

## On Land and at Sea



*Tacho-Frequency Displays are ideal for redundant speed monitoring*

**Encoders that are used for pitch and azimuth positioning or for speed measurement in wind turbines are exposed to a harsh working environment. High expectations are placed on the availability of the signals, since downtimes are disproportionately more expensive and replacement far more time-consuming than for most sectors of automation engineering.**

There are many encoders on the market for positioning and rotary speed measurement in wind turbines. At first glance they all appear to be similar - or even the same - in their functionality and characteristics. However, as is often the case, the advantages they offer for particular customer applications and areas of operation lie in the details.

### **Rugged, accurate Sendix encoders in the pitch drive.**

Using a rugged encoder from the Sendix Absolut series, the angle of the rotor blade in the pitch drive is measured and adjusted via the pitch controller. Variants with additional incremental signals or sine/cosine signals can be used for speed regulation in the frequency inverter.

If even greater safety is required, a resolver that is integrated in the encoder housing can, in addition to the multiturn signals, send resolver signals to the frequency inverter, which then utilises these analogue signals as rotational speed and direction information. Resolver and encoder are independent systems. This redundancy increases the availability and the blades can be taken out of the wind in the case of a malfunction.

Multiturns from Kübler feature very accurate optical scanning. In conjunction with their proven optical drive they have no need for a battery to store the number of revolutions. They thus provide absolute immunity against the influences of magnetic fields, caused for instance by electromagnetic brakes as are often employed in pitch drives.

### **Always suitable: application determines encoder versions.**

Furthermore, Kübler offers singleturn and multiturn encoders, which are mounted either centrally in the rotor blade shaft or eccentrically with a pinion on the blade gear rim. The accessories necessary for installation (gearwheels, mounting brackets, protective covers) are pre-assembled and enable fast, safe installation everywhere, including out in the field. Spring-mounted installation systems ensure that the contact pressure of the gearwheel is not too great and that the loading of the encoder bearings cannot be exceeded.

Kübler encoders used for pitch and azimuth measurement can be reset to the zero position via a reset signal from the controller. For special cases the devices also have a reset button in the cover. So, during mounting or servicing, the rotor blade reference can be manually set, even in the field. This is helpful – not least when mounting the components in the restricted environment of the rotor hub.

### **Better than the norm: maximum sea-water resistance**

In order to meet the general requirements for components that are suitable for use offshore, Kübler offers its encoders with a sea-water resistant coating of the housing components. In addition, the encoders are tested to the IP67 protection level, which all means that they are more than able to cope with the damp, salty air in offshore applications. They comply fully with the requirements for components used in a corrosive environment, such as, for example, with EN ISO 12944-2 Class C3. Here too Kübler goes one step further and tests its encoders according to the highest requirements of the standard IEC 68-2-11 over a time period of 672 hours in the salt-spray chamber. This test is specified by the automobile industry, although cars only have to withstand this test for a maximum of 120 hours.

### **As a matter of principle: braving heat and cold**

In contrast to applications in factories and assembly shops, encoders that are installed in wind turbines are operated in a wide range of temperatures. Depending on the location, daytime and night-time temperatures - and also summer and winter temperatures - can vary wildly. However, after a shutdown, the system must be able to be started up again safely and the signals must always be available. For such extreme conditions Kübler offers a working temperature range from -40°C up to +90°C, so the position monitoring or speed measurement neither 'freezes up' nor 'overheats'. High-temperature versions can function in environments, where the temperature is up to 105°C. This can play a decisive role in applications in slip ring housings or in particularly hot locations in wind power plants.

The speed measurement at the generator is an important measured variable for the entire control loop of the plant. Accurate, high-resolution encoders are necessary for supplying the controller with speed information in real time. The harsh operating conditions on the generator B-side are no

problem for the Kübler incremental encoders. Isolating inserts eliminate shaft currents and the associated damage they do to bearings. A wide diverse variety of accessories and stator couplings enable easy installation without impairing the measuring accuracy. Even a large amount of generator shaft expansion poses no problem here.

In collaboration with its customers, Kübler defines special product tests, such as the Highly Accelerated Life Test (HALT). Here encoders are placed in a chamber and subjected to both extremes as well as to quick changes of temperature, and at the same time are accelerated in three dimensions.

### **Monitoring the difference between the speed of the rotor hub and the generator**

The speed information from the encoders is brought together in the controller, evaluated and then sent from there to the turbine's control loop. In wind turbines a supplementary, redundant monitoring of the speed is desired. Mostly it is the slow rotor speed that is evaluated and – for wind turbines with gears – the fast speed at the generator. For this purpose Kübler offers tachometer/frequency meters for monitoring the difference between the speed of the rotor hub and that of the generator; the meters offer safe relay contacts to break the safety chain. This means that additional safety can be offered if there is a deviation in the two speeds, or in the case of over-speed. Hour meters display the exact amount of hours during which the plant has produced current on the grid. Thanks to the electromechanical hour meters the information is available at all times, even if no supply voltage is present. Both the speed and the number of hours run can be viewed and monitored by the operator in the tower base – independently of the controller – without having to connect his laptop to the controller.

### **On top of the world: Safe, even at high elevations**

Wind turbines are being erected more and more in mountainous regions. Even if the logistics and grid connections in high locations are difficult, the advantages are obvious. The lack of population and the high wind speeds are attractive determining factors. These pose new challenges to the manufacturers of the turbines and components. Kübler encoders can be used at altitudes up to more than 3,000 meters above sea-level. Neither the low atmospheric pressure in these high areas nor the quick changes in temperature cause any problems for the electronics or for the rugged housing components.

*Hall 9, Stand E67*

### **Online-Info**

**[www.kem.de/0311418](http://www.kem.de/0311418)**