



Increase profits and performance for all types of wind turbines and wind farms

Ovation™ Green Wind Turbine Control



Intelligent Control Solutions

Advanced Control Technology that Maximizes Turbine Performance and Profitability

Increase Reliability

Emerson's Ovation™ Green Wind Turbine Control platform leverage the experience and success of more than 65,000 installed systems worldwide and +45 years within the wind business. Since installation of our first wind turbine control system decades ago, we have combined our well-known technology and knowhow with outstanding robustness and dedicated user-friendliness, making our control platforms the strongest, most powerful and advanced solutions on the market today.

Wind control solutions from Emerson help to ensure safe and reliable operation, and optimize the wind turbine's output according to the given weather conditions. It handles all communication interfaces, and make collected and stored operation data available for further analysis and optimization.

Modular, Plug-and-Play Solution

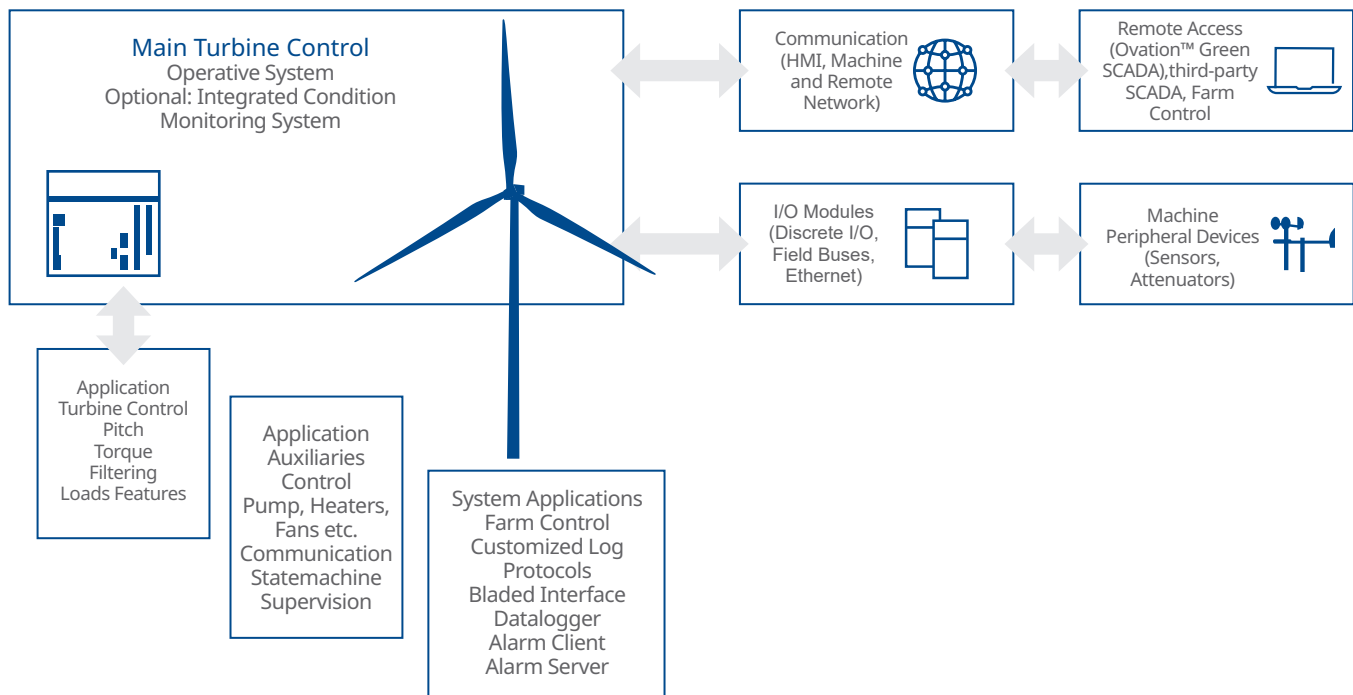
Emerson's wind turbine control systems are highly modularized, ensuring our customers maximum flexibility. Our modular plug-and-play solution supports a scalable and open control setup in order to minimize complexity and ensure easy maintenance. Our extensive product portfolio enables us to deliver solutions for all setups, ranging from small wind turbines to large on- and offshore wind turbines, securing maximum performance, high availability and optimal energy production.

Key Benefits:

- **Proven Track Record:**
+65,000 installed systems and +45 years within the wind business.
- **Designed for Wind:**
Robust hardware, specifically designed for operating in harsh environments.
- **Modular Plug-and-Play Solution:**
Highly modularized plug-and-play solution ensuring maximum flexibility.
- **Powerful Redundant Concept:**
Hardware and software redundancy ensuring the highest operation reliability and higher availability.
- **Event-based Operation:**
Fast data sampling and precise control.
- **Unique Control Strategies:**
Advanced control algorithms reducing loads and/or improving energy production.
- **Self-Configuration:**
Easy installation with automatic module detection and self-configuration.
- **Self-Diagnostics:**
Self-diagnosing in each module for optimal operation and error reporting.
- **Data Logging:**
Advanced event based data logging and storage.
- **Multiple Programming and Simulations:**
CoDeSys, Matlab, C/C++, GH Bladed and Simpack.
- **Maintenance Free:**
Designed to be maintenance free for the whole wind turbine lifetime.

Control Overview

Control System Platforms		
Ovation™ WP4200 CPU Controller- 00, - 08, - 09, - 10	<ul style="list-style-type: none"> • CPU: 2x ARM Cortex™- A15 1.2 GHz • DSP: 2x TI C66X 750 MHz • DDR III RAM: 1 GB • Flash disk: 1 GB SLC NAND + 4 (up to 64) GB eMMC • Communication speed: 10/100/1000 Mbit/s • Integrated CMS • Operation temperature: -30 to +60°C (fanless operation) • Storage temperature: -40 to +85°C 	The Ovation™ WP4200 platform is based on the multicore CPU technology. It offers superior performance and with its built-in floating point unit it is perfectly suited for high demanding control- and regulation applications. The controllers are equipped with high-speed gigabit Ethernet interface, for communication in the wind farm. It also features safety chain relay logic that integrates with the safety system to fulfill the requirements in the ISO 13849-1 standard.
Ovation™ WP100 CPU Controller- 00, - 30, - 31, - 32	<ul style="list-style-type: none"> • CPU: ARM Cortex™- A8 1000 MHz • DDR III RAM: 1024 MB • Flash Disk: 1024 MB • Communication speed: 10 kbit/s to 1 Mbit/s • Built-in GPS receiver • Operation temperature: -30 to +60°C (fanless operation) • Storage temperature: -40 to +85°C 	The Ovation™ WP100 platform is specially designed for control of small and medium sized wind turbines. The WP100 controller is built with focus on compatibility and flexibility and has various on-board I/O channels that makes it possible to use the controller as standalone (without additional I/O modules) to control systems with limited complexity. The controller is equipped with two high-speed interfaces that work as separate network interfaces. The controller also features safety chain relay logic.
Interface Modules	<ul style="list-style-type: none"> • Ovation™ WP-Line 111 MK II - Power Supply • Ovation™ WP-Line 112 MK II - Gigabit Ethernet Switch/PSU • Ovation™ WP-Line 151 MK II - Grid Measurement • Ovation™ WP-Line 351 MK II - COMBI I/O • Ovation™ WP-Line 411 MK II - 16 PT100/PT1000 • Ovation™ WP-Line 412 MK II - 32 PT100/PT1000 • Ovation™ WP-Line 413 MK II - 16 Analog Current Output • Ovation™ WP-Line 414 MK II - COMBI I/O (DI/DO/PT) • Ovation™ WP-Line 415 MK II - 32 Analog Input • Ovation™ WP-Line 416 MK II - 64 Digital Input • Ovation™ WP-Line 417 MK II - 64 Digital Output • Ovation™ WP-Line 418 MK II - COMBI I/O (DI/DO/AI/PT) • Ovation™ WP-Line 419 MK II - COMBI I/O (DI/AO/AI) • Ovation™ WP-Line 420 MK II - 16 digital input • Ovation™ WP-Line 421 MK II - 32 digital input • Ovation™ WP-Line 422 MK II - 48 digital input • Ovation™ WP-Line 423 MK II - 64 digital input • Ovation™ WP-Line 424 MK II - 32 DIN/16 DOUT • Ovation™ WP-Line 425 MK II - 32 DIN/16 DOUT/16x AIN(I) • Ovation™ WP-Line 426 MK II - 16 DIN, 16 PT100/PT1000 • Ovation™ WP-Line 511 MK II - CANopen Master 	The WP-Line interface modules adds flexibility to the Emerson turbine control systems. With the WP-Line modules you are able to combine, build and create your ultimate setup.
HMI Interfaces		
Ovation™ WP4052 Touch Display	<ul style="list-style-type: none"> • 15" TFT with 1024 x 768 resolution, 16 bit colours • Maximum user comfort via the HMI principle • User-friendly menu structure • USB port available • Pressure sensitive touch screen; responds to finger, gloved hand or pen 	The Ovation™ WP4052 graphic color touchscreen display ensures quick and reliable survey of functions and data in the wind turbine. It provides maximum user comfort via the HMI principle and a user-friendly menu structure. The Ovation™ WP4052 display is available in a cold climate version with internal heater.
Ovation™ WP4053 Touch Display	<ul style="list-style-type: none"> • 7" TFT with 800 x 480 resolution, 16 bit colours • Maximum user comfort via the HMI principle • User-friendly menu structure • USB port available 	The Ovation™ WP4053 graphic color touchscreen display is compatible with the Ovation™ WP4x00, WP100 and WP3x00 MK II platforms. It gives the possibility to start/stop the turbine, access diagnostic data, parameter changing and troubleshooting. It is the perfect solution for cost-optimized setups where size of the display is one of the crucial factors.



Software Architecture

Emerson's Ovation™ Green Wind Turbine Control platform use the advanced OS42xx operating system software, featuring Failsafe Flash file system, TCP/IP protocol stack, WEB-server, plug-and-play identification/configuration of all WP-Line modules, status code system, 30-year summation structure, menu system and log systems. The software architecture is also offering:

- Event-based architecture
- High real-time performance – fast reaction to async. events
- Integrated Matlab Simulink programming and modeling
- Integrated DLL generation for GH Bladed, DigSILENT PowerFactory or similar tools
- Open Protocol\Modbus\IEC61400-25\Open MPP\OPC

Emerson's controllers handle the executing of up to 10 different synchronous/asynchronous applications running in parallel. As an example this could be: turbine control application, grid quality monitor and condition monitoring applications, standard communication protocols, customer specific communication protocols, CoDeSys RTS etc.

Take Control

Emerson's Ovation™ Green software and automation portfolio provides a unique and open controller engineering tool giving you complete control of an individual wind turbine, a wind farm and or a fleet of wind assets. Our advanced software empowers you to rapidly change application source code, regulating the control system and allowing you to quickly respond to changes and new requirements.

Tools & Functions

Our wind turbine control platforms are supported by an extensive package of tools and functions, covering the needs of all parties; from the R&D department - over the service department - to the professional end-user.

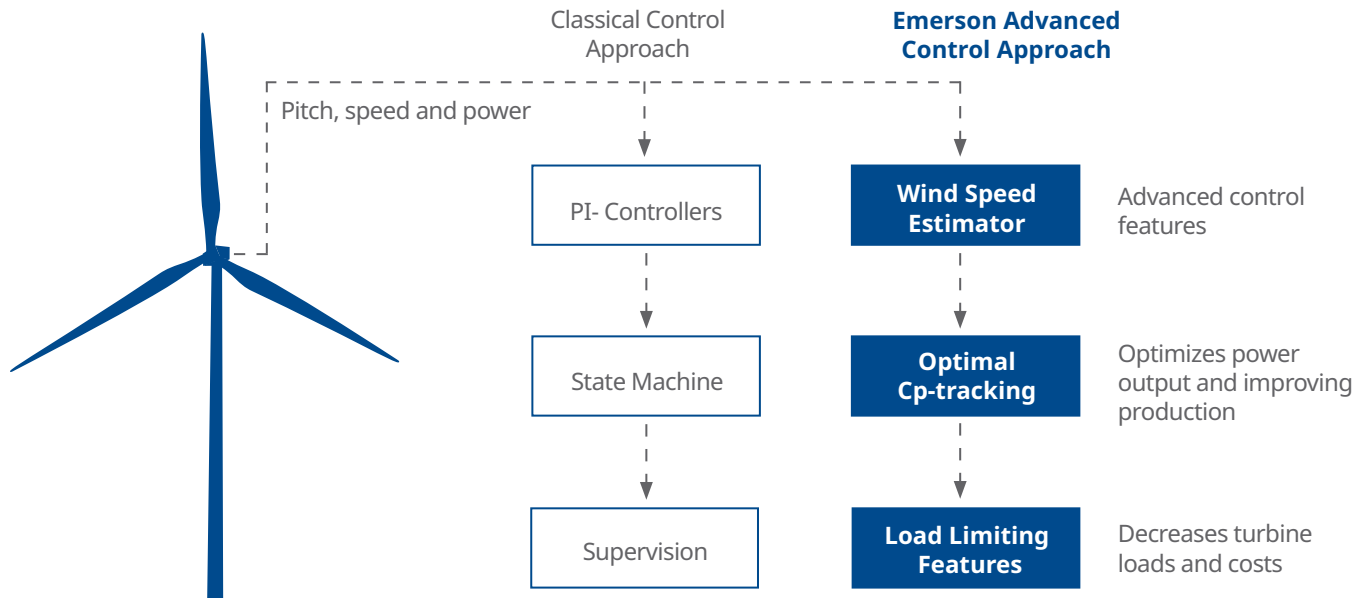
Off-the-shelf standard applications based on Emerson's long-standing experience in wind helps you reduce overall system implementation costs. You can choose among several applications within wind turbine control, park control, substation control, met-station control etc.

Application software source code can be acquired from Emerson and gives you a jump start to the development of your own customized application software.

Language customization tool supporting uni code ensures high reliability and efficiency as your users can operate the system in their native language.

Our innovative controller engineering tool allows your engineers and technicians to customize existing or create new control applications as well as generate detailed documentation and reports, all in an intuitive environment built around a standard Microsoft Windows platform. The software supports multiple programming languages including ANSI C/C++ and Structured Text, and compiles ready-to-use applications for Emerson's Ovation™ Green Wind Turbine controllers and DLLs for simulation tools.

Advanced Control



Powerful Control for Wind

As the wind industry pushes to lower turbine costs while enhancing quality and performance, Emerson's intelligent wind turbine control platforms enable customers to achieve both. Our solutions offer superior performance and is developed specifically to withstand the harsh environmental conditions in the wind industry on- and offshore. Our systems are developed for unmanned operation and contains no moving parts.

Emerson's Electromagnetic Compatibility (EMC) laboratory enables us to test all components during development and all series productions. Our turbine control hardware is tested twice the EMC standard. We have tested our modules against this standard through more than 30 years, ensuring the highest level of robustness and reliability throughout the product lifetime.

A wind turbine has an expected lifetime of 20 to 30 years. Emerson's turbine control platforms are designed to be maintenance free for the whole wind turbine lifetime.

Advanced Control for Lower Energy Costs

Emerson's wind turbine control system consists of hardware and software to operate the turbine machinery. We not only specialize in the hardware setup, we also have leading industry knowledge in load and control optimization features.

Emerson's load and control experts are specialized in wind turbine optimization and deliver a wide range of advanced control features. By applying advanced control integration knowhow and services, we are able to reduce loads and/or improve energy production and thereby reduce the cost of energy.

This includes algorithms and drives for controlling main turbine blade pitch, rotor speed, generator power and yaw positioning, but also the supporting functions such as cooling, lubrication, power supply, etc.

Reducing the Cost of Energy

- Load calculation and optimization to improve AEP.
- Unique proprietary control strategies to improve production and performance (2PI and torque).
- Robust pitch and power control for optimal power production.
- Individual Pitch Control for reduction of nacelle tilt and yaw, blade and tower extreme and fatigue loads.
- Drivetrain damping for reduction of fatigue loads on drivetrain and gearbox.
- Active tower damping for reduction of tower fatigue loads.
- Load and control software toolbox - to optimize the design and load calculations for all sizes of wind turbines.

For more information visit
www.Emerson.com/Ovation-Green



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