SENSOR SOLUTIONS FOR RAIL VEHICLES
OUR SENSORS FOR RAILWAY APPLICATIONS

Decades on the move worldwide

Rail vehicles are subject to extreme environmental conditions. They operate in any weather and all regions of the earth. Above all the running gear must withstand large temperature changes, high atmospheric humidity, dust and stone impacts. Sensors mounted here are subjected directly to these effects.

For decades our resilient products have been proven all over the world. With our ready-to-connect sensor systems, you can reliably acquire rotational speed, temperature, acceleration or mileage for common applications in the rail vehicle.

The high availability and stable function of our products are the result of our quality policy. We are certified according to IRIS, DIN EN ISO 9001 and ISO 14001. We qualify our products for railway rolling stock in our in-house test laboratory. Our products therefore meet all common requirements such as EN 50155 and DIN EN IEC 61373 as well as DIN EN 50121-2-3.
1 Traction monitoring: rotational speed acquisition for drive control
2 Automatic train protection: acquisition of the speed
3 Bogie monitoring: acquisition of rotational speed, oscillation, vibration and temperature
4 Wheel slide protection: rotational speed acquisition for brake control
5 Maintenance: acquisition of the mileage
SPEED SENSORS

Customised acquisition of rotational speed and velocity

Our speed sensors acquire movements from 0 Hz just as reliably as they acquire fast rotations at up to 25 kHz. As they operate contactlessly, they are completely maintenance-free and wear-free.

Magnetic sensors with proven technology

With the magnetic measuring technique, the sensors scan a ferromagnetic target wheel. The magnetic field in the sensor changes due to the rotating tooth wheel and in this way modulates the voltage.

The electronics convert the modulated voltage into square-wave signals. Here the signal frequency is directly proportional to the rotational speed of the shaft. This measuring technique has been proven for decades in rail vehicles worldwide.

Lightweight design thanks to eddy current principle

On the other hand, with the eddy current technique the eddy currents induced by the measuring scale are acquired by secondary coils. The target wheels used are made of an electrically conductive material such as aluminium.

The weight-saving design is a real advantage. In addition, the sensor is ideal for use in environments containing iron as the sensor does not attract any magnetic particles such as iron chips or dust.

The solution for numerous tasks

Our speed sensors output the signals on up to four channels. By means of electrical isolation, the sensor can provide independent signals for several control units. If it also outputs a fixed voltage, e.g. the brake control system can detect standstill.

The direction of rotation of the target wheel is acquired either via a directional signal or the evaluation of two channels with 90° phase offset. Here an index pin in the flange ensures the correct assignment of the channels to the direction of rotation.

Resistant to interference fields

The inversion of the signals reduces the effect of coupled interference signals as the control system evaluates the voltage difference between the signal and the inverted signal. In this way it obtains stable measured values even with long connection cables or strong interference fields.

Sensors with current output are more suitable for usage in extreme electromagnetic interference fields as current signals are less susceptible to electromagnetic fields. A positive side effect: the control system detects a wire break without additional function monitoring.
Tailor-made for your application

We adapt our sensors to your needs. If the mounting positions of the sensor and target wheel require a specific position for the active elements in the sensor tip, we position the sensor elements to suit your requirements. We also realise special functions and special flanges for our customers. Tell us your requirement and we will integrate, for example, pulse division or a self-test into the electronics.

Irrespective of whether SIL, UIC or Ex application

Upon request we manufacture products for special applications such as the Ex area, SIL applications or for UIC requirements. We harmonise all the necessary components.

Complete systems immediately ready to use

We would be pleased to equip your sensors with cables, cable protection and connectors as complete systems save you time during wiring. We will stock individual components such as special connectors and special cables for you as necessary. We have many components always in stock:

- Railway cables from various manufacturers
- Cable protection such as Rubber sleeve, PMA conduit, Anaconda, etc.
- Connection technique
  Connectors from any manufacturer, flying lead

Every ready-for-use sensor is checked for correct function and insulation before delivery.

SPEED SENSORS

- Withstand high shock and vibration loads due to encapsulated electronics
- Withstand dust and water and meet the requirements of protection class IP 68 according to DIN EN 60529
- Operate reliably at temperatures from -40 °C to +120 °C
- Meet the EMC requirements of DIN EN 50121-3-2
- They are extremely compact and easy to mount using standard flanges
- As ready-to-connect systems, they are operational immediately
One sensor supplies signals for up to four control systems

High-quality monitoring systems ensure more safety during operation. Here the individual systems require very different signals. Anyone who is using an increasing number of control systems will find a space-saving solution with our multichannel sensors. Up to four sensor systems are integrated into one standard housing.

Four individually arranged sensor elements can be realised technically. If necessary, each system has a dedicated power supply and is decoupled electrically. A fixed phase relationship can be generated between two channels if required. It is also possible to output a standstill voltage for brake control systems.

Tailored to your application

We will prepare an individual multichannel sensor for you; please state the following information in your enquiry:

- Number of electrically isolated systems (channels)
- Signal pattern required
- Signal output current and/or voltage
- Direction and/or standstill detection
- Flange shape required
- Maximum length of the sensor tube
- Special requirements (UIC, type test etc.)

Our specialists check the feasibility and clarify all technical details with you.

EXAMPLE APPLICATION

**Drive control**
2-channel voltage output with 90° phase offset and detection of direction

**Brake control**
1-channel voltage output with standstill voltage

**Event recorder**
1-channel voltage output

Key data

- 4 channels
- 3 electrically isolated measuring systems
  - 1× for drive control,
  - 1× for brake control
  - 1× event recorder

Sensor system 1
Sensor system 2
Sensor system 3
## VARIETY OF SPEED SENSORS

### Technical data

<table>
<thead>
<tr>
<th>Measuring technique</th>
<th>GEL 247</th>
<th>GEL 247/1</th>
<th>GEL 247/4</th>
<th>GEL 247/5</th>
<th>GEL 247/6</th>
<th>GEL 247/7</th>
<th>GEL 247/8</th>
<th>Multi-channel sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of channels</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Housing material</td>
<td>VA</td>
<td>VA</td>
<td>VA</td>
<td>VA</td>
<td>VA</td>
<td>VA</td>
<td>VA</td>
<td>VA</td>
</tr>
<tr>
<td>Standard installation position</td>
<td>90°</td>
<td>90°</td>
<td>90°</td>
<td>90°/45°</td>
<td>0°/90°</td>
<td>90°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positioning using index pin</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Module of target wheel</td>
<td>1 - 3.5</td>
<td>2 - 3</td>
<td>1 - 3.5</td>
<td>1 - 3.5</td>
<td>1 - 3.5</td>
<td>1</td>
<td>1 - 3.5</td>
<td>1 - 3.5</td>
</tr>
<tr>
<td>Type test according to EN 50155</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 68</td>
<td>IP 68</td>
<td>IP 68</td>
<td>IP 68</td>
<td>IP 68</td>
<td>IP 68</td>
<td>IP 68</td>
<td></td>
</tr>
<tr>
<td>Special approvals</td>
<td>UIC</td>
<td>UIC</td>
<td>UIC</td>
<td>UIC</td>
<td>UIC</td>
<td>ATEX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output signals</td>
<td>Electrically isolated</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Voltage output (HTL)</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Current output</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Standstill voltage</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Inverted signals</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Direction of rotation detection</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Integrated interpolation</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EC = eddy current technique; Al = aluminium; VA = stainless steel; UIC = as per UIC certificate B-004/2011-04 and B-001/2019-01; ATEX = for the Ex area

### SUITABLE TARGET WHEEL

Speed sensor and target wheel form a unit on the acquisition of rotations. We would be pleased to manufacture a suitable target wheel for your sensor.

- Made of ferromagnetic steel
- Modules from 0.2 to 3.0
- Involute gear teeth (others upon request)
- Outside diameter from 150 mm to 500 mm
- Individual inside diameter
- Ready to mount with bores, feather keyways etc.
- Standard tooth wheels are available on short delivery times from stock
ACQUISITION OF VIBRATION AND TEMPERATURE

Detecting overloads on the running gear at an early stage

In motors and bearings, the temperature is indicative of uneconomical or even critical states. Our compact platinum resistor thermocouples acquire every change and make undesirable heating on the running gear clearly apparent.

Temperature acquisition
› Pt100 or Pt1000 measuring element
› Measuring range from -40 °C to +250 °C
› Connection using 2, 3 or 4-wire technology

Mechanical effects such as wheel flats on the wheel or defects on the rail subject the running gear to loads. To detect these loads at an early stage, we use MEMS blocks, among others. The measured values from these blocks provide information on the shocks and vibration suffered.

Vibration and shock acquisition
› Up to 3 measuring axes (x/y/z)
› Measuring range up to 700 m/s²
› High shock resistance (< 4000 g)

Temperature acquisition with minimal effort

The compact thermocouples according to DIN EN 60751 are available with stainless steel tube and brass flange. For an optimal measurement, we adapt the length of the measuring tube to your application. The temperature sensors are checked according to DIN EN 50155 and meet protection class IP 68.

Upon request we manufacture special flanges or connect the sensor to a speed sensor via a cable harness. This feature significantly simplifies the cabling.
Optimally utilising the tight space on the bogie and measuring three variables at once

Due to limited installation space, it is often necessary to combine several sensor types in one housing. Our CombiCODERs provide the perfect solution here. They measure rotational speed, temperature and vibration at the same time. We combine the components individually to suit your requirements and adapt the shape as necessary.

Using the CombiCODER, you can reduce the effort for mounting and maintenance significantly. Instead of three or four sensors, you only need to mount and check one sensor.

### COMPLETE SYSTEMS

**Easy mounting and reliable operation**

Ready-to-connect sensors save time during mounting. Hundreds of products fitted with cables and connectors leave our works every day. Use complete systems and reduce the work steps on the vehicle.

Especially in railway engineering, the components fitted must meet an extensive array of standards and directives. We would be pleased to advise you on the configuration of your sensor in relation to the cables and connectors that can be used. We base the evaluation of the materials on the following standards:

- Fire-resistant in accordance with DIN EN 45545
- Halogen-free in accordance with DIN EN 50267-2-1
- Flame-retardant in accordance with DIN 50265-2 / DIN 50266-2
- Temperature, UV and ozone-resistant

Tell us about your requirements and we will agree with you the right material.

---

<table>
<thead>
<tr>
<th></th>
<th>Rotational speed 1/2 channels</th>
<th>Temperature Pt100 / Pt1000</th>
<th>Vibration/shock 1/2/3 axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>2</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>4</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>
Precise measured values are required these days for real-time regulation. Here rotary encoders with integrated bearings are used. It is typical for these measuring systems that the scanning unit and target wheel are integrated into one housing. Both components are exactly matched. With pulse numbers of up to 10,000 increments per turn, the encoders cover all measuring ranges in the vehicle and have been proven for decades in railway rolling stock.

**Proven incremental rotary encoders**

Our magnetic incremental encoders acquire the angular change on a rotating shaft. The integrated sensors contactlessly scan the target wheel installed.

The magnetic sensor provides $1-V_{pp}$ differential signals and HTL or TTL signals. It is possible to derive from the signals generated the direction of rotation, the distance covered and the speed of the rotating shaft.

**One axle encoder – many output signals**

For wheel slide protection, train protection and ancillary applications on the bogie we offer special multichannel axle encoders. They provide different signals for several control systems and therefore exploit their full potential.

The sensors output independent square-wave signals on up to eight channels. Here the push-pull electronics generate up to three different pulse numbers. Output takes place either in voltage or current levels.

Configuration and output of the channels can be carried out individually or in groups with a fixed phase relationship. In this way the characteristics of the output signals can be matched exactly to the control units. As such you obtain a solution individually tailored to the application.
Measuring systems for high loads

Extreme shaft loads often occur in railway rolling stock. For this specific case we offer precision speed sensors with a special coupling. The integrated, flexible hollow shaft coupling with a diameter of 20 mm permits mounting on motors with high axial and radial shaft motion. Alternatively, the rotary encoder is available with a 16 mm solid shaft.

Up to 5 independent, fully encapsulated sensor modules can be positioned in a stainless steel housing. We individually adapt each module to your application and the control system. As such the system is of versatile application.

Withstanding extreme weather conditions

All rotary encoders provide exact measured values even with changing temperatures, humidity, heavy vibration, and condensation. Additional protection measures can be selected for special environmental effects, for instance protective lacquers or a condensation drain. Talk to us.

ROBUST MAGNETIC INCREMENTAL ENCODERS

<table>
<thead>
<tr>
<th>Features</th>
<th>Axle encoder GEL 27xx</th>
<th>Incremental rotary encoder GEL 293</th>
<th>Precision rotary encoder GEL 295x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulses per turn</td>
<td>800</td>
<td>266,240</td>
<td>1024</td>
</tr>
<tr>
<td>Housing diameter</td>
<td>155 mm</td>
<td>115 mm</td>
<td>115 mm</td>
</tr>
<tr>
<td>Output signals</td>
<td>A/B/N, A/B/N, A/B/N</td>
<td>A/B/N, A/B/N, Speedometer signal</td>
<td>A/B/N, A/B/N, Sin/Cos 1 Vpp</td>
</tr>
<tr>
<td>Signal level</td>
<td>HTL / TTL</td>
<td>HTL / TTL</td>
<td>HTL / TTL</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 67</td>
<td>IP 66</td>
<td>IP 67</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 °C to +100 °C</td>
<td>-20 to +85 °C</td>
<td>-40 °C to +120 °C</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>10 to 30 V DC / 5 V DC</td>
<td>10 to 30 V DC / 5 V DC</td>
<td>10 to 30 V DC / 5 V DC</td>
</tr>
<tr>
<td>Housing material</td>
<td>Aluminium</td>
<td>Polyamide glass fibre reinforced with stainless steel flange</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Maximum permitted rotational speed</td>
<td>5000 min⁻¹</td>
<td>8000 min⁻¹</td>
<td>6000 min⁻¹</td>
</tr>
</tbody>
</table>
Analyse the state of every wheel set and optimise maintenance using the data provided via RFID.

- Mileage
- Date and time of readout
- Data from the last reading
- Type, number and diameter of wheel set
- Wagon number
- Serial number of the encoder
- Status of temperature limit violation

ODOMETER

Proven odometer lowers costs sustainably

The predictive maintenance of goods wagons is intended to minimise downtimes. Because wear is dependent on utilisation, the acquisition of the mileage is useful. Utilisation-dependent maintenance with our energy self-sufficient odometer has significant advantages:

- Lowers the repair costs if wear parts are replaced as a function of the mileage before consequential damage occurs.
- Increases the vehicle availability because unexpected failures are avoided.
- Is free of operating costs because the system does not have any batteries and is wear-free in operation.
- Reduces the maintenance costs because the data are read and evaluated with the aid of a portable reader via RFID.
- Provides more billing transparency for rented goods wagons.

The basis of the system is formed by an incremental encoder that is mounted on the bearing cover. It obtains energy by induction from the rotational movement of a magnetic assembly that sits on the bearing’s pressure plate. It has already been in use successfully for 10 years. It saves the contactlessly acquired revolutions internally. The measured values and the wheel set data configured are read via RFID using a portable reader. The data can be further processed using a USB port or via WLAN, for example in a maintenance program.

- Batteryless, maintenance-free operation
- Monitoring of temperature thresholds
- Usage in potentially explosive atmospheres
- Can be retrofitted to any axle effortlessly
SENSOR TESTER

Greater certainty during vehicle maintenance

Out tester optimises maintenance and service work on rail vehicles. Using this device your technicians can check the operating behaviour of any speed sensors. Provided the sensor has a current or voltage output and provides square-wave signals.

The portable device measures and compares the signals on the individual channels or tracks. It outputs values such as output voltage, signal level, phase offset and duty on a display device connected via WLAN or Ethernet. Here the entire data conversion and evaluation process takes place in the tester, without any additional software or app.

Irrespective of whether you use a smartphone, laptop or tablet, the integrated web browser displays the signals graphically. This information makes it easier to analyse the operating behaviour. At the press of a button, a report documents the measured values and can be printed out and saved. This feature gives you more certainty during the sensor test.

Connection is particularly convenient with the aid of the Interface-Box. This box supplies the sensor and tester with electrical power and provides the communication via Ethernet. The necessary connection cables are also available as is a test jig including target wheel with customer-specific module. A movable bracket with holes for common flanges on railway rolling stock sensors ensures set-up is quick.

Tester, interface box with power supply unit and connection-ready cables, together with a test jig with variable mounting brackets, are available as a complete set. If necessary, we will assemble the necessary connection cables for you to suit your connector variants.
Vehicle availability and route utilisation are key drivers in railway rolling stock today. These requirements are ensured by numerous control systems and an ever-increasing number of measuring devices on the vehicle. Integrated solutions will be necessary in the future to follow this trend.

Our response is called i$^3$SAAC. These are integrated, intelligent and interactive Sensors that exchange their data with Autonomous Actuators and Controllers. As such our solutions provide not only measured values but also valuable and condition-oriented information. The upstream instance receives the necessary specific, prepared data.

A part of our multifunctional speed sensors are an example. Several measuring elements are integrated into one housing; these elements output the data on rotational speed, temperature and vibration. In addition, information on the condition of bearings, the status of the measuring scale or histograms can be provided serially.

The functions we realise with i$^3$SAAC are essentially designed by our customers as we develop our products for you and your applications.
On accelerating a weight of several thousand tons, the control of the physical forces presents a technical challenge. Today the special control systems for drive and brake control or train protection undertake this task.

These systems must operate reliably even in extreme conditions. However, some components are directly subjected to the weather, as well as stone impacts and dust. Sensors for example are mostly mounted on the running gear and must withstand much.

For this reason, the electronic components in our products are protected against extreme weather conditions, humidity, shock and vibration by special manufacturing methods. Our long-lasting sensors have been proven in rail vehicles for decades. The majority of these are individual solutions that we have developed for an application in close cooperation with our customers.
OUR SOLUTIONS FOR YOUR APPLICATION

1 Traction monitoring

When a train pulls away, up to 3,000 tons of inertial mass must be accelerated. To prevent the wheel sets from spinning, the drives are controlled by a control system.

It synchronises the output of motors and distributes the power evenly between the axles. Sensors installed on the motor or on the gear acquire the rotational speed and direction of rotation of the drive.

Our speed sensors detect standstill just as reliably as the achievement of maximum speed. With a measuring range from 0 Hz up to 25 kHz, they are excellently suited for this task.

Alternatively, our incremental rotary encoders are used for drive control. They are characterised by high reliability even under the most extreme shock and vibration loads.
2 Automatic train protection

Systems for Automatic Train Protection (ATP) ensure, among other aspects, that the speed allowed is not exceeded and the distance to the train in front is maintained.

One control parameter for these systems is the speed of the train. The system determines this parameter from the rotational speed of the axles. Ideally, this speed is measured directly at the wheel set.

Our robust multichannel incremental encoders are designed for mounting on the end of the axle. These axle encoders provide reliable measured values for various tasks of automatic train protection even at high loads.

At high mechanical loads, precision rotary encoders are an alternative to axle encoders. However, speed sensors are also used in this application.

3 Bogie monitoring

The bogie not only carries an enormous weight, but it also absorbs the forces acting on the tyres and bearings. For this reason, continuous monitoring of the running gear is particularly important for safe operation as wear and material fatigue appear in many forms. Today an increasing number of measured parameters ensure safety. On the other hand, the installation space on the bogie is limited.

Our rotational speed and temperature sensors provide the necessary measured parameters to detect safety-related events on the bogie and to eliminate malfunctions at an early stage.

If the space is limited, combined systems are more suitable. Our CombiCODERs and multifunctional axle encoders also acquire the temperature and acceleration along with the rotational speed. They utilise the space optimally.

4 Wheel slide protection

Wheel slide protection systems are intended to prevent the blocking of wheel sets during the braking process. The blocking of the wheel sets produces wheel flats on the tyre that cause premature wear on the bogie and on the rails. For this reason, wheel slide protection systems control the braking force on each individual axle.

They evaluate the rotational speeds of the individual vehicle axles for exact brake control. Our speed and multichannel sensors comply not only with common railway standards, but also with the conditions from the UIC for usage with common brake control units. For this reason, they are particularly appropriate for wheel slide protection systems.
Product Qualification

Tested by us and reliably in use worldwide

Equipment must function trouble-free and reliably. The basis for this situation is created by standards that define the characteristics and test methods. Our accredited laboratory gives you the certainty that our products have been tested in accordance with the standards as the accreditation according to DIN EN ISO / IEC 17025 proves that we meet all requirements that are placed on an independent laboratory.

At the same time, it verifies that our laboratory has a suitable management system and competent test personnel. Both are regularly assessed and monitored by Deutsche Akkreditierungsstelle (DAkkS), the national accreditation body for Germany. Our laboratory is listed in the DAkkS register (D-PL-20731-01).

Upon request, you will receive qualified measuring systems with an internationally recognised conformity assessment.

Accredited EMC and Environment tests

- DIN EN 50121-3-2  Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus
- DIN EN 50155  Railway applications – Rolling stock – Electronic equipment
- DIN EN 60068-2-1  Environmental testing – Part 2-1: Tests – Test A: Cold
- DIN EN 60068-2-2  Environmental testing – Part 2-2: Tests – Test B: Dry heat
- DIN EN 60068-2-14  Environmental testing – Part 2-14: Tests – Test N: Change of temperature
- DIN EN 60068-2-30  Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic
- DIN EN 60068-2-64  Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance
- DIN EN 60529  Degrees of protection provided by enclosures (IP Code)
- DIN EN 61000-4-2  Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques; Electrostatic discharge immunity test
- DIN EN 61000-4-4  Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
- DIN EN 61000-4-5  Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
- DIN EN 61373  Railway applications – Rolling stock equipment – Shock and vibration tests

We conduct other environment and EMC tests, for example according to DIN EN 61000-4-8, upon request. If necessary, we will prepare with you a specific test plan. Talk to us.
QUALITY AND SERVICE

Quality products for high availability

A large portion of our products are used in long-term investment goods such as rail vehicles. Hence, the strategic corporate goals of durable excellent product quality and high level of reliability are pursued in their entirety in all business segments.

For us quality management starts as early as product development and extends as a common theme through all areas of the organisation. Each year we subject our measures to internal and external audits. As such we are certified to DIN EN ISO 9001, ISO 14001 as well as the railway standard IRIS.

This is your guarantee for durable and reliable products. Our customers also have the option to audit us as a supplier at any time.

It is our goal to achieve a reliable measuring solution for your application. We look forward to accepting the challenge!

The right contact person for every issue

Whether new development or further development, we support you during every phase of your project with our know-how. It is our vision to impress our customers as a solution provider for sensor or actuator-related system intelligence. From the first contact to after-sales service, we offer you comprehensive support.

Your applications require a specific sensor or you need information on a product? Our support team will clarify all technical questions and will be pleased to prepare you a quotation. Simply send us your enquiry!

Technical support +49 208 9963 - 215 support@lenord.de

You need the products urgently, or you have questions about delivery conditions, repairs or an order? Our Customer Service Center will be happy to assist you with commercial queries!

Customer Service Center +49 208 9963 - 216 kundencenter@lenord.de