During the 10 years since it was established, the Finnish company Winwind Ltd has developed into an internationally recognized wind turbine manufacturer and supplier of wind energy solutions. The key to the company’s success was the development of an innovative 3 MW wind turbine with permanent magnet technology, which was superior to the conventional technologies that dominated the market until then. For controlling its 3 MW windmills, Winwind utilizes a PC- and EtherCAT-based automation platform from Beckhoff, which enables the integration of control, visualization and data management on a single PC.
From pilot wind turbine to series production

The first wind turbine built by Winwind had a capacity of 1 MW, even though it was already clear at this stage that larger wind turbines would be required in the future. In 2004, the company started developing the 3 MW version based on a Beckhoff automation platform. Series production of this Winwind turbine started in 2006.

In its 3 MW wind turbines Winwind uses Multibrid-based technology in which the stator of the permanent magnet synchronous generator...
Meanwhile, Winwind has also become the market leader for wind power in Estonia with a total capacity of more than 100 MW across four wind farms. The first wind farm was Viru-Nigula Tuulepark consisting of eight 3 MW turbines which were supplied as a turnkey solution, i.e. Winwind not only supplied the wind turbines, but also dealt with all structural and electrical works. With its 13 3 MW wind turbines, Aulepa is the largest wind farm in the Baltic countries. Once the second stage is completed, it will have a total capacity of 48 MW with an annual output of 123 GWh. This is enough power to cover the annual electricity demand of 43,000 households and reduces annual CO2 emissions by around 120,000 tons.

One of Winwind’s largest customers in Finland is PVO-Innopower Oy. The company operates a wind farm with a total capacity of almost 50 MW at Ajos, Kemi.

270 MW installed wind capacity worldwide
Meanwhile, Winwind windmills are used in wind farms in the Czech Republic, Estonia, Finland, France, India, Portugal, and Sweden. One of the largest Finnish customers is PVO-Innopower Oy. The company operates a wind farm with a total capacity of almost 50 MW at Ajos, Kemi. The 1 and 3 MW windmills are built on land and on artificially created islands. The windmills reliably produce electricity despite very adverse weather conditions with temperatures down to around 25 °C below zero (-13 °F). A solution developed by Winwind prevents the icing up of the windmills and guarantees consistent operation, even under arctic conditions.

Innovative system design meets PC Control
The 3 MW wind turbine is controlled by a Beckhoff CX1020 Embedded PC with Windows XP Embedded operating system and TwinCAT PLC automation software. A user-friendly human-machine interface (HMI), which provides the user with an overview of the system state, is integrated into the control platform. Kimmo Kaappola, Automation and Electrification Manager at Winwind explains the reasons why the company decided to use the Beckhoff Embedded PC as the basis for the control system: „For us, the decisive argument was the fact that the same control platform not only deals with supervisory control and dynamic control of the wind turbines, but can also be used as HMI and for data logging,” he said. “And thanks to the versatile and highly efficient TwinCAT ADS communication, it is possible to use the same HMI interface within the wind farm to link
all the wind turbines with the park control system. Moreover, the use of ADS communication substantially simplifies logging of the data from the different wind turbines within a wind farm.”

**EtherCAT cost-effectively networks tower base to nacelle**

Winwind uses EtherCAT as the primary communication system for its wind turbines. In addition to its high performance, the fast bus system offers a high degree of flexibility. The EK1501 EtherCAT coupler and the EK1521 junction terminal for the Beckhoff EtherCAT Terminal system permit flexible topologies based on glass fiber technology and cost-effective communication between the tower base and the nacelle. “The option of integrating other bus systems such as CANopen into the EtherCAT I/O system via convenient gateway terminals was another key factor in our decision to use the Beckhoff control platform,” said Kimmo Kaappola. “In addition, EtherCAT is also very suitable for diagnostic purposes, unlike traditional bus systems. Since more and more manufacturers offer EtherCAT interfaces for wind turbines, we are possibly en route to a single bus solution for the industry. This makes wind turbine control simpler and more robust.” One of the latest developments at Winwind was the integration of ABB converters with the EtherCAT fieldbus.

**ABB converter systems with EtherCAT interfacing**

ABB’s full-power converters for wind turbines offer system manufacturers a high-performance, reliable solution that meets the requirements of long service life and simple maintenance. Due to their modularity the ABB converters are suitable for installation in the nacelle or the tower and can be operated in conjunction with all common generators. The converter system not only supplies the required current frequency and voltage, it also supports weak grids by feeding in or absorbing reactive power. In this way wind turbines can operate at their optimum duty point and feed energy into the grid with high efficiency.

Winwind uses ABB low-voltage converters for its 1 MW turbines and medium-voltage converters for its 3 MW turbines. Winwind recently successfully tested interfacing of the converter via EtherCAT in a 1 MW prototype system, thereby replacing the previous Canopen fieldbus solution. EtherCAT interfacing offers clear benefits for system manufacturers: Sub-bus systems and associated master connections are no longer required, and the system is faster and the control architecture leaner.

Optional converter cooling with air or liquid enables optimum adaptation of the wind turbines to different locational and climatic conditions. The liquid-cooled converters with fully encapsulated control cabinets are designed for operation under extreme conditions, such as offshore or in the desert. Liquid cooling offers additional benefits: In view of the ever increasing wind turbine generator outputs it enables more power to be produced within the same cabinet volume. It eliminates heat losses from the converter and therefore prevents the surrounding equipment and electronics from heating up.

Wind turbines are generally equipped with a built-in monitoring unit. The converter can provide additional data for analysing error states or the turbine output. ABB offers a remote monitoring system that offers the windfarm operators direct access to the converter and parameters such as DC and AC voltage, output, reactive power, temperature and speed.