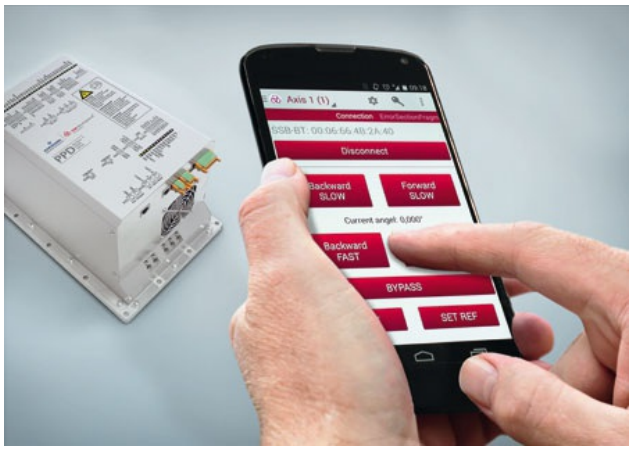
CAN Newsletter Online

WIND POWER CONTROL SYSTEMS

CAN for pitch control and climate sensors

CAN networks have been used in pitch control systems for many years. At the Husum Wind 2015, some companies showed climate sensors with CAN connectivity.



The Perfectpitch controller can communicate wirelessly with smartphones and tablets transferring diagnostic data (Photo: SSB Wind Systems)

FOR MANY YEARS, MARKET-LEADING PITCH CONTROL sub-systems have provided embedded CANopen networks connecting hydraulic or electrical drives and encoders. Moog (Germany) has sold more than 40 000 units, many of them with pitch valves supporting CANopen. Competitor SSB Wind Systems (Germany), daughter of the Emerson Industrial Automation, also provides optional CANopen connectivity. Deeply embedded is another CAN network communication with the PPD (Perfect Pitch Drives) devices. Lenord + Bauer also uses CAN networks in its pitch control system, of which the company has installed about 20 000. In addition, the German company offers condition-monitoring equipment. The control system is based on the GEL 8230 integrated PLC (programmable logic controller) running Codesys, which complies with IEC 61131. It can control up to 64 devices connected via CANopen.

Besides actuators, such a pitch control system comprises CANopen connectable sensors including rotary encoders. Encoders with CANopen interfaces are also used in azimuth (yaw) control systems. Encoder manufacturers have been improving their products regarding costs and robustness. There is also need for functional safety. First encoders supporting CANopen Safety are available.

Reducing development effort

In order to integrate such pitch control systems into the overall wind power control system, Bachmann (Austria) and Beckhoff (Germany), among others, provide integrated software platforms. The benefit for the system designers is that just one software design environment is needed. Of course, these platforms support the integration of CANopen-based pitch control systems. Bachmann's Wind Turbine Template (WTT) helps to reduce the development and commissioning time of the controller software. Beckhoff's Twincat 3 Wind Framework is the competitor; it is based on database architecture. Of course, these development platforms are only suitable for the providers' control systems. Other wind power control systems also support CANopen-based pitch controllers. Even Siemens integrates CANopen pitch controllers produced by a third party in its controller.

Increasing demands on measurements

Modern wind power systems are designed more professionally. Not only regarding materials for blades and mechanical improvements, but also by additional measurements, for example to detect ice or undesirable vibrations. Several companies have launched CAN connectable sensors. Fos 4 x (Germany) presented its ice detection sub-system at the Husum Wind tradeshow in September 2015. Optionally, the sub-system comes with a CAN interface. It is based on fiber optical metrology sensors. They are installed in the rotor blade. The sensors can be placed in the tip of the rotor blade, where they even detect very small ice masses. The sub-system is also suitable for retrofit. Retrofit is an increasing business for elder wind power system. Thousands of wind turbines have been in operation for ten years and more. Retrofitting is supported for example by the above-mentioned WTT software framework. It comprises 15 years of experiences in programming wind power controllers. Based on the IEC 61400-25 data structures, the template provides the user with all the components of a wind power plant (nacelle, rotor, converter, generator, and monitor).

The ice detection sensors by Fos 4 x are purely fiber optic. They are connected to the measurement unit in the nacelle, which forwards the measurement results via CAN to other control units. The sensors and the connection to the measurement unit are non-electrical. The fiber optic components can be integrated into the blade's fiber composite material. The ice detection sub-system comprises vibration sensors, too. According to the provider, the sub-system decreases downtimes. Last winter, they allowed to produce additional 40 MWh per installed MW in 14 turbines, calculated the company.

The IP65-rated housing of the ice detection sub-system is also suitable for retrofitting and optionally provides a CAN interface (Photo: Fos 4 x)

Other sensors continuously monitor the blade tension. Phoenix Contact showed its Rotor Blade Tension Monitoring (RBTM) sub-system in Husum. It provides optional CANopen connectivity. RBTM detects the stress on the rotor blades. In the event that the set limit value is exceeded, alarms are triggered and send to other sub-systems via CAN, e.g. for pitch or yaw control.

Other companies such as Leine & Linde (Sweden) offer ice detection and humidity sensors without a CAN interface. To connect them to CAN-based networks, CAN modules with analog inputs or converters are needed. For climate measurement, temperature and wind sensors may also be needed. Some of them are already equipped with CAN interfaces, while others need a junction box to transfer the measurements to other CAN-based sub-systems.

Gram & Juhl (Denmark) presented the M-System for turbine condition monitoring in Husum. It synchronously collects data from

accelerators and sensors, and optionally transfers them to the wind turbine controller via CANopen. Alarms are transmitted via the CAN interface, too. The sub-system provides up to 24 channels and other connectivity including for Ethernet, Modbus, and serial interfaces. The company guarantees a lifetime of 20 years. This is an important feature because of the high investments in wind power systems.

Measured and pre-processed data can be transmitted via GSM to the wind power plant management system. The Karpagam Journal of Engineering Research reported about an Indian research project on a CAN-based monitoring and fault diagnostic system for wind turbines.

New ideas require additional control systems

The wind power industry is still in progress. Even if this industry is not growing as fast as it did in the past, it will reach US$19 million by 2024 according to the Danish Make market researchers. This figure includes operation as well as service and maintenance. Wind power is not just carbon-free and renewable, it also saves fresh water, which will run short in the future. Thermal plants, no matter if coal, natural gas, or nuclear, require massive quantities of water for cooling. Fracking also needs a dramatic amount of water.

Besides the improvement of existing wind power technology including floating offshore wind power system, new ideas are welcome. Professor Helge Madsen from the Technical University of Denmark has developed a smart blade control and flap system. The Worldwind magazine had a report on this idea. Another idea is the Enerkite which looks like a paraglide. It uses a CAN-networked drive to control the movements.