# Instruction Manual

**Shock Accelerometers**

**Type 8742A…**

CE

002-096e-01.19

# Instruction Manual

## Shock Accelerometers

## Type 8742A…

## CE

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002-096e-01.19

# Table of Contents

# 1 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 in the content without obligation to notify any person or organization of such changes or improvements.



# 2 Introduction

By choosing Kistler shock accelerometers you have opted for an instrument distinguished by precision, long life and technical innovation. Please read these instructions carefully before installing and operating these instruments.

Kistler offers a wide selection of measuring instruments and comprehensive systems including:

* Sensors for force, pressure, acceleration, shock, vibration and strain.
* Associated signal conditioners and accessories.
* Piezoresistive pressure transducers and transmitters with associated amplifiers.

Kistler can also provide entire systems for special purposes in the automotive industry, plastics processing, and biomechanics. Our general catalog provides information on Kistler products and services. Detailed technical data sheets are available on most products offered.

Worldwide customer service is at your disposal should you have any questions regarding this or other Kistler products. Information on your specific application is also available from Kistler.

# 3 Important Guidelines

To ensure your personal safety, please observe the safety guidelines in this section.

## 3.1 For your safety

* Carefully follow the installation information contained in section 5 of this manual.

* Do not drop the instrument.
* Store in the case provided and in a clean, dry environment.
* Power the instrument in accordance with the instructions in section 6 of this manual.

## 3.2 Precautions

Kistler sensors are thoroughly tested before leaving the factory. To maintain safe and reliable operation, it is important to follow the instructions herein.

* Do not mount accelerometers on high voltage surfaces.
* Keep cable clear of power lines and open machinery.
* Never operate or store the unit beyond the specified temperature range.
* Do not exceed the maximum specified current.
* Never exceed the maximum specified voltage.
* Follow the instructions for mounting. Do not over tighten.
* When not in use, store the accelerometer in the container supplied. Always store in a clean, dry area.
* Keep the connector clean and covered when not in use
• Exercise care during cable connection. Cable connector center pin should align with the female receptacle on the accelerometer.
* Follow the recommendations in section 7.4

## 3.3 Using This Manual

Information contained herein includes a technical description, installation and operating instructions, powering and considerations for cable length. Section 8 contains a listing of mounting accessories and cables available to assist with your measurement needs.

It is recommended that the entire manual be read prior to installation and operation of shock accelerometers. The user who has prior experience with Piezotron type accelerometers may want to confine reading to particular sections of interest.

We have endeavored to arrange these instructions in a manner that allows for easy location of topics of interest. Your Kistler representative is also available to assist with any questions.

Information contained herein may be subject to change.

## 3.4 Shock Accelerometer Types

This manual is applicable to all shock accelerometers listed on the title page. Please see the product data sheets at the rear of this manual for detailed specifications.

**Figure 1: 8742A and 8741A…M1… Shock Accelerometer**

## 3.5 Manual Nomenclature

Throughout this manual some special designations and nomenclature are used for specific terms and concepts relating to shock sensors. These are explained in Table 1.

| | |
|---|---|
| Term: | FS |
| Definition: | Full Scale |

**Table 1: Manual Nomenclature**

# 4 General Description

Kistler shock accelerometers are shear mode shock and vibration measuring instruments. These units are intended for pyroshock testing, metal-to-metal impact studies, drop testing, etc. 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 used in this accelerometer, the output is a low impedance voltage signal which is proportional to the applied acceleration.

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.



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# 5 Technical Information, Functional Description

## 5.1 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. Shock accelerometers are specially tailored to measure high acceleration from pyro shock levels to impact test information.

## 5.2 Shear Element Background

The sensing assembly 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. Since force is mass times acceleration (from Newton's second law), the charge produced is proportional to acceleration, since m is constant. This is represented by:

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

The sensing element offers many advantages over previous shear and compression mode designs. Because of shear construction the accelerometer is insensitive to thermal transients, transverse (cross-axis) motion and the effects of base strain.

## 5.3 Low Impedance 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 with an output impedance typically below 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 share a common line. The coupler provides a constant current source to the accelerometer and decouples the DC bias (see Section 6.1.3) from the measuring instrument. The useful 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 contaminated atmospheres. They eliminate the problems associated with high impedance output types by providing a low impedance voltage signal with enhanced high frequency response. The calibration factors for these accelerometers are given in mV/g.


**Figure 2: Diagram of a Low Impedance Acceleration System**

1. Low impedance (voltage output) accelerometer
2. Coaxial cable
3. Coupler (constant current supply) or dual mode amplifier
4. Cable
5. Readout or analysis equipment

# 6 Installation

## 6.1 General

For proper operation of shock accelerometers, care must be taken during the installation process. Careful installation will result in optimal high frequency response, accuracy and reliability.

## 6.2 Surface Preparation

A smooth, flat surface is necessary for both stud and adhesively 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 optimum frequency response, the surface and hole preparation should be according to the instructions in Table 3. The roughness should not exceed 32 microinches (0.8 micrometers).

## 6.3 Stud Mounting

The stud on both units is an integral part of the mounting base and thus not removable. The following guidelines should be followed when mounting shock accelerometers.

1. Drill and tap an adequate hole to ensure a flush mount of the accelerometer. Make sure the stud does not bottom out. A chamfer should be machined at the top of the mounting hole to ensure that the base of the accelerometer makes full contact with the mounting surface (See table 3).
2. Completely clean the surface prior to mounting.
3. Apply a thin coat of silicon grease to both the accelerometer and 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 2. Do Not Over Tighten.

| in-lbs | Nm | Accelerometer Types |
|---|---|---|
| 18 ±2 | 2 ±0.2 | 8742A |
| 30 ±5 | 3.4 ±0.5 | 8742A….M1 |

**Table 2: Recommended Mounting Torque**

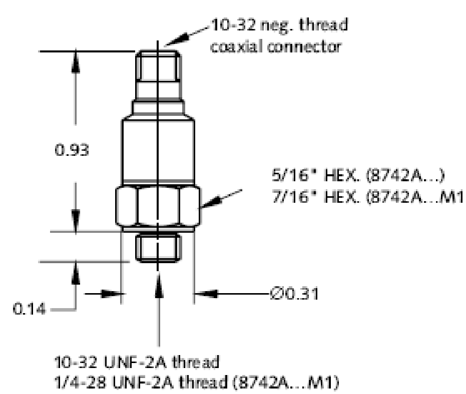
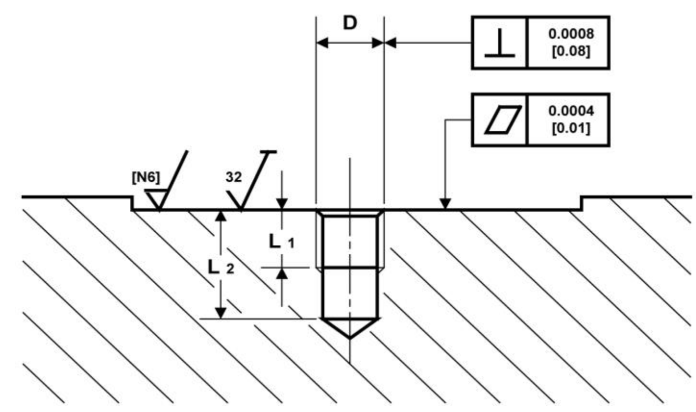



**Figure 3: Dimensions that vary by designation.**

Outline dimensions used in mounting that vary by series designation are shown in Figure 3. Type designations that include the letter E are sized in metric units.




| Surface Dia. | D | L1 inch [mm] | L2 inch [mm} |
|---|---|---|---|
| 3/8" minimum | 10-32 UNF | 0.156 [4.0] | 0.315 [8.0] |
| 1/2" minimum | ¼-28 UNF | 0.22 [5.6] | 0.42 [10.7] |

**Table 3: Mounting Surface Preparation**

## 6.4 Securing Cables

Figures 4 and 5 show the correct and incorrect ways 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 cables be secured to the accelerometer mounting surface to minimize cable and connector fatigue failures. Secure cables with a cable clamp.

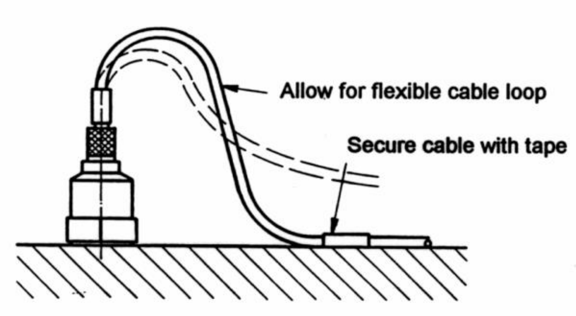



**Figure 4: Correct Cable Strain Relief**

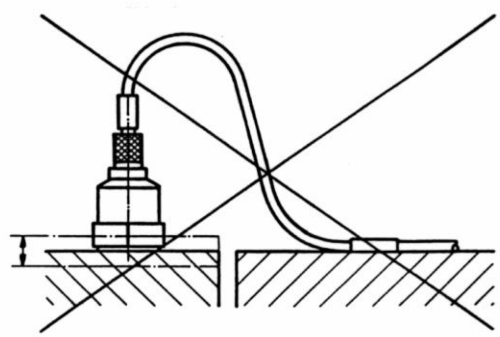


**Figure 5: Incorrect Cable Strain Relief**

See Section 8.5 for information on cables available from Kistler.

# 7 Operation

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 shock acceleometer's internal electronic impedance converter. This section is intended to provide the user with the information necessary to ensure accurate measurements with shock accelerometers. Topics to be covered include powering, signal conditioning, frequency response and driving long cables.

## 7.1 Powering

### 7.1.1 Using "Built In" Power Sources

Many FFT analyzers and vibration monitors are available with internal accelerometer power supplies. Often identified as "Constant Current Sources", these internal power supplies are generally compatible with Kistler shock accelerometers.

Before using the built-in power source, compare the measurement instrument current source specifications with the current and voltage specifications of the shock accelerometer to be used. If the instrument accelerometer power is within the range required by the specific shock accelerometer there should be no problem with compatibility. If the user plans to drive long cables (over 430 feet/130 m) the guidelines in section 6.2 should be followed. The accelerometer low frequency response may be affected by the input impedance of the measuring instrument as discussed in Section 6.4.4.

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

### 7.1.2 Kistler Couplers

Kistler offers a comprehensive line of power supply/couplers and dual mode amplifiers. If the user is utilizing these instruments, they are designed for compatibility with K-Shear accelerometers. The chart below provides a listing of available power supply/couplers. Please request data sheets on specific models.

| Type | Description |
|---|---|
| 5108A | Passive coupler. Customer provides power. |
| 5114 | Battery or line powered single channel coupler for hand held or surface use. |
| 5118B | Same as features as Type 5114 plus front panel adjustable gain and filter provision. |
| 5148 | 16-channel rack mountable AC powered coupler with unity gain. LEDs indicate circuit integrity. Front panel BNC output connectors. |
| 5165A | Universal laboratory charge amplifier for dynamic measurements; charge, Piezotron (IEPE) and voltage inputs; integrated data acquisition; Ethernet interface; TEDS |

**Table 4: Coupler Table**

### 7.1.3 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.

Figure 6 is a simplified schematic diagram of the shock accelerometer. When excited, the quartz element produces a charge proportional to the measurand. The resultant voltage(developed across Cr in Figure 6) is applied to the input of the internal impedance converter (Electrometer Amplifier). The impedance converter will produce an output voltage that follows the input faithfully.

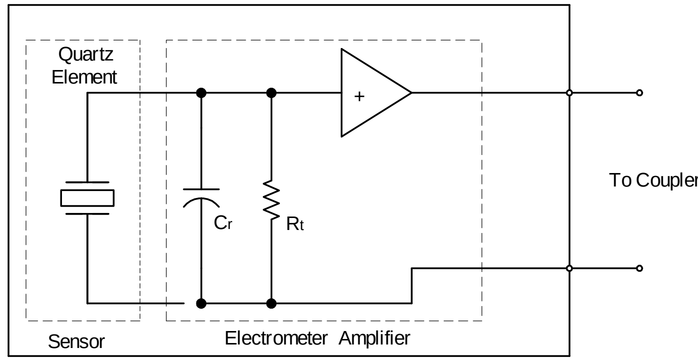



**Figure 6: Simplified Diagram of the Shock Accelerometer**

The source resistor (Rs), while located in the coupler, is a 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 (Figure 7) provides a device with a high dynamic resistance while allowing sufficient current to flow.

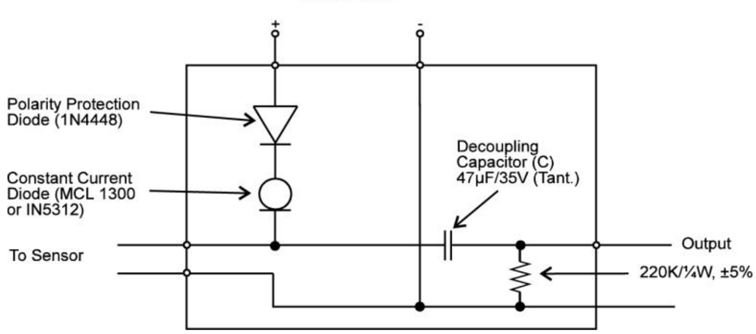



**Figure 7: Schematic Diagram Of A Simple Coupler**

Figure 7 shows a schematic of a simple power supply coupler for shock accelerometers. DC power is supplied from a 24 volt source such as a regulated power supply or batteries. One advantage of the Piezotron system is the fact that a simple two wire coaxial cable is used for both power and signal. Because the signal and power both share the same line, 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 assures a full undistorted ±5 Volt output amplitude (See Figure 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



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(See Figure 9). The following equations are provided to calculate the maximum full scale voltage available when operating with a reduced voltage.

Maximum positive amplitude:

$$+Fs = (Es - 1) - Eb$$

Maximum negative amplitude:

$$-Fs = Eb - 2$$

Where:

Fs = Full scale output (peak)
ES = DC supply voltage (sometimes called compliance voltage)
Eb = bias voltage (from calibration certificate)

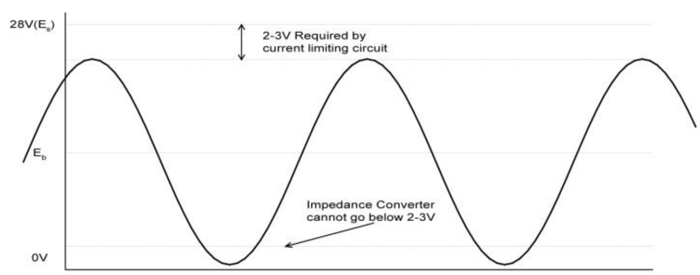


**Figure 8: Output Signal When Operated With 28V Supply**

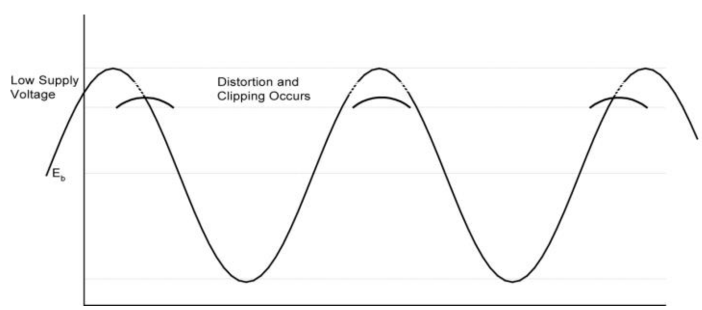


**Figure 9: Example of Output Distorting and Clipping when Supply Voltage is Low**

The shock accelerometer requires a minimum of 4mA of current to enable the capturing of high frequency data.


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### 7.1.4 Sensor Power-Up

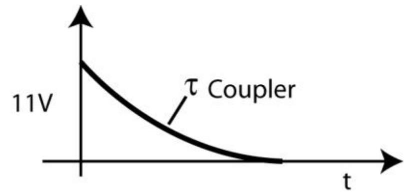


**Figure 10: Behavior Of The Output Signal During Power-Up**

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

### 7.1.5 Overload Recovery

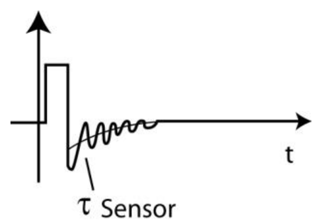


**Figure 11: Output Behavior During Overload and Recovery**

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 on 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. Figure 11 illustrates a typical overload and recovery sequence.

### 7.1.6 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 25mV RMS or less. The polarity must be maintained throughout the system since applying reversed polarity power may cause damage to the accelerometer.

## 7.2 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 to 4 mA. Most Kistler couplers are set at the factory to provide 4mA of source current. 4mA is a good compromise value for maximum frequency response and high reliability.

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

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

For the user's convenience a chart is provided (See Table 5). The values given are based on a cable capacitance of 30 pF/foot (98 pF/m). The list of cables available from Kistler can be found in section 9.3. All cables in this section are 30pF/ft (98 pF/m). except for the 1331, 1635 and 1639 which are 20 pF per foot(65 pF/m).

| Maximum Frequency +/- 5% | Cable Length Ft (meters) | Current (mA) Required For Output Signal +/- 1 Volt | Current (mA) Required For Output Signal +/- 5 Volts |
|---|---|---|---|
| 10 kHz | 1000 (300) | 2 | 10 |
| | 2000 (600) | 4 | 18 |
| 9 kHz | 1000 (300) | 2 | 9 |
| | 2000 (600) | 4 | 17 |
| 8 kHz | 1000 (300) | 2 | 8 |
| | 2000 (600) | 3 | 15 |
| 7 kHz | 1000 (300) | 2 | 7 |
| | 2000 (600) | 3 | 14 |
| 6 kHz | 1000 (300) | 2 | 6 |
| | 2000 (600) | 3 | 12 |
| 5 kHz | 1000 (300) | 2 | 5 |
| | 2000 (600) | 2 | 10* |

* Based on 30 pF/ foot (98 pF/meter)

**Table 5: Current Requirements for Driving Long Cables**



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The current requirements can be calculated using the following equation:

$$I = 2\pi\ fCE$$

Where:

$$I = \text{Current in Amperes}$$
$$f = \text{Frequency in Hz}$$
$$C = \text{Capacitance in Farads}$$
$$E = \text{Output in Volts, Peak}$$

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

If a requirement calls for 1,000 feet (300m) of cable and the maximum frequency of interest is only 5 kHz than the user should select (From Table 5) 5 mA of current rather than the 10 mA required for the full 10 kHz range. 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 (in the data sheet) is based on 4 mA of supply current. It is necessary to degrade the maximum operating temperature when operating under increased temperature conditions. The graph in Figure 12 shows the approximate maximum temperature vs. operating current.

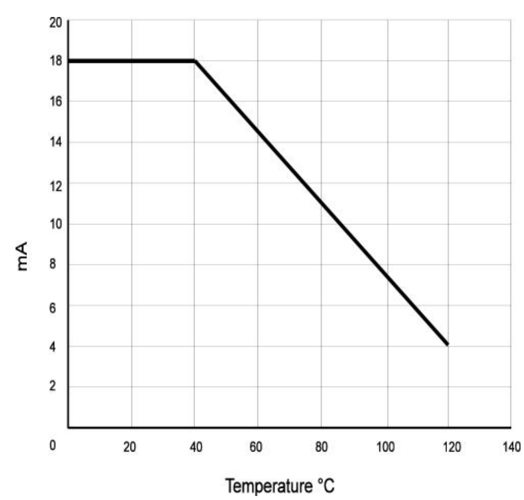


**Figure 12: Maximum PIEZOTRON Current as a Function of Operating Temperature**

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

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

where:

I = Current in mA

t = Temperature is □C

## 7.3 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.

### 7.3.1 Definition and Frequency Response Standards

Frequency response is defined as a maximum specified amplitude variation, from an established reference frequency, over a specified bandwidth. Shock accelerometers are specified with maximum variations of ±5% to ±10%. Kistler uses the industry standard reference frequency of 100Hz.

Many users may be more familiar with the common frequency response standard for electronic equipment which is generally *3dB. In most mechanical applications an error of *3db (about *30%) does not provide the required accuracy; thus, *5% (*10% in some cases) is considered a more useful and accurate limit.

### 7.3.2 High Frequency Limitations

The inherent high frequency limit of an accelerometer is a function of its mechanical characteristics Shock accelerometers can be represented as an undamped single degree-of-freedom spring-mass system. Accelerometers are modeled 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:

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

of a single degree of freedom system

$f_n$ = undamped natural (resonant) frequency (Hz)
$f$ = frequency at any given point of the curve (Hz)
$a_o$ = output acceleration
$a_b$ = mounting base of reference acceleration $\left(\frac{f}{fn} = 1\right)$
$Q$ = factor of amplitude increase at resonance

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

Using the basic equation for resonance one can better understand the basic accelerometer mechanical system and the affect on high frequency response.

$$f_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

The spring constant (k) is determined by the stiffness of the quartz crystal and preload stud. The mass (m) is the supported part of the accelerometer structure. This spring-mass system is the basic component that converts the input forces into acceleration. As with any single degree-of-freedom system, a resonance condition will occur (per the above equation) which causes the sensitivity to increase with frequency.

It is desirable to have a uniform frequency response over the specified frequency range. As can be seen, (Figure 13), the sensitivity greatly increases when approaching resonance. About a 5% amplitude rise can be expected at 9/40 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.

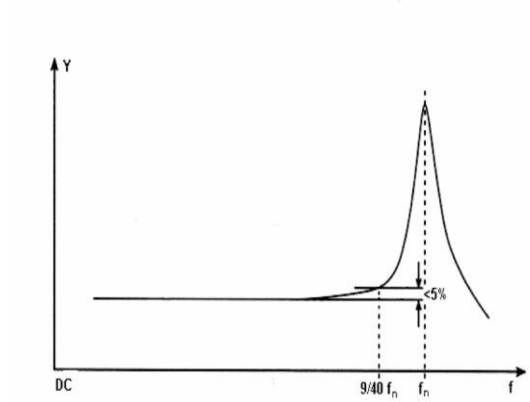


**Figure 13: Typical Frequency Response of a Piezoelectric Accelerometer**

Section 5 provides important information regarding mounting. It is important that these instructions are followed to ensure optimal transmissibility at high frequencies. Mounting to rough surfaces, using soft adhesives and magnetic mounts will limit the high frequency range to some value lower than the specified frequency range.

### 7.3.3 Low Frequency Limitations - Transducer

The low frequency response of accelerometers is an electrical limitation. The design of shock accelerometers is such that low frequency drift caused by temperature variations is virtually eliminated.

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

At low frequencies the amplifier input circuit acts as a single order high-pass filter (See Figure 6) whose amplitude and phase are:

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

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

The high pass filter has a time constant (*) as 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 *=RC. As capacitance and/or resistance is increased, the time constant becomes longer thus an increase in the low frequency response since frequency is the reciprocal of time.

The low frequency limit of shock 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 measured * found on the unit's calibration certificate. The following equation can be used to determine where the low frequency response will be 5% below reference

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

where:

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

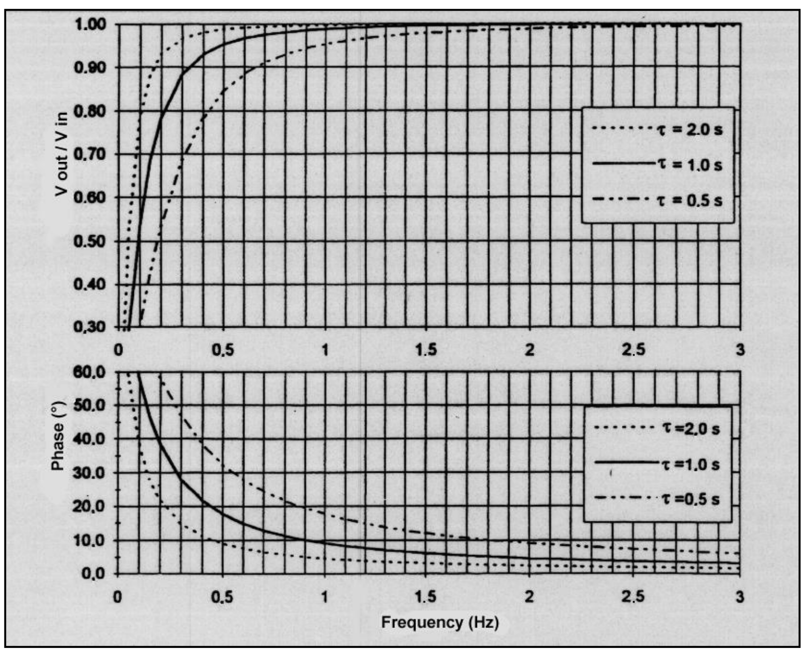


**Figure 14: Frequency and Phase Response of Shock Accelerometers at Low Frequencies are Dependent on the Time Constant**



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### 7.3.4 Low Frequency Limitations - Coupler and Readout Instrumentation

When making low frequency measurements with K-Shear accelerometers it is important that the user consider the affects 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 that specified in the coupler data sheet and the readout instrument's specifications. The actual low frequency limit will be the higher of the two. As an example, an FFT analyzer is being used that has a low frequency cutoff of 0.5Hz and a coupler with a 0.07 Hz low frequency cutoff is being utilized. The low frequency response limit will be 0.5 Hz.

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

When using a simple coupler circuit (Figure 7), with AC coupling, a time constant equal to the product of the decoupling capacitor's (C) capacitance times the readout instrument's input impedance will be produced. Using the formula  = RC (The readout instruments impedance = R) it can be seen that the lower the readout instrument's input impedance (Z), the shorter the time constant thus degrading the low frequency response. In systems with AC bias decoupling the time constant can be approximated by taking the product of the transducer and coupler time constants and dividing by their sum.

When using a simple coupler (Figure 7) the user should be aware that the system formed by the coupler and readout instrumentation can shorten the time constant thus degrading the low frequency response. The new system time constant can be approximated by the equation:

$$\tau = \frac{R_1 \text{ x } R_2}{R_1 + R_2} C$$

Where:

$R_1$ = Output resistance of the coupler

$R_2$ = Input resistance of the readout instrument

$C$ = Capacitance of the Coupler's output capacitor

# 8 Maintenance and Calibration

## 8.1 General

The hermetically sealed construction of shock accelerometers precludes any internal maintenance or repairs. External cleaning is important as covered in section 7.4.

## 8.2 Trouble Shooting

Should the user experience any problems with a shock accelerometer, the following procedure should be followed.

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

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:

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

B. If the bias reading is high:

   1. Disconnect the accelerometer at the accelerometer end of the cable.

   2. If the bias indicator reading decreases; the accelerometer is defective.

C. If the bias indicator reads low, disconnect the accelerometer

   1. If the bias indicator still reads low, replace the cable.

   2. 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 these cases, 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 Volts. Defects should show-up as in A and B above.

If it is determined that the accelerometer requires repair, please contact the factory or your local distributor/representative for repair information.

## 8.3 Repairs

Field repair is not possible. Please return the accelerometer to the factory together with a statement of problems encountered and unit serial number. Recalibration is recommended when returning an accelerometer to the factory. Please contact the factory and obtain a return authorization number prior to return.

## 8.4 Cleaning

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

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

## 8.5 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 standard in a "back-to-back" configuration. The standard and test accelerometer are excited at appropriate frequencies and levels. The resultant amplitudes of both accelerometers are then compared to determine if the test unit is within tolerance.

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.

# 9 Accessories

## 9.1 Cables

| Type | Description |
|---|---|
| 1631Csp(x) | Premium, low noise cable/connector.<br>10-32 pos. to BNC pos. |
| 1635Csp(x) | Premium, low noise cable/connector.<br>10-32 pos. to 10-32 pos. |
| 1639Asp(x) | Premium industrial cable/connector.<br>10-32 pos. to BNC pos. |
| 1761sp(x) | General purpose cable/connector.<br>10-32 pos. to BNC pos. |
| 1762sp(x) | General purpose cable/connector.<br>10-32 pos. to BNC pos. |
| 1601Bsp | BNC pos. to BNC pos. |
| 1603Bsp | BNC neg.to BNC pos. |

x= Length in meters, please specify

Consult Kistler for any special cable needs.

# 10 Warranty

Regarding the warranty reference is made to the agreement between the respective contracting parties.