

Sensors – The Eyes and Ears of the High-tech World

a report by

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Safety and driving comfort are two of the key considerations when buying a car. As a result, tests – ultimately crash tests – are carried out during the vehicle's development to determine in advance whether or not the vehicle satisfies the defined requirements under various degrees of stress. The vehicle itself must function reliably under adverse road conditions and in different climatic environments. The acoustics are also optimised at the same time. Loud noise in the passenger compartment is prevented, thereby ensuring maximum driving comfort for the people in the car.

The Importance of Sensor Technology in the Automotive Sector

Sensors are used to determine early on whether a vehicle satisfies all the functional requirements, and to enable any necessary adaptations or improvements to be carried out. Acting as the “eyes and ears of the modern, high-tech world”, they do the work of humans, detecting the oscillations and vibrations that the vehicle is subject to during the various individual test phases. They capture and return accurate data which, after analysis, provides information on whether the vehicle needs to be improved and where adaptations need to be made. Sensors are therefore indispensable when it comes to ensuring road safety and maximum driving comfort. But just as a small child needs to learn the relationship between cause and effect, between a blow and pain, measuring cell technology also needs to learn. The measuring accuracy and service life of sensors has been increased through ongoing product enhancements. The ever-decreasing size of the measuring cells has also meant that they can be used in many more applications.

Industry Experience and Expertise

Since October 2000, MWS Sensorik GmbH has been based in Pfaffenhofen, near Munich, in Germany. The specialists, with their technological expertise, are the first choice for sensors in the field of vibration and pressure-measuring technology. Their list of worldwide customers includes automotive manufacturers and their suppliers, companies in the aerospace industry, geophysics, medicine and deep-

drilling technology. Specialist measuring cells are used in train and rail monitoring. Ultra-precise sensors measure earth movements and check the stability of dams on heavily used water courses.

The company sets particular store on its choice of high-quality and innovative sensor elements, which it procures from leading American manufacturers and sells exclusively in Germany, Austria, Switzerland and the Benelux states.

MWS Sensorik GmbH also develops customised solutions and, using original equipment manufacturer (OEM) products from its US contract partner, manufactures accelerometers. Leading automotive manufacturers and their suppliers worldwide use these measuring cells successfully in prototypes, test runs on testing galleries, crash tests, dummy tests and in tests on hydraulic systems.

Advice and Service

By marketing exclusively high-end products from Honeywell, the premium brand among the manufacturers of accelerometers, MWS Sensorik GmbH provides customers in Germany, Switzerland, Austria and the Benelux states with top-quality sensors. Customers in Germany can also contact MWS Sensorik GmbH for a wide range of high-quality pressure sensors and accelerometers from the US company MSI Measurement Specialities.

MWS Sensorik GmbH provides advice on the best use of the sensors, offering information on other areas of application and supplying customer support and sensor calibration services. This innovative company is also responding to the growing demand for customised solutions by adapting existing products to the needs and specifics of each individual application. The company is also developing new products that reflect the suggestions, ideas and concepts of its customers.

Product Features

Whether for series use or for precision measurements, MWS Sensorik GmbH uses two technologies in its accelerometers, which are produced in-house. The



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company offers both piezo-resistive and capacitive sensors based on silicon and servo technology, together with sensor testing equipment and sensor calibration services. The smallest measuring range lies between 0g and 2g, while the largest ranges from 0g to 1,000g – divided up into 10 measuring ranges.

The company's high-performance accelerometers can be used universally and feature outstanding sturdiness and shock resistance, coupled with tremendous resistance to heat. Depending on the application involved, the customer can use specially developed, ultra-small and flat modules for narrow spaces or they can use dice-shaped modules that enable the sensors to be fastened in place on several sides. Built into an aluminium casing, the piezo-resistive, single and triple-axial, temperature-compensated, signal-boosted accelerometers with low-microphony cables are extremely light. The chip in the measuring cell is also protected from becoming overloaded due to a mechanical stop.

Specific Customer Benefits

One of the company's special services is the bundling of products. In close collaboration with the customer, MWS Sensorik GmbH develops customised solutions that match the specifications of the particular application. Using high-quality materials, this innovative company adapts the sensors to suit the requirements of the situation in hand and equips the measuring cells with special modules and cables. As has recently been confirmed by multiple automotive manufacturers, the price-to-performance ratio at MWS Sensorik GmbH is excellent.

Crash Tests Pave the Way to Sensor Development

In a crash test, a frontal collision and side impact are simulated. Sensors developed specially for the crash tests provide information on whether a car's crumple zone needs to be improved and whether the materials inside the car shatter badly in the event of impact. Measuring cells are attached to dummies. These record the movements of the dummies during impact. Inside the dummies, there are sensors that determine the forces that would be exerted on the passengers at a certain impact speed.

Because measuring cells are also built into the front of the bodywork and are therefore subjected directly to the tremendous force of an impact during the crash test, the measuring cell can only be used once. As a result, there is a need for inexpensive sensors. Consequently, MWS Sensorik GmbH started developing and producing inexpensive accelerometers for use in crash tests. These types of sensor can also be used in many other applications, such as to

monitor air bag sensors. Because the forces to which they are subjected are not as high in this instance as they are in the simulation of a head-on collision, MWS Sensorik GmbH has developed long-life sensors that can be used for several years. The sensors are equipped with high-quality casings and cables, thereby enabling MWS Sensorik GmbH to secure valuable market share against its three key competitors.

Areas of Application for MWS Sensors

Ninety per cent of MWS Sensorik GmbH's accelerometers, which are produced in-house, are used in the automotive industry. The accelerometers from Measurement Specialities and Honeywell are also used in the field of medical technology, in satellites and space shuttles for the aerospace industry, in deep drilling and tunnel-boring applications for the geophysics industry and in instrumentation and control technology for mechanical engineering. The versatile, high-quality products have enabled the company to achieve a high-profile market position, especially in the automotive sector. Vehicle developers and safety engineers rely on the highly sensitive sensors to provide them with data from various testing routines, which they can use as the basis for further improvements.

Sensors for Vehicle Development

In order to supply both the crash test market and the vehicle development sector with accurate and flexible sensors that are adapted to suit the application in hand, MWS Sensorik GmbH now buys capacitive sensors for small measuring ranges from a US manufacturer. The company uses these products to develop high-quality sensors that satisfy the requirements of the vehicle developers and, as a result, have made great inroads into the market for vehicle development, together with its associated material strength and acoustics sectors.

Strength Measurements

During a new development, every vehicle undergoes a series of different tests. Strength measurements tackle the question of whether the axles are stable, whether the gear system is suspended correctly so that no resonant frequencies occur and whether the engine is fitted in such a way as to ensure that it will be able to withstand many kilometres of driving.

In the vehicle manufacturer's strength testing department, sensors are attached to the axles of the vehicle being tested. The prepared vehicle is then put on a testing gallery, where it drives over skid courses or road humps. The sensors are then used to determine what kind of vibrations occur on the axles and the engine housing and whether the axles, gear

suspension and bodywork remain stable even under extreme strain.

With these types of testing method, it is not just the test object that is subjected to extreme conditions. The sensors, which have to remain sensitive and must record reliably any oscillations triggered by road humps and impacts, are also put under extreme stress. MWS Sensorik GmbH has a range of particularly sturdy sensors which, when built into high-quality casings, can withstand even the most extreme influences on the vehicle. For example, during one vehicle test run for a German automobile manufacturer, a sensor came loose at around 200km/h and smashed into the tarmac. Nevertheless, the sensor still returned the necessary data once the test run had finished, and could even be used in the next round of tests.

Comfort Measurements

Comfort measurements relate to the noise levels inside the car. Measurements provide information on the noise inside the vehicle and, hence, reveal whether the noise levels would irritate the people inside the car. As a result, sensors are used, for example, to check whether the tank has been installed and fixed in place so that no gurgling or glugging sounds can be heard inside the car, regardless of how full the tank is.

Vibrations are propagated into the vehicle's interior and have a direct effect on driving comfort. In certain situations, the seats begin to squeak or the windscreen wipers start to rattle. The data obtained through the use of sensors provides information on the speed at which this type of acoustic disturbance first occurs and provides a starting point for major adaptations, changes and improvements.

MWS Sensorik GmbH also offers standard products for comfort measurements, along with customised solutions that have been created to suit each individual situation.

Sensor Technology for the Air Bag

Air bags are one of the key safety components of any vehicle – many cars now have front and side air bags for the driver and passenger. All these air bag systems use accelerometers, arranged at various points on the vehicle's bodywork. They are the first components of an air bag system to receive information about a crash. They must detect the deceleration that occurs in the event of a collision reliably, and must convert this information into a precise electrical signal that triggers the air bag.

Vibrations in the bodywork will cause the dashboard,

in which the front air bags are located, to oscillate. Appropriate testing methods must be used to ensure that the air bag only inflates after a collision, and not just because of small vibrations.

MWS Sensorik GmbH can also supply precise measuring cells for these applications. If the sensors need to be fitted with special cables, or the cables have to be longer than normal, MWS Sensorik GmbH is happy to provide the perfect solution.

A Global Presence Through a Distributor Network

The in-house production facilities, which were opened just over two years ago, are responsible for around a third of the company's sales, and by selling pressure sensors and accelerometers from American contract partners and producing and developing customised accelerometers, MWS Sensorik GmbH has made a name for itself throughout Germany, across Europe and beyond. The technology leader Kayser & Threde (Munich) lists MWS Sensorik GmbH on its website for crash test users (<http://www.crash-network.de>) – a fact that has since drawn the attention of distributors as far afield as the Far East to the innovative German company.

MWS Sensorik GmbH also operates on the American market. In the automotive sector, MWS Sensorik GmbH's high-quality, versatile and inexpensive products have already enabled the company to become a contact for renowned automobile manufacturers and their suppliers.

Challenges and Goals

As the options for using measuring cells depend greatly on the size of the cell, MWS Sensorik GmbH's specialists are focusing on miniaturising the components and systems used in their accelerometers. The company is working on new technologies in order to continue being able to build its products inexpensively on even smaller scales in future, and to enable it to focus on customer-specific applications in greater detail. The company is also looking to expand its portfolio of services, and to step up its activities in the calibration sector. ■

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