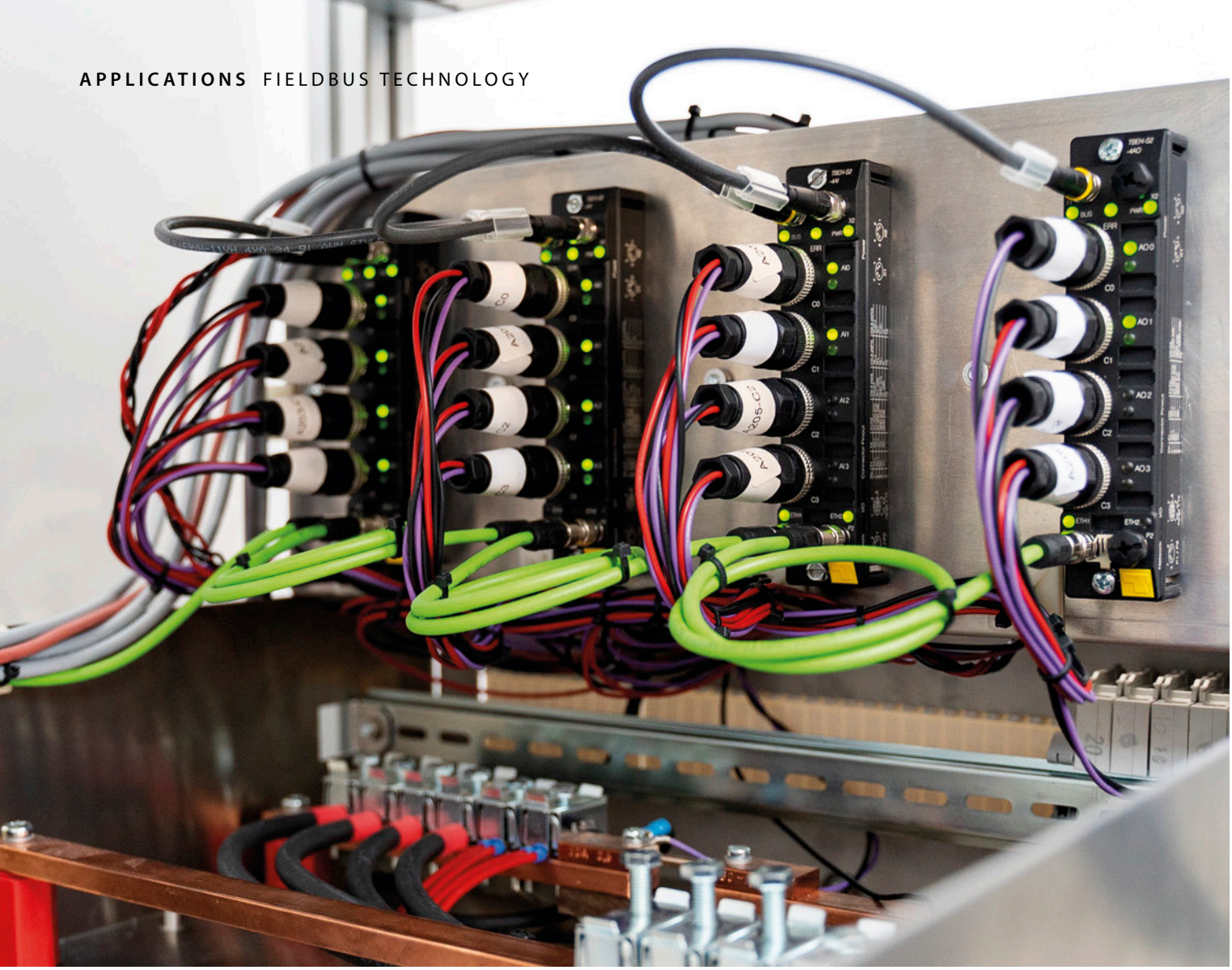


Cell Block

Turck's TBEN block I/O modules with their own LabVIEW driver improve system flexibility and mobility in test stands for fuel cells at FutureE

Instead of an external control cabinet and long cable routes: Turck's IP67 block modules with integrated LabVIEW driver considerably simplify the creation and expansion of test stands

"Battery storage alone will not be enough," Siegfried Limmer says of the energy transition. "We will need both technologies in future, hydrogen and battery storage technology." He is already noticing daily the growing demand for fuel cells as part of this trend. As managing director of the development consultants FutureE in Nürtingen, Siegfried Limmer works on the development of fuel cell systems together with his employees and partners. His customers come from the materials handling, automotive and commercial vehicle industries, but also from the energy or building sectors.

Optimization potential: fuel cell system

"The subject of fuel cells will increasingly become a major topic for discussion and I expect that we will grow with this," the managing director says with confidence. He has good reason to do so since the use of hydrogen in a fuel cell still offers tremendous optimization potential. This electrochemical process involves the oxidation of hydrogen gas at the anode with water formed at the cathode through the supply of oxygen. The electrons released in this process can be used to drive electrical loads. However, like the combustion engine, which has undergone constant improvement since its invention, there is still also considerable optimization potential in fuel cell technology. It is also possible for example to fine-tune the electrolyte or the catalyst of the reactions in addition to improvements made with regard to temperature, pressure and other reactant conditions.

Test stand for the technology

To test its own fuel cell systems, FutureE developed a test stand similar to the one that could also be used in a laboratory environment. Testing in this case involves

more than just a quality check after production. It is a major part of the development work since the efficiency of a fuel cell depends on several parameters which are run through in multiple iterations to determine the ideal operating parameters for different load scenarios of a fuel cell system. This ensures that the system is always run with the optimum operating parameters in different ambient conditions – both at zero degrees and five percent air humidity as well as at a tropical 40 degrees and 80 relative humidity.

LabVIEW: virtual standard for test stands
LabVIEW from National Instruments is virtually the standard software for extensive test procedures in R&D. However, LabVIEW is also used to run test stands in product development and increasingly also in parallel with production. "The programming required with a PLC is considerably greater, particularly when making calculations with array functions. LabVIEW also offers considerably more options than a PLC when it comes to designing the graphical user interface," Albert Wais explains. He has known Siegfried Limmer for years, also from their time together at Ballard, the fuel cell manufacturers. Wais has specialized in LabVIEW programming and supports FutureE here with the ongoing projects. For Wais, LabVIEW was virtually set as the software for operating the test stand. The program makes it possible to automate entire test series and run them automatically.

Signal connection in the control cabinet: undesired and established
Test stands in R&D are normally set up in a control cabinet which houses the instrumentation and control technology as well as the controller, IT and communication technology. The control cabinet is usually located outside of the test area since climatic conditions simulated inside it are challenging. This therefore requires the cables to the sensors and actuators on the test stand and test object to be routed individually from the test area to the control cabinet.

Problems often arise during testing that were unforeseeable during the planning phase. "Additional signals are then also required for this. Even though spare channels are planned in, more channels are needed in the end," Wais explains the dilemma from his experience. "This then requires us to once more route several cables in the control cabinet to the test and laboratory area, and this often involves considerable mechanical effort and in some cases, new approvals."

Learning from industry: decentralized signal connection
Decentralized signal connections are now well established in industry as an alternative to point-to-point connection. I/O modules with IP67 protection are installed directly at the machine, capturing signals and transferring them to the controller via a single Ethernet cable. IP67 I/O solutions were previously rarely used for communicating with test stands, partly because the I/O modules designed for Industrial Ethernet can hardly communicate with LabVIEW. "Although NI offers a driver for Ethernet/IP, it is so basic that you can't really work with it properly," Albert Wais explains the situation. The fact that National Instruments does not consider Ethernet/IP as a priority for LabVIEW is understandable, especially since the software has only in recent years been increasingly used for parallel testing in production.

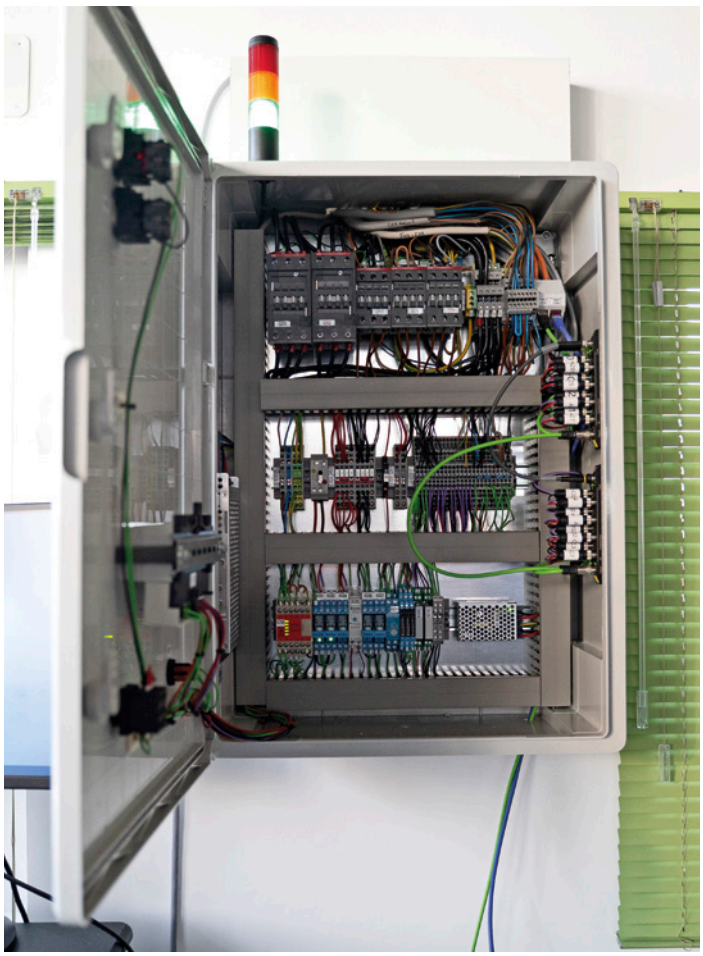
»The TBEN-S modules are ideal for climatic tests. We fit them directly in the climate chamber and only have to route out a single cable. We can then add additional modules in the climate chamber flexibly – without having to route new cables. This flexibility is a major benefit for us.«

Siegfried Limmer | FutureE

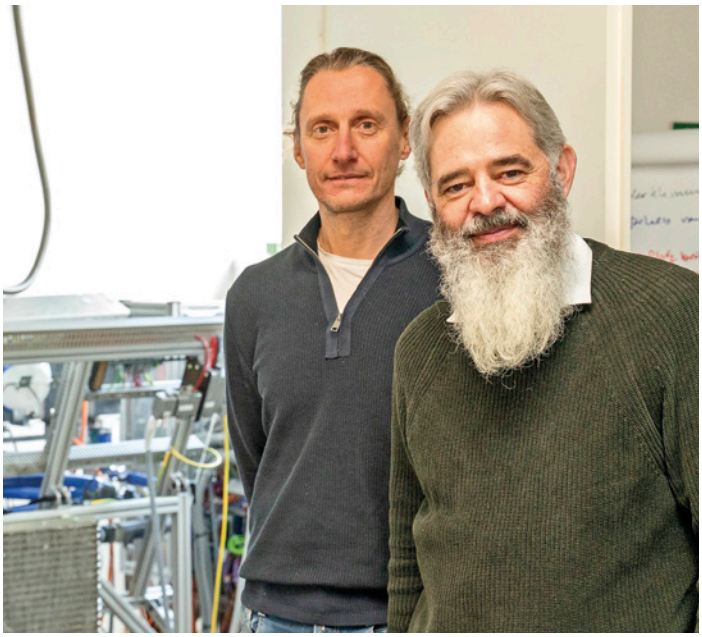
Unique: IP67 I/O modules with LabVIEW driver
Albert Wais himself was involved in the work to close this gap. Wais and co-workers from special machine builders Kirschenhofer wrote a LabVIEW driver for Turck's TBEN-S decentralized I/O modules for a project for Kirschenhofer and Britax Römer. "This was a enormous task because we had selected for the RFID module in this project the most complex RFID module

QUICK READ

Hydrogen could be one of the central enablers of a CO2-free energy supply. For this to be successful, companies like FutureE based in Nürtingen are constantly working on the optimization of their fuel cell technology. The company uses Turck's decentralized TBEN-S IP67 block I/O modules on a fuel cell test stand. The integrated LabVIEW driver of the modules enables direct signal connection in the test area. This considerably reduces the time required for setting up the test stand and simplifies expansions and their mobile use.



The control cabinet of the test area is located close to the operator PC and can be made considerably smaller than usual thanks to the decentralized signal connection



Albert Wais (l.) and Siegfried Limmer in front of the test stand, which can be customized and expanded thanks to Turck's TBEN modules with integrated LabVIEW driver

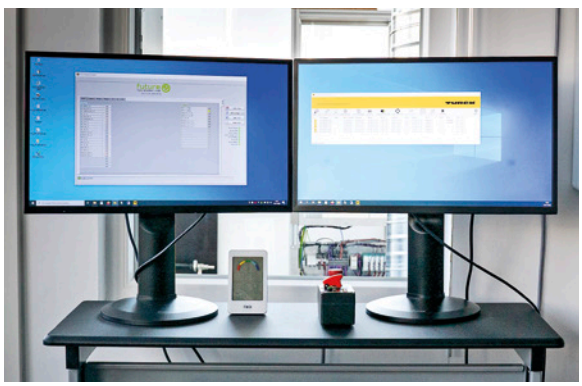
of the TBEN-S series." The work, however, was worth it: Users can now find drivers for most of Turck's IP67 I/O modules in the NI LabVIEW driver database. Wais consequently recommended Turck's TBEN-S modules for the LabVIEW signal connection also for the test stand of FutureE. "The TBEN-S modules are ideal for climatic tests. We fit them directly in the climate chamber and only have to route out a single cable. We can then add additional modules in the climate chamber flexibly – without having to route new cables. This flexibility is a major benefit for us," Siegfried Limmer confirms

End customer benefits from flexibility

Actuators such as for the cooling water controller and the cooling fan also have to be connected in addition to the signals for the sensors on the test stand. Flexibility is also ensured here thanks to the modules themselves. The DXP channels of the TBEN-S for example can be used as inputs or outputs without any configuration required. The use of the modular I/O system on the test stand also brings benefits for the FutureE customer. "Our customers mostly get involved in the development as well after we have handed over a system. They then also benefit from the ability to add functions easily at a later time or expand the system." The system is handed over in such a way that customers can later run through their own test scenarios via the LabVIEW user interface, and these routines can be defined by the customer.

Conclusion

Managing director Limmer is just as pleased with the test stand project as he is with the I/O modules. "With every customer, requirements are different. One time we are developing systems for a forklift truck and another time for a heating system or a portable generator. These always involve different requirements, which we can nevertheless fulfill with the I/O modules. We therefore greatly appreciate the modules. They make our work easier."



A conventional Windows PC can be used to run the test stand thanks to the Ethernet/IP LabVIEW interface of the TBEN-S modules

Author | Ralf Moder is Sales Specialist at Turck
Customer | www.future-e.com
Webcode | more22252e