



S E R I E S 3 9 9 1

MEMS HIGH-G SHOCK ACCELEROMETERS

- Titanium housing and OEM configuration available
- Slight damping reduces resonance amplification
- Mechanical over-range stops improve survivability
- Wide band frequency response
- Low power consumption
- Low warm-up drift



TYPICAL APPLICATIONS

- Safe and Arm
- Smart Fuzes
- Weapons Data Recorders
- Explosive Environments (pyroshock)
- Metal-to-metal Impact
- Blast Loading of Structures / Blast Survivability

STATE-OF-THE-ART MEMS DESIGN AND FABRICATION

Series 3991 MEMS high-amplitude shock accelerometers from PCB Piezotronics (PCB®), represent state-of-the-art industry technology for miniature, high amplitude, DC response acceleration sensors. This series is capable of measuring long duration transient motion, as well as, responding to and surviving extremely fast rise times, typical of a high-G shock event. Both a packaged and an OEM configuration are offered, to fulfill a variety of installation requirements.

The air-damped acceleration sensing element, is micromachined from silicon, is manufactured with the latest advances in etching techniques and equipment. This tiny element measures just 2.5 x 1.7 x 0.9 mm (L x W x H), and incorporates a seismic mass, protective over-range stops and a full-active, piezoresistive Wheatstone bridge.

Series 3991 is intended to fulfill the most demanding aerospace and defense application requirements. Their design concepts were born from more than 20 years of PCB® expertise in very high-G shock (≥ 20000 G) measurement applications and sensor development. Our design team has the most experience in the world for these applications. Our process engineers utilized the latest and most sophisticated techniques and equipment to achieve the desired performance levels that previously have not been attainable.

As with all PCB® instrumentation, these sensors are complemented with toll-free applications assistance, 24-hour customer service and are backed by our Total Customer Satisfaction no risk policy.



| MEMS HIGH-AMPLITUDE SHOCK ACCELEROMETERS | | | |
|-------------------------------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| Model Number | 3991B112KG | 3991B1120KG | 3991B1160KG |
| Environmental | | | |
| Sensitivity (10VDC excitation) | 0.020 mV/g | 0.010 mV/g | 0.003 mV/g |
| Sensitivity | 0.02 mV/V/g | 0.001 mV/V/g | 0.0003 mV/V/g |
| Measurement Range | ± 0 to 2000 g | ± 0 to 20000 g | ± 0 to 60000 g |
| Frequency Range (± 1 db) | 10 kHz | 10 kHz | 20 kHz |
| Resonant Frequency | > 20k Hz | > 60k Hz | > 120k Hz |
| Overload Limit (Shock) | ± 10000 g pk | ± 60000 g pk | ± 100000 g pk |
| Overload Limit (Mechanical Stops) | ≥ 2.2 kg | ≥ 30 kg | ≥ 80 kg |
| 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 |
| Excitation Voltage (Typical) | 10 VDC | 10 VDC | 10 VDC |
| Excitation Voltage | 3.3 to 15 VDC | 3.3 to 15 VDC | 3.3 to 15 VDC |
| Bridge Resistance ($\pm 2k$ ohms) | 2k ohms | 6k ohms | 6k ohms |
| Physical | | | |
| Size (Height x Length x Width) | 0.11 x 0.56 x 0.28 in (2.79 x 14.22 x 7.11 mm) | 0.11 x 0.56 x 0.28 in (2.79 x 14.22 x 7.11 mm) | 0.11 x 0.56 x 0.28 in (2.79 x 14.22 x 7.11 mm) |
| Weight | 0.045 oz (1.28 gm) | 0.045 oz (1.28 gm) | 0.045 oz (1.28 gm) |
| Mounting | (2) Through-holes / Screws | (2) Through-holes / Screws | (2) Through-holes / Screws |
| Housing | Titanium | Titanium | Titanium |
| Cable Length | 10 ft (3 m) | 10 ft (3 m) | 10 ft (3 m) |
| Electrical Connection | 034 FEP, Integral Cable | 034 FEP, Integral Cable | 034 FEP, Integral Cable |
| Cable Termination | Pigtails | Pigtails | Pigtails |
| Supplied Accessories | | | |
| Mounting Screw | (2) Model 081A110 (4-40 x 1/4" SHCS) | (2) Model 081A110 (4-40 x 1/4" SHCS) | (2) Model 081A110 (4-40 x 1/4" SHCS) |
| Calibration Certificate | ACS-62 Shock Calibration | ACS-62 Shock Calibration | ACS-62 Shock Calibration |



Model 080A213

Triaxial mounting block for Model 3991B11XXKG (Screw 080A110)



LN Mini 8-Pin DIN Connector

Bridge input mating connector

MODEL NUMBERING SYSTEM FOR SERIES 3991 HIGH-AMPLITUDE SHOCK ACCELEROMETERS

1) Single Axis Series 3991

| | | | | | |
|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------|
| 3991B | Single axis, MEMS DC response shock accelerometer (revision A) | | | | |
| 2) Configurations | | | | | |
| | 11 | Titanium housing, 10 ft (3m) integral cable, 4 conductor FEP cable, terminating in pigtails, two through-bolt mounting holes | | | |
| 3) Measurement Range | | | | | |
| | | 2KG 20KG 60KG | ±2000 G ±20000 G ±60000 G | | |
| 4) Integral Cable Length (add only if selecting integral cable and other than standard length shown above) | | | | | |
| | | / XXX | Specify XXX as desired in feet | | |
| 5) Cable Termination (add only if selecting integral cable with other than pigtail connection) | | | | | |
| | | LN | Mini 8-pin DIN connector | | |
| | | AY | 4-pin plug | | |
| Examples | | | | | |
| 3991B | 11 | 60KG | /020 | LN | Single axis, titanium housing, integral 4 conductor FEP cable, 60000 G range with 20 ft (6.1m) cable terminating with Mini 8-Pin DIN connector |



Typical Rear Panel

| MEMS SENSOR SIGNAL CONDITIONER | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------|
| Model Number | 482C27 |
| Channels | 4 |
| Sensor Input Types | Differential/Single-ended MEMS/Bridge, ICP®/Voltage |
| Compatible Sensor Series | 350X, 360X, 371X, 374X, 3991, load cells |
| Gain | x0.1 to x2000; x0.1 to x200 [1] |
| Gain Increment | 0.1 |
| Output Range | ±10 V |
| Frequency Response | DC to 100k Hz (-3dB) |
| Temperature Range (Operating) | +32 to +122 °F 0 to +50 °C |
| Excitation Voltage | 0 to 12 VDC unipolar or bipolar [2] |
| Computer Controller | Ethernet/RS-232 |
| Power Required | 9 to 18 VDC [3] |
| Input Connectors | (4) 8-socket mini DIN, (4) BNC Jacks |
| Output Connectors | BNC Jacks |
| Size (Height x Width x Depth) | 3.2 in x 8.0 in x 5.9 in 8.1 cm x 20 cm x 15 cm |
| Weight | 2.25 lb (1.021 kg) |
| Supplied Accessories | |
| (1) 017AXX Power Cord; (1) 488A14 Universal Power Adaptor; (1) MCSC Control Software | |
| Additional Accessories | |
| Auto Lighter Adaptor | 488A13t |
| Input Mating Connector(s) | 8-pin mini DIN, AC |
| Additional Versions | |
| 8-channel 19" rack mount version, computer control only | 483C28 |
| Notes | |
| [1] Maximum gain for bridge/MEMS input is x2000 and for ICP®/voltage input is x200. | |
| [2] In bipolar mode, +Vexc and -Vexc track each other. They are equal and opposite. | |
| [3] Supplied with 85 to 264 VAC, 47 to 400 Hz Universal Power Adaptor. | |

The Model 482C27 four-channel, benchtop signal conditioner is fullfeatured and cost effective. It offers low noise operation and simplicity of use. Each channel is selectable between two input types: Bridge/MEMS or ICP®/Voltage.

For the bridge inputs, this model offers 0 to 12 VDC unipolar or bipolar excitation voltage for use with single-ended or differential MEMS and bridge sensors, like load cells and reaction torque sensors. This model features incremental gain of x0.1 to x2000, auto zero, auto balance, AC/ DC coupling, normalization, and shunt calibration. The bridge inputs are compatible with full bridge sensors as well as 1/2 and 1/4 bridge sensors, with internal switchable bridge completion resistors.

For the ICP® inputs, the model offers 0 to 20 mA of constant current excitation, to power ICP® sensors or in-line ICP® charge converters. This model features incremental gain of x.1 to x200, normalization and AC/DC coupling.

The base unit of this model is powered from 9 to 18 VDC, however, it is supplied with a universal voltage, AC power adaptor. Optional auto lighter adaptor, Model 488A13, is also available.



Model 483C28

8-channel version, computer control only



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PCB Piezotronics, Inc. is a designer and manufacturer of microphones, vibration, pressure, force, torque, load, and strain sensors, as well as the pioneer of ICP® technology used by design engineers and predictive maintenance professionals worldwide for test, measurement, monitoring, and control requirements in automotive, aerospace, industrial, R&D, military, educational, commercial, OEM applications, and more. With a worldwide customer support team, 24-hour SensorLineSM, and a global distribution network, PCB® is committed to Total Customer Satisfaction. Visit www.pcb.com for more information. PCB Piezotronics, Inc. is a wholly owned subsidiary of MTS Systems Corporation. Additional information on MTS can be found at www.mts.com.

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