

5.0

Ahead of the Times

Technology – a bridge to a remote future

More than twenty years of experience make Bachmann electronic the most sought-after supplier of integrated automation solutions for wind turbines. The figures speak for themselves: Bachmann know-how is present in over 120,000 turbines - one in three of every installation worldwide. Market-confirmed technological leadership and maximum availability guarantees turbine operation, optimal productivity, and minimal maintenance costs far into the future.

Wind turbines are production systems: they only generate revenue when they're running. And the quicker, more constantly and longer they are connected to the grid, the sooner initial investments can be amortized, and profit generated.

Achieving this goal demands a systematic and coordinated overall solution that integrates turbine automation, operational control and monitoring, exact knowledge of turbine condition, and safe integration into the power grid, as well as data acquisition and operator intervention options. Bachmann offers just such a solution: for onshore and offshore, for the development of new installations, and for retrofits, significantly extending productive lifetimes.

The power of automation

When it comes to performance, robustness and safety, Bachmann's M1 automation system has been the number one choice for decades. With a proven availability of 99.96%, the M1 ensures the smooth operation of modern wind turbines.

Next-generation multicore processors deliver the necessary computing power to implement detailed monitoring functions directly on the controller, alongside the regular machine automation tasks. This reduces complexity and allows the cross-checking of selected sensor data directly with the turbine's condition parameters. As a result, targeted damage limitation measures can be promptly initiated during critical operating situations.



Predictive maintenance with integrated Condition Monitoring

Bachmann's Condition Monitoring portfolio provides a modular, future-proof, and all-inclusive package. Individual functions can be flexibly combined to allow the step-by-step integration of Condition Monitoring into single turbines or entire wind farms.

Advanced technologies and sensors enable seamless monitoring of the drivetrain, tower structure, and rotor blades. The WebLog Condition Monitoring software suite consolidates the configuration, acquisition and processing of data from all monitoring systems installed in machinery and structures, providing state-of-the-art predictive maintenance tools and methodology. Available as an ongoing subscription service or for on-demand, in-depth analysis, the specialist Bachmann Remote Monitoring Service monitors the turbine and reports on its condition.

The advantages are self-evident: wind turbines are always safely operated under ideal conditions, and they stay connected to the grid for as long as possible. Early error detection significantly reduces operating and maintenance costs. Downtimes are reduced, and the economic efficiency of the plant is enhanced.

Fully protected on the Smart Grid

Bachmann grid metering and protection modules integrate operational control, grid metering, voltage quality monitoring, protection and fault logging in a single unit. They ensure that critical grid states are detected as early as possible, whilst maintaining full compliance with modern grid connection standards.



The Bachmann Smart Power Plant Controller (SPPC) permits the regulated integration and monitoring of all power generators and components interlinked at the grid connection point to form a master power plant. The SPPC fully complies with the requirements of VDE-AR-N 4120:2018 as well as VDE-AR-N 4110. All grid performance and quality management system components have been tested by TÜV Nord and are certified according to the international grid codes set out in BDEW, FGW T3 & TR, ENA ER G59/3 or IEEE C37.90. Operators can be certain of meeting the high standards imposed on the grid compatibility of wind turbines.

Wind Power SCADA: Transparent mosaic

The Bachmann Wind Power SCADA solution (WPS) provides operators with an overview ranging from complete wind farms down to the smallest detail of each individual turbine. The multi-device software is built on pure web technology and supports standard protocols such as OPC UA and IEC 61400-25. It significantly shortens development and commissioning times for visualization systems. All kinds of display devices, such as smartphones, tablets, terminals or PCs, can be easily and simultaneously connected via a web browser.

WPS also complements the Bachmann Wind Turbine Template software control platform (WTT), which provides tested, reusable software modules for standardized tasks in accordance with the IEC 61400-25 turbine automation structures. WTT enhances turbine safety and availability and, thanks to prefabricated components, significantly shortens the development lead times of operations management, reducing the time to market for new turbines.

Retrofit: New life for old turbines

Retrofits enable legacy wind turbines to remain operational at a fraction of the investment cost of repowering.

Obsolete control components are replaced by state-of-the-art components that are far superior to the previous designs in performance and operational reliability, even under the harshest environmental conditions. Software upgrades enable wide-ranging access to data on relevant operating functions, with security according to the latest standards, and provide interfaces to current SCADA platforms.

Operators can optimize the performance of their turbines at all times and monitor every aspect of their condition. And last, but not least, a retrofit establishes the groundwork to implement state-of-the-art sensor technologies, comprehensive Condition Monitoring, as well as meeting key grid technology demands.

All for One

The intelligent combination of powerful hardware components and advanced software applications minimizes the risk of production downtimes and optimizes yields - for both new turbine installations and retrofits. Bachmann electronic's single-source technologies and systems provide the basis for the future-proof power generation of renewable energy.





Going Far Beyond the Turbine

Integrated solutions for the wind energy of tomorrow

Bachmann electronic stands amongst the pioneers of wind power. The company has been an established market player for more than 20 years, with over a third of wind power generation worldwide now generated by turbines equipped with Bachmann technology.

But the Austrian specialist is by no means resting on its laurels. “Wind Energy 5.0” is the company’s latest innovation. **Gabriel Schwanzer, Director Business Unit Wind at Bachmann**, explains to us what exactly Wind Energy 5.0 means for Bachmann and its customers around the globe.

Bachmann’s M1 automation system is synonymous with top performance and maximum availability in wind energy. But the company’s portfolio covers far more than turbine automation. From the early days it also extended to condition monitoring.

Unsurprisingly, Bachmann has since grown into one of the sector's leading suppliers of Condition Monitoring systems. Another focus area is secure data and energy connectivity - within the wind farm, as well as across multiple sites and into the power grid, ensuring grid compatibility. And last, but not least, Bachmann helps first-generation wind turbines gain a new life through retrofitting.

Sustainable, people-oriented and resilient - that is how a paper from the European Commission for Research and Innovation formulates the strategy for Industry 5.0 and its societal role. Mr. Schwanzer, are these concepts related to the underlying principles of Wind Energy 5.0?

Absolutely. Without a sustainable approach, we will never be able to meet the challenges posed by dwindling resources and climate change. This means that our power generation output must be continuously improved relative to the required input of resources.

We will only succeed in doing that, however, if our focus is on the full lifecycle right from the start, and if we think about how to keep plants running for longer, with higher productivity. Specifically, in terms of wind turbines, this means integrating them perfectly and safely into an entirely new energy supply landscape.

It is clear that the tasks we face are becoming increasingly complex. We will increase our efforts to assist all involved - operators, users, and service personnel. We provide them with tools in an ever more rapidly changing environment to identify the right course of action at the right time, to therefore make the right decisions. This will optimize output, conserve energy and resources, and ultimately boost the economic viability and competitiveness of wind energy.

When we talk about resilience, we mean the ability to deal with change quickly, flexibly, and in a "healthy" way. We particularly need those attributes in wind turbines, as in all renewable energy sources - they all generate power depending on external influences. After all, renewables are becoming increasingly critical to our energy supply. Five years ago a small wind farm was feeding just 5 to 10 megawatts into the grid, but today - with well over five times the installed turbine power and a denser network of farms - the same farm can easily supply 80 to 100 megawatts.

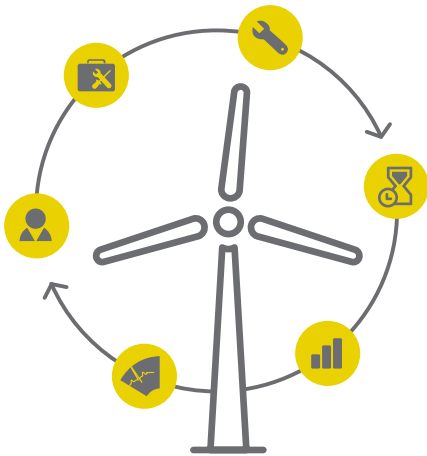
Protection of the turbine and the grid, as well as the optimal balance of supply and demand in power generation, are becoming increasingly more important. This means that we need to enable more robust production, safeguard plants more effectively against malfunctions, and ensure that they are available to supply the grid at all times as part of the critical power supply infrastructure.

And what exactly is Bachmann doing to support this?

The most important thing is that our thinking extends far beyond the actual wind turbine, and we have expanded our portfolio accordingly. Our Condition Monitoring Systems represent a key response to the above issues. They help operators to keep their wind turbines online longer under the best possible conditions, therefore optimizing yield. They also detect operational anomalies at an early stage before they can cause major damage. This reduces maintenance costs and the risk of major failures.

We have long since expanded our systems from "traditional" drive train monitoring to include monitoring of the rotor blade as well as the entire tower superstructure. Specialists are on-call day and night at our monitoring centers all around the world, contributing knowledge gained from thousands of monitored installations, and supporting our customers with complex analyses.





One of our latest advances in this context is the application of Structural Health Monitoring to the wind energy sector. This can be used, for example, to prove that the tower superstructure retains sufficient reserves for safe operation beyond its planned lifetime. A smart retrofit can provide a wind turbine with another ten or more years of service, truly giving it “a second life”.

Such analytical possibilities represent a still relatively new discipline, however. That's why we are researching ever more sophisticated algorithms, as well as increasingly deploying Artificial Intelligence. These enable us to detect changes in the operation of a wind turbine even earlier and more precisely than ever before, providing operators with the knowledge they need to intervene. Through these algorithms, operators learn from the behavior of a single machine and can derive inferences concerning similar turbines in other wind farms, or indeed in installations anywhere else worldwide.

In short: The operational data we collect is now on such a massive scale that it is impossible for humans alone to efficiently analyze it. So, we support operators in precisely the areas where they need to make key decisions and enable them to do so in a targeted way. And if, as a result, they can get two or three percent more yield from each turbine by optimizing its characteristic curve, for example, they will be in a position to recoup their investment even more quickly, and generate electricity from wind competitively.

You have talked about wind turbines needing to be more “agile” on the grid in order to develop the necessary resilience. What does that mean in concrete terms?

This comment is accurate, but it actually applies to every subsystem involved in power generation and distribution. The processes in the power grid are complex and influenced by numerous factors. The dynamic nature of renewables - their fluctuating availability - is probably the biggest challenge when it comes to replacing fossil fuels in our large-scale power plants.

Our wind farm controllers provide smart, on-site connectivity, controlling the operation of individual turbines in line with grid demand and according to their specific operational status. This means fluctuating demand for power in the grid can be more efficiently met based on variable control, while safeguarding turbines against undue strain and therefore running installations far more economically because they stay connected for longer.

And lastly, storage technologies, such as batteries, pumped-storage power plants and Power-to-X, are playing an increasingly important role in the overall solution. Without them, we will find it difficult to introduce wind turbines or photovoltaic plants as substitutes for oil, gas or nuclear power. These technologies are converging and need to be managed together. That is why we see wind farms as being embedded in the overall renewables environment. And we provide the interfaces to interconnect the involved subsystems.

Robust, high-availability turbine automation, intelligent turbine monitoring, standardized communication interfaces, tools for dynamic wind farm control, and a state-of-the-art web-based SCADA system to round off the overall solution - that's what Wind Energy 5.0 means for us!

Thank you very much for talking to us, Mr. Schwanzer.



[Click here to find out more about the complete Wind Automation portfolio from Bachmann.](#)

