

OMICRON Magazine



PROTECTION SYSTEM VALIDATION
WITH DIGITAL TWINS



DEAR READERS,

Welcome to the latest edition of our OMICRON Magazine! We are excited to present you with an array of insightful articles that focus on sharing knowledge, innovation, quality, and support.

We have curated articles in the knowledge section that empower you with valuable information and expertise. On page 20, discover the world of UHF PD measurements and explore how UHF 800 can help your GIS testing with multiple ultra-high frequency measurements. Gain practical insights that will enhance your understanding of this vital technique. Additionally, on page 18, we invite you to delve into the captivating customer story of Semar Electric in Italy and their successful integration of VOTANO 100 into their production line. Learn from their experience and expand your knowledge.

The Innovation section highlights cutting-edge technologies and advancements. Turn to page 6 to explore the concept of a digital twin, which enables early engineering tests and can simplify troubleshooting in later lifecycle phases. Discover how these innovations transform the testing

landscape and facilitate more efficient and accurate assessments. Additionally, please familiarize yourself with the latest features of our CMC Swift on page 24, and learn more about our continuous commitment to improvement and innovation.

Quality is one of OMICRON's fundamental pillars, and we are dedicated to providing reliable and secure solutions. On page 28, we introduce a new PTM 5.00 Safety Feature that enhances the CPC 100, highlighting our commitment to delivering high-quality products that meet rigorous safety standards.

Support is at the heart of everything we do, and we aim to provide you with the assistance you need during your projects. On page 14, find out about the remarkable journey of commissioning a digital substation in Iceland that showcases our dedication to supporting you through complex endeavors. Additionally, on page 9, discover one of our most significant events: the IES 2023, which offers valuable opportunities for networking, training, and knowledge-sharing for our worldwide OMICRON team. Furthermore,

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gain insights from our Sales Partner Interview with Federico Hahn from IDUR Representaciones S.A. in Chile, on page 32. The interview underscores our commitment to building solid partnerships and providing localized support.

As you immerse yourself in the pages of this magazine, we hope you find inspiration and practical insights while experiencing a deeper understanding of our commitment to knowledge, innovation, quality, and support. We hope you're

able to take advantage of the resources and expertise we offer. Enjoy reading!

If you have any feedback about this issue, please let me know – I look forward to hearing from you.

Yours sincerely,



Lia Thum

Editor in Chief, OMICRON Magazine

*«Quality is
not an act,
it is a habit.»*

Aristotle

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Good solutions always focus on the user
and the environment



KNOWLEDGE



SUPPORT



INNOVATION



QUALITY



PROTECTION SYSTEM VALIDATION WITH DIGITAL TWINS

Iterative Closed Loop Testing for virtual IEDs

The emergence of virtual devices, or Digital Twins, continues to change processes in more and more industries. Digital Twins mimic a physical device as closely as possible. There are significant benefits to using virtual devices during the life-cycle stages of a system. Using Digital Twins enables early engineering tests and can simplify troubleshooting in later lifecycle phases. Even system relevant industries such as the electric power industry are now embracing this new technology. In the protection systems of electric power systems, Digital Twins from Intelligent Electronic Devices (IEDs) allow the performance of protection systems to be tested during early engineering stages or before rolling out new settings or firmware versions for the physical IEDs. RelaySimTest is the first tool to use such virtual systems efficiently.

Virtual IEDs contain all the protection functions, algorithms, and interfaces of the physical IEDs that they represent. Testing protection systems using virtual IEDs allows the design and logic of the protection system to be validated before the physical IEDs are installed. These early tests can help increase protection design and testing quality and thus shorten commissioning and testing time in the field. Testing such a virtual system does not require hardware, as neither physical IEDs nor physical test sets are necessary.

Test cases can be created and replayed on virtual IEDs that form a virtual replica of the future protection system. This enables engineers and technicians to find design and logic errors early. In addition, they can also uncover errors in the protection system test plan. Afterward, the corrected test plan can be re-used to efficiently test the physical protection system.



*«Testing protection systems using virtual IEDs allows **the design and logic of the protection system to be validated before the physical IEDs are installed.**»*

The advantages of testing protection systems using virtual IEDs include the following details:

- › There is no need for spare IEDs at a central location
- › No physical test sets are required
- › There are no test set output power limitations
- › The number of usable test signals is unlimited
- › Intensive tests can be run without stressing physical IEDs
- › Troubleshooting is sped up
- › Test quality is increased

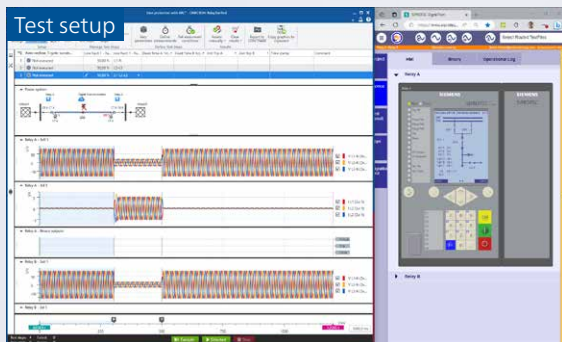
Whether physical or virtual, proper protection system validation usually requires precise transients to be injected into the system under test. A wide range of test cases are of interest when comprehensively validating a protection system. Depending on the system under test, these may include changing infeed and load conditions,

circuit breaker events, stability tests with faults outside the protected zone, and various fault scenarios inside the protected zone.

Early industry attempts at testing virtual protection systems included replaying COMTRADE files. COMTRADE files may originate from a disturbance recorder and can be created by protection testing solutions. However, this approach has several limitations. Only a fraction of the relevant power system events are usually available to a system operator as a COMTRADE file originating from a disturbance recorder. Creating COMTRADE files for each test case and importing these into the virtual IED platform is time-consuming. More importantly, testing virtual protection systems by replaying COMTRADE files does not allow the test system to react dynamically to the protection system's response. ▶

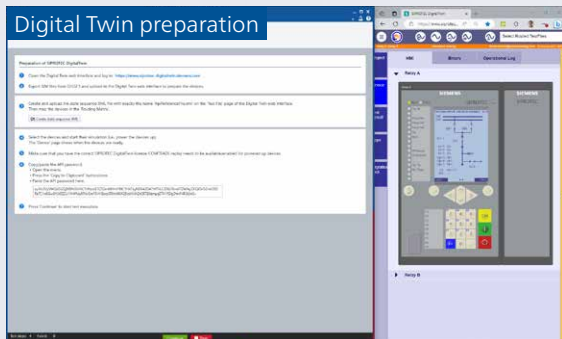
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Test setup



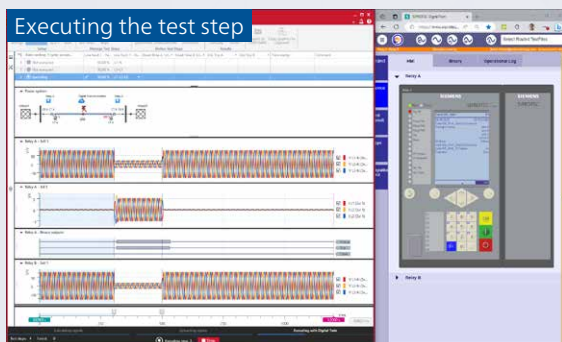
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Digital Twin preparation



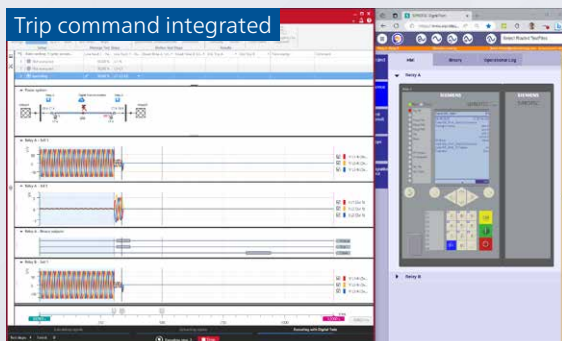
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Executing the test step



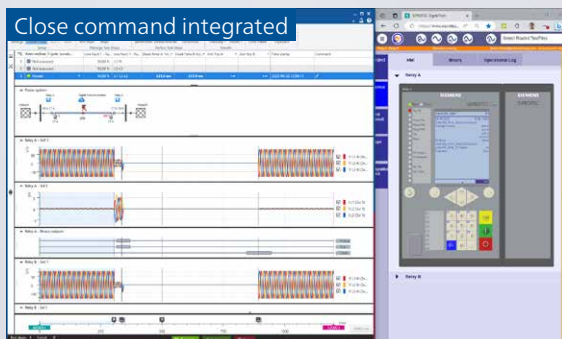
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Trip command integrated



5

Close command integrated



With the most recent version of RelaySimTest, users can efficiently validate virtual protection systems, including protection design, logic and communication. As with physical protection systems using RelaySimTest, the new version can also iteratively adapt its power system calculation to the response of virtual IEDs. The application programming interface (API) from the Siemens SIPROTEC DigitalTwin is used for COMTRADE exchanges between the DigitalTwin and RelaySimTest. The patented Iterative Closed Loop (ICL) technology creates test signals that respond to the sequence of trip and close commands issued by IEDs with precision. OMICRON CMC users have been using ICL to efficiently validate physical protection systems with physical IEDs for many years. Now they can also test virtual systems consisting of virtual IEDs.

Right now, Digital Twin protection technology is available with the SIPROTEC line. The only things required to test a virtual protection system like this are the following:

- › A SIPROTEC DigitalTwin subscription
- › A RelaySimTest Digital Twin subscription
- › A good internet connection
- › An internet browser



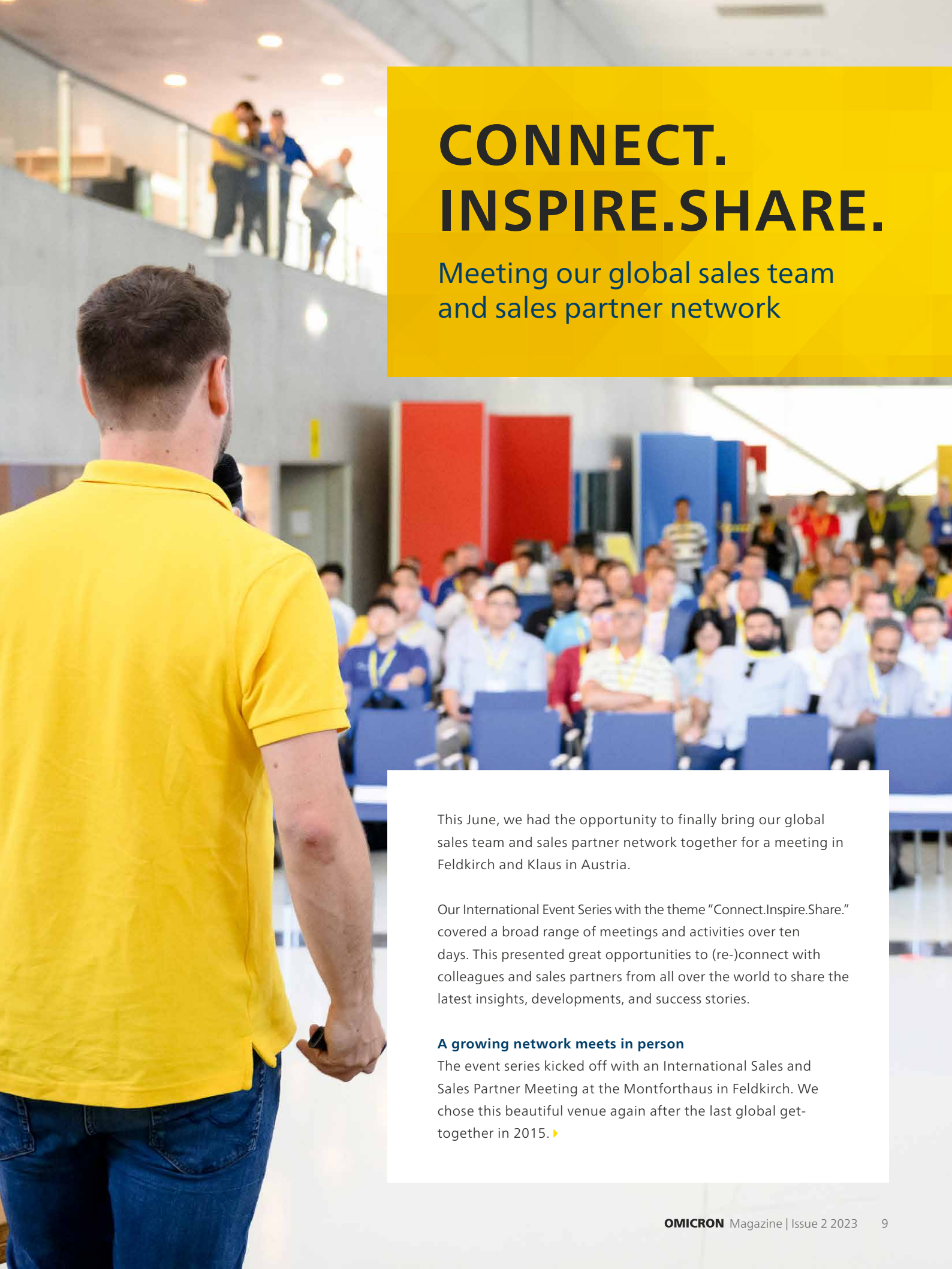
LISTEN TO THE PODCAST

Interested in this topic?

In this episode, we will learn about the concept of the digital twin and its application as a diagnostic and condition assessment tool in the electrical power industry. Scan the QR-Code or visit:

omicron.energy/episode55



A man in a yellow polo shirt is seen from the back, holding a microphone and addressing a large, diverse group of people seated in a modern, multi-level hall. The audience is wearing lanyards. In the background, other people are visible on an upper level.

CONNECT. INSPIRE.SHARE.

Meeting our global sales team
and sales partner network

This June, we had the opportunity to finally bring our global sales team and sales partner network together for a meeting in Feldkirch and Klaus in Austria.

Our International Event Series with the theme “Connect.Inspire.Share.” covered a broad range of meetings and activities over ten days. This presented great opportunities to (re-)connect with colleagues and sales partners from all over the world to share the latest insights, developments, and success stories.

A growing network meets in person

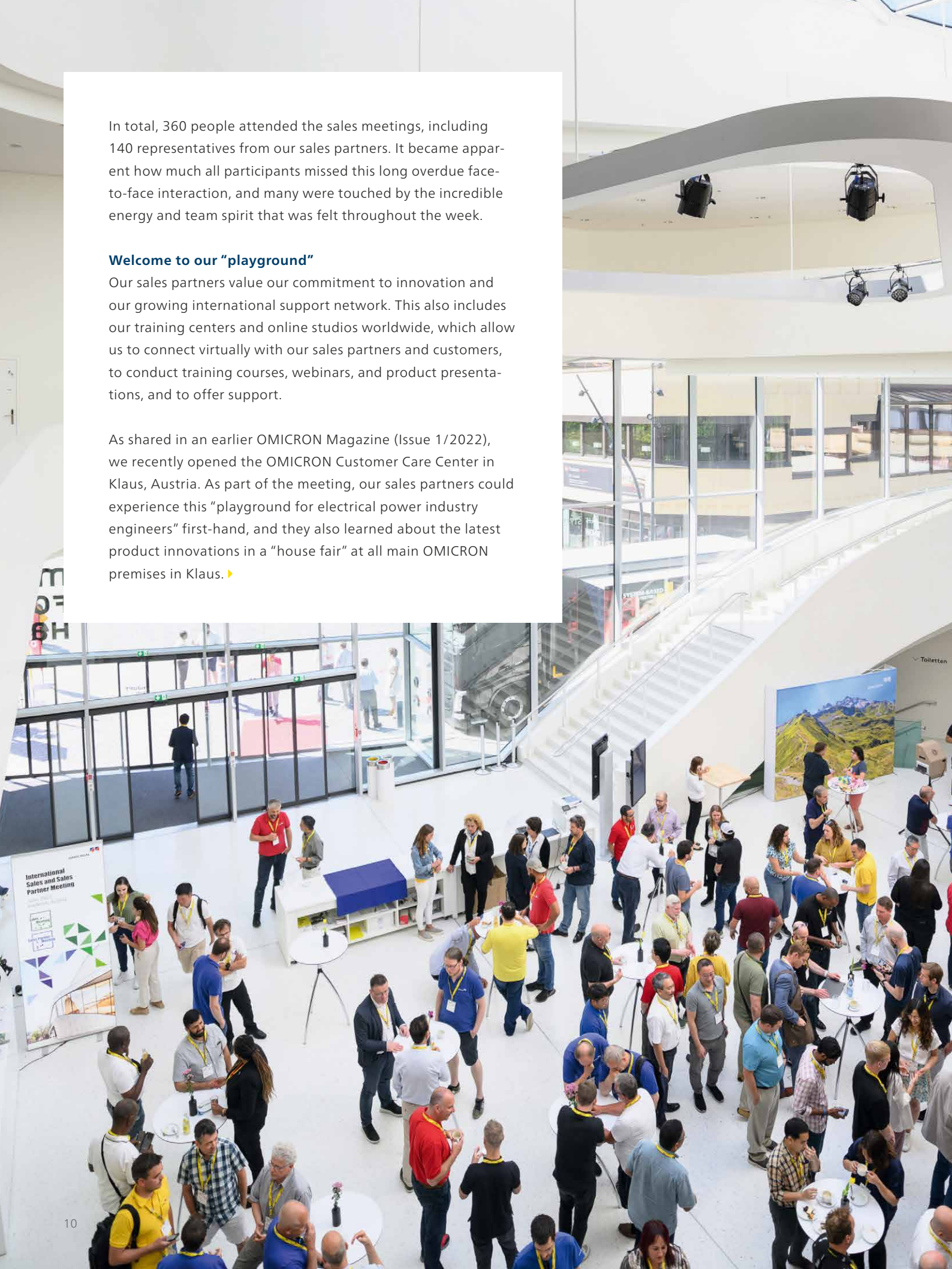
The event series kicked off with an International Sales and Sales Partner Meeting at the Montforthaus in Feldkirch. We chose this beautiful venue again after the last global get-together in 2015. ▶

In total, 360 people attended the sales meetings, including 140 representatives from our sales partners. It became apparent how much all participants missed this long overdue face-to-face interaction, and many were touched by the incredible energy and team spirit that was felt throughout the week.

Welcome to our “playground”

Our sales partners value our commitment to innovation and our growing international support network. This also includes our training centers and online studios worldwide, which allow us to connect virtually with our sales partners and customers, to conduct training courses, webinars, and product presentations, and to offer support.

As shared in an earlier OMICRON Magazine (Issue 1/2022), we recently opened the OMICRON Customer Care Center in Klaus, Austria. As part of the meeting, our sales partners could experience this “playground for electrical power industry engineers” first-hand, and they also learned about the latest product innovations in a “house fair” at all main OMICRON premises in Klaus. ▶





Connect.



«We sell fantastic test equipment, but at the end of the day, it's about the people, the different cultures, and backgrounds we come from. **We all center around this one common topic: OMICRON.**»

Alexander Dierks,
Alectrix, South Africa



«Alectrix has been an OMICRON Sales Partner for over 25 years, and I've recently joined the company as Sales Engineer. **There were so many things to explore and so many exciting stories to share during this meeting.** I'm also glad to see women among the attendees – it's motivational. Diversifying our industry and cherishing our different backgrounds is a mission.»

Pinky Seshabela,
Alectrix, South Africa



«We have been working together with OMICRON for more than 15 years. **I'm impressed by their commitment to innovation, and I really appreciate meeting here with all the experts to exchange and learn from each other.** This spirit of sharing knowledge is what makes OMICRON unique to me. This is an excellent benefit for us as a Sales Partner, and it's great for our customers too.»

Mike Dogget,
Robert W. Chapman & Co., United States



«I have been a Sales Partner since 2006. **I am really impressed with OMICRON's company culture and the quality of their solutions and products.** My customers love them. I am really looking forward to the training days and learning about the latest trends.»

Constant,
PT Citra Wahana Sekar Buana, Indonesia

Inspire.



*«To inspire is to lift somebody up and to help them fly. It is the wind beneath their wings. Spending this valuable time together in person, **will give us plenty of opportunities to become the wind beneath each other's wings.**»*

Marc Andreas Vogg,
OMICRON, United States



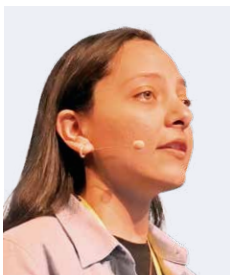
*«We have been working together with OMICRON since 2002. My primary motivation for attending this meeting was to meet the OMICRON team members in person with whom I correspond in my daily work. **I really appreciate this possibility for personal exchange.**»*

Evi Katogoudis,
PROTASIS S.A, Greece



*«It's inspiring to meet so many old and new friends. We have been an OMICRON Sales Partner for 19 years, and I am very happy to be here. **It's motivational for me to have such a strong supportive network and to know that my customers and I can rely on it.**»*

Federico Hahn,
IDUR, Chile



*«We've had a partnership with OMICRON for more than 25 years in Egypt. For me, it was the first time I joined a Sales Partner Meeting, and I loved it. **I connected with peers and colleagues from all over the world during this meeting, and I truly enjoyed it.**»*

Lina El-Laithy,
Sahara, Egypt



Comprehensive training program

After the first five days of the sales meetings, we used the weekend to socialize and celebrate with team members, sales partners, and families during the OMICRON World Festival at our premises in Klaus. We concluded the event series with an extensive three-day training program, with more than 200 participants. More than 100 training sessions, offered by 30 trainers, covered the latest testing, diagnostics, and monitoring trends and took a deep dive into our solutions portfolio.

This International Event Series 2023 was a great success and a memorable milestone in our company's history. We are carrying the momentum of Connect.Inspire.Share with us as a community to reach new heights and to serve our customers in the best possible way. 🟡

For a more detailed insight, what Connect.Inspire.Share means to us, watch our event video:

📺 youtu.be/Ct9A26Aww2s



Share.

*«The event series is a great opportunity **to get to know the different regions and gain insight into their different processes.** I am really looking forward to learning from everyone here.»*



Itzel Guerrero,
OMICRON, Mexico

HOW ICELAND IS BREAKING NEW GROUND

Landsnet and OMICRON pave the way for the future of digital substations through cooperation

Landsnet operates the approximately 3,200 km / 1,980 mi transmission network in Iceland with a total of 83 substations. In 2019, the decision was made to fully digitize all substations according to IEC 61850 over the next few years. Landsnet and OMICRON have been working together on this ambitious project since 2021. So far, the transition has been a great success, and several digital substations are already in operation. Read on to learn more about the transition to digital substations and the ambitious project in Iceland.

Pioneering drives innovation

This is not the first project to introduce digital substations, but Landsnet is taking it to another level in terms of scope and its pioneering nature. New technologies have often only been used in pilot substations, but here, they are being implemented directly in the transmission network. We are supporting Landsnet to carry out the complete conversion of the nationwide transmission network to digital substations systematically and efficiently.

Overcoming new challenges

In addition to the many benefits digital substations bring, they present many new challenges. Overcoming these challenges requires a step-by-step, systematic approach from the very start. Our OMICRON Consulting Service has many years of project experience with digital substations. Therefore, we could provide Landsnet with a suitable strategy and excellent planning advice. We also provided the appropriate tools for new technologies in the form of products and customized solutions, and sharing our knowledge



has also enabled Landsnet to use these tools efficiently.

Sharing knowledge and empowering people

When our partnership began, extensive specification and design work was required for the basis of a widespread rollout. The proper protocols had to be selected, and comprehensive specifications and implementation instructions had to be created. These were then used to derive templates for Landsnet's standard topologies. With the help of these templates, subsequent substations can be planned and implemented much more efficiently. Careful selection and pre-testing of Intelligent Electronic Devices (IEDs) and network components also contributed significantly to their success. By providing automated test plans for functional and compatibility testing, Landsnet could perform an efficient Factory Acceptance Test (FAT). Despite the travel restrictions, we did everything possible to provide the best possible remote support for the FAT.

*«The project was a jump in at the deep end in many aspects. **Especially in the design and specification phase, there were many obstacles to overcome. But with OMICRON we had an experienced partner who supported us significantly.»***



Birkir Heimisson,
Specialist in Digital & Smart-Grid Development,
Landsnet

A truly exceptional experience

In February 2023, we were able to perform the Site Acceptance Test (SAT) at the digital substation in Hróttatunga. The gas-insulated 132 kV substation with six switch bays is located about 160 km / 100 mi from Reykjavik in an icy landscape of breathtaking

beauty. The SAT was also a highlight from a technical point of view. The system architecture, consisting of IEDs from different manufacturers with network redundancy mechanisms, was demanding and complex. Many of our solutions for testing and commissioning digital substations were used in ►

ICELAND

Capital: Reykjavík

Population: approx. 380,000

Area: 103,125 km² / 39,817 mi²

100% renewable energy: 70% hydro, 30% geothermal

National dish: Hákarl (fermented shark)

«The cooperation with Landsnet is a great journey together to fully digital substations. By sharing knowledge and experience and finding new solutions to challenges, we ensure that the success story continues.»



Matthias Wehinger,
Digital Substation Expert, OMICRON

the SAT. The substation communication network, protection and control equipment, and instrument transformers with their merging units were tested thoroughly. Reusing the pre-defined FAT test plans with some minor adaptations for SAT saved a lot of effort. The SAT was completed successfully and efficiently to the satisfaction of all participants. There was a lively and constructive exchange with the operating personnel from Landsnet.

Suitable solutions for digital substations

We at OMICRON have several products and solutions for testing and commissioning different aspects of digital substations. In this project, we were able to use many of them in parallel. These are some of them:

- › **DANEO 400:** Used as a network analyzer for system communication verification, Precision Time Protocol (PTP) time synchronization testing, network redundancy and performance checks.
- › **Test Universe:** Automated protection testing for individual IED protection functions.
- › **RelaySimTest:** System based protection testing of busbar protection and line differential with power system simulation.
- › **StationScout:** Automation system testing such as interlocking logic testing and SCADA signal testing.
- › **IEDScout:** Used as a tool for visualizing and troubleshooting IEC 61850 devices.



CMC 850, MBX1 and DANEO 400

Meeting the demands of the future

Landsnet is convinced that digital substations can make better use of existing transmission networks and open up many new possibilities. Load fluctuations and dynamic changes in the network can be compensated efficiently with digital technology. The extensive digital data from operations makes it possible to detect events immediately, and this data can be used to react quickly and remotely during normal operations or unexpected events. Digital sub-

stations are also more environmentally friendly than conventional substations. Thanks to the more compact design, the smaller number of components required, and the drastically reduced wiring effort, valuable resources can be saved.

A role model for transformation

Landsnet's nationwide power grid transformation will support the further deployment of digital substations in other regions. The project can serve as a model for driving tech-

nological change. Utilities worldwide can benefit from Iceland's experience as they implement digital substations. And with a growing number of digital substations, grids will be prepared for further expanding renewable energy.

The ongoing cooperation between OMICRON and Landsnet has been a great success for both of them. We are already planning future steps because challenges still lie ahead, and we look forward to tackling them together. ■

LANDSNET

- › Operator of the Icelandic Transmission System
- › Established in 2004
- › Over 93% owned by the Icelandic State
- › 148 employees
- › Transmission System:
 - › ≈ 3,200 km / 1,980 mi overhead lines
 - › ≈ 330 km / 205 mi underground cables
- › 83 substations

Digital substation
in Hríttunga

VT TESTING AT SEMAR ELECTRIC

Increasing efficiency with a model-based approach

Voltage transformers (VTs) need to transform primary voltages to smaller voltages with precision on their secondary side. These voltages serve as the input signals for secondary devices, such as protection relays or electricity meters. Manufacturers need to fulfill high-quality requirements while improving their production lines' efficiency so that prices can stay attractive for their international clients. Semar Electric in Cairo Montenotte, Italy, has made its VT production line more efficient by integrating the VOTANO 100.

Voltage and current transformer (CT) manufacturers verify the performance of their CTs and VTs during several stages of the production process. A voltage transformer needs to perform correctly in ratio, phase, polarity, and accuracy class, and a current transformer must have proper winding resistance, excitation curve, knee point, and ratio, to name but a few of the most important parameters. Thus, these VTs and CTs must undergo several testing stages during production. The first tests occur before the pre-assembled VT or CT active part goes through the

resin-casting process. The second one is the final production test.

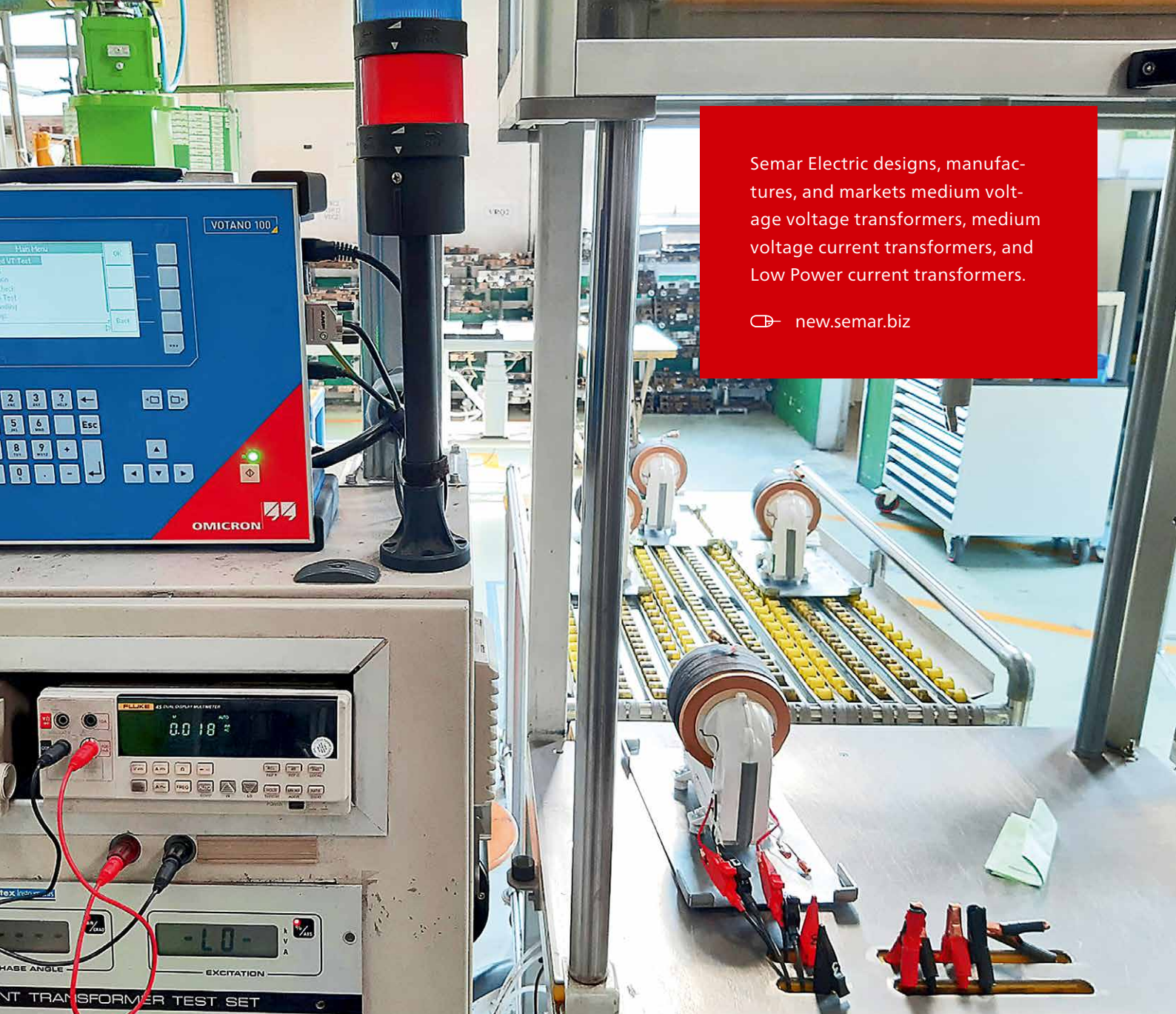
For the first test phase, Semar Electric optimized testing performance and production efficiency by integrating the CT Analyzer for their CT tests a few years ago. They have currently integrated the VOTANO 100 into their VT production line. Semar Electric controls the VOTANO 100 directly from the production software via the VOTANO 100 API. During the transition from their former measurement bridge to the VOTANO 100 measurement, Semar Electric used both measurement methods to compare results. These comparisons have shown that the results of the measurement bridge and the results of the VOTANO 100 correspond well.

The main advantage the VOTANO 100 measurement has over the measurement bridge is the amount of time it saves. With a bridge measurement, one leg of the bridge circuit must be balanced with the voltage transformer under test for each measured value. The VOTANO 100, on the other hand, automatically performs several measurements in quick succession to

determine the most critical parameters of the VT, such as the winding resistance or the magnetization curve.

During these tests, VOTANO 100 determines the VT model elements and automatically calculates the accuracy of the voltage transformer from these intermediate results. Seconds later, VOTANO 100 outputs an automatic VT class assessment. This class assessment





Semar Electric designs, manufactures, and markets medium voltage voltage transformers, medium voltage current transformers, and Low Power current transformers.

new.semar.biz

VT ready for testing in VOTANO 100 measurement

works for all VT classes produced at the Semar Electric plant, including class 0.1. The time this improved process saves during production means that more voltage transformers can be produced with the same level of quality. This makes the process more efficient, increases productivity, and enables Semar Electric to be more competitive in the global market by offering high-quality value well worth the money. ■

«VOTANO 100 automatically performs several measurements in quick succession to determine the most critical parameters of the VT, such as the winding resistance or the magnetization curve.»

PARTIAL DISCHARGE TESTING ON GAS-INSULATED SWITCHGEAR

With multiple ultra-high frequency measurement modes, our UHF 800 system provides you with sensitive on-site partial discharge measurements on GIS

What is partial discharge? Partial discharge (PD) is a localized dielectric breakdown of an insulation system under electrical stress. It can lead to dielectric failure if left undetected or if it's not rectified in a timely manner. This is because PD weakens the insulation's strength over time, making it unable to withstand operational stress. Therefore, detecting, measuring and locating PD inside of high-voltage (HV) asset insulation, such as in rotating machines, transformers, switchgear and power cables, is essential.

PD measurement is a sensitive and non-invasive method accepted worldwide for detecting insulation weakness in HV assets. It's used to assess the insulation condition during quality control at the factory and on-site commissioning after the asset has been installed. Once in service, PD measurement is performed periodically to ensure the reliable operation of assets in the grid.

As with other high-voltage (HV) assets, partial discharge (PD) activity in Gas-Insulated Switchgear (GIS) is an indication of developing and potential failure-causing defects in the insulation. Typical problems inside of GIS that can cause PD are sharp conductive objects or particles deposited on the outer conductor, inner conductor, or attached to the insulating spacers. Such particles need to be found inside of the GIS and removed, especially during onsite commissioning to ensure reliable in-service operation.





*«PD activity is a reliable indicator for the insulation condition in electrical equipment, **as it is often a sign of developing insulation defects that can potentially cause dielectric failure.**»*



Stefan Hoek,
Product Manager, OMICRON

Optimizing sensitivity for on-site PD measurements

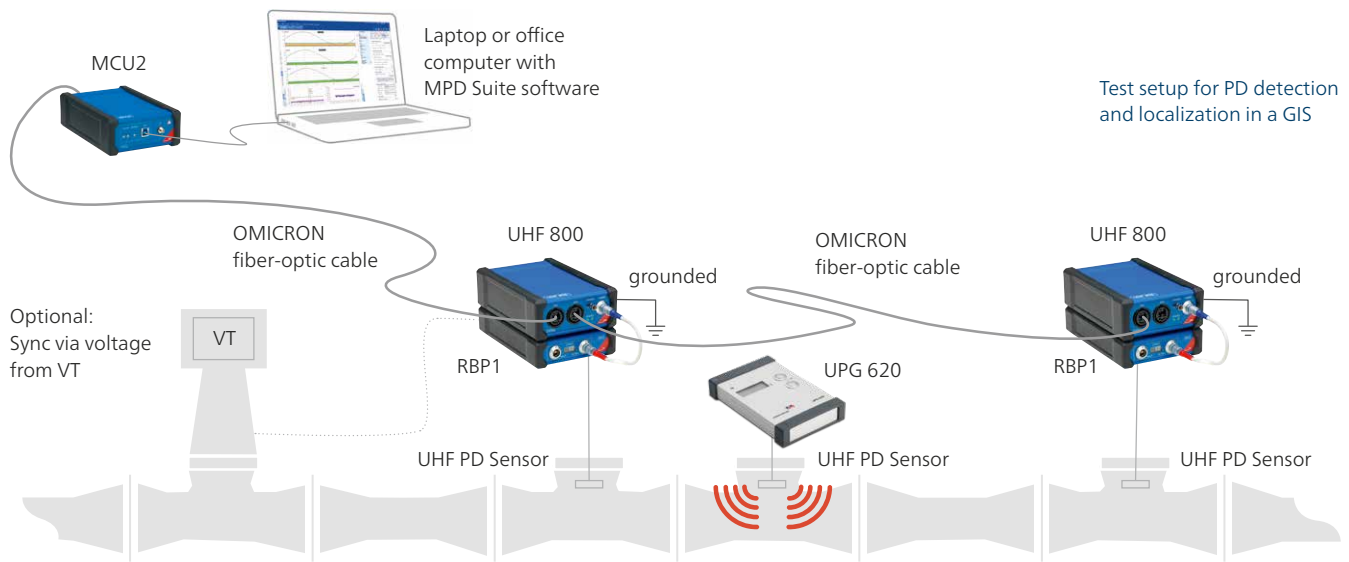
In GIS systems with SF₆ insulation, PD generates electromagnetic waves in a broad frequency spectrum due to their short rise time. Protrusions and particles or voids inside insulators may generate low-level partial discharges, which require a sensitive PD measurement, especially for testing GIS on site.

Compared with performing PD measurements in optimized factory and laboratory test environments, on-site PD measurements are often compromised by significantly higher interference signal levels, namely external noise.

For on-site commissioning testing and troubleshooting on GIS, the ultra-high frequency (UHF) method has established itself as the standard method for PD measurements to ensure the required sensitivity. The common bandwidth of the UHF PD measurement method is typically from 100 MHz to 2 GHz. In a sensitive UHF PD measurement, even minor defects generating low-level partial discharges can be detected in GIS, and it's a reasonable alternative to expensive on-site tests being used for low-level PD detection, such as the lightning impulse test.

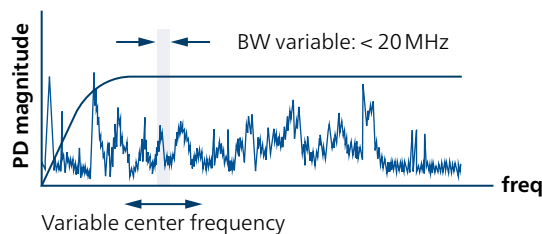
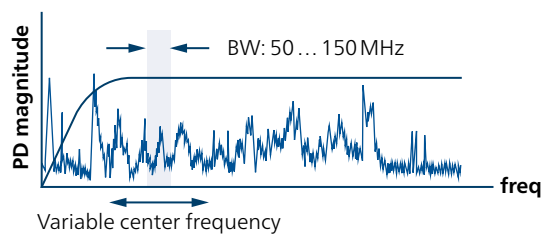
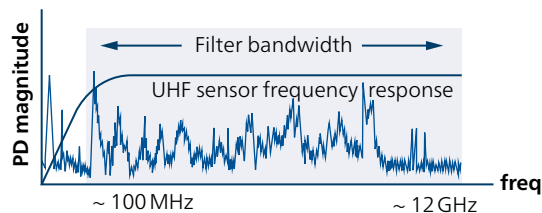
Different UHF PD measurement modes

There are different approaches to performing UHF PD measurements. Wideband measurements are appropriate for ►



disturbance-free test environments, such as in a test lab, and require minimal setup effort. For disturbance-prone onsite test environments, medium-band and narrowband measurements with different bandwidth filters provide you with a more selective measurement. Therefore, they reject external noise and disturbances effectively.

The measurable signal spectrum depends heavily on the situation. Due to the encapsulation of the GIS, the signal-to-noise ratio can be quite good. However, with PD sensors closer to the outdoor bushings, outside disturbances can still be measured in specific signal frequency ranges. This can influence the measurement sensitivity, especially when only a simple broadband measurement is performed.



Broadband measurement methods are quite common, but medium-band and narrowband measurement methods are more selective and robust against external noise. The variable narrowband measurement method, in particular, makes selecting frequency windows free of interference in onsite testing environments possible.

Finding an optimal signal-to-noise ratio

A suitable measurement frequency window can be identified by simply observing the input frequency spectrum in which a high signal-to-noise ratio (SNR) results in high measurement sensitivity. Suitable frequency windows with acceptable SNR can even be found under challenging conditions with high external noise levels. Therefore, you can improve PD measurement results onsite despite elevated levels of interference by using a frequency-selective PD measurement system that allows you to switch between different measurement modes, bandwidths, and center frequencies. ■

Our UHF 800 PD measurement system allows you to select from various measurement modes – (a) broadband mode, (b) medium-band and (c) narrow-band modes with selectable measurement frequency and bandwidth.

SEE THE VIDEO



Watch our video to learn how our UHF 800 system is set up and used for PD testing on gas-insulated switchgear.



youtu.be/0PzraSYCEU8

LISTEN TO THE PODCAST

Interested in this topic?



If you want to learn more about partial discharge testing in the UHF range, listen to the following episode of our Energy Talks podcast series. Scan the QR-Code or visit:



omicron.energy/episode29

AT A GLANCE: UHF 800

Ultra-high frequency partial discharge measurement and analysis system

- › Ultra-high frequency (UHF) PD measurements ranging from 100 to 2,000 MHz
- › Spectrum Evaluation feature and adjustable measurement filters for optimal signal-to-noise ratio
- › Robust and flexible for PD measurements in laboratories, testing bays and in the field
- › Supports CIGRE "Application guide for sensitivity verification" (Brochure 654)
- › Single-channel and synchronous multi-channel PD measurements performed off-line and on-line
- › Configurable user interface for individualized PD testing and customized reporting

omicronenergy.com/uhf800

NEW FEATURES: CMC SWIFT MEETS CPOL2

Perform polarity checks and quick checks
with more mobility than ever before



CMC Swift allows you to control your CMC test sets easily and wirelessly. With CMC Swift, you can enjoy complete freedom of movement without a laptop by performing a whole series of checks directly from your smartphone. The features from the latest update give you even more options, such as performing wiring checks in combination with the CPOL2 polarity checker.

Perform wiring checks easily

When commissioning substations and secondary technology, hundreds of connections and functions have to be checked. Besides the correct wiring of instrument transformers, logic signals, trip and control signals for circuit breakers, and various auxiliary signals must be wired carefully. Something can go wrong in an instant or be overlooked in the process. In fact, wiring problems, such as the incorrect polarity of a voltage or current transformer path, are among the most common errors in electrical systems. Therefore, wiring and polarity checks are among the first critical steps during commissioning.

CMC Swift allows you to control the output of a DC-free test signal via the voltage or current outputs of your test set. Using this sawtooth signal, you can easily perform polarity and

wiring checks in your substation with the CPOL2 – without any additional cable connections. In addition, the instrument transformer won't be magnetized unintentionally due to the DC-free signal.

Another new function also allows you to display power during wiring tests. This enables you to effortlessly check the power flow direction by reading the active power on the protection relay.

Ramps and triggers with CMC Swift

CMC Swift also provides two new functions for simple tests that enable a quick, manual setup for ramps and triggers. The output values for the ramp function can be adjusted live via a distinct input area until a trip operation occurs. Triggers for controlling the test procedure can be set up in the app for the binary inputs and overloads. This means, for example, that you can stop the output from the test variables immediately when a specific switching event occurs.

Supply the protection relay with voltage

In addition to the output of the sawtooth signal, the current version of CMC Swift also offers the option of controlling the DC output of your CMC in order to supply the protection relay with power during testing. ■

More information about CMC Swift and CPOL2 can be found on our website:

 omiconenergy.com/cmcs swift

 omiconenergy.com/cpol2



LISTEN TO THE PODCAST

Interested in this topic?

Be sure to listen to our podcast episode "CMC Swift: Bringing a mobile testing app to life – The development of a mobile testing app for the CMC test sets". Scan the QR-Code or visit:

 omiconenergy.com/episode64



DOWNLOAD NOW

Try CMC Swift now and leave your laptop behind for simple checks in the future.



GET OFF THE ROOF!

INZELL is a research project that is currently being carried out in the Max Bögl Group's industrial cell in Sengenthal, Germany (read more about it in issue 1/2023 of the OMICRON Magazine). Once the research project has been completed, the aim is to be able to use the industrial cell as an island grid during an emergency situation. Numerous generators that draw on renewable energy produce the power required for the industrial cell. For instance, a floating photovoltaic system has been installed on the company's pit lake. OMICRON is actively involved in the INZELL project and was also responsible for commissioning the photovoltaic system on the lake.



Many companies already have energy generation plants to reduce electricity procurement costs and enable production to continue or facilitate controlled shutdowns during extended power outages. In an island grid, i. e., when the higher-level network is unavailable, the generation plants, storage facilities, and load management systems must all function perfectly together. And it works both ways: During the energy transition, these industrial cells can support the stability of the public power grid by contributing to renewable energies. Both of these aspects are being explored as part of the INZELL project.

Powerful PV system

The Max Bögl Group's industrial cell data is impressive: Approx. 25.5 GWh of electricity is generated each year. Alongside wind turbines, photovoltaic systems are the most significant contributors to electricity production.

Roof installations provide a capacity of approx. 2.5 MW. However, the floating PV park on the company's pit lake is particularly remarkable. This photovoltaic system boasts a connected capacity of 1.6 MW.

Fully operational

We were asked to commission the floating photovoltaic system. "We perform primary testing on the system, checking the phase assignment and the transfer ratio of the current and voltage transformers. It makes no difference whether the photovoltaic system is installed on a roof or a lake," explains Michael Biller, Application Engineer with OMICRON Engineering Services. "The uncoupling connection also needs to be checked. For example, in the event of a fault, a grid disconnection will cause the photovoltaic system to shut down immediately. This protects both the grid and the genera-

tor itself." In addition to performing standard tests, engineers checked the integration of the photovoltaic system into the signaling and telecontrol technology. These checks ensure that the measured values and messages from the photovoltaic system are reliably transmitted to the control center. The engineers also checked the photovoltaic system's remote control.

The floating photovoltaic system has enabled the Max Bögl Group to substantially increase its solar capacity for electricity production – despite not having suitable roof space. "Our tests confirmed that the system was working properly and meant that the photovoltaic system could be fully commissioned," says Michael.

Major research project

The positive effects of floating photovoltaic systems are currently being ex-



MISSED THE FIRST PART?

Read the introduction to the INZELL project in part 1 and learn about the project's background. Scan the QR-Code or visit:

 omicron.energy/inzell-part1



plored around the world. The German Fraunhofer Institute has calculated that the potential capacity of artificial lakes in Germany alone is some 44 GW. The institute also mentioned the following advantages:

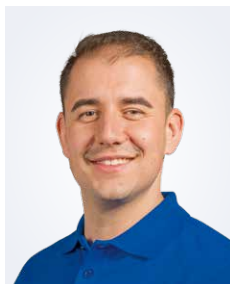
- › It would ease the competition for land use.
- › The cooling effect of the water increases electricity production.
- › There is less water loss due to evaporation.

"Thanks to the cooling effect of the water, Bögl's floating installation is expected to achieve a yield increase of up to five percent compared to roof installations. During the next few months, an accompanying study will provide concrete results," explains Christoph Trabold, Application Engineer with OMICRON Engineering Services and Project Manager for INZELL at

OMICRON. He adds: "A parallel study is also expected to provide some exciting insights concerning ecological impact. For example, water heated by direct sunlight is expected to be reduced. The photovoltaic system also protects the creatures living in the water from

birds of prey, which can support species conservation." The results are being eagerly anticipated. After all, they could be game-changing when it comes to expanding the exploitation of solar energy on unused pit lakes – not just in Germany but worldwide. ■

*«When it comes to commissioning, it makes no difference **whether the photovoltaic system is installed on a roof or a lake.**»*



Michael Biller,
Application Engineer, OMICRON

NEW SAFETY FEATURES THAT PTM 5.00 ADDS TO THE CPC 100

Imagine this scenario: It's a hot day, and John is on-site testing voltage transformers. He's been working all morning injecting 1,400 V into the HV terminals of multiple VTs and taking secondary measurements with the junction box, relay terminals, and further downstream equipment. He's been repeating these tests for hours using the Quick card function from the CPC 100. As he completes the last set of measurements, he walks back to the VT to disconnect the clamp but doesn't realize that the CPC 100 is still outputting voltage. He comes into contact with the high voltage and receives a fatal shock.

Mistakes like this happen very quickly because human senses can't detect electrical hazards, and thus, they remain invisible. As with most accidents, multiple factors contribute to their occurrence. In this case, the five safety rules were violated, the red/green status lights of the CPC 100 wasn't observed, and John had been performing dangerous tasks without a co-worker. He was likely fatigued after a long, hot day doing repetitive tests.

At OMICRON, we strive to make the best products and continuously look for ways to improve our devices and related work. Safety is one of our highest priorities and we're always introducing new features that reduce risks.

We're proud to announce the release of two new CPC 100 features contained in the latest version of the PTM 5.00 software: 2 kV-Timeout in Quick and Rapid Fault Sense (RFS).

Considering its unique output characteristics, these features are tailored to address the specific working environment in which the CPC 100 is used.

2 kV-Timeout in Quick is easy to explain: The CPC 100 will terminate high voltage injection in the Quick-Test card after a 10-second default. This time limit can be user-defined and

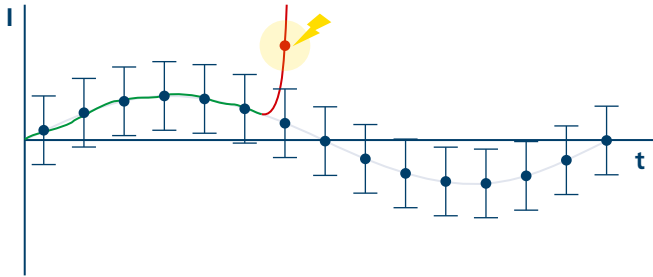
deactivated if required; it resets itself with every reboot. This may contribute to safety when a user is distracted and loses situational awareness.

In a nutshell: RFS is an output supervisor that can detect output changes and initiate an immediate switch-off of the CPC 100. However, a little more information is required to describe how it works. The IEC TS 60479-2 Standard gives us a general idea of how fast the device must be switched off to lower the risk for heart fibrillation effectively. Assuming, for example, that there's 1 Ampere of body current during an accident, it must switch off in less than one millisecond to keep the risk reasonably low. For comparison: Standard Residual Current Devices (RCDs) typically trip within a few tenths of a millisecond and require additional supervised circuits to be isolated from the ground. They're too slow for high body currents, and many CPC 100 applications require a direct connection to the ground. So, we had to think differently.

Building a system that can meet these requirements is an immense technical challenge. However, RFS may be capable of addressing this issue because it can detect faults within a few hundred microseconds. The output semiconductor amplifier is much faster than a physical relay so it can switch off the CPC 100 immediately.

*«Since they're both
software-based, virtually
every CPC 100 can be
updated immediately,
free of charge. Stay safe!»*

RFS is based on a statistical analysis of the output signals. It slices each period of the signal into various equal parts called buckets. The buckets are analyzed for their mean value and variance. If the CPC 100 detects that newly measured values are not within the expected range of the previously measured ones, the unit switches off immediately.



Periodic signal with RFS Buckets and a detected fault

RFS requires a few stable signal periods (typically a few seconds) to become active. This is the case after output activation and every time the amplitude or frequency is changed (either automatically by the device or manually by the user).

RFS has been tested comprehensively, but since it's only activated in selected test cards and requires complex signal detection and interpretation and a few seconds to become active, its operability cannot be guaranteed in all situations. When triggered, RFS will significantly limit exposure to dangerous current and voltage during an accident sequence. However, RFS cannot prevent accidents from happening. Thus, users must not take an increased risk or rely on the unconditional functioning of RFS.

Therefore, Quick-Timeout and RFS are an addition, not a replacement for current safety measures.

With the latest version of PTM 5.00 offering you 2 kV-Timeout in Quick and RFS for the CPC 100, we've added two powerful features for preventing accidents and lessening their severity in the future. Since they're both software-based, virtually every CPC 100 can be updated immediately, free of charge. Stay safe! ■

ALWAYS OBSERVE THE FIVE SAFETY RULES:

1. Disconnect completely.
2. Secure against re-connection.
3. Verify that the installation is dead.
4. Carry out grounding and short-circuiting.
5. Provide protection against adjacent live parts.

UPDATE YOUR CPC 100

 omcronenergy.com/ptm



DID YOU KNOW?

The optional CPC 100 accessory SAA2 has additional red/green status lights to raise awareness and an emergency-off button for local control.





OMICRON GERMAN USER MEETING

30 years of knowledge transfer

The ever-quicken pace of technological change in our complex society makes regular knowledge transfer indispensable for everyone, especially those responsible for system-critical infrastructures such as the electrical power grid. Since the first OMICRON German User Meeting (GUM) in 1993, the event has developed into a unique platform for protection, automation and control technology specialists throughout the German-speaking world and

beyond. The German-speaking event is held annually at various locations in Germany. No other event in the PAC industry offers comparable opportunities for peer exchange between power system operators, service providers, and manufacturers.

This year's 30th edition of GUM was held from May 23rd to 25th on the shores of Central Europe's largest freshwater body, Lake Constance, in Lindau, Germany. Over 300 OMICRON

users enjoyed high-level networking, heard technical presentations, attended hands-on seminars, and could view products and the corresponding testable switchgear elements at an exhibition.

One of the main topics at this year's GUM was risk prevention. In his keynote speech, Hannes Buzanich from Vorarlberger Energienetze GmbH pointed out the danger of blackouts and the importance of prevention.



your fingertips

GUM 2024
June 4–6, 2024
in Wolfsburg, Germany

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The technical presentations on this crucial topic also included an in-depth talk about cybersecurity. Andreas Klien from OMICRON addressed the issue by discussing the importance of attack detection and vulnerability management. With over 30 seminars, the guests could delve into specific areas of expertise. Among the most popular of these seminars were “Interference analysis made easy,” “IEC 61850 for beginners,” and “Ground fault, how best to test.”

A particular highlight from this year's event was a visit to OMICRON's headquarters in nearby Klaus, Austria. The OMICRON product management staff was ready to respond to questions during the evening's exhibition in the OMICRON Customer Care Center, allowing visitors to benefit from practical insights and first-hand experience. During practical seminars, the product managers demonstrated their respective products, such as StationScout, StationGuard,

COMPANO 100, RelaySimTest, and the Adresys ANGEL React system, in a realistic environment with authentic substation elements that enabled them to simulate the participants' everyday life. Company tours allowed the attendees to learn more about OMICRON's technology and workflow. They were also able to play a role in influencing the future GUM event concept by using an idea box, app, online survey, or through direct exchange. ■

ON SITE: OMICRON IN CHILE

Federico Hahn from Idur Representaciones S.A. gives us his insight into the power sector

Idur Representaciones S.A. started in 2002 with Rodolfo Braun and his strategic partners in Santiago de Chile with the objective of providing their experience and solutions for the medium and high voltage electrical testing market. Since then, Idur Representaciones S.A. has been consolidating this market, making OMICRON products the benchmark for electrical tests in Chile in national electrical companies based mainly on product innovation, quality, and after-sales service.

How is the energy grid structured?

Federico Hahn: The National Electric System in Chile includes installations for electrical generation, transmission, and consumption. It encompasses territory from the regions of Arica – Parinacota (North) to the Tenth Region (Isla Grande de Chiloé, South).

It's the largest system (32,100 km / 19,950 mi of transmission lines in 3,300 km / 2,050 mi of territory) providing electrical energy to the Chilean territory with an installed capacity of up to 29,500 MW and a supply coverage that reaches about 98.5% of the population.

What resources are being used to generate power?

53.3% of the National Electric System's (SEN) capacity corresponds to resource-based generation. It consists of hydro-electric origin, solar photovoltaic, biomass, and geothermal renewables. The other 46.7% corresponds to gas-fired thermo-electric natural plants natural, coal or petroleum derivatives.

What are the current hot topics for the energy supply market?

Chile is building up its renewable energy infrastructure and working to spur investments in energy storage, electric vehicles, green hydrogen, and its derivatives. Investments in transmission and distribution are also required to support electrification. Easing permit bottlenecks, appropriate land-use planning, and practical early-stage community consultation work that help build projects on time without compromising environmental standards – also need to be addressed.

What kind of challenges are your customers facing?

Key challenges along the decarbonization highway include building up the requisite transmission infrastructure and incorporating grid storage solutions to compensate for intermittent wind and solar power. A decade-long drought has impacted the output of conventional hydroelectric plants, which account for about 25% of the country's installed capacity of 29.5 GW. It has also lessened their ability to balance short-term variations in the power system.

When looking towards the future, where do you see the biggest challenges in the power sector and in general?

Our country has widened its target by executing a plan to close coal-fired power plants. Today they get about 30% of their power from non-conventional renewable energy (NCRE) plants, chiefly solar and wind.

That number is increasing due to the support of a decarbonization drive from the energy ministry's 2050 national energy policy. The policy established a 2030 target of 80% power from renewables and a 2050 goal of a 100% clean grid. Energy efficiency is expected to account for 35% of greenhouse gas emission reductions necessary to achieve carbon neutrality in Chile by 2050.

Thank you for the interview. ■



Federico Hahn,
Manager,
Idur Representaciones S.A.

 idur.cl



Moai Statues on the Easter Island

North
America

Latin
America

ABOUT CHILE

Capital: Santiago de Chile

Inhabitants: 19,600,000

Currency: CLP Peso Chileno

Language: Spanish

National Dish: Empanadas

National Drink: Pisco Sour

National Sport: Futbol Soccer

DOS AND DON'TS IN CHILE

- › **Visit a vineyard** and enjoy a glass of a Cabernet Sauvignon red wine.
- › **Don't ask if** Chile's pisco sour is better than other countries'.

DESIGNED TO MEET TODAY'S NEEDS

Good solutions always focus on the user and the environment

The complexity and dynamics of the power grid is constantly increasing, and at the same time, new testing priorities are emerging as a result of ongoing decarbonization. In order to take these developments into account, the test equipment must also be continuously equipped with new functions. Experience shows that the best ideas and suggestions for improvements come from practical use. The requirements placed on testing equipment vary greatly depending on the application area. We will show you how COMPANO 100 is used in different areas based on three examples.



EXAMPLE 1: AN ALL-ROUNDER AT WORK



Vincent Pfeiler founded SHB Electric in 2010 as a sole proprietorship and now employs about 30 people. SHB Electric provides maintenance, installation, and repair for electrical equipment. Among other various tools, COMPANO 100 is being used as a testing device. Vincent gives insight into his work in the following interview and shares his experiences with COMPANO 100.

Hello Vincent Pfeiler, thank you for making the time to speak to us. Are there any trends emerging in your field?

Vincent Pfeiler: In the early days of SHB Electric, the company's activities were mainly limited to cleaning, replacement, and mechanical maintenance of electrical equipment. However, the tasks have become much more complex in recent years. The focus has shifted towards testing and commissioning, so appropriate test equipment now plays a central role in our work. A positive aspect of this is customers' increased interest in testing solutions.

What tests do you perform at the customer's site?

We perform a variety of tests on electrical equipment at the customer's site. These include circuit breaker contact resis-

tance, switching times, maximum phase and ground current protection, transformation ratios, and testing instrument transformers. Recently, there have been increasing requests for partial discharge tests, but unfortunately, we don't have the necessary equipment yet.

Why did you decide to go with COMPANO 100?

We were impressed by its versatility, compact size, and battery-powered operation. We use many of OMICRON's applications for testing, but we have also found other uses for this device. For example, the COMPANO 100 is also very suitable for measuring the ratio of distribution transformers.

How has COMPANO 100 changed your work routine?

With COMPANO 100, we can provide more personnel with the necessary equipment for testing substations. COMPANO 100 makes this possible by combining the functions of four devices in one. This eliminates the need for the following devices: single-phase current and voltage source, micro-ohmmeter, milli-ohmmeter, and single-phase ratiometer. COMPANO 100 has been so convincing that we're using five devices now.

Thanks for your time. ▶



SHB ELECTRIC

- › Maintenance, installation, and repair for electrical equipment
- › Founded in 2010
- › 30 employees
- › 24/7 support
- › Operating throughout France and abroad as well

EXAMPLE 2: WHAT KINDS OF CHANGES WILL THE ELECTRIFICATION OF INDUSTRY BRING?



In the decarbonization process, many energy-intensive industrial processes are being electrified. This development often makes maintaining power quality a major challenge. Electric arc furnaces and rolling mills in the steel industry have a particularly negative impact on power quality. In this context, Yusuf

Gok from our sales partner MARKE gave us an excellent opportunity for a field test in Türkiye. During the test, we used COMPANO 100 and a new function for the calculated measurement in a compensation system for power quality. Yusuf shares his insights with us in the following interview.

Hello Yusuf Gok, thank you for taking the time to talk to us. Why are many industrial companies in Türkiye changing their processes?

Yusuf Gok: Türkiye's export orientation is leading companies to invest in expanding production capacities and modernization with new technologies for energy efficiency. In addition, Türkiye's geopolitical and strategic location makes it increasingly interesting for international companies. The resulting new investments are primarily focused on future-proof technologies and are driving the electrification of industry forward. Another accelerating factor is that many companies are entering the energy market. They aim to cut costs with renewable energies and profit from electricity sales.



Electric arc furnace
for steel production

What kinds of challenges does this transformation present?

Modern devices are much more sensitive to power quality issues. Therefore, a stable, continuous, and reliable power supply is vital to their operation. In this context, compensation systems are essential in ensuring power quality in the industrial sector. Voltage fluctuations and other disturbances can only be reduced by using such equipment to provide the required power quality.

What was your experience with the COMPANO 100 field test like?

We tested a wide range of equipment, such as circuit breakers, disconnectors, protection relays, current transformers, voltage transformers, harmonic filters, capacitors, and the grounding system. The results were very impressive due to COMPANO 100's efficiency.

The new calculated measurement function allowed us to verify that the capacitors met their labels' specifications without disconnecting them.

How do you see the potential of the new type of calculated measurement?

The new type of calculated measurement has great potential for testing capacitor units. As the number of compensation systems is constantly increasing, the need for testing capacitor units will also increase. Adding this new function to the wide range of functions it already has, makes COMPANO 100 an excellent choice for this testing area.

Thanks for your time. ▶



MARKE ELEKTRONİK

- › Testing solutions for electrical power industry
- › Founded in 1993
- › Representation of OMICRON in Türkiye
- › Authorized training center of the OMICRON Academy



Compensation system in the industrial sector

EXAMPLE 3: THIS IS WHERE TESTING MEETS MOBILITY



The railway sector is growing rapidly worldwide, and with it, the demand for testing railway systems. This is why Josef Schmidbauer, Product Manager for COMPANO 100 at OMICRON, is receiving more requests. As a portable and multifunctional test device, COMPANO 100 is particularly well suited to the needs of customers in the railway sector.

Hello Josef, thanks for your time.

What can COMPANO 100 perform in the rail sector?

Josef: COMPANO 100 is often used for basic current and voltage transformer tests. However, it can also be used for micro-ohm measurements – which are necessary when testing rails and other equipment grounding. With up to 1,000 watts of power and 100 amps of test current, plenty of reserves exist. This allows testing for EN50122 or EN50153 with the required cable lengths and currents.

Which testing functions are currently in demand?

Recently, we have received more and more requests for testing DC protection systems. Here COMPANO 100 is well

suited for direct testing of DC overcurrent protection (IDMT) since a DC output is possible. In addition, there is interest in testing di/dt protection functions – which require a continuous current ramp as a test signal.

What exactly is the di/dt protection function for?

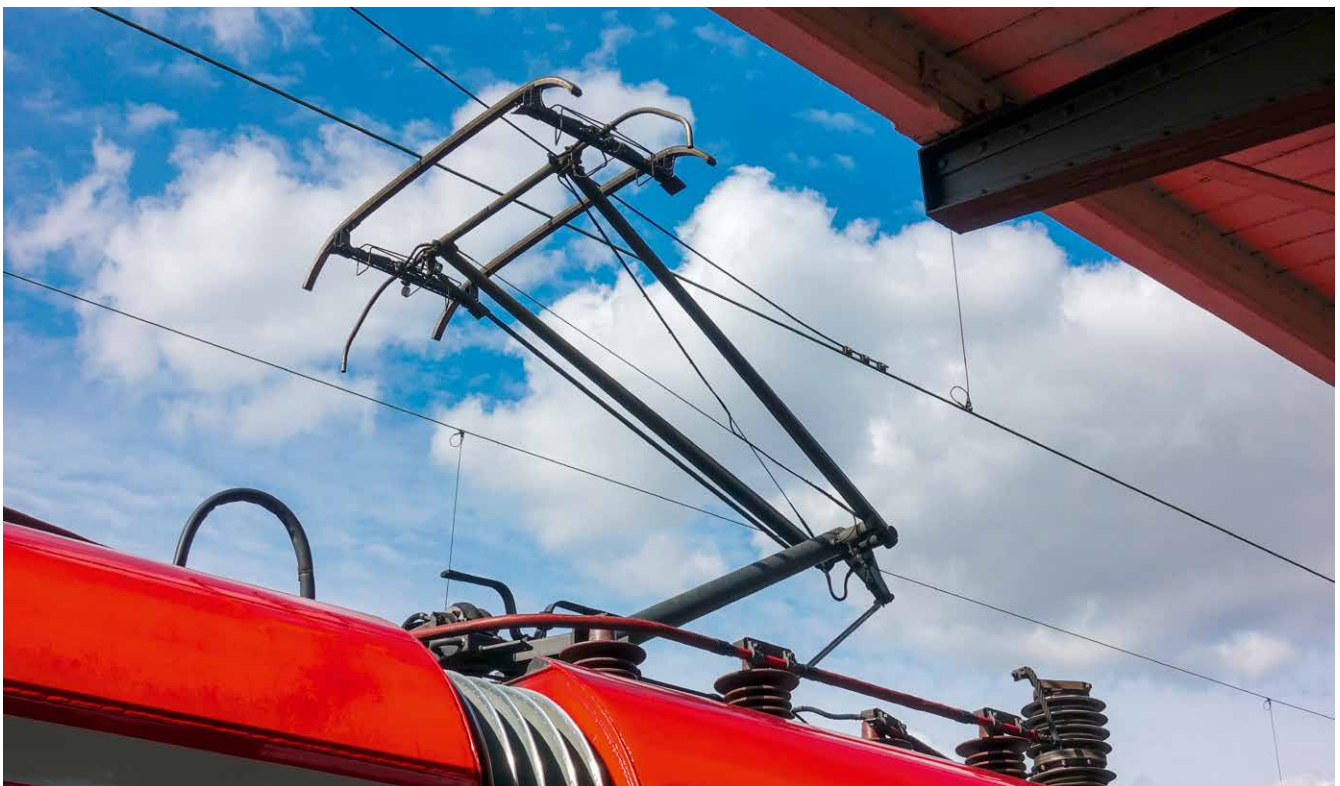
As with almost all protection functions, the aim is to detect faults in the system and minimize damage to people and equipment. In the event of a fault in the DC rail power supply, the current rises rapidly. While an overcurrent protection only switches off when a certain value is reached – a relay with di/dt protection function detects that the current is rising faster than allowed and can switch off more quickly.

How well does the new function work in the field?

During development, we could already test the new function with railway customers from Asia and Europe on protection relays from various manufacturers. The tests went very well, and testing the new function outside the laboratory was helpful. In addition, the exchange with customers in the field provided important feedback for further product development.

Thanks for your time. ■

Pantograph used to connect train to catenary





WHAT'S GOING ON

We are continuing to share our knowledge. We are going to reach out to you physically or digitally with our events, trade shows, conferences, webinars and training courses. Keep yourself up to date by checking out our events and training courses.

Scan QR-Code to get fast access to all links:



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WE ARE LOOKING FORWARD TO SEEING YOU.