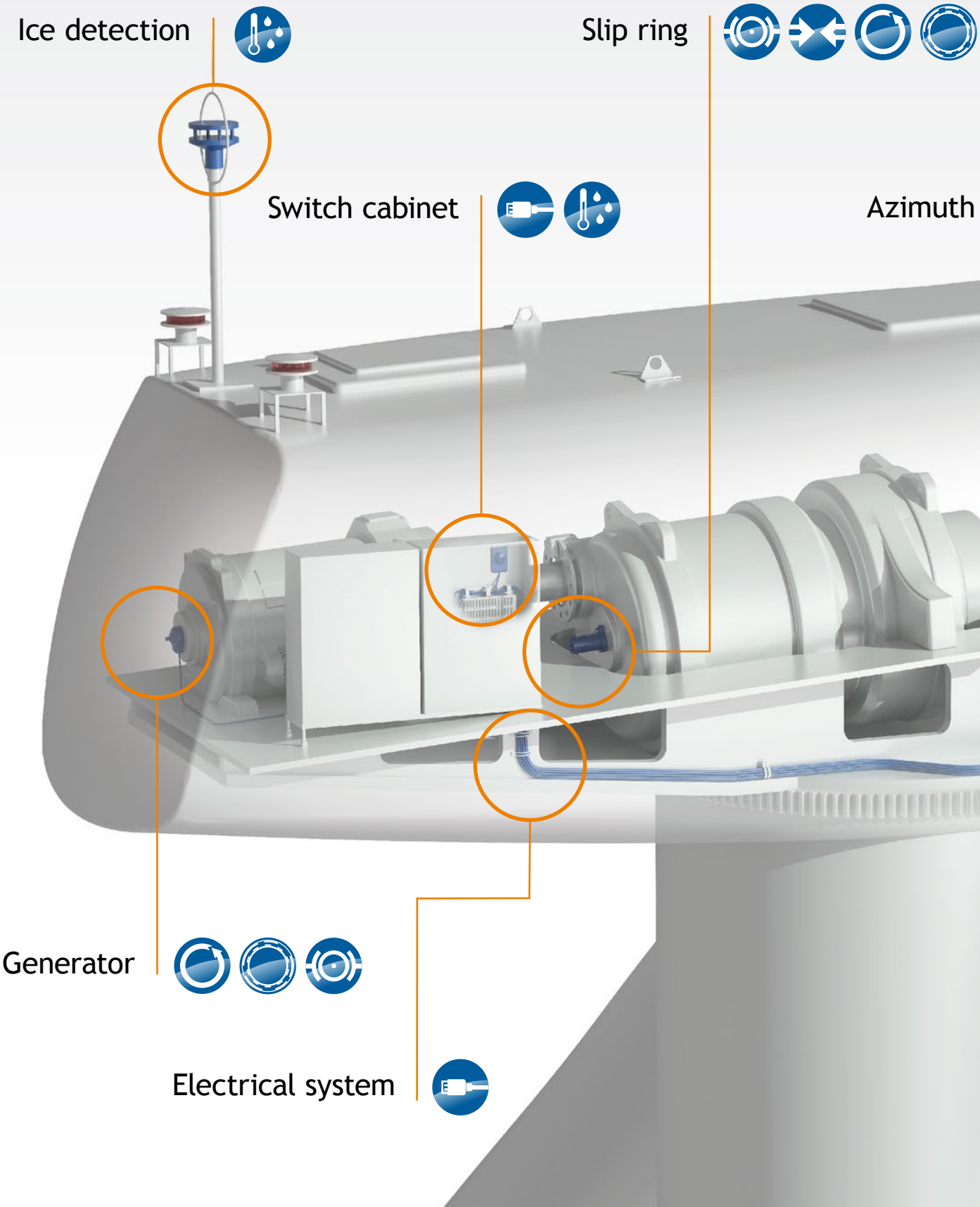
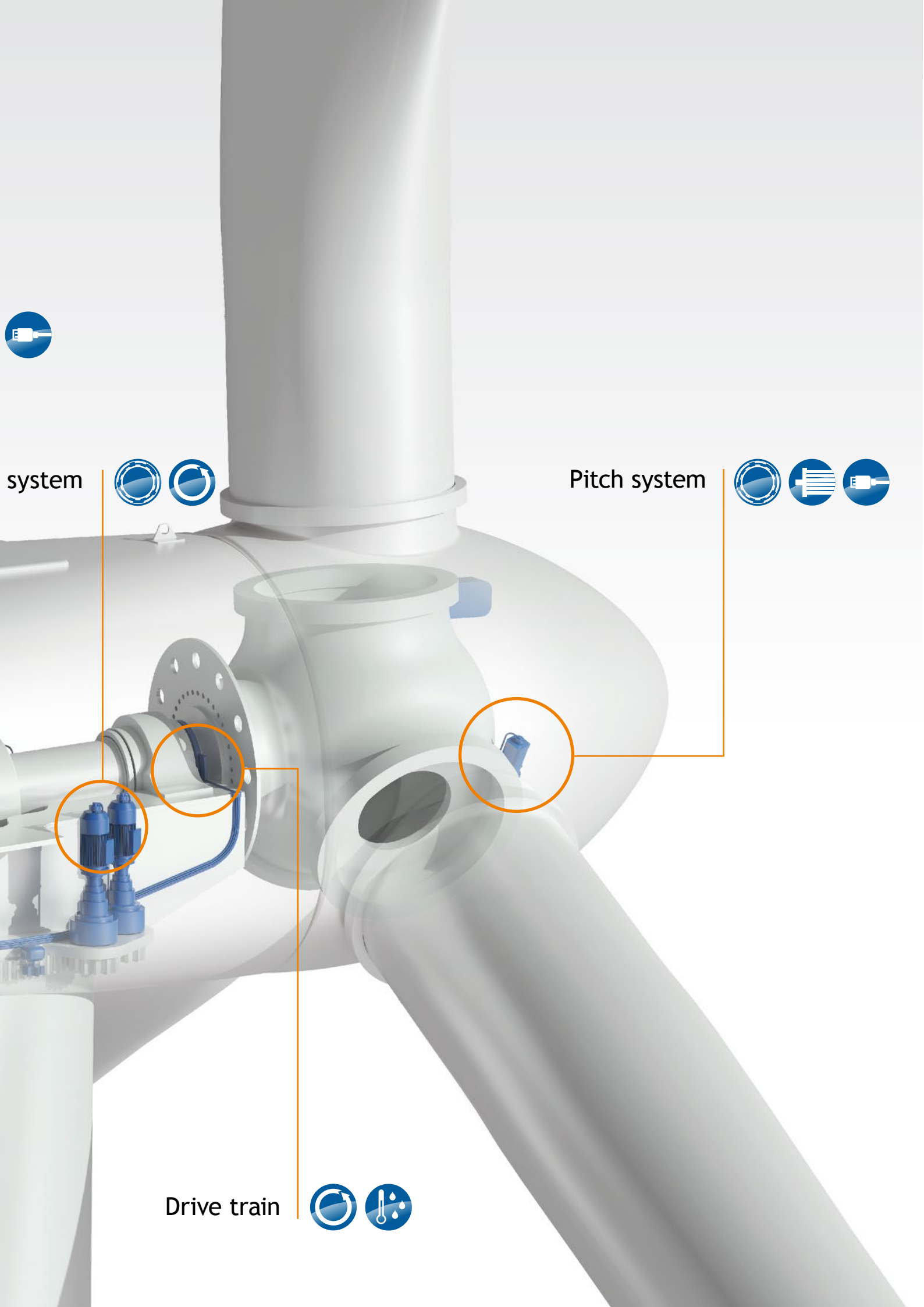
Who sets the right impulses
for the future of your technology?

LEINE LINDE
SYSTEMS

Your central point of contact
for applications throughout the wind turbine




system
Pitch system
Drive train

Technology at the highest level:
A range of functional components

Magnet ring rotary encoder MRI 2202

Intelligent design to meet the growing demand for large shafts: extremely accurate measuring signals, a robust construction and a cost-optimized design together with ease of assembly and dismantling make rotational speed measurement with the magnet ring particularly efficient.

Page 10

Contents

Innovations need two things: a solid foundation and a clear head.

As an independent, flexibly operating company within the HEIDENHAIN Group, LEINE LINDE SYSTEMS is able to set the right impulses for the industry with pinpoint accuracy. With established technology and with innovations you have yet to even consider. With solutions for problems you have yet to recognize. With synergistic effects that you regarded as impossible.

How do we manage this?

We like to take a broader view! Of course we know our way around the sector and have been supporting the development of renewable energies and wind energy in particular since the 1990s. At the same time we have the resources of a leading worldwide technical corporation at our disposal – a corporation that has been gathering experience in mechanical engineering since 1889. Here we profit from factors such as an exchange of information with technicians and engineers, from know-how in science and basic research and from technically refined products, including the documentation. This variety of expertise within the Group means that we not only develop better products for our clients but now provide support in advance for the planning of new turbines with complete project management.

What does project management mean?

The structures within the group enable us to take part in clients' projects at an early stage and provide meaningful input from the very outset. Whether for feasibility studies, engineering or quality management – a large number of clients make use of our experienced expert team to improve or develop their turbines. We provide many of the leading manufacturers of wind energy turbines as well as the suppliers and service companies with our products.

Quality is not just determined during inspection but during production as well.

LEINE LINDE SYSTEMS is the main point of contact within the HEIDENHAIN group of companies for renewable energy sources and for wind energy in particular. We represent the group-wide industry sales for prominent European companies such as HEIDENHAIN, Leine & Linde, LTN Servotechnik, E + E Electronics, RSF Electronics and SEM. All of these companies have two decisive features in common: a great manufacturing depth and meticulous quality control. In wind energy with its increasing requirements – especially those placed on the measuring technology of future-oriented turbines – this is a decisive advantage.

Single component or system?

At our Hamburg location, we pool the precise knowledge that is required for the industry. For our clients this means a profound understanding of the applications as well as a unique product portfolio ranging from connection leads, rotary encoders and slip rings through to complete switch cabinets.

Standard or custom-made?

In fact both! Many of our products have already been successfully operating in wind turbines for many years. In these installations, barely any two products are the same. This is because each one is produced, adapted or refined especially to meet the wishes of the client. And then there are also the solutions which nobody has yet thought about and which allow us to provide new impulses for the industry.

The answer to (almost) all questions?

It's customer proximity – without a doubt. That is the advantage of a small, mobile company such as we are. If you wish, you have direct and immediate personal access to our team of experts. We can then work as partners to find a short route to suitable solutions. So come and have a word with us!

Absolute encoders for pitch, azimuth and slip ring

Within one or more revolutions (single-turn or multiturn) the encoder immediately delivers clear, absolute values – by inductive or optical scanning. Depending on requirements, communication can be managed via serial interfaces (SSI, EnDat) or field bus systems such as PROFIBUS, PROFINET or CANopen. The generously dimensioned ball bearings ensure a long service life.

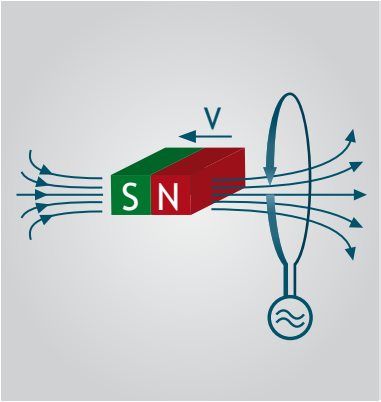
Products

Absolute encoders with optical scanning	
EQN / ROQ 400	Multiturn encoder with stator coupling, clamping or synchro flange
RSA / RHA 500	Sturdy and versatile 13-bit single-turn encoder in hollow or solid shaft design
RSA / RHA 600	Robust multiturn encoder with digital interface for pitch or azimuth system

Absolute encoders with inductive scanning	
ISA / IHA 600	Rotary encoder with sturdy ball bearings in hollow or solid shaft design for single-turn or multiturn applications

Models

Shafts	Solid shaft: 6 + 10 mm round, hollow shaft: 12 mm through-bore or blind hollow shaft (SSI / EnDat), 12 mm blind hollow shaft (field bus)
Flange	Solid shaft: 58 mm Ø synchro or clamp-style flange Hollow shaft: 58 mm Ø with stator coupling
PPR	Absolute: 25 bit (13-bit single-turn + 12-bit multiturn) or 31 bit (19-bit single-turn + 12-bit multiturn)
Electronics	SSI, EnDat, PROFIBUS, PROFINET, CANopen, SSI / HTL, SSI / RS-422, DeviceNet
Connections	SSI / EnDat: M23, cable Field bus: M12, screw terminals
Extras	Additional versions – e. g. including connecting leads, gateway and other accessories – are available on request. You can obtain MTTF and PFH_d values on request.



Principle of inductive scanning

Electromagnetic induction denotes the physical law according to which a movement within a magnetic field – for example due to rotation of the shaft – induces an electrical potential. This voltage signal is evaluated in order to determine position. The advantage: signal generation is largely unaffected by vibration, impact and dirt.

Incremental rotary encoders
for measuring rotational speed

Be it on the generator or the slip ring, optical scanning ensures precise feedback of the rotational speed on the fast or slow shaft. Evaluation is possible via various incremental signals. With its very sturdy ball bearings, the rotary encoder is designed for high mechanical loads. The integrated ADS diagnostics system together with high-quality accessories is available as an installation aid and to extend the range of functions for the rotary encoder.

Products

Incremental rotary encoders with optical scanning

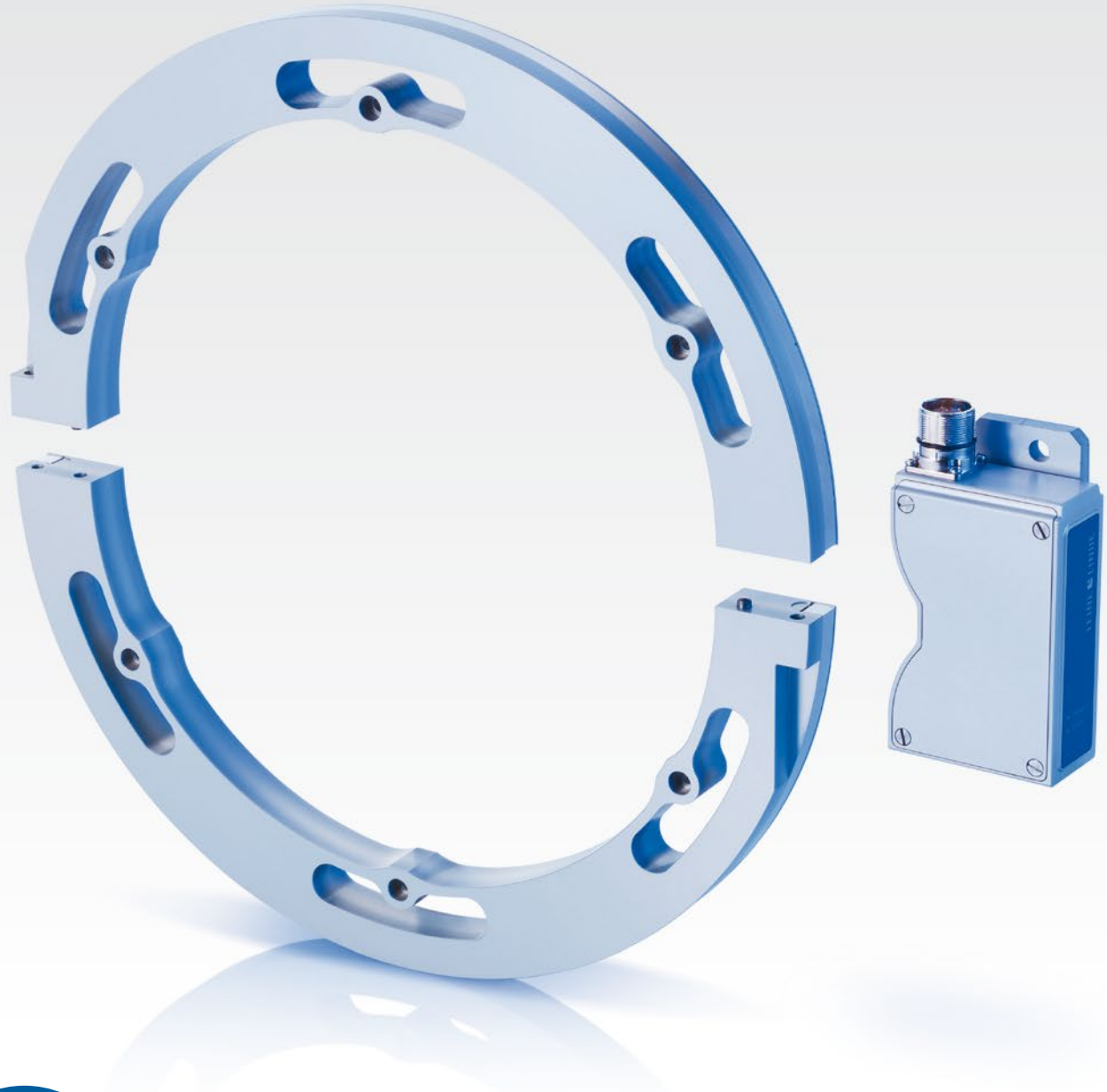
XHI / XSI 800	Robust rotary encoder for the classic generator feedback application – optionally with ADS™ Classic / Online (Advanced Diagnostic System)
XHD / XSD 800	DUO rotary encoder in sturdy design with two galvanically separated outputs for two different signals
CHI 700	Rotary encoder for applications in extremely confined spaces through a combination of robustness and compact design
RHI / RSI 500	58 mm rotary encoder – very versatile and easy to install due to modular construction and a number of versions with solid or hollow shaft

Models

Shafts	Solid shaft: 6 – 10 mm, 11 mm keyway, Hollow shaft: 8 – 15 mm, 16, 20, 25 mm, ¾ + ⅝ inch, 1 inch Blind hollow shaft: 8 – 15 mm, 12 and 16 mm, 12 mm feather keys, 17 mm tapered
Flange	Solid shaft: 58 mm Ø synchro or clamp-type flange, 115 mm Ø Euro flange Hollow shaft: 58 mm Ø with stator coupling, 100 mm + 110 mm Ø
PPR	Incremental: 100, 500, 512, 1024, 2048, 2500, 3072, 4096, 5000, 8192, 10000 ppr Absolute: 10-bit or 13-bit (single-turn)
Electronics	HTL, HC-HTL, TTL, RS-422, 1 Vpp, Optolink Absolute: analogue, parallel, SSI, CANopen
Connections	M23, M12, cable, screw terminals
Extras	Additional versions – e. g. including connecting leads, gateway and other accessories – are available on request. You can obtain MTTF and PFH_d values on request.

Principle of an incremental signal

The incremental signal enables the rotational speed and the relative position within one revolution to be determined. Measurement is carried out with the aid of a graduated disc, which is divided into partial steps (increments) and a defined number of sinusoid signals when the encoder shaft rotates. Incremental encoders are generally used in a closed loop, in rotational speed control circuits or as an instrument for measuring rotational speed.



Magnet ring rotary encoders
for large shaft diameters

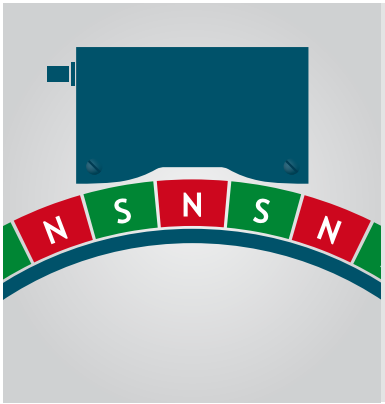
For rotational speed measurement in gearless wind turbines or on hybrid drives: the bearingless sensor is designed for high mechanical loads and can be divided into segments for easy mounting – even on already installed shafts. Various pulse-per-revolution rates are possible via the magnetic scanning system and an electronic evaluation unit. It is also possible to programme a reference point for the absolute measurement of a relative position.

Products

Incremental rotary encoders with magnetic scanning	
MRI 2202	Magnetic ring rotary encoder for flange mounting, scanning distance up to 3 mm
MRI 2302	Magnetic rotary encoder for clamp-mounting on the shaft, scanning distance up to 3 mm
MRI 2206	Magnetic ring rotary encoder with scanning distance increased up to 6 mm, flange mounting
MRI 2306	Magnetic ring rotary encoder with scanning distance increased up to 6 mm, clamp mounting
ERM 2400	High-precision bearingless rotational speed sensor, with compact dimensions, for large shaft diameters of up to 100 mm

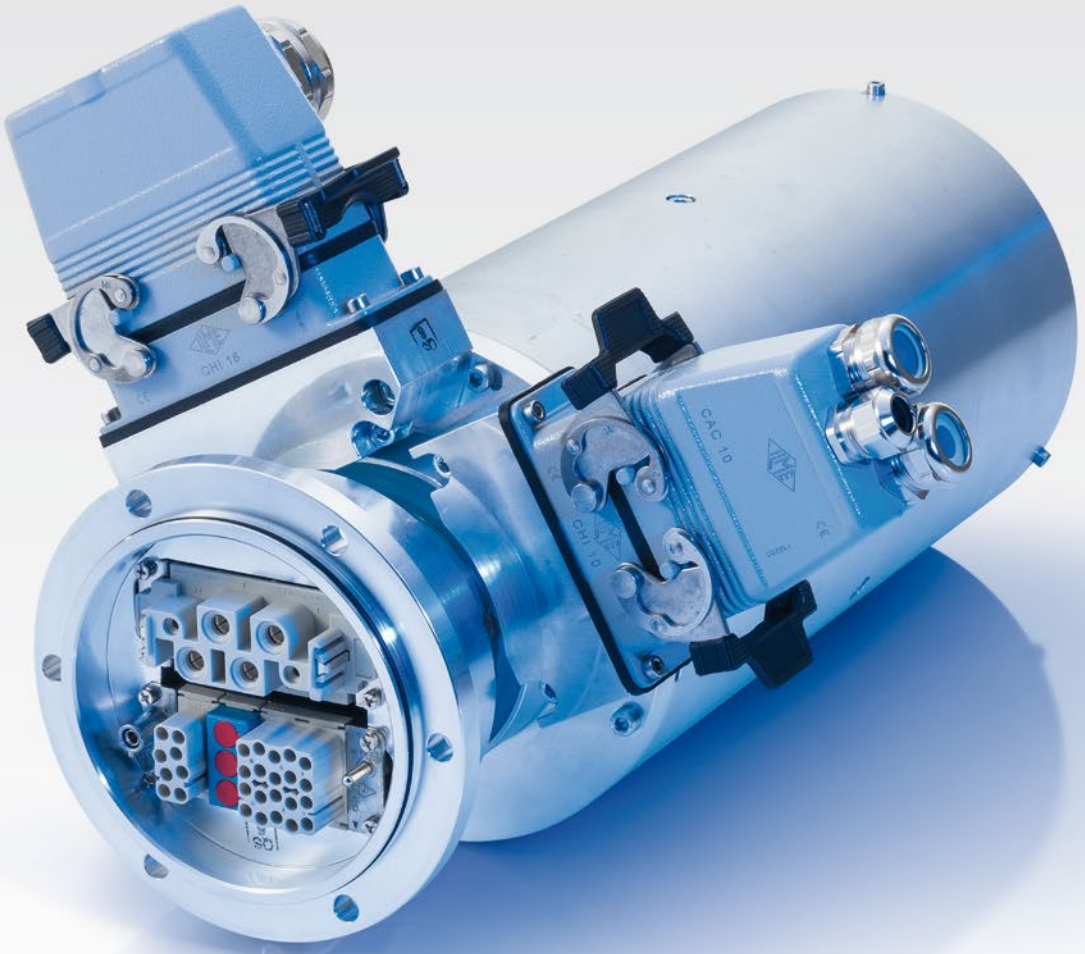
Models

Shafts	Customer-specific design, inside and outside diameter variable
PPR	Customer-specific design, e. g. 1024 or 2048 ppr or similar, maximum scanning frequency: 100 kHz
Electronics	Electronic evaluation unit: sturdy scanning head with double sensor element, HTL, HC-HTL, TTL, RS-422, Optolink
Connections	M23, cable
Extras	Other versions – e. g. in stainless steel model or with connection lead included – are available on request.



Principle of magnetic scanning

A magnetic tape is divided up magnetically by means of alternating north and south poles and inserted into a robust aluminium ring. This ring is mechanically fastened directly on the shaft or a flange. During rotation, the magnetic encoding is read by a non-contact method from a fixed, electronic scanning head and transmitted in various interface formats. One positive side effect is that a large air gap between the rotating ring and scanning head tolerates radial and axial movement.



Slip rings for power, signal and data transmission

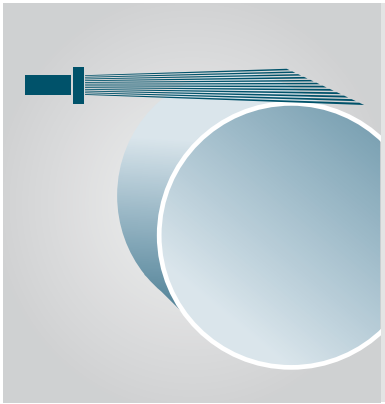
Whether for pitch system or generator, power, signal and data transmission are guaranteed even under high mechanical loads thanks to robust slip rings. The modular, compact and cost-saving construction leads to straightforward installation and means that customer-specific adaptation is readily possible. Our high-quality contact technology renders contact lubrication superfluous and considerably reduces maintenance of the slip rings.

Products

Slip rings (selection)	
SC100	Compact slip ring for signal transmission in hydraulic pitch systems
SC168	Slip rings with power, signal and data paths, very compact, extremely versatile, optical signal transmission optionally available
SC210	Slip ring with power, signal and data paths, transmission capacity of up to 250 A, connection of rotor blade heating systems possible

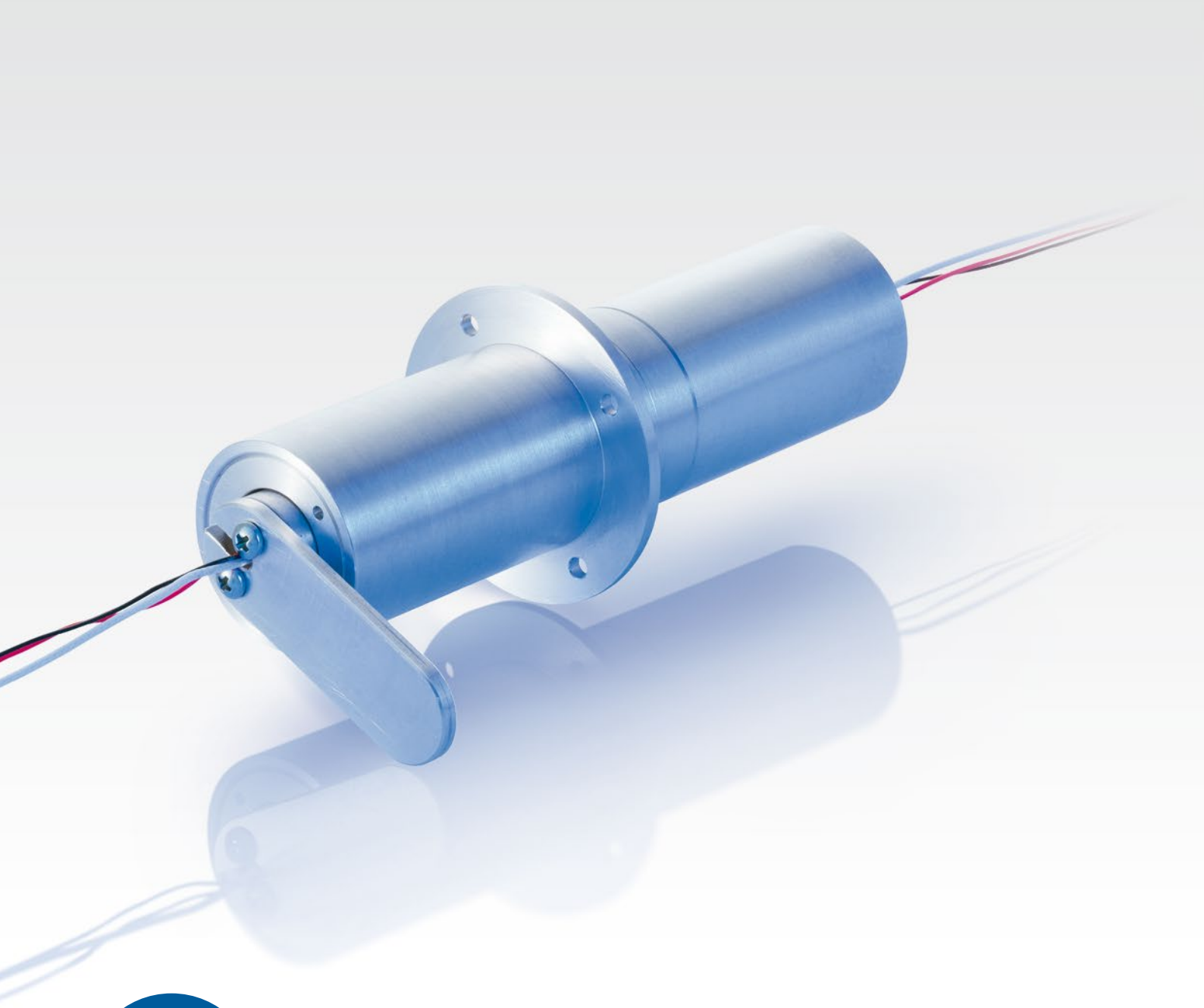
Models

Transfer	Power: voltages of up to 1000 V AC, currents of up to 250 A (higher on request) Data: all types of field bus
Electr. connection	Customer-specific design (e. g. male / female connector, terminal box, connecting cables, etc.)
Mech. connection	Customer-specific design
Extras	• Supply and mounting of a rotary encoder • Fibre-optic rotary joints (FORJ) • Non-contact rotary joint possible (1-channel or 2-channel) Transfer rate of 0.155 Gbps to 1.25 Gbps (2.95 Gbps on request) • Media feed-through connectors • Slip ring retrofit and maintenance concepts • Offshore and cold-climate version



Principle of fibre-bundle contacts

Fibre bundles or multifibres consisting of several individual wires are arranged in parallel and rub on mutually insulated rings. The wires are made of a high-grade noble metal alloy and can carry a current of up to 10 amperes. Using many redundant individual wires means that the transfer reliability is significantly higher in comparison to high-maintenance gold contacts.



Non-contact rotary joints
for maximum data transfer

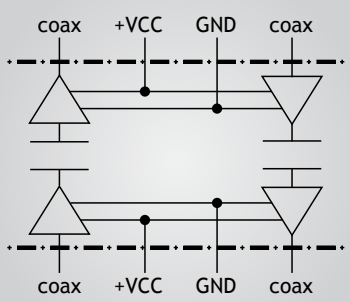
Our encapsulated, non-contact rotary joints for pitch slip rings are small, robust, long-lasting, maintenance-free and efficient. High transfer rates of up to 1.25 Gbps can be attained. In the CF032, for example, the data leads are connected only by means of coaxial cables – optical waveguides are not necessary. Communication is possible from Ethernet-based field bus systems with real-time capability.

Products

Non-contact rotary joints for optical signal transmission in pitch slip rings	
SF020	Non-contact rotary joint, 1-channel
CF032	Non-contact rotary joint, 2-channel, input/output signals via copper cable (coaxial), extremely robust, with aluminium housing and steel ball bearings, unique on the market
K32ST	Fibre-optic rotary joint (FORJ) for the direct connection of optical waveguides

Models

Electronics	All Ethernet-based field bus systems with real-time capability – others on request, transfer rate of 0.155 Gbps up to 1.25 Gbps (2.95 Gbps on request)
Electr. connection	Coaxial data lead and power supply as copper cable
Mech. connection	Customer-specific design
Opt. connection	Connection of multimode optical waveguide to fibre-optic rotary joint via ST plug (others on request)



Principle of a non-contact rotary joint

The non-contact optical rotary joint has an especially long service life and is free of wear. It is connected via a normal copper lead and transfers the signal actively and virtually without delay or signal loss. Here the optical data transmission can take place via one or two channels (= in both directions) in an axial method. In the case of bidirectional axial transmission in the full-duplex method, up to 1.25 Gbps can be attained.

Pitch motors with minimal reaction times

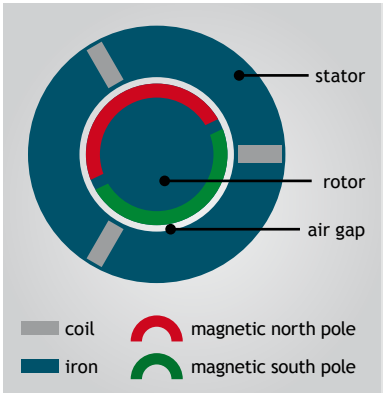
For fast, precise rotor blade adjustment with low energy consumption. Compared with conventional motors, the permanent-magnet-excited, brushless AC servo motor offers a lower inertia, higher maximum torques and a higher overall efficiency. Additional highlights are the compact design with interior holding brake, full sealing and the omission of an external cooling fan.

Products

SynchroPitch™-motors	
SP190	For wind turbines with an output of between 1 MW and 3 MW, three optional windings for different speeds. Example: SP190 (F) for 2.5 MW wind turbine Rated output: 4.2 – 7.7 kW Overall size: H x B: 190 x 190 mm, L: 451 mm / Weight: approx. 42.5 kg
SP260	For wind turbines with an output of between 3 MW and 10 MW, two optional windings for different speeds. Example: SP260 (C) for 6 MW wind turbine Rated output: up to 19.0 kW Overall size: H x B: 260 x 260 mm, L: 560 mm / Weight: approx. 130 kg

Models

Flange	SP190: IEC112 (IEC132 on request) SP260: IEC180 (IEC160 on request)
Brake	SP190: 70 Nm to 140 Nm (holding torque) SP260: 100 Nm to 230 Nm (holding torque)
Connections	Customer-specific design
Extras	Connecting leads, plugs, terminal box, offshore paint coatings, etc. Other versions – e. g. with installed rotary encoder (incremental or absolute) or resolver – are available on request.



Principle of the permanent-magnet-excited motor

The PM motor generates the kinetic energy by means of a constant magnetic excitation field in the rotor circuit. This magnetic field is not established with the aid of electromagnets but by means of magnetized material (permanent magnet) so that no energy is required for the excitation. Our SynchroPitch™ motors, for example, have high-grade samarium-cobalt magnets installed, which are highly corrosion-resistant.

Sensors for condensation, temperature and humidity

For straightforward integration in the nacelle, tower, hub, switch cabinet and inverter: our sensors provide measurements of condensation, humidity, temperature and moisture in oil that are reliable, have long-term stability and exhibit the desired accuracy. All humidity sensors are preset in the factory, thus eliminating time-consuming adjustment on site.

Products

Sensors	
EE 21	Combined humidity and temperature sensor: extremely precise with large measuring range, easy to install
EE 46	Condensation / dew point guard: detects condensation before it is formed, potential-free contact, programmable switching point
EE 160	Combined humidity and temperature sensor: cost-effective, accurate measurement, protected against contamination and condensation
EE 381	Moisture in oil sensor: permanent monitoring of the moisture content, entry of oil-specific parameters possible

Models

Measuring range	Relative humidity: 0 … 100%, Temperature: -40 °C … +60 °C, Water activity: 0 … 1 aw
Protection class	IP 65, IP 40 (EE46)
Electronics	0 … 10V, 0/4 … 20 mA, RS 485, potential-free switching contacts
Connections	M12, cable, screw terminals, DIN / VDE 0627
Extras	Other versions – e. g. with accessories or with special sensor coating for salt-laden air – are available on request.

Principle of moisture measurement

The measurement is taken by means of extremely accurate thin-layer technology subjected to long-term testing with a special protection against dust, salt or chemical contaminants. A thin layer absorbs water from the environment and thus changes the electrical capacitance of a capacitor, from which the relative humidity (RH) is determined. This indicates the ratio of the absolute humidity to the maximum possible quantity that can be absorbed (= 100 per cent humidity).

Ice sensor for advance reporting of ice formation

Extreme site conditions in mountainous, high-altitude or cold regions (such as in the Alps, Scandinavia or Canada) or also regulations in building and operating permits call for special ice sensors. Our ice sensor designed for easy mounting on the nacelle detects the threat of ice formation in advance so that the turbine can be switched off or a blade heating system activated.

Products

Ice sensor

EE 33-MFTJ	Temperature and humidity for outside: special heating technology for fast measurement of environmental change, with UV protective screens – no distortion of the measuring signals

Models

Operating range	Temperature of electronics: -40 °C … +60 °C Temperature of sensor technology: -40 °C … +180 °C Relative humidity: 0 … 100% RH
Protection class	IP 65
Electronics	0 … 10V, 0/4 … 20 mA, RS 485, potential-free relay contacts
Connections	Screw terminals, M12
Extras	Other versions – e. g. with accessories or with special sensor coating for salt-laden air – are available on request.

Principle of the ice sensor

Our ice measuring system is equipped with a combined humidity/ temperature sensor as well as a dedicated temperature sensor. As the only such instrument on the market, the combined sensor has a double-heated probe that reliably prevents condensation and, in conjunction with the separate temperature sensor, thus ensures timely and exact detection of ice formation.

Cables and leads for control and data transmission

From prototype and creation of initial samples to the production of small and large series, from connecting cable to complete switch cabinet: we can supply you with customized leads or cable systems – preassembled, subjected to 100% functional inspection and electrical testing. In combination with the highly modern production technology for assembly and coating, this leads to reliable, safe connections and efficient system solutions.

Products

Cables & leads

Our service for you:

- Selection of technology and preliminary development
- Series development
- Project planning and management
- Production
- Including 100%-functional inspection and electrical testing

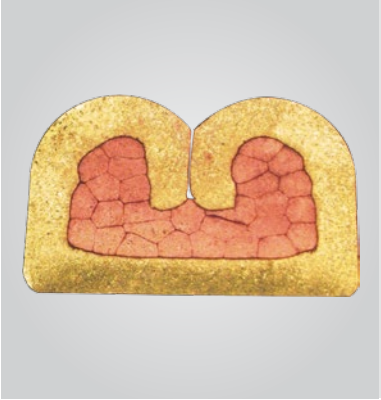
You receive (a selection):

- Data and power leads
- Control and supply leads
- POF and hybrid cables (signal, power, air)
- Systems and out-of-the-box solutions
- Cable carrier
- Hot-melt coating
- Labelling of leads and cable cores
- Mechanical attachments including leads

Models

Connections

- All plug and contact techniques
- Fine soldering technology
- Crimping technology (Ø crimp: 0.032 mm² – 35 mm², larger on request)



Principle of quality assurance in crimping

In addition to automatic controls – e. g. to monitor the crimping tools or the crimping force of the machine – additional inspections also take place to guarantee the high quality of our crimp connections. Besides electrical and mechanical tests, these inspections also include micrographs of the cross-section which occur regularly during the production process. Appropriate test records document the inspections.

There when you need us
Worldwide expertise

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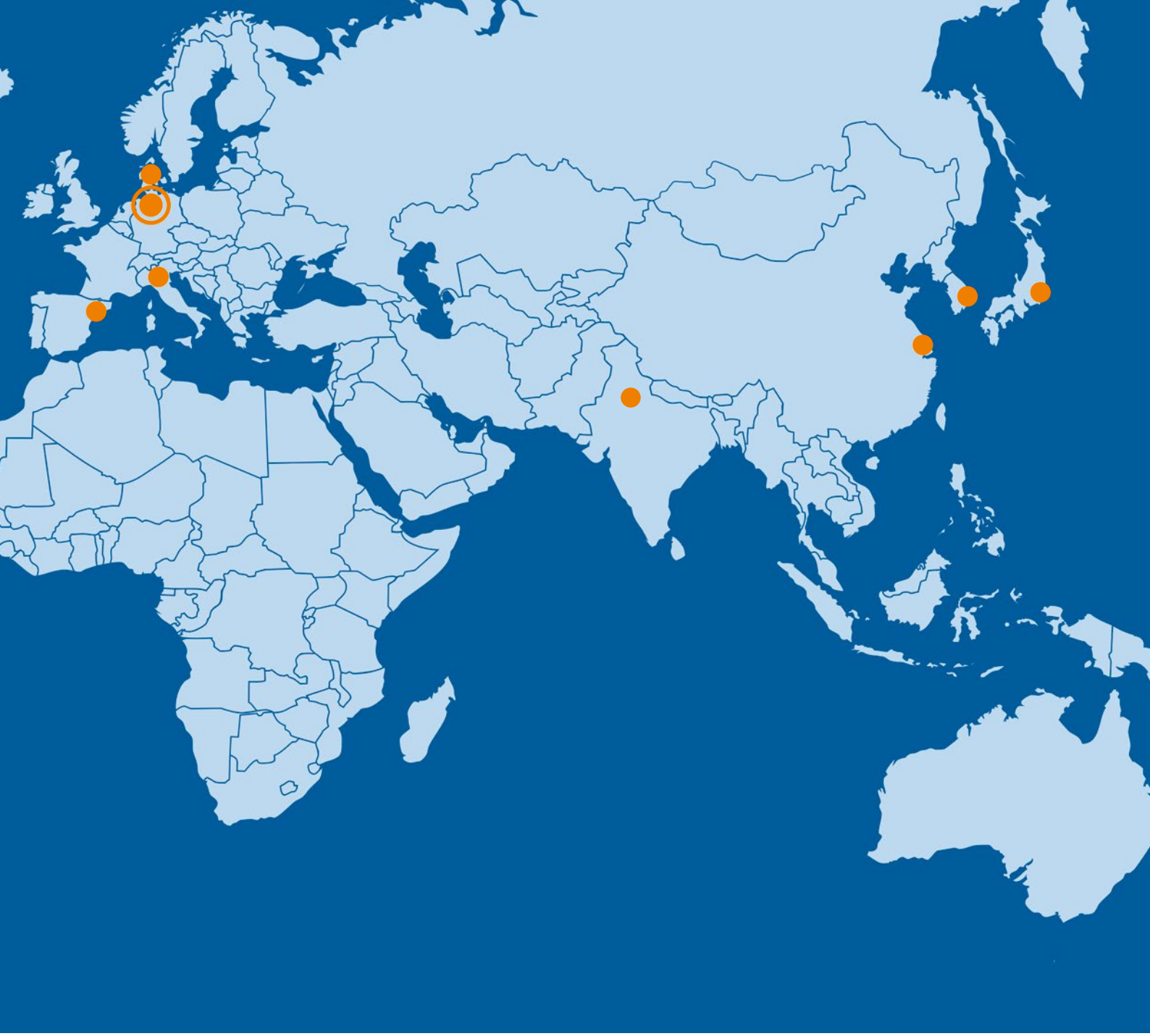

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