KISTLER

measure. analyze. innovate.

# Accelerometers

**Providing quick, accurate and reliable motion data**

# Kistler has a great deal to offer

This catalog provides comprehensive information on all Kistler products for the measurement of acceleration.

The overview of the Kistler range is followed by detailed information on our products in tabular form and a presentation of the company as a whole.

Detailed catalogs are also available on the full range of Kistler products for the measurement of force and pressure.

As Kistler measuring instruments are used in a great variety of fields, separate brochures are also available for the following applications:

- Engines
- Vehicles
- Manufacturing
- Plastics Processing
- Biomechanics

The aim of this series of brochures is to help you make the right choice from our wide range of products and to suggest ways of optimizing their application.

Please contact us for any brochures you require. You will find the address of your nearest Kistler branch on the back page of the catalog. Alternatively, you can email us at info@kistler.com

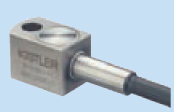
We wish you every success with Kistler measurement instruments and thank you for your confidence and interest.

# Contents



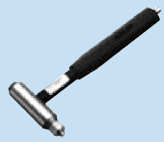






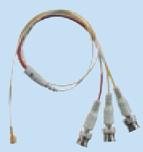














# Kistler Measures Acceleration

Accelerometers are used in every avenue of the dynamic test environment and Kistler has developed families of products covering this expansive range of applications. From ultra low motions encountered in wafer fabrication technology to shock spectra reconstruction experienced in pyrotechnic separation event studies, and everywhere between, an optimal sensor solution is available. Static events are captured with the K-Beam static and low frequency product offerings. Very high frequency activity is routinely measured using any of several miniature piezoelectric single axis or triaxial types. Many sensing technologies including piezoceramic, natural quartz and variable capacitance approaches have been extensively explored and are employed as needed to accommodate the demands of the applications.

Some applications include:

## Structural Testing

Mechanical devices, assemblies, and constructions of all types are investigated using accelerometers to measure their dynamic response when subjected to a known input. The deformation pattern, when the specimen experiences resonance, can be computed from the measured data. Known as Experimental Modal Analysis (EMA), this field of study often uses a member of the PiezoBeam family or Ceramic Shear family where their general characteristics have been adapted to accommodate most requirements of common tests. Typical highlight features include high output from a low weight sensor, ground isolation, and an inexpensive package providing an economical solution for large channel count applications.

## Aerospace and Military

Very demanding applications are encountered in the military and aerospace industry where any error may present a life-threatening situation. This category also covers a tremendous range of applications and nearly all accelerometer product offerings have been used in these important investigations. Flutter testing, rocket launch pad dynamics, aircraft EMA, ammunition investigations, helicopter rotor reactions, etc. are a few of the common measurements performed.


## Automotive/Transportation

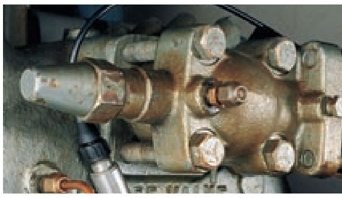
Ride quality has been receiving tremendous attention in recent years. New vehicle designs are presenting less noise to the occupants and the subtle details of the intricacies of road/tyre interaction, bump & jar response, and the overall feel of the ride are important to even the common customer. The K-Beam family covers the low to mid frequency range of many investigations and the many piezoelectric offerings extend into the higher frequency areas of interest.

## Civil Engineering

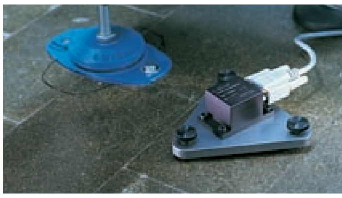
Very low frequency activity is of interest when studying extremely large structures such as bridges, buildings or dams. These specimens require DC capable accelerometers since most dynamic activity is in the very low frequency realm often in the range of a few hertz. The K-Beam product family is commonly used to measure vibration and acceleration in this arena.

## Environmental Stress Screening

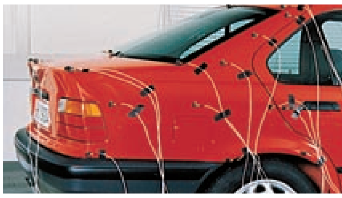
Computer components, automotive electronics, and miniature mechanical assemblies are often exposed to an aggressive life test or actual functional tests under extreme environmental conditions. This may involve multiple impact drop testing or wide range thermal cycling and many of the K-Shear product offerings have been tailored to survive and perform extremely well even under incredibly abusive conditions. The -M5 and -M8 suffixes provide extreme high and low temperature capabilities respectively and the Shear Shock type 8742 and 8743 survive after many exposures to high-level cyclic inputs.



Remarkable lifetime under any condition.



Precise, ultralow frequency, measurements are common using a K-Beam solution.



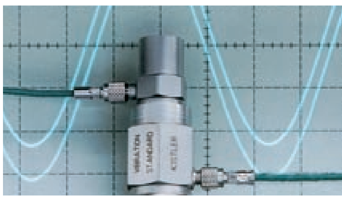
Modal studies easily accomplished using an array of inexpensive accelerometers.

Tilt and comfort controlled using K-Beam feedback.

Space quality measurements are routine.


Flight safety issues measured accurately with K-Beam family.

Harsh environments present negligible concern when using K-Shear accelerometers.



On site or factory calibration solutions available.

# Design and Use of Piezoelectric Accelerometers

## Measuring acceleration

Piezoelectric accelerometers consist essentially of three basic elements: the sensor body, the piezoelectric sensing element and the seismic mass. Initially piezoelectric accelerometers incorporated a compression design whereby the compression cut, quartz crystal sensing element is preloaded between the base plate and seismic mass. Because of the constant seismic mass, the force acting on the measuring element is proportional to the acceleration in accordance with Newton's first law: F = ma. An electrical charge is generated proportional to the force (and hence the acceleration). Because they are basically AC coupled devices, piezoelectric accelerometers are not suitable for measuring constant (DC) accelerations like those generated in a centrifuge. For "true" DC acceleration measurement, refer to Kistler K-Beam accelerometers with variable capacitance sensing elements.

Although the compression cut quartz design was widely accepted with it's inherent characteristics of long term stability, low mass, high rigidity and subsequent high resonant frequency, Kistler has focused on accelerometers which utilize a shear mode quartz element that is sensitive to imposed shearing forces and unaffected by other orthogonal force components. In addition, the primary charge sensitivity of shear mode quartz is twice that for compression mode quartz. This results in a smaller seismic system design in shear mode units and thereby reduces their overall size and mass. As in the compression design, the force acting on the element is proportional to the acceleration in accordance with Newton's first law: F = ma and an electrical charge is generated proportional to the acceleration.

Kistler incorporates several other design features into their K-Shear units which provide combined features uncommon and superior to conventional compression designs.

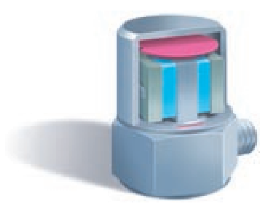
Conventional compression type accelerometers can be designed to be insensitive to stresses resulting from imposed base strain simply by making the base extremely large.

The advantages of the shear design are realized by efficiently packaging the seismic system in a manner which isolates it from mechanically induced stresses such as base or case strain. With the K-Shear construction the imposed base/case strain is isolated from the quartz and is essentially negligible at the root of the seismic support.

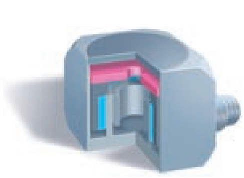
Output resulting from thermally induced stress is also negligible in K-Shear accelerometers. On compression type accelerometers, stresses caused by expansion or contraction of internal elements act directly on the preload mechanism which results in a charge output from the quartz. Similar expansion or contraction of the preload screw in K-Shear accelerometers results in stresses which act in an insensitive crystal direction. The optimized K-Shear design further reduces thermal effects by producing a nearly uniform, self-cancelling thermal stress.

Piezotron and Picotron accelerometers are low impedance types which incorporate a miniature, built-in impedance converter for the charge-to-voltage conversion. Picotron units are distinguished from Piezotron by virtue of their very small (pico) size. Ceramic Shear is a new family of accelerometers designed for OEM and multichannel applications (i.e. modal analysis). They feature high output, low noise and extended temperature range in a low or high impedance package. PiezoBeam accelerometers incorporate a bimorph ceramic sensing element and a miniaturized, hybrid charge amplifier for the charge-to-voltage conversion. These units feature very high output (up to 1000 mV/g) in a very small (down to 5 grams), rugged package. For use in thermally stable environments.

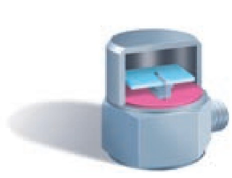
In addition to incorporating either compressive or K-Shear designs, most Kistler piezoelectric accelerometers utilize built-in charge-to-voltage converters for low impedance, voltage output. The low end frequency response is usually limited to 0.5 Hz, which is adequate for most shock and vibration applications. Low impendance output also allows the usage of general purpose sensor cable in environments where moisture or contamination would be detrimental to the high insulation resistance for high impedance accelerometers. The low impedance design also provides immunity to RF/EMI.



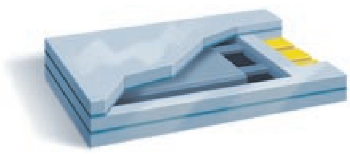
K-Shear®



Annular Shear



PiezoBeam®



K-Beam®

# Capacitive Accelerometers

## Design and use of Variable Capacitance Accelerometers

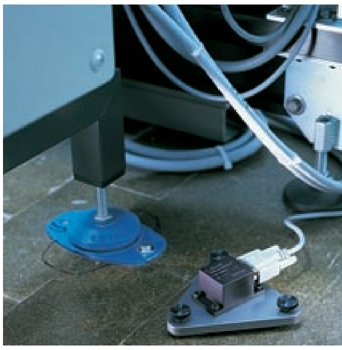
Measurement of low frequency events including static or DC capability is accomplished using various designs based on the "variable capacitance" sensor principle. In a typical design, a diaphragm centered between two electrodes forms the seismic mass of the spring mass systems. The gap between each electrode and the central mass creates a repeatable electrical capacitance. When the mass is forced off center by an imposed acceleration, a differential capacitance exists between the two initially equal 'capacitors'. This differential capacitance is linearly proportional to the applied acceleration within the specified amplitude range of the accelerometer. An electrical 'bridge' type circuit is used to achieve an appropriate voltage output. Using a differential approach creates immunity or common mode rejection to environmental influences since both 'capacitors' react similarly and the difference is usually negligible.

MEMS (Micro Electro Mechanical Sensor) technology is used in several designs since it offers very low seismic weight and a relatively stiff silicon supporting structure. The bulk micromachining processes now produce very high accuracy and repeatable elements that are required for high precision sensor designs. Advanced designs include a servo or feedback loop to restore the central mass to its origin by presenting an electrostatic restoring force to the appropriate electrode. Thus a 'null' type sensor is achieved yielding the best noise characteristics available in the industry. It's also entirely non-magnetic and therefore insensitive to magnetic fields.

Overload protection is incorporated in all designs with the surrounding electrodes limiting displacement of the seismic mass. Also, damping is achieved in some designs resulting from the compressed cavity gas reducing transient stresses. The relatively rugged construction compares well against competitive strain gauge type accelerometers. Power requirements are simple where often a single nine-volt battery connection is all that is required in addition to the output lead. The ease of installation combined with a robust, reliable sensor has guided these accelerometers into many applications formally outfitted with piezoresistive or expensive Servo type accelerometers.

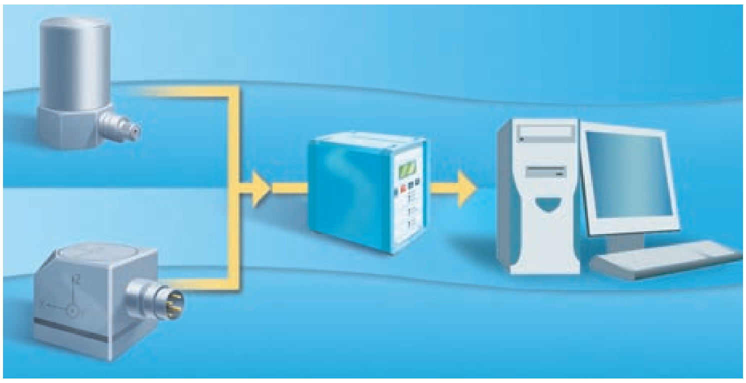
Ride quality studies in many areas of transportation such as automobiles, trains, aircraft and marine vehicles have utilized the variable capacitance products where the frequencies of interest and ease of use made their selection obvious. The operation and refinement of wafer fabrication equipment has been extensively investigated using K-Beam accelerometers that are well adapted to measure the low level, low frequency events common to the processes. Dynamic studies on large structures require great accuracy at very low frequencies and again are an ideal fit to the variable capacitance product range.

Ground motion effects accurately recorded.

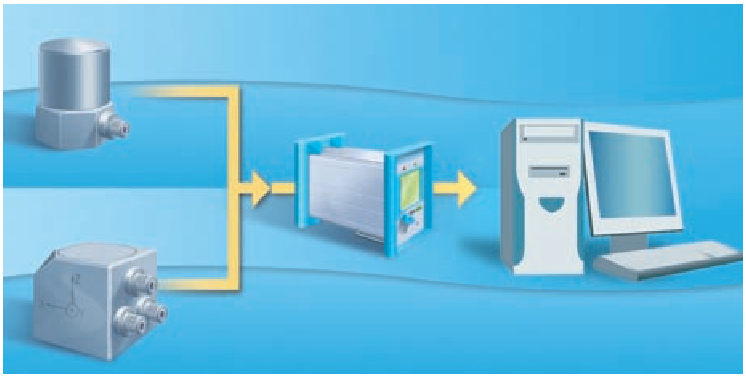


Smallest vibrations easily captured.

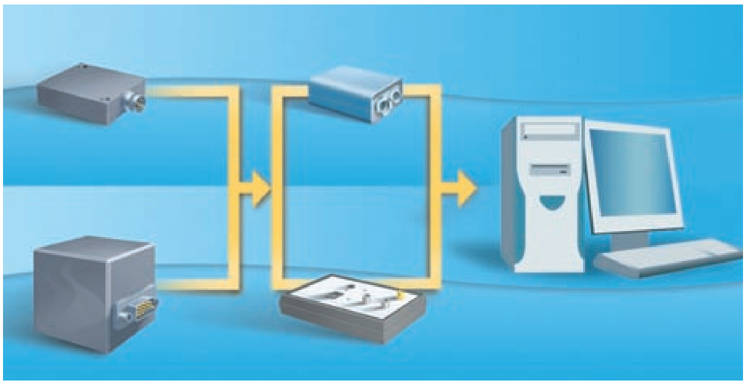
# Acceleration Measuring Systems



Economical measurement solutions offered by the low impedance approach.



Versatile system configurations provided through charge amplifier functionality.



DC acceleration system easily configured.

## Low impedance piezoelectric system (voltage mode)

**Features**

- Low output impedance, <100 ohms
- Low noise output signal
- Fixed accelerometer range and voltage sensitivity
- Simple two-wire system for power and signal with no special cable conductor requirements
- Lower cost per channel
- Simple and inexpensive signal conditioning; power supply/coupler and standard cables
- Coupler for setting of gain, range, filtering and time constant
- Frequency response from 0.5 to 20,000 Hz

## High impedance piezoelectric system (charge mode)

**Features**

- Wide measuring range
- One accelerometer can be used over its entire measuring range by selecting an appropriate charge amplifier range
- Push-button, electronic or computer-controlled resetting of charge amplifier.
- Sensors having operational temperature range up to 250°C and above
- Charge amplifier for setting of range, filtering and time constant
- Frequency response from 0.5 to 20,000 Hz

## Silicon micromachined variable capacitance system

**Features**

- True static and dynamic measuring response
- Frequency response from 0 to 300 Hz
- Both acceleration and inclination information possible using AC or DC coupled output
- Output signals can be either single-ended, bi-polar, differential voltages or current

See Piezoelectric Accelerometer Theory on pages 82 to 87 for further information.

# Accelerometer Mounting

For an accelerometer to accurately sense and generate useful data, it must be properly coupled to the test object. This requires that the accelerometer mounting be rigid over the frequency range of interest. The methods for mounting an accelerometer usually depend on the accelerometer and the test structure. A selection of studs, isolated mounting pads, wax, magnets, and triaxial cubes are available from Kistler to solve virtually any mounting/installation problem. Some accelerometers have an electrically isolated mounting surface which provides electrical (ground) isolation between the sensor signal ground and the mounting surface.

## Stud mounting

The best method for mounting an accelerometer is with a threaded stud. Most Kistler mounting studs are machined from Beryllium Copper for high strength and low modulus of elasticity, coupled with high elastic limits. These studs provide excellent coupling between the accelerometer's mounting surface and the test object.

Care should be taken to ensure that the two mounting surfaces mate evenly. The mounting threads must be perpendicular to the surface and free of any burrs. The surface must also be flat to ensure good coupling. Adding a slight amount of grease or oil between the mounting surfaces improves the coupling, especially at higher frequencies.

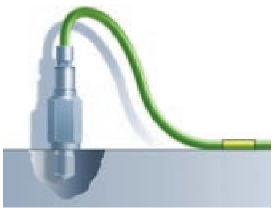
A designated mounting torque provides the proper coupling force between the accelerometer and the test object without overstressing and distorting the accelerometer mounting base. Always use the proper sockets and torque for each Kistler accelerometer as listed on the individually supplied calibration certificates.

## Adhesive mounting

This simple method is ideal for mounting where drilling holes is not practical or where the mounting surface is not flat.

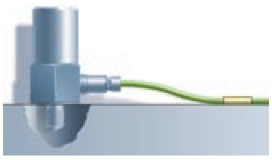
**Direct Adhesive Mounting**
Many lightweight accelerometers are designed strictly for adhesive mounting. When properly mounted, these units will provide accurate data within the specified frequency range. This method is ideal for modal and structural analysis where the test structure cannot be modified for mounting the accelerometers. For measurements up to 5 kHz, wax mounting is a suitable adhesive.

**Isolated, Adhesive Pad Mounting**
Hard anodized aluminium mounting pads offer several advantages when the accelerometer must be mounted to irregular surfaces or when ground isolation is required. These pads are adhesively mounted to the test structure providing a flat mounting surface and a high quality mounting thread. The hard anodized surface provides ground isolation between the sensor and the mounting surface. This is particularly useful in preventing ground loops.



Top-mounted connector.

Tape or clamp to relieve stress on connector



Side-mounted connector.

Tape or clamp to relieve stress on connector (about $2^1/_2$ to 3 inches from connector)

# Accelerometer Mounting

## Magnetic mounting

For special applications where the accelerometer needs to be mounted to ferromagnetic structures for a quick test, one of several Kistler magnetic mounts can be used.

The accelerometer is first mounted to the magnet. These mounts can then be moved quickly to measure vibrations at several different locations. Due to the higher mass, magnets are only recommended for measurements of vibrations with frequencies up to 1000 Hz. Further, the added mass may affect the measurement of very light structures due to mass loading.

## Triaxial mounting

Several triaxial mounting cubes are available from Kistler which allow mounting of up to three individual accelerometers in orthogonal directions. The cube's added mass and size must be considered and may affect the overall system frequency response. Kistler also offers integral triaxial units for those applications where mass and size profile are critical. The optimized integral package often provides the best measurement solution.

## Strain relieving cables

Accelerometer cables should be taped or clamped to the same surface on which the accelerometer is attached to avoid motion between the vibration surface and the tie down point. These techniques will prevent flexing of the cable near the connector and thereby minimize any resultant frequency response errors.

## Accelerometer mounting accessories

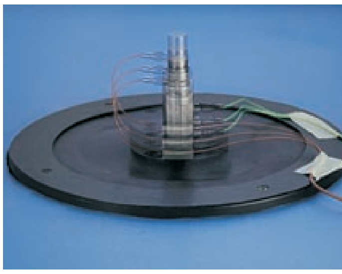
Refer to pages 69 to 71 for details on mounting accessories for Kistler accelerometers.

## Kistler calibration

Kistler accelerometers are calibrated in the factory and delivered with a calibration certificate. The reference sensors are cross-referenced to national standards. Kistler operates a NIST traceable calibration center and the calibration laboratory No. 049 of the Swiss Calibration Service for the measurands: force, pressure, acceleration and electric charge. Kistler and some of its group companies offer a recalibration service and the company records in its archives the details of when and how often a particular sensor was calibrated.

Kistler offers an on-site service for recalibrating built-in sensors, thereby helping to keep downtimes to a minimum. In addition, Kistler offers a whole range of instruments for use in calibration laboratories.

Our calibration service receives the highest marks. The calibration of your instruments, manufactured by Kistler or someone else, is performed with the utmost care and precision. Our standard prompt service is exceptional. The Kistler Calibration Laboratory has been in conformance with the requirements of ANSI/NCSL Z540-1-1994, MIL-STD-45662A, ISO 9001:2000 and now is fully accredited to ISO/IEC 17025.



On site, traceable, calibration systems.


National referenced calibration services available.

# Product Information

The selection process to identify the best accelerometer for a specific application is complicated and often difficult when detailed data sheets are reviewed independently. The following pages group the accelerometer product offerings by category and specification.

This valuable table should be used as a general guide to refine the selection options to a few choices where more specific detail is available on the page identified in the table. The data sheet containing all relevant information is readily available on the internet at www.kistler.com

# Product Overview

| Low Amplitude, Low Frequency (0 to 300 Hz) Measurements, Single Axis | | | | | | | | | Voltage Output |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8310A50 | 50 | 40 | 0,0057 | 0 ... 500 | 17 | side, 4 pin | 4-40 cap screw | yes | 23 |
| 8310A50M11 | 50 | 40 | 0,0057 | 0 ... 500 | 17 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8310A25A1 | 25 | 80 | 0,0029 | 0 ... 300 | 17 | side, 4 pin | 4-40 cap screw | yes | 23 |
| 8310A25A1M11 | 25 | 80 | 0,0029 | 0 ... 300 | 17 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8305A10M2 | 10 | 200 | 0,0014 | 0 ... 180 | 6,5 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8310A10 | 10 | 200 | 0,0028 | 0 ... 180 | 17 | side, 4 pin | 4-40 cap screw | yes | 23 |
| 8310A10M11 | 10 | 200 | 0,0028 | 0 ... 180 | 17 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8312A10 | 10 | 200 | 0,0028 | 0 ... 180 | 12 | side, 4 pin | 4-40 cap screw | yes | 25 |
| 8305A10 | 10 | 100 | 0,0014 | 0 ... 180 | 6,5 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8305A10M4 | 10 | 100 | 0,0014 | 0 ... 180 | 6,5 | side, integral cable to 4-pin pos. | 4-40 cap screw | yes | 23 |
| 8305A10M7 | 10 | 100 | 0,0014 | 0 ... 180 | 6,5 | side, integral cable to 4-pin neg. | 4-40 cap screw | yes | 23 |
| 8330A2,5 | 2,5 | 1500 | 0,0000025 | 0 ... 200 | 28,5 | side, 4 pin | 4-40 cap screw | yes | 25 |
| 8310A2 | 2 | 1000 | 0,00054 | 0 ... 300 | 17 | side, 4 pin | 4-40 cap screw | yes | 23 |
| 8310A2M11 | 2 | 1000 | 0,00054 | 0 ... 300 | 17 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8312A2 | 2 | 1000 | 0,00054 | 0 ... 300 | 12 | side, 4 pin | 4-40 cap screw | yes | 25 |
| 8305A2M2 | 2 | 1000 | 0,00028 | 0 ... 250 | 6,5 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8305A2 | 2 | 500 | 0,00028 | 0 ... 250 | 6,5 | side, integral cable to pigtails | 4-40 cap screw | yes | 23 |
| 8305A2M4 | 2 | 500 | 0,00028 | 0 ... 250 | 6,5 | side, integral cable to 4-pin pos. | 4-40 cap screw | yes | 23 |
| 8305A2M7 | 2 | 500 | 0,00028 | 0 ... 250 | 6,5 | side, integral cable to 4-pin neg. | 4-40 cap screw | yes | 23 |

# Product Overview

| General Purpose Vibration Measurement, Single Axis | | | | | | | | High Impedance Charge Mode | |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range ±g** | **Sensitivity pC/g** | **Threshold $g_{rms}$** | **Frequency Response Hz (±5%)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8202A10 | 2 000 | –10 | 0,03 | 5 … 10 k | 14,5 | side, 10-32 | 10-32 stud | no | 28 |
| 8203A50 | 1 000 | –50 | 0,0006 | 5 … 4 k | 44,5 | side, 10-32 | 10-32 stud | no | 28 |
| 8274A5 | 2 000 | –5.5 | 0,01 | 1 … 10 k | 4,0 | top, 10-32 | 10-32 stud | no | 29 |
| 8276A5 | 2 000 | –5.5 | 0,01 | 1 … 7 k | 4,0 | side, 10-32 | adhesive | no | 29 |

| General Purpose Vibration Measurement, Single Axis | | | | | | | | Low Impedance Voltage Mode | |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range ±g** | **Sensitivity mV/g** | **Threshold $g_{rms}$** | **Frequency Response Hz (±5%)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8704B5000 | 5 000 | 1 | 0,13 | 1 ... 10 k | 7,1 | top, 10-32 | 10-32 stud | with pad* | 33 |
| 8720A500 | 500 | 10 | 0,01 | 1 ... 9 k | 4,9 | side, 10-32 | wax or adhesive | yes | 35 |
| 8704B500 | 500 | 10 | 0,01 | 1 ... 10 k | 8,6 | top, 10-32 | 10-32 stud | with pad* | 33 |
| 8704B500M1** | 500 | 10 | 0,01 | 1 ... 10 k | 9,6 | top, 10-32 | 10-32 stud | yes | 33 |
| 8702B500 | 500 | 10 | 0,01 | 1 ... 10 k | 8,6 | side, 10-32 | 10-32 stud | with pad* | 33 |
| 8702B500M1** | 500 | 10 | 0,01 | 1 ... 10 k | 9,6 | side, 10-32 | 10-32 stud | yes | 33 |
| 8704B100 | 100 | 50 | 0,01 | 0,5 … 10 k | 8,6 | top, 10-32 | 10-32 stud | with pad* | 32 |
| 8704B100M1 | 100 | 50 | 0,01 | 0,5 … 10 k | 9,6 | top, 10-32 | 10-32 stud | yes | 32 |
| 8702B100 | 100 | 50 | 0,01 | 0,5 … 10 k | 8,6 | side, 10-32 | 10-32 stud | with pad* | 32 |
| 8702B100M1 | 100 | 50 | 0,01 | 0,5 … 10 k | 9,6 | side, 10-32 | 10-32 stud | yes | 32 |
| 8704B50 | 50 | 100 | 0,006 | 0,5 … 10 k | 8,6 | top, 10-32 | 10-32 stud | with pad* | 32 |
| 8704B50M1 | 50 | 100 | 0,006 | 0,5 … 10 k | 9,6 | top, 10-32 | 10-32 stud | yes | 32 |
| 8702B50 | 50 | 100 | 0,006 | 0,5 … 10 k | 8,6 | side, 10-32 | 10-32 stud | with pad* | 32 |
| 8702B50M1 | 50 | 100 | 0,006 | 0,5 … 10 k | 9,6 | side, 10-32 | 10-32 stud | yes | 32 |
| 8141 | 50 | 100 | 0,002 | 10 … 6 k | 30 | integral to 10-32 | M6 cap screw | yes | 30 |
| 8774A50 | 50 | 100 | 0,0025 | 1 ... 10 k | 4,0 | top, 10-32 | 10-32 stud | with pad* | 39 |
| 8776A50 | 50 | 100 | 0,0025 | 1 ... 7 k | 4,3 | side, 10-32 | wax or adhesive | no | 39 |
| 8776A50M1 | 50 | 100 | 0,0025 | 1 ... 7 k | 4,3 | side, 10-32 | wax or adhesive | yes | 39 |
| 8776A50M3 | 50 | 100 | 0,0025 | 0,5 ... 4 k | 4,3 | side, 10-32 | wax or adhesive | yes | 40 |
| 8776A50M6 | 50 | 100 | 0,0025 | 1 ... 10 k | 4,5 | side, 10-32 | 10-32 stud, integral | with pad* | 39 |
| 8710A50M1 | 50 | 100 | 0,002 | 0,35 … 7 k | 43 | side, 10-32 | 1/4-28 stud | yes | 34 |
| 8752A50 | 50 | 100 | 0,002 | 0,5 … 5 k | 115 | top MIL-C-5015 | 1/4-28 stud | yes | 38 |
| 8704B25 | 25 | 200 | 0,003 | 1 … 9 k | 8,6 | top, 10-32 | 10-32 stud | with pad* | 32 |
| 8704B25M1 | 25 | 200 | 0,003 | 1 … 9 k | 9,6 | top, 10-32 | 10-32 stud | yes | 32 |
| 8702B25 | 25 | 200 | 0,003 | 1 … 9 k | 8,6 | side, 10-32 | 10-32 stud | with pad* | 32 |
| 8702B25M1 | 25 | 200 | 0,003 | 1 … 9 k | 9,6 | side, 10-32 | 10-32 stud | yes | 32 |
| 8784A5 | 5 | 1 000 | 0,0004 | 1 … 6 k | 21 | top, 10-32 | 10-32 stud | with pad* | 41 |
| 8786A5 | 5 | 1 000 | 0,0004 | 1 … 6 k | 21 | side, 10-32 | 10-32 stud | with pad* | 41 |
| 8712A5M1 | 5 | 1 000 | 0,0004 | 0,5 … 8 k | 51 | side, 10-32 | 1/4-28 stud | yes | 34 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

** Extended low frequency of 0,5 Hz available as M3 option

# Product Overview

| Shock/Impact/Impulse Measurements, Single Axis | | | | | | | | | High Impedance Charge Mode |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range ±g** | **Sensitivity pC/g** | **Threshold $g_{rms}$** | **Frequency Response Hz (±5%)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8044 | –20 k… +30 k | –0,3 | 0,1 | » 0 ... 8 k | 7,0 | top, 10-32 | 10-32 stud | no | 27 |

| Shock/Impact/Impulse Measurements, Single Axis | | | | | | | | | Low Impedance Voltage Mode |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range ±g** | **Sensitivity mV/g** | **Threshold $g_{rms}$** | **Frequency Response Hz (±5%)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8743A100 | 100 k | 0,05 | 2,6 | 0,5 ... 10 k | 4,5 | integral to 10-32 | 10-32 stud, integral | no | 38 |
| 8742A50 | 50 k | 0,1 | 1,3 | 1 ... 10 k | 4,5 | top, 10-32 | 10-32 stud, integral | no | 37 |
| 8742A20 | 20 k | 0,25 | 0,5 | 1 ... 10 k | 4,5 | top, 10-32 | 10-32 stud, integral | no | 37 |
| 8742A10 | 10 k | 0,5 | 0,25 | 1 ... 10 k | 4,5 | top, 10-32 | 10-32 stud, integral | no | 37 |
| 8742A5 | 5 k | 1 | 0,13 | 1 ... 10 k | 4,5 | top, 10-32 | 10-32 stud, integral | no | 37 |
| 8704B5000 | 5 k | 1 | 0,13 | 1 ... 10 k | 7,1 | top, 10-32 | 10-32 stud | no | 33 |

| Miniature, Ultra Light Weight, Single Axis | | | | | | | | | Low Impedance Voltage Mode |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range ±g** | **Sensitivity mV/g** | **Threshold $g_{rms}$** | **Frequency Response Hz (±5%)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8614A1000M1 | 1000 | 2,5 | 0,04 | 10 … 25 k | 0,7 | integral twisted wire pair to 10-32 | wax or adhesive | with pad* | 30 |
| 8614A500M1 | 500 | 4 | 0,025 | 10 … 25 k | 0,7 | integral twisted wire pair to 10-32 | wax or adhesive | with pad* | 30 |
| 8730A500 | 500 | 10 | 0,02 | 2 … 10 k | 1,9 | top, 10-32 | 5-40 stud, integral | no | 36 |
| 8730AE500 | 500 | 10 | 0,02 | 2 … 10 k | 1,9 | top, 10-32 | M3 stud, integral | no | 36 |
| 8730A500M1 | 500 | 10 | 0,02 | 2 … 7 k | 2,5 | top, 10-32 | 5-40 stud, integral | yes | 36 |
| 8732A500 | 500 | 10 | 0,01 | 2 … 7 k | 1,1 | integral coax cable to 10-32 | wax or adhesive | yes | 36 |
| 8734A500 | 500 | 10 | 0,01 | 2 … 7 k | 1,2 | integral coax cable to 10-32 | screws | yes | 36 |
| 8728A500 | 500 | 10 | 0,008 | 2 … 10 k | 1,6 | integral coax cable to 10-32 | wax or adhesive | no | 35 |
| 8778A500 | 500 | 10 | 0,01 | 2 … 9 k | 0,29 | integral coax cable to 10-32 | wax or adhesive | yes | 40 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

| Modal Analysis & Structural Testing, Single Axis | | | | | | | | | Low Impedance Voltage Mode |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range ±g** | **Sensitivity mV/g** | **Threshold $g_{rms}$** | **Frequency Response Hz (±5%)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8772A50 | 50 | 100 | 0,002 | 1 ... 5 k | 8,0 | side, 10-32 | adh., wax or clip | yes | 39 |
| 8632C50 | 50 | 100 | 0,001 | 1 ... 6 k | 6,0 | side, 10-32 | wax or adhesive | yes | 31 |
| 8636C50 | 50 | 100 | 0,001 | 1 ... 6 k | 5,0 | side, 10-32 | 5-40 stud | yes | 31 |
| 8772A10 | 10 | 500 | 0,0005 | 1 ... 5 k | 8,0 | side, 10-32 | adh., wax or clip | yes | 39 |
| 8632C10 | 10 | 500 | 0,00028 | 1 ... 5 k | 6,0 | side, 10-32 | wax or adhesive | yes | 31 |
| 8636C10 | 10 | 500 | 0,00028 | 1 ... 5 k | 5,0 | side, 10-32 | 5-40 stud | yes | 31 |
| 8772A5 | 5 | 1000 | 0,0004 | 1 ... 5 k | 8,0 | side, 10-32 | adh., wax or clip | yes | 39 |
| 8632C5 | 5 | 1000 | 0,00012 | 1 ... 3 k | 6,0 | side, 10-32 | wax or adhesive | yes | 31 |
| 8636C5 | 5 | 1000 | 0,00012 | 1 ... 3 k | 5,0 | side, 10-32 | 5-40 stud | yes | 31 |

# Product Overview

## TEDS – Accelerometers, Single Axis — Low Impedance Voltage Mode

| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
|---|---|---|---|---|---|---|---|---|---|
| 8704B100T | 100 | 50 | 0,01 | 0,6 ... 9 k | 9,6 | top, 10-32 | 10-32 stud | with pad* | 32 |
| 8704B50T | 50 | 100 | 0,006 | 3 ... 7 k | 8,6 | top, 10-32 | 10-32 stud | with pad* | 32 |
| 8772A50T | 50 | 100 | 0,002 | 1 ... 5 k | 8,0 | side, 10-32 | adh., wax or clip | yes | 39 |
| 8632C50T | 50 | 100 | 0,001 | 1 ... 6 k | 6,0 | side, 10-32 | wax or adhesive | yes | 31 |
| 8704B25T | 25 | 200 | 0,003 | 1 ... 9 k | 8,6 | top, 10-32 | 10-32 stud | with pad* | 32 |
| 8772A10T | 10 | 500 | 0,0005 | 1 ... 5 k | 8,0 | side, 10-32 | adh., wax or clip | yes | 39 |
| 8632C10T | 10 | 500 | 0,00028 | 1 ... 5 k | 6,0 | side, 10-32 | wax or adhesive | yes | 31 |
| 8772A5T | 5 | 1000 | 0,0004 | 1 ... 5 k | 8,0 | side, 10-32 | adh., wax or clip | yes | 39 |
| 8632C5T | 5 | 1000 | 0,00012 | 1 ... 3 k | 6,0 | side, 10-32 | wax or adhesive | yes | 31 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

## High Temperature Vibration Measurements — Low Impedance Voltage Mode

| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
|---|---|---|---|---|---|---|---|---|---|
| 8702B500M5 | 500 | 10 | 0,01 | 2 ... 7 k | 8,6 | side, 10-32 | 10-32 stud | with pad* | 33 |
| 8710A50M5 | 50 | 100 | 0,002 | 1 ... 7 k | 43 | side, 10-32 | 1/4-28 stud | yes | 34 |
| 8752A50M5 | 50 | 100 | 0,002 | 1 ... 5 k | 115 | top MIL-C-5015 | 1/4-28 stud | yes | 38 |
| 8794A500M5 | 500 | 10 | 0,002 | 1 ... 10 k | 7,6 | integral to 4-pin | 4-40 cap screw | no | 51 |
| 8793A500M5 | 500 | 10 | 0,002 | 1 ... 10 k | 11 | side, triax-4 pin | 4-40 cap screw | no | 51 |
| 8795A50M5 | 50 | 100 | 0,001 | 1 ... 4 k | 32 | side, triax-4 pin | 10-32 stud | with pad* | 52 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

## Low Temperature Vibration Measurements — Low Impedance Voltage Mode

| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
|---|---|---|---|---|---|---|---|---|---|
| 8702B500M8 | 500 | 10 | 0,01 | 2 ... 7 k | 8,6 | side, 10-32 | 10-32 stud | with pad* | 33 |
| 8728A500M8 | 500 | 10 | 0,008 | 2 ... 10 k | 1,6 | integral to 10-32 | wax or adhesive | no | 35 |
| 8710A50M8 | 50 | 100 | 0,002 | 1 ... 7 k | 43 | side, 10-32 | 1/4-28 stud | yes | 34 |
| 8793A500M8 | 500 | 10 | 0,002 | 1 ... 10 k | 11 | side, triax-4 pin | 4-40 cap screw | no | 51 |
| 8795A50M8 | 50 | 100 | 0,001 | 1 ... 4 k | 32 | side, triax-4 pin | 10-32 stud | with pad* | 52 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

# Product Overview

| Acoustic Emission | | | | | | | | Low Impedance Voltage Mode | |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity $dB_{ref\ 1V\ (m/s)}$ | Threshold $g_{rms}$ | Frequency Response Hz (±10 dB) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8152B1 | N/A | 57 | N/A | 50 k … 400 k | 29 | integral to pigtails | M6 cap screw | yes | 43 |
| 8152B2 | N/A | 48 | N/A | 100 k … 900 k | 29 | integral to pigtails | M6 cap screw | yes | 43 |

| Low Amplitude, Low Frequency (0–300 Hz) Measurements, Triaxial | | | | | | | | Voltage Output | |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8393A10 | 10 | 200 | 0,00283 | 0 ... 180 | 60 | side, 9 pin micro D | 4-40 cap screw | yes | 45 |
| 8393A2 | 2 | 1000 | 0,00054 | 0 ... 300 | 60 | side, 9 pin micro D | 4-40 cap screw | yes | 45 |

| High Impedance Triaxial | | | | | | | | High Impedance Charge Mode | |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity pC/g unless noted | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8290A25M5 | 2 000 | –25 | 0,001 | 5 … 4 k | 53 | 10-32 neg. | 10-32 stud | no | 45 |

| General Purpose Vibration Measurement, Triaxial | | | | | | | | Low Impedance Voltage Mode | |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8792A500 | 500 | 10 | 0,01 | 1 ... 5 k | 29 | side, triax-4 pin | through hole, 10-32 cap screw | yes | 50 |
| 8793A500** | 500 | 10 | 0,002 | 2,5 ... 10 k | 11 | side, triax-4 pin | 4-40 cap screw | no | 51 |
| 8794A500** | 500 | 10 | 0,002 | 2,5 ... 10 k | 7,6 | integral triax cable to 4-pin | 4-40 cap screw | no | 51 |
| 8791A250 | 250 | 20 | 0,006 | 1 ... 2 k | 4,0 | integral triax cable to 4-pin | wax or adhesive | no | 49 |
| 8792A100 | 100 | 50 | 0,009 | 0,5 ... 5 k | 29 | side, triax-4 pin | through hole, 10-32 cap screw | yes | 50 |
| 8792A50 | 50 | 100 | 0,005 | 0,5 ... 5 k | 29 | side, triax-4 pin | through hole, 10-32 cap screw | yes | 50 |
| 8795A50 | 50 | 100 | 0,001 | 1 ... 4 k | 32 | side, triax-4 pin | 10-32 stud | with pad* | 52 |
| 8792A25 | 25 | 200 | 0,003 | 1 ... 5 k | 29 | side, triax-4 pin | through hole, 10-32 cap screw | yes | 50 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

** Extended low frequency of 1 Hz available as M3 option

# Product Overview

| Miniature, Ultra Light Weight, Triaxial | | | | | | | | | Low Impedance Voltage Mode |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8694M1 | 500 | 4 | 0,025 | 10 ... 20 k | 2,5 | integral to 4-pin | wax or adhesive | with pad* | 47 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

| Modal Analysis & Structural Testing, Triaxial | | | | | | | | | Low Impedance Voltage Mode |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8690C50 | 50 | 100 | 0,001 | 1 ... 6 k | 11,2 | side, triax-4 pin | wax or adhesive | yes | 46 |
| 8692C50 | 50 | 100 | 0,001 | 1 ... 6 k | 16 | side, triax-4 pin | adhesive or magnet | yes | 46 |
| 8692C50M1 | 50 | 100 | 0,001 | 1 ... 6 k | 16 | side, triax-4 pin | 10-32 stud | yes | 46 |
| 8690C10 | 10 | 500 | 0,00028 | 1 ... 5 k | 11,2 | side, triax-4 pin | wax or adhesive | yes | 46 |
| 8692C10 | 10 | 500 | 0,00028 | 1 ... 5 k | 16 | triax-4 pin | adhesive or magnet | yes | 46 |
| 8692C10M1 | 10 | 500 | 0,00028 | 1 ... 5 k | 16 | triax-4 pin | 10-32 stud | yes | 46 |
| 8690C5 | 5 | 1000 | 0,00012 | 1 ... 3 k | 11,2 | side, triax-4 pin | wax or adhesive | yes | 46 |
| 8692C5 | 5 | 1000 | 0,00012 | 1 ... 3 k | 16 | triax-4 pin | adhesive or magnet | yes | 46 |
| 8692C5M1 | 5 | 1000 | 0,00012 | 1 ... 3 k | 16 | triax-4 pin | 10-32 stud | yes | 46 |

| TEDS – Accelerometers, Triaxial | | | | | | | | | Low Impedance Voltage Mode |
|---|---|---|---|---|---|---|---|---|---|
| Model | Range ±g | Sensitivity mV/g | Threshold $g_{rms}$ | Frequency Response Hz (±5 %) | Mass grams | Connector Location & Type | Mounting Method & Thread Size | Ground Isolation | Page # |
| 8793A500T | 500 | 10 | 0,002 | 1 ... 10 k | 11 | side, triax-4 pin | 4-40 cap screw | no | 51 |
| 8690C50T | 50 | 100 | 0,001 | 1 ... 6 k | 11,2 | side, triax-4 pin | wax or adhesive | yes | 46 |
| 8795A50T | 50 | 100 | 0,001 | 1 ... 4 k | 32 | side, triax-4 pin | 10-32 stud | with pad* | 52 |
| 8690C10T | 10 | 500 | 0,00028 | 1 ... 5 k | 11,2 | side, triax-4 pin | wax or adhesive | yes | 46 |
| 8690C5T | 5 | 1000 | 0,00012 | 1 ... 3 k | 11,2 | side, triax-4 pin | wax or adhesive | yes | 46 |

* Adhesive mounting pads made of aluminium with a hard anodized shell provide ground isolation, see datasheet 8434_000-281

# Product Overview

## Special Accelerometer Types

| Axial Rotational, Single Axis | | | | | | | | | Voltage output |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range krads/s²** | **Sensitivity µV/rad/s²** | **Threshold rads/s²** | **Frequency Response Hz (±5 %)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8838 | ±150 | 34 | 4 | 1 ... 2 k | 18,5 | side, 4 pin | through hole, 10-32 cap screw | yes | 41 |

| Lateral Rotational, Single Axis | | | | | | | | | Voltage output |
|---|---|---|---|---|---|---|---|---|---|
| **Model** | **Range krads/s²** | **Sensitivity µV/rad/s²** | **Threshold rads/s²** | **Frequency Response Hz (±5 %)** | **Mass grams** | **Connector Location & Type** | **Mounting Method & Thread Size** | **Ground Isolation** | **Page #** |
| 8840 | ±150 | 34 | 4 | 1 ... 2 k | 18,5 | side, 4 pin | through hole, 10-32 cap screw | yes | 41 |

**TEDS Templates**

| Suffix No. | TEDS Templates |
|---|---|
| T | Default – IEEE1451.4 v0.9 template 0 (UTID 1) |
| T01 | IEEE1451.4 v0.9 template 24 (UTID 116225) |
| T02 | LMS template 117 free form at pont ID |
| T03 | LMS template 118, automotive format (field 14 geometry = 0) |
| T04 | LMS template 118, aerospace format (field 14 geometry = 1) |
| T05 | IEEE1451.4 v1.0 template 25, transfer function disabled |
| T06 | IEEE1451.4 v1.0 template 25, transfer function enabled |

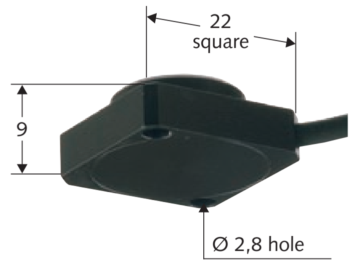
M1 Ground isolated
M2 Long time constant (Piezoelectric)
Single polarity power supply and differential output (K-Beam)
M3 Long time constant and ground isolated
M4 Integral cable terminated in 4-pin positive connector
M5 High temperature (166 °C)
M6 Integral stud
M7 Integral cable terminated in 4-pin negative connector
M8 Cryogenic/Low temperature (-195 °C)
M11 Integral cable terminated in pigtail
T TEDS

# Acceleration

Single axis static/low frequency accelerometer options include integral cable, environmentally sealed and hermetic configurations. Case or base isolation is provided by a durable, hard anodized aluminium construction. Some types operate symmetrically about a 2,5 volt DC voltage and others provide an output symmetric about a zero volt baseline. Integral cable types provide the necessary measurement performance characteristics in an economical package while the four pin connector types provide an improved seal, replaceable cable and some advanced signal conditioning. The 8310's offer an internal temperature sensor thereby providing a means of subsequent temperature compensation.

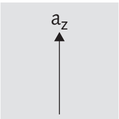
## Variable Capacitance Accelerometer

### **K-Beam Capacitive Accelerometer** Type 8305A…




| **Specifications** | | **Type 8305A2** | **Type 8305A10** |
|---|---|---|---|
| Range | g | ±2 | ±10 |
| Sensitivity, ±5% | mV/g | 500 | 100 |
| Output at Zero g, ±5% | V | 2,5 | 2,5 |
| Frequency Response, +5% | Hz | 0 … 200 | 0 … 180 |
| Non-Linearity | %FSO | ±0,4 | ±0,4 |
| Resolution/Threshold | µg | 280 | 1410 |
| Transverse Sensitivity typ. | % | 1 | 1 |
| Shock (0,5 ms half sine) | g | 6 000 | 6 000 |
| Temp. Coeff.: Bias typ. | mg/°C | 0,2 | 1 |
| Sensitivity typ. | %/°C | 0,02 | 0,02 |
| Phase Shift max. @ 100 Hz | deg. | 20 | 20 |
| Operating Temperature | °C | –40 … 85 | –40 … 85 |
| Power Supply | mA | 0,7 | 0,7 |
| | VDC | 7 … 16 | 7 … 16 |
| Housing/Base | type | Al., hard anodized | |
| Sealing | type | Epoxy | Epoxy |
| Mass | gram | 6,5 | 6,5 |

**Measuring direction**




**Connection**
Std.: pigtail
M2: pigtail

M2 versions, operate from a single polarity supply and provides a differential output.

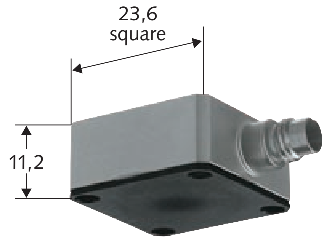
**Characteristics**
Small, lightweight variable capacitance sensing element, can be operated from a 9 volt battery, CE compliant

**Applications**
Low frequency vibration measurements

**Accessories**
Power supply: Type 5210
Mounting cube: Type 8516

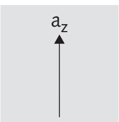
**Datasheet** 8305A_000-217

### **K-Beam Capacitive Accelerometer** Type 8310A…




| **Specifications** | | **Type 8310A2** | **Type 8310A10** |
|---|---|---|---|
| Range | g | ±2 | ±10 |
| Sensitivity, ±5% | mV/g | 1000 | 200 |
| Output at Zero g | V | ±30 | ±30 |
| Frequency Response, ±5% | Hz | 0 … 250 | 0 … 180 |
| Non-Linearity | %FSO | ±0,8 | ±0,8 |
| Resolution/Threshold | µg | 540 | 2 830 |
| Transverse Sensitivity typ. | % | 1 | 1 |
| Shock (0,7 ms half sine) | g | 6 000 | 6 000 |
| Temp. Coeff.: Bias typ. | mg/°C | 0,2 | 1 |
| Sensitivity typ. | %/°C | 0,02 | 0,02 |
| Phase Shift max. @ 100 Hz | deg. | 20 | 20 |
| Operating Temperature | °C | –40 … 85 | –40 … 85 |
| Power Supply | mA | 1,3 | 1,3 |
| | VDC | 3,8 … 16 | 3,8 … 16 |
| Housing/Insulator Base | type | Titanium/Al., hard anodized | |
| Sealing | type | Hermetic | Hermetic |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 17 | 17 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Low Power, 1,3 mA, bipolar output, 2 V FS, zero volt output at zero g, CE compliant, temperature output provided
M11: includes integral cable

**Applications**
Vehicle ride quality studies, structural analysis, building & bridge vibration

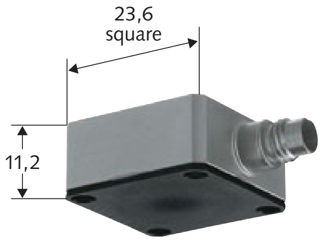
**Accessories**
Cable: Type 1592A…, 1592M1…, 1786C…
Power supply: Type 5210
Mounting cube: Type 8518A

**Datasheet** 8310A_000-218

# Acceleration

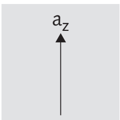
## Variable Capacitance Accelerometer

### **K-Beam Capacitive Accelerometer** Type 8310A…




| Specifications | | Type 8310A25A1 | Type 8310A50 |
|---|---|---|---|
| Range | g | ±25 | ±50 |
| Sensitivity, ±5% | mV/g | 80 | 40 |
| Output at Zero g | V | ±40 | ±40 |
| Frequency Response, ±5% | Hz | 0 ... 300 | 0 ... 500 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Resolution/Threshold | µg | 2 940 | 5 700 |
| Transverse Sensitivity typ. | % | 2 | 2 |
| Shock (0,7 ms half sine) | g | 3 000 | 3 000 |
| Temp. Coeff.: Bias typ. | mg/°C | 3 | 5 |
| Sensitivity typ. | %/°C | 0,02 | 0,02 |
| Phase Shift max. @ 100 Hz | deg. | 20 | 20 |
| Operating Temperature | °C | –40 ... 85 | –40 ... 85 |
| Power Supply | mA | 13 | 13 |
| | VDC | 6 ... 16 | 6 ... 16 |
| Housing/Insulator Base | type | Titanium/Al., hard anodized | |
| Sealing | type | Hermetic | Hermetic |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 17 | 17 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Low Power, 1,3 mA, bipolar output, 2 V FS, zero volt output at zero g, CE compliant, temperature output provided
M11: includes integral cable

**Applications**
Vehicle ride quality studies, structural analysis, building & bridge vibration

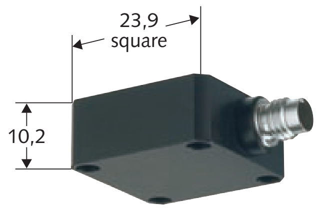
**Accessories**
Cable: Type 1592A…, 1592M1…, 1786C…
Power supply: Type 5210
Mounting cube: Type 8518A

**Datasheet** 8310A_000-218

# Acceleration

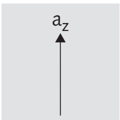
## Variable Capacitance Accelerometer

### **K-Beam Capacitive Accelerometer** Type 8312A…




| Specifications | | Type 8312A2 | Type 8312A10 |
|---|---|---|---|
| Range | g | ±2 | ±10 |
| Sensitivity, ±5% | mV/g | 1000 | 200 |
| Output at Zero g | V | 0 | 0 |
| Frequency Response, ±5% | Hz | 0 ... 250 | 0 ... 180 |
| Non-Linearity | %FSO | ±0,8 | ±0,8 |
| Resolution/Threshold | µg | 540 | 2 830 |
| Transverse Sensitivity typ. | % | 1 | 1 |
| Shock (500 µs half sine) | g | 6 000 | 6 000 |
| Temp. Coeff.: Bias typ. | mg/°C | 0,2 | 1 |
| Sensitivity typ. | %/°C | 0,02 | 0,02 |
| Phase Shift max. @ 100 Hz | deg. | 20 | 20 |
| Operating Temperature | °C | –40 ... 85 | –40 ... 85 |
| Power Supply | mA | 1,3 | 1,3 |
| | VDC | 3,8 ... 16 | 3,8 ... 16 |
| Housing/Base | type | Al., hard anodized | |
| Sealing | type | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 12 | 12 |

**Measuring direction**




**Connection**
4-pin pos.

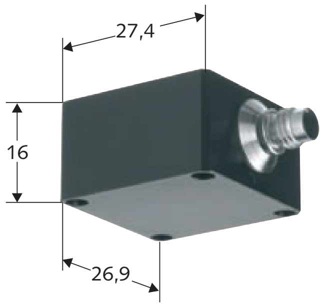
**Characteristics**
Low power, zero volt output at zero g, bipolar output: ±2 V FS, CE compliant

**Applications**
Vehicle ride quality studies, structural analysis, building & bridge vibration

**Accessories**
Cable: Type 1592A…, 1592M1…, 1786C…
Power supply: Type 5210
Mounting cube: Type 8518

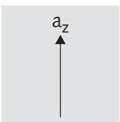
**Datasheet** 8312A_000-219

### **ServoK-Beam Capacitive Accelerometer** Type 8330A…




| Specifications | | Type 8330A2,5 |
|---|---|---|
| Range | g | ±2,5 |
| Sensitivity, ±5% | mV/g | 1500 |
| Frequency Response, ±5% | Hz | 0 … 200 |
| Non-Linearity | %FSO | ±0,2 |
| Resolution/Threshold | µg | <2,5 |
| Transverse Sensitivity typ. | % | 0,4 |
| Shock (500 µs half sine) | g | 1500 |
| Temp. Coeff.: Bias typ. | mg/°C | 0,2 |
| Sensitivity typ. | %/°C | 0,0055 |
| Phase Shift max. @ 100 Hz | deg. | –1 |
| Operating Temperature | °C | –40 ... 85 |
| Power Supply | mA | 8,5 |
| | VDC | ±6 … ±15 |
| Housing/Base | type | Aluminium, hard anodized |
| Sealing | type | Epoxy |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 28,5 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Variable capacitance analogue force feedback operation, zero volt output at zero g, ultra low noise, CE compliant

**Applications**
Low frequency, low amplitude vibration measurements typical to critical machine process control

**Accessories**
Cable: Type 1592M1..., 1788A...
Mounting cube: Type 8530

**Datasheet** 8330A_000-242

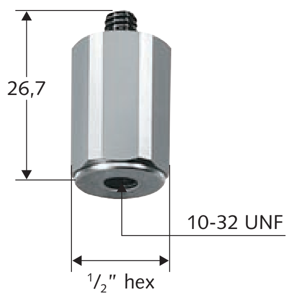
# Vibration

Single axis accelerometers are available in many configurations to accommodate the widely varying test conditions. Critical constraints often include size, weight, sensitivity, frequency response, etc. These variables are interrelated, therefore a compromise must be established during the selection process. Accelerometer families have been created with an optimized set of parameters intended for a particular field of testing. Dynamic accelerometer families include PiezoBeam, Ceramic Shear, and the K-Shear constructions. Typically the PiezoBeam family provides high output in an economical, lightweight package tuned for a Modal Analysis environment. Ceramic Shear types provide improved thermal transient characteristics. K-Shear offers high quality, general-purpose capability covering the widest range of applications. Further classification provides focus to important criteria such as miniature size or high temperature capability.

# Vibration

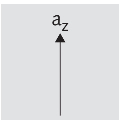
## Charge Output

### Quartz Accelerometers Type 8002…




| Specifications | | Type 8002 |
|---|---|---|
| Range | g | ±1000 |
| Sensitivity | pC/g | –1,0 |
| Frequency Response, –1 ... 5% | Hz | ≈0 … 6 000 |
| Threshold nom. | grms | 0,02 |
| Transverse Sensitivity max. | % | 5 |
| Non-Linearity | %FSO | ±1 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 |
| Operating Temperature | °C | –195 … 260 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Epoxy |
| Mass | gram | 20 |
| Sensing Element | type | Quartz/compression |

**Measuring direction**




**Connection**
10-32 neg.

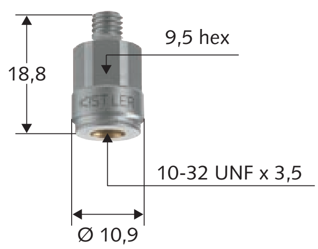
**Characteristics**
High impedance, charge mode, quartz stability and repeatability, wide operating temperature range.
*for the 8002K refer to page 80

**Applications**
Used with 5022 to form a complete calibration primary standard. Long duration shock pulses or high frequency vibrations even in cryogenic or high temperature environments.

**Accessories**
Mounting Stud: Type 8402
Cable: 1631C…
Charge Amplifier: 5022

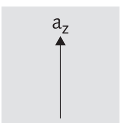
**Datasheet** 8002_000-205

### High Impact Quartz Compression Accelerometer Type 8044




| Specifications | | Type 8044 |
|---|---|---|
| Range | g | –20 k ... 30 k |
| Sensitivity, ±5% | pC/g | –0,3 |
| Frequency Response, ±5% | Hz | ~0 ... 8 k |
| Threshold | $g_{rms}$ | 0,07 |
| Transverse Sensitivity typ. | % | <5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 100 k |
| Temp. Coeff. of Sensitivity | %/°C | 0,02 |
| Operating Temperature | °C | –195 ... 205 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Welded/Epoxy |
| Mass | gram | 7 |
| Insulation Resistance | Ω | $\geq 10^{13}$ |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
High impedance charge mode, wide measuring range, stable quartz element, lightweight, miniature package

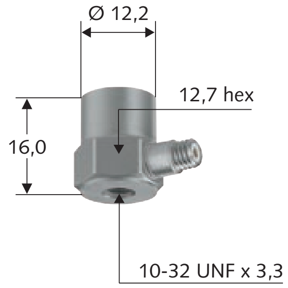
**Applications**
Measuring and analyzing shock and vibration with very high amplitudes of acceleration

**Accessories**
Cable: Type 1631C…
Charge amplifier:
Type 5000 series

**Datasheet** 8044_000-209

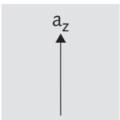
# Charge Output, Extreme Temperature

## **Ceramic Shear Accelerometer** Type 8202A…




| Specifications | | Type |
|---|---|---|
| | | **8202A10** |
| Range | g | ±2 000 |
| Sensitivity, ±5% | pC/g | –10 |
| Frequency Response, ±5% | Hz | 5 ... 10 k |
| Threshold | $g_{rms}$ | 0,001 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | 0,14 |
| Operating Temperature | °C | –70 ... 250 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Mass | gram | 14,5 |
| Insulation Resistance | Ω | $\geq 10^{13}$ |

**Measuring direction**




**Connection**
10-32 neg.

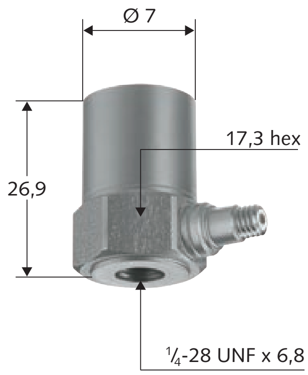
**Characteristics**
High impedance, charge mode, high temp 250 °C, ceramic shear sensing element, low transverse sensitivity, two year warranty

**Applications**
Automotive, aerospace and environmental testing where low impedance sensors are limited by temperature range

**Accessories**
Cable: Type 1631C…
Charge amplifier:
Type 5000 series

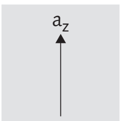
**Datasheet** 8202A_000-212

## **Ceramic Shear Accelerometer** Type 8203A…




| Specifications | | Type |
|---|---|---|
| | | **8203A50** |
| Range | g | ±1000 |
| Sensitivity, ±5% | pC/g | –50 |
| Frequency Response, ±5% | Hz | 5 ... 4 k |
| Threshold | $g_{rms}$ | 0,006 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | 0,14 |
| Operating Temperature | °C | –70 ... 250 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Mass | gram | 44,5 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
High impedance, charge mode, high temp 250 °C, ceramic shear sensing element, low transverse sensitivity, two year warranty

**Applications**
Automotive, aerospace and environmental testing where low impedance sensors are limited by temperature range

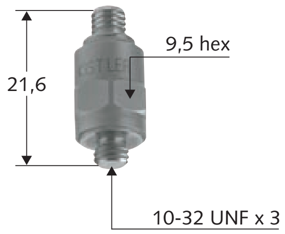
**Accessories**
Cable: Type 1631C…
Charge amplifier:
Type 5000 series

**Datasheet** 8202A_000-212

# Vibration

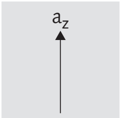
## Charge Output

### **Ceramic Shear Accelerometer** Type 8274A…




| **Specifications** | | **Type** |
|---|---|---|
| | | **8274A5** |
| Range | g | ±2 000 |
| Sensitivity | pC/g | –5,5 |
| Frequency Response, ±7% | Hz | 1 … 12k |
| Non-Linearity | %FSO | ±1 |
| Resolution/Threshold | $g_{rms}$ | 0,01 |
| Transverse Sensitivity typ. | % | 1,5 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. Sensitivity typ. | %/°C | 0,10 |
| Operating Temperature | °C | –54 … 165 |
| Housing/Insulator Base | type | Titanium |
| Sealing | type | Hermetic |
| Mass | gram | 4 |

**Measuring direction**




**Connection**
10-32 neg.

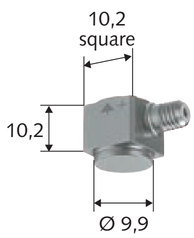
**Characteristics**
High impedance, ceramic shear sensing element, wide frequency response, low transverse sensitivity, lightweight, rugged connector, priced for OEM applications

**Applications**
Impact and vibration related applications including condition monitoring and vehicle testing

**Accessories**
Cable: Type 1631C…
Charge amplifier: Type 5000 series
Adh. mounting pad: Type 8436
Mounting magnet: Type 8452A
Mounting cube: Type 8524
Mounting cube: Type 8526

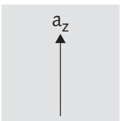
**Datasheet** 8274A_000-213

### **Ceramic Shear Accelerometer** Type 8276A…




| **Specifications** | | **Type** |
|---|---|---|
| | | **8276A5** |
| Range | g | ±2 000 |
| Sensitivity | pC/g | –5,5 |
| Frequency Response, ±5% | Hz | 1 … 7 k |
| Non-Linearity | %FSO | ±1 |
| Threshold | $g_{rms}$ | 0,01 |
| Transverse Sensitivity typ. | % | 1,5 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. Sensitivity typ. | %/°C | 0,10 |
| Operating Temperature | °C | –54 … 165 |
| Housing/Insulator Base | type | Titanium |
| Sealing | type | Hermetic |
| Mass | gram | 4 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
High impedance, ceramic shear sensing element, wide frequency response, low transverse sensitivity, lightweight, rugged connector, priced for OEM applications

**Applications**
Impact and vibration related applications including condition monitoring and vehicle testing

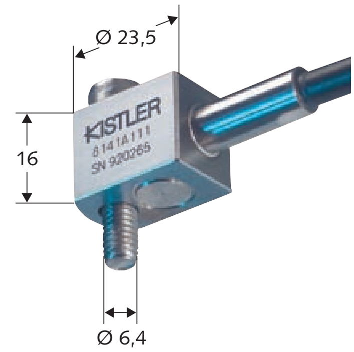
**Accessories**
Cable: Type 1631C…
Charge amplifier: Type 5000 series
Adh. mounting pad: Type 8436
Mounting magnet: Type 8452A
Mounting cube: Type 8524
Mounting cube: Type 8526

**Datasheet** 8274A_000-213

# Vibration

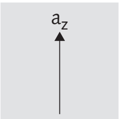
## Voltage Output, Piezotron Accelerometer

### Piezotron Ceramic Shear Accelerometer Type 8141




| Specifications | | Type 8141 |
|---|---|---|
| Range | g | ±50 |
| Sensitivity | mV/g | 100 |
| Frequency Response, ±5% | Hz | 10 ... 6 k |
| Threshold | $g_{rms}$ | 0,002 |
| Transverse Sensitivity | % | 2 |
| Non-Linearity | %FSO | 1 |
| Shock (1 ms pulse) | g | ±5 000 |
| Temp. Coeff. of Sensitivity | %/°C | 0,14 |
| Operating Temperature | °C | –40 ... 80 |
| Power Supply | mA | 3 ... 6 |
| | VDC | 20 ... 30 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 30 |
| Mounting | type | Cap screw M8 x 25 |

**Measuring direction**




**Connection**
pigtails

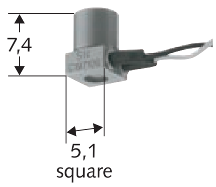
**Characteristics**
Rugged, hermetically sealed construction with durable integral cable. Piezoceramic shear sensing elements.
CE compliant

**Applications**
Measurement of vibration on machine structures, bearing monitoring, machine tools or as a built-in integral component of a machine diagnostic system

**Accessories**
Coupler: Type 5127B

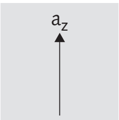
**Datasheet** 8141_000-203

### Picotron Miniature Quartz Compression Accelerometer Type 8614A…




| Specifications | | Type 8614A500M1 | Type 8614A1000M1 |
|---|---|---|---|
| Range | g | ±500 | ±1000 |
| Sensitivity, ±5% | mV/g | 4 | 2,5 |
| Frequency Response, ±5% | Hz | 10 ... 25 k | 10 ... 25 k |
| Threshold | $g_{rms}$ | 0,025 | 0,04 |
| Transverse Sensitivity typ. | % | <5 | <5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | –500 ... 10 k | ±2 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 121 | –54 ... 121 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Titanium | Titanium |
| Sealing | type | Epoxy | Epoxy |
| Mass | gram | 0,7 | 0,7 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, small and lightweight, very high resonant frequency,
CE compliant

**Applications**
P.C. board component shock and vibration testing, monitoring missile and aircraft vibration; high speed rotating component equipment performance and wear signature; and vibration responses of thin-walled structures

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

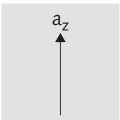
**Datasheet** 8614A_000-225

# Voltage Output, Piezotron Accelerometer

## PiezoBeam Cube Accelerometer Type 8632C…


| Specifications | | Type 8632C5 | Type 8632C10 | Type 8632C50 |
|---|---|---|---|---|
| Range | g | ±5 | ±10 | ±50 |
| Sensitivity, ±5% | mV/g | 1000 | 500 | 100 |
| Frequency Response, ±5% | Hz | 1 ... 3 k | 1 ... 5 k | 1 ... 6 k |
| Threshold | $\mu g_{rms}$ | 120 | 280 | 1000 |
| Transverse Sensitivity | % | <1 | <1 | <1 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (0,2 ms pulse) | g | 7 000 | 10 000 | 10 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,04 | 0,08 | 0,08 |
| Operating Temperature | °C | 0 ... 65 | 0 ... 65 | 0 ... 65 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Al., hard anodized | | |
| Sealing | type | Epoxy | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 6 | 6 | 6 |

**Measuring direction**




**Connection**
10-32 neg.

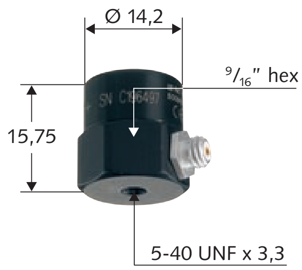
**Characteristics**
Low impedance voltage mode, high sensitivity, small cubic design, ground isolated, CE compliant
T: TEDS option available

**Applications**
Modal analysis or structural investigations in thermally stable environments

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

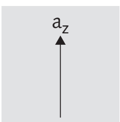
**Datasheet** 8632C_000-229

## PiezoBeam Accelerometer Type 8636C…




| Specifications | | Type 8636C5 | Type 8636C10 | Type 8636C50 |
|---|---|---|---|---|
| Range | g | ±5 | ±10 | ±50 |
| Sensitivity, ±5% | mV/g | 1000 | 500 | 100 |
| Frequency Response, ±5% | Hz | 1 ... 3 k | 1 ... 5 k | 1 ... 6 k |
| Threshold | $\mu g_{rms}$ | 120 | 280 | 1000 |
| Transverse Sensitivity | % | <1 | <1 | <1 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (0,2 ms pulse) | g | 7 000 | 10 000 | 10 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,04 | 0,08 | 0,08 |
| Operating Temperature | °C | 0 ... 65 | 0 ... 65 | 0 ... 65 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Al., hard anodized | | |
| Sealing | type | Epoxy | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 5,5 | 5,5 | 5,5 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
High sensitivity, very low noise, dynamic range >90 dB, low transverse sensitivity, CE compliant

**Applications**
Low frequency measurements, vibrations & oscillations in mechanical structures and for modal analysis in thermally stable environments

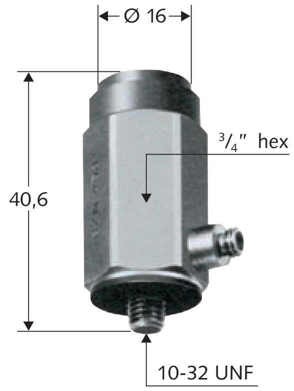
**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series
Adh. mounting pad: Type 8434
Mounting magnet: Type 8450A

**Datasheet** 8630C_000-227

# Vibration

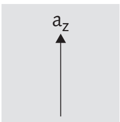
## Voltage Output, Piezotron Accelerometer

### **Piezotron Vibration Standard Accelerometer** Type 8676K




| Specifications | | Type 8676K |
|---|---|---|
| Range | g | ±250 |
| Sensitivity (+10%, -2%) | mV/g | 10 |
| Frequency Response, ±5% | Hz | 20 … 5 000 |
| Threshold nom. | $g_{rms}$ | 0,01 |
| Transverse Sensitivity max. | % | 2 |
| Non-Linearity | %FSO | ± 0,5 |
| Shock Limit (1ms pulse) | g | 1000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,02 |
| Operating Temperature | °C | –15 … 65 |
| Power Supply | mA | 4 … 20 |
| | VDC | 20 … 28 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Epoxy |
| Mass | gram | 80 |
| Sensing Element | type | Quartz/compression |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Quartz accuracy and stability, rugged design, low base strain sensitivity, low mass loading sensitivity, ground isolated

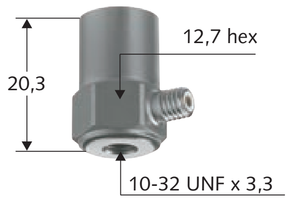
**Applications**
Transfer standard for back-to-back calibration of accelerometers field calibrations.

**Accessories**
Mounting Stud: Type 8410
Thread Converter: Type 8414
Cable: 1761B…
Coupler: 5100 series

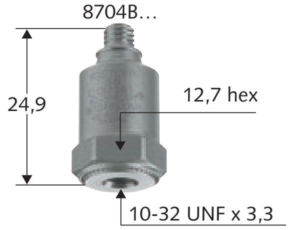
**Datasheet** 8676K_000-233

### **K-Shear Accelerometer** Type 8702B…, 8704B…

8702B…

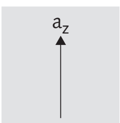



8704B…




| Specifications | | Type 8702/04B25 | Type 8702/04B50 | Type 8702/04B100 |
|---|---|---|---|---|
| Range | g | ± 25 | ±50 | ±100 |
| Sensitivity, ±5% | mV/g | 200 | 100 | 50 |
| Frequency Response, ±5% | Hz | 1,0 ... 8 k | 0,5 ... 10 k | 0,5 ... 10 k |
| Threshold | $g_{rms}$ | 0,002 | 0,004 | 0,006 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) | g | 2 000 | 2 000 | 2 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 100 | –54 ... 100 | –54 ... 100 |
| Power Supply | mA | 4 | 4 | 4 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Titanium | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Mass (8702) | gram | 8,7 | 8,7 | 8,7 |
| Mass (8704) | gram | 7,5 | 7,5 | 7,5 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, ultra low base strain, low thermal transient response, quartz-shear sensing elements, CE compliant
M1: ground isolated
T: TEDS option available

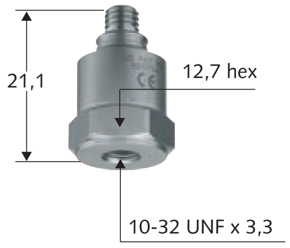
**Applications**
General purpose vibration measurement, vehicle or environmental testing, ESS and modal analysis

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8702B_000-239

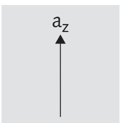
## Voltage Output, Piezotron Accelerometer

### **K-Shear Shock Accelerometer** Type 8704B5000




| Specifications | | Type 8704B5000 |
|---|---|---|
| Range | g | ±5 000 |
| Sensitivity, ±5% | mV/g | 1 |
| Frequency Response, ±5% | Hz | 1 ... 10 k |
| Threshold | $g_{rms}$ | 0,13 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 10 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 |
| Operating Temperature | °C | –54 ... 120 |
| Power Supply | mA | 4 |
| | VDC | 20 ... 30 |
| Housing/Base | type | Titanium |
| Sealing | type | Hermetic |
| Mass | gram | 7,1 |

**Measuring direction**




**Connection**
10-32 neg.

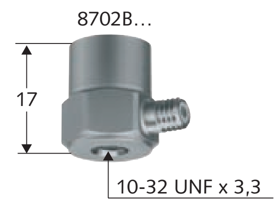
**Characteristics**
Low impedance voltage mode, quartz-shear sensing elements ultra-low base strain, ultra low thermal transient response, CE compliant

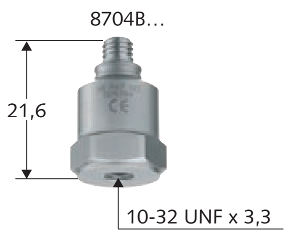
**Applications**
Measurement and control during mechanical shock testing

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8704B_000-240

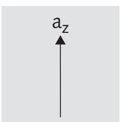
### **K-Shear Accelerometer** Type 8702B…, 8704B…




| Specifications | | Type 8702B500 | Type 8704B500 |
|---|---|---|---|
| Range | g | ±500 | ±500 |
| Sensitivity, ±5% | mV/g | 10 | 10 |
| Frequency Response | Hz | 1…10 k | 1…10 k |
| Threshold | $g_{rms}$ | 0,01 | 0,01 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 | –0,03 |
| Operating Temperature | °C | –54 … 120 | –54 … 120 |
| Power Supply | mA | 4 | 4 |
| | VDC | 20 … 30 | 20 … 30 |
| Housing/Base | type | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic |
| Mass | gram | 8,2 | 7,1 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, ultra low base strain, low thermal transient response, quartz-shear sensing elements, CE compliant
M1: ground isolated
M3: low freq. and ground isolated
M5: high temp. (166 °C)
M8: low temp. (–196 °C)
T: TEDS option available

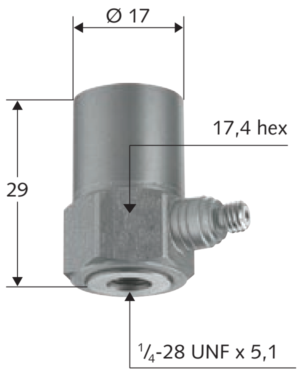
**Applications**
General purpose vibration measurement, vehicle or environmental testing, ESS and modal analysis

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8702B_000-238

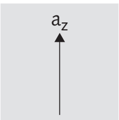
## Voltage Output, Piezotron Accelerometer

### K-Shear Continuous Duty Accelerometer Type 8710A…




| Specifications | | Type 8710A50M1 | Type 8710A50M5 | Type 8710A50M8 |
|---|---|---|---|---|
| Range | g | ±50 | ±50 | ±50 |
| Sensitivity, ±5% | mV/g | 100 | 100 | 100 |
| Frequency Response, ±5% | Hz | 0,3 … 7 k | 1 … 7 k | 1 … 7 k |
| Threshold | $g_{rms}$ | 0,002 | 0,002 | 0,002 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) | g | 2 000 | 2 000 | 2 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 | –0,03 | –0,03 |
| Operating Temperature | °C | –54 … 120 | –54 … 165 | –195 … 120 |
| Power Supply | mA | 2 … 18 | 2 … 18 | 2 … 18 |
| | VDC | 20 … 30 | 20 … 30 | 20 … 30 |
| Housing/Base | type | St. Stl. | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 43 | 29 | 29 |

**Measuring direction**




**Connection**
10-32 neg.

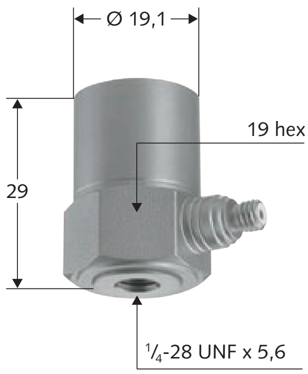
**Characteristics**
Low impedance voltage mode, ultra low thermal transient response, ground isolated, CE compliant
M5: high temp. (166 °C)
M8: low temp. (–196 °C)

**Application**
Testing applications where a rugged accelerometer with a wide frequency range is required: Precision automotive testings, ESS and industrial applications

**Accessories**
Cable: Type 1631C…, 1761B…, 1939
Coupler: Type 5100 series

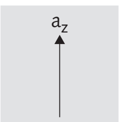
**Datasheet** 8710A_000-241

### K-Shear High Sensitivity Accelerometer Type 8712A…




| Specifications | | Type 8712A5M1 |
|---|---|---|
| Range | g | ±5 |
| Sensitivity, ±5% | mV/g | 1000 |
| Frequency Response, ±5% | Hz | 0,5 … 8 k |
| Threshold | $g_{rms}$ | 0,0004 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 1000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –54 … 100 |
| Power Supply | mA | 4 |
| | VDC | 20 … 30 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 51 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, very high sensitivity, quartz-shear accuracy & stability, high immunity to thermal transients, welded hermetic construction, ground isolated, CE compliant

**Applications**
Applications involving low amplitude vibrations over a wide frequency range. Examples include heavy structures, suspension vibration building and machines

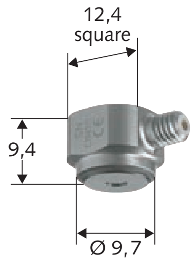
**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8712A_000-244

# Vibration

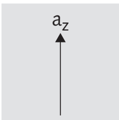
## Voltage Output, Piezotron Accelerometer

### **K-Shear Accelerometer** Type 8720A…




| **Specifications** | | **Type** |
|---|---|---|
| | | **8720A500** |
| Range | g | ±500 |
| Sensitivity, ±5% | mV/g | 10 |
| Frequency Response, ±5% | Hz | 1 ... 9 k |
| Threshold | $g_{rms}$ | 0,01 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –54 ... 120 |
| Power Supply | mA | 4 |
| | VDC | 20 ... 30 |
| Housing/Base | type | Titanium |
| Sealing | type | Hermetic |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 4,9 |

**Measuring direction**




**Connection**
10-32 neg.

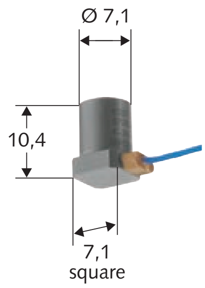
**Characteristics**
Low impedance, voltage mode, quartz-shear sensing element, ultra low base strain sensitivity, ultra low thermal transients, lightweight, small size, ground isolated, CE compliant

**Applications**
Modal analysis and measurement on light structures, the small size allows for installation on items with limited mounting space

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

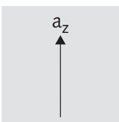
**Datasheet** 8720A_000-246

### **K-Shear Miniature Accelerometer** Type 8728A…




| **Specifications** | | **Type** |
|---|---|---|
| | | **8728A500** |
| Range | g | ±500 |
| Sensitivity, ±5% | mV/g | 10 |
| Frequency Response, ±5% | Hz | 2 ... 10 k |
| Threshold | $g_{rms}$ | 0,02 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –54 ... 120 |
| Power Supply | mA | 2 ... 18 |
| | VDC | 20 ... 30 |
| Housing/Base | type | Titanium |
| Sealing | type | Epoxy |
| Mass | gram | 1,6 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, small, lightweight. integral cable, quartz-shear stability & precision, CE compliant

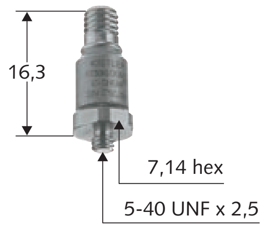
**Applications**
Precision measurements on small, thin-walled structures or where space is limited, ideal for high frequency vibration measurements

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8728A_000-247

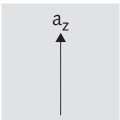
## Voltage Output, Piezotron Accelerometer

### K-Shear Miniature Accelerometer Type 8730A…




| Specifications | | Type 8730A500 | Type 8730A500M1 |
|---|---|---|---|
| Range | g | ±500 | ±500 |
| Sensitivity, ±10% | mV/g | 10 | 10 |
| Frequency Response, ±5% | Hz | 2 ... 10 k | 2 ... 7 k |
| Threshold | $g_{rms}$ | 0,02 | 0,02 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 120 | –54 ... 120 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic |
| Ground Isolation | MΩ | – | 100 |
| Mass | gram | 1,9 | 2,5 |

**Measuring direction**




**Connection**
10-32 neg.

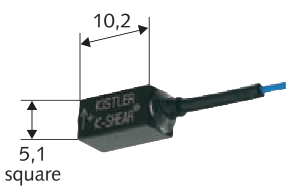
**Characteristics**
Quartz-shear sensing element, low impedance output, ultra low base strain sensitivity, minimal thermal transient response, CE compliant
Metric Thread available (AE)

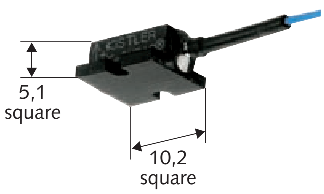
**Applications**
Precision measurements on small, thin-walled structures

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8730A_000-248

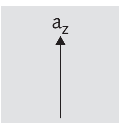
### K-Shear Micro Accelerometer Type 8732A…, 8734A…




| Specifications | | Type 8732A500 | Type 8734A500 |
|---|---|---|---|
| Range | g | ±500 | ±500 |
| Sensitivity, ±5% | mV/g | 10 | 10 |
| Frequency Response, ±5% | Hz | 2 ... 10 k | 2 ... 10 k |
| Threshold | $g_{rms}$ | 0,01 | 0,01 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 120 | –54 ... 120 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Al./Titanium | |
| Sealing | type | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 1,1 | 1,3 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, quartz-shear element, low profile and lightweight, standard automotive footprint and mounting, CE compliant

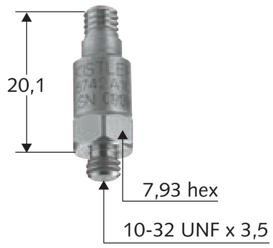
**Applications**
Precision vibration measurement or modal analysis on small, thin-walled structures where space is limited

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8732A_000-249

## Voltage Output, Piezotron Accelerometer

### **K-Shear Shock Accelerometer** Type 8742A…




| **Specifications** | | **Type 8742A5** | **Type 8742A10** | **Type 8742A20** |
|---|---|---|---|---|
| Range | g | ±5 k | ±10 k | ±20 k |
| Sensitivity, ±5% | mV/g | 1 | 0,5 | 0,25 |
| Frequency Response, ±7% | Hz | 1 ... 10 k | 1 ... 10 k | 1 ... 10 k |
| Threshold | $g_{rms}$ | 0,13 | 0,25 | 0,50 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) | g | 50 k | 50 k | 50 k |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 120 | –54 ... 120 | –54 ... 120 |
| Power Supply | mA | 2 ... 20 | 2 ... 20 | 2 ... 20 |
| | VDC | 18 ... 30 | 18 ... 30 | 18 ... 30 |
| Housing/Base | type | St. Stl. | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Mass | gram | 4,5 | 4,5 | 4,5 |

**Measuring direction**

$a_z$

**Connection**
10-32 neg.

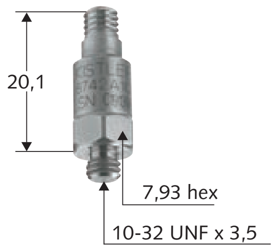
**Characteristics**
Low impedance voltage mode, unique quartz-shear sensing element, low transverse sensitivity, wide bandwidth, high resonant frequency, CE compliant

**Applications**
Impact and vibration related applications including shock and vehicle testing

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8742A_000-250

### **K-Shear Shock Accelerometer** Type 8742A…




| **Specifications** | | **Type 8742A50** |
|---|---|---|
| Range | g | ±50 k |
| Sensitivity, ±5% | mV/g | 0,10 |
| Frequency Response, ±7% | Hz | 1 ... 10 k |
| Threshold | $g_{rms}$ | 1,30 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 100 k |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –54 ... 120 |
| Power Supply | mA | 2 ... 20 |
| | VDC | 18 ... 30 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Mass | gram | 4,5 |

**Measuring direction**

$a_z$

**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, unique quartz-shear sensing element, low transverse sensitivity, wide bandwidth, high resonant frequency, CE compliant

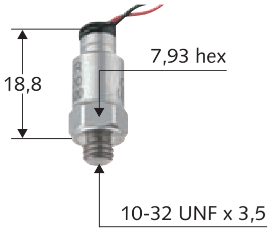
**Applications**
Impact and vibration related applications including shock and vehicle testing

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8742A_000-250

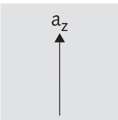
## Voltage Output, Piezotron Accelerometer

### **K-Shear Shock Accelerometer** Type 8743A…




| **Specifications** | | **Type 8743A100** |
|---|---|---|
| Range | g | ±100 k |
| Sensitivity, ±5% | mV/g | 0,05 |
| Frequency Response, ±7% | Hz | 0,5 ... 10 k |
| Threshold | $g_{rms}$ | 2,6 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 120 k |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –54 ... 120 |
| Power Supply | mA | 2 ... 20 |
| | VDC | 18 ... 30 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Mass | gram | 4,5 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance, voltage mode, unique quartz sensing element, low transverse sensitivity, wide bandwidth, high resonant frequency, CE compliant

**Applications**
Impact and vibration related applications including shock and vehicle testing

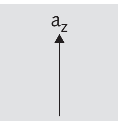
**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8742A_000-250

### **K-Shear Industrial Accelerometer** Type 8752A…


| **Specifications** | | **Type 8752A50** | **Type 8752A50M5** |
|---|---|---|---|
| Range | g | ±50 | ±50 |
| Sensitivity | mV/g | 100 (±5%) | 100 (±10%) |
| Frequency Response | Hz | 0,5 ... 5 k (±5%) | 1 ... 5 k (±10%) |
| Threshold | $g_{rms}$ | 0,002 | 0,002 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | 2 000 | 2 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 | –0,03 |
| Operating Temperature | °C | –54 ... 120 | –54 ... 165 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 115 | 115 |

**Measuring direction**




**Connection**
2-pin
MIL-C-5015

**Characteristics**
Low impedance voltage mode, quartz-shear stability & precision, insensitive to thermal transients, case and ground isolated, CE compliant

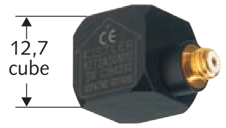
**Applications**
Industrial applications for machinery monitoring, predictive maintenance and analysis of gears and anti-friction bearings

**Accessories**
Cable: Type 1770A…, 1772A…, 1776A…, 1778A…
Coupler: Type 5100 series

**Datasheet** 8752A_000-251

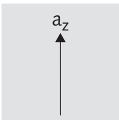
# Voltage Output, Piezotron Accelerometer

## **Ceramic Shear Accelerometer** Type 8772A…




| **Specifications** | | **Type 8772A5** | **Type 8772A10** | **Type 8772A50** |
|---|---|---|---|---|
| Range | g | ±5 | ±10 | ±50 |
| Sensitivity, ±5% | mV/g | 1000 | 500 | 100 |
| Frequency Response, ±5% | Hz | 1 ... 5 k | 1 ... 5 k | 1 ... 5 k |
| Threshold | $\mu g_{rms}$ | 400 | 500 | 2 000 |
| Transverse Sensitivity | % | <5 | <5 | <5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (0,2 ms pulse) | g | 5 000 | 7 000 | 7 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,15 | –0,10 | –0,10 |
| Operating Temperature | °C | 0 ... 65 | 0 ... 65 | 0 ... 65 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Al., hard anodized | | |
| Sealing | type | Epoxy | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 8 | 8 | 8 |
| Mounting | type | Adhesive/wax | Adhesive/wax | Adhesive/wax |

**Measuring direction**




**Connection**
10-32 neg.

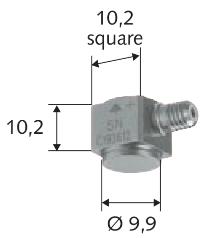
**Characteristics**
Low impedance voltage mode, lightweight, ceramic shear sensing element, cube shaped for mounting flexibility, CE compliant
T: TEDS option available

**Applications**
Modal analysis applications exposed to environmental factors

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series
Mounting clip: Type 8474

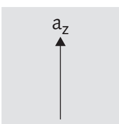
**Datasheet** 8772A_000-253

## **Ceramic Shear Accelerometer** Type 8774A…, 8776A…




| **Specifications** | | **Type 8774A50** | **Type 8776A50M1** | **Type 8776A50M6** |
|---|---|---|---|---|
| Range | g | ±50 | ±50 | ±50 |
| Sensitivity, –5 ... 30% | mV/g | 100 | 100 | 100 |
| Frequency Response, ±5% | Hz | 1 ... 10 k | 1 ... 7 k | 1 ... 10 k |
| Threshold | $g_{rms}$ | 0,0025 | 0,0025 | 0,0025 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±0,5 | ±1 | ±1 |
| Shock (0,2 ms pulse) | g | 5 000 | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,14 | –0,14 | –0,14 |
| Operating Temperature | °C | –54 ... 121 | –54 ... 121 | –54 ... 121 |
| Power Supply | mA | 2 ... 20 | 2 ... 20 | 2 ... 20 |
| | VDC | 18 ... 30 | 18 ... 30 | 18 ... 30 |
| Housing/Base | type | Titanium | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Ground Isolation | MΩ | – | 10 | – |
| Mass | gram | 4,0 | 4,3 | 4,5 |

**Measuring direction**




**Connection**
10-32 neg.
Side connector: 8776
Top connector: 8774

**Characteristics**
Low impedance voltage mode, high sensitivity, high resolution ceramic, shear sensing element, rugged connector, priced for OEM applications, CE compliant

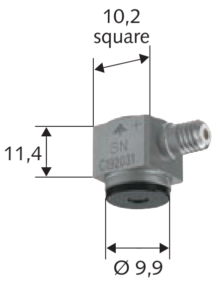
**Applications**
Modal analysis where environmental changes or temperature transient are prevalent

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8774A_000-255

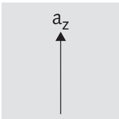
## Voltage Output, Piezotron Rotational Accelerometer

### **Ceramic Shear Accelerometer** Type 8776A…




| **Specifications** | | **Type** **8776A50M3** |
|---|---|---|
| Range | g | ±50 |
| Sensitivity, ±5% | mV/g | 100 |
| Frequency Response, ±5% | Hz | 0,5 ... 4 k |
| Threshold | $g_{rms}$ | 0,003 |
| Transverse Sensitivity typ. | % | 3 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,14 |
| Operating Temperature | °C | –54 ... 120 |
| Power Supply | mA | 2 ... 20 |
| | VDC | 18 ... 30 |
| Housing/Base | type | Titanium |
| Sealing | type | Hermetic |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 4,3 |
| Mounting | type | Adhesive/wax |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
High sensitivity, high resolution, economical pricing

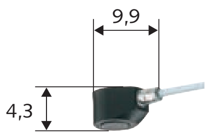
**Applications**
Low level vibration and where wide bandwidth and rugged construction are required

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8774_000-255

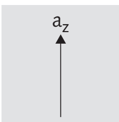
## Voltage Output, Piezotron Accelerometer

### **Ceramic Shear Miniature Accelerometer** Type 8778A…




| **Specifications** | | **Type** **8778A500** |
|---|---|---|
| Range | g | ±500 |
| Sensitivity, ±5% | mV/g | 10 |
| Frequency Response, ±5% | Hz | 2 ... 9 k |
| Threshold | $g_{rms}$ | 0,01 |
| Transverse Sensitivity typ. | % | 3 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,14 |
| Operating Temperature | °C | –54 ... 121 |
| Power Supply | mA | 2 ... 20 |
| | VDC | 18 ... 30 |
| Housing/Base | type | Titanium/Hard Anod. Aluminium |
| Sealing | type | Epoxy |
| Mass | gram | 0,29 |
| Ground Isolation | MΩ | 10 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance voltage mode, ultra low base strain and thermal transient response, ground isolated assembly, high 10 mV/g sensitivity, CE compliant
M14: version available (repairable twisted pair cable)

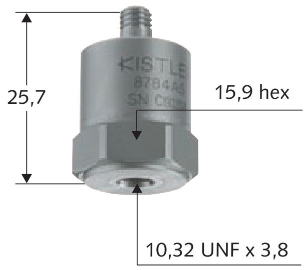
**Applications**
Precision vibration measurement, modal analysis on small, thin walled structures or where space is limited and mass loading is of primary concern

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series
Removal Tool: Type 1378
Twisted pair replacement cable

**Datasheet** 8778A_000-256

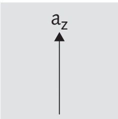
## Voltage Output, Piezotron Accelerometer

### **Ceramic Shear Accelerometer** Type 8784A…, 8786A…




| Specifications | | Type 8784A5 | Type 8786A5 |
|---|---|---|---|
| Range | g | ±5 | ±5 |
| Sensitivity, ±5% | mV/g | 1000 | 1000 |
| Frequency Response, ±5% | Hz | 1 ... 6 k | 1 ... 6 k |
| Threshold | $g_{rms}$ | 0,0004 | 0,0004 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | 2 500 | 2 500 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 80 | –54 ... 80 |
| Power Supply | mA | 2 ... 20 | 2 ... 20 |
| | VDC | 18 ... 30 | 18 ... 30 |
| Housing/Base | type | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic |
| Mass | gram | 21 | 21 |

**Measuring direction**




**Connection**
10-32 neg.
Side connector: 8786

**Characteristics**
Ceramic shear sensing element, low impedance, voltage mode, high sensitivity, less than 1 mg resolution, rugged connector for repeated connections, priced for OEM, CE compliant

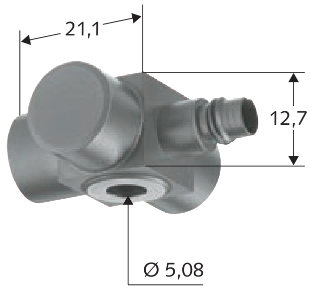
**Application**
Low impact and vibration related applications including condition monitoring and vehicle testing

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8784A_000-257

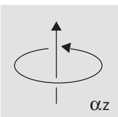
## Voltage Output, Piezotron Rotational Accelerometer

### **K-Shear Axial/Lateral Rotational Accelerometer** Type 8838, 8840

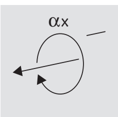



| Specifications | | Type 8838 | Type 8840 |
|---|---|---|---|
| Range | krads/s² | ±150 | ±150 |
| Sensitivity | μV/rad/s² | 34 | 34 |
| Frequency Response | Hz | 1 ... 2 k | 1 ... 2 k |
| Threshold noise | rad/s² | 4 | 4 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Shock (1 ms pulse) | g | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 |
| Operating Temperature | °C | –54 ... 121 | –54 ... 121 |
| Power Supply | mA | 4 | 4 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 18,5 | 18,5 |
| Mounting | type | Cap screw | Cap screw M5 x 20 |

**Axial Measuring direction 8838**




**Lateral Measuring direction 8840**




**Connection**
4-pin Microtech pos.

**Characteristics**
Shear quartz piezoelectric, principal, axial or lateral oscillations, hermetic construction, lightweight and convenient thru hole mount, CE compliant

**Applications**
Axial or shaft type measurements on an oscillating but non-rotating specimen (8838), plate or lateral rotational acceleration measurements with type 8840

**Accessories**
Cable: Type 1592M1…, 1578A, 1786C…

**Datasheet** 8838_000-271

# Acoustic Emission

Acoustic Emission (AE) are transient elastic waves during the rapid release of energy from localized sources within a material. AE waves range in frequency from a few kHz to several MHz.

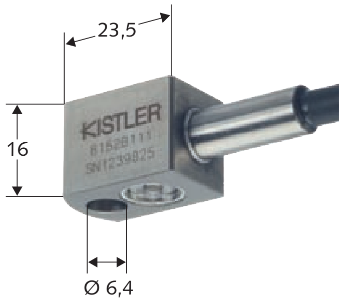
The source of these emissions in metals is closely associated with the dislocation movements accompanying plastic deformation and the initiation and extension of cracks in a structure under stress. Sources of AE include melting, phase transformation, thermal stresses, cool down cracking, friction mechanisms and stress build up.

The AE sensor can be used to monitor processes such as:
- Stamping
- Deep Drawing
- Cutting Tool Breakage
- Fracture of metal or composite pressure vessels
- Fracture of stressed structures/ bridges
- Detecting loose parts in an electronic assembly
- Detecting, locating and evaluating flaws in materials
- Insect activity in wood
- Steam Valve leaks
- Partial discharge in transformers

AE sensors can warn of faults when they are occuring, not just whether or not they exist like traditional non-destructive text methods, i.e. x-ray, dye penetrants, eddy current, ultrasonic transmission or microscopic inspection. Detectable AE signals are emitted before visual signs of fracture or cracking appear.

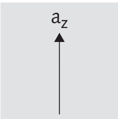
## Voltage Output, Piezotron Acoustic Emission Sensor

### Piezotron Ceramic Shear Acoustic Emission Sensor Type 8152B…




| Specifications | | Type 8152B1 | Type 8152B2 |
|---|---|---|---|
| Frequency range, ±10 dB | kHz | 50…400 | 100…900 |
| Sensitivity (nom.) | $dB_{ref\ 1V\ (m/s)}$ | 57 | 48 |
| Overload Shock 0,5 ms pulse | g | 2 000 | 2 000 |
| Overload vibration | g | ±1000 | ±1000 |
| Operating temperature range | °C | –40…60 | –40…60 |
| Supply: Constant current | mA | 3…6 | 3…6 |
| Voltage (coupler) | V DC | 5…36 | 5…36 |
| Output: Voltage (full scale) | V | ±2 | ±2 |
| Output bias | V DC | 2,5 | 2,5 |
| Mass | gram | 29 | 29 |
| Case material | | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic |
| Ground Isolation | Ω | ≥1 | ≥1 |

**Measuring direction**




**Connection**
pigtails

**Characteristics**
High sensitivity and wide frequency range, inherent high-pass-characteristic, robust, suitable for industrial use (Degree of protection IP 65 resp. IP 67), ground isolated, CE compliant

**Applications**
Measurement of very high frequency phenomena particularly on machine structures. Crack formation investigations, fatigue studies and machine tool diagnostics

**Accessories**
Magnetic clamp: Type 8443B
AE Coupler: Type 5125B…

**Data sheet** 8152B_000-204

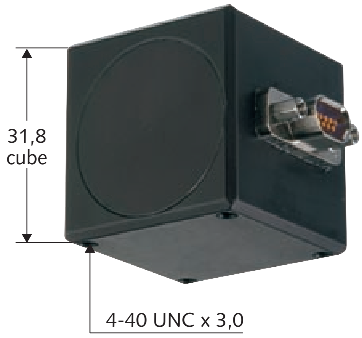
# Triaxial

The PiezoBeam, Ceramic Shear, K-Shear and K-Beam technologies have been packaged into triaxial assemblies providing a convenient means to obtain three orthogonal data sets from a single sensor. The integral package is less cost than three separate accelerometers mounted to a common center and typically easier to set-up and operate due to mounting and cabling considerations.

# Triaxial

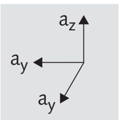
## Capacitive Accelerometer

### K-Beam Capacitive Triaxial Accelerometer Type 8393A…




| Specifications | | Type 8393A2 | Type 8393A10 |
|---|---|---|---|
| Range | g | ±2 | ±10 |
| Sensitivity, ±5% | mV/g | 1000 | 200 |
| Output at Zero g, ±30 mV | V | 0 | 0 |
| Frequency Response, ±5% | Hz | 0 ... 250 | 0 ... 180 |
| Non-Linearity | %FSO | ±0,8 | ±0,8 |
| Resolution/Threshold | μg | 540 | 2830 |
| Transverse Sensitivity typ. | % | 1 | 1 |
| Shock (700 μs half sine) | g | 6 000 | 6 000 |
| Temp. Coeff.: Bias typ. | mg/°C | 0,2 | 1 |
| Sensitivity typ. | %/°C | 0,02 | 0,02 |
| Phase Shift max. @ 100 Hz | deg. | 20 | 20 |
| Operating Temperature | °C | –40 ... 85 | –40 ... 85 |
| Power Supply | mA | 4 | 4 |
| | VDC | 3,8 ... 16 | 3,8 ... 16 |
| Housing/Base | type | Al., hard anodized | |
| Sealing | type | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 |
| Mass | gram | 60 | 60 |

**Measuring direction**




**Connection**
9-pin micro D pos.

**Characteristics**
Excellent thermal performance, operates from 3,8 to 16 VDC, CE compliant

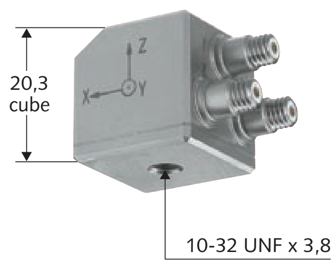
**Applications**
Structural dynamics for bridges and buildings; transportation, robotics, human motion and seismic ground measurements

**Accessories**
Cable: Type 1792A2
cap screw 4-40 UNC x 0,19"

**Datasheet** 8393A_000-224

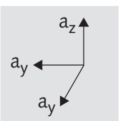
## Charge Output, Extreme Temperature

### Ceramic Shear Triaxial Accelerometer Type 8290A…




| Specifications | | Type 8290A25M5 |
|---|---|---|
| Range | g | ±1000 |
| Sensitivity, ±15% | pC/g | –25 |
| Frequency Response: | | |
| stud mounted ±10% | Hz | 5 ... 4 k |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | 0,13 |
| Operating Temperature | °C | –70 ... 250 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Mass | gram | 53 |

**Measuring direction**




**Connection**
Type 10-32 neg.

**Characteristics**
High impedance, charge mode Ceramic Shear sensing element, low transverse sensitivity, long-term stability at extended temperatures

**Applications**
General vibration measurements with varying test conditions, vehicle vibration and NVH testing, general laboratory and ESS

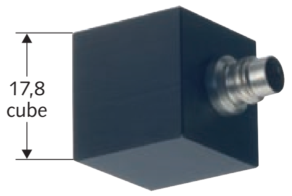
**Accessories**
Mounting stud:
Type 8402, 8411 (only supplied outside N.A.)
Charge amplifier: Type 5000 series
Cable: Type 1631C…

**Datasheet** 8290A_000-215

# Triaxial

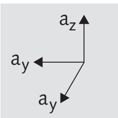
## Voltage Output, Piezotron Accelerometer

### **PiezoBeam Triaxial Accelerometer** Type 8690C…




| Specifications | | Type 8690C5 | Type 8690C10 | Type 8690C50 |
|---|---|---|---|---|
| Range | g | ±5 | ±10 | ±50 |
| Sensitivity, ±5% | mV/g | 1000 | 500 | 100 |
| Frequency Response, ±5% | Hz | 1 … 3 k | 1 … 5 k | 1 … 6 k |
| Threshold | $\mu g_{rms}$ | 120 | 280 | 1000 |
| Transverse Sensitivity | % | <1 | <1 | <1 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (0,2 ms pulse) | g | 5 000 | 10 000 | 10 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,04 | 0,08 | 0,08 |
| Operating Temperature | °C | 0 … 65 | 0 … 65 | 0 … 65 |
| Power Supply | mA | 2 … 18 | 2 … 18 | 2 … 18 |
| | VDC | 20 … 30 | 20 … 30 | 20 … 30 |
| Housing/Base | type | Al., hard anodized | | |
| Sealing | type | Epoxy | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 11,2 | 11,2 | 11,2 |

**Measuring direction**




**Connection**
4-pin pos.

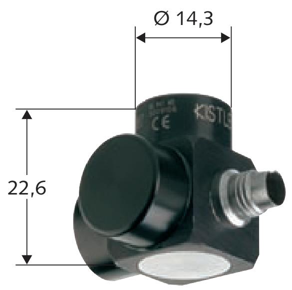
**Characteristics**
Low impedance voltage mode, high sensitivity small, cubic design, thermal stability, CE compliant
T: TEDS option available

**Applications**
Modal analysis or structural testing

**Accessories**
Cable: Type 1756B…, 1578A…
Coupler: Type 5100 series
Mounting clip: Type 8476

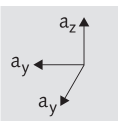
**Datasheet** 8690C_000-234

### **PiezoBeam Triaxial Accelerometer** Type 8692C…




| Specifications | | Type 8692C5 | Type 8692C10 | Type 8692C50 |
|---|---|---|---|---|
| Range | g | ±5 | ±10 | ±50 |
| Sensitivity, ±5% | mV/g | 1000 | 500 | 100 |
| Frequency Response, ±5% | Hz | 1 … 3 k | 1 … 5 k | 1 … 6 k |
| Threshold | $\mu g_{rms}$ | 120 | 280 | 1000 |
| Transverse Sensitivity | % | <1 | <1 | <1 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (0,2 ms pulse) | g | 5 000 | 10 000 | 10 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,04 | 0,08 | 0,08 |
| Operating Temperature | °C | 0 … 65 | 0 … 65 | 0 … 65 |
| Power Supply | mA | 2 … 18 | 2 … 18 | 2 … 18 |
| | VDC | 20 … 30 | 20 … 30 | 20 … 30 |
| Housing/Base | type | Al., hard anodized | | |
| Sealing | type | Epoxy | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 16 | 16 | 16 |
| Mounting | type | Magnetic | Magnetic | Magnetic |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Low impedance voltage mode, high sensitivity, thermal stability, CE compliant
M1: 10-32 mounting hole option available

**Applications**
Modal analysis or structural testing

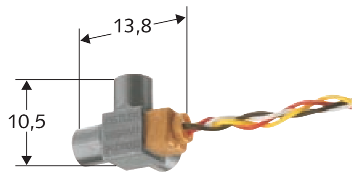
**Accessories**
Cable: Type 1756B…
Extension cable: Type 1578A…
Coupler: Type 5100 series

**Datasheet** 8692C_000-236

# Triaxial

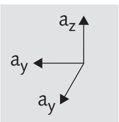
## Voltage Output, Piezotron Accelerometer

### **Piezotron Miniature Quartz Compression Accelerometer** Type 8694…




| **Specifications** | | **Type 8694M1** |
|---|---|---|
| Range | g | ±500 |
| Sensitivity nom. | mV/g | 4 |
| Frequency Response, ±5% | Hz | 10 ... 20 k |
| Threshold | $g_{rms}$ | 0,025 |
| Transverse Sensitivity | % | 5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse width) max. | $g_{pk}$ | ±2 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –55 ... 135 |
| Power Supply | mA | 4 |
| | VDC | 12 ... 30 |
| Housing/Base | type | Titanium |
| Sealing – Housing/Connector | type | Epoxy |
| Mass | gram | 2,5 |

**Measuring direction**




**Connection**
4-pin neg.

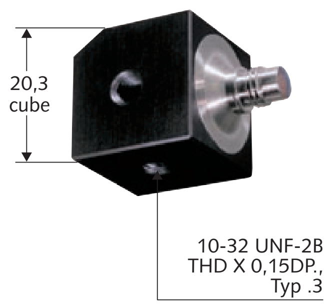
**Characteristics**
Low impedance voltage mode, small size and lightweight, less than 2,5 grams, very high resonant frequency, CE compliant

**Applications**
Dynamic characteristics of very light test objects, measuring of vibrations on thin-walled structures, modal testing

**Accessories**
Anodized adaptor: Types 8439, 8440 for ground isolation
Cable: Type 1578A…, 1576…
Coupler: Type 5100 series

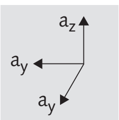
**Datasheet** 8694M_000-237

### **Annular Ceramic Shear Triaxial Accelerometer** Type 8762A…




| **Specifications** | | **Type 8762A5** | **Type 8762A10** | **Type 8762A50** |
|---|---|---|---|---|
| Range | g | ±5 | ±10 | ±50 |
| Sensitivity, ±5% | mV/g | 1000 | 500 | 100 |
| Frequency Response, ±5% | Hz | 0,5 … 6 000 | 0,5 … 6 000 | 0,5 … 6 000 |
| Threshold | $g_{rms}$ | 0,0003 | 0,00035 | 0,0012 |
| Transverse Sensitivity typ. | % | ≤5 | ≤5 | ≤5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (0,2 ms pulse) max. | $g_{pk}$ | 5 000 | 7 000 | 7 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,02 | –0,02 |
| Operating Temperature | °C | –54 … 80 | –54 … 80 | –54 … 80 |
| Power Supply | mA | 2 … 18 | 2 … 18 | 2 … 18 |
| | VDC | 20 … 30 | 20 … 30 | 20 … 30 |
| Housing/Base | type | Al./hard anodized | | |
| Sealing | type | Epoxy | Epoxy | Epoxy |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 23 | 23 | 23 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Cubed triaxial, (3) 10-32thd. mounting holes, low thermal transient response, durable hard anodized Al. housing, gnd. isolated
T: TEDS option available

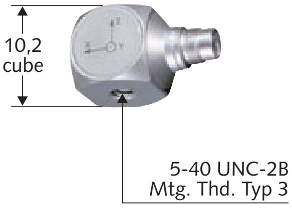
**Applications**
Modal analysis, automotive bodies and aircraft structures, general vibrations

**Accessories**
Cable: Type 1756B…
Extension Cable: Type 1578A
Coupler: Type 5100 series

**Datasheet** 8762A_000-456

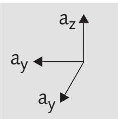
## Voltage Output, Piezotron Accelerometer

### Ceramic Shear Triaxial Accelerometer Type 8763A…




| Specifications | | Type 8763A500 |
|---|---|---|
| Range | g | ±500 |
| Sensitivity, ±10% | mV/g | 10 |
| Frequency Response, ±5% | Hz | 1 … 12 000 |
| Threshold | $g_{rms}$ | 0,018 |
| Transverse Sensitivity typ. | % | 2,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse width) max. | $g_{pk}$ | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,14 |
| Operating Temperature | °C | –54 … 121 |
| Power Supply | mA | 2 … 20 |
| | VDC | 18 … 30 |
| Housing/Base | type | Titanium |
| Sealing | type | Hermetic |
| Mass | gram | 3,3 |

**Measuring direction**




**Connection**
Mini 4-pin pos.

**Characteristics**
Mini cube design, (3) 5-40 thread holes, light weight, mini 4-pin connector, low base strain sensitivity, CE Compliant

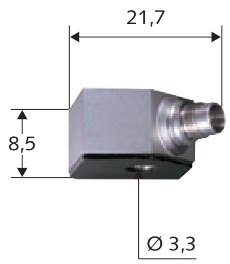
**Applications**
Dynamic vibration, shock measurement, light weight structures

**Accessories**
Cable: Type 1784A(K)03
Coupler: Type 5100 series

**Datasheet** 8763A_000-474

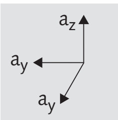
## Voltage Output, Piezotron Accelerometer

### PiezoStar Miniature Triaxial Shear Accelerometer Type 8765A…




| Specifications | | Type 8765A250M5 |
|---|---|---|
| Range | g | ±250 |
| Sensitivity, ±10% | mV/g | 20 |
| Frequency Response, ±5% | Hz | 1 … 9 000 |
| Threshold | $g_{rms}$ | 0,002 |
| Transverse Sensitivity typ. | % | 2,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse width) max. | $g_{pk}$ | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,008 |
| Operating Temperature | °C | –54 … 165 |
| Power Supply | mA | 2 … 20 |
| | VDC | 18 … 30 |
| Housing/Base | type | Titanium |
| Sealing | type | Hermetic |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 6,4 |

**Measuring direction**




**Connection**
Mini 4-pin pos.

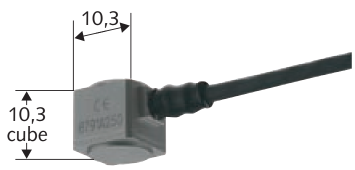
**Characteristics**
Super low thermal transient sensitivity, high temp, hermetic sealing, low base strain, mini 4-pin connector, and PiezoStar material

**Applications**
Modal analysis, automotive bodies and aircraft structures, general vibrations

**Accessories**
Insulated mounting screw M2,5 x 12
Cable: Type 1784A…K03
Coupler: Type 5100 series

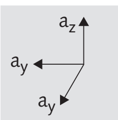
**Datasheet** 8765A_000-472

### K-Shear Miniature Triaxial Accelerometer Type 8791A…




| Specifications | | Type 8791A250 |
|---|---|---|
| Range | g | ±250 |
| Sensitivity, ±15% | mV/g | 20 |
| Frequency Response, | | |
| ±5%, adhesive mount | Hz | 2 ... 2 k |
| ±10%, adhesive mount | Hz | 1 ... 4,5 k |
| Threshold | $g_{rms}$ | 0,006 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) | g | 3 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –55 ... 120 |
| Power Supply | mA | 2 ... 20 |
| | VDC | 18 ... 30 |
| Housing/Base | type | Titanium |
| Sealing – Housing/Connector | type | Epoxy |
| Mass without cable | gram | 4 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Quartz shear sensing elements, high immunity to thermal transients, ultra-low base strain sensitivity, CE compliant

**Applications**
The extremely low mass is highly attractive where mass loading of specimens is a concern

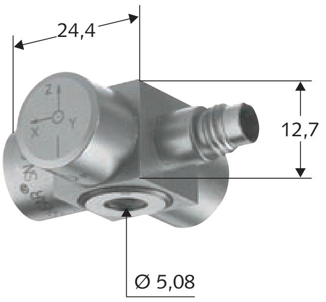
**Accessories**
Mounting wax: Type 8432
Cable: Type 1578A…, 1756B…
Coupler: Type 5100 series

**Datasheet** 8791A_000-259

# Triaxial

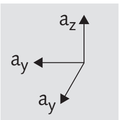
## Voltage Output, Piezotron Accelerometer

### **K-Shear Triaxial Accelerometer** Type 8792A…




| Specifications | | Type 8792A25 | Type 8792A50 | Type 8792A100 |
|---|---|---|---|---|
| Range | g | ±25 | ±50 | ±100 |
| Sensitivity, ±5% | mV/g | 200 | 100 | 50 |
| Frequency Response, ±5% | Hz | 1,0 ... 5 k | 0,5 ... 5 k | 0,5 ... 5 k |
| Threshold | $g_{rms}$ | 0,002 | 0,004 | 0,006 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) max. | g | 2 000 | 2 000 | 2 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 | –0,06 | –0,06 |
| Operating Temperature | °C | –55 ... 100 | –55 ... 100 | –55 ... 100 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | St. Stl. | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Ground Isolation | MΩ | 10 | 10 | 10 |
| Mass | gram | 29 | 29 | 29 |

**Measuring direction**




**Connection**
4-pin pos.

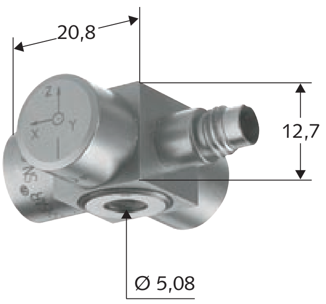
**Characteristics**
High immunity to thermal transients, ultra-low base strain sensitivity, wide frequency range, ground isolated, low profile design, CE compliant
T: TEDS option available

**Applications**
Center hole mounting capability allows orientation of exit cable or axis alignment. The low profile package accommodates restricted space environments

**Accessories**
Socket cap head screw, 10-32 x 0,75" and M5 x 20 mm
Cable: Type 1578A…, 1756B…
Coupler: Type 5100 series

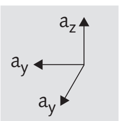
**Datasheet** 8792A_000-260

### **K-Shear Triaxial Accelerometer** Type 8792A…




| Specifications | | Type 8792A500 |
|---|---|---|
| Range | g | ±500 |
| Sensitivity, ±5% | mV/g | 10 |
| Frequency Response, –5, + 10% | Hz | 1 ... 5 000 |
| Threshold | $g_{rms}$ | 0,01 |
| Transverse Sensitivity typ. | % | 1,5 |
| Non-Linearity | %FSO | ±1 |
| Shock (1 ms pulse) max. | g | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,06 |
| Operating Temperature | °C | –55 ... 100 |
| Power Supply | mA | 2 ... 18 |
| | VDC | 20 ... 30 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Hermetic |
| Ground Isolation | MΩ | 10 |
| Mass | gram | 29 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
High immunity to thermal transients, ultra-low base strain sensitivity, wide frequency range, ground isolated, low profile design, CE compliant

**Applications**
Center hole mounting capability allows orientation of exit cable or axis alignment. The low profile package accommodates restricted space environments

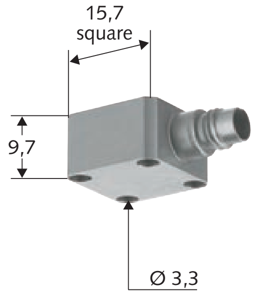
**Accessories**
Socket cap head screw, 10-32 x 0,75" and M5 x 20 mm
Cable: Type 1578A…, 1756B…
Coupler: Type 5100 series

**Datasheet** 8792A_000-260

# Triaxial

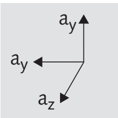
## Voltage Output, Piezotron Accelerometer

### **K-Shear Triaxial Accelerometer** Type 8793A…




| Specifications | | Type 8793A500 | Type 8793A500M5 | Type 8793A500M8 |
|---|---|---|---|---|
| Range | g | ±500 | ±500 | ±500 |
| Sensitivity | mV/g | 10 | 10 | 10 |
| Frequency Response, ±5% | Hz | 2,5 ... 10 k | 2,5 ... 10 k | 2,5 ... 10 k |
| Threshold | $g_{rms}$ | 0,002 | 0,002 | 0,002 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) max. | g | 5 000 | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 | –0,03 | –0,03 |
| Operating Temperature | °C | –55 ... 120 | –55 ... 165 | –195 ... 120 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | St. Stl. | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Mass | gram | 11 | 11 | 11 |

**Measuring direction**




**Connection**
4-pin pos.

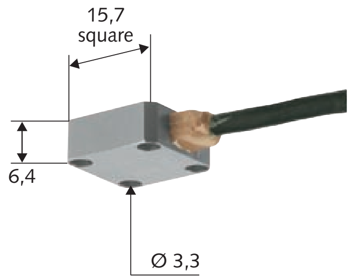
**Characteristics**
Low impedance voltage mode, low profile design, quartz shear accuracy and stability, hermetically sealed, CE compliant
M3: low frequency 1 Hz option available
T: TEDS option available

**Applications**
Useful for measuring small and lightweight structures, where mass loading must be kept at a minimum

**Accessories**
Cap screws 4-40 x 0,5"
and M2,5 x 12 mm
Cable: Type 1756B…, 1578A…
Coupler: Type 5100 series

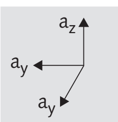
**Datasheet** 8793A_000-261

### **K-Shear Triaxial Accelerometer** Type 8794A…




| Specifications | | Type 8794A500 | Type 8794A500M5 | Type 8794A500M3 |
|---|---|---|---|---|
| Range | g | ±500 | ±500 | ±500 |
| Sensitivity | mV/g | 10 | 10 | 10 |
| Frequency Response, ±5% | Hz | 2,5 ... 10 k | 2,5 ... 10 k | 1 ... 10 k |
| Threshold | $g_{rms}$ | 0,002 | 0,002 | 0,002 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) max. | g | 5 000 | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,02 | –0,02 | –0,02 |
| Operating Temperature | °C | –55 ... 120 | –55 ... 165 | –55 ... 120 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | St. Stl. | St. Stl. | St. Stl. |
| Sealing – Housing/Connector | type | Welded/Epoxy | Welded/Epoxy | Welded/Epoxy |
| Mass | gram | 7,6 | 7,6 | 9 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Low impedance voltage mode, low profile design, quartz shear accuracy and stability, CE compliant, ground isolation version available
M3: low frequency 1 Hz option available

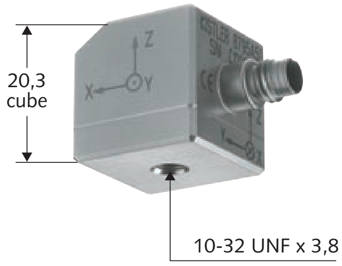
**Applications**
Measurements in confined spaces. The low profile design provides an aerodynamic advantage for in-flight flutter testing

**Accessories**
Mounting screw 4-40 x 0,375"
and M2,5 x 10 mm
Cable: Type 1756B…, 1578A…
Coupler: Type 5100 series

**Datasheet** 8794A_000-263

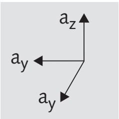
## Voltage Output, Piezotron Accelerometer

### **K-Shear Triaxial Cube Accelerometer** Type 8795A…




| **Specifications** | | **Type 8795A50** | **Type 8795A50M5** | **Type 8795A50M8** |
|---|---|---|---|---|
| Range | g | ±50 | ±50 | ±50 |
| Sensitivity, ±10% | mV/g | 100 | 100 | 100 |
| Frequency Response, ±5% | Hz | 1 … 4 k | 1 … 4 k | 1 … 4 k |
| Threshold | $g_{rms}$ | 0,001 | 0,001 | 0,001 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 | 1,5 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Shock (1 ms pulse) max. | $g_{pk}$ | 5 000 | 5 000 | 5 000 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 | –0,03 | –0,03 |
| Operating Temperature | °C | –55 … 120 | –55 … 165 | –195 … 121 |
| Power Supply | mA | 2 … 18 | 2 … 18 | 2 … 18 |
| | VDC | 20 … 30 | 20 … 30 | 20 … 30 |
| Housing/Base | type | Titanium | Titanium | Titanium |
| Sealing – Housing/Connector | type | Hermetic | Hermetic | Hermetic |
| Mass | gram | 32 | 32 | 32 |

**Measuring direction**




**Connection**
4-pin pos.

**Characteristics**
Titanium case, patented K-Shear design, hermetically sealed, CE compliant
T: TEDS option available

**Applications**
Vehicle vibration and noise harshness (NVH) testing, general laboratory and modal testing

**Accessories**
Mounting stud:
Type 8402, 8411
Cable: Type 1578A…, 1756B…
Coupler: Type 5100 series

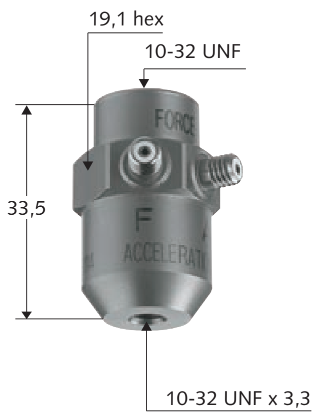
**Datasheet** 8795A_000-264

# Impulse

A selection of Impulse Hammers is available covering ranges of applications from small to very large mechanical structures. The force-instrumented hammer contains a load cell at the impact end where a variety of tips can be attached. The input power spectrum provided to a test structure can be controlled by appropriate selection of hammer and contact tip. The hammer designs are rugged with the cabling conveniently exiting the rear of the handle. Hammer mass and tip interchanges are accommodated by simple threaded engagement to the hammerhead.

## Force Sensor

### Piezotron Impedance Head Type 8770A…




| Specifications | | Type 8770A5 | Type 8770A50 |
|---|---|---|---|
| **ACCELERATION** | | | |
| Range | g | ±5 | ±50 |
| Sensitivity, ±10% | mV/g | 1000 | 100 |
| Frequency Response, ±5% | Hz | 1 ... 4 k | 1 ... 4 k |
| Threshold | $g_{rms}$ | 0,0004 | 0,001 |
| Transverse Sensitivity typ. | % | 1,5 | 1,5 |
| Temp. Coeff. of Sensitivity | %/°C | 0,14 | 0,14 |
| **FORCE** | | | |
| Range | N | 22 | 222 |
| Sensitivity, ±10% | mV/N | 225 | 22,5 |
| Threshold | N | 0,0006 | 0,006 |
| Temp. Coeff. of Sensitivity | %/°C | 0,05 | 0,05 |
| Operating Temperature | °C | –54 ... 80 | –54 ... 121 |
| Power Supply | mA | 2 ... 18 | 2 ... 18 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Housing/Base | type | Titanium | Titanium |
| Sealing | type | Hermetic | Hermetic |
| Mass | gram | 34 | 34 |

**Measuring direction**

$a_z$

**Connection**
10-32 neg.

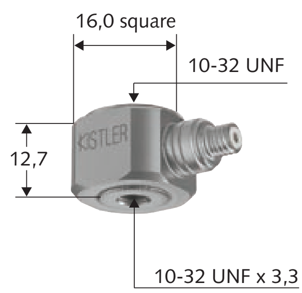
**Characteristics**
Low impedance voltage mode, sensitivity unaffected by mounting torque wide frequency range, CE compliant

**Applications**
Modal analysis, typically installed on a test article and connected by a threaded stinger to a shaker. Measures input force and acceleration simultaneously

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series

**Datasheet** 8770A_000-252

### Quartz Compression High Impedance Load Cell Type 9222




| Specifications | | Type 9222 |
|---|---|---|
| Range Compression | N | 20 000 |
| Range Tension | N | 2 000 |
| Threshold | mN | 8,9 |
| Sensitivity (nom.) | pC/N | –84,5 |
| Non-Linearity | %FSO | ±0,5 |
| Rigidity | kN/µm | >0,8 |
| Temp. Coeff. of Sensitivity | %/°C | 0,036 |
| Operating Temperature | °C | –195 ... 150 |
| Insulation Resistance | Ω | $10^{13}$ |
| Capacitance | pF | 23 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Welded/Epoxy |
| Mass | gram | 19 |

**Measuring direction**

$F_z$

**Connection**
10-32 neg.

**Characteristics**
High impedance, charge mode output, rugged quartz sensor, wide measuring ranges for compression and tension, quasi-static response

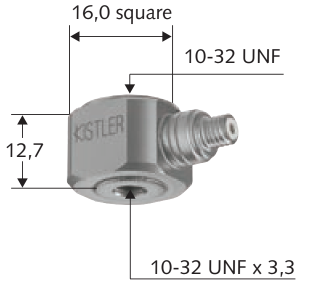
**Applications**
Force applications such as press fit assembly, crimping and impact force testing; can be used with shakers for modal analysis, machine tool measurements or various automotive, aerospace and robotic testing

**Accessories**
Cable: Type 1631A…, 1631C…
Charge amplifier: Type 5000 series
Impact pad: Type 900A1

**Datasheet** 9212_000-418

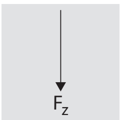
## Voltage Output Force Sensor

### Quartz Compression Piezotron Load Cell Type 9712B…




| Specifications | | Type 9712B5 | Type 9712B50 | Type 9712B250 |
|---|---|---|---|---|
| Range Compression | N | 22,2 | 222 | 1,11 kN |
| Range Tension | N | 22,2 | 222 | 1,11 kN |
| Threshold | mN | 0,445 | 4,45 | 22,2 |
| Sensitivity (nom.) | mV/N | 200 | 20 | 4 |
| Non-Linearity | %FSO | ±1 | ±1 | ±1 |
| Rigidity | kN/µm | >0,8 | >0,8 | >0,8 |
| Temp. Coeff. of Sensitivity | %/°C | –0,018 | –0,018 | –0,018 |
| Operating Temperature | °C | –50 ... 120 | –50 ... 120 | –50 ... 120 |
| Power Supply | mA | 4 | 4 | 4 |
| | VDC | 20 ... 32 | 20 ... 32 | 20 ... 32 |
| Housing/Base | type | St. Stl. | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic | Hermetic |
| Mass | gram | 19 | 19 | 19 |

**Measuring direction**




**Connection**
10-32 neg.

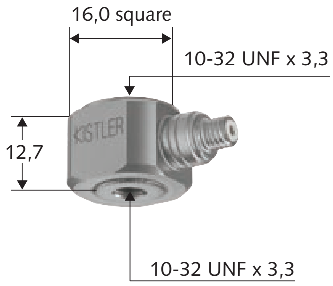
**Characteristics**
Low impedance voltage mode, rugged quartz sensor, wide measuring range, uses standard low cost cables, CE compliant

**Applications**
Force applications where high sensitivity, high rigidity and fast responses are required

**Accessories**
Cable: Type 1761B…
Charge amplifier: Type 5100 series
Impact pad. Type 900A1

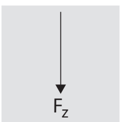
**Datasheet** 9712_000-417

### Quartz Piezotron Load Cell Type 9712B…




| Specifications | | Type 9712B500 | Type 9712B5000 |
|---|---|---|---|
| Range Compression | N | 2000 | 20 000 |
| Range Tension | N | 2 000 | 2 000 |
| Threshold | mN | 44,5 | 445 |
| Sensitivity (nom.) | mV/N | 2 | 0,2 |
| Non-Linearity | %FSO | ±1 | ±1 |
| Rigidity | kN/µm | >0,8 | >0,8 |
| Temp. Coeff. of Sensitivity | %/°C | –0,018 | –0,018 |
| Operating Temperature | °C | –50 ... 120 | –50 ... 120 |
| Power Supply | mA | 4 | 4 |
| | VDC | 20 ... 32 | 20 ... 32 |
| Housing/Base | type | St. Stl. | St. Stl. |
| Sealing | type | Hermetic | Hermetic |
| Mass | gram | 19 | 19 |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
Low impedance, voltage mode, rugged quartz sensor, wide measuring ranges, uses standard low cost cables, CE compliant

**Applications**
Force applications where high sensitivity, high rigidity and fast responses are required

**Accessories**
Cable: Type 1761B…
Coupler: Type 5100 series
Impact pad: Type 900A1

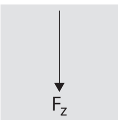
**Datasheet** 9712_000-417

## Voltage Output Force Sensor

### **Impulse Force Hammer** Type 9722A...


| Specifications | | Type 9722A500 | Type 9722A2000 |
|---|---|---|---|
| Force Range | N | 0 ... 500 | 0 ... 2 000 |
| Frequency Range, –10 dB | Hz | 8 200 | 9 300 |
| Resonant Frequency | kHz | 27 | 27 |
| Sensitivity (nom.) | mV/N | 10 | 2 |
| Rigidity | kN/µm | 0,8 | 0,8 |
| Time Constant | s | 500 | 500 |
| Operating Temperature | °C | –20 ... 70 | –20 ... 70 |
| Power Supply | mA | 2 ... 20 | 2 ... 20 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Length of handle | mm | 188 | 188 |
| Hammer Head Dimensions: | | | |
| Diameter | mm | 17,5 | 17,5 |
| Length | mm | 61 | 61 |
| Mass | gram | 100 | 100 |

**Measuring direction**




**Connection**
BNC neg.

**Characteristics**
Low impedance voltage mode, quartz force sensing element guarantees long-term stability, sensor cable integrated to hammer handle, CE compliant

**Applications**
Analyze the dynamic behavior of mechanical structures

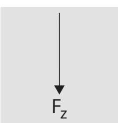
**Accessories**
Cable: Type 1601B…
Coupler: Type 5100 series

**Datasheet** 9722A_000-272

### **Impulse Force Hammer** Type 9724A...


| Specifications | | Type 9724A2000 | Type 9724A5000 |
|---|---|---|---|
| Force Range | N | 0 ... 2 000 | 0 ... 5 000 |
| Frequency Range, –10 dB | Hz | 6 600 | 6 900 |
| Resonant Frequency | kHz | 27 | 27 |
| Sensitivity (nom.) | mV/N | 2 | 1 |
| Rigidity | kN/µm | 0,8 | 0,8 |
| Time Constant | s | 500 | 500 |
| Operating Temperature | °C | –20 ... 70 | –20 ... 70 |
| Power Supply | mA | 2 ... 20 | 2 ... 20 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Length of handle | mm | 231 | 231 |
| Hammer Head Dimensions: | | | |
| Diameter | mm | 23 | 23 |
| Length | mm | 89 | 89 |
| Mass | gram | 250 | 250 |

**Measuring direction**




**Connection**
BNC neg.

**Characteristics**
Low impedance voltage mode, quartz force sensing element guarantees long-term stability, sensor cable integrated to handle of hammer, CE compliant

**Applications**
Analyze the dynamic behavior of mechanical structures

**Accessories**
Cable: Type 1601B…
Coupler: Type 5100 series

**Datasheet** 9724A_000-273

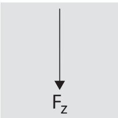
# Impulse

## Voltage Output Force Sensor

### Impulse Force Hammer Type 9726A...

| Specifications | | Type 9726A5000 | Type 9726A20000 |
|---|---|---|---|
| Force Range | N | 0 ... 5 000 | 0 ... 20 000 |
| Frequency Range, –10 dB | Hz | 5 000 | 5 400 |
| Resonant Frequency | kHz | 27 | 27 |
| Sensitivity (nom.) | mV/N | 1 | 0,2 |
| Rigidity | kN/µm | 0,8 | 0,8 |
| Time Constant | s | 500 | 500 |
| Operating Temperature | °C | –20 ... 70 | –20 ... 70 |
| Power Supply | mA | 2 ... 20 | 2 ... 20 |
| | VDC | 20 ... 30 | 20 ... 30 |
| Length of handle | mm | 236 | 236 |
| Hammer Head Dimensions: | | | |
| Diameter | mm | 32 | 32 |
| Length | mm | 94 | 94 |
| Mass | gram | 500 | 500 |

**Measuring direction**




**Connection**
BNC neg.

**Characteristics**
Low impedance voltage mode, quartz force sensing element guarantees long-term stability, sensor cable integrated to hammer handle, CE compliant

**Applications**
Analyze the dynamic behavior of mechanical structures

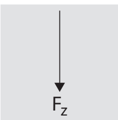
**Accessories**
Cable: Type 1601B…
Coupler: Type 5100 series

**Datasheet** 9726A_000-274

### Impulse Force Hammer Type 9728A...

| Specifications | | Type 9728A20000 |
|---|---|---|
| Force Range | N | 0 ... 20 000 |
| Frequency Range, –10 dB | Hz | 1000 |
| Resonant Frequency | kHz | 20 |
| Sensitivity (nom.) | mV/N | 0,2 |
| Rigidity | kN/µm | 2,7 |
| Time Constant | s | 500 |
| Operating Temperature | °C | –20 ... 70 |
| Power Supply | mA | 2 ... 20 |
| | VDC | 20 ... 30 |
| Length of handle | mm | 343 |
| Hammer Head Dimensions: | | |
| Diameter | mm | 51 |
| Length | mm | 154 |
| Mass | gram | 1500 |

**Measuring direction**




**Connection**
BNC neg.

**Characteristics**
Low impedance voltage mode, quartz force sensing element guarantees long-term stability, sensor cable integrated to handle of hammer, CE compliant

**Applications**
Analyze the dynamic behavior of mechanical structures

**Accessories**
Cable: Type 1601B…
Coupler: Type 5100 series

**Datasheet** 9728A_000-275

# Electronics & Software

Powering, conditioning and computer interface solutions are available from a suite of electronic equipment tailored to provide measurement flexibility with utmost quality and integrity. Couplers from inexpensive single channel to large, modular, multi-channel platforms can be selected. Charge amplifiers with dual mode (low and high impedance) capability offer adaptability to a variety of sensor configurations. Gain, filtering, and conditioning aspects of the measurement chain are contained in this section of the catalogue.

# Electronics & Software

## Signal Conditioner

### **Charge Meter** Type 5015A

| Specifications | | Type 5015A |
|---|---|---|
| Measuring Range | pC | ±2 ... 2 200 000 |
| Frequency Response (wide band) | Hz | ~0 ... 200 k |
| Output Voltage | V | ±10 ... ±2 |
| Output Current | mA | 2 |
| Accuracy (range dependent) | % | <±3 ... <±0,5 |
| Power | VAC | 115/230 |
| Temperature Range | °C | 0 ... 50 |
| Dimensions with frame | mm | 105,3 W x 142 H x 253,15 D |
| Mass | kg | 2,3 |

**Connection**
Input & output:
BNC neg.
Remote control:
6 pin; DIN 45322
RS-232C:
9-pin D-Sub

**Characteristics**
Single-Channel charge amplifier Piezotron input (option), menu-driven operation, direct signal evaluation, CE compliant

**Applications**
Measure dynamic pressure, force strain and acceleration from piezoelectric sensors

*Contact Kistler for different versions of this Charge Meter

**Datasheet** 5015A_000-297

### **In-Line Charge Converter Module** Type 5050A…

| Specifications | | Type 5050A0.1 | Type 5050A1 | Type 5050A10 |
|---|---|---|---|---|
| Sensor Signal Voltage | Vpp | 10 | 10 | 10 |
| Gain | mV/pC | 0,1 | 1 | 10 |
| Noise (Broad Band 1 … 10kHz) | $\mu V_{rms}$ | 5 | 10 | 70 |
| Input Resistance min. | kΩ | 100 | 100 | 100 |
| Input Capacitance | nF | 30 | 30 | 30 |
| Frequency Response –5% | Hz | 1 … 20 000 | 1 … 20 000 | 1 … 20 000 |
| Constant Current | mA | 2 … 18 | 2 … 18 | 2 … 18 |
| Compliance Voltage | VDC | 20 … 30 | 20 … 30 | 20 … 30 |
| Operating Temperature Range | °C | –40 … 80 | –40 … 80 | –40 … 80 |
| Signal Polarity | | inverted | inverted | inverted |
| Sealing | type | Welded/Epoxy | Welded/Epoxy | Welded/Epoxy |
| Housing | material | Stainless Steel | Stainless Steel | Stainless Steel |
| Input Connector | type | 10-32 neg. | 10-32 neg. | 10-32 neg. |
| Output Connector | type | BNC neg. | BNC neg. | BNC neg. |
| Mass | gram | 28 | 28 | 28 |

**Connection:**
BNC neg.

**Characteristics:**
Two wire, single ended device, rugged, stainless steel case, wide frequency response, three gain versions, CE conforming

**Applications:**
High temp. measurements where a low impedance device cannot withstand the environment

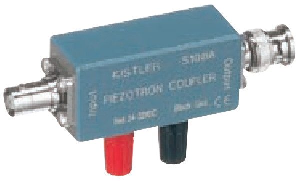
**Accessories:**
Cable: Type 1635C….
Coupler: Type 5100 series

**Datasheet** 5050A_000-452

# Electronics & Software

## Signal Conditioner

### Piezotron Low Impedance Coupler Type 5108A




| Specifications | | Type 5108A |
|---|---|---|
| Sensor Supply Current | mA | 4 |
| Sensor Signal Voltage | Vpp | 20 |
| Frequency Response, (5 Vpp & 2 m cable) | Hz | 0,02 ... 87 k |
| Output Voltage | Vpp | 20 |
| Gain | | 1 |
| Power | VDC | 22 ... 30 |
| Temperature Range | °C | 0 ... 50 |
| Power | type | Banana jacks |
| Dimensions | mm | 57,2 L x 22,2 H x 22,2 W |
| Mass | gram | 65 |

**Connection**
Input: BNC neg.
Output: BNC pos.
Power: banana jacks, polarity (+ red, – black)

**Characteristics**
Simple to operate, AC coupled, reverse polarity protection, CE compliant. Use with low impedance Piezotron sensors with built-in electronics

**Accessories**
Cable: Type 1761B…

**Datasheet** 5108A_000-328

### Multimeter Coupler Type 5110


| Specifications | | Type 5110 |
|---|---|---|
| Input: Excitation current (± 10%) | mA | 2 |
| Input: No load voltage | VDC | ≤ 20 |
| Output: Voltage swing | Vpp | ≤ 18 |
| Output: Voltage gain | | 1 |
| Output to BNC connector: Frequency Response, ± 5% 5 Vpp | Hz | 0,07 … 60 000 |
| Time Constant (±10%) | s | 10 |
| Output to Multimeter: Frequency Response, ± 5% 5 Vpp | Hz | 0 … 60 000 |
| Internal battery | Type | 9V alkaline (IEC 6LR61) |
| Case Dimensions | mm | 96,5 L x 25,4 H x 61,0 W |
| Weight (battery included): | gram | 150 |
| Connectors: Sensor, Output | Type | BNC neg. |
| Connectors: Multimeter | Type | Banana |
| Temperature Range Operating | °C | –10 … 54 |

**Connection:**
Input: BNC neg.
Output: BNC neg.
Multimeter: Banana jacks

**Characteristics:**
Turn a digital multimeter into a hand-held relative vibration measurement system or verify sensor and cable integrity with this portable, low cost, battery-operated coupler

**Accessories:**
Kit: Type 5110S1 kit includes 5110, carrying case, mounting wax and 9 V battery

**Datasheet** 5110_000-329

# Electronics & Software

## Signal Conditioner

### Power Supply/Coupler Type 5114

| Specifications | | Type 5114 |
|---|---|---|
| Sensor Excitation Current | mA | 2 |
| Sensor Excitation Voltage | VDC | 20 |
| Frequency Response | Hz | 0,07 … 60 k |
| Output Voltage | Vpp | 20 |
| Gain | | 1 |
| Power | VDC | 9 |
| Temperature Range | °C | –10 … 54 |
| Mass | gram | 250 |

**Connection**
Input & output:
BNC neg.
External power:
2,1 mm jack

**Characteristics**
Provides constant current excitation, monitors condition and sensors and cables, 3,5 digit LCD display AC-DC or battery powered, CE compliant

**Application**
Power and monitor Piezotron sensors

**Accessories**
AC-DC power adaptor:
Type 5752 (120 V)
Type 5757 (230 V)

**Specify Version**
5114: supplied with 9 V alkaline battery
5114S1: supplied with 9 V alkaline battery, 115 VAC power adaptor and carrying case
5114S1(E): same as S1 only with 230 VAC power adaptor, 9 V alkaline battery

**Datasheet** 5114_000-330

### Power Supply/Coupler Type 5118B…

| Specifications | | Type 5118B2 |
|---|---|---|
| Sensor Supply Current | mA | 2 |
| Sensor Signal Voltage | Vpp | 10 |
| Frequency Response, ±5 | Hz | 0,02 ... 40 k |
| Output Voltage | Vpp | 20 |
| Gain | | 1, 10, 100 |
| Power Supply | Battery | 4 x 1,5 V AA, alkaline |
| Temperature Range | °C | –20 ... 50 |
| Dimensions | mm | 91 W x 46 H x 191 D |
| Mass | kg | 0,5 |

**Connection**
Input & output:
BNC neg.

**Characteristics**
Selectable gain and low pass, plug-in filters, high pass filtering, panel selectable, exclusive "Rapid Zero" feature AC-DC or battery powered, CE compliant

**Applications**
Powering low impedance sensors where test conditions require flexible signal conditioning

**Optional Accessories**
AC-DC power adaptor (115 VAC):
Type 5752
AC-DC power adaptor (230 VAC):
Type 5757
Panel mounting kit: Type 5702
Low/high pass filters

**Datasheet** 5118B_000-331

## Signal Conditioner

### **AE Coupler** Type 5125B…, **Piezotron Coupler** Type 5127B…


| **Specifications** | | **Type 5125B** | **Type 5127B** |
|---|---|---|---|
| Sensor Excitation Current | mA | 4 | 4 |
| Sensor Signal Voltage | Vpp | 16 | 20 |
| Frequency Response, ±5 | Hz | 15 k … 1 M | 0,1 … 30 k |
| Output Voltage | Vpp | 10 | 20 |
| Gain | | 10, 100 | 1, 10 |
| Power | mA | < 70 | 50 |
| | VDC | 15 … 36 | 22 … 30 |
| Temperature Range | °C | 0 … 60 | 0 … 60 |
| Housing | type | aluminium | aluminium |
| Dimensions | mm | 114 W x 147 H x 36 D | 114 W x 147 H x 36 D |
| Mass | kg | 0,270 | 0,270 |

**Connection**
Input: BNC neg. or cable strain relief
Output: 8-pole round connector DIN 45326

**Characteristics**
Built-in RMS converter and limit monitor, plug-in filter elements, rugged case, vibration-proof construction, CE compliant

**Applications**
Vibration and acoustic emission (AE) sensors,
5125B AE coupler,
5127B Piezotron coupler

**Accessories**
8-pole round connector:
Type 1500A57
Low/high pass filters

**Specify Version**
request data sheet below for all ordering options

**Datasheet** 5127_000-323

### **Four Channel Piezotron Coupler** Type 5134A1

| **Specifications** | | **Type 5134A1** |
|---|---|---|
| Sensor Excitation Current | mA | 4 |
| Sensor Excitation Voltage | VDC | 20 |
| Frequency Response | Hz | 0,04 … 30 k |
| Output Voltage | Vpp | 20 |
| Gain (7 set points) | | 1, 2, 5, 10, 20, 50, 100 |
| Power | VAC | 115/230 |
| Temperature Range | °C | 0 … 50 |
| Dimensions | mm | 94 W x 150 H x 196 D |
| Mass | kg | 1,8 |

**Connection**
Input & output: BNC neg.

**Characteristics**
RS-232C interface for remote control and monitoring, sensors circuit open/short alarm, non volatile memory for set parameters, seven selectable gains, four selectable low pass filters, CE compliant

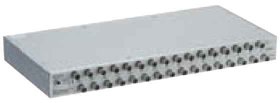
**Applications**
General vibration lab use with single axis or triaxial accelerometers

**Specify Version**
Without case: Type 5134A0

**Datasheet** 5134A_000-332

## Signal Conditioner

### 16-Channel Power Supply/Coupler Type 5148



| Specifications | | Type 5148 |
|---|---|---|
| Sensor Excitation Current | mA | 4 |
| Sensor Excitation Voltage | VDC | 24 |
| Frequency Response, ±5 | Hz | 0,05 ... 50 k |
| Output Voltage | Vpp | 20 |
| Gain | | 1 |
| Power | VDC | 115/230 |
| Temperature Range | °C | 0 ... 50 |
| Dimensions | mm | 483 W x 45 H x 222 D |
| Mass | kg | 2,5 |

**Connection**
Input rear:
16 BNC neg.

Output rear:
16 BNC neg.

Output front:
16 BNC neg.

**Characteristics**
Provides constant current excitation for Piezotron and voltage mode piezoelectric sensors, LED's indicate circuit integrity, convenient front/rear BNC connectors, standard rack mountable, CE compliant

**Applications**
Multi-channel low impedance sensor power at economical price per channel

**Datasheet** 5148_000-333

### Impedance Converter and Capacitor Type 557, 558


| Specifications | | | Type 557, 558 |
|---|---|---|---|
| Sensor Signal Voltage | | Vpp | 10 |
| Output Signal Voltage | | Vpp | 10 |
| Gain | | | 0,97 |
| Excitation Voltage | | VDC | 20 ... 30 |
| | | mA | 4 |
| Range Capacitance (nom.) | | pF | 3 |
| Input Resistance | | Ω | $5 \times 10^{10}$ |
| Temperature Range | | °C | –55 ... 120 |
| Sealing | | type | Welded/Epoxy |
| Mounting | on sensor | type | 557 |
| | in-line | type | 558 |

**Connection**
557
10-32 pos.
10-32 neg.

558
10-32 pos.

**Characteristics**
Compatible with high impedance, miniature construction In-line or direct attachment to sensor, optional range capacitors to tailor output signal, two wire constant current, source operation

**Application**
Conversions of charge signals from piezoelectric sensors into proportional voltage signals. High temperature installations requiring charge output sensors

**Accessoires**
571A… Range capacitors available

**Datasheet** 557_000-388

# Electronics & Software

## Signal Conditioner

### **K-Beam Power Supply** Type 5210

| Specifications | | Type 5210 |
|---|---|---|
| Sensor Excitation Current | mA | 25 |
| Sensor Excitation Voltage | V | 9 |
| Frequency Response | Hz | 0 ... 750 |
| Output Voltage | V | ±8 |
| Gain | | 1, 2, 10, 20 |
| Power | Battery | 9 V |
| Temperature Range | °C | –10 ... 54 |
| External DC input | type | 2,1 mm jack |
| Dimensions | mm | 146 L x 91,4 W x 32,8 H |
| Mass | gram | 260 |

**Connection**
Sensor: 4-pin, Microtech pos.
Output signal: BNC neg.
External DC input: 2,1 mm jack (tip+)

**Characteristics**
Adjustable offset control for higher resolution measurements, battery or external power, gain and filtering options, low battery indicator, complete kit available, CE compliant

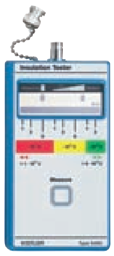
**Applications**
Power any single K-Beam accelerometer from a casual check to an in-depth study

**Accessories**
AC-DC power adaptor (115 VAC): Type 5752
AC-DC power adaptor (230 VAC): Type 5757

**Specify Version**
5210: supplied with 9 V battery
5210S1: supplied with 9 V battery, 115 V power adaptor 5752 and carrying case
5210S1(E): same as S1 only with 230 V power adaptor 5757, 9 V battery and carrying case

**Datasheet** 5210_000-334

### **Insulation Tester** Type 5493



| Specifications | | Type 5493 |
|---|---|---|
| Measuring Range | Ω | $10^{11}$ to 4 x $10^{13}$ |
| Measuring Voltage | V | 5 |
| Admissible Voltage, max. | V | 700 |
| Measurement display | | logarithmic |
| Battery Power | VDC | 9 |
| Dimensions | mm | 150 L x 79 W x 36 H |
| Mass | gram | 290 |

**Connection**
BNC neg.

**Characteristics**
Small, robust, for measuring high insulation resistance on the spot; low measuring voltage of 5 V, logarithmic indication avoids the need for range switching, automatic switchoff, CE compliant

**Applications**
Measure insulation resistance of cables and equipment

**Datasheet** 5493_000-354

## Vibration Switch

### **K-Guard Industrial Vibration Switch** Type 8810

| **Specifications** | | **Type 8810** |
|---|---|---|
| Frequency Range –3 dB | Hz | 10 ... 1000 |
| Velocity Range | mm/sec | 100 |
| Setpoint Range | mm/sec | 2 ... 50 |
| Setpoint Accuracy | % | ±10 |
| Sensitivity | mV/mm/sec | 50 |
| Operating Temperature | °C | 0 ... 60 |
| Power Supply | mA | 50 |
| | VDC | 18 ... 30 |
| Humidity | % | 10 ... 90 |
| Integral Cable Length | m | 3 |
| Mass | gram | 400 |

**Connection**
pigtails

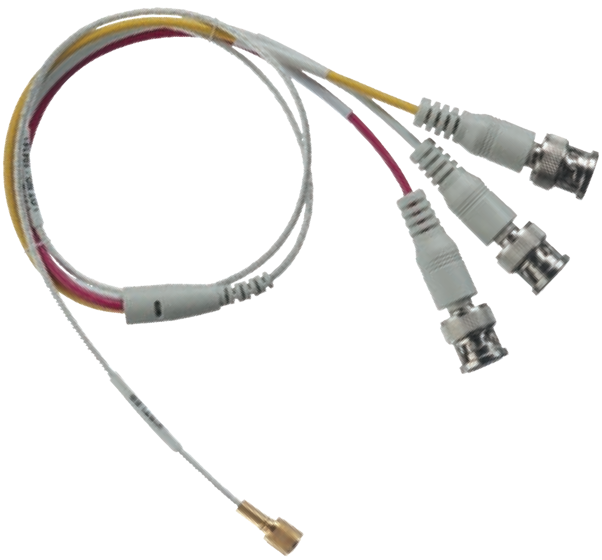
**Characteristics**
A vibration monitor with, velocity trip, monitor outputs, adjustable time delay, small size and lightweight, CE compliant

**Applications**
Vibration monitoring on cooling towers and machinery such as fans, motors, conveyers, motor/generator sets, centrifugal pumps, and other types of industrial machinery

**Datasheet** 8810_000-268

# Accessories

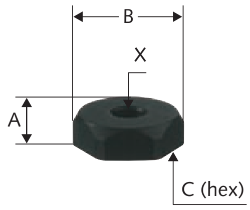
Common accessories extend the flexibility of the accelerometer families often adapting to less than optimal conditions. For instance, the variety of adhesive mounting pads provide ground isolation while permitting a reasonable attachment in situations where tapping a threaded hole is unacceptable. A series of magnet mounts provides an alternate solution if the structure is a ferrous material. Also included in this section are a variety of conversion studs to accommodate a previous mounting site with a different accelerometer with different threads. Mounting cubes provide a means of obtaining accurate orthogonal measurements at a reasonable cost.



# Accessories

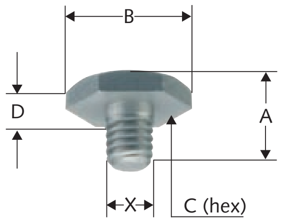
## Mounting

### **Adhesive Mounting** Type 8434, 8436, 8438



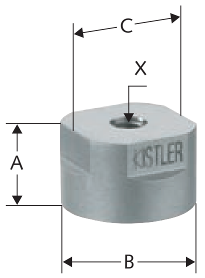

| **Specifications** | | **Type 8434** | **Type 8436** | **Type 8438** |
|---|---|---|---|---|
| A | mm | 4,8 | 4,8 | 7,9 |
| B | mm | 12,5 | 15,7 | 21,1 |
| C | mm | 11,2 | 14,2 | 19 |
| D | mm | – | – | – |
| Thread X | | 5-40 | 10-32 | $^{1}/_{4}$-28 |
| Mass | gram | 1,25 | 1,96 | 5,78 |
| Material | | Anodized Aluminium | | |
| Recommended Sensors | | 8730A, 8791A | 8202A, 8284A, 8702B, 8704B, 8774A, 8784A, 8786A | 8203A, 8710A, 8712A, 8752A, 8795A* (* With 8410 mounting stud) |

### **Adhesive Mounting** Type 8439, 8440




| **Specifications** | | **Type 8439** | **Type 8440** |
|---|---|---|---|
| A | mm | 5,1 | 5,1 |
| B | mm | 7,1 | 7,1 |
| C | mm | 6,3 | 6,3 |
| D | mm | 1,5 | 1,5 |
| Thread X | | M3 | 4-40 |
| Mass | gram | 0,18 | 0,18 |
| Material | | Anodized Aluminium | Anodized Aluminium |
| Recommended Sensors | | 8614A | 8614A |

### **Magnetic Mounting** Type 8450, 8452, 8456

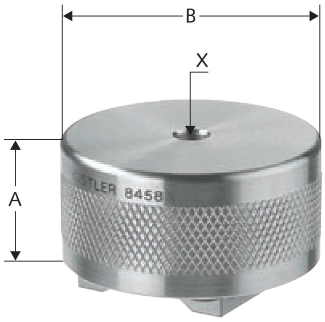



| **Specifications** | | **Type 8450A** | **Type 8452A** | **Type 8456** |
|---|---|---|---|---|
| A | mm | 7,6 | 11,2 | 11,2 |
| B | mm | 12,7 | 17,8 | 24,9 |
| C | mm | 11,1 | 15,9 | – |
| Thread X | | 5-40 | 10-32 | $^{1}/_{4}$-28 |
| Holding Force | N | 26,7 | 53,4 | 133 |
| Mass | gram | 6 | 19 | 57 |
| Material | | 17-4 PH | 17-4 PH | 17-4 PH |
| Recommended Sensors | | 8636C, 8730A | 8202A, 8702B, 8704B, 8774A, 8784A, 8786A, 8795A | 8203A, 8710A, 8712A, 8752A |

**Datasheet** 8434_000-281

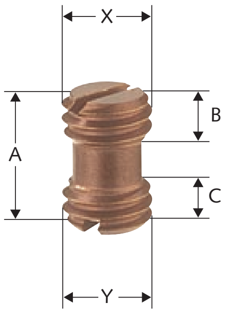
## Mounting

### **Magnetic Mounting** Type 8458



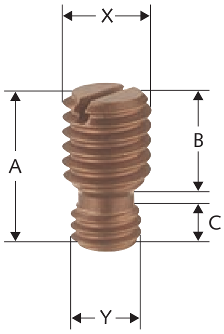

| **Specifications** | | **Type 8458(1)** |
|---|---|---|
| A | mm | 31,7 |
| B | mm | 47,0 |
| C | mm | – |
| Thread X | | $^{1}/_{4}$-28 |
| Holding Force | N | 178 |
| Mass | gram | 102 |
| Material | | 17-4 PH |
| Recommended Sensors | | 8203A, 8710A, 8712A, 8752A |

### **Mounting Stud** Type 8402, 8404, 8410




| **Specifications** | | **Type 8402** | **Type 8404** | **Type 8410** |
|---|---|---|---|---|
| A | mm | 7,1 | 7,1 | 6,4 |
| B | mm | 2,5 | 2,5 | 2,0 |
| C | mm | 2,5 | 2,5 | 3,3 |
| Thread X | | 10-32 | 10-32 | 10-32 |
| Thread Y | | 10-32 | 10-32 | 1/4-28 |
| Material | | BeCu | 17-4 PH | BeCu |
| Recommended Sensors | | 8202A, 8290A25, 8638B, 8702B, 8704B, 8770A, 8786A, 8795A | 8044 | – |

### **Mounting Stud** Type 8411, 8416, 8418



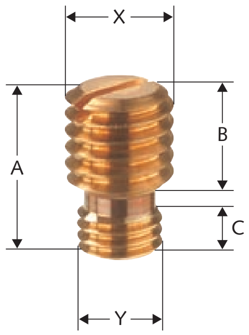

| **Specifications** | | **Type 8411** | **Type 8416** | **Type 8418** |
|---|---|---|---|---|
| A | mm | 10,9 | 6,6 | 7,1 |
| B | mm | 3,3 | 2,3 | 2,3 |
| C | mm | 6,4 | 3,3 | 3,8 |
| Thread X | | 10-32 | 5-40 | 5-40 |
| Thread Y | | M6 | 10-32 | M6 |
| Material | | BeCu | 316 St. Stl. | 316 St. Stl. |
| Recommended Sensors | | 8702B, 8704B, 8770A, 8774A, 8784A, 8786A, 8795A | 8636C | 8636C |

**Datasheet** 8434_000-281

# Accessories

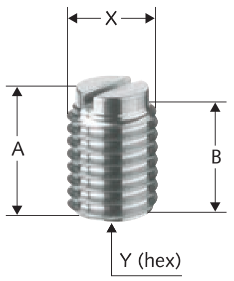
## Mounting

### **Mounting Stud** Type 8421, 8412, 8420



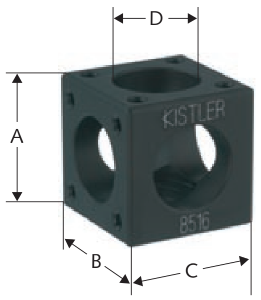

| **Specifications** | | **Type 8421** | **Type 8412** | **Type 8420** |
|---|---|---|---|---|
| A | mm | 13,2 | 9,4 | 9,4 |
| B | mm | 6,4 | – | – |
| C | mm | 4,6 | – | – |
| Thread X | | M8 | 1/4-28 | 5-40 |
| Thread Y | | 1/4-28 | – | – |
| Material | | BeCu | 18-8 St. Stl. | 18-8 St. Stl. |
| Recommended Sensors | | 8203A, 8710A, 8712A, 8752A | 8203A, 8710A, 8712A, 8752A | 8636 |

### **Mounting Stud** Type 8414



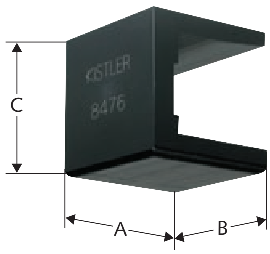

| **Specifications** | | **Type 8414** |
|---|---|---|
| A | mm | 8,9 |
| B | mm | 8,1 |
| Thread C | | – |
| Thread X | | 1/4-28 |
| Y | | 10-32 |
| Material | | 17-4 PH St. Stl. |
| Recommended Sensors | | 8710A, 8712A, 8752A (adapts a 10-32 Mounting Stud into a 11/4-28 Mounting Hole) |

### **Magnetic Mounting** Type 8516, 8518, 8530




| **Specifications** | | **Type 8516** | **Type 8518** | **Type 8530** |
|---|---|---|---|---|
| A | mm | 25,4 | 40,7 | 33,0 |
| B | mm | 25,4 | 40,7 | 33,0 |
| C | mm | 25,4 | 40,7 | 33,0 |
| D | mm | 15,1 | 15,1 | 22,1 |
| Mass | gram | 20 | 26,3 | 38 |
| Material | | Al. | Al. | Al. |
| Recommended Sensors | | 8305 | 8310, 8312 | 8330 |

### **Mounting Clip** Type 8474, 8476




| **Specifications** | | **Type 8474** | **Type 8476** |
|---|---|---|---|
| A | mm | 19,5 | 25,4 |
| B | mm | 17,8 | 25,4 |
| C | mm | 18,5 | 25,4 |
| Mass | gram | 5 | 10 |
| Material | | Derlin | Derlin |
| Recommended Sensors | | 8772 | 8690 |

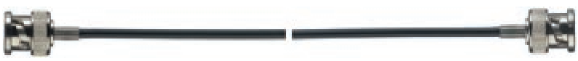
**Datasheet** 8434_000-281

## Cable

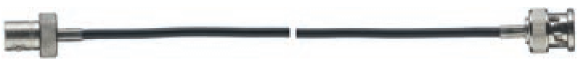
| Specifications | | Type 1511 |
|---|---|---|
| Connection | | BNC pos.<br>BNC pos. |
| Length | m | 1/sp* |
| Diameter | mm | 6,4 |
| Used for | | Used for charge amplifier and coupler output signals |

| Specifications | | Type 1576 |
|---|---|---|
| Connection | | 4-pin pos.<br>3x BNC pos. |
| Length | m | 0,2 |
| Diameter | mm | 1,78 |
| Used for | | Distribution cable for 8694M1 |

| Specifications | | Type 1592A |
|---|---|---|
| Connection | | 4-pin neg.<br>4-pin neg. |
| Length | m | 2/4/sp* |
| Diameter | mm | 2,49 |
| Used for | | General purpose extension cable |



| Specifications | | Type 1601B |
|---|---|---|
| Connection | | BNC pos.<br>BNC pos. |
| Length | m | sp* |
| Diameter | mm | 6,35 |
| Used for | | High impedance charge mode cables, commonly used as extension cables |



| Specifications | | Type 1603B |
|---|---|---|
| Connection | | BNC neg.<br>BNC pos. |
| Length | m | sp* |
| Diameter | mm | 3,00 |
| Used for | | High impedance charge mode cables, commonly used as extension cables |

| Specifications | | Type 1631C |
|---|---|---|
| Connection | | 10-32 pos.<br>BNC pos. |
| Length | m | 1/2/3/5/8/sp* |
| Diameter | mm | 2,01 |
| Used for | | High impedance charge mode cables |

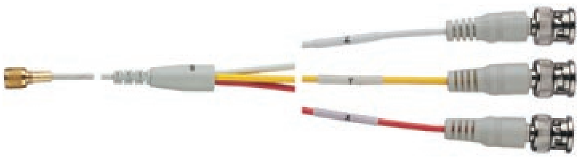
**Datasheet** 1511_000-471
sp* = special length, according to customer specifications

# Accessories

## Cable

| Specifications | | Type |
|---|---|---|
| | | **1635C** |
| Connection | | 10-32 pos.<br>10-32 pos. |
| Length | m | 1/2/3/5/8/sp* |
| Diameter | mm | 2,01 |
| Used for | | High impedance charge mode cables |

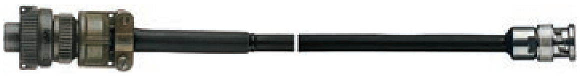
| Specifications | | Type |
|---|---|---|
| | | **1641** |
| Connection | | 10-32 pos.<br>BNC pos. |
| Length | m | sp* |
| Diameter | mm | 2,01 |
| Used for | | High impedance charge mode cables |



| Specifications | | Type |
|---|---|---|
| | | **1756B** |
| Connection | | 4-pin neg.<br>3x BNC pos. |
| Length | m | 0,5/3/10/sp* |
| Diameter | mm | 1,78 |
| Used for | | Triaxial accelerometers: Types 8690<br>8692, 8791, 8793, 8794, 8795 |

| Specifications | | Type |
|---|---|---|
| | | **1761B** |
| Connection | | 10-32 pos.<br>BNC pos. |
| Length | m | 1/2/3/5/sp* |
| Diameter | mm | 2,01 |
| Used for | | Teflon insulated, voltage mode cables |

| Specifications | | Type |
|---|---|---|
| | | **1762B** |
| Connection | | 10-32 pos.<br>10-32 pos. |
| Length | m | 1/2/3/5/sp* |
| Diameter | mm | 2,01 |
| Used for | | Teflon insulated, voltage mode cables |



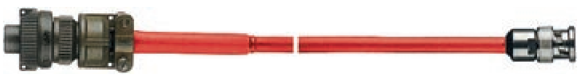
| Specifications | | Type |
|---|---|---|
| | | **1770A** |
| Connection | | MS3106 (MIL-C-5015)<br>BNC pos. |
| Length | m | 3/sp* |
| Diameter | mm | 6,35 |
| Used for | | Aluminium, with backshell and strain releif,<br>for applications below 250 °C |

**Datasheet** 1511_000-471

sp* = special length, according to customer specifications

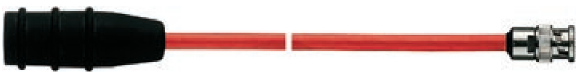
# Accessories

## Cable



| Specifications | | Type 1772A |
|---|---|---|
| Connection | | MS3106 (MIL-C-5015)<br>BNC pos. |
| Length | m | 3/sp* |
| Diameter | mm | 6,35 |
| Used for | | Aluminium, with backshell and strain releif,<br>for applications below 350 °C |

| Specifications | | Type 1776A |
|---|---|---|
| Connection | | MS3106 (MIL-C-5015)<br>BNC pos. |
| Length | m | 3/sp* |
| Diameter | mm | 6,35 |
| Used for | | Silicon, quick disconnect, splash proof,<br>for applications below 250 °C |



| Specifications | | Type 1778A |
|---|---|---|
| Connection | | MS3106 (MIL-C-5015)<br>BNC pos. |
| Length | m | 3/sp* |
| Diameter | mm | 6,35 |
| Used for | | Silicon, quick disconnect, splash proof,<br>for applications below 350 °C |

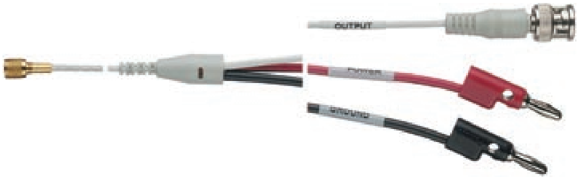
| Specifications | | Type 1784AK02 |
|---|---|---|
| Connection | | Mini 4-pin neg |
| Connection | | 4-pin pos. |
| Length | m | 0,5 |
| Diameter | mm | 1,5 |
| Used for | | Sensors with the Kistler Mini 4-pin<br>connector (8763 & 8765) |

| Specifications | | Type 1784AK03 |
|---|---|---|
| Connection | | Mini 4-pin neg |
| Connection | | (3) BNC pos. |
| Length | m | 1/5/10 |
| Diameter | mm | 1,5 |
| Used for | | Sensors with the Kistler Mini 4-pin<br>connector (8763 & 8765)<br>in triaxial applications |

**Datasheet** 1511_000-471
sp* = special length, according to customer specifications

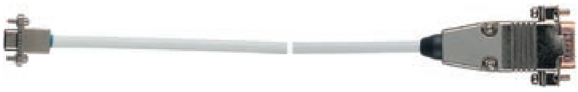
# Accessories

## Cable



| **Specifications** | | **Type** |
|---|---|---|
| | | **1786C** |
| Connection | | 4-pin neg.<br>2x Banana Jacks for power,<br>BNC pos. signal out |
| Length | m | 2/5/10/20 |
| Diameter | mm | 2,67 |
| Used for | | Breakout power supply cable: Type 8304, 8310, 8324, 8838, 8840 |

| **Specifications** | | **Type** |
|---|---|---|
| | | **1788A** |
| Connection | | 4-pin neg.<br>3x Banana Jacks for power,<br>BNC pos. signal out |
| Length | m | sp* |
| Diameter | mm | 2,67 |
| Used for | | Breakout power supply cable: Type 8330 |



| **Specifications** | | **Type** |
|---|---|---|
| | | **1790A2** |
| Connection | | 9-pin Micro pos.<br>9-pin D-sub pos. |
| Length | m | 2 |
| Diameter | mm | 4,45 |
| Used for | | Mating cable: Type 8393 |

| **Specifications** | | **Type** |
|---|---|---|
| | | **1794A** |
| Connection | | 9-pin D-sub pos.<br>2x Banana Jacks for power,<br>3x BNC pos. signal out |
| Length | m | sp* |
| Diameter | mm | 2,67 |
| Used for | | Breakout power supply cable: Type 8393 |

**Datasheet** 1511_000-471
sp* = special length, according to customer specifications

# Accessories

## Electronic (Interfaces)

**TEDS Editor** Type 5000M04

The module is used in conjunction with a personal computer to read and write information stored in TEDS capable sensors.  The supplied software allows for data to be written and read using the following template formats:

• P1451.4 v0.9 template 0  (UTID 1)

• P1451.4 v0.9 template 24  (UTID 116225)

• LMS template 117 for free format point id

• LMS template 118 for geometry format point id (automotive and aerospace resolutions)

• P1451.4 v1.0 template 25

# Calibration

Kistler takes pride in its control and concern for the integrity and accuracy of our calibration system. Our system is compliant with ANSI/NCSL Z540-1-1994, MIL-STD-45662A, ISO 9001: 2000 and now is fully accredited to ISO/IEC 17025. Considerable resources in personnel and equipment have been devoted to the maintenance and management of this system and all primary and working standards used in calibration of our products.

Kistler believes that, not only are you buying a technically superior product, guaranteed to meet or exceed your expectations, but you are also buying a calibration certificate attesting to the performance, accuracy and traceability of your device.

All Kistler products are calibrated using NIST traceable calibration standards, whose reliability and repeatability have been demonstrated through periodic verification and historical data. In fact, Kistler products are used as primary standards in many well known calibration laboratories throughout the world.

## Charge Amplifier

### Calibration Systems Types 8802, 8804

| Specifications | | Type 8802 | Type 8804 |
|---|---|---|---|
| Acceleration Range | g | ±250 | ±250 |
| Acceleration Limit | g | ±1000 | ±1000 |
| Threshold | $g_{rms}$ | 0,02 | 0,01 |
| Ref. Voltage Sensivity at 100 Hz, 10 g and 23,9 °C | mV/g | 10 ±0,01 | 10 ±0,01 |
| Frequency Response | Hz | 10 … 10 000 | 10 … 10 000 |
| Transverse Sensitivity at 100 Hz | pC/s | ≤2 | ≤2 |
| Time Constant | s | 1 | 1 |
| Non-Linearity | % | ±0,5 | ±0,5 |
| Operating Temperature | °C | –21 … 57 | –21 … 57 |
| Temp. Coeff. of Sensitivity | %/°C | –0,04 | –0,04 |
| Output Voltage FSO | V | ±2,5 | ±2,5 |
| Ground Isolation | Ω | – | $>10^7$ |
| Output Impedance | Ω | <15 | <15 |
| Power Supply | VAC | 115/230 | 115/230 |
| Mass | Gramm | 20 | 80 |

**Connection**
10-32 neg.

**Characteristics**
This system features unique stability, linearity and repeatability

**Applications**
System for calibration of sensors. Lab standard or back-to-back calibration transfer

**System Components**
8802 = 8002/5022
8804 = 8076/5022

**Datasheet** 8802_000-520
8804_000-521

### Reference Shaker Type 8921

| Specifications | | Type 8921Y26 |
|---|---|---|
| Frequency | Hz (rads) | 159,2 (1000) |
| Acceleration rms, ±3% | g | 1 |
| Velocity rms, ±3% | mm/sec | 10 |
| Displacement rms, ±3% | µm | 10 |
| Max. Load | gram | 300 |
| Operating Temp. | °C | 10 ... 40 |
| Power Supply | mA | 300 |
| | VDC | 12 |
| Battery | type | built-in rechargeable |
| Mass | kg | 2 |
| Dimensions | mm | 76,2 H x 107 W x 178 D |

**Characteristics**
Test measurement system integrity, convenient self-contained and portable, rechargeable battery, tests sensors up to 300 g of weight, CE compliant

**Applications**
The 8921 reference shaker can be used to confirm the sensitivity of acceleration, velocity, and displacement sensors

**Accessories**
10-32 to M5 stud: Type 8451
1/4-28 to M5 stud: Type 8453

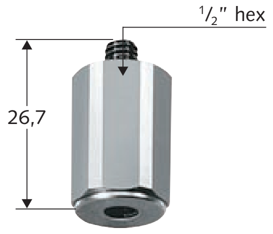
**Specify Version**
8921Y26: supplied with 115 VAC battery charger
8921: supplied with 230 VAC battery charger

**Datasheet** 8921_000-362

# Calibration

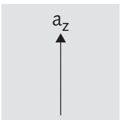
## Charge Amplifier

### Quartz Compression Laboratory Primary Standard Accelerometers Type 8002K…




| Specifications | | Type 8002K |
|---|---|---|
| Range | g | ±1000 |
| Sensitivity | pC/g | –1,0 |
| Frequency Response, –1 ... 5% | Hz | ≈0 … 6 000 |
| Threshold nom. | $g_{rms}$ | 0,02 |
| Transverse Sensitivity max. | % | 2 |
| Non-Linearity | %FSO | ±0,5 |
| Temp. Coeff. of Sensitivity | %/°C | –0,03 |
| Operating Temperature | °C | –70 … 120 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Epoxy |
| Mass | gram | 20 |
| Sensing Element | type | Quartz/compression |

**Measuring direction**




**Connection**
10-32 neg.

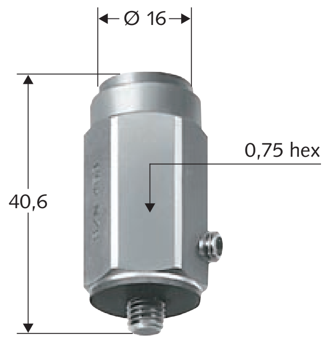
**Characteristics**
High impedance, charge mode, quartz stability and repeatability, wide operating temperature range.

**Applications**
Used with 5022 to form a complete calibration primary standard. Long duration shock pulses or high frequency vibrations even in cryogenic or high temperature environments.

**Accessories**
Mounting Stud: Type 8402
Cable: 1631C…
Charge Amplifier: 5022

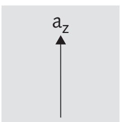
**Datasheet** 8002_000-205

### Vibration Standard Quartz Accelerometer Type 8076K




| Specifications | | Type 8076K |
|---|---|---|
| Range | g | ±1000 |
| Sensitivity | pC/g | 1 |
| Frequency Response, ±4% | Hz | 0,5 … 5 000 |
| Threshold nom. | $g_{rms}$ | 0,01 |
| Transverse Sensitivity max. | % | 2 |
| Non-Linearity | %FSO | ±0.5 |
| Temp. Coeff. of Sensitivity | %/°C | 0,02 |
| Operating Temperature | °C | –20 … 65 |
| Housing/Base | type | St. Stl. |
| Sealing | type | Epoxy |
| Mass | gram | 80 |
| Sensing Element | type | Quartz/compression |

**Measuring direction**




**Connection**
10-32 neg.

**Characteristics**
High impedance charge mode, quartz accuracy and stability, rugged design, low base strain sensitivity, ground isolated. Low mass loading

**Applications**
Used with 5022 to form a complete back-to-back calibration transfer standard. High precision laboratory accelerometer

**Accessories**
Mounting Stud: Type 8410
Cable: 1631C…
Charge Amplifier: 5022

**Datasheet** 8076K_000-210

# Piezoelectric Theory

## Piezoelectric effect

The piezoelectric effect was discovered by Pierre and Jacques Curie in 1880. It remained a mere curiosity until the 1940's. The property of certain crystals to exhibit electrical charges under mechanical loading was of no practical use until very high input impedance amplifiers enabled engineers to amplify their signals. In the 1950's electrometer tubes of sufficient quality became available and the piezoelectric effect was commercialized.

Walter P. Kistler patented the charge amplifier principle in 1950 and gained practical significance in the 1960's. The introduction of highly insulating materials such as Teflon and Kapton greatly improved performance and propelled the use of piezoelectric sensors into virtually all areas of modern technology and industry.

Piezoelectric measuring systems are active electrical systems. That is, the crystals produce an electrical output only when they experience a change in load. For this reason, they cannot perform true static measurements. However, it is a misconception the piezoelectric instruments are suitable for only dynamic measurements. Quartz transducers, paired with adequate signal conditioners, offer excellent quasistatic measuring capability. There are countless examples of applications where quartz based sensors accurately and reliably measure quasi-static phenomena for minutes and even hours.

## Applications of piezoelectric instruments

Piezoelectric measuring devices are widely used today in the laboratory, on the production floor and as original equipment. They are used in almost every conceivable application requiring accurate measurement and recording of dynamic changes in mechanical variables such as pressure, force and acceleration. The list of applications continues to grow and now includes:

- Aerospace: Modal testing, wind tunnel and shock tube instrumentation, landing gear hydraulics, rocketry, structures, ejection systems and cutting force research
- Ballistics: Combustion, explosion, detonation and sound pressure distribution
- Biomechanics: Multi-component force measurement for orthopedic gait and posturography, sports, ergonomics, neurology, cardiology and rehabilitation
- Engine Testing: Combustion, gas exchange and injection, indicator diagrams and dynamic stressing
- Engineering: Materials evaluation, control systems, reactors, building structures, ship structures, auto chassis structural testing, shock and vibration isolation and dynamic response testing
- Industrial/Factory: Machine systems, metal cutting, press and crimp force, automation of force-based assembly operations and machine health monitoring
- OEMs: Transportation systems, plastic moulding, rockets, machine tools, compressors, engines, flexible structures, oil/gas drilling and shock/vibration testers.

## Piezoelectric sensors (Quartz based)

The vast majority of Kistler sensors utilize quartz as the sensing element. As discussed in other sections of this catalogue, Kistler also manufactures sensors which utilize piezo-ceramic elements and micro machined silicon structures. However, the discussion in this section will be limited to quartz applications. Quartz piezoelectric sensors consist essentially of thin slabs or plates cut in a precise orientation to the crystal axes depending on the application. Most Kistler sensors incorporate a quartz element, which is sensitive to either compressive or shear loads. The shear cut is used for patented multi-component force and acceleration measuring sensors. Other specialized cuts include the transverse cut for some pressure sensors and the patented polystable cut for high temperature pressure sensors.
See figures 1 and 2.

Although the discussion which follows focuses on accelerometer applications, the response function for force and pressure sensors has essentially the same form. In fact, many force applications are closely related to acceleration. On the other hand, pressure sensors are designed to minimize or eliminate (by direct compensation of the charge output) the vibration effect. Call Kistler directly for more information on this subject or refer to page 100 which lists available technical articles.

The finely lapped quartz elements are assembled either singly or in stacks and usually preloaded with a spring sleeve. The quartz package generates a charge signal (measured in picoCoulombs) which is directly proportional to the sustained force. Each sensor type uses a quartz configuration which is optimized and ultimately calibrated for its particular application (force, pressure, acceleration or strain). Refer to the appropriate section for important design aspects depending on application.

Quartz sensors exhibit remarkable properties, which justify their large scale use in research, development, production and testing. They are extremely stable, rugged and compact. Of the large number of piezoelectric materials available today, quartz is employed preferentially in sensor designs because of the following excellent properties:

- High material stress limit, approximately 150 N/mm$^2$
- Temperature resistance up to 500 °C
- Very high rigidity, high linearity and negligible hysteresis
- Almost constant sensitivity over a wide temperature range
- Ultra high insulation resistance ($10^{14}$ ohms) allowing low frequency measurements (<1 Hz)

**High and low impedance**

Kistler supplies two types of piezoelectric sensors: high and low impedance. High impedance units have a charge output which requires a charge amplifier or external impedance converter for charge-to-voltage conversion. Low impedance types use the same piezoelectric sensing element as high impedance units and also incorporate a miniaturized built-in charge-to-voltage converter. Low impedance types require an external power supply coupler to energize the electronics and decouple the subsequent DC bias voltage from the output signal.

## Dynamic behavior of sensors

Piezoelectric sensors for measuring pressure, force and acceleration may be regarded as under-damped, spring mass systems with a single degree of freedom. They are modelled by the classical second order differential equation whose solution is:

$$\frac{a_o}{a_b} \cong \frac{1}{\sqrt{\left[1-\left(\frac{f}{f_n}\right)^2\right]^2+\left(\frac{1}{Q^2}\right)\left(\frac{f}{f_n}\right)^2}}$$

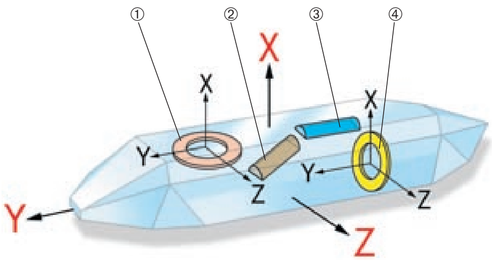
Where:

$f_n$ = undamped natural (resonant) frequency (Hz)
$f$ = frequency at any given point of the curve (Hz)
$a_o$ = output acceleration
$a_b$ = mounting base or reference acceleration ($f/f_n = 1$)
$Q$ = factor of amplitude increase at resonance

Quartz sensors have a Q of approximately 10 to 40 and therefore the phase angle can be written as:

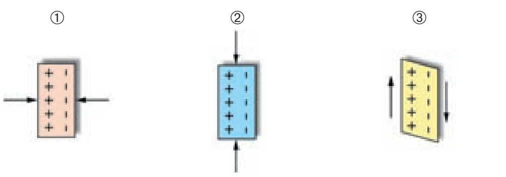
$$\text{phase lag (deg)} \cong \frac{60}{Q}\left(\frac{f}{f_n}\right) \text{ for } \frac{f}{f_n} \leq \frac{2}{5}$$

A typical frequency response curve is shown in figure 3. As shown, about 5% amplitude rise can be expected at approximately 1/5 of the resonant frequency ($f_n$). Low-pass (LP) filtering can be used to attenuate the effects of this. Many Kistler signal conditioners (charge amplifiers and couplers) have plug-in filters for this purpose.



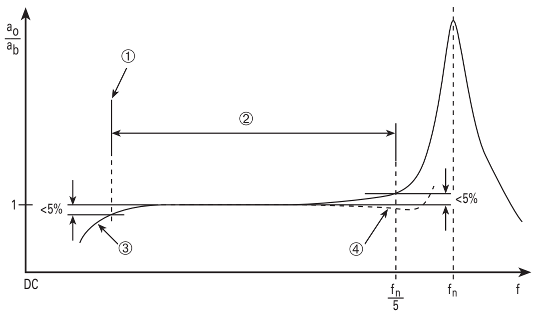

① = compression cut ② = polystable cut ③ = transverse cut ④ = shear cut

Figure 1
Quartz bar




① = longitudinal effect ② = transverse effect ③ = shear effect

Figure 2
Piezoelectric effect




① = low frequency limit determined by RC roll-off characterstics
② = useable range
③ = HP filter
④ = with LP filter

Figure 3
Typical frequency response curve

## Charge amplifiers

Basically the charge amplifier consists of a high-gain inverting voltage amplifier with a MOSFET or J-FET at its input to achieve high insulation resistance. A simplified model of the charge amplifier is shown in figure 4.

The effects of $R_t$ and $R_j$ will be discussed below. Neglecting their effects, the resulting output voltage becomes:

$$V_o = \frac{-q}{C_r} \times \frac{1}{1+\frac{1}{AC_r}\left(C_t + C_r + C_c\right)}$$

For sufficiently high open loop gain, the cable and sensor capacitance can be neglected and the output voltage depends only on the input charge and the range capacitance.

$$V_o = \frac{-q}{C_r}$$

In summary, the amplifier acts as a charge integrator which compensates the sensor's electrical charge with a charge of equal magnitude and opposite polarity and ultimately produces a voltage across the range capacitor. In effect, the purpose of the charge amplifier is to convert the high impedance charge input (q) into a useable output voltage ($V_o$).

**Time constant and drift**
Two of the more important considerations in the practical use of charge amplifiers are time constant and drift. The time constant is defined as the discharge time of an AC coupled circuit. In a period of time equivalent to one time constant, a step input will decay to 37% of its original value.

Time Constant (TC) of a charge amplifier is determined by the product of the range capacitor ($C_r$) and the time constant resistor ($R_t$):

$$TC = R_t C_r$$

Drift is defined as an undesirable change in output signal over time, which is not a function of the measured variable. Drift in a charge amplifier can be caused by low insulation resistance at the input ($R_j$) or by leakage current of the input MOSFET or J-FET.

Drift and time constant simultaneously affect a charge amplifiers output. One or the other will be dominant. Either the charge amplifier output will drift towards saturation (power supply) at the drift rate or it will decay towards zero at the time constant rate.

Many Kistler charge amplifiers have selectable time constants which are altered by changing the time constant resistor ($R_t$). Several of these charge amplifiers have a "Short", "Medium" or "Long" time constant selection switch. In the "Long" position, drift dominates any time constant effect. As long as the input insulation resistance ($R_j$) is maintained at greater than $10^{13}$ ohms, the charge amplifier (with MOSFET input) will drift at an approximate rate of 0.03 pC/s. Charge amplifiers with J-FET inputs are available for industrial applications but have an increased drift rate of about 0.3 pC/s.

In the "Short" and "Medium" positions, the time constant effect dominates normal leakage drift. The actual value can be determined by referring to the appropriate operation/instruction manual which is supplied with the unit. Kistler charge amplifiers without "Short", "Medium" or "Long" time constant selection, operate in the "Long" mode and drift at the rates listed above. Some of these units can be internally modified for shorter time constants to eliminate the effects of drift.

**Frequency and time domain considerations**
When considering the effects of time constant, the user must think in terms of either frequency or time domain.

The longer the time constant, the better the low-end frequency response and the longer the useable measuring time. When measuring vibration, time constant has the same effect as a single-pole, high-pass (HP) filter whose amplitude and phase are:

$$\frac{V_o}{V_{in}} = \frac{2\pi f\,(TC)}{\sqrt{1+\left[2\pi f\,(TC)\right]^2}}$$

$$\text{phase lead (deg)} = \text{arc tan}\ \frac{1}{2\pi f\,(TC)} \cong 80\sqrt{\frac{V_{in}-V_o}{V_{in}}}$$

For example, the output voltage has declined approximately 5% when f x (TC) equals 0.5 and the phase lead is 18 degrees.

When measuring events with wide (or multiple) pulse widths. The time constant should be at least 100 times longer than the total event duration. Otherwise, the DC component of the output signal will decay towards zero before the event is completed.

**Selection matrix**
Other design features incorporated into Kistler charge amplifiers include range normalization for whole number output, low-pass filters for attenuating sensor resonant effects, electrical isolation for minimizing ground loops and digital/computer control of setup parameters.

## Low impedance piezoelectric sensors

Piezoelectric sensors with miniature, built-in charge-to-voltage converters are identified as low impedance units throughout this catalogue. These units utilize the same types of piezoelectric sensing element(s) as their high impedance counterparts. Piezotron, Picotron, PiezoBeam, Ceramic Shear and K-Shear are all forms of Kistler low impedance sensors.

In 1966, Kistler developed the first commercially available piezoelectric sensor with internal circuitry. This internal circuit is a patented design called Piezotron. This circuitry employs a miniature MOSFET input stage followed by a bipolar transistor stage and operates as a source follower (unity gain). A monolithic integrated circuit is utilized which incorporates these circuit elements. This circuit has very high input impedance ($10^{14}\ \Omega$) and low output impedance ($100\ \Omega$) which allows the charge generated by the quartz element to be converted into a useable voltage. The Piezotron design also has the great virtue of requiring only a single lead for power-in and signal-out. Power to the circuit is provided by a Kistler coupler (Power Supply), which supplies a source current (2–18 mA) and energizing voltage (20–30 VDC). Certain (extreme) combinations of other manufacture's supply current and energizing voltage (i.e. 20 mA and 18 VDC, respectively), together with actual bias level, may restrict operating temperature range and voltage output swing. Call Kistler for details. Connection is as shown in figure 5. A Kistler coupler and cable is all that is needed to operate a Kistler low impedance sensor.

The steady state output voltage is essentially the input voltage at the MOSFET Gate plus any offset bias adjustment. The voltage sensitivity of a Piezotron unit can be approximated by:

$$V_o \cong \frac{q}{C_q + C_r + C_G}$$

The range capacitance ($C_r$) and time constant resistor ($R_t$) are designed to provide a predetermined sensitivity (mV/g) and upper and lower useable frequency. The exact sensitivity is measured during calibration and its value is recorded on each unit's calibration certificate.

Since its invention, the Piezotron design has been adapted by manufactures worldwide and has become a widely used standard for design of sensors which measure acceleration, force and pressure. The concept has become known by many names besides Piezotron such as low impedance or voltage mode. Also, a number of "brand names" have emerged by other manufactures.

Picotron is a miniature accelerometer whose circuitry is very similar to the Piezotron. PiezoBeam incorporates a bimorph ceramic element and a miniature hybrid charge amplifier for the charge-to-voltage conversion. K-Shear is the newest member of the Kistler low impedance family and utilizes a shear quartz element together with the Piezotron circuitry.

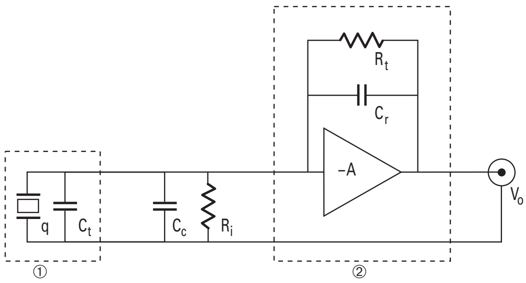
**Time constant**

The time constant of a Piezotron or Picotron sensor is:

$$TC = R_t\,(C_q + C_r + C_G)$$

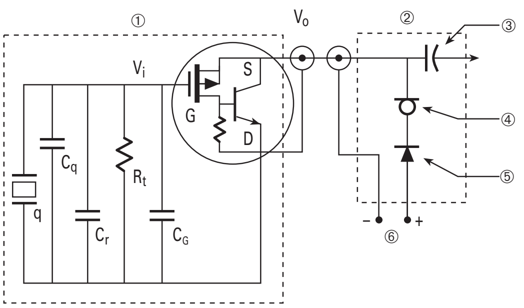
A PiezoBeam's time constant is the product of its hybrid charge amplifier's range capacitor and time constant resistor.

Time constant effects in low impedance sensors and in charge amplifiers are the same. That is, both act as a single pole, high-pass filter as discussed previously.




① = piezoelectric accelerometer
② = charge amplifier
$V_o$ = output voltage
A = open loop Gain
$C_t$ = sensor capacitance
$C_c$ = cable capacitance
$C_r$ = range (or feedback) capacitor
$R_t$ = time constant resistor (or insulation of range capacitor)
$R_i$ = insulation resistance of input circuit (cable and sensor)
q = charge generated by the sensor

Figure 4
Simplified charge amplifier model




① = accelerometer
② = coupler
③ = decoupling capacitor
④ = constant current diode
⑤ = reverse polarity protection diode
⑥ = DC source
q = charge generated by piezoelectric element
$V_i$ = input signal at gate
$V_o$ = output voltage (usually bias decoupled)
$C_q$ = sensor capacitance
$C_r$ = range capacitance
$C_G$ = MOSFET GATE capacitance
$R_t$ = time constant resistor

Figure 5
Piezotron
Circuit & coupler

## Low impedance power supply (coupler)

All of the low impedance types mentioned earlier require similar excitation for their built-in electronics. A single two-wire coaxial cable and a Kistler power supply coupler is all that is needed. Both the power into and the signal out from the sensor are transmitted over this two-wire cable. The coupler provides the constant current excitation required for linear operation over a wide voltage range and also decouples the bias voltage from the output.

**Time constant**
Bias decoupling methods can be categorized as AC or DC. DC methods of bias decoupling will not effect a low impedance sensor's time constant and therefore permit optimum low frequency response. An offset voltage adjust is used to "zero" the bias. AC decoupling methods, however, can shorten the low impedance sensor's time constant and degrade low frequency response. In low impedance systems, with AC bias decoupling, the system time constant can be approximated by taking the product of the sensor and coupler time constants and dividing by their sum. The resulting frequency response can be computed as before.

**Selection matrix**
Many other performance features are incorporated into Kistler's line of power supply couplers. Included are versions with multi-channel inputs, 100X gain, plug-in filters and computer controled set-up parameters.

**Dual mode charge amplifiers**
Another method for powering low impedance sensors is to use a Dual Mode charge amplifier (high/low impedance). Dual mode units can be used as standard charge amplifiers with high impedance sensors or as couplers (with adjustable gain) for low impedance units.

## High and low impedance system comparison

**Similarities**
Both systems utilize the same type of piezoelectric sensing element(s) and therefore are AC coupled systems with limited low frequency response or quasistatic measuring capability. Their respective time constants determine the useable frequency range.

**High impedance systems**
Usually high impedance systems are more versatile than low impedance. Time constant, gain, normalization and reset are all controlled via an external charge amplifier. In addition, the time constants are usually longer with high impedance systems allowing easy short-term static calibration. Because they contain no built-in electronics, they have a wider operating temperature range.

**Low impedance systems**
Generally, low impedance systems are tailored to a particular application. Since the low impedance sensor has an internally fixed range and time constant, it may limit use to their intended application. High impedance systems, with control of range and time constant via an external charge amplifier, have no such restriction.

However, for applications with well-defined measuring frequency and temperature ranges, low impedance (Piezotron) systems offer a potentially lower cost (i.e. charge amplifier vs. coupler cost) alternative to high impedance systems. In addition, low impedance sensors can be used with general purpose cables in environments where high humidity/contamination could be detrimental to the high insulation resistance required for high impedance sensors. Also, longer cable lengths, between sensor and signal conditioner and compatibility with a wide range of signal display devices are further advantages of low impedance sensors.

## External impedance converters

An alternative method for processing charge from high impedance sensors is to use an external impedance converter. This method is often used to exploit the high temperature range of high impedance sensors while implementing the convenience and cost effectiveness of the coupler.

External impedance converters incorporate the same circuitry as the Piezotron. The only difference is that the sensor cable capacitance must be added to the sensor capacitance ($C_q$).

## Sensor quality/calibration

Over the years, the Kistler name has become synonymous with QUALITY. We at Kistler are dedicated to continuous improvement in all areas; Design, Manufacturing, Quality Control, Quality Assurance and Calibration.

All Kistler products are manufactured in conformance with the requirements of ISO 9001: 2000 and MIL-I-45208A. Kistler's calibration system complies with the requirements of MIL-STD-45662A and ANSI/NCSL Z540. Calibrations performed at Kistler are traceable to NIST, or the Swiss Federal Office of Metrology. Calibration laboratories are accredited to ISO/IEC 17025. Kistler takes full advantage of the latest technology, performing computer controlled testing, calibration and data collection. Kistler products are used as primary standards for many of the world's leading test and national calibration laboratory facilities, including NIST.

## Kistler calibration techniques

**Force sensors**
The calibration of force sensors is very similar to pressure sensors. The unit under test is calibrated against a standard force ring whose calibration is traceable to NIST. A hydraulic press is used to generate forces for this calibration.

**Accelerometers**
Kistler acceleration standards are periodically calibrated by an independent third party providing NIST traceability. These primary standards are used to calibrate a set of working standards at Kistler. The working standards are configured to accept direct mounting of the unit under test. "Back to Back" calibration technique minimizes errors. Calibration is performed on a sinusoidal motion shaker.

## Glossary and technical references

A glossary of technical terms used throughout this catalogue follows this section. Also, refer to the inside back cover for a comprehensive list of Kistler technical articles that have been compiled over the years by authorities in the field of piezoelectric instrumentation.

# Capacitive Accelerometer Theory

**The fundamental principle of operation for a capacitive accelerometer is the property that a repeatable change in capacitance exists when a sensing structure is deflected due to an imposed acceleration.**

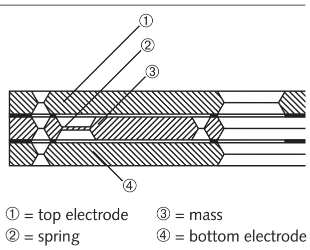



Figure 1
Typical capacitive accelerometer arrangement

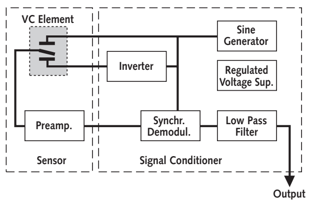



Figure 2
Electrical schematic

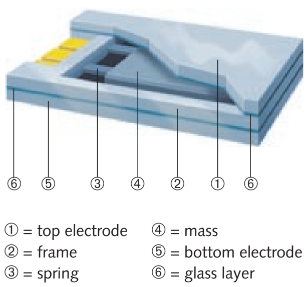



Figure 3
MEMS variable capacitance accelerometer

The acceleration creates a force (F) acting on a suspended flexure of known mass (m). The flexure moves predictably and in a controlled manner dictated by its stiffness (k). A gas filled gap (d) exists between surrounding electrodes as shown in figure 1. The inertial force can be calculated from Newton's Second Law of Motion as:

$$F = m\,a \qquad \text{[Eq. 1]}$$

Knowing the force, a displacement of the flexure can be estimated using a simple spring calculation:

$$x = F/k \qquad \text{[Eq. 2]}$$

However, in practice, Finite Element Analysis (FEA) is employed to model the complicated spring designs. This displacement alters the gaps on either side of the flexure in an equal but opposite proportion. The distance between the flexure and surrounding electrodes (l), is then the nominal [zero g] spacing (d) ± the spring deflection (x) or:

$$l_1 = d + x \quad \& \quad l_2 = d - x \qquad \text{[Eq. 3]}$$

Knowing the electrode area (A) and the permitivity constant of the gas (E), the capacitance formed by the gaps can be determined from:

$$C_1 = A\,\varepsilon/l_1 \quad \& \quad C_2 = A\,\varepsilon/l_2 \qquad \text{[Eq. 4]}$$

This capacitance difference causes an imbalance in a bridge network of the internal electronic circuit. Internal signal conditioning incorporates AC excitation and synchronous demodulation. In addition, it provides power for the accelerometer element and outputs an analogue voltage proportional to the acceleration signal.

The key operating principle of figure 2 is that a variable capacitive element unbalances a bridge relative to applied acceleration. The electronic action is summarized as follows:

- A voltage regulator stabilizes the accelerometer sensitivity and assures internal functions remain constant despite the supply voltage level
- A square wave generator produces excitation for the bridge circuit
- A capacitive bridge produces two signals with amplitudes relative to the applied acceleration
- Diodes rectify and produce two opposing DC signals
- The opposing signals are summed to form the representative output
- A preamplifier provides gain
- A built-in low pass filter attenuates unwanted signals above the operating frequency range

Kistler micromachined K-Beam accelerometer sensing elements consist of very small inertial mass and flexure elements chemically etched from a single piece of silicon. The seismic mass is supported by flexure elements between two plates, which act as electrodes. As the mass deflects under acceleration, the capacitance between these plates changes. Under very large accelerations (or shocks), the motion of the mass is limited by the two stationary plates thereby limiting the stress placed on the suspension and preventing damage. The typical design is shown in figure 3.

The damping of the mass by an entrapped gas creates a “squeeze film” providing an optimized frequency response over a wide temperature range. Additionally, its differential capacitive design assures immunity to thermal transients. The effort of damping is shown in figure 4a and appropriate damping is tuned with a specific spring mass system to achieve optimal frequency response (figure 4b).

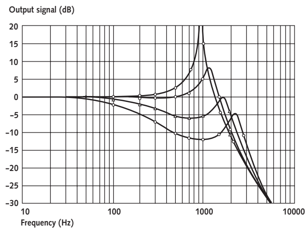



Figure 4a
Effect of damping

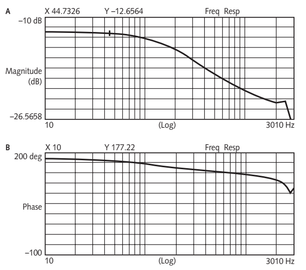



Figure 4b
Tuned system

# Glossary

**Bias voltage**
DC (no load or quiescent) output level of a low impedance sensor powered by constant current excitation.

**Ceramic Shear**
Kistler piezoelectric accelerometer family which utilizes ceramic shear sensing elements.

**Charge amplifier**
Electronic unit which utilizes a high-gain voltage amplifier with negative, capacitive feedback for converting a charge from a piezoelectric sensor into a low impedance output voltage.

**Charge output**
Output in Pico Coulombs (pC) from a piezoelectric sensor without a built-in charge-to-voltage converter (see High impedance).

**Circuit integrity indication**
A quick-look reference on couplers or dual mode charge amplifier for identifying whether a low impedance system has the proper bias voltage. Analogue meters and multi-color LEDs are the most commonly used indicators.

**Constant current excitation**
Method of powering low impedance sensors to insure minimal sensitivity variation over a wide voltage range. A piezotron coupler or any other ICP type power supply may be used for this purpose.

**Coupler**
Electronic unit which supplies constant current excitation to low impedance sensors and decouples the subsequent bias voltage.

**Cross talk**
Another term for cross axis or transverse sensitivity; used on Kistler multi-component force sensors to describe the output on one axis caused by inputs on the others.

**Drift**
An undesirable change in output signal, over time, which is not a function of the measurand.

**Dual mode**
Refers to a charge amplifier which can be used either with high impedance, charge output or with low impedance, voltage output sensors.

**Ground isolation**
The electrical resistance between the signal return/common and mounting ground of a sensor, or between an electrical connector shield and power ground of a charge amplifier/coupler.

**High impedance**
Another term for a piezoelectric sensor with charge output (i.e. pC/mechanical unit).

**Hysteresis**
The maximum difference in output, at any measured value within the specified range when the value is approached first with increasing and then decreasing measurand.

**Impedance converter**
A miniature electronic unit with MOSFET input and bipolar output for converting high impedance, charge outputs (from a sensor) into low impedance, voltage outputs. Impedance converters can be built into the sensor (see Low impedance) or can be used externally for special applications.

**Impedance head**
Sensor that simultaneously measures both force and acceleration during modal analysis testing.

**Insulation resistance**
The resistance of a high impedance sensor, cable or charge amplifier measured between the signal lead and connector ground.

**K-Beam®**
Kistler's solid-state, variable capacitance based line of accelerometers, which are suitable for measuring low frequencies or even steady-state conditions.

**K-Shear®**
Kistler's piezoelectric accelerometer family. Low impedance accelerometer, which utilizes quartz shear sensing element.

**Linearity**
The closeness of a calibration curve to a specified straight line. Kistler uses "Best straight line through zero" which is defined as follows: two parallels are sought, as close together as possible but enclosing the entire calibration curve. In addition, the median parallel must pass through zero (no measurand, no output signal). The slope of this median parallel is the sensitivity of the sensor. Half the interval between the two parallels, expressed as a percentage of Full-Scale Output (FSO), is the linearity.

**Low impedance**
Another name for a piezoelectric sensor with a miniature, built-in charge to voltage converter. Output is typically in mV/mechanical unit. K-Shear, Piezotron, Picotron and PiezoBeam are all forms of low impedance sensors.

**Low pass filter**
An electronic network for passing low and attenuating high frequencies. Many plug-in types are available for Kistler charge amplifiers and power supply/couplers.

**Measurand**
A physical quantity, property or condition which is measured (i.e. pressure, force or acceleration).

**MEMS**
Micro Electro Mechanical Sensor

**Multi-Component force sensor**
Kistler design utilizing compressive and shear quartz elements for measuring up to three force components and three moments.

**Natural frequency**
The frequency of free (not forced) oscillations of the sensing element of a fully assembled sensor.

**Pico Coulomb (pC)**
A unit of electrical charge equivalent to 1x10$^{-12}$ amps.

**Picotron**
Miniature accelerometer with Piezotron circuitry.

**PiezoBeam®**
Low impedance accelerometer. Incorporates a bimorph ceramic element charge when mechanically loaded.

**Piezoelectric sensor**
Sensor with a sensing element that generates an electrical charge when mechanically loaded.

**Piezotron®**
Patented Kistler piezoelectric sensors with miniature, built-in impedance converters (see Impedance converter).

**Polystable®**
Patented Kistler quartz element incorporated into pressure sensor designs for operating temperatures up to 350 °C.

**Quasistatic**
Term which denotes Kistler's ability to make short-term static or near DC measurements with high impedance sensors and charge amplifiers.

**Resonant frequency**
The measurand frequency at which a sensor responds with maximum output amplitude.

**Rise time**
The length of time for the output of a sensor to rise from 10% to 90% of its final value as a result of a step-change of measurand.

**Sensitivity**
The ratio of the change in sensor output to a change in the value of the measurand. Expressed in pC or mV per mechanical unit.

**TEDS**
Transducer Electronic Data Sheet. Characteristic data stored digitally internal to sensor, IEEE 1451.4 compliant.

**Temperature coefficient of sensitivity**
The change in sensitivity of a sensor at different (constant) operating temperatures. Typically expressed as a percent change per unit temperature change (%/°C).

**Time constant**
(TC) Refers to the discharge time of an AC coupled circuit. In the time domain, a DC signal will decay to 37% of its original value in a period of time equivalent to one time constant.

In high impedance systems, the time constant is the product of the charge amplifier's range capacitor and time constant resistor. In low impedance systems, the system time constant can be approximated by taking the product of sensor and coupler time constants and dividing by their sum.

In frequency domain, time constant can be related to a high pass filter network with a low frequency cutoff (–5% pt.) equal to 0.5/TC.

**Threshold**
The smallest change in the measurand that will result in a measurable change in sensor output.
For charge output sensors, threshold denotes the equivalent noise level in a standard charge amplifier. For voltage output sensors, threshold denotes the equivalent noise level of its built-in charge to voltage converter.

**Transverse sensitivity**
The output of an accelerometer caused by acceleration perpendicular to the measuring axis.

**Voltage output**
Output from a piezoelectric sensor with a built-in charge-to-voltage converter (see Low impedance).

# Kistler – Customer Service

**Kistler offers a comprehensive range of services:**

## Technical advice

Experienced specialists from every area of application are at the disposal of our customers. Kistler consultancy services include the identification and definition of each individual measurement task, the development of the solution, the selection of the appropriate measuring system and the planning of the installation.

## Test equipment

Kistler provides its customers with proper equipment to help solve specific application problems.

## Repair service

In the event of the failure of a measuring chain, Kistler specialists help to keep downtime of machinery or production lines to a minimum.

## Calibration

Kistler offers a calibration service for the periodic testing of measuring accuracy in accordance with ISO 17025. If necessary, this service can be performed on site. Kistler keeps a comprehensive record to show which sensors have been calibrated, as well as when and how. Kistler also has a whole series of instruments for equipping calibration laboratories.

## Information

In order to keep customers constantly aware of the latest information, Kistler passes on its specialist knowledge at exhibitions, trade fairs, conferences, symposiums and seminars. Information in the form of data sheets, brochures, reprints, operating instructions and application descriptions is also available to our customers in printed or electronic form.

## Training

Kistler trains its engineers thoroughly at its own training center so that their knowledge corresponds to the latest state of the art. Kistler also holds regular seminars for customers on special subject areas.

You can count on the support of experienced specialists.

A highly effective repair service minimizes downtime.

A calibration service periodically checks measuring accuracy.

Many Kistler products are available from stock.

Kistler engineers are always abreast of the latest developments.

# The Kistler Spectrum

**With around 5000 products, Kistler covers a broad spectrum.**

## Acceleration

In addition to the field of acceleration measurement covered in this brochure, Kistler is involved in three other product areas:

## Force

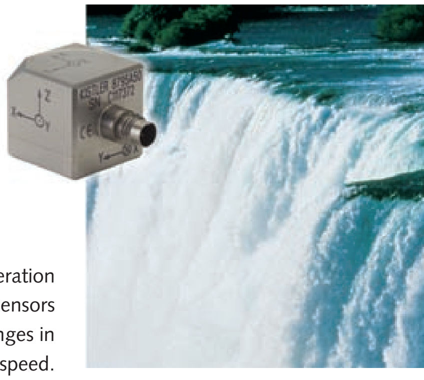
Kistler sensors have been used for almost 50 years for dynamic and quasi-static measurements ranging from very small to very large forces. Kistler force sensors have proved their worth wherever precise results are needed and however extreme the conditions.

## Pressure

Kistler sensors can be used to measure almost any pressure – from the gas pressure in internal combustion engines to the pressure in a plastic melt or a pressure drop in dialysis equipment. They also serve to supply precise process information under extreme conditions.

## Measurement and analysis

Kistler technology serves to measure minute variations in pressure, force or acceleration, even under extreme conditions, and to display them on high-precision electronic instruments. Kistler also supplies the hardware and software needed to convert the raw data for measurement related process control.



In the acceleration field, Kistler sensors measure changes in speed.

Kistler sensors measure force, torque and strain.

Kistler sensors can be used to measure almost any pressure.


Kistler supplies hard-ware and software for measurement related open-loop and closed-loop process control.

# Kistler Applications

**Kistler sensors are used in applications of all kinds.**

## Engines

Kistler measuring technology helps engineers to optimize the operation of internal combustion engines, combining maximum efficiency with minimum exhaust pollution.

## Vehicles

Kistler sensors help to make automobiles safer and more comfortable and reduce the cost of road maintenance. They serve to measure forces of all kinds in the vehicle suspension, bodywork, and wheels, as well as the road surface.

## Manufacturing

To maintain the quality and reduce the costs of mass production, the manufacturing processes must first be determined and optimized in a series of tests and subsequently kept under constant monitoring. Kistler supplies the measuring technology for both applications.

## Instruments and equipment

Kistler pressure, force and acceleration sensors are to be found in any number of machines and electrical equipment for industrial applications. They support open-loop and closed-loop control of a wide variety of processes.

## Plastics processing

Kistler pressure sensors and control technology make it possible to increase process quality in the manufacture of plastic components. Constant manufacturing quality reduces scrap and start-up losses and increases profitability.

## Biomechanics

Through high precision measurement of human gait, Kistler force plates help athletes to optimize their performance and physicians to understand the locomotor system and reduce stresses.

## Acceleration

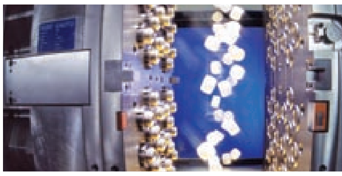
A wide variety of accelerometers are offered to accommodate even the most demanding measurements. Miniature types provide minimal mass loading yet provide significant signal for analysis. High sensitivity types are available for testing of low amplitude motions down to steady state, DC. Our accelerometers have been optimized for the most common applications and custom solutions are readily available.

Internal combustion engines become more economical and environmentally friendly.

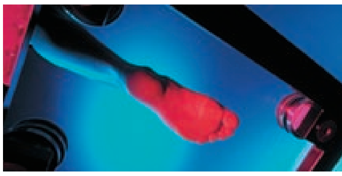
Cars become safer and more comfortable.

Mass production becomes more cost effective.

Industrial processes are precisely controlled and regulated.



Process quality in the manufacture of plastic components is improved.



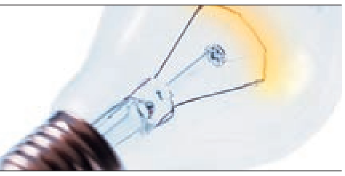
Kistler force plates optimize performance in many sports.

Ride quality of mass transit systems is optimized when tilt and sway are accurately measured and controlled.

# Kistler in Brief

measure.

analyze.



innovate.

Kistler enjoys a worldwide reputation as a leading supplier of measurement technology. Kistler sensors use the piezoelectric effect, piezoresistive or capacitive, to measure pressure, force and acceleration.

## Our aim

The top priority at Kistler is to satisfy the needs and requirements of our customers. This includes developing leading-edge products and helping our customers to obtain optimum results from their application.

## Our philosophy

Our success is based on innovative technologies, precise knowledge of our markets and a comprehensive range of services.

## measure. analyze. innovate.

**measure.**
Our core strength is the use of sensors to measure physical changes.

**analyze.**
The physical changes measured have no intrinsic significance by themselves. It is only through analysis and evaluation of the measurements that a process can be understood. To this end, we supply our customers with all the necessary hardware and software to analyze these changes.

**innovate.**
The information obtained in this way constitutes the basis for innovative products and serves to open up new horizons.

## Successful research

Over the years, Kistler's heavy investment in research and development has generated a number of revolutionary innovations:

- the world's first commercial quartz sensor
- the patented two-wire constant current technology constituting the basis for today's sensors with integrated microelectronic circuitry
- the first high-temperature pressure sensors up to 350 °C, polystable quartz cut
- the first three-component force measuring sensors
- own crystal growth capabilities for special high sensitivity and high temperature crystals.

These innovations resulted in solutions to numerous measuring problems for the first time.

## Comprehensive services

Kistler also supplies a comprehensive range of services, including technical advice for all applications, calibration and repair services, as well as regular training.

## Kistler today

Established in Winterthur (Switzerland) in 1959, Kistler currently employs 650 staff worldwide, around 15% of whom are engaged in research and development.

In addition to its headquarters at Winterthur, Kistler is represented in over 50 countries and has group companies in the USA, Germany, Austria, Denmark, Finland, France, Italy, the Netherlands, Norway, Sweden, the United Kingdom, Japan, the People's Republic of China, India, Korea, Singapore and Taiwan.



www.kistler.com

## Our History

1957
Kistler Instruments established in Winterthur, Switzerland.

1958
First miniature quartz pressure sensor, a device which is to set the standard in pressure measuring technology.

1962
Kistler Instrument Corp. moves to its own facilities in Clarence, NY.

1963
Establishment of the German group company near Stuttgart.

1965
Kistler introduces the world's first quartz force sensor.

1966
Kistler moves into its new company building in Winterthur/Wülflingen.

1967
First charge amplifier with MOS-FET.

1968
Kistler introduces another world innovation, three-component force sensors, capable of measuring all three components of a force and their exact direction.

1973
Kistler launches sensors based on the piezoresistive technology.

1974
Introduction of quartz sensors for temperatures above 350 °C.

1979
Kistler Instrument Corp. expands and moves to Buffalo, NY.

1980
Introduction of the world's first quartz strain sensor, an instrument which, even today, offers unrivalled sensitivity.

1983
Introduction of Kistler's unique quartz wheel force dynamometer.

1986
Establishment of the Japanese group company in Tokyo.

1987
Introduced first Piezo Beam® - low impedance accelerometer that incorporates a bimorph ceramic element and hybrid charge amp for ultra-high sensitivity in a small, rugged package

1989
Another world first from Kistler – a high-temperature sensor with a diameter of only 5 mm for use in engine measuring technology.

1991
Kistler becomes an accredited calibration station ("SCS 049") for pressure, force, acceleration and electric charge.

1992
Introduced first K-Beam® - solid-state, variable capacitance based line of accelerometers for measuring low frequency or steady-state conditions.

1997
Certified according to ISO 9001

Introduced Ceramic Shear piezoelectric accelerometer which utilizes ceramic shear sensing elements.

2000
Major expansion of the production plant in Winterthur.

2002
Introduced ServoK-Beam® - solid-state, variable capacitance based line of accelerometers designed to replace traditional servo accelerometers due to the exceptional performance, small size and inexpensive cost.

2004
Achieved ISO/IEC 17025 Accreditation.

First PiezoSmart sensors for combustion engine measurements.


Research efforts focused on one objective: ultra-modern, customer-oriented solutions.


Kistler solutions are developed in close cooperation with the user.


A world first: Kistler quartz sensors.


Kistler is represented in over 50 countries worldwide.


Kistler Instrumente AG, Winterthur, Switzerland


Kistler Instrument Corp., Amherst, NY

## Kistler today

Today, Kistler Instrumente AG ranks with over 650 employees as a world leader in the measuring technology market. 17 group companies and over 40 distributors guarantee a close contact to the customer.

# Technical Literature

## Technical publications and application brochures*

### Acceleration

| | |
|---|---|
| PiezoBeam accelerometers: reliable design for modal analysis | 20.148 |
| Measuring simultaneously translational and angular acceleration with the new TAP system | 20.149 |
| Lightweight capacitive accelerometers for low frequency measurements | 20.159 |
| A consideration of the effects of local rotations on the output of various accelerometer designs | 20.167 |
| New acoustic emission sensors for in-process monitoring | 20.171 |
| K-Beam capacitive accelerometers – for static response | 20.179 |
| K-Shear accelerometers | 20.184 |
| Basic theory of the hammer test method | 20.195 |
| Energy transfer during impact testing | K20.230 |
| A case for low impedance | K20.240 |
| The Piezotron concept as a practical approach to vibration measurement | K20.250 |
| A comparison of angular acceleration and translation acceleration measurements on a free-free beam | K20.270 |
| Shear mode quartz shock sensor | 20.300 |
| IEEE P1451.4: Measurement with smart transducers | 20.302 |
| A novel Annular Shear piezoceramic accelerometer with central preload and optimized volumetric efficiency | 20.304 |
| Force limited vibration tests | K20.310 |
| Structural testing-modal analysis | 54.202* |
| K-Beam capacitive accelerometers | 54.203* |
| High temperature accelerometers | 54.205* |
| Shear mode quartz shock sensor | 920-248 |

### Force

| | |
|---|---|
| Piezoelectric sensors for the combined measurement of forces and acoustic emission for in-process monitoring | 20.170 |

### Theory

| | |
|---|---|
| Piezoelectric measuring instruments and their applications | 20.116 |
| Frequency response of piezoelectric transduces | K20.260 |

# Product Index

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