

- Motor Feedback Systems
- Bearingless Encoders
- Encoders
- Linear Measuring Technology
- Single Cable Solutions

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!



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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





Functional Safety

Safety is – not least because of the UE Machinery Directive 2006/42/EC – an integral part of plants manufacturing. The selection of the right encoder for Functional Safety must be governed by the principle that safety will be achieved by an intelligent interaction between the encoder and the controller. Moreover, certified Kübler products allow faster certification of the whole system (motor controller) than standard products.

Customized solutions

Standardizing and modularization are of essential importance in the drive technology. 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 the drive technology, which requires optimal encoder motor connection. In short: we want to supply the ideal sensor for your drive.

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. Eleven 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.



Technologies for Drive Technology

Innovations from tradition. Kübler products benefit from 55 years experience in automation technology. Over time they have been further developed for use in drive engineering. Small details make a big difference. Our products feature many intelligent top-quality extras and offer our customers key benefits. In doing so, they make a significant contribution to the high availability and safety of the machines.

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.

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, BiSS and BiSS Safety.



The outputs and supply voltage are short-circuit protected.



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.

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.

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.



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.

Housing geometry



The compact design dimensions specially conceived for drive engineering as well as the very compact connector solution permit optimal integration on or under fan cowls.



The version with tangential cable outlet is ideal for tight mounting spaces and allows fast and simple installation.



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.



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.



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.

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.

Motor Feedback Systems for Servo Motors

Sendix S36 Motor-Line



ROBUST DESIGN

Its robust construction makes the Sendix S36 Motor-Line particularly shock and vibration resistant.

Mechanical robustness

- Latest mechanical gear technology
- Robust bearing structure in Safety-Lock™ Design
- Reliable connector technology
- Torque-proof stator coupling
- Wide temperature range

Electronic robustness

- Blue LED technology for accurate scanning and long service life
- Phased Array Sensor technology

- ⊕ Premium quality perceptible in everyday operation. The robust design ensures reliable and perfect operation of your motors – even in harshest environments

COMPACT

Consistent size of only 36 mm for:

- All singleturn and multiturn variants
- All medium and high power ranges with a resolution ≤ 2048 ppr SinCos or ≤ 24 bits fully digital

- ⊕ High-resolution and compact. Possibility to standardize the attachment between the encoder and the motor, and thus to reduce the number of motor variants. This saves space and costs.

ALL INTERFACES

An encoder platform with all classical and all open source interfaces for the Single Cable Solution.

- ⊕ From now on, you and your customers will have maximum flexibility when selecting your preferred electrical interfaces.

HIGH SIGNAL QUALITY

The use of the Phased Array Sensor technology allows achieving a resolution ≤ 2048 ppr SinCos or ≤ 24 bits fully digital, ensuring in addition high signal quality also in the event of shocks and vibrations.

- ⊕ Performance increase thanks to the high resolution. The controlled servo motor shows a more stable operating behavior and produces less heat.

FUNCTIONAL SAFETY

Certified Motor Feedback System, from the sensors, through the mechanics, up to the electrical interface.

- ⊕ Safe speed monitoring and fast acceptance for the certification of the complete system.



Shaping the Future with Kübler

New Single Cable Solutions for the drive technology. So far, the interface was the limiting factor. This will change in the future thanks to the open source and fully digital

BiSS Line and SCS open link interfaces for Motor Feedback Systems. They will allow enormous cost advantages and offer the possibility of developing smart motor concepts.



Single Cable Solution

The Sendix S36 Motor-Line will in the future offer both the open source BiSS Line and SCS open link interfaces.



ANALYTICS FOR SMART MOTOR

Functions such as the electronic data sheet (EDS), saving customer-specific user data and the connection of additional sensors such as for example temperature sensors are available for the analytics.

⊕ A permanent condition monitoring of the motor allows detecting and correcting faults at an early stage. This leads to higher plant availability and performance improvement.

Analytics ^{Intelligent Sensor}
IIoT

Condition Monitoring
Smart Motor
Predictive Maintenance

Bearingless Encoders

For asynchronous / geared motors.

Thanks to their contactless measuring principle, the magnetic bearingless encoders are at the same time wear-free and robust. They ensure faultless continuous operation of your motors. Their compact design is particularly suitable for tight installation spaces. Unlike encoders with bearings, they allow a large hollow shaft up to $\varnothing 390$ mm. This ensures perfect integration of the bearingless encoders in any motor concept.

YOUR BENEFIT

- Space and costs savings
- Faultless continuous operation of your motors
- Sensor solution scalable thanks to different magnetic ring sizes
- Optimal mounting solution in smallest installation spaces



www.kuebler.com/bearingless_encoders

Smart Bearingless Encoders

Reduce system costs. Increase robustness. Save installation space.

Kübler will find, together with you, the suitable solution that will allow making your motors even more compact both today and in the future. You will thus reduce your system costs and obtain an individually integrated sensor solution. The Smart Technology provides evaluated data for Condition Monitoring and Predictive Maintenance.

+ YOUR BENEFIT

- 100% integration in the motor
- Slim motor design
- High assembly tolerance
- Accurate control
- Ready for the Smart Motor

THE SUITABLE SOLUTION FOR EVERY APPLICATION

RLI – PERFORMANCE

The smart bearingless encoder

Smart Technology:

- The digital signal processing with active signal errors correction ensures highest signal quality
- Integrated digital signal filters and electronic nameplate with user memory
- Adjustable line number and application-specific programmable filters
- Possibility for Condition Monitoring and Predictive Maintenance

FOR HIGH-PERFORMANCE APPLICATIONS

- Very high resolution reaching 2,000,000 ppr
- Direct digital output of position, speed and acceleration
- Highest signal quality over the whole speed range from 0 to 12,000 rpm
- Digital interface SPI, RS485 and BiSS

RLI – STANDARD

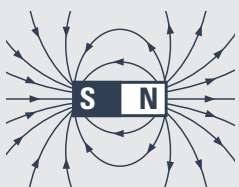
FOR STANDARD APPLICATIONS

- Resolution up to 16,000 ppr
- High signal quality

RLI – BASE

FOR SIMPLE APPLICATIONS

- Resolution up to 500 ppr
- Low signal quality requirements

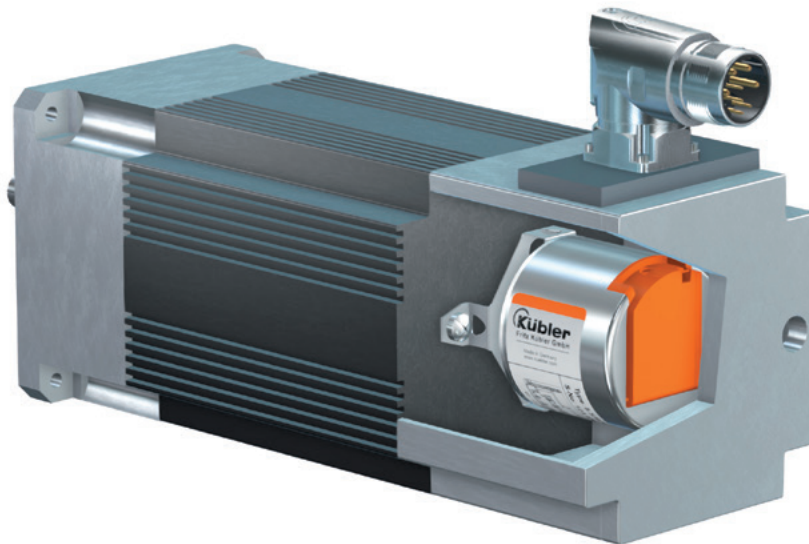


INTERFERENCE FIELDS – NO PROBLEM. KÜBLER SHIELDING TECHNOLOGY.

Electromagnetically actuated brakes generate strong magnetic fields, which make the operation of a bearingless magnetic encoder in their immediate proximity impossible. A shielding method calculated by FEM manages to shield the interference field of the brake at 100 % in the area of the sensor.

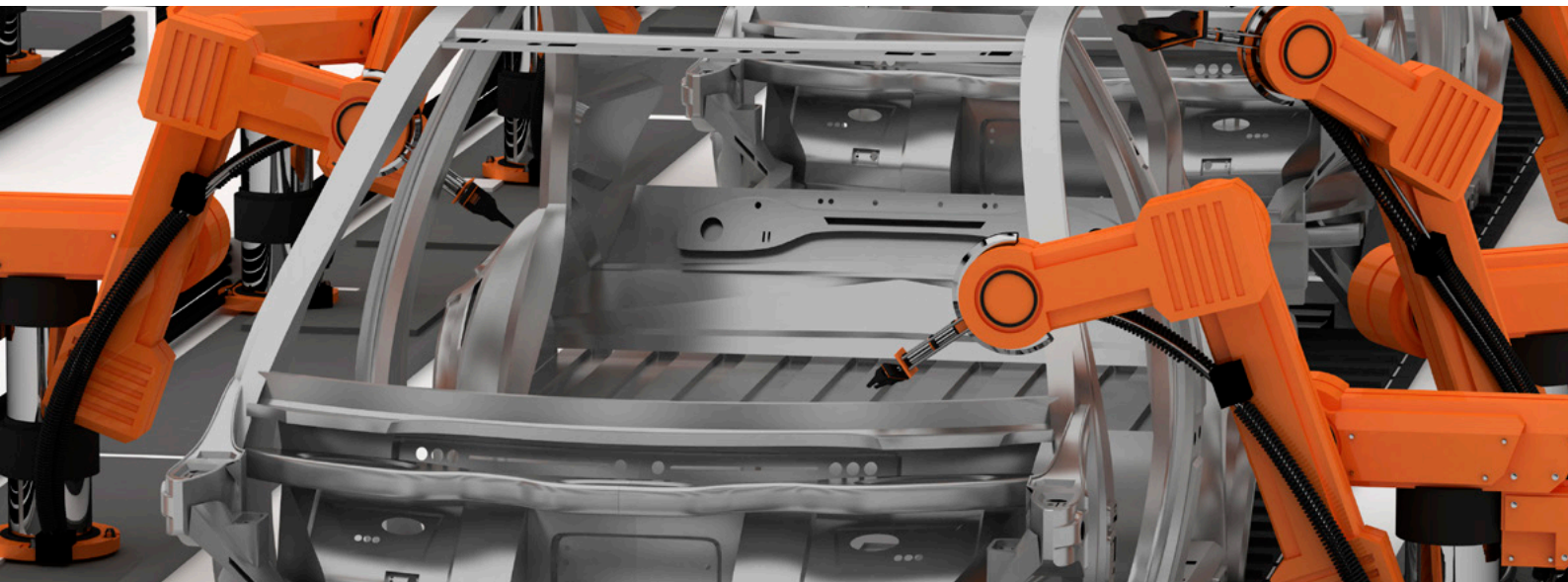
Servo Motors

Synchronous servo motors are predestined for all applications requiring accuracy and dynamics. They thus suit optimally for converter operation. Motor feedback systems are essential components in drive systems to ensure optimal control characteristics - in particular for dynamic axes, smooth speed controls and for positioning accuracy. They thus make a significant contribution to the performance of the whole plant.



Application-specific requirements

Installation	The small size of the motors means that every millimetre counts. For this reason it is important to use sensors that are compact but nevertheless of high performance.
Commutation	In order to ensure effective control of servo motors, it is important to have exact information concerning the position of the rotor. This can be provided by either a singleturn or multiturn encoder.
Temperature range	The self heating of powerful synchronous motors can notably lead to high ambient temperatures. Because of the high degree of integration of the sensor technology into these drives, the encoders are more directly exposed to the high temperatures than is the case with other motors.
Accuracy	Good control, especially with a high number of poles, requires high accuracy of the encoder.



Absolute encoders for servo motors

Servo motors are characterized by their high dynamics and performance. These features are only reached if the servo amplifier can control the motor optimally. This requires high-performance sensors such as Kübler's encoders.



	Sendix S3674 Singleturn	Sendix S3684 Multiturn
General information	Motor feedback system for the medium and high performance range	Motor feedback system for the medium and high performance range
Mechanical interface	Hub shaft \varnothing 8 mm Tapered shaft \varnothing 8 mm	Hub shaft \varnothing 8 mm Tapered shaft \varnothing 8 mm
Electrical interface	RS485 + SinCos (Hiperface [®] 1) compatible)	RS485 + SinCos (Hiperface [®] 1) compatible)
Size	\varnothing 36 mm	\varnothing 36 mm
Resolution SinCos	1024 or 2048 ppr	1024 or 2048 ppr
Resolution max.	19 bit ST	19 bit ST + 12 bit MT
Speed max.	12000 min ⁻¹	12000 min ⁻¹
Temperature range	-30 ... +120°C	-30 ... +120°C
Power supply	5 V DC 7 ... 30 V DC	5 V DC 7 ... 30 V DC

1) Hiperface[®] is a registered trademark of Sick Stegmann GmbH.

i Outlook

In the future, further motor feedback systems with fully digital interface or Single Cable Solutions will be available (see also pages 8 - 9).



Encoders for stepper motors

Whenever a high resolution is required in smallest mounting spaces, Kübler's miniature encoders are the ideal choice.



	2400 / 2420	2430 / 2440	3610 / 3620	3700 / 3720
General information	Incremental miniature encoder with optical sensor	Incremental miniature encoder with magnetic sensor	Incremental compact encoder with optical sensor	Incremental economy encoder with optical sensor
Mechanical interface	Shaft max. 6 mm blind hollow shaft max. 6 mm	Shaft max. 6 mm blind hollow shaft max. 6 mm	Shaft max. 6 mm hollow shaft max. 8 mm	Shaft max. 8 mm hollow shaft max. 8 mm
Electrical interface	Push-pull	RS422	Push-pull, RS422	Push-pull, RS422
Size	ø 24 mm	ø 24 mm	ø 36 mm	ø 37 mm
Resolution max.	1024 ppr	256 ppr	2500 ppr	1024 ppr
Speed max.	12000 min ⁻¹	12000 min ⁻¹	12000 min ⁻¹	6000 min ⁻¹
Temperature range	-20 ... +85°C	-20 ... +85°C	-20 ... +85°C	-20 ... +70°C
Power supply	5 ... 24 V DC 8 ... 30 V DC	5 V DC	5 V DC 5 ... 18 V DC 8 ... 30 V DC	5 V DC 5 ... 30 V DC 10 ... 30 V DC



Linear measuring technology for linear motors

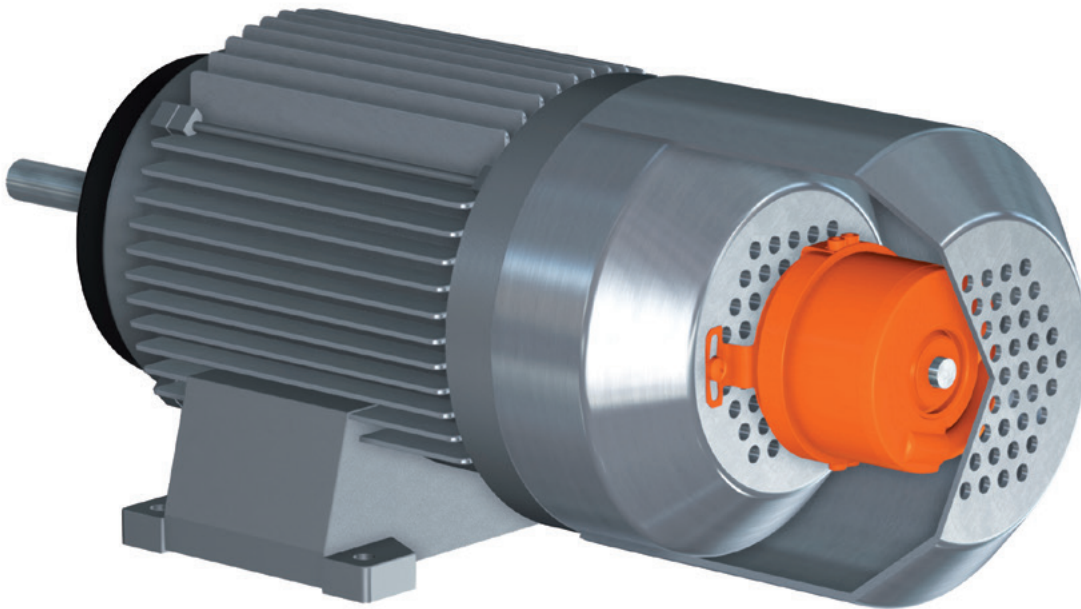
The Limes product family is a very compact solution for non-contact magnetic scanning and represents a cost-effective alternative in applications that do not require the high accuracy of glass scales. This magnetic measuring system shows its strong points especially in the presence of dirt, oils and humidity. Therefore, this measuring system is optimally suited for use in the linear drive technology.



	Limes LI20 / B1	Limes LI50 / B2	Limes LA10 / BA1	Limes LA50 / BA5
General information	Linear measuring technology for linear motors	Linear measuring technology for linear motors	Linear measuring technology for linear motors	Linear measuring technology for linear motors
Electrical interface	RS422 / push-pull	RS422 / push-pull	Absolute SSI / BiSS incremental SinCos absolute fieldbus	Absolute SSI / BiSS absolute fieldbus
Size	10.2 x 25 x 40 mm	10.2 x 25 x 40 mm	16 x 30 x 70 mm	24 x 26 x 75 mm
Resolution max.	10 µm	5 µm	1 µm	10 µm
Measuring length	Max. 20 m	Max. 20 m	Max. 8 m	Max. 20 m
Accuracy	Depends on measuring length 0.06 mm at 1 m	Depends on measuring length 0.08 mm at 1 m	Depends on measuring length 0.03 mm at 1 m	Depends on measuring length 0.17 mm at 1 m
Temperature range	-20 ... +80°C	-20 ... +80°C	-10 ... +70°C	-10 ... +70°C
Type of connection	Cable	Cable	M12 connector	Cable

Asynchronous Motors

Asynchronous motors are the all-rounders amongst electrical drives. For every requirement there is a drive and for every drive there is a suitable Kübler encoder. Whether as a fan motor in a small 63 size, or as a geared motor in a 225 size, asynchronous motors place special demands on encoders, above all when it comes to mechanical and electrical ruggedness. Because of their robust technology Sendix encoders prove themselves, especially in harsh environmental conditions.



Application-specific requirements

- | | |
|--------------------------|--|
| Mounting | Especially during the mounting of encoders the mechanics can be overloaded. This can lead to the encoder being prematurely damaged, so that the average service life is not reached. |
| Motor options | If a motor next to the encoder is to be equipped with further sensors, then the motor shaft must be fed through the encoder. |
| Temperature range | When using asynchronous motors extremely high temperature ranges can occur, which place increased demands on the sensors and on the way they are mounted. |
| Magnetic fields | Both the motor and the electromagnetic brakes create stray magnetic fields, which can affect the sensors. |



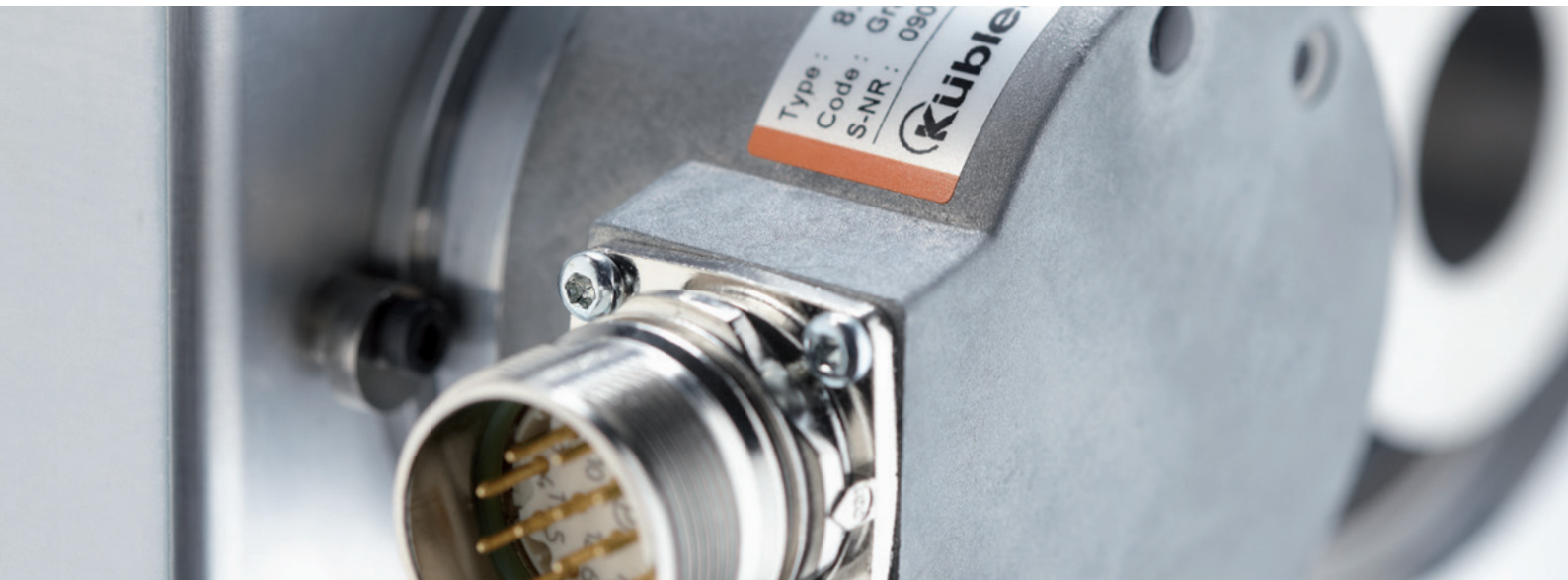
Incremental encoders for asynchronous motors

The incremental Sendix encoders are available in many versions, with the suitable connection variant for almost every field of application, or as economically optimized versions.

Both approaches have one in common – their compact construction.



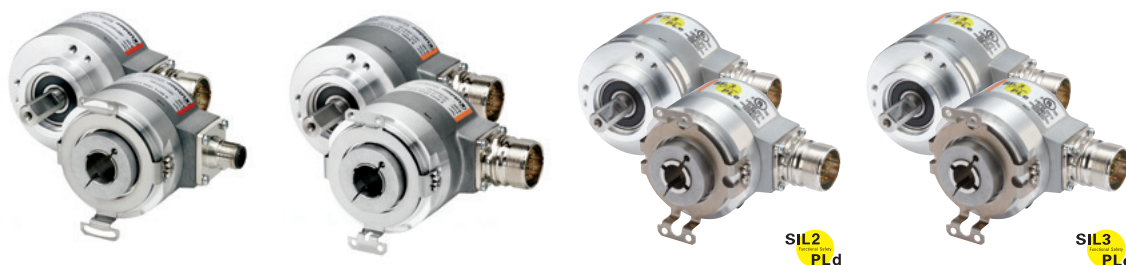
	Sendix Base KIS40 / KIH40	Sendix 5000 / 5020	Sendix SIL 5814FSx / 5834FSx	RLI50, RLI20
Mechanical interface	Shaft max. 6 mm blind hollow shaft max. 8 mm	Shaft max. 12 mm hollow shaft max. 15 mm	Shaft 10 mm hollow shaft max. 14 mm	On request (customer-specific)
Electrical interface	push-pull, open collector, RS422	push-pull, open collector, RS422	SinCos	Push-pull, RS422 SinCos
Size	ø 40 mm	ø 58 mm	ø 58 mm	40 x 25 mm (sensor head)
Resolution max.	2500 ppr	5000 ppr	2048 ppr	On request (resolution depends on ring diameter)
Speed max.	4500 min ⁻¹	12000 min ⁻¹	9000 / 12000 min ⁻¹	12000 min ⁻¹
Temperature range	-20 ... +70°C	-40 ... +85°C	-40 ... +90°C	-20 ... +80°C
Power supply	5 V DC 10 ... 30 V DC	5 V DC 5 ... 30 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	4.8 ... 26 V DC (RS422) 4.8 ... 30 V DC (Push-Pull)



Absolute encoders for asynchronous motors



The absolute Sendix encoders – available both as singleturn and multiturn versions - are first of all robust and highly accurate. The multiturn gear uses a purely optical sampling technology and is totally insensitive to magnetic fields. Moreover, the first stage is mounted on two ball bearings and underlines the robust construction of these encoders.



	Sendix 5853 / 5873	Sendix 5863 / 5883	Sendix SIL 5863FS2/5883FS2	Sendix SIL 5863FS3/5883FS3
Mechanical interface	Shaft max. 10 mm hollow shaft max. 15 mm	Shaft max. 10 mm blind hollow shaft max. 15 mm hollow shaft max. 14 mm	Shaft 10 mm hollow shaft max. 14 mm	Shaft 10 mm hollow shaft max. 14 mm
Electrical interface	SSI or BiSS	SSI or BiSS	SSI or BiSS	SSI or BiSS
Size	ø 58 mm	ø 58 mm	ø 58 mm	ø 58 mm
Resolution max.	21 bit	17 bit singleturn + 12 bit multiturn	17 bit singleturn + 12 bit multiturn	17 bit singleturn + 12 bit multiturn
Speed max.	12000 min ⁻¹	12000 min ⁻¹	9000 / 12000 min ⁻¹	9000 / 12000 min ⁻¹
Temperature range	-40 ... +90°C	-40 ... +90°C	-40 ... +90°C	-40 ... +90°C
Power supply	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC



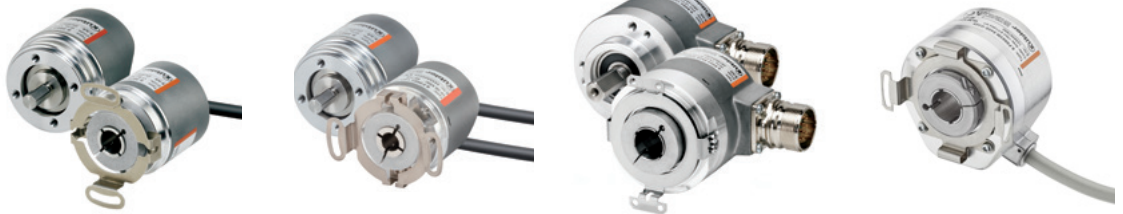
Absolute encoders for asynchronous motors without mechanical gear



The patented Intelligent Scan Technology™, which won several awards, is the core of these absolute Sendix encoders.

These optical encoders include all singleturn and multiturn functions on an OptoASIC, therefore ensuring in the same time a very high reliability and a high resolution.

The multiturn version reaches a 24 bit resolution. Its outstanding feature is its wear-free functionality thanks to the optical sensor without mechanical gear.

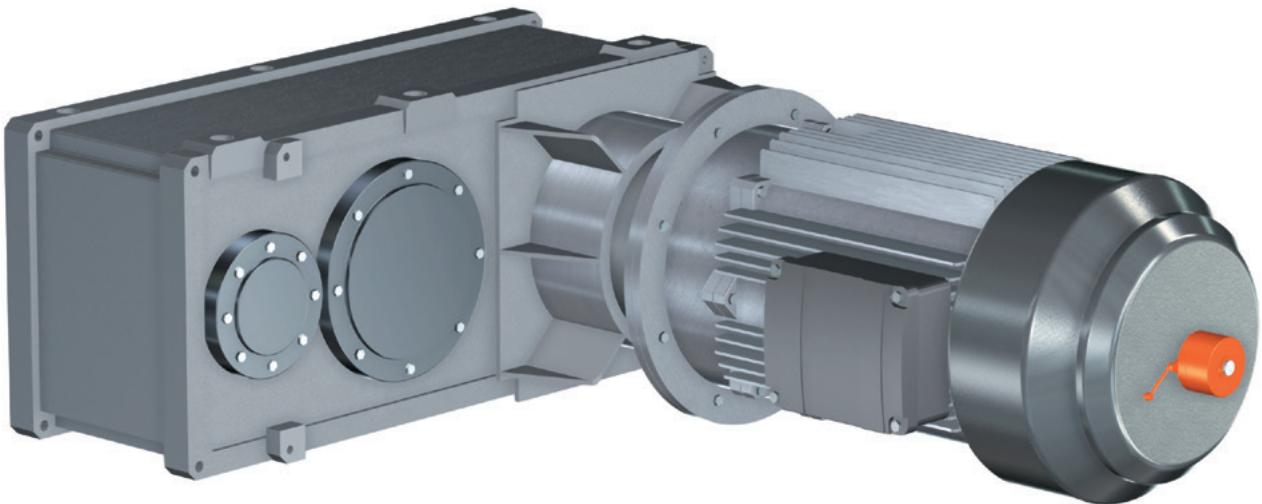


	Sendix F3653 / F3673	Sendix F3663 / F3683	Sendix F5863 / F5883	Sendix F5883M / F5888M
Mechanical interface	Shaft max. 10 mm blind hollow shaft max. 10 mm hollow shaft max. 8 mm	Shaft max. 10 mm blind hollow shaft max. 10 mm hollow shaft max. 8 mm	Shaft max. 10 mm hollow shaft max. 15 mm	Hollow shaft max. 15 mm
Electrical interface	SSI or BiSS	SSI or BiSS	SSI or BiSS	SSI or BiSS incremental outputs SinCos and RS422, CANopen
Size	ø 36 mm	ø 36 mm	ø 58 mm	ø 58 mm
Resolution max.	17 bit	17 bit singleturn + 24 bit multiturn	17 bit singleturn + 24 bit multiturn	17 bit singleturn + 24 bit multiturn
Speed max.	12000 min ⁻¹	12000 min ⁻¹	12000 min ⁻¹	9000 min ⁻¹
Temperature range	-40 ... +90°C	-40 ... +90°C	-40 ... +85°C	-40 ... +85°C
Power supply	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC

Large Motors / Generators

A tough nut. Accurate speed information is an important measurement for the control loop of a plant. Measuring systems that supply this information are often subjected to harsh environmental conditions but must not suffer any loss of reliability.

Kübler incremental encoders can handle strong vibration or extreme variations in temperature without any problem. Here, their wide-ranging mounting options guarantee easy, safe installation. Kübler offers the complete range of solutions, from the extremely rugged Sendix Heavy Duty through to the compact, bearingless Limes encoder systems.



Application-specific requirements

Ruggedness	The ruggedness of the sensor technology plays a crucial role with large drives. Shocks and impacts encountered in this class of drives are higher than elsewhere.
Service life / Maintenance	In applications where large motors or generators are used, downtimes are very expensive; for this reason maintenance and any replacement of a component must be very simple.
Weather and environmental conditions	Large motors are employed primarily in harsh environments. The protection class of the sensors is thus correspondingly important, so that breakdowns can be avoided.
High currents	Despite well-earthed machine housings, large motors and generators carry a certain shaft current on the rotor. The equipotential bonding from the rotor to the stator via the encoder bearings can damage the encoder.



Incremental encoders for large motors / generators

Many different Kübler encoders have been designed for use in large motors and generators.

Compact versions, Sendix Heavy Duty encoders for extreme bearing loads or bearingless versions for long service life – Kübler encoders are exactly adapted to the application-specific requirements.

In the end, it is the application that will decide which encoder will be used.



	A020 / A02H	Sendix Heavy Duty H100	Sendix Heavy Duty H120	RLI500, RLI200, RLI50, RLI20
General information	Tight mounting conditions and applications with high bearing forces	Applications with high bearing loads and very high shaft currents	Applications with high bearing loads and very high shaft currents	Bearingless encoder for tightest mounting situations (only 10 mm deep)
Mechanical interface	Hollow shaft max. 42 mm	Shaft 11 mm	Hollow shaft max. 28 mm	On request (customer-specific)
Electrical interface	Push-pull, RS422, SinCos	Push-pull, RS422	Push-pull, RS422	Push-pull, RS422 SinCos
Size	ø 100 mm	ø 115 mm	ø 100 mm	40 x 25 mm (sensor head)
Resolution max.	5000 ppr	3600 ppr	5000 ppr	On request (resolution depends on ring diameter)
Speed max.	6000 min ⁻¹	6000 min ⁻¹	6000 min ⁻¹	12000 min ⁻¹
Temperature range	-40 ... +80°C	-40 ... +100°C	-40 ... +100°C	-20 ... +80°C
Power supply	5 V DC 5 ... 30 V DC 10 ... 30 V DC	5 ... 30 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC	4.8 ... 26 V DC (RS422) 4.8 ... 30 V DC (Push-Pull)

Encoders for Elevator Technology

Encoders for elevator motors are available in various versions. In order to provide the suitable solution for every motor, Kübler offers a wide encoder portfolio for the motor manufacturers.



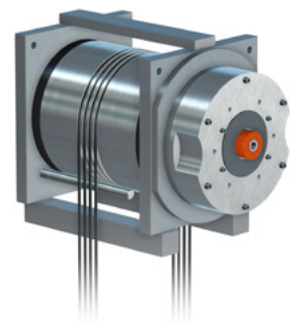
www.kuebler.com/elevator



Encoders for gearless motors

The advantages of the gearless motors are first of all a high torque at small rotary frequencies and smooth and silent operation. Encoders for these applications must above all be flexible in terms of electrical interfaces and mounting possibilities.

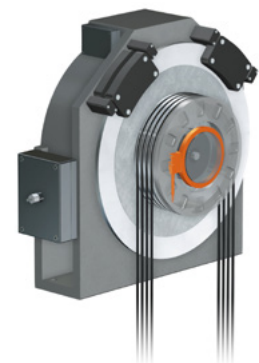
Incremental encoders Sendix 5834 Motor-Line (tapered shaft)
Absolute encoders singleturn Sendix 5873 Motor-Line (tapered shaft)



Bearingless encoders for direct drives (external rotor motors)

The bearingless encoders are made of a magnetic ring and a sensor head. They are predestined for external rotor motors, which, thanks to their compact and flat construction, can be integrated directly in the elevator shaft. Individual adaptation of the measuring system to the dimensions of the drive are here one of the most important prerequisites.

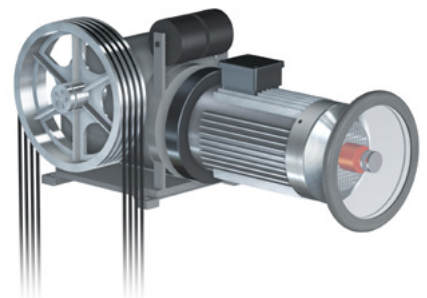
Bearingless encoders RLI500, RLI50,
 RLI200, RLI20
 (see page 17 and 21)



Encoders for geared motors

In geared motors, an incremental encoder mounted between the motor and the hand wheel measures the rotational speed for speed control and transmits it to the complete drive module (CDM). These encoders feature a large hollow shaft and compact dimensions, together with a high resolution.

Incremental encoders 5821, A020, A02H (hollow shaft)



Explosion Protection – ATEX / IECEx

In hazardous areas encoders must comply with special protective regulations, as even the smallest spark can have very serious consequences.

Positioning tasks occur in many hazardous environments – whether in mining, in the chemical industry or also in oil production.

Especially for those applications that require absolute position values, Kübler offers the Sendix absolute encoders with ATEX / IECEx approval. The singleturn and multiturn ATEX encoders with “flameproof-enclosure” housings are approved for zones 1, 2, 21 and 22 and certified according to the ATEX guidelines and IECEx standards.





Sendix ATEX / IECEx encoders

The shock and vibration resistant ATEX / IECEx encoders operate flexibly with a resolution of up to 17 bits (singleturn) and 29 bits (multiturn).

In addition the incremental version supplies a push-pull, RS422 or SinCos signal. With their IP67 protection level and wide temperature range of -40°C up to +60°C, the ATEX / IECEx encoders remain sealed even under the rigours of tough everyday use and offer good security against failures in the field. Thanks to the housing and flange made of seawater durable aluminium they are ideal for use in offshore and coastal applications. The compact design with an installation depth of only 145 mm, a diameter of 70 mm and a space saving cable outlet round off the diverse, flexible options for use in hazardous EX areas.

Incremental encoders	Sendix 7000 / Sendix 7020 (shaft / hollow shaft) Sendix SIL 7014FSx (shaft)
Absolute encoders singleturn	Sendix 7053 / Sendix 7073 (shaft / hollow shaft) Sendix 7058 / Sendix 7078 (shaft / hollow shaft) Sendix SIL 7053FSx (shaft)
Absolute encoders multiturn	Sendix 7063 / Sendix 7083 (shaft / hollow shaft) Sendix 7068 / Sendix 7088 (shaft / hollow shaft) Sendix SIL 7063FSx (shaft)



www.kuebler.com/atex-encoders

Functional Safety (FS)

Safety is – not least since the EU Machinery Directive 2006/42/EC – an “integral part of the construction of drives”.

When choosing the right encoder for functional safety the principle applies that safety is achieved through the intelligent combination of encoder, controller and actuator.

But safety goes further than this: safe components are characterized by a robust reliable interface and by the ability to cope with high mechanical and electronic loads. Both Sendix SIL encoders with SSI absolute and additional SinCos interface and also the SinCos version of the incremental encoders have been certified up to SIL3 by the German Institute for Occupational Safety (IFA).





Encoders for Functional Safety

In order to achieve safe incremental information with the encoder, the controller must monitor the validity of the analog, 90° phase-shifted sine/cosine signals with the help of the function:
 $\sin^2 + \cos^2 = 1$.

In order to obtain safe information with the encoder regarding the absolute position, the controller counts the incremental pulses and compares the result with the absolute position also provided by the encoder. A 100% reliable mechanical connection is required for a safe function in the applications. Suitably sturdy fixing elements can help eliminate the risk of faults.

Incremental SinCos encoders

Sendix SIL 5814FS2 / FS3 (shaft)
Sendix SIL 5834FS2 / FS3 (hollow shaft)

Absolute singleturn SSI / SinCos encoders

Sendix SIL 5853FS2 / FS3 (shaft)
Sendix SIL 5873FS2 / FS3 (hollow shaft)

Absolute multiturn SSI / SinCos encoders

Sendix SIL 5863FS2 / FS3 (shaft)
Sendix SIL 5883FS2 / FS3 (hollow shaft)



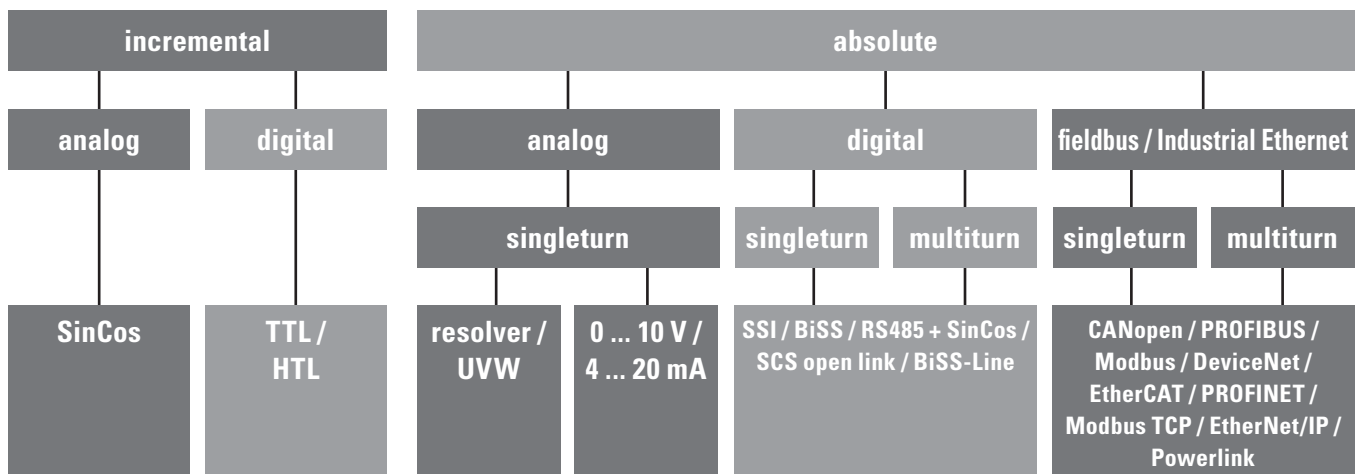
www.kuebler.com/safety

Overview Electrical Interfaces

Encoders have various tasks to fulfil in elevator engineering.

One of the most frequent tasks is to supply information concerning speed, for better control of the motor using a CDM – Complete Drive Module. For this type of speed control motor feedback is necessary, which is suitable for improving the speed quality and the control response. As a rule a SinCos or TTL / HTL signal is used for this purpose.

A further task is the positioning of the drive. This can occur both incrementally and absolutely. The dynamic control of synchronous servo motors requires the feedback of the rotor position within a revolution. This is achieved using singleturn absolute encoders with a BiSS or SSI interface.



Single Cable Solutions

The Single Cable Solutions combines the motor power supply line and the data communication in one single cable. Requiring less cables and connectors, this technology simplifies installation and thus reduces in the same time the error sources.

Not all protocols are suitable. They must be specially tailored to this application, such as for example SCS open link or BiSS Line.

Safety is not simply a trend, but it is establishing itself as a standard in the drive technology. It is therefore important to pay attention to safety-relevant characteristics when choosing the interface.

Field buses or industrial Ethernet interfaces are principally used in the application and are not directly involved in speed regulation. The position control can operate with these encoders.



Incremental interface (SinCos, TTL / HTL)

The SinCos interface provides a sine wave-shaped voltage signal. High-quality encoders allow very high interpolation of this signal, which benefits the speed control. This means that the SinCos signals can be processed in many various ways in the subsequent electronics. The steady signal evolution makes sure that signal information is available at any time. This is an advantage in drives for speed control, even for very slow motions.

The cosine precedes the sine by 90° so that one of the signals emits a valid value also when passing the zero point. This is also the great difference with digital incremental signals such as HTL or TTL. These have signal states in which both channels A and B can have simultaneously the value zero or one, which does not allow detecting errors.

By contrast, even though the encoders with incremental interface (TTL / HTL) also generate a sine wave shaped scanning signal, this signal is then digitized in the encoder and provided to the subsequent electronics as a rectangular pulse.

Various output types are available for transmission.

SSI interface

The synchronous serial interface (SSI) is a digital interface for absolute encoders. This means that the SSI interface allows digital and absolute transmission of motion or angular information. It is therefore particularly well suited for applications requiring reliability and signal robustness in industrial environments. Another advantage is the fact that transmission requires significantly less lines than parallel interfaces. It also allows much longer cable lengths.

At rest, the clock and data lines are at a high level. With the first falling clock-pulse edge, the current encoder data are stored in the buffer ready to be sent. With the next rising clock-pulse edge, the data are transmitted bit by bit, starting with the MSB.

The transfer of a complete data word requires $n+1$ rising clockpulse edges (n =resolution in bit), e.g. 14 clock signals for a complete readout of a 13 bit encoder.

After the last positive going clock-pulse edge the data line will remain for the duration of the monoflop time t_3 at a low level, until the encoder is ready for a new data word. The clock line must stay high for at least as long, and then can begin a new readout sequence again with the next falling edge.

BiSS Interface

The BiSS interface is a fully-digital bidirectional connection for absolute measuring systems. Therefore, BiSS is perfectly suited for dynamic axes with very high accelerations, constant speed control and best positioning accuracy possible.



Advantages of the BiSS interface

The great advantage of the BiSS interface is its open source protocol for sensors, inverters and drives, offering e.g. high speeds (data rate up to 10 MHz) and a delay compensation for the optimal operation of the drive system. The selection of the components is not imposed by a licensed interface, but only by the requirements of the application, which results in more flexibility and higher cost-efficiency.

- ▶ BiSS is fully-digital and bidirectional and is perfectly suited as a motor feedback system for both linear and rotary axes.
- ▶ BiSS is not proprietary and therefore cost-efficient and flexible. This ensures a much wider choice of available products.
- ▶ The inverters equipped with an RS422 and RS485 interface can mostly be used for BiSS thanks to an extension with a firmware update for BiSS, thus opening the possibility of using an open source interface.
- ▶ There is nevertheless also the possibility of a quick and simple BiSS Master implementation with free BiSS IPs on processors and FPGAs.
- ▶ Advantages for the commissioning of motor and inverter thanks to plug-and-play using the motor data and maintenance information that can be stored in and retrieved from the encoder and to the possibility to set the absolute measuring system to a predefined position value.
- ▶ Information and evaluation of the complete system during operation thanks to Condition Monitoring and to the delay compensation for accelerated communication, e.g. to minimize drift effects due to temperature.



www.kuebler.com/biss

BiSS SAFETY

BiSS Safety is entirely based on BiSS C and uses all of its protocol options. All identification features, electronic data sheets and diagnosis possibilities are entirely preserved.

The further development of BiSS for safety-relevant applications (BiSS Safety) presupposed the following functionalities:

- Achieving SIL2 and SIL3 with the existing BiSS protocol
- Keeping all physical interfaces for the use of existing and new sensors

The external structure remains a point-to-point wiring such as for a standard BiSS protocol. But, inside the device, two independent sensors are used for generating the position data and securing the transmission. BiSS Safety uses here the 'Black Channel' approach for safe data communication.

BiSS LINE

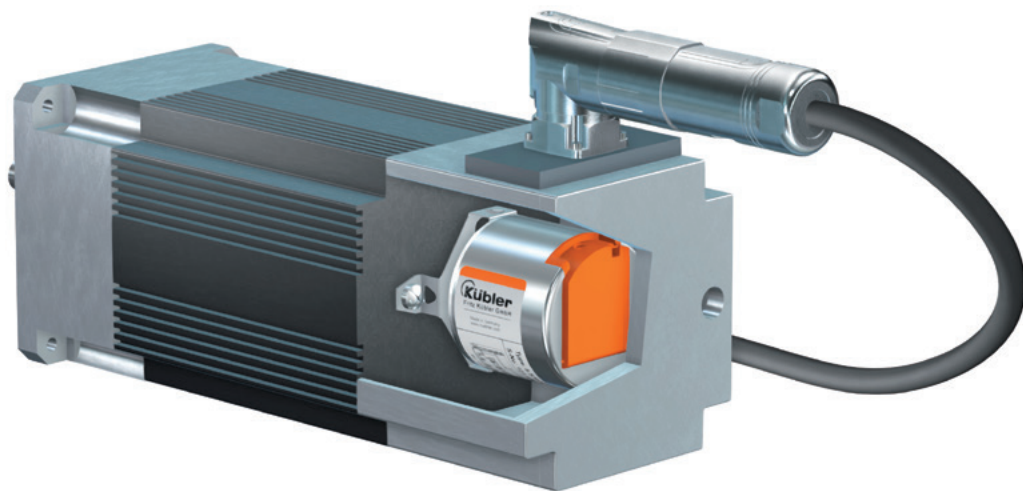
BiSS Line uses standard components available on the market for the cables and connectors and transmits the 8B10B-encoded BiSS data via RS485 PHYs using the known 2 or 4-wire technology.

The transmission speed of 12.5 MBaud is comparatively high. The unique features of BiSS Line are: open-source interface for Single Cable Solutions and bus structure for multiple slaves. An essential point is the implementation of a forward error correction (FEC), which is a prerequisite for high availability of the data communication even with disturbed and poor-quality cables and connectors.

Single Cable Solution for Servo Motors

Open standardized. Safe and performant.

SCS open link is based on an innovative interface that supports 2-wire and 4-wire applications, is IIoT-capable and allows cable lengths up to 100 m.



SCS (Single Cable Solutions) advantages

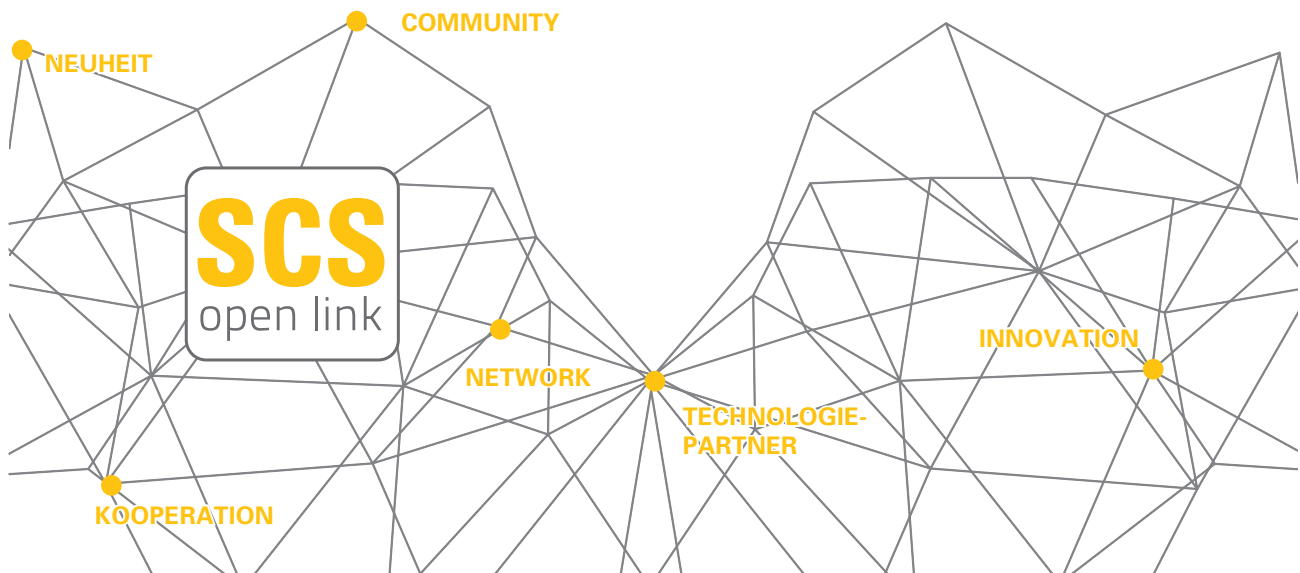
Your benefits at a glance

- + Space-saving wiring system
- + Installation and energy costs savings
- + Free choice of the sensors
- + Simplified spare parts storage
- + Certified up to SIL3 / PLe
- + Future-proof for IIoT

This interface offers fast, interference-free data transmission and is suitable for single and multiturn encoders as well as for linear scales. Power and encoder signals are transmitted via one single cable. Data transmission rates up to 10 MBaud and controller cycles up to 32 kHz can be achieved.

This opens a wide range of new application possibilities for drive and machine manufacturers.

- ▶ Standardized and nevertheless open interface, optimized for drive applications
- ▶ Robust, EMC-stable and fast protocol
- ▶ Simple and secured "safety evaluation" also for several axes
- ▶ Certified up to SIL3 for applications with functional safety
- ▶ Fastest cycle time of up to 32 kHz
- ▶ Transmission of the complete position word in one telegram
- ▶ Always downward compatible
- ▶ Hardware-compatible with HDSL
- ▶ IP core available for simple FPGA implementation



Open standard

SCS open link is understood as an open standard with the objective of promoting a protocol accessible to all members of the community. This allows ensuring that all drive system components from different manufacturers can interact.

This standard is promoted, developed further and maintained by the companies Baumer, Hengstler and Kübler, which take care to ensure downward compatibility and forward-looking functions. The open standard allows the community to participate.

Conformance test

In order to ensure compliance with our standards, the SCS open link test laboratory is in charge of the certification of products using the SCS open link protocol. This allows ensuring the standard conformity and interoperability with other products from different manufacturers. Common use in a plant is therefore possible without problem.

The very lean master implementation does not require additional testing. The slaves can be replaced frequently in the lifetime of a machine and they can often be provided by different manufacturers. Uncompromising compatibility must be guaranteed in this case.

Fixing and Connection Solutions

Perfect integration into the drive can only be successful if an optimal connection of the encoder to the motor is made.

For the rotating motor shaft and motor housing Kübler offers a wide choice of standard fixing and connection options, with which the desired encoder variants can be combined in a modular design principle. In addition to this individual, customized solutions can be worked out.

Fixing on the motor housing

Torque stop

For applications with axial and radial play with constant rotary movements.



Stator coupling

For applications with axial and radial play with high dynamics.



Tether arm

For applications with low axial and radial play, flexible in use.



Individual fixing solutions

E.g. ez Fan-clip – mounting solution on fan grill.
For instant easy fixing of the encoder directly onto the fan grill of the gear housing.

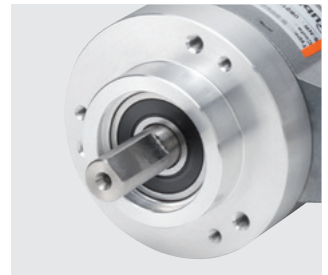


Fixing to the motor shaft

Shaft

Simple mounting on various shaft diameters via suitable couplings.

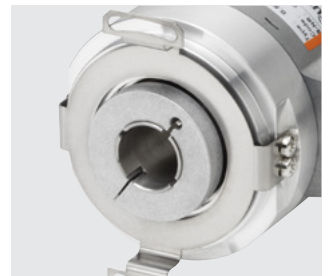
- Easy to centre
- Long service life
- Max. tolerance
- High speed



Hollow shaft

Accurate centring and reduced vibration.

- Long service life
- Max. tolerance
- High accuracy



Safety-oriented coupling

For applications requiring safe transmission of the rotary movement.



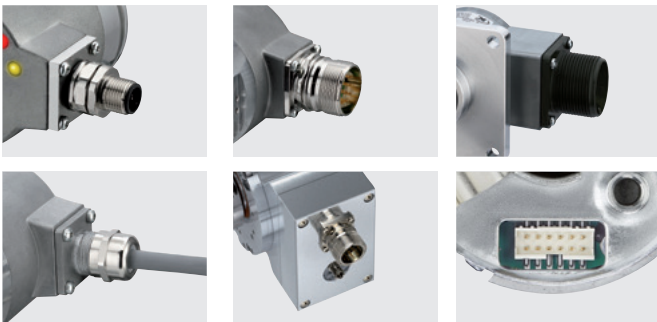


Additional accessories at: www.kuebler.com/accessories
 Additional connection technology at: www.kuebler.com/connection_technology

Connection solutions

Standard connection solutions

- PCB plug-in connectors: M12, M23, MIL
- Cable connection
- Terminal box
- Optical fiber signal transmission technology
- PCB connectors



Individual connection solutions

Kübler offers space-saving installation options for M12 and M23 connectors under the fan cowl.

- Lead-through M12 straight, IP67
- Male connector with external thread, IP67, central fastening



Accessories connection technology

Cables

All cables – for incremental, absolute and fieldbus encoders – can also be ordered by the metre as open-ended cable:

- PVC and PUR cables
- Halogen-free cables
- Bus cables



Connectors

Kübler offers a range of connectors for self-assembly with a protection level of up to IP67, for example as male connector M23 with external thread or as socket with metal union nut.



Cordsets, pre-assembled

Kübler offers pre-assembled cordsets in a variety of connector versions as well as with a different number of cores (5, 8, 10, 12, 18).



Optimal Solutions thanks to Customer-Specific Development

The ideal sensor for your drive – that is our goal: for simple, fast and error-free mounting – highest reliability of the signals – long service life and minimum costs.

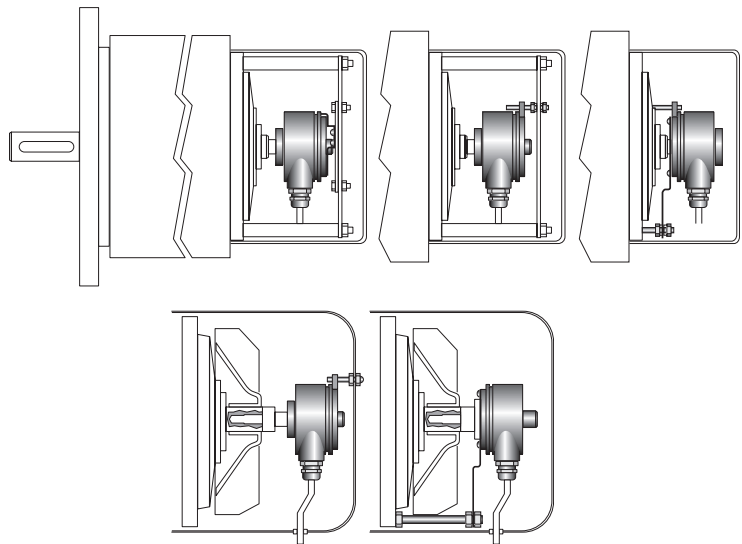
During development of customer-specific solutions Kübler focuses on 3 principles:

- Lean Design (coordinating the materials and functionality to the application)
- Design to Cost (aligning development to target costs)
- Cost of Ownership (fast installation, simple maintenance, long service life)

Fixing solutions

The correct mounting and fixing solution of an encoder in a drive is crucial for reliable operation and peace of mind. The wide variety of drives and the increasing demands placed on drives (especially in respect of installation space) pose new challenges every day.

By the use of intelligent solutions, closely matched to the drive, great savings can be made when it comes to space, time and costs. Furthermore, specific fixing elements can be developed, which are tailored to the installation space of the housing or the geometry of the flange and shaft; this ensures an optimal connection and the highest degree of accuracy.

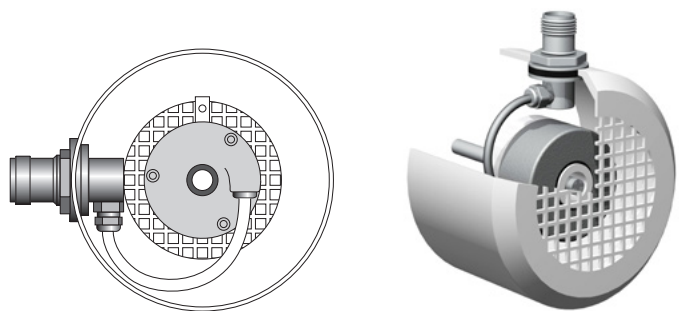


Connection solutions

The cable and connectors used to connect an encoder with the PLC must be matched to the installation space available as well as being capable of withstanding the prevailing environmental conditions such as humidity, cold or heat.

Here too, the setting-up of special cables or the development of specific connectors can lead to the right solution.

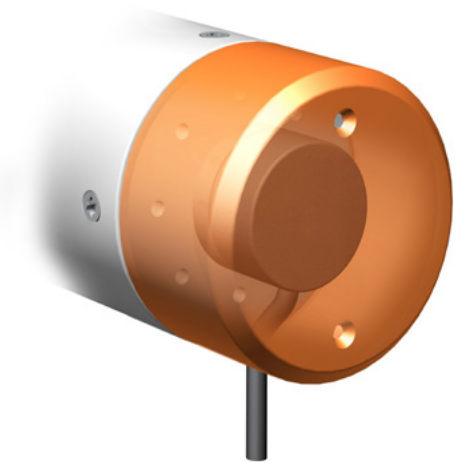
In particular, the cable or connector transition from the motor housing to the outside world requires innovative constructions, in order to guarantee reliability and freedom from errors.





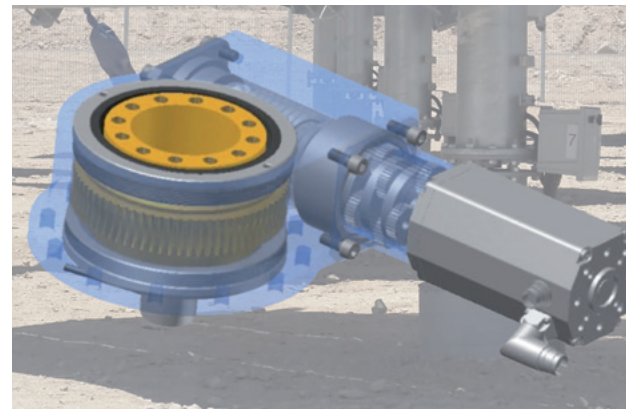
Protection concepts

Kübler does not leave protection of its sensors to chance. The application areas for drives are very diverse. Kübler has designed appropriate specific protective covers, which take into consideration the design of the encoder, as well as the IP protection level, temperature and operating conditions. With its extensive experience in difficult application areas, such as steel production, wind turbines or in mobile applications, Kübler has developed special housing and seal designs, as well as coating solutions, which also withstand the high demands of outdoor applications in respect of condensation or extreme fluctuations in temperature.



Advantages of customized integrated drive solutions

- High reliability, as all component parts have been specifically designed for your drive.
- Particular focus on a longer service life when selecting the product.
- Simple, fast mounting thanks to a high degree of integration.
- Development of solutions for simple maintenance.
- Warranty and support from a single source.
- Reduced costs, as the solution is directly tailored to the drive. No "over-engineering".

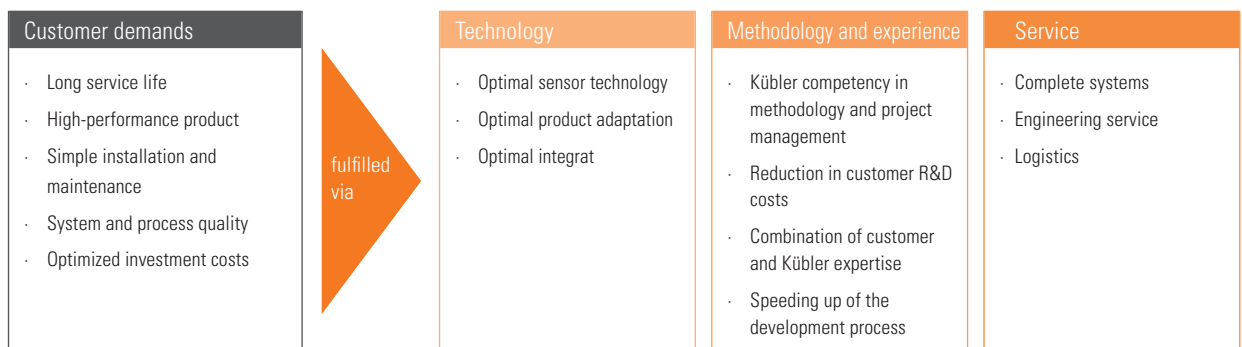


Tailor-made Solutions – Kübler Design System

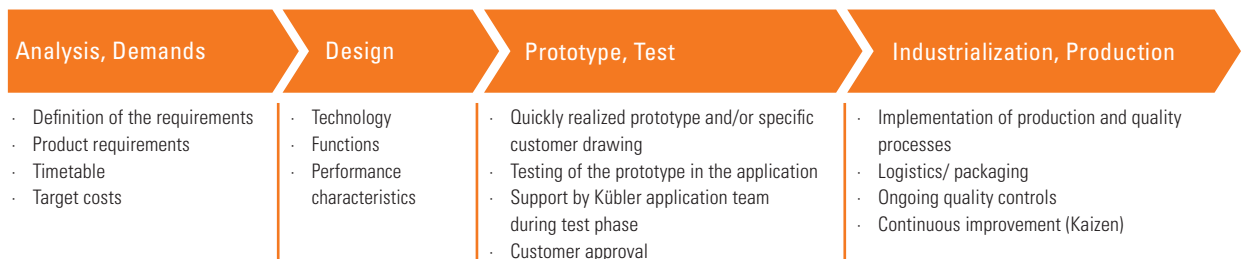
With the KDS method our customers receive a lasting solution to lowering costs, reducing the number of models available or eliminating quality deficiencies. With KDS we develop product and engineering solutions together. The method stands out because of its structured process; this delivers innovation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

Kübler Germany / Austria	+49 7720 3903 952
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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