

Everything Ship Shape

On the super yacht Limitless, Turck's TBEN compact block I/O modules with IP69K protection provide reliable EtherNet/IP communication between sensors/actuators and PLC

With a length of 97 meters, Limitless is classed as a super yacht. The ship was launched in 1997 from the Lürssen shipyard in Bremen. Whilst not a particularly significant age for a ship, a great deal of development has gone on in the field of electronics and automation over the past twenty years. This is particularly the case since the yacht's electrical equipment is in fact 24 years old, as it was installed shortly after the construction of the yacht was started. The period from when the construction of a ship of this size is started to the time when it is completed is around four years.

Technical equipment getting on in years

The yacht is equipped with two boarding ladders, two small platforms which can be lowered on the water and two large platforms. One of the platforms opens up to lower a tender into the water. The other platform at the stern of the ship is lowered onto the water surface. The ship also has a gangway at the stern, which likewise moves out of the hull of the ship. The yacht can thus be accessed from the stern. The yacht also includes several impressive features, including two cranes, a swimming pool, and a number of automatically



Floating transformer: The stern of the Limitless opens out as a platform, the rear boarding ladder just moves straight out



When the platform with the boarding ladder is deployed, the inclination of the platform must be measured in relation to the ship

operated and secured doors; all of which are hydraulically operated. A modern control technology had not yet been installed when the Limitless was built. The equipment was controlled with relay devices and simple point-to-point connections.

In recent years, the faults on the moving parts of the yacht's equipment have increased. Moreover, the functioning moving elements were no longer state of the art. A central controller was not possible. Everything had to be operated by pushbutton at the equipment. Akerboom Yacht Equipment in Leiden, Netherlands, was commissioned by the captain to complete the technical refit of the entire ship. The company has gained a reputation in the field of electrical yacht equipment and is part of the Feadship Group, which also includes the De Vries shipyard.



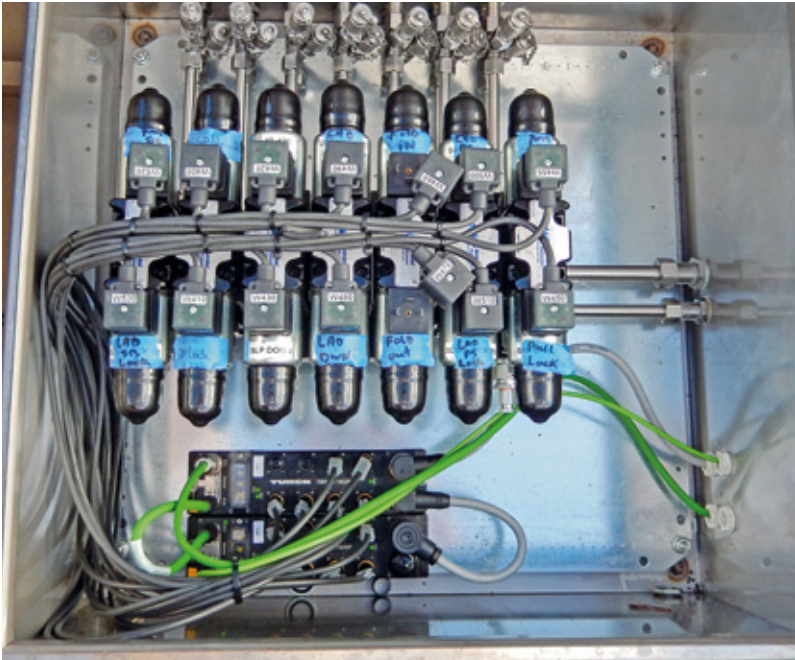
EtherNet/IP controllers replace island solutions

Previously, each crane and each automated platform on the ship had its own control cabinet, in which the signals of the devices and drives were wired directly. A central controller did not exist. Akerboom replaced these several island solutions with I/O modules with EtherNet/IP communication and two modern controllers.

Ed Groen in 't Woud from Akerboom was in charge of the technical aspects of the project and was considerably involved in the implementation: "It soon became clear to us that we needed a modern industrial controller for the automated systems. We decided on two Allen-Bradley controllers with EtherNet/IP communication." Both controllers are networked and can be reached from the central control room. In theory, one

QUICK READ

Dutch ship equipment supplier Akerboom Yacht Equipment reworked the entire automation setup on the 20 year old super yacht Limitless with state of the art technology. Two controllers and one EtherNet/IP network replace the previously used point-to-point wiring of equipment such as cranes, boarding ladders or platforms. Akerboom relies on Turck's robust TBEN-L and S Ethernet block I/O modules to transfer a large number of I/O signals. With their fully encapsulated plastic housing and protection to IP69K, the I/O modules are ideal for use on ships, eliminating the need for control cabinets or other protective measures.



Each Turck TBEN-L-16DOP block I/O provides 16 digital outputs for connecting hydraulic valves



Control cabinets and other protective devices are no longer necessary with Turck's robust block I/O solutions with IP69K protection



Ed Groen in 't Woud is very satisfied: "Turck's I/O blocks have saved us a lot of wiring work."

controller would have been enough but with a ship's length of virtually 100 meters the wiring required would have been too much.

TBEN I/O modules save space and time

"I came across Turck when looking for the right I/O solution. I was looking for robust I/O blocks which could bring my signals directly from the field to the controller via EtherNet/IP," said Groen in 't Woud. "The controller manufacturer could only offer one solution, which did not have an integrated power supply for the connected sensors and actuators. This would have required time consuming assembly of special connectors, which we wanted to avoid. The design and the high degree of protection of Turck's TBEN-L were also ideal. We love plastic because it can't rust. The IP69K I/O block modules also saved us a lot of space as well as

wiring. Many control cabinets on board are now unnecessary because the TBEN-L modules are mounted directly next to the hydraulic valves. Today the room formerly used for control cabinets is used for storing wetsuits."

A large number of digital input signals are used on the ship. These are supplied, by end position switches, which detect the position of the locking bolts in the doors. Analog signals are output by inclination sensors. Turck's B1N360 inclinometers detect the inclination of platforms when they are lowered onto the water. Measuring the inclination in relation to the ship and not as an absolute value is an important requirement here.

As the ship is constantly swaying slightly, Ed Groen in 't Woud and his team installed two inclinometers: One in the control cabinet, the other directly at the platform. The sensor on the ship supplies the reference value. The controller calculates the actual angle between the platform and the ship by subtracting both inclination values. The analog signals of the inclinometers are brought to the controller via Turck's ultra-compact TBEN-S2-4AI I/O station. The TBEN-S modules with a width of only 32 millimeters are even more compact than the TBEN-L, whilst still meeting IP69K requirements at the same time. A TBEN-S is installed in the back area and in front area of the yacht. Both bring the signals from two platforms to the controller.

There are also no analog signals. The hydraulic drives are not regulated with conventional proportional or servo valves. "For us there is virtually only one manufacturer for proportional valves. For that reason they are also relatively expensive," explains Ed Groen in 't Woud. In the luxury goods sector, customers keep an eye on costs. Groen in 't Woud has developed an alternative solution for the dynamic control of hydraulic drives.

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Ed Groen in 't Woud | Akerboom Yacht Equipment

Block I/Os simplify wiring

This solution was really effective through the use of the TBEN-L1-16DOP digital block I/O modules. This enables all the output signals to be brought from the controller via an Ethernet line to the digital valves. "Turck's I/O block modules save us a lot of wiring work. Our mechanics could also wire the M12 connectors easily, without any electrical knowledge or a detailed wiring plan." As multi-protocol devices, the TBEN I/O modules can be used on controllers equally with Profinet, EtherNet/IP, and Modbus TCP protocols.

The complete refit of the yacht was impressive. As the Limitless was also given a visual makeover and the remaining onboard electronics and air conditioning were also brought up to the current state of the art, the ship almost looks brand new. The crew can now operate all systems locally via HMIs, via remote control, or via the central control room. The yacht owner was extremely pleased, although he could certainly have bought a new ship. However, as he had been involved in the construction of the Limitless himself, he is very attached to his yacht. As they say in Germany, "Old love never rusts!"

Efficient regulation of hydraulic cylinders

On another ship that is currently being reworked by Akerboom with Turck solutions, they even can dispense with further analog signals. The hydraulic drives are not controlled by conventional proportional or servo valves. Groen in 't Woud has developed an alternative solution for the dynamic control of hydraulic drives.

The drives of the platforms and cranes have to be dynamically controlled in order to be able to execute the movements faster. The force of the hydraulic cylinders therefore has to be controlled by the oil pressure. Instead of controlling this with a constant



All technical systems can now be operated via a touch screen

pump output and dynamic valves, digital valves are used on the Limitless, which only determine the direction of the oil flow. Groen in 't Woud regulates the force of the cylinders with a variable pump output. The frequency inverter that drives the hydraulic pump has an EtherNet/IP interface via which it can be dynamically controlled.

The controller has a function block or add-on stored in it for each movement schema, which sets how long the pump is to be run at which frequency. In this way, dynamic positioning sequences can be run in order, for example, to retract and extend the ladders and gangways on the ship quickly, judder-free, and also economically. Digital valves do not lose energy through heat loss, as is the case with proportional valves.

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