



Smart Rail

High-Accuracy ASC Inertial Sensors Ensure Safe and Comfortable Train Operation

Without inertial sensors, modern rail transport would be inconceivable. They detect the position of trains, monitor the state of the tracks and ensure optimum travel comfort.

ASC's new smart sensor technology can even monitor infrastructure in real time and detect damage early on, so that network operators can plan their maintenance activities even more efficiently in the future. Inertial sensors perform numerous important tasks in the development and operation of trains. One of them is high-precision measurement of oscillations and vibrations on rolling stock, tracks and bridges. The data obtained from these measurements form the basis for safe, comfortable rail transport. Engineers can draw valuable information from them for train design and infrastructure maintenance. Sensors also ensure that the train dispatchers at the Deutsche Bahn railway control centres always know the exact location of any given train. Satellite navigation alone is not enough, because the signals are susceptible to interference.

ASC is specialised in measurement technology and manufactures a wide range of highly sensitive accelerometers and gyroscopes, as well as inertial measurement units (IMU) for rail transport testing and monitoring. The sensors collect data in a wide variety of applications – not only in rolling stock, but also on tracks.

Fatigue Strength Testing under Extreme Conditions

Capacitive accelerometers from ASC do many things, including making trains safer. Alstom, the rolling stock manufacturer, measures the running dynamics (as per EN 14363) and the bogie strength (as per EN 13749) under real-life conditions. The ASC sensors used for this purpose not only have a high signal amplitude of $\pm 2.7V$ for measurement ranges from $\pm 2g$ to $200g$, but also a wide DC frequency range of up to $7kHz$. They also have high long-term stability, enabling accurate measurement of even low linear accelerations and low-frequency, dynamic and static constant accelerations. The sensors are extremely robust to weather



ASC OS-series



ASC IMU 7

conditions, withstanding shocks of an intensity of up to $6,000g$ and operating in a temperature range between $-40^{\circ}C$ ($-40^{\circ}F$) and $+125^{\circ}C$ ($257^{\circ}F$). These are important prerequisites for use on test tracks, as the measurement technology is exposed to all kinds of weather on them.

Track Damage Detected Early

Capacitive and piezoelectric accelerometers are also essential for continuous track monitoring



(CTM). Deutsche Bahn AG has been using ASC sensors for track data acquisition on its long-distance trains for several years, with the sensors in normal operation measuring the vertical acceleration in the wheelset bearings and the acceleration inside the car bodies (as per EN 13848).

DB Systemtechnik GmbH – Deutsche Bahn’s engineering office – can use the data obtained to identify irregularities in the longitudinal level of the track structure. Variations in longitudinal level have a major impact on performance levels. If there are errors in the geometry, maintenance measures must be taken immediately. In extreme cases, whole sections of track may even have to be closed. Sensors using CTM allow potential damage to be detected and remedied at an early stage. This has absolutely no adverse effect on vehicle operation.

Smart Solutions for the Railway of the Future

ASC GmbH is a founding member of the new Digital Railway Solutions

Alliance (DRS). The alliance of leading European rail technology pioneers is committed to leveraging innovative digital technologies to improve the efficiency, safety and capacity of the worldwide railway network. ASC will support the cooperation with its entire product portfolio in analogue, digital and smart form.

The goal of the Digital Railway Solutions Alliance is to push digitalisation of railway infrastructure in order to develop sustainable, efficient solutions for rail network operators and transport companies in Europe and beyond. The idea for the alliance originated in October 2021 and has been continuously shaped and refined since, before officially launching in May 2022 at iaf, the International Exhibition on Track Technology.

ASC GmbH will assume an important role within the DRS Alliance, for example by contributing the company’s ASC AiSys® sensor systems, which will serve as an ideal basis for digitalisation of the railway infrastructure. Not only do ASC

AiSys® sensor systems process huge data quantities, they also perform pre-processing functions such as A/D conversion and filtering, and are capable of analysing and evaluating pre-processed data and features. This allows real-time monitoring of trains and tracks.

The capabilities of ASC AiSys® smart sensor systems go even further, however, such as the use of self-learning algorithms for prediction of future material fatigue. Since the sensor systems can easily be integrated in networks or clouds, they are ideal for numerous condition monitoring and predictive maintenance applications in the railway sector. ASC AiSys® smart sensor systems are also valuable in artificial intelligence applications: by converting raw data into information they provide the basis for creating digital twins, for example.

Partner of



Your Solution provider for high-accuracy inertial sensors: analog - digital - smart

Made in Germany



ASC inertial sensors ensure safe and comfortable train operation:

- EN 14363
Running Characteristics of railway vehicles
- EN12299
Ride Comfort for passengers
- EN13848
Characterisation of track geometry
- EN13749
Structural requirements of bogie frames
- Infrastructure Monitoring