

- Incremental Encoders
- Absolute Encoders
- Bearingless Encoders
- Slip Rings
- Transmission Technology
- Functional Safety
- Services

# Kübler worldwide

The Kübler Group is a worldwide leading and strongly growing family-run company with four production sites, eleven subsidiaries and strong agents in more than 50 countries.

Kübler always focuses on understanding the application of the customer. This results in suitable products and solutions. So trust in a technically well-founded advice and benefit from a lasting application support. Over 480 persons are working all over the world for Kübler and pursue one goal: inspire their customers!



## Europe

Austria  
Belarus  
Belgium  
Bulgaria  
Croatia  
Czech Republic  
Denmark  
Estonia  
Finland  
France  
Germany  
Great Britain  
Greece  
Hungary  
Iceland  
Ireland

Lithuania  
Italy  
Netherlands  
Norway  
Poland  
Portugal  
Russia  
Slovakia  
Slovenia  
Spain  
Sweden  
Switzerland  
Turkey  
Ukraine

## Africa

Egypt  
Morocco  
South Africa  
Tunisia

## North and South America

Argentina  
Brazil  
Canada  
Mexico  
Peru  
U.S.A.

## Oceania

Australia  
New Zealand

## Asia

China  
Hong Kong  
India  
Indonesia  
Israel  
Lebanon  
Malaysia  
Philippines  
Singapore  
South Korea  
Taiwan, R.O.C  
Thailand  
United Arab Emirates  
Vietnam



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Added value for our customers



## Flexibility and quality

A wide product range characterized by high quality standards allows us to meet a variety of very different customer requirements. In addition, our constant goal is to reduce system costs and to create added value thanks to innovations.

## Innovation and partnership

For us, innovation comes from creativity that allows us thinking out of the box. We develop, jointly with our customers, novel products, solutions and services. Thanks to the close proximity to our customers, we make sure that our innovations meet all their requirements.



Headquarters in Villingen-Schwenningen





## Robust and durable

Kübler sensors have been developed for use in challenging environments. In wind turbines, they have been providing their services for many years, ensuring safe and reliable operation. They withstand highest stresses due to heat and cold, high air humidity and high salinity, as well as to strong vibrations.

## Customer-specific development

Standardizing and modularization are of essential importance in wind turbines. Nevertheless, special solutions are still an important element in many companies to allow them realizing customer-specific applications. Kübler has been proving for many years its ability to respond flexibly to special solutions, especially in wind turbines, where an optimal connection of the sensor to the generator or rotor is required.

In short: we want to supply the ideal sensor for your turbine.

## Kübler Group – 55 years of innovation

Founded in the year 1960 by Fritz Kübler, the family business is now led by the next generation of the family, his sons Gebhard and Lothar Kübler. Ten international group members and distributors in more than 50 countries offer local product know-how, service and advice throughout the world. Innovative product and sector solutions, as well as solutions for functional safety and a high level of service, are the reasons behind our global success. The strict focus on quality ensures the highest levels of reliability and a long service life for our products in the field. Over 480 dedicated people worldwide make this success possible and ensure that customers can continue to place their trust in our company.



## The comprehensive portfolio for control and monitoring

Whether blade angle measurement, wind direction tracking, position and rotary speed control or signal and load transmission – Kübler has the right product. His many years of experience in this sector ensure the customers reliable products and the best consultation.

Besides encoders and sensors for turbine control, Kübler offers a comprehensive portfolio of safety encoders and slip rings. These can be ideally combined and, together, offer many advantages.

### 1 Position and speed measurement of rotor and generator shafts

Incremental and absolute bearingless encoders



### 2 Speed measurement of rotor shaft on the slip ring

Compact and cost-effective incremental Sendix KI40 encoders



### 3 Speed measurement of generator shaft

Incremental Sendix Heavy Duty H120 encoders



### 4 Rotary speed monitoring

Safety-M compact safety modules



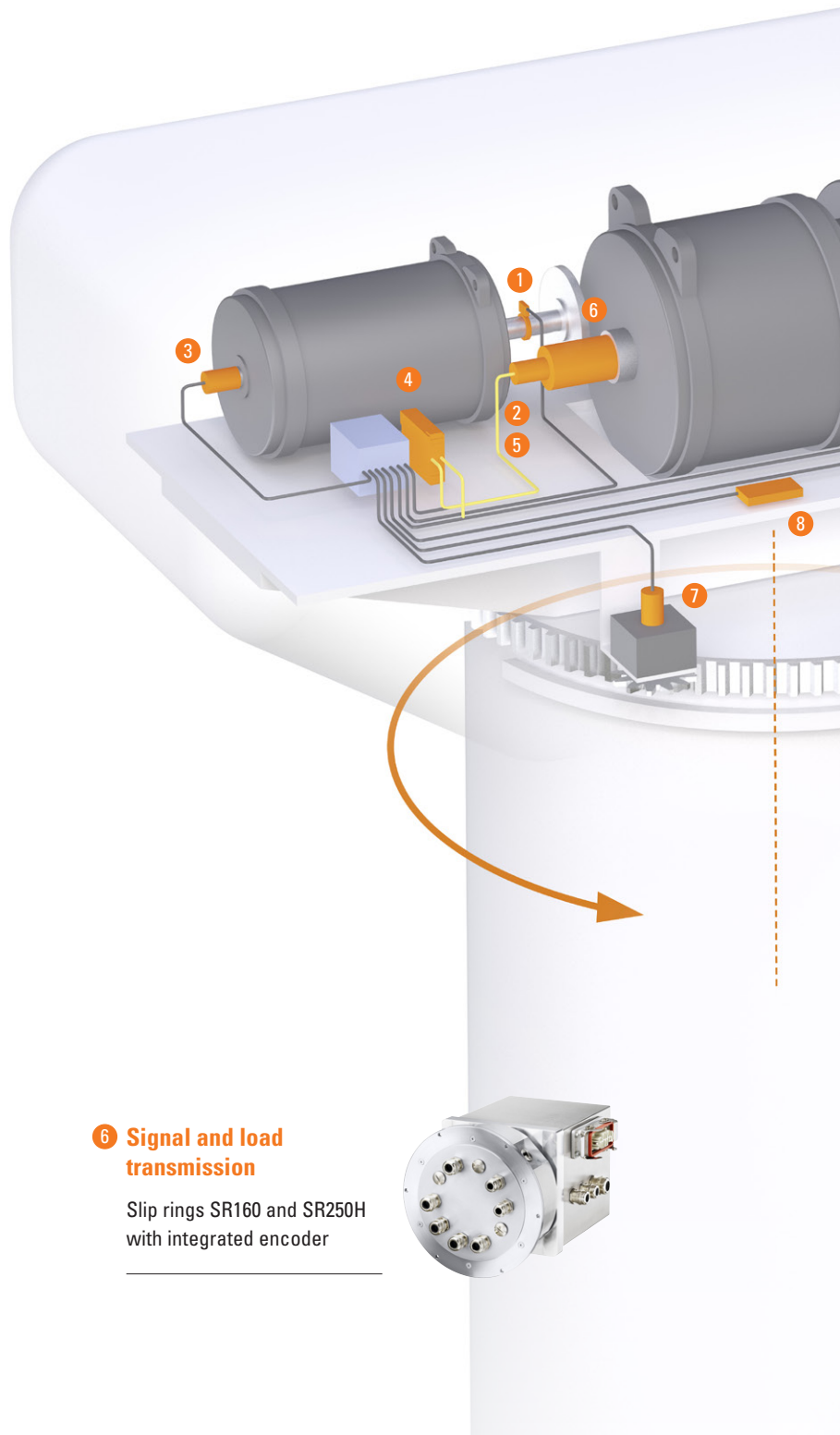
### 5 Monitoring of rotor speed and rotor position

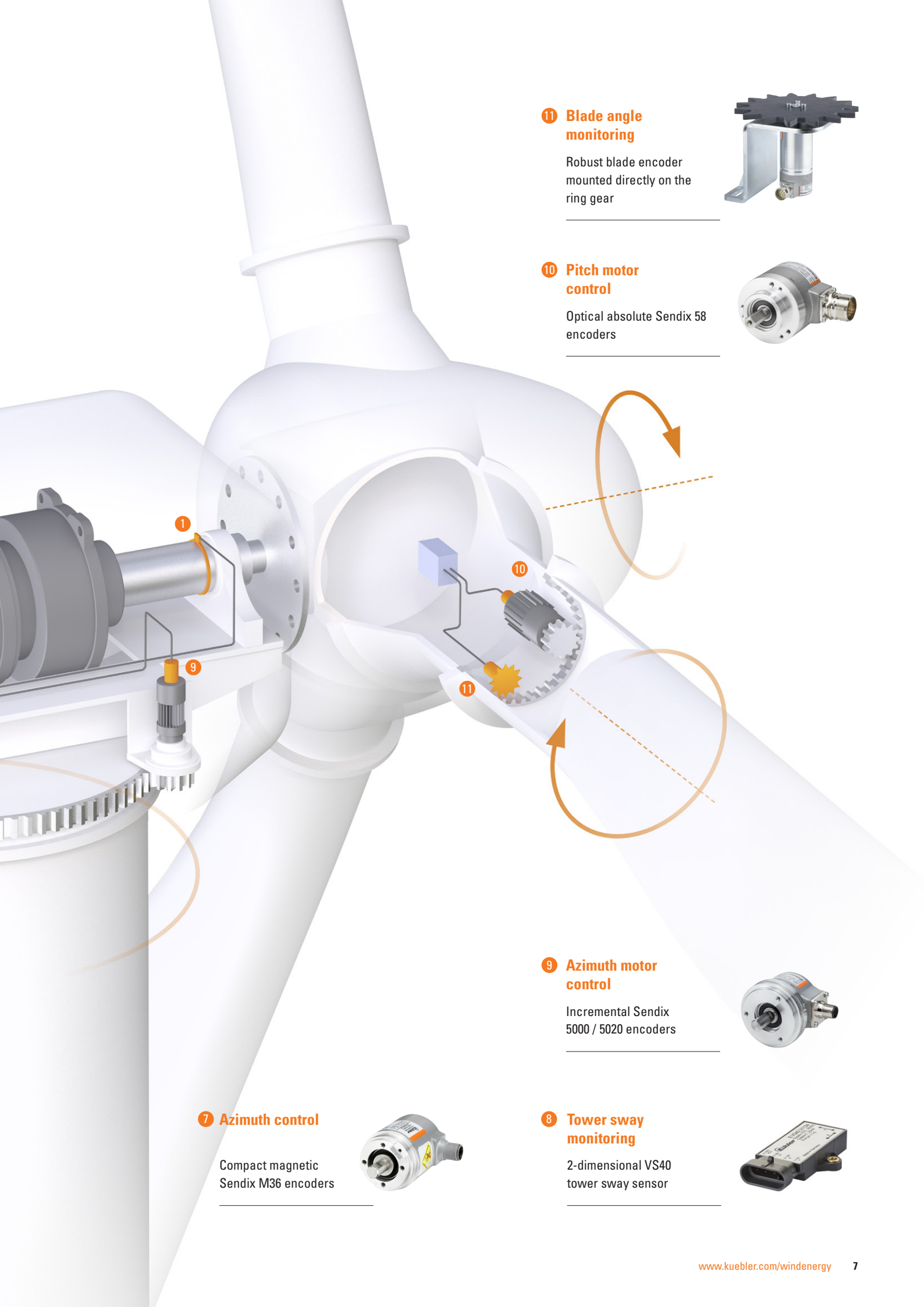
Incremental and absolute Sendix SIL 58 encoders



### 6 Signal and load transmission

Slip rings SR160 and SR250H with integrated encoder





**11 Blade angle monitoring**

Robust blade encoder mounted directly on the ring gear



**10 Pitch motor control**

Optical absolute Sendix 58 encoders



**9 Azimuth motor control**

Incremental Sendix 5000 / 5020 encoders



**7 Azimuth control**

Compact magnetic Sendix M36 encoders



**8 Tower sway monitoring**

2-dimensional VS40 tower sway sensor



## Pitch and azimuth control

Safety first! Measuring systems form an integral part of the safe control of pitch and azimuth and need to offer reliable, precise availability at all times. No matter when nor where, Kübler Sendix series encoders set standards here when it comes to safety, accuracy and ruggedness – whether in the drive or as a stand-alone measuring system in wind turbines.

The flexible and wide-ranging options offered by the Kübler Sendix encoders create the ideal solution for every eventuality when it comes to the construction of wind turbines and ensure a long service life and optimal costs.



	11 Complete system	10 Sendix 58 encoders	7 Sendix M36 encoders	10 Sendix F36 / F58 encoders
Description	Sendix 5863 multiturn encoder combined with robust bearing unit, mounting bracket and drive toothed wheel	Multiturn encoders, shaft and hollow shaft versions, highly accurate scanning, 100% magnetic field resistant  5863/5883, 5868/5888	Compact multiturn encoders, shaft and hollow shaft versions, high IP protection level, easy installation in tight mounting spaces, extremely robust variant available  M3661/M3681, M3663/M3683, M3668/M3688	Electronic multiturn encoders, no gear and therefore less sensitive, cost-effective and highly accurate sensors  F3663/F3683, F5863/F5883
Characteristics	ø 58 mm, optical, mechanical multiturn Safety-Lock™ design	ø 58 mm, optical, mechanical multiturn Safety-Lock™ design	ø 36 mm, magnetic, electronic multiturn Energy Harvesting Technology Safety-Lock™ design	ø 36 / 58 mm, optical, electronic multiturn Intelligent Scan Technology™ Safety-Lock™ design
Mechanical interface	shaft max. 10 mm	shaft max. 10 mm hollow shaft max. 15 mm blind hollow shaft max. 15 mm	shaft 10 mm blind hollow shaft max. 10 mm	shaft max. 10 mm hollow shaft max. 15 mm blind hollow shaft max. 15 mm
Electrical interface	SSI, BiSS + 2048 ppr SinCos or + 2048 ppr RS422	SSI, BiSS + 2048 ppr SinCos or + 2048 ppr RS422, PROFIBUS, CANopen, EtherCAT and PROFINET	analog, SSI, CANopen	SSI, BiSS + 2048 ppr SinCos or + 2048 ppr RS422
Resolution max.	17 bit singleturn + 12 bit multiturn	17 bit singleturn + 12 bit multiturn	14 bit singleturn + 24 bit multiturn	17 bit singleturn + 24 bit multiturn
Speed max.	12000 min <sup>-1</sup>	12000 min <sup>-1</sup>	6000 min <sup>-1</sup>	12000 min <sup>-1</sup>
Temperature range	-40°C ... +90°C	-40°C ... +90°C	-40°C ... +85°C	-40°C ... +90°C
Power supply	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	10 ... 30 V DC	5 V DC 10 ... 30 V DC

## Position / speed measurement of rotor and generator shafts

A tough nut. Accurate position and speed informations are important measurement values for the control loop of a wind turbine. Measuring systems that supply this information are often subjected to harsh environmental conditions but must in no way suffer any loss of reliability.

Kübler offers here the complete range of solutions: from the extremely robust Sendix Heavy Duty H120 encoder mounted on the generator, through compact and cost-effective Sendix 5000 or Sendix KIS40 encoders for slip ring integration, up to bearingless encoders with magnetic rings or magnetic tapes, which can be mounted directly on the rotor or generator shaft.

Smart, bearingless encoders offer, if needed, highest resolutions and allow high control accuracy thanks to the digital signal processing with active signal errors correction. The flexible encoder systems are genuine all-rounders. They provide information about position, rotational speed and acceleration, and additional outputs allow their direct integration in the condition monitoring system or in the safety monitoring of the plant.



	<b>3 Sendix Heavy Duty H120 encoders</b>	<b>9 Sendix 5000 / 5020 encoders</b>	<b>5 Sendix SIL 58FS encoders</b>	<b>1 Bearingless encoders RLI Performance</b>
Description	Extremely resistant incremental encoders. Integrated bearing isolation max. 2.5 kV, IP66 and IP67 thanks to double shaft protection.	Robust incremental shaft or hollow shaft encoders. Unique variants variety, sets new standards in its class.	Certified incremental and absolute encoders for highest safety and reliability. Optimally combinable with Safety-M safety modules.  5814FS2/5834FS2, 5853FS2/5873FS2	<ul style="list-style-type: none"> <li>Smart bearingless encoders</li> <li>Freely adjustable line count with reference signal(s)</li> <li>Status LED, Status output</li> <li>Optional integrated vibration sensor (possibility for condition monitoring and predictive maintenance)</li> <li>Integrated digital signal filters and electronic type label with user memory</li> </ul>
Characteristics	ø 100 mm, optical, incremental, HD-Safety-Lock™ design	ø 50 mm, optical, incremental, Safety-Lock™ design	ø 58 mm, optical, incremental and absolute Safety-Lock™ design	Sensor head 100 x 60 x 25 mm, magnetic ring or magnetic tape incremental
Mechanical interface	hollow shaft max. 28 mm	shaft max. 12 mm hollow shaft max. 15 mm	shaft max. 10 mm hollow shaft max. 14 mm	Magnetic ring up to ø 390 mm (larger diameters on request) Magnetic tapes for mounting on very large shafts > ø 500 mm
Electrical interface	RS422, optical fiber, push-pull	RS422, open collector, push-pull	SinCos, SSI, BiSS + SinCos	RS422, push-pull, SSI, BiSS, analog
Resolution max.	5000 ppr	5000 ppr	2048 ppr. SinCos 17 bit singleturn	Resolution freely programmable (in the factory or by the customer)
Speed max.	5000 min <sup>-1</sup>	12000 min <sup>-1</sup>	12000 min <sup>-1</sup>	12000 min <sup>-1</sup> (mechanically limited acc. to the magnetic ring diameter)
Temperature range	-40°C ... +100°C	-40°C ... +85°C	-40°C ... +90°C	-20°C ... +80°C
Power supply	5 V DC 10 ... 30 V DC	5 VDC 5 ... 30 VDC 10 ... 30 VDC	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC

# Slip rings and transmission technology

Good hint. Kübler slip rings provide for all plant types with hydraulic or electrical pitch control a reliable transmission of power, signals and data from the nacelle to the rotating hub. Also the transmission of classical fieldbuses and of Ethernet-based communication is ensured without any problem. All from one single source: The suitable incremental and absolute Kübler encoders allow of course perfect integration in the slip ring. A comprehensive range of transmission technology, cables, connectors and pre-assembled cordsets ensures reliable transmission for suitable and error-free communication. Besides encoders for rotational speed and position control, a tower sway sensor completes the plant monitoring portfolio.



	<b>6 SR160 and SR250H slip rings</b>	<b>8 VS40 – tower sway sensor</b>	<b>Optical fiber transmission modules (LWL)</b>	<b>Connection technology</b>
<b>Description</b>	<p>Reliable and robust contact technology for transmission of electrical load up to 85 A (higher on request), data and signal, fieldbus, protocol independent Ethernet transmission</p> <ul style="list-style-type: none"> <li>· Very long service life, no maintenance</li> <li>· Integrated incremental or absolute encoder</li> <li>· Up to IP65 protection</li> <li>· Various connection options</li> <li>· Robust design – aluminum or stainless steel housing mission available</li> <li>· High flexibility by modular design options, tailored to customer requirements</li> <li>· Operating temperature -30°C ... + 60°C</li> </ul>	<p>Tower sway sensor for 2-dimensional measurements</p> <ul style="list-style-type: none"> <li>· Resolution ±2g</li> <li>· Analog output (4 ... 20 mA / 0.5 ... 4.5 V DC)</li> <li>· High FIT and MTBF values</li> </ul>	<p>Optical fiber transmitter, receiver and cable</p> <ul style="list-style-type: none"> <li>· Available for incremental and SSI signals</li> <li>· Signal transmission through one single glass fiber</li> <li>· Safe signal transmission up to 2000 m</li> <li>· Withstands extremely strong electromagnetic fields</li> <li>· Potential separation</li> <li>· Accessories: Simplex patch cable, ST multimode coupling</li> </ul>	<p>Connectors and cables</p> <ul style="list-style-type: none"> <li>· Connectors, cables and preassembled cordsets</li> <li>· M12, M23, MIL and many others</li> <li>· Fieldbus connection technology</li> </ul>
<b>Use</b>	<p>Transmission of power, signals and data from the nacelle to the rotating hub. Innovative contact technology with a three chamber system for safe and reliable operation in harsh environments.</p>	<p>Tower sway monitoring in 2 axes. Simple reading and processing of the analog signals by the control.</p>	<p>Optical transmission of the speed signals from the generator or from the rotor to the tower base. No line-conducted interference in the optical fiber cables, e.g. due to generators, inverters or power cables.</p>	<p>For a reliable connection of all electrical components. Sensors and connection cables prequalified from one hand.</p>

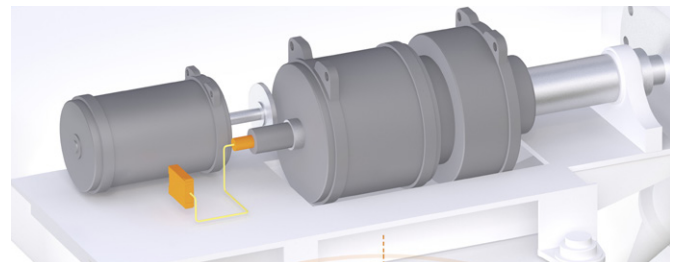
## Solutions for Functional Safety

Safe single components alone do not fully ensure a safe global application. Only the optimal interaction between safety sensors and safety monitoring modules offers reliable solutions, which will meet the necessary safety requirements. The optimal combination of Kübler's Safety-M modules and Sendix SIL encoders allows the easy implementation of a safe drive monitoring system.

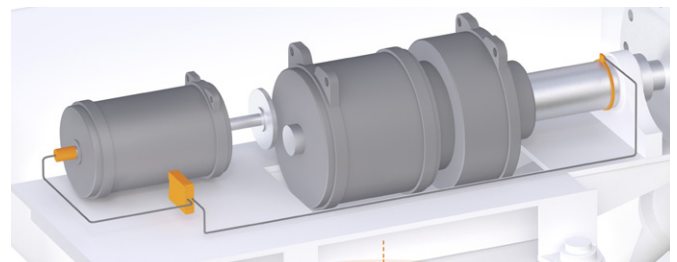


Description	<p><b>4 Safety-M compact SMCx speed monitor</b></p> <p>Complete speed monitor in smallest construction space</p> <ul style="list-style-type: none"> <li>· Integrated signal splitters to forward the encoder signals to a converter, CMS or control</li> <li>· Local diagnostics thanks to front-side status LED and removable OLED touch screen with plain text display</li> <li>· Easily configurable with parameters</li> <li>· 1 or 2 incremental encoder interfaces (HTL/proximity switch, TTL, SinCos)</li> </ul>
Use	Speed monitoring of up to 2 incremental encoders or HTL speed signals in the drive train e.g. from a generator or rotor
Power supply	24 V DC +5 %
Number of encoder interfaces	2 – to monitor 2 incremental encoders SinCos, RS422, Push-pull
Inputs and outputs	4/2 safe digital inputs 8/4 safe digital outputs 2 safe relay outputs
Parameterizing / Programming	Easy parameterizing by means of touch display or free PC software "SafeConfig OS6.0"

The Safety-M compact module monitors rotational speed signals directly from the slow-speed rotor shaft or from the high-speed generator shaft. Safe overspeed detection can occur in two ways:



1 – By means of a safe encoder such as the Sendix SIL 5834FS2 with SinCos signals, for example integrated in a slip ring on the rotor shaft.



2 – By means of two encoders at different measuring points in the drive train. In addition, the difference between the rotor and generator shafts allows here monitoring slippage or transmission breakage.

## Technologies for the wind industry

Innovations from tradition. Kübler products benefit from 55 years experience in automation engineering.

Over the years they have undergone ongoing development and been optimized for use in drives, in outdoor and offshore applications and not least in wind turbines.

Small details make a big difference. Our products feature many intelligent, high-quality extras, which offer our customers important advantages, whilst at the same time making a significant contribution to the high availability of the wind turbine.

### Robust bearings



Kübler encoders boast a very sturdy and robust bearing construction, brought together under the term Safety-Lock™.



Encoders with Safety-Lock™ have positive interlocked bearings with a large bearing span and special mounting technology. This means they are able to tolerate installation errors as well as large shaft loads, as can occur as a result of temperature expansion or vibration.

### Shaft isolation



Even well-earthed machine housings and rotors of generators and large motors carry a shaft current on the rotor.

The equipotential bonding from the rotor to the stator via the encoder bearings leads to spark erosion and can damage the encoder. This can be remedied by isolating the encoder bearings. Isolating inserts can be used with all Sendix compact encoders.

### Optical encoder technology



Magnetic field-resistant, even strong magnetic fields, as they are generated in the environment of brakes or geared motors, are not a problem for optical encoders.



This technology does not use any components sensitive to magnetic fields and allows high sampling rates.



Thanks to its first stage mounted on two ball bearings and to the specifically developed special toothing, the multiturn gear module acts durably against wear and can be used for high speeds up to 9000 rpm.

### High protection level / seawater durable



A high protection level is achieved as a result of the integrated radial shaft seal. This, together with the wide temperature range and the bearing technology, ensures outdoor use is possible without problems.



Many versions of the Sendix family of devices have now been tested and certified to IEC 68-2-11 for resistance to the effects of salt-spray over a period of up to 672 hours – the highest test level. The high certification level for the Sendix encoders attests a high level of corrosion resistance.

### Insensitive to interference: OptoASICs



The resistant Kübler OptoASIC technology is characterized by good EMC features, high shock resistance and particular reliability in the application.

### Wide temperature range



High heat resistance – combined with high rotational speeds – make the Kübler Sendix encoders the optimal solution for all applications in a high temperature environment.



## Hardened down to the last detail



The durable construction that comes as standard, permits high shock and vibration values; these are both tested and certified. The values are extremely important in drive engineering, as the potential applications for the motors are highly diverse.



## Approvals

All encoders from the Kübler company carry the CE mark and are tested for electromagnetic compatibility and immunity to interference. As an option, our products can be UL approved.

Products with Ex approval and products certified for Functional Safety complete Kübler's products range.



## Energy Harvesting Technology



The magnetic encoders of the M36 family include the so-called Energy Harvesting Technology. This technology allows counting reliably the number of revolutions even in case of a power failure.

The necessary energy is generated directly by the rotating magnetic field.

The benefit is obvious: this technology allows doing totally without gear and without battery. In addition to enhancing the compactness and longevity of the encoder, this also increases cost-effectiveness, which plays a determining role in cost-sensitive applications.

## Electrical interfaces



Kübler encoders boast a wide variety of interfaces. Along with incremental interfaces such as TTL / HTL and SinCos, there are also absolute interfaces such as SSI and BiSS, as well as interfaces for all usual field bus systems. The outputs and supply voltage are short-circuit protected.

## Intelligent Scan Technology™



The Intelligent Scan Technology™ is a technology patented by Kübler that allows realizing electronically the multiturn feature with an optical encoder. This technology is based on the many years of experience in the area of 100 % magnetically insensitive OptoASICs. The result: a very high resolution reaching 41 bits.

## Simple / fast installation



Innovative connection technology with plug-in spring terminal connectors allows for fast, safe installation without tools. Maximum connection safety with minimal connection times.

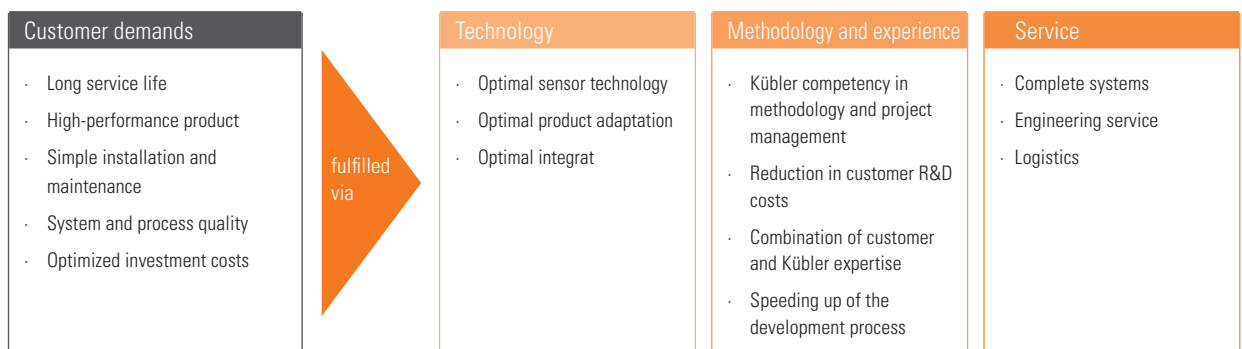


## Tailor-made solutions – Kübler Design System

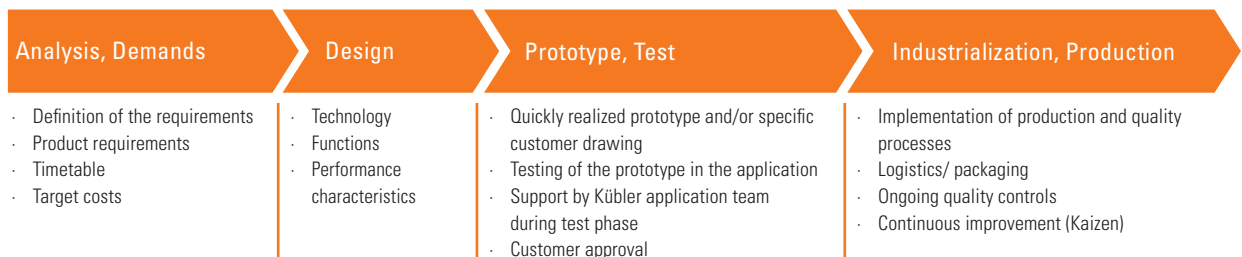
With the KDS method our customers receive a lasting solution to lowering costs, reducing the number of models available or eliminating quality deficiencies. With KDS we develop product and engineering solutions together. The method stands out because of its structured process; this delivers innovation through experience and cooperation with the customer.

*Gebhard and Lothar Kübler, Managing Directors Fritz Kübler GmbH*

### The Kübler Design System – satisfying customer demands



### The 4 phases of the Kübler Design System



### PRESALES

- Selection tool
- Kübler website: Product Finder

Kübler industry specialists for applications and complete integration solutions – on site worldwide.



- Delivery Service 10 by 10
- 48 h Express and Repair Service

Sample Service – Fast delivery of customized versions



# Kübler Service for Planning Dependability

Fast, reliable service and professional advice have top priority at Kübler. We are globally on your doorstep in 8 service and application centres and offer our customers planning dependability. Our processes and services are certified and are constantly being improved.

## 24one 24one delivery promise

Manufacturing in 24 hours. For orders placed on working days before 9 AM, the product will be ready for dispatch on that same day. 24one is limited to 20 pieces per delivery.



## Sample Service

We manufacture samples of special designs or according to customer specification within shortest time.



## 10 by 10

We will manufacture and deliver 10 encoders within 10 working days (365 days a year - with the exception of 24th Dec. until 2nd Jan.)



## Technical Support

Kübler' applications team is present on site all over the world for advice, analysis and support.



## 48 h Express Service

We can process your order within 48 hours; we can ship stock items the same day.

<b>Kübler Germany / Austria</b>	<b>+49 7720 3903 952</b>
Kübler France	+33 3 89 53 45 45
Kübler Italy	+39 0 26 42 33 45
Kübler Poland	+48 6 18 49 99 02
Kübler Turkey	+90 216 999 9791
Kübler China	+86 10 8471 0818
Kübler India	+91 8600 147 280
Kübler USA	+1 855 583 2537



## Safety Services

- Adapted service packages
- Individual customer solutions



## AFTERSALES



Service Excellence provided by Kübler application specialists for target sectors



Service Centres, globally on your doorstep: Advice, analysis, support during installation in over 50 countries

Product security – replacement models at the end of the product life-cycle



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R600.949.001 09 150 18 ES - Edition 2018