

Kistler's core competence is the development, production and use of sensors for measuring pressure, force, torque and acceleration. Kistler's know-how and electronic systems can be used to prepare measuring signals for use in analyzing physical processes, controlling and optimizing industrial processes, improving product quality in manufacturing and improving performance in sports and rehabilitation.

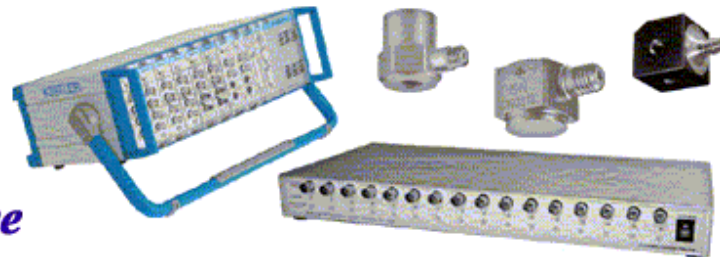
Kistler offers a comprehensive range of sensors and systems for engine development, automotive engineering, plastics and metal processing, installation technology and biomechanics.

A worldwide sales presence in the form of 25 group companies and 30 distributors ensures customer proximity, application support on an individual level and short lead times.

With a staff of 1 200, the Kistler Group is one of the world's leading providers of dynamic measuring instrumentation. The Kistler Group achieved turnover of 235 million Swiss Francs in the 2011 financial year.

**KISTLER**  
measure. analyze. innovate.

## ***Acceleration/Force/Torque/Pressure***



Kistler Instrument Corporation began U.S. operations in 1955. Kistler is one of the world's leading suppliers of measurement technology. Their pressure sensors, force-sensors and accelerometers use the piezoelectric effect for precise measure of mechanical properties. Kistler is a Swiss company operating world-wide. Their products are employed in a large array of applications from engines to bio-mechanics.

**Quality System Standard: ISO 9001:2000**

The piezoelectric pressure transducer is based on the piezoelectric principle discovered by Jacques and Pierre Curie in 1880. They found that the surfaces of certain crystals – including quartz – become electrically charged when the crystal is subjected to mechanical stress. This charge is exactly proportional to the force acting on the crystal and is measured in picocoulombs ( $1 \text{ pc} = 10^{-12} \text{ coulomb}$ ).

As active devices, piezoelectric pressure transducers can only measure quasistatic as opposed to truly static processes. This type of pressure transducer is therefore ideal for dynamic measurement. It is used wherever rapid changes in pressure at temperatures up to 400 °C have to be measured and recorded as accurately as possible. An uncooled pressure transducer generally uses quartz or other crystals developed and grown by Kistler. These *PiezoStar*<sup>®</sup> crystals are particularly sensitive and temperature stable.

### **The Piezoresistive Pressure Transducer**

The piezoresistive pressure transducer builds on the semiconductor effect first described by Charles S. Smith (*Piezoresistive Effect in Germanium and Silicon*) in 1954. Under mechanical stress, the change in the electrical resistance of semiconductors is up to two orders of magnitude greater than in metals. This type of transducer therefore opened up completely new applications compared with the metal strain gage methods of the time. Since then, other similar techniques have been developed, such as thin film on metal and thick layer on ceramic.

### *Typical Pressure Transducer Applications:*

- Dynamic measurement of cylinder pressure and fuel injection pressure in the development of internal combustion engines
- Continuous monitoring of cylinder pressures in large diesel engines
- Measurement of explosion pressures in the development of air bags
- Control of injection molding cavity pressure in order to maximize quality and minimize rejection

## *Kistler Force*

### **Kistler Force**

#### **Kistler Model 9712 High Impedance Load Cells**

The 9712B series of force sensing load cells measure dynamic events in a wide variety of applications. Available in measuring ranges from 5 lbf. to 5,000 lbf. and contained in a conventional load cell style housing, all models are capable of measuring compression and tension forces.

#### **Kistler Models 9212, 9222 High Impedance Load Cells**

The 9212 and 9222 are force sensing load cells that measure quasi-static and dynamic events in a wide variety of applications. Available in two different load cell style housing configurations (hex and square), the 9212 has a 50 pC/lbf sensitivity while the 9222 has 19 pC/lbf.

#### **Kistler Models 9251A, 9252A, 9250A4, 9251A4 3-Component Force Sensor**

The force sensor contains 3 pairs of quartz rings which are mounted between two steel plates in the sensor housing. Two quartz pairs are sensitive to shear and measure the force components  $F_x$  and  $F_y$ , while one quartz pair sensitive to pressure measures the component  $F_z$  of a force acting on the sensor. The electrical charges proportional to the displacement components are led via electrodes to the corresponding connectors.

#### **Kistler Models 9301B, 9371B Quartz Force Links**

The force sensor is mounted under preload between two nuts and, therefore can measure compression and tension. The quartz element yields an electric charge which is proportional to the force. This is picked off by an electrode and transferred via a connector.

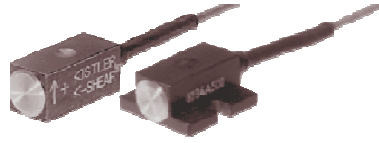
#### **Kistler Model 8730A Miniature K-Shear® Accelerometers**

The 8730A500 Series are miniature, lightweight accelerometers weighing only 1.9 grams. Only the M1 version, which is slightly larger and "off-ground"; weights 2.5 grams. These sensors are constructed in a welded, hermetically sealed titanium case. The units are designed with a 10-32 top connector for convenience and reliability. The basic 8730A500M1 and its M1 and M8 versions contain integral 5-40 threaded mounting stud. For low temperature or cryogenic applications down to -320°F (-195°C), the 8730A500M8 and 8730AE500M8 are available.



#### **Kistler Models 8732A & 8734A Micro K-Shear® Accelerometers**

The 8732A500 and 8734A500 micro K-Shear accelerometers offer the user a small, lightweight, low profile accelerometer designed for measuring shock and vibration on very small articles. The rectangular body shape of the 8732A500 offers easy adhesive mounting on any side particularly in tight locations.



### **Kistler Model 8752A Industrial K-Shear® Accelerometer**

The 8752A50 and the 8752A50M5 high temperature 165°C version and industrial accelerometers that feature reliable accuracy characteristics required for use in the most demanding of machine vibration measurements. With Kistler's K-Shear design, the inaccuracies long associated with industrial acceleration measurements are eliminated.



### **Kistler Model 8791A250 K-Shear® Miniature Triaxial Accelerometer**

The 8791A250 shear triaxial is a low impedance, voltage mode accelerometer in a miniature, cube-shaped enclosure designed for adhesive mounting. The triaxial design permits simultaneous impact and vibration measurements in three mutually perpendicular axes: X, Y and Z.



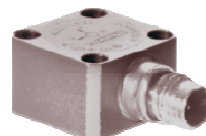
### **Kistler Model 8792A K-Shear® Triaxial Accelerometer**

The 8792A series of quartz shear triaxial accelerometers are rugged, low impedance voltage mode sensors. They are available in four ranges from 25g to 500g with sensitivities from 10mV/g to 200mV/g. This triaxial design allows simultaneous shock and vibration measurements in three mutually perpendicular axes: X, Y and Z.



### **Kistler Model 8793A Quartz K-Shear® Triaxial Accelerometers**

The 8793A500 triaxial accelerometer family of models measure shock and vibration in three mutually perpendicular axes. They are available in two extended operating temperature ranges; the 8793A500M5 for high temperature 330°F operation and the 8793A500M8 for low temperature -320°F (low) cryogenic operation. All types are of stainless steel welded construction, hermetically sealed in a unique flat package design that will provide many years of reliable operation.

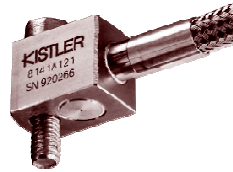


### **Kistler Model 8794A K-Shear® Triaxial Accelerometers**

The 8794A500 is a triaxial accelerometer that measures shock and vibration in three mutually perpendicular axes. It is designed in a unique flat package and built in a welded, environmentally sealed, stainless steel case, providing years of reliable operation. This sensor is available as a 8794A500M5 version, featuring a higher operating temperature up to 165°C and in a 8794A500M3 version with a low end frequency point of 1Kz.

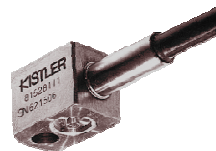
### **Kistler Model 8141A Piezotron® Vibration Sensor**

Rugged, hermetically sealed, ground-insulated acceleration sensor with integral impedance transformer (charge amplifier) and low-impedance voltage output of +/-5V. Its compact design allows it to be fitted close to the process. The sensor is easily surface mounted with only one M6 or 1/4 inch screw. The measuring chain is suitable for recording and monitoring vibrations in machine structures, for monitoring and as part of a machine diagnosis.



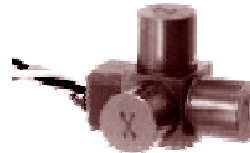
### **Kistler Model 8152B Piezotron® Acoustic Emission Sensor**

Piezotron® Acoustic Emission Sensor with built-in impedance converter for measuring acoustic emission (AE) above 50 kHz in machine structures. With its small size, it mounts easily near the source of emission and captures the signal optimally. The sensor has a very rugged housing, welded tight (degree of protection IP65 resp. IP67). The small size may easily be mounted nearly everywhere: a M6-bolt is all that is needed.



### **Kistler Model 8694M1 Piezotron® Miniature Triaxial Accelerometer**

The 8694M1 Piezotron® triaxial accelerometer essentially consists of three individual sensor elements mounted in an orthogonal configuration with each containing a quartz-crystal measuring assembly, a seismic mass and an integral impedance converter. The quartz assembly located between the sensor body and the seismic mass is preloaded by a flexible member. The electrical charge yielded by each quartz crystal measuring element is directly proportional to the portion of the acceleration signal incident on the sensor's mounting surface.



### **Kistler Model 8765A PiezoSTAR® Miniature, Voltage Model Triaxial Accelerometer**

The 8765A250M5 triaxial accelerometer measures shock and vibration in three orthogonal axes. The 8765A is a miniature 6.4 gram center hole triaxial accelerometer with a +/-250g measurement range and 20 mV/g sensitivity. The 8765A is a miniature IEPE triaxial accelerometer designed for high temperature applications. The triaxial design permits simultaneous shock and vibration measurements in three perpendicular axes: X, Y and Z.



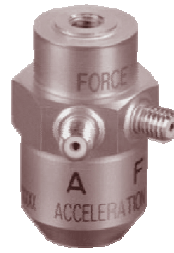
### **Kistler Models 8838 & 8840 Axial/Lateral Rotational Accelerometers**

The 8838 and 8840 are a novel complement of shear mode sensors that are designed to respond to two distinctly different forms of induced oscillations. The internal orientation of the quartz elements enables the 8838 accelerometer to measure oscillations occurring about the unit's mounting axis when installed in a non-rotating test application. The element orientation of the 8840 accelerometer is such that the unit will accurately measure the acceleration magnitude of oscillations induced to its mounting base.



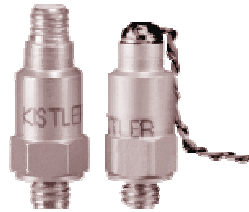
### **Kistler Model 8770A Impedance Head Acceleration, Force Sensor**

A unique sensing element construction optimizes the capabilities of this sensor. The result is a device which yields simultaneous dynamic acceleration and force measurements from exactly the same location on a test structure. Its crystal isolation and tuned channel phase matching allows for the acquisition of Driving Point (DP) data with optimal spatial and temporal coincidence.



### **Kistler Models 8742A & 8743A Shock Accelerometers**

This unique shock accelerometer series incorporates a stable quartz, shear design and are tailored to measure high accelerations from pyroshock to impact testing. The 100 kHz resonance frequency ensures accurate measurements of high speed events, virtually eliminating zero shift and internal amplifier saturation.



### **Kistler Model 9722A Impulse Force Hammer**

The dynamic response of a mechanical structure while either in a development phase or an actual use environment can readily be determined by impulse force testing. Using an FFT analyzer, the transfer function of the structure can be determined from a force pulse generated by the impact of a hammer and the response signal measured with an accelerometer. The impulse force test method, yields extensive information about the frequency and attenuation characteristics of the system under test.



### **Kistler Model 7013C Quartz Pressure Sensor**

The Kistler Model 7013C is an industrial sensor for measuring cylinder pressures in internal combustion engines. Sensor and cable together form an oil- and splash-proof unit. Suitable for longtime measurements and arduous duties.



### **Kistler Model 7613C Piezotron® Quartz Pressure Sensor**

Industrial sensor for measuring cylinder pressures in internal combustion engines. Sensor and cable together form an oil- and splash-proof unit. Suitable for longtime measurements and arduous duties. Impedance converter with low-impedance voltage output.



### [Kistler Model 7031 Quartz Pressure Sensor, Acceleration-Compensated](#)

Quartz pressure sensor for measuring dynamic and quasistatic pressures up to 250 bar at temperatures up to 200°C. The built-in accelerometer compensates interference signals produced by shock or vibration in the direction of the sensor axis.



### [Kistler Model 6005 Quartz High Pressure Sensor](#)

Quartz pressure sensor for measuring dynamic and quasistatic pressures up to 1000 bar at temperatures up to 200°C. Excellent cycling life and endurance in continuous operation with pressure shocks and rapid pressure rises.

### [Kistler Series 4260/4262 General Piezoresistive Static Pressure Sensors](#)

The Kistler Series 4260/4262 General Piezoresistive Static Pressure Sensors are versatile high performance pressure sensors that will operate in harsh test environments where temperature extremes, high vibration and shock levels are present.



### [Kistler Model 7261 Low Pressure Quartz Transducer](#)

Low pressure quartz transducer for dynamic and short term static pressure measurements from vacuum to 10 bar. High resonant frequency, flush welded diaphragm.



### [Kistler Model 6115A Measuring Spark Plug](#)

The measuring spark plug Type 6115A allows cylinder pressure measurements to be made without the need for a separate measuring bore. The measuring spark plug M12 x 1.25 incorporates a miniature piezoelectric pressure sensor.



## [Kistler Signal Conditioners](#)

### **Measurement & Analysis**

Powering, conditioning and computer interface solutions are available from a suite of electronic equipment tailored to provide measurement flexibility with utmost quality and integrity. Couplers from inexpensive single channel to large, modular, multichannel platforms can be selected. Charge amplifiers with dual mode (low and high impedance) capability offer adaptability to a variety of sensor configurations.





## Kistler Calibration Equipment

Most Kistler force sensors are factory calibrated and delivered with a calibration certificate traceable to national standards. Kistler also offers calibration services at customer request with minimum turnaround time.

### **Features:**

- Static and dynamic calibration of pressure sensors
  - Pressures to 100,000 psi
  - Portable
- IEEE-488 and RC232C interfaces

**Pressure Pulse Generator** - Capable of generating impulse pressures of 365 to 72,500 psi over a 5 to 10 millisecond period.

**Hydraulic High Pressure Generator** - Portable or stationary generator for static calibration of high pressure sensors.



**Calibrator** - Portable, 2 channel, microprocessor-controlled calibrator which may be used with Kistler reference sensors and pressure generators.

## Kistler Electronics

Kistler Instruments have unquestionably the largest and broadest range of electronics/instrumentation in this market. It would be beneficial to review the matrix table available to assist and narrow your range of selection. Refer to detailed data sheets for operation specifications and options.

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



## Kistler Mounting

The mounting of accelerometers, force sensors and pressure transducers are important considerations when attaching these products to achieve maximum response and performance. Kistler has a wide range of mounting adapters for their extensive range of transducers.



We suggest you review this section when selecting a transducer. In addition you

may wish to contact one of our applications personnel to help guide you through your selection.

## **Kistler Measuring Instruments/Systems**

### **Kistler has a great deal to offer**

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

- Engines
- Vehicles
- Manufacturing
- Plastics Processing
- Biomechanics



## **Kistler Monitoring & Control Units**

Kistler control monitors are used for the integrated monitoring and control of production processes. The CoMo II and CoMo II-S record two associated measurands (e.g. press force and "displacement") and evaluate their functional relationship. The parameters for the monitoring functions and the methods of evaluation can be operator selected and adjusted within wide limits. The monitors are specifically designed for process engineering and no special programming or software knowledge is needed for the configuration of process evaluation parameters.



## **Kistler Preloading**

### **Set of Preloading Elements for Load Washers**

The standardized preloading elements are used for mounting the load washers Types 9001A... 9071A. A set of preloading elements consists of a preloading bolt, a hexagon nut, a centering sleeve and two insulating washers.



### **Set of Preloading Elements for Force Sensors**

The standardized preloading elements are used for mounting the multicomponent force sensors Types 907X with internal diameter of 40.5 mm. A set of preloading elements consists of a hollow preloading bolt, a screw nut, a centering sleeve and a sliding washer.

