maritime.application

THE SAFE FUTURE
OF YOUR MARITIME & OFFSHORE PLANT

bachmann.

BACHMANN
KEEPS YOU
ON COURSE

We deliver technology to automate the offshore and shipbuilding sector: Safely, with flexibility and in a modular way

Bachmann electronic offers customers worldwide in the marine and offshore sector sophisticated automation technology. All our activities are focused on the benefit of our customers: We deliver tailored hardware solutions and are guided by the highest standards. Meeting specialized market and customer requirements has long become a standard task for us.

Together with our
CUSTOMERS
we develop perfectly integrated automation solutions

MARITIME & OFFSHORE ESSENTIALS

- Perfect engineering tools
- Certified
- Impressive redundancy
- Maintenance through integrated CBM
- Integrated power management
- Open communication with all standards

... for the maximum availability and efficiency of your ships and offshore plants

CONDITION MONITORING

- Over 15 years of CMS expertise
- Over 6,000 CMS installed worldwide
- The world's first GL certification of a PLC-integrated CMS
- Individual retrofit solutions made to measure

... because a weather forecast on its own is not enough

INTEGRATED AUTOMATION

- One tool
- One hardware
- Open & flexible
- Web-based

... the right solution for every requirement

POWER MANAGEMENT

- Fully integrated solution
- Easily scalable
- Individually adaptable templates
- Measuring, protecting and synchronizing
- Responding in milliseconds

... for developing highly innovative solutions using our templates

REDUNDANCY

- Scalable with standard components
- Network redundancy with warm standby / hot standby
- Maximum availability
- Integrated diagnostics
- Bumpless switchover within one cycle
- Affordable
- Technologically tested

...to ensure an optimum power supply
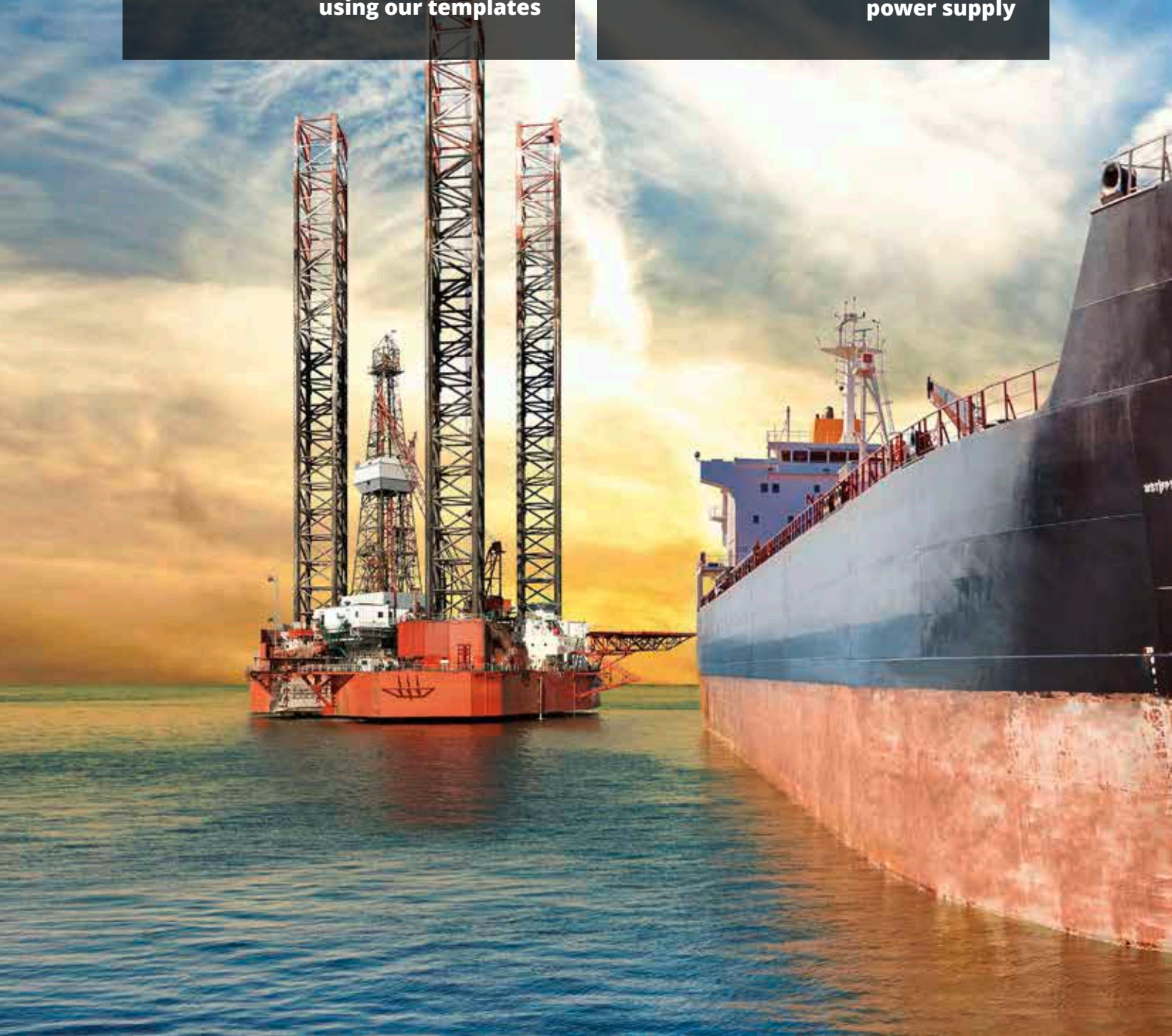
THE SAFE FUTURE
OF YOUR MARITIME AND OFFSHORE PLANT

Everything is under control with

Bachmann system solutions

Our broad and modular product range meets really every customer requirement. We provide you with a homogeneous and comprehensive system solution that also ensures a high level of availability and long-term capability. We offer you everything from a single source and at the highest quality.

Complete ships and offshore plants automated with up to

20,000 I/OS

automated

A system availability over

99.97 %

confirmed by customers

THE BACHMANN
SYSTEM

The automation technology for

maritime and offshore

We understand the big picture and are always thinking ahead for you. Our innovative solutions ensure efficient engineering of your plants. This is what the intelligent automation of state-of-the-art maritime and offshore plants looks like.

TOP TECHNOLOGY WITHOUT LIMITS

Automate your offshore plant with Bachmann, secure in the knowledge that every eventuality is covered. Our innovative automation systems stand out on account of their extraordinary robustness, high performance and open interfaces.

Openness in hardware and software

The M1 system operates as a real-time system. Different open-loop and closed-loop control programs are adapted in modules and run simultaneously in a preemptive multitasking environment. Like the hardware, the software system is also modular and can be structured and extended as required following our »no limits« principle. The controller offers additional reserves for expansions or plant-specific modifications.

Functionality means »ready-to-use«

The modular M1 system offers an extensive range of hardware, consisting of over 200 devices and modules. This system contains a large number of configurable modules for all necessary plant functions, such as visualization, networking, closed-loop control and diagnostics, to provide you with all the basic functions from the start. We place great importance in ensuring that all tools are developed according to international standards, and can also be integrated and parameterized flexibly.

Equipped for challenging climates

The ColdClimate modules of Bachmann electronic are the solution for all applications in demanding climatic conditions, especially where maximum plant availability is critical. The Cold-Climate modules are first choice, especially when demanding environmental conditions (e.g. temperature, air humidity, salt spray) are involved. For you this means: Safe operation, even with extreme transient temperatures from -40 to +70 °C, and reliable continuous operation guaranteed in the temperature range from -30 to +60 °C with condensation.
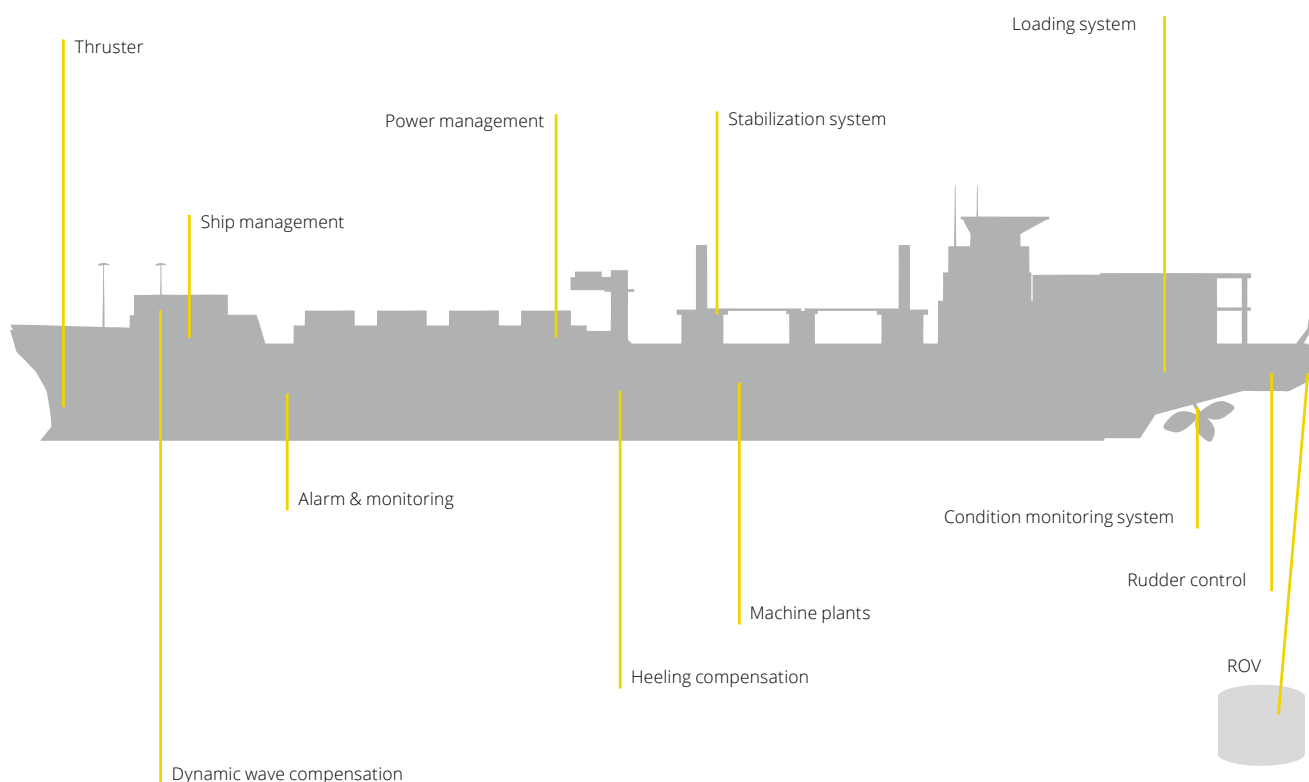
ColdClimate
–40 to 70 °C

System Concept

Scalable and open

In order to minimize complexity and maximize ease of maintenance, all components of the M1 controller system are consistently developed as part of a modular system. In this way, optimum scalability is ensured for a wide range of requirements. The M1 system perfectly combines the openness of a PC-based controller with the reliability of industrial hardware platforms. A state-of-the-art system architecture designed for effective networking capability enables it to be integrated easily in the area of the controller and plant peripherals.

▼ Regardless of the type of ship or offshore and marine application involved: We offer you products for tailored solutions. Meeting highly specialized requirements has long become a standard task for us.

Thruster

Loading system

Power management

Stabilization system

Ship management

Alarm & monitoring

Condition monitoring system

Rudder control

Machine plants

Heeling compensation

ROV

Dynamic wave compensation

Certified systems

Internationally accredited test institutes verify the conformity of our Bachmann systems with the most important global standards and thus provide approval for the most demanding applications.

VIRTUAL COMMISSIONING OF SHIPS THROUGH HIL-SIMULATION

Model-Based Design

Simulation is an issue that virtually all machine and plant builders have to consider. The absence of ways to implement a straight-forward simulation has up to now prevented it from being included in the development process. However, companies that do explore this approach are able to solve tasks that were previously just a remote possibility. Bachmann's technology gives machine and plant builders the possibility to simulate small tasks right through to complex ones.

Highlights of model based design

- Development of automation algorithms (open-loop and closed-loop) directly in Controllab/20-sim or MATLAB® / Simulink®

- Automatic code generation and transfer to the M1 controller

- Online communication between the development environment and the PLC program for convenient parameterization and diagnostics

- Integrated simulation modes for the I/O modules used in the application

- Integrated interfaces to visualization systems and other PLC systems

- Integrated interfaces to automation programs created in conventional programming languages (IEC 61131-3, C/C++)

- Support for hardware-in-the-loop systems (HIL)

The challenges placed on the automation in offshore applications and on ships in particular are constantly increasing. The increasing size of plants and the introduction of new technologies have also increased the complexity of operational control programs. New development techniques for creating these programs are needed in order to minimize the development effort required on the one hand, and to bring out technically mature and highly available plants on the other. This is where the benefits of simulation for the virtual commissioning of ships and offshore plants are clear to see.

Control task

A ship control system consists of software pro-grams for the individual plants. Input signals, such as commands, positions, pressures or temperatu-res are read, processed and output to actuators such as motors, pumps or valves. These programs can be simple but also increase in complexity the greater the level of automation required.

Hardware-in-the-loop (HIL) simulation

Bachmann M1 controller can process the cont-rol and simulation software at the same time. Developers can carry out function tests on sub-systems right through to complete installations from their desktop.

Cost efficiency

»Getting to market faster with the better solu-tion« – this is the basic paradigm of our global economy. The many programming options of the Bachmann M1 automation system help here. Calculable investments that are also inexpensive compared to their benefits pay for themselves quickly. The customer-friendly license model of M-Target for Simulink® does not involve any unit-based purchase of licenses and thus has no negative effect on product pro-fitability. 20-sim can be purchased directly from the manufacturer and has the M1 already integ-rated as a target.

Model Based Design
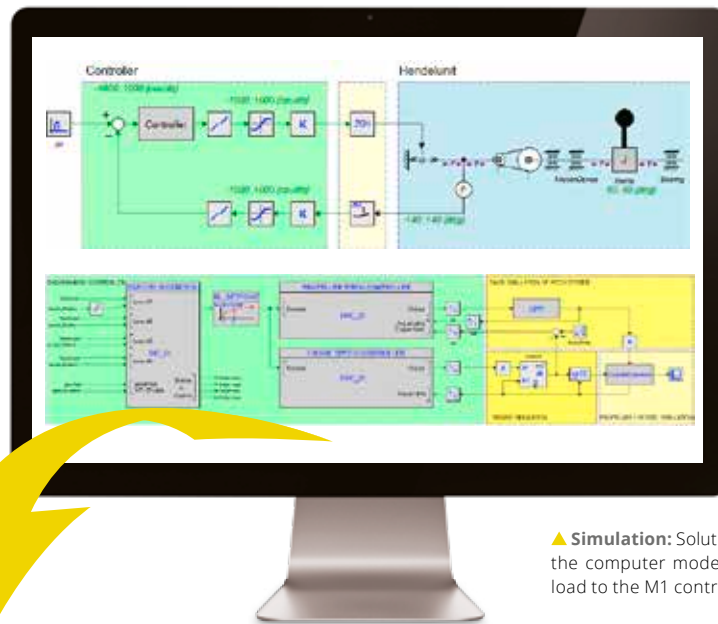
▲ **Simulation:** Solution development on the computer model and direct download to the M1 controller.

The Simulation Steps

1. Manual test
The individual functions of the plants are tested manually by means of test lists via the visualization.

2. Function simulation
Simple simulations in which the runtime program is tested can be created with the PLC development tool according to IEC 61131.

2.1 Model-based simulation
This simulates the process features and the plant behavior. During the development of a software more process knowledge is required in order to increase its quality. The development tools used mostly consist of higher-level programming languages such as C/C++. Model-based development environments such as MATLAB® / Simulink® and 20-sim are used for very complex tasks or dynamic simulations. Libraries which emulate or simulate mechanical processes are provided in model-based development environments.

3. Determining the remaining lifespan
The results of the remaining lifespan calculation which determines the maintenance intervals can also be tested with the simulation. These can be used as a basis for a CMS expansion.

4. Code generation
The automatic code generation further increases the quality of the software as the process once tested always runs immediately. The simulation program can be generated from the same measuring point list and thus prevent transmission errors.

5. Automatic test
The visualization is operated by a test sequencer which automatically processes the functions of the test list. This enables all functions to be reproduced. The result is stored in a test log.

Shorter commissioning times
Any errors that occur are restricted to the wiring. The onsite commissioning of ships and plants starts with a tested software and visualization, thus considerably reducing the costly commissioning time required. Development engineers are hardly required on the installation site any more, thus considerably reducing costs for commissioning and travelling. Planning and keeping to schedules become easier. Dangerous situations for people and machinery on ships can also be prevented.

Best features of the M1
Thanks to its outstanding features, the Bachmann M1 controller enables the simulation to be run simultaneously with the plant program on the same controller. Even 'smaller' tasks can now be tested easily by simulation, thus making it possible to achieve a high standard in the quality of the software.

ALL-IN-ONE ENGINEERING

SolutionCenter

The Bachmann SolutionCenter represents a genuine milestone in the reduction of engineering costs. All areas of the engineering process are covered as part of a single complete software solution: configuration, programming, control, motion control, communication, safety, visualization, as well as testing and commissioning.

### SolutionCenter – All-in-one engineering tool

The SolutionCenter supports all aspects of the engineering for marine applications and perfectly integrates with Bachmann devices and systems. It was designed in collaboration with experienced users and allows effective engineering in all phases. Through the plugin concept, the SolutionCenter enables necessary functions or user-specific requirements to be added at any time. This can be done either by selecting a third-party plugin from the extensive offering or with in-house developments.

Component Manager

More than ever, modern marine plants consist of complex mechatronic systems which can only be implemented through the close collaboration of all the engineering sciences required for the process. This complexity is handled by breaking down the plant into logical function units also known as components. Bachmann's Component Manager is designed for this task. The tool allows you to form systems from different components, which are represented as software modules. Components can not only be created in the optimum programming lan-

▼ **Component Manager:** Clear application display in the Solution-Center.


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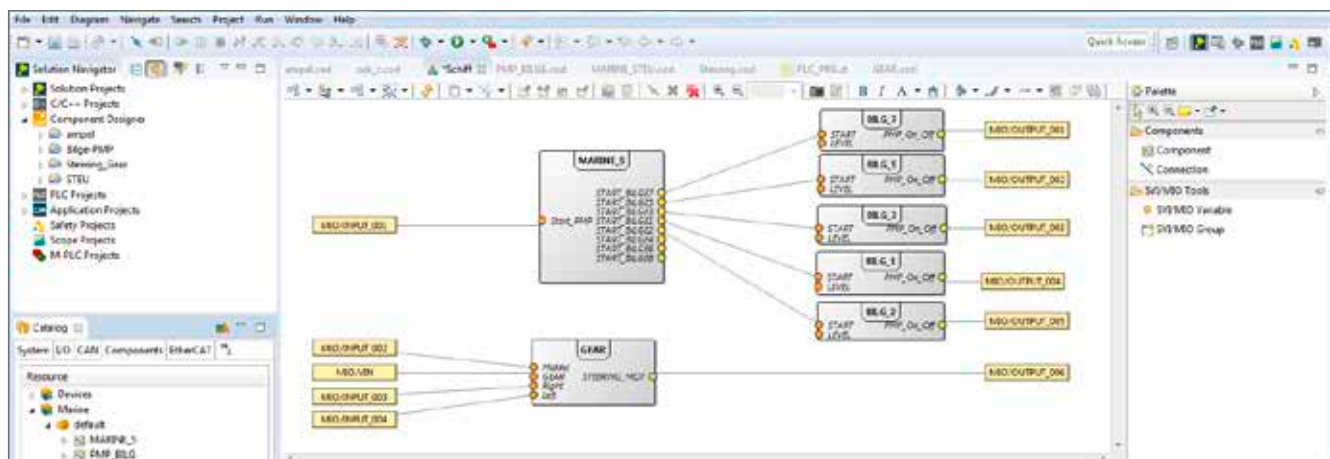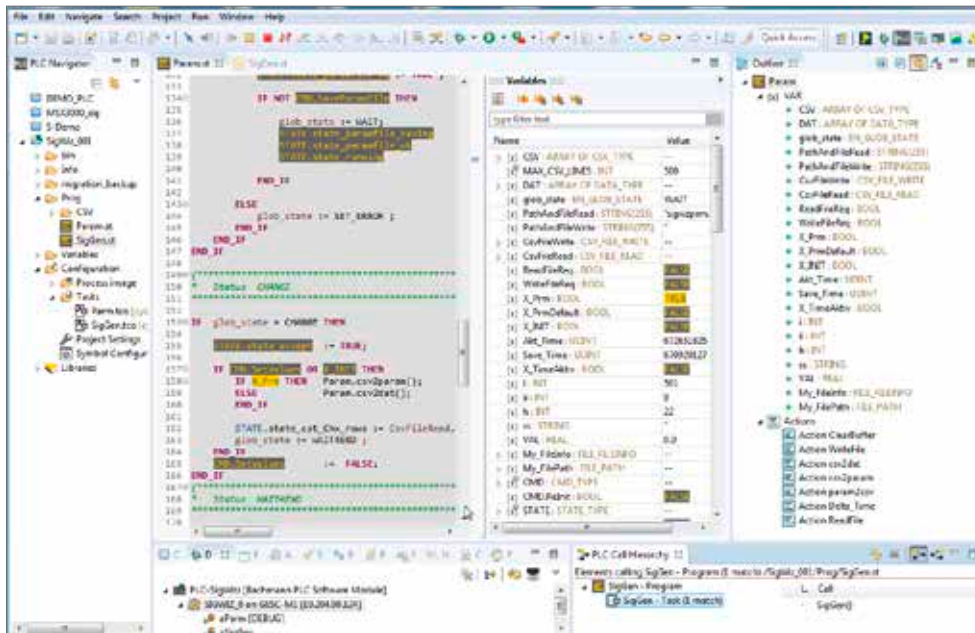
◀ **PLC Developer:** Modern editor for IEC 61131-ST fully integrated in the SolutionCenter.

guage for your task but also purchased and reused. This makes it possible to add new custom variants, product versions or new functions (different software module combinations, additional modules,...) without modifying the existing software. This methodology makes use of modern tools to support the engineering process. Through the plugin concept, Solution-Center makes it possible to use all common versioning systems (SVN, GIT,...) and thus manage the entire history of the project with all its components.

Programming tools

SolutionCenter provides modern programming environments for creating the software modules. Automation tasks and requirements can be addressed both with the new PLC Developer tool from Bachmann as well as with the proven M-PLC Tool in IEC 61131. Programming in C/C++ at the same time in the form of autonomous modules or as libraries for the PLC environment is also possible. Simulations and closed-loop control tasks can be modeled and simulated with MATLAB® / Simulink®. The
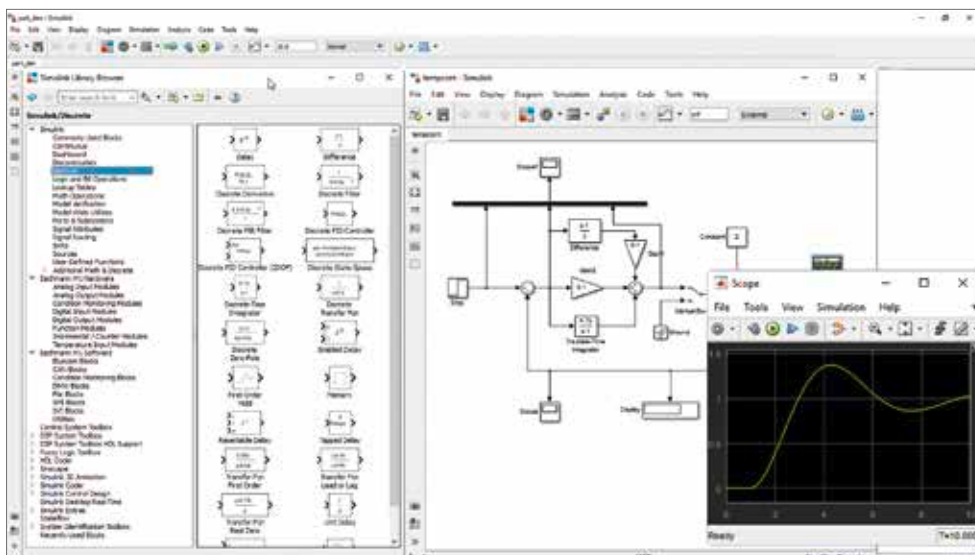
◀ **MATLAB®/Simulink®:** Development of open and closed-loop control programs for the M1 using the M-Target Toolbox.
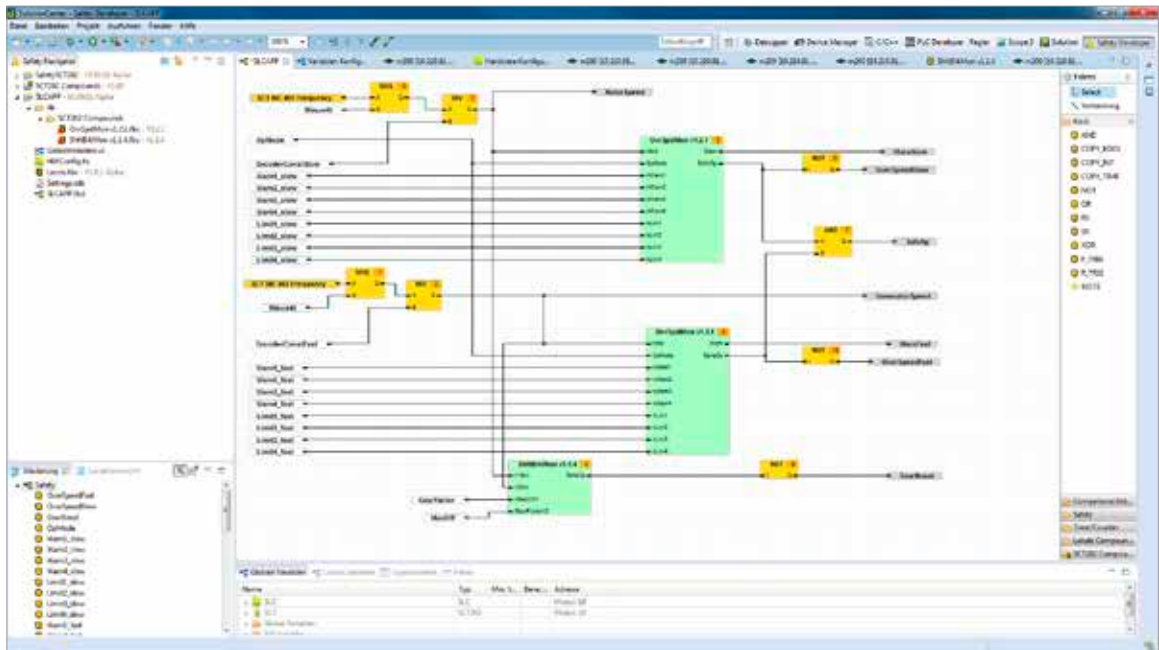
▼ **Seamless integration:** The complete integration in the SolutionCenter reduces the time required for the configuration and reduces downtimes, thanks to the simple remote diagnostics and onsite troubleshooting.

M-Target Toolbox and interface developed by Bachmann ensures perfect integration with the M1 automation target system. Extensive libraries are available in any programming language for a variety of tasks.

Test/quality/simulation

Quality assurance tests must be carried out during and after software development. Solution-Center supports the programmer while performing extensive software test procedures (unit test, static code analysis …) as well as when testing the application software. The component-oriented design of the application program enables targeted-testing. Software can be tested as a complete application or as individual software modules. For these tasks, processes based on CSV tables, as well as extensive processes such as hardware-in-theloop (HIL) are available.

Security/safety

Plants in the energy sector must comply with stringent security and safety standards. This involves both the area of unauthorized access to the controller as well safety shutdowns in dangerous conditions. SolutionCenter allows the configuration of extensive security features and provides the Safety Editor – a user-friendly CFC Editor for programming the safety controller integrated in the M1 system. A wide range of libraries are available for the rapid implementation of the safety application. This includes the exchange of variables with the operational control program.

Communication

Modern plants are no longer possible today without the implementation of a network. The M1 controller supports all commonly available networks, fieldbuses and protocols, such as

Ethernet TCP/IP, PROFINET, EtherCAT, CAN bus or Modbus, IEC 61400-25, IEC 60870-5-104 or OPC UA. The configurators required are also included as well as diagnostic and testing tools.

Visualization

The increasing complexity and constantly rising level of automation in different plants require the use of HMI and SCADA systems that support both very small applications, with only a few dozen information items as well as large-scale plants, with around 100,000 process variables. It must be possible to adapt visualizations quickly and effectively to the requirements of the application to support these requirements. SolutionCenter provides solutions for this based on standard technologies (OPC UA, HTML5 …).

Diagnostics

In all engineering phases, the SolutionCenter offers an interface to all the information about the plant. With dynamic processes, the display of physical variables as a numerical value is not enough. The »Scope 3« software oscilloscope enables automatic long-term archiving (logging) as well as the automatic recording of sporadically occurring events in relation to other process variables. The acquired data can be archived in a database for subsequent processing. »Scope 3« is fully integrated in the SolutionCenter. This enables, for example, Scope recording configurations to be assigned to a project and kept in the integrated version manager.

Operational control

During the operating phase, SolutionCenter provides support with a clearly arranged display of all ships. The actual operating state as well as all the necessary parameters are clearly shown. SolutionCenter provides all turbine data and information required for the operation of the plant.

▲ **Fast commissioning, lower service cost:** Using Scope 3 to make the plant transparent quickly and down to the microsecond range.

Bridge

- Alarm & monitoring
- Configuration
- Information management
- Remote diagnostics
- Teleservice
- Simulation
- Cruise control
- Maneuvering controls
- Automatic track keeping
- Autopilot

Cabin

- Alarm & monitoring
- Extended alarm system
- Information system

Deck

- Active heave compensation
- Cranes
- Winches
- Gangways
- Cable drums
- Trenchers
- ROV
- A frames

Machine Control Room

- Alarm & monitoring
- Dynamic positioning
- Energy management
- Drive control
- Rudder control
- Ship automation general
- Diesel electric drive control
- Transient recorder

Machine/Cargo Room

- Anchor & winch control
- Ballast compensation control
- Condition monitoring
- Motor control
- Fuel conditioning
- Process control
- Water treatment

Network 2

Network 1

2nd Master CPU (optional)

Connection to I/O stations

CANopen®

MODBUS

NMEA

SAE J1939

PROFI **BUS**®

FAST BUS

Connection to I/O stations
or third-party system

CANopen®

MODBUS

NMEA

SAE J1939

PROFI **BUS**®

FAST BUS

bachmann.
AutomationSystem

bachmann.
SolutionCenter

CMS
Condition
Monitoring
System

MOE
Maritime&Offshore
Essentials

**Power
Management**

**Redundancy
Control**

**Model Based
Design**

Safety Control

**ColdClimate
–40 to 70 °C**

SCADA
atvise

BUMP-LESS BACKUP IN CASE OF FAILURE

Redundancy Control

Bachmann automation solutions stand out on account of their highly robust design and maximum availability. Nevertheless, no single system can guarantee complete freedom from failure on its own. The use of a redundancy system enables you to increase the availability of your installation or ship effectively and sustainably.

Malfunctions and failures in important operating components reduce the uptimes of machines and plants. In addition to this, they often lead to consequential damage and lengthy repairs. This involves considerable costs, and the production downtime leads to financial losses. Redundancy systems increase the capabilities of automation systems through the feature of single fault tolerance. This makes it possible to ensure continuous productivity – even while maintenance or modifications are being carried out on the plant – 24 hours a day, 7 days a week. Bachmann's redundancy solutions enable you to increase the availability of your plant effectively and sustainably: System variants that are tailored to meet any particular requirement enable you to optimize productivity and operational reliability. The seamless embedding in the proven hardware, engineering and programming concept already in place, together with the robustness of tried and tested Bachmann components, guarantee the highest level of operational reliability, thus maximizing yield. This optimum combination not only guarantees single fault tolerance throughout but also multiple fault tolerance in many cases.

▼ Integrated network diagnostics makes the actual status available at a glance.

Redundancy Control

Hot standby redundancy

- Network redundancy included
- Two master CPUs
- Automatic synchronization of master CPUs
- Bumpless switchover
- Redundancy cycles up to 1 ms possible
- Automatic switchover between variables and process value sources within one PLC cycle
- Time synchronization of all stations
- Configuration and monitoring in the SolutionCenter
- Enhanced diagnostic and programming interfaces for monitoring and evaluating the redundancy status
- Freely adjustable switchover time, automatic switchover in the event of a fault

Short switchover times

The switchover time is a quality feature of a network redundant system. Typical systems often operate using a ring topology. In the event of a failure the network devices reroute the data packets. However, the detection of a fault and the subsequent switching takes time. The redundancy solutions from Bachmann directly integrate the detection and switchover operation in the communication end points. This approach allows considerably better switchover times, and any topology can be selected thanks to the comprehensive Ethernet conformity.

Fault detection integrated in the end points

Another benefit of the integration is the voting mechanism used by all Bachmann terminal devices. After being configured once in the application program, redundant process variables here can be used and processed as a single variable without having to manually read or write the values twice. Management and fault detection are completely handled by the system, thus reducing the workload for the user.
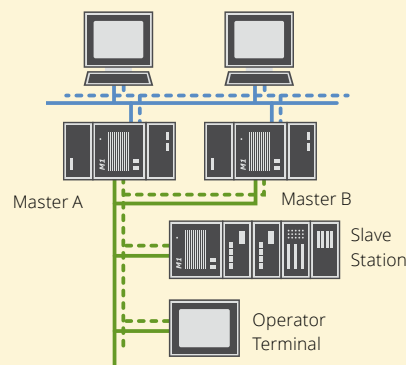
Scalable and cost efficient

With Bachmann systems, redundancy can be tailored to meet the requirements at hand. The use of standard components offers a wide choice of powerful CPUs which can communicate with the substations either via copper or fiber optic connections. Combined with the product variants, this results in the most economical solutions – from simple network redundancy to protection from communication failures, right through to the virtually fully available system.

Warm standby redundancy

- Network redundancy included
- Two master CPUs
- Diagnostic interface for monitoring and evaluating the redundancy status
- Slaves decide the CPU from which the data packet is to be used (voter)
- Configurable switchover time
- Synchronization of master CPUs not integrated
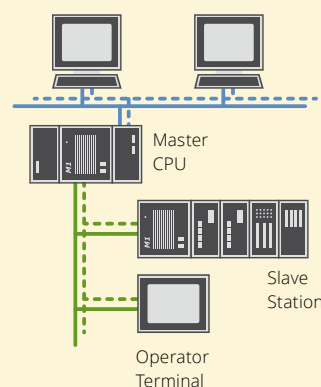
Network redundancy

- One master CPU
- Redundant communication (cyclical and acyclical)
- Fully autonomous, double communication guarantees optimum reliability for any selected transmission medium (copper/fiber optic)
- Redundant Ethernet-based networking, full support of TCP/IP-based parallel communication
- Freely selectable network topology: Radial, linear, ring and combinations
- Simple configuration in development environment, integrated diagnostics (status, quality)
- Programming interface, libraries and system variables for easy creation of applications
- Network switchover in the same PLC cycle
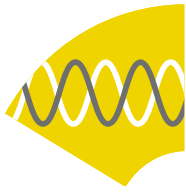
GRID MEASUREMENT AT THE HIGHEST LEVEL

Initiatives such as the All Electric Ship (AES) require the increasing stability and controllability of shipboard energy grids. Capacity bottlenecks must always be prevented and the ship's engines must always have power available. The coordination of grid protection, the hard real-time monitoring of loads, and the fast and targeted supply of electrical energy are fundamental requirements here.

Fully integrated and still easily scalable

Several technology modules are available for the power management alone. The GSP274 module makes Bachmann's experience in the automation of decentralized energy generation units available for maritime applications. It

ensures the safe, reliable and automated synchronization of generators to the ship's power grid. For this the module measures the grid at three points and actuates two circuit-breakers via a relay output, taking the switch delay into account. The GMP232 grid measurement and protection module from Bachmann integrates

Power Management
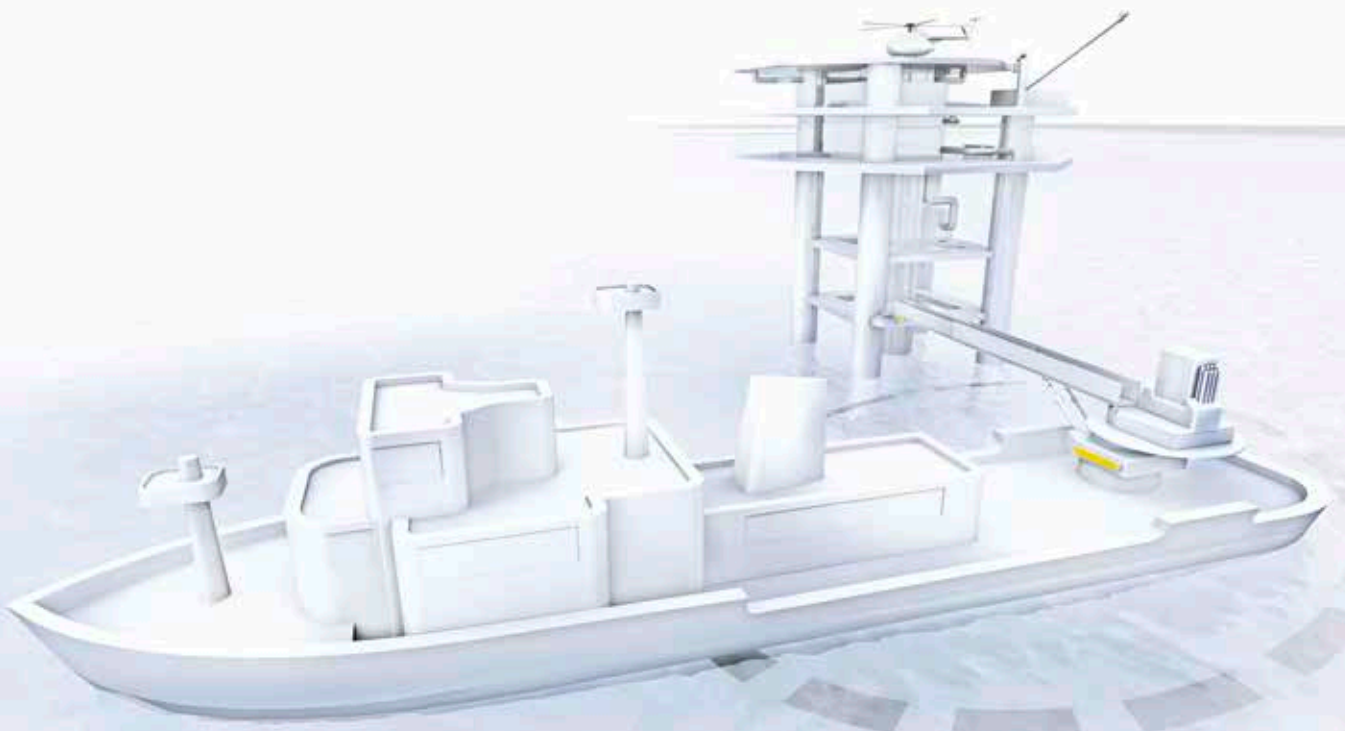
the protection and monitoring functions in the „conventional» control tasks. The third module GM260 can be used for measuring the grid. Software modules with standard and easy to operate interfaces round off the package.

Maritime power supply

A central power management control unit enables you to implement advanced real-time power management solutions with remote technology modules connected by fiber optic cables. This ensures that the coordination between the power generation units and the dynamically changing load demands is straightforward and reliable.

Tasks of the power management system

The system must ensure that sufficient load reserves are always available at the busbar. In order to do this, generators are automatically started and synchronized, and loads with a low priority disconnected. To detect faults with a high level of accuracy, the GMP232 and GSP274 are equipped with an integrated data recorder. This enables up to 16 measuring channels to be recorded with precise synchronization for four

seconds at a maximum resolution of 100 µs. The recording can be triggered remotely or activated in the event that predefined limit values are exceeded. The measuring data is then available in the SolutionCenter or as an exportable file in the Comtrade format. In the event of a fault, this makes it possible to safely and reliably reconstruct the causes without any additional effort.

High performance PLC

To handle all these tasks, the M1 marine automation system comes with a high performance processing unit and offers high speed and reliable networking options at the same time. The M1 automation system allows a high degree of flexibility whilst still ensuring a high level of functional integration at the same time. Development engineers can thus be certain that they can even implement non-standard tasks. Operating and maintenance personnel appreciate the safe and reliable diagnostic options for system events. The data can be fully integrated in the central alarm & monitoring system. This therefore reduces maintenance work and enables abnormal system loads to be detected early on before they can cause significant damage.
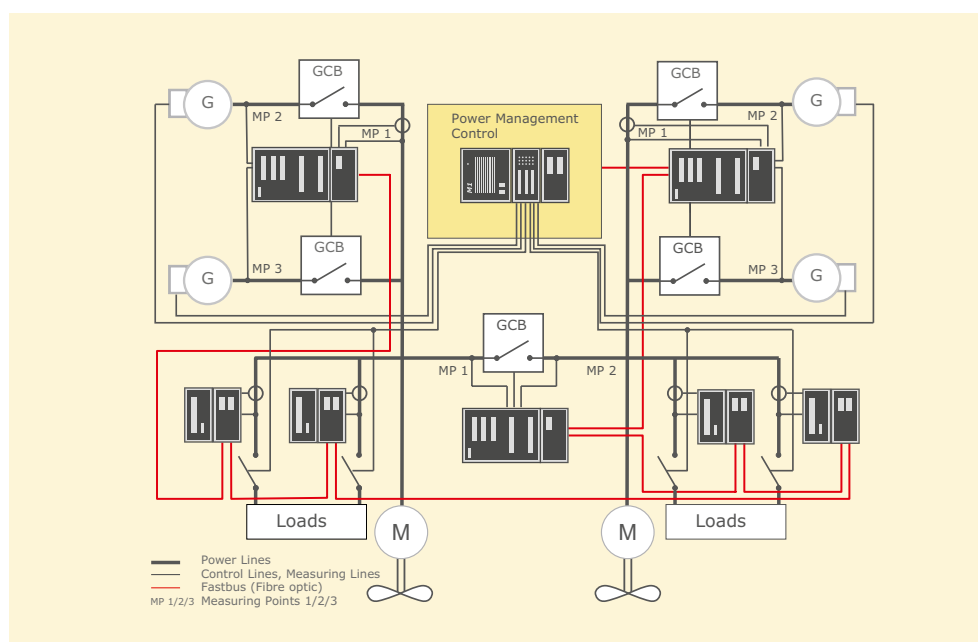
GSP274 – functions

- **Grid measurement**

- **Grid voltage:** 480 V

- Additional to the GMP232 module: **4 additional voltage inputs** (total 7; GMP 3), **1 additional current input** (total 4; GMP 3)

- **Grid monitoring** Additional to the GMP232 module – Q/V protection (reactive power/ undervoltage monitoring)

- **Event lists**

- **Data recorder**

- **Synchronization:** Monitoring of synchronization conditions

- **Certification – VDE AR 4105:** Grid and system protection; requires two-channel measuring and tripping; mandatory in Germany when connecting energy generation plants to the low-voltage grid
  Unit certificate FGW TR3: Simplifies the issuing of plant certificates. Plant certificates must be issued in Germany in order to obtain the »system services bonus« (= higher feed-in tariff).

Power Lines
Control Lines, Measuring Lines
Fastbus (Fibre optic)
MP 1/2/3 Measuring Points 1/2/3
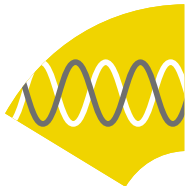
HYDRAULIC VALVES FULLY UNDER CONTROL

Proportional Valve Amplifier

Hydraulic systems are becoming increasingly more technically sophisticated with a growing need for the electronic control of their components. Hydraulic valve amplifiers normally control valves by means of pulse width modulation (PWM). This enables both the size of the amplifiers as well as their power dissipation to be reduced. The proportional valve amplifiers of the PVA200 series from Bachmann electronic are equipped with a state-of-the-art PWM output circuit with up to 8 channels for current regulated control. This integrated solution provides the user with a host of benefits: maximum output with a minimum size and minimum costs for commissioning and maintenance.

The controller normally sends the appropriate control commands to the hydraulic valves. For an electromagnetic hydraulic valve it requires either a position control with two positions (open/closed) or a standard analog signal (0-20 mA) to define a setpoint for the amplifier. The direct connection of the valve coils to the PVA200 module of the controller is an alternative possibility. Its PWM output carries out the proportional position control directly. The current regulated by the PWM signal through the coils corresponds to the force that acts on the valve piston. This moves to the required position and thus regulates the required quantity of hydraulic oil. Using the PWM technology requires no adaptions to the valve coil: The piston moves proportionally to the current flow. Besides the efficient control of the current, it is also possible to overlay it with a dither, make corrections to the characteristics, or compensate the underlap and overlap, as well as limit the ramps and provide protection from short circuits.
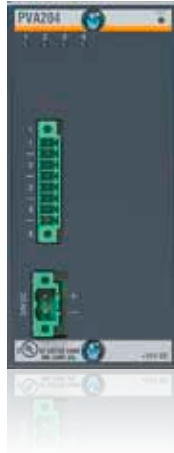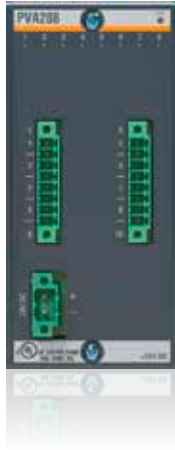
Full control

The PVA200 modules are designed to control proportional valves with one coil, bipolar coils or two coils directly without an additional amplifier. With a mounting width of only 55 mm, the PVA208 module can thus control up to eight coils. The current regulated control automatically compensates the temperature of the coil resistance caused by self-heating or changes in oil temperature. The flow characteristics can also be linearized as required with a freely configurable curve with up to 20 interpolation points for each coil.

Problems solved

Stiction and hysteresis are known problems with continuous valves. This can lead to erratic and unpredictable behavior in a hydraulic proportional valve. The stiction prevents the movement of the valve spool if the changes of the input signal are too small. When the signal finally becomes large enough to initiate movement, the piston will tend to overshoot the position required for accurate control. Hysteresis is the tendency for the spool shift to be different depending on whether the input signal is increasing or decreasing, even when the input values are identical. This problem is solved through the use of dither. Dither is a rapid, small movement of the spool around the desired position. It is intended to keep the piston moving to avoid stiction and average out hysteresis.

Benefits for the user

The PVA200 modules generate a constant superimposed dither current irrespective of the output current. Both the dither frequency as well as the dither amplitude, which can be between 0 to 30 percent of the rated current are set independently of each other. The dither can thus be optimally adjusted to the particular valve and to the characteristics of the hydraulic system.

Curve correction and configuration

- Characteristic curve correction with up to 20 support points per coil
- Tabular or graphical input of support points
- Adjustable current and flow (accuracy +/- 5 mA)
- Adjustable rising and falling ramps (0.1 s to 10 s)
- Adjustable dither amplitude (0 to 30 % of the rated current)
- Transparent current management in SolutionCenter
- Fault monitoring, short circuit and overload protection

	PVA204	PVA208
Valve types	Unipolar coil, bipolar coil or valves with 2 coils	
Coils	4/2/2	8/4/4
Voltage	24 VDC (18 to 34 V)	
Coil current	2 A / 2,5 A / 2,5 A	1 A / 2 A / 2 A
Current-regulated	Yes, ±5mA accuracy	
Dither	Adjustable from 0 to 30 % in 0,1 % of I_{Nenn}	
Dither frequency	40 to 500 Hz (in 5 Hz steps)	
PWM frequency	Fixed 50 kHz	
Coil supply voltage	24 VDC (18 to 34 V)	

SAFETY WITHOUT COMPROMISE

Modern safety solutions using a programmable safety controller make it possible to implement functions that go far beyond the conventional emergency-stop chain. Bachmann offers a complete safety package that is successfully used in a wide range of different applications under the toughest conditions.

In modern machine and plant building, the protection of personnel and systems is regulated by the new Machinery Directive. This directive and the associated safety standards stipulate the use of the latest methods and measures in the implementation of safety devices in order to ensure the optimum protection of people and goods. In addition to this, each safety component is developed and tested under the supervision of a certification body. Operators of offshore installations and also shipping companies not only benefit from the increased personal protection provided but also benefit financially. Critical signals can already be acquired and

evaluated using several sensors. An approved component such Bachmann's »safety control« PLC, combined with the integrated testing and monitoring functions, eliminates the need for multiple acquisition whilst keeping life cycle costs low.

Safety engineering under control

The safety components of Bachmann are ideal for use on ships and offshore plants. Operational management, control, safety engineering and operating devices are perfectly matched and offer open communication. The fastest possible response times, intuitive operation

and comprehensive diagnostic options guarantee the highest possible level of safety. All Bachmann safety modules are certified with the highest safety category SIL3 and PL3 for machines and systems. The safety modules can be arranged within the plant control system as required, thus enabling the implementation of individually tailored solutions. Safety channels that are not required can be used as standard digital I/Os without any restrictions. Safety relays can be replaced thanks to the 2 A outputs of the remote SDO204 output module. This saves space, wiring effort and additional costs. With the integration of the Safety Developer in the SolutionCenter engineering tool, Bachmann makes safety programming easy for the user on the basis of established standards such as IEC 61131-3 and PLCopen Safety.
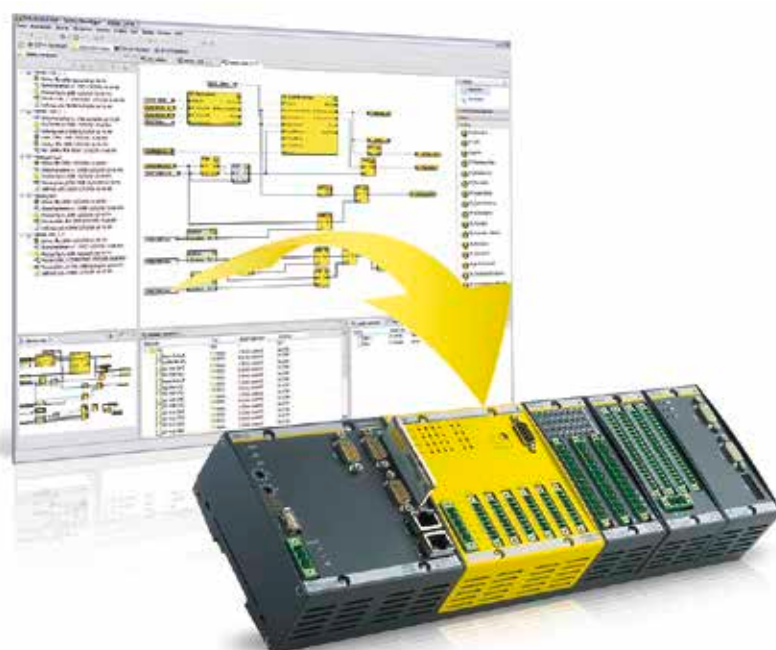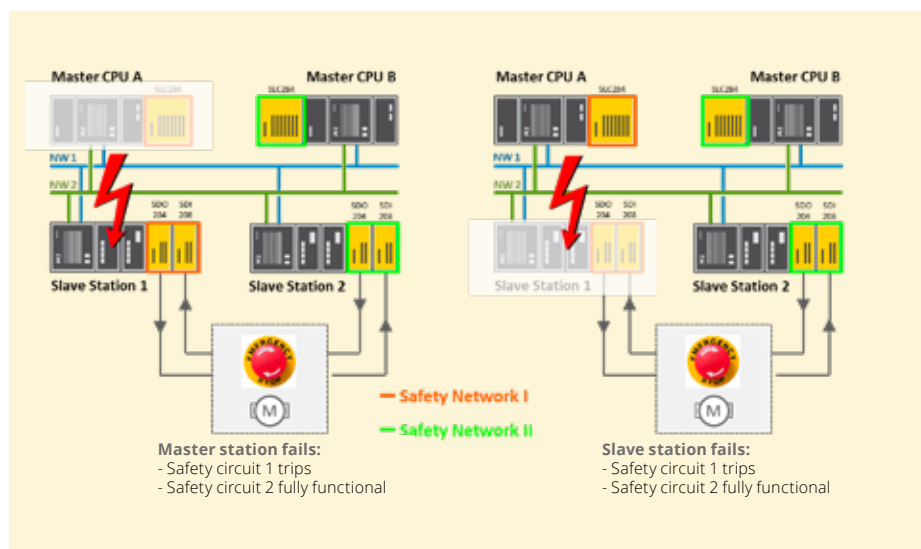
Keeping it safe with Bachmann

All the safety modules of Bachmann, together with the necessary programming tools and function blocks, have all been certified according to the relevant standards by the TÜV Süd certification body. UL508 approval also ensures safety when operating in North America. All modules are available as coldclimate versions. Safety is thus also guaranteed in extreme environmental conditions.

Benefits for manufacturers and plant operators

Programmable safety engineering makes practical implementation and daily use easy. It enables the secure monitoring of all the internal states of an installation during operation, including the safety circuits, also via teleservice functions. Bachmann offers you tailored solutions based on the experience gathered from the successful use of control components in offshore installations all over the world.

Safety Control

▼ Fault tolerance

— Safety Network I
— Safety Network II

Master station fails:
- Safety circuit 1 trips
- Safety circuit 2 fully functional

Slave station fails:
- Safety circuit 1 trips
- Safety circuit 2 fully functional

Safety standards and regulations

- IEC 60945
- IEC 61508
- ISO13849
- IEC 62061
- EN 61511

CONTROLLERS WITH LONG-TERM AVAILABILITY IN SHIPBUILDING

Saving Resources

The service life of ships and offshore platforms is normally meant to last for decades. This means that the automation systems have to be available for a very long time as well. Long-term availability here primarily means two things: Firstly the long service life of the components and secondly, the possibility to easily replace hardware modules or make system enhancements to hardware and software even after 15 or 20 years.

The maintenance of the availability of onboard machinery and plants is always the key objective. For this the automation components must be able to run continuously in failsafe operation. This requires AAA quality and a proven high level of reliability. If a device replacement is nevertheless required, the controllers must be 100% compatible both mechanically as well as functionally. Functional compatibility is important so that no software adaptions are required when a module is replaced. The controller must be mechanically compatible so that the new device can be replaced and connected 1:1 in the existing system.

Quality standards

Highest quality standards in product development and manufacturing are the foundation of long lasting automation components. At Bachmann, a quality assurance system to ISO 9001 has already been in place since 1996. The development standard based on the V model, in which each development phase has a corresponding test phase, has already been in place at the company for 15 years. The detailed and complete documentation of all processes in development and production gives Bachmann still today easy access to articles over 20 years old, so that they can be produced as repair spares according to the same standards and processes as for the latest products. Bachmann designs and manufactures its test equipment itself. The in-house development of test equipment ensures that testing and measurement processes meet the latest technological and normative standards as well as providing the possibility to test if necessary older equipment which has to be delivered as replacements for repairs.

Intelligent component management

A module is only as good as the components it consists of. That's why Bachmann only relies on high quality components from reputable suppliers. All incoming components also have to meet a host of other criteria as well as providing the basic function. In an extensive process, a team of experts examine components in terms of supply security, quality, failure probability,

price, identification, packaging, approvals and naturally correct operation. Their processing by the manufacturing department is inspected and the development department carries out function tests up to the limit of the load tolerance. Incoming goods tests are then defined and audits are carried out with manufacturers and suppliers if required. Only when the result reports do not show any objection to the use of the components does the automation specialist release them in the article master data for the defined applications. Through intelligent supplier management, Bachmann ensures the long-term availability of each individual component by using only reliable manufacturers and robust technologies as well as running a second source strategy. All components are also monitored in a database in relation to their life cycle, which can lead to warnings like »do not use for new developments« right through to the active replacement through redesign. Bachmann thus ensures that all required components, even after 15 or 20 years, are available to make replacement equipment.
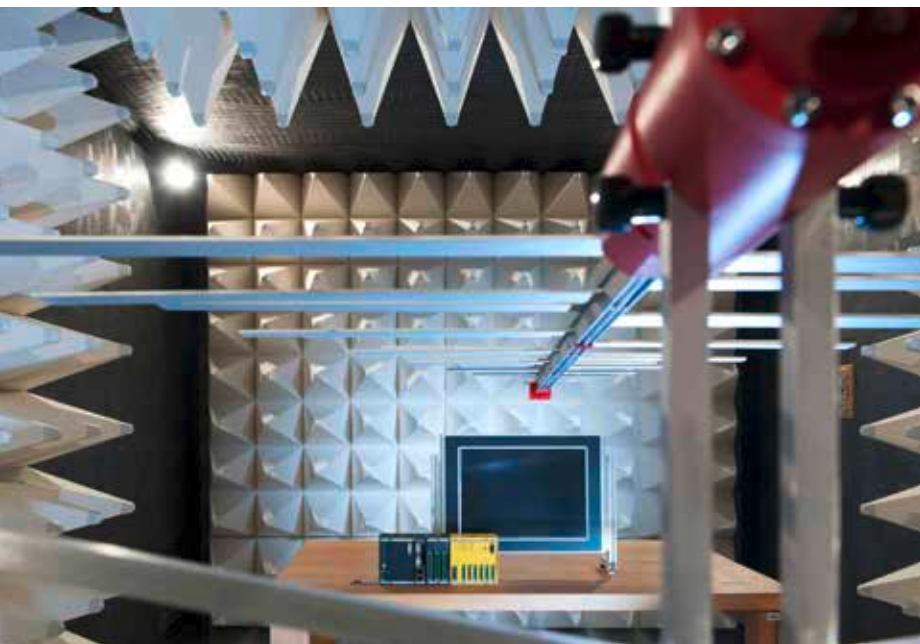
Climatic test

In the development phase, a wide range of different internal specification tests are performed in accordance with the standards and requirements of certification bodies. These include climatic tests according to the European standard EN/IEC 61131-2, which lays down the equipment requirements and tests for programmable controllers. All automation components at Bachmann also undergo temperature change tests according to EN/IEC 60068-2-14 (test Nb). The highly accelerated life test (HALT) climatic and stress test subjects the test objects to conditions that are more severe than in an Arctic climate. The HALT test exposes an electronic module for release to a climatic change test under full load and in excess of the normal operating temperature limits (from +90 to -60 °C).

The functional limits in the temperature range are tested first of all, i.e. the temperature range is continually extended at full load beyond the upper and lower limits in cycles until the device ceases to function. In the second test, the controller is subjected to vibration in all six directions across a broad frequency range and at increasing intensity every cycle until it fails. The shocks range up to 25 times the gravitational acceleration.

In the third step, an identical module is exposed to the combined temperature and vibration limits in which the modules previously still functioned until it fails. In these extreme conditions the test objects are effectively aged and damaged in order to determine any electrical and mechanical weaknesses early on. In this way Bachmann tests the electrical function of the device and its reserves, the component dimensioning as well as the electromechanical design, such as solder points and connectors. Only in this way is it possible to detect and rectify damage already in the development phase that would otherwise only appear during operation 15 to 20 years later.

▲ EMC test laboratory

different loads and operating modes, the system integration test department tests all relevant combinations of any new or modified devices and any software. System tests then test the specifications of the devices in the networked automation system. Only in this way is it possible to test the interaction with other modules or the effects of particular constellations. Individual acceptance tests are also carried out by the appropriate customer advisor for complex applications involving custom developments and new developments. The production release for a new automation component is only issued when all the tests described have been successfully completed.

Interference immunity thanks to in-house EMC laboratory

Automation products in the EU are required to observe the guidelines for electromagnetic compatibility. However, the measurement of electromagnetic compatibility (EMC) presents a particular challenge since the results cannot be predicted or simulated in every case. Bachmann has therefore set up its own EMC test laboratory, in which all the standard tests for interference immunity, such a electrostatic discharge (ESD), burst (interference from high frequency switch operations) and surge (high energy pulses caused by switching large currents) can be carried out. The standard here is set by Bachmann's own stringent EMC guidelines, which provide a large safety margin over and above the requirements of the general standard. The Bachmann EMC test bay can test emitted interference in a frequency range from 30 MHz to 3 GHz. Thanks to its advanced multiple shielding through shield plates, ferrite tiles and specially coated polystyrene pyramids, the chamber is designed for a frequency range from 1 MHz to 18 GHz. This makes it easy for Bachmann to test improvements to devices directly in terms of their EMC and implement them quickly.

Before production release

The following function tests include component tests, in which all modules are tested for features such as functionality, accuracy, response to faults, diagnostics, robust design, maintenance ability, usability and efficiency. As onboard PLC components are part of a highly diversified system consisting of different modules and programs, old and new software versions as well as

Quality in series

Quality assurance in series production starts with a visual inspection. This is an automatic optical inspection (AOI) based on an ideal picture. In this way, any mechanical deviations, such as short circuits, positioning errors, breaks or incorrect components mounted on the printed circuit boards can already be identified. Bachmann either removes any affected boards or reworks them. The detected faults are then reported back to the preceding process in each manufacturing and test step so that systematic problems can be rectified immediately. The subsequent InCircuit test (IC) applies power to the controller boards and is the first electrical test in the production process. This can detect fault patterns such as the following: short circuits, missing components, incorrect component orientation, tolerance problems, incorrect component values or unsoldered components. Bachmann's high standard of quality assurance is particularly demonstrated by the so-called run-in test, a climatic and function test, which every module has to undergo before shipment. For this continuous testing of the finished product the modules are placed in climatic chambers, in which they are switched on and off continuously at a particular rhythm for 48 hours and also through extreme temperature changes. This process creates the artificial aging of devices and thus induces the failure of any defective components. The probability of failure of electronic components is normally at its highest during the first few months of use and then not until the end of its service life. The expedited artificial aging provided by the run-in tests enables the more susceptible initial phase of a

device's life cycle to be avoided. This means that if faults are to occur at all, then this happens in the test laboratory and not on board. The 48 h run-in test thus makes a significant contribution to increasing the reliability and lifespan of Bachmann modules.

Intelligent design

Particularly in the development of automation components for shipbuilding, the observance of international standards plays an important part, as well as compliance with the guidelines of relevant certification bodies such as DNV GL, Bureau Veritas (BV), Lloyds Register (LR) or American Bureau of Shipping (ABS). The certificates of these authorized bodies ultimately verify that the products can be safely used for maritime applications. A design with maximum longevity is of key importance. Thanks to its considerable design reserves, the Bachmann modules have a particularly long service life. They are specified for ambient temperatures up to 60 °C, whilst only 50 °C is required as the market standard. This means that the modules have up to twice as high a lifespan during operation at ambient temperatures of below 50 °C. Thanks to the metal housing and high quality screw connections, the modules have a high degree of robustness. The high quality standards in product development and manufacturing have enabled Bachmann to implement automation architectures with a proven availability of 99.97 percent. The calculated values for the mean time between failure (MTBF) also verify the high degree of reliability of the modules: This is 200 years for CPUs, up to 400 years for digital I/O modules and 200 years for analog I/O modules.

Compatibility

Besides the quality of the hardware and software, their compatibility for a secure long-term availability is critical. Bachmann has therefore drawn up internal guidelines which define clear rules for compatibility and which are used at the same time as development guidelines. With this concept, Bachmann aims to enable the user to replace a CPU with a more powerful or newer one by simply inserting the memory card of the »old« CPU in the new one, and restarting the new one without any software adaption necessary, fully in line with the »plug & play« principle. Software design is playing an increasingly more important role with regard to compatibility. The architecture of the system software, such as the many possibilities of the engineering software for the M1 automation system, ensures that the user program is compatible over different controller generations. Bachmann's entire automation architecture is generally designed to be modular and open, with the ability to be expanded flexibly.

This not only simplifies the use of the automation systems in mostly heterogeneous architectures on board, but increases long-term availability through the principle of backward or downward compatibility. The hardware modules can also be configured flexibly. The latest generation of Bachmann's I/O or function modules offers the same functionality on delivery as the module to be replaced. The special feature is that new functions, which for example were not yet possible years ago with the first delivery, can also be added by simply configuring in Bachmann Solution-Center. This multi-function capability leads in many cases to the possibility for several older modules to be replaced with just one new one.

▲ All Bachmann modules undergo a 48 hour run-in test in the climatic chamber.

MORE AVAILABILITY, GREATER YIELD

Condition Monitoring System

Drives for drilling equipment, excavator pumps, pipe handling systems, propulsion systems, control systems etc. are some of the critical equipment used in shipbuilding. The prevention of breakdowns and therefore also any unexpected downtimes for this critical equipment is the task of the 24/7 condition monitoring system for ship operation.

In conjunction with a method of forecast modeling, the CMS is required to detect potential fault conditions before actual damage becomes noticeable and critical. This should likewise provide sufficient time for implementing preventative measures and repairs or procuring spare parts.

First CMS to be fully integrated in an automation solution

The wear occurring on plants is primarily determined by the way in which the plants are subject to stress. »Stand-alone« condition monitoring systems were developed primarily for condition based maintenance. Having access to the relevant process variables online makes it possible to take the latest operating states of the ship into account. The M1 marine automation system is the first fully integrated and programmable CMS solution available that provides the appropriate hardware modules required for incorporating the various signals, as well as the necessary software. The M1 system analyzes the data combined from oil, water and vibration sensors with operating hours and operating conditions, as well as

environmental factors such as waves, wind and currents. The wear process is closely related to the way in which the machines are used. It is even possible for environmental conditions and the movement of the ship to accelerate the wear process even with minor loads.

Minimizing system downtime

The system failures of shipboard machines can cause the shutdown of the ship's entire operation, thus resulting in a correspondingly high financial loss. For decades, every ship has been equipped with a central »alarm and monitoring system« that warns the crew in the event of a critical fault or critical values. The integration and use of analyzed CMS data is the next step towards minimizing system failures and notifying the crew in good time and as extensively as possible. However shipboard machinery is subject to a slow process of wear due to the stress it is exposed to during operation. This stress depends on environmental factors and on the way in which the crew operate the system. This slow process of wear cannot be handled by the conventional AMS system.

CMS
**Condition
Monitoring
System**

DNV·GL

Marine M1 automation solution

The IACMS Integrated Automation & Condition Monitoring System from Bachmann combines the control functions with the condition monitoring (CMS) and functions as a redundant data server for the AMS system. The operating personnel receive an online warning message in advance about the increasing wear, enabling the owner to reduce the life cycle costs of the fleet.
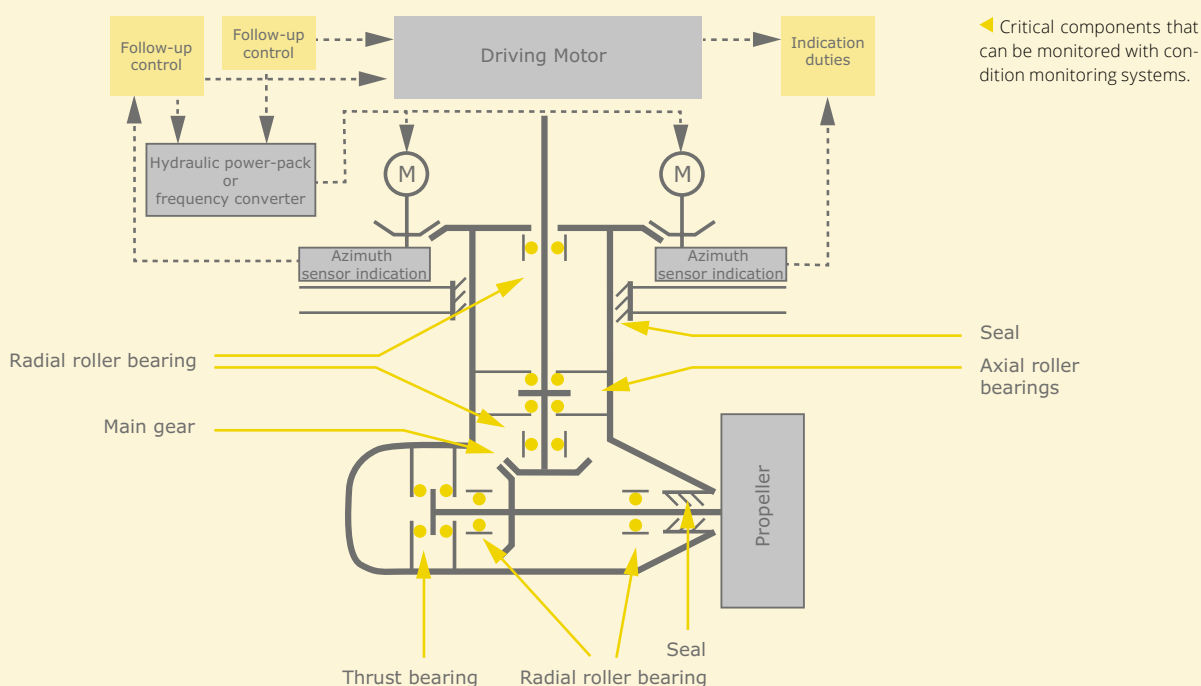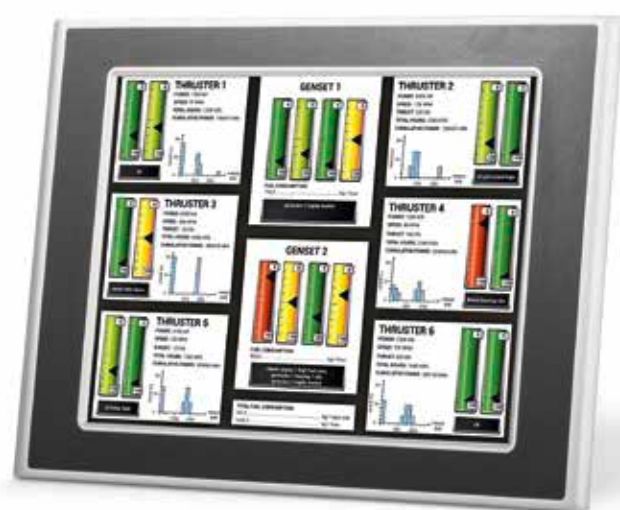
Increased performance and know-how

This display of online and on board information about the machine status with the same hardware that these systems are controlled and regulated with is not the only expertise that we offer.

Major benefits for crew and owner

The use of IACMS means that different systems on board can be controlled with the same hardware and software. This improves understanding and simplifies training for the crew, whilst at the same time reducing initial costs for the owner. If CMS data is fed to the ship management system, it is possible to make a continuous assessment of the current status and availability of the ship.

▶ **An example of the monitoring screen of an operator station.** This example is of a semi-submersible with six controllable thrusters and four gensets driven by diesel engines.

◀ Critical components that can be monitored with condition monitoring systems.

Follow-up control

Follow-up control

Driving Motor

Indication duties

Hydraulic power-pack or frequency converter

Azimuth sensor indication

Azimuth sensor indication

Radial roller bearing

Main gear

Seal

Axial roller bearings

Propeller

Thrust bearing

Radial roller bearing

Seal

SCADA AND HMI OF THE FUTURE

M1 webMI pro

The widespread global use of Internet-enabled mobile devices has taken place at breathtaking speed. Their simple and intuitive operation is impressive. Internet and software applications no longer have a fixed location but can be used from anywhere in the world. With »M1 webMI pro«, Bachmann electronic is impressively demonstrating its technology leadership: Each M1 controller is turned into the central server for fixed or mobile HMI devices.

Benefits of M1 webMI pro at a glance

- Value displays with high refresh rate
- Any browser-based device becomes an HMI
- Operation and visualization when and where you need it
- Loss-free scaling to all screen sizes
- As safe as Internet banking (HTTPS)
- Short refresh in the browser instead of time-consuming software rollouts
- Use of the application on different devices (smartphone, tablet or stationary HMI devices)
- Integration in higher-level SCADA applications

Engineering and maintenance – an important cost factor

Plants are becoming increasingly more complex with ever increasing requirements. This also naturally increases the effort required for engineering and maintenance as well. It is often not only necessary to allow for local visualization in the field, but also for the connection to a control center, a separate visualization for teleservice and sometimes also solutions for mobile terminal devices. Often each requirement here has to be implemented with separate applications. With many visualization products, the handling of different terminal devices and screen resolutions is also not possible.
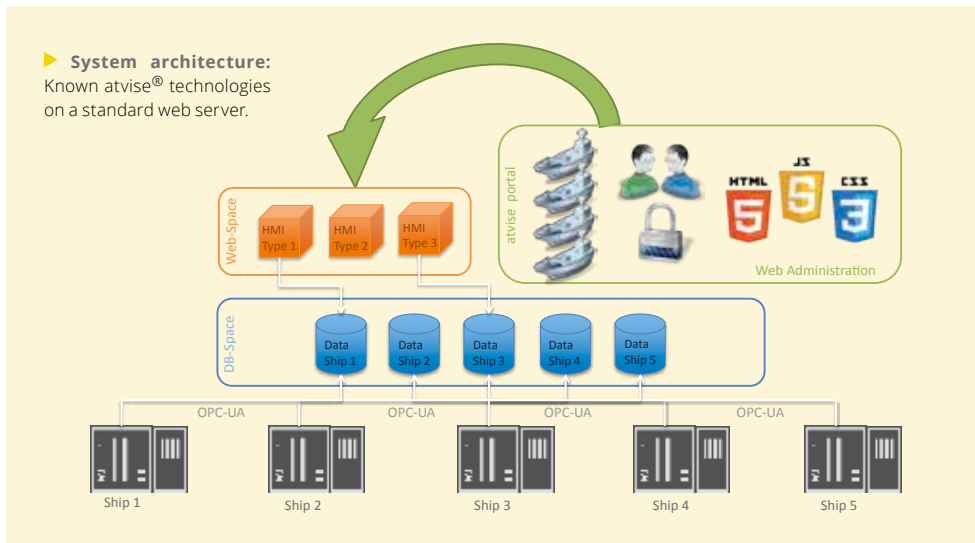
Pure web visualization for the Bachmann M1

Bachmann electronic is now launching a powerful product for pure web visualizations on the market called »M1 webMI pro«. A slim-line web server that is directly installed on the M1 controller enables the connection of any visualization devices, such as smartphones but also powerful operator terminals. Provided the necessary authorizations are in place, the application can now be accessed from anywhere in the world. Thanks to »M1 webMI pro« all the important information can be shown in a single

view and with stunning definition. Perfect graphic results can be achieved on any visualization page without any losses in quality when scaling and zooming. This is thanks to the extraordinary benefits of HTML5 and SVG (scalable vector graphics), the basis for all graphic objects.

State-of-the-art project engineering and simple delivery

The »atvise® builder« engineering tool is used for drawing process pictures, configuring animations and events as well as for other settings. A number of ready-made graphic objects and layouts, as well as the flexible reuse of pages using parameter transfers, make it possible to create visualizations efficiently. Integrated editors even allow the drawing of new SVG graphic objects or the creation of additional functions with user-defined Java scripts. Once the visualization is completed, this is transferred to the web server via FTP with just a single click. This makes the delivery of visualizations to large and distributed installations child's play. Time-consuming software installations on all HMI devices involved become completely unnecessary. The latest version of the application is always shown as soon as a client connects with the central web server or reloads the web page. Special installations or a restart of the HMI devices are no

▶ **System architecture:** Known atvise® technologies on a standard web server.

M1 webMI pro *Web Machine Interface*

longer necessary. All operator units are thus automatically brought up-to-date – without any interruption and irrespective of time and place.

Increased efficiency included

The development of web technologies had to allow from the outset for a wide range of different terminal devices, since different screen sizes and resolutions are normally used. Visualization design in 'M1 webMI pro' is much easier however, since only a single application has to be created for all devices. If the visualization solution is also implemented directly on the controller, the configuration of the relevant data interfaces is also unnecessary: The variables can be accessed directly, an OPC server or any proprietary protocols become obsolete. Ultimately, this kind of web solution not only means more efficiency in engineering but also a real increase in cost efficiency.

SCADA with 64-bit power

The increasing complexity and the constantly rising level of automation in a wide range of different installations require future-oriented technologies for monitoring and controlling processes effectively. SCADA systems make a key contribution here and ensure a high level of safety. This is especially the case if they offer, like the atvise® product line, operation that is not restricted to a particular location or device. The »atvise® SCADA« control station combines the latest web technology with a high performance client-server architecture.

While user interfaces can be displayed in web browsers without any installation required, central functions such as process connection, historization, alarm signaling can be run in highly effi-

cient server structures. The full utilization of the internal data structures of the latest processors increases system efficiency. At the same time, the 64-bit data width enables the utilization of considerably more main memory which ultimately allows larger projects with more process variables (nodes). Released operating systems include Windows XP SP3, Windows 7 (32-bit and 64-bit), Windows 8 (32-bit and 64-bit), Windows Server 2008 and Windows Embedded Standard 7. Besides other minor improvements, version 2.5 also contains functions for filling in the process history (value archive) at a later time, such as when the transfer of only temporarily connected process connections is blocked.

▼ **State-of-the-art visualization solution on a tablet:** Ship control in pure web technology.

OUR CUSTOMERS

Applications in the maritime sector

Many of the leading global manufacturers and operators of ship and offshore plants rely on us. Together with them, we are setting new benchmarks and achieving new success.

TOGETHER
ON COURSE

**Redundant controllers for diesel electric
propulsion systems on ships**

Special safety concepts ensure a high level of reliability and safety
for a ship propulsion system. New functions are continuously being
integrated in the ship's control system. A collaboration between Wärtsilä
SAM Electronics and Bachmann electronic produced an innovative
concept for use with diesel electric drives.

▼ The Royal Princess with
diesel electric propulsion –
controlled by the Bachmann
M1 automation system.

Concept: redundant propulsion

The main components of a diesel electric drive are the diesel generator(s), frequency inverters, propulsion motor, propeller and controller. Unlike conventional systems with two engines, which are each coupled directly to a propeller, with diesel electric propulsion systems the diesel engines drive generators. These all feed the same busbar from which both the drives as well as the other loads are supplied. This therefore makes the availability of a drive independent of an individual diesel engine since a reduced propulsion capacity is still provided in the event of a failure. Considerable importance is placed on a high level of redundancy, particularly with the design of diesel electric propulsion systems for cruise liners. This redundancy is always based on a single fault event. Simultaneous multiple faults are not considered here. The propeller motors themselves are provided with two stator winding systems, each fed by a separate 6/3 phase, 12/6 pulse power section of a frequency inverter. Each converter section is supplied by an independent transformer with its own circuit-breaker.

Distributed control has major benefits

The Wärtsilä SAM Electronics propulsion system controller integrates the frequency inverters in the ship system. For this various remote I/O systems distributed over the entire ship are connected to the controller via fieldbuses. The frequency inverters are run in active standby mode. This means that the active controller collects the signals and also makes these available to the standby controller via Ethernet. If one controller fails, the standby system can then take over all control tasks seamlessly. This approach also saves on cabling and enables an improved monitoring of the interfaces. If a single I/O system fails, the decentralized arrangement of the I/Os also ensures that not all of the system information is lost. Appropriate processes are triggered depending on which I/O system is no longer available. If the fieldbus to the bridge fails, for example, the drive saves the last control lever setting and initiates an alarm: The failure of a

steering console is indicated and control can be switched to another console, such as in the engine control room.

Changeover to the M1 controller

The implementation of these complex concepts and control tasks requires the use of a powerful controller. Wärtsila SAM Electronics decided to use here the M1 automation system from Bachmann electronic. »The scalable M1 system comes with the certificates required for ship applications and offers the right controller for every performance level, whilst still ensuring downward compatibility,« explains Hermann Knirsch, drives and special systems manager of technology and design at Wärtsila SAM Electronics. »It thus offers the level of flexibility required, whilst the guaranteed long-term availability ensures also the level of safety required for current projects and those in the future.«

All interfaces »on board«

The M1 controller covers all the interfaces required: Modbus RTU / TCP, PROFINET, CANOpen and SAE J1939 come as standard. »The Modbus UDP protocol was specially implemented for us at short notice by Bachmann,« explains Hermann Knirsch, delighted with the excellent cooperation. The controllers can also be expanded with serial, CAN, DeviceNet and PROFIBUS communication modules as required.

Integrated controller library

»Bachmann electronic is a cooperative partner offering excellent technical support on site,« says Verena Franzen, from Drives, Special Systems Technology and Application Design at Wärtsila SAM Electronics. »The cooperation thus enabled the joint and successful integration of a Wärtsila SAM Electronics controller library on the Bachmann system. All the tried and tested functions are thus still available. It also offers Wärtsilä SAM Electronics the possibility of using other previously unused fieldbus protocols such as PROFIBUS, PROFINET, Modbus / TCP etc. In this way, components such as the frequency inverters can be integrated even better.«

> » The scalable M1 system offers the right controller for every performance level. «
>
> Hermann Knirsch,
> Drives and Special Systems Manager
> of Technology and Design,
> Wärtsilä SAM Electronics

WÄRTSILÄ

Wärtsilä SAM Electronics is one of the world's leading suppliers in the shipbuilding industry. The company is headquartered in Hamburg and has over 100 years of experience in the field of maritime electronics and electrical engineering. Wärtsilä SAM Electronics develops and manufactures state-of-the-art products, and offers innovative solution concepts for the technically challenging requirements of any type of ship. As a competent partner for shipping companies and shipyards, the company can take overall responsibility for complex system projects.

www.sam-electronics.de

Clearly designed PLC editor

The adaption of Wärtsilä SAM Electronic's own PLC editor specially developed for complex applications considerably simplified the work processes for the engineering and commissioning of the first project. The graphical editor enables the creation and visualization of complete functions. The status of signals is very clearly displayed in different colors. Faults can be localized and rectified quickly. This graphical editor is used for maintaining the software of the old and the new system. Partial applications from existing installations that are still implemented on the previous systems can thus be easily used again for new installations.

New functions: Teleservice

»Another benefit of Bachmann's M1 system is the greater CPU performance and range of interfaces compared to the controllers we used previously,« Verena Franzen continues. This enables us to integrate completely new functions into the system. »For example, it will be possible in future to access the system directly from shore via satellite. This means that diagnostics can be carried out without having to send out a technician to the ship and that expert help can be given to the crew in the event of failures,« Verena Franzen describes the resulting benefits. »The support of the crew when changing parameters can also be carried out from shore at a later time without any problem. This saves time – and money.«

▼ **Diesel electric drive control for a cruise liner:** Redundant controller design with the M1 automation system.
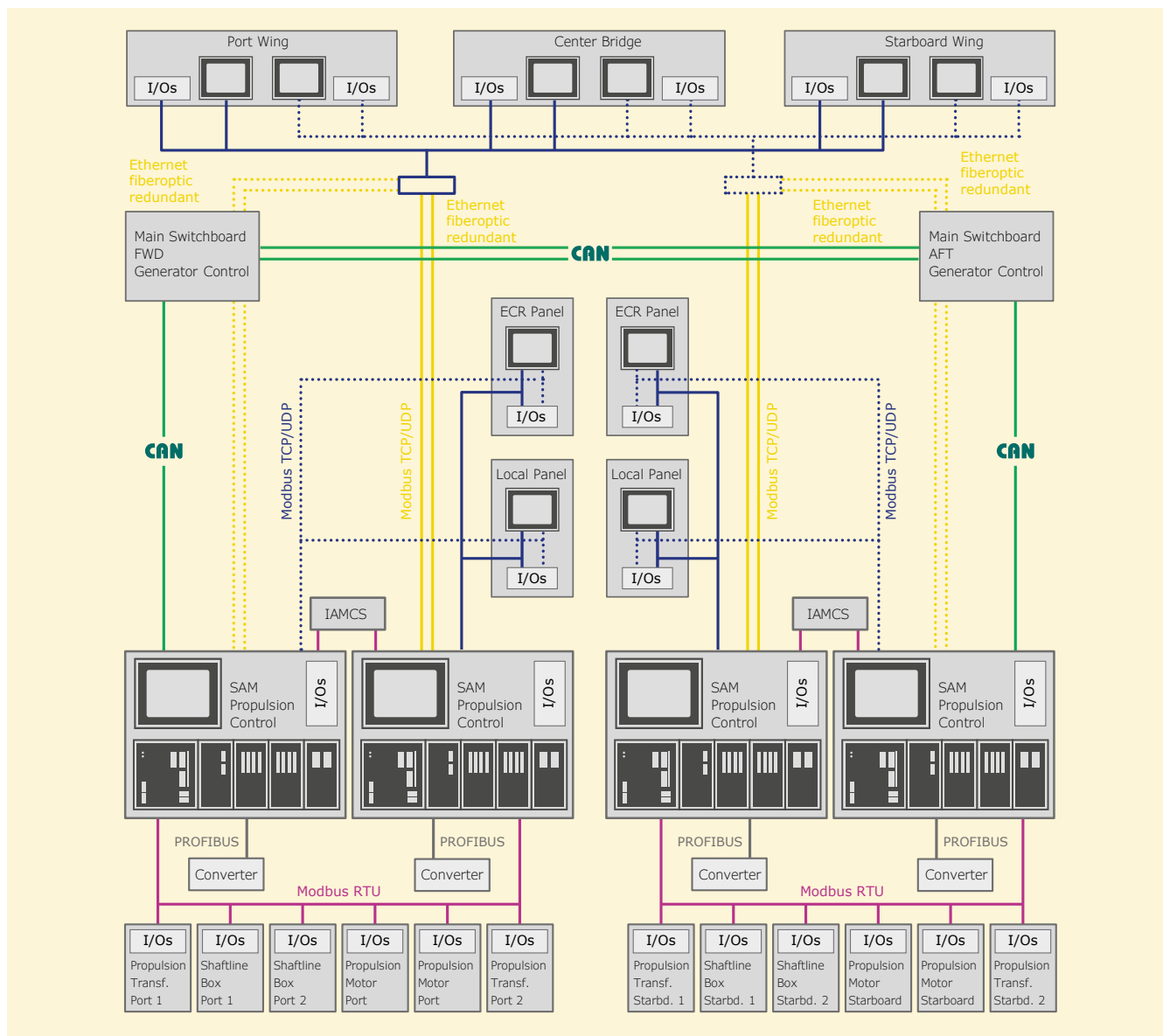
▲ One of the two propeller motors in the cruise liner Royal Princess.

Perfect redundancy: hot standby

Another new function provided is the »hot standby« function. Thanks to the high-speed Ethernet communication between the two controllers of a drive, the standby controller can be activated quickly in the event of a fault. The standby controller thus takes over as soon as the active controller fails, for example, due to a fault in the power supply: The drive is immediately activated and runs at the old speed value. This offers additional safety and the availability of the drive is always ensured in the event of a fault.

Successful cooperation – with a future

Controllers for diesel electric propulsion systems must be able to be integrated simply into the existing network structures of the ship, and master the increasing requirements with regard to functionality, safety and availability. »With the Bachmann M1 automation system Wärtsilä SAM Electronics has been completely successful in this,« Hermann Knirsch is convinced. »We therefore aim to continue the cooperation developed from this collaborative work for future propulsion system projects.«

» Bachmann
is a cooperative
partner. «

Verena Franzen,
Technology and Design,
Power Conversion Hamburg,
Wärtsilä SAM Electronics

MONITORING FROM FAR AND NEAR

Utilizing ship's engine data profitably

A modern monitoring system that acquires all the relevant data of a ship and makes it available for any terminal device with internet access – that was MAP Engineering's idea. In Bachmann they found a partner that provided them with the support required for this development.

MAP Engineering was founded as a successor to MAP Ltd and thus benefits from years of experience in ship automation. Their solutions have been installed on many luxury yachts, ferries and working boats. The company is still surprising the market with innovative solutions: »We are continually working on new and further developments for our products. We place particular importance here on environmental sustainability,« explains Alexander Meinardus, founder and CEO at MAP Engineering Ltd.

An idea is born

One of these new developments is the monitoring system. »Most modern engines are provided with a communication interface such as J1939 or Modbus,« explains Alexander Meinardus. »We asked ourselves whether it was possible to read this data – irrespective of engine manufacturer or type – and make it available quickly on different terminal devices.« Using the M1 automation system from Bachmann electronic, customers can obtain marine certified components as a standard solution. »This is one reason why we have been working closely with Bachmann since the founding of the company,« explains Alexander Meinardus. »We therefore contacted Bachmann when we started to look for a solution for our new idea.«

Step by step to success

The development team at MAP Engineering slowly and cautiously explored the new subject. »In an initial step – on the recommendation of the Bachmann experts – we connected the CAN interface of an MX220 processor module to an MTU engine,« Alexander Meinardus recalls. »And we were soon able to read signals for variables such as temperature, fuel consumption and speed without any problem.« From this initial trial came a standard box which can read the data from engine

> » Using the M1 automation system from Bachmann electronic, customers can obtain marine certified components as a standard solution.
> This is one reason why we have been working closely with Bachmann since the founding of the company. «
>
> Alexander Meinardus,
> Founder and CEO of
> MAP Engineering

▲ The high speed craft Typhoon Tow was equipped with a monitoring system from MAP Engineering Ltd.

manufacturers like MTU, MAN, Caterpillar, Volvo and many more. In the next step, the data had to be brought into an easily legible and user-friendly form. »For this we use M1 webMI pro,« confirms Alexander Meinardus.

This server for web visualization is installed directly on the controller. This makes it possible to turn any terminal device with internet access into a user interface. »In this way, the captain of a ship can access all relevant ship data on the bridge, but also via his smartphone or from a computer in the office of the shipping company,« Alexander Meinardus explains. The user interface was given a modern look and feel.

»For this we redesigned elements, added new functions and increased user-friendliness,« Alexander Meinardus continued. »The user interface can naturally also be adapted to all a customer's individual requirements.

▲ **Clear display:** This provides the skipper with a view of all the relevant data.

Positive response

The initial presentations delighted the customers. »All the data of an engine is reliably provided quickly and can be viewed from any terminal device. This made a big impression on our customers,« Alexander Meinardus notes. »All the data can also be fed into the fleet management system of a shipping company. This also increases the availability of their ships.« For MAP Engineering it's clear that they have found the right partner in Bachmann electronic. »Our systems are certified more quickly, they function reliably and we receive support whenever we put questions to the experts at Bachmann,« Alexander Meinardus sums up the benefits of the collaboration with Bachmann.

» All the engine data is reliably provided quickly and can be viewed from any terminal device. This has made a big impression on our customers. «

Alexander Meinardus,
Founder and CEO of
MAP Engineering

KNOW-HOW
IN A TWIN PACK

**CSI relies on Bachmann technology
for its system solutions**

The Dutch company CSI Control Systems is renowned for its expertise in the field of alarm and monitoring systems for the marine and offshore sector. Successful operation on the market with these kinds of solutions also requires a reliable and powerful hardware as well as extensive know-how. Criteria that Bachmann electronic fulfills – thus providing the basis for the successful partnership between both companies. This successful combination was received by the market with a great deal of interest.

▲ The 182 meter long ferry Kaitaki is the largest of its kind in New Zealand waters. It is equipped with the latest alarm, monitoring and control system from CSI and Bachmann.

CSI CONTROL SYSTEMS

The Dutch company CSI was founded in Vlaardingen in 1967. Its ten employees are experts in the development and supply of alarm and monitoring systems for marine and offshore applications. Several thousand ships worldwide are fitted with solutions from CSI.

www.csi-systems.nl

Alarm and monitoring systems for marine and offshore applications have to take over several functions. For example, the level of a ship's ballast tanks has to be monitored, and sometimes valves and pumps have to be operated. The reliable functioning of the drive must also be guaranteed. CSI has already supplied thousands of ships and customers worldwide with the systems required for these tasks. »We have been placing our trust in Bachmann as a reliable partner for the hardware for around two years,« says Berry de Krieger, senior service engineer and co-owner of CSI.

Innovative modules from Bachmann

Bachmann mainly supplies CSI with I/O modules. These are used to integrate a number of different sensors and actuators into the controller. »The main reason for our partnership is the fact that these modules are further developed very quickly,« explains Antoinette Willemsen, direc-

> » Bachmann has the necessary know-how and always offers innovative solutions. Their products also have the necessary certification. «
>
> Antoinette Willemsen, Director Business Development at CSI

tor of business development at CSI. »Bachmann has the necessary know-how and always offers innovative solutions. Another plus point is the fact that they come with all the relevant certifications for marine and offshore use, which considerably reduces our workload as a small company.«

Fast, robust and affordable

Ronald Epskamp, sector manager at Bachmann, knows how important certificates are: »175 Bachmann modules have already been certified by DNV GL and other institutions for use in critical applications in the marine and offshore sectors.« Bachmann stand out on account of its fast delivery, competitive prices and the robust quality of its modules. »Another plus point is their speed,« a delighted Berry de Krieger explains. The response time within the CSI system is no more than ten milliseconds. »In the event of an emergency shutdown of the main engine or if a bearing overheats, this is extremely important,« de Krieger adds. Several alarms mostly occur at virtually the same time. In order to reconstruct

19" Touch Screen
24Vdc
Network Switch
HCR Aft.

LMS3 Valve Control
128 Digital Inputs
96 Digital Outputs
16 Analogue Inputs

Wheelhouse
17" Touch Screen
24Vdc
LMS4 56 Digital Inputs 8 Digital Outputs
Group Alarm Units
Network Switch

19" Touch Screen
24Vdc
19" Touch Screen
24Vdc
19" Touch Screen
24Vdc
Network Switch
230Vac
Log printer

Cabin Units 8597

Network Switch
19" Touch Screen
24Vdc
HCR Fwd.

Cabinet ER Aft LMS2
10" wide Flatpanel pc
10 x Terminal board Analogue
8 x Terminal board Digital

Cabinet ER Aft LMS1
10" wide Flatpanel pc
12 x Terminal board Analogue
4 x Terminal board Digital

32 Digital Inputs
I/O Unit
Bow Thruster Room

Engine Control Room

Fiber Optics Ring
Ethernet over Fiber
UTP ethernet Cat5E

◀ Alarm, monitoring and control system ready for many safe journeys after the retrofit.

the event so that the cause of the fault can be found, a fast and correct recording of the relevant data is needed. »Only in this way is it possible to rectify problems swiftly and effectively,« the experienced engineer sums up.

Positive response of the market

The partnership between CSI and Bachmann has attracted the attention of the market. Croon Elektrotechniek, a company based in Rotterdam, and one of the largest Dutch companies for the electrical equipment of ships, is already using the system solution of the two companies: »We will be using the alarm and monitoring systems of CSI and Bachmann from now on,« Piet Faasse, technical manager for marine & offshore at Croon, confirms.

This kind of recognition is very important for the companies involved. »The margins in the shipbuilding and shipping industry are very small. Only companies that can supply robust quality at a competitive price are considered,« Antoinette Willemsen elaborates and adds: »Together with Bachmann we have been successful here, as shown by the feedback from our customers.« For CSI the partnership has definitely been a gain: »For us a long-term collaboration with Bachmann is an obvious decision.«

» Delivering robust quality products worldwide and at a competitive price is a powerful sales argument. Together with Bachmann we can do this successfully. «

Berry de Krieger,
Senior service engineer at CSI

SAFE OPERATION FOR INLAND SHIPPING

Modules for navigation, monitoring and fleet management

The automation of ships requires the management of some complex tasks. Argonics GmbH has broken these tasks down into manageable platform and has thus been able to create some innovative products. The modular platform from Bachmann electronic and its networking capability enables the concepts of Argonics to be implemented easily, thus simplifying routine ship operations.

›Divide and rule‹ – this is the principle by which complex and at first seemingly unmanageable tasks are normally broken down into hierarchical levels. Each level is divided in turn into individual modules which handle definable tasks that are disconnected from each other. By networking individual modules it is possible to exchange information and interact with each other. »This procedure enabled us to create different products for simplifying routine tasks in the inland shipping industry,« explains Alexander Lutz, founder and CEO of Argonics GmbH. »Naturally it also requires the appropriate hardware components in order to implement our concepts in a real system.« For this Argonics uses the M1 automation system from Bachmann electronic. »Its modularity as well as the wide range of networking options impressed us,« Alexander Lutz continues.

Simplified navigation

Different modules, such as argoPropControl, argoPilot and argoCruiseControl are available for navigating ships. The argoPropControl module ensures on the lowest level that the propulsion units implement the skipper's settings for rudder angle and engine speed. »This involves the installation of separate controller and I/O modules for each drive unit in order to ensure maximum safety,« Alexander Lutz explains. On the next level, the argoPilot module functions as a Yawcontroller. Keeping the ship on track. argoCruiseControl additionally ensures that all propulsion engines are always under an even load. »This saves fuel and reduces wear,« Alexander Lutz explains further. The two modules supply setpoints to the argoPropControl module. »This is implemented without the need for additional hardware. The modules are simply

argonics

Argonics GmbH was founded in Stuttgart in 2014. It was formed from the ›3G Navigation‹ enterprise of the TTI GmbH enterprise company of Stuttgart University. Argonics produces innovative products for navigating and monitoring ships.

www.argonics.de

networked together,« says Alexander Lutz. argoTrackPilot was the first system developed of its kind in inland shipping for the automatic guidance of ships along set routes. This module, which is exclusively available from Argonics for the highest navigation level, draws on the functionality of the modules of the subordinate levels. In this case, the argopilot module is set with the set speed, which in turn supplies the rudder angle settings to argoPropControl. All modules for navigating the ship require access to the drive hardware and different sensors such as the GNSS global satellite navigation system or the tack and rudder angle indicator. This is implemented via communication modules which use special protocols such as J1939 or NMEA. »These can be easily implemented in the M1 automation system or are supplied already integrated,« a delighted Alexander Lutz explains.

Targeted monitoring

Different monitoring modules can likewise access the variables of the navigation and communication modules. argoMultiDisplay shows on touch screens all the data relevant for ship management. »The visualization is specially implemented according to customer specifications as many configurable instruments are available,« Alexander Lutz explains. In the event of critical states alarms are also indicated to the skipper via the argoMultiDisplay.

Illuminating insights

The argoDataPortal is based on Bachmann's atvise® portal, which enables the shipping company to access all the relevant data of their ships. »This data is transferred from the ships to the onshore database via an openVPN connection,« Alexander Lutz explains. If the connection is interrupted, all the data is buffered locally on

» Bachmann electronic's state-of-the-art control architecture allows us to create modules for all areas of navigation, monitoring and fleet management of inland shipping, thus simplifying the routine tasks of the skipper as well as those of the shipping company. «

Dr. Alexander Lutz,
Founder and CEO of Argonics GmbH

the ships. »The technical officers of the shipping company can analyze the saved data in order to identify problems early on and organize the maintenance work,« Alexander Lutz describes the benefits of the portal. »argoDataPortal also enables the ship handling skill of the skipper to be assessed and also enables the requirements of the shipping company to be transferred to the ships via a feedback channel.« The argoTracker is used if the shipping company only requires the information of position and speed data.

»argoTracker sends here the information of a GNSS receiver cyclically to a web server which the shipping company can access,« Alexander Lutz explains.

»Bachmann electronic's state-of-the-art controller architecture allows us to create modules for all areas of navigation, monitoring and fleet management of inland ships and thus simplify the daily work of the skipper,« Alexander Lutz sums up in closing.

▼ The navigation and monitoring equipment on inland vessels is divided into individual modules. The ship also transfers information to an onshore database server.

← openVPN →

Monitoring
argo
argo
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Na
argo
argo
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← Digital →
← Analog →
← MODBUS →
← Ethernet →
← J1939 →
← NMEA →
← CANopen →
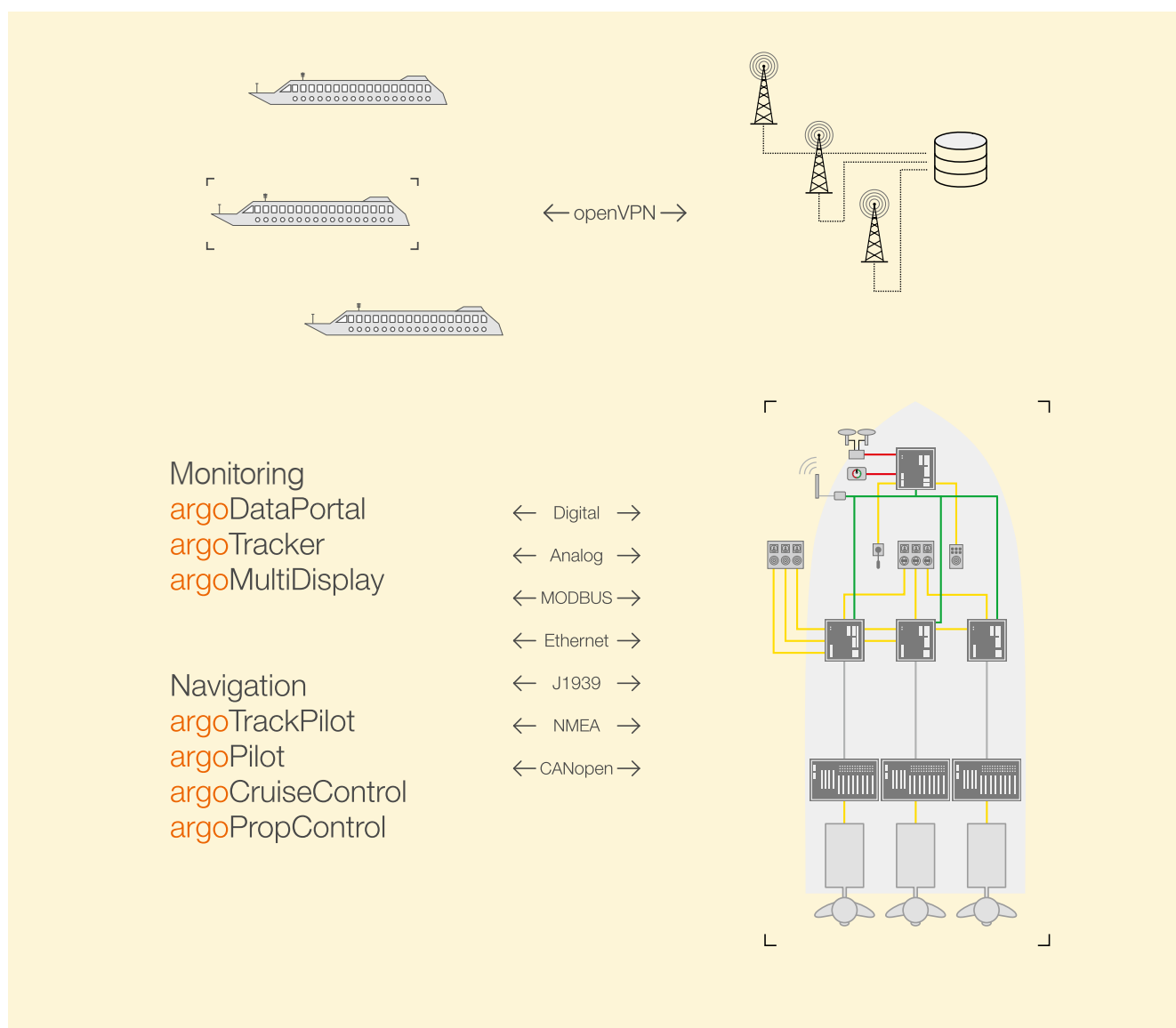
TANK MANAGEMENT WITH SAFETY

Reducing complexity on board and increasing efficiency

Market conditions are forcing shipping companies and ship owners to achieve greater efficiency with a reduced crew on board. A safe and reliable controller and monitoring system are therefore essential. Wilhelm Sander Fertigung (WSF) has developed SANSYS and the associated SANVISU operator interface, a new integrated valve control and tank management system for ships that was type tested and certified by GL. In the event of a disconnection or a failure of the main components, SANSYS provides universal redundancy and network redundancy. The system is made up of solutions from the portfolio of Bachmann electronic.

SANDERMARINE
MARINE + OFFSHORE EQUIPMENT

The trading company was founded in 1926 and Wilhelm Sander has had its own production since 1984. The Bremen-based company initially concentrated on valves and drives and is now a system supplier of remote control systems for ship valves for the shipbuilding and offshore sector.

www.sandermeson.com/
the-group/sander-marine

The system is what WSF GmbH calls its ›Task Carrier‹: It gives the user complete control of the entire tank management of the ship or installation. SANSYS supplies reliable information about tanks – whether they are filled or discharged – as well about valves and pumps – whether they are working precisely. It also supplies the crew or the owner with information about the tank contents, temperatures and pressures.

Single or redundant controller configuration

The company, which is based in Bremen, Germany, uses the powerful MPC240 and MC200 controllers from Bachmann for the implementation. This can be designed either as a single or a redundant system. The use of a redundant control system for the WSF application can be designed for both network and CPU hot standby redundancy. The implementation is also straightforward since the hardware components and the application software are identical for a single and for a redundant system. With CPU

hot standby redundancy, both masters run synchronously. Bumpless switching is executed and updates can be carried out whilst the system is running. The software hot standby redundancy consists of an automatic system comparison as well as a time synchronization and automatic failover. Network redundancy provides protection from failures in the communication structure with a switchover time that is shorter than a PLC cycle. It features an integrated diagnostic function for the status and quality of the network connection and can be used for both cyclical and acyclical communication.

Maximum safety for customers

The controller is used together with the robust input and output system (I/O system) consisting of densely packed I/O modules that are a match for the harshest environmental conditions in the offshore sector. »Bachmann supplies a redundant system with standard components that offers our customers maximum safety,« says Jörg Balzer, technical manager at Wilhelm
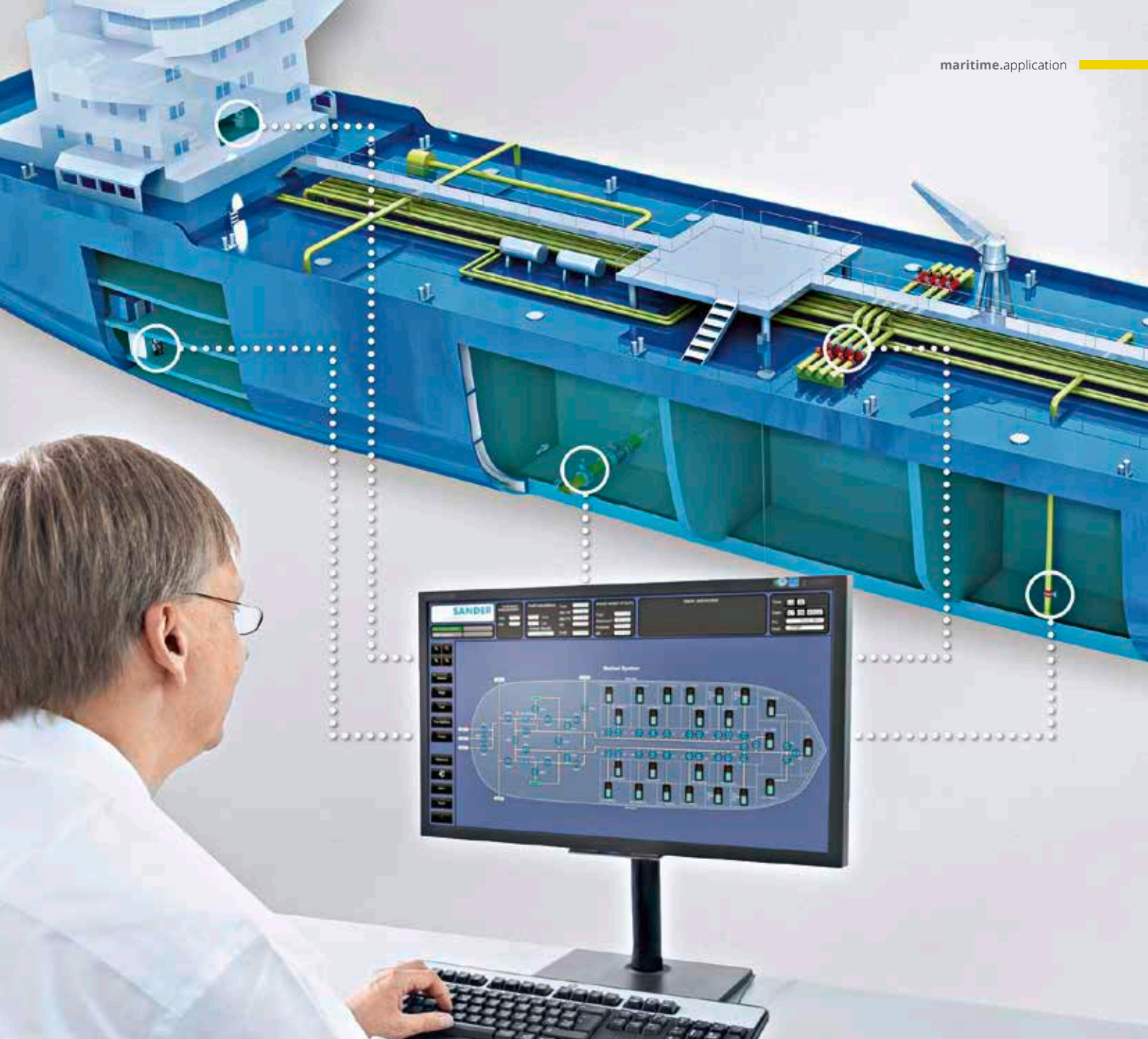
Sander Fertigung. The on board power supply is also redundant in order to prevent failures and can be switched to manual or automatic. All devices are also protected from overvoltage.

Further options for more functionality

SANSY can communicate with other systems such as a loading PC or an alarm and monitoring system (AMS) using the interfaces provided and those established in shipbuilding. Remote maintenance is carried out using secure Internet connections or with a local update of the application using a memory card (PC, CF) or standard USB stick. Several applications can be run in parallel and autonomously using the Bachmann controller. Water ingress detection and/or condition monitoring can be added as an option to applications such as valve control, anti-heeling, tank content measuring, pump control, simulation, deck lighting and fan cooling if required. Condition monitoring, for example, can be used to give early warning of wear on actuating elements such as valves (flaps) and pumps. »Thanks to the extensions possible, we are well equipped for the future and can expand our portfolio without having to change the existing application,« says Jörg Balzer.

Simple handling thanks to the Project Manager

The PLC programs required are created by project designers and service technicians using the Project Manager of Bachmann's Maritime

▲ Clicking the tool icon in the manual valve system dialog shows the operating instructions for the selected valve. This shows the maintenance personnel how to change the modules.

& Offshore Essentials (MOE). »The Project Manager enables us to automatically generate our PLC software error-free in a short space of time,« Klaus Milde, technical manager at WSF, highlights and adds: »Objects such as valves, pumps and tanks can thus be created in a library and automatically linked with the PLC variables.« Frequently used valve movements with activation sequences, delay times and the activation of the required pumps can be defined so that the ship's crew can call them up and start them. This application offers greater convenience and safety. »Thanks to the Valve Editor we can

meet customer requirements right up to shortly before shipment,« says Jörg Balzer and adds: »All project-related data can be parameterized. No reprogramming is required for individual fine tuning.« An OT200 operator terminal is installed in the control cabinet door in the machine room to allow local operation. All Bachmann products come with the necessary shipping approvals such as Germanischer Lloyd (GL), Lloyd's Register of Shipping (LR), Det Norske Veritas (DNV), American Bureau of Shipping (ABS) and Bureau Veritas (BV), as well as the SANSYS and SANVISU systems.

Visualization – location-independent and scalable

The associated SANVISU visualization system provides the operator interface for controlling and managing all SANSYS functions. Here also, the Bremen based company relies on a product from Bachmann and uses the atvise® SCADA system. »The innovative and scalable visualization system and a browser, or if required Apple and Android apps, enable me to have my alarms, tank content data and more instantly in view,« Jörg Balzer says. From the bridge or from the ship's office, I can access the web application with a standard browser from any location and from any device. The installation of any additional software is unnecessary. Thanks to the vec-

» Several applications can be run in parallel on the Bachmann controller. We are thus well equipped for the future and can add condition monitoring, deck lighting and water ingress detection to our portfolio without having to change the existing application. «

Jörg Balzer,
Design manager,
Wilhelm Sander Fertigung GmbH

tor graphics (SVG) used, the application is scalable without any loss and can be adapted to any screen size – regardless of whether this is for a laptop, a tablet or a smartphone. The zooming of the details of all ship areas can be carried out without any problem. The SANSYS dialog windows provide operators and maintenance personnel with a particularly convenient multi-lingual feature. The SanSys manual system dialog explains the user interface, enabling new crew members to familiarize themselves with the system. Clicking the icon in the manual valve system dialog shows the operating instructions for the selected valve. This shows the maintenance personnel how to change the modules. Clicking the information icon displays the drawing of the selected device and the spare parts list (parts list system dialog). The crew can order the correct spare part quickly and in a targeted way. The relevant documentation is always provided at the correct point, thus preventing panic and misunderstanding on board in the event of a fault.

Convenient tank content measurement

Tank measuring with SANSYS is carried out as follows: Geometric data for the tanks as well as other ship-related parameters from the tank list of the shipyard, the so-called sounding list, are read in by the Bachmann controller in the form of a CSV file. The auto configuration of the individual tanks through the read operation is a key element in the standardization of the application program. Changes to the PLC source code thus become unnecessary since any adaption is carried out by inputs via the operator interface of the visualization. The reading in of a file containing the tank data saves any labor-intensive and error-prone editing of tank lists during commissioning in the shipyard. Data from the fuel system can for example be transferred to the ship owner's cell phone. The systems from WSF also come with a type approval from the well-known shipping classification societies such as DNVGL. Wilhelm Sander Fertigung offers its customers a service for remotely monitoring systems by its qualified personnel in order to suggest targeted measures in response to changes. For this the system status is transfer-

red to the Bremerhaven company for analysis. In recent years, the company has produced a number of innovations and further developments. WSF, with its engineering, service and consulting portfolio, has grown from the former trading company to become a system supplier for shipbuilding and the offshore industry.

▼ Integrated tank management
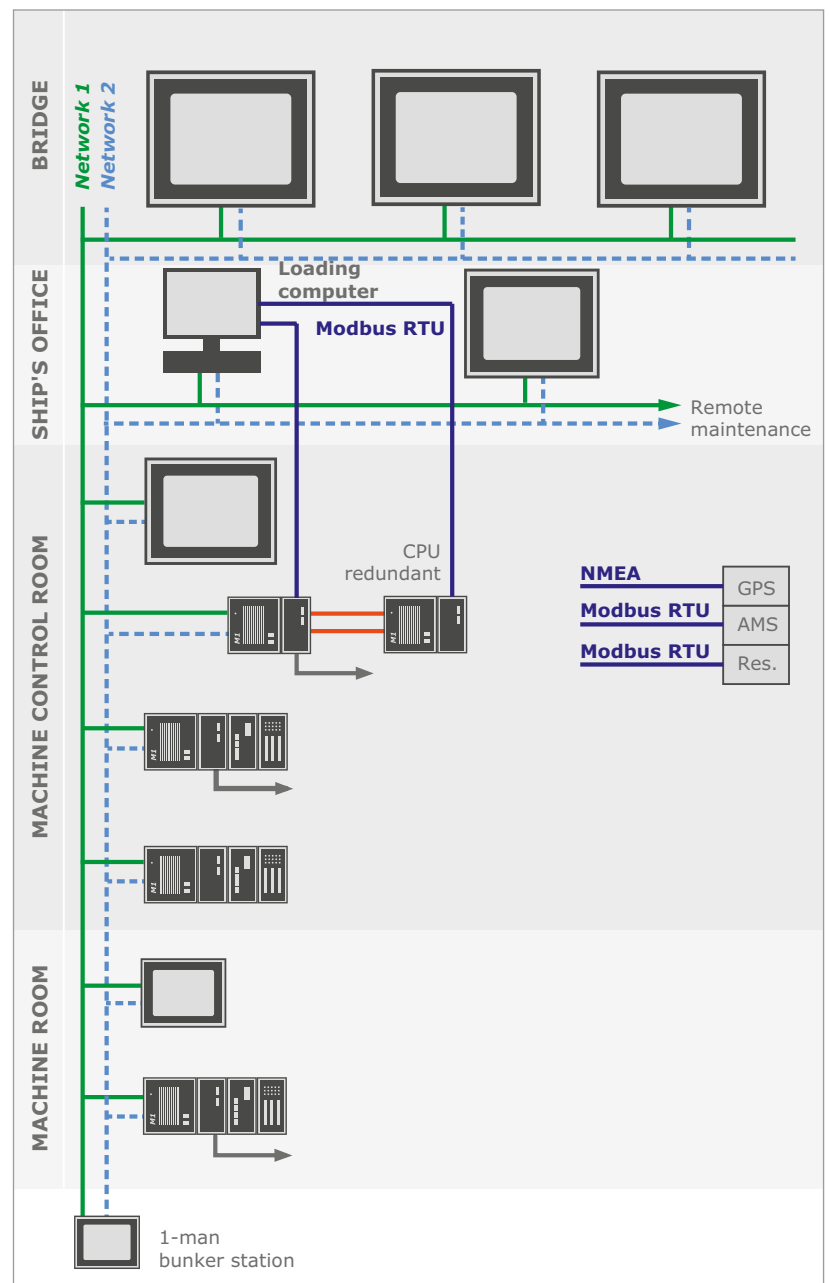
CONVENIENT AND EFFICIENT SHIP OPERATION

Voith control system with the M1 automation system

from Bachmann electronic

Outstanding results can be achieved if propulsion and control systems are perfectly integrated with each other. The Voith control system now offers faster actuation and more precise propulsion control. The specializations of the Voith technology group include the area of propulsion components and systems for shipping. For over 80 years the company has been developing and manufacturing the optimum propulsion system for all ship types – ferries, platform suppliers, tugs or support ships. Voith has recently developed a control system for its propulsion systems that both increases ease of operation and ensures more efficient ship operation. Bachmann electronic's M1 automation system is one of its most important components.

Open architecture

»One frequently stated customer request for the supply of a complete system consisting of propeller and controller was a key reason for developing our own control system,« Kristian Wege, head of Electrical Ship Remote Controls at Voith, recalls the beginnings of the project. The company very quickly developed a control system to the highest technical standard and perfectly matched to the benefits of the company's own propulsion systems. At the same time the greatest possible openness was ensured, so that components already in place can still be used without any problem. Communication inside the system is implemented with interfaces such as CAN-Bus, Modbus TCP/IP and RTU, Profibus DP, OPC UA or NMEA. The user-friendly M-Target for Simulink® interface is a key benefit of the M1 automation system. Voith uses MATLAB® / Simulink® as standard software for developing complex open-loop and closed-loop control systems. The program code automatically generated from the simulations can be implemented directly on the M1 automation system. The

software thus provides the basis for the early analysis, validation and verification of individual software components and enables considerable time and cost savings when working on and commissioning the system.

Precision even in high swells

The Voith control system offers faster actuation and more precise propulsion control. This is of particular benefit to all ships and floating platforms requiring accurate control and dynamic high precision positioning – even in rough seas. The modern systems from Voith can even compensate up to 90 percent of the rolling motion of the ship.

> » The open system architecture enables the implementation of a wide range of control systems in the shortest possible time. «
>
> Kristian Wege,
> Head of Electronic Remote Control,
> Voith Digital Solutions GmbH
> Product Creation VT Marine

Secure remote access

Bachmann electronic's M1 automation system is also one of the most important components of this system. The control system shows all data and the occurrence of faults for monitoring. The monitoring here can be implemented both locally on the bridge as well as in the engine or propeller room, also remotely via an integrated visualization software. The M1 webMI pro visualization software enables pro-

VOITH

Voith Turbo is a division of the Voith Group founded in 1867. The company is setting new standards in the energy, oil and gas, paper, raw materials and transport sectors, and has a turnover of 4.3 billion euros with over 20,000 employees in more than 60 countries. Voith Turbo specializes in intelligent propulsion solutions and systems. Customers from a wide range of sectors, such as oil and gas, energy, mining and mechanical engineering, marine engineering, rail and utility vehicles rely on the top technologies of Voith Turbo.

www.voith.com

Bridge
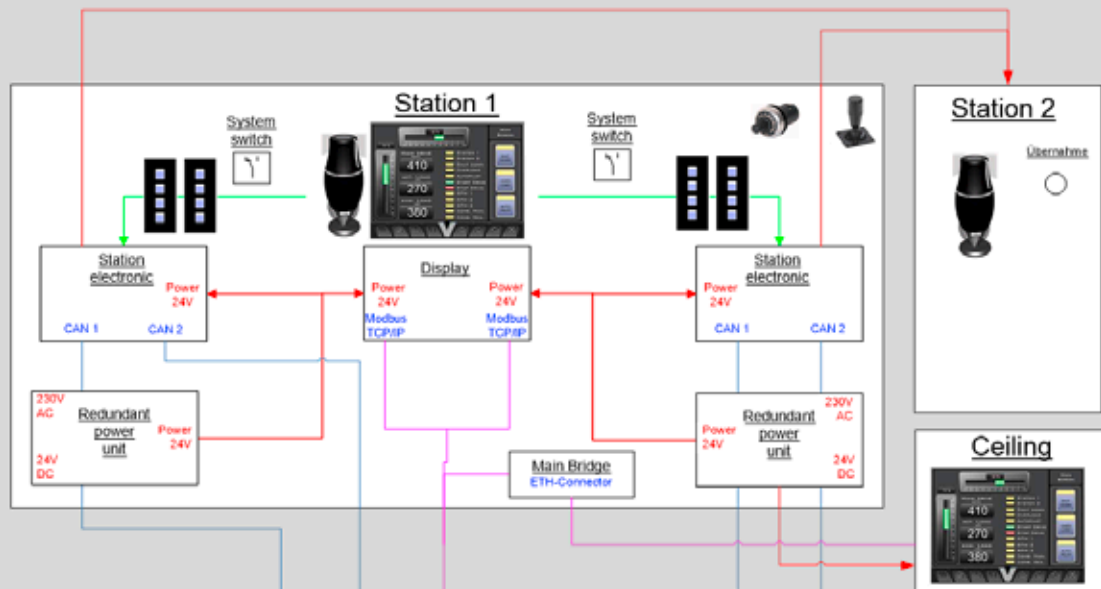
ECR room

Propeller room

Propeller room

Station 1

Station 2

System switch

System switch

Übernahme

410
270
380

Station electronic

Station electronic

CAN 1 · CAN 2

CAN 1 · CAN 2

Power 24V

Power 24V

Display

Power 24V · Power 24V

Modbus TCP/IP · Modbus TCP/IP

Redundant power unit

Redundant power unit

230V AC · 24V DC

230V AC · 24V DC

Power 24V

Power 24V

Main Bridge ETH-Connector

Ceiling

410
270
380

ECR ETH-Connector

410
270
380

VSP Controller

VSP Controller

CAN 1 · CAN 2

CAN 1 · CAN 2

Redundant power unit

Redundant power unit

230V AC · 24V DC

230V AC · 24V DC

CAN Gateway

CAN Gateway

Power 24V

Power 24V

CAN2

CAN 1 · ETH · CAN 2

CAN 1 · ETH · CAN 2

CAN 1 · ETH · CAN 2

CAN 1 · ETH · CAN 2

Power 24V

CPU System 1 & I/O Modules

Power 24V

CPU System 2 & I/O Modules

Power 24V

CPU System 1 & I/O Modules

Power 24V

CPU System 2 & I/O Modules

Drive interface

Alarmsystem

Power management

Drive interface

Alarmsystem

Power management
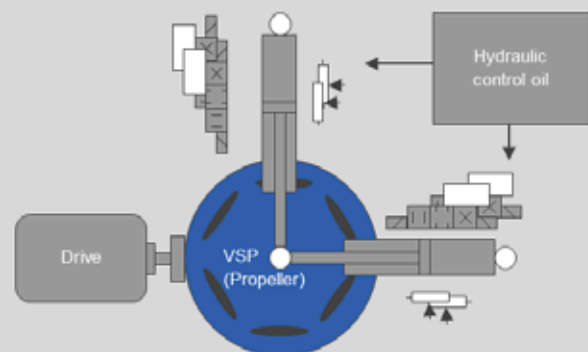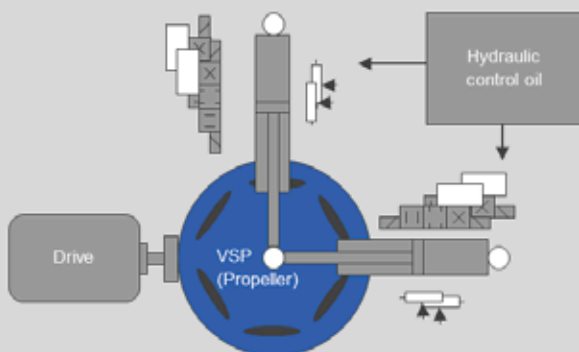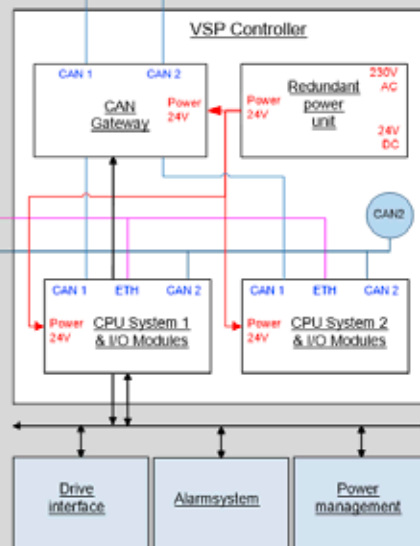
Hydraulic control oil

Hydraulic control oil

Drive

VSP (Propeller)

Drive

VSP (Propeller)

blem-free remote diagnostics via a cell phone or satellite network. A specialist can also read all the operating states and error logs, set new parameters or install updates whilst observing the highest security standards. Secure remote access considerably shortens the reaction times in the event of technical problems and enables the creation of completely new maintenance and service concepts.

Maximum ease of operation

The development of the control system also placed particular importance on optimum operability. For example, individual bridge components – joystick, steering wheel, control lever and intuitive touch display – were ergonomically designed in collaboration with Stuttgart University. The Voith control system also features the new electronic control and assistant functions which reduce fuel consumption by giving handling recommendations.

Satisfaction for all involved

»Voith is impressed by Bachmann's M1 automation system. A reliable hardware and the clear configuration interface for implementing hardware and software projects, as well as extensive diagnostic and analysis options are the outstanding features of the controller package,« Kristian Wege says. Voith's customers also benefit from the short response times required for customizations and the low commissioning costs. The smooth completion of these processes is ensured due to the continuous testing and optimizations during the development phase of the control system.

◄ The M1 automation system is installed in the engine room where it records all the operating data and any faults. The monitoring can be carried out from the bridge as well as in the engine or propeller room. M1 webMI pro also enables remote access for service and maintenance at any time.

REVOLUTIONARY PROCESS IN SHIPBUILDING

Model-based simulation with Bachmann hardware

Propulsion control systems for ships normally undergo factory testing or are tested with prototypes during commissioning. As these systems are becoming increasingly more complex, complete testing within a limited period of time is difficult. Bakker Sliedrecht has joined up with Bachmann electronic and Controllab to create a new model-based simulation process. The first ships, including the cable laying ship Ndurance, were tested with the new process – with great success.

BAKKER SLIEDRECHT

Bakker Sliedrecht Electro Industrie B.V. was founded in the Netherlands in 1919. The company plans, develops and implements electrical engineering solutions in the maritime and industrial sector. Maintenance, technical acceptance and repair work complete the portfolio of the company.

www.bakkersliedrecht.com

Typical testing procedures in shipbuilding are mostly very complex. New approaches are therefore in great demand. »We were on the lookout for new options because the demanding requirements of the ship's operators are particularly increasing the complexity of the control and monitoring systems. A reduction in diesel and energy consumption is required whilst maintaining maximum availability at the same time,« Anthon Knoops, manager of engineering automation at Bakker Sliedrecht summarizes. »Normal test procedures were no longer satisfactory here.« Together with Bachmann electronic and Controllab, we created an environment that linked a virtual model with the actual propulsion control system. All signals are exchanged between the systems. The benefits are obvious: The test engineer sits at his desk and can perform all the tests via the Bakker Integrated Modular Alarm Monitoring and Control System (BIMAC). »Far more scenarios can be run through on the virtual model than with onsite testing,« Anthon Knoops emphasizes the benefits of simulations.

Dynamic design process

The new implementation of BIMAC also makes a new kind of design possible. »What has for a long time been standard practice in mechatronics we are now introducing in the shipbuilding sector. Instead of using fixed CAD models, we develop a dynamic model that is adapted to requirements during the design process,« explains Paul Weustink, manager of industrial projects at Controllab. Continuous testing enables faults to be identified already during the design phase and the architecture of the controller adapted accordingly. The powerful, modular M1 controller system from Bachmann electronic provides here the ideal basis: This uses standard interfaces and the system is intentionally designed as an open system. This ensures the effortless transfer of customized programs.

Revolutionary Procedure in Shipbuilding

BIMAC has already proved to be an ideal solution in practical applications: Bakker Sliedrecht received the order from Shanghai Zhenhua

▲ The giant cable drum on the Ndurance.
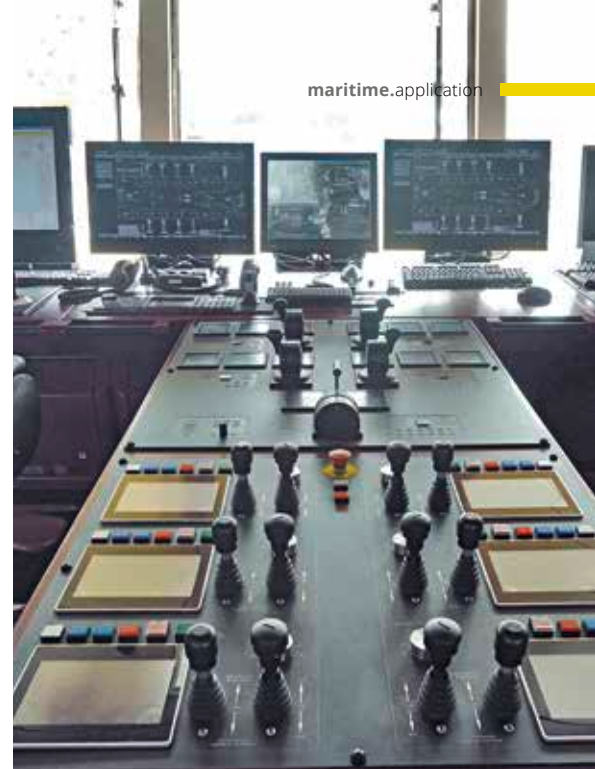
▲ The installed M1 controllers provide a constant stream of information on the bridge about the onboard systems via the BIMAC system.

Heavy Industries Co. Ltd (ZPMC) for equipping the new N class ships of excavator specialists Boskalis with the most important electronic systems. The order comprised the planning and supply of the control cabinets, the multi-drive systems for the motors and winches, as well as the controller system based on BIMAC – implemented with the Bachmann M1 controller. Even before the cable laying ship was launched, all relevant tests could be carried out in accordance with the stringent requirements of the certification and classification bodies. From their headquarters in the Netherlands, the engineers at Bakker Sliedrecht could test the azimuth drives of the ship, couplings, gears and diesel generators. The availability of the onboard grid and the adherence to the strict redundancy requirements, particularly with regard to the automatic control of the ship using dynamic positioning, were also successfully tested. »A large number of certification and approval bodies were interested in the results, so that they could use the test procedure for their own purposes in the future,« Ronald Epskamp, marine sector manager at Bachmann, explained the significance of the project. BIMAC enables the companies to do far more than functional testing. »In future we will be able to show clearly what happens in the entire grid in the event of a fault and how such faults can

be prevented. This not only applies to electronic components but even mechanical components,« Ronald Epskamp stresses.

Efficient solution

» Far more scenarios can be run through on the virtual model than is possible with testing on site. «

Anthon Knoops,
Manager Engineering Automation
at Bakker Sliedrecht

Model-based simulation makes it possible to save time and money for development projects: The construction of expensive prototypes for test purposes is no longer necessary. Tried and tested controller and drive models are then available for later use with new design tasks. The early testing enables electronic and mechanical components to be selected precisely to requirements. All this saves costs and thus reduces the overall budget for shipbuilding. »We are happy that our efforts have been worthwhile,« says a delighted Anthon Knoops. »In Bachmann electronic and Controllab we have found some competent partners with whom we have jointly created an innovative and as yet unique system in the shipbuilding sector.«

Controllab was founded at the University of Twente, Netherlands, in 1995. The company develops and sells simulation software for industry and ship-building.
www.controllab.nl

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SYSTEMS FOR SUSTAINABLE SHIPPING

HyPS builds hybrid system with Bachmann hardware

Reducing emissions and lowering fuel costs are not only the aims of the automotive industry. This is also becoming increasingly important in the shipping sector and can be achieved through the use of hybrid systems. The Dutch company HyPS is a specialist in this technology for propulsion and power supply applications in ships. In Bachmann they have found a partner that provides them with optimum support.

HyPS is a company based in Gel-dermalsen (Netherlands), which has specialized in hybrid power supplies and hybrid propulsion systems. Its service portfolio includes both the design and development as well as the supply and maintenance of the systems.

www.hyps.nl

Hybrid power supply and hybrid propulsion systems are the passion of the employees at HyPS. »One day we were faced with the decision whether or not to invest our efforts in hybrid systems, and if so, then with all our energy and commitment,« explains Rudolf Van Heek, product manager at HyPS. »Only in this way were we able to be successful.« The company took the risk and won. »Through our concentration on hybrid systems we also had the necessary resources to examine every single order down to the smallest detail and supply a system that provides the best solution,« Rudolf Van Heek explains the reason for HyPS's success. »Thanks to our intensive exploration of the subject we were able to learn a lot and acquire a tremendous amount of specialist knowledge.«
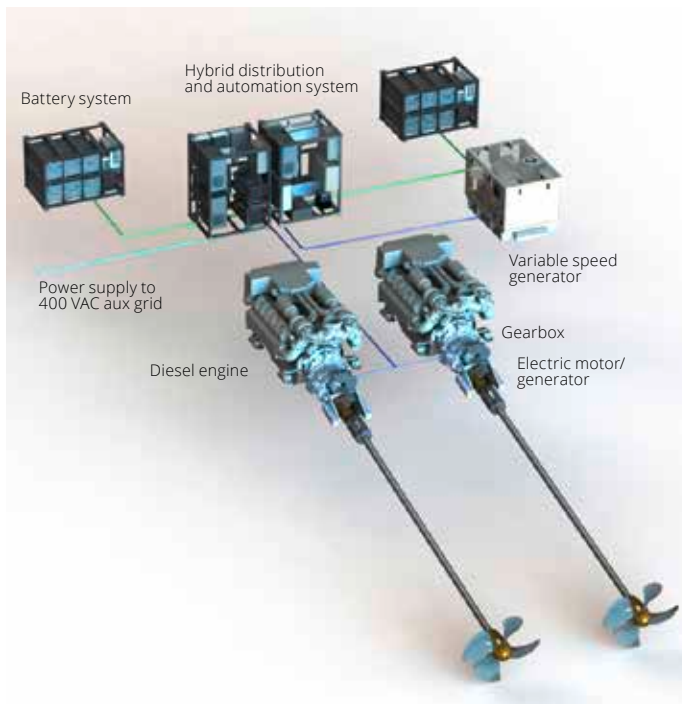
An optimum system for every ship

Regardless of whether they are for commercial shipping or private yachts, hybrid systems offer some impressive benefits. »In commercial shipping it's the reduced emissions and low fuel costs, and in the private sector, the convenience of the system and the green image,« Rudolf van Heek describes the most important reasons why customers choose a hybrid system for their ships. Regardless of where it is used, the basic infrastructure is the same. »The difference is in the details,« explains Rudolf van Heek. »That's why we collect information on the range

of the ship, environmental conditions, and the requirements of the power supply and battery storage system.« From this information HyPs creates a system which is optimally suited to the particular ship.

Hybrid automation system

The Hybrid Automation System (HAS) is required to meet several tasks. On the one hand it must process the drive commands from the bridge, provide the required power and continuously optimize operation. The core of the HAS is an MX213 processor module from Bachmann. A CAN bus master module is used to integrate components with local control units, such as the battery storage system and generators, into the control system. This process uses standards such as SAE J1939, CAN native and CANopen as a basis. All the required sensors are integrated via the GIO212. »The result is a very compact and at the same time flexible controller system,« Rudolf van Heek explains. »This allows us to expand our solution at any time without carrying out any major changes to the existing concept. For example, we are currently building a redundant control system – likewise with tried and tested Bachmann components.« HyPS was impressed by the flexibility offered by the M1 automation system. »However, we also chose Bachmann because we were able to implement the programming here in C++,« Rudolf van Heek

▲ **SolutionCenter:** Engineering and diagnoses with Solution-Center in C++ and IEC 61131-3 is combined with Simulink

▲ HyPS hybrid power and propulsion system

recalls. All configurations of the system are defined with the SolutionCenter – Bachmann's extensive engineering tool. The software module on the controller is designed so that it subsequently configures itself.

All inputs and outputs, runtime programs, project-specific features and functions, as well as communication protocols are thus activated automatically. »Every hybrid system we build is tested intensively by us in-house,« Rudolf van Heek explains. »To simulate onboard conditions as realistically as possible we have integrated a steel floor in the test bay.« With this procedure we can even detect and rectify early on faults which occur through electromagnetic phenomena. »The system is then normally accepted without any problem,« Rudolf van Heek confirms.

Competitive team

The cooperation between HyPS and Bachmann works brilliantly. »Our software combined with the Bachmann hardware produces an unbeatable system for shipping,« Rudolf van Heek is certain. This successful partnership is also due to our shared corporate philosophy: »We are both future-oriented companies and are mutually inspiring each other with innovations,« Rudolf van Heek explains. It is therefore no surprise that HyPS is already working on the next innovation.

»The benefits of hybrid systems can be optimized if they are operated correctly. Today switching between propulsion with fuel or with electricity from the battery storage system is done manually,« Rudolf van Heek explains. »In future this process will be carried out automatically depending on the actual and forecast operating conditions, thus reducing maintenance costs, increasing the lifetime of machines and naturally also further reducing harmful emissions.«

» Our software combined with the Bachmann hardware produces an unbeatable system for shipping. «

Rudolf van Heek,
Product manager at HyPS

A FOUNDATION YOU CAN BUILD ON

Ships fitted with an automation system

using Bachmann hardware

The openness of the system solution and its verification by standard shipping certificates were the reason why Ulstein Power & Control AS turned to Bachmann. Using the M1 controller as a basis, they created an automation system that can integrate any number of function units and be adapted to special customer requirements – and not just in shipbuilding.

Ulstein Power & Control AS is part of a Norwegian family business which has focused its operations on ship design and the construction of special ships. Two to three special ships are built each year in its own shipyard in Ulsteinvik (Norway). The subsystems they develop, such as for the ship's power supply or automation, are used by different ship builders all over the world.

Openness and shipping certification essential

Ulstein broke new ground in the development of an innovative automation system for ships: »Our aim was to create a system that was completely based on open source software and was entirely open in its application and further development,« explains Rune Volden, R&D manager at Ulstein Power & Control AS. »With this idea in

mind we set out to find hardware suppliers that could make such an implementation possible.« Two criteria were decisive for Ulstein to start talking with manufacturers at all: »It was vital that the individual components are certified to IEC 60945 or can be certified easily,« Rune Volden explains. »We also wanted a PC-based controller that would allow very simple data exchange with our software.« It was at Bachmann that Ulstein found this unique combination. »We were able to easily read the values on the PLC and also write on it. All relevant interfaces come already integrated,« Rune Volden explains.

Communication standard for extensive networks

The new ULSTEIN IAS® automation system is decentralized. »All ship automation tasks are

Ulstein Power & Control AS is corporate branch of the Ulstein Group ASA. The family-owned company was founded in 1917 and specializes in the construction and development of special ships for research and for offshore use. Ulstein Group ASA is headquartered in Ulsteinvik (Norway) and has around 700 employees in seven countries all round the world.

www.ulstein.com

» We appreciate the collaboration with Bachmann very much. There were one or two challenges on the way but the team always solved problems – and, very importantly, always by the agreed time. «

Rune Volden,
R&D Manager at Ulstein Power & Control AS

therefore mapped to small independently operating subsystems,« Rune Volden describes. »The idea behind this is to ensure the functionality of the ship even in the event of a fault.« Ready-to-use standard modules for pumps and valves, for example, enable the fast implementation of the automation and reduce costs for the engineering. A well functioning communication standard is needed in order to provide all the data from the extensive network in time at the right place. »We work with the Data Distribution Standard (DDS), a communication protocol that is perfectly suited for distributed networks and can handle large data sets easily,« Rune Volden

describes. On the ULSTEIN IAS® the company uses open standards entirely.

Together towards success

Two ships have now been fitted with ULSTEIN IAS®. »Jan De Nul – a leading Belgian company in the field of dredgers and land reclamation – has ordered two multi-purpose vessels for subsea rock installation and a variety of other functions, in which we are using our new automation system,« a delighted Rune Volden says. »We passed the acceptance tests for the first sections very successfully– not least because we rely on standard modules, such as for pumps and valves

▼ ULSTEIN AMS™ optimize the efficiency of ship operations with optimized user interface, that make operations safer and reduces the risk of human errors.

▼ **Scalable and flexible:** The Jan De Nul multi-purpose vessels automated with Ulstein IAS® (Photo © Jan De Nul)

▶ **Installation at reduced cost:** New hardware and software components can be added to the configuration system and whilst the setup is automatically.

or also the ballast water system. This reduces engineering costs, reduces faults and increases the quality of our automation.« Thanks to the pleasing test results, the automation can be installed soon: »We are supplying the system to the shipyard in China in autumn 2016 and the ships will be launched in the early part of 2017,« Rune Volden describes the future schedule.

Bachmann has also played its part in the success of the ULSTEIN IAS®. »We appreciate the collaboration with Bachmann very much. There were one or two challenges on the way but the team always solved problems – and, very importantly,

always by the agreed time,« a delighted Rune Volden confirms. »In terms of technology, the openness of the system, the quality and reliability of the Bachmann products impressed us greatly.« And we are also sure of the course we will take in future. »We would really like to use our IAS in other areas such as in wind power. We are sure that it has been well worthwhile,« Rune Volden sums up. »We like working together with Bachmann. They are dedicated and innovative. These are good foundations for a long-term partnership.«
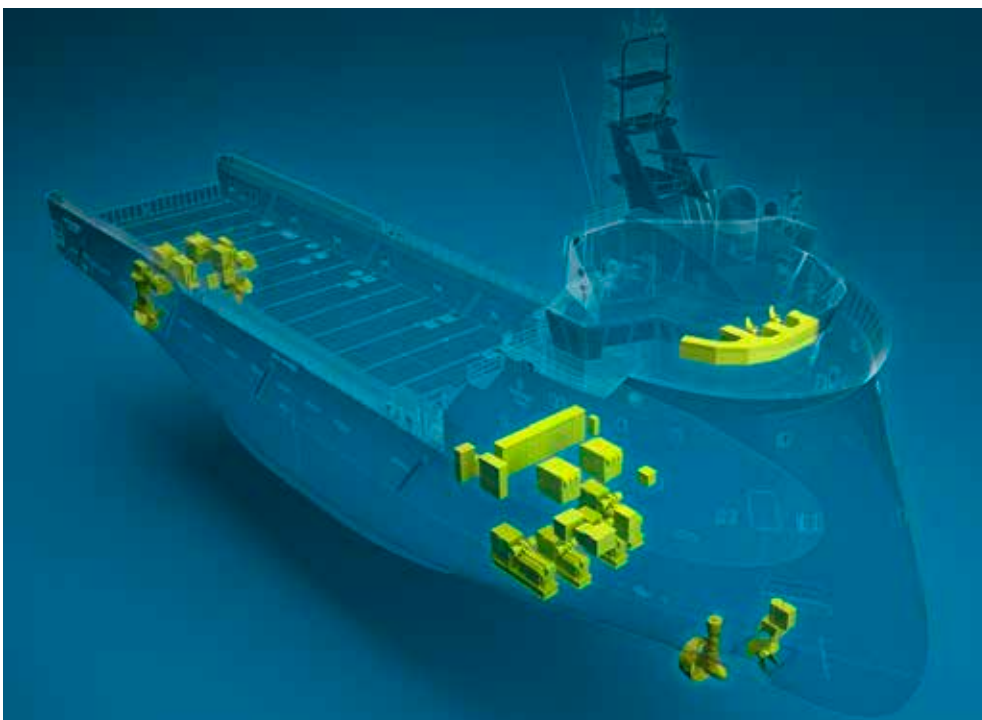
◀ The ULSTEIN IAS® automation system enables the control and monitoring of machines and drives, ship's power, alarm systems, power supply – and also management. However, it can also be used for other function-critical systems.

PRECISE, CHALLENGING AND EXCITING

Cable angle in view

Cable laying for offshore wind turbines works with M1 automation from Bachmann. In the middle of 2014 Van Oord, a solution supplier for dredging coastal areas and building plants for offshore power generation, launched the cable laying vessel Nexus.

▲ The DAM is mounted directly at the CHUTE. The existing arm enables simpler positioning.

partner in technical solutions

The engineering company Pliant is based in Breda (NL), and develops technical solutions for agriculture, the food industry, the marine and offshore sector as well as the recycling industry. The company also includes robotics to its fields of activity, as well as visual scanning systems and machine controls.

www.pliant.nu

This multi-functional vessel is used for installing electrical cables for offshore wind farms. Difficult environmental factors – such as high waves – turn this task into a major challenge. An innovative winding system from Pliant was used to prevent damage to the electricity cable. The M1 automation system from Bachmann ensures that the cable laying is reliable.

The first task of the 123 meter long cable laying vessel Nexus is the laying of power cables between the wind turbines of the Gemini wind farm, 85 kilometers off the coast at Groningen (North Netherlands). The ship will transport a full load of up to 5,000 tons of cable. The expansion of the offshore wind farm is to be completed in 2017 and an annual production of 2.5 TWh of electricity is planned.

Constantly changing environmental conditions

One of the major challenges in this work is the high waves on the open sea – the lowering of employees or the installation of wind turbines becomes here a huge feat. The considerable motion of the ship is the largest problem for cable laying: »The underwater cables are unwound from a large carousel in the middle of the ship and then slide off board at the rear of the ship down a chute to the bottom of the sea,« Alex Heurkens, CEO at Pliant in Breda, describes the laying process. »If the end of the ship rises and falls several meters on account of the swell, this is critical for the cable – it is either put under too much tension and is thus damaged or it is compressed and in the worst case even breaks off. This results in expensive repairs.«

Always the correct tension

In order to control the unwinding of the cable, the Nexus cable-laying vessel is equipped with an electrohydraulic system, which controls the tension of the cable during unwinding and regulates it accordingly. This is done by monitoring the tension of the cable: »We are constantly checking the departure angle of the cable. In the offshore sector this is called a DAM or 'departure angle measurement system',« Alex Heurkens explains. »It is the angle between the cable and the vessel – at the moment when it leaves the ship«, Heurkens continues. »This angle provides reliable information about the actual tension of the cable.« The data collected is passed on to the controller of the cable tensioner and this is adjusted accordingly. In this way, even severe rising and falling movements do not present a problem for the cable.

» The M1 offers the required performance to make this process at all possible. «

Alex Heurkens,
General Direktor at Pliant
in Breda

Impressive marine approvals and performance

The measuring system developed for this task consists of a sensor box with three vertically arranged Sick LMS 511pro laser scanners for measuring distance. With a frequency of 25 Hz, these scanners provide a precise and reliable image so that the departure angle can be determined exactly. The control of the processes inside the sensor box and the connection to the vessel's automation system is handled by a Bachmann M1 controller. »The data from all three lasers is continuously processed by the PLC. This calculates directly the precise position of the cable and passes these values on to the higher-level control system,« Alex Heurkens outlines the process. »The M1 offers the required performance to make this process at all possible. It also provides all the required interfaces for the cameras and for controlling the valves.«

Added to this is the fact that the M1 automation system is very robust and also comes with all the marine approvals that are required: »The sensor box is located at the back of the ship directly above the cable outlet. It is therefore exposed to seawater, wind and rain without any protection,« Heurkens continues. »These are conditions in which only a few controllers can operate reliably and accurately. The Bachmann M1 is one of them.«

▼ Three vertically arranged laser scanners measure the departure angle of the cable at the aft of the ship.
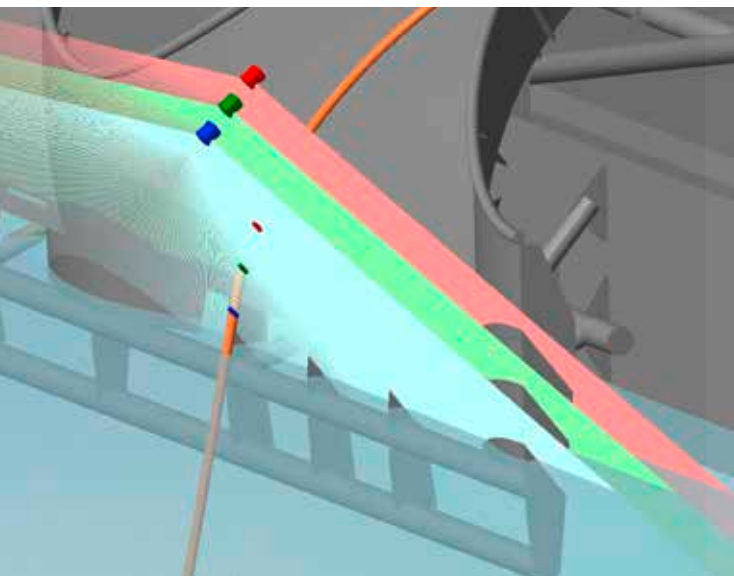
▼ The DAM (Departure Angle Measurement) is used to control the departure angle of the cable. The Bachmann M1 controller controls the processes inside the sensor box and the connection to the vessel's automation system.

RADIATION-FREE MONITORING

Nuclear-free density and concentration measuring

with proven M1 controller from Bachmann

With its DENS-ITOMETER, the British company ITS (Industrial Tomography Systems) has managed to develop a measuring system that operates without the need for a nuclear energy source. It thus offers a greener and inexpensive alternative to conventional devices for this task. The rugged systems of Bachmann electronic have made a vital contribution here.

The British company ITS (Industrial Tomography Systems) is a worldwide leader in the development and manufacture of tomography measuring systems. This technology enables measurements in pipes and tanks, thus offering a deeper insight in the dynamics of complex processes.

www.itoms.com

The measurement of the density and solid particle concentration of liquids in pipe slurry is particularly important in the hydraulic conveying of (wet) dredged material. In order to determine these metrics only products operating with nuclear radiation could previously be used. This is not the case with the DENS-ITOMETER from ITS, which is also known as the »Gamma Buster« due to the absence of a nuclear energy source. »The DENS-ITOMETER is the result of years of development in successfully using the measuring techniques of electrical resistance conductivity in sea water based areas,« explains Ken Primrose, CEO of ITS.

Ruggedness for harsh en vironments

The kernel program of the software was developed by ITS with MATLAB® / Simulink® and then tested on a standard PC. After consulting with industrial customers, it quickly became clear this was not suitable for use in the intended environment. »The computers were not industrially robust and could not therefore be deployed,« Ken Primrose explains. It was here that Bachmann electronic was able to stand out. The M1 controller hardware was the only industrial controller tested that was able to process the software directly and was optimally suited for use by the excavation and building company due to its rugged design. The DENS-ITOMETER consists of a pipe-based sensor, and Bachmann's M1 controller is housed in the control cabinet together with the p2+ device from ITS and the associated equipment. The system also reliably supplies real-time data irrespective of flow regime and material concentration, even in extreme conditions, such as with 1.2 meter pipe diameters or slurry conveying rates of over 30,000 tons per hour.

Radiation-free measurement

The pipe-based sensor is provided with electrodes which are arranged on the inside. The solids concentration can thus be determined according to the conductivity inside the cross-sectional volume of the pipe. The sensor is connected with the ITS devices and the M1 controller, where the data is evaluated with the software, and the density of the slurry flowing in the pipe is calculated. The acquired data is then visualized via webMI in a graph and tomograms via a browser. The concentration information is provided as a 4-20 mA signal. Once installed, the DENS-ITOMETER requires no further maintenance or specially trained personnel.
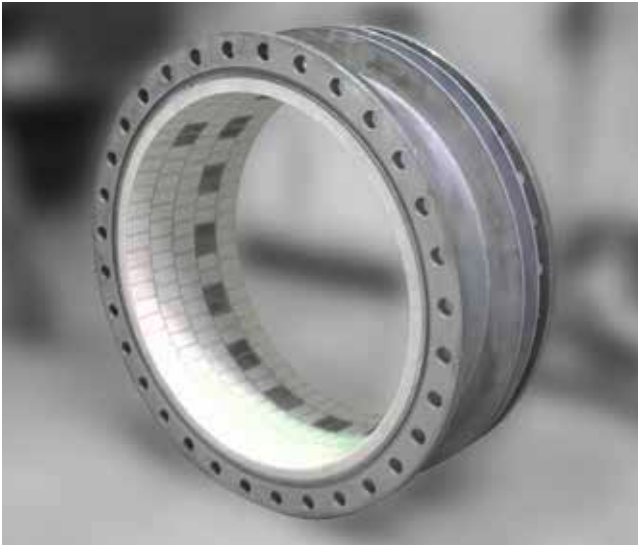
▲ The DENS-ITOMETER pipeline sensor.

▲ The M1 controller is installed in the control cabinet.

Successful operation

Already during the development phase, the DENS-ITOMETER from ITS was deployed on a suction hopper dredger owned by Van Oord, the leading dredger company, and compared with a gamma densitometer. Even in extreme field applications, the device reliably supplied the required information – in real-time. It is now used in several excavators. It is not only used here for monitoring slurry. The measu-ring of solids content in pipeline is also required in a large number of sectors such as the food industry. »The many years of development and the extensive know-how involved make the DENS-ITOMETER the most unique measuring system to date,« says Ken Primrose, »thanks to the easy handling and the low operating costs it is currently our number one selling industrial tomography system.«
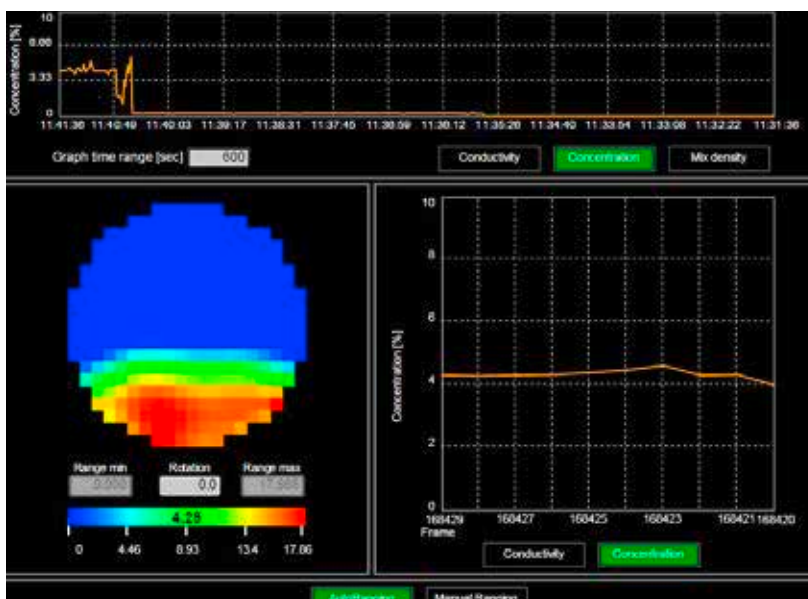
◀ Everything in view: The acquired data is visualized in a graph.

MORE THAN A FACELIFT

Tailored measured value processing for the

FOMO4524 research engine of Flensburg University

An analysis of the measuring technology on the FOMO4524 medium-speed 700 kW research engine at the Flensburg University of Applied Sciences uncovered several weak points that had developed over the years. Besides hardware faults, both the programmable controller (PLC) and the evaluation software contained settings and results that were no longer plausible. A repair seemed just as costly as a completely new installation. The decision was therefore taken to implement – at slightly more cost than a repair – a completely new measured value processing system for the slow signals of the engine and its supply systems.

Requirements and solutions

The objective of the new installation was not just restricted to rectifying faults. Several factors had to be taken into account in order to improve the future work at the test stand: It also had to be ensured that students and employees with a knowledge of engines but without any experience in PLCs could operate and modify the plant, whilst still making it possible to carry out advanced mathematical tasks such as numerical derivations or the filtering of signals. Through the increased automation of the evaluation functions, savings had to be made in personnel costs and particularly fuel costs, which are around 1000 euros per test day. The software used also had to make it easy to present algorithms transparently, provide informative comments for them, as well as document any changes. Besides the clearly designed operation and presentation of results, it also had to have a uniform design and contemporary user interface. Finally, calculation parameters and results values had to be managed easily and saved with backup functions.
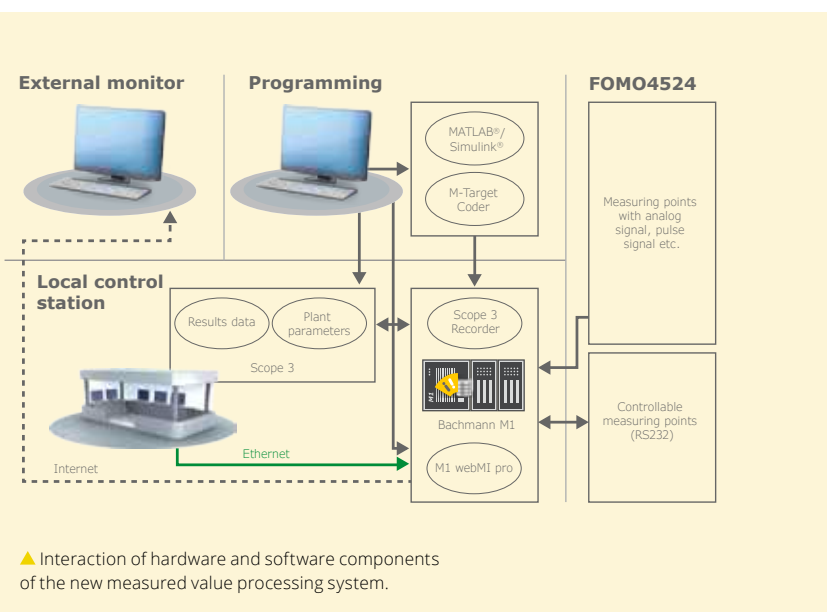
PLC programming via MATLAB® / Simulink®

When the university assessed the products available on the market, they particularly took the simplicity and transparency of the PLC programming and maintenance into consideration as well as the purchase cost. Bachmann electronic was chosen since the programming of the M1 automation system could largely be carried out using the MATLAB® / Simulink® software which was available at the university. Students created a tailored measured value system from different hardware and software components, which could stand up in comparison with any solution created professionally. Commands and formulas were combined into graphical blocks in MATLAB® / Simulink® and then uploaded onto the PLC unit. Besides the basic functions of measured value processing, such as the calculation of a heat flow rate from temperature, mass flow rate and specific heat capacity, new functions such as signal filtering using parameterizable low pass filters or the automatic determination of the stationary operating state using the time derivation of status signals could be implemented.

Improved result quality

Since the skills required for this type of PLC programming could be learned quickly, several additional functions were defined which served to improve the quality of the results. In the simpler version, the specific heat capacity values still used as constant parameters could thus also be included in future with a minimum of effort as temperature-dependent variables. The graphical user interface also enabled more complex functions to be displayed without any knowledge of an extensive syntax.

Tailored graphical user interfaces

The measured data is visualized via the ›M1 webMI pro‹ software, which is installed directly on the PLC. This enables any device with a web browser and a network or Internet connection to the PLC to be used as an HMI (Human Machine Interface). The software supports the clear display of the operating data over several monitors and also enables the measured data of different locations to be viewed simulta-

▲ Interaction of hardware and software components of the new measured value processing system.

▲ Visualization of the measured values for the exhaust system.

neously via an Internet connection. This last feature is particularly important for the FOMO4524 run in Flensburg since the Flensburg Maritime Center collaborates with partners in Southern Germany, Austria and Switzerland. The measured data visualization is output in scalable vector graphics (SVG) format, allowing the loss-free changing of the display scale.

Uniform and individually tailored

The visualizations are designed and configured in ›atvise® builder‹. This offers several ready-to-use displays which can be configured easily to suit particular requirements. Displays and interface animations can also be created easily by the users themselves. The object-oriented program structure enables a summary of parameters of the same type to be shown in different displays. In this way, changes on a reference display unit can be transferred to all connected devices. This ensures the uniform appearance of the HMI that is tailored to the requirements at hand.

When the HMI was created, the new functions included tabs for the structured ordering of different display areas, as well as links to jump labels for changing between different displays and bar graphs for mean value deviations. Superimposed graph curves, autoscaling functions, as well as color changes for out of range values were also positively received by the project team and gave rise to a visually attractive design for greater functionality. The clear programming structure even enables major adaptions to be made by relatively inexperienced users after a short introduction. The expansion of the fuel system planned for 2015 will therefore also be possible with very little effort with regard to the maintenance of the measured value processing.

Documentation of measured values

Both the raw data measured at the engine as well as the different values calculated are documented using the ›Scope 3.0‹ software. This includes the saving of the data on the PLC as well as the creation of archives in CSV format on the PC. The visualization now enables the choice between real-time data and saved archive data, and the display of measured values as configurable plots. Time step widths can be set in groups of measured values independently of

the visualization and the documentation. In this way result parameters for different signals can be stored so that any superfluous data collections are avoided. The possibility to set the data storage function to individual requirements enables different storage strategies to be used for the saving of test data for stationary and mobile operation within one recording. In the forthcoming months, the most suitable method for processing the archive data will be examined as part of another student-based project. This will make it possible to provide a clear and attractive design for test reports with a minimum of effort in terms of personnel.

Conclusion

The introduction of the new hardware and software completely fulfilled the hopes of the university for a cost-effective way to considerably improve the processing of measured values. The idea of letting the students take care of the PLC and visualization largely on their own also proved to be successful. The Flensburg University of Applied Sciences is therefore planning in the next two years to modernize further engine test stands in the same way.

» The simplicity and transparency in the M1 automation system made a big impression on us. «

Prof. Dr.-Ing. Michael Thiemke,
Marine engineering,
FH Flensburg

EVERYTHING UNDER CONTROL – EVEN IN STRONG WIND

Safe installation of offshore wind turbines with Boom Lock©

Offshore operations have increased rapidly in recent years: Wind turbines are thus becoming increasingly larger and wind farms are being located increasingly further away from the coast. To make their installation possible, ships have been continually adapted for operation in rough seas. However, up to now very little attention has been paid to cranes and their central task – lifting. Until today: This is because High Wind has developed a ground breaking solution in the form of Boom Lock©, using the technology of Bachmann electronic.
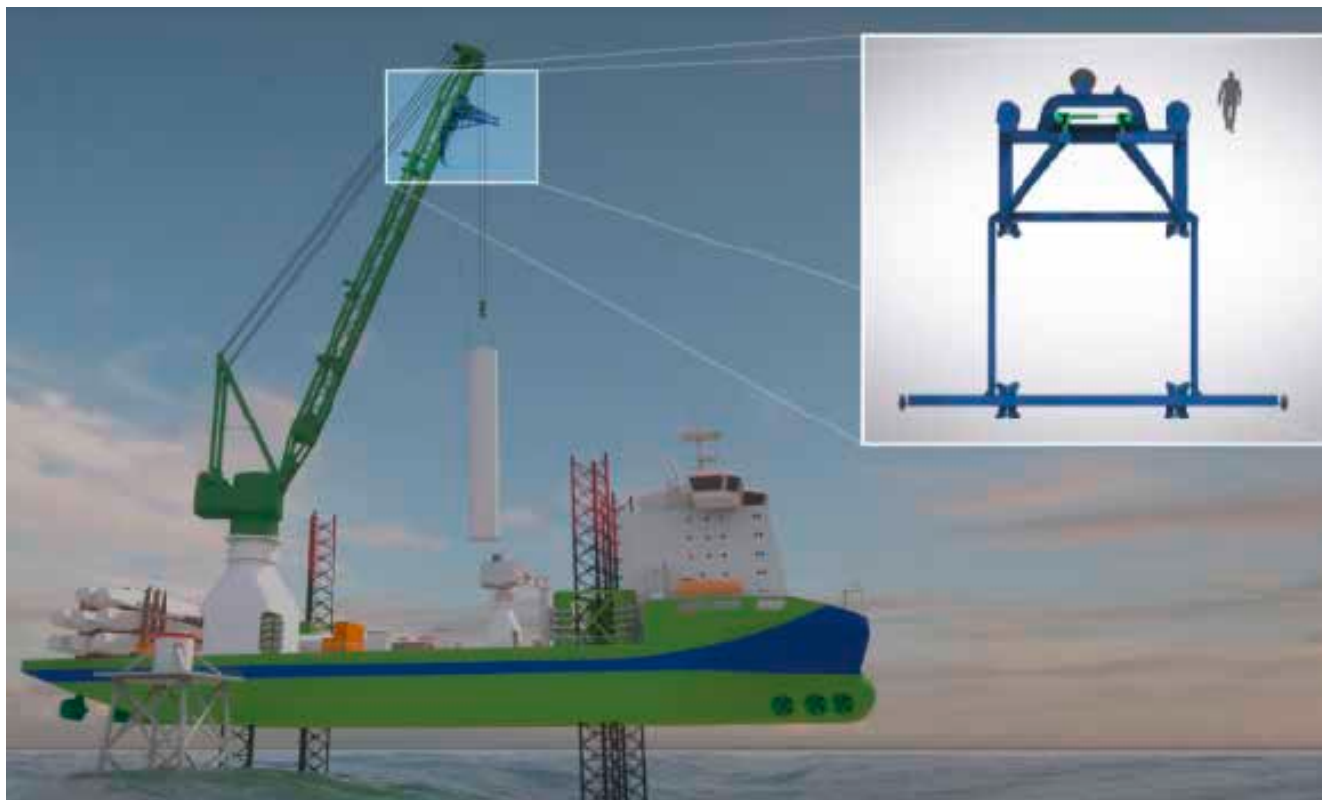
▲ Boom Lock® is a mechatronic system that enables offshore wind turbines to be installed faster and more safely even in strong winds.

Boom Lock® is a mechatronic system that enables offshore wind turbines to be installed faster and more safely even in strong winds. »With Boom Lock® these can be erected even at wind speeds of 15 m/s. This results in a doubling of the time window in which the installation can take place,« explains Ole Jacob Wang Nielsen, general manager at High Wind. »The installation time is also shortened by 25 percent.«

More precision, more safety

Boom Lock® is fastened directly on offshore cranes. »If the distance between the turbine part to be installed and the crane becomes critical, Boom Lock® fixes the hook in a metal frame and thus prevents any lateral swinging. However, forward and backward movements still remain possible,« explains Ole Jacob Wang Nielsen. »Only at the end of the installation is the hook completely fixed. From this point onward, very precise movements are also possible.« Boom Lock® is controlled by the crane operator. »We have ensured that we restrict the normal operation of the crane as little as possible,« Ole Jacob Wang Nielsen notes. »Boom Lock® can be activated with just one button on the keypad and then controlled with the usual operating elements.« Together

with engineering consultants Controllab, High Wind built a realistic simulator to provide training and qualification facilities for people working with the new tool. An integrated safety system also prevents collisions and damage by providing functions such as overload warnings.

All requirements fulfilled

Boom Lock® started with an idea. High Wind wanted to create a tool that gives us complete control of the load moved by a crane in all directions. It also had to be suitable for all components and turbines and had to avoid as much as possible any impairment of the capability and functionality of the crane ship. Access to the new tool also had to be as easy as possible. With Boom Lock® this idea became reality. High Wind also brought Bakker Sliedrecht and Controllab on board as partners. Besides PLC code, the Bachmann M1 controller also understands the C code automatically generated by 20SIM and comes with integrated safety functions. Bachmann was a clear choice due to the key arguments in its favor. Together with Controllab High Wind simulated, tested and optimized the system even before the prototype was built. The required modules of the M1 automation system are installed both in the

» We use a powerful MH212 processor module, which handles all the control tasks and provides all the necessary interfaces for the inputs, outputs and encoders. «

Ole Jacob Wang Nielsen,
General manager at High Wind

control cabinet and also in the Boom Lock®. The powerful MH212 processor module handles all the control tasks and provides all the necessary interfaces for the inputs, outputs and encoders. The extensive safety concept was created by system integrator Bakker Sliedrecht, who was also responsible for building the control cabinet and cabling, together with Bachmann specialists.

Successful test run: Tremendous interest in Boom Lock©
The results of the first trials in practice were impressive. In a test run, the blade of a 6 MW turbine could be held stably in the wind – at a wind speed of 15 m/s with gusts up to 20 m/s. Since then an offshore project was successfully completed in which fifteen 3.3. MW turbines were installed. Several companies have already expressed their interest. High Wind are convinced that Boom Lock's success is not just down to them alone. Reliable partners like Bachmann, Controllab and Bakker Sliedrecht, who took part in the project with great enthusiasm and commitment are the key to this success.

▲ The operator has full information on the crane and the Boom Lock®

◄ Hook block designed for safe lifting of heavy load gets guidance from the Boom Lock® system

ALWAYS ON THE RIGHT COURSE

Powerful ship controls with

the Bachmann M1 system

Schottel has become the market leader in the field of ship propulsion systems on account of its continuous further development of products, its insistence on the highest quality standards, as well as its worldwide presence and proximity to the customer. In order to meet the more demanding requirements placed on the control systems, Schottel has recently started to rely on the Bachmann M1 system. The product line ranges from thrusters up to 1.4 MW to fully controllable rudder propellers up to 6 MW, right through to complete propulsion systems up to 30 MW.

Schottel has been developing and producing propulsion and maneuvering systems for ships of all sizes, application fields and waters for over 50 years. With over 800 employees worldwide, the company manufactures a wide range of rudder and control systems.

www.schottel.de

Some time ago Schottel decided to extend and optimize its Masterstick control system. This was because of the increased demand on the computing and processing speed of the controller and the resulting need for increased CPU performance. This was previously not fully achievable with the system used.

Masterstick – the simple way to steer a ship

The Masterstick is a control system that can control up to six ship propulsion systems at the same time. The drive thrust and ship's direction are controlled in combination by a joystick. The ship's direction of movement is a result of the movement of the joystick. The degree of deflection determines the thrust. Using an operator console (panel) the captain can select diffe-

rent drive and control modes as well as other options. The console also serves to provide the captain with different visual information.

Performance – robust design – openness

The requirements placed on the new control system were very high. After intensive searching and comprehensive tests, Schottel decided to go with Bachmann's M1 system. »The high computing power, the compact and robust design and the total openness of the M1 system absolutely impressed us,« explains Christian Böttinger, project manager for the Masterstick at Schottel. This enabled the company to implement a quick migration and meant considerable savings in time and costs: The complex control systems that already existed in C-code could be

integrated into the software of the new controller simply and quickly without any major changes.

High computing power required

A further challenge to the ship's steering is the implementation of the extremely complex and computing intensive controller for the »Auto-heading« function that automatically maintains the ship's course. To do this, a quick and precise piloting of the drives is required, which permanently reads and calculates information from a compass that is attached to the automation system. The results from the calculation are then continually transferred in turn to the manually preset course so that the selected course is always held. The difficulty with all of this is in assigning the manipulated variables to the drives in real-time, according to the ship and

drive specific parameters. To do this the drive's actual values such as the steering angle, pitch signal (the propeller's pitch control) or the rotation speed must be taken into account in the calculations in addition to the compass signal at all times. The control of the port and starboard swaying of tugboats presents a similarly complex problem. This too requires real-time computing power. If a drive fails, an optimal heading must still be precisely and quickly determined, especially when towing ships for example into a harbor, which requires an extremely high degree of maneuverability.

Impressive range of features

The extensive array of interfaces on the MX213 CPU allow an extremely slim design of the required controller hardware. This allows the

compass to be directly connected to the CPU via one of the integrated RS232 interfaces. Because the processor module can operate up to eight different CAN buses, the six important drive systems can also be operated directly without further intelligence. The integrated web functionality of Bachmann's CPU also impressed Schottel. »We were thrilled with how fast visualizations could be generated and saved to the processor module's compact flash card as a Java applet using Bachmann's SolutionCenter,« says project leader Böttinger. With systems that are not equipped with a touch panel, a standard web browser allows for access to these applets. »These access possibilities and the security standards right up to the SSL encryption also greatly ease and simplify remote maintenance,« Christian Böttinger adds.

Brilliant functionality

Beside the high performance, the range of interfaces and the robustness of the system, the Schottel engineers appreciate the powerful SolutionCenter engineering tool. This enabled

▶ **The Masterstick:** Simultaneous control of six ship propulsion systems.

Gyro Compass

Wind Sensor

Visualization Masterstick

AFT Panel (group 4)

STB Panel (group 3)

PS Panel (group 2)

Main Panel (group 1)

RS232/RS485

RS232/RS485

Ship Ethernet (LAN)

router

LAN

CAN

CAN

CAN

24V DI

Global propulsion CAN system

| Switchbox 1 | Switchbox 2 | Switchbox 3 | Switchbox 4 | Switchbox 5 | Switchbox 6 |

connector plug

1 2 3

CAN

Portable Panel (group 5)
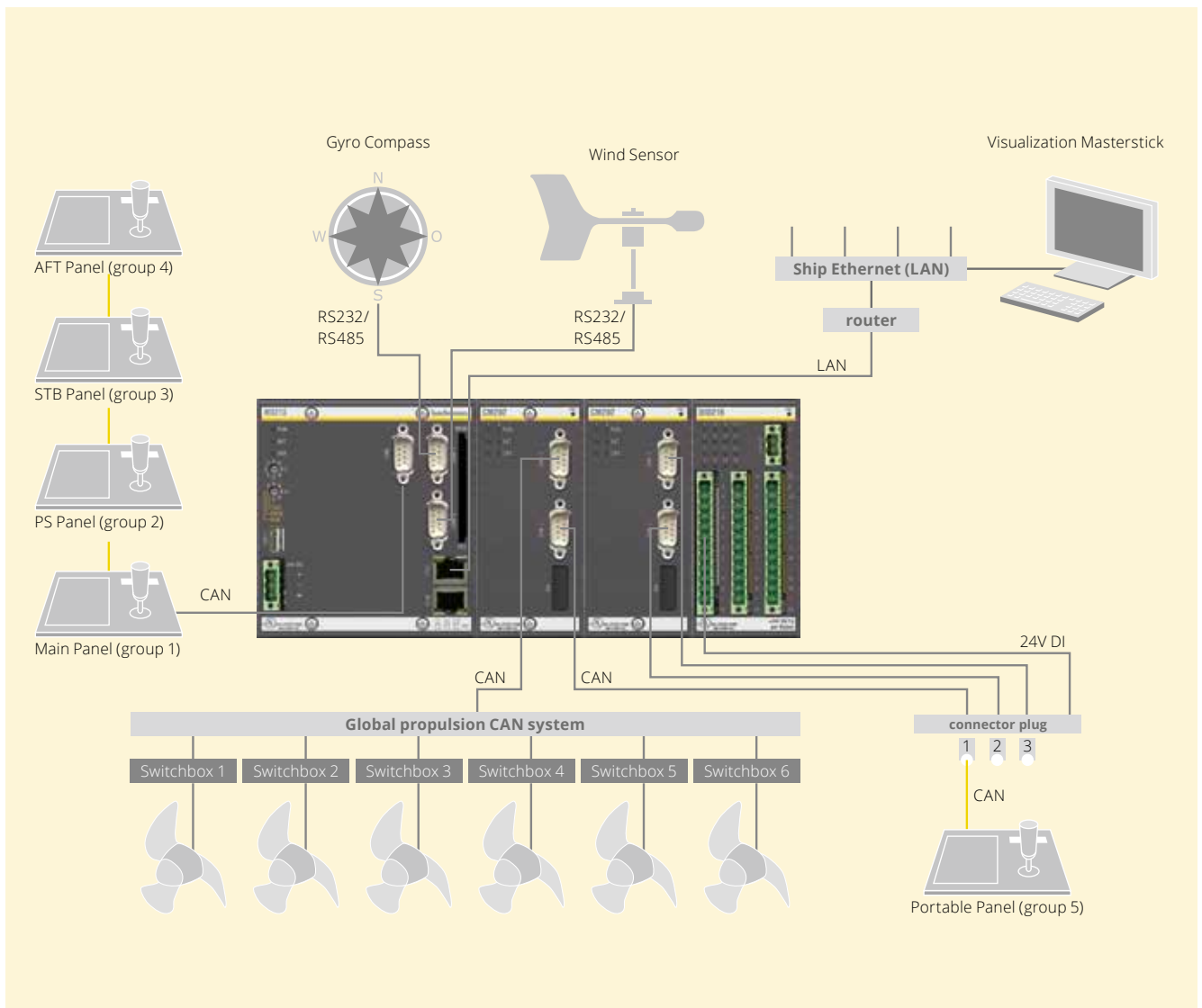
▲ The high performance and the wide range of interfaces allow an extremely compact design for the ship's control system.

the »Masterstick« project to be implemented on a standard controller system in a very short time. The key benefit was the fact that Schottel's core expertise in closed-loop control technology, which had been collected over many years and had resulted in a large number of tested closed-loop control C routine modules, could be ported easily and efficiently onto the M1 controller. Schottel's control engineers were also impressed by the integration of MATLAB® / Simulink® into the M1 system, which dramatically saved time during calibration. »Last but not least, the excellent and competent customer and application support from Bachmann engineers confirmed to us that our decision to go with the M1 system was the right one,« Stefan Buch, manager of Electric and Electronic Development at Schottel, sums up.

AVAT & BACHMANN

The innovation drivers of efficient controller systems for gas and dual-fuel engines

AVAT GmbH has established itself worldwide as a reliable and competent engineering partner on the market. With its team of 80 employees, the Tübingen-based company has been well-known amongst reputable manufacturers of large engines. With over 7,000 installations, AVAT is one of the largest, independent suppliers of control systems for gas and dual-fuel engines. The specialists develop these in the rating classes from 400 kW to 10 MW, with particular importance placed on increasing efficiency as well as smooth operation. The core of the AVAT system solution is the M1 control technology of Bachmann electronic. This provides flexible maritime automation with open software and hardware and has all the relevant marine approvals, such as DNV-GL (Det Norske Veritas and Germanischer Lloyd).

Together on course for environmental protection

The world's oceans have been the most important transport routes since the beginning time. Due to the increase in maritime transport, more stringent emission laws are already applicable in coastal waters. »Environmentally-friendly drive concepts are therefore more in demand than ever before,« explains Martin Greve, head of product management at AVAT. »Compared to diesel units, low-emission gas engines are being used increasingly more frequently.« Ship operators thus benefit from the reduced production of smoke and soot, as well as the flexibility of operating dual-fuel engines with natural gas or liquid fuel. »The regulation of gas engines and the monitoring of operating parameters are highly complex areas, requiring a great deal of know-how,« explains the graduate engineer. »Combustion processes must be ensured in changing gas mixtures and increased nitrogen oxide emissions or ignition failures must be prevented. Engine control and gas propulsion combustion processes also have to be coordinated precisely.« Reliable and powerful components are indispensable for this kind of control solution. For this reason AVAT chose Bachmann electronic's automation system.

Flexible, autonomous and custom controllers

Based on a modular system, all engine manufacturers receive perfectly matched controller solutions from AVAT – from the combustion control right through to teleservice. If necessary, this can also be expanded with several function modules at a later time. This offers engine manufacturers maximum flexibility, individuality and openness in the controller solution.

The powerful M1 controller technology of Bachmann electronic is an important element of the openECS engine control from AVAT. This fan-less industrial controller was designed especially for the harshest environmental conditions and guarantees smooth operation on rough sea. The proven PLC is designed for the extended temperature range from -30 °C to +70 °C at the top level as well as worldwide and long-term availability. Bachmann electronic's robust M1 can also withstand all typical engine vibrations. The controller platform also comes with all the relevant marine classifications and, together with the AVAT technology modules, handles functions such as anti-heeling, speed, power or mixture control and engine control. Bachmann electronic's system architecture designed for network

The Gansslos engineering consultancy was started in 1988, offering development services in the field of decentralized energy generation and power supply technology. AVAT Automation GmbH was founded in Tübingen (Germany) in 1993. The company is one of the specialist engineering partners for manufacturers of large engines, plant builders, energy suppliers and operators of decentralized energy systems. Its portfolio includes a range of hardware, software and services for energy automation.

www.avat.de

capability also enables the M1 to be integrated easily into innovative controller platforms, as well as that of the engine control system. Real-time Ethernet, CAN, Profinet and many other open standard interfaces ensure trouble-free communication.

Greater degree of freedom for engine manufacturers

Several different programming languages can be used for programming the Bachmann controller: IEC 61131-3, C/C++, Java, Controllab 20-sim, MATLAB® / Simulink® or HTML5. The IEC 61131-3 development environment also offers the application developer a wide range of ready-to-use functions in the form of function blocks and libraries, which save a great deal of time.

Engine manufacturers and plant builders are able to implement their applications on their own or have them developed by AVAT – the certified system integrator for Bachmann (CSI). AVAT allows customers to access the source code of the software levels. This makes it possible to view and change all details at any time. The central database is a special feature of the openECS. All relevant data objects are managed at a central location so that monitoring, logging and recording functions run in the background. This program configuration can be changed quickly and allows comprehensive monitoring functions and complex release conditions to

be implemented. »Our customers particularly benefit from the standard functionality on all levels, simplified testing and detailed simulation options. Engine simulation is particularly important for manufacturers or plant builders. This significantly reduces costly testing and commissioning times,« product manager Greve further explains.

Operating status called up from anywhere in the world

With preconfigured VPN routers establishing encrypted communication between a secure rendezvous server, authorized users can log into controller platforms in order to obtain information about actual plant status. This saves considerable time and costs for maintenance and service operations. AVAT can also boast a new software module which sends time-triggered or event-triggered encrypted data packets to central servers. These are further processed into status indications or fault messages and sent by email or SMS to the responsible service employees.

Together on course for success

The innovative controller concept is very well received on the market. Engine manufacturers and plant builders particularly appreciate the openness and flexibility of this system. »You can configure your own controller platform to customer specifications at any time,« Thomas

◀ **The openECS open control concept:**
From the very beginning, engine manu-
facturers or plant builders are included in
the configuration of the system in order
to offer the optimum possible controller
platform.
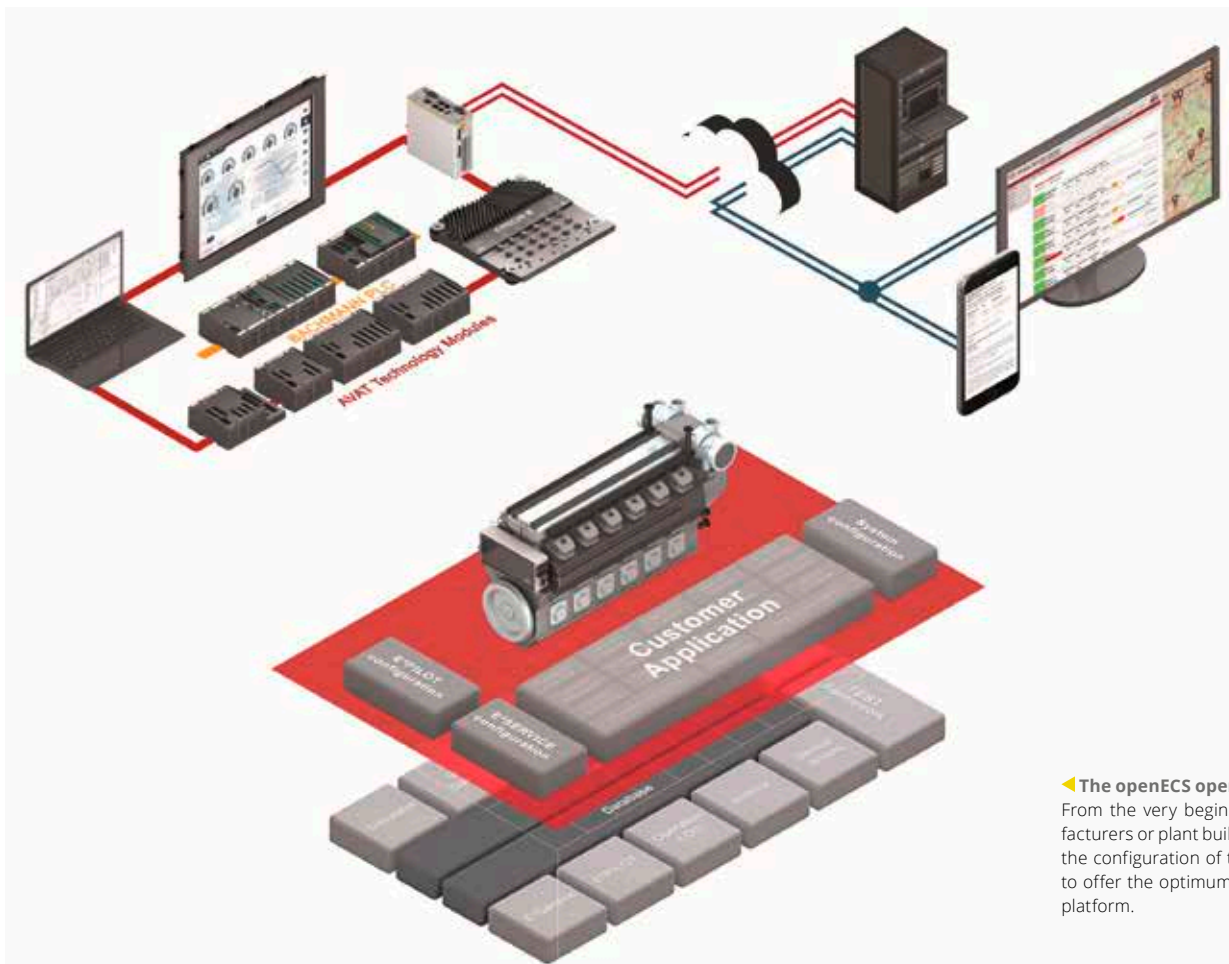
Hutter, sales manager for large engine auto-
mation, describes the product features. »Our
modular system, consisting of hardware and
software modules, offers the right modules for
standard applications right through to complex
tasks. Every customer can determine themsel-
ves whether to purchase just components or a
fully developed system. In any case, they receive
a tailored controller solution that meets their
requirements 100 percent.«

»We chose Bachmann electronic because we
found the M1 to be a controller that already
comes with a host of marine certifications. The
expansion with AVAT technology modules has
resulted in a highly specialized engine control
system for large gas engines. We also appreciate
the expert advice and partner-based support
which was a key factor in the success of the col-
laboration with Bachmann electronic,« Thomas
Hutter emphasizes.

» We also appreciate the expert
advice and partnering support
that is a central factor in the
successful collaboration with
Bachmann electronic. «

Thomas Hutter,
Sales manager for large engines

A NEW CORE

Modern machine monitoring

for river cruiser

A ship repair often also involves the replacement of a large section of the automation system. In this operation the technology is brought up to the state of the art and made ready for the challenges of the future. besecke GmbH & Co. KG was awarded a repair order requiring the replacement of the machine controls. For this, they approached Bachmann electronic.

besecke automation

besecke was founded in 1948 as an armature winding shop and now supplies automation and system technology all over the world. Maritime systems is one of the company's specializations in addition to the food and automotive industry as well as specialized engineering. The portfolio includes basic and detailed planning, project and building management, as well as the commissioning of maritime plants. The company has been part of the Lürssen Group since 1989 and has approx. 170 employees at sites in Bremen, Emden and Rostock (Germany).

www.besecke.de

The Maritime Systems business unit of besecke specializes in ship automation. Besides the planning, project management and commissioning of turn-key installations, the company also offers a host of specialized product solutions such as scalable automation systems, power management systems, navigation, fire alarm systems and infotainment systems. Solutions from besecke are installed in yachts, river cruisers, ferries, containers and government vessels.

In 2014 a German shipping company approached besecke. The wheel house of one of their river cruisers had been severely damaged in an accident. besecke was awarded the order to restore and maintain the machine monitoring system. »The machine monitoring system consisted of two old MODICON controllers,« recalled Knut Hermann, software designer at besecke. »These old controller components were hardly available, and so we ultimately had to modernize the entire machine monitoring system in order to ensure the availability of spare parts in the future.«

Impressive technology

The client's requirements were clear: »The repair had to be completed during winter storage – a period of three months. It was also necessary for the existing control cabinets, terminals and cables

to be further used and so the new components had to fit into the old structures,« Knut Hermann lists the most important criteria. »We built an entirely new redundant communication system between the two controllers in the engine room and in the wheel house.« besecke used Bachmann's M1 automation system for the project. »We chose the MX213 processor module with its two serial interfaces which we require for engine monitoring as well as for different input and output modules,« Knut Hermann explains. Besides the innovative and robust technology, the compact design of the Bachmann modules also impressed. »This allowed us to save space, which is always required on board a ship,« the project designer continued. The programming was carried out by integrating the CODESYS development environment. »We also found the Bachmann SolutionCenter appealing, as it allowed us to enter all the parameters. The wide range of analysis options that the software offers impressed us,« Knut Hermann explained.

State-of-the-art visualization

besecke also used Bachmann technology for the operator interface. »OT1312 and OT1207 operator terminals from Bachmann were also used both in the engine room and in the wheel house, for which we implemented a web-based visualization with M1 webMI pro,« Knut Hermann adds.

▲ The new OT panel, integrated in the wheel house

▲ The new operator interface is clearly designed and meets the requirements of the skipper. Alarms in the event of faults or limit value violations are recognizable at a glance.

»The customer thus benefits from the features of a new and advanced vector-based visualization user interface via which it is possible to set alarms and tank monitoring functions as required. The skipper thus has an overview of all relevant data and alarms, which are shown clearly and immediately.« The M1 webMI pro web server is installed on the controller without the need for additional hardware. Any terminal device can thus access it independently of the operating system installed.

Partnership with a future
besecke is entirely delighted with Bachmann. »We found the collaboration with Bachmann to be very good. We were optimally supported, both from the commercial as well as the technical sales side,« Knut Hermann confirms. »All our questions concerning project design, parameters and programming were always answered as quickly as possible.« It is therefore no surprise that besecke wishes to implement other projects with Bachmann.

» All our questions concerning project design, parameters and programming were always answered as quickly as possible. «

Dipl.-Ing. (FH) Knut Hermann,
Software project design engineer for ›Maritime Systems‹,
besecke GmbH & Co. KG

THREE EXPERTS – AND A COMMON GOAL

Only one thing counts: the best solution

The two Dutch companies Alewijnse and Van Oord together with Bachmann electronic have a lot in common: All three are progressive, independent family-run companies and are some of the best in their sector. They have been working together successfully for nearly ten years. The experts of the three companies know each other well. They also now have a new joint goal in sight: the control of two ships with trailing suction hopper dredgers.

From 2017 two additional ships will be added to the fleet of the Dutch shipping company Van Oord. These are being built by the LaNaval shipyard in Bilbao, Spain: 158 m long, 36 m wide and with a load capacity of around 17,000 m³, these two giants are designed for coastal land reclamation worldwide and for providing pipe and cable routes for offshore installations such as wind farms.

Many participants

The construction of a ship involves tasks and responsibilities over several stages: These kinds of special ships are often tendered by their future owners mostly years before the order is placed. The contract is then awarded to a shipyard which builds the ship as the project manager and implements the owner's requirements. For this the shipyard selects the relevant system suppliers already while the tender is being drawn up and presents this to the shipping company before the contract is awarded. This requires the coordination of dozens of suppliers while the concept is being developed, for which the shipyard ultimately takes overall responsibility – for implementation in line with specifications and for keeping within the budget and the deadline.

Strategic partners

The shipyard is free in all cases to select the systems and subcontractors to be used. However, for the implementation of special sub-functions, particular suppliers that the ship-ping company wishes to include are already stated in the specifications. For Van Oord, Bachmann is one of this kind of strategic partner. Bachmann has been implementing system solutions on Van Oord's special ships since 2009. At this time the company had evaluated a new control system and found Bachmann's M1 controller to be a system that meets both the processing speed requirements of the process control specialists as well as the hardware requirements of the automation engineers.

Bachmann implemented Van Oord's key requirements, such as the development of special interface cards with galvanically isolated inputs or the porting of existing VMI-based systems. As Theo Poorter, process control engineer in the ship management department for process control at Van Oord, recounts, the close cooperation started from the very first moment: »I will always remember our first meetings as part of a training seminar at Bachmann headquarters in Feldkirch. We bombarded the engineers with questions and they answered every one.« One thing particularly impressed him: »If they didn't know something, they were also honest in saying so. But they always returned to the seminar room a few hours later with the relevant specialists and presented the solution,« a smiling Theo Poorter recalls. »This is how we have repeatedly experienced Bachmann over the years: Talks were not lengthy but always straightforward.«

> » Talks were not lengthy but always straightforward. «
>
> Theo Poorter
> Engineer for process control
> at Van Oord

Van Oord
Marine ingenuity

Van Oord is one of the leading companies in the field of dredging, marine engineering and offshore projects (oil, gas and wind). The familyrun company is headquartered in Rotterdam, Netherlands, and has over 5,000 employees worldwide and a fleet of over 100 special ships.

www.vanoord.com

▲ Extremely helpful function in the hMI: Important system details (such as interactive descriptions of the I/O modules) are stored in the SCADA system. This reduces the time required for commissioning or troubleshooting in the event of a malfunction.

▲ Extensive installation: The control system installation on both special ships consisted of 26 switch cabinets in total. The switch cabinets are assembled in Alewijnse's factory and shipped to the shipyard prewired.

Alewijnse Marine Systems based in Nijmegen, Netherlands, is a complete system supplier and system integrator supplying control solutions and electrical equipment for ships. The familyowned company was founded over 125 years ago and has around 1,300 employees worldwide.

www.alewijnse.com

Better, faster and cheaper

With the two ships now built it's always the one thing that matters: How can the work carried out with them be completed better, faster and more economically. It must therefore also be possible to further develop applications on these special ships, since the service life of a ship is around 30 years. The trust placed in the selected suppliers and the future security of the systems used here is like a life insurance for staying competitive with this kind of ship over such a long period. The shipyard found Alewijnse to be a system supplier that has a thorough grasp of this business. The Dutch system integrator responsible for the development and construction of electrical equipment on ships has extensive experience in the field of dredgers – and is well acquainted with the Bachmann M1 system through its experience from other applications. »It was therefore also easy for us to meet the shipyard's requirements in terms of the desired use of the Bachmann components,« explains Johan van Rikxoort, product manager for dredging and offshore at Alewijnse. Alewijnse also thinks it has the security needed with regard to the required future investment security: »Bachmann will soon have been in the business for 50 years, the technologies in use are being continually further developed, are always stateoftheart, are provided with the necessary certificates for shipbuilding – and will be available for many years to come,« Johan van Rikxoort confirms.

Joint solution for ambitious plan

From the planning stage to the launch of the ship, many years are spent onshore. The system suppliers were nevertheless faced with an ambitious time schedule. »As always,« explains a smiling Elda KavazbasicMulalic, lead engineer and project manager at Alewijnse. »Of prime importance was naturally how the project could be developed and completed better and faster together.« The three companies and all involved already knew each other from other projects and we soon found that we shared one thing in common: »The simple fact that we all have the same goal. This enabled us to find solutions that would not have been possible on our own,« as Johan van Rikxoort adds.

More together

Alewijnse thus not only added particularly useful functions to the specifications »in passing«, but also created a highly efficient redundancy solution that surpassed what was originally intended. »The dredger controller integrates over 2,500 I/Os – a level of integration that shouldn't be underestimated. Any subsequent maintenance work in severe conditions is thus also accordingly difficult,« Elda KavazbasicMulalic outlines one constraint. Wiring plans and other technical information were consequently stored in the operator system for each Alewijnse module, thus considerably simplifying any troubleshooting during operation. new technical solution Each day that a technical

◀ In Alewijnse's 'Captain's Cabin': Exchange between project partners (from left: Johan van Rikxoort (Alewijnse), Joeri ten Napel (Bachmann electronic), Theo Poorter (Van Oord), Elda Kavazbasic-Mulalic (Alewijnse))

fault prevents this type of ship from operating is tremend ously expensive. No wonder that the client placed particular importance on the redundancy solution proposed by Alewijnse and Bachmann, and the required availability, CPU performance, communication speed and fault tolerance ensured by this design. Although this type of solution implemented was new for shipbuilding, »this was not a problem for us,« says Van Oord's representative, Theo Poorter, adding: »We trusted each other that this solution would work and offer us the highest level of performance. There was no need for a contract. When everyone pulls together, any problems are also shared and solved together.«

Same culture, same objective
Alewijnse's Johan van Rikxoort also had the same view: »The corporate culture of our three companies is similar in so many respects. Communication between us is open, we share each other's knowhow – and ultimately also our daily challenges.« In other words, »each party always brings some added value.« He also notes another important point with regard to trust: Transparency. »We know at all times the current development and production status of the system components supplied by Bachmann, and are thus kept in the picture at every step. Furthermore, whenever a decision has to be taken, decision making channels are short and each party feels committed to the agreement made.«

Trust as the key to success
»Never before was a ship built in this way – and neither will one be built like this again. Each subsystem is an individual solution. As there is no series production there is no routine safety system either.« This is how Johan van Rikxoort describes his work environment and the new and unknown challenges that he has to face together with his automation team each day. Taking the entire risk assessment and choice of possible fallback solutions into consideration, however, one thing counts for him above all: »You must trust your experience – and that of your partners.« Or as he otherwise puts it: »Find someone who is in the same boat as you and everything is possible.«

» Find someone who is in the same boat as you and everything is possibe. «

Johan van Rikxoort
Product manager for dredging and offshore at Alewijnse

PRECISE CONSUMPTION DATA IN THE SHIPPING INDUSTRY

DIMAR-TEC supports

environmentally friendly shipping

The reduced consumption of resources and reduced CO_2 emissions are also an important issue in the shipping industry. The »Fuel Efficiency Controller« (FEC) from DIMAR-TEC offers a system that measures the actual fuel consumption with a high degree of precision in accordance with ISO 3046 requirements. The requirements of several customers brought the company one step further: The »Energy Efficiency Controller« (EEC) ensures a guaranteed reduction in fuel consumption. Bachmann's M1 controller is also the core of the solution here.

DIMAR-TEC is a trailblazer in areas such as Green Shipping or Maritime 4.0. The company is intensively engaged in researching how to accurately measure the different fuel consumptions on ships in order to identify potential savings in resources and in CO_2 emissions.

Reduced fuel consumption and clean environment

Since 2003 DIMAR-TEC has been a supplier of sensors and technical services for optimizing the performance of ship engines. The fuel costs for a medium-sized to large container ship are 3 to 6 million US dollars a year. Even small savings in fuel oil consumption are worthwhile. The specific fuel oil consumption (SFOC) is one of the key factors in the performance of a drive system. »However, with conventional data acquisition systems this can only been determined with great difficulty. The tolerance of the data is also often greater than the optimization potential, so that the reality often does not match up to expectations,« CEO Olaf Kuss explains.

Well thought-out sensors

The fuel oil used by ship diesel engines is often subject to considerable variations in composition and thus also in energy content. In order to determine the consumption data precisely according to ISO 3046, air pressure, relative humidity as well as different performance characteristics must also be taken into account as well as the density of the fuel oil: Only in this way can a reference index be determined, by which measured data can be reliably compared over long periods of time. DIMAR-TEC's fuel efficiency controller (FEC) is such a system, which records all the required background conditions at different points in the drive and auxiliary system with 20 to 30 sensors. »The FEC enables us to show different characteristic values and specific maritime performance indicators in real time. It also allows us to record all the data at intervals specified by the customer as statistically relevant mean values according to the requirements of ISO 3046,« Olaf Kuss explains. This enables shipping and charter companies to assess the consumption values precisely, compare them with the data of other ships and fleets, and take any necessary measures to save fuel and quantify the results.

Auxiliary systems in view

Guaranteed savings in fuel consumption can be achieved by optimizing cooling water pumps and fans. »The Energy Efficiency Controller (EEC) was therefore developed as an upgrade module for the FEC at the customer's request,« Olaf Kuss explains. Auxiliary systems are designed for a maximum load and are also normally operated at this level. The EEC regulates their performance down to the actual requirements. In this way, it is possible to save at least 75 percent of the electrical power required for the auxiliary systems – this is DIMAR-TEC's guarantee.

DIMAR-TEC PTE LTD

DIMAR-TEC Pte. Ltd. is headquartered in Singapore, the Asian shipping metropolis, and specializes in the optimization of diesel units in ship operation. Founded in Singapore in 2003, DIMAR-TEC now operates worldwide with service centers in Singapore, Germany and the Philippines.

www.dimar-tec.com

### Challenging operating conditions in the maritime industry

»Our system is based on an M1 controller from Bachmann. As several applications can be run simultaneously on this system, we also developed the »FEC-Shaft Power Meter« (FEC-SP) based on this platform,« Olaf Kuss explains. »The benefit here is that we can offer a highly reliable and easy-to-install standard product for integration in our existing systems at half the standard market price.« The FEC-SP is used to measure the power at the drive shaft. If this is placed in relation to the actual fuel consumption and the environmental conditions, any problems with the engine or its degree of efficiency can be easily identified. The aim here is to ensure the optimum operation of the engine at all times: »Generally, this is the case at 80 percent of the engine output.« Due to the versatility of the M1 platform DIMAR-TEC's

FEC-SP is also available as a mobile version FEC2GO! This enables the company to provide shipyards with the perfect tool for test runs, for ship owners who have to calibrate their ship engines, and service companies wishing to carry out before/ after comparisons after repairs.

Safe and straightforward parameterization and operation

For DIMAR-TEC it was clear from the start that their solution had to offer the ability to be parameterized as required and to be commissioned by service technicians or the ship's crew without any programming knowledge. This is because system modifications sometimes have to be carried out when a ship is commissioned, or for example when a faulty onboard sensor output has to be replaced with a different signal. The ability for personnel to make the necessary adaptions in the field simply and quickly is a

▼ The three software modules FEC, EEC and FEC-SP are available as stand-alone systems as well as integrated complete solution.

Integrated Fuell Efficiency Controller FEC
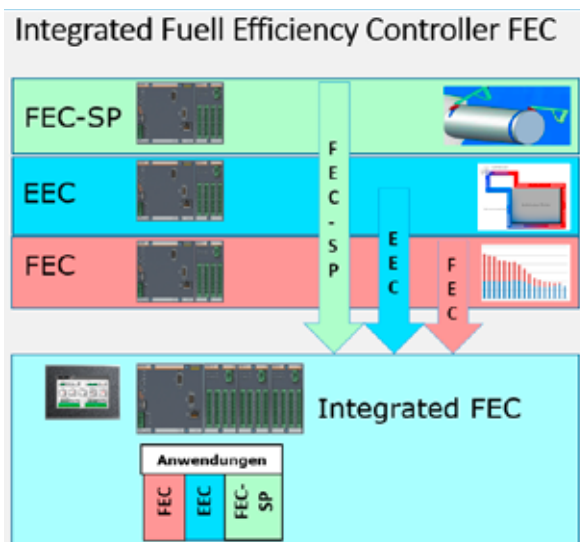
▼ If the output at the drive shaft is placed in relation to the actual fuel consumption and the environmental conditions, optimum and eco-friendly ship operation is ensured.

FUEL EFFICIENCY CONTROLLER FEC

▲ Clear graphics indicate deviations from the ideal operating point and thus enable the optimization of fuel consumption: Display of the shaft power as a function of engine speed. Operating limits and the overload curve are included as a reference.
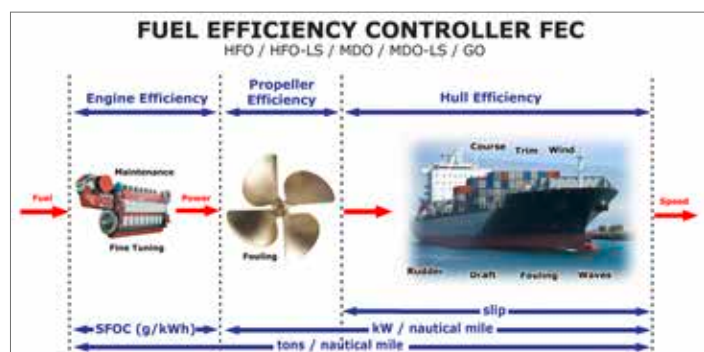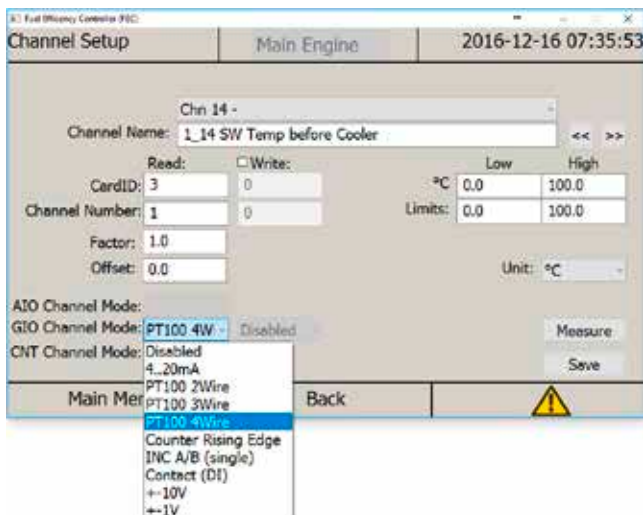
▲ The software modules can be assigned parameters as required via PC or touch screen without having to change the code on the PLC. This is critical since incorrect signal specifications can be adjusted by the ship's crew during a retrofit.

benefit here. »Together with Bachmann electronic, we were able to achieve this,« Olaf Kuss confirms. All input and output signals can be assigned individually via a touch display or the JAVA visualization for standard PCs without the operator having to intervene in the PLC program. Users can thus work with the system safely and simply. »We are able to integrate all our knowledge about shipping systems in a project during the engineering phase so that size, interfaces and customer expectations are fully clarified before the installation is started. The installation can finally also be carried out by the ship's crew or by external service partners. If DIMAR-TEC carries out the installation, the costs for it can be guaranteed, which in turn considerably reduces project risks and costs for the shipowner,« Olaf Kuss explains the benefit.

True companion on the way to success

DIMAR-TEC is highly satisfied with the overall result: »Our system boasts an impressive performance. Thanks to the modular design, we can implement the perfect solution for any shipowner.« The three FEC, FEC-SP and EEC modules are independent of each other and are available as stand-alone solutions. However, they can also be installed as an integrated system since the modules can be operated in any required combination on only one controller. »This is a benefit that only the Bachmann solution could offer,« the CEO emphasizes. »We were always in touch with our personal contacts in sales and service, who also know our specific application. This proves that the choice of Bachmann as our long-term and future-oriented partner was the right one.«

▶ Compact solution: The FEC is installed in the engine room and thus minimizes the cabling with retrofits.

MARITIME ELECTRONICS SUPPORT

The first project between Bachmann Electronic and the Kooiman Marine Group

A veritable hive of activity; that is the best way to describe daily operations at the Kooiman Marine Group's Zwijndrecht shipyard. There are multiple ongoing projects to be seen as the yard's slipways and outfitting quays are all occupied, as is the covered shipbuilding hall.

Kooiman Marine Group is a far-reaching combination of maritime expertise. It has a rich history and extensive experience in inland shipping, seagoing shipping, the fishing industry and harbour equipment. Kooiman develops and builds new, customized ships, renovates existing ships, maintains and repairs damage to hulls, propulsion and other systems.

www.kooimanmarinegroup.com

»We work with a clear vision to offer a wide scope of services to the broadest possible range of maritime sectors,« says George Beute, manager operations at Kooiman Ship Electric, part of the Kooiman Marine Group. »This includes design and engineering, new build, repair and conversion, pipefitting and interiors to the dredging, offshore, inland shipping, harbour and fisheries industries.«

These services also include Beute's own field of expertise; maritime electronics. And one contract in particular demonstrates how the Kooiman Marine Group is tackling technological developments in this area in a proactive manner. »This is the conversion of a 90-metre dry bulk carrier into a trailing suction hopper dredger with both wet and dry offloading capabilities. In terms of electrical systems, our aim was to have efficient, and therefore cost effective, use of cable. The primary aims of the client were to maintain flexibility and reduce the amount of hardware press buttons. We achieved this by using remote I/O [input/output] applications with straightforward, user-friendly controls.« It was at this point that the Kooiman Marine Group called on external support from automation technology suppliers Bachmann Electronic. »We knew that we needed to develop our software engineering skills, so we

decided to bring in Bachmann; a company that is definitely in the top segment of maritime electronics,« Beute adds.

Training course

The cooperation began by initially addressing Kooiman's aims for the project, states Joeri ten Napel, key account manager marine for Bachmann electronic. »In terms of programming languages, there are so many options open. We had to find the most suitable for their requirements, while matching their way of thinking regarding user-friendliness.« Bachmann then continued their support by offering three one-day training courses at their Dutch offices, as well as a two-day course in the company's corporate headquarters in Austria. »There was a two-week interval between each training day, during which they could experiment with a test set,« Ten Napel goes on to say. »We saw very quickly just how committed Kooiman's team was in making this project work.« Specifically for the dredger conversion, Bachmann supplied three PLCs, and 4 touchscreens incorporating 600 I/O systems. »You can see the advantage of delivering a system like ours. Software can be added where needed, meaning that adjustments and modifications can be made quickly and easily.«

▲ »Definitely in the top segment of maritime electronics«, is Kooiman's verdict.

◀ Converting this dry bulk carrier the aim was to have cost effective use of cable.

Programmer potential

After showing great potential during the initial training days, Wouter Joosten, PLC Scada programmer at Kooiman Ship Electric, played a key role in the software programming during the entire project. Consequently, Joosten has written software relating to numerous aspects of the future dredger's daily operations. These include dredging controls, tank measurements, diesel motor controls, all exterior lighting, and an overview of electric and hydraulic systems. »I had some previous programming experience, but not as in-depth as I have learnt during the cooperation with Bachmann. If I ever had a problem, I could always approach them for assistance,« he says. »My personal knowledge – with HMI [Human Machine Interface] and touchscreens, in particular – has increased significantly in the last year and a half.« The technical assistance that Joosten is referring to relates to the remote desktop support provided by Bachmann application engineer Hans van der Sman, which the company also supplements with additional education, conceptual advice, templates and proof of concepts.

Looking ahead

With the dredger conversion close to completion, how does Beute see the new knowledge being applied to future projects at the yard? »What we are seeing from the market is that, whether it's an inland shipping barge or an offshore vessel, ships need to be able to be operated in an integrated way. This trend is only going to increase. By gaining these new skills, we have the relevant knowledge in our own hands. We are looking forward to taking on more complex projects in the future.« Ten Napel agrees: »We have seen what is possible with this project. The Kooiman Marine Group has the potential to offer many more options to its clients in the future. They have the framework so if they want to offer condition monitoring, power management or remote monitoring, for example, all this is possible. It is just the beginning.«

BACHMANN
TRAINING
OFFERING

Profit from our knowledge

Solid know-how combined with first-class products is the key to perfect automation. We offer you both. Take advantage of our extensive training program, which we will gladly adapt to your individual needs.

SOLUTION CENTER

The SolutionCenter as an integrated and user-friendly engineering tool for project engineering, commissioning, configuration and diagnostics. The training also includes an introduction to programming and visualization.

MODEL BASED DESIGN

The MATLAB® program package from MathWorks offers a software tool for model-based development of controller applications. »M-Target for Simulink®« enables the user to integrate seamlessly in this development process inside the M1 controller environment.

REDUNDANCY CONTROL

This training course provides a rapid introduction to configuring and creating redundant applications with the M1 automation system.

POWER MANAGEMENT

The safety and efficiency of the electrical energy supply are placing increasing demands on generation, transmission and consumers. This training seminar provides the knowledge required to use Bachmann grid measurement, monitoring and synchronization modules in the M1 controller system.

SAFETY CONTROL

This seminar offers a practical and basic understanding of how to implement functional safety. You are shown how to program safety applications based on the Bachmann safety products in hardware and software.

CONDITION MONITORING SYSTEM

Condition monitoring involves the monitoring of the machine state through the measuring and analysis of meaningful physical variables. The training covers the basics of condition monitoring as well as providing a detailed knowledge of the hardware and software.

M1 WEBMI PRO

atvise® provides the user with a web-based visualization for different applications and visualizations. Mobile application, HMI up to SCADA solutions can be implemented with only one visualization. Standards such as HTML5, SVG and JavaScript enable very open and flexible solutions for any application. At the end of this training seminar each participant will have created an extensive sample project.

ALWAYS STAYING UP-TO-DATE

Targeted support

Even if the training needed for engineering is kept to a minimum thanks to the standard development environment: updating and deepening one's knowledge of individual engineering areas at regular intervals is worthwhile. The sound knowledge of personnel, combined with first-class products, is after all the key to perfect automation.

Benefits of engineering training

- Perfect program adaption to individual requirements thanks to the modular concept
- Intensive knowledge transfer through hands-on training
- Training seminars held on site at Bachmann or as webinar
- Access to the in-depth knowledge of Bachmann application engineers

Precisely tailored programs
Bachmann's training offering ranges from the proven standard training seminars right through to workshops tailored to your individual requirements. The modular training concept enables the creation of training programs tailored precisely to company requirements. The training is always centered around an intensive knowledge transfer and hands-on practice with special problem solving tasks.

Flexible knowledge transfer
The training sessions are held either in a Bachmann branch office or directly on site in the company. Individual modules can also be offered as webinars if required. Following each training course, the participants will receive a personalized certificate.

No questions unanswered
If a question remains unanswered despite the extensive training offer, Bachmann customers benefit from the know-how of several application engineers. These work in close proximity to the development team. They know every small detail of the Bachmann solutions and can therefore make use of all options available.

Basic Training	User Training	Advanced Training
Basic knowledge of automation required	Basic training and specific knowledge recommended	Basic training and specific knowledge of programming required
Bachmann automation	PLC programming	Maritime Applications
		Redundancy
		bluecom (Ethernet real-time protocol)
	Visualization M1 webMI pro	Advanced Visualization M1 webMI pro
	atvise® SCADA	
	Motion Control	
	Condition Monitoring	
	Grid measurement and monitoring	
		Programming with C/C++ Developer
		Application development with M-Target for Simulink®
Safety technology	Safety technology (Safety Developer)	Model-based development with MATLAB® / Simulink®
Service technician		Customer-specific workshops

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