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The Bachmann Customer Magazine 11 | 2025

FACING REALITY

HEAVYWEIGHTS ON THE ROAD | SUN IN THE TANK
DEEP DRILLING COCKPIT OF THE FUTURE | THE SPACE SAVER
THREE LINES TO WATCH | THE PARTNERSHIP PLATFORM | THE FUTURE IS HERE

Staying the course in turbulent times

In the face of volatile markets, geopolitical tension, and shortening innovation cycles, those who simply react to their surroundings will fall behind. We choose the opposite approach: Act with foresight, invest strategically, and think long-term.

Our transformation, from wind turbine automation specialist to comprehensive solutions provider for energy infrastructure, was not a coincidence: It was a conscious decision.

And we are seeing the benefits of this approach across our industries. From offshore wind parks in the North Sea, to intelligent storage solutions, control systems for autonomous shipping, and the development of future-proof technology for mechanical and plant engineering: We are proving ourselves to be a reliable partner and solutions provider at every level, in every area, all across the globe.

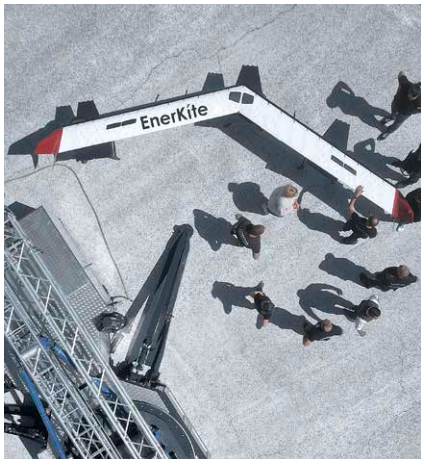
As a medium-sized, owner-managed company, we can think and act long term. And, of course, we anticipate highs and lows. But what makes us stronger is keeping an eye on the future, investing in skills, and not letting the odd storm throw us off course.

This is precisely our claim – and our promise to our customers:
Bachmann delivers. Today. Tomorrow. And for the future.

I hope you enjoy reading this year's real.times.

Warmest regards,

Bernhard Zangerl
CEO Bachmann electronic



MAIN THEME

ENERGY

MARITIME

Imprint

Publisher	Bachmann electronic GmbH, Kreuzäckerweg 33, 6800 Feldkirch, Austria, www.bachmann.info
Responsible for the Content	Stephan Unger (v. i. S. d. P.)
Editorial Work and Implementation	Stephan Unger, Frank Fladerer, Antonija Markovic, Simon Mayr, Thomas Knäple, up! consulting ag
Photo Credit	Adobe Stock, Armac Industrial Automation, Bachmann electronic GmbH, Bentec GmbH, Burkhardt GmbH, CMB.TECH nv, Dromec, EnBW Energie Baden-Württemberg AG, EnerKíte GmbH, Eurus Energy America Corporation, HOB Aggregaten, Kwant Controls B.V., QuinteQ, Schottel GmbH, SMA Solar Technology AG

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Interview

"ENERGY IS NOT JUST A TREND – IT IS THE FUTURE."

In a world where geopolitical tensions, volatile markets, and rapidly changing technologies impact on everyday working life, Bachmann remains focused on the long term. The company has evolved from an automation provider for individual wind turbines to a leading solutions provider for the entire energy infrastructure.

In this interview, CEO Bernhard Zangerl discusses the importance of continuity and adaptability, and how a medium-sized company can achieve stability in a volatile environment.

Mr. Zangerl, considering the industries you serve, how would you describe Bachmann's position in today's market?

Despite geopolitical tensions and volatile markets, I am optimistic about our industry's future. Energy will remain one of the biggest global topics over the coming decades. Fossil fuels are finite, making the energy transition inevitable.

Twenty-five years ago, the small renewable energy industry was focused mainly on individual technologies. Our focus was on the automation of energy generation. Today, our portfolio extends far beyond: from generation, to distribution, intelligent control, and energy management. Rather than focusing on individual transactions, we adopt a network-based approach, spanning both technologies and national borders. We aim to facilitate efficient energy transportation and distribution while reducing overall consumption. This logical next phase of development will be crucial in the coming decades. We have been working towards this goal for a number of years, pursuing a strategy of targeted acquisitions, product development, and expanding expertise. This gives us the chance to not only meet future requirements, but to actively shape them.

But there is still a perception that renewable energy generation is too expensive and therefore unfeasible. What is your perspective?

The debate surrounding the cost of electricity from renewable energy sources is often politically charged - and rarely honest. Fossil fuels appear cheaper at first, but we are all indirectly exposed to the cost of subsidization and, above all, follow-up costs. Wind and solar power are free sources of energy, and the cost of setting up facilities is comparable to that of other technologies. In good locations, onshore wind farms generate electricity at prices similar to those of nuclear power stations. I am convinced that, as renewables become more mainstream, cost comparisons will become fairer. The full analysis of the costs of today's electricity production, from CO_2 removal to final storage, is clear: Renewables are not too expensive and there is no other alternative.

»We strive to be the partner who can answer any question about energy.«

Bernhard Zangerl
CEO Bachmann electronic

How do you manage the ups and downs within the industry?

The key is to find pragmatic solutions that consider both environmental sensitivities and economic realities. I believe that's precisely where we excel at Bachmann. Energy demand is rising and fossil fuels are running out – these are facts. Politicians often think in terms of election cycles, rather than generations, and they usually only act under pressure. The longer you wait, the more drastic the required action becomes. Ultimately, reality catches up and forces change, and that's what we're preparing for.

What are the implications for your company?

For us, this requires flexibility to cope with operational highs and lows, all the while maintaining a clear strategic direction. Short-term fluctuations are inevitable – the key is to plan for the long term. We anticipate market trends and ensure that we have the right products available. This requires patience and the courage to think long term, while avoiding rash decisions while running the day-to-day business.

Can you say with confidence that the decisions you made in recent decades were the right ones?

We have consciously evolved from being an automation provider for individual wind turbines, to a comprehensive solutions provider in the energy supply sector. We now offer an expansive portfolio, from wind and solar power, to combined heat and power (CHP) and hydropower, as well as energy management systems that control entire energy networks.

We offer systems that regulate the use of more environmentally friendly fuels and electric propulsion systems for ships. We also enable load balancing in the power supply of industrial processes, helping to avoid expensive peak loads. This strategic expansion began over ten years ago. At that time, it was clear that sustainability meant considering not just individual plants, but also offering integrated solutions for complete energy infrastructures.

Our vision is to evolve from being the leading provider of wind turbine automation, to becoming the dominant player in the entire energy infrastructure – the first port of call for the generation, distribution and management of electrical energy. We strive to be the partner who can answer any question about energy. Our customers under-stand that while Bachmann products may not be the cheapest, they work. As one of our American customers put it: "If Bachmann can't solve it, no one can."

But this goes beyond the development of new products?

That's right. We are successfully migrating our established image in the wind sector to the broader energy sector. To do this, we are continually expanding our product portfolio and enhancing our expertise. For instance, our teams in Rendsburg and Bochum are developing retrofit packages for wind turbines, battery storage solutions, and microgrids. In my professional opinion, developing competence is more important than developing products.

As we continue to progress, Bachmann solutions across our industries are becoming increasingly energy-centric. We focus on areas that allow us to leverage our strengths and become the industry leader. We have already achieved this in the energy sector – today, Bachmann is much more synonymous with energy automation than many of its competitors.

Oslo Branch

TAKING OFF LIKE A ROCKET

In the current business climate, innovation cycles are becoming shorter. Market decisions are made on a short-term basis, rather than a long-term one, which poses a significant financial risk. How are you approaching this challenge?

Innovation cycles in the renewable energy sector have become so short recently that manufacturers have often been unable to achieve sufficient production volumes. This will lose pace, but the aforementioned ups and downs remain a real challenge. Geopolitical tensions and fluctuating markets are all part of the game. What matters is perseverance, strategic focus, and the willingness to endure lean periods. Short-term profit maximization jeopardizes long-term stability. As a medium-sized, owner-managed company, we can think long-term, build resilience, and seize opportunities as they arise. Continuity, clear ownership, and a strong will to actively shape change. This is what makes us resilient to every crisis - and gives us the confidence to continue successfully on our course - even in a volatile world.

Mr. Zangerl, thank you very much for speaking to us.

The decision to enter the Norwegian market with a local office, allowing sales and application engineers to collaborate directly with customers, was a carefully considered one. But no one predicted so much success within the very first year. Bachmann's current employees were overwhelmed by the positive response from customers and the direct proximity to projects. "Sometimes you just have to do it," said Ronald Epskamp, head of the business unit for maritime applications at Bachmann, regarding the 2024 founding. The initiative was rewarded: "Customer inquiries skyrocketed last year. We could not have predicted such a rapid establishment of our presence in the Norwegian market," says Epskamp, clearly delighted.

This development has encouraged Bachmann to expand further in Norway and pursue activities in other markets. Even in this age of high digitalization, personal presence counts.


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»Reality calls for constant improvement.«

Condition Monitoring

TAKING IT EASY

Dromec, headquartered in Rhenen, Netherlands, specializes in high-performance winch development. A fishing company customer was struggling with defective gearboxes in its electric winches. The cause of the issue was a mystery. Dromec sought advice from the condition monitoring experts at Bachmann Monitoring.

If a winch gearbox malfunctions while a vessel is at sea, it creates a significant problem for the fishing company. "Fishers sometimes sail for over half a day to reach their fishing grounds. If a defect occurs, they have to go all the way back to repair the winch, which means losing a full day's catch," explains Geerart de Vree, Technical Director at Dromec.

The company already experienced four defective gearboxes. To determine the cause behind the failure, Dromec temporarily installed a Bachmann M200 controller, three vibration sensors on each of the two gearboxes, and two sensors on the ship's two 200 kW electric motors. The experts at Bachmann Monitoring thoroughly analyzed and interpreted the recorded data. "The condition monitoring system provided us with a comprehensive and precise overview of the individual components. For instance, we identified a rusted bearing on the electric motor's fan due to increasing friction, which had created a new frequency in the spectrum. This meant we could replace the bearing before it failed completely," says Geerart de Vree.

However, the main problem remained unresolved. Gearboxes continued to malfunction. “Interestingly, the phenomenon did not occur as the catch was brought in - when torque was high. It occurred as nets were deployed, when load was minimal and the winches were rapidly unwinding the lines. That was a surprise." Dromec subsequently modified the control system to trigger a warning signal for the captain when the ship's speed exceeded a set threshold. "Flyshoot fishing takes about 90 minutes. If maximum speed is reduced by 10%, fishers only lose around 30 seconds when setting the nets – less than 5 minutes over a whole day," calculates Geerart de Vree, adding: "Since we made this adjustment, the gearboxes have been operating perfectly. We are happy to see everything running smoothly again."

DROMEC

– Develops winches and drives

– Established in 1996

– Headquartered in Rhenen (NL)

www.dromecwinches.com

Dromec relied on Bachmann's expertise to evaluate the reasons for recurring gearbox defects in the winches of a fishing boat.

Crane Automation

HEAVYWEIGHTS ON THE ROAD

Mammoet has developed the world's strongest land-based crane, the SK6000. This impressive construction tool sets new standards in heavy-duty logistics and plays a key role in major projects such as offshore wind farm construction, refinery building, and large energy power plant construction.

Asisto, Mammoet's system integrator for this project, and Bachmann electronic GmbH, a leading provider of automation solutions, collaborated to help overcome the challenges of automating the crane.

Part of the Bachmann controller.

The Mammoet SK6000 boasts an incredible load capacity of up to 6,000 tons and is designed to move huge loads safely and precisely. However, its true engineering skill lies not only in its performance but also in its modular design, which allows it to be tranported in around 300 shipping containers. The development of the SK6000 was a project of extraordinary scale: the world's most experienced heavy-duty engineers were hard at work for several years, with hundreds of specialists involved in the implementation. Only a handful of companies worldwide have the necessary expertise and capacity to even consider building a crane of this magnitude.

Choosing the Right Partner

When selecting the control technology and partner for the SK6000 project, Asisto and Mammoet faced several challenges. Initially, they considered using an off-the-shelf system based on Siemens technology but encountered difficulties in technical implementation and component availability. It was during this time that they first contacted Bachmann, which had impressed them with its smart implementation of redundancy and flexibility in a previous project.

"We were looking for a PC-based controller system that offered high speed and PLC safety level," says Rob de Hond of Asisto. "Bachmann's solution met our requirements, and their ability to deliver components quickly was a significant advantage, especially during the Covid-19 pandemic."

Close Cooperation and Technical Challenges

Bachmann's close cooperation and fast response times played a crucial role in the project's success. "We were impressed by Bachmann's quick response times, sometimes as short as 15 to 20 minutes," notes Jeroen Leemeijer of Asisto. "This direct and efficient communication made project management much easier."

One of the technical challenges the team faced was synchronizing hydraulic cylinders and electrical winches, particularly when controlling multiple winches with heavy loads simultaneously.

"We worked closely with Bachmann to develop a customized solution for the SK6000," explains Sander de Vos of Asisto. "Their expertise and flexibility were instrumental in overcoming the technical challenges we faced."

Another major challenge was integrating a new safety level, which involved not only ensuring the physical

SK6000 from Mammoet – the largest land-based crane in the world.

security of the machines but also implementing cybersecurity measures to protect the system from external threats. Bachmann's expertise and flexibility were instrumental in overcoming these challenges.

"We had to break new ground in terms of safety requirements," says Rob de Hond of Asisto. "Bachmann helped us develop a strategy that met both the requirements of the project and the security requirements of the industry."

Remote Maintenance and Future Prospects

The implementation of a remote access system enables Asisto to service the crane and its controller remotely, responding quickly to problems and reducing dependence on external support. The team plans to train local operation crews to carry out minor maintenance and diagnostics, ensuring faster response times and increased efficiency.

Looking to the future, Asisto is extremely positive about their collaboration with Bachmann. "The decision to choose Bachmann as our long-term partner was the right one from both a technical and strategic perspective," says Sander de Vos of Asisto. "The introduction of an open platform, such as OpenBridge for atvise, opens new possibilities for us, enabling us to adapt the system to our specific needs and make it future-proof."

Bachmann's Joeri ten Napel adds, "We are proud to have been a part of this complex project and look forward to continuing our collaboration with Asisto. Our goal is to provide innovative solutions that meet the evolving needs of the industry."

In addition to the technical advantages, the collaboration between Asisto and Bachmann has also led to a stronger partnership. "We have developed a strong relationship with Bachmann, which is based on trust and mutual understanding," says Jeroen Leemeijer of Asisto. "This partnership enables us to work together more efficiently and to develop innovative solutions that meet the needs of our customers."

The SK6000 project has also demonstrated the importance of flexibility and adaptability in the development of complex systems. "The project required a high degree of flexibility and adaptability from all parties involved," says Sander de Vos of Asisto. "Bachmann's ability to adapt to changing requirements and to develop customized solutions was instrumental in the project's success."

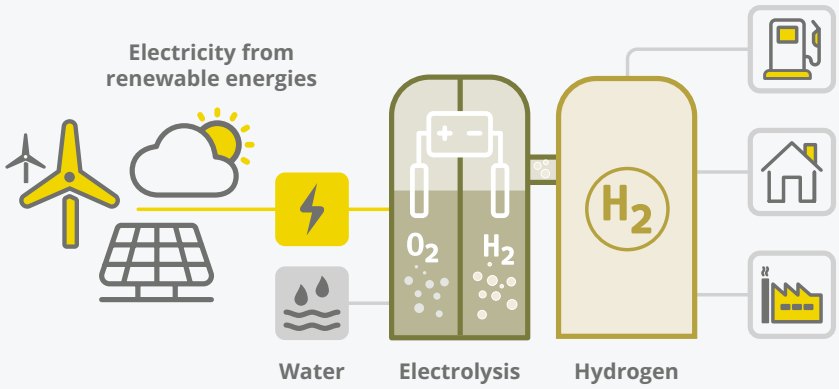
In conclusion, choosing Bachmann for the SK6000 project was a decisive step. Despite initial difficulties, particularly with the implementation of security and communication systems, Bachmann proved to be an extremely reliable and committed partner. Bachmann's flexibility, fast response times, and technological expertise contributed to the successful implementation of this complex project. The collaboration between Asisto and Bachmann has led to a stronger partnership and has demonstrated the importance of flexibility and adaptability in the development of complex systems.

Model-based Development for an Electrolyzer

SUN IN THE TANK

Green hydrogen is a solution for the temporary storage of sustainably generated electrical energy; one that also makes it mobile. The efficient operation of electrolyzers requires intelligent converter systems. For best-possible control, SMA Solar Technology relies on model-based development with Bachmann's M-Target for Simulink®.

GREEN HYDROGEN – A KEY ELEMENT OF THE ENERGY TRANSITION



In an energy supply system that increasingly relies on fluctuating renewable sources, such as solar and wind power, green hydrogen is becoming indispensable. It serves as a flexible energy storage medium, a clean fuel, and the basis for a CO_2-free industry.

However, efficient and economical green hydrogen production requires more than just electrolyzers – it requires intelligent systems that dynamically provide energy according to current supply and demand for electrolysis.

For over four decades, SMA, headquartered in Niestetal, Germany, has been a leading innovator in the field of renewable energy technology. The company's advanced inverter technologies and system solutions have shaped the evolution of the industry. That's why SMA is also developing solutions to ensure the sustainability and reliability of future hydrogen production. Hydrogen produced by electrolysis from renewable energies is entirely free of carbon dioxide emissions. Its storage options give it a central role in the decarbonization of the energy supply.

Inverters are a key component for grid-friendly and efficient energy conversion in hydrogen applications – and a core competence for SMA. The company was in search of a new solution for a green hydrogen production pilot plant. Bachmann's M200 controller took on the coordinated control and monitoring of the converters, which are required for three electrolyzers with a total output of 8 MW.

New approaches

SMA needed an innovative approach for the development of the control and regulation program. Their control and regulation engineering teams closely collaborated to reduce application development time. Notably, all developers worked with a uniform engineering tool for the first time. Previously, regulation engineers developed necessary current controllers using a model-based approach with MATLAB®/Simulink®. Generated libraries were then integrated into the plant automation system by the control engineering team, in accordance with IEC61131-3.

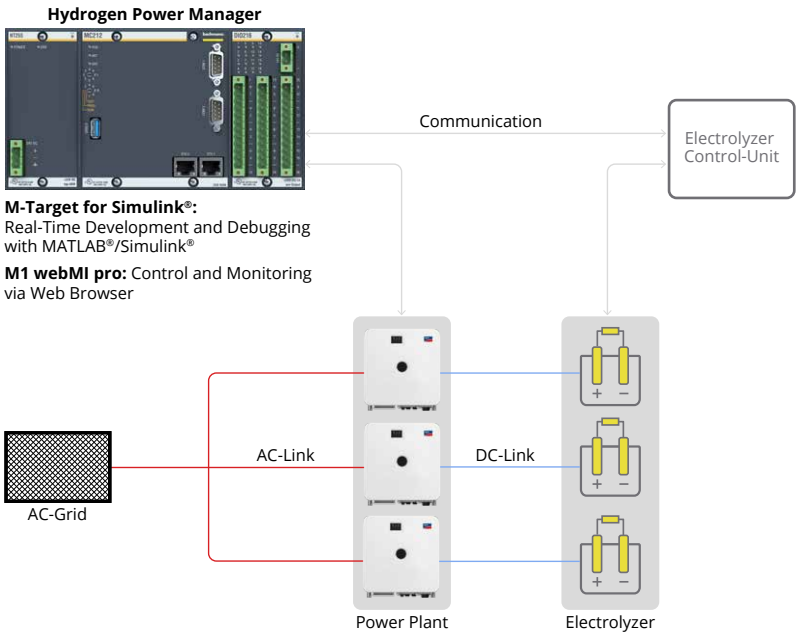
The pilot project saw the first time that Simulink® was used by all developers as a common development and simulation environment. Regulation and control engineers programmed graphically, using the toolboxes that best suited their needs. "This enabled us to develop a shared perspective on the overall application. In addition, the code is more transparent and less prone to errors," explains Chokri Khalfet, System Development Engineer at SMA's Innovation Center.

Bachmann's M-Target for Simulink® solution will enable SMA to send code straight from Simulink® to the controller. This is a major advance in the connection of model-based development and programming. According to Khalfet, this will also improve time to market.

Seamless integration testing

The new control code is processed on a Bachmann MC212 CPU and will be known at SMA as the "Hydrogen Power Manager". The entire application software can be simulated in two ways: at the developer's workstation and in dedicated software test systems in MATLAB®/Simulink®, which allow it to be tested against a wide variety of scenarios without any risk.

It was put through its paces in a hardware-in-the-loop (HIL) test setup, together with real SMA inverters. To confirm the functionality of the initial automation, SMA checked that the inverter was operational and communicating with the electrolyzer control system. Then, current regulators were put into operation, and their parameters optimized. Consequently, each rectifier supplies the exact current value required by its respective electrolyzer.



The Hydrogen Power Manager was developed using a model-based approach with M-Target for Simulink®. SMA relies on M1 webMI pro for operation and monitoring.

»M-Target for Simulink® streamlines the creation of functions by reducing the need for extensive PLC coding experience amongst developers.«

Chokri Khalfet
System Development Engineer
SMA Solar Technology AG

Here, too, the development pathway demonstrates its strengths. Both the basic control of the rectifiers, as well as the current control, are integrated in a common application program. This not only reduces code complexity, but also saves developers a lot of integration time and minimizes the search for errors.

Relaxed commissioning and reliable operation

The construction of large electrolyzers is complex. Complete functional testing is usually only possible at the installation site during commissioning. The addition of external components, such as the Hydrogen Power Manager, increases uncertainty. However, SMA reassured us that the necessary functionality for controlling the inverters and communicating with the electrolyzers had been verified in advance through simulation on the test setup.

SMA relies on M1 webMI pro for the operation and diagnosis of the Hydrogen Power Manager. M1 webMI pro is a web HMI based on native web technology and implemented directly on the M200 controller. This solution's high performance ensures that the current system status can be monitored during continuous operation and interventions made as required.

Goal achieved

By using model-based development across development teams for the first time, SMA was able to rapidly implement the optimal solution. Due to the nature of the system, some questions arose during the revision of the original cyclic PLC program and porting to the Simulink® function block language, but SMA quickly resolved them - with Bachmann's support. "The collaboration ran very smoothly and was very helpful," says Chokri Khalfet. The next projects are already in the pipeline. And another step has been taken toward a successful energy transition.

SMA SOLAR TECHNOLOGY AG

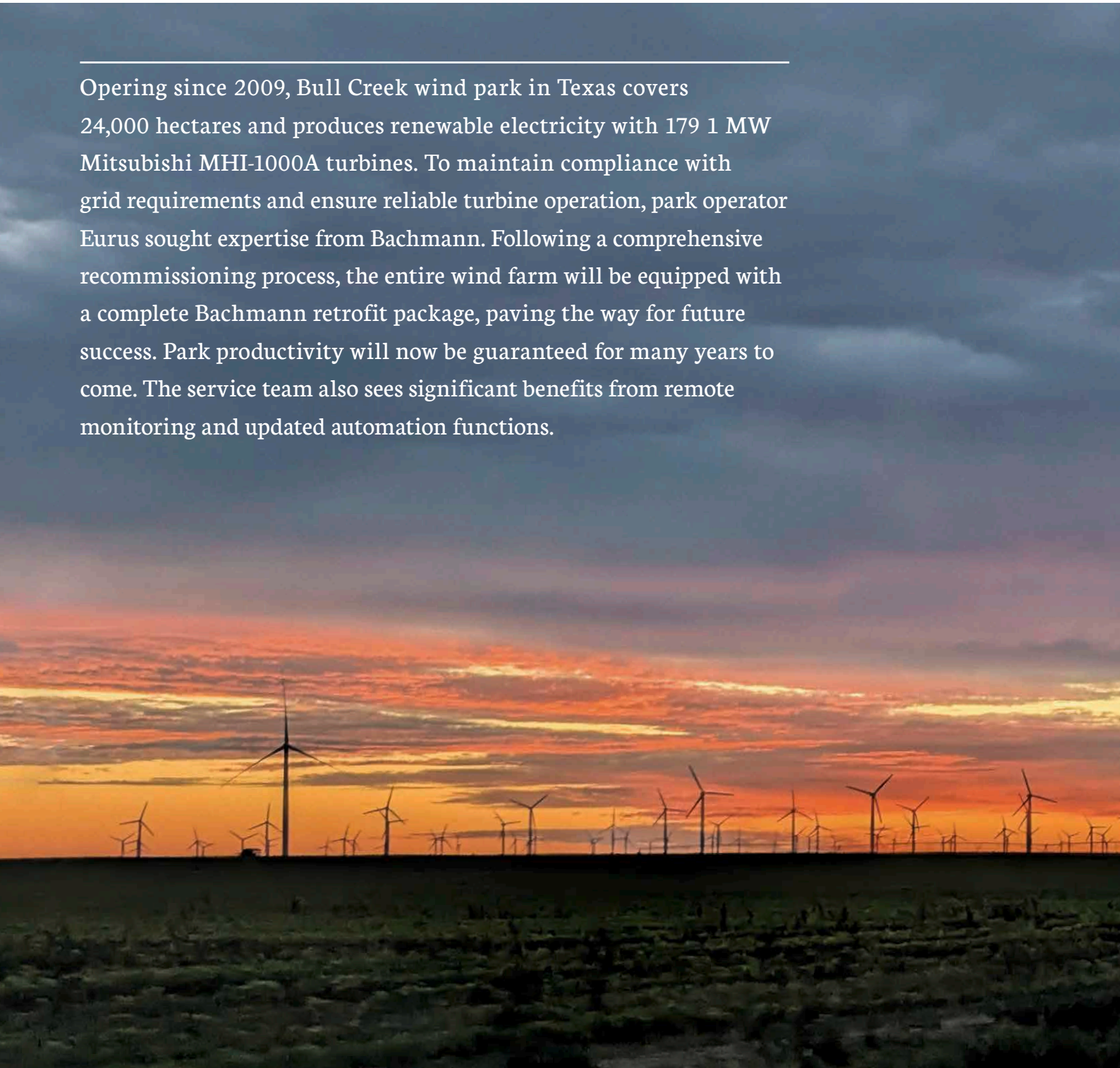
- Established in 1981
- Headquarters in Niestetal (Germany)
- More than 4,000 employees worldwide
- Sales and service companies in 19 countries
- Revenue: €1.53 million (2024)

www.sma.de

Complete Retrofit

TAILWIND FOR FUTURE PROFIT

Opering since 2009, Bull Creek wind park in Texas covers 24,000 hectares and produces renewable electricity with 179 1 MW Mitsubishi MHI-1000A turbines. To maintain compliance with grid requirements and ensure reliable turbine operation, park operator Eurus sought expertise from Bachmann. Following a comprehensive recommissioning process, the entire wind farm will be equipped with a complete Bachmann retrofit package, paving the way for future success. Park productivity will now be guaranteed for many years to come. The service team also sees significant benefits from remote monitoring and updated automation functions.



The challenge: guaranteeing safe operation

Eurus faced mounting challenges from its existing turbine control systems. Acquiring spare parts for outdated systems was proving difficult, resulting in extended downtime and expensive repairs. Furthermore, the original SCADA system failed to meet current reporting requirements and lacked adequate monitoring functionality, but system development had come to an end. Eurus needed a future-proof solution to ensure the safe operation of its wind park.

The solution: a complete package for the future

Eurus found what it needed in Bachmann's modern and scalable complete retrofit solution. By combining controls retrofitting with remote visualization and operation, as well as condition monitoring, Eurus will be able to keep track of every detail in the entire park. This comprehensive solution establishes a foundation of proactive maintenance planning, which will boost electricity production. At the same time, it meets the owners' requirements for site reliability.

Constant control, from anywhere

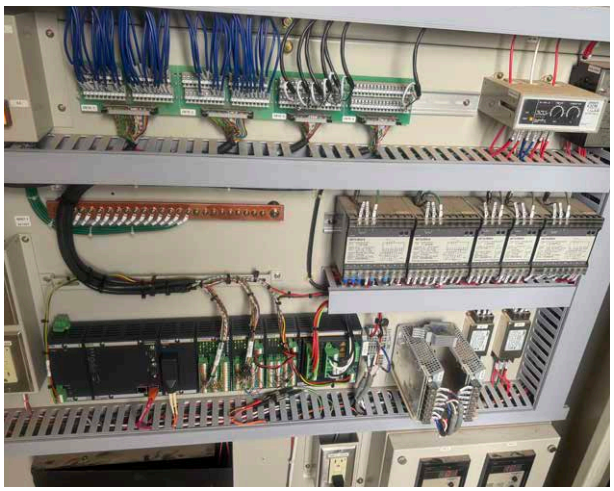
With Bachmann's web-based forsiteSCADA, Eurus can effectively monitor the entire wind park from its central control center. The visualization and control solution aggregates live data on to individually configured dashboards, which can be easily compared with historical data.

Bachmann's M1 WebMI pro enables Eurus technicians to perform detailed fault diagnostics with ease. These diagnostics can be performed either directly in the nacelle via Ethernet, or remotely via smartphone, tablet, or PC.

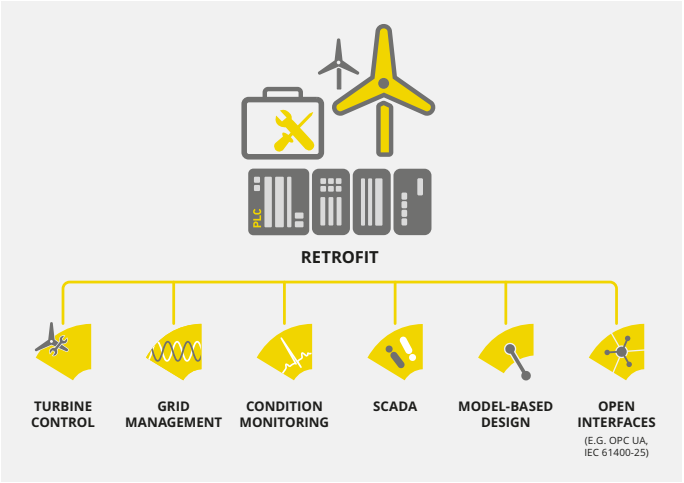
Each turbine's mechanical drivetrain is also continuously monitored by Bachmann's monitoring experts in the Remote Control Center. Damage can be detected at an early stage based on regular status reports. This feature enables Eurus to schedule targeted on-site maintenance, which prolongs the service life of the turbines.

Open to individual functions

The new SCADA system was required to meet a fundamental standard: the mandatory reporting mandated by NERC (North American Electric Reliability Corporation) in accordance with



Quick retrofit: With pre-prepared stations and plug-and-play adapter sets, a controls retrofit can be completed in less than two days. This approach also minimizes installation errors. Pictured: The control system in the tower base, which also includes grid measurement.



Ready for the future: Bachmann's retrofit solution is based on six pillars, ranging from the turbine to grid management and open interfaces.

the "GADS" guidelines (Generating Availability Data System). With forsiteSCADA, Bachmann experts can precisely customize and implement these and other individual reports and visualization tools in order to meet Eurus' specific requirements.

Cybersecurity in parallel

The risk of cyberattacks in critical infrastructure has increased significantly over recent years – and continues to rise rapidly. Compliance with the latest cybersecurity measures is essential for modern control solutions. With its robust access control feature, Bachmann's Wind Turbine Template provides a reliable solution. Even during retrofitting, individual user profiles enableparameter change tracking and alarm acknowledgement. The new control solution also significantly reduces the number of potential attack points by combining the original controller and a separate SCADA gateway module into one, single address per turbine.

Precise preparation = rapid installation

Eurus initiated the retrofitting process for the 179 turbines in July 2025. Thanks to Bachmann's forward-thinking preparation, including pre-assembled cable harnesses and pre-measured mounting rails, technicians were able to retrofit the turbine control system in less than two days on average. All modules were subjected to a 48-hour installation test under extreme conditions to ensure long, safe operation.

Prepared for tomorrow

Bachmann's modular design and transparent data access help prepare Eurus for the future requirements of the American energy landscape. Additionally, the control solution provides a scalable basis for future site expansion, including the integration of additional wind turbines, solar power generation, battery storage systems, and other renewable energies. These can be seamlessly integrated into the new park control system at any time, thanks to Bachmann's Smart Power Plant Controller.

EURUS ENERGY AMERICA

- Operates various wind parks, photovoltaic systems, and battery storage systems in North and South America.
- Over 600 MW of installed capacity
- Part of Eurus Energy Holdings Corporation, which operates facilities with a total capacity of 5 GW of renewable electricity worldwide (www.eurus-energy.com/en/).

www.eurusenergy.com

atvise® in the Cloud

EVERYTHING (AND EVERYONE) IN VIEW

Burkhardt GmbH, based in Mühlhausen, Germany, specializes in efficient combined heat and power (CHP) plants. Customers are supplied with heat and electricity from around 500 ultra-efficient plants. Visualization and user interfaces are created quickly thanks to the object-oriented engineering approach from atvise®. Additionally, global plant data is funneled into a central atvise® cloud environment. Burkhardt uses this data to identify potential improvements for future plant developments. Its service team can also provide fast, targeted maintenance.

Burkhardt's combined heat and power plants provide a reliable source of electrical and thermal energy from a variety of sustainable sources, including wood pellets, wood chips, and natural gas. The cloud solution from atvise® enables the central monitoring of plants worldwide, allowing convenient troubleshooting through remote access.

Sustainable foundation

Burkhardt has used atvise® for the visualization and operation of its CHP plants for the past eleven years. "We initially chose the Bachmann solution for two main reasons: HTML technology, which was not yet widely used, and the software's absolute openness," explains Roland Kipfstuhl, Head of Software Development at Burkhardt. The company was laying the foundations of a future-proof solution. It succeeded: Around 500 CHP plants are now operating worldwide; operated and visualized with Bachmann's solution.

The center of Burkhardt's universe

Burkhardt customers have access to all necessary system functions via clear user interfaces, which simplifies plant operation. However, Burkhardt wanted detailed, remote insights into their customers' systems. The CHP specialist made the right decision early on with atvise®. The cloud-enabled, web-based visualization solution gives Burkhardt secure, centralized access to customer installations and applications.

A treasure trove of data

Around 5,000 data points from each individual CHP plant converge in a private cloud environment at Burkhardt. "With atvise® as the hub, our technicians can access all the necessary aspects of a customer's power plant at any time. Thanks to the web-based interface, service staff have convenient, mobile access to the plant on their smartphones," says the head of software development.

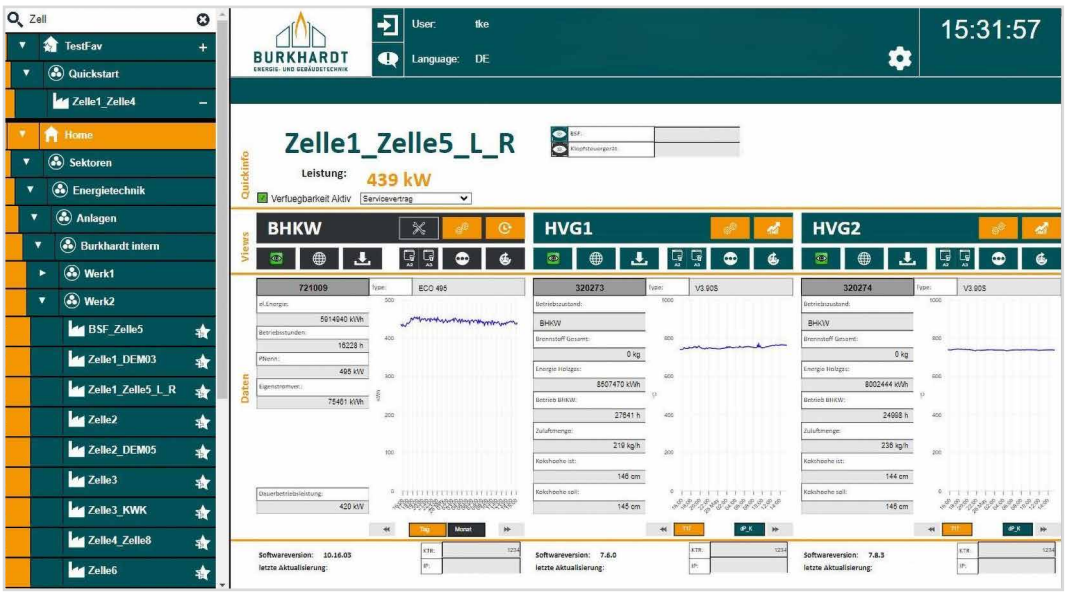
Data is stored for up to two years and condensed by Burkhardt into valuable information. Plant engineers use findings from aggregated measurements, alarms, and malfunctions to further develop and improve their plants.

Concentrated engineering efficiency

The Bachmann solution gives Burkhardt's engineering team more time for development. With the object-oriented engineering approach, adapting the operating and visualization interfaces of new systems to respective customer applications is fast and straightforward. Kipfstuhl explains: "When we configure a new system, we draw on a central library filled with abstract, predefined objects. We have packed all our application know-how into these templates - diagrams, faults, alarms, and other elements." Burkhardt specialists can quickly create user interfaces with all the necessary functions. "All we have to do is create project-specific flowcharts, and we can deliver the visualization. This frees up time for our colleagues in the engineering department," says Kipfstuhl.

Versatility like never before

Burkhardt takes full advantage of the flexibility offered by the Bachmann solution. Not only does the R&D department rely on atvise®; the service organization does too. Even spare parts orders are placed via the system. "We put a lot of thought into imple-



Burkhardt utilizes insights gained from the aggregated measurements, alarms, and malfunctions to guide the further development and targeted improvement of its power plants.

»atvise® consolidates thousands of data points from customer power plants worldwide, turning them into valuable information. We use these insights for the targeted further development of our power plants.«

Roland Kipfstuhl
Head of Software Development at Burkhardt

menting spare parts management. We wanted to cover as much functionality as possible in a shared environment. Thanks to Bachmann's flexible solution, we were able to program this function with JavaScript and Python to perfectly match our business processes," explains Kipfstuhl. Open interfaces enabled seamless connection to the Burkhardt ERP system. Customers have access to a cataloged list of all installed assemblies and system parts via the visualization. "During a service call, they can simply compile their shopping cart via the user interface, and place a spare parts order directly in atvise®. The order is immediately entered into our ERP system, with our shipping and accounting departments notified," says Kipfstuhl.

Safety squared

Such a high degree of networking entails a high level of responsibility, as the specialists are well aware. "When operating a cloud solution, you have to be aware of potential cyber risks," says the head of software development. Therefore, Burkhardt regularly commissions external partners to carry out detailed system penetration tests. The company refers to the penetration tests that Bachmann carries out at regular intervals on atvise®: "Based on this, we also comprehensively test other security-critical areas, such as VPN tunnels or port forwarding of the firewall," explains Kipfstuhl.

The multi-client capable visualization solution allows the precise definition of user roles – down to the specific rights assignment for each visualization element. This multi-client capability is essential to Kipfstuhl: "Thanks to clear group assignments, our technicians see their topics, and the customer sees theirs. If our support team were to simply connect remotely to the on-site visualization, the customer could observe sensitive information on their HMI, such as access data and passwords."

Higher centralization with single sign-on

Burkhardt is already well positioned in cybersecurity, thanks in no small part to Bachmann's visualization solution. Nevertheless, it wants to focus even more on this area and implement additional security functions. "atvise® is always one step ahead of us. Bachmann is constantly delivering new functions that we often cannot implement immediately," says Roland Kipfstuhl with a smile. The next update will focus on central login options with "OpenID." This will extend the existing single sign-on (SSO) to connected third-party products.

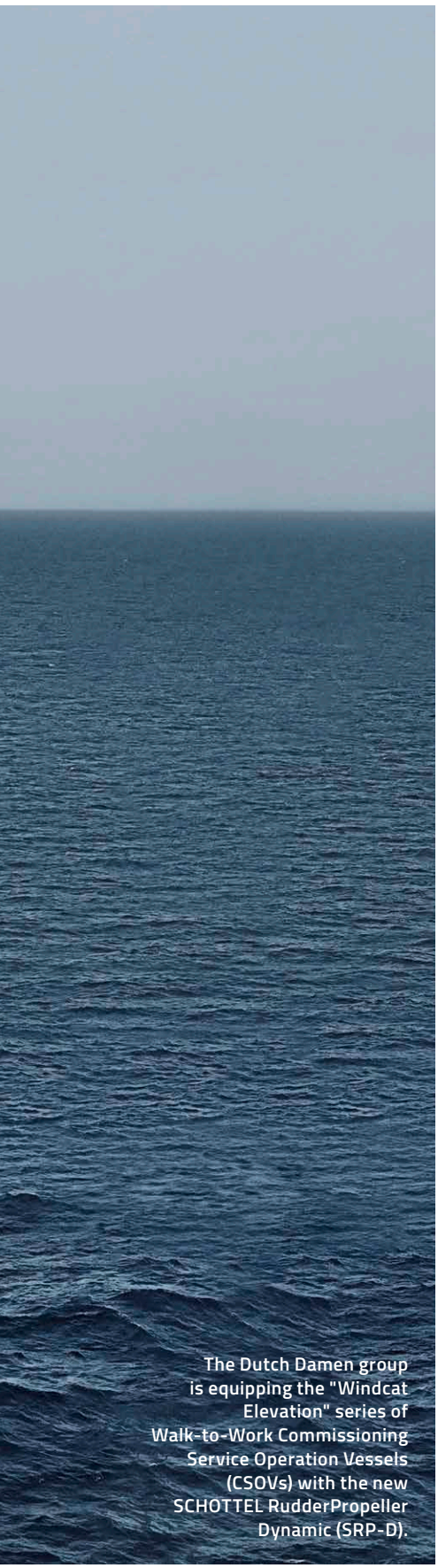
BURKHARDT GMBH

- Specialist in energy and building technology
- Headquartered in Mühlhausen (Germany)
- Established in 1879, seven locations in Germany and Italy with about 470 employees

www.burkhardt-gruppe.de

Autonomous Shipping

SECURE POSITIONING



The Dutch Damen group is equipping the "Windcat Elevation" series of Walk-to-Work Commissioning Service Operation Vessels (CSOVs) with the new SCHOTTEL RudderPropeller Dynamic (SRP-D).

With unprecedented performance, the new "RudderPropeller SRP-D" from German propulsion and steering specialist SCHOTTEL meets the increasing requirements for the efficient use of walk-to-work (W2W) vessels. The performance and modularity of Bachmann's M200 control system play a key role in this success.

Seventy-five years ago, Josef Becker, founder of the SCHOTTEL shipyard, presented a brand-new invention: an innovative maritime propulsion and steering unit combining rudder and propeller – the rudder propeller. The novelty was that the entire propeller could rotate 360 degrees to determine the direction of the ship's propulsion, making a separate rudder redundant.

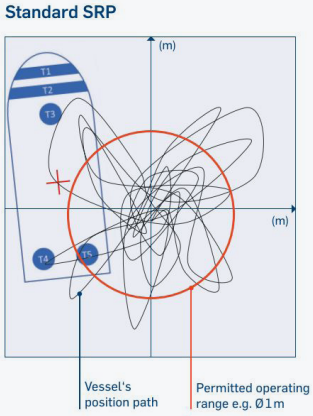
Since then, this propulsion type has been continuously optimized and installed in thousands of ships, especially those requiring maximum maneuverability, high bollard pull, and maximum steering force. Examples include harbor tugs and service vessels, such as those used for the construction and maintenance of offshore platforms and wind turbines. With the new "RudderPropeller SRP-D," (The "D" stands for "dynamic"), SCHOTTEL has a system to meet increasing demand for the efficient use of Service Operation Vessels (SOVs).

Precisely positioned

SOVs, often referred to as "walk-to-work vessels," enable the safe and efficient transfer of personnel and materials between offshore platforms and service bases on land. These vessels are equipped with gangways and other features designed to help provide a direct and stable crossing between the ship and the platform. A Dynamic Positioning System (DP) makes this possible. The DP automatically steers the vessel and maintains a stable position, even in wind and waves, without the use of anchors or mooring lines. This computer-controlled system receives feedback from numerous sensors, which record movement in every spatial dimension, as well as wind and sea conditions, currents, and many other parameters. The system then calculates necessary propulsion and steering commands, ensuring precise positioning and enabling operation during increasingly challenging conditions.

»The dynamics of the rudder propeller are crucial for the ship's positioning accuracy.«

Jan Glas
Director of Product Management
& Business Intelligence
at SCHOTTEL



Thanks to shorter response times, external forces such as sea conditions, wind, and currents can be addressed more quickly and precisely. This improves the ship's positioning accuracy.

Speed counts

"Simply put, our rudder propeller receives steering commands from a computer, not a control lever," says Jan Glas, Director of Product Management & Business Intelligence at SCHOTTEL, describing how the two systems cooperate. "The thruster's dynamics are crucial for the ship's positioning accuracy because the ship must be in the right place quickly." This is especially important for W2W transport to offshore wind turbines because, unlike a single oil rig, a wind farm has many turbine locations. The crew needs to be able to service as many turbines as possible during a shift, even in rough seas. The required landing time is therefore a decisive factor for efficient service operations.

A whole new dynamic

SCHOTTEL has significantly improved the dynamic positioning (DP) capability of its rudder propellers with targeted reinforcement. Thanks to an optimized control structure, the SRP-D propulsion can perform up to five complete 360° rotations per minute – more than twice as many as conventional propulsion units. Faster acceleration and deceleration of the electric motor enable rapid thrust changes in any direction. This increased responsiveness enables a quicker and more precise reaction to external forces, such as wind and current, giving the vessel greater positioning accuracy. "This reduces the footprint of dynamic positioning, while enabling us to work much more precisely, because the motion of the ship has decreased," says Glas. Additionally, the propulsion unit's propeller shaft is at an eight-degree incline. He explains: "This approach minimizes interaction between the propulsion unit and the hull, as well as opposing flow between the propulsion units themselves, significantly optimizing thrust yield and distribution." In some cases, it also reduces the ship's fuel consumption.

Performance is crucial

"The days of manual control levers are gone," says Glas. Ship control systems are now becoming integrated with third-party and higher-level control systems. However, he notes that this also makes them more dependent

on external parameters, which requires awareness and operation of a higher number of interfaces. The Bachmann M200 control system excels in precisely this area: It provides the flexibility and performance required to meet real-time, redundancy, and cybersecurity requirements. It also facilitates both necessary control speed and response to DP requirements.

Additionally, propulsion system failure could be disastrous in many situations, making the availability of these systems crucial. The systems must ensure the ship's safe positioning at all times, even in an emergency. For this reason, the entire control system is designed to be fully redundant, with hot standby, allowing seamless transition between systems.

High propulsion system loads

However, the high dynamics of the propulsion unit are only activated at low speeds. "Hydrodynamic loads that act on the propulsion unit are smaller then, so the system can handle higher inertial loads," says Glas. Steering increases structural load on the propulsion, including the shaft and steering gear. One unit weighs between 20 and 50 tons. "That's a lot of moving mass. Furthermore, spindle forces are also generated on the rotating propeller, which act as vertical moment."

Efficient change

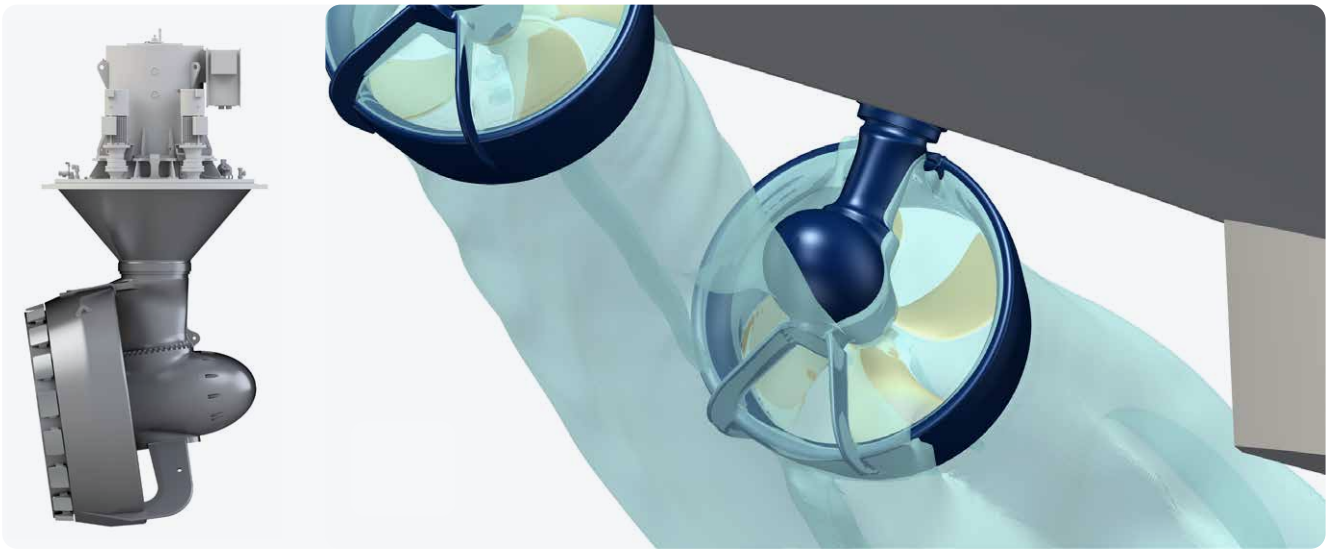
The new SRP-D rudder propeller significantly increases a ship's DP performance. A quick response to external forces also significantly reduces thrust requirements. Overall, vessels operate much more efficiently and safely, extending operating time throughout the year – a decisive advantage in constructing and operating offshore infrastructure and a step forward on the path towards decarbonized energy infrastructure.

SCHOTTEL GMBH

- Headquartered in Spay am Rhein (Germany)
- Around 100 sales and service locations worldwide
- Established in 1921
- Supplies complete propulsion systems and control systems for vessels of all types and sizes

www.schottel.de

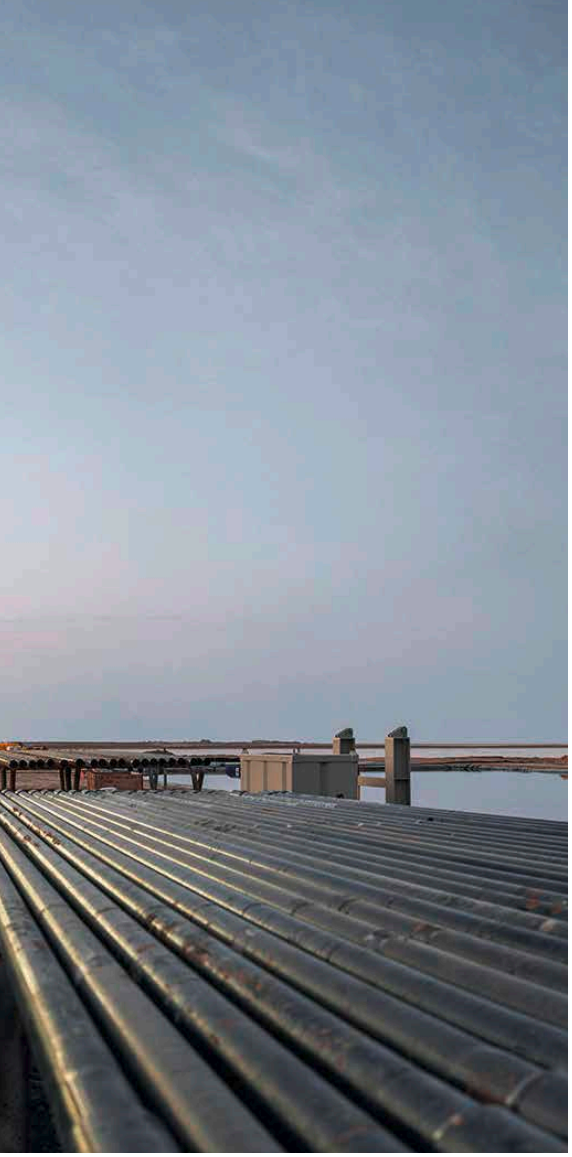
SCHOTTEL SRP-D rudder propeller: An eight-degree propeller shaft angle minimizes interactions between the propulsion system and the hull. Thrust losses, caused by counterflow from the propulsion units, can be reduced by 30% with the propulsion system. This leads to increased thrust efficiency in dynamic positioning (DP) operation and minimizes “forbidden zones.”



atvise® in the Cyber Chair

DEEP DRILLING COCKPIT OF THE FUTURE

Processes in the oil and gas industry have long been controlled by traditional operating elements. However, day-to-day drilling crew operations are now increasingly supported by digital systems. One key driver towards digitalization is Bentec's state-of-the-art control room, which features their cyber chair. Thanks to Bachmann's atvise®, demanding drilling processes can be clearly visualized and implemented.



Drilling technicians in the cyber chair stay in total control with the atvise® visualization and user interfaces, which are perfectly tailored to the application. The user interface was designed with usability experts to ensure high safety.

Everything at a glance with atvise®

Bentec develops and manufactures systems and equipment for oil, gas, and geothermal drilling. One of the company's most modern oil drilling rigs is in Oman. Several rig machines are connected via two redundant atvise® servers. Drilling technicians can monitor and control operations conveniently from a control room, located directly on the rig. Cyber chairs equipped with joysticks, rotary wheels, touch encoders, and numerous touchscreens provide complete control. A drilling assistant monitors operations across four screens. The office area, housed separately in containers, also provides process visualization on three monitors. The tank system and machines are equipped with their own local HMI.

Special application – special requirements

Bentec switched to atvise® for system visualization and operation once the previous solutions had reached their limits. "Our applications are special. This starts with the displays. We visualize processes from top to bottom, instead of from left to right, which is the usual approach. Our previous SCADA system was too inflexible," explains Michael Buhr, electrical engineer at Bentec.

Additionally, Bentec's systems, which were equipped with conventional switches, were increasingly being fitted with additional automation and optimization systems. This required drilling additional mounting holes and laying new cables. "In potentially explosive areas, adjustments like these require a lot of work," says Buhr.

The future is web-based

As well as a fully digital operating concept, which enables more flexible and efficient responses, Buhr was looking for a future-oriented, web-based foundation. Bentec's drilling systems remain in operation for up to 30 years. System-dependent solutions can inevitably cause driver problems when defective hardware must be replaced. Buhr is confident that open web technologies will continue to work well in the future.

During initial research, Bentec was disappointed by many web-based solutions. "Some of the interfaces were completely overloaded and garish, and many functions were predefined, which made them less applicable for us." However, things are different with atvise®: thanks to the openness of the Bachmann solution, all functionalities were customizable to Bentec's exact requirements.

Flexible engineering

Following initial training, Bentec developers started creating customized widgets for plant operation. They expanded existing atvise® elements to include numerous functionalities. These include different languages and measurement units for international operating personnel. However, rotary wheel increments, as well as automatic activation and resetting of touch encoders, were programmed to occur as soon as a specific field in the user interface was activated or deactivated. With atvise®, all these functions can be implemented directly via widget, eliminating the tedious task of searching for and grouping different components. Creating the interface is easy, too: Drag widgets from the catalog, scale and adjust them, observe the live values, and start your work. That's it," says Buhr happily.

Drilling technicians also benefit from a reduced workload. When interventions become necessary, care has been taken to minimize distraction from the actual process. For example, requests are communicated via voice call, meaning that technicians only need to look at the screen when necessary.

Safety first

Interface design was focused on maximizing operational safety right from the start. The visualization design was developed with the help of a team from the University of Osnabrück, who contributed expertise in safe user interface design for medical applications. "We gave a lot of thought to the color scheme and shape of the buttons. Separate controls for turning on and off also increase safety, as do the physical rotary wheels with touch encoders on the cyber chair, which we use instead of software sliders," explains Buhr.

Efficiency even away from the rig

A uniform look and feel across the various interfaces offers another advantage for Bentec. Michael Buhr's team compiled a catalog of individually configured widgets that can be reused for a wide variety of visualizations and applications. "The user interfaces of our other applications, such as battery storage, are already seeing benefits. This is because we can use the existing code base and the same clear Highcharts displays as for our drilling rigs," says Buhr happily. But that's not all. Bentec also plans to use atvise® for other oil rig systems to improve efficiency and safety.

»We use a redundant atvise® server and a higher-level user interface for our rig. The great thing about atvise® is that, even during the stand-alone operation of individual machines, the server still runs locally. This makes all widgets available on the local HMI, even in offline mode.«

Michael Buhr
Electrical Engineer, Bentec

BENTEC GMBH

- Systems and equipment for oil, gas, and geothermal drilling
- Headquarters in Bad Bentheim, Germany
- Over 125 years of industry experience

www.bentec.com

Kinetic Battery

THE SPACE SAVER

The increasing electrification of port-based central logistics processes is putting power grids to the test. Electrically powered, high-performance equipment, such as heavy-duty cranes, can cause enormous and volatile power surges. Quick storage solutions can reduce these peaks and relieve the strain on the power grid. QuinteQ, based in Culemborg, Netherlands, has taken flywheel storage technology - originally developed for outer space - and adapted it for use in mobile containers. The Dutch company is facilitating port electrification worldwide. How is this possible? Electrical capacity can be expanded at anytime, anywhere – eliminating the need for expensive, time-consuming grid expansion.

»The M200 system's extremely fast and accurate grid measurement and protection functions are ideal for high-performance port facilities with short-term peaks in energy demand.«

Timo Pauel
New Business Development Manager
QuinteQ

QUINTEQ

- Established in the Netherlands in 2016
- Driving the energy transition forward with flexible flywheel energy storage solutions
- Used in ports, construction sites, railway applications, and microgrids

www.quinteqenergy.com

Kinetic energy storage

Battery storage systems are becoming increasingly prevalent. It is hard to imagine many modern applications without them. However, due to technological limitations, production-ready lithium-ion storage systems have several disadvantages, including a limited number of charging cycles, high flammability, and dependence on sensitive supply chains.

The specialists at QuinteQ have designed a flywheel solution to eliminate many of these disadvantages. "Our flywheel contains almost no rare earth materials. It doesn't require electrochemical cells, so operational safety is higher. The storage system is virtually maintenance-free and allows over 350,000 charging cycles, with an operating life of 15 years or more," says Timo Pauel, QuinteQ's New Business Development Manager, proud of his team and their work.

Speed is compact

QuinteQ's flywheel design focuses on speed rather than mass. "The amount of storable energy is linearly related to the flywheel's mass. However, speed has a quadratic effect on storage capacity," says Pauel, explaining the physical principles. Thanks to a high rotational speed of over 10,000 revolutions per minute, a flywheel can be compact in diameter. This makes them ideal for use in mobile containers, which can be deployed temporarily or permanently in a wide variety of locations, to reduce peak loads.

Adapted for terrestrial conditions

It took a while for this sophisticated storage technology to find its footing on the Dutch coast. It was originally developed by Boeing for use in space. However, in 2016, the US government dropped the project, forcing Boeing's R&D department to abandon it. QuinteQ subsequently acquired around 200 patents from Boeing, and has continued to develop the concept ever since.

"Applications in space demand extremely compact and safe storage solutions. Functionality comes first; cost comes second. That's not the case on Earth," Pauel smiles. "We did everything we could to reduce complexity, improve cost efficiency, and increase power output with flywheel dimensions almost comparable to those of other systems."

Winning pilot projects

QuinteQ tested the developed technology in several pilot projects and continuously optimized the design.

In Rotterdam, for instance, a 400-kVA flywheel storage system supported the port's primary power supply. There are three electric cranes in operation, causing high load peaks during loading and unloading. Thanks to QuinteQ's solution, power consumption from the grid decreased by 65% during the pilot project, significantly reducing load peaks.

In another Dutch installation, QuinteQ's flywheel relieved the grid in Moerdijk. The port operator added another transshipment area with another heavy-duty crane. In the pilot project, peak power consumption decreased by over 70%. Thanks to the storage solution, both cranes can now operate in parallel without exceeding their contractually defined limits.

For its pilot installations, QuinteQ relies on the Bachmann M200 control system, which features grid measurement and protection functions. "We received targeted support from Bachmann in engineering our control systems. During the development process, our programmers approached the Bachmann experts repeatedly with specific questions. We did a lot of short online sessions, and got valuable tips for possible solutions – the collaboration was really efficient," says Pauel happily.

Series production with Bachmann

Following successful completion of the pilot projects, series production of the flywheel storage systems is now underway.

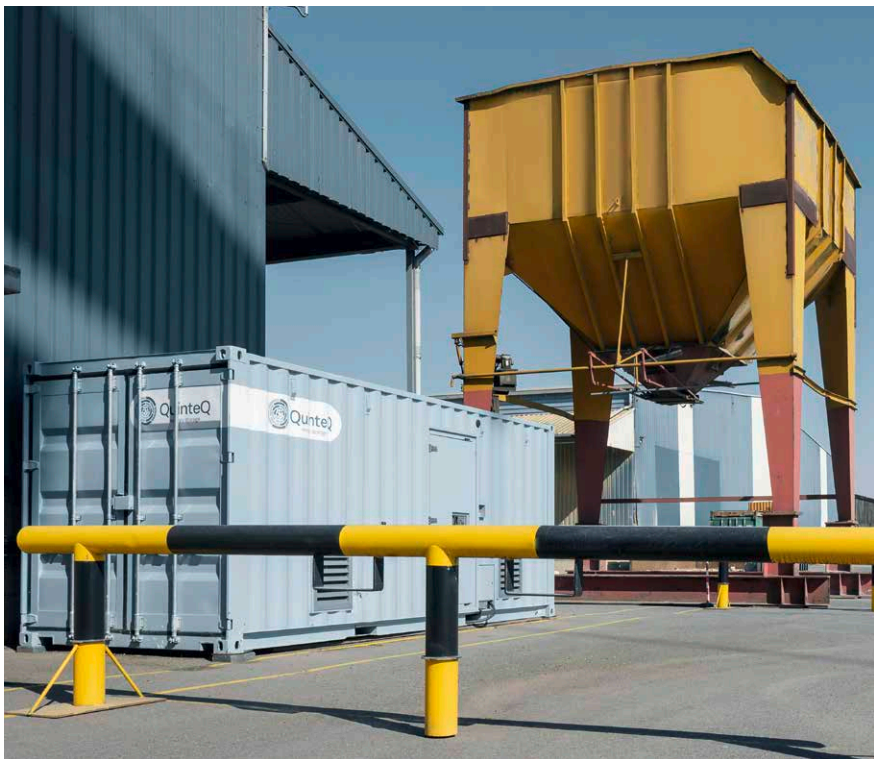
In addition to an M200 controller, the series version uses the M100 I/O system with space-saving UIO108 high-density modules. These modules offer up to 50% more channels than standard I/O modules, with the same compact form.

The flywheel is available with 300 kVA and 600 kVA power ratings. Depending on the application, QuinteQ will configure the appropriate total power with several flywheels. "Our scalable solution can be installed in 10-, 20-, and 40-foot containers. We can fit up to 4 MVA of power in one container."

The QuinteQ container solution is plug-and-play, and includes the flywheel and the Bachmann control system. QuinteQ defines the exact charging and discharging behavior parameters for each application in advance. Once connected to the port grid, the storage system immediately relieves the main grid, with no further preparation necessary.

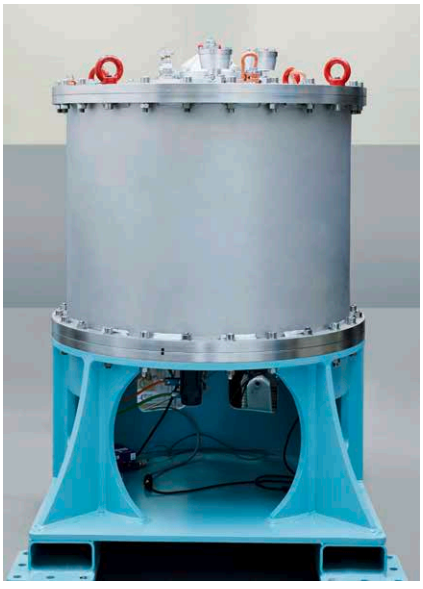
Expansion ahead!

Timo Pauel is certain that QuinteQ's pioneering storage solution will relieve the burden on Dutch port networks over the coming years. "Our flywheel solution paves the way for the global use of an advanced storage technology – in the maritime sector and beyond. The Bachmann control systems are just as robust as our technology. Nothing stands in the way of long-term application in regions with challenging climates across the world."



Scalable and flexible: With QuinteQ's modular flywheel design, containers can be combined into large energy storage systems. Capacity, charging and discharging can be precisely adapted to local energy requirements.

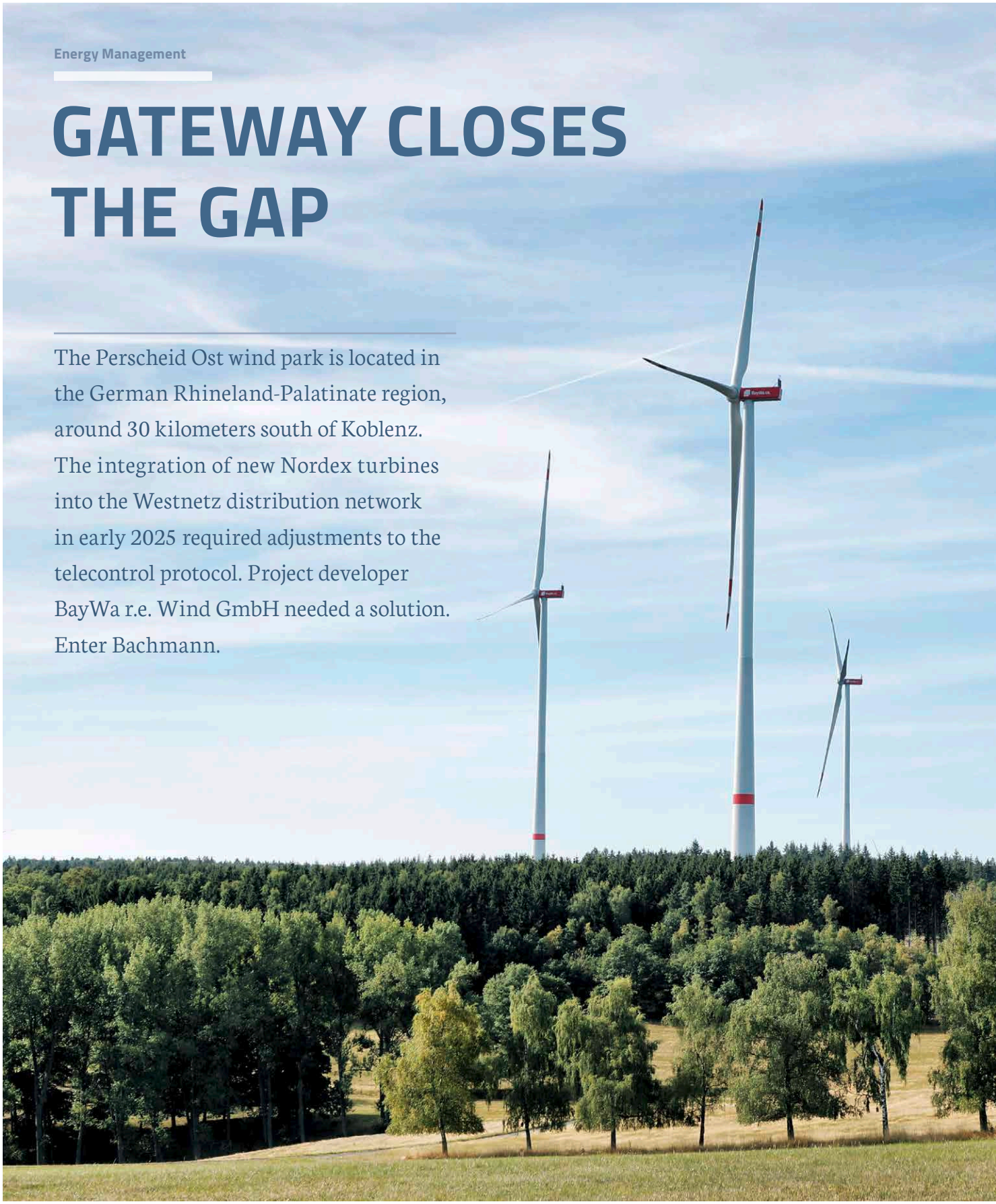
An electric flywheel storage system features a rotating body, or flywheel, that is powered by an electric motor for the storage of kinetic energy. When required, the motor acts as a generator, converting the stored kinetic energy back into electrical energy.



Energy Management

GATEWAY CLOSES THE GAP

The Perscheid Ost wind park is located in the German Rhineland-Palatinate region, around 30 kilometers south of Koblenz. The integration of new Nordex turbines into the Westnetz distribution network in early 2025 required adjustments to the telecontrol protocol. Project developer BayWa r.e. Wind GmbH needed a solution. Enter Bachmann.



The wind park comprises three Nordex N163 turbines, each one 164 meters tall and with a rated output of 5.7 MW. The park will generate approximately 48,000 MWh of renewable electricity annually, supplying around 16,000 households. However, during commissioning, it became apparent that the turbine control system could not provide confirmation following a control command, which was required by the grid operator. Westnetz demands a two-stage response to any command to switch off a circuit breaker, as well as specific error messages if a circuit breaker has not switched off, or has been switched off without an explicit request.

Precise solution

The Nordex power plan controller's telecontrol technology was unable to provide these error messages, so BayWa r.e. needed a solution for its new wind turbines. BayWa r.e. found what it needed at Bachmann. Working closely with Bachmann's R&D department at the company headquarters in Feldkirch, as well as with the applications department in Rheinbach, Germany, BayWa r.e. could quickly implement the Westnetz requirements. Now nothing stood in the way of commissioning. "This solution has another advantage: we don't need a higher-level park controller," confirms Tomas Adler, Grid Engineer at BayWa r.e. Solar Projects GmbH.

Remote control for advanced users

The software solution has been enhanced by adding reverse direction functionality to the IEC 60870-5-104 protocol. With the Bachmann solution, the data interface is completely separate from the operational management logic – another advantage. "This allows logic and data models to be maintained independently," explains Alexander Braun, application engineer at Bachmann's Rheinbach site. The converter was implemented on an MX213 CPU, which works as a gateway. It acts as an interface between the Nordex control system and the Westnetz telecontrol unit. For future projects, plans are in place to use a MX215 CPU, which has three independent Ethernet ports. "This means we can save on an additional gateway for VPN communication with the head office, configure the system remotely, and speed up commissioning even more," Adler explains.

WHAT IS A GATEWAY?

A gateway is an interface connecting different networks or systems to enable the exchange of data between them. It translates protocols, and filters and forwards information, acting like an interpreter between two languages.

In wind energy, for instance, gateways connect turbine controllers with central park controllers or SCADA systems. In photovoltaic, hydropower, and battery storage systems, gateways serve as a bridge between generation units, energy management systems, and grid operators. In industrial environments, they connect machine controls with higher-level control systems or cloud services. In the maritime sector, they integrate onboard systems with port and fleet management solutions.

To be effective, gateway-enabled controllers must support open, standardized communication protocols, ensure high data security, and offer sufficient computing power to process data streams in real time.

Using a Bachmann M200 controller as a gateway allows seamless system integration and secure operation, even in heterogeneous environments. This system offers a standard server interface according to IEC 60870-5-104.

BAYWA R.E.

– Independent Power Producer (IPP)

– Plans, develops, and builds wind, solar, and battery storage plants. Active in plant operation and maintenance, as well as energy trading.

– The world's leading solar wholesale supplier.

www.baywa-re.com

»We need to think about tomorrow, today.«

AI in Engineering

THE SMART SIDEKICK

Artificial intelligence (AI) is approaching industrial automation at an increasing pace. Customers want to know how AI can be used on a day-to-day basis. At the same time, AI-supported engineering solutions require a secure framework.

Bachmann is researching the possibilities and limitations of AI tools for development, with initial prototypes showing promising results.

Clear desire

The impetus for Bachmann's increased AI activities came directly from the market. "We have recently received an increasing number of inquiries about AI strategies and integrating tools such as 'Copilot' into development processes," explains Jürgen Strodl, who oversees technical support for global distributors at Bachmann.

"The fact is that AI tools are now being used more and more in industry, with or without the support of system manufacturers," says Strodl. Bachmann has decided to proactively build expertise in this area. The goal is to help customers develop applications as efficiently and securely as possible right from the start.

Turbo-charged engineering

atvise® is based entirely on standard technologies, such as HTML, CSS, and JavaScript, and uses OPC UA as its central communication protocol. This is the optimal basis for AI integration – modern, large language models are trained using these open standards.

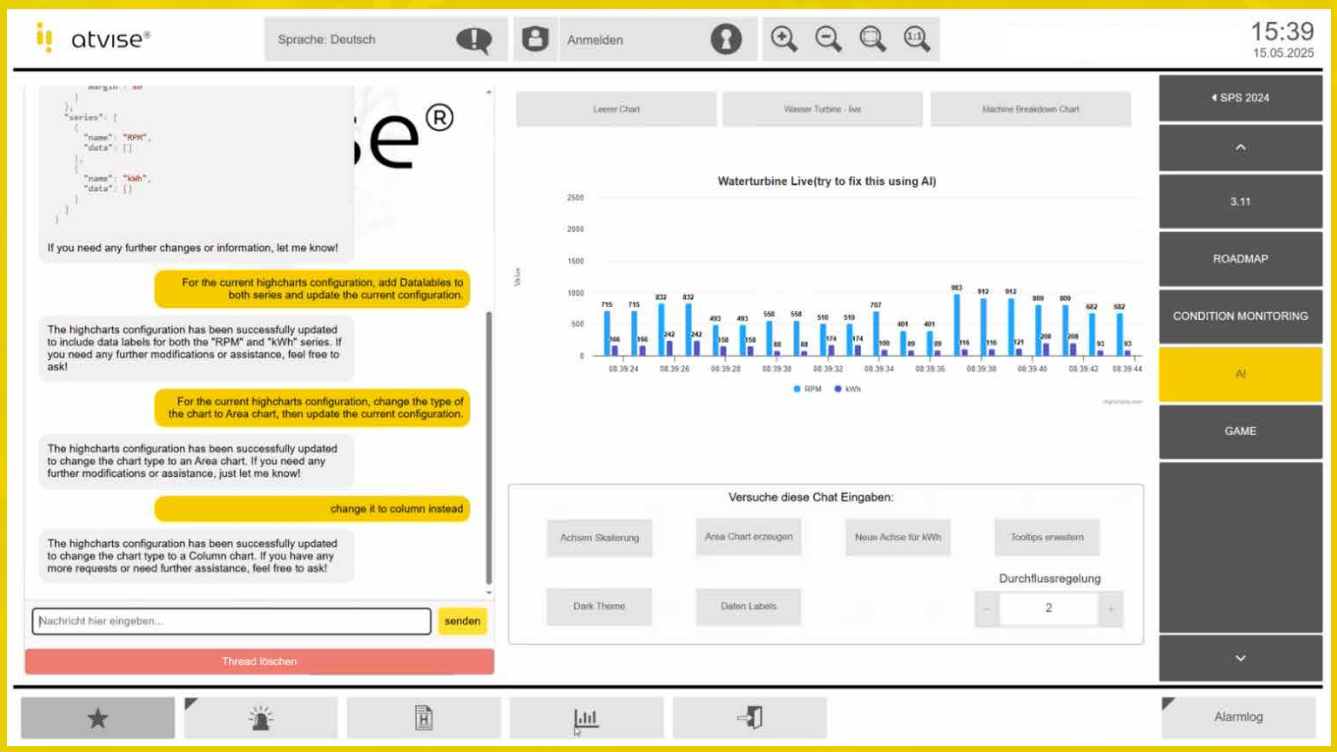
"For certain atvise® applications, AI can reduce development time by a factor of five," says Jürgen Strodl. This significant efficiency improvement results from readable, structured code and automatic commenting. What used to require time-consuming manual rework is now quickly solved by AI. "AI tools are best used for smaller tasks. Complex visualizations with many interacting object types are still difficult to implement. However, even the code blocks for smaller tasks sometimes comprise thousands of lines of code," explains Strodl.

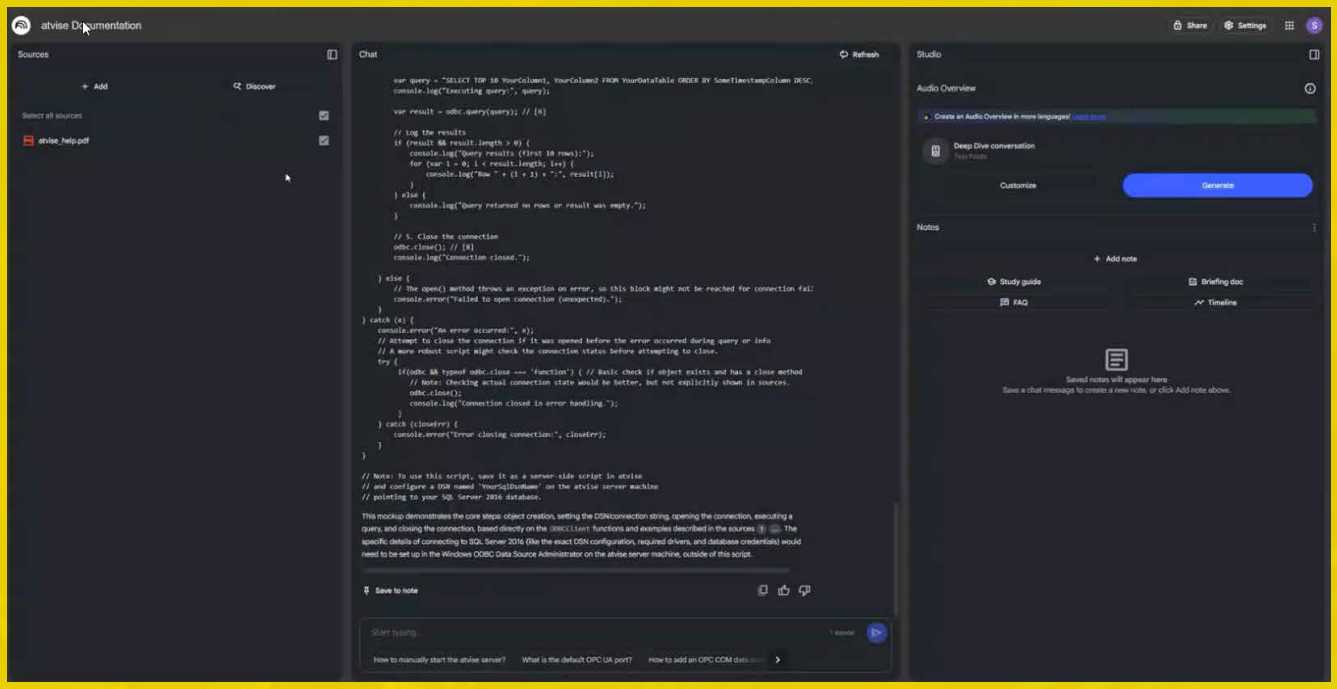
Using Highcharts smartly

For the SPS trade fair in Nuremberg, Bachmann experts developed an AI chatbot for the efficient configuration of Highcharts in atvise®. This prototype shows how visualizations can be easily and immediately adjusted in the software using only voice input.

This is possible thanks to OpenAI's Function Calling API. When the system recognizes a request to modify a chart, it reads the current diagram configuration, combines it with the user input, and writes the adjusted configuration back to the atvise® project. Users can easily change the Y-axis scaling, switch chart types, or add data labels via voice command – all in real time.

Intuitive chart configuration with atvise®: The AI chatbot translates user requests directly into Highcharts visualizations.





Thanks to the automated analysis of atvise® Help, the AI assistant can provide precise answers and refer users directly to the relevant documentation.

Removing barriers

Until now, many Highcharts functions were reserved for experts. However, with AI solutions like these, such functions are now easily accessible to all users. Jürgen Strodl explains, "atvise® is an incredibly powerful tool. However, some functions require in-depth application knowledge. That's why some of our customers shy away from exploiting its full potential. This is the number one barrier we've seen at atvise®. If we can use these tools to lower the entry barriers, it would be a huge win for our customers."

Looking? Found!

One Bachmann customer converted the extensive HTML help from atvise® into a PDF so they could apply Google's NotebookLM for content analysis. Not only does the tool provide correct answers to technical questions, it also cites the relevant documentation. The much-cited hallucination problems of AI failed to appear.

"It's important for programmers to recognize when an AI result isn't 100 percent accurate. Targeted training in the use of such tools is essential," Jürgen Strodl clarifies. This is why Bachmann defines "dos and don'ts" for customers; to ensure the safe and efficient use of AI tools.

Faster support

AI is also used in the Solution Center, specifically in developing complex applications with Bachmann experts. Here, specialists rely on GitHub Copilot, which can be integrated as a plugin via the Eclipse Marketplace. This tool significantly reduces work-load, particularly for repetitive standard tasks, such as automatic code completion, error analysis, and explaining complex code sections. As a result, customers benefit from faster application implementation.

Careful handling of sensitive data

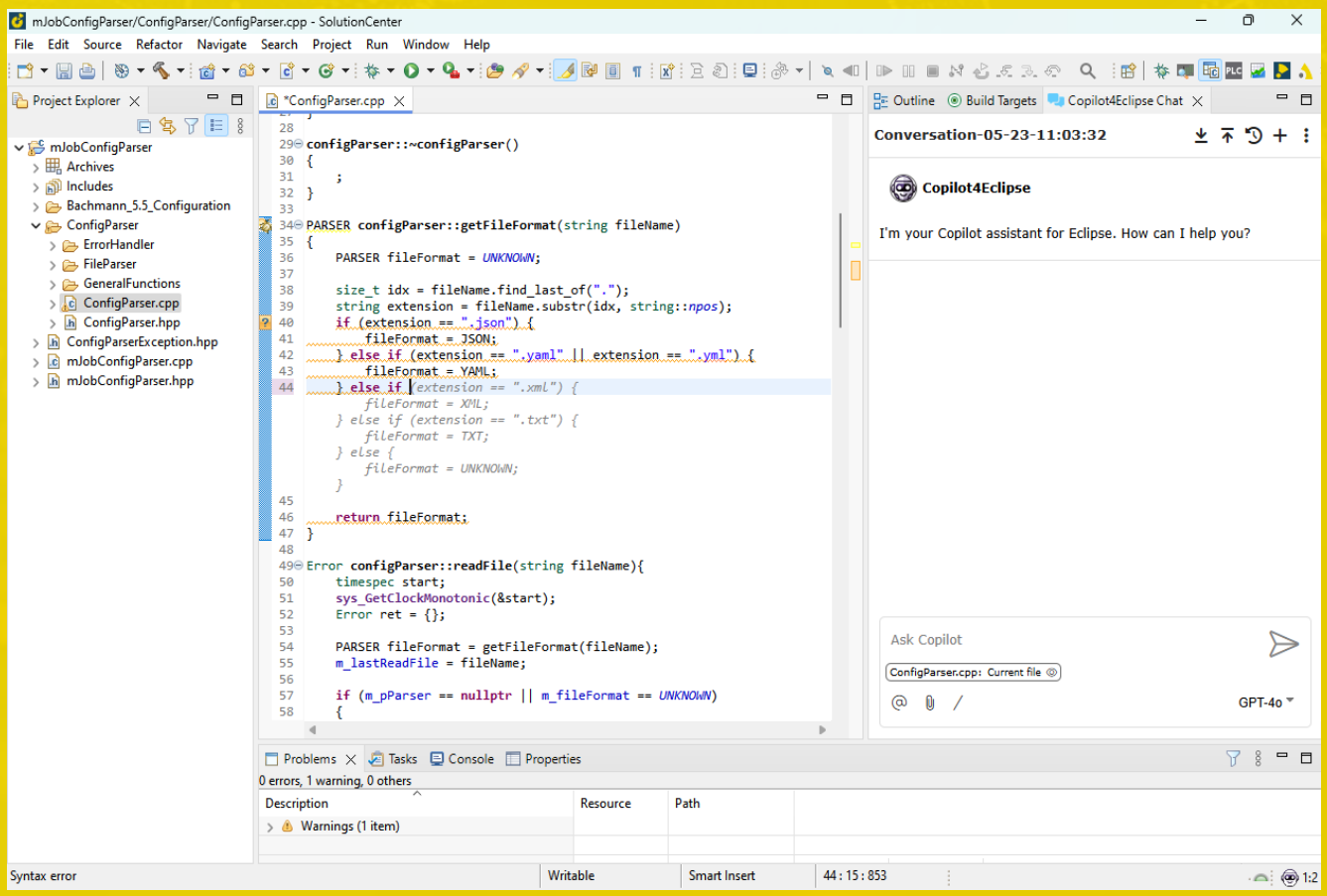
When asked why such productivity boosters are not yet widely available to Bachmann customers, Jürgen Strodl has a clear answer: "The key issue here is the protection of sensitive customer data. Detailed knowledge about system processes and structures, and their applications, must not fall into the wrong hands. Clear guidelines are a basic requirement when AI is used in industrial applications, whether on the customer side or the system supplier side." Bachmann is currently working intensively on such guidelines, not least due to the EU's AI Act, which requires risk-based rules for AI applications. When using GitHub Copilot, Bachmann does not use any customer-specific code and works exclusively on an anonymous basis.

»For certain applications, using AI can reduce development time by a factor of five.«

AI for everyone

Bachmann's goal is clear: to use AI as a tool to make complex automation solutions more accessible to customers. To ensure data protection and availability in productive applications, Bachmann is now considering setting up its own AI systems.

GitHub Copilot significantly speeds up routine tasks in application development with the SolutionCenter – for example, with the "code completion" function.



Serial Interfaces

JUST NOSTALGIA? NOT AT ALL!

SERIAL INTERFACE MODULES: COM102 AND COM104

- Two or four independent serial interfaces
- Galvanic port isolation from each other and from ground
- Choice of RS-232, RS-422, or RS-485 for each port
- Modbus RTU/ASCII, IEC 60870-5-101 and -103, and DNP3 protocols
- Implementation of custom protocols in PLC and C/C++

Here follows an ode to serial interfaces and protocols. Why, you ask?

Understandable, given that the antiquated D-Sub connector has long since become obsolete in the PC sector, while Ethernet has become well established in automation for various fieldbuses. However, Bachmann's modern M100 I/O system and software still continue to support serial processes. And for good reason.

Proven technology...

Serial ports are simple, robust, and independent. Cables can be installed without special crimping tools, and extended up to several kilometers long. Communication often takes place from point to point, meaning complete isolation from the IT/OT infrastructure. This boosts confidence in operational safety, and eliminates the need to configure firewalls or administer access rights. This is a decisive advantage, especially for communication between energy generation plants and large energy supplier systems, because interconnecting IT systems is often considered a security risk. This is why well-established protocols, such as IEC 60870-5 (-101/-103) and DNP3, continue to use serial interfaces, despite the availability of TCP/IP alternatives.

Serial interfaces are often the most efficient solution for industrial applications, such as RFID readers or specially developed peripheral devices for the exchange of small, clearly defined amounts of data. Compared to EtherCAT or Profinet devices, implementing serial ports is easy, and component costs significantly lower. Using proprietary protocols reduces the costs of such applications. However, there are also advantages to manufacturer-independent protocols. With the popular Modbus protocol, for instance, simple read-and-write access can be easily defined.

...meets modern platforms

These are just a few reasons why Bachmann provides comprehensive support for serial connections in hardware and software. All aforementioned protocols can be installed on the controller as ready-to-use software solutions. Proprietary protocols can easily be implemented in PLC and C/C++ using library modules.

The sustained, strong demand for RS204 interface modules for the M200 controller confirms the importance of serial interfaces in automation. This is why Bachmann has developed modules with serial interfaces for the new M100 I/O system. These modules are available with two or four COM ports, and can be used in either the standard or extended climate range. New modules behave identically to the RS204 ports on the M200 controller's CPU, and can be combined as desired using the same software tools and implementations. Hardware interfaces can be flexibly configured. Each port can be configured as standard RS-232, RS-422, or RS-485. Going forward, the industry will still retain some sense of nostalgia. And that's not a bad thing.

»True vision requires clear solutions.«

Turbine Retrofit

BACK IN PROFIT

As wind turbines age, they become more expensive to operate: Frequent malfunctions and increasing maintenance requirements take their toll on yield. Spare parts availability is no longer guaranteed, and operators don't always have access to the turbine and its parameterization options. With marketers now calling for higher flexibility and tougher safety requirements, operators are at a stretch. But a Bachmann turbine retrofit makes future profitability a possibility once more.

Cost-effective entry into the world of condition monitoring: The new CMScore can easily monitor the drivetrain of an existing turbine.

Quick, reliable yield increase. Bachmann offers custom retrofit packages for a variety of systems.

Higher yield, lower load

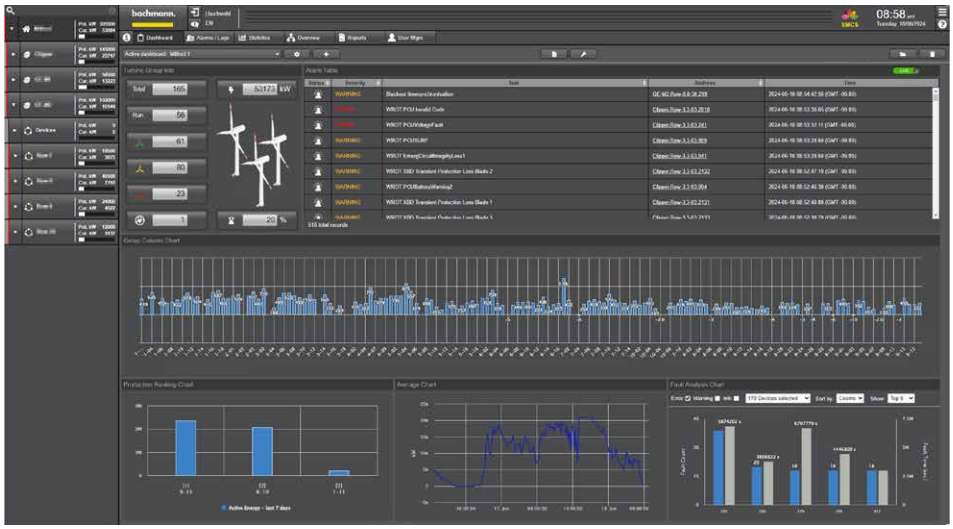
Bachmann's retrofit solutions replace outdated technical components and integrate state-of-the-art technologies for operators to ensure the long-term profitability of their plants. On the one hand, yields go up thanks to higher performance and availability. On the other hand, condition analysis based on actual load measurement data often allows the service life of the plant to be extended significantly beyond its original planned useful lifetime.

A proven five-step process ensures the quick, seamless, low-risk implementation of a retrofit solution. Compliance with current IEC standards and cybersecurity measures is standard, as is the detailed training of service personnel and comprehensive testing to ensure performance.

Welcome to the one-stop shop

Bachmann's retrofit portfolio ranges from individual performance-enhancing components to a total automation refit. Thanks to decades of expertise in turbine automation technology, as well as experience with over 150,000 installed systems, Bachmann delivers well-designed, perfectly coordinated complete solutions for turbine control, grid integration, and condition monitoring:

forsiteSCADA was specifically developed for the complex monitoring, control, and data management of wind turbines and parks. This web-based system facilitates both remote access and seamless integration of condition monitoring information. It's a flexible system that can be used in almost any type of wind turbine. The architecture



Always keep a close eye on the park. With its superior range of functions, Bachmann's browser-based "forsiteSCADA" is precisely tailored to the hardware components of its control solution.

of the Wind Turbine Template (WTT) software package enables flexible and simple implementation of operational management and control.

The certified **Smart Power Plant Controller (SPPC)** meets all requirements imposed on energy park operators by grid connection points and marketers. It can be connected directly to the turbine or an existing park controller and supports hybrid plants (see page 54).

For the optimal monitoring of major wind turbine components, such as the drivetrain, gearbox, and rotor blades, Bachmann combines modular, precisely tailored measurement technologies with intuitive software solutions and plug-ins. **Online diagnostics in WebLog** can detect damage early on, which facilitates targeted, on-site maintenance planning and extends the service life of the turbine. It also optimizes operating strategies and increases annual electricity production.

Before starting a project, Bachmann uses model-based simulation to ensure reliability in planning and implementation. With Bachmann, operators are also legally protected: "Perfectly selected components are one thing. When carrying out a retrofit, you have to take care not to infringe on any patents held by the turbine manufacturer. We understand the importance of this and, as a result, conduct extensive research in advance of every retrofit solution," explains Gabriel Schwanzer, Director of the Wind/Energy Business Unit at Bachmann.

An off-the-shelf productivity boost

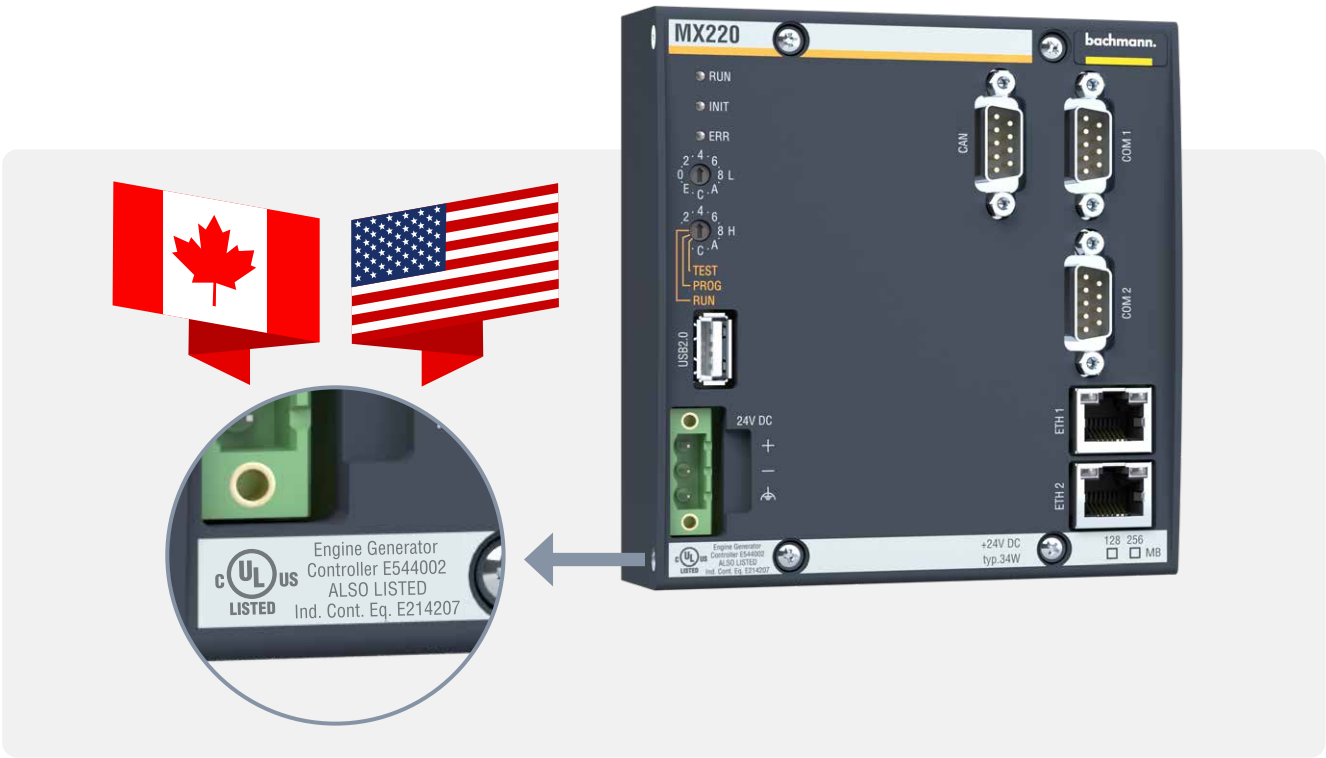
Bachmann offers preconfigured and pre-assembled retrofit packages for many popular turbine models; installed with minimal effort. Installation is planned precisely and turbines are quickly back online and generating profit.

Depending on the turbine type, different success scenarios arise. For instance, the "VeAccess" remote package for VESTAS V80/90 systems eliminates the need for repeated service trips, and provides full transparency (see page 609 for more information on the VeAccess package). The Clipper complete retrofit solution increased power production after only three-days of installation. Another option is a SCADA retrofit, which is specially adapted for GE's 1.5/2.5 and ESS turbine types. Monitoring is easy thanks to the intuitive visualization environment, which includes secure user management and remote execution of routine commands. The complete package for Mitsubishi MHI-1000A systems significantly improves the park performance curve following any curtailment requirements by the grid operator. This increases cumulative energy yield with definable performance setpoints. Additionally, automatic self-start routines bring turbines quickly back online after a grid disturbance. A preconfigured access and SCADA solution, with powerful analytics functions, is also available for Senvion systems and park controllers. This solution can be easily integrated into older systems thanks to a software-controlled rollout process.

These are just a few examples of wind turbines that have been given a new lease on life thanks to retrofit solutions from Bachmann. Retrofits are on the up!

ENERGY GENERATION STANDARDS: M200 RECEIVES UL6200 APPROVAL

The ANSI/CAN/UL/ULC 6200 standard, also known as UL6200, was developed to meet the specific safety requirements of energy generation plants in Canada and the USA. Bachmann's M200 control system is now fully certified to this standard.



The UL6200 standard focuses heavily on electrical and electronic control devices used in energy generation. In addition to basic standards, the UL6200 guideline defines risk reduction in areas such as fire hazards, material selection, and behavior in the event of communication failure or overload. However, it also pays special attention to the development process and software design.

In January 2025, Bachmann received comprehensive approval for over one hundred M200 control system products in accordance with UL categories FTPM and FTPM7 (UL6200). This includes network measurement, protection, and synchronization modules; the MX2xx and MC2xx CPU families; infrastructure components; and a wide range of analog and digital I/O modules. These type approvals are essential, not only for our numerous customers in the USA and Canada, but also for OEM manufacturers and system integrators worldwide who wish to export generation units or subordinate components to North America.

The certificates can be downloaded from the Bachmann website or from UL Product iQ®.

Breaking records in industrial application:
The PPC1200 web terminal powerhouse is due for release in 2026.

Find the datasheet here.

THE HARD FACTS:

- Multi-touch displays from 7" (800x480 pixels) to 23.8" (Full HD)
- Latest Intel Atom® processors
- Up to 8 GB RAM and 16 GB fixed memory
- Interfaces (Eco): 1x Ethernet, 2x USB
- Interfaces (Premium): 2x Ethernet, 4x USB, 1x HDMI, 1x MicroSD; optional RS232/RS422/RS485, microSD, 2x Gbit Ethernet or 1x 2.5 Gbit Ethernet

COMING SOON: THE NEW PPC1200 PANEL PC

Bachmann proudly presents: Our new web terminal – the turbocharged low- and medium-class powerhouse. With its newly developed motor and optimized chassis, the PPC1200 will replace the OT1200 by the end of 2026. We expect it to break one track record after another.

Select your vehicle

The new PPC1200 series panel PCs will be available in two configurations. The Eco version has been specially developed for price-sensitive industrial applications. The Premium PPC1200, on the other hand, comes with a wide range of features. It offers numerous additional connections and a long list of extra interfaces. The pit crew can monitor what's happening on a separate screen, and securely store important data with a RAID 1 system.

Obliterate lap times

The PPC1200 is fast. Very fast. It's based on state-of-the-art technology, including the latest Intel Atom® processors and LPDDR5 memory modules. We sent it to the atvise® wind tunnel to make sure. The benchmark test over several hours revealed an impressive performance: Even the Eco version outperforms its predecessor, the OT1200, up to eightfold. The most demanding visualizations can be rendered at lightning speed.

24 Hours in Le Mans

Our new racing car is built for continuous use. It relies exclusively on industrial components and can easily withstand sub-zero temperatures. The pre-installed industrial browser and display are designed for constant operation. The display shows the instruments in high resolution and clarity.

Designed for every race team

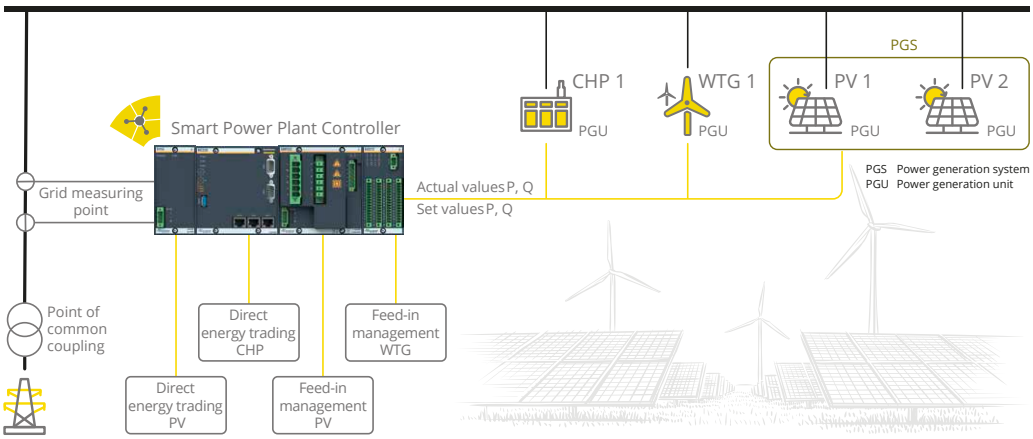
Thanks to numerous display sizes, the PPC1200 fits into any garage. With tailored décor and the customer logo, it blends perfectly into the existing race team design.

Get in – and go!

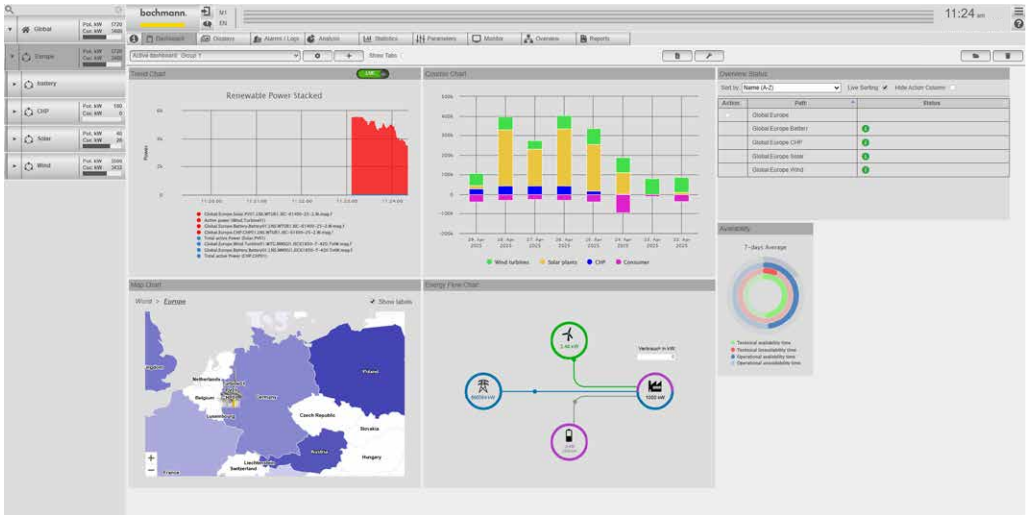
Thanks to the plug-and-play configuration interface, initial setup and software updates take place in no time at all. Driver changes during pit stops are also completed in record time with the PPC1200 thanks to the integrated RFID interface, which facilitates easier authentication.

HYBRID POWER PLANTS: BRINGING IT ALL TOGETHER

Hybrid power plants combine the advantages of different types of power generation – and their popularity is increasing. But so are the challenges facing operators· The higher the number of power generation units (PGUs) and manufacturers involved, the more difficult it becomes to operate efficiently and maintain grid stability and quality. Hybrid park operators need to precisely manage power at the point of coupling, and for this they need open solutions designed by industry experts. With its established Smart Power Plant Controller, and the brand-new forsiteSCADA, Bachmann delivers a complete solution for all.



Certified power plant controller: The Bachmann Smart Power Plant Controller connects wind and solar power plants, as well as combined heat and power plants, to the point of common coupling. It also communicates with direct marketers and feed-in management.



A SCADA system specifically for hybrid parks: When integrated into forsiteSCADA, Bachmann's Smart Power Plant Controller facilitates the control and monitoring of entire hybrid power plants. Thanks to the flexible licensing model, even operators with a small fleet of generation units can benefit.

Compliance with connection guidelines

With its clever Smart Power Plant Controller (SPPC), Bachmann was one of the first manufacturers to launch a VDE-AR-N 4110/4120-certified park controller on the market. The Bachmann controller is based on a powerful processor and the highly accurate GMP232/x2 grid detection and protection module. It considers all the functionalities required by connection guidelines when determining the setpoint for active and reactive power control, and then forwards these to the PGUs.

The existing Smart Power Plant Controller will soon also be certified according to VDE-AR-N 4130 and the European energy standard DIN EN 50549. In future, even more European operators will benefit from the advantages of this flexible and fast park controller.

Effortless configuration, immediate response

For a better overview of the different topologies and energy generation types, the Smart Power Plant Controller includes local configuration and operating visualization with M1 WebMI pro. With its clear interface, the controller can be easily configured – it does not require programming knowledge. Higher-level functionalities, such as primary control or the grouping and prioritization of connected PGUs, are also supported. One particular advantage for hybrid power plants: groups can be formed independently of the type of energy generated.

Controller behavior can be adjusted at any time with just a few clicks, for example, to meet new specifications from the grid operator. In addition, PGU groups can be easily assigned to new direct marketers in no time at all.

Easily certify (entire) plants

A behavioral PC simulation from the Smart Power Plant controller, required for plant certification, is also included. In addition to a MATLAB® simulation model, the PowerFactory and PSCAD models can also be integrated into the respective grid simulation programs. Furthermore, a generic function mockup model can be provided to the certification body.

Open for today and tomorrow

The SPPC supports all common IEC and bus protocols and promotes easy configuration and commissioning.

Thanks to the open and standardized interfaces, systems from a wide range of manufacturers can be integrated, regardless of their communication and operating requirements. For example, an existing grid meter can remain in use at the point of coupling.

Thanks to the modular design of Bachmann hardware, nothing prevents future expansion of a hybrid park – even if the new PGUs are geographically dispersed. And thanks to the openness of the SPPC, customized energy management functions can be easily implemented at any time.

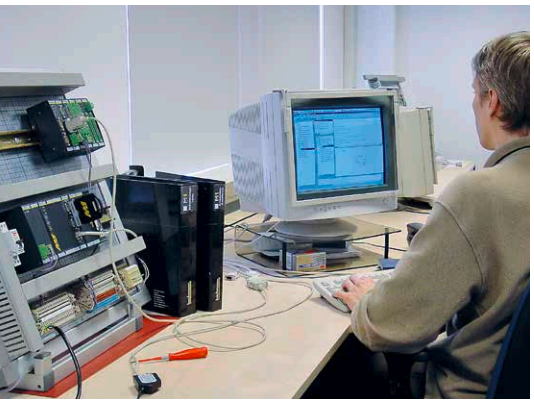
GMP232/X2

- Reliable measurement of all relevant parameters in three-phase electrical networks
- Extremely low latency thanks to full integration into the control system
- Multiple monitoring functions to protect PGUs and the grid

Find the datasheet here.


»Diversity leads
to both
joy and success.«

THE CONTROL PIONEERS



Twenty-five years ago, Wilfred Guldemond, now Operations Manager at Armac, automated the first customer applications with the M200 control system.

Congratulations to Armac Industrial Automation on their 25th anniversary! This inspiring collaboration began when the first Bachmann control system found its way to the Netherlands.

Armac has been working with the M200 controller since their first hardware generation, including for the automation of Xeamos post-treatment systems for maritime and industrial applications. Pictured: hardware engineer Berry Teunissen (left) and software engineer Peter Mocking (right).

ARMAC INDUSTRIAL AUTOMATION

- Software and hardware engineering, as well as control cabinet construction, from a single source
- Around 20 employees
- Headquartered in Andelst, Netherlands.

www.armac.nl/en

Every project undertaken by this high-tech system integrator has one thing in common: they are extremely demanding and require creative implementation concepts. Back in 2000, the Dutch company was already aiming high, trying to achieve pioneering results. "Bachmann shared this attitude. With the M200 control system, the Austrians were far ahead of their time," says Wilfred Guldemond, Armac's operations manager. That was reason enough to choose the controller supplier, which at the time was still largely unknown in the Netherlands.

Armac's first joint project with Bachmann was to automate a German cardboard box production plant. "The valves had to dispense adhesive precisely and very quickly. The Bachmann system was perfect," says Guldemond. Since then, Armac has implemented numerous other projects with Bachmann, including controls for industrial printers, visualization of chemical tanks, and predictive control of large vessels.

For Armac, one main advantage of Bachmann hardware is durability. The first-generation M200 control system has been operating switch heaters for the Dutch national railway since 2007. This is not only because the controller, which is installed directly at the switch, can withstand high temperature fluctuations between summer and winter, as well as electromagnetic stress. As the Operations Manager explains: "The Ethernet port, which was anything but common in 2007, is also largely responsible for this. It allows us to conveniently control the switches remotely via TCP/IP, even today. "

In addition to robustness, the control system's open design proved advantageous in the early years – due to the restricted number of protocols available for Ethernet connection at the time. "With M-PLC, we were able to develop our own protocols," says Wilfred Guldemond. This is another reason why Armac has implemented its most innovative projects to date with Bachmann.

Airborne Wind Turbines

THREE LINES TO WATCH

Kites fly at high altitudes, have smaller wings, and do not require towers, leaving the landscape practically undisturbed.

Based in Eberswalde, Germany, EnerKite is bringing genuine movement to wind power: with aerial wind turbines. These turbines utilize strong and steady high-altitude winds to deliver double the annual yield of conventional wind turbines with the same capacity. The algorithms necessary for system control are computationally very intensive, and therefore benefit from the high performance of Bachmann CPUs.

Without a tower, and with minimal impact on the landscape, the system starts rotating automatically even in calm conditions, delivering maximum efficiency. According to EnerKîte, this approach would allow 80% of the global land area to be developed for commercial wind energy generation – three times more than conventional systems. The system's low footprint requirements and simple, mobile installation make it ideal for island grids and decentralized power generation in countries with weak grid infrastructure. Industry and agriculture also benefit from a self-sufficient energy supply. It makes expected energy cost easier to plan, and saves costs in the long term.

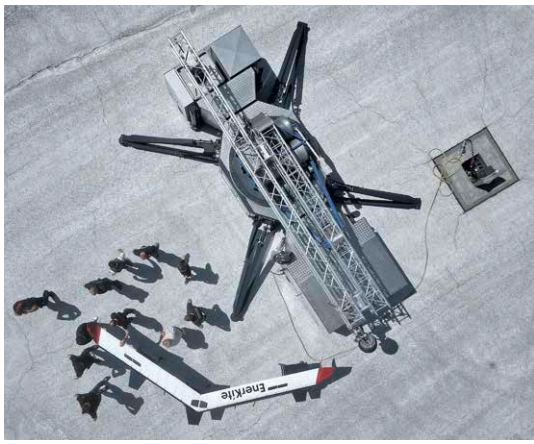
Double the wind

Another key advantage of the solution is its simultaneity factor, which is 100 percent higher than that of a conventional wind turbine. The EnerKîte system can produce electricity for 5,000 to 6,000 full-load hours per year – around twice as much as a comparable wind turbine. An interesting side effect is that the required battery storage in the grid could be significantly smaller.

Complex system control

Complex mathematical calculations are necessary to ensure the kite's carbon rib structure is always positioned at the optimal angle and trajectory. The algorithms use powerful Kalman filters, among other elements, to estimate the system state. These algorithms were simulated in MATLAB® and can be loaded directly onto the Bachmann controller using M-Target for Simulink®. The MH230 CPU, which operates at 2.3 GHz, delivers the necessary performance level for processing this demanding application with very short cycle times.

Similar to photovoltaics, these efficient, decentralized, small-scale systems can provide a continuous electricity supply and are theoretically scalable up to the megawatt class. The prospects for this system are promising!



The ground station contains an electrical system with converters, drives, a battery, and a rotation device for takeoff and landing, including a mast, rope guide, drums, a generator, and a gearbox.

ENERKÎTE

- Develops decentralized ground supply systems fed by kites at high-altitude wind
- Established in 2010
- Headquartered in Eberswalde (Germany)

www.enerkite.de
www.enerkite-invest.de

During the summer months, greenhouses require up to 2.6 MWh of energy daily to stay cool and dry. The energy management system, which consists of a grid connection, a PV system, and a battery, is supplemented by a generator equipped with a Bachmann M200 controller and a GSP274 grid recording, synchronization, and protection module. Thanks to web technology, access is either direct from the HMI or remote from any browser.

Intelligent Peak Load Caps

FINALLY, UNLIMITED DEVELOPMENT

HOB Aggregaten in Lopik, the Netherlands, is known for generators with control solutions that are precisely tailored to customer needs. This customization requires a flexible control system and versatile engineering capabilities.

HOB was reaching the limits of its previous solution. Control and network measurement were implemented on systems from two different manufacturers. For its latest "Stage V" generators, the Dutch company chose an integrated system from Bachmann. "With a powerful processor and the GSP274 module, Bachmann combines network detection, synchronization, and protection – directly on the controller. This eliminates annoying delays between setpoint setting and network measurement, as well as the synchronization problems we had to contend with," says Mark Boere, an electrical engineer at HOB Aggregaten.

HOB puts their heart and soul into developing each individual customer application. Bachmann's SolutionCenter gives them the freedom to do so. HOB was able to replicate the pre-existing control algorithms without any issue. "More importantly, we can now implement system optimizations that were previously impossible because the control system had reached its limits, we were hindered by slow communication, or manufacturers didn't consider these functions profitable for our small field of application," says Boere.

In addition to generators, HOB plans to develop customer-specific battery solutions. "With Bachmann's future-proof solution, we are confident that we can create outstanding solutions that are not yet available on today's market," says Mark Boere.

HOB AGGREGATEN

- Develops silent generators from 10 to 2,000 kVA
- Customized, intelligent control systems
- Established in 1983, based in Lopik (Netherlands)

www.hob-aggregaten.nl

Bachmann Website

THE PARTNERSHIP PLATFORM

The Bachmann website is so much more than just an online business card for our business. It is packed with engaging articles that deliver industry know-how at the highest level. Growing numbers of Bachmann customers value the website as a source of collective expertise, and visitor numbers are steadily increasing worldwide. Exciting customer innovation projects have played a huge role in this success. With our website as a platform, Bachmann customers have seen a significant boost in their online reach. Is your project on board?

The right format for every project

The Bachmann website offers eye-catching opportunities to showcase project highlights. For example, a comprehensive microsite featuring a detailed project description and useful animations, or a collaborative video portrait. Alternatively, a column on the site offers the chance to highlight individual aspects of a project and track progress over several months. Community members can choose to stay up-to-date on new content automatically via email. Need some examples? Scan the QR codes! You will receive the created content completely free of charge.

Show the world how you are shaping your industry's future with us. We're ready – get in touch: **cooperation@bachmann.info**

OUR COOPERATION COULD LOOK LIKE THIS:

Article: Repair ship for underwater cables from C-Systems

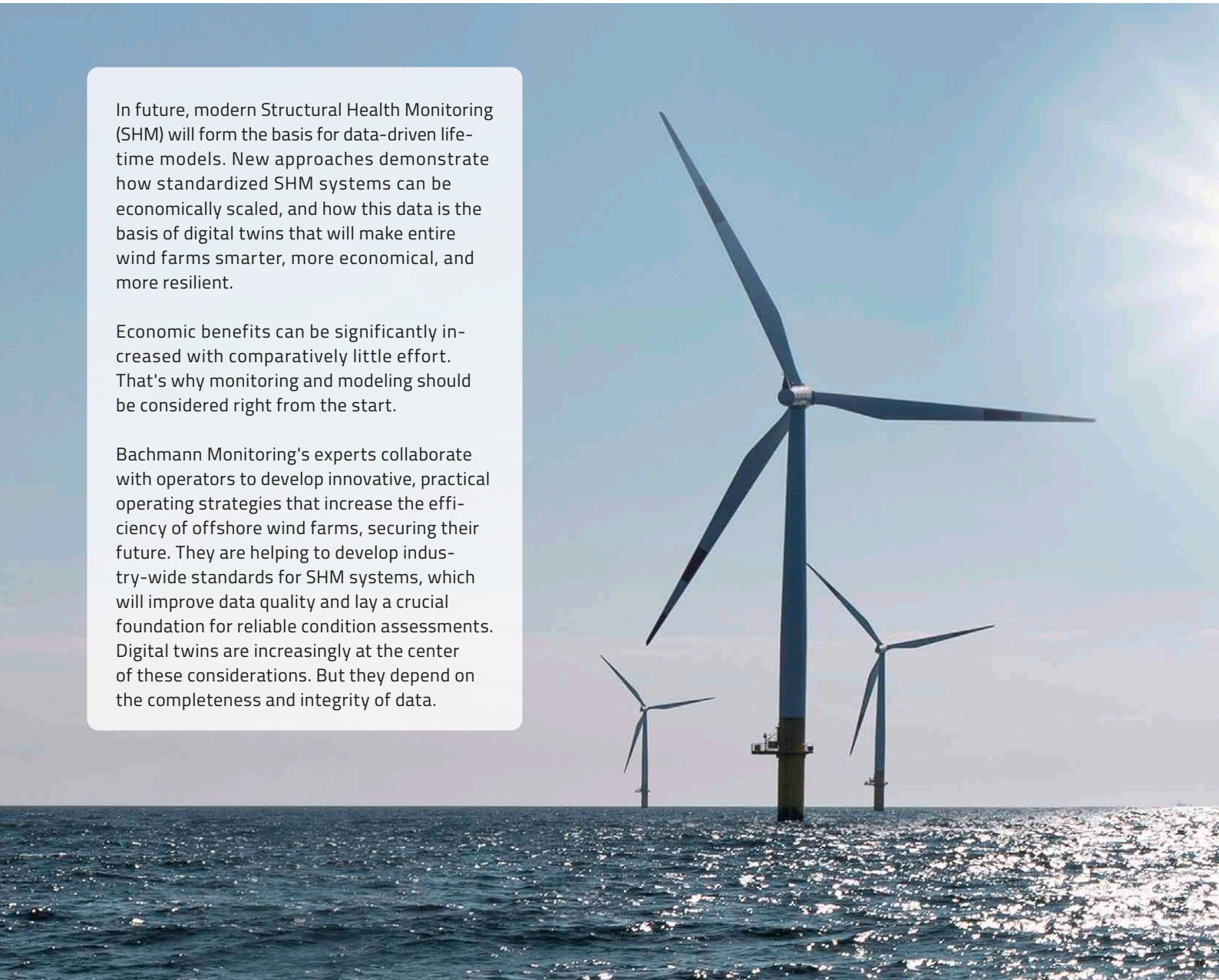
Video portrait: Remote control and fully automated guidance for inland waterway vessels with argonics

Microsite: A Airborne wind turbines from EnerKíte

Structural Health Monitoring

DIGITAL INTELLIGENCE FOR OFFSHORE WIND FARMS

Offshore wind is a cornerstone of the energy transition, but it is facing mounting cost pressures. Intelligent solutions that increase operational safety, optimize maintenance, extend turbine service life, and minimize costly material usage are becoming increasingly important. The solution is a combination of precise measurement technology, clever standardization, and digital twins.



In future, modern Structural Health Monitoring (SHM) will form the basis for data-driven lifetime models. New approaches demonstrate how standardized SHM systems can be economically scaled, and how this data is the basis of digital twins that will make entire wind farms smarter, more economical, and more resilient.

Economic benefits can be significantly increased with comparatively little effort. That's why monitoring and modeling should be considered right from the start.

Bachmann Monitoring's experts collaborate with operators to develop innovative, practical operating strategies that increase the efficiency of offshore wind farms, securing their future. They are helping to develop industry-wide standards for SHM systems, which will improve data quality and lay a crucial foundation for reliable condition assessments. Digital twins are increasingly at the center of these considerations. But they depend on the completeness and integrity of data.

LOW COSTS – LONGER SERVICE LIFE

Sensor-based Structural Health Monitoring (SHM) is key to the lifetime extension of offshore wind farms. By continuously recording mechanical load, vibrations, corrosion, and environmental conditions, SHM provides a realistic basis for reliable service life models. When supplemented by CMS and SCADA data, SHM provides a comprehensive picture of overall structural condition.

Typically, around 10 percent of the turbines in a park are monitored with SHM. These turbines are specifically selected based on location, design, and load criteria. This representative measurement data is then used to calibrate numerical models, delivering relevant conclusions for the entire park.

Certified load comparisons – with real data

The goal is to reliably forecast remaining service life based on standardized load comparisons (IEC TS 61400-28, DNVGL-ST-0262). Design documents, location and operating data, and measurement results are incorporated into the analysis. Any gaps in the data are filled in – the more complete the data, the more accurate the models and the fewer conservative assumptions are needed, ultimately reducing project costs.

Simulating critical scenarios

The focus is on actual on-site load compared to the original design, particularly wind, waves, and operating load. Based on this information, engineering firms can simulate critical load scenarios and calculate fatigue and remaining service life of all relevant components. This includes the rotor blades, tower, foundation, and connections and also accounts for variants of individual turbines with different outputs.

Big benefits, low cost

The result reduces uncertainty and makes service life forecasts more realistic. Maintenance and component replacement can be planned more effectively, leading to economical operation well beyond design life. Investing in SHM represents less than one percent of the total project cost, yet the benefits are many times greater.

In future, digital twins will automate the evaluation process through targeted networking of all data and models, opening up a new level of operational optimization.

Read the detailed technical article.

DATA-DRIVEN EFFICIENCY

The operation and maintenance of offshore wind turbines is complex and costly. Digital twins – digital representations of real plants – create new opportunities for predictive maintenance, optimized operation, and lifetime extension.

Early damage detection

Conventional methods often struggle to detect corrosion, fatigue, and damage caused by waves or ice formation, and by the time they are detected, it is often too late. Digital twins use SHM data for condition-based monitoring, enabling the early detection of damage and targeted intervention. This reduces downtime and increases safety.

Real-time operational optimization

Digital twins simulate changing environmental and operating conditions and dynamically adjust plant control. This promotes an optimal balance between yield and load, even with fluctuating grid demand and harsh weather conditions.

Well-founded service life forecasts

Combining real load data with material models and design parameters enables reliable predictions about remaining service life, retrofit requirements, and replacement investments.

Smart park assessment with limited SHM coverage

Even turbines without monitoring systems can be modeled into the SHM. Evaluations based on clusters of similar systems and clever modeling increase the transferability of condition or damage patterns to the entire park.

Design review during operation

Measurement data proves how well operating conditions correspond to original design assumptions. This means that reserves and optimization potential become apparent as early as the design stage of new plants.

Dynamic maintenance planning

Not all turbines age at the same rate. Digital twins help to direct maintenance resources where they are most needed; based on demand instead of rigid planning.

Immediate assessment after extreme events

Digital twins enable a quick condition assessment of difficult-to-access systems following a storm or an impact.

Data is the lifeline of the digital twin

The quality of a digital twin depends on the quality of its data. In addition to design and simulation data from CAD, FEM, or load assumptions, this includes all available SHM measurement data, such as vibration and corrosion data, as well as foundation monitoring data (e.g. scour monitoring). Environmental parameters, such as wind, waves, ice, temperature, and salinity, as well as operating data (power, pitch, and maintenance history), supplement the data pool.

Bachmann brings worlds together

With highly available SHM, CMS, and SCADA systems, Bachmann provides reliable, consistent, high-quality data – the basis for robust digital twins.

Read the in-depth technical article.

STANDARDS FOR GREATER INVESTMENT SECURITY

The continuous monitoring of offshore wind turbines using SHM has become an essential component of higher operational safety and economic efficiency. At the same time, SHM tenders for wind farms with monopile or jacket foundations are becoming increasingly similar – clearly indicating the growing need for standardization.

Despite the technical maturity of SHM systems, standards are still missing, especially for established foundation structures. Systematic standardization increases system availability and improves the quality and significance of data; a key prerequisite for the use of digital twins.

Based on data quality

Digital twins only reach their full potential with complete, quality-assured, real-time data. Standardized systems allow for the consistent, compatible, and automated collection of SHM data. Combined with CMS and SCADA data, this creates a comprehensive digital representation of the plant.

Standardized monitoring

Typical monopile designs can be used to derive clear characteristic and limit values for monitoring load cycles and damage, which defines the minimum requirements for measured variables, sensor locations, specifications, and the number of channels. Additional signals, such as those from wave radar, scour sensors, or bolt monitoring, are also included in the standard design. Cable routing and data management follow a consistent system approach.

Less engineering, more efficiency

Standardization significantly reduces engineering cost and testing duration, thereby lowering manufacturing cost. At the same time, SHM system performance increases and technical risk decreases.

In summary, standardized SHM solutions increase technical reliability, simplify operation, and secure the investment over its entire life cycle. Project planners and operators who opt for standard solutions early on benefit both economically and technically. Owners and operators further benefit from expert advice, even during the planning phase.

Read the in-depth technical article.

Training

BY EXPERTS, WITH EXPERTS

Participants of the Bachmann expert training course were delighted to have successfully completed the program while exchanging valuable experience.

At Bachmann's training center in Feldkirch, Austria, the primary focus is on intensive knowledge transfer and hands-on problem solving. The first expert training course on the GMP232/x2 and GSP274 network measurement modules was a resounding success. As well as the practical nature of the course, participants appreciated the opportunity to exchange experience.

The two-day course covered the configuration of measurement and protection functions, extensive practical applications, and programming grid-relevant functions in IEC 61131-3. Morten Haas, an electrical engineer at Dutch shipbuilder Royal Roos B.V., found the succinct, competent introduction to the wide range of applications of these two powerful modules particularly important: "On ships, power supply systems must handle rapidly increasing loads, such as when cranes or winches are started up. During training, I learned how and where we can optimally use the modules."

Arjan Boeve, development engineer at Bredenoord in Apeldoorn, Netherlands, was another one of the participants. The company has supplied mobile power solutions for 85 years, individually developing them to solve specific problems on a worldwide scale. "In a very short time, I got to know the extensive implemented protection functions. I was impressed by the diagnostic options with Scope 3," said Boeve, pleased with what he learned and the time he will save on future implementations.

The training naturally included an insider look at Bachmann's development, production, and quality management departments. All participants appreciated the honest and open exchange and, last but not least, the surroundings and hospitality in Vorarlberg. "We had a lot of fun, as well as learning something new," says Boeve with a smile.

IEC 62443-4-2

SECURE AUTOMATION – NOW CERTIFIED

Cyberattacks on industrial control systems are increasing worldwide. For operators of critical infrastructures, this necessitates robust, future-proof solutions with certified cybersecurity. Bachmann has solved this challenge: the M200 series, certified according to IEC 62443-4-2.

IEC 62443 AT A GLANCE

IEC 62443-4-1

Certifies the development process for secure products (e.g. threat analysis, coding guidelines, patch management).

IEC 62443-4-2

Certifies the technical cybersecurity of components (e.g. user authentication, protocol protection, data integrity).

CYBER RESILIENCE ACT

EU regulation on mandatory cybersecurity for digital products – Bachmann is prepared.

Developed according to the 'defense in depth' principle, Bachmann products feature a security concept with multiple layers of protection.

Future-proof and compliant

At Bachmann, plant protection is based on the 'defense in depth' principle, which involves coordinated protective measures at different levels of control, to increase resilience and minimize the impact of an attack. Our customers receive a robust, future-proof platform with effective protection against cyber threats, while supporting integration into higher-level OT security architectures.

Covers the entire security chain

Bachmann is certified according to IEC 62443-4-1 for secure development processes. Together, these two standards cover the entire cybersecurity chain – from development and implementation to operation.

With this dual certification, Bachmann is fully prepared for the upcoming EU Cyber Resilience Act (CRA). This act will impose strict cybersecurity requirements on future networked products. Our customers already benefit from a solution that goes beyond pure functionality and complies with regulations.

»Pioneers are always on the move.«

The green hydrogen journey

WIND, WATER, WONDER

What if an imperceptible gas held the answer to one of the most pressing problems of our time? This is not science fiction: Hydrogen, especially green hydrogen from renewable sources, is arguably the greatest hope for the energy transition. It creates no emissions, is flexible to use, and is easily stored. Hydrogen could fill the gap between fluctuating wind and solar production and constant energy demand. But is green hydrogen really the holy grail for the future of energy generation – or an overpriced illusion with limited impact? We predict a near future where the North Sea wind is more than just a fresh breeze.

Anna and the green grid

Anna, our protagonist, stands on the shore and stares out to sea. Before her stand enormous wind turbines, rotating steadily in the breeze – silent, yet full of energy. As a Bachmann engineer, Anna oversees one of the first hybrid power plants in northern Germany, where wind supplies the electricity for hydrogen production. For Anna, this is not a future project; it is everyday life.

"Green hydrogen," she murmurs, letting her gaze wander across the reflective rotor blades. "It still sounds like marketing. But it's real craftsmanship – living, breathing technology."

A lot has changed over recent years. Electricity generated from wind turbines no longer flows into the grid alone. When demand is low, electricity is redirected to a container station at the base of the plant. There, electrolysis devices use it to divide water into oxygen and hydrogen. When electricity is generated from wind energy, as is the case here, the resulting hydrogen is free from CO_2. Anna affectionately calls it "clean storage."

Electrifying potential

The benefits are clear. Compared to batteries, hydrogen is capable of storing huge amounts of energy for weeks or months at a time. It's no wonder, then, that the manufacturing, transportation, and even real estate industries are suddenly paying attention. Anna envisions hydrogen-powered buses, a paper mill powered by the hydrogen produced in its drying processes, and a housing development that gets heat and power from a hydrogen-powered combined heat and power plant.

Anna sees hydrogen as an element that can do just about anything: "It can store electricity, provide heat, power vehicles." But, in reality, it's not quite that simple. Not yet, anyway.

Obstacles along the way

Although green hydrogen is promising, its use remains a challenge. Electrolysis is expensive and not as efficient as it could be. A significant amount of energy is lost during the conversion process. Despite constant efficiency improvements – with new materials and optimized cell structures promising over 90% efficiency in the near future – we are not quite there yet.

In addition, the infrastructure is lagging behind. Hydrogen must be stored and transported safely. The pressure tanks, pipes, and compressors required are more expensive than fossil fuel alternatives. And anyone attempting to feed hydrogen into the existing gas grid will quickly encounter regulatory barriers.

Courage for change

"This is where Bachmann comes in," says Anna. "We specialize in connecting different energy sources, storage technologies, and consumers – digitally, securely, and efficiently." The hybrid power plant demonstrates how well electricity, hydrogen, heat, and mobility can work in tandem. Intelligent control systems ensure that electricity is used where needed, stored when the sun isn't shining, and saved if the wind isn't blowing. "We build smart energy systems," she adds.

Looking into the near future

When Anna returns to the control room that afternoon, she sees that electrolysis is running at full capacity and the hydrogen storage tank is 78% full. A container, pressurized to 350 bar, is ready for transport. Tomorrow, it will be transported to a filling station in the city to supply a fleet of trucks.

Anna smiles. It might not be perfect yet, but it works. And that's more than many people believed possible.

An enabler, not an illusion

Green hydrogen isn't magic; it's physics, chemistry, and engineering. Its strengths are flexibility, the combination of different sectors, and energy storage over extended periods of time. And the risks? High costs, energy losses during conversion, missing infrastructure, and political uncertainty.

However, the signs point to change. Hydrogen's potential continues to grow. Wind energy is expanding, and new technologies and networked system solutions emerging, such as those from Bachmann. While hydrogen may not be the holy grail, it certainly has a significant role to play in a future free from CO_2.

As Anna likes to say, "When the wind blows, we don't build walls. We build electrolyzers."

Bachmann Technology Symposium

THE FUTURE IS HERE

Yesterday, autonomous shipping was just a vision; today, it's a reality. Around 70 participants at the third Bachmann Technology Symposium witnessed this firsthand. The event took place once again in an exclusive setting - the International Maritime Museum, in Hamburg's Speicherstadt.

Steering a ship on the open sea was once considered the pinnacle of human navigation. However, due to the rapid growth of global trade and increasing demands for efficiency and sustainability, this concept has become outdated. Today, the shipping industry faces complex challenges: fuel costs must be reduced, emissions must be cut, and schedules must be precisely adhered to – all while the volume of traffic at sea and on inland waterways increases.

Autonomous shipping is becoming increasingly important in meeting these requirements. Real-time data, digital scheduling, artificial intelligence, and augmented reality technologies should make navigation safer and more efficient. Autonomous technologies are therefore fundamentally transforming maritime logistics. The transition from manual control to data-driven assistance and automation systems is a significant step toward intelligent, resource-efficient mobility on the water.

This topic was the focus of the 3rd Bachmann Technology Symposium in Hamburg. Internationally renowned experts presented on the latest developments in automation and propulsion technology, shipping maintenance strategies for long-term success, and current and future legal requirements, particularly regarding cybersecurity risks.

Precise maneuvering

Dr. Dirk Jürgens, Head of R&D at Voith Turbo Marine, opened the symposium. He presented the Voith Schneider Propeller (VSP) as a pioneer for autonomous shipping. More than 4,600 of these propulsion systems have been built since 1926. They combine thrust and steering, react in a fraction of a second, and enable precise maneuvering even under the most adverse conditions. Jürgens emphasized the further advances in efficiency and controllability of the latest eight-blade eVSP generation. Model-based hydrodynamics, digital twins, and real-world tests paved the way for autonomous positioning – for ferries, offshore service vessels, or a network of remote tugs. Dr. Jürgens confirmed that international regulations are becoming increasingly open to pilot projects. Ferries are the obvious first candidates for autonomous operation.

»Autonomous shipping is no longer just a promise for the future; it's reality, and it's fundamentally changing the maritime world – making it safer, more efficient, and more sustainable. «

Ronald Epskamp
Manager Business Unit Maritime
Bachmann electronic

Automation in inland shipping

Dr. Alexander Lutz, founder and Managing Director of Argonics, demonstrated the establishment of automation in inland shipping, despite confined space and complex conditions. Systems such as the Track Guidance Assistant (TGAIN) and Argo Trackpilot increase safety, reduce the captain's workload, and save fuel by optimizing travel routes, providing lock warnings, and precisely calculating bridge passages, even in poor visibility. "The fact that over 550 systems have been sold since 2017 proves their practicality," said Dr. Lutz. However, a complete legal framework is still missing. Certification processes have been ongoing since 2013, with the first concrete agreement not expected until 2027 at the earliest. According to Dr. Lutz, national differences remain significant. "Belgium and the Netherlands are open to the technology, while the approval situation in Germany is much more restrictive." Until then, the captain remains fully responsible, similar to a vehicle autopilot. The adaptable systems learn during the commissioning phase, forming a practical bridge between current navigation and future autonomy.

Lack of regulation

Katja Baumann, Managing Director of the Maritime Competence Center MARIKO in Leer, Germany, and Leo van der Burg, Business Development Director of the Dutch industry association FME, provided insight into "Ferry Go!", an Interreg pilot project on autonomous shipping in the German-Dutch Wadden Sea. Due to its changing tides, sandbanks, and high traffic density, the region is considered particularly challenging for navigation and route planning. The project aims to test the practicality, cost, and retrofitability of available systems. It will also investigate human-machine interactions and clarify acceptance issues. However, the two experts named lack of regulation as the critical bottleneck on the road to autonomous shipping. There is a need for clear definitions, internationally uniform safety standards, and binding liability. Above all, questions regarding cybersecurity and data security remain unresolved, especially in light of current geopolitical tensions. The International Maritime Organization (IMO), however, is working on a set of rules for Maritime Autonomous Surface Ships (MASS), expected to take effect around 2034. Until then, autonomous shipping will remain a regulatory testing ground.

Just do it!

Liam Williams, a Rotterdam Mainport Institute student, offered an unconventional yet practical perspective: While interning at the Dutch company Van Oord N.V., he converted a motorboat to Level 3 autonomy in three months using commercially available components. Jorn Bertens, Van Oord's procurement manager, emphasized that they created a functioning demonstrator with a budget of around €2,000 – albeit without obstacle detection and far from commercial maturity. The ensuing discussion showed that general autonomy in large ships, such as those used by Van Oord, is still far off. However, Bertens sees potential in smaller boats and automated ship navigation for highly specialized offshore operations, such as laying cables or foundations with high precision at depths of up to 1,500 meters.

Design? Yes, but only with standards.

Prof. Kjetil Nordby is the head of the Ocean Industries Concept Lab at the Oslo School of Architecture and Design. Through the "OpenBridge" project, he presented an approach to overcoming the problems posed by incompatible operating systems on ships. "Today, even switches that appear identical differ in their function," noted the researcher. This poses a risk in multi-vendor environments, both on board and in remote operation centers.

OpenBridge 6.0 provides an open-source design system and guidelines for developing secure, efficient, and scalable interfaces in maritime and industrial environments. According to Prof. Nordby, it can be expanded to include remote collaboration and fleet control. The goal is to develop a consistent operating system that works across different ship types and manufacturers. However, as became clear during the discussion, without internationally coordinated standards, each system risks remaining unique, posing corresponding risks to safety and efficiency.

Divided progress

Dr. Urs Vogler, Team Leader of Safety at the classification society DNV GL, highlighted the challenges that certification bodies face due to the diversity of autonomous concepts. Autonomy can range from simple remote control and assistance systems, to fully unattended operation. These categories are clearly distinct from a technical perspective, yet difficult to classify from a regulatory standpoint. At sea, existing rules, such as those for crossing or overtaking, are in conflict as well. Additionally, current regulations always require a crew on board. The central question is therefore: To what extent can the crew be reduced, and who is responsible when an incident occurs – the crew or the ship's owners? According to Vogler, regulation for autonomous vessels does not replace existing regulation, but acts as an additional layer on top. However, a clear, internationally applicable framework is still years away.

Smart maintenance becomes indispensable

The final part of the symposium addressed smart maintenance and how innovative approaches to data

collection and processing can improve machine availability and productivity. Dr.-Ing. Philipp Krenkel and Andreas Börgmann from HYDAC explained the importance of operating fluid monitoring for smart maintenance. Using a drive as an example, they demonstrated that the ingress of water and particles into the lubricating oil is practically unavoidable when drive screws are always running in water. Modern sensor systems continuously record parameters such as water content and particle contamination, providing the basis for strategies such as dehydration and targeted filtration. This ensures drive availability and optimizes system architecture. Smaller lubricant tanks require less space, weigh less, cost less, and reduce consumption and CO_2 footprint.

Dr. Holger Fritsch, Managing Director of Bachmann Monitoring, demonstrated how predictive maintenance can be achieved through artificial intelligence, machine learning, and targeted maintenance planning. In an impressive presentation, he illustrated why smart maintenance is indispensable for maritime applications. Offshore wind farms, for instance, require specialized ships for foundation, cable, and lifting operations, and any failure immediately impacts schedules and budgets. Downtime for a single vessel leads to high costs and can jeopardize an entire project, particularly if the failure occurs at a critical juncture. "This is where the decisive advantage of predictive maintenance comes into play," said Dr. Fritsch. "Smart maintenance combines condition data, clear planning, and targeted measures into a robust strategy that helps prevent critical failures, while also avoiding over-maintenance."

Dr. Fritsch gave a detailed explanation on how data is transformed from raw values into usable knowledge: A process using AI. However, Fritsch emphasized Bachmann's pragmatic approach: Depending on the task, they use Bayesian filters, fuzzy logic, or neural networks, often in a hybrid combination with physical models. "Our goal is always to reduce complexity to the essentials and substantiate decisions with actual substance," Fritsch said. This transforms a flood of data into a tool that ensures availability, productivity, and ultimately, the success of the investment.

Put together: A broad spectrum

The autonomous shipping symposium offered a multifaceted view of the technologies, concepts, and regulatory issues currently driving the industry. From new propulsion solutions and assistance systems, to questions of certification and smart maintenance - both the size of the field and the urgent need for coordinated standards, reliable regulation, and practical innovations became crystal clear.

Participants agreed that the main driver for autonomy is safety, in addition to the increasing shortage of skilled workers. In the long term, autonomous shipping will enable smaller crews, higher fleet efficiency, reduced energy consumption, and fewer collisions. However, it is also expected that the role of the crew will change. The most critical factor in implementing safe autonomous shipping is cybersecurity.

A valuable day

For participants, it was the content that made the day exciting. They particularly appreciated the opportunity to engage in direct dialogue with experts, make valuable connections, and participate in inspiring discussions. The historic warehouse building in Hamburg provided a unique atmosphere that underlined the special character of the event.

»Ships are not just machines; they are floating investments. Availability is not just an option – it's business-critical.«

Dr. Holger Fritsch,
Managing Director of Bachmann Monitoring

The lack of remote-control functionality means that operators of older wind turbines are often unable to perform necessary fault analyses off-site. Even resetting simple error messages remotely is often impossible. Bachmann's VeAccess retrofit easily delivers a comprehensive remote monitoring solution for Vestas V80/90 turbines.

The retrofit package enables targeted fault diagnosis, remote control and troubleshooting – helping to avoid costly on-site service calls. This saves time and reduces operating costs, while significantly increasing turbine availability.

Remote Access Retrofit

THE END OF UNPLANNED SERVICE CALLS

Efficiently planned service calls

VeAccess enables wind park operators to monitor turbine operating status, logbooks, live data, diagrams and parameter changes from any location. High-quality aggregated data is available at any time for dedicated remote fault analysis. The days of sending a service team to the same turbine twice because the necessary spare part was not in the car are gone.

Lower downtime

Thanks to this retrofit solution, many functional operations can be triggered remotely: plant components can be operated manually, and the wind turbine can be started and stopped. In the event of an overspeed shutdown, the Vestas Overspeed Guard can be restarted quickly. This significantly reduces downtime following shutdowns. Additionally, technicians working with the system can make more effective use of their expertise, thanks to time saved on travel.

Sophisticated technology, rapid installation

The VeAccess retrofit solution only uses certified individual Bachmann components. Each hardware module in the nacelle's M200 control system, as well as the M100 I/O system in the tower base, undergoes a 48-hour climate stress test before shipping. Extremely robust, EMC-protected hardware, together with future-proof software, ensures maximum functional reliability over an extended period.

The Bachmann solution can be installed in about three hours and does not require specialist knowledge. This minimizes downtime during retrofitting. Certification-critical functions, such as safety shutdown and load control, are unaffected by remote access, meaning that the system operating license remains unaffected.

Detailed analysis with flexible data recording

The retrofitted remote system facilitates the continuous and complete recording of all plant data, with efficient controller storage preventing data loss. The Scope 3 function, integrated into the M1 WebMI pro visualization solution, enables precise analysis of recorded data. The intuitive visualization makes it easy to display data snapshots. All data points can be configured as triggers. Recorded data can be exported as images, PDFs or CSV files for use in reports.

No open backdoors

Ethernet ports are a possible entry point for cyberattacks. But Bachmann's retrofit solution minimizes risk through the use of the latest security standards, designed in accordance with IEC 62443. The M200 control system includes secure access and user management, which allows the management of user data such as names and passwords, as well as

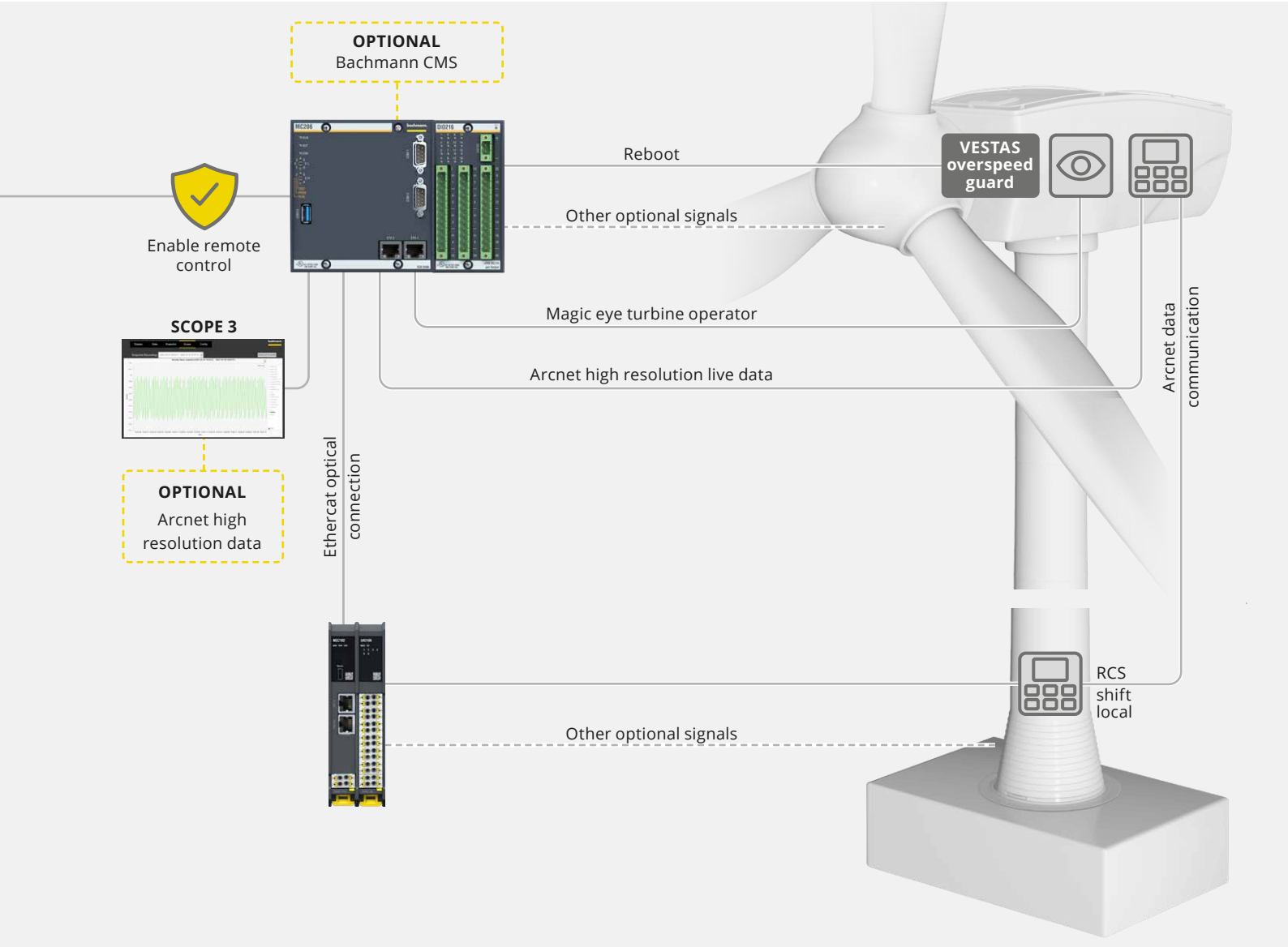
Hardware becomes software – with added value:
Bachmann's web-based remote panel features the exact same layout as the Vestas on-site Service Box. Service personnel can operate the system without additional training. However, operators receive additional useful information from several extra navigation elements, which help them correctly assess system status. And thanks to the additional service command buttons in the Bachmann solution, the team no longer has to memorize complicated key combinations

start and end times. It also offers extensive rights handling for variables and files on the controller.

Open for more

The retrofit solution can be connected to Bachmann's forsiteSCADA via OPC UA. This makes VeAccess a foundation for convenient and secure fleet monitoring. The Wind Turbine Template (WTT) also offers a library interface for implementing special data processing in the C language. If operators have any further requirements in future, they can easily be integrated into the solution thanks to its open structure and extensive protocol support.

» The retrofit does not affect critical functions such as safety shutdown or load control. Therefore, the system operating license remains valid.«



Rapid Prototyping

INTUITIVE MANEUVERS

Kwant Controls, based in Sneek, Netherlands, was voted Frisian Company of the Year 2025. Thanks to its strong innovative process, the maritime propulsion, control, and steering systems manufacturer prevailed against larger regional contenders. This is also high praise for Bachmann: Kwant Controls has relied on efficient software and hardware solutions from Feldkirch for over 15 years.

Kwant Controls uses a rapid prototyping platform, based on the M200 control system, to develop complex algorithms for haptic feedback from control levers.

Kwant Controls also uses the M200 control system from Bachmann for its "CAESAR" platform. This platform is a complete control solution for the propulsion, steering, thrusters, and stabilizers of vessels.

Kwant Controls was one of Bachmann's first customers in the maritime sector, selecting its control systems back in 2009. "Bachmann was much less known in the industry back then. But, in addition to both companies being family-owned, we recognized another major similarity: Our core values are innovation and quality," says Coen de Keijzer, Managing Director and Owner at Kwant Controls.

Reliable control systems

With its CAESAR platform, Kwant Controls offers a comprehensive control solution for ship propulsion, steering, auxiliary thrusters, and stabilizers. The platform regulates yawing, rolling, heaving, and pitching, thus ensuring higher performance, fuel efficiency, and operational safety.

Kwant Controls uses Bachmann's robust M200 control system for the CAESAR platform. In addition to the MX207 and MX213 processors, the individually configured control cabinets contain CM202 CAN interfaces, as well as various analog and digital input and output modules. Redundant installation ensures maximum reliability.

Future-proof investment

Kwant Controls uses commercially available hardware in its solutions. This secures independence for customers and

guarantees a quick supply of spare parts. Coen de Keijzer recalls software engineers' frustration in the pre-Bachmann era: "When the manufacturer updated the control systems in the past, we sometimes had to rewrite the entire software program. That was really time-consuming. With the Bachmann control system, however, our software engineering efforts have decreased significantly because this solution is completely backward-compatible. We can guarantee our customers fast software upgrades and excellent support for future performance requirements."

Rapid embedded board prototyping

Kwant Controls relies on Bachmann to develop complex algorithms for its latest generation of haptic-feedback control levers. Kwant Controls uses a rapid prototyping platform based on the M200 control system to develop these elements. The control algorithm is simulated in Controllab 20-sim using an approximate physical model, which is measured for validation and optimization. Finally, the algorithm is loaded onto the target via Controllab's 20-sim4C and calibrated. "The more complicated the control algorithm, the more finely tuned it has to be," explains de Keijzer. "The Bachmann control system is ideal. With a conventional software implementation on an embedded board, these processes would take up to four times longer." Once the final parameter set has been correctly configured, it can be immediately reloaded into the model, and the control algorithm finalized with the parameters.

Specialists from Kwant are impressed by more than just time saved: They can now also develop embedded firmware for new microcontrollers while creating the control algorithms. With conventional development methods, however, the firmware requirements would first have to be finalized.

In future, Kwant Controls plans to integrate additional systems into the haptic feedback of the control lever, which will enable more intuitive ship maneuvers. "We are considering additional cameras or proximity sensors, for example. But we have to be careful not to integrate too much haptic feedback. Otherwise, there is a risk that operators will be distracted by or misinterpret the signals. That can be dangerous," says de Keijzer. With the rapid prototyping platform and M200 control system, Kwant Controls has an optimal solution for quickly and accurately developing feedback functions as much as they require.

»Thanks to Bachmann, our systems are future-proof. Backward compatibility allows us to guarantee our customers quick and easy software upgrades to meet future requirements.«

Coen de Keijzer
Managing Director and Owner of Kwant Controls B.V.

KWANT CONTROLS

– Headquartered in Sneek (Netherlands)

– Developing solutions for propulsion, steering, thrusters, and stabilizers for all vessel types since 1937

– Solutions represented in 60% of all seagoing vessels

www.kwantcontrols.com

EXHIBITIONS AND EVENTS

INDUSTRY

ALL ABOUT AUTOMATION

Friedrichshafen, Germany
10. - 11.03.2026
Booth: B3-224

MARITIME

ASIA PACIFIC MARITIME

Marina Bay Sands, Singapore
25. - 27.03.2026

WIND ENERGY

WINDEUROPE ANNUAL EVENT

Madrid, Spain
21. - 23.04.2026
Booth: 9-F142

INDUSTRY

IFAT MUNICH

Munich, Germany
04. - 07.05.2026

INDUSTRY

ALL ABOUT AUTOMATION

Wels, Austria
20. - 21.05.2026
Booth: 226

WIND ENERGY

CLEANPOWER CONFERENCE & EXHBITION

Houston, Texas, USA
01. - 03.06.2026
Booth: #3111

INDUSTRY

ALL ABOUT AUTOMATION

Hamburg, Germany
02. - 03.06.2026
Booth: B6 131

RENEWABLE ENERGY

EES EUROPE

Munich, Germany
23. - 25.06.2026

MARITIME

SMM

Hamburg, Germany
01. - 04.09.2026
Booth: B6.307

RENEWABLE ENERGY

SOLAR & STORAGE LIVE

Birmingham, United Kingdom
22. - 24.09.2026
Booth: G1

WIND ENERGY

WINDENERGY

Hamburg, Germany
22. - 25.09.2026
Booth: A4.219

WIND ENERGY

WINDENERGIETAGE

Linstow, Germany
10. - 12.11.2026
Booth: 155

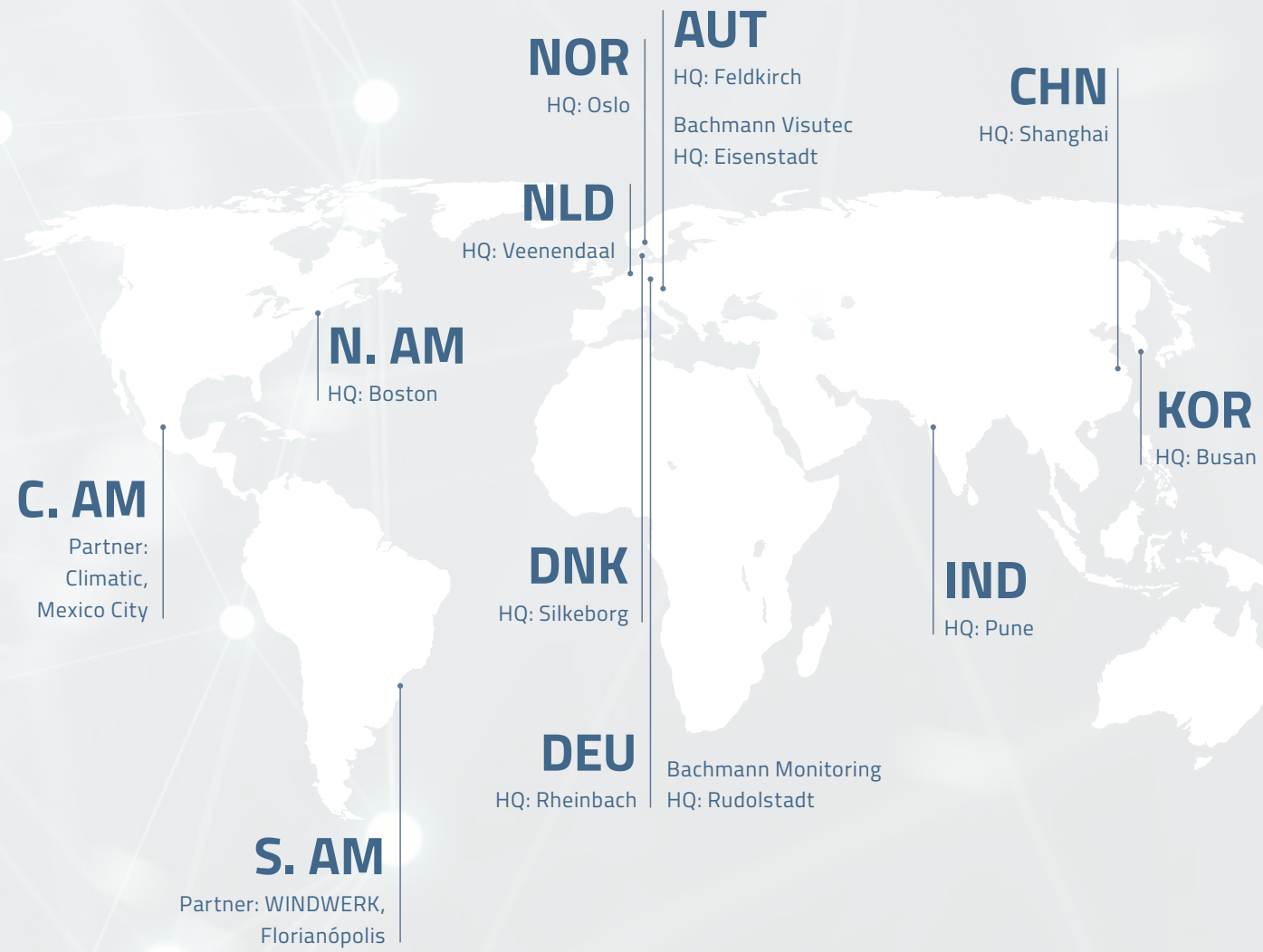
RENEWABLE ENERGY

ENERGYDECENTRAL

Hannover, Germany
10. - 13.11.2026

Find out more about upcoming events on our website.

GLOBALLY PRESENT



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