

▼ An appearance that will become increasingly rare in the future: To achieve global climate targets, the maritime sector will also have to switch to clean energy in the future. This will cause engine rooms to change significantly.

Towards research for greener shipping

The future is being tested in the Zero Emissions Lab with control technology from Bachmann electronic

If it wants to achieve global climate targets, then the maritime sector must make the transition to clean energy. The EU has defined clear targets that support this. The Maritime Research Institute Nederland (MARIN) is researching solutions at its 'Zero Emissions Lab' (ZEL) and testing the engine rooms of the future. MARIN relies on control technology from Bachmann electronic's MC200 series to equip its future lab.

MARIN started working on the Zero Emissions Lab concept, a facility for configuring and testing the propulsion performance of climate-neutral or zero-emission ships, back in 2017. To plan and realize the ZEL, MARIN brought together maritime automation experts from Bachmann electronic and system integrator Raster Industrial Automation. Part of the ICT Group, Raster specializes in high-quality, functional safety systems and sophisticated production and process automation.

Overcoming technical limits

In the age of automation, the possibilities can seem limitless. Translating requests and requirements into technically feasible, safe and sustainable solutions was nevertheless challenging in this case. There was nothing comparable to ZEL, meaning no examples or empirical data. „Fortunately, Raster is great at even reinventing the wheel when they have to,“ says Joeri ten Napel, Key Account Manager at Bachmann electronic. The Raster’s team specializes in developing custom solutions.

Raster initially assisted MARIN by defining the safety requirements that were to be specified in the software. Then a system was developed that could integrate the energy and hydrodrive systems and enable the realistic coupling of the drive hydrodynamics with the energy supply.

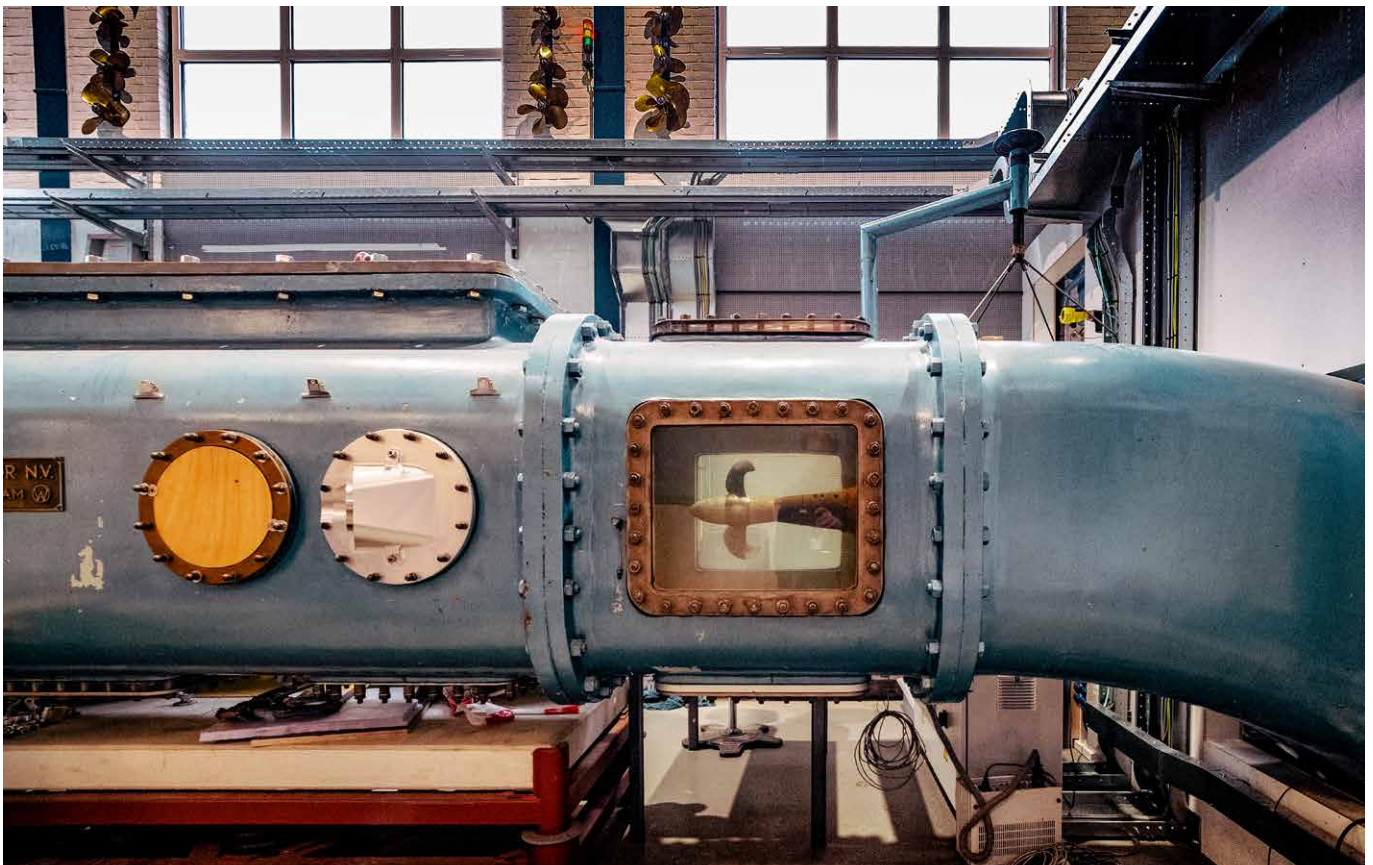
Energy is distributed to the consumer loads via a 700-volt DC bus. All power source types can be connected to the DC bus, for example fuel cells, batteries, supercapacitors or generators. The supporting systems, such as the inverter and the transformer for the 400 V AC power supply, are also connected to the DC bus. Electric motors on the ship’s shaft system, which drive a propeller in a cavitation tunnel, provide the connection to the hydrodynamics.

„Bachmann proved to be an excellent partner for this project. We received extensive support with determining the necessary adjustments to make the system technically feasible“, comments Martijn Kooij, Managing Director, Raster Industrial Automation.

Software for energy source modeling

There is no space for additional hardware in the ZEL. To ensure flexibility for future test configurations, despite lack of space, one of three electric motors is specifically designed to emulate different combustion engines. Depending on the modeling, this can be used to simulate power generation from the use of various advanced fuels, such as compressed hydrogen or methanol. „MARIN can load models with different characteristics into the system, maintaining the necessary energy source flexibility,“ explains Rob van Rooijen, Senior Software Engineer at Raster.

▼ The cavitation tunnel propeller is driven by two motors on the ship’s shaft system.





“Raster’s work is a real complement to ours because of their qualifications and expertise in the field of safety.”

Joeri ten Napel

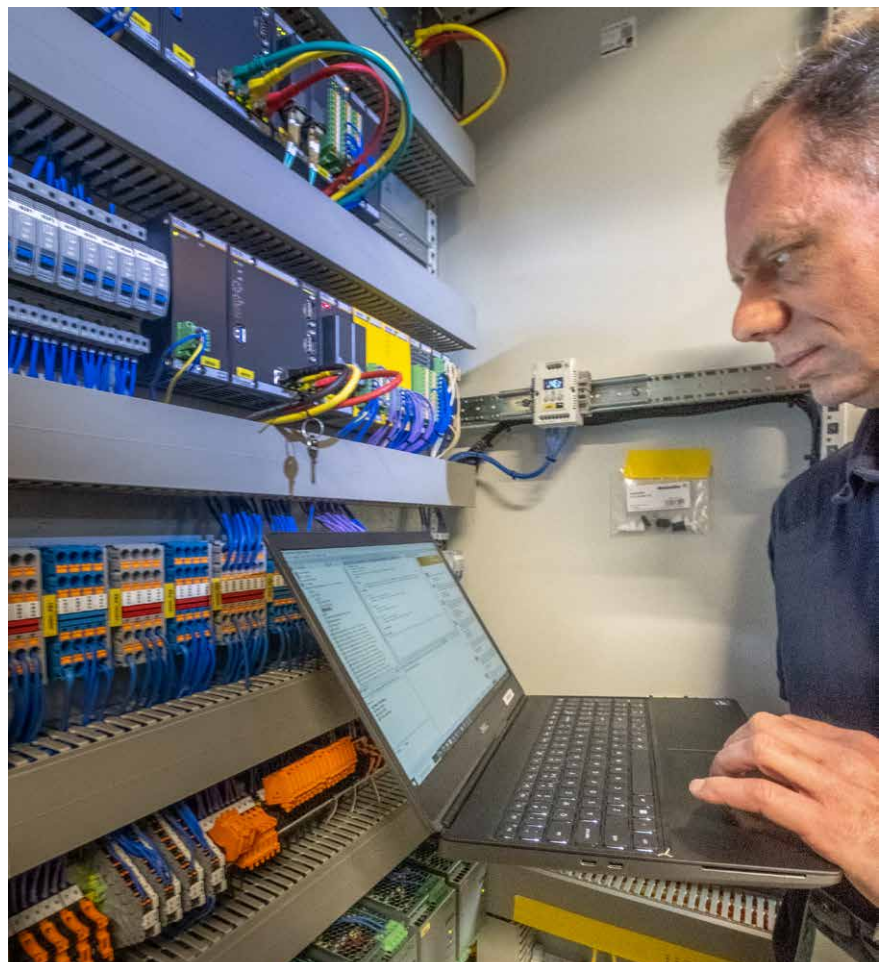
Key Account Manager
at Bachmann electronic.

The experts at Raster designed the system using the modularity of Bachmann’s extensive product range. The complex control topology in the ZEL comprises 17 CPUs from the Bachmann MC200 series.

Rugged M200 hardware

Thanks to its wide range of powerful CPUs based on industrial (Pentium) processors and an extensive range of input/output modules, the M200 system can easily fulfill individual requirements such as those in this project. – The MC200 CPUs used offer scalable processors with up to four physical computing cores and up to 1.6 GHz clock frequency.

Real-time bus systems enable the automation to be decentralized without any loss of performance. Designed for the toughest ambient conditions, they guarantee fail-safe operation with fan-less installation from -40 °C up to an ambient temperature of +70 °C.



▼ Rob van Rooijen’s team (Raster Industrial Automation) had to master a challenging task of harmonising the control system: The future lab is redundantly designed with four CPUs and a safety controller, which are located on the starboard and port side of a ship.



▼ Project meeting at MARIN's Zero Emissions Lab: Exchange between project partners (from left): Martijn Kooij (Raster Industrial Automation), Joeri ten Napel (Bachmann electronic), Rob van Rooijen (Raster Industrial Automation).

State-of-the-art system architecture designed for seamless networking capability enables the M200 to be integrated easily in peripheral controller and system components. Real-time Ethernet permits real-time controller networking and supports all currently available fieldbus systems. It enables external components to be connected via standard interfaces.

Challenging coordinating

The main control system of the Zero Emissions Lab has a redundant design with four CPUs and a safety controller, which are located on the starboard and port sides of a ship. The current total of seven different consumer loads or energy sources each have their own controller.

Coordinating all these subsystems was a major challenge: „Raster did an excellent job of creating the flexibility MARIN wanted within the software architecture, which ensures both machine and process reliability,“ says Joeri ten Napel, Key Account Manager at Bachmann. With this setup, with its Zero Emission Lab MARIN has created the optimal conditions for making informed decisions along the journey to zero-emissions shipping.



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Maritime Automation



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