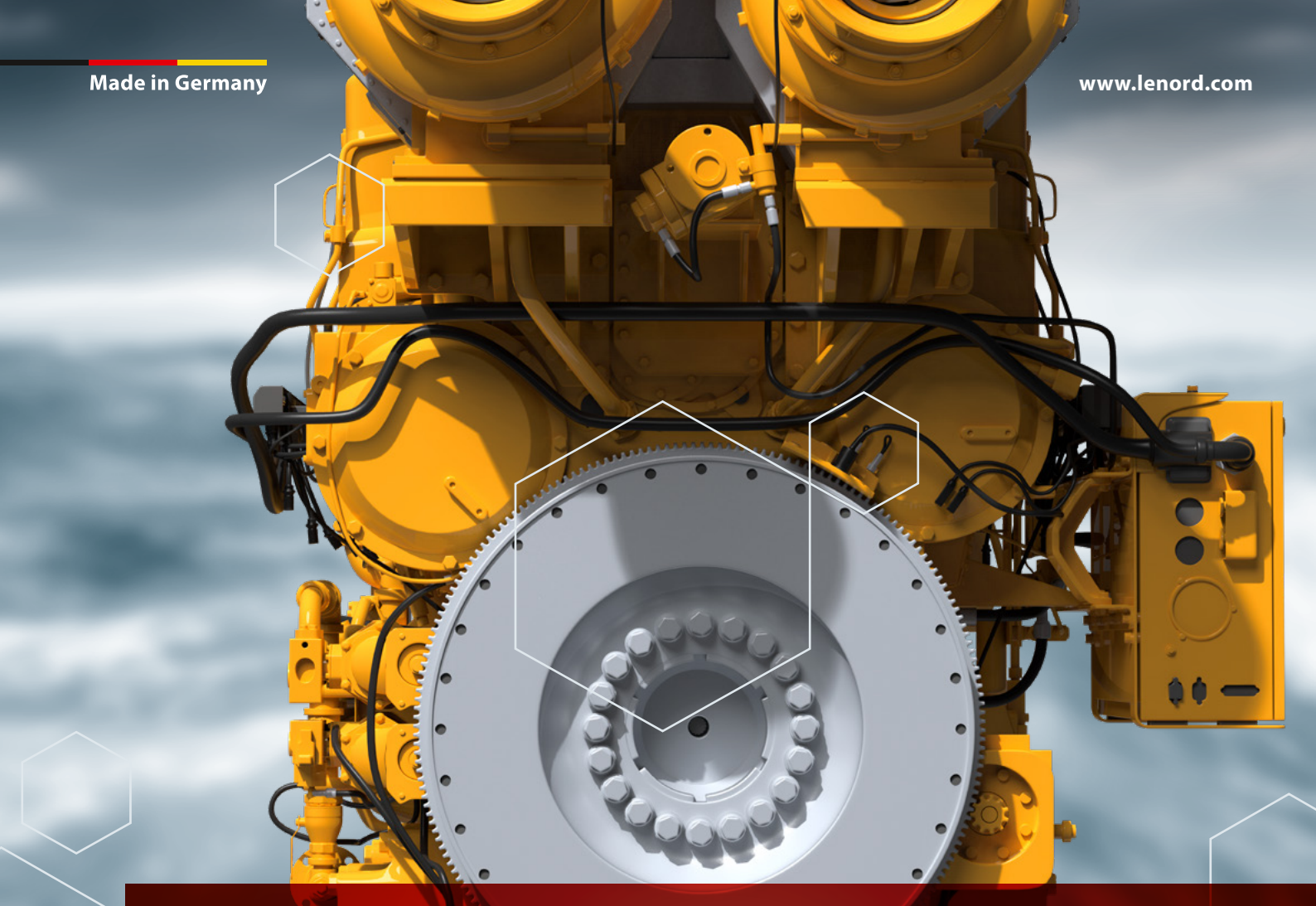
Made in Germany

www.lenord.com

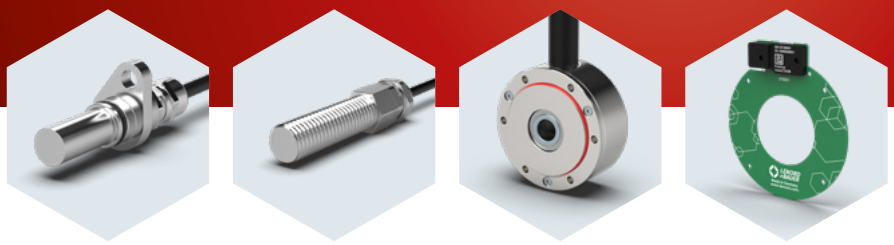


Product line

Motion sensors

for maritime applications

- Railroad rolling stock
- Packaging machines
- Machine tools
- General mechanical engineering
- Renewable energies
- E-mobility
- **Maritime applications**



Motion sensors and integrated drive technology

LENORD +BAUER

Finding solutions. Founding trust.

On the high seas for 20 years

Sensors for maritime combustion engines and electric motors

Trust our expertise in drive technology. For over 20 years, we have been developing and supplying sturdy and reliable pole wheel and speed encoders for maritime applications. These encoders are used for speed control or positioning in cruise ships, special ships and tankers. They also detect rotation angles in pod drives and positions in sluice gates. Furthermore, they are used in gearbox and winch applications. We provide sensors with ATEX certification for potentially explosive areas.

Our durable products have proven themselves under extreme operating conditions such as high temperature fluctuations, vibrations, shock, salt water and fog as well as critical electromagnetic fields.

As a recognized development partner, we create individual and pioneering customer solutions and harmonize your technological and economic system requirements. We are already implementing innovative sensor technology today for your future requirements.

Your advantages at a glance

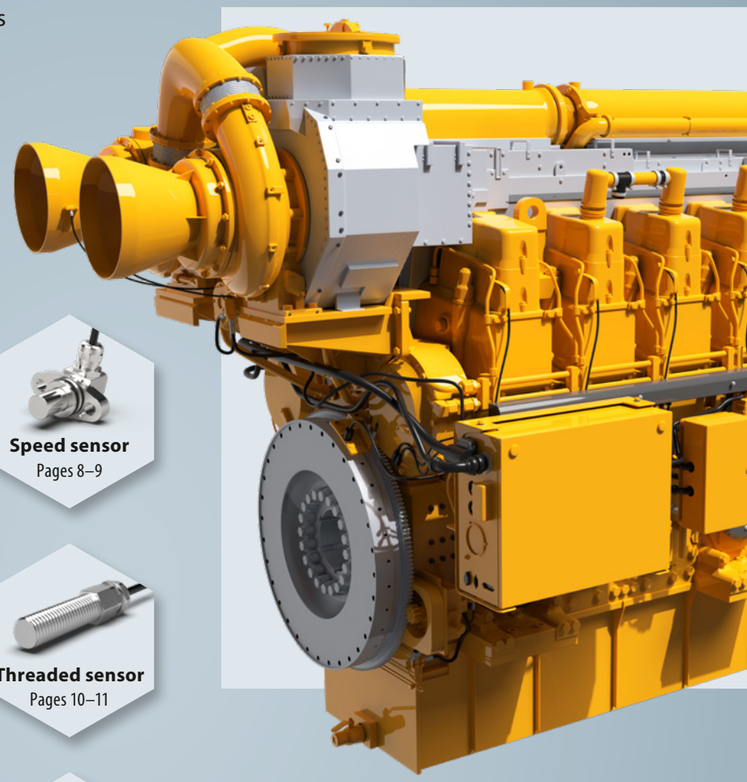
- Shock and vibration resistant due to encapsulation of the electronics
- Reliable at temperatures from -40 °C to +120 °C
- Degree of protection IP 68: Dust and waterproof according to DIN EN 60529
- Electromagnetic compatibility according to DNV-CG-0339

For use even under extreme conditions

Oils and lubricants do not impair the function of our robust sensors. Even acid-resistant and explosion-proof product types have already been implemented.

The ideal solution for every application

Whether for combustion engines, hybrid drives or electric motors, we supply the right sensor technology for your drive train.



Conventional drives with diesel engine

On the high seas, you have to be able to rely on technology that works. The durability and robustness of the installed components are therefore of primary importance. That is why the electronic components of our products are protected from extreme climate conditions, humidity, shock, impact and vibration by special manufacturing methods. Our durable sensors have stood the test in heavy-duty applications for decades.

Our plug-and-play sensor systems reliably acquire rotational speed, temperature, and acceleration.

Speed sensor
Pages 8–9

Threaded sensor
Pages 10–11

CombiCODER
Pages 12–13

Rotary encoder
Pages 14–15

VarioCODER
Pages 16–19

Electrified drive train

Electric drives are also becoming increasingly important in the maritime industry. Electric motors are emission-free, silent and less maintenance-intensive. Drive control using high-resolution sensors is vital. This not only increases the motor performance and reliability, but also energy efficiency.

Electric drive motors are becoming more compact, and have to accommodate more and more power per kilogram of drive weight. Modern sensor technology must be able to adapt to these requirements with flexibility. That is why we realize customized designs for you. **We adapt to the installation conditions of the motor, not the motor to our sensor.** For both asynchronous and synchronous electric motors, our sensors increase motor efficiency and reduce noise due to precise control.

Sensor solutions overview

Magnetic incremental or inductive

Speed sensor

- Flange- or thread-mounted
- Reliable speed sensors with HTL or TTL signals
- Robust design with various cable protection systems for mounting on the motor

Features

- Standard borehole pattern
- Low jitter signals
- Phase-true signals by adjusting to the measuring scale of the application
- Stable duty cycle of the individual tracks
- Optimum protection against environmental influences due to stainless steel housing

Advantages

- Good EMC behavior thanks to back-bias magnet technology and passive measuring scales
- Proven technology in the heavy-duty sector for years with over one million sensors installed around the world

Fields of application

- Combustion engines
- Asynchronous motors for ship propulsion and electric auxiliary drives
- Piston rods, for example in sluice gates

Incremental encoder

- Extremely robust rotary encoder with stainless steel housing for measuring rotary movements
- Contactless magnetic scanning of an integrated measuring scale

Features

- High EMC resistance and interference immunity
- Wide temperature range from -40 °C to +120 °C
- Degree of protection IP67
- Vibration resistance up to 20 g

Advantages

- Up to five measuring systems can be integrated
- Low-maintenance, durable operation in the harshest ambient conditions
- High resistance to condensation, splash water, condensation and chemically aggressive substances

Fields of application

- Winches and crane applications
- Asynchronous motors for ship propulsion systems

VarioCODER rotor position encoder

- Reliable rotor position encoders with sine and cosine signals
- Installation kit for direct integration in the motor
- Compatible with all standard controllers and inverters with sin/cos interface

Features

- Offset-free signals with very good amplitude synchronization over the entire temperature range
- Attainable angular accuracy < 0.5°el.
- Immune to stray magnetic fields from the motor due to magnet-free technology
- Suitable for high-speed motors
- ASIL C-capable as an individual sensor or ASIL D-capable as a multiple sensor

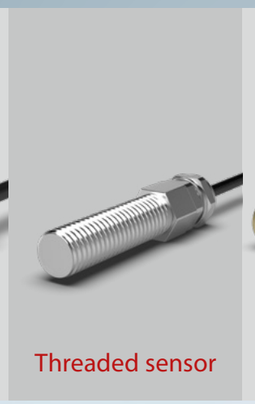
Advantages

- Customizable for the specific installation location in the motor
- Significantly more mounting options are allowed than with conventional resolver systems
- Immediate signal output for calculating the angle after switching on without reference search routine
- High reliability with regard to mechanical loads
- Customized function samples and C samples available within a few weeks

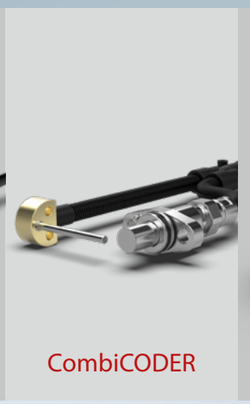
Fields of application

- Marine and auxiliary drives
- Synchronous PM, IPM and reluctance motors

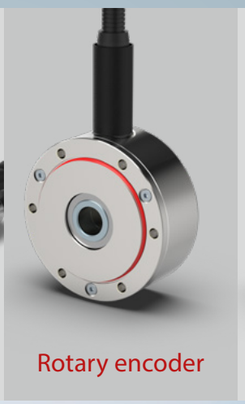
Speed sensor



Threaded sensor



CombiCODER



Rotary encoder

VarioCODER

High drive efficiency thanks to smart sensor solutions

Speed sensor

The solution for a wide range of tasks

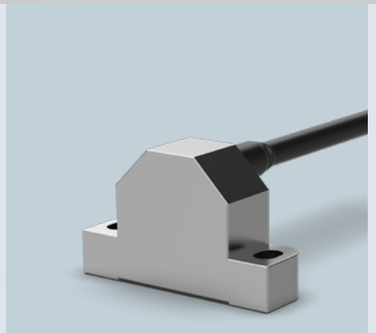
Our speed sensors output the signals on up to eight channels. Due to electrical isolation, the sensor can issue independent signals for multiple control units. Additional diagnostic modes can also be implemented, for example to detect standstill, direction of rotation, cable breakages or short circuits reliably.

We adapt our sensors to your needs. If the mounting position of the sensor and measuring scale requires a specific position of the active elements in the sensor tip, we position the sensor elements according to your requirements. For example, highly dynamic, short-wave air gap changes can occur between the flywheel and the sensor when the ship is operating at full load. We counter these with individually adapted speed sensors using special sensor elements.

We also design special functions and special flanges for our customers on the basis of our extensive modular system. Tell us your wishes and we will integrate, for example, a pulse divider or a self-test in the electronics.

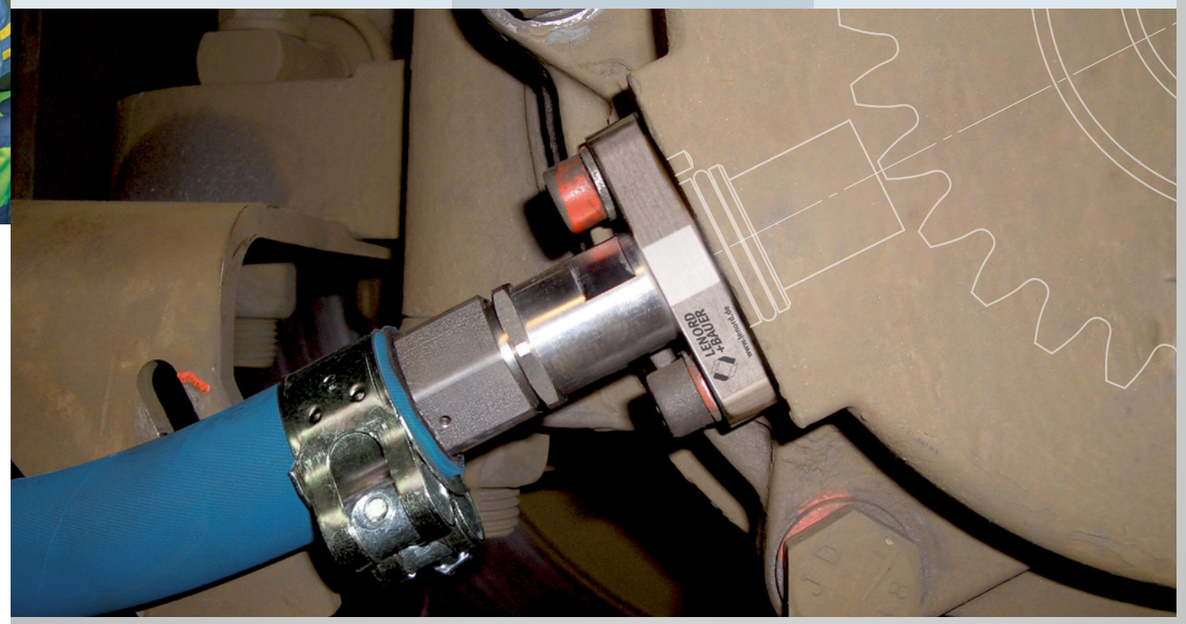
On request, we certify products for special applications such as ATEX or for DNV applications. We coordinate all necessary components and offer you support to certify your system.

GEL 247



GEL 248

GEL SEI10



Customized sensors from the modular system

Product advantages at a glance

- Shock and vibration resistant due to encapsulation of the electronics
- Resistant to chemicals
- Safe detection of slow motion (0 Hz)
- Simple mounting: Extremely compact design with standard flanges
- Reliable at temperatures from -40 °C to +120 °C
- Ready for immediate use as a plug-and-play system

Whether they are part of the wider portfolio or are customer-specific – Lenord+Bauer sensors are durable, high-quality and tested to comply with standards in every respect.

Threaded sensor

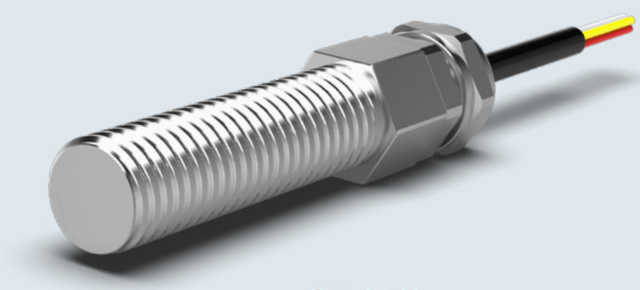
Space-saving rotational speed measurement

In addition to tried-and-tested speed sensors with flange housing, threaded sensors with one or alternatively two channels are another assembly variant for threaded or through holes. These space-saving sensors can be easily integrated into existing designs without any mechanical adjustments thanks to standard thread types and nominal lengths as well as individual cable fabrication.

They acquire the rotational speed and direction of rotation directly at the motor or gearbox and detect even the smallest movements of the drive with a measuring range of 0 Hz to 20 kHz.

Robust, high-resolution sensors were developed for use in the harshest ambient conditions. They are suitable, for example, for regulating the ignition and injection timing for engine monitoring. To calculate the crankshaft position, a threaded sensor scans a flywheel on the camshaft. Missing teeth as reference marks make it possible to determine the correct position.

The maintenance- and wear-free magnetic measuring system in the thick-walled stainless steel housing withstands both shocks and vibrations. Certification in accordance with DNV, SIL, ATEX or IECEx is possible as an option.



GEL 2460

Product advantages at a glance

- Multi-channel capability
- Shock and vibration resistant due to encapsulation of the electronics
- Thick-walled stainless steel housing
- Also in customer-specific thread types and lengths
- Safe detection of slow motion (0 Hz)
- Special types also in small quantities

We adapt our highly integrated sensor technology to your thread sizes.

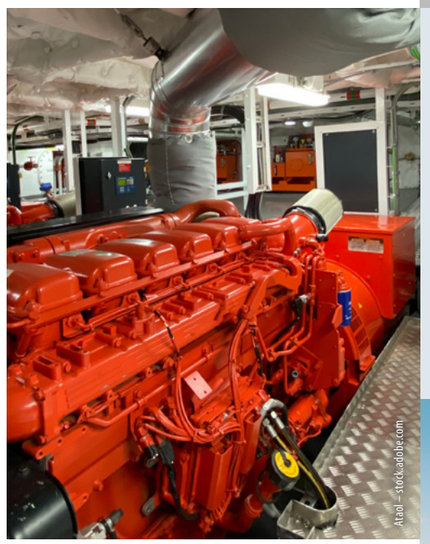
For retrofitting or new constructions: Use threaded sensors with a measuring range from 0 Hz.

CombiCODER

Acquisition of rotational speed, vibration, and temperature

The temperature of motors and bearings can indicate inefficient or even critical conditions. Our compact platinum resistance thermometers record any changes and warn of any unwanted heat build-up. The compact temperature sensors according to DIN EN 60751 are available with stainless steel tubes and brass flanges. For optimal measurement, we adapt the length of the measuring tube to your application.

If the installation space is limited, our CombiCODER combines several sensor types in a single housing. For example, they simultaneously measure rotational speed, temperature and vibrations. Alternatively, we combine different sensors individually according to your specifications and adapt the design if necessary. Your advantage: Instead of mounting three to four sensors, you only have to mount and test one sensor. This significantly reduces the time required for assembly. Upon request, we manufacture special flanges or connect, for example, the temperature sensor to a speed sensor using a cable harness. This greatly simplifies cabling.



CombiCODER

Our sensors have proven themselves in demanding drive applications for decades.

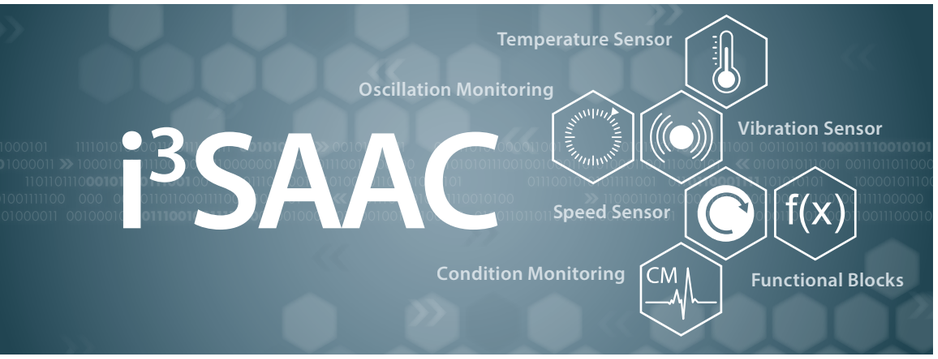
Temperature acquisition

- Pt100 or Pt1000 measuring elements
- Measuring range from -40 °C to +200 °C
- Connection in 2-, 3- or 4-wire technology
- Degree of protection IP 68

Vibration and shock acquisition

- Up to 3 measuring axes (x/y/z)
- Measuring range up to 100 m/s²
- High shock load capacity up to 4,000 g
- Analog or digital output signals

Preventive maintenance in ship propulsion



Our solutions provide not only measured values but also valuable condition-based information. The use of oscillation monitors in our systems enables you to make more accurate forecasts of the drive status and therefore more precise predictive maintenance.

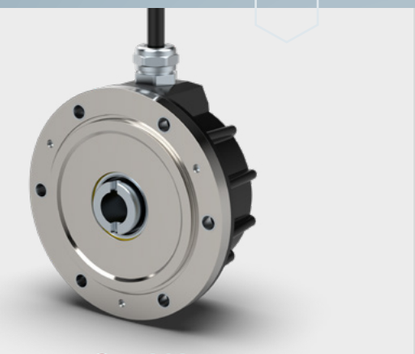
Rotary encoder

Tailored for extreme conditions

Precise measured values are required for dynamic drive control. Rotary encoders with their own bearings and a wide variety of housing designs are used in this instance. A typical feature of these measuring systems is that the scanning unit and the measuring scale are integrated in a single housing. Both components are precisely matched to each other. With pulse rates of up to 10,000 increments per revolution, the encoders fulfill high accuracy requirements.

Our proven magnetic incremental encoders acquire the change in angle on a rotating shaft. The integrated sensors scan the built-in measuring scale in contactless mode. The magnetic sensor system supplies 1-V_{pp} differential signals and HTL or TTL signals.

All rotary encoders provide accurate measured values even under changing temperatures, humidity, strong vibrations and condensation. Additional protective measures can be selected for special environmental influences, such as protective coatings. Talk to us.



GEL 293

GEL 295

Low-maintenance sensors for precise drive control

Product advantages at a glance

- High mounting tolerance due to integrated measuring scale
- Suitable for numerous applications
- Special coupling reduces backlash
- Magnetic sensors, no optical system
- Upon request with reference pulse
- High resolution

Gain accuracy with proven sensor technology.

Product qualification

100 % tested and reliable in use worldwide

Our products are installed in durable capital assets such as boats and ships or in crane systems. These must function trouble-free on a permanent basis. Our sensor solutions make a significant contribution to this. They are characterized by excellent product quality and high reliability. These points are embedded in our strategic corporate goals, which we pursue holistically in all corporate areas.

Quality management for us already begins in the product development stage and is a constant in all business areas. Every year, we put our measures to the test in external and internal audits.

This is your guarantee for durable and reliable products. We also offer our customers the opportunity to audit us as a supplier at any time.

Our goal is to provide you with a reliable measurement solution for your application. We are keen to meet the challenge!

EMC and environmental testing

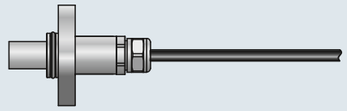
Standard	Testing and measurement techniques
DIN EN 60068-2-1	Environmental testing – Test A: Cold
DIN EN 60068-2-2	Environmental testing – Test B: Dry heat
DIN EN 60068-2-14	Environmental testing – Test N: Change of temperature
DIN EN 60068-2-27	Environmental testing – Test Ea and guidance: Shock
DIN EN 60068-2-30	Environmental testing – Test Db: Damp heat, cyclic
DIN EN 60068-2-64	Environmental influences – Test Fh: Vibration, broadband noise (digitally controlled) and guidance
DIN EN 60529	Degrees of protection provided by enclosures (IP code)
DIN EN 61000-4-2	Electromagnetic compatibility (EMC) – Electrostatic discharge immunity test
DIN EN 61000-4-4	EMC test and measurement processes – Testing electromagnetic immunity to transient electrical disturbances/burst
DIN EN 61000-4-5	Electromagnetic compatibility (EMC) – Surge immunity test
DIN EN 61000-4-6	Electromagnetic compatibility (EMC) – Immunity to conducted disturbances, induced by radio-frequency fields

Our standard portfolio includes sensors that are subjected to extensive endurance tests in our own laboratory. These are certified in accordance with the relevant norms and standards, depending on their intended use.

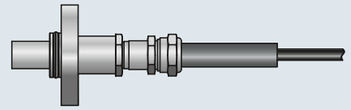
Among others, some of our sensors have been certified in accordance with DNV according to DNV-CG-0339, ATEX according to Directive 2014/34/EU and IECEx according to EN IEC 60079-0.

Easy to mount and reliable in operation

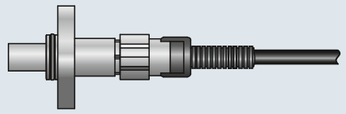
Examples of possible cable outlets



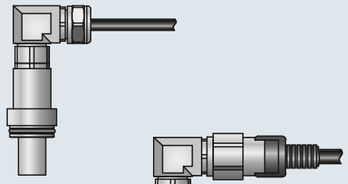
Standard, straight



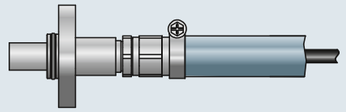
Anaconda Sealtite, straight



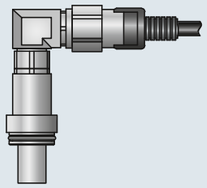
Flexible conduit, straight



with 90° angle



Rubber sleeve, straight



with 90° angle and flexible conduit

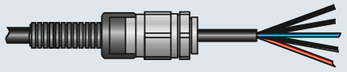
Plug-and-play sensors save time during assembly. Hundreds of products equipped with cables and connectors leave our factory every day. Use complete systems and reduce the number of operations.

Tell us your requirements and we will coordinate the suitable material with you.

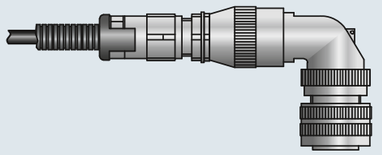
We can equip your sensors with cables, cable protection and connectors using highly specialized manufacturing processes, because complete systems save time and assembly costs. We have a permanent stock of many components for customer-specific designs.

Every sensor undergoes a detailed routine test before delivery. Correct execution of the core assignment and compliance with the insulation voltage and naturally all necessary electrical parameters are checked and documented. This is also the case for customer-specific versions. There are no exceptions.

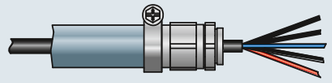
Examples of possible cable ends and connectors



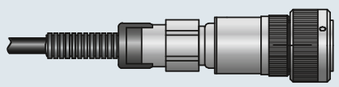
Flexible conduit and flying lead



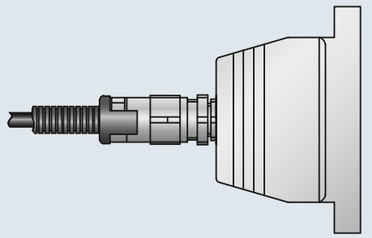
Flexible conduit with round connector angled



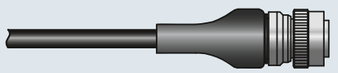
Rubber sleeve and flying lead



Flexible conduit with round connector



Flexible conduit with rectangular connector (HTS connector)



Cable with shrinkable molded part

VarioCODER

You have requirements. We have solutions.

Designers of electric drives often face a dilemma: They either choose a standard sensor, which has to be integrated in a complex process, or they have a customized sensor developed, which is expensive and often not sufficiently robust and accurate.

The solution is our VarioCODER inductive rotor position encoder. Thanks to modern design and production methods, you will receive a customized, zero-series sample in the shortest possible time. Thanks to its variable geometry and configurable technical features, it always fits perfectly and is currently the best price-performance package on the market. The electronics are state of the art. This is reflected in a high stray field immunity, a very short latency and a wide temperature application range. It also sets the standard for the accuracy of rotor position encoders.

GEL SEK10

The configure-to-order process for the VarioCODER

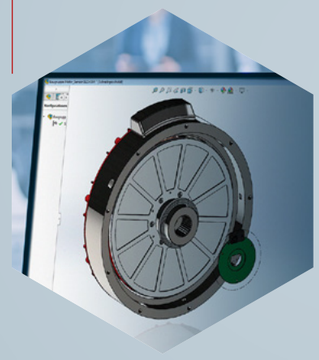
In just a few steps, we will help you find your individual sensor solution.

Understanding requirements

In an initial meeting, we discuss the details of your application, the installation location and available installation space, mechanical tolerances and interfaces with your control system.

Product planning

We configure a suitable product from our modular system for you based on your specifications.



Creating a C sample

You will receive your individual C sample within a few weeks.

Customized qualification

If necessary, we can perform additional tests in our in-house laboratory.

Start of delivery

After receiving your approval for series delivery, we utilize digital and automated supply chains.

Figures: Gorodenkoff – stock.adobe.com

Synchronous or asynchronous

The right sensors for electrified drive trains

Efficiency, noise and durability of electric motors depend on the control performance. Our speed sensors and rotor position encoders provide you with highly accurate feedback data for drive speed and torque control.

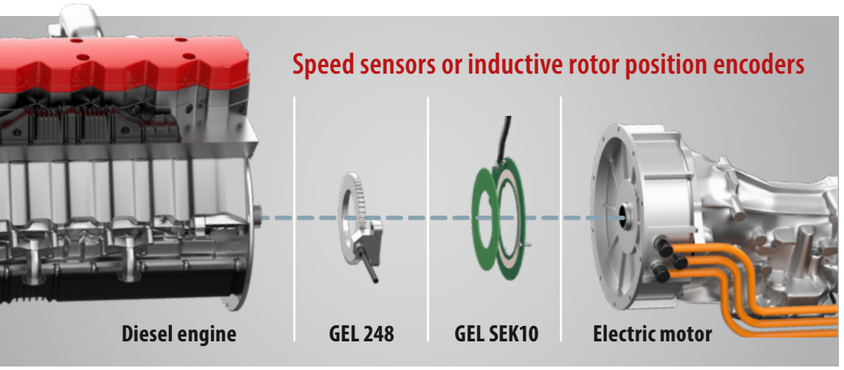
The inductive rotor position encoder provides stable, offset-free sine and cosine signals corresponding to the number of pole pairs of the synchronous machine. This signal quality is vital for optimal analog/digital conversion of the controller, as offsets and amplitude errors lead to incorrect quantification and thus incorrect calculation of the angle. This has a direct influence on the drive control accuracy.

Its compact and installation-tolerant design, insensitivity to stray electromagnetic fields, and cost-effective construction and connection technology make it a superior alternative to resolver systems commonly in use today.

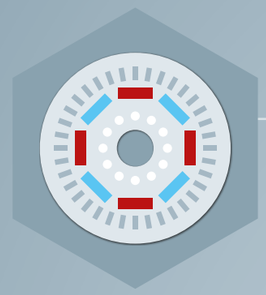
Do you use asynchronous motors? You can rely on our robust incremental encoders. These encoders provide AB signals and are suitable as an option for safety-critical applications thanks to their self-diagnostic capability or defined standstill signals.

Gorodenkoff – stock.adobe.com

Space-saving solution also for hybrid motors

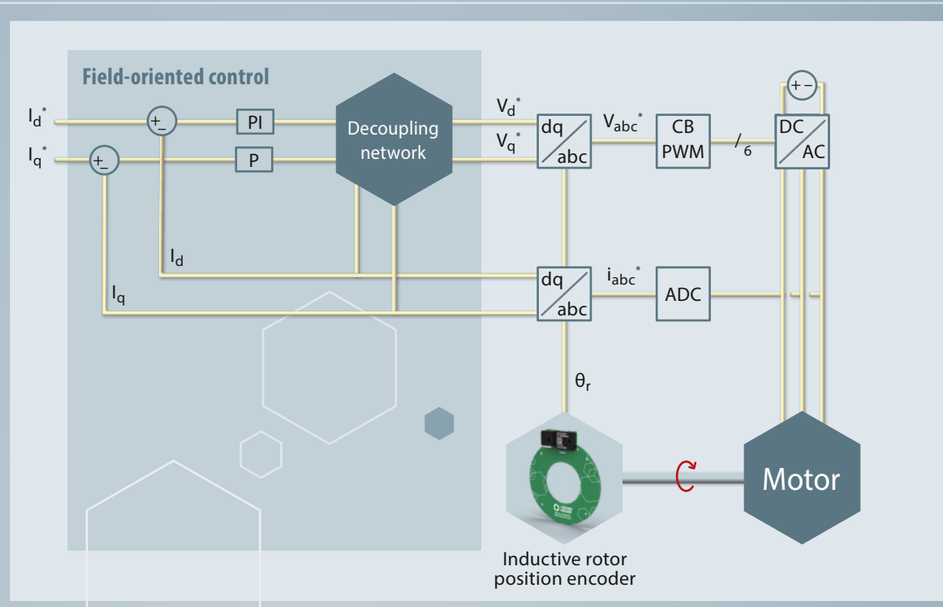


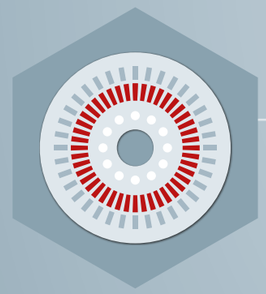
Take advantage of increased design freedom and install the sensor where it suits you best!



Synchronous machine structure

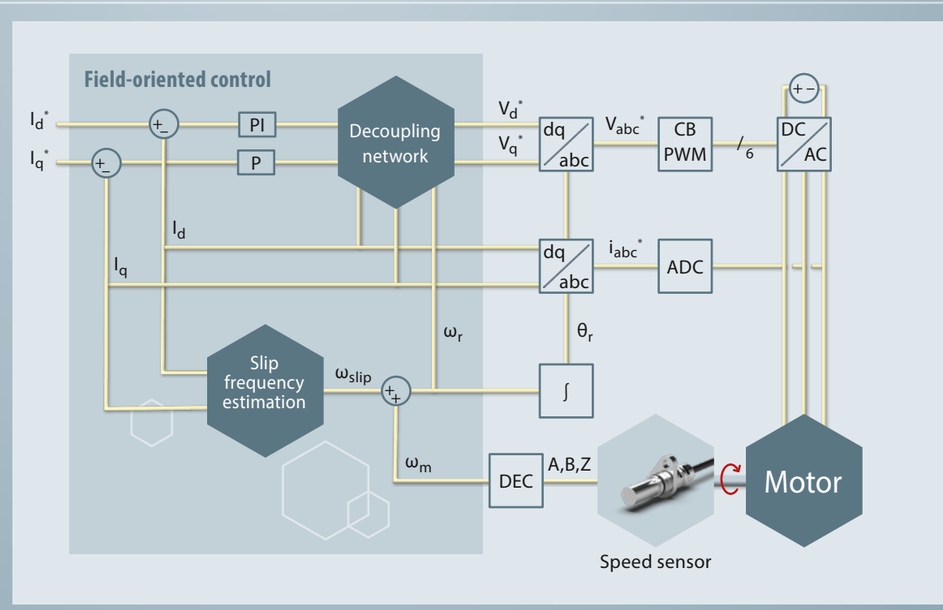
In synchronous machines, a defined magnetic field is already applied to the motor rotor. This is usually created by permanent magnets. Here, field-oriented control can be carried out directly with the rotor angle, since it is equal to the angle of magnetic flux. The smaller and more accurately the smallest angular change can be measured, the better the field-oriented control can ensure low-vibration operation.





Asynchronous machine structure

Asynchronous motors require the rotor speed to calculate the magnetic flux angle. The higher the resolution of the speed sensor signals, the faster the smallest speed deviations are detected. The field-oriented control reacts optimally and ensures low-vibration running.



Expertise at your side

Our know-how gives you a technological advantage

We are an international specialist in the field of motion sensors and integrated drive technology. We develop, produce and distribute leading technology solutions for the mobility and machinery sectors. Our products ensure that high-speed trains run safely, packaging machines are set up with minimum effort, tool spindles are precisely monitored and car electric drives are controlled in an energy-efficient manner. For almost 60 years, our customers have been benefiting from extensive technical consultancy competence and our knowledge of applications.

We are the competent partner for you when it comes to efficiently integrating sensors and actuators, intelligently transforming signals into value-added functions and making them accessible interactively. With us, data streams become usable information at the point of origin. Integration into your system environment thus becomes possible intuitively.

Rely on our experience, which guarantees you low lifecycle costs, high availability and digital future reliability.

Lenord+Bauer – Finding solutions. Founding trust.

High quality standards

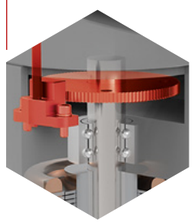
To ensure excellent product quality and high failsafe performance, we naturally have a consistent process landscape and are certified as per DIN EN ISO 9001, DIN EN ISO 14001 and DIN ISO/TS 22163 (IRIS). This process landscape is monitored and confirmed annually by an external body. In addition, you can, of course, audit us as a supplier.

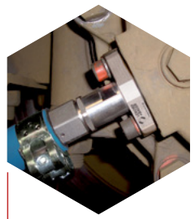
Active in future markets worldwide

1965
Lenord, Bauer & Co. GmbH is set up in a basement in Oberhausen

1973
The company headquarters is built in Oberhausen

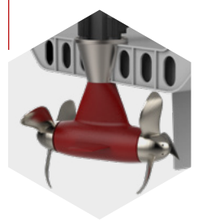
1993
Sensors for high precision and speed in machine tool applications





1996
Robust and wear-free sensor solutions for rail traffic

1999
Pole wheel position and speed encoders prove themselves under extreme operating conditions in ship propulsion systems

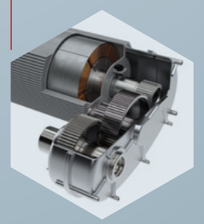


2008
Drive technology for packaging machines: The first generation of positioning drives is launched on the market

2011
Internationalization: New subsidiary is established in Shanghai

2012
New production plant in Gladbeck is inaugurated

2019
Sensor for electro-mobility: Efficient drive control for synchronous and asynchronous motors



2021
Lenord+Bauer Italy and USA are launched

The optimum solution for you

The right partner for every issue

Whether you have a new or subsequent development, we provide support in the form of our know-how for every phase of your project. We are at your side right from the initial contact to our after-sales service.

What if your application needs an individual sensor or you need information about a specific product? Our support team will clarify all technical issues in detail and provide you with a cost estimate without delay. Just submit us your inquiry.

We are available to offer you advice and support at every stage of your project.

Technical consultation

+49 208 9963 215 // support@lenord.de

Order processing

+49 208 9963 216 // kundencenter@lenord.de

Information available without delay

Whether you are looking for product brochures, technical information, manufacturer's declarations or certificates, you are sure to find them in our download area. If you are planning a new installation or modernization, we will also be happy to provide you with our STEP files on request.

www.lenord.de/en/service/download-area

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For you locally

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