

The move towards Integrated Safety

Encoders Whether in high rack storage areas or in theatre backdrops, the integration of safety functions directly in the inverter affords added value through higher availability.

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Integrated safety components save on installation space and reduce costs

The assessment of the hazard potential of a machine is carried out in line with safety standards DIN EN 61508, Functional Safety, and EN ISO 13849-1, Machinery Directive. Depending on the severity of the possible injury and the potential frequency of occurrence of a failure, the machine has to be designed in accordance with the requirements of the determined safety class. These are divided into Performance Levels (PL) from 'a' to 'e'. Depending on the level required, a higher performance factor is necessary when it comes to failure recognition/ diagnostics (Diagnostic Coverage DC) as well as the common occurrence of failures (Common Cause Failure CCF).

Machines are equipped with a wide variety of speed- or position controlled drives. These movements can sometimes have a considerable hazard potential, from which the user has to be protected. The main measures taken to achieve this protection include light curtains or protective enclosures and motion limiting switches, allied with switching the machines off. A de-energised idle drive means a safe condition. However it may be necessary for a person to be within the danger area of a machine whilst it is running, for example to eliminate a fault. This of course means that the safety function has to be widened to cover the movements of the machine, in the form of reduced speed, safe working area or limitation of the torque. For the user this means that his plant can be considerably more profitable.

Trend: Safety in Inverters

Depending on their Performance Levels these higher-value safety functions require special measures to be taken and structures followed in respect of the components forming the sensor, control and actuator chain. Many inverters have to be equipped with an additional safety module in order to achieve this functional safety. In conjunction with safe positioning limit switches can then be cut down on and the scope of the original safety control system considerably reduced. This can bring not only a gain in functions but also a saving on costs. Of course, this can then also put extra demands on the encoder, which often means that a further redundant encoder has to be used in addition to the motor encoder – a time-consuming and expensive solution. What would be preferable would be to design the motor encoder as a safe encoder that could be used up to PLe. Then there would be no need for the extra encoder and the space requirement would stay the same – a big advantage for the user when it comes to costs and installation. The SENDIX SIL encoders for functional safety from the Kübler company provide the answer. These are available in three main variants. Firstly there is the SENDIX SIL incremental encoder with pure Sin/Cos signals and secondly there are the SENDIX SIL absolute single-/multiturn encoders with additional absolute SSI data. These encoders carry certification for use up to PLe. This is achieved by monitoring the sine/cosine signals with the help of the function $\sin^2 + \cos^2 = 1$. In order to obtain safe information regarding the position – even after a power-down condition – the safety module compares the internal position from the incremental signals with the absolute value of the encoder. Using just one encoder requires a 100% reliable mechanical connection. Suitable sturdy fixing elements help eliminate the risk of failures and guarantee a 100% safe shaft

connection. Magnetic insensitivity as a result of purely optical scanning as well as mechanical multiturn gears guarantee error-free operation even in environments susceptible to interference, as can occur for example with magnetic brakes. The wide temperature range from -40°C up to $+90^{\circ}\text{C}$, together with a protection level of up to IP67, allow for use in a wide range of applications.

Implemented applications

There are numerous applications, where the integration of the safety function directly in the inverter and the use of a safe encoder have brought additional benefits as a result of higher availability.

They include the automation of high rack storage systems or of backdrops in theatres and event halls. Here, where people are constantly present under suspended loads, the highest safety level PLe applies.

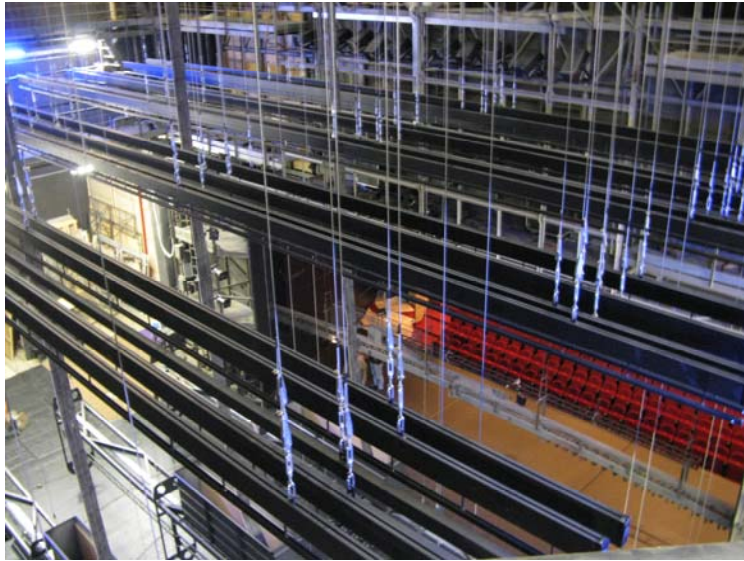
At a glance

The core business of the **Kübler** Group is the development, manufacture and marketing of leading-edge position and motion sensors, as well as of innovative counting and transmission technology.

The family business was founded in 1960 and is today run by the second generation of Gebhard and Lothar Kübler. It is active worldwide, with an export share of around 70%.



Safe drives are used in the robots accessing automated high rack storage systems. SENDIX SIL incremental encoders improve the performance and allow for limit switches to be dispensed with.



1 The inner workings of theatre stages – precise positioning of scenery backdrops.



2 Exact positioning is also of utmost importance in the automobile industry.