Miniature PiezoBeam® Accelerometer

Lightweight, IEPE Triaxial TEDS Accelerometer

Type 8688A is a high sensitivity triaxial accelerometer that simultaneously measures vibration in three orthogonal axes. The sensor is designed primarily for modal analysis applications and offers selective use as a general purpose vibration sensor.

- IEPE, ±5 g, ±10 g, and ±50 g ranges
- Smallest PiezoBeam® triaxial accelerometer with lowest mass
- Low cost, miniature and lightweight triaxial
- High sensitivity, low noise and high dynamic range
- Choice of ranges and sensitivities
- Ground isolated mounts
- TEDS option
- Conforming to CE

Description

Internal to the PiezoBeam accelerometer is a unique sensing element consisting of a ceramic beam supported by a center post that, when bending occurs as a result of being subjected to vibration, the cantilevered beam element yields an electrical charge. The charge signal is converted by the internal low noise charge amplifier to a proportional high level voltage signal at an output impedance of less than 500 ohms. Patented methods are used to thermally compensate the sensing element.

Type 8688A is a miniature and lightweight triaxial accelerometer that reduces mass loading on thin-walled structures important to multi-channel modal applications or general vibration measurements.

Type 8688A triaxial accelerometers, have an integral 4 pin connector and is designed for easy installation in confined areas where sensor may be mounted on any of three faces. Type 8688A has welded titanium housing and is ground isolated when mounted with the mounting clip or adhesive mounting adapter. The sensing element design provides outstanding amplitude and phase response over a wide frequency range.

The accelerometer operates directly from the internal power source found in most FFT analyzers, from several Kistler Piezotron® power supply couplers or any industry standard IEPE (Integrated Electronic Piezo Electric) compatible power source.

Application

This miniature and lightweight triaxial accelerometer series is ideally suited for multiple channel modal analysis on small components or subsystems, as well as full vehicle testing for aviation, space, automotive and a wide range of general test structures.

NOTE: Requires a thermally stable environment. Slight temperature fluctuations may cause high thermal transient output or error.

Accessing TEDS Data

 Accelerometers with a “T” suffix are variants of the standard version incorporating the “Smart Sensor” design (PiezoSmart®). Viewing an accelerometer’s data sheet requires an Interface/Coupler, such as Kistler LabAmp Type 5165A... The interface operates per the Class 1 MMI defined in IEEE 1541.4, altering the operating mode of the PiezoSmart® sensor while allowing the program editor software to read or add information contained in the memory chip.
## Technical Data

<table>
<thead>
<tr>
<th>Type Number</th>
<th>Unit</th>
<th>8688A5 / 8688A5T</th>
<th>8688A10 / 8688A10T</th>
<th>8688A50 / 8688A50T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration range</td>
<td>g</td>
<td>±5</td>
<td>±10</td>
<td>±50</td>
</tr>
<tr>
<td>Acceleration limit</td>
<td>g&lt;sub&gt;peak&lt;/sub&gt;</td>
<td>±8</td>
<td>±16</td>
<td>±80</td>
</tr>
<tr>
<td>Threshold (1 ... 10 kHz)</td>
<td>g&lt;sub&gt;ref&lt;/sub&gt;</td>
<td>0.00014</td>
<td>0.00016</td>
<td>0.00036</td>
</tr>
<tr>
<td>Sensitivity (±10 %)</td>
<td>mV/g</td>
<td>1000</td>
<td>500</td>
<td>100</td>
</tr>
<tr>
<td>Resonant frequency mounted, nom.</td>
<td>kHz</td>
<td>15</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Frequency response (±5 %)</td>
<td>Hz</td>
<td>0.5 ... 3000</td>
<td>0.5 ... 3000</td>
<td>0.5 ... 5000</td>
</tr>
<tr>
<td>Phase shift &lt;5 °</td>
<td>Hz</td>
<td>2 ... 3000</td>
<td>2 ... 3000</td>
<td>2 ... 5000</td>
</tr>
<tr>
<td>Amplitude non-linearity</td>
<td>% FSO</td>
<td>±1</td>
<td>±1</td>
<td>±1</td>
</tr>
<tr>
<td>Time constant nom.</td>
<td>s</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Transverse sensitivity typ. (max. 3)</td>
<td>%</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### Environmental

| Base strain sensitivity @ 250 µε | g/µε | 0.004 | 0.004 | 0.004 |
| Random vibration max. | g<sub>ref</sub> | 50 | 50 | 100 |
| Shock limit (1 ms pulse) | g<sub>peak</sub> | 7000 | 7000 | 10000 |
| Temperature coeff. of sensitivity | %/°C | 0.17 [0.09] | 0.23 [0.13] | 0.23 [0.13] |
| Operating temperature range | °C | –40 ... 55 [-40 ... 130] | –40 ... 65 [-40 ... 150] | –40 ... 65 [-40 ... 150] |

### Output

| Bias nom. | VDC | 13 | 13 | 13 |
| Impedance | Ω | <100 | <100 | <100 |
| Voltage full-scale ** | V | ±5 | ±5 | ±5 |

### Power supply *

| Voltage ** | VDC | 22 ... 30 | 22 ... 30 | 22 ... 30 |
| Constant current | mA | 2 ... 6 | 2 ... 6 | 2 ... 6 |

### Construction

| Sensing element type | PiezoBeam | PiezoBeam | PiezoBeam |
| Housing/base material | Titanium | Titanium | Titanium |
| Sealing-housing/connector (EN 60529) type | Hermetic | Hermetic | Hermetic |
| Connector type | ¼–28, 4 pin pos. | ¼–28, 4 pin pos. | ¼–28, 4 pin pos. |
| Ground isolated | with accessory | with accessory | with accessory |
| Mass | grams | 6.7 | 6.7 | 6.5 |
| Mounting type | wax, adhesive, clip, magnet, stud (10-32 UNF-2B) | wax, adhesive, clip, magnet, stud (10-32 UNF-2B) | wax, adhesive, clip, magnet, stud (10-32 UNF-2B) |
| Mounting torque | N·m [in-lbf] | 0.7 [6.2] | 0.7 [6.2] | 0.7 [6.2] |

* If a Data Acquisition System (DAQ) is used, it must allow an input voltage greater than or equal to the minimum power supply voltage.

** A power supply voltage of less than the minimum recommended voltage will decrease sensor range (i.e. clipping).

1 g = 9.80665 m/s², 1 in = 25.4 mm, 1 Gram = 0.03527 oz, 1 lbf-in = 0.113 N·m
Mounting
The cube-shaped configuration of the triaxial accelerometer allows for the sensor to be attached to the test surface using any available side with wax, adhesive and/or tape. The off-ground mounting clip can be used in three sensor orientations for mounting flexibility. The primary mounting surface also has a 10-32 UNF threaded hole which is compatible with ground isolated screw-on mounting accessories. Namely, an adhesive mounting base and a magnetic mounting base. The specified frequency response is unaffected when the adhesive mounting base or magnetic mounting base is used. When the ground isolated mounting clip is used, the upper frequency limits are as follows:

- Without grease: 1 kHz (±5 %) for all ranges
- With grease: 3 kHz (±5 %) for 5 g and 10 g ranges
- With grease: 4 kHz (±5 %) for the 50 g range

Reliable and accurate measurements require that the mounting surface be clean and flat. The instruction manual for the Type 8688A... series provides detailed information regarding mounting surface preparation.

Fig. 1: Mounting accessories

Accessories Included
- Ground isolated mounting clip
- Ground isolated adhesive mounting clip
- Mounting wax

Optional Accessories
- Magnetic mounting base

Optional Cables
- Fluoropolymer jacketed breakout cable, ¼–28 4 pin (neg.) to 3x BNC (pos.) (xx = length: 3, 5, or 10 meters – For other special length requests use 1756CK04sp)
- Flexible silicone jacketed breakout cable – ¼–28 4 pin (neg.) to 3x BNC (pos.); (xx = length: 1, 3, 5, or 10 meters)

Ordering Key

| Measuring range | Type 8688A...
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>±5 g</td>
<td>5</td>
</tr>
<tr>
<td>±10 g</td>
<td>10</td>
</tr>
<tr>
<td>±50 g</td>
<td>50</td>
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</table>

TEDS Templates / Variants

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>Standard</td>
</tr>
<tr>
<td>T</td>
<td>Default IEEE 1451.4 V0.9 Template 0 (UTID 1)</td>
</tr>
<tr>
<td>T01</td>
<td>IEEE 1451.4 V0.9 Template 24 (UTID 116225)</td>
</tr>
<tr>
<td>T02</td>
<td>LMS Template 117, Free format Point ID</td>
</tr>
<tr>
<td>T03</td>
<td>LMS Template 118, Automotive Format (Field 14 Geometry = 0)</td>
</tr>
<tr>
<td>T04</td>
<td>LMS Template 118, Aerospace Format (Field 14 Geometry = 1)</td>
</tr>
<tr>
<td>T05</td>
<td>P1451.4 V1.0 Template 25 – Transfer Function Disabled</td>
</tr>
<tr>
<td>T06</td>
<td>P1451.4 V1.0 Template 25 – Transfer Function Enabled</td>
</tr>
</tbody>
</table>
Measuring Chains

IEPE Sensor and Customer IEPE Compatible DAQ

<table>
<thead>
<tr>
<th>Measuring</th>
<th>Connecting</th>
<th>Amplifying</th>
<th>Acquiring</th>
<th>Analyzing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types 8688...</td>
<td>Type 1756B... or Type 1734A... (4 pin neg. to 3x BNC pos.)</td>
<td></td>
<td>IEPE Compatible Data Acquisition Unit (customer supplied)</td>
<td>Laptop (customer supplied)</td>
</tr>
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</table>

IEPE Sensor and Kistler LabAmp

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<th>Analyzing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types 8688...</td>
<td>Type 1756B... or Type 1734A... (4 pin neg. to 3x BNC pos.)</td>
<td>Type 5165A... Conditioning and Data Acquisition</td>
<td>Ethernet Cable</td>
<td>Notebook with LabAmp GUI</td>
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</tbody>
</table>

Note: This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.