

# GeoWatch

## GeoSys

geophysical measuring solutions

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## Strategic Alliance between Terra and GeoSys

**GeoSys AG** and **Terra Technology Corp.**, Redmond, (WA), USA co-operate in a strategic alliance to jointly design, manufacture, market and sell world-wide various seismic instruments, vibration recording equipment and servo accelerometer products for the scientific markets of seismic research, earthquake engineering, civil engineering and geophysical engineering. Terra Technology Corp. has been servicing these markets with technically advanced digital recording equipment and high quality servo accelerometers since the founding of the company in 1972. GeoSys AG, was formed in 1992 and is made up of experienced engineers dedicated to provide high quality instruments to service these chosen markets.

The principle tenet of both GeoSys and Terra Technology is providing geophysical measuring solutions to customers' problems and meeting the customers' needs. This tenet is fulfilled by superior products in terms of features, functions, quality, reliability and price performance. Both companies have very strong technical expertise to support, service and assist the customers in accomplishing their individual goals.

The collaboration in the strategic planning, design, marketing, sales, manufacturing and support of products is envisioned to have a synergistic effect on the combined companies which will improve productivity, lower cost and make the companies more competitive in a global market. GeoSys markets, sells and services Terra products in Europe, Africa, Middle East, India and the former Soviet Block countries. Terra markets, sells and services GeoSys products for North and South America and the Pacific Rim countries. This alliance also facilitates better service and responsiveness to the world wide customer base.

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## Project Watch

The sensor is one of the most important device within a system for measuring vibrations. Various sensor types for different applications are in use. Depending on the application, acceleration or velocity has to be measured. The technique of some of the current sensor types are discussed below.

### Force Balance Accelerometer SSA-320

This type of sensors are low noise, stable units which provide wide dynamic range and flat response from DC up to 50 Hz available with different full scale ranges. It is a closed-loop device with a very low seismic mass (one gram).

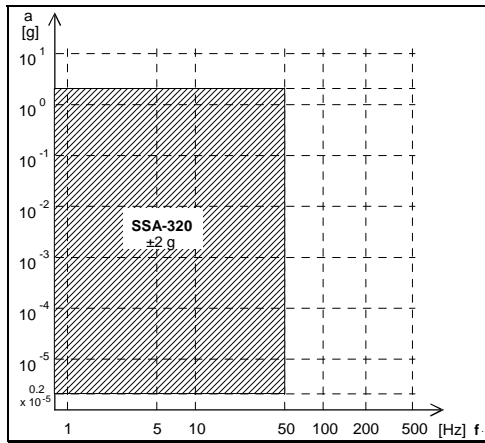


Fig: 1 SSA-320 Dynamic and Frequency Range

A coil of wire with an unbalanced weight attached to it is suspended in a permanent magnetic field. It is free to move in one degree of freedom only (unbalanced pendulum). When subjected to an acceleration, this pendulum moves with respect to the accelerometer frame, and a differential position sensor electronically senses this movement. The electronic circuit causes a current to flow into an amplifier and through the coil of wire suspended in the magnetic field. The force generated by this current is of opposite direction to the input acceleration and rises in value until the force generated matches the force of input acceleration. The current through the coil is directly proportional to acceleration and is converted to a voltage.

### Capacitive Silicon Accelerometer GSA-320

The capacitive sensor is a low noise, stable unit that provides a dynamic range of about 84 dB and flat response from DC up to 1000 Hz. It is a "solid state" product whose shock resistance is much higher than the accelerometers of classical technology. The sensor offers better resolution and better zero stability compared to piezoresistive devices.

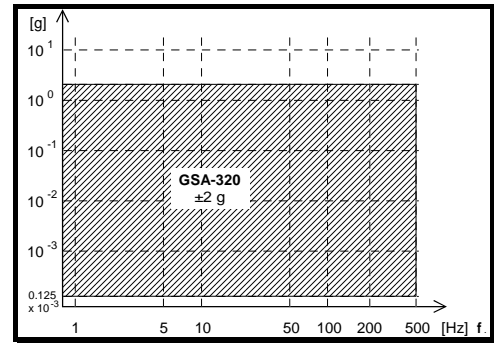


Fig: 2 GSA-320 Dynamic and Frequency Range

The key element of the sensor module is a micro-machined silicon chip comprising a movable plate suspended by flexure bars. It is deflected when acceleration perpendicular to the surface is applied. The max. deflection is about 2 micrometer only. This deflection is transformed into an electrical signal by measuring the variations of the capacitor formed by the movable plate and fixed electrodes placed on either side. The latter is made of aluminium thin films deposited on glass plates, which are themselves fixed to outer silicon plates in order to provide good mechanical stability. The cavity containing the movable plate is sealed hermetically at reduced pressure to achieve controlled damping. The output voltage is directly proportional to the acceleration and can be used directly or can be converted to a velocity signal by integration.

### Piezoresistive Silicon Accelerometer GSA-310

The piezoresistive sensor is a low noise, stable unit that provides a dynamic range of about 84 dB and flat response from DC up to 200 Hz. It is a "solid state" product with a very high shock resistance.

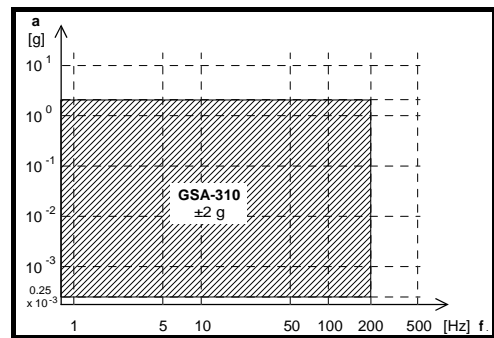


Fig: 3 GSA-310 Dynamic and Frequency Range

## Project Watch

A batch-fabricated accelerometer consists of a silicon spring with a silicon mass attached to it. Diffused piezoresistors are mounted in a bridge configuration on the flexure. Acceleration causes the mass to move with respect to the frame, creating stress in the piezoresistors, which changes their resistor values. A constant current flow through this resistor bridge gives a voltage which is directly proportional to the acceleration. The signal can be converted to a velocity signal by integration.

### Velocity Sensor GSV-320

This geophone based sensor provides a very wide dynamic range. Depending on the application different geophones and electronic circuits with different bandwidth are used.

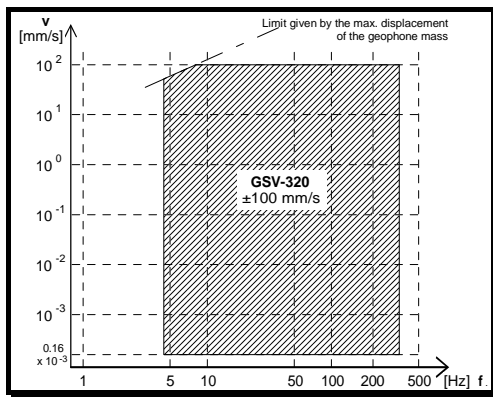


Fig: 4 GSV-320 Dynamic and Frequency Range

A coil of wire with a mass attached to it is suspended in a permanent magnetic field. It is free to move a few millimetres. When subjected to an acceleration, this mass moves with respect to the geophone frame, the magnetic field induces a voltage signal into the coil of wire, which is proportional to the velocity. This signal is filtered and amplified. The damping is given with the current flow through the coil of wire and can be adjusted with the damping resistor connected parallel to the coil. The output signal can also be converted to acceleration by differentiation.

### Velocity Sensor GSV-310

This velocity sensor is based on the capacitive silicon accelerometer GSA-320. The acceleration output is integrated. The GSV-310 convinces with its 1 Hz response and is used in many low frequency civil engineering applications.

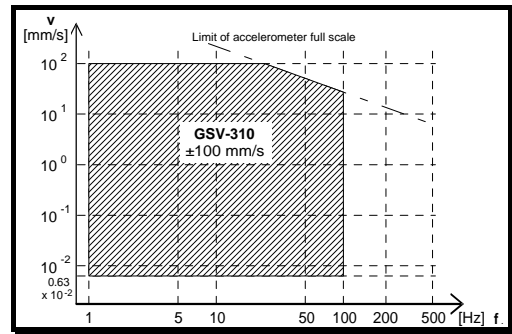


Fig: 5 GSV-310 Dynamic and Frequency Range

All sensors are housed in a very compact case. The sealed cast aluminium housing contains an MS style connector or a sealed cable inlet. It is equipped with a single bolt for fixing and three levelling screws.

Electrical gain selection and temperature sensing, 0 to 20 mA current loop signal transmission and extensive over voltage protection are some of the standard options available to all the sensors.

If you are not familiar with the definition of "Offset, Hysteresis, Cross Axis Sensitivity, Linearity Error" etc., GeoSys has prepared a technical paper which helps to understand this matter more thoroughly.

If you are interested to receive your own copy, please contact us. We will be pleased to mail you one and any other literature of our product line you may require.

### Specification of Sensors

GeoSys Sensor:	GSV-320	GSV-310	GSA-310	GSA-320	SSA-320
Frequency Range	4.5 to 350 Hz	1 to 100 Hz	DC to 200 Hz	DC to 500 Hz	DC to 50 Hz
Full Scale Range	± 1, 10, 100 mm/s	± 1, 10, 100 mm/s	± 0.25, 0.5, 1, 2 g	± 0.25, 0.5, 1, 2 g	± 0.25, 0.5, 1, 2 g
Linearity	< 0.3 % full scale	< 0.5 % full scale	< 1 % full scale	< 0.5 % full scale	< 0.05 % full scale
Hysteresis		< 0.2 % full scale	< 0.2 % full scale	< 0.2 % full scale	< 0.005 % full scale
Dynamic Range	> 96 dB	> 84 dB	> 78 dB	> 84 dB	> 120 dB
Cross Axis Sens.	< 0.1 %	< 0.01 %	< 0.03 g/g	< 0.0001 g/g	< 0.0005 g/g
Sensor Type	Geophone	Capacitive	Piezoresistive	Capacitive	Force Balance

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## Project Watch

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### GSR-12

The GSR-12 works out to be a real winner within the 12 Bit Strong Motion market. Many customers already decided to buy the compact and easy-to-use recording system.

The **GeoSys** attitude is to adopt and improve the product continually. Therefore we are proud to be in the position to announce some new features implemented in the compact GSR-12 recorder.

#### ❑ Dial-Up System

The GSR-12 automatically calls a predefined telephone number after an event has been recorded. Co-ordinated by the local computer, the files stored in the GSR-12 are transferred to the computer. An automatic system can be built which allows having an overview of all the recorders installed in a specific area or e.g. over the entire country

#### ❑ Civil Engineering

For our customers with applications in the civil engineering field, we implemented new functions such as higher sampling rates, on-line calculation of the vector sum ( $\sqrt{x^2 + y^2 + z^2}$ ), effective value based on DIN 4150 and a Test Furier Transfromation to calculated the dominant frequencies within a recorded event. With an efficient data reduction algorithm it is possible to record permanently. This allows having more statistical information of the vibration behaviour during a construction period.

### GeoSys' Representatives

GeoSys has established recently some new local representatives which are taking care of our customers needs in their countries. This allows our customers to be in closed contact with experienced people within their region and get the right and quick support on any related business.

#### ❑ New Representatives

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