LENORD +BAUER
... automates motion.

Automation of motion made by Lenord + Bauer

- Position acquisition
- Speed measurement
- Rotational speed measurement
- Temperature measurement
- Mileage acquisition
- Acceleration measurement
- Open loop control/closed loop control/positioning
- Adjustment/positioning

TURN POTENTIAL INTO EFFICIENCY

Our success is the success of our customers

Together with our customers we have been developing solutions for efficient automation for more than forty years.

As experienced and innovative specialist for motion acquisition and control, we have the skills to understand motion as a whole and to develop and implement efficient solutions for process and motion sequences.

We recognise and analyse the automation potentials together with our customers from various sectors, such as mechanical engineering, steel industry, railway technology or power generation. Tailor-made solutions that go beyond pure product development are created in dialogue with you.

Today we represent the entire spectrum of highly efficient automation, ranging from problem analysis, complete process engineering, project management, product or software development, all the way to on-site commissioning.

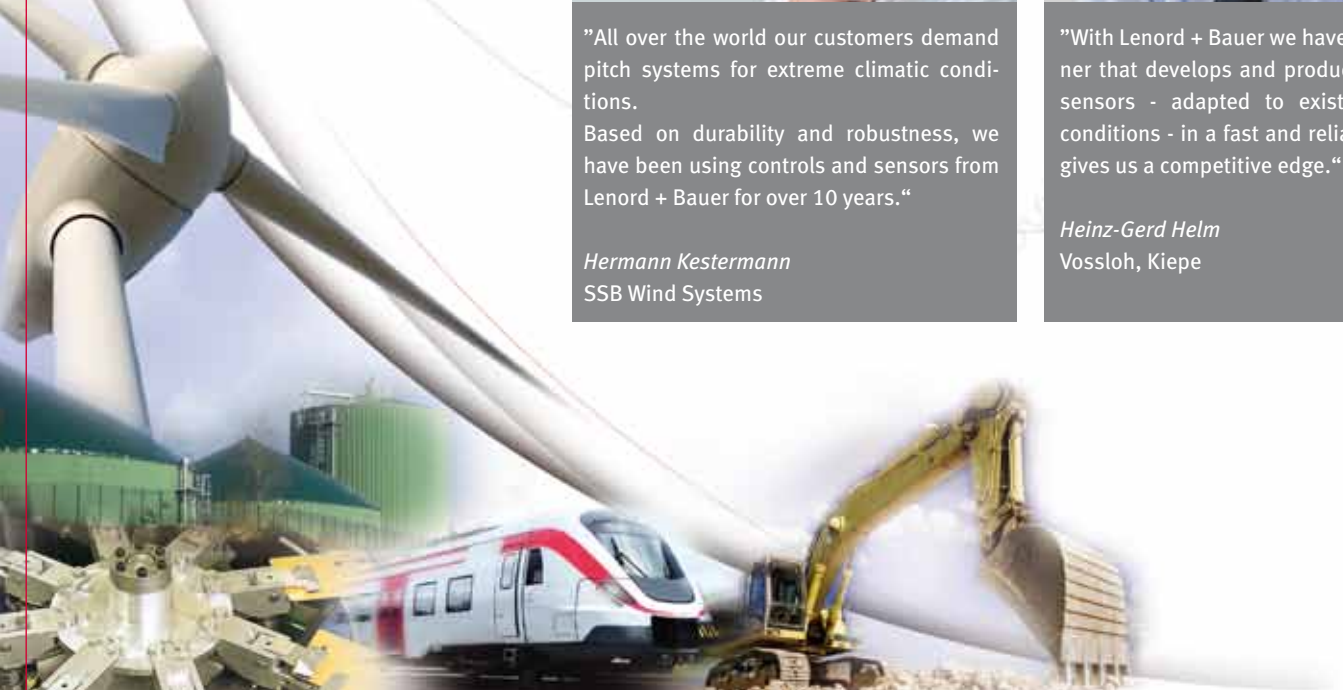
Our robust sensors and controls, which are often customised or adapted, form the basis of these solutions. Producing these high-performance components and systems ourselves ensures reliable quality and innovative capacity.

”All over the world our customers demand pitch systems for extreme climatic conditions.
Based on durability and robustness, we have been using controls and sensors from Lenord + Bauer for over 10 years.“

Hermann Kestermann
SSB Wind Systems

”With Lenord + Bauer we have found a partner that develops and produces individual sensors - adapted to existing technical conditions - in a fast and reliable way. This gives us a competitive edge.“

Heinz-Gerd Helm
Vossloh, Kiepe



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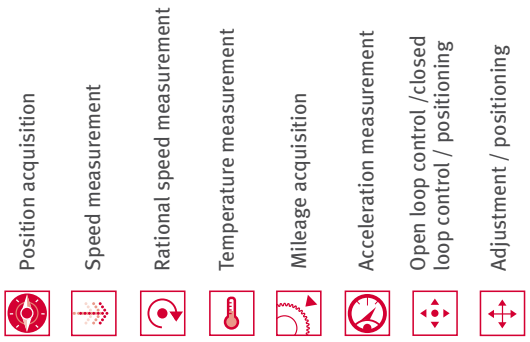


Precise acquisition, efficient control – even under extremely harsh conditions

A key task of automation is the precise acquisition of motion, its visualisation and reliable control. The innovative systems from Lenord + Bauer help our customers cope with even the harshest operating conditions.

Our automation cockpit offers the complete spectrum of state-of-the-art intelligent sensors and automation systems. Products from Lenord + Bauer allow high-precision acquisition, communication and visualisation of data such as positions, speeds, revolutions, mileage, but also of temperatures.

These high-availability sensor systems provide the reliable basis for exactly planned reactions. Our customers also use intelligent systems from Lenord + Bauer, which are often specifically developed or individually adapted, for subsequent open loop control, closed loop control or positioning.
In this regard, long service life under particularly harsh environmental conditions is a typical requirement. Humidity, wind and dust, as well as mechanical loads and strong vibrations, are the rule.
With magnetic, contactless sensors and intelligent controls from Lenord + Bauer, our customers have practical, durable automation systems available to them.
All Lenord + Bauer products are of particularly robust design and tested to that effect. Thus, our automation solutions and products, which are largely resistant to strong interferences, form a long-lasting and reliable basis for the sustained success of our customers.

Adjustment/ Positioning

Open loop control/ Closed loop control/ Positioning

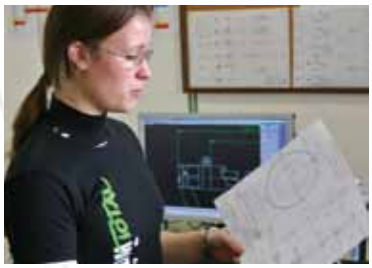
Visualisation

Fields of application

Dirt · Vibration · Heat · Cold · Humidity · Robustness · Reliability 99,9%

From the initial idea to efficient automation solution

Applying different core principles and high vertical integration allow us to develop and produce automation systems and products that give our customers a competitive edge and ensure long-term availability.



Our customers demand individual, innovative and highly integrated automation solutions and products as well as standard products within shortest time, from small series to thousands of pieces per year.

Lenord + Bauer is optimally prepared to meet this challenge. Our success is based on automation know-how and more than forty years of experience gathered from many industries. Lenord + Bauer uses the latest development tools and has a state-of-the-art production. New products are tested in our own application and test laboratory already during the development phase. Moreover, Lenord + Bauer has completed the fusion of mechanics and electronics in the areas of development and production years ago.
This close connection between mechanical and electronic development, design and production gives our customers the necessary competitive edge. The reliable quality of the products is ensured. This results in shorter innovation cycles and minimised reaction times, for instance in case of individual developments.

In-house electronic development and production

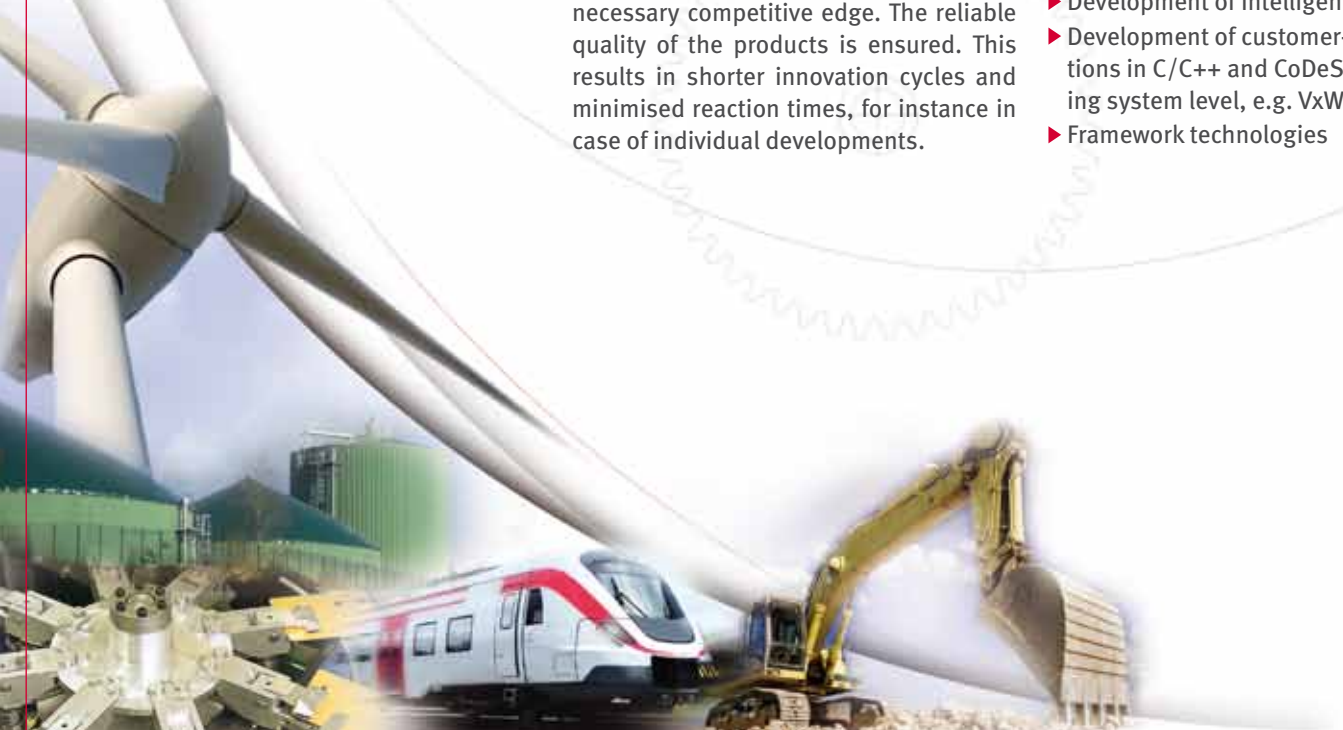
- Layout of analogue and digital circuits
- Micro system technology
- Industrial PC technology
- Packaging technology
- Encapsulation and micro encapsulation technology
- Micro assembly technology
- Manual and SMD placement of printed circuit boards

In-house mechanical development and production

- Design of individual, customised housings in various materials
- High-precision work pieces, e.g. measuring scales
- Development of mechatronics solutions, such as format adjustment

In-house software development

- Development of intelligent sensors
- Development of customer-specific functions in C/C++ and CoDeSys at operating system level, e.g. VxWorks
- Framework technologies



Fields of application

Railway technology
Absolute reliability and robustness due to magnetic and contactless technology

Solutions for:
- Engine speed measurement
- Anti-skid protection
- Traction monitoring
- Automatic train protection
- Mileage acquisition
- Temperature measurement

Energy
Efficiently regulated energy production through innovative control technology and sensors

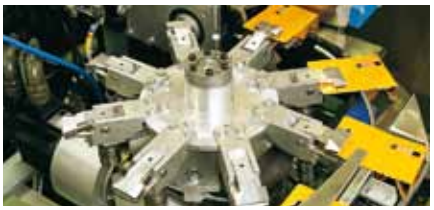
Solutions for:
- Wind turbines
- Tidal power plants
- Photovoltaic plants
- Biogas plants

Machine tool engineering
Efficient regulation of high speeds exceeding 100,000 min^{-1} from the world market leader with a global market share of about 80%

Solutions for:
- A-, B- and C-axes
- High-speed spindles

Mobile machines
Sustainable use of resources, protection of people and machines through reliable sensors

Solutions for:
- Municipal vehicles
- Construction machines
- Agricultural and forestry machines



General mechanical engineering services
Engineering, with the goals of: Efficient production, reduction of downtimes, increased machine safety, original equipment or retrofitting.

Solutions for:
- Packaging, filling and rolling machines
- Blast furnaces
- Conveyor and crane systems
- Storage systems
- Food industry
- Special purpose machine construction

Extensive automation know-how

We contribute to the success of our customers by using high-performance components or intelligent systems.

Communication

PROFINET · EtherCAT · EtherNet/IP · PROFIBUS · CANopen · DeviceNet · SSI

Technology

- Target wheels
- Measuring scales
- GMR/AMR/Hall
- PT100/1000
- MEMS (acceleration sensors)

Embedded systems

- 16/32 bit micro controller
- PowerPC
- DSP (Digital signal processor)

Fields of application

Engineering

- Product development
- Application development
- Programming in C++
- Web technology (server)
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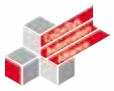


System integration

- Housing technology
- Encapsulation technology
- Fabrication
- Hybrid technology

Interfaces

- TTL
- HTL
- Stand still voltage
- 4 to 20 mA
- 0 to 10 V
- RS 232/485

MiniCoder

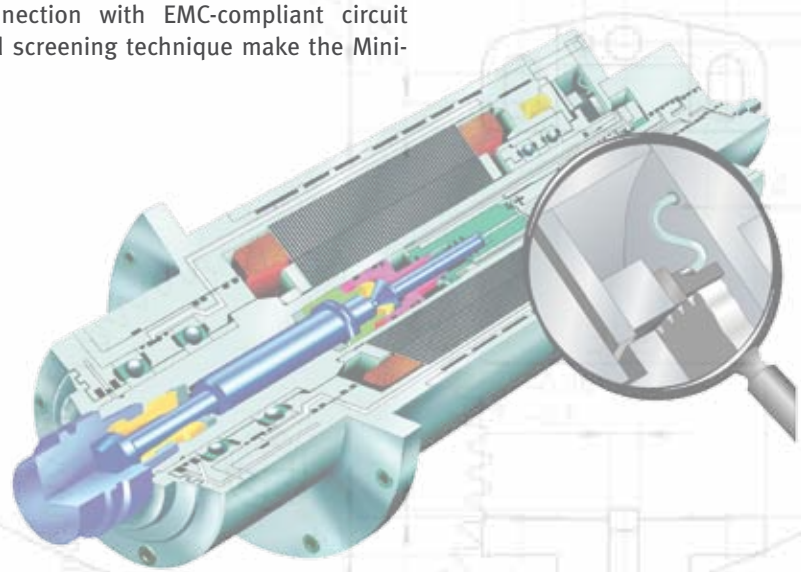
The highly integrative MiniCoders are the alternative to conventionally mounted rotary encoders in drives.

The incremental acquisition of rotational movement is performed by contactless scanning of a ferromagnetic target wheel. Due to the high level of vertical integration at Lenord + Bauer it is possible to design and produce the suitable measuring scale for almost any application in the machine tool sector.

MiniCoders do not need their own bearings and are therefore wear and maintenance free. With regard to performance, they are in no way inferior to sensor systems with bearings. Very high rotational speeds and tooth frequencies up to 200 kHz can be achieved.

The fully encapsulated construction in connection with EMC-compliant circuit and screening technique make the MiniCoder a compact measuring system according to protection class IP 68, offering a high level of electrical and mechanical robustness.

As world market leader in this field, Lenord + Bauer can look back on many years of experience with the individual and application-oriented use of MiniCoders as space-saving and high-precision measuring system. We use this knowledge to meet the increasing demands of the market, together with our customers.



SensorLine
LENORD+BAUER

Fields of application

GEL 2432
- RS422 output
- Measurement of linear movement
- Interpolation factor available ex factory

GEL 2442/GEL 2443
- Safety integrated
- Metallic coating
- Optional amplitude control

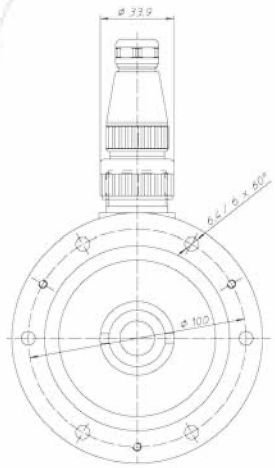
GEL 2444
- Metal housing
- IP 68
- Speed range from 0 to 70,000 min $^{-1}$

Target wheels
- Individually adapted
- Various materials
- High precision

	GEL 2432	GEL 2442/2443	GEL 2444
Output signal	5 V TTL/ RS422	1 V_{pp}	5 V TTL/ RS422
Interpolation	1 to 20	-	1 to 20
Protection class	IP 67	IP 68	IP 68
Supply voltage	5 V DC	5 V DC	5 V DC
Power consumption without load	‹ 0.2 W		
Measuring scale	Target wheels/measuring rods	Target wheels	Target wheels
Width of target wheel	min 2.0 mm	min 4.0 mm	min 4.0 mm

Incremental encoders

Incremental encoders for truly heavy-duty applications.



Incremental encoders convert rotational movement into electrical signals. The encoders from Lenord + Bauer combine the advantages of a magnetic measuring system with a robust mechanical design. They have proven themselves worldwide in various applications, even in most harsh industrial environments. It goes without saying that these encoders offer high reliability and a long service life. To guarantee these requirements, the incremental encoders can be equipped with additional features.

Protection against humidity

The encoder's electronic is coated with a highly effective protection against humidity, salt-water atmosphere and corrosive vapours. This ensures proper functioning even under tough conditions for years to come.

Condensed water outlet

In case of repeated condensation, water may accumulate in the encoder. This water can drain off through the condensed water outlet. Alternatively, sintered elements or breathable membranes may also be used for pressure balance.

Protection against vibration

The additional fixing of mechanical parts with special plastic prevents the electronics and the connections inside the encoder from vibrating. This allows trouble-free continuous operation even when exposed to extreme vibration and shock.

SensorLine
LENORD+BAUER

Fields of application

GEL 207/208
- High resolution
- Extremely robust
- Express service (24 h)

GEL 260
- Integrated interpolation
- Optional explosion protection
- Speedometer output

GEL 2010
- Stainless steel 1.4305
- Encapsulated electronics
- Acid-resistant

GEL 2360
- Through hollow shaft
- Stainless steel 1.4105
- Compact design

GEL 293
- Flexible coupling
- Extreme protection against vibration
- Speedometer output

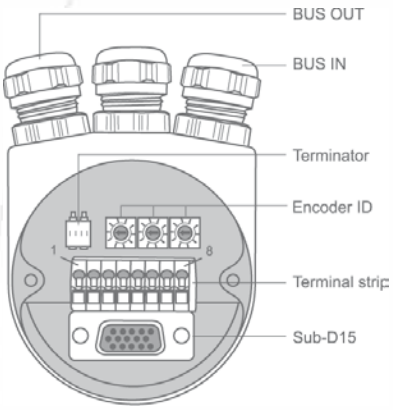
GEL 209
- High resolution
- Integrated bearing pedestal
- Express service (24 h)

GEL 219
- Square flange
- High shaft load (500 N)
- Condensed water outlet

	GEL 207/208	GEL 260	GEL 2010	GEL 2360	GEL 293	GEL 209	GEL 219
Max. resolution (steps)	136,192	273,408	1,024	2,048	266,240	136,192	136,192
Housing diameter	58 mm	90 mm	58 mm	58 mm	115 mm	58 mm	58 mm
Protection class	IP 65	IP 65	IP 67	IP 65	IP 66	IP 65	IP 65
Temperature range	-20 °C to +85 °C	-20 °C to +85 °C	-20 °C to +70 °C	-40 °C to +85 °C	-20°C- to +85°C	-20 °C to +85 °C	-20 °C to +85 °C
Supply voltage	10 to 30 V 5 V	10 to 30 V 5 V	10 to 30 V 5 V	10 to 30 V 5 V	10 to 30 V 5 V	10 to 30 V 5 V	10 to 30 V 5 V
Signals	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$
Signal level	HTL TTL	HTL TTL	HTL TTL	HTL TTL	HTL TTL	HTL TTL	HTL TTL
Additional signals		Speedometer signal			Speedometer signal		

Absolute encoders

High-resolution magnetic absolute encoders with intelligent digital and analogue interfaces.



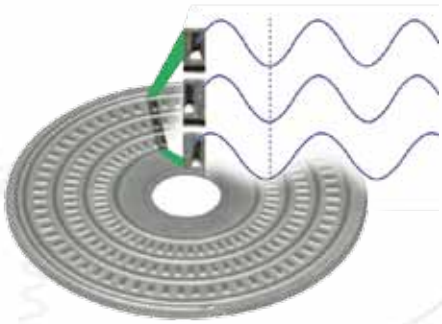
Absolute encoders have proven successful in industrial application. The need for innovative rotary encoders grows with increasing requirements on highly dynamic control processes and degree of automation. By combining a robust mechanical design with high-resolution and magnetic sensing principles, Lenord + Bauer has been setting standards for years.

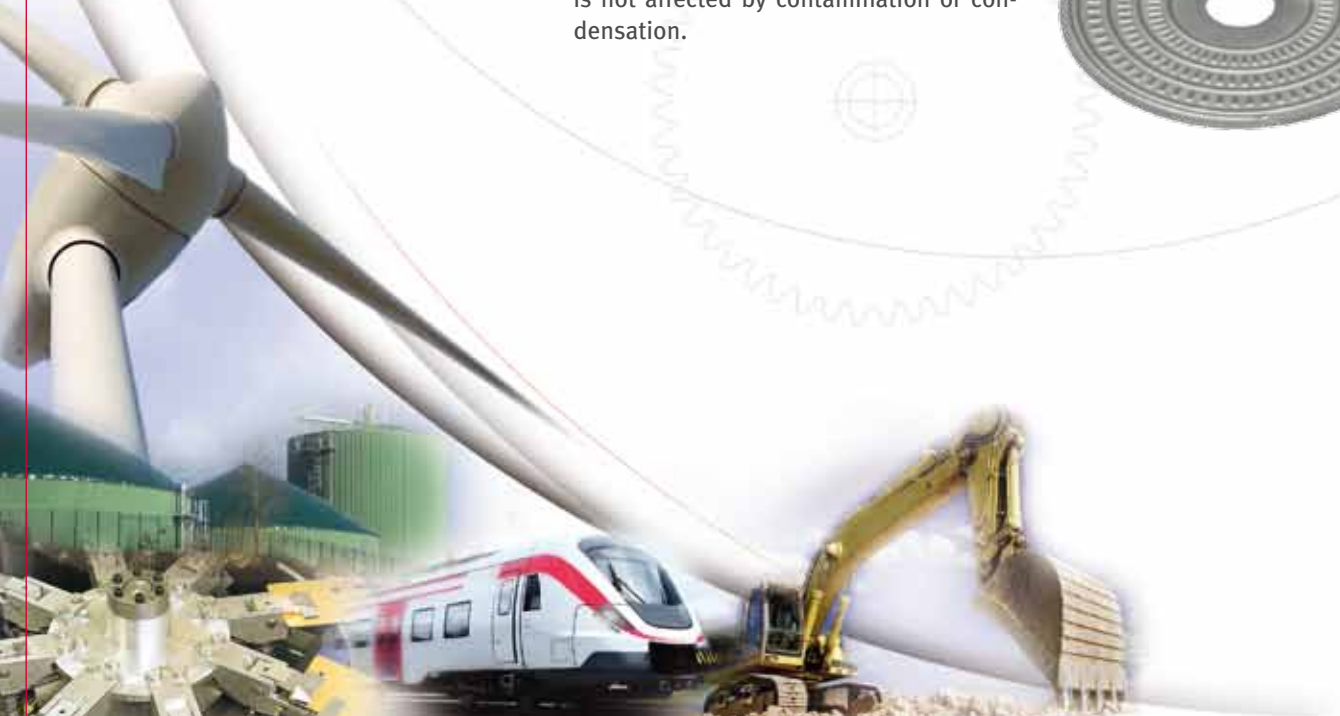
The magnetic innovation:
Metallic contour disc and innovative vernier evaluation

The absolute encoders GEL 235, 2351 and 2352 are true innovators. The well-known vernier principle has been used on these rotary encoder types, in line with a new method. This innovative technology is based on scanning an integrated, high-precision code disc made of ferromagnetic steel. This code disc – same as optical code discs – is produced by means of optical lithography and chemical etching technology. The magnetic system works with a high resolution and offers decisive advantages. Unlike optical systems with transparent code discs, the scanning performance of the metallic contour disc is not affected by contamination or condensation.

Integrated flexibility:

The functional principle of the absolute rotary encoders GEL 2035 and 2037 is based on contactless magnetic scanning of a diametric magnet that is embedded in the encoder shaft.
The orientation of the magnetic field is acquired directly as absolute position within a single turn via magneto-resistive (MR) sensors. The rotations are acquired either by an electronic or mechanical gear and also placed in non-volatile storage. Magnetic scanning is resistant to deterioration, temperature deviations, contamination or condensation.





SensorLine
LENORD+BAUER

Fields of application

GEL 235
- Modular fieldbus cap
- High resolution through contour disc
- High operating temperature range
- ATEX class

GEL 2035
- IP 69K option
- Heavy-duty flange option
- Additional resolver signal

GEL 2351
- Intelligent analogue interface
- High resolution through contour disc
- Stainless steel design

GEL 2037
- Compact design
- Magnetic gear
- Additional resolver signal

GEL 2352
- High resolution through contour disc
- Compact design
- Integrated digital interface (SSI, CANopen)

	GEL 235	GEL 2035	GEL 2351	GEL 2352	GEL 2037
Resolution per revolution	65,536	4,096	65,536	65,536	4,096
Number of revolutions	4,096	4,096	-	4,096	4,096
Housing diameter	58 mm	58 mm	58 mm	58 mm	58 mm
Length of housing	46.5 mm (SSI) 75 mm (fieldbus)	43.1 mm	24 mm	24 mm	45 mm
Absolute accuracy	0.1°	0.8°	0.1°	0.1°	0.8°
Max. protection class	IP 67	IP 69K	IP 67	IP 67	IP 67
Temperature range	-40 °C to +105 °C	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C	-40 °C to +85 °C
Supply voltage	10 to 30 V 5 V	10 to 30 V	10 to 30 V	10 to 30 V	10 to 30 V
Interfaces	SSI CANopen PROFIBUS DP EtherCAT	SSI SSI+Resolver	4 to 20 mA 0 to 10 V	SSI	SSI SSI+Resolver
Options	Explosion protection Stainless steel	IP 69K Heavy-duty flange	Smooth-running bearing Condensed water outlet	-	-

Speed sensors

Successful for more than 15 years. High-precision speed sensors from Lenord + Bauer, suitable for even the harshest conditions.

By scanning a measuring scale, speed sensors generate pulses and can thus detect rotational and linear motion. Target wheels or measuring rods made of ferromagnetic or electroconductive materials serve as respective measuring scales.

Due to the compact and resistant construction of the speed sensors, they are predestined for use in rail traffic. The sensors from Lenord + Bauer have been successfully applied in drive controls, brake systems or train control all over the world, even under harshest conditions. Thanks to the extremely robust design, these reliable and high-precision measuring systems are also ideal for hydraulic cylinders used in the heavy industry, like for instance on oil drilling platforms or in lock gates. Also available as ATEX-compliant version for potentially explosive atmospheres.
The high reliability of the sensors also reduces the life cycle costs of the end user.

The speed sensors provide the square-wave signals required for the respective application on up to 3 channels as voltage or current signals. In this respect, they measure tooth frequencies from 0 to 25 kHz. A stand still voltage signal, as required for instance for brake systems, can also be realised. The electronic system is protected against shock and vibrations by multi-step encapsulation. All speed sensors are tested in accordance with EN 50155 and protection class IP 68. This includes, for example, EMC and temperature compatibility, as well as shock and vibration.

As an option, Lenord + Bauer offers sensors with pulse multiplication.

Restrictions in design force customers to revert to existing measuring scales, which, however, do not meet the requirements of the control in use. For example, the pulses provided by the scanned measuring scale exceed the amount that can be processed. For such cases, sensors of the series GEL 247 are ready. Sensor types that divide the pulse numbers sensor-internally by a factor of up to 10 are available upon request.

In connection with years of know-how in the fabrication of sensor systems, Lenord + Bauer can fulfil almost all customer requirements.

SensorLine
LENORD+BAUER

Fields of application

GEL 247
- 1 or 2 channel output
- Module 1 to 3.5
- Measuring range from 0 Hz

GEL 2471
- Electrically conductive measuring scale
- IP 68
- Module 2 to 3

GEL 2472
- 2 DC-isolated measuring systems in 1 housing
- Robust stainless steel housing
- Different supply voltages

GEL 2474/GEL 2475/ GEL 2476
- Current and voltage output
- Stainless steel housing
- Increased sensing distance

GEL 2477
- High resolution through pulse multiplication
- 2 channel
- Square-wave signals

GEL 2478
- ATEX certification (IIG Ex ib IIB T4)
- Scanning of measuring rods
- Increased sensing distance

GEL 248
- Module 0.7 to 4.00
- Compact design
- Large air gap up to 4 mm (M=4)

	GEL 247	GEL 2471	GEL 2472	GEL 2474/ GEL 2475/ GEL 2476	GEL 2477	GEL 2478	GEL 248
Supply voltage U_s	10 to 30 V DC	10 to 20 V DC	10 to 20 VDC	10 to 30 V DC	10 to 30 V DC	10 to 28 V DC (ATEX); 10 to 30 V DC (without ATEX)	10 to 30 V DC (with HTL output); 5 V ± 10 % (with TTL output)
Max. number of channels	2	2	3	2	2	2	2
Current consumption (without load)	‹ 15 mA to 60 mA (depending on waveform)	40 mA	40 mA	‹ 12 mA to 60 mA	50 mA	‹ 45 mA	50 mA
Module target wheel (M)	1.00 to 3.5	2.00 / 3.00	typ. 2.00 / 3.00	depending on encoder type 1.00 to 3.50	1.00	1.00 to 3.50	0.70 to 4.00
Max. permissible air gap (depending on module)	0.1 mm to 1.3 mm	typ. 0.7 mm to 0.8 mm	max. 1.5 mm	0.2 mm to 3.0 mm	0.4 mm to 1.0 mm	0.2 mm to 3.0 mm	0.2 mm to 3.5 mm
Material target wheel	ferromagnetic steel	elect. conductive materials	ferromagnetic steel	ferromagnetic steel	ferromagnetic steel	ferromagnetic steel	ferromagnetic steel

Temperature sensors and combi sensors

Temperature acquisition in rail vehicles is becoming ever more important. The GEL 2161 from Lenord + Bauer is the right instrument for this task.

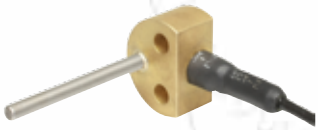
Temperature sensors
With fire protection according to DIN 5510 and NF F16-101, measuring range from -40 °C to + 250 °C, protection class IP 68 and type tests according to EN 50155, these temperature sensors are precisely tailored to the harsh conditions prevailing in rail traffic.

Last but not least, the fact that the GEL 2161 is available in two, three or four-wire technology confirms the claim that Lenord + Bauer produces customer –oriented and application-specific sensors. Based on many years of experience in the fabrication of sensor systems, we can direct the signals of a temperature sensor and, for instance, a speed sensor to one connector, thus minimising our customers' cabling by combining the 2 sensors.

Combi sensors
Due to a lack of installation space or other requirements it is necessary to combine several basic sensor types on one connector, or to arrange them in a housing. Lenord + Bauer allows for this fact by developing combi sensors. Thus, it is possible to provide speed sensors with temperature sensors and vibration sensors in one housing according to customer's requirements.

SENSORLINE
LENORD+BAUER

Fields of application

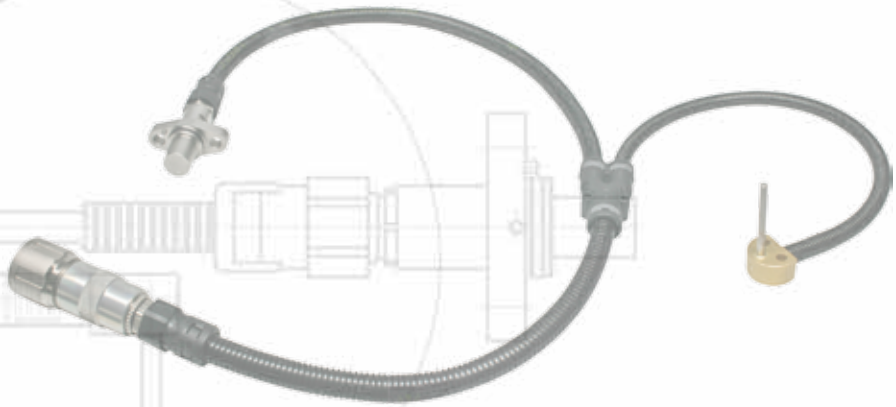


GEL 2161

- Measuring range -40 °C to +250 °C
- PT100-/PT1000 technology
- Type test according to EN 50155

Combi sensors

- Multi-channel speed sensor with interpolation
- Multi-channel speed sensor + temperature sensor
- Multi-channel speed sensor + temperature sensor + shock sensor



	GEL 2161
Measuring element	PT100/PT1000
Limit value deviation	Tolerance class B
Electromagnetic compatibility	Rail vehicles: EN 50121-3-2
Measuring range	-40 °C to +250 °C
Protection class	IP 68
Type test	EN 50155

Odometer

Energy self-sufficient mileage acquisition to optimise maintenance intervals for goods trucks.

To ensure the traffic safety of rail vehicles it is necessary to monitor the axle mileage to prevent accidents by replacing or turning tyres in a timely manner, or by inspecting the wheel bearings. These days it is common to lease instead of buy goods trucks, calculating costs on a mileage basis. Hence, a reliable and accurate measurement of the distance travelled is also in the interest of the vehicle owners.

Existing mechanical or mechatronic odometers are prone to strong mechanical loads, or they require a battery for energy supply, which in turn increases maintenance costs. An alternative is the use of a maintenance-free, energy self-sufficient electronic mileage counter that extracts the required energy from the rotatory axis motion by means of induction. At the same time it detects the revolutions and stores the counter reading. A RFID reader allows readout of the stored vehicle data as well as preparation and transfer of the data for automatic evaluation. The resulting optimisation of the maintenance cycles offers a high cost savings potential.

Acquired and stored data

- Mileage
- Date and time of readout
- Mileage during previous readout
- Wheel set type and wheel set number
- Wheel diameter
- Vehicle number
- Vehicle keeper marking
- Status display for a previous exceedance of temperature limits

SensorLine
LENORD+BAUER

Fields of application

GEL 2510

- Magnetic sensor technology: Robust and durable, resistant to dirt, oil, humidity and vibration
- Energy autonomous, no battery required
- Contact-less scanning, maintenance-free
- Compact and unobtrusive
- Tamper-proof
- Type test according to EN 50155
- Approved for use in potentially explosive areas, such as refineries
- Wireless transmission via RFID technology
- Simple transmission from reader to PC via USB
- Simple data processing and reporting

Operating and storage temperature range	-40 °C to +85 °C
Protection class	IP 68
Shock/vibration	IEC 6173 Cat 3.
EMC	EN 50121-3-2
Ignition protection	II 2G EEx ib IIB T4
Type test	EN 50155

Redundant rotary encoders

Traditionally safe. Incremental redundant absolute rotary encoders facilitate safety functions in modern mechanical engineering.

Tandem encoder GEL 292

The concept
Process automation, process data acquisition and the necessity to monitor and protect processes, require several separate encoders mounted on one shaft. To meet this requirement, the encoders must be equipped with a continuous shaft or hollow shaft. The assembly and coupling of the encoders requires special design features. In this regard, the mounting length of the encoder system must be kept short enough to permit trouble-free application.

The solution
Thanks to the integration of a flexible coupling in the rotary encoder, the tandem solution allows assembly of different encoders in a relatively short kit. The individual encoders are equipped with a flexible-mounted hollow shaft, into which coupling elements are fitted. The encoders are attached to each other in a space-saving way via the coupling elements. Each tandem system must have at least one basic module GEL 292. The end element of an encoder system can be a rotary encoder with a hollow shaft, or a device with a continuous shaft.
This is a simple way to achieve diverse redundancy with conventional methods.

Integrated redundant rotary encoder system GEL 2036

The design of conventional tandem systems is such that it always requires a sufficiently large assembly area. Based on this requirement, Lenord + Bauer has advanced the magnetic sensor technology for redundant absolute rotary encoders. A 58 mm diameter standard housing has been equipped with a redundant multiturn rotary encoder with SSI interface. Completely DC-isolated sensor levels achieve, for instance, 256 steps per revolution, with a total resolution of 65536 revolutions. Additional resolution and rotary encoder variations can be realised in combination with SSI or fieldbus interfaces.

SensorLine
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Fields of application

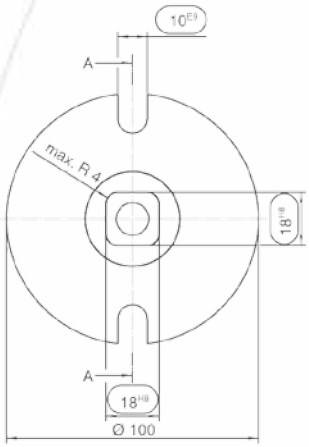
GEL 2036
- Compact design
- DC-isolated sensor units
- Integrated fieldbus interfaces

GEL 292
- Combination of incremental and absolute encoders
- Modular design
- Standard components

	GEL 2036	GEL 292
Resolution per revolution	65,536	4,096
Number of revolutions	4,096	4,096
Housing diameter	58 mm	58 mm
Length of housing	46.5 mm (SSI) 75 mm (fieldbus)	43.1 mm
Absolute accuracy	0.1°	0.8°
Max. protection class	IP 67	IP 67
Temperature range	-40 °C to +105 °C	-40 °C to +85 °C
Supply voltage	10 to 30 V 5 V	10 to 30 V
Interfaces	SSI CANopen PROFIBUS DP EtherCAT	SSI SSI+Resolver
Options	Explosion protection stainless steel	IP 69K heavy-duty flange

Application-specific encoder systems

Focusing on the essential. Extreme environmental conditions call for individual product characteristics.



Each application has its own specific requirements. As a rule, 80% of all applications can be covered with standard products. If standard products are no longer adequate, Lenord + Bauer offers application-specific sensors that are tailored exactly to the needs of the customer.

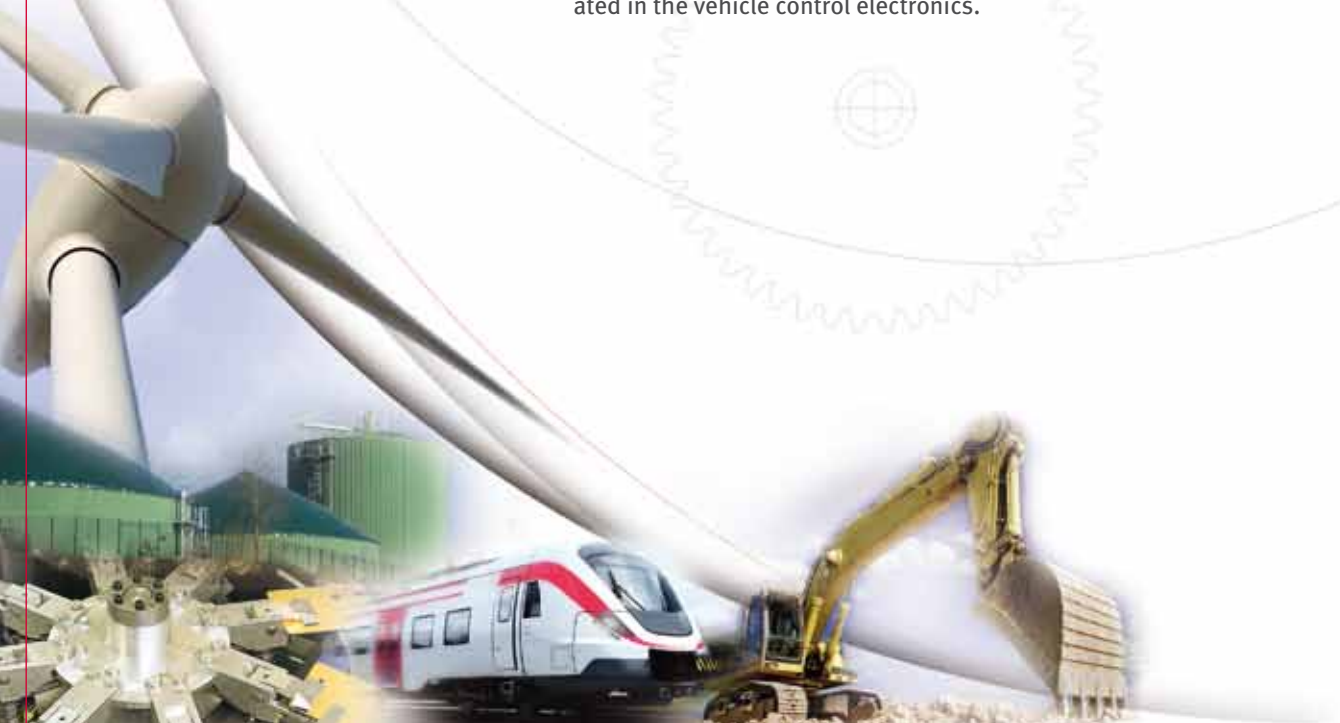
Multi-channel rotary encoder GEL 27XX

The multi-channel incremental encoder has been specifically developed for the requirements of the rail vehicle industry. The rotary encoder has been designed to provide independent output signals for different control electronics such as motor speed sensing, anti-skid protection, train control and rolling distance measurement.
On the inside, the incremental encoder features a metallic measuring scale that is connected with the axis. This measuring scale is scanned by one or several magnetic sensors. The evaluation electronics generates pulses whose output is in the form of square-wave signals with defined voltage or current levels. The output frequency is proportional to the rotational speed of the axis. The signals are evaluated in the vehicle control electronics.

Types GEL 2710 and 2712 are intended for bogies with outside bearings. They are flanged onto the bearing cover of the wheel set and driven by a clutch disc, for instance. GEL 2701 is suitable for bogies with inside bearings. The wheel set is equipped with a rotor flange, allowing the incremental encoder to turn freely. A torque support connected to the bogie frame prevents the encoder from simultaneous rotation. All types can be customised with various cables, protective sleeves and plugs

Rotary encoder for extreme applications GEL 2952

This rotary encoder was specifically designed for the extreme loads experienced in rail traffic. A modular design allows customer-specific adaptations of the sensor system to the respective application. An encapsulated sensor module inside a stainless steel housing provides excellent protection in case of extreme use. An integrated, patented flexible coupling with a 20 mm diameter also permits mounting to drive elements with high axial and radial shaft motion.



SensorLine
LENORD+BAUER

Fields of application

GEL 2701

- Max. 8 channels
- Max. 3 different pulse numbers
- Various flange forms for each vehicle

GEL 2952

- Patented flexible coupling
- Encapsulated electronics
- Stainless steel housing

	GEL 27XX	GEL 2952
Max. resolution	110	1024
Housing diameter	155 mm	115 mm
Protection class	IP 67	IP 67
Temperature range	-40 °C to +100 °C	-40 °C to +120 °C
Supply voltage	10 to 30 V 5 V	10 to 30 V 5 V
Signals	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$	A/B/N $\overline{A}$/$\overline{B}$/$\overline{N}$ sin/cos
Signal level	HTL TTL	HTL TTL

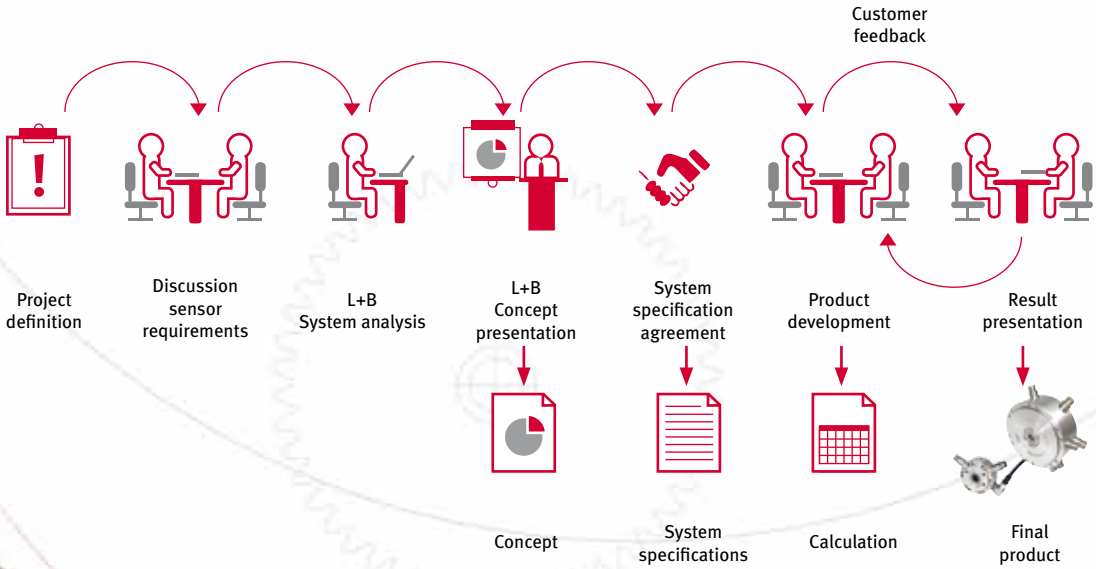
Customised sensors and measuring scales

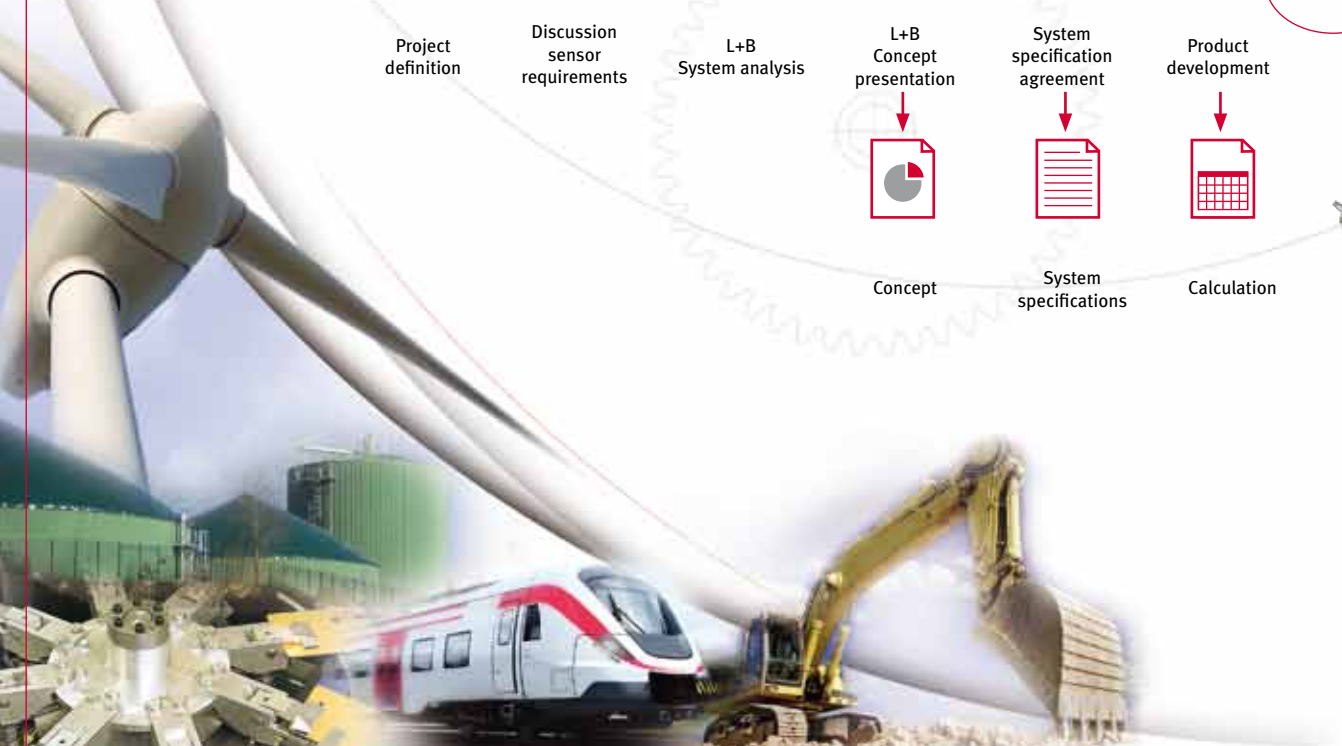
Tailored to your applications. Based on its technology modules and extensive knowledge of the industry, Lenord + Bauer provides the right sensor solution for your respective requirements.

Extreme conditions of use

With our many years of experience in project engineering of client-specific sensor systems from design to realisation, we produce optimised system solutions for our customers based on our technology modules. Fundamental technical knowledge and long-term cooperation with established system houses and research institutes form the basis for our innovative short cycle product developments.

Together with our customers we develop a sensor concept that is tailored specifically to the requirements of the application. Robust basic sensors and core know-how in the areas of magnetic circuit and measuring scale permit product use in applications that are not suitable for standard solutions. The high level of vertical integration allows Lenord + Bauer to quickly develop prototypes for complex projects and produce small series in any field.





SENSORLINE
LENORD+BAUER

Fields of application

Example:
Sensors for marine propulsion
- Six-fold redundancy
- Extremely high availability
- Long-term supply capability
- Stainless steel

Example:
Tooth wheels
- Definition of tooth shape
- In-house production of measuring scales
- In-house test bench

Example:
Slotted disc with sensor
- Definition of slot contour
- Customised sensor contour
- Qualification of measuring scale

	Customised sensors
Measuring scale	Development and production of customised measuring scale
Position sensors	Combination of incremental and absolute measuring techniques
Additional sensors	Temperature, acceleration
Housing design	Adaptation of housing to respective mounting conditions Separation of sensor and evaluation is possible
Max. protection class	IP 69K
Temperature range	-40 °C to +120 °C
Supply voltage	10 to 30 V 5 V
Interfaces	Incremental or analogue interfaces
Communication	SSI CANopen PROFIBUS DP EtherCAT ProfiNet
Options	Explosion protection stainless steel

Compact controls

Reliable MotionControllers for sophisticated tasks in rough environments.

Throughout the world, motion controllers from Lenord + Bauer meet all onshore and offshore requirements. They are optimised for the rough environment of rotor hubs in wind turbines, used as Hot Climate Version (HCV) in the hot and humid area of South China or as Cold Climate Version (CCV) for -20 °C temperatures at 2000 m altitude in the Central Asian Plateau.
Lenord + Bauer MotionControllers have been successfully used all over the world for more than 15 years and in over 20,000 wind turbines.

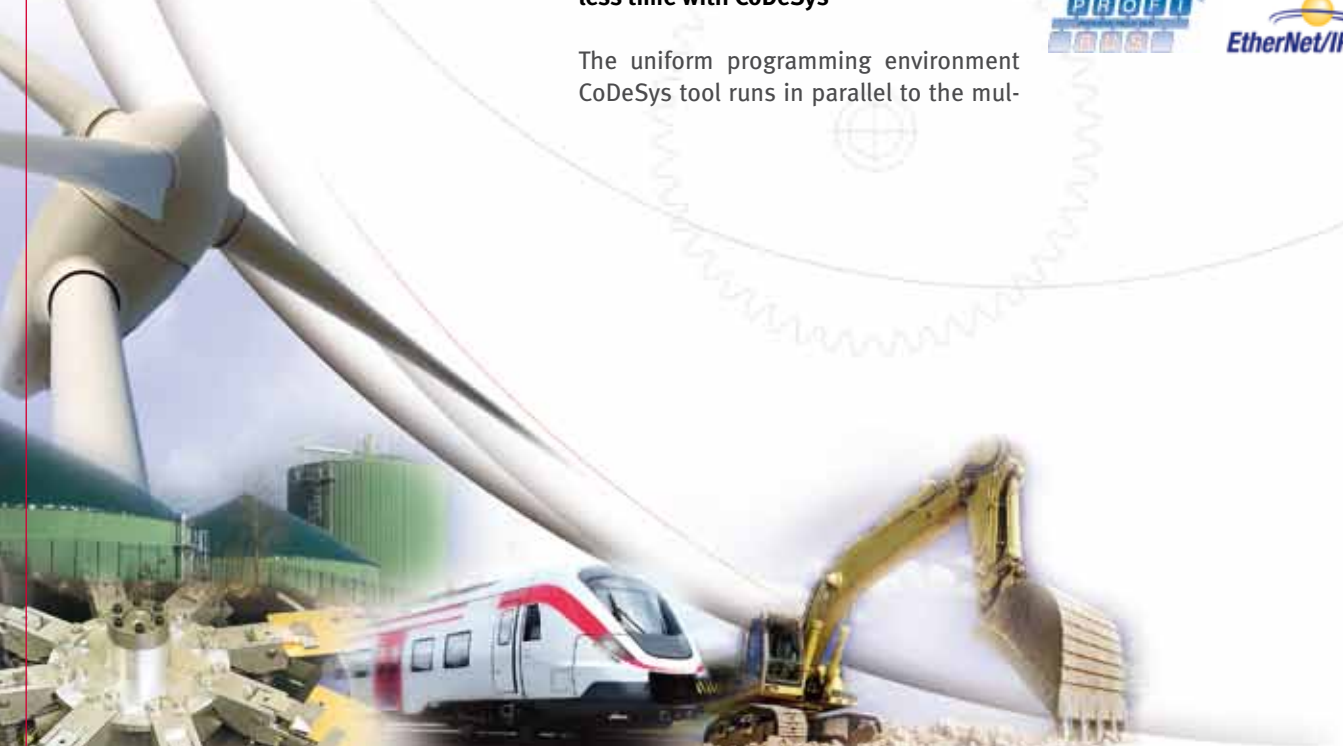
The controllers of the product family GEL 8200 feature a terminal with LC-Display, keyboard, integrated IEC 61131-PLC, fieldbus systems and multi axis control with a maximum of 6 controlled axes. A total of up to 64 axes can be controlled via the CAN bus. In addition to being equipped with a wide range of digital and analogue inputs and outputs, the controllers can evaluate up to six SSI encoder signals.

Create your target application in less time with CoDeSys

The uniform programming environment CoDeSys tool runs in parallel to the multi axis control and provides complete parameter transparency. According to requirements, the suitable IEC programming languages can be selected for each individual module. The IEC61131-3 programming languages FBD, LD, ST, IL, SFC are available.

Establishing connection with open system communication

System communication is the basis of modern control solutions. In the product family GEL 8200, two CAN interfaces as well as two serial interfaces are already integrated. In addition, an extension slot allows the use of other standard bus systems without adaptation of the PLC.



MOTIONLINE
LENORD+BAUER

Fields of application

GEL 8230 Pitch Controller for wind turbines
- Positioning controller for max. 6 axes
- Open to all standard fieldbus systems
- Extended temperature range

GEL 8235 Pitch Controller
- Positioning controller for max. 6 axes
- Open to all standard fieldbus systems
- Extended temperature range
- Mounted on top hat rails

GEL 8240 Motion Controller
- Cam plates and main shafts
- CNC function
- Automation of complex motion sequences
- Ready-made solutions, e.g. "Flying saw" or "Rotating cutter"

GEL 8245 Motion Controller
- Cam plates and main shafts
- CNC function
- Automation of complex motion sequences
- Ready-made solutions, e.g. "Flying saw" or "Rotating cutter"
- Mounted on top hat rails

GEL 8250 Compact Controller
- Positioning controller for max. 6 axes
- Optimised for use in wind turbines
- Extended temperature range
- 6 x SSI encoder inputs

	GEL 8230	GEL 8240	GEL 8250	GEL 82x5
LCD and keyboard	Yes	Yes	Yes	No
Digital inputs	22 to 30	22 to 30	30	22 to 30
Digital outputs	15	15	15	15
Analogue inputs	1 to 3	1 to 3	3	1 to 3
Analogue outputs	3	3	3	3
PT100 inputs	0 to 4	0 to 4	0 to 4	0 to 4
SSI encoder inputs	3	3	6	3
Serial interface	2	2	2	2
CANopen	2	2	2	2
PROFIBUS DP	optional	optional	optional	optional
EtherNet/IP	optional	optional	optional	optional
DeviceNet	optional	optional	optional	optional

Customised controls

Lenord + Bauer develops robust compact controls for installation in switch cabinets, for top hat rail or as overall decentralised control system.

Customised electronics

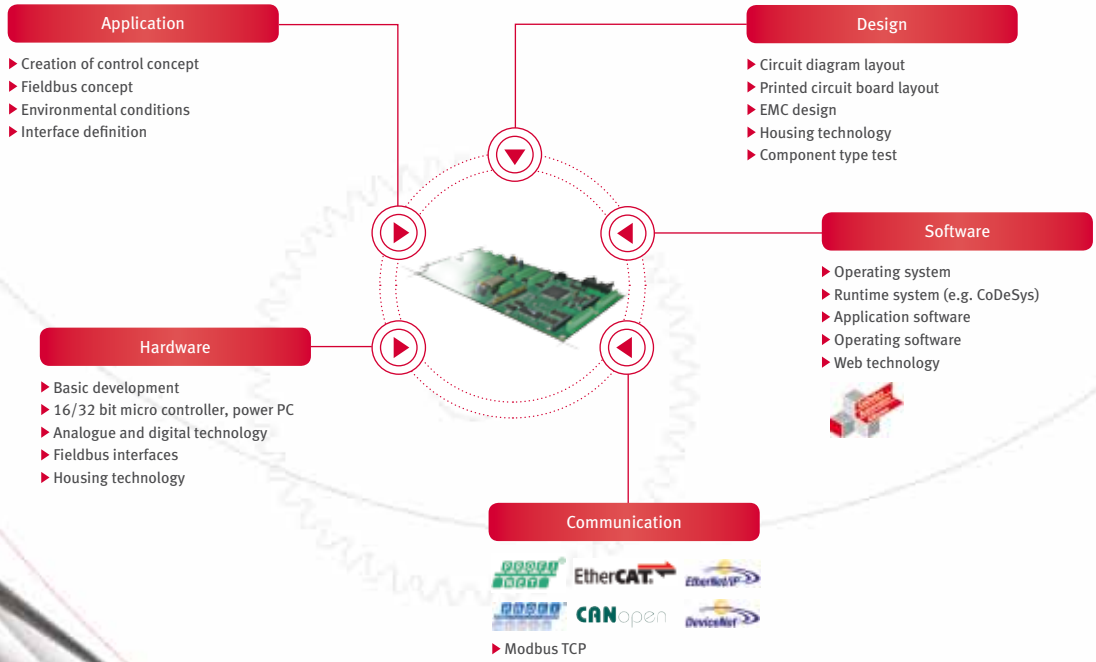
Based on our 40 years of know-how from control and sensor development, as well as 15 years experience in automation of wind turbines, Lenord + Bauer – in cooperation with its customers – continuously implements new, technologically advanced and customised solutions.

Take advantage of our experience to secure your success

- High level of experience from worldwide application of our products
- Efficient combination of robust mechanics with latest hardware and software solutions
- Fast and uncomplicated development of prototypes for your specific application
- Quality-tested series production of your solution (for annual quantities from only one to thousands of pieces)
- Short development cycles, comprehensive customer project support and industry-specific application know-how

Fields of application

- Wind turbines (onshore, nearshore, offshore)
- Hydropower
- Robust industrial environments
- Mechanical engineering



MOTIONLINE
LENORD+BAUER

Fields of application

GEL 8210 MotionController
Customised positioning controller for maximum 2 axes
- Open to all standard fieldbus systems
- Modular expandable
- Customised form factor
- Optimised for use in wind turbines

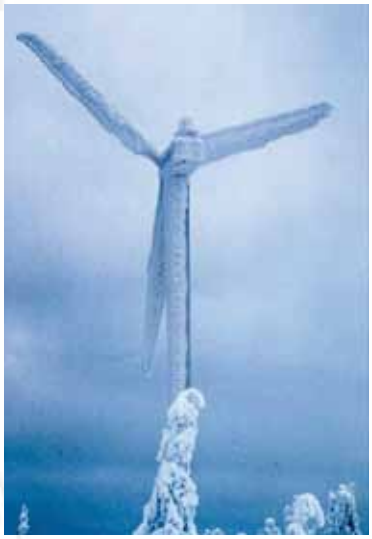
LD 100 MotionCard
Offers the complete performance range for complex motion automation.
- PLC and cam plate functions integrated in one servo converter
- Simple replacement of mechanical cam plates and main shafts
- CNC function
- Automation of complex motion sequences
- Ready-made solutions, e.g. "Flying saw" or "Rotating cutter"

GEL 89520 extension module for MotionController GEL 8210
Offers the complete performance range for complex motion automation.
- Multifunction I/O card
- Ethernet TCP/IP
- Remote service Web (via WEB browser)
- FTP, HTTP communication

	GEL 8210	LD 100	GEL 890520
LCD and keyboard	-	-	-
Digital inputs	16	7	8
Digital outputs	8	3	8
Analogue inputs	2	-	-
Analogue outputs	1	-	-
PT100 inputs	4	-	-
SSI encoder inputs	2	-	-
Serial interface	1 to 2	1	-
USB port	1	-	-
PLC function IEC 61131-3	optional	Yes	-
CANopen	2	1	-
PROFIBUS DP	optional	optional	-
EtherCat	-	-	-
EtherNet/IP	optional	-	1
DeviceNet	optional	optional	-
InterBUS S	optional	optional	-

Bus terminals and bus terminal controllers for top hat rail

MotionControl system solutions from one source.



Source: Griebl KG

With the bus terminal GEL 8500 you can extend PLC or display controls from Lenord + Bauer. in a fast and convenient way. All MotionControllers and MotionPLCs from Lenord + Bauer feature a CANopen master function, allowing easy extension via the bus terminal.

Brief description
The bus terminal for the extended temperature range GEL 8500 is a CANopen enabled remote module with six digital inputs and outputs, as well as four PT100 inputs. Especially noteworthy is the integration of two 230 V AC switching outputs. The fieldbus interface is designed as CANopen slave according to CiA draft standard DS302 and DS401.

The tall design, and thus minimum space requirement on the top hat rail, makes the bus terminal ideal for decentralised solutions. The bus terminal is mounted on a standard top hat rail.
The signal connection level has been developed for permanent wiring with connector strips. Connection is in front via spring-cage terminals. Multicolour light diodes on the front side provide information on voltage supply, device status as well as fieldbus status of the equipment.
In addition to the flexible and decentralised I/O extension of controls and frequency converters, the fieldbus terminal GEL 8500 can also decentralise functions in your machine thanks to sufficient computing power.

Decentralisation of functions
Besides its use as remote module, the bus terminal can be equipped with customised software. This customised software and the corresponding Windows Service Tool make it possible to swap certain functions from the PLC to the device.

Currently available software packages:

- I/O and PT100 extension as well as temperature monitoring and closed loop control via fieldbus, starting at an operating temperature of -40 °C

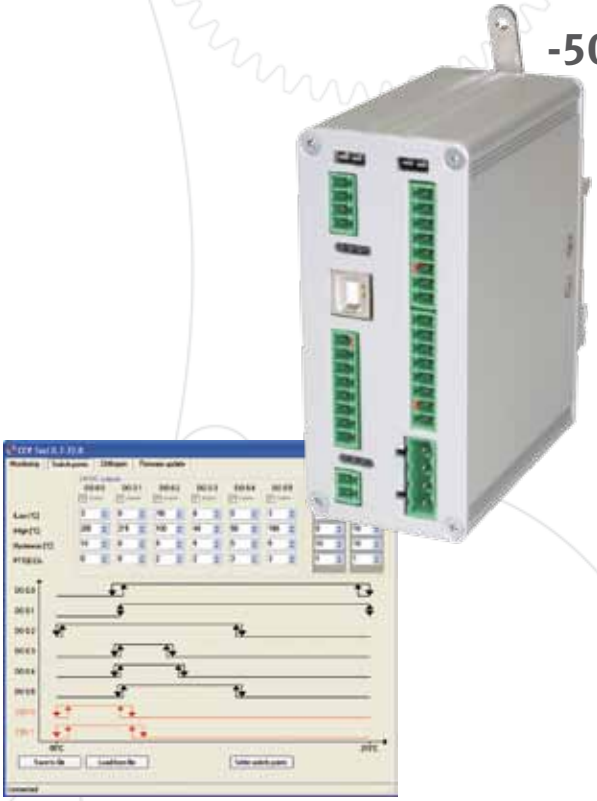
Communication
The fast and convenient data exchange with the superimposed fieldbus master control or the service and operating software is based on CAN bus and the USB port.

Parameterisation of special functions via Windows Service Tool
The fieldbus terminal GEL 8500 is parameterised via CAN bus, USB service port or via service and operating software.

Use in wind turbines
The bus terminal GEL 8500 has been optimised for the rough environment of the rotor hub on wind turbines. It is therefore in compliance with all onshore or offshore requirements, as well as all CCV and HCV requirements.

MOTIONLINE
LENORD+BAUER

Fields of application



-50 °C to +85

CANopen

GEL 8500
Fieldbus terminal for extended temperature range

- Extended temperature range
- Operating temperature -40 °C to +85 °C
- Storage temperature: -50 °C to +85 °C
- Digital outputs 230 V AC
- Coated printed circuit boards
- Compact and robust construction

CANopen

	GEL 8500
CANopen	Slave (DS302, DS401)
LCD and keyboard	-
Digital inputs 24 V DC	6
Digital outputs 24 V DC	6
Digital outputs 230 V AC	2
Analogue inputs	-
PT100 inputs	4
Analogue outputs	-
Operating temperature	-40 °C to +85 °C
Storage temperature	-50 °C to +85 °C

Positioning systems

Intelligent positioning systems for flexible application in sophisticated packaging and production technology.

In modern production plants, feed axes are increasingly automated by actuators. The automation of mechanical feed systems results in a significant reduction of set-up and down times in large production lines, allowing efficient processing of even small batch sizes. The positioning systems are integrated in the plant control, thus eliminating the need to set new formats via handwheel.
The intelligent positioning systems from Lenord + Bauer are based on a 32 bit microprocessor technology, are operated with 24 V DC and combine in their robust and compact housings the following features:

- Motor and gear
- Absolute-measuring sensor
- Power and control electronics
- Various fieldbus profiles
- Process I/Os
- Display and keyboard

Technical features
The positioning systems GEL 6111 and GEL 6110 provide a torque of 5 Nm via a worm gear or 10 Nm via a compact spur gear. With multiturn absolute rotary encoders on magnetic basis there is no longer a need for reference search routine or emergency stop following a power failure. After power is on, the batteryless positioning systems detect their absolute position and are immediately ready for use and maintenance-free.
Standard fieldbus profiles, such as CANopen DS402, PROFIBUS DP V0/V1 or even Ethernet TCP/IP are supported. In addition, the GEL 6111 is freely programmable via CoDeSys, features digital control inputs/outputs and is therefore ideal for plant retrofits. The positioning drive GEL 6110 in stainless steel achieves protection class IP 67 and offers a greatly simplified connection technique by means of a drag chain-suitable hybrid cable.
In connection with the PowerBox GEL 6500, Lenord + Bauer offers a system solution. With the hybrid cable, the power supply and the desired interface profile of the positioning systems are configured via the power box.
Active system protection against thermal overload and a comprehensive system software allow load-dependent duty cycles well above the common 25%.

Applications
The product line GEL 6110, GEL 6111 and GEL 6500 is optimal for various fields of application, ranging from packaging machines, food industry, plastics processing machines, tool sector, as well as large production facilities.

MotionLine
LENORD+BAUER

Fields of application

GEL 6110

- 2 Nm/230 rpm, 5 Nm/100 rpm, 10 Nm/40 rpm
- Compact spur gear, optional with holding brake
- Stainless steel housing with high protection class, plug/ hybrid cable

GEL 6111

- 5 Nm via self-locking worm gear
- Freely programmable via CoDeSys, process I/Os
- CANopen DS402, PROFIBUS DP V0/V1, Ethernet TCP/IP, EtherCAT

	GEL 6110	GEL 6111	GEL 6500
Logic supply	24 V DC / 0.5 A	24 V DC / 0.5 A	24 V DC / 1 A
Motor supply	24 V DC 4 A, max. 10 A	24 to 40 V DC 5 A, max. 12 A	24 V DC max. 40 A
Logic protection	1 A resetting	1 A resetting	
Motor protection	external	external	integrated power management
Interfaces	CANopen DS402 PROFIBUS DP	CANopen DS402 PROFIBUS DP Ethernet	ProfiNet EtherCAT EtherNet I/P PROFIBUS DP CANopen additional upon request
Nominal torque	2 Nm/230 min^{-1} 5 Nm/100 min^{-1} 10 Nm/40 min^{-1}	5 Nm/40min^{-1}	
Assembly	15 mm semi hollow shaft	20 mm hollow shaft	top hat rail
Housing dimension W x H x L in mm	60 x 100 x 160 (125)	110 x 90 x 200	115 x 50 x 185
Housing	stainless steel 1.4301	aluminium cast	aluminium cast
Protection class	IP 67	IP 64	IP 20
Operating temperature	-10 °C to +60 °C	0 to +60 °C	0 to +85 °C
Condensation	permitted	max. 90% humidity	non-condensing
Options	brake, hybrid cable	digital process I/Os	5unit/10unit PowerBox

Availability, for the most part, is a matter of quality

High availability is one of the critical success factors of our customers.
The Lenord + Bauer quality principle ensures this requirement.

Practical suitability and long-term availability of our automation solutions and products is of particular importance to our customers. The main objective is the reliable and long-term functionality of Lenord + Bauer products, even under harshest operating conditions. Quality in development and production form the basis for this principle. This is why, early on, we have implemented test strategies for quality assurance that accompany the entire development and production process. In addition, we continuously optimise these strategies in dialogue with our customers.

The following methods and other project-related tests ensure the high quality of our products:

- Use of modern CAD and CAE tools with integrated simulation and test routines
- Analysis methods for vibration and resonance effects (finite element method, FEM)
- Function tests, from single components to entire systems
- Detailed optical fault analysis, followed by in-circuit tests
- Shock and vibration tests according to industrial standards
- Cyclic temperature tests under operating conditions, from -40 °C to +125 °C
- Pressure tests up to 8 bar
- EMC tests, as part of the CE declaration of conformity
- Climate and salt spray test

Fields of application

Lenord + Bauer is certified according to

- ISO 9001 (quality)
- ISO 14001 (environment)
- IRIS
  (International Railway Industry Standard)


CERTIFICATE
ISO 9001:2000
DEKRA
Lenord, Bauer & Co. GmbH
IAF


CERTIFICATE
ISO 14001:2004
DEKRA
Lenord, Bauer & Co. GmbH
IAF


CERTIFICATE
International Railway Industry Standard (IRIS)
Revision 01, November 2007
IRIS
Certification

IRIS Certification

Application support and training

We support our customers right from the time an automation solution is planned and accompany the entire process, with focus on the individual customer.

The expertise acquired in automation technology allows Lenord + Bauer to provide its customers with a high level of knowledge already at the time of planning and project engineering of machines, plants and systems. Together with our customers we develop hardware and software concepts and specify individual products and sensors.

Our sector and product management is engaged in professional dialogue with the customer. Requirements are addressed on site at customer's facility and problems are analysed together. This is how innovative automation solutions and products are created at Lenord + Bauer.

According to customer's requirements, we offer our support during project engineering and commissioning. Our software specialists develop applications, software modules and couple devices from other manufacturers via various fieldbus systems. We focus on the function of the machines or system as a whole, not only our own product. We never leave our customers "out in the cold"; we work with them to find solutions for virtually any challenge.

During project engineering or after successful commissioning, we provide intensive instruction and training.

Challenge us! We look forward to your automation task and a successful cooperation.