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Comparison of Sensors for Measuring Acceleration, Vibration, Inclination

Micro-Sensor's sensors are based on a technology called a difference capacitor and are called MEMS acceleration sensors. Their sensors have a MEMS silicon tongue between two conductive plates. The tongue and the plates act as capacitors. If the tongue moves between the plates the capacitance change is proportional to the rate of acceleration. If there is a tilt, the tongue moves because of its mass in direction of earth surface, so it is possible to measure inclination too.

Piezo sensors consist of a piezo-sensitive material. They put out a voltage if there is an acceleration. This technology is fast but not able to measure very low frequencies (and inclination).

A **Servo** sensor has a pendulum on a scale. The pendulum moves in direction towards the center of earth every time.

A **Liquid** sensor also consists of two plates, but there is a conductive liquid instead of a tongue. Both types can measure inclination very precisely, but the liquid sensor is not able to measure acceleration and inclination.

A **Gyroscope** only measures a rotation independent of gravity.

Micro-Sensor's MEMS acceleration sensors most important feature is the combination of inclination, acceleration and vibration measurements in one sensor.

Type	Functions			Frequency Range	
	Inclination	Acceleration	Vibration	lower (Hz)	upper (Hz)
MEMS (Micro-Sensor)	yes	yes	yes	>0	2000-3500
Piezo	no	yes	yes	0.07-10	6000-20000
Servo / Liquid	yes	bad	no	>0	0.1-10
Gyroscope	yes*	no	no	>0	2000

*only measurement of rotation, not of inclination against earth surface

Most sensors are mounted outside or in an exposed environment. Micro-Sensor sensors are engineered to be resistant to most chemicals. They are designed to work in temperatures from -40°C to +85°C (-40°F to 185°F).

Micro-Sensor's current customers are:

Wind Turbine Generators
Sinovel (China), Inox (India), AREVA Wind (France / Germany), DEWI (German Windenergy Institute), Doosan Heavy (Korea)
A lot of other possible customers in Europe are testing M-S sensors.
Application: Measurement of movement of tower and nacelle

Agriculture and Forest Machines
Maschinenfabrik Krone GmbH
Application: System "Rock Protect" (detection of stones in harvesters), calibration of balances in harvesters

Trains and Locomotives
Bombardier (Germany, Italy, Switzerland), TALGO (Spain)
Application: Measurement of Vibration across rail