

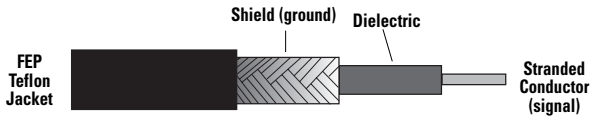
Series 030 Miniature Low-Noise Coaxial Cable

Usage

General purpose use with ICP® sensors and low impedance voltage signals.

Outer Jacket	PTFE Tape, blue	
Diameter	0.043 in	1.10 mm
Capacitance	30 pF/ft	98 pF/m
Temperature Range	-130 to 500 °F	-90 to 260 °C
Impedance	50 ohm	

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
030A10	10 ft	3.0 m

3-56 Coaxial Plug (EK) 10-32 Coaxial Plug (EB)

030C10	10 ft	3.0 m

3-56 Coaxial Plug (EK) BNC Plug (AC)

Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

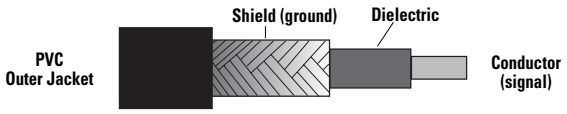
Series 012 Low-Cost Coaxial Cable (RG58/U)

Usage

General purpose use with ICP® sensors and low impedance voltage signals. Recommended for use as a sensor extension cable for long distance signal transmission and as output cable from signal conditioner. Maintains CE conformance.

Outer Jacket	PVC, black	
Diameter	0.193 in	4.90 mm
Capacitance	29 pF/ft	95 pF/m
Temperature Range	-40 to 176 °F	-40 to 80 °C
Impedance	52 ohm	

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
012A03	3 ft	0.9 m
012A10	10 ft	3.0 m
012A20	20 ft	6.1 m
012A50	50 ft	15.2 m

BNC Plug (AC) BNC Plug (AC)

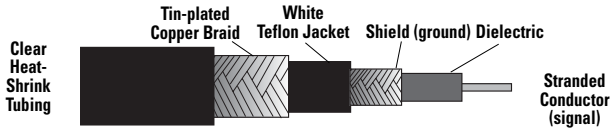
Series 005 Ruggedized, General Purpose Coaxial Cable (002 Type)

Usage

For use with ICP® sensors where cable may be prone to being pinched or crushed.

Outer Jacket	Clear, Polyolefin Heat-Shrink Tubing Over Tin-Plated Copper Braid	
Diameter	0.200 in	5.08 mm
Capacitance	29 pF/ft	95 pF/m
Temperature Range	-67 to +275 °F	-55 to +135 °C
Impedance	50 ohm	

Construction



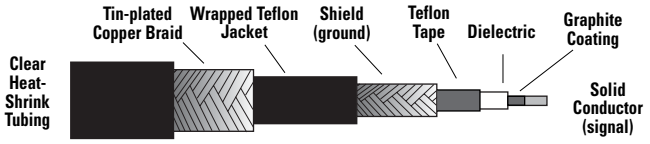
Series 006 Ruggedized, Low-Noise Coaxial Cable (003 Type)

Usage

For use with charge output sensors where cable may be prone to being pinched or crushed.

Outer Jacket	Clear, Polyolefin Heat-Shrink Tubing Over Tin-Plated Copper Braid	
Diameter	0.200 in	5.08 mm
Capacitance	29 to 32 pF/ft	95 to 105 pF/m
Temperature Range	-67 to +275 °F	-55 to +135 °C
Impedance	50 ohm	

Construction



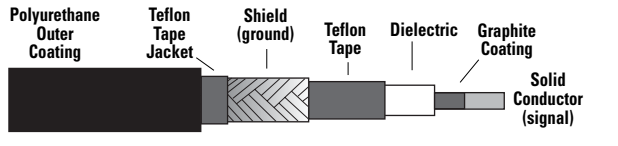
Series 038 Polyurethane Low-Noise, Coaxial Cable

Usage

For use with charge output sensors. Suitable for submerged use.

Outer Jacket	Polyurethane, Blue	
Diameter	0.119 in	3.02 mm
Capacitance	29 to 32 pF/ft	95 to 105 pF/m
Temperature Range	-58 to +250 °F	-50 to +121 °C
Impedance	50 ohm	

Construction



Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

Series 031 Twisted Two Conductor (field-repairable)

Usage

General purpose use with ICP® sensors and low impedance voltage signals. Recommended when a lightweight, flexible cable is required as with high shock applications and drop tests.

Outer Jacket	Extruded PTFE Teflon, red and white	
Diameter (each conductor)	0.03 in	0.76 mm
Capacitance	7 pF/ft	23 pF/m
Temperature Range	-67 to 392 °F	-55 to 200 °C

Construction

Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
031A05	5 ft	1.5 m
031A10	10 ft	3.0 m
031A20	20 ft	6.1 m

10-32 Coaxial Plug (AW) 10-32 Coaxial Plug (AW)

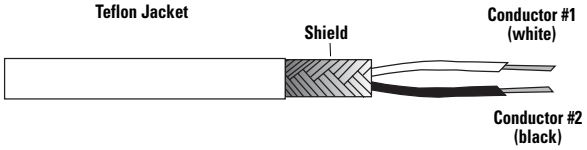
Series 032 General Purpose, Twisted Shielded Pair

Usage

For use with ICP® sensors in high RFI and EMI environments. Recommended for use with case-isolated sensors.

Outer Jacket	FEP Teflon, Clear	
Diameter	0.085 in	2.16 mm
Capacitance	20 pF/ft	66 pF/m
Temperature Range	-130 to +392 °F	-90 to +200 °C
Impedance	45 ohm	

Construction



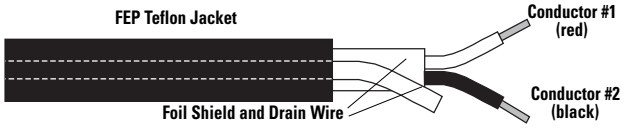
Series 020 High-Temperature, Twisted Shielded Pair

Usage

For use with ICP® sensors in high RFI and EMI environments. 100% foil shield.

Outer Jacket	FEP Teflon, Red	
Diameter	0.157 in	3.99 mm
Capacitance (between conductors	51 pF/ft	167 pF/m
Capacitance (between conductor & shield)	97 pF/ft	318 pF/m
Temperature Range	-90 to +392 °F	-70 to +200 °C
Impedance	29 ohm	

Construction



Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

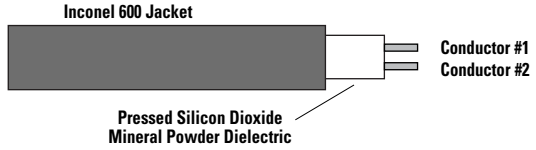
Series 013 Hardline 2-Conductor Cable

Usage

For use in extreme temperatures and pressurized liquids with ICP® and charge output sensors.

Outer Jacket	Inconel 600	
Diameter	0.125 in	3.2 mm
Capacitance	230 pF/ft	752 pF/m
Temperature Range	-300 to +1200 °F	-184 to +650 °C
Impedance	50 ohm	

Construction



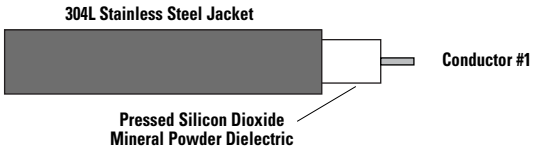
Series 023 Hardline Coaxial Cable

Usage

For use in extreme temperatures and pressurized liquids with ICP® and charge output sensors.

Outer Jacket	Copper Plated 304L Stainless Steel Over Copper Core	
Diameter	0.059 in	1.5 mm
Capacitance	34 pF/ft	111 pF/m
Temperature Range	-300 to +1200 °F	-184 to +650 °C
Impedance	50 ohm	

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
023A10	10 ft	3.0 m

10-32 Coaxial Plug (FZ) 10-32 Coaxial Jack (GA)

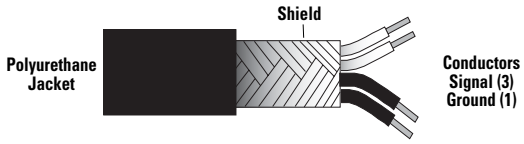
Series 059 Shielded, Twisted 4-Conductor Cable

Usage

For use with industrial, triaxial ICP® sensors.

Outer Jacket	Polyurethane, Black	
Diameter	0.250 in	6.35 mm
Capacitance	36 pF/ft	118 pF/m
Temperature Range	-58 to +250 °F	-50 to +121 °C

Construction



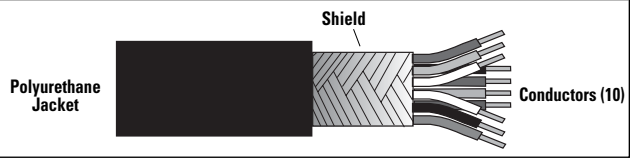
Series 037 Shielded, Ten Conductor Cable

Usage

For use with triaxial capacitive accelerometers

Outer Jacket	Polyurethane, Black	
Diameter	0.154 in	3.91 mm
Temperature Range	-58 to +250 °F	-50 to +121 °C

Construction



Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

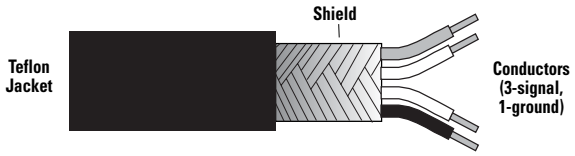
Series 010 Twisted, Shielded Four-Conductor

Usage

General purpose use with triaxial ICP® accelerometers and single axis capacitive accelerometers. Maintains CE conformance.

Outer Jacket	Teflon	
Diameter	0.1 in	2.54 mm
Capacitance	31 pF/ft	102 pF/m
Temperature Range	-130 to +392 °F	-90 to +200 °C

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
010G05	5 ft	1.5 m
010G10	10 ft	3.0 m
010G15	15 ft	4.5 m
010G20	20 ft	6.1 m
010G25	25 ft	7.6 m
010G30	30 ft	9.1 m
010G50	50 ft	15.2 m

4-Socket Plug (AY) — (3) BNC Plugs (AC)

010F05	5 ft	1.5 m
010F10	10 ft	3.0 m
010F15	15 ft	4.5 m
010F20	20 ft	6.1 m
010F25	25 ft	7.6 m
010F30	30 ft	9.1 m

4-Socket Plug (AY) — (3) 10-32 Coaxial Plugs (EB)

010D05	5 ft	1.5 m
010D10	10 ft	3.0 m
010D20	20 ft	6.1 m
010D25	25 ft	7.6 m
010D30	30 ft	9.1 m

4-Socket Plug (AY) — 4-Socket Plug (AY)

Dimensions shown are in inches (millimeters).

Cable Specifications and Standard Models

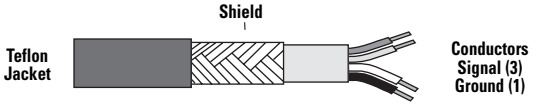
Series 034 Shielded Four-Conductor

Usage

General purpose use with triaxial ICP® accelerometers and single axis capacitive accelerometers. Exhibits low noise emission and is lightweight. Maintains CE conformance.

Outer Jacket	Extruded FEP Teflon	
Diameter	0.07 in	1.77 mm
Capacitance	28 pF/ft	92 pF/m
Temperature Range	-130 to +392 °F	-55 to +200 °C

Construction



Standard Cable Assemblies

Model Number	Length (feet)	Length (meters)
034G05	5 ft	1.5 m
034G10	10 ft	3.0 m
034G15	15 ft	4.6 m
034G20	20 ft	6.1 m
034G25	25 ft	7.6 m
034G30	30 ft	9.1 m
034G50	50 ft	15.2 m

4-Socket Plug (AY) — (3) BNC Plugs (AC)

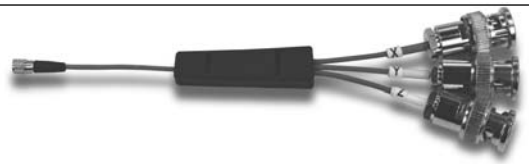
034F05	5 ft	1.5 m
034F10	10 ft	3.0 m
034F20	20 ft	6.1 m
034F30	30 ft	9.1 m
034F50	50 ft	15.2 m

4-Socket Plug (AY) — (3) 10-32 Coaxial Plugs (EB)

034D05	5 ft	1.5 m
034D10	10 ft	3.0 m
034D20	20 ft	6.1 m
034D30	30 ft	9.1 m
034D50	50 ft	15.2 m

4-Socket Plug (AY) — 4-Socket Plug (AY)

034K10	10 ft	3.0 m
034K20	20 ft	6.1 m
034K30	30 ft	9.1 m
034K50	50 ft	15.2 m



Mini 4-Socket Plug (EH) — (3) BNC Plugs (AC)

034H05	5 ft	1.5 m
034H10	10 ft	3.0 m
034H20	20 ft	6.1 m
034H30	30 ft	9.1 m
034H50	50 ft	15.2 m

Mini 4-Socket Plug (EH) — (3) 10-32 Plugs (EB)

Multi-Conductor Cables

MULTI-CONDUCTOR CABLES

Multi-conductor cables minimize tangles and reduce overall cable costs. They also offer the user numerous cable/termination variations to suit a particular data transmission requirement, as well as the ability to consolidate several cables into one.

Model 009F "xx"
Flat ribbon cable
DB50 female to DB50 male
Specify "xx" length in feet

Model 009H "xx"
Shielded ribbon cable
DB50 female to DB50 male
Specify "xx" length in feet

Model 009L05
Multi-Conductor Cable
VXI to 4 BNC plugs
5 ft (1.5 m) length

Model 009S05
Multi-Conductor Cable
VXI to VXI
5 ft (1.5 m) length

Model 009B "xx"
Ruggedized
Shielded multi-conductor cable
DB50 female to DB50 male
Specify "xx" length in feet

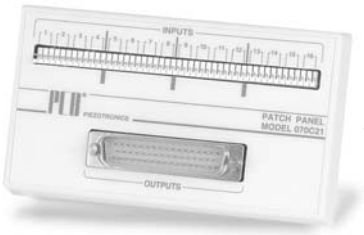
Model 009A "xx"
Ruggedized
Multi-Conductor Cable
DB50 female to 16 BNC Plugs
Specify "xx" length in feet

Dimensions shown are in inches (millimeters).

PATCH PANELS

Input patch panels serve as a central collection point for individual sensor cables installed in multi-channel measurement arrays. The sensor signal paths are then consolidated and transmission to readout or data acquisition equipment is accomplished by a single, multi-conductor cable.

Output patch panels connect via multi-conductor cables to the output connectors on high density rack or modular signal conditioners. The sensor signal paths are then expanded to individual BNC's for each channel for subsequent connection to data acquisition equipment.



Model 070C21

16-channel input patch panel
16 IDC pin inputs
DB50 output

Model 070C29

16-channel input patch panel
16 BNC jack and
16 IDC pin inputs
DB50 output

Model 070A33

32-channel input patch panel
32 BNC jack and 32 IDC pin inputs
2 DB50 outputs
Rack mount

Model 070A34 (not pictured)

32-channel output patch panel
2 DB37 inputs
32 BNC jack outputs
Rack mount

Dimensions shown are in inches (millimeters).

Connector Adaptors

070A01

SCOPE INPUT T CONNECTOR
BNC plug to two 10-32 coaxial jacks. Used for splitting low-impedance signals.

10-32 COAXIAL COUPLER 070A05
10-32 coaxial jack to 10-32 coaxial jack. Joins two cables terminating in 10-32 coaxial plugs.

BNC T CONNECTOR 070A11
BNC plug to two BNC jacks. Used as a cable splitter.

1/4 in max wall thickness
5/16 in mtg thd

10-32 HERMETIC FEED-THRU 070A14
10-32 coaxial jack to 10-32 coaxial jack. Tapped 5/16-32.

MODEL "EB" 10-32 COAXIAL CONNECTOR
10-32 crimp-on style coaxial connector. Requires tool contained in 076C31 kit.

MODEL 076C31 10-32 COAXIAL CRIMP-ON CONNECTOR KIT
Includes 1 pin insertion tool, 1 sleeve-crimping tool, and 20 Model "EB" connectors with cable strain reliefs. (Wire stripper and soldering iron not included).

070A02

SCOPE INPUT ADAPTOR
10-32 coaxial jack to BNC plug. For adapting BNC connectors for use with 10-32 coaxial plugs.

CABLE ADAPTOR 070A08
10-32 coaxial jack to BNC jack. Joins cables terminating in a BNC plug and a 10-32 coaxial plug.

BNC COUPLER 070A12
BNC jack to BNC jack. Joins two cables terminating in BNC plugs.

10-32 COAXIAL RIGHT ANGLE CONNECTOR ADAPTOR 070A20
10-32 coaxial jack to 10-32 coaxial plug. For use in confined locations.

076A25

076A05

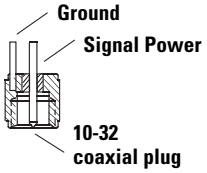
076A05 10-32 COAXIAL PLUG
Microdot connector, screw-on type.

076A25 CONNECTOR TOOL
Used to install 076A05 screw-on type microdot connector.

MODEL 076A30 MICRODOT SCREW-ON CONNECTOR KIT
One Model 076A25 Tool and 20 Model 076A05 10-32 coaxial connectors for emergency repair of 002-type cables.

070A03

CONNECTOR ADAPTOR
10-32 coaxial plug to BNC jack. Converts 10-32 connectors for use with BNC plugs. Do not use on sensor connectors.



070B09

SOLDER CONNECTOR ADAPTOR
10-32 coaxial plug to solder terminals. Excellent for high-shock applications. User-repairable.

1/8 in max wall thickness
1/2 in mtg thd

070A13

FEED-THRU ADAPTOR
10-32 coaxial jack to BNC jack. Bulkhead connects BNC plug to 10-32 coaxial jack.

085A18

PLASTIC PROTECTIVE CAP
Provides strain relief for solder connector adaptors, as well as protects 10-32 cable ends.

085A40

10-32 COAXIAL SHORTING CAP
Used to short charge mode sensor connectors during storage and transportation.

Dimensions shown are in inches (millimeters).

Mounting Accessories

- **Adhesive mounting bases**
- **Easy-mount clips**
- **Tools**
- **Magnetic mounting bases**
- **Mounting studs**
- **Triaxial mounting adaptors**

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Mounting Accessories

ADHESIVE MOUNTING BASES

Adhesive mounting bases are utilized to facilitate adhesively mounting an accelerometer to a test surface. The base is secured to the test object with a suitable adhesive such as epoxy, super-glue or wax. The accelerometer is then stud mounted to the adhesive mounting base. The use of the adhesive mounting base eliminates the adhesive from being in direct contact with the sensor and potentially clogging its tapped mounting hole. Accelerometers may easily be moved about multiple bases installed in various locations. All bases are machined of lightweight aluminum with a grooved side for applying the adhesive and a hardcoat finish which provides electrical isolation between the test object and the accelerometer. For proper mounting, match the hex size on the accelerometer to the hex size on the adhesive base. Use the next larger adhesive base hex size if a match is unavailable.

Model No.	Hex size	Thickness		Mtg. Thread
080A14	5/16 in	0.32 in	8.1 mm	10-32
M080A14	5/16 in	0.32 in	8.1 mm	M5 × 0.8
080A15	5/16 in	0.125 in	3.18 mm	5-40
M080A15	5/16 in	0.125 in	3.18 mm	M3 × 0.50
080A04	3/8 in	0.200 in	5.08 mm	10-32
M080A04	3/8 in	0.200 in	5.08 mm	M6 × 0.75
080A178	1/2 in	0.120 in	3.05 mm	10-32 male
080A	1/2 in	0.187 in	4.75 mm	10-32
M080A	1/2 in	0.187 in	4.75 mm	M6 × 0.75
080A12	3/4 in	0.200 in	5.08 mm	10-32
M080A12	3/4 in	0.200 in	5.08 mm	M6 × 0.75
080A13	3/4 in	0.200 in	5.08 mm	1/4-28
*080A19	3/4 in	0.375 in	9.53 mm	10-32
080A68	7/8 in	0.200 in	5.08 mm	10-32
M080A68	7/8 in	0.200 in	5.08 mm	M6 × 0.75

* suitable for use as a stud mounted, electrical isolation base with a 10-32 accelerometer mounting stud inserted into each end.

Model 080A

Model 080A12

Model 080A178

Model 080A19

MOUNTING PADS FOR ARRAY ACCELEROMETERS

These specially designed mounting pads are for use with array accelerometers that incorporate their electrical connection within their mounting surface

Model 080A140
Mounting pad with
10-32 electrical connector
for use with Model 333B31

Model	Cable Length
080B40	10 ft (3 m)
080B37	25 ft (7.6 m)
080B38	50 ft (15.2 m)

Mounting pad with 3-socket adhesive base with integral cable that terminates with a 3-socket IDC connector for use with Model 333B (available with BNC plug termination by specifying suffix /AC to model number, e.g., 080B40/AC)

Model 080A115
Mounting pad with integral 10 ft (3 m) cable and BNC plug termination for use with Model 333B31

Dimensions shown are in inches (millimeters).

EASY-MOUNT CLIPS

Easy-Mount Clips offer practical and economical installation techniques for accelerometers in multi-channel vibration measurement applications.

The clips can be attached to the test structure via double-sided tape or adhesive. Once the clips are installed, accelerometers are simply snapped into the clips to make vibration measurements.

More measurement points and orientations can be accommodated with fewer sensors by installing clips at all desired points and populating them with as many sensors as are available. Sensors are then moved to remaining clip locations until all measurements are accomplished. Triaxial measurements can be made with single axis, cubic shaped accelerometers by changing axis orientation for successive measurements.

Swivel style clips permit sensors installed on curved or sloped surfaces to be aligned along the desired plane and axis. These clips both rotate and pivot to provide full flexibility in alignment.

Models 080A160, 080A172, 080A173

Shown with sensor (sensor not included)

Easy-Mount Clip Model	080A172	080A173	080A160
Size (length × width × height)	0.55 × 0.55 × 0.25 in (14 × 14 × 6.4 mm)	0.6 × 0.6 × 0.25 in (15.2 × 15.2 × 6.4 mm)	0.81 × 0.81 × 0.32 in (20.6 × 20.6 × 8.1 mm)
Weight	0.5 gm	0.6 gm	1.4 gm
Frequency Limit (± 5%) (grease mount)	2000 Hz	2000 Hz	2000 Hz
Frequency Limit (± 10%) (grease mount)	4000 Hz	3000 Hz	2500 Hz
Frequency Limit (± 5%) (dry mount)	1000 Hz	1000 Hz	1000 Hz
Frequency Limit (± 10%) (dry mount)	1300 Hz	1300 Hz	1300 Hz
Temperature Range (continuous)	-65 to 125 °F (-54 to 52 °C)	-65 to 125 °F (-54 to 52 °C)	-65 to 125 °F (-54 to 52 °C)
High Temperature Limit (short term exposure)	175 °F (79 °C)	175 °F (79 °C)	175 °F (79 °C)
Compatible Accelerometers	333B32, 333B33, 356B11, 356B21	333B42, 333B53, 356A12, 356A22	356A02, 356A15, 356A16, 356A17
Notes: Actual attainable frequency limits may be higher than specified, particularly for lower weight accelerometers, and may differ depending on axis of motion. An interface of silicone grease between clip and accelerometer aids in mechanical coupling to improve attainable frequency range.			
Ordering Information			
100-Piece Bag of Easy-Mount Clips	080A181	080A183	080A185

Models 080A174, 080A176, 080A177

Shown with sensor (sensor not included)

Easy-Mount, Swivel Clip Model	080A174	080A176	080A177
Size (base diameter × maximum height)	0.5 × 1.22 in (12.7 × 31.0 mm)	0.5 × 1.22 in (12.7 × 31.0 mm)	0.75 × 1.39 in (19.1 × 35.2 mm)
Weight	3.6 gm	3.6 gm	5.5 gm
Frequency Limit (± 10%) (grease mount)	1000 Hz	1000 Hz	1000 Hz
Temperature Range (continuous)	-65 to 125 °F (-54 to 52 °C)	-65 to 125 °F (-54 to 52 °C)	-65 to 125 °F (-54 to 52 °C)
High Temperature Limit (short term exposure)	175 °F (79 °C)	175 °F (79 °C)	175 °F (79 °C)
Compatible Accelerometers	333B32, 333B33, 356B11, 356B21	333B42, 333B53, 356A12, 356A22	356A02, 356A15, 356A16, 356A17
Notes: Actual attainable frequency limits may be higher than specified, particularly for lower weight accelerometers, and may differ depending on axis of motion. An interface of silicone grease between clip and accelerometer aids in mechanical coupling to improve attainable frequency range.			
Ordering Information			
25-Piece Bag of Easy-Mount Swivel Clips	080A182	080A184	080A186

Dimensions shown are in inches (millimeters).

Mounting Accessories

ADHESIVES

Many adhesives have been successfully used for securing adhesive mounting bases to test objects. These include epoxies, waxes, super glues, hot melt glues, and dental cement. Some provide more permanent attachment than others. Stiffer adhesives provide better transmission of high frequencies. Adhesives should be selected which perform adequately for the required application and environmental conditions. PCB offers petro wax and quick bonding gel.

Model No.	Description	Quantity Provided
080A24	Petro Wax	4 squares, 1 x 1 x 0.25 in ea.
080A109	Petro Wax	1 square, 1 x 1 x 0.25 in
080A90	Quick bonding gel	1 tube, 0.10 oz (3 gm)

Model 080A90
Quick bonding gel

ADHESIVE MOUNT REMOVAL (other than wax)

Note — A debonder should always be used to avoid sensor damage.

To avoid damaging the accelerometer, a debonding agent must be applied to the adhesive prior to sensor removal. With so many adhesives in use (everything from super glues, dental cement, epoxies, etc.), there is no universal debonding available. The debonder for the Loctite 454 adhesive that PCB offers is Acetone. If you are using anything other than Loctite 454, you will have to check with the individual manufacturers for their debonding recommendations. The debonding agent must be allowed to penetrate the surface in order to properly react with the adhesive, so it is advisable to wait a few minutes before removing the sensor.

Model 080A109
Petro Wax

TOOLS

Removal tools help avoid sensor damage and assist with the removal of adhesively mounted "teardrop" style accelerometers. The shear force applied snaps the bond of most super glues and epoxies.

Model No.	Applicable Sensor
039A27	352A21, 352C22, 357A09, 357C10
039A26	352C23
039A28	352A24
039A29	357A08
039A07	740B02
039A31	352A60
039A08	0.4 in (10.2 mm) cube shaped accelerometers
039A09	0.45 in (11.4 mm) cube shaped accelerometers
039A10	0.55 in (14 mm) cube shaped accelerometers

Removal tool for miniature teardrop accelerometers

Removal tool for cube shaped accelerometers

Probe tips install onto accelerometers to enable their use as hand-held vibration sensors. This technique is useful if installation space is severely limited or for determining installation locations where vibration is most prevalent.

Model 080A09
Probe Tip with 10 - 32 tapped hole

Model 076A22
BNC connector tool

Helps grip BNC's for connection to crowded panels

Dimensions shown are in inches (millimeters).

MAGNETIC MOUNTING BASES

Magnetic mounting bases allow a convenient, temporary method of installing accelerometers to ferrous, magnetic surfaces. Select a magnetic base with a larger diameter than the accelerometer base. **Note** — always exercise caution when using a magnetic base as the attractive installation forces can cause excessive shock to the sensor. It is recommended to install the magnet to the test object on an edge and then "roll" the assembly gently into position.

Model 080A30

Model 080A27

Model 080A179

Model 080A130

Model 080A54

Model No.	Diameter	Thickness		Mounting Thread	Force		Uses
080A30	3/8 in hex	0.23 in	5.84 mm	5-40 female	2.5 lb	11 N	miniature, 2 gm accelerometers
M080A30	3/8 in hex	0.2 in	5.08 mm	M3 × 0.5 female	2.5 lb	11 N	miniature, 2 gm accelerometers
080A27	3/4 in hex	0.27 in	6.86 mm	10-32 male	12 lb	54 N	general purpose
080A179	0.75 in	0.42 in	10.7 mm	10-32 female	12 lb	54 N	general purpose
080A54	1-3/8 in hex	0.49 in	12.45 mm	1/4-28 male	50 lb	225 N	industrial accelerometers
080A130	0.75 in	0.72 in	18.29 mm	1/4-28 stud	15 lb	68 N	curved surfaces
080A26	0.75 in	0.37 in	9.4 mm	adhesive	N/A	N/A	mounting pad to mate with magnet

MOUNTING STUDS

Mounting studs are used to secure the accelerometer to the test object. To insure accurate measurements, always mount the accelerometer with the recommended mounting torque and avoid bottoming the stud into the test object's or the accelerometer's tapped mounting hole. The use of a stud with a shoulder will usually avoid bottoming, however insure that the base of the sensor is counter-bored to accept the shoulder. Once installed the accelerometer's base should be in close contact with the test object surface.

Model 081A08

Model 081B05

Model 081B20

Model 081A21

Model 080A149

Model	Threads			Comment
081A27	5-40 male	to	5-40 male	for some triaxial accelerometers
081A90	5-40 male	to	10-32 male	adaptor stud
080A149	5-40 female	to	10-32 male	mounting adaptor
M080A149	M3 × 0.5 female	to	10-32 male	mounting adaptor
080M260	6-32 female	to	10-32 male	adapts ring sensors to existing 10-32 tapped mounts
081B05	10-32 male	to	10-32 male	with shoulder, for most accelerometers
M081B23	10-32 male	to	M5 × 0.8 male	adaptor stud
M081B05	10-32 male	to	M6 × 0.75 male	adaptor stud, with shoulder
081A08	10-32 male	to	1/4-28 male	adaptor stud
081B20	1/4-28 male	to	1/4-28 male	with shoulder, for industrial accelerometers
081A96	1/4-28 male	to	1/4-28 male	stainless stl. for Model 350A96 shock accelerometer
M081B20	1/4-28 male	to	M6 × 0.75 male	adaptor stud, with shoulder
081A21	10-32 male	to	10-32 male	electrical isolation mounting pad/stud
081C21	10-32 male	to	10-32 male	electrical isolation mounting pad/longer stud
081A45	6-32 thd. × 0.625 inch length			cap screw for Series 355 ring shaped accelerometers
M081A45	M3 × 0.5 thd. × 16 mm length			cap screw for Series 355 ring shaped accelerometers

Dimensions shown are in inches (millimeters).

TRIAXIAL MOUNTING ADAPTORS

Adapts three standard, uni-axial accelerometers for monitoring vibration in three orthogonal axes. Hex size listed represents the maximum allowable hex size for the installed uni-axial accelerometers.

Style "A"

Style "B"

Style "C"

Triaxial Mounting Adaptors

Model	Dimensions	Material	Mounting via	Accel. fasteners	Max. hex	Style
080B16	0.37 in (9.4 mm) cube	anodized Al	10-32 tap	5-40 taps	5/16 in	A
M080B16	0.37 in (9.4 mm) cube	anodized Al	10-32 tap	M3 × 0.5 taps	5/16 in	A
080A196	0.44 in (11.18 mm) cube	anodized Al	10-32 tap	5-40 taps	3/8 in	A
080A17	0.812 in (20.62 mm) cube	stainless stl.	10-32 screws	10-32 taps	3/8 in	B
M080A17	0.812 in (20.62 mm) cube	stainless stl.	M5 × 0.8 screws	M5 × 0.8 taps	3/8 in	B
080B10	0.866 in (22 mm) cube	stainless stl.	8-36 screws	10-32 taps	1/2 in	B
M080B10	0.866 in (22 mm) cube	stainless stl.	M4 × 0.7 screws	M6 × 0.75 taps	1/2 in	B
080C10	0.866 in (22 mm) cube	anodized Al	8-36 screws	10-32 taps	1/2 in	B
080A180	1.00 in (25.4 mm) cube	titanium	10-32 screws	1/4-28 taps	7/8 in	C
M080A180	1.00 in (25.4 mm) cube	titanium	M5 × 0.8 screws	M6 × 0.75 taps	7/8 in	C
080B11	1.24 in (31.5 mm) cube	anodized Al	10-32 screws	10-32 screws	7/8 in	B
M080B11	1.24 in (31.5 mm) cube	anodized Al	M5 × 0.8 screws	10-32 screws	7/8 in	B
080A62	1.23 in (31.24 mm) cube	stainless stl.	10-32 screws	1/4-28 screws	7/8 in	B
080A57	1.48 in (37.6 mm) cube	stainless stl.	10-32 screws	1/4-28 screws	1-1/4 in	B
M080A57	1.48 in (37.6 mm) cube	stainless stl.	M5 × 0.8 screws	1/4-28 screws	1-1/4 in	B

Model	Dimensions	Material	Mounting via	Accel. fasteners	Note
080A114	0.90 cube	Aluminum	10-32 tap	10-32 electrical jack	use only with models 333A31, 333A41 or 333A51
080B55	0.812 cube	Ryton	adhesive	press fit	use only with model 333B
080A141	1.125 cube	Crastin	adhesive	press fit	use only with model 333B
080A153	1.265 cube	Delrin	10-32 tap	4-40 screws	use with series 3701

Dimensions shown are in inches (millimeters).

Technical Information

- **Introduction to accelerometers**
- **Driving long cable lengths**
- **Introduction to microphones**
- **TEDS - Transducer Electronic Data Sheet**
- **Conversions, article reprints, glossary**

Information to assist with vibration analysis is readily available. Many technical papers have been published and may be found by searching for specific topics on the worldwide web. Information pertinent to PCB accelerometers and their operation is offered within this catalog section. Additional information may be obtained through the following:

Professional Organizations

IEST (Institute of Environmental Sciences and Technology)
5005 Newport Dr., Rolling Meadows, IL 60008
ph: (847) 255-1561 • fax: (847) 255-1699
www.iest.org

SEM (Society for Experimental Mechanics, Inc.)
7 School St., Bethel, CT 06801
ph: (203) 790-6373 • fax: (203) 790-4472
www.sem.org

SAVIAC (Shock and Vibration Information Analysis Center)
5136 Celestial Way
Columbia, MD 21044
ph: (301) 596-0100 • fax: (301) 596-6400
www.saviac.org

Vibration Institute
6262 South Kingery Hwy., Ste. 212
Willowbrook, IL 60527
ph: (630) 654-2254 • fax: (630) 654-2271

Trade Magazines

Sound and Vibration
27101 E. Oviatt Rd., Bay Village, OH 44140
ph: (440) 835-0101 • fax: (440) 835-9303

Sensors
One Phoenix Mill Lane, Suite 401
Peterborough, NH 03458
ph: (603) 924-5400 • fax: (603) 924-5401

Vibrations
A Publication of the Vibration Institute
(see Professional Organizations at left)

Test Engineering & Management
3756 Grand Ave., Ste. 205, Oakland, CA 94610
ph: (510) 839-0909 • fax: (510) 839-2950

Noise & Vibration Worldwide
Multi-Science Publishing Co. Ltd.
5 Wates Way, Brentwood, Essex CM15 9TB
United Kingdom
ph: 44 (0) 1277 224632 • fax: 44 (0) 1277 223453

Publications

Mechanical Vibrations: Theory and Applications
Francis Sing Tse, Ivan E. Morse, Rolland Theodore Hinkle
Allyn and Bacon
ISBN 0-205-05940-6

Shock & Vibration Handbook
Cyril M. Harris
McGraw-Hill, Inc.
ISBN 0-07-026801-0

Vibration Testing: Theory and Practice
Kenneth G. McConnell
John Wiley & Sons Inc.
ISBN 0-471-30435-2

On-Line

www.vibrationworld.com

www.equipment-reliability.com

TYPICAL APPLICATIONS FOR ACCELEROMETERS

If something moves, it experiences acceleration. Measurement of this acceleration helps us gain a higher understanding of the nature of the motion, understanding that increases our awareness of an event or encourages refinement of the engineering design of a moving device. For a man made object, motion is regarded as either desirable or undesirable. Desirable motion, for example, is the monitoring of performance of a controlled process, such as the action of an intake valve on an automobile engine. Two situations demonstrating motion that is undesirable are the monitoring of a process undergoing an upset, such as the excessive vibration caused by a worn motor bearing, or a process in need of control, such as the motion stabilization of a sophisticated optical instrument platform. Some applications in which PCB's accelerometers have demonstrated to be successful include:

Machinery Vibration Analysis — Increased vibration levels, detected by periodically monitoring rotating machinery vibration, are an indication of bearing or gear wear, imbalance, or broken mounts. Machinery like motors, pumps, compressors, turbines, paper machine rolls, and fans, engaged in critical processes, are routinely monitored to predict failure, intelligently schedule maintenance, reduce downtime, and avoid catastrophic interruption of production runs. Such programs have successfully proven to increase production and save money by minimizing downtime.

Balancing — Performance and longevity of rotating machinery is improved when rotors, turbines, and shafts are properly balanced. Measurement signals generated by accelerometers implemented into balancing machinery provide indication of the severity of any imbalance. This measurement, in conjunction with a timing signal provided by a tachometer or key phasor, allows for proper counterweight sizing and placement to bring machinery into acceptable balance.

Environmental Stress Screening — Latent defects, such as inadequate solder bonds of a printed circuit board or inadequately tightened fasteners, often appear in the hands of an end user after a product is transported or subjected to its service environment. Many such defects can be discovered by intentionally inducing vibration stress to the product before final release. Test specimens are mounted to a vibrating shaker and instrumented with accelerometers to flag abnormal response characteristics. Such practices help reduce the number of faulty goods reaching end users, improving customer satisfaction, the manufacturer's reputation for quality, and the costs associated with providing warranty repairs. Often, temperature, humidity, or other simulated conditions are combined with vibration to better simulate the environment in which a product is used.

Vibration Control — Desired vibration, such as that induced for the purpose of environmental stress screening, must be precisely controlled. Accelerometers sense generated vibration at the driving point of a vibration exciter or shaker. This sensor's measurement signal is then fed into a vibration controller, which adjusts the input parameters that drive the shaker. This is known as a closed-loop feedback control system and is not unlike the cruise control feature of an automobile.

Active Vibration Reduction — To enhance user comfort levels of sound and motion generated by such items as household appliances, aircraft, and machinery, designers are now considering the use of active electronic techniques where passive methods, such as isolation, insulation, and damping have become insufficient or impractical. Accelerometers are used to sense the disturbing vibration induced, structure-borne sound, or motion. The measurement signal is then manipulated, typically with digital signal processing, into one of opposing phase for use in driving an actuator or shaker to null the annoying vibration. This closed-loop control method proves useful in applications like helicopters, marine hulls, dishwashers, and aircraft fuselages.

Dimensions shown are in inches (millimeters).

Introduction to Accelerometers

Structural Testing — Accelerometers measure stimulus response and structural resonance characteristics of a wide variety of mechanical devices, from small computer disk drive components to massive bridges, buildings, and civil structures. Such measurements allow designers to optimize product performance and life cycle by selecting construction materials with proper strength and stiffness characteristics. Vibration measurements can also provide an indication of stress, fatigue, damage, or defective assembly due to loose or missing fasteners, welds or joints on finished goods, or items undergoing maintenance assessment.

Modal Analysis — Accelerometers measure relative phase and amplitude of structural motion, allowing operating deflection shape determination, which offers a virtual study of the animated mode shapes. This computerized representation enables designers to optimize performance and user comfort for such items as automobiles, aircraft, and satellites.

Seismic Vibration — Accelerometers detect motion of the ground, buildings, floors, foundations, bridges, and other civil structures for purposes of earthquake detection, geological exploration, condition assessment monitoring, and impact surveys of nearby activities such as mining, construction, or heavy vehicle transportation.

Package Testing — Measuring the shock experienced by a packaged product compared to the level of actual shock exposure allows assessment of the effectiveness of a packing material or package design. Package testing can also be used to measure vibration and shock that a product may experience during transport.

Shock — Accelerometers measure the maximum impact acceleration levels experienced by such items as vehicles and crash dummies. Metal-to-metal impacts, pyroshock studies, and shock exposure experienced by space vehicles and cargo during liftoff and stage separation are also measured and analyzed using shock accelerometers.

Motion and Attitude Detection and Stabilization — Accelerometers monitor motion and orientation of items that rely on precise positioning for proper operation. The measurement signal can be used to warn of excessive motion during upset conditions so that equipment is not operated when inadequate performance is certain. Measurement signals can also be used in a feedback-control-loop scenario to perform active motion reduction to maintain levels within acceptable limits. Apparatus requiring such attention to motion includes sensitive optical instruments, satellite antennas, lasers, surveillance cameras, and semiconductor fabrication equipment.

Ride Quality, Response, and Simulation — Accelerometers play a key role in vehicle design by measuring their response to on- and off-road conditions. Suspension performance, chassis and frame evaluations, engine mount damping, drivetrain NVH, and rider comfort levels are among the many studies conducted. Proving ground tests, dynamometers, electrodynamic shaker, and hydraulic motion simulators are all methods of providing input stimulus to vehicle structures for which accelerometers are used to measure the resulting vibration, shock, and motion of the vehicle and its components.

Flight Testing — Accelerometers are used to measure the dynamic properties of aircraft wings and structure during their development. They are also used during development and testing of engines, landing gear, and other subcomponents.

Introduction to Accelerometers

INTRODUCTION TO ACCELEROMETERS

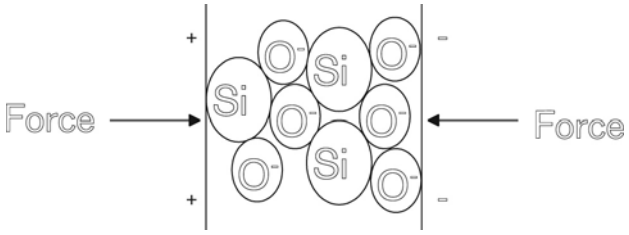
Accelerometers are sensing transducers that produce an electrical output signal proportional to the acceleration aspect of motion, vibration, and shock. Some accelerometers also measure the uniform acceleration aspect of earth's gravitational effect. Most accelerometers generate an electrical output signal that is proportional to an induced force. This force is proportional to acceleration, according to Newton's law of motion, F=ma, where "F" is the induced and subsequently measured force, "m" is the mass creating the force, and "a" is acceleration. Acceleration measurements are quite useful for a wide variety of applications due to this proportionality to force, one of science's truly fundamental, physical measurement parameters.

Types of Accelerometers Offered by PCB

PCB designs and manufactures accelerometers that utilize either piezoelectric or capacitive sensing technology. Piezoelectric accelerometers rely on the self-generating, piezoelectric effect of either quartz crystals or ceramic materials to produce an electrical output signal proportional to acceleration. Many such accelerometers contain built-in signal conditioning circuitry and are known as voltage mode, low-impedance, Integrated Electronic Piezoelectric (IEPE) or Integrated Circuit - Piezoelectric (PCB's trademarked name, "ICP®") sensors. Piezoelectric accelerometers that do not contain any additional circuitry are known as charge output or high-impedance sensors. Piezoelectric accelerometers are capable of measuring very fast acceleration transients such as those encountered with machinery vibration and high-frequency shock measurements. Although they can respond to slow, low-frequency phenomenon, such as the vibration of a bridge, piezoelectric accelerometers cannot measure truly uniform acceleration, also known as static or DC acceleration. Capacitive accelerometers sense a change in electrical capacitance, with respect to acceleration, to vary the output of an energized circuit. Capacitive accelerometers are capable of uniform acceleration measurements, such as the gravitational effect of the earth. They can also respond to varying acceleration events but with limitation to low frequencies of up to several hundred hertz.

Function of Piezoelectric Accelerometers

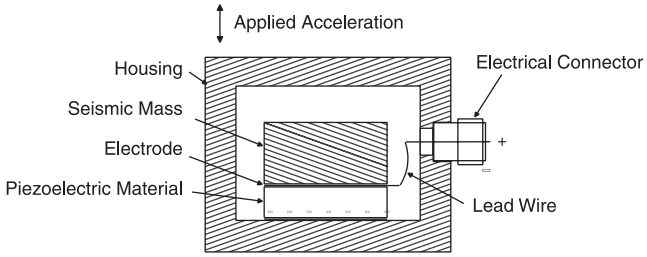
As stated above, piezoelectric accelerometers rely on the self-generating, piezoelectric effect of either quartz crystals or ceramic materials to produce an electrical output signal proportional to acceleration. The piezoelectric effect is that which causes a realignment and accumulation of positively and negatively charged electrical particles, or ions, at the opposed surfaces of a crystal lattice, when that lattice undergoes stress. The number of ions that accumulate is directly proportional to the amplitude of the imposed stress or force. The piezoelectric effect is depicted in the following figure of a quartz crystal lattice.



Piezoelectric Effect of a Quartz Crystal Lattice

In the creation an accelerometer, it is necessary that the stress imposed upon the piezoelectric material be the direct result of the device undergoing an acceleration. To accomplish this, a mass is attached to the crystal which, when accelerated, causes force to act upon the crystal. The mass, also known as a seismic mass, creates a force directly proportional to acceleration according to Newton's law of motion, F=ma. Thin metallic electrodes, typically made of gold foil, serve to collect the accumulated ions. Small lead wires interconnect the electrodes to an electrical connector or feed-through, to which signal transmission cabling is attached. Piezoelectric accelerometer signals generally require conditioning before being connected to readout, recording, or analysis equipment. This signal conditioning is either remotely located or built into the accelerometer.

Dimensions shown are in inches (millimeters).



Piezoelectric Sensing Materials

Two categories of piezoelectric material predominantly used in accelerometer designs are quartz and polycrystalline ceramics. Quartz is a naturally occurring crystal; however, the quartz used in sensors today is produced by a process that creates material free from impurities. Ceramic materials, on the other hand, are man made. Different specific ingredients yield ceramic materials that possess certain desired sensor properties. Each material offers distinct benefits, and material choice depends on the particular performance features desired of the accelerometer.

Quartz

Quartz is widely known for its ability to perform accurate measurement tasks and contributes heavily in everyday applications for time and frequency measurements, such as wrist watches, radios, computers, and home appliances. Accelerometers also benefit from several unique characteristics of quartz. Since quartz is naturally piezoelectric, it has no tendency to relax to an alternative state and is considered the most stable of all piezoelectric materials. Quartz-based sensors, therefore, make consistent, repeatable measurements and continue to do so over long periods of time. Also, quartz has no output occurring from temperature fluctuations, a formidable advantage when placing sensorsin thermally active environments. Because quartz has a low capacitance value, the voltage sensitivity is relatively high compared to most ceramic materials, making it ideal for use in voltage-amplified systems. Conversely, the charge sensitivity of quartz is low, limiting its usefulness in charge-amplified systems, where low noise is an inherent feature. The useful temperature range of quartz extends from -440 °F (-262 °C) to approximately +600 °F (+315 °C).

Ceramics

A wide variety of ceramic materials are used for accelerometers, and which material to use depends on the requirements of the particular application. All ceramic materials are man made and are forced to become piezoelectric by a polarization process. This process, known as “poling,” exposes the material to a high-intensity electrical field, which aligns the electric dipoles, causing the material to become piezoelectric. If ceramic is exposed to temperatures exceeding its range or to electric fields approaching the poling voltage, the piezoelectric properties may be drastically altered or destroyed. Accumulation of high levels of static charge also can have this effect on the piezoelectric output.

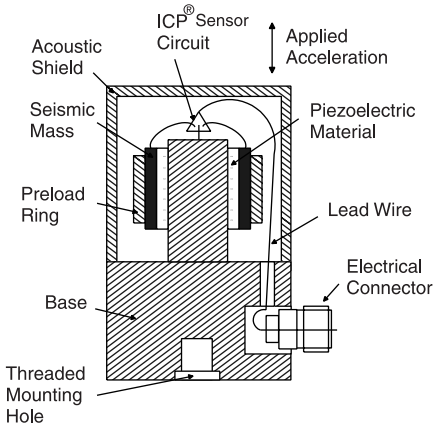
Differences in ceramics utilized determine such factors as charge sensitivity, voltage sensitivity, and temperature range. High charge output ceramics may be mated with built-in charge amplifier circuits to achieve high output signals, high resolution, and an excellent signal to noise ratio. Certain high-temperature ceramics are used for charge mode accelerometers — some with temperature ranges to 900 °F (482 °C). Applications for such high temperature accelerometers include the monitoring of engine manifolds and superheated turbines.

Structures for Piezoelectric Accelerometers

A variety of mechanical structures are available to perform the transduction principles required of a piezoelectric accelerometer. These configurations are defined by the nature in which the inertial force of an accelerated mass acts upon the piezoelectric material. Such terms as compression mode, flexural mode and shear mode describe the nature of the stress acting upon the piezoelectric material. Current designs of PCB accelerometers utilize, almost exclusively, the shear mode of operation for their sensing elements. Therefore, the information provided herein is limited to that pertaining to shear mode accelerometers.

Shear Mode

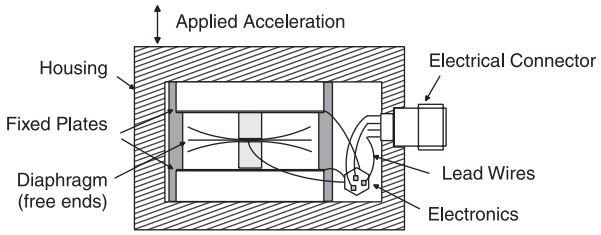
Shear mode accelerometer designs feature sensing crystals attached between a center post and a seismic mass. A compression ring or stud applies a pre-load force to the element assembly to insure a rigid structure and linear behavior. Under acceleration, the mass causes a shear stress to be applied to the sensing crystals. This stress results in a proportional electrical output by the piezoelectric material. The output is collected by electrodes and transmitted by lightweight lead wires to either the built-in signal conditioning circuitry of ICP sensors, or directly to the electrical connector for charge mode types. By having the sensing crystals isolated from the base and housing, shear mode accelerometers excel in rejecting thermal transient and base-bending effects. Also, the shear geometry lends itself to small size, which promotes high frequency response while minimizing mass loading effects on the test structure. With this combination of ideal characteristics, shear mode accelerometers offer optimum performance.



Shear Mode Accelerometer

Function of Capacitive Accelerometers

Capacitive accelerometers sense a change in electrical capacitance, with respect to acceleration, to vary the output of an energized circuit. The sensing element consists of two parallel plate capacitors acting in a differential mode. These capacitors operate in a bridge circuit, along with two fixed capacitors, and alter the peak voltage generated by an oscillator when the structure undergoes acceleration. Detection circuits capture the peak voltage, which is then fed to a summing amplifier that processes the final output signal.



Capacitive Accelerometer

Structure of Capacitive Accelerometers

Capacitive accelerometers sense a change in electrical capacitance, with respect to acceleration, to vary the output of an energized circuit. When subject to a fixed or constant acceleration, the capacitance value is also a constant, resulting in a measurement signal proportional to uniform acceleration, also referred to as DC or static acceleration. PCB's capacitive accelerometers are structured with a diaphragm, which acts as a mass that undergoes flexure in the presence of acceleration. Two fixed plates sandwich the diaphragm, creating two capacitors, each with an individual fixed plate and each sharing the diaphragm as a movable plate. The flexure causes a capacitance shift by altering the distance between two parallel plates, the diaphragm itself being one of the plates. The two capacitance values are utilized in a bridge circuit, the electrical output of which varies with input acceleration.

Dimensions shown are in inches (millimeters).

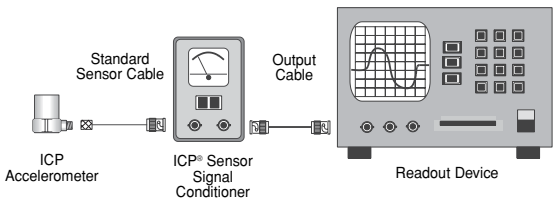
ACCELERATION MEASUREMENT SYSTEMS

Piezoelectric accelerometers can be broken down into two categories that define their mode of operation. Internally amplified ICP® accelerometers contain built-in microelectronic signal conditioning. Charge output accelerometers contain only the sensing element with no electronics.

ICP® Accelerometers

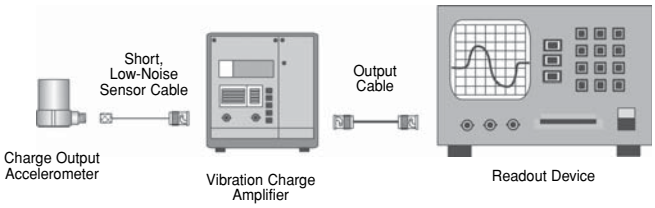
ICP®, as described earlier, is PCB's registered trademark that stands for "Integrated Circuit - Piezoelectric" and identifies PCB sensors that incorporate built-in, signal-conditioning electronics. PCB is credited as the company most responsible for development of this technology. The built-in electronics convert the high-impedance charge signal that is generated by the piezoelectric sensing element into a usable low-impedance voltage signal that can be readily transmitted, over ordinary two-wire or coaxial cables, to any voltage readout or recording device. The low-impedance signal can be transmitted over long cable distances and used in dirty field or factory environments with little degradation. In addition to providing crucial impedance conversion, ICP® sensor circuitry can also include other signal conditioning features, such as gain, filtering, and self-test features. The simplicity of use, high accuracy, broad frequency range, and low cost of ICP® accelerometers make them the recommended type for use in most vibration or shock applications. However, an exception to this assertion must be made for circumstances in which the temperature, at the installation point, exceeds the capability of the built-in circuitry. The routine temperature range of ICP® accelerometers is 250 °F (121 °C); specialty units are available that operate to 350 °F (177 °C).

The electronics within ICP® accelerometers require excitation power from a constant-current regulated, DC voltage source. This power source is sometimes built into vibration meters, FFT analyzers, and vibration data collectors. A separate signal conditioner is required when none is built into the readout. In addition to providing the required excitation, power supplies may also incorporate additional signal conditioning, such as gain, filtering, buffering, and overload indication. A typical system set-up for ICP® accelerometers is shown below.

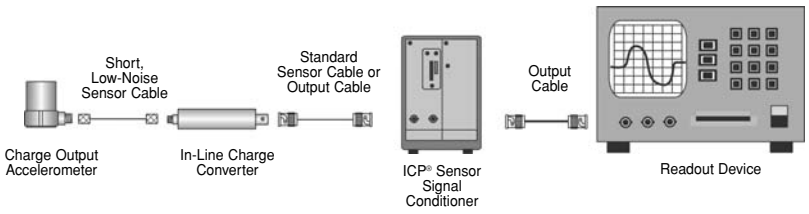


Charge Output Accelerometers

Charge output sensors output a high-impedance, electrical charge signal that is generated by the piezoelectric sensing element. This signal is sensitive to corruption from environmental influences. To conduct accurate measurements, it is necessary to condition this signal to a low-impedance voltage before it can be input to a readout or recording device. A charge amplifier or in-line charge converter is generally used for this purpose. These devices utilize high-input-impedance, low-output-impedance inverting amplifiers with capacitive feedback. Adjusting the value of the feedback capacitor alters the transfer function or gain of the charge amplifier.



Typically, charge output accelerometers are used when high temperature survivability is required. If the measurement signal must be transmitted over long distances, PCB recommends the use of an in-line charge converter, placed near the accelerometer. This minimizes the chance of noise. In-line charge converters can be operated from the same constant-current excitation power source as ICP® accelerometers for a reduced system cost.



Sophisticated laboratory-style charge amplifiers usually include adjustments for normalizing the input signal and altering the feedback capacitor to provide the desired system sensitivity and full-scale amplitude range. Filtering also conditions the high and low frequency response. Some charge amplifiers provide dual-mode operation, which can be used to provide power for ICP® accelerometers or to condition charge output sensors.

Because of the high-impedance nature of the output signal generated by charge output accelerometers, several important precautionary measures must be followed. Always use special low-noise coaxial cable between the accelerometer and the charge amplifier. This cable is specially treated to reduce triboelectric (motion induced) noise effects. Also, always maintain high insulation resistance of the accelerometer, cabling, and connectors. To insure high insulation resistance, all components must be kept dry and clean.

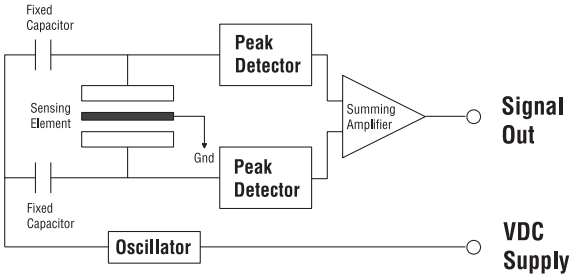
Dimensions shown are in inches (millimeters).

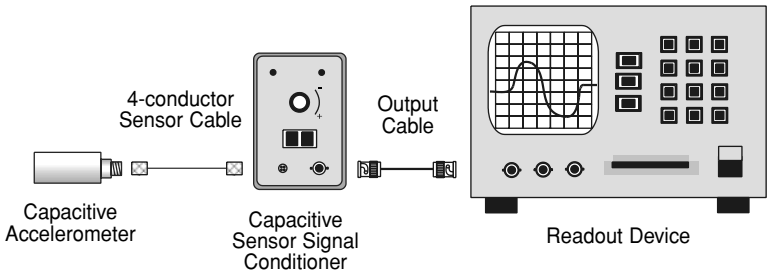
Capacitive Accelerometers

Capacitive accelerometers operate on a three-wire system with one wire carrying the excitation power, one wire carrying the measurement signal, and the third wire serving as a common ground. Once energized, the capacitive accelerometer generates an output measurement signal directly proportional to input acceleration, with respect to its specific acceleration sensitivity value. The output signal is a low-impedance voltage capable of being transmitted over ordinary wires and over long distances.

The excitation voltage required of a capacitive accelerometer is a fixed, DC voltage ranging in value from 10 to 28 VDC, depending on specific model. Additional conditioning of this voltage, such as current limitation, is unnecessary. An attractive feature of the capacitive accelerometer is its ability to operate from basic power requirements. It may be used with a simple battery hookup. Some low-voltage-supply versions may even be operated from a 12 VDC automobile battery.

A peculiar item of concern with capacitive accelerometers is their inherent zero-g offset voltage. This voltage is the result of electrical component tolerances and is typically a value less than 200 mV. This value can be nulled by the zero-adjust feature of most common oscilloscopes, however, all PCB signal conditioners for use with capacitive accelerometers include a zero-offset adjust feature to null this ouput. The ability to null the offset in the signal conditioner is especially advantageous when utilizing readout or recording instruments that may not have a zero-offset feature.





Dimensions shown are in inches (millimeters).

ACCELEROMETER MOUNTING CONSIDERATIONS

Frequency Response

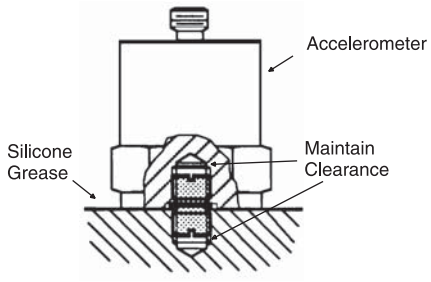
One of the most important considerations in dealing with accelerometer mounting is the effect the mounting technique has on the accuracy of the usable frequency response. The accelerometer's operating frequency range is determined, in most cases, by securely stud mounting the test sensor directly to the reference standard accelerometer. The direct, stud mounted coupling to a very smooth surface generally yields the highest mounted resonant frequency and therefore, the broadest usable frequency range. The addition of any mass to the accelerometer, such as an adhesive or magnetic mounting base, lowers the resonant frequency of the sensing system and may affect the accuracy and limits of the accelerometer's usable frequency range. Also, compliant materials, such as a rubber interface pad, can create a mechanical filtering effect by isolating and damping high-frequency transmissibility.

Surface Preparation

For best measurement results, especially at high frequencies, it is important to prepare a smooth and flat machined surface where the accelerometer is to be attached. Inspect the area to ensure that no metal burrs or other foreign particles interfere with the contacting surfaces. The application of a thin layer of silicone grease between the accelerometer base and the mounting surface also assists in achieving a high degree of intimate surface contact required for best high-frequency transmissibility.

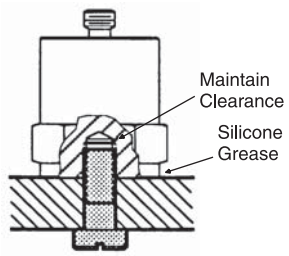
Stud Mounting

For permanent installations, where a very secure attachment of the accelerometer to the test structure is preferred, stud mounting is recommended. First, grind or machine on the test object a smooth, flat area at least the size of the sensor base, according to the manufacturer's specifications. Then, prepare a tapped hole in accordance with the supplied installation drawing, ensuring that the hole is perpendicular to the mounting surface. Install accelerometers with the mounting stud and make certain that the stud does not bottom in either the mounting surface or accelerometer base. Most PCB mounting studs have depth-limiting shoulders that ensure that the stud cannot bottom-out into the accelerometer's base. Each base incorporates a counterbore so that the accelerometer does not rest on the shoulder. Acceleration is transmitted from the structure's surface into the accelerometer's base. Any stud bottoming or interfering between the accelerometer base and the structure inhibits acceleration transmission and affects measurement accuracy. When tightening, apply only the recommended torque to the accelerometer. A thread-locking compound may be applied to the threads of the mounting stud to safeguard against loosening.



Screw Mounting

When installing accelerometers onto thin-walled structures, a cap screw passing through a hole of sufficient diameter is an acceptable means for securing the accelerometer to the structure. The screw engagement length should always be checked to ensure that the screw does not bottom into the accelerometer base. A thin layer of silicone grease at the mounting interface ensures high-frequency transmissibility.



Adhesive Mounting

Occasionally, mounting by stud or screw is impractical. For such cases, adhesive mounting offers an alternative mounting method. The use of separate adhesive mounting bases is recommended to prevent the adhesive from damaging the accelerometer base or clogging the mounting threads (miniature accelerometers are provided with the integral stud removed to form a flat base). Most adhesive mounting bases available from PCB also provide electrical isolation, which eliminates potential noise pick-up and ground loop problems. The type of adhesive recommended depends on the particular application. Petro Wax (available from PCB) offers a very convenient, easily removable approach for room temperature use. Two-part epoxies offer stiffness, which maintains high-frequency response and a permanent mount. Other adhesives, such as dental cement, hot glues, instant glues, and duct putty are also viable options with a history of success.

Dimensions shown are in inches (millimeters).

There is no one "best" adhesive for all applications because of the many different structural and environmental considerations, such as temporary or permanent mount, temperature, type of surface finish, and so forth.

A variety of adhesives are available from many manufacturers, who usually provide specification charts and application bulletins for their adhesives. A Consumer Report's article entitled "Which Glue for Which Job" (Jan. 1988) provides rating information on adhesives. A Popular Science magazine article, "Secrets of the Superglues" (Feb. 1989), provides informative data on the use of superglues. Loctite provides an adhesive "Selector Guide" for its products.

For most accelerometer adhesive mounting applications, PCB Series 080 Adhesive Mounting Bases are suggested. These mounting pads keep the accelerometer base clean and free of epoxy that may be very difficult to remove. Also, Series 080 Mounting Bases allow the accelerometer to be easily removed from the test structure without damage to either the sensor or the test object.

Surface flatness, adhesive stiffness, and adhesion strength affect the usable frequency range of an accelerometer. Almost any mounting method at low acceleration levels provides the full frequency range of use if the mounting surface is very flat and the sensor is pressed hard against the surface to wring out all extra adhesive. Generally, as surface irregularities or the thickness of the adhesive increase, the usable frequency range decreases.

The less-stiff, temporary adhesives reduce an accelerometer's usable frequency range much more than the more rigid, harder adhesives. Generally, temporary adhesives are recommended more for low-frequency (<500 Hz) structural testing at room temperature. Petro Wax is generally supplied with most of the accelerometers for a quick, temporary mounting method used during system set-up and check-out. When quick installation and removal is required over a wide frequency range up to 10 kHz, use a Series 080A Adhesive Mounting Base with one of the stiffer, more permanent adhesives. Also, consider a magnetic mount, using the Series 080A27 Super Magnet with Model 080A20 Steel Adhesive Mounting Pad for such measurements. For both, the mounting surface must be very flat to achieve accurate high-frequency information.

Care should be exercised in selecting and testing an adhesive when concern exists regarding the possible discoloration or damage to the test structure's surface finish. Test the adhesive first on a hidden location or a sample of the structure's finish. Temporary adhesives like Petro Wax or beeswax offer a good solution for quick installation in room-temperature applications. When higher temperatures are involved, apply a piece of aluminized mylar tape to the test structure and mount the accelerometer with adhesive base using one of the other types of adhesives. After the test, the tape can be easily removed with no damage to the surface finish of the structure.

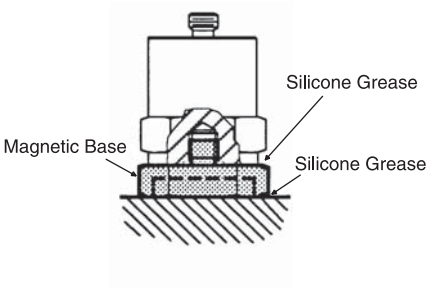
	Mounting Surface Condition		Temperature		Availability	
Adhesives	Flat & Smooth Surfaces	Rough Surfaces (Casting, etc.)	Room Temp. Only	Elevated Temp. (see Mtg. Spec.)	Commercial	PCB Piezotronics (request sample)
Temporary/Easily Removed						
Petro Wax	■	■	■			■
Bee's Wax	■	■	■		■	
Duct Putty	■	■	■		■	
Two-sided Sticky Tape	■	■	■		■	
Semi-Permanent/Permanent						
Super Glue (Thin one part quick dry)						
Loctite® 430 Super Bonder	■			-65°F to +175°F	■	■
Eastman 910	■			-65°F to +180°F	■	
Super Glue-Gap Filling (thick liquid & gel)						
Pacer RX-50 "Gel"		■		-114°F to +180°F	■	
Loctite® 498 Super Bonder		■		-40°F to +223°F	■	
Loctite® 422 "Gap Filling"		■		-65°F to +175°F	■	
Hot Glue (apply with hot glue gun)	■	■		Various Grades from +150°F	■	
Permanent						
Two Part Std Commercial Epoxies	■	■		to +250°F	■	
Loctite® 325 Speed Bonder	■	■		-65°F to +350°F	■	

Magnetic Mounting

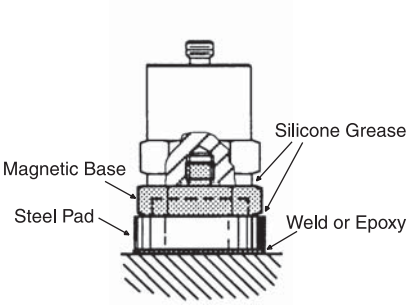
Magnetic mounting bases offer a very convenient, temporary attachment to magnetic surfaces. Magnets offering high pull strengths provide best high-frequency response. Wedged dual-rail magnetic bases are generally used for installations on curved surfaces, such as motor and compressor housings and pipes. However, dual-rail magnets usually significantly decrease the operational frequency range of an accelerometer. For best results, the magnetic base should be attached to a smooth, flat surface. A thin layer of silicone grease should be applied between the sensor and magnetic base, as well as between the magnetic base and the structure. When surfaces are uneven or non-magnetic, steel pads can be welded or epoxied in place to accept the magnetic base. Use of such a pad ensures that periodic measurements

Dimensions shown are in inches (millimeters).

are taken from the exact same location. This is an important consideration when trending measurement data.



Magnet Mounted Directly to Test Surface



Probe Tips

Handheld vibration probes or probe tips on accelerometers are useful when other mounting techniques are impractical and for evaluating the relative vibration characteristics of a structure to determine the best location for installing the accelerometer. Probes are not recommended for general measurement applications due to a variety of inconsistencies associated with their use. Orientation and amount of hand pressure applied create variables, which affect the measurement accuracy. This method is generally used only for frequencies less than 1000 Hz.

Mass Loading

The vibrational characteristics of a structure can be altered by adding mass to that structure. Since most measurements are conducted to quantify the structural vibration, any alteration of the vibration leads to an inaccurate evaluation of the vibration. An accelerometer that is too heavy, with respect to the test structure, may produce data that does not correctly represent the vibration of interest. Use care when selecting an accelerometer and mounting hardware to avoid the effects of mass loading.

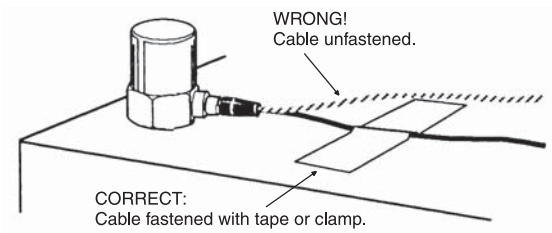
Ground Isolation, Ground Noise, and Ground Loops

When installing accelerometers onto electrically conductive surfaces, a potential exists for ground noise pick-up. Noise from other electrical equipment and machines that are grounded to the structure, such as motors, pumps, and generators, can enter the ground path of the measurement signal through the base of a standard accelerometer. When the sensor is grounded at a different electrical potential than the signal conditioning and readout equipment, ground loops can occur. This phenomenon usually results in current flow at the line power frequency (and harmonics thereof), potential erroneous data, and signal drift. Under such conditions, it is advisable to electrically isolate or "float" the accelerometer from the test structure. This can be accomplished in several ways. Most accelerometers can be provided with an integral ground isolation base. Some standard models may already include this feature, while others offer it as an option. Optional ground-isolated models are identified by the prefix "J"; for example, Model J353B33. The use of insulating adhesive mounting bases, isolation mounting studs, isolation bases, and other insulating materials, such as paper beneath a magnetic base, are effective ground isolation techniques. Be aware that the additional ground-isolating hardware can reduce the upper frequency limits of the accelerometer.

Cables and Connections

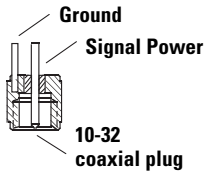
Cables should be securely fastened to the mounting structure with a clamp, tape, or other adhesive to minimize cable whip and connector strain. Cable whip can introduce noise, especially in high-impedance signal paths. This phenomenon is known as the triboelectric effect. Also, cable strain near either electrical connector can lead to intermittent or broken connections and loss of data.

To protect against potential moisture and dirt contamination, use RTV sealant or heat-shrinkable tubing on cable connections. O-rings with heat shrink tubing have proven to be an effective seal for protecting electrical connections for short-term underwater use. The use of only RTV sealant is generally only used to protect the electrical connection against chemical splash or mist.

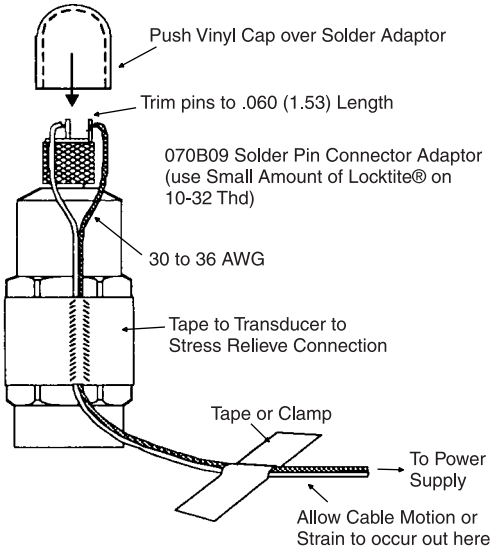


Under high shock conditions or when cables must undergo large amounts of motion, as with package drop testing applications, the use of a solder connector adaptor and lightweight ribbon cables are generally recommended. These solder connector adaptors provide a more durable connection and can be installed onto the accelerometer with a thread locking compound to prevent loosening. Use of lightweight cables helps to minimize induced strain at the connector, which can create an erroneous output signal. Electrical connection fatigue is also minimized, reducing the possibility of intermittent or open connections and loss of data. Solder connector adaptors are installed onto the cable with solder. This easy connection makes this type of connector user- or field-repairable in times of crisis. Normally, a flexible plastic plug is placed over the electrical connections for protection, as well as to provide cable strain relief.

The solder connector adaptor provides an affordable and simplistic method for making cables in the field, as well as a ruggedized connection that is capable of surviving 100,000 g. Only solder and a soldering iron are required. No special tools or equipment are necessary for installation on a cable end. Because of the reliability and strength of this connection, these connectors are recommended for use in shock applications.



Solder Connector Adaptor



CABLE DRIVING CONSIDERATIONS AND CONSTANT CURRENT LEVEL

Operation over long cables may effect frequency response and introduce noise and distortion when an insufficient current is available to drive cable capacitance.

Unlike charge mode systems, where the system noise is a function of cable length, ICP® sensors provide a high voltage, low impedance output well-suited for driving long cables through harsh environments. While there is virtually no increase in noise with ICP® sensors, the capacitive loading of the cable may distort or filter higher frequency signals depending on the supply current and the output impedance of the sensor.

Generally, this signal distortion is not a problem with lower frequency testing within a range up to 10,000 Hz. However, for higher frequency vibration, shock, or transient testing over cables longer than 100 ft. (30 m.), the possibility of signal distortion exists.

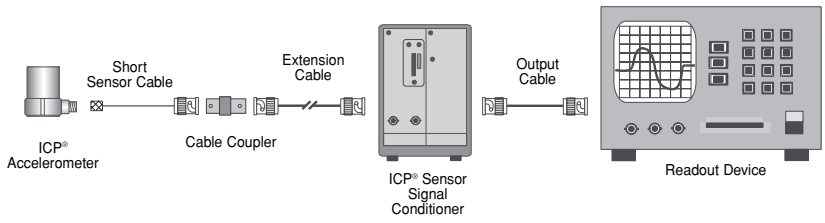
The maximum frequency that can be transmitted over a given cable length is a function of both the cable capacitance and the ratio of the peak signal voltage to the current available from the signal conditioner according to:

$$f_{max} = \frac{10^9}{2\pi CV / (I_c - 1)}$$

where, f_{max} = maximum frequency (hertz)
C = cable capacitance (picofarads)
V = maximum peak output from sensor (volts)
I_c = constant current from signal conditioner (mA)
10^9 = scaling factor to equate units

Note that in the equation, 1 mA is subtracted from the total current supplied to the sensor (1c). This is done to compensate for powering the internal electronics. Some specialty sensor electronics may consume more or less current. Contact the manufacturer to determine the correct supply current. When driving long cables, the equation

Dimensions shown are in inches (millimeters).



above shows that as the length of cable, peak voltage output or maximum frequency of interest increases, a greater constant current will be required to drive the signal.

The nomograph on the next page provides a simple, graphical method for obtaining the expected maximum frequency capability of an ICP® measurement system. The maximum peak signal voltage amplitude, cable capacitance, and supplied constant current must be known or presumed.

For example, when running a 100 ft. cable with a capacitance of 30 pF/ft, the total capacitance is 3000 pF. This value can be found along the diagonal cable capacitance lines. Assuming the sensor operates at a maximum output range of 5 volts and the constant current signal conditioner is set at 2 mA, the ratio on the vertical axis can be calculated to equal 5. The intersection of the total cable capacitance and this ratio result in a maximum frequency of approximately 10.2 kHz.

The nomograph does not indicate whether the frequency amplitude response at a point is flat, rising, or falling. For precautionary reasons, it is good general practice to increase the constant current (if possible) to the sensor (within its maximum limit) so that the frequency determined from the nomograph is approximately 1.5 to 2 times greater than the maximum frequency of interest.

Note that higher current levels will deplete battery-powered signal conditioners at a faster rate. Also, any current not used by the cable goes directly to power the internal electronics and will create heat. This may cause the sensor to exceed its maximum temperature specification. For this reason, do not supply excessive current over short cable runs or when testing at elevated temperatures.

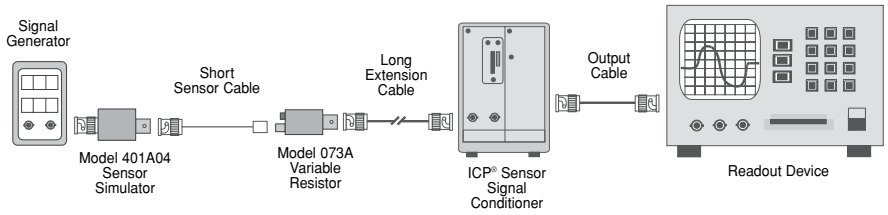
Experimentally Testing Long Cables

To more accurately determine the effect of long cables, it is recommended to experimentally determine the high frequency electrical characteristics.

The method illustrated below involves connecting the output from a standard signal generator into a unity gain, low-output impedance (<5 ohm) instrumentation amplifier in series with the ICP® sensor. The extremely low output impedance is required to minimize the resistance change when the signal generator/amplifier is removed from the system.

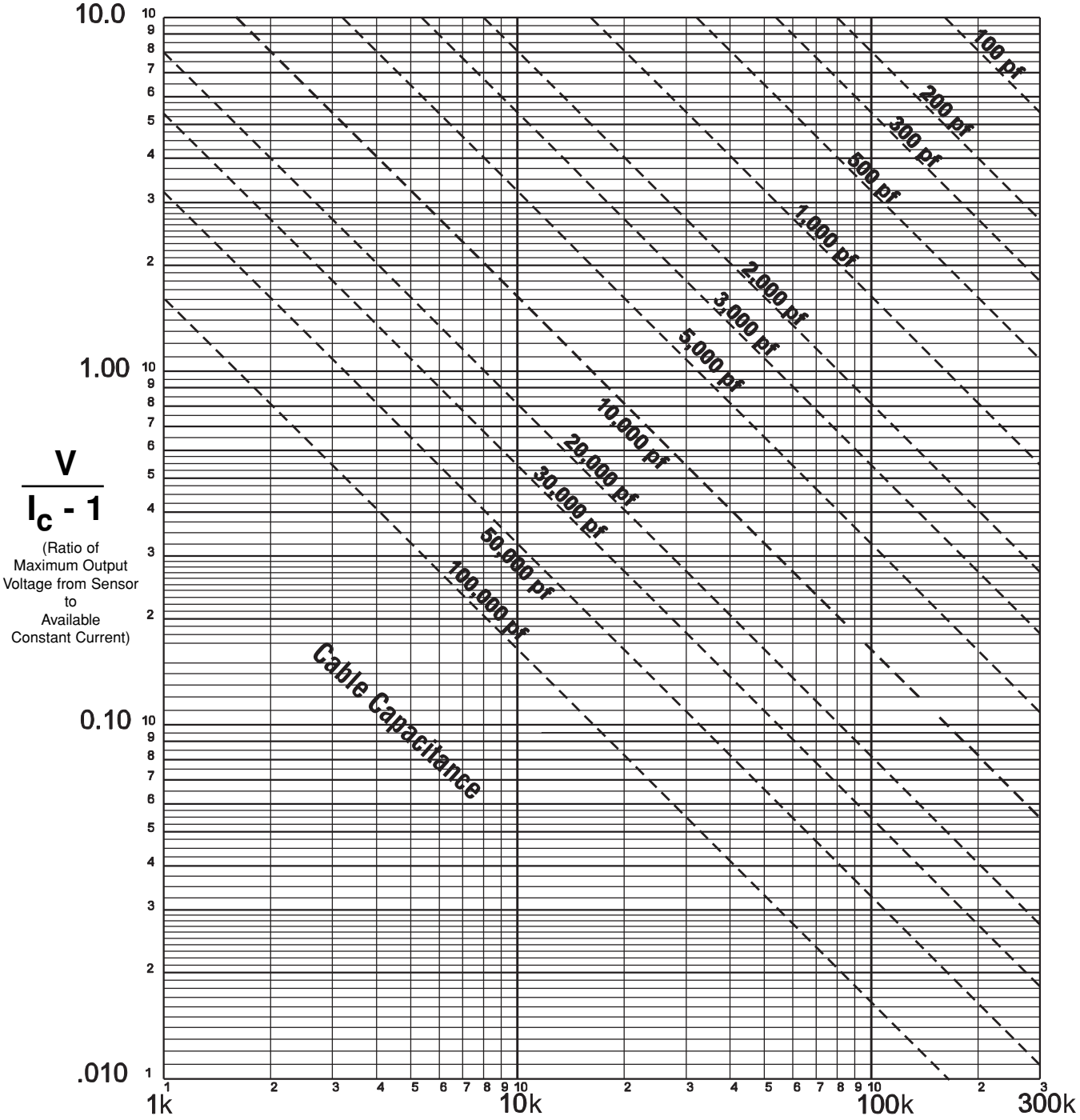
In order to check the frequency/amplitude response of this system, set the signal generator to supply the maximum amplitude of the expected measurement signal. Observe the ratio of the amplitude from the generator to that shown on the scope. If the ratio is 1:1, the system is adequate for your test. (If necessary, be certain to factor in any gain in the signal conditioner or scope.) If the output signal is rising (1:1.3 for example), add series resistance to attenuate the signal. Use of a variable 100 ohm resistor will help set the correct resistance more conveniently. Note that this is the only condition that requires the addition of resistance. If the signal is falling (1:0.75 for example), the constant current level must be increased or the cable capacitance reduced.

It may be necessary to physically install the cable during cable testing to reflect the actual conditions encountered during data acquisition. This will compensate for potential inductive cable effects that are partially a function of the geometry of the cable route.



Driving Long Cable Lengths

Cable Driving Nomograph



f_{max} = Maximum frequency given the following characteristics

C= Cable capacitance (pF)
V= Maximum output voltage from sensor (volts)
I_c= Constant current level from power unit (mA)
10^9= Scale factor to equate units

Dimensions shown are in inches (millimeters).

TYPICAL APPLICATIONS FOR MICROPHONES

Microphones measure broadband sound pressure levels from multiple sources. When the microphone signal is post processed, the frequencies can be correlated with the sound source, and if necessary, related back to the wavelength of the sound. Acoustical measurement of this sound, through the use of high-precision condenser microphones, provides a better understanding of the nature of the sound. Sound can be desirable, as in music, or undesirable sound, referred to as noise. Some applications for acoustical studies that require microphones include:

Research and Product Design — Excessive sound pressure can cause damage to products or human hearing. Microphones are used to measure the pressure level exerted on a surface. Sound pressure can shake plaster off walls or cause damage to an airplane wing. Sound measurement is used in a variety of applications including: the study of door slams, clutch engagements, starter impact and sunroof noise. Analysis of engine noise in a cabin or car interior, or sound exhibited from consumer appliances are tested to extend the lifespan of the product and keep the external noise minimal, for the comfort of the user

Preventive Maintenance — Increased sound levels, or changes in frequency can indicate that a product is not working to its capacity. Motors, gears, bearings, blades, or other industrial components can all experience changes in decibel level or frequency shift when not working properly. High precision microphones can be utilized to confirm that a product is experiencing a problem, or can be used to predict failure of a component.

Audiometric Calibration — Universities, governments and independent companies have audio testing equipment to perform hearing tests and research projects. Microphones are used to test and calibrate the systems to ensure the accuracy of the test equipment.

Compliance — Microphone tests can be performed and recorded for verification of pressure levels on products, and can be utilized in legal situations. Companies will use high precision microphone tests for proof of sound pressure levels during design. Microphones are used on sound level meters to ensure compliance with national standards for shop noise

Environmental Noise Analysis — There are certain sound pressure levels that the human ear can be subjected to for specific amounts of time before ear damage can occur (dose). A few of these are industrial shop noise, airports, and automotive highway noise. Acoustic testing is performed so that a better understanding of the sound levels that are experienced in these surroundings is achieved, and the necessary adjustments can be made in order to provide greater personal protection. The automotive market will utilize high precision microphones for "Squeak and Rattle" tests in order to provide a quieter ride.

Multiple Channel Testing — Acoustic holography, and pressure mapping are areas where microphone use has been increasing. Grids of microphones can be set-up to tell the difference in the sound pressure at different points around an engine or a car tire well. Calculations can be made per zone or spectrum. Some applications include seismic activity monitoring, satellite tracking, and automotive and industrial noise source identification. Microphones can be utilized to transform 2-dimensional complex sound pressure information into 3-dimensional acoustic fields, using basic wave equations, to indicate surface intensity and radiation patterns.

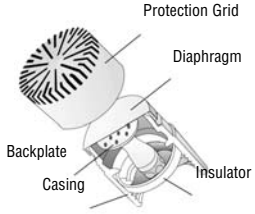
Introduction to Microphones

INTRODUCTION TO MICROPHONES

High precision microphones are used in acoustical test and measurement applications to determine the sound pressure, in decibels (dB), that is exerted on an object at different frequencies and wavelengths. Acoustic testing is performed for a variety of applications, including new product design, product monitoring, predictive maintenance, and personal protection. Pressure from sound not only can damage material items, but also can damage the most precious and delicate design created to perceive it, the human ear.

Condenser Microphone

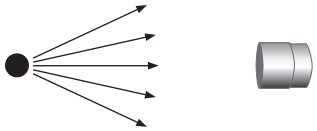
A condenser microphone is constructed by forming a capacitor between a thin, flexible diaphragm and a back plate. As sound pressure levels approach the diaphragm, it causes the diaphragm to deflect. The distance that the diaphragm moves, in relationship to the back plate, will cause a change in the capacitance. The capacitance change is then detected electrically. In order to measure the capacitance, a charge must be applied to the cartridge. In traditional microphones, a DC polarization voltage is supplied by an external power supply. In the modern (prepolarized) designs, a polymer (called an electret), contains its own internal polarization. The electret contains frozen electrical charges, which are stimulated by low-cost, ICP® constant current supply (2 - 20 mA). A voltage can then be measured and output from the changes in capacitance. Programs in external devices can then convert this output into sound pressure levels in decibels.



Cutaway Drawing of a Precision Microphone

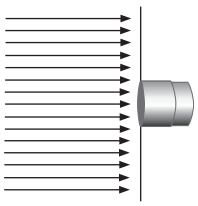
Microphones Field Types Offered by PCB

PCB offers the three most common microphone types used for testing; free-field, pressure, and random incident. A free-field microphone is designed to be most accurate when measuring sound radiating from a single source, pointing directly at the microphone. The sound waves propagate freely, with no objects present which may disturb or influence the sound field. The free-field microphone measures the sound pressure as it exits from the sound source, without the influence of the microphone itself. These microphones work best in open areas, where there is no hard or reflective surfaces, such as anechoic rooms.



Sound Field Measured by a Free-Field Microphone

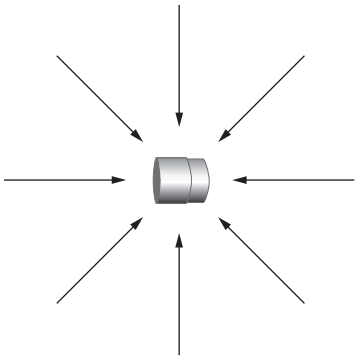
A pressure field microphone is designed to measure the sound pressure that exists in front of the diaphragm. It is described to have the same magnitude and phase at any position in the field. It is usually found in an enclosure, or cavity, which is small when compared to wavelength. The microphone will include the measurement changes in the sound field caused by the presence of the microphone. The sound being measured is coming from one source at a direction pointing directly at the microphone. Testing of pressure exerted on walls, structures, or pressure exerted on airplane wings are examples of pressure field microphone applications.



Sound Field Measured by a Pressure Microphone

A random incident microphone, also referred to as a "diffuse field" type, is designed to be omni-directional and measure sound pressure coming from multiple directions. The random incident microphone will measure the sound as if it existed before the introduction of the microphone itself into the diffuse field. When taking sound measurements in a church or in a shop with hard, reflective walls, you would utilize this type of microphone.

Dimensions shown are in inches (millimeters).



Sound Field Measured by a Random Incident Microphone

Dynamic Response

Sound pressure level is typically measured in Pascals (Pa). The lowest amplitude that a normal healthy human ear can detect is 20 millionths of a Pascal (20mPa). Since the pressure numbers represented by Pascals are generally very low and not easily managed, another scale was developed and is more commonly used, called the Decibel (dB). The decibel scale is logarithmic and more closely matches the response reactions of the human ear to the pressure fluctuations.

Sound Pressure Level References

0 dB = 0.00002 Pa	Threshold of Hearing
60 dB = 0.02 Pa	Business Office
80 dB = 0.2 Pa	Shop Noise
94 dB = 1 Pa	Large Truck
100 dB = 2 Pa	Jackhammer
120 dB = 20 Pa	Airplane Take-Off
140 dB = 200 Pa	Threshold of Pain

PCB specifies the maximum dynamic range of its microphone cartridges based on allowable harmonic distortion levels and the design and physical characteristics of the microphone. The specified maximum dB level will refer to the point where the diaphragm will approach the backplate. The maximum decibels that a microphone will output in a certain application is dependent upon the voltage supplied, and the particular microphone's sensitivity. In order to calculate the maximum output for a microphone, using a specific preamplifier and its corresponding peak voltage, use the following formulas:

$$\text{Pressure (Pa)} = \frac{\text{Voltage (V)}}{\text{Sensitivity (mV/Pa)}}$$

$$\text{dB} = 20 \log (P/P_0)$$

P = Pressure in Pascals (Pa)

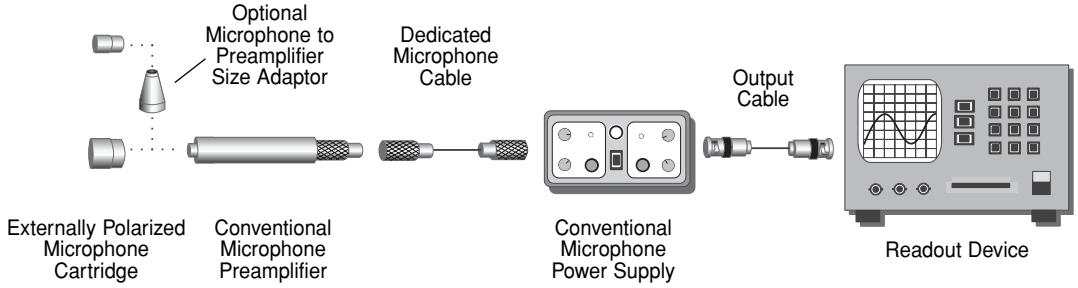
P_0 = Reference Pressure (0.00002 Pa)

Formulas for determining maximum microphone output

ACOUSTIC MEASUREMENT SYSTEMS

There are two types of precision condenser microphones offered by PCB; externally polarized and prepolarized. The cartridge from a condenser microphone operates on basic transduction principles. It transforms the sound pressure into capacitance variations, which are then converted to an electrical signal. This conversion process requires a constant electrical charge (polarization voltage), which is either applied by a by a power supply or built into the microphone. Externally Polarized microphones will differ, when compared to the Prepolarized microphones, in the relationship of how the constant charge of the capacitance between the diaphragm and backplate is applied. Externally Polarized and Prepolarized microphones will each require different components for optimum operation.

Externally polarized microphones are based on a capacitive transduction principle. These high precision condenser microphones require a constant electrical charge for polarization from an external source. This voltage source comes from an external power supply, which ranges from 0V (and can be used with Prepolarized microphones) to 200V. PCB's Externally Polarized microphone set-up requires the use of

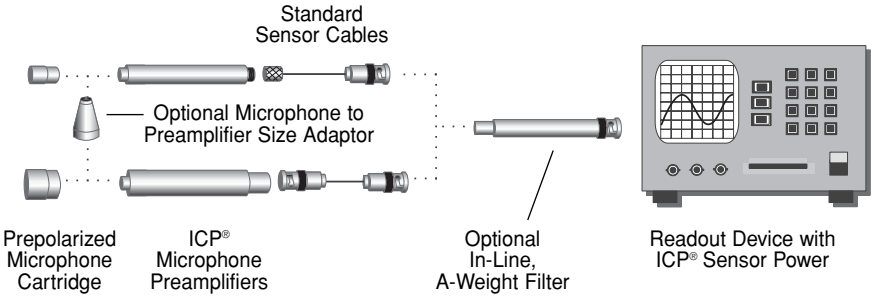


Externally Polarized Microphone System

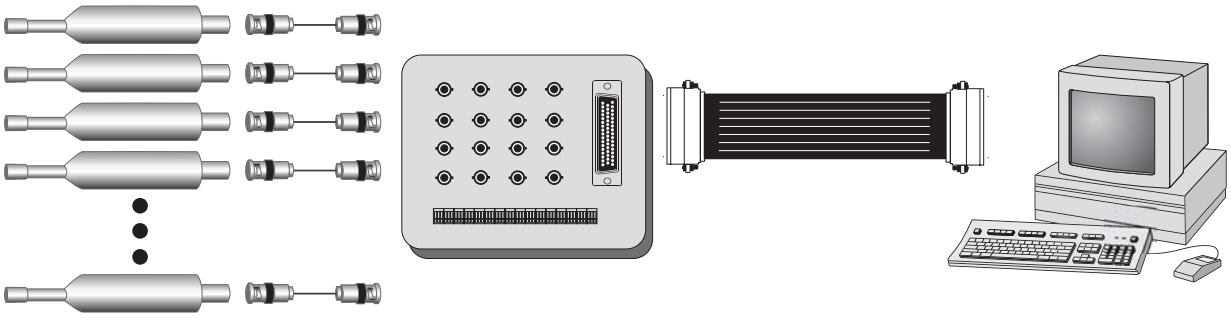
7-conductor cabling with LEMO connectors. Externally polarized microphones are the traditional design, and are still utilized for compatibility reasons.

Prepolarized microphones are also high precision condenser type microphones. The polarization process is accomplished by adding a polymer that is applied to the backplate. This permanently charged polymer contains frozen electrical charges and is commonly referred to as an electret. The prepolarized microphones can be powered by inexpensive and easy-to-operate ICP® sensor power supplies (constant current signal conditioners) or directly powered by a readout device that has constant current power built-in. This enables the owner to use low impedance coaxial cables with BNC or 10-32 microdot connectors (rather than 7 Pin conductor cabling with LEMO connectors), for both current supply and signal to the readout device. This newer design has become very popular in recent years due to its cost savings and ease of use characteristics.

Array microphones are free-field type microphones which are designed to offer a cost effective solution for multiple channel sound measurement. This makes Nearfield Acoustic Holography (NAH) measurements practical. Grids can be constructed to take 2D mapping measurements. The 130D20 and 130D21 have an integrated microphone and preamplifier. The 130 series utilizes the prepolarized microphone design, and are powered by any constant current (2 - 20mA) signal conditioner. Although the 130 series is more sensitive to changes in temperature and less accurate than the 377 series, the 130 series is very accurate for frequency response, ideal for trending, and offer an inexpensive alternative to the 377 series of microphones.



Prepolarized Microphone System



Array Microphone System

Dimensions shown are in inches (millimeters).

TEDS – Transducer Electronic Data Sheet

- **Digital communication enables transducer self identification and retrieval of calibration data**
- **Self-identification organizes multi-channel testing**
- **Saves time and reduces errors**
- **Automatically identify PM data collection points**
- **Standardized for industry compatibility**
- **Stores NIST traceable calibration data**
- **On-board calibration data satisfies ISO & QS 9000 requirements**

SMART SENSORS PROVIDE SELF IDENTIFICATION

TEDS *is a "***T***ransducer* **E***lectronic* **D***ata* **S***heet" embedded in a sensor for the purpose of maintaining critical sensor information, reducing paperwork, providing better management of transducers, reducing user error, and saving time and money.*

Sensors incorporating Transducer Electronic Data Sheet (TEDS) are mixed-mode (analog/digital) sensors that have a built in read/write memory that contains relevant information about the sensor and its use. Also referred to as "smart" transducers or sensors, a portion of the memory is reserved for sensor specifications as defined by the manufacturer while another portion is user definable. Manufacturer information includes manufacturer name, model number, serial number, sensor type, sensitivity, etc. The user can select from dozens of transducer templates that include more sensor specific information and/or test information like channel ID, location, position, direction, tag number, etc.

The mixed-mode design allows the transducer to operate in two different modes. The first is its traditional IEPE (Integrated Circuit Piezoelectric) measurement mode, with its wide bandwidth, wide range, and analog output signal. The second mode is the digital communication mode, which switches the analog circuitry out of the system and passes the transducer's memory content over the same wires used to access the analog output. This enables the additional capability of the TEDS to operate with existing cabling.

The TEDS feature was designed with a "plug-n-play" concept in mind. By containing relevant information that can be accessed digitally, a sensor simply needs to be "plugged into" a system which can digitally read all of the pertinent information about the sensor. This includes NIST traceable calibration data that satisfies ISO 9001 and QS 9000 requirements, which can eliminate the need for maintaining to printed calibration records.

Even though TEDS sensors contain digital information, the basic sensor design and performance is unchanged. It still operates as a standard ICP® sensor and can be used with existing ICP® sensor signal conditioners. In order to access the digital TEDS information however, additional circuitry is required in the signal conditioner or data collector. Since the basic sensor is unchanged, not only are its wide bandwidth, dynamic range, and 2-wire system maintained, but also its cost effectiveness.

Conversions and Useful Formulas

Voltage sensitivity of a charge output piezoelectric sensor:

$$V = \frac{q}{C}$$

V = voltage sensitivity
q = charge sensitivity
C = capacitance of sensor

Voltage sensitivity of a charge output piezoelectric sensor with source follower:

$$V = \frac{q}{c1 + c2 + c3}$$

C_1 = capacitance of sensor

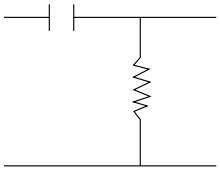
C_2 = capacitance of interconnecting cable

C_3 = input capacitance of unity gain source follower

Time constant for a first order, high pass filter:

$t = RC$

R = resistance in ohms
C = capacitance in farads
t = time constant in seconds



Lower corner frequency (-3 dB) for an RC time constant:

$$f_c = \frac{1}{2 \pi RC}$$

f_c = frequency at which signal is attenuated by -3 dB

Lower -5 % frequency point for an RC time constant:

$$f_{-5\%} = \frac{3}{2 \pi RC}$$

$f_{-5\%}$ = frequency at which signal is attenuated by 5 %

Approximate upper +5 % frequency point for single degree-of-freedom mechanical system:

$$f_{+5\%} = \frac{f_r}{5}$$

$f_{+5\%}$ = frequency at which signal is amplified by 5 %

f_r = natural (resonant) frequency

Approximating two time constants in series for oscillating signals:

$$\frac{(R_1C_1)\,(R_2C_2)}{\sqrt{(R_1C_1)^2 + (R_2C_2)^2}}$$

Approximating two time constants in series for transient inputs lasting up to 10 % of the smaller time constant value:

$$\frac{(R_1C_1)\,(R_2C_2)}{(R_1C_1) + (R_2C_2)}$$

Rise time of a piezoelectric sensor:

$$t_r = \frac{1}{2\, f_r}$$

t_r = rise time

f_r = natural (resonant) frequency of the sensor

Acceleration:

$$\frac{m}{sec^2} = \frac{g}{9.81}$$

Temperature:

$$°C = \frac{(°F\text{-}32)\ 5}{9}$$

Weight:

$$gm = \frac{lb}{453.59}$$

$$gm = \frac{oz}{28.35}$$

Dimensions shown are in inches (millimeters).

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Glossary of Terms

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A-Weighting Filter — A broadband filter used to approximate the loudness level sensitivity of the human ear when listening to pure tones.

Acceleration — The time rate of change of velocity. Typical units are ft/s2, meters/s2, and G's (1G = 32.17 ft/s2 = 9.81 m/s2). Acceleration measurements are usually made with accelerometers.

Accelerometer — Transducer whose output is directly proportional to acceleration. Most commonly use piezoelectric crystals to produce output.

Aliasing — A phenomenon which can occur whenever a signal is not sampled at greater than twice the maximum bandwidth of the signal. Causes high frequency signals to appear at low frequencies. Aliasing is minimized by filtering the signal to a bandwidth less than fi the sample rate. When the signal starts at 0 Hz (baseband signals), *bandwidth* can be exchanged to *maximum frequency* in the definition above.

Alignment — A condition whereby the axes of machine components are either coincident, parallel, or perpendicular, according to design requirements.

Amplification Factor (Synchronous) — A measure of the susceptibility of a rotor to vibration amplitude when rotational speed is equal to the rotor natural frequency (implies a flexible rotor). For imbalance type excitation, synchronous amplification factor is calculated by dividing the amplitude value at the resonant peak by the amplitude value at a speed well above resonance (as determined from a plot of synchronous response vs. rpm).

Amplitude — The magnitude of dynamic motion or vibration. Amplitude is expressed in terms of peak-to-peak, zero-to-peak, or rms. For pure sine waves only, these are related as follows: rms = 0.707 times zero-to-peak; peak-to-peak = 2 times zero-to-peak. DSAs generally read rms for spectral components, and peak for time domain components.

Anti-Aliasing Filter — Most commonly a low-pass filter designed to filter out frequencies higher than fi the sample rate in order to minimize aliasing.

Anti-Friction Bearing — See Rolling Element Bearing.

Asymmetrical Support — Rotor support system that does not provide uniform restraint in all radial directions. This is typical for most heavy industrial machinery where stiffness in one plane may be substantially different than stiffness in the perpendicular plane. Occurs in bearings by design, or from preloads such as gravity or misalignment.

Asynchronous — Vibration components that are not related to rotating speed (also referred to as nonsynchronous).

Attitude Angle (Steady-State) — The angle between the direction of steady-state preload through the bearing centerline, and a line drawn between the shaft centerline and the bearing centerline. (Applies to fluid-film bearings.)

Auto Spectrum (Power Spectrum) — DSA spectrum display whose magnitude represents the power at each frequency, and which has no phase.

Averaging — In a DSA, digitally averaging several measurements to improve accuracy or to reduce the level of asynchronous components. Refer to definitions of rms, time, and peak-hold averaging.

Axial — In the same direction as the shaft centerline.

Axial Position — The average position, or change in position, of a rotor in the axial direction with respect to some fixed reference position. Ideally the reference is a known position within the thrust bearing axial clearance or float zone, and the measurement is made with a displacement transducer observing the thrust collar.

Balancing Resonance Speed(s) — A rotative speed that corresponds to a natural resonance frequency.

Balanced Condition — For rotating machinery, a condition where the shaft geometric centerline coincides with the mass centerline.

Balancing — A procedure for adjusting the radial mass distribution of a rotor so that the mass centerline approaches the rotor geometric centerline.

Band-Pass Filter — A filter with a single transmission band extending from lower to upper cutoff frequencies. The width of the band is normally determined by the separation of frequencies at which amplitude is attenuated by 3 dB (a factor 0.707).

Bandwidth — The distance between frequency limits at which a band-pass filter attenuates the signal by 3 dB. In a DSA, the measurement bandwidth is equal to [(frequency span)/(number of filters) x (window factor)]. Window factors are: 1 for uniform, 1.5 for Hanning, and 3.4 for flat top (P301) and 3.6 for flat top (P401). See flat top for more information.

Baseline Spectrum — A vibration spectrum taken when a machine is in good operating condition; used as a reference for monitoring and analysis.

Blade Passing Frequency — A potential vibration frequency on any bladed machine (turbine, axial compressor, fan, etc.). It is represented by the number of blades times shaft-rotating frequency.

Block Size — The number of samples used in a DSA to compute the Fast Fourier Transform. Also the number of samples in a DSA time display. Most DSAs use a block size of 1024. Smaller block size reduces frequency resolution.

Bode — Rectangular coordinate plot of 1x component amplitude and phase (relative to a keyphasor) vs. running speed.

BPFO, BPFI — Common abbreviations for ball pass frequency of defects on outer and inner bearing races, respectively.

Bow — A shaft condition such that the geometric centerline of the shaft is not straight.

Brinneling (False) — Impressions made by bearing rolling elements on the bearing race; typically caused by external vibration when the shaft is stationary.

Broadband Noise — Unwanted sound that contains multiple frequencies.

Calibration — A test during which known values of the measured variable are applied to the transducer or readout instrument, and output readings varied or adjusted.

Campbell Diagram — A mathematically constructed diagram used to check for coincidence of vibration sources (i.e. 1 x imbalance, 2 x misalignment) with rotor natural resonances. The form of the diagram is like a spectral map (frequency versus rpm), but the amplitude is represented by a rectangular plot, the larger the amplitude the larger the rectangle. Also known as an interference diagram.

Cascade Plot — See Spectral Map.

Cavitation — A condition which can occur in liquid-handling machinery (e.g. centrifugal pumps) where a system pressure decrease in the suction line and pump inlet lowers fluid pressure and vaporization occurs. The result is mixed flow which may produce vibration.

Center Frequency — For a bandpass filter, the center of the transmission band, measured in a linear scale.

Charge Amplifier — Amplifier used to convert accelerometer output impedance from high to low, making calibration much less dependent on cable capacitance.

Coherence — Measures how much of the output signal is dependent on the input signal in a linear and time-invariant way. It is an effective means of determining the similarity of vibration at two locations, giving insight into the possibility of cause and effect relationships.

Condenser Microphone — A high precision measuring device, constructed by forming a capacitor between a thin, flexible diaphragm and a back plate. In conventional microphones a DC voltage is applied externally. In modern (prepolarized) designs, frozen electric charges are contained in a polymer within the microphone cartridge.

Constant Bandwidth Filter — A band-pass filter whose bandwidth is independent of center frequency. The filters simulated digitally by the FFT in a DSA are constant bandwidth.

Constant Percentage Bandwidth — A band-pass filter whose bandwidth is a constant percentage of center frequency. 1/3 octave filters, including those synthesized in DSAs, are constant percentage bandwidth.

Critical Machinery — Machines which are critical to a major part of the plant process. These machines are usually unspared.

Critical Speeds — In general, any rotating speed which is associated with high vibration amplitude. Often, the rotor speeds which correspond to natural frequencies of the system.

Critical Speed Map — A rectangular plot of system natural frequency (y-axis) versus bearing or support stiffness (x-axis).

Cross Axis Sensitivity — A measure of off-axis response of velocity and acceleration transducers.

Cycle — One complete sequence of values of a periodic quantity.

Damping — The quality of a mechanical system that restrains the amplitude of motion with each successive cycle. Damping of shaft motion is provided by oil in bearings, seals, etc. The damping process converts mechanical energy to other forms, usually heat.

Damping, Critical — The smallest amount of damping required to return the system to its equilibrium position without oscillation.

Decibel — A logarithmic value used to commonly describe sound pressure levels.

Decibels (dB) — A logarithmic representation of amplitude ratio, defined as 10 times the base ten logarithm of the ratio of the measured power to a reference. dBV readings, for example, are referenced to 1 volt rms. dB amplitude scales are required to display the full dynamic range of a DSA. dB values for power or voltage measurements yields the same result.

Degrees of Freedom — A phrase used in mechanical vibration to describe the complexity of the system. The number of degrees of freedom is the number of independent variables describing the state of a vibrating system.

Digital Filter — A filter which acts on the data after it has been sampled and digitized. Often used in DSAs to provide anti-aliasing protection before internal re-sampling.

Differentiation — Representation in terms of time rate of change. For example, differentiating velocity yields acceleration. In a DSA, differentiation is performed by multiplication by *jw* in the frequency domain, where w is frequency multiplied by 2p. (Differentiation can also be used to convert displacement to velocity.)

Glossary of Terms

Discharge Time Constant (DTC) — Time required for a sensor or measuring system to discharge its signal to 37% of the original value from a step change of measurand. This time constant directly relates to the low frequency measuring capability for both transient and sinusoidal events. (it should not be confused with rise time, which relates to high frequency response).

Discrete Fourier Transform — A procedure for calculating discrete frequency components (filters or lines) from sampled time data. Since the frequency domain result is complex (i.e., real and imaginary components), the number of frequency points is equal to half the number of time samples (for a real FFT). When using zoom analysis, the FFT uses complex time data and then the number of frequency lines is equal to the number of time samples.

Displacement — The change in distance or position of an object relative to a reference.

Displacement Transducer — A transducer whose output is proportional to the distance between it and the measured object (usually the shaft).

DSA — See Dynamic Signal Analyzer.

Dual Probe — A transducer set consisting of displacement and velocity transducers. Combines measurement of shaft motion relative to the displacement transducer with velocity of the displacement transducer to produce absolute motion of the shaft.

Dual Voting — Concept where two independent inputs are required before action (usually machine shutdown) is taken. Most often used with axial position measurements, where failure of a single transducer might lead to an unnecessary shutdown.

Dynamic Motion — Vibratory motion of a rotor system caused by mechanisms that are active only when the rotor is turning at speeds above slow roll speed.

Dynamic Signal Analyzer (DSA) — Vibration analyzer that uses digital signal processing and the Fast Fourier Transform to display vibration frequency components. DSAs also display the time domain and phase spectrum, and can usually be interfaced to a computer.

Eccentricity, Mechanical — The variation of the outer diameter of a shaft surface when referenced to the true geometric centerline of the shaft. Out-of-roundness.

Eccentricity Ratio — The vector difference between the bearing centerline and the average steady-state journal centerline.

Eddy Current — Electrical current which is generated (and dissipated) in a conductive material in the presence of an electromagnetic field.

Electrical Runout — An error signal that occurs in eddy current displacement measurements when shaft surface conductivity varies.

Engineering Units — In a DSA, refers to units that are calibrated by the user (e.g., in/s, g's).

External Sampling — In a DSA, refers to control of data sampling by a multiplied tachometer signal. Provides a stationary display of rpm-related peaks with changing speed.

Far Field — A region that is located far from the source where the acoustic pressure and particle velocity are essentially in-phase. This permits acoustic intensity to be determined from measurements of acoustic pressure coming from a single source in a reflection-free environment. The distance should be at least equal to the dimensions of the sound source, and at least one wavelength of the frequency of interest.

Fast Fourier Transform (FFT) — A computer (or microprocessor) procedure for calculating discrete frequency components from sampled time data. A special case of the Discrete Fourier Transform, DFT, where the number of samples is constrained to a power of 2 for speed.

Filter — Electronic circuitry designed to pass or reject a specific frequency band.

Finite Element Modeling — A computer aided design technique for predicting the dynamic behavior of a mechanical system prior to construction. Modeling can be used, for example, to predict the natural frequencies of a flexible rotor.

Flat Top Filter — FFT window function which provides the best amplitude accuracy for measuring discrete frequency components. Note: there are several different flat top windows. The HP proprietary P401 is the "best" flat top window. P301 is the most common.

Fluid-Film Bearing — A bearing which supports the shaft on a thin film of oil. The fluid-film layer may be generated by journal rotation (hydrodynamic bearing), or by externally applied pressure (hydrostatic bearing).

Forced Vibration — The oscillation of a system under the action of a forcing function. Typically forced vibration occurs at the frequency of the exciting force.

Free Field — A sound field that does not contain reflections. In this type of field, sound waves travel without disturbance. Outdoor environments or anechoic chambers are examples.

Free Vibration — Vibration of a mechanical system following an initial force - typically at one or more natural frequencies.

Frequency — The repetition rate of a periodic event, usually expressed in cycles per second (Hz), revolutions per minute (rpm), or multiples of a rotational speed (orders). Compare to orders that are commonly referred to as 1x for rotational speed, 2x for twice rotational speed, etc.

Frequency Response Function — The amplitude and phase response characteristics of a system.

Dimensions shown are in inches (millimeters).

G — The value of acceleration produced by the force of gravity.

Gear Mesh Frequency — A potential vibration frequency on any machine that contains gears; equal to the number of teeth multiplied by the rotational frequency of the gear.

Hanning Window — FFT window function that normally provides better frequency resolution than the flat top window, but with reduced amplitude accuracy.

Harmonic — Frequency component at a frequency that is an integer multiple of the fundamental frequency.

Heavy Spot — The angular location of the imbalance vector at a specific lateral location on a shaft. The heavy spot typically does not change with rotational speed.

Hertz (Hz) — The unit of frequency represented by cycles per second.

High Spot — The angular location on the shaft directly under the vibration transducer at the point of closest proximity. The high spot can move with changes in shaft dynamics (e.g., from changes in speed).

High-Pass Filter — A filter with a transmission band starting at a lower cutoff frequency and extending to (theoretically) infinite frequency.

Hysteresis — Non-uniqueness in the relationship between two variables as a parameter increases or decreases. Also called deadband, or that portion of a system's response where a change in input does not produce a change in output.

Imbalance — Unequal radial weight distribution on a rotor system; a shaft condition such that the mass and shaft geometric center lines do not coincide.

Impact Test — Response test where the broad frequency range produced by an impact is used as the stimulus. Sometimes referred to as a bump test. See impulse response for more information.

Impedance, Mechanical — The mechanical properties of a machine system (mass, stiffness, damping) that determine the response to periodic forcing functions.

Impulse Response — The response of a system to an impulse as input signal. The output then produces the impulse response that is the time domain equivalent to the Frequency Response Function, FRF.

Influence Coefficients — Mathematical coefficients that describe the influence of system loading on system deflection.

Integration — A process producing a result that, when differentiated, yields the original quantity. Integration of acceleration, for example, yields velocity. Integration is performed in a DSA by dividing the frequency lines by *j*w, where w is frequency multiplied by 2p. (Integration is also used to convert velocity to displacement.)

Journal — Specific portions of the shaft surface from which rotor applied loads are transmitted to bearing supports.

Keyphasor — A signal used in rotating machinery measurements, generated by a transducer observing a once-per-revolution event. The keyphasor signal is used in phase measurements for analysis and balancing. (Keyphasor is a Bently Nevada trade name.)

Lateral Location — The definition of various points along the shaft axis of rotation.

Lateral Vibration — See Radial Vibration.

Leakage — In DSAs, a result of finite time record length that results in smearing of frequency components. Its effects are greatly reduced by the use of weighted time functions such as Flat top or Hanning windows.

Linearity — The response characteristics of a linear system remain constant with input level and/or excitation signal type. That is, if the response to input a is $k \cdot a$, and the response to input b is $k \cdot b$, then the response of a linear system to input $(a + b)$ will be $(k \cdot a + k \cdot b)$, independent of the function k. An example of a non-linear system is one whose response is limited by mechanical stop, such as occurs when a bearing mount is loose.

Lines — Common term used to describe the filters of a DSA produced by the FFT (e.g., 400 line analyzer).

Linear Averaging — See Time Averaging.

Loudness — a subjective physiological description of the magnitude of an auditory sensation.

Low-Pass Filter — A filter whose transmission band extends from dc to an upper cutoff frequency.

Mechanical Runout — An error in measuring the position of the shaft centerline with a displacement probe that is caused by out-of-roundness and surface imperfections.

Micrometer (MICRON) — One millionth (.000001) of a meter. (1 micron = 1 x E-6 meters @ 0.04 mils.)

Microphone — An electromechanical sensor for measuring acoustical properties. Designed to convert sound pressure level into an electrical output that can be quantified.

MIL — One thousandth (0.001) of an inch. (1 mil = 25.4 microns)

Modal Analysis — The process of breaking complex vibration into its component modes of vibration, very much like frequency domain analysis breaks vibration down to component frequencies.

Mode Shape — The resultant deflected shape of a rotor at a specific rotational speed to an applied forcing function. A three-dimensional presentation of rotor lateral deflection along the shaft axis.

Glossary of Terms

Modulation, Amplitude (AM) — The process where the amplitude of a signal is varied as a function of the instantaneous value of a another signal. The first signal is called the carrier, and the second signal is called the modulating signal. Amplitude modulation always produces a component at the carrier frequency, with components (sidebands) at the frequency of the carrier frequency plus minus the modulating signal.

Modulation, Frequency (FM) — The process where the frequency of the carrier is determined by the amplitude of the modulating signal. Frequency modulation produces a component at the carrier frequency, with adjacent components (sidebands) at frequencies around the carrier frequency related to the modulating signal. The carrier and sidebands are described by Bessel functions.

Natural Frequency — The frequency of free vibration of a system. The frequency at which an undamped system with a single degree of freedom will oscillate upon momentary displacement from its rest position.

Near Field — The region near a complex sound source where the acoustic pressure and particle velocity are not in phase.

Nodal Point — A point of minimum shaft deflection in a specific mode shape. May readily change location along the shaft axis due to changes in residual imbalance or other forcing function, or change in restraint such as increased bearing clearance.

Noise (1) A subjected characteristic of sound waves that is not desirable. Unwanted sound is considered noise.

(2) Any component of a transducer output signal that does not represent the variable intended to be measured.

Nyquist Criterion — Requirement that a sampled system needs to be sampled at a frequency greater than twice the bandwidth of the signal to be sampled.

Nyquist Plot — A plot of real versus imaginary spectral components that is often used in servo analysis. Should not be confused with a polar plot of amplitude and phase of 1x vibration.

Octave — The interval between two frequencies with a ratio of 2 to 1. A doubling of frequency.

Octave Filter — A band pass filter having an equal bandwidth of its center frequency. Most common octave filters are the 1/1 octave filter containing 11 bands, and the 1/3 octave filter containing 32 bands.

Oil Whirl/Whip — An unstable free vibration whereby a fluid-film bearing has insufficient unit loading. Under this condition, the shaft centerline dynamic motion is usually circular in the direction of rotation. Oil whirl occurs at the oil flow velocity within the bearing, usually 40 to 49% of shaft speed. Oil whip occurs when the whirl frequency coincides with (and becomes locked to) a shaft resonant frequency. (Oil whirl and whip can occur in any case where fluid is between two cylindrical surfaces.)

Orbit — The path of the shaft centerline motion during rotation. The orbit is observed with an oscilloscope connected to x and y-axis displacement transducers. Some dual-channel DSAs also have the ability to display orbits.

Oscillator-Demodulator — A signal conditioning device that sends a radio frequency signal to an eddy-current displacement probe, demodulates the probe output, and provides output signals proportional to both the average and dynamic gap distances. (Also referred to as Proximitor, a Bently Nevada trade name.)

Peak Hold — In a DSA, a type of averaging that holds the peak signal level for each frequency component.

Period — The time required for a complete oscillation or for a single cycle of events. The reciprocal of frequency.

Phase — A measurement of the timing relationship between two signals, or between a specific vibration event and a keyphasor pulse. Phase is often measured as a function of frequency.

Piezoelectric — Any material which provides a conversion between mechanical and electrical energy. For a piezoelectric crystal, if mechanical stresses are applied on two opposite faces, electrical charges appear on some other pair of faces.

Pink Noise — Pink noise has equal energy in each octave band. Its energy is equal to 1/f, which describes a -dB/octave response.

Polar Plot — Polar coordinate representation of the locus of the 1x vector at a specific lateral shaft location with the shaft rotational speed as a parameter.

Power Spectrum — See Auto Spectrum.

Preload, Bearing — The dimensionless quantity that is typically expressed as a number from zero to one where a preload of zero indicates no bearing load upon the shaft, and one indicates the maximum preload (i.e., line contact between shaft and bearing).

Preload, External — Any of several mechanisms that can externally load a bearing. This includes “soft” preloads such as process fluids or gravitational forces as well as “hard” preloads from gear contact forces, misalignment, rubs, etc.

Pressure Field — An area that is small compared to its corresponding wavelength. In this field type, the sound pressure being measured should have the same magnitude and phase at any point. You will find pressure fields in enclosures, cavities, calibrators, pistonphones or other small chambers.

Proximitor — See Oscillator/Demodulator.

Pure Tone — A sound that contains a single frequency.

Radial — Direction perpendicular to the shaft centerline.

Radial Position — The average location, relative to the radial bearing centerline, of the shaft dynamic motion.

Dimensions shown are in inches (millimeters).

Radial Vibration — Shaft dynamic motion or casing vibration which is in a direction perpendicular to the shaft centerline.

Random Incidence Field — Sound arriving from multiple directions simultaneously with equal level. Also referred to as a diffuse field. An area that contains reflective surfaces which produce reverberation. Halls, churches and factories with hard walls will produce this type of field.

Real-Time Analyzer — See Dynamic Signal Analyzer.

Real-Time Rate — For a DSA, the broadest frequency span at which data is sampled continuously. Real-time rate is mostly dependent on FFT processing speed. If the definition of real-time rate is "not miss any data", the real-time rate will be window dependent. The real-time rate will decrease when using any other window than uniform.

Rectangular Window — See Uniform Window.

Reference Sound Pressure — The minimal amount of sound that a healthy human ear can detect. Quantified as 20 micro Pascals (20mPa). Used for the logarithmic conversion of pascals to decibals.

Relative Motion — Vibration measured relative to a chosen reference. Displacement transducers generally measure shaft motion relative to the transducer mounting.

Repeatability — The ability of a transducer or readout instrument to reproduce readings when the same input is applied repeatedly.

Resolution — The smallest change in stimulus that will produce a detectable change in the instrument output.

Resonance — The condition of vibration amplitude and phase change response caused by a corresponding system sensitivity to a particular forcing frequency. A resonance is typically identified by a substantial amplitude increase, and related phase shift.

Rolling Element Bearing — Bearing whose low friction qualities derive from rolling elements (balls or rollers), with little lubrication.

Root Mean Square (rms) — Square root of the arithmetical average of a set of squared instantaneous values. DSAs perform rms averaging digitally on successive vibration spectra, frequency line by frequency line.

Rotor, Flexible — A rotor which operates close enough to, or beyond its first bending critical speed for dynamic effects to influence rotor deformations. Rotors which cannot be classified as rigid rotors are considered to be flexible rotors.

Rotor, Rigid — A rotor which operates substantially below its first bending critical speed. A rigid rotor can be brought into, and will remain in, a state of satisfactory balance at all operating speeds when balanced on any two arbitrarily selected correction planes.

Runout Compensation — Electronic correction of a transducer output signal for the error resulting from slow roll runout.

Seismic — Refers to an inertially referenced measurement or a measurement relative to free space.

Seismic Transducer — A transducer that is mounted on the case or housing of a machine and measures casing vibration relative to free space. Accelerometers and velocity transducers are seismic.

Signal Conditioner — A device placed between a signal source and a readout instrument to change the signal and/or bandwidth. Examples: attenuators, preamplifiers, charge amplifiers, filters.

Signature — Term usually applied to the vibration frequency spectrum which is distinctive and special to a machine or component, system or subsystem at a specific point in time, under specific machine operating conditions, etc. Used for historical comparison of mechanical condition over the operating life of the machine.

Slow Roll Speed — Low rotative speed at which dynamic motion effects from forces such as imbalance are negligible.

Sound Pressure — The physical characteristic of sound that can be measured by microphones. Typically measured in decibels, pascals, newtons per square meter, or pounds per square inch (psi).

Spectral Map — A three-dimensional plot of the vibration amplitude spectrum versus another variable, usually time or rpm.

Spectrum Analyzer — An instrument which displays the frequency spectrum of an input signal.

Stiffness — The spring-like quality of mechanical and hydraulic elements to elasticity deform under load.

Strain — The physical deformation, deflection, or change in length resulting from stress (force per unit area).

Subharmonic — Sinusoidal quantity of a frequency that is an integral submultiple of a fundamental frequency.

Subsynchronous — Component(s) of a vibration signal which has a frequency less than shaft rotative frequency.

Synchronous Sampling — In a DSA, it refers to the control of the effective sampling rate of data; which includes the processes of external sampling and computed resampling used in order tracking.

Temperature Coefficient — The percentage change in the sensitivity of a sensor as a result of a unit change in the operating temperature of the sensor; expressed as a percent per degree: i.e., %/°F of %/°C.

Time Averaging — In a DSA, averaging of time records that results in reduction of asynchronous components with reference to the trigger.

Time Record — In a DSA, the sampled time data converted to the frequency domain by the FFT. Most DSAs use a time record of 1024 samples.

Torsional Vibration — Amplitude modulation of torque measured in degrees peak-to-peak referenced to the axis of shaft rotation.

Tracking Filter — A low-pass or band-pass filter which automatically tracks the input signal versus the rpm. A tracking filter is usually required for aliasing protection when data sampling is controlled externally.

Transducer — A device for translating the magnitude of one quantity into another quantity.

Transient Vibration — Temporarily sustained vibration of a mechanical system. It may consist of forced or free vibration or both. Typically this is associated with changes in machine operating condition such as speed, load, etc.

Transverse Sensitivity — See Cross-Axis Sensitivity.

Trigger — Any event which can be used as a timing reference. In a DSA, a trigger can be used to initiate a measurement.

Unbalance — See Imbalance.

Uniform Window — In a DSA, a window function with uniform weighting across the time record. This window does not protect against leakage, and should be used only with transient signals contained completely within the time record.

Vector — A quantity which has both magnitude and direction (phase).

Waterfall Plot — See Spectral Map.

Wavelength — The distance from one pressure peak to the next corresponding pressure peak. Derived by dividing the speed of sound by a frequency. The lower the frequency, the larger its wavelength.

White Noise — Unwanted sound that contains spectral properties that are the same for all frequencies, given that the same bandwidth is used for all frequencies.

Dimensions shown are in inches (millimeters).

Vibration Application Inquiry Form

The vibration sensors listed in this catalog represent our most popular sensors, which are only a fraction of the sensors we offer. In addition to our standard sensors, PCB can customize sensors to meet your specific needs. Please fill out this inquiry form with any information available to you, so that we may help you with your dynamic measurement application. If you would like to discuss your application, or if it is not listed, please call, fax, E-mail, or write to PCB for suggestions.

Name: _____ Date: _____

Company: _____ Phone: _____ Ext.: _____

Dept.: _____ Fax: _____

Address: _____ City/State: _____ Zip _____

1. NATURE OF REQUEST

❑ Inquiry ❑ Order ❑ Quotation ❑ Delivery Information ❑ Complaint ❑ Trouble with Equipment
❑ Service or Repair ❑ Equipment Operation ❑ Visit required from PCB or Sales Representative in your area

2. DESCRIBE THE APPLICATION (check all that apply)

INDUSTRY

❑ Aerospace
❑ Pulp and Paper
❑ Power Plant
❑ Military
❑ Automotive
❑ Laboratory Research
❑ Microelectronics
❑ Civil Engineering
❑ Other

MEASUREMENT TYPE

❑ Balancing
❑ ESS
❑ Shock
❑ Diagnostic Testing
❑ Seismic
❑ Trend Analysis
❑ Predictive Maintenance
❑ Modal Analysis
❑ High Frequency Testing
❑ Vibration Control
❑ Vibration Isolation
❑ Other

3. PHYSICAL

Physical Design: ❑ Single-Axis Accelerometer ❑ Triaxial Accelerometer ❑ Thru-Hole or Ring-Type Accelerometer

Desired Characteristics:

Sensitivity _____ mV/g or _____ pC/g

Frequency Range _____ to _____ Hz (within ± _____ %) or (± _____ dB)

Resonance Frequency _____ kHz

Maximum Weight _____ grams

Size Limitation H _____, L _____, W _____; or _____ Diameter

4. DYNAMIC

What is the approximate vibration amplitude level to be measured? _____ g peak, _____ m/s^2 peak

What is the maximum vibration amplitude expected to be present? _____ g peak, _____ m/s^2 peak

What is the desired resolution? _____ g peak or rms _____

What is the maximum frequency of interest? _____ Hz or _____ CPM

What is the minimum frequency of interest? _____ Hz or _____ CPM

5. MECHANICAL AND ENVIRONMENTAL

Continuous operating temperature range (min. to max.): _____ to _____ °C, to _____ °F

Will the temperature be cycling? _____ If yes, at what cycling profile? _____

What is the storage temperature? _____ °C, _____ °F

Are high amplitude mechanical signals present? _____

What is the highest shock level expected to be present? _____ g peak

Describe in detail, operating environment _____

Vibration Application Inquiry Form

6. CABLING AND MOUNTING

Electrical Connection Location: ❑ Axial (Top) Exit ❑ Radial (Side) Exit

Connector Type: ❑ Military Style ❑ 10-32 ❑ 5-44 ❑ Integral Cable ❑ Four-Pin ❑ Other _____

Cable Type: ❑ Coaxial Cable ❑ Two-Conductor Shielded ❑ Twisted Pair ❑ Other _____

Other Cable Requirements _____

Mounting Type: ❑ Removable Stud ❑ Integral Stud ❑ Captive Bolt ❑ Adhesive ❑ Magnetic Base ❑ Other_____

Thread Size: ❑ 5-40 ❑ 10-32 UNF ❑ 1/4 -28 UNF ❑ Other _____

7. ELECTRICAL

What is the readout device? ❑ A to D ❑ Scope ❑ Other (specify) _____

What is the input impedance of the readout device (if applicable)? _____

Can the readout device supply 24 to 27 VDC and 2 to 20 mA excitation to sensor? _____

What kind of signal conditioner would you like? Single channel _____ Multiple channel _____ How many? _____

What cable lengths will be driven? Cable length _____ ft, _____ m Cable Capacitance _____ pF/ft, _____ pF/m

Will the cable be near electromagnetic interference sources (i.e., AC power lines, radio equipment, motors, and generators)?

Describe: _____

Is the sensor or cable located near areas prone to electrostatic discharges? _____

Should the sensor be: ❑ Ground-Isolated ❑ Case-Isolated

8. OTHER SPECIFIC REQUESTS OR REQUIREMENTS

_____

_____

_____

_____

_____

For Shock Applications, Please complete the following:

9. SHOCK ACCELEROMETERS APPLICATION SPECIFICS

What is the pulse duration? _____

What is the pulse shape? ❑ Half sine ❑ Square ❑ Other (specify) _____

Is the event repetitive? ❑ Yes ❑ No

If yes, time between events _____

Is the shock caused by ❑ Pyro ❑ Metal to metal ❑ Other (specify) _____

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Dimensions shown are in inches (millimeters).

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Sound level measurements
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Crash testing
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Drop testing
Electric motor testing
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Force press monitoring
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Stamping operations monitoring
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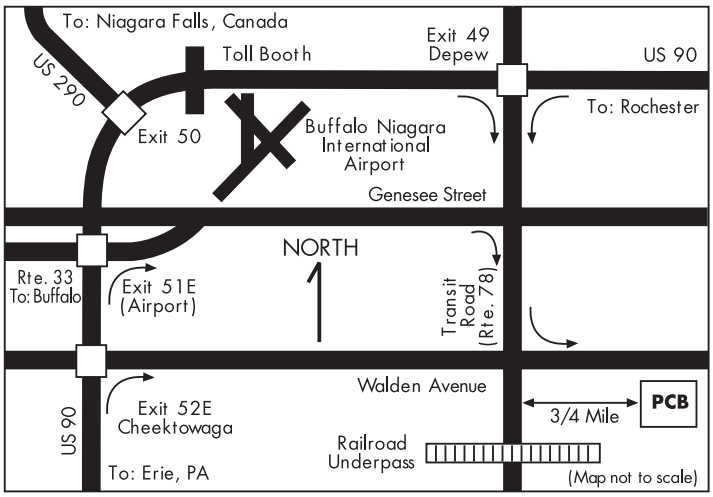

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