measure. analyze. innovate.

Instruction Manual

Single-Axis K-Shear-Accelerometers

Types

8702B...,
8704B...,
8728A...,
8730B...

CE

Single-Axis PiezoStar Accelerometers

Types

8703A...,
8705A...,
8712B...,
8715A/B...

CE

002-086e-03.24

Foreword

Thank you for choosing a Kistler quality product characterized by technical innovation, precision and long life.

Information in this document is subject to change without notice. Kistler reserves the right to change or improve its products and make changes to the content without obligation to notify any person or organization of such changes or improvements.

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Content

Total pages: 51

1. Introduction

Thank you for choosing a quality product from Kistler. Please read through this manual thoroughly to enable you to fully exploit the various features of your product.

To the extent permitted by law Kistler accepts no liability if this instruction manual is not followed or products other than those listed under *Accessories* are used. These instructions describe Kistler Single-Axis K-Shear Quartz and PiezoStar IEPE accelerometers.

Performance features at a glance:

- High thermal stability with PiezoStar crystals for dynamic temperature applications from –196 to 165 °C (–320 to 330 °F)
- Wide frequency ranges thanks to high rigidity and resonance frequencies
- Long-term stability
- Wide mounting configurations for all environments
- Conforming to CE

Kistler offers a wide range of products for use in measuring technology:

- Piezoelectric sensors for measuring force, torque, strain, pressure, acceleration, shock, vibration and acoustic emission
- Strain gage sensor systems for measuring force and torque
- Piezoresistive pressure sensors and transmitters
- Signal conditioners, indicators and calibrators
- Electronic control and monitoring systems, as well as software for specific measurement applications
- Data transmission modules (telemetry)

Kistler also develops and produces measuring solutions for the application fields engines, vehicles, manufacturing, plastics and biomechanics sectors.

Our product and application brochures, in addition to our detailed data sheets, will provide you with an overview of our product range.

If you require additional help beyond what can be located online or in this manual, please contact Kistler‘s extensive support organization or visit us online at **www.kistler.com**.

2. Important information

It is essential for you to review the following information, which is intended to ensure your personal safety when working with the K-Shear and PiezoStar Shear IEPE Accelerometers and contribute toward a long-fault-free service life.

2.1 For your safety

NOTE

This product has been manufactured in compliance with current valid safety regulations. It has left the factory in a perfect, safe condition. In order to maintain this condition and ensure safe operation, compliance is required with the instructions and warning notes contained within this manual or imprinted on the product itself.

Compliance with local safety regulations, which may apply to the use of power line operated electrical and electronic equipment, is strongly recommended.

- Do not drop the instrument.
- Store in the case provided and in a clean, dry environment.
- Power the instrument in accordance with the instructions provided in this manual.
- Do not mount accelerometers on high voltage surfaces.
- Keep cable clear of power lines and open machinery.

2.2 Precautions

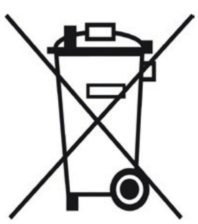
Compliance with the following precautionary measures is vital to ensure safe and reliable operation:

- Never expose the instrument to contamination or oil mist.
- Never operate or store the instrument outside the specified temperature range.
- Never exceed the maximum stated voltage
- **DO NOT OVERTIGHTEN** while stud or screw mounting the sensor.
- Do not expose the unit to excessive shock, i.e. by using a hammer or dropping the unit.
- When not in use, store the accelerometer in the container supplied.
- The environment should be as dry, clean and free from vibrations as possible.
- Keep the connector clean and covered when not in use.
- Follow the recommendations detailed in Section 7.2.

If there is evidence that safe operation is no longer possible, the instrument must be powered off and rendered safe against accidental start-up. Safe operation is no longer possible when the product:

- shows visible signs of damage
- is no longer operating
- has been subjected to prolonged storage under unsuitable conditions

2.3 Disposal of electronic equipment



Do not discard old electronic equipment in municipal trash. For disposal at end of life, please return this product to the nearest authorized electronic waste disposal service or contact your Kistler sales office for disposal instructions.

2.4 Nomenclature

Throughout this manual, special designations and nomenclature are used for terms and concepts relating to K-Shear and PiezoStar Shear sensors. These are identified in Table 1.

Term	**Definition**
Fs	Full-scale
Es	DC supply voltage (a/k/a compliance voltage)
Eb	Bias voltage (from calibration certificate)
f	Frequency in Hz
R_1	Output resistance of the coupler
R_2	Input resistance of the coupler
I	Current in Amperes
C	Capacitance in Farads
τ	Time constant
E	Output in Volts, Peak
R	Read-out impedance
Z	Input impedance
PiezoStar	Special piezoelectric crystals
IEPE	Integrated Electronics Piezoelectric
TEDS	Transducer Electronic Data Sheet

Table 1: Manual nomenclature

3. Product description

Kistler K-Shear and PiezoStar accelerometers are shear mode shock and vibration measuring instruments. A self-generating piezoelectric sensing element is used in conjunction with the built-in, internal circuit Piezotron impedance converter. As with most accelerometers, the sensitivity of this series is expressed in terms of the ratio of the electrical output to applied acceleration (e.g. mV/g). In the case of Piezotron devices, such as K-Shear, the output is a low impedance voltage signal that is proportional to the applied acceleration. K-Shear accelerometers utilize a quartz piezoelectric crystal, while PiezoStar accelerometers utilize a proprietary piezoelectric crystal to create the acceleration charge.

Being a low impedance device, no charge amplifier or special cabling is required and transmission over long lines is possible with a minimum of noise pick-up.

Accelerometers with a “T” suffix, such as Type 8702B…T are variants of the standard version incorporating the 'Smart Sensor' design. Viewing an accelerometer’s data sheet requires a compatible Data Acquisition system or coupler, such as Kistler LabAmp Type 5165A... The Interface provides negative current excitation (reverse polarity), thereby altering the operating mode of the PiezoSmart sensor and allowing the program editor software to read or add information contained in the memory chip.

Kistler publication K20.302 IEEE P 1451.4 Measurement with Smart Transducers includes information on the IEEE Standard 1451.4, the operating manner of smart sensors, and a detailed review of the TEDS Editor and data sheet content. Call Kistler to request a copy.

3.1 Piezoelectric measurement concept

Piezoelectric accelerometers convert acceleration into an electric charge. The charge derived by the accelerometer is proportional to the force acting on the internal quartz (piezoelectric) element. Accordingly, the mechanical variable (acceleration) is derived from a force measurement.

3.2 K-Shear background

The sensing assembly (see Fig. 1) consists of a center post, quartz piezoelectric crystals, seismic mass and a preload bolt. Since the unit is operated in a shear arrangement, it will sense motion perpendicular to the base. When the accelerometer is attached to a vibrating structure, the mass exerts a shear force on the quartz piezoelectric crystal. This applied force causes the piezoelectric material to produce an electric charge. Force = mass x's acceleration (from Newton's second law). Since m is the constant, the charge produced is proportional to acceleration. This is represented by the equation:

$$a = \frac{F}{m}$$

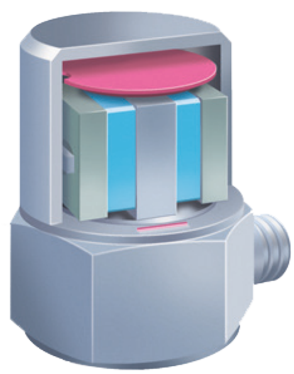


Fig. 1: Inside view of a typical single-axis shear accelerometer

The K-Shear sensing element offers many advantages over previous shear and compression mode designs. Due to its shear construction, the accelerometer is insensitive to thermal transients, transverse (cross-axis) motion and the effects of base strain. This insensitivity to activities occurring in an adjacent axis minimize cross talk effects in these triaxial accelerometers.

3.3 PiezoStar background

Kistler PiezoStar accelerometers utilize the same basic construction as our K-Shear accelerometers except for one key difference. PiezoStar accelerometers utilize a new proprietary piezoelectric crystal which produces higher charge output when compared to quartz based accelerometers and also a have a higher operating temperature. When mated with internal Piezotron electronics, the accelerometer has the additional benefit of providing much lower temperature coefficient of sensitivity when compared to quartz and ceramic-based accelerometers.

3.4 Low impedance (IEPE) output

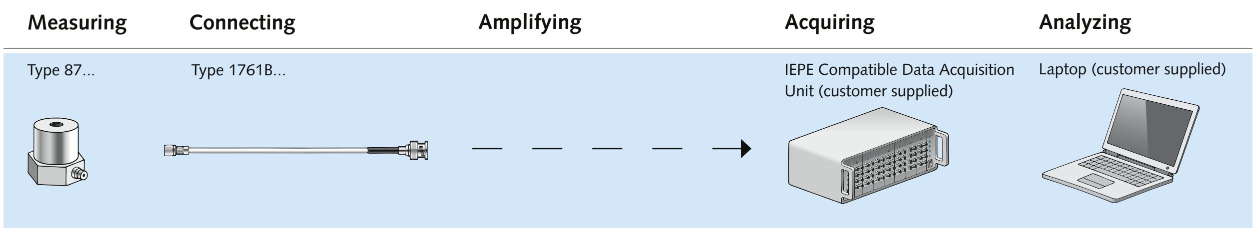
Contained within the accelerometer housing is a miniature electronic circuit. This circuit converts the high impedance charge signal generated by the piezoelectric element into a low impedance voltage output signal. All accelerometer types have a nominal output less than 100 ohms.

The integral impedance converter is powered by an external power source (coupler) that uses a two-wire cable between the accelerometer and coupler. The signal and power source share a common line. The coupler provides a constant current source to the accelerometer and decouples the DC bias (see Section 5.1.3) from the measuring instrument. The useable signal is seen as a varying voltage over an 11 VDC (nominal) bias.

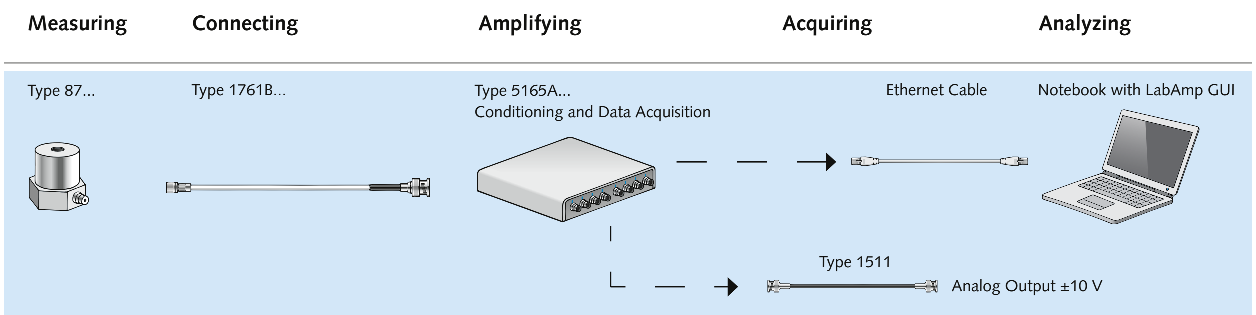
Low impedance accelerometers are ideally suited for applications where long or moving cables are required, in high humidity or other impure atmospheres. They eliminate the difficulties associated with a high impedance output by providing a voltage signal with low impedance and a high frequency response. The calibration factors for these accelerometers are given in mV/g.

Table 2 depicts a typical low impedance measurement system. Couplers vary considerably in appearance, depending upon the application and the number of sensors making up the system. It can also be directly integrated to the data acquisition system.

IEPE sensor and customer IEPE compatible DAQ



IEPE sensor and Kistler LabAmp



Note: Due to its miniaturize connector, the Type 8715A/B... sensor will need an extension cable Type 1766A between the sensor and the Type 1761B cable.

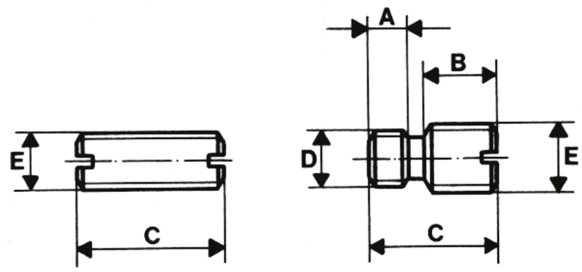
Table 2: IEPE sensor/customer IEPE compatible DAQ and IEPE sensor and Kistler LabAmp measuring chains

3.5 Accessories

All accelerometers designed for stud mounting are supplied with the appropriate studs. All accelerometers designed for screw assembly mounting are supplied with a mounting screw. All units intended for adhesive mounting are provided with mounting wax. See Tables 3, 4 & 5 for more details regarding mounting stud dimensions or refer to the unit specifications listed on the respective data sheet for each model.

3.5.1 Studs

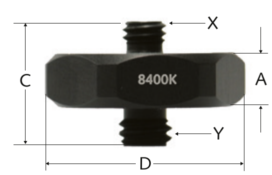
The following studs can be used with Kistler accelerometers:



Type	A	B	C	D	E	Used with
8402	2.5 [0.10]	2.5 [0.10]	7.1 [0.28]	10-32 UNF	10-32 UNF	8702, 8704
8410	2.0 [0.08]	3.2 [0.13]	6.4 [0.25]	10-32	¼–28	8712
8411	2.8 [0.11]	6.6 [0.26]	10.4 [0.41]	10-32 UNF	M6	8702, 8704
8412	–	–	9.5 [0.37]	–	¼–28	8712
8421	3.3 [0.13]	7.5 [0.30]	12.3 [0.48]	¼–28	M8	8712
8451	2.8 [0.11]	5.0 [0.20]	8.8 [0.34]	10-32	M5	8702, 8703, 8704, 8705
8453	3.7 [0.15]	5.1 [0.20]	9.8 [0.38]	M5	¼–28	8712

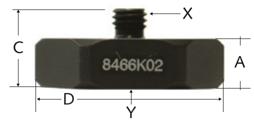
Table 3: Mounting studs (dimensions in mm [in])

Isolated mounting studs are also available to avoid ground loop issues.



Type	A	C	D	THD. X	THD. Y	Used with
8400K01	3.4 [0.13]	11.6 [0.46]	12.7 Hex [0.50 Hex]	10-32	10-32	8702, 8703, 8704, 8705
8400K03	5.5 [0.22]	12.8 [0.50]	19.1 Hex [0.75 Hex]	10-32	M6	8702, 8703, 8704, 8705

Table 4: Isolated mounting studs (dimensions in mm [in])



Type	A	C	D	THD. X	THD. Y	Used with
8466K07	5.1 [0.20]	7.6 [0.30]	8.89 Hex [0.35 Hex]	5-40	5-40	8730

Table 5: Isolated mounting adaptor (dimensions in mm [in])

3.5.2 Adhesive mounting pads

Keeps adhesive material out of the tapped hole or stud and provides ground isolation.

Type	Description
8434, 8436M02	Use to adhesively mount Type 8730
8436	Use to adhesively mount Types 8702, 8703, 8704, 8705
8438	Use to adhesively mount Types 8712

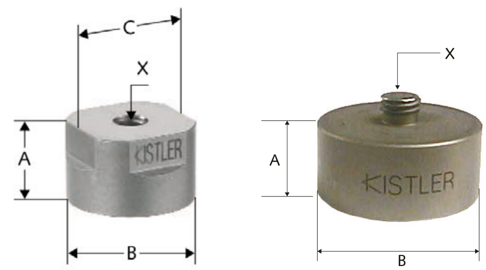
Table 6: Adhesive mounting bases with female thread

Type	Description
8440K03	Mounting base with integral stud for adhesive mounting; Types 8702, 8703, 8704, 8705

Table 7: Adhesive mounting bases with male thread

3.5.3 Magnetic mounting bases

These offer a convenient, temporary attachment to a ferromagnetic test structure. A notched mounting unit is available for mounting on curved surfaces. Magnetic bases find use in applications requiring vibration monitoring of large rotating machinery. Note that usage of some mounting bases can add considerable mass and reduce high frequency response. High care should be taken while usage of magnetic mounting bases in order to avoid shock during ferromagnetic surface approach. This could lead to irreversible damage to the sensor.



Type	A	B	C	THD. X	Used with
8450A	7.6 [0.30]	12.7 [0.50]	11.1 [0.44]	5-40 fem.	8730
8452A	11.2 [0.44]	17.8 [0.70]	15.9 [0.62]	10-32 fem.	8702, 8703, 8704, 8705
8456	11.3 [0.44]	25.0 [0.98]	–	¼–28 male	8712
KIG4662 B-3	14.0 [0.55]	18.0 [0.71]	–	10-32 male	8702, 8705
KIG4662 B-4	10.9 [0.43]	18.0 [0.71]	12.7 [0.50]	6-32 fem.	8702, 8703, 8704, 8705
KIG4662 B-6	5.8 [0.23]	9.4 [0.37]	7.1 [0.28]	5-40 fem.	8730

Table 8: Magnetic mounting adaptors (dimensions in mm [in])

3.5.4 Triaxial mounting cubes

Allows for two or three single-axis accelerometers to be precisely mounted to perform biaxial or triaxial acceleration measurements. Cube attachment to the test surface can either be by stud or adhesive for some types. Accelerometer attachment to the cube can be in a similar manner.

Type	Description
8502	For use with Types 8702, 8703, 8704, and 8705. Weight: 117 grams
8510	For use with Type 8730. Weight: 19 grams
8514	For use with Types 8702 and 8704. Weight: 35 grams

Table 9: Triaxial mounting cubes

3.5.5 Cables

All K-Shear and Piezostar accelerometers with detachable cables are furnished without cables. Refer to cable datasheet Ref. 000-471 for more details.

Cables used with K-Shear and Piezostar accelerometers are summarized below.

Type	Description
1761B...	General purpose cable/connector. 10-32 pos. to BNC pos. Accelerometer output cable.
1762B...	General purpose cable/connector. 10-32 pos. to 10-32 pos. Accelerometer output cable.
1511sp	General purpose cable/connector. BNC pos to BNC pos. Output or extension cable.
1766AK01	Extension cable 5-44 pos. to 10-32 neg. for usage with Type 8715A/B... sensors
1768A...K01	Flexible cable 10-32 pos. to BNC pos. Accelerometer output cable
1768A...K02	Flexible cable 10-32 pos. to 10-32 pos. Accelerometer output cable

Table 10: Cables

4. Installation

This section provides the user with a quick means of placing the Kistler K-Shear or PiezoStar Shear IEPE accelerometers into operation. Careful installation will result in optimal, high frequency response, accuracy and reliability. Dimensional characteristics can be found on their respective data sheets.

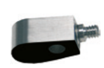
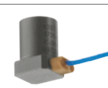
Type	Mounting description
8702B... 	Stud, magnet or adhesive mounting
8703A... 	Stud, magnet or adhesive mounting
8704B... 	Stud, magnet or adhesive mounting
8705A... 	Stud, magnet or adhesive mounting
8712B... 	Stud, magnet or adhesive mounting
8715A/B... 	Adhesive, through hole screw mounting
8728A... 	Adhesive mounting
8730B... 	Stud, magnet or adhesive mounting (with base)

Table 11: Mounting options

4.1 Surface preparation

A clean, flat surface is necessary for both stud and adhesive-mounted accelerometers. If the surface is not completely flat, the coupling between the accelerometer and the test article introduces distortion into the measurement. A rough surface creates voids between the mounting surfaces that reduce high frequency transmissibility.

For optimal frequency response with stud mount units, the surface and hole preparation should be performed according to the instructions in Table 13. The roughness should not exceed 32 micro inches (0.8 micrometers).

4.2 Stud mounting

Type 8730B… is specifically designed for stud mounting. Most Kistler mounting studs are machined from Beryllium Copper for high strength and low modulus of elasticity, coupled with high elastic limits. The studs are removable, allowing both stud and adhesive mounting. The studs on Types 8702B…, 8703A…,8704B…, 8705A…, and 8712A… are removable allowing both stud and adhesive mounting The Type 8715A/B... sensor is delivered with a ground isolated screw kit for through hole mounting. The following guidelines should be followed when stud mounting accelerometers:

1. Drill and tap an adequate hole to ensure a flush mount of the accelerometer. Make sure the stud does not bottom out and firmly secures the accelerometer. A chamfer should be machined at the top of the mounting hole to ensure that the base of the accelerometer.

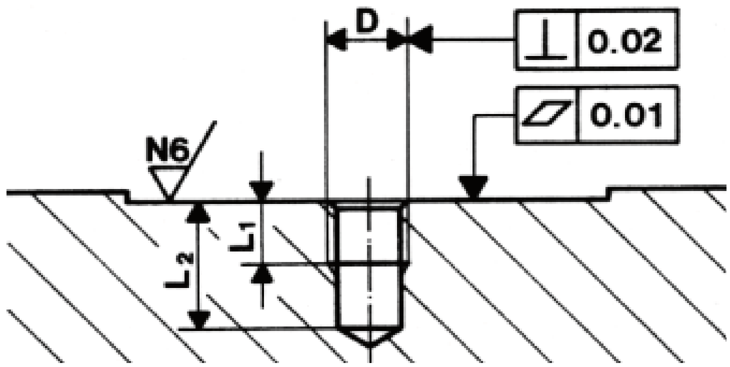
2. Completely clean the surface prior to mounting.

3. Apply a thin coat of silicon grease to both the acclerometer and the mounting surface.

4. Always use the proper sockets and a torque wrench when installing accelerometers. Tighten the accelerometer to the torque specified on the individually supplied calibration certificate or as specified in Table 12. **DO NOT OVERTIGHTEN.**

N·m	in-lbs	Accelerometer Types
2±0.2	18±2	8702, 8703, 8704, 8705, 8712
1±0.1	10±2	8730
0.5±0.05	4.5±0.5	8715

Table 12: Recommended mounting torque



Stud Type	D	L1 mm [in]	L2 mm [in]
8400K01	10-32	6.0 [0.24]	9.4 [0.37]
8400K03	M6	4.5 [0.18]	8.0 [0.32]
8402	10-32	4.0 [0.16]	8.0 [0.32]
8410	10-32	4.0 [0.16]	8.0 [0.32]
8411	M6	8.0 [0.32]	12.0 [0.47]
8412	¼–28	5.0 [0.20]	11.0 [0.43]
8421	M8	8.0 [0.31]	16.0 [0.63]
8446AE3	M2.5	6.0 [0.24]	10.0 [0.39]
8446AM3	4-40	5.0 [0.20]	8.0 [0.32]
8453	M5	6.4 [0.25]	9.6 [0.37]

Table 13: Stud mounting preparation

4.3 Direct adhesive mounting

Some K-Shear accelerometers are specifically designed for adhesive mounting (i.e. Type 8728A500 and eventually Type 8715A/B...) and require no special mounting adapters. Units furnished with stud holes or screws can also be used with adhesives.

The surface should be smooth and flat. A cyanoacrylate type adhesive, such as Eastman 910 or Loctite 496 super glue, is recommended. While epoxies can also be used, cyanoacrylate adhesives provide an extremely thin bond which provides optimal frequency response.

Knowing the operating temperature of the accelerometer aids in the appropriate selection of the adhesive. Some adhesives lose holding force at elevated temperatures. The accelerometer could fall from the test article and experience a damaging shock. Measuring information could be flawed if the accelerometer is not held in close contact to the surface under study.

When adhesive mounting an accelerometer with a tapped hole, make certain that no adhesive is allowed to enter the hole. This could eventually make stud mounting difficult.

CAUTION

DO NOT attempt to remove accelerometers solely by twisting with pliers, a wrench or impacting! Applying torque with a wrench or other tools will damage the stainless steel housing or the connector, or can lead to irreversible overload of the internal electronics. Remove these accelerometers using a recommended cyanoacrylate solvent (e.g., Loctite 768), then twist with fingers. If conditions permit, Petro-Wax (see Section 4.4) is the ideal mounting material for these sensors.

4.4 Mounting with wax

Bee's wax has been used as a mounting agent for many years. The provided Petro Wax (Kistler Type 8432 or P/N P102 from Katt and Associates; P.O. Box 623, Zoar, Ohio 44697, or equivalent) is a good replacement for bee's wax. It is formulated to provide improved frequency response. Wax is a good mounting agent for lightweight sensors in temporary installations where near room temperatures are encountered. Type 8728 is specifically designed for wax/ adhesive mounting.

CAUTION

Specific caution needs to be taken when unmounting 50 g sensors due to the very high ouput piezostar element and the very sensitive electronic. Avoid cracking the adhesive for releasing the sensor. If possible use adhesive mounting plate and remove the sensor from the base before removing the adhesive.

4.5 Mounting with magnet

Magnetic mounting is a convenient way to take measurements on ferro-magnetic surfaces. Magnetic mounting adds considerable mass and reduces high frequency response. Make sure that the mounting surface is flat and clean. An oil or grease film greatly enhances the coupling, hence improving the working frequency range.

CAUTION

This mounting method is convenient, but it also can be very destructive to the sensor when mounting to a structure. A direct approach to the ferromagnetic surface can generate a metal to metal sharp shock as high as 5,000 g.

Table 14 shows magnetic bases available from Kistler along with their characteristics. In order to achieve the specified holding strength, a thin grease film should be applied to the mounting surface.

Sensor Type	Magnet Type	Holding Strength N [lbs]	Upper frequency limit (± 5 %)	Mass (g)
8702B	8452A, KIG4662B-4	53 [12]	4	18
8703A	8452A, KIG4662B-4	53 [12]	4	18
8704B	8452A, KIG4662B-4	53 [12]	4	18
8705A	8452A, KIG4662B-4	53 [12]	4	18
8712B	8456	130 [30]	3	43
8730B	8450A	26 [6]	10	7

Table 14: Magnetic mounting specifications

When attaching to a structure where the magnetic mounting base is already threaded onto the sensor, a sharp metal to metal impact can occur that can lead to sensor overload and damage. In order to prevent it, always try to first mount the magnet onto the surface then thread the sensor onto the magnet mounting base or approach the mounting surface with an angle as illustrated below.

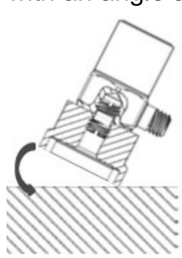
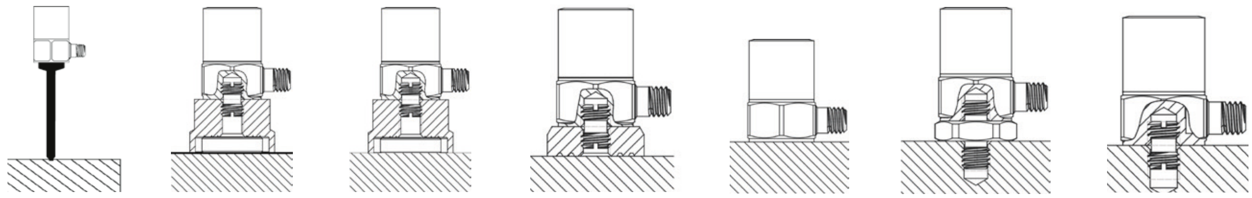


Fig. 2: Surface approach recommendations

4.6 Summary of mounting methods



Probe | Magnetic base with foil | Magnetic base | Adhesive mounting base | Direct adhesive mounting | Isolated stud mounting base | Stud mounting

Mounting Method	Accessory Type	Advantages	Disadvantages	Remarks
Probe		Quick measurement	Lower accuracy	
Magnetic base	8450A, 8452A, KIG4662Bx, 8458A	Easy & quick installation	Adds considerably to mass loading, lowers resonant frequency	Limited to ferromagnetic materials
Adhesive mounting base	8434, 8436, 8436M02, 8440K0x	Allows stud mounting, provides electrical isolation	Lowers resonant frequency	Pads are usually exposed to test specimen
Adhesive wax	8432 Petrowax, bees wax	Ideal for lightweight units	Limited temperature range; not sutable for larger sensors	Fast & clean
Adhesive cement	Loctite, Permabond (cyanoacrylate), hot melt, Epoxy	Good, strong coupling of sensor to specimen; higher temperature capability than wax	Difficult to remove sensor; requires solvents, removal tool and/or heat	Suited for more permanent applications & high frequency measurements
Isolated mounting stud	8400K0x	Allows both strong coupling & ground isolation	Requires threaded hole in specimen; base slightly lower resonance frequency	Control mounting torque; use silicone grease
Mounting stud	8402, 8410, 8411, 8421, 8451, 8453, 8412	Best couping of sensor to test speciment for highest frequency response	Requires threaded hole in specimen	Control mounting torque; use Silicone grease

*Please refer to data sheet 000-471 for more information.

Table 15: Mounting methods overview

NOTE

Stud mounting must conform to manufacturer's complete specifications.

4.7 Securing cables

Fig. 3 and Fig. 4 depict the correct and incorrect methods for installing cables. Allow a sufficient radius to ensure a proper strain relief. The actual radius will depend on the cables being used. It is recommended that the cables be secured to the vibrating surface to minimize cable and connector fatigue failures. Secure cables with a cable clamp. Tape is acceptable on temporary installations.

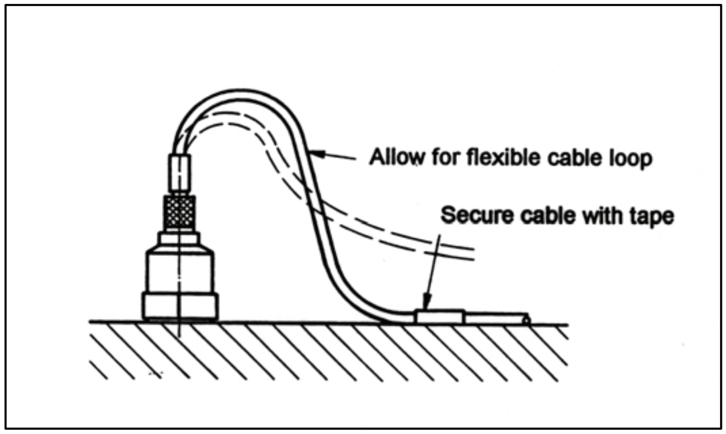


Fig. 3: CORRECT cable strain relief

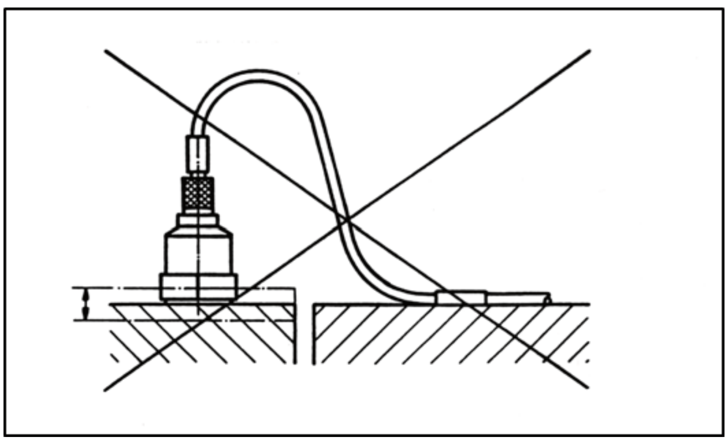


Fig. 4: INCORRECT cable strain relief

*See Section 3.5.5 for cables available upon request from Kistler.

4.8 Mass loading effects

When a device such an accelerometer is attached to a test article, the acceleration to be measured will be altered. These effects can be reduced significantly by the proper selection of the measuring accelerometer. It should be assumed that the presence of an accelerometer does not significantly affect the system response, provided the dynamic mass of the accelerometer is considerably less than the test specimen. As a general 'rule-of-thumb', the weight of the accelerometer should be no greater than 10 % of the weight of the test specimen. An example of possible accelerometer-induced distortion is the instance of a heavy sensor mounted in the center of a thin printed circuit board.

5. Operating instructions

Piezoelectric accelerometers are self-generating transducers. While the quartz piezoelectric sensor does not require an external power source, it is necessary to provide power to the K-Shear's internal electronic impedance converter. This section is intended to provide the user with the information necessary to ensure accurate measurements with K-Shear accelerometers. Topics to be covered include powering, signal conditioning, frequency response and driving long cables.

5.1 Powering

5.1.1 Using "Built-In" power sources

Many FFT analyzers and vibration monitors are available with internal accelerometer power supplies that provide constant current power to Kistler and other low impedance piezoelectric sensors. These power supplies are typically known as constant current source supplies. The industry also recognizes these power sources as voltage mode piezoelectric units by the universal designation, Integral Electronic PiezoElectric (IEPE).

Prior to using the built-in power source, compare the measurement instrument current source specifications with the current and voltage specifications of the PiezoStar Shear accelerometer to be used. If the instrument accelerometer power is within the range required by the specific PiezoStar Shear accelerometer, there should be no issues with compatibility. If the user plans to drive long cables (over 430 ft /130 m), the guidelines in Section 5.1.7 should be followed. The accelerometer low frequency response may be affected by the input impedance of the measuring instrument, as discussed in Section 5.1.13.

CAUTION

Many industrial monitors have adjustable current controls. Exceeding the maximum current rating of any accelerometer may cause permanent damage and void the warranty.

5.1.2 Kistler couplers

Kistler offers a comprehensive line of power supply/ couplers and dual mode amplifiers. They are designed for compatibility with ceramic shear accelerometers. Please refer to Kistler Acceleration catalog ref. 900-380.

5.1.3 The constant current power supply/coupler

To better understand the purpose of the current source, a review of the Piezotron impedance converter is in order. Fig. 4 is a simplified schematic diagram of the PiezoStar Shear accelerometer. When excited, the crystal element produces a charge proportional to the measurand. The resulting voltage (developed across CR in Fig. 5) is applied to the input of the internal impedance converter (Electrometer Amplifier). The impedance converter will produce an output voltage that follows the input accordingly.

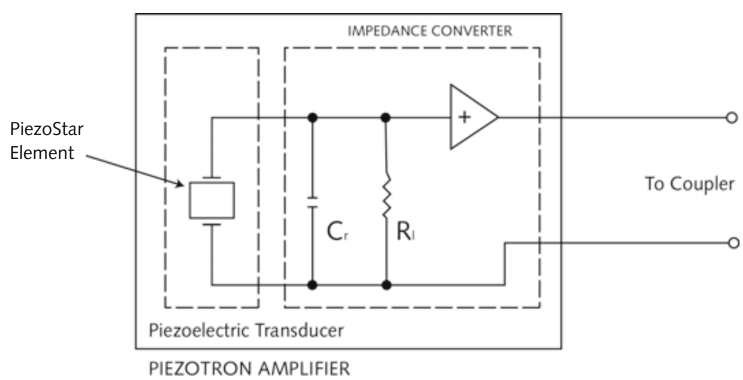


Fig. 5: Basic diagram of PiezoStar shear accelerometers

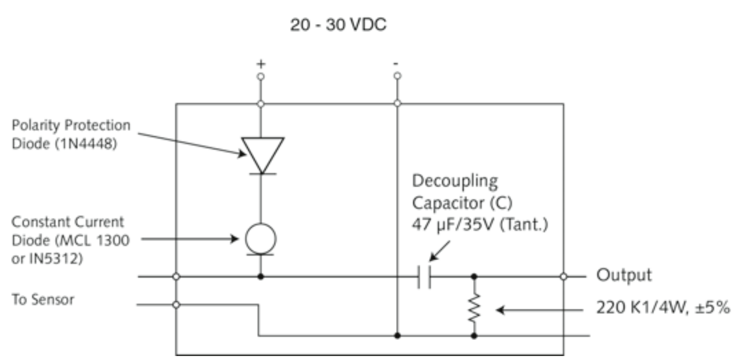


Fig. 6: Schematic diagram of a basic coupler

The source resistor (Rs), while located in the coupler, is part of the source follower circuit. In order for the Piezotron to provide enough gain, Rs must have a high dynamic resistance while being able to provide enough current (low DC resistance) as not to affect the high frequency response of the system. Replacing Rs with a constant current diode (Fig. 6) provides a device with a high dynamic resistance while allowing sufficient current to flow.

Fig. 5 shows a schematic of a simple power supply coupler for PiezoStar Shear accelerometers. DC power is supplied from a 24-Volt source, such as a regulated power supply or batteries. The Piezotron system houses an advantageous, two-wire coaxial cable sharing both the power source and the signal across the same line. Therefore, it is necessary to include the capacitor C to decouple (or block) the DC from the measurement instrument input.

Operating within the voltage range of 20 ... 30 VDC ensures full, undistorted ±5 Volt output amplitude (see Fig. 8). If the source voltage is reduced, distortion and clipping of the signal will occur if one attempts to use the full amplitude range of the accelerometer (see Fig. 9). The following equations are provided to calculate the maximum full-scale voltage available when operating with reduced voltage.

Maximum positive amplitude:
$+Fs = (Es - 1) - Eb$

Maximum positive amplitude:
$-Fs = Eb - 1$

Nomenclature:

Fs = full-scale output voltage (peak)
Es = DC supply voltage (a/k/a "compliance voltage")
Eb = bias voltage (from calibration certificate)

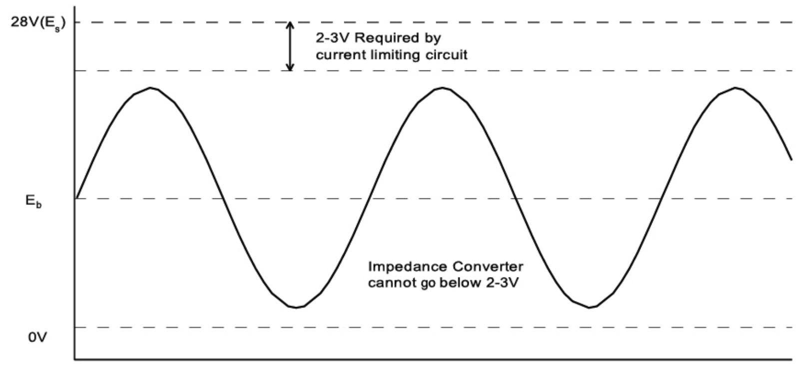


Fig. 8: Output signal when operated with 28 V supply

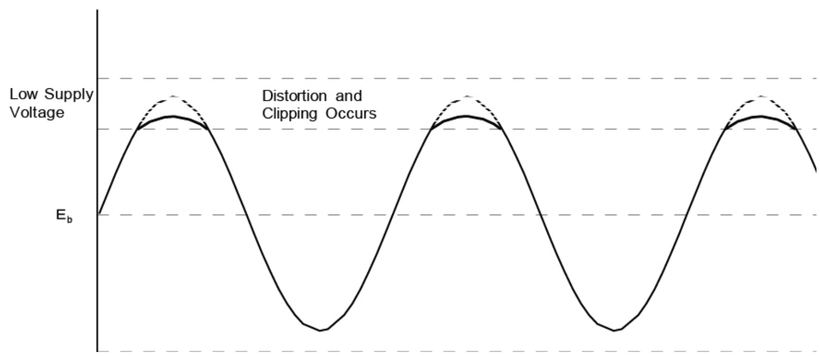


Fig. 9: Example of output distorting and clipping when supply voltage is low

5.1.4 Sensor power-up

When power is first applied to the sensor through an AC coupled coupler, a voltage will appear at the output of the coupler (see Fig. 10). As the coupling capacitor discharges, the DC output from the coupler will drop to zero Volts. This "settling time" is equal to 5 x's the time constant of the coupler employed. Allow time for the unit to "settle" before making measurements.

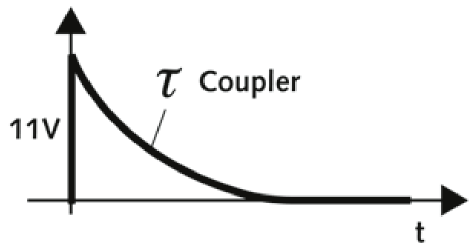


Fig. 10: Behavior of the output signal during power-up

5.1.5 Overload recovery

Whenever the impedance converter is driven by a signal exceeding the normal operating range, certain components will become non-operational. During this non-operational state, the amplifier components are protected from overload damage. The amount of time required for recovery from an overload depends upon several factors. Important for overload recovery time is the size of the overload. As with power-up, the time constant makes the biggest contribution to the recovery time. Fig. 11 illustrates a typical overload and recovery sequence.

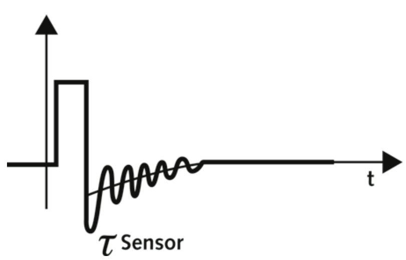


Fig. 11: Output behavior during overload and recovery

5.1.6 Supply voltage effects

Long-term fluctuations in the power supply level between 24 and 30 Volts can be tolerated. The sensitivity shift caused by such deviation is less than 0.05 % / Volt. A normal noise level is maintained if the power supply ripple is 25 mV RMS or less. The polarity must be maintained throughout the system. Applying reversed polarity power may cause damage to the accelerometer.

5.1.7 Driving long cables

The voltage mode Piezotron circuit allows for long cable runs with low-noise susceptibility. Most laboratory instruments with built-in accelerometer power provide current in the range of 2 … 4 mA. Most Kistler couplers are set at factory default to provide 4 mA of source current. 4 mA is a fair compromise value for maximum frequency response and high reliability.

Assuming a cable capacitance of 30 pF/ft (98 pF/m), the full frequency range of PiezoStar Shear accelerometers can be realized (±5 V output) up to a length of 430 ft (130 m) with 4 mA of drive current. Most Kistler cable types and common RG58 coaxial cable have a rated capacitance of 30 pF/ft (98 pF/m). For most laboratory applications, this is sufficient.

As cable length is increased, the cable capacitance becomes significant thereby loading the Piezotron impedance converter. If the current is not sufficient enough to charge the cable at an adequate rate, high frequency distortion will result. The solution is to increase the drive current.

For your convenience, a chart is provided below (see Table 16). The values given are based on a cable capacitance of 30 pF/ft (98 pF/m). A list of cables available from Kistler can be found in Section 3.3.2.

Maximum Frequency ±5 %	Cable Length Ft (m)	Current (mA) Required for Output Signal ±1 V	Current (mA) Required for Output Signal ±5 V
10 kHz	1,000 (300) 2,000 (600)	2 4	10 18
9 kHz	1,000 (300) 2,000 (600)	2 4	9 17
8 kHz	1,000 (300) 2,000 (600)	2 3	8 15
7 kHz	1,000 (300) 2,000 (600)	2 3	7 14
6 kHz	1,000 (300) 2,000 (600)	2 3	6 12
5 kHz	1,000 (300) 2,000 (600)	2 2	5 10

* Based on 30 pF/ft (98 pF/m)

Table 16: Current requirements for driving long cables

The current requirements can be calculated using the following equation:

$$I = 2\pi fCE$$

Nomenclature:

I = Current in Amperes
f = Frequency in Hz
C = Capacitance in Farads
E = Output in Volts, Peak

Never use more current than required to make the desired measurement. Never exceed the maximum current.

If a requirement calls for 1,000 ft (300 m) of cable and the maximum frequency of interest is only 5 kHz, the user should select 5 mA of current rather than 10 mA for the full 10 kHz range (see Table 16). As current is increased the noise produced by the Piezotron circuit will also increase. The miniature Piezotron amplifier will produce more heat as current is increased, resulting in reduced life and reliability.

The specified maximum temperature range is based on 4 mA of supply current. It is necessary to lower the maximum operating temperature while operating under increased temperature conditions. The graph in Fig. 12 depicts the approximate maximum temperature vs. operating current.

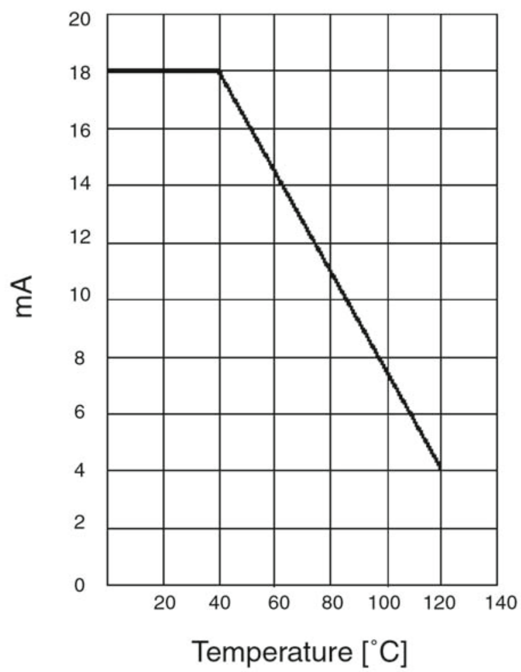


Fig. 12: Maximum Piezotron current as a function of operating temperature

The equation for computing the maximum current for a specific temperature is:

$$I_{max} = 0.16\,(150 - T_{max})$$

Nomenclature:
I = Current in mA
T = Temperature in °Celsius

5.1.8 Ground loops

The ground loop is one of the most common causes of ground noise. It will usually manifest itself as unwanted noise occurring at the line frequency (50 … 60 Hz). Ground loops occur when current flows between the accelerometer and coupler/conditioner grounds. If the coupler ground and the accelerometer ground are at exactly the same potential, there will be no resulting ground loop between these two devices. If the ground potential varies between the accelerometer mounting surface and the coupler ground, a slight current will flow causing a ground loop to occur (see Fig. 13).

While the amount of current might seem insignificant, the measurement levels are generally very low and the ground current will appear on the signal at a measurable level. There can be many causes of ground loops in a complete measurement system. However, the ground path between the accelerometer and coupler is among the most common.

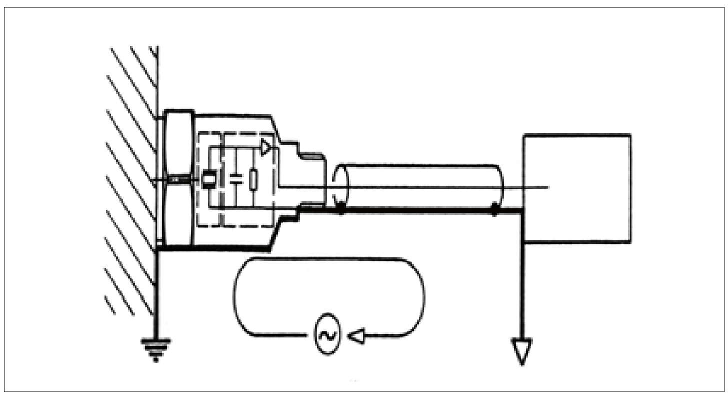


Fig. 13: Current path (loop) between the coupler and accelerometer ground

One method used to eliminate ground loops is to isolate the ground of the accelerometer from the ground of the test article (See Fig. 14 and 15). K-Shear accelerometer Type 8712B5D0IH… and models with the suffix "M1" are ground isolated; therefore, there should be no ground currents flowing between the accelerometer or other devices.

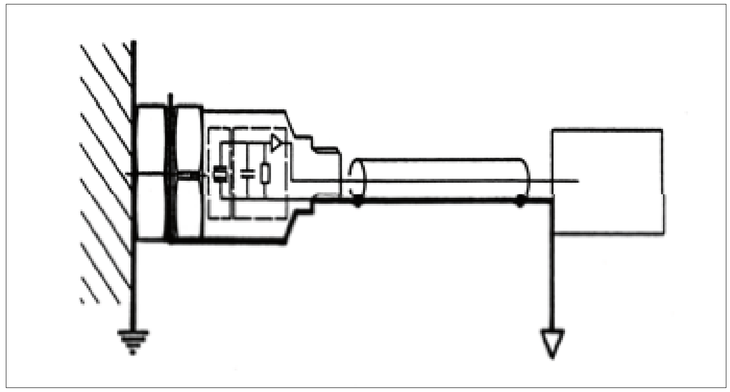


Fig. 14: The current path is broken with the use of a ground isolation pad

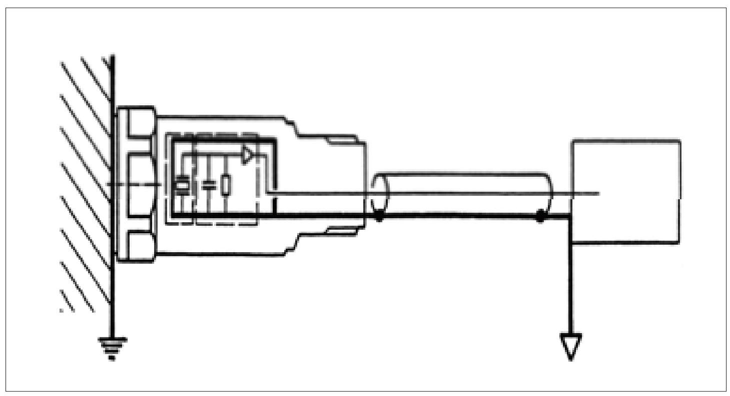


Fig. 15: Isolated accelerometer eliminates current path

Kistler offers isolation mounting studs for non-isolated PiezoStar Shear accelerometers. See Section 3.5.1 for details.

5.1.9 Ground isolation

As mentioned in Section 5.1.8, ground isolation is used to eliminate ground loops. Ground isolation can be achieved by using isolation mounting studs with non-isolated accelerometers, or by using an accelerometer with built-in ground isolation. Fig. 14 and Fig. 15 illustrate how the ground path is modified using these techniques.

These units rely upon a built-in anodized aluminum pad to achieve ground isolation. The anodizing acts as a dielectric to provide isolation. The pad is completely anodized providing isolation both on the upper side, in contact with the accelerometer body, and bottom mounting surface. If unusually rough conditions should penetrate the anodizing on the mounting surface, isolation will be provided by the upper surface pad.

5.1.10 Frequency response limits

All accelerometers have specified frequency limits, which are a function of the mechanical and electrical design. In order to better understand the measurement process and limitations, this section will describe both the inherent limitations and limitations imposed by the installation, operation and measurement-analysis instrumentation.

5.1.11 Frequency response definition and standards

Frequency response is defined as a maximum specified amplitude variation, from an established reference frequency, over a specified bandwidth. K-Shear and Piezostar Shear Accelerometers are specified with maximum variations of ±5 and ±10 %. Kistler uses the industry standard reference frequency of 100 Hz in the U.S., and 1,000 rads [159.2 Hz] internationally. Some users may be more familiar with the common frequency response standard for electronic equipment, which is generally ±3 dB. In most mechanical applications, an error of ±3 dB (about ±30 %) does not provide the necessary accuracy. Therefore, ±5 % (±10 % in some cases) is considered a more reliable and accurate limit.
.

5.1.12 High frequency limitations

The inherent high frequency limit of an accelerometer is a function of its mechanical characteristics. PiezoStar Shear accelerometers can be represented as an undamped, single degree-of-freedom, spring-mass system.

The spring constant is determined by the stiffness of the ceramic material and preload stud. The mass is the supported element of the accelerometer structure. This spring-mass system is the main component that converts the input forces into acceleration. As seen with any single degree-of-freedom system, a resonance condition will occur causing the sensitivity to increase with frequency.

It is desirable to have a uniform frequency response over the specified frequency range. As depicted in Fig. 16, the sensitivity greatly increases when approaching resonance. A 5 % amplitude rise can be expected at 0.22 of the resonant frequency. It is possible to operate above the maximum specified frequency by applying the appropriate correction factors, or filtering to compensate for the resonant rise in response.

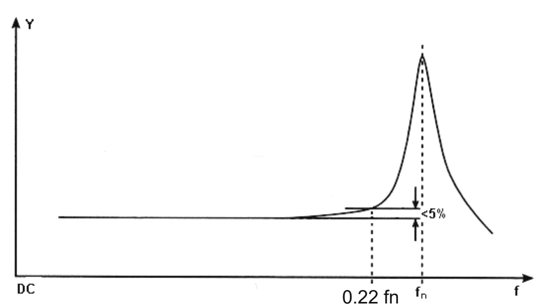


Fig. 16: Typical frequency response of a piezoelectric accelerometer

Section 4 outlines important information regarding mounting. It is important to follow these mounting instructions in order to ensure optimal transmissibility at high frequencies. Mounting to rough surfaces, using soft adhesives and magnetic mounts, will limit the high frequency range to a value lower than the specified frequency range.

5.1.13 Low Frequency limitations - accelerometer

The low frequency response of accelerometers is an electrical limitation. The PiezoStar Shear is designed for low frequency drift, caused by temperature variations, to be virtually eliminated.

The PiezoStar Shear sensing element is a self-generating device, which produces a charge proportional to the applied acceleration. The piezoelectric output charge is applied to the high impedance input of the FET, where it is then converted to a low impedance output voltage signal.

At low frequencies, the amplifier input circuit acts as a single-order high-pass filter (see Fig. 17), whose amplitude and phase are:

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

phase lead (deg) = arc tan $\frac{1}{2\pi f(\tau)}$ $\tilde{}80 \sqrt{\frac{V_{in} - V_o}{V_{in}}}$

The high-pass filter has a time constant (τ) determined by the capacitance and resistance of the internal amplifier gate circuit. The time constant is defined as the time required for the capacitors to reach 63.3 % of full charge, as determined by τ = RC. As capacitance and/or resistance increases, the time constant becomes longer. This results in an increase in low frequency response (frequency is the reciprocal of time).

The low frequency limit of Kistler PiezoStar Shear accelerometers is defined as the point where the response is –5 % (also –10 % where specified) below the reference point (100 Hz). The low frequency specification is a nominal value. The actual low frequency point of your specific accelerometer can be determined from the measurement, located on the unit's calibration certificate. The following equation can be used to determine where the low frequency response will be 5 % below reference:

$$f_{-5\,\%} = \frac{0.5}{\tau}$$

Nomenclature:

f = frequency in Hz
τ = time in seconds (from calibration certificate)

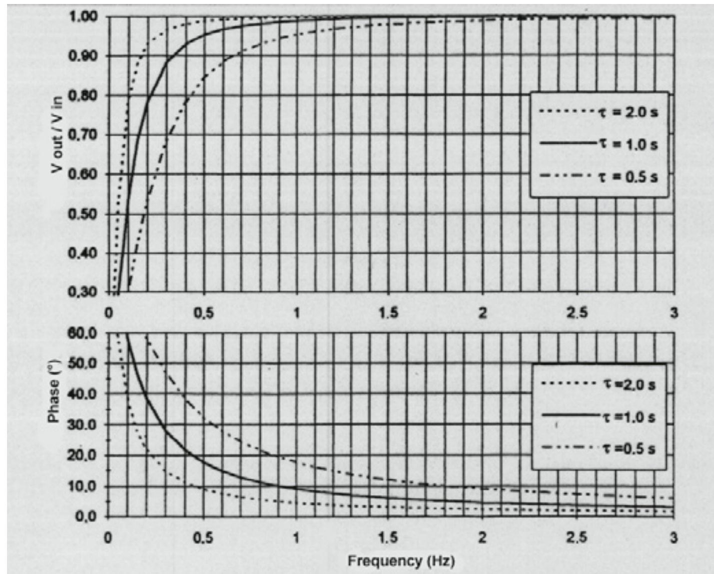


Fig. 17: Frequency and phase response of a PiezoStar Shear Accelerometers at low frequencies are dependent upon the time constant.

5.1.14 Low frequency limitations - coupler and read-out instrumentation

When making low frequency measurements with PiezoStar Shear accelerometers, it is important for the user to consider the effects of the coupler and measurement instrumentation on the low frequency response.

If the coupler selected includes an isolation amplifier, the low frequency cutoff will be specified in the coupler data sheet and the read-out instrument's specifications. The actual low frequency limit will be the higher of the two. For example, if an FFT analyzer is being used that has a low frequency cutoff of 0.5 Hz and a coupler with a 0.07 Hz low frequency cutoff, the low frequency response limit will be 0.5 Hz.

If DC methods of bias decoupling are utilized, the accelerometer’s time constant will be unchanged, thereby providing optimal low frequency response.

When using a simple coupler circuit (see Fig. 6) with AC coupling, a time constant equal to the product of the decoupling capacitor's (C) capacitance x’s the read-out instrument's input impedance will be produced.

Using the formula τ = RC (readout instrument's impedance = R), the lower the read-out instrument's input impedance (Z), the shorter the time constant, thereby degrading the low frequency response. In systems with AC bias decoupling, the time constant can be approximated by taking the product of the accelerometer and coupler time constants and dividing by their sum.

When using a simple coupler (see Fig. 6), the system formed by the coupler and read-out instrumentation can shorten the time constant, thereby degrading the low frequency response. The new system time constant can be approximated by the equation:

$$\tau = ((R1 \times R2) / (R1+R2)) \times C$$

Nomenclature:

R_1 = output resistance of the coupler
R_2 = input resistance of the coupler
C = capacitance of the coupler's output capacitor

6. Technical data

For detailed specifications, please refer to each sensor Type's corresponding data sheet or contact Kistler for more information.

7. Calibration & maintenance

7.1 Calibration

Calibration consists of the precise determination of the accelerometer sensitivity by direct comparison, at various frequencies, to a National Institute of Standards and Technology (NIST) traceable standard accelerometer. The test accelerometer is attached to the top of the reference accelerometer in a 'back-to-back' configuration. The reference and test accelerometer are excited at equivalent frequencies and levels. The resulting amplitudes of both accelerometers are then compared to determine if the test unit is within tolerance of the specified acceptance parameters.

7.2 Maintenance

Clean the accelerometer with Isopropyl alcohol and lint- free paper wipes. Never use an air-blast to clean the connector; it may deposit a water vapor film. Excess cyanoacrylate adhesive (i.e. Eastman 910, Loctite 430, etc.) on the mounting surface may be removed with dimethylformamide or acetone. Refer to the adhesive manufacturer's product label for recommended removal agent.

Do not use an abrasive on the base surface. This can affect the flatness, thereby reducing high frequency transmissibility.

Factory repair is recommended where trained personnel and appropriate measuring equipment and fixtures are available. Recalibration is recommended when returning an accelerometer to the factory. Kistler is an accredited ISO 17025 Laboratory and offers such calibration services. A calibration certificate will be supplied showing calibration results from standards traceable to NIST.

8. Troubleshooting

Should the user experience issues with a PiezoStar Shear accelerometer, the following procedure should be followed:

- Check for possible intermittent cables. Faulty cables are the most common cause of accelerometer measurement issues. The application of a test signal at the accelerometer end of the cable is an effective means to determine if the issue is with the accelerometer, cable, or measurement instrument

Kistler couplers are equipped with a bias monitor, which can be used to check the cable integrity and detect malfunctions in the accelerometer. Use the bias monitor as follows

- With the accelerometer connected, check for a normal reading on the bias indicator (normal range should be around 11 VDC).

- If the bias reading is high, disconnect the accelerometer at the accelerometer end of the cable.
- If the bias indicator reading decreases, the accelerometer is defective.
- If the bias indicator reads low, disconnect the accelerometer.
- If the bias indicator still reads low, replace the cable.
- If the bias level changes when the cable is disconnected, the accelerometer is defective.

Analysis and measurement equipment with built-in accelerometer sources generally do not have bias monitors. In this case, the user can attach a T-connector to the measurement/analysis instrument and measure the actual bias voltage. If the system is operating properly, the bias voltage should measure approximately 11 V.

If it is determined that the accelerometer requires repair, please contact your local Kistler representative for repair instructions.

9. Storage & transit considerations

If the instrument is to be stored or transported for an extended period of time, please follow these safety precautions:

- The temperature should be maintained between –20 °C and 60 °C (–4 °F and 140 °F).
- All connectors must be covered with dust caps.
- Contamination must be prevented from entering the unit.
- The environment should be dry and as free from vibration as possible.
- Do not store or transport the instrument in such a manner that pressure is applied on the sensor.
- When not in use, the instrument should be stored in the original packing materials or carrying case when not in use.

10. Warranty

Please reference the Kistler Instrument Standard Product Warranty under Terms and Conditions for Sales and Service.

11. Declaration of conformity

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de conformité

The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Miniature K-SHEAR® Accelerometer**
Type / Typ / Type	**8704B…Series, 8704M…Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, April 2021

Kim Pfluger,
Engineering Director
North America

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de conformité

The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Miniature K-SHEAR® Accelerometer**
Type / Typ / Type	**8702B…Series, 8702M…Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, April 2021

Kim Pfluger,
Engineering Director
North America

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de conformité

The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Miniature K-SHEAR® Accelerometer**
Type / Typ / Type	**8728A…Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, October 2nd, 2020

Kim Pfluger
Engineering Director
North America

KISTLER
measure. analyze. innovate.

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de conformité

The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Miniature K-SHEAR® Accelerometer**
Type / Typ / Type	**8730A…Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, October 6th 2020

Kim Pfluger
Engineering Director
North America

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de conformité

The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Miniature K-SHEAR® Accelerometer**
Type / Typ / Type	**8703A…Series, 8000M046**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, October 2nd, 2020

Kim Pfluger
Engineering Director
North America

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The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Miniature K-SHEAR® Accelerometer**
Type / Typ / Type	**8705A...Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

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2011/65/EU	**ROHS including all amendments up to the date of this document**

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EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, October 2nd, 2020

Kim Pfluger
Engineering Director
North America

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The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**Ceramic Shear Accelerometer**
Type / Typ / Type	**8715X…Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN61000-6-3:2007 / IEC61000-6-3:2005,
PART 6-3 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN61000-6-1:2007 / IEC61000-6-1:2005,
PART 6-1 LIGHT INDUSTRIAL, COMMERCIAL, RESIDENTIAL EMC

Kistler Inst. Corp.
Amherst, October 2nd, 2020

Kim Pfluger
Engineering Director
North America

KISTLER
measure. analyze. innovate.

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de conformité

The manufacturer / Der Hersteller / Le Fabricant:

Kistler Instrument Corporation, 75 John Glenn Drive, Amherst, NY 14228 USA

hereby declares that the product /
erklärt hiermit, dass das Produkt /
déclare que le présente produit:

Name / Name / Nom	**PiezoSTAR Accelerometer**
Type / Typ / Type	**8712B…Series**
Modules / Module / Modules	**none / keine / sans**
Options / Optionen / Options	**all / alle / toutes**

complies with the following provisions of directives /
die folgenden Bestimmungen der Richtlinien erfüllt /
est conforme aux dispositions suivantes des directives:

2014/30/EU	**(EMC / EMV / EMC)**
2011/65/EU	**ROHS including all amendments up to the date of this document**

The following harmonised standards were applied /
Folgende harmonisierte Normen wurden angewandt /
Les normes harmonisées suivantes furent appliquées:

EMC Emission / EMV Störaussendung / Emission EMC

EN 61000-6-3:2007 + A1:2011
EN 61000-6-4:2007 + A1:2011
EN 61326-1:2013 **(Class A+B equipment)**

EMC Immunity / EMV Störfestigkeit / Immunité EMC

EN 61000-6-1:2007
EN 61000-6-2:2005
EN 61326-1:2013 **(Class A+B equipment)**

Kistler Inst. Corp.
Amherst, May 2021

Kim Pfluger,
Engineering Director
North America