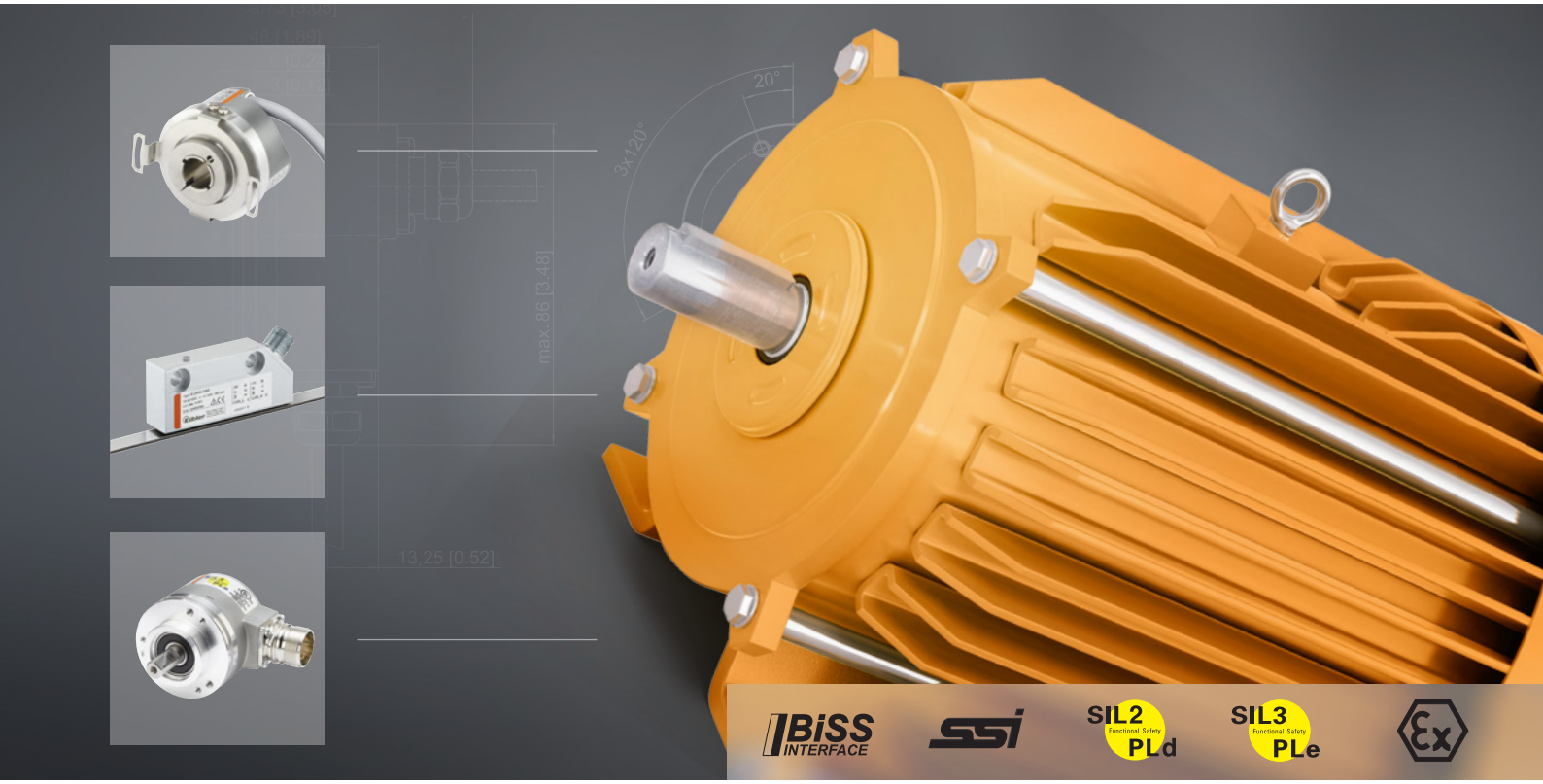
DRIVE TECHNOLOGY

Kübler



- Incremental Encoders
- Absolute Encoders
- Functional Safety
- Fixing and Connection Solutions
- Customized Solutions
- Services

pulses for automation

Solutions for Drive Technology

Flexible
Innovative
Adding value
Partnership-based

The Kübler Group belongs today to the leading specialists worldwide in the fields of position and motion sensors, functional safety, counting and process technology as well as transmission technology.

The drive technology is one of our most important core activities offering products, solutions and services that inspire our customers.

We rely on close and personal co-operation to produce solutions with high customer benefit.

Contents

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. 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.

Technologies for drive engineering

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.

Sendix F5883M/F5888M Motor-Line encoders

The optical Sendix F5883/F5888 multiturn encoders in the Motor-Line version stand out particularly because of their reduced overall depth of only 43 mm with a through hollow shaft up to 15 mm. This opens up new possibilities when dimensioning the motors and for installation in tight mounting spaces. Their technical features make the F5883M/F5888M the ideal devices for use in geared / asynchronous motors.

SSI · BiSS INTERFACE · SinCos · RS422 TTL · CANopen

Your advantages at a glance

- + High-resolution multiturn encoder for optimum control
- + Predestined for the drive engineering thanks to its design optimized for geared / asynchronous motors
- + Cost-efficient thanks to simple plug-and-play commissioning
- + Reduction of life cycle costs due to the optimization of drive efficiency thanks to the high-resolution absolute and analog encoder signals
- + Reduction of development and material costs thanks to the same overall depth as an incremental encoder (e.g. Sendix 5020)

Characteristics

Resolution
- SSI or BiSS interface with up to 17 bit singleturn resolution and additional 2048 SinCos signals
- Optional: fully-digital BiSS interface with 17 bit resolution
- Patented Intelligent Scan Technology™ with 24 bit multiturn resolution
- CANopen with 32 bit total resolution (16 bit MT + 16 bit ST)

Electrical interface
- SSI or BiSS interface with additional SinCos signals
- Electronic data sheet
- Possibility of setting the measuring system to a predefined position value (electronic zeroing)
- CANopen interface

Mechanical interface
- Through hollow shaft up to 15 mm diameter
- Tangential cable outlet
- Robust bearing structure in Safety-Lock™ Design

Sendix 5873 Motor-Line encoders

The Sendix 5873 singleturn encoders with SSI or BiSS interface and optional 2048 ppr SinCos signals are predestined for the elevator technology. Furthermore, the Sendix 5873 in Motor-Line version convince with their plug-and-play commissioning including an electronic data sheet and the possibility of setting the absolute measuring system to a predefined position (electronic zeroing).

Your advantages at a glance

+ High-resolution singleturn encoder for optimal travel comfort
+ Predestined for the elevator technology thanks to its design optimized for gearless drives
+ Cost-efficient thanks to simple plug-and-play commissioning
+ Reduction of life cycle costs due to the optimization of drive efficiency thanks to the high-resolution absolute and analog encoder signals
+ Reduction of the energy costs thanks to the electronic switching based on the high-resolution absolute position information of the measuring system

Characteristics

Resolution

- SSI or BiSS interface with 13 or 17 bit singleturn resolution and additional 2048 SinCos signals
- Optional: fully-digital BiSS interface with 21 bit resolution

Electrical interface

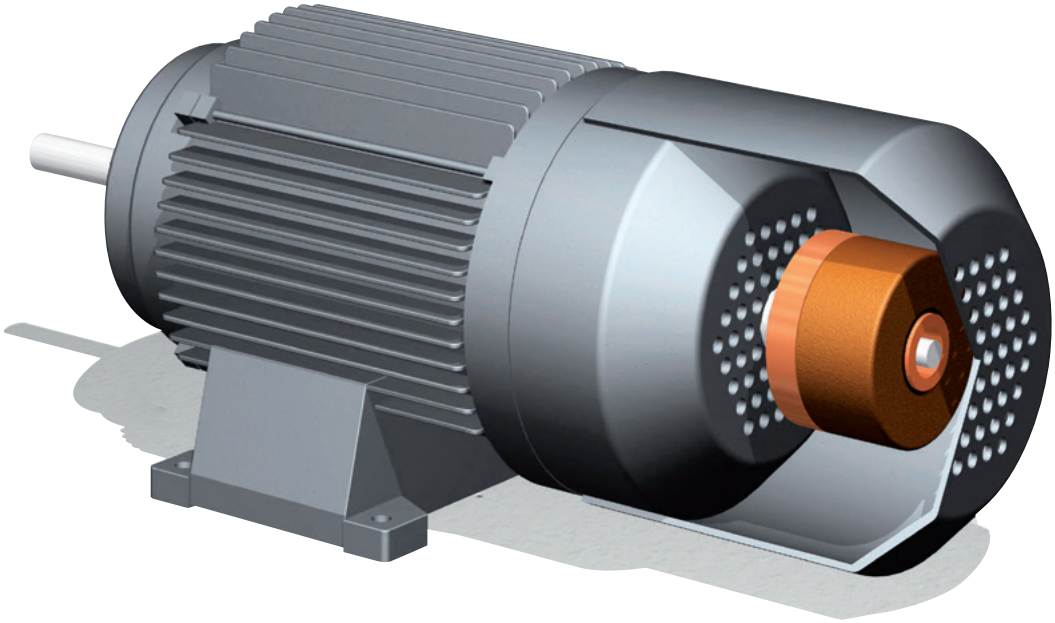
- SSI or BiSS interface with additional SinCos signals
- Electronic data sheet
- Possibility of setting the measuring system to a predefined position value (electronic zeroing)
- Optional SET key – to zero the Sendix 5873 Motor-Line at any desired position

Mechanical interface

- Tapered shaft with stator coupling, ø 72 mm or tapered shaft with expanding coupling, ø 65 mm
- Tangential cable outlet
- Robust bearing structure in Safety-Lock™ Design

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 5814 / 5834	Sendix SIL 5814FSx / 5834FSx
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. 15 mm	shaft 10 mm hollow shaft max. 14 mm
Electrical interface	push-pull, open collector, RS422	push-pull, open collector, RS422	SinCos	SinCos
Size	ø 40 mm	ø 58 mm	ø 58 mm	ø 58 mm
Resolution max.	2500 ppr	5000 ppr	2048 ppr	2048 ppr
Speed max.	4500 min^{-1}	12000 min^{-1}	12000 min^{-1}	9000 / 12000 min^{-1}
Temperature range	-20 ... +70°C	-40 ... +85°C	-40 ... +90°C	-40 ... +90°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	5 V DC 10 ... 30 V DC

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

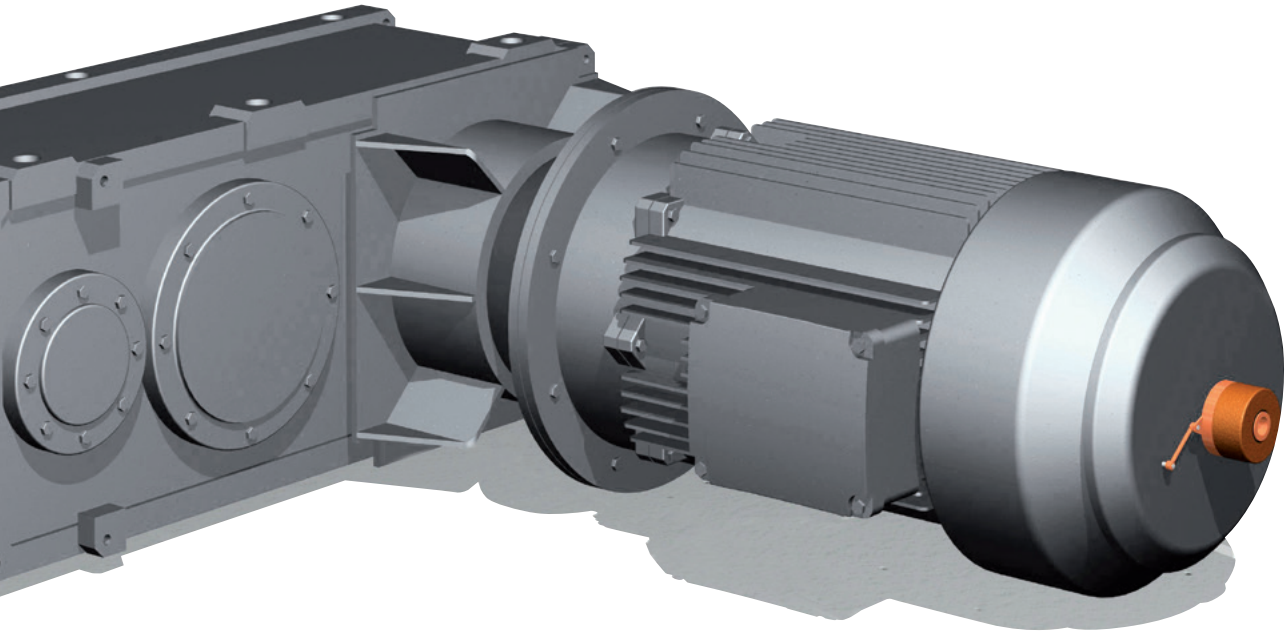
Absolute encoders for asynchronous motors without mechanical gear

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
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
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.

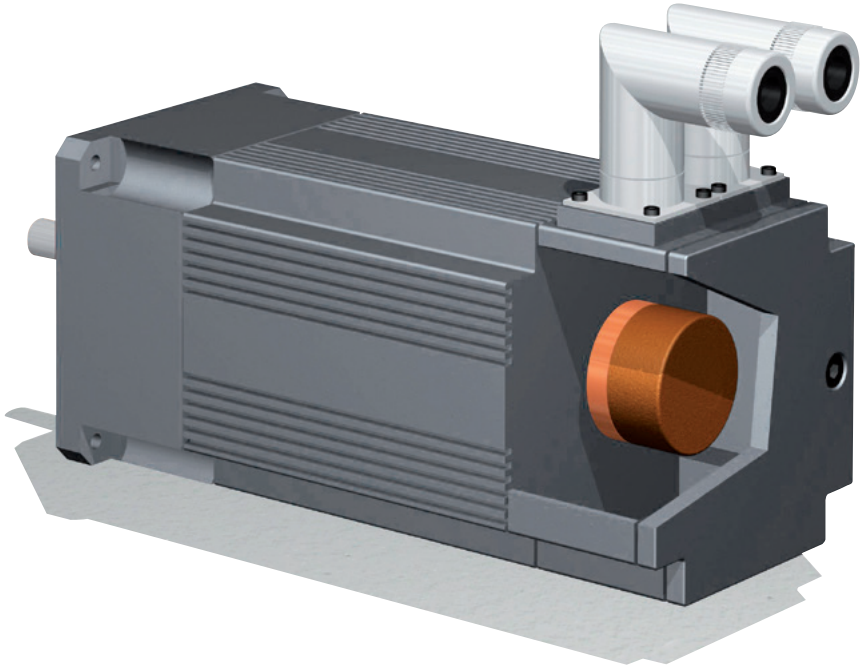
Incremental encoders for large motors / generators

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	RLI200
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 encoders for smallest mounting spaces, non-contact measuring principle
Mechanical interface	hollow shaft max. 42 mm	shaft 11 mm	hollow shaft max. 28 mm	hollow shaft max. 390 mm
Electrical interface	push-pull, RS422, SinCos	push-pull, RS422	push-pull, RS422	push-pull, RS422
Size	ø 100 mm	ø 115 mm	ø 100 mm	40 x 25 mm
Resolution max.	5000 ppr	3600 ppr	5000 ppr	16000 ppr
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 4.8 ... 30 V DC

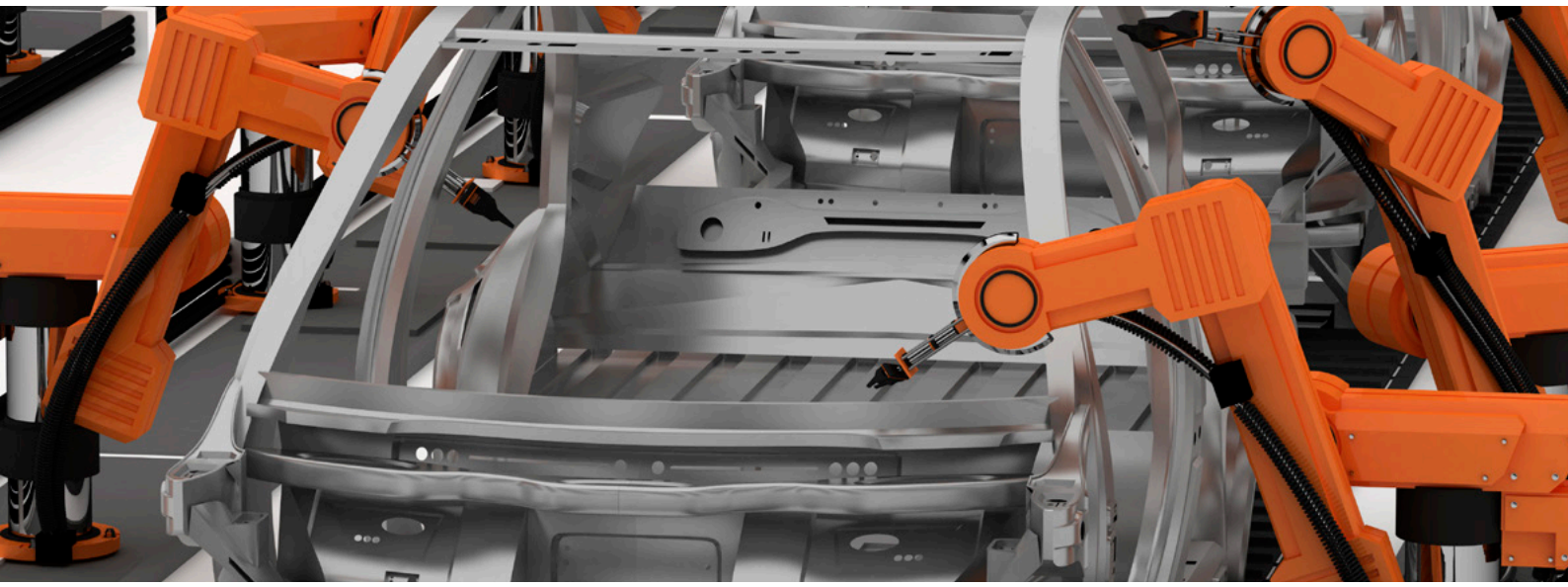
Synchronous motors

The family of synchronous motors includes very small motors, as well as stepper motors, dynamic servo motors and gearless drives.
Stepper motors are very small drives for lower performance ranges. Kübler encoders are perfect for these applications because of their compact size and design. Servo motors are drives for high precision and dynamics with permanent magnet technology and very compact size and design.
Gearless drives are used, wherever gear reduction can be dispensed with by optimizing the direct chain. Gearless drives have a very high number of poles and in consequence a slow final speed with very high torque levels.



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 dynamic servo motors

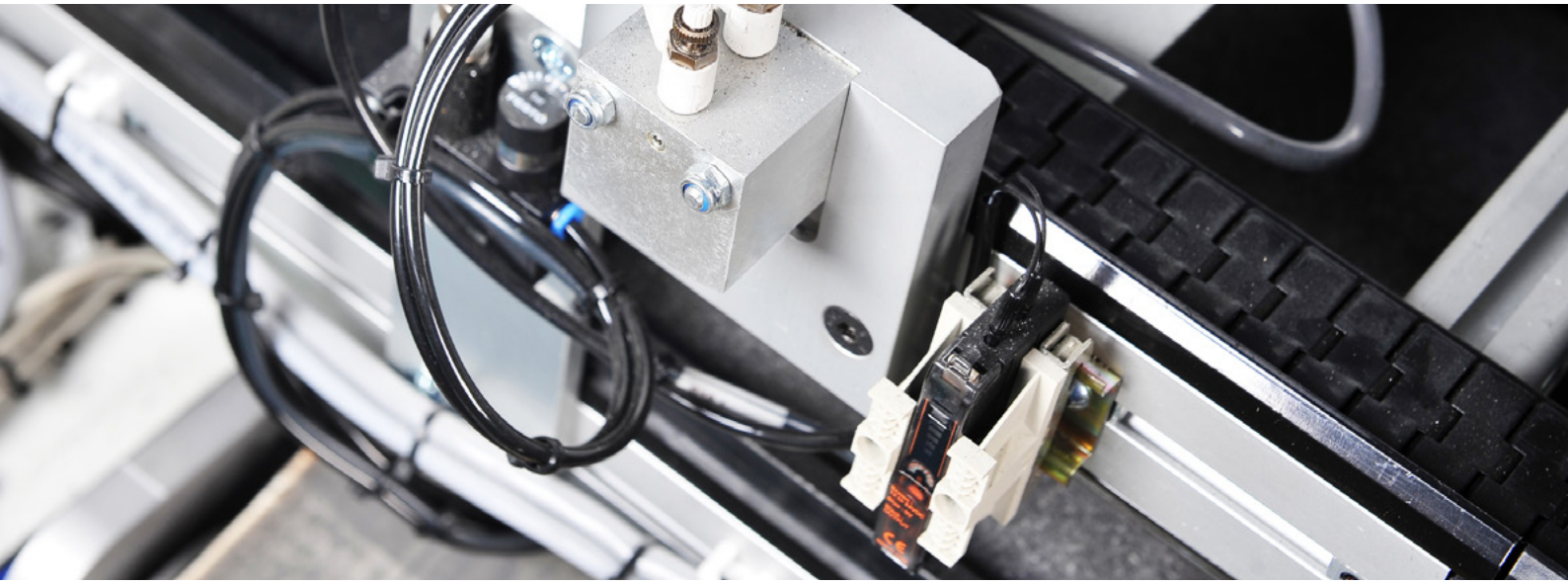
Servo motors are characterized by their high dynamics and performance. These features are only reached if the servo amplifier can control the motor optimally. This requires high-performance sensors such as Kübler's encoders.

	2450 / 2470	Sendix F3653 / F3673
General information	miniature encoders with 12 bit resolution for microdrives	absolute encoders for high performance with up to a 17 bit resolution
Mechanical interface	shaft max. 6 mm blind hollow shaft max. 6 mm	shaft max. 10 mm blind hollow shaft max. 10 mm hollow shaft max. 8 mm
Electrical interface	SSI	SSI or BiSS
Size	ø 24 mm	ø 36 mm
Resolution max.	12 bit	17 bit
Speed max.	12000 min^{-1}	12000 min^{-1}
Temperature range	-20 ... +85°C	-40 ... +90°C
Power supply	5 V DC	5 V DC 10 ... 30 V DC

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



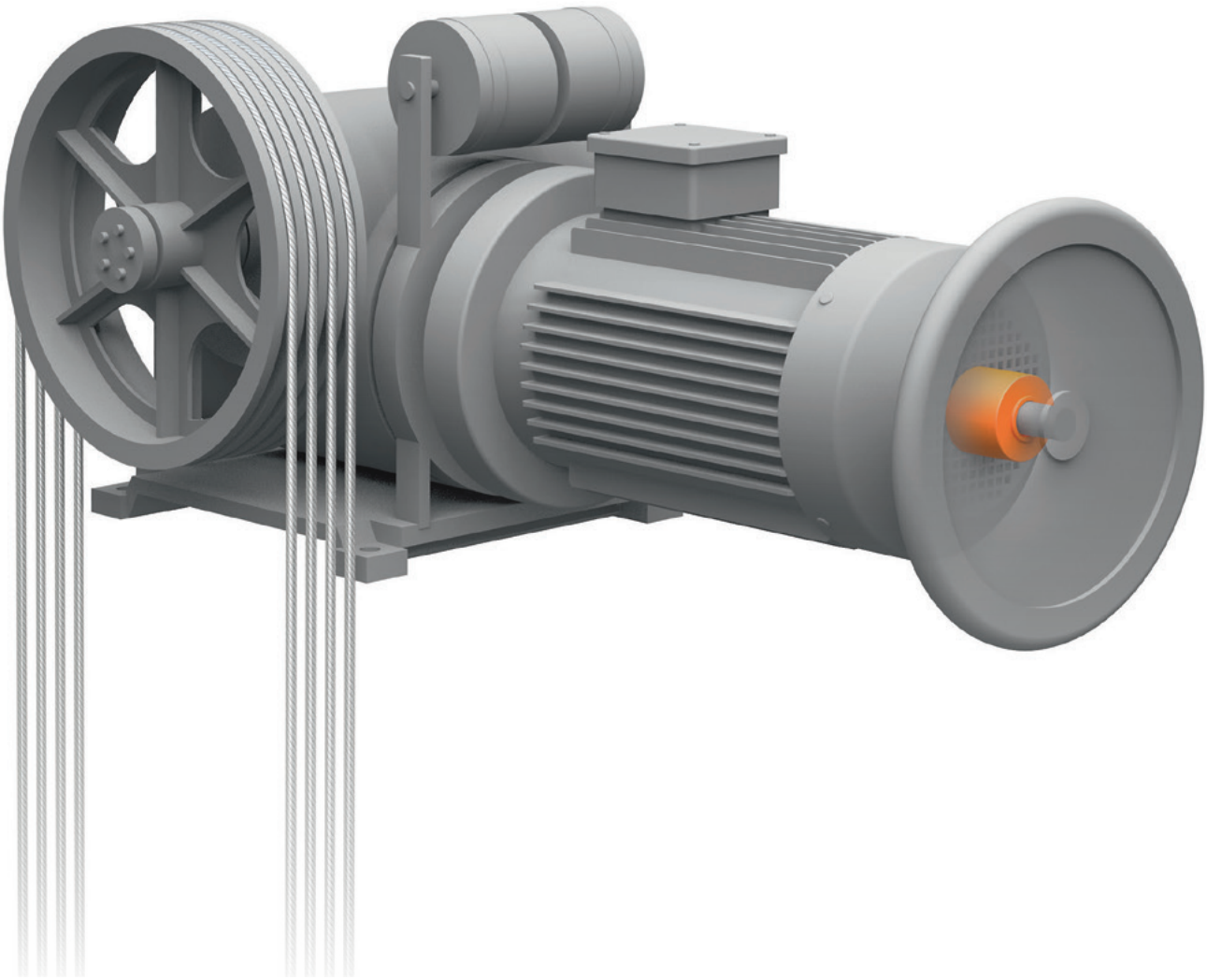
Linear measuring technology for linear motors

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

Encoders for geared motors for the elevator technology

Geared motors are used for the new construction, but mainly for the modernization of elevator systems. Their main features are the reduction gear and a handwheel at the end of the motor shaft. On these drives, an incremental encoder mounted between the motor and the handwheel measures the rotary speed for speed control and transmits it to the CDM – Complete Drive Module.



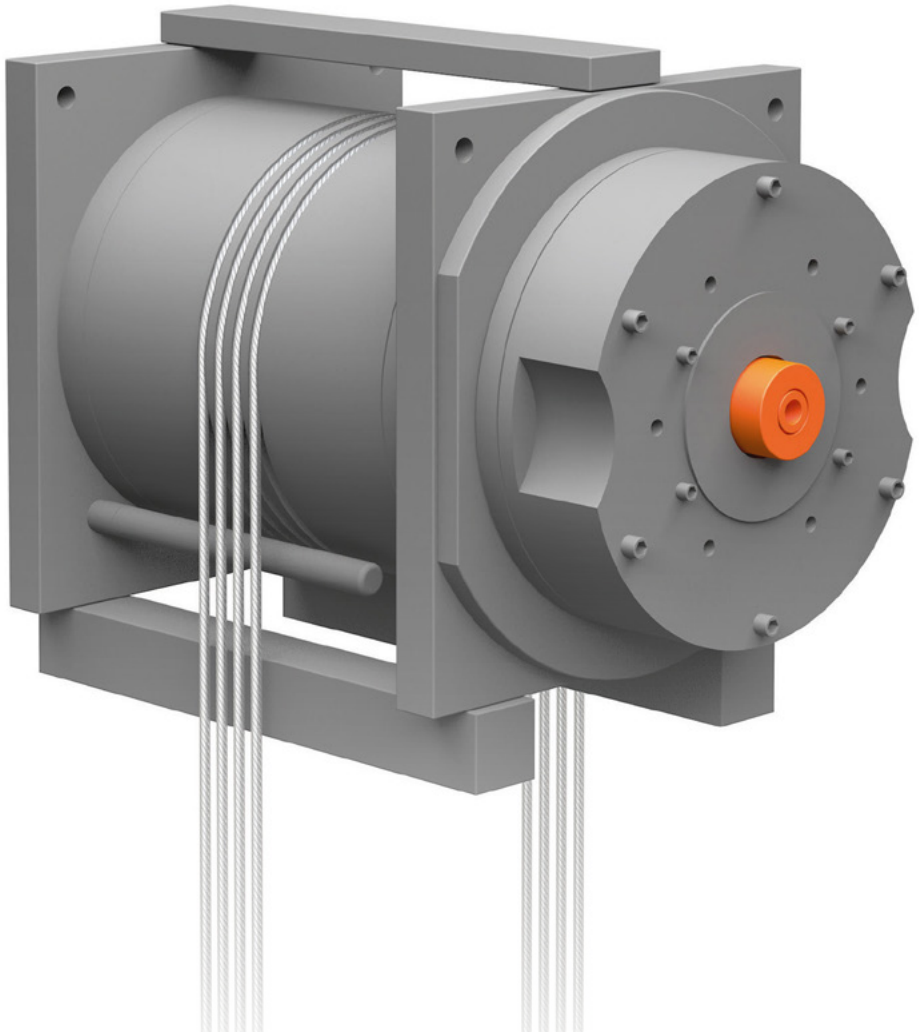
Encoders for geared motors

The encoders for geared motors are characterized in particular by their large hollow shaft and their compact size intended for tight mounting spaces. In addition, high encoder resolution is necessary in order to ensure optimum speed regulation.

	5821	A020 / A02H
General information	compact encoder for large smoothly-operating drives and tight mounting space	tight mounting conditions and applications with high bearing forces
Mechanical interface	hollow shaft max. 28 mm	hollow shaft max. 42 mm
Electrical interface	push-pull, RS422	push-pull, RS422, SinCos
Size	ø 58 mm	ø 100 mm
Resolution max.	5000 ppr	5000 ppr
Speed max.	2500 min^{-1}	6000 min^{-1}
Temperature range	-20 ... +70°C	-40 ... +80°C
Power supply	5 V DC 8 ... 30 V DC	5 V DC 5 ... 30 V DC 10 ... 30 V DC

Encoders for gearless drives in elevator technology

Direct drives (gearless drives) are the consistent further development of geared motors. Their advantages are primarily a high torque even at small rotary frequencies, as well as uniform and silent operating properties.
Direct drives are therefore perfectly suited for use in the elevator technology.



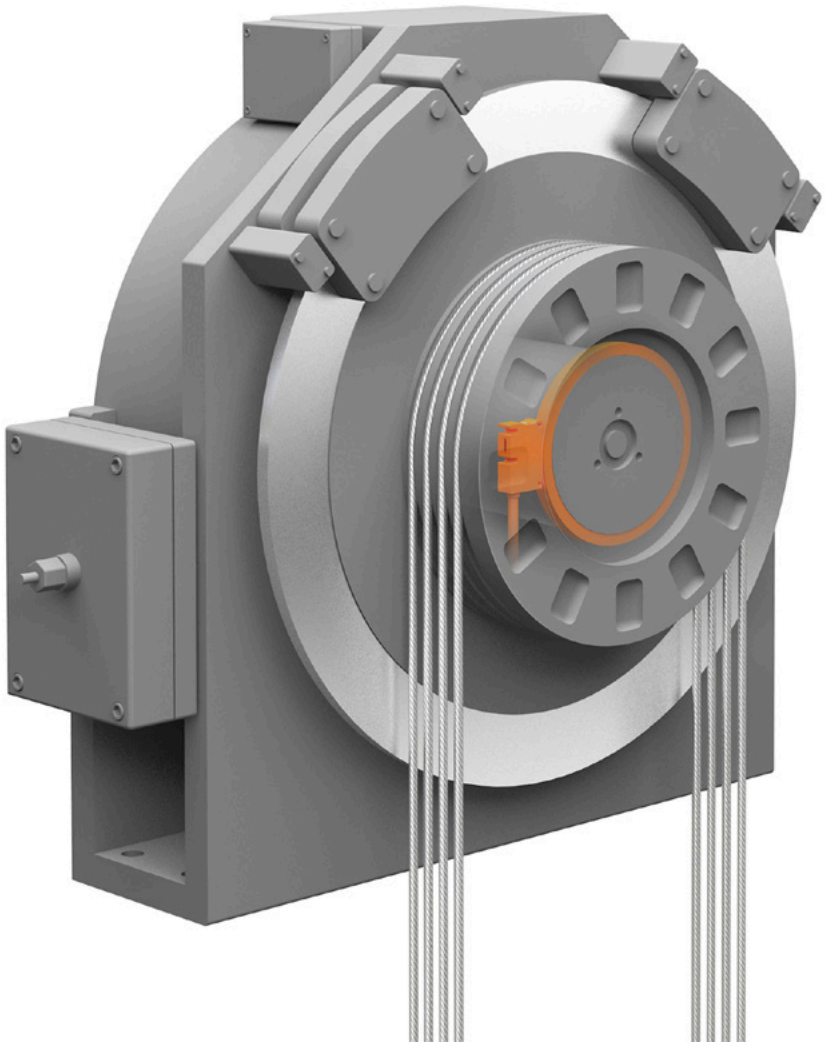
Encoders for gearless drives

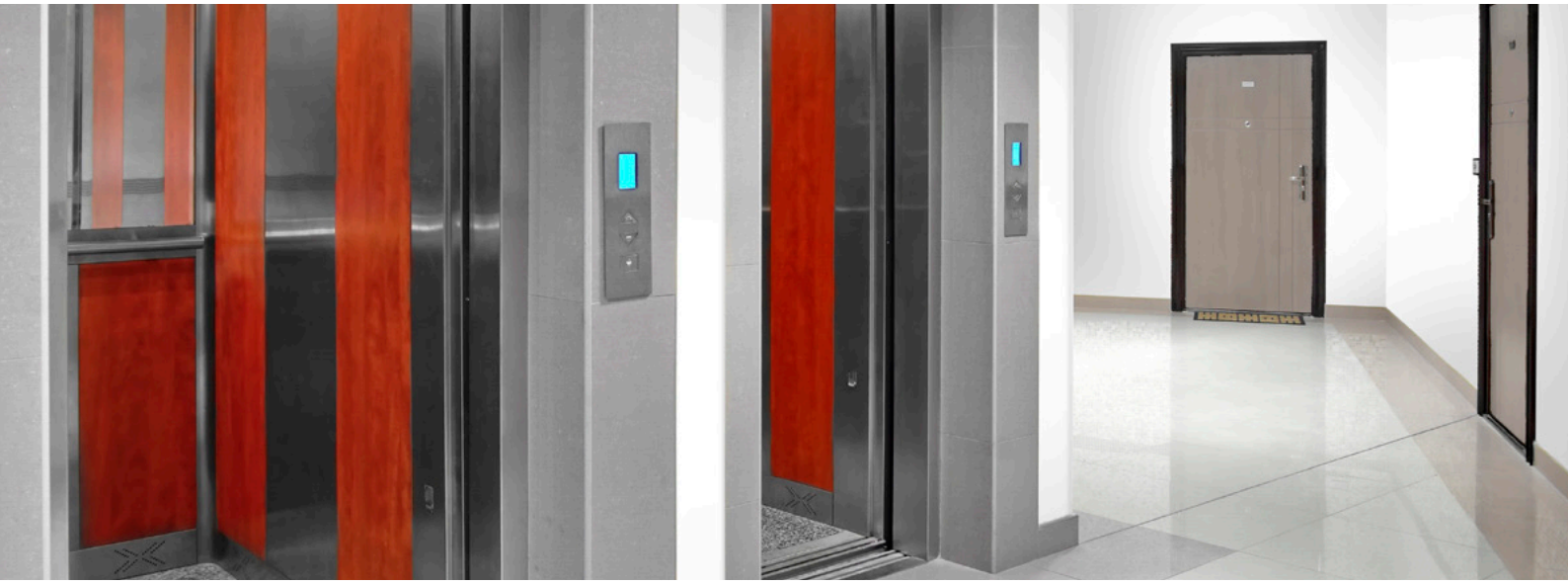
Flexibility is the main characteristic of the encoders for gearless drives. They provide the suitable encoder technology, the optimal mechanical mounting, but also the electrical interface.
The drive and/or the system determine the choice of the suitable encoder.

	Sendix 5873.GK	**Sendix 5873.HK**
General information	absolute encoder with tapered shaft and robust bearing structure in Safety-Lock™ design	absolute encoder with tapered shaft and robust bearing structure in Safety-Lock™ design
Mechanical interface	tapered shaft 10 mm with stator coupling, ø 72 mm (further mechanical interfaces on request)	tapered shaft 10 mm with expanding coupling, ø 65 mm (further mechanical interfaces on request)
Electrical interface	absolute SSI / BiSS incremental SinCos	absolute SSI / BiSS incremental SinCos
Size	ø 58 mm	ø 58 mm
Resolution max.	13 bit or 17 bit + 2048 ppr SinCos optional: 21 bit, fully-digital	13 bit or 17 bit + 2048 ppr SinCos optional: 21 bit, fully-digital
Speed max.	9000 min^{-1}	9000 min^{-1}
Temperature range	-40 ... +105°C	-40 ... +105°C
Power supply	5 V DC 10 ... 30 V DC	5 V DC 10 ... 30 V DC

Bearingless encoders for direct drives

Direct drives designed as external rotor motors are available in various versions which are characterized by a compact and particularly flat construction.
Generally, these drives do not require an additional machinery room and are installed directly in the elevator shaft.

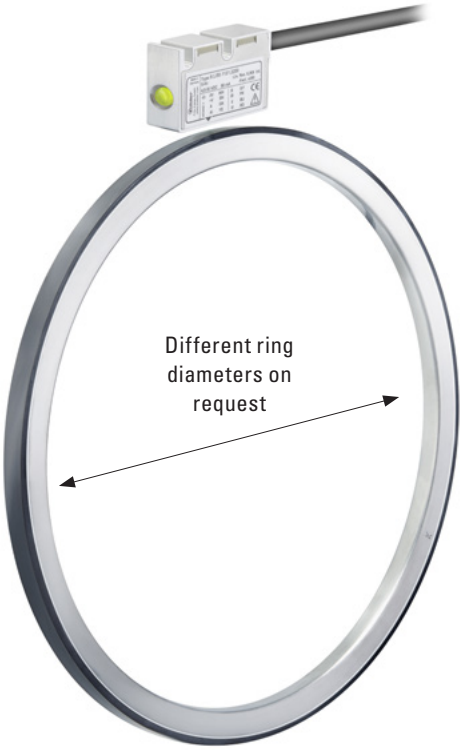




Bearingless encoders for direct drives

The bearingless encoders are made of a magnetic ring and a sensor head. They are ideal for compact and flat external rotor motors. The non-contact measuring principle, with its reduced mounting depth and various magnetic ring diameters, is perfectly suited for tight installation possibilities. Individual adaptation of the measuring system to the dimensions of the drive are here one of the most important prerequisites.

	RLI200
General information	bearingless encoder for tightest mounting situations, non-contact measuring principle
Mechanical interface	hollow shaft max. 390 mm
Electrical interface	push-pull, RS422
Size	40 x 25 mm
Resolution max.	16000 ppr
Speed max.	12000 min^{-1}
Temperature range	-20 ... +80°C
Power supply	4.8 ... 26 V DC 4.8 ... 30 V DC



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).

Encoder family for Functional Safety

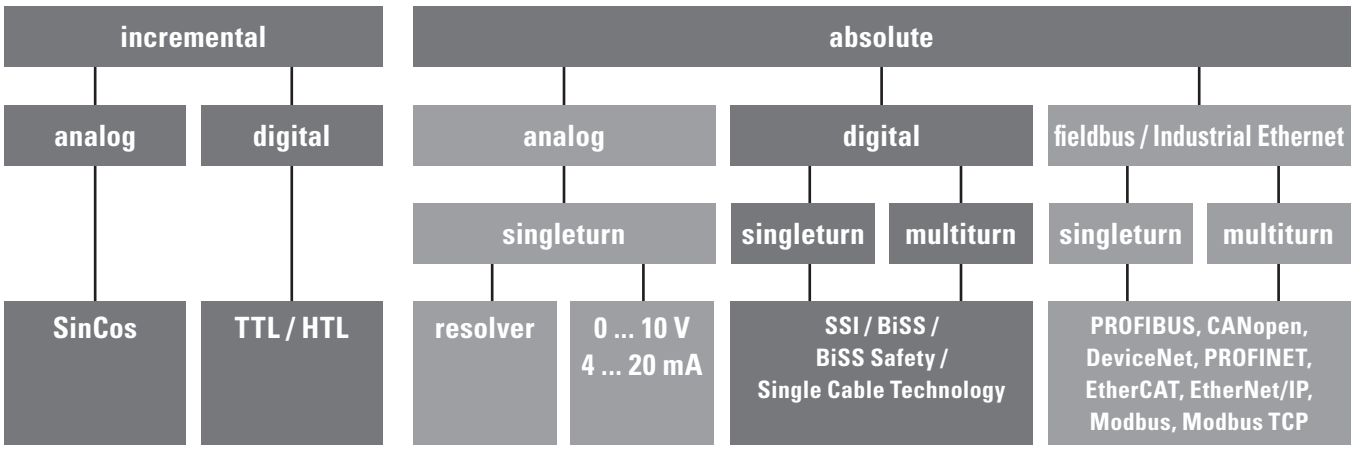
In order to achieve safe incremental information with the encoder, the controller must monitor the validity of the analog, 90° phase-shifted sine/cosine signals with the help of the function: $\sin^2 + \cos^2 = 1$.
In order to obtain safe information with the encoder regarding the absolute position,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

Electrical interfaces for encoders

Encoders have various tasks to fulfil in drive engineering.
One of the most frequent tasks is to supply information concerning speed, for better control of the motor using a frequency inverter. 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 as well as absolutely. For dynamic control with synchronous motors, feedback of the rotor position within a revolution is necessary. Singleturn absolute encoders with a BiSS or SSI interface are used to achieve this.



Single Cable Technology

Single Cable Technology is a new fully digital interface intended mainly for the drives and elevator technology. Its particular feature is the energy and data transmission through one single connection line.

Your benefit:

- Time and cost saving – reduced wiring
- Future-proof technology – fully digital protocol, certified up to SIL3
- Energy saving together with improved dynamics – weight reduction through fewer components in the drive system
- More flexibility – Single Cable Technology is optimally designed for many and mainly also new application areas in the drives and elevator technology
- Smart Motor:
  - Electronic data sheet (EDS) to save customer-specific data
  - Condition Monitoring for machine condition acquisition
  - Connection of additional external sensors such as temperature sensors for additional functionality

Therefore, Single Cable Technology is ideally suited for a Smart Motor and for Industry 4.0.

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 motion and angle measuring systems. 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 t3 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.

www.kuebler.com/ssi-interface

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

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.

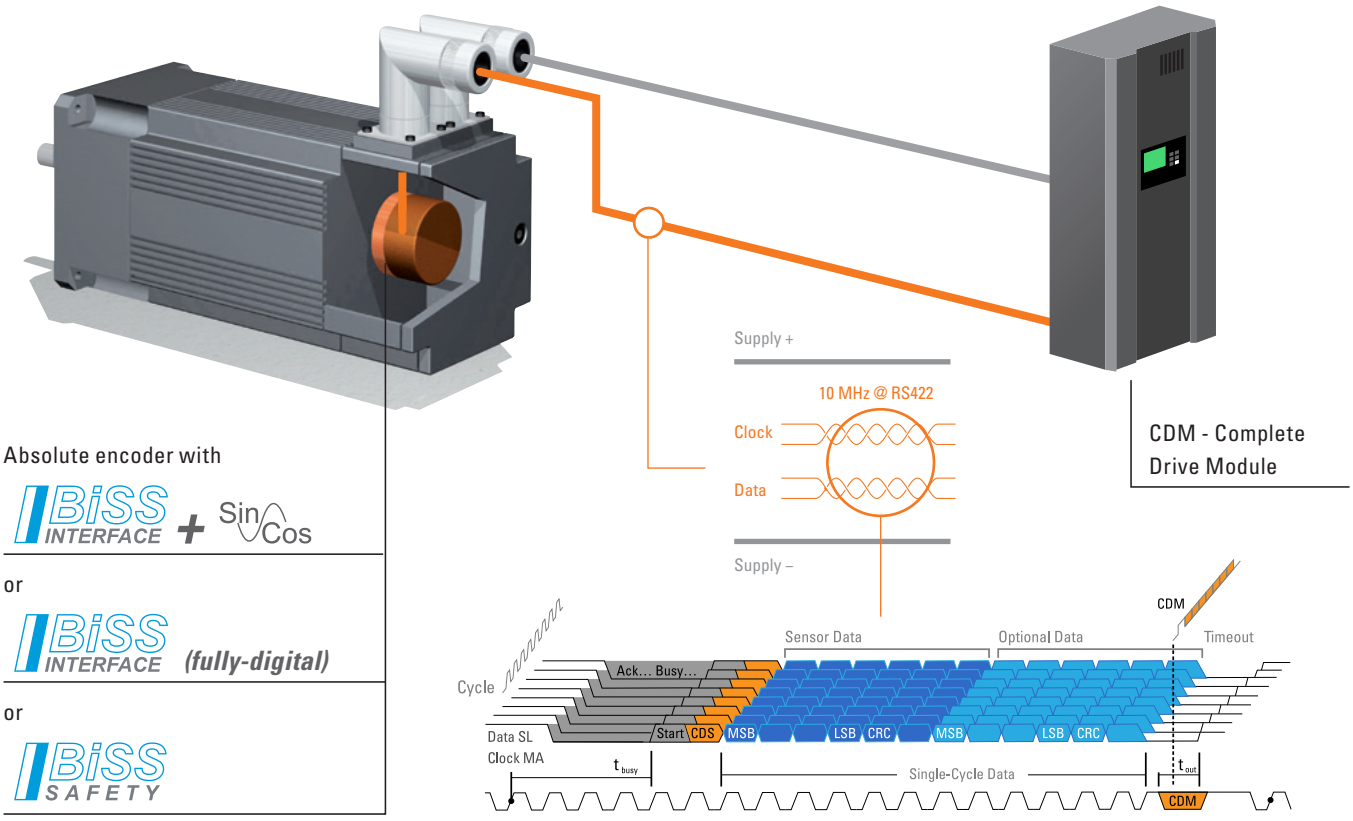
- BiSS is fully-digital and bidirectional and is perfectly suited as a motor feedback system for both linear and rotary axes.
- As the BiSS interface is not proprietary, it is cost-efficient and flexible. This ensures a much wider choice of available products.
- The inverters equipped with an RS422 and 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.

Contact persons for advice and support for the implementation of BiSS

Stefan Schubert
Team leader Service & Application
Phone: +49 7720 3903-35
E-Mail: stefan.schubert@kuebler.com

Rainer Grüninger
Service & Application
Phone: +49 7720 3903-764
E-Mail: rainer.grueninger@kuebler.com

www.kuebler.com/biss_en



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 Support Tool

The BiSS Support Tool assists you in the implementation. The following components are available in a set for this purpose:

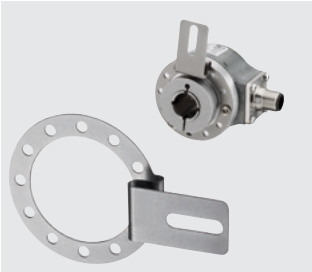
- Sendix 5873 Motor-Line (8.5873.HK3E.C323)
- BiSS-to-PC Adapter (USB)
- GUI Software for Windows PC
- Analysis board
- Adapter cables for connecting the components

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.



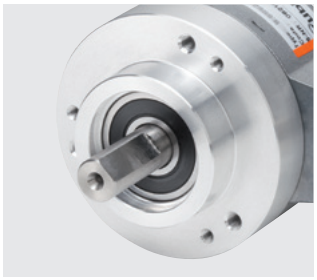
Stator coupling
For applications with axial and radial play with high dynamics.

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

Individual connection solutions

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

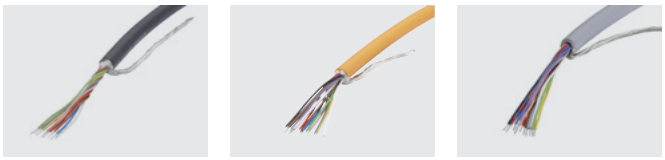
- Lead-through M12 straight, IP67
- Male connector with external thread, IP67, central fastening

Accessories connection technology

Cables

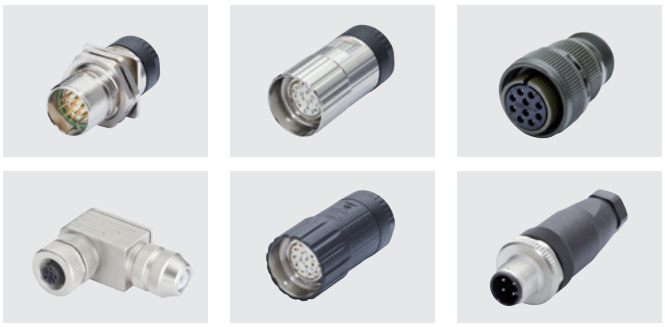
All cables – for incremental, absolute and fieldbus encoders – can also be ordered by the metre as open-ended cable:

- 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).

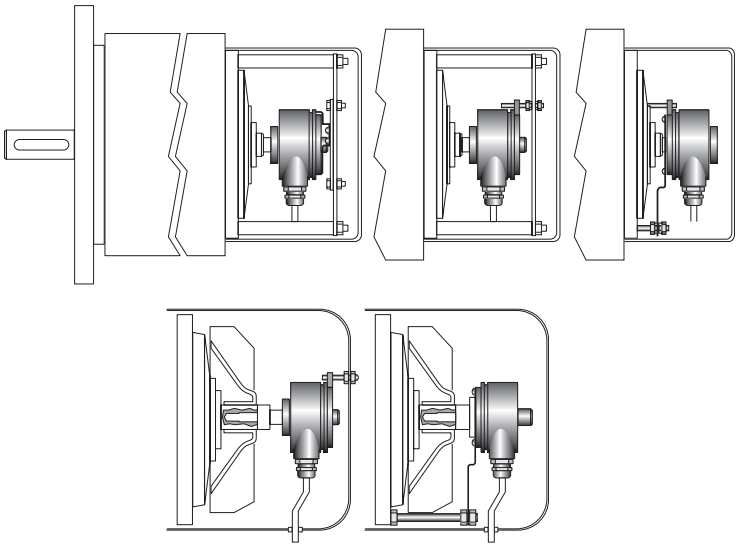
Optimal solutions thanks to customer-specific development

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 (aliging development to target costs)
- Cost of Ownership (fast installation, simple maintenance, long service life)

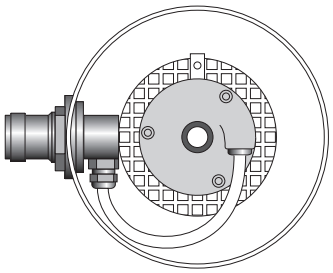
Fixing solutions

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.



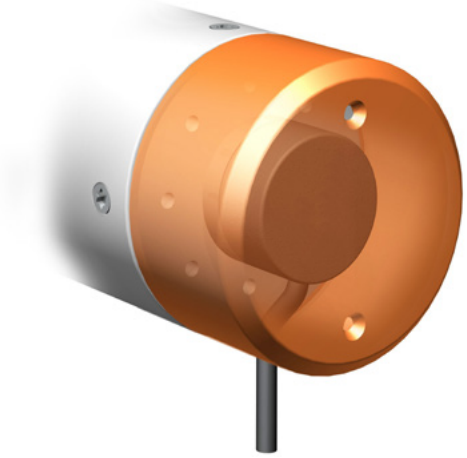
Connection solutions

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.



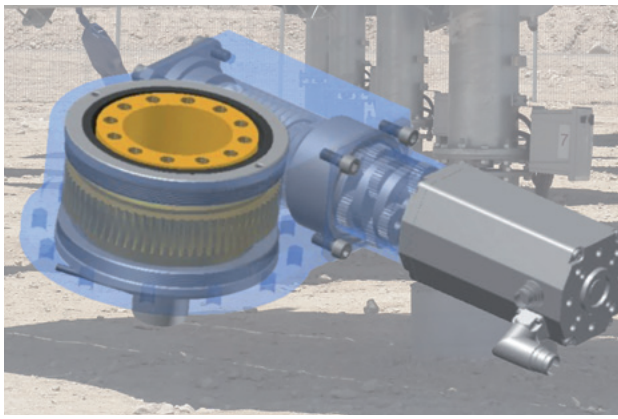
Protection concepts

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

Customer demands

- Long service life
- High-performance product
- Simple installation and maintenance
- System and process quality
- Optimized investment costs

fulfilled via

Technology

- Optimal sensor technology
- Optimal product adaptation
- Optimal integrat

Methodology and experience

- Kübler competency in methodology and project management
- Reduction in customer R&D costs
- Combination of customer and Kübler expertise
- Speeding up of the development process

Service

- Complete systems
- Engineering service
- Logistics

The 4 phases of the Kübler Design System

Analysis, Demands

- Definition of the requirements
- Product requirements
- Timetable
- Target costs

Design

- Technology
- Functions
- Performance characteristics

Prototype, Test

- Quickly realized prototype and/or specific customer drawing
- Testing of the prototype in the application
- Support by Kübler application team during test phase
- Customer approval

Industrialization, Production

- Implementation of production and quality processes
- Logistics/ packaging
- Ongoing quality controls
- Continuous improvement (Kaizen)

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 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.

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.)

48 h Express Service

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

Safety Services

- Adapted service packages
- Individual customer solutions

Sample Service

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

Technical Support

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

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

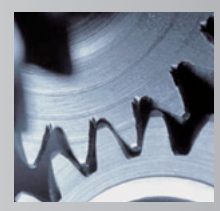
AFTERSALES

Kübler plus

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



www.kuebler.com/drives

Kübler Group
Fritz Kübler GmbH
Schubertstrasse 47
78054 Villingen-Schwenningen
Germany
Phone +49 7720 3903-0
Fax +49 7720 21564
info@kuebler.com
www.kuebler.com

R.600.195.001 11 050 16 ES