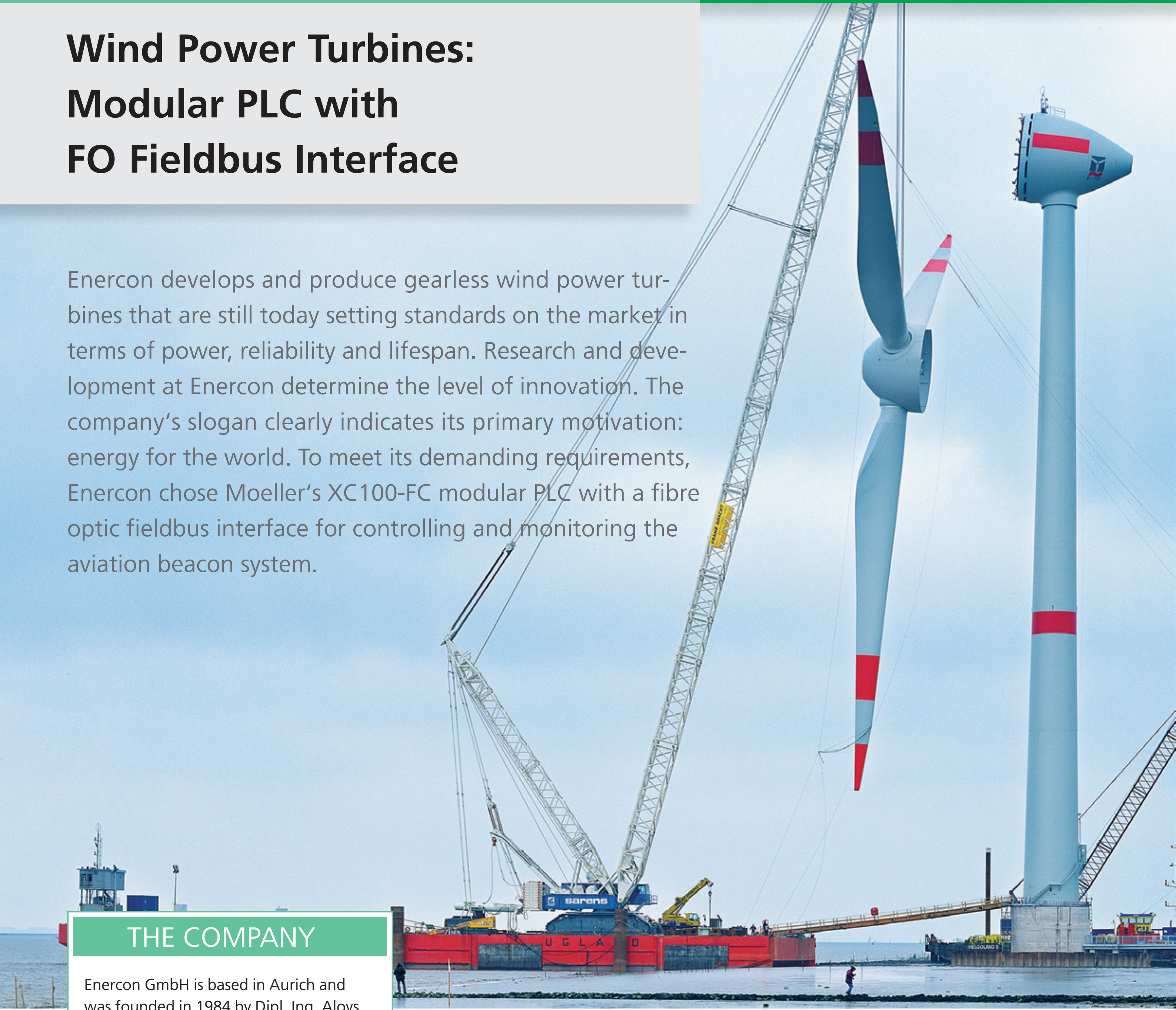
Wind Power Turbines: Modular PLC with FO Fieldbus Interface



Enercon develops and produce gearless wind power turbines that are still today setting standards on the market in terms of power, reliability and lifespan. Research and development at Enercon determine the level of innovation. The company's slogan clearly indicates its primary motivation: energy for the world. To meet its demanding requirements, Enercon chose Moeller's XC100-FC modular PLC with a fibre optic fieldbus interface for controlling and monitoring the aviation beacon system.

THE COMPANY

Enercon GmbH is based in Aurich and was founded in 1984 by Dipl. Ing. Aloys Wobben. In 1991, the research-based company developed and produced the first gearless wind turbine in the world. The technology is still well-established and sets standards in technology, quality and safety on all continents. The industrial series production of wind turbines followed in 1993. Enercon operates as a full-scale manufacturer: all key components such as rotors, ring generator and grid feeding system are all developed and manufactured in-house. Enercon has been market leader in Germany for years and is third in the market worldwide. It has production sites in Germany (Aurich, Emden, Magdeburg), Sweden, Brazil, India and Turkey. As of March 2006 Enercon had installed more than 8 600 turbines worldwide with a total output of 8.8 GW.

Enercon places tremendous importance on high quality and ensures that only first class materials are used. With this in mind, the company collaborates closely with all its suppliers, and thus also with Moeller. Enercon wind turbines are equipped with state-of-the-art microelectronic control technology developed in-house. The main processing unit, which is the central element of the control system, is in continuous contact with the peripheral control elements, such as the yaw control and active pitch control system. Its function is to adjust the individual system parameters to ensure the wind turbines operate at optimum yield under all weather conditions.

Preventing downtimes

The correct feeding of electricity from the wind turbine into the grid requires the monitoring of the grid connection. Grid parameters such as voltage, current and frequency are measured on the low-voltage side between the turbine inverter and the system transformer. All measured values are continuously transmitted to the system control, enabling the turbine to react immediately to changes in the grid voltage or frequency. As soon as the defined limit values of the system protection are exceeded, the wind turbine is safely shut down and service is informed. When the voltage and frequency return to within the permissible tolerances, the wind turbine is automatically started up again, thus preventing lengthy downtimes.

Aviation beacons of the Enercon wind turbines

Depending on the requirements of the authorities there are two types of aviation beacons – obstacle beacons and hazard beacons. Obstacle warning lights are fixed red omnidirectional lights with a medium light intensity of at least 10cd in the horizontal beamspread (-2° to +8°). Hazard beacons are red flashing or flashing strobe omnidirectional lights. Hazard beacon systems are normally required for wind turbines with a total height over 100 metres, since the unmarked section of the wind turbine extends by more than 15 metres. The obstacle and hazard beacon systems each consist of two lights placed on the roof of the nacelle that are run in synchronised operation. This excludes the possibility of a standing rotor blade from blocking the view of the beacon.

Mounting the hub of the wind power turbines

The control, monitoring and possible standby supply is installed in a central control cabinet. This consequently reduces the external equipment required to a brightness sensor, the beacon lights themselves and, if necessary, a visibility meter. To keep the cabling for these components as short as possible, the control cabinet for the beacon system is housed in the nacelle. Control cabinets for beacons with a standby supply are located in an air-conditioned control cabinet.

The Moeller XC100-FC modular PLC with an FO fieldbus interface handles a host of different tasks. It controls and monitors both the grid supply as well as the standby supply. It is also responsible for the management of the accumulator. In addition to this, it handles the control and monitoring of the air conditioning, i.e. the heater and fan. Furthermore, the XC100-FC controls the beacon lights and records their operating hours, controls their intensity and monitors them. In addition to the beacon management system, the XC100-FC modular PLC also controls wind park synchronisation, communicates with the brightness sensor and the visibility meter. Visibility at hub height is a parameter used for controlling daytime lighting. This is a cyclical white strobe light with an intensity of 20 000 cd. If one of the visibility measurements or the management system fails, the beacons must be switch to 100% output. All visibility measurements are evaluated to form a mean value every ten minutes. XC100-FC provides detailed warning and fault indications for this.

A central beacon management system must carry out essential tasks in accordance with the General Regulations for the Lighting of Obstacles to Aircraft September 2, 2004: It should thus synchronise the flash sequence in a wind park, and if necessary, manage the measurement of visibility and ambient brightness in order to control the beacons, as well as document the parameter-based control.

Modular PLC with fibre optic fieldbus interface

XC-CPU101-FC is the name of the powerful modular PLC with the CANopen fibre optic fieldbus interface from the Moeller XC100 range of programmable controllers. This ensures highly noise-free data transfer – even in environments susceptible to excessive electromagnetic interference.

As an alternative to the serial programming interface, the XC100 can also be programmed via the CANopen fieldbus, thus opening up the possibility of use in decentralised systems. The entire installation can thus be operated and programmed centrally as well as from a distance. Other features include an integrated real-time clock as well as a slot for a Multi-Media Memory Card (MMC with standard file system). MMC allows operating system, application program or even recipe data to be updated.

The PLC comes with eight digital inputs and six short-circuit-proof outputs. Four inputs are designed as interrupt inputs, thus enabling a simple and direct response to events, irrespective of the cycle time.

The modular PLC can be expanded locally with up to 15 XIOC signal modules. A wide range of digital, analog or communication modules are available for use. The high density XIOC I/O modules enable users to connect up to 32 I/O points. The XC100-FC has an outstandingly compact design with a 30 millimetre mounting width and 100 millimetre height. All I/O signals are wired using pre-assembled cables thus saving valuable time. With the XC100/200 controllers, users can create a maximum expansion with up to 494 digital signals – with a mounting width of only 510 millimetres.

Quicklink ID:

MS1310

CONCLUSION

Enercon has been a Moeller customer for years and appreciates the quality of its products, service and reliability. Enercon has therefore been using Moeller components, such as contactors and control circuit devices, for a long time. The automation solution in the wind turbines consists of several components networked together via fibre optic cables to ensure noise-immune data transfer. The XC100 with the fibre optic CANopen interface fitted into Enercon's automation concept perfectly. The fieldbus network also enables data transfer to higher-order systems as well as central programming. The flexible XIOC signal modules also ensure optimum adaptions to the task at hand.

Moeller GmbH
Hein-Moeller-Str. 7–11
53115 Bonn
Fax: +49 (0)228 602-2275
E-Mail: info@moeller.net
Internet: www.moeller.net

MOELLER

An Eaton Brand