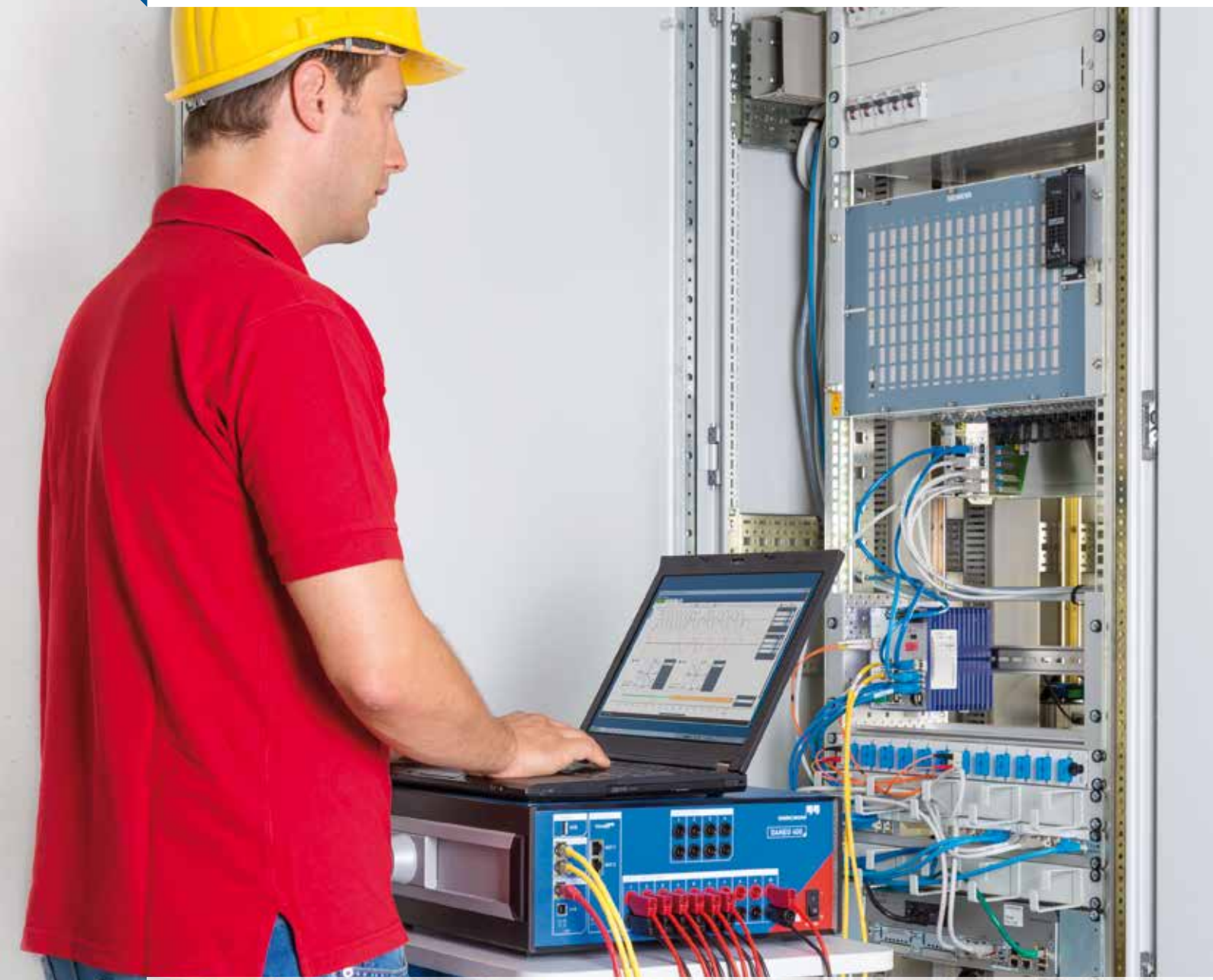
The OMICRON Customer Magazine

Volume 4 Issue 2 2013

OMICRON Magazine

Innovative Power System Testing Solutions



16 Digital and analog at the same time: The new DANEO 400

Bernhard Forti
Managing Editor OMICRON Magazine

Dear readers,

"We are the Internet!" might be a more appropriate headline for the latest issue of the OMICRON Magazine. After countless hours of teamwork our new webpage is online. A milestone in history. One small step for man, a giant leap for …

Hold on! Just a minute! I wouldn't want to take Neil Armstrong's famous first words from the moon landing out of context. But, for us this is an important step. The navigation and design are completely new, all the content has been thoroughly updated and the customer area has become much more user-friendly.

What is even more important for us than the webpage, is our direct contact with you. Did you know that the only people answering the phone on the OMICRON support hotline are well educated engineers? It's the same thing when you send an email to us requesting support: You will always have direct contact with a technician.

So is this really the best way to go? We wanted to find out for ourselves by conducting a customer survey in Switzerland, Germany and Austria. According to that survey the way we're spreading our detailed knowledge is being particularly admired, two examples of this are the local user meetings and the OMICRON magazine.

What is also important to our customers are our innovations. Do you know the Disney movie Tron from 1982? The story was revolutionary: After becoming digitized, the main character played by Jeff Bridges is able to exist in two worlds. This is similar to the new DANEO 400: It analyses conventional signals and network signals at the same time. Read more in the main article of this magazine on page 16.

Innovation is something that one must-have, and durability is another. Just recently our first customer, the power supply company Netz Burgenland, confirmed that their CMC 56 is still in use – after 23 years of being in service! Read more of this exciting story about the first CMC on page 24.

To be honest, getting feedback like that and seeing the results of the customer survey makes us proud to be doing what we do. I am especially delighted to hear that the OMICRON magazine has become a wellspring of knowledge. The success of the magazine is only made possible by having an excellent team all the way from the editors to the print shop. So right here and now I want to give a most sincere thank you to all of them and to the effort that they continue to put into this magazine.

And I also want to thank you as a reader – there wouldn't be a magazine without you reading it.

Thank you!

Bernhard Forti

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Take it easy

Put your binary I/Os where you need them—with the new ISIO 200

One frequent requirement expressed by system integrators and panel builders is the need for a device that handles a small number of I/Os that cannot be wired to the existing substation automation devices (e.g. protection relays) because there are either no free terminals left or the connection is so remote that the wiring would be too complicated. With ISIO 200, our small and cost effective I/O terminal, we offer you an easy-to-use solution for such demands when IEC 61850 GOOSE messaging is used in a power utility automation system.

When flexibility meets simplicity

ISIO 200 is a versatile and compact binary I/O terminal. As a component of an automation system, the terminal interfaces with binary signals that are not handled by other devices of the system. It communicates via the fast and robust IEC 61850 GOOSE protocol, and therefore interoperates with a wide range of devices. In addition, you can also utilize ISIO 200 by combining with CMC test sets for testing complex protection schemes.

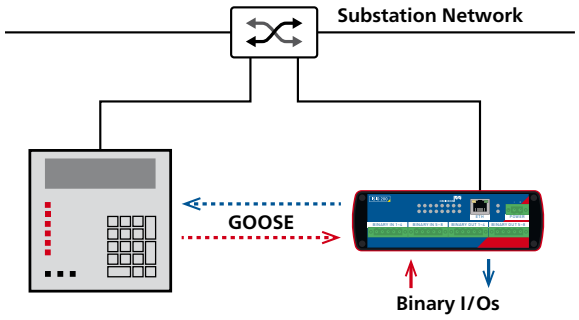
ISIO 200 does not require a dedicated power supply because it is supplied with Power over Ethernet (PoE). The PoE supply that ISIO 200 uses minimizes wiring efforts and simplifies handling. For applications with devices without PoE, either a PoE injector or an external DC supply can be used.

Easy configuration

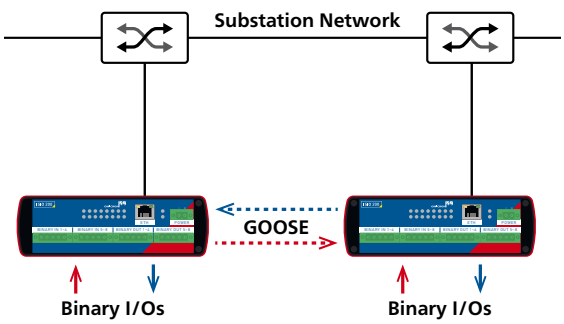
You can configure ISIO 200 via a built-in web interface and download its configuration description in the standardized SCL format for further use in the IEC 61850 engineering process. Therefore, you do not need to install and use any special configuration software on a computer.

ISIO 200 in regular automation system operation

As an integrated part of an automation system, ISIO 200 provides the additional binary I/Os that are frequently required with ease and efficiency. Furthermore, with two devices positioned 'back-to-



Easy and efficient:
I/O extension for automation system utilizing GOOSE.



Out of the box:
Back-to-back binary I/O forwarding via Ethernet.

back', binary status information can be tunneled through the power utility communication network. If you order ISIO 200 devices in matched pairs, they are pre-configured to subscribe to each other. They work right out of the box without requiring any further setup.

ISIO 200 for testing purposes

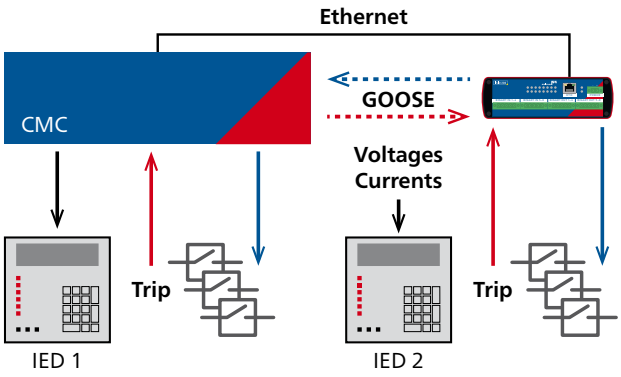
Testing in automation systems often requires long distances to be bridged or an extension of CMCs' binary I/O capabilities. When used for testing purposes, ISIO 200 serves as an accessory for CMC test sets and facilitates access to remote binary I/O terminals. It can be placed near remote terminals to minimize conventional wiring. The longer distance to the test set is simply bridged with an Ethernet cable. In addition, it can be installed as a permanent test terminal with the binary I/Os of a protection relay wired to an ISIO 200 device. When testing sophisticated protection schemes, for example with main and backup protection and tele-communications, you can utilize ISIO 200 by adding binary I/Os to the CMC test sets.

www.omicron.at/isio200

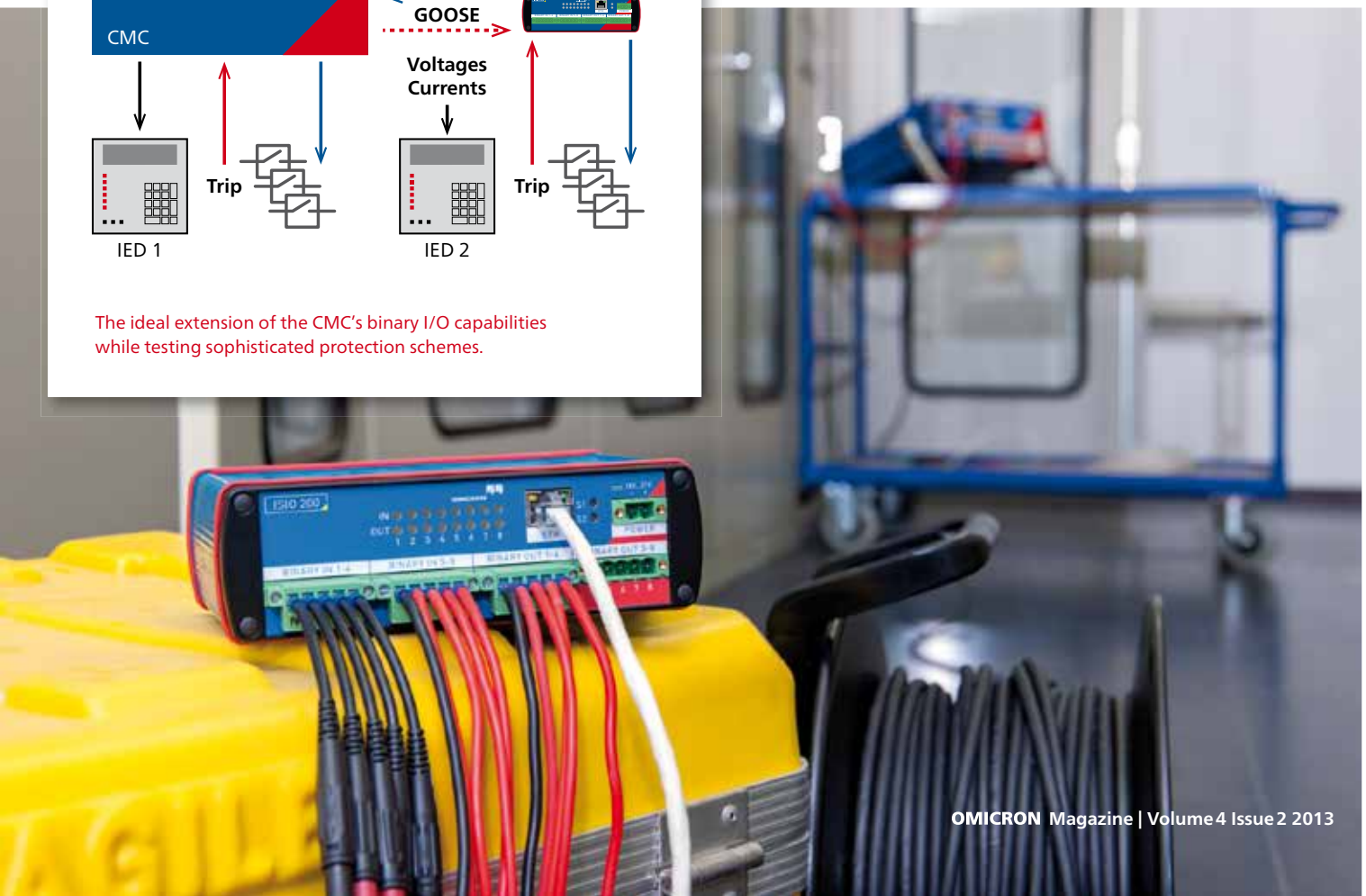
Fred Steinhauser
Product Manager

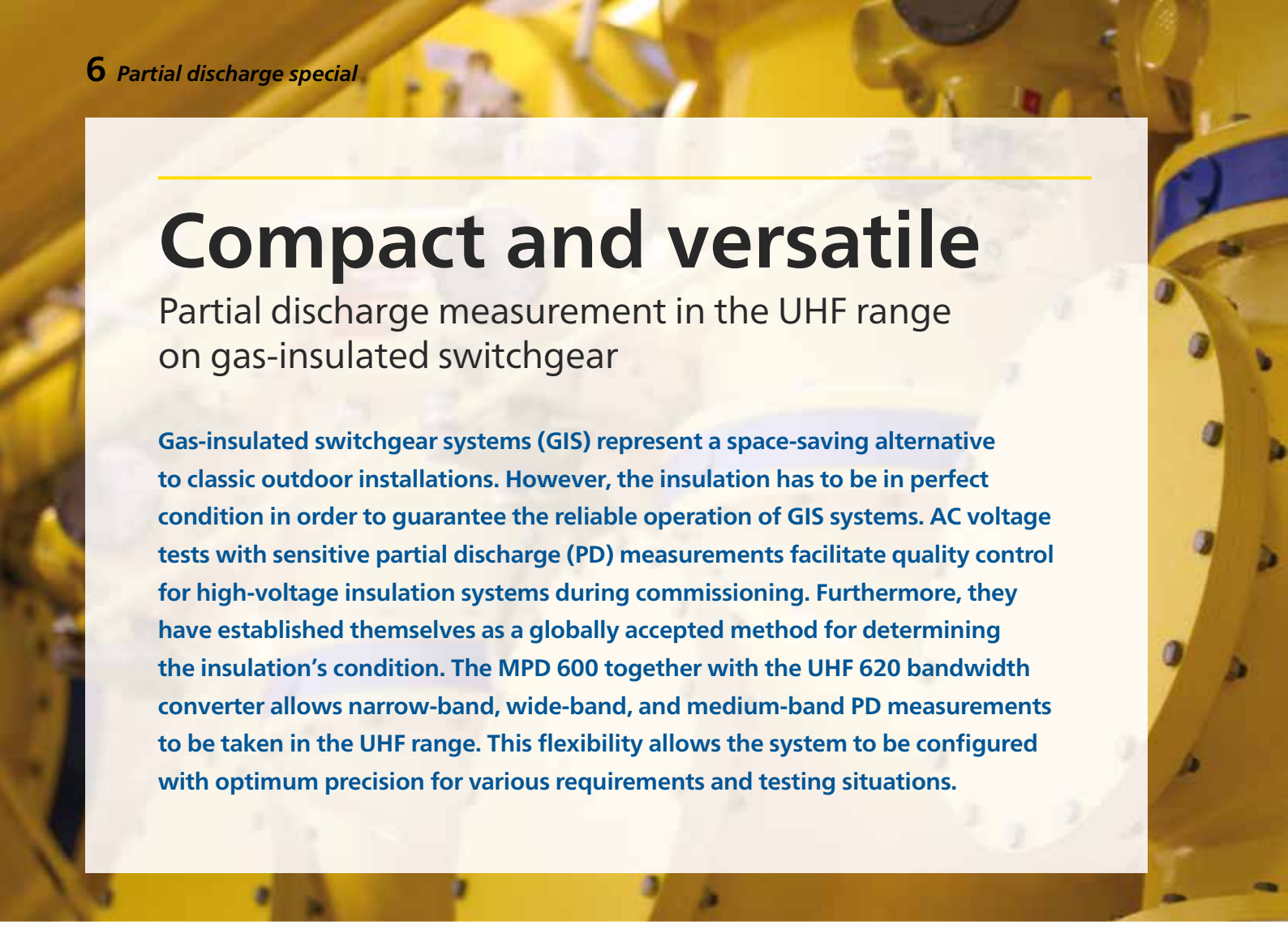
ISIO 200

- Cost-effective way to add binary I/Os to a power utility automation system
- Interoperable with a wide range of devices communicating via IEC 61850 GOOSE messages
- Simple configuration, IEC 61850 engineering support via built-in web interface
- Convenient bridging of long distances between binary I/Os
- No dedicated power supply needed when used with devices with PoE ports
- Enables CMC test sets for testing complex systems with a large number of binary I/Os



The ideal extension of the CMC's binary I/O capabilities while testing sophisticated protection schemes.





Compact and versatile

Partial discharge measurement in the UHF range on gas-insulated switchgear

Gas-insulated switchgear systems (GIS) represent a space-saving alternative to classic outdoor installations. However, the insulation has to be in perfect condition in order to guarantee the reliable operation of GIS systems. AC voltage tests with sensitive partial discharge (PD) measurements facilitate quality control for high-voltage insulation systems during commissioning. Furthermore, they have established themselves as a globally accepted method for determining the insulation's condition. The MPD 600 together with the UHF 620 bandwidth converter allows narrow-band, wide-band, and medium-band PD measurements to be taken in the UHF range. This flexibility allows the system to be configured with optimum precision for various requirements and testing situations.

Even the tiniest sharp edges or particles can reduce the insulation's quality and lead to PD. These fault locations are often detected using so-called lightning impulse tests. However, since the time and costs associated with transporting and setting up a surge generator are extremely high, sensitive PD measurements can be a valuable alternative.

Targeted interference suppression using different measurement methods

In GIS systems with sulfur hexafluoride (SF_6) insulation, PD generates electromagnetic waves across a very wide frequency range due to their short signal rise times.

A frequency range between 100 MHz and 2 GHz is typically used for PD measurements in GIS systems, since this frequency range is relatively insensitive to external interference such as the corona. Other typical sources of interference in this frequency range, such as radio waves or mobile communications, generally operate within a narrow bandwidth and are therefore easy to filter out.

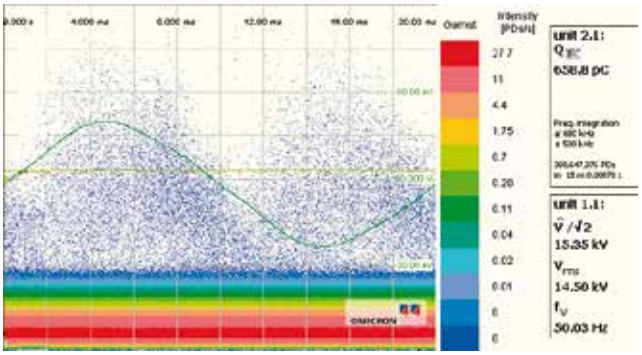
The MPD 600 combined with the UHF 620 offers multiple measurement methods in the UHF range for on-site testing and deployments in the field:

- UHF wide-band measurement with permanent bandwidth (e.g. bandwidth 1.9 GHz)
- UHF narrow-band measurement with variable center frequency (bandwidth of a few MHz)
- UHF medium-band measurement with variable center frequency (e.g. bandwidth 70 MHz)

Thanks to the selectable frequency bandwidth, users can react to interference in the immediate environment and perform sensitive and efficient measurements. The selectable center frequency allows frequency windows with minimal interference to be chosen.

Partial discharge

Partial discharge (PD) is a local electrical discharge which can lead to partial or complete failures of high-voltage insulation systems. Even the tiniest sharp edges or particles can reduce the insulation's quality and lead to PD.



Phase-resolved PD pattern of 'moving particles'.

UHF wide-band measurement with permanent bandwidth

When performing wide-band measurements, recordings are taken across several hundred MHz. The recorded signal is forwarded from the UHF 620 to the MPD 600 system. There it is prepared for evaluation in the form of standardized, phase-resolved PD patterns. Typical signs of partial discharges show up as collections of pulses at certain phase angles.

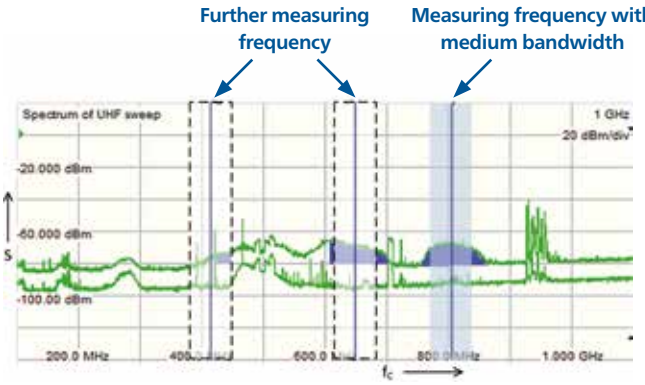
With this approach, measurements can be taken very easily. However, one disadvantage of the wide-band method is that it often has a lower signal-to-noise ratio (SNR). Even narrow-band interference within the measurement range can lead to reduced sensitivity.

UHF narrow-band measurement with variable center frequency

UHF narrow-band measurements offer a higher degree of sensitivity. They can be performed using a permanent or adjustable frequency range. Potential interference can also be partially or completely filtered out by switching the frequency range.

When using the narrow-band method, measurements are usually taken within a bandwidth of just a few MHz. Choosing the optimum center frequency allows the resonance frequencies of the test object to be used and specific interference ranges to be avoided. This for example, is a significant advantage in environments with high levels of interference such as switching stations or heavily populated industrial and urban areas.

One disadvantage, however, is that the resonance frequency depends on the fault location. This can lead to shifts in resonance during the testing sequence. Therefore, it is important to check and, if necessary, to readjust the frequency window setting to maintain a high level of sensitivity.



Signal spectrum (upper line) and interference spectrum (lower line) with three potential and well-suited frequency windows with high signal-to-noise ratio (blue areas).

OMICRON's MPD 600 with the UHF converter UHF 620.

The combination: UHF medium-band measurement with variable center frequency

Medium-band measurements combine the advantages of wide-band and narrow-band measurements, while also facilitating a variable center frequency selection. Since the frequency can be chosen within a range from 100 MHz to 2 000 MHz, narrow-band interference can easily be avoided. Due to the wider measurement range, potential resonance shifts have no effect on the measurement sensitivity. Therefore, subsequent adjustments of the PD measurement window are unnecessary.

Measurements and evaluations should be performed in multiple frequency windows to ensure reliable and sensitive detection of partial discharges. According to empirical values, a medium bandwidth of 70 MHz is a reasonable compromise between selective measurement and the reliable use of sensitive measurement or resonance frequencies. Therefore, the primary advantage of the medium-band measurement method is the combination of high sensitivity and selectivity, while still being able to tolerate the influence of resonance shifts over a wide frequency range.

Compact and safe GIS testing

The combination of the MPD 600 and UHF 620 allows targeted and highly sensitive measurements to be carried out for different situations and environments. Thanks to the use of fiberoptic cables, the user and the measurement computer are electrically isolated from the recording unit and the GIS. Thus, any potential interference and the risk of dangerous over-voltages for the user are reduced.

Stefan Hoek
GIS Product Manager

MPD 600

- > IEC-compliant partial discharge measurement in the laboratory and on site
- > Excellent interference suppression for measurements under difficult conditions
- > High measurement accuracy thanks to completely digital data processing
- > Parallel and synchronous multi-channel partial discharge measurements
- > High safety level for the user thanks to electrical isolation

www.omicron.at/mpd600

UHF 620

- > Highly sensitive real-time partial discharge measurements on GIS systems and power transformers
- > Flexible center frequency and measurement bandwidth for various measuring situations
- > Easy to control via MPD software

www.omicron.at/uhf620

AES
the power of being global

Insulation condition status 24/7

Partial discharge monitoring of power generators

AES 3C Maritza East 1 is a 670 MW thermal power plant located in Stara Zagora Province in south-cental Bulgaria. It is the first large-scale power plant to be built in Bulgaria in the past 20 years, the single largest foreign investment in Bulgaria, and one of the largest green field investments in southeast Europe.

Global energy provider AES recently selected the OMS 600 online continuous partial discharge monitoring system for two turbo generators at its thermal power plant AES 3C Maritza East 1 in Galabovo, Bulgaria. The system keeps an eye on the condition of the generators' stator insulation, making maintenance more efficient and helping to prevent premature equipment failure. AES 3C Maritza East 1 is one of four plants that make up the Maritsa Iztok energy complex, the largest of its kind in southeastern Europe and the biggest producer of energy in Bulgaria.

AES launched its 670 MW thermal power energy plant in Galabovo, Bulgaria in 2011. To protect its investment and to extend the life of its two 20 kV, 436 MVA generators, AES was looking for a permanently installed online partial discharge (PD) monitoring system. "AES is one of the biggest investors in the Bulgarian power generation sector," says Ivan M. Ivanov, Chief of Electricians at AES 3C Maritza East 1. "To maximize our investment and to ensure reliable service, monitoring the health of our generators is critical on a regular basis."

Generators are subjected to many stress factors

In the course of their operating lifetime, turbo generators are continuously faced with thermal, electrical, and mechanical stress. Failure statistics for rotating machines show that over half of failures are caused by stator insulation damages. Degraded insulation in stator windings causes various inter-turn, phase-to-phase or phase-to-ground faults. These may require unplanned outages or even result in a complete machine failure. Therefore, a majority of these faults can be predicted by monitoring PD. The data collected during PD monitoring is used to identify trends. This enables appropriate maintenance and repair measures to be planned in advance to extend the life of the asset and prevent unnecessary outages.

Local support is key to OMICRON service

Engineers at the AES plant in Galabovo are already satisfied CT Analyzer users. They first became aware of OMS PD monitoring technology at a recent OMICRON Roadshow in Bulgaria. With the support of Contragent 35 Ltd., OMICRON's Bulgarian sales and engineering partner, local contact was established with the AES team. Contragent provided the customer with details about the OMS system and was present with OMICRON representatives during evaluation meetings, on-site inspections and trainings. OMICRON met on site with the asset management team at AES 3C Maritza East 1 on numerous occasions to define monitoring system requirements and to plan an efficient system ▸

installation with a minimum of downtime required for each generator. "This added face-to-face support in the local language is one of the ways we at OMICRON can best serve the needs of the customer," says Steffen Kurz, OMICRON project leader of the AES installation in Bulgaria.

Installation of one of two OMS 600 data acquisition units at the AES power plant in Galabovo.

Contragent 35 Ltd.

OMICRON's local partner in Bulgaria, Contragent 35 Ltd., is specialized in the production and trade of electrical materials and equipment for the Bulgarian power and industry sectors. The company was founded in 1990 and it has grown rapidly into a leading trading and manufacturing company in the Bulgarian market.

www.contragent.com

Following an extensive review of available PD monitoring solutions, AES selected the OMS 600 system to meet its requirements at the Galabovo power plant. In addition to monitoring equipment, OMICRON's full service package includes customized system design, project management, on-site installation, calibration and commissioning, as well as system training, and remote data analysis and reporting by OMICRON PD experts.

The installed OMS 600 system consists of high-capacitance sensors, data acquisition units with IP65 enclosures, a central monitoring server and monitoring software. The sensors are mounted within the main terminal box of each of the two generators. The sensors' high capacitance (1.1 nF) delivers the critical sensitivity to detect PD impulses in a wide frequency range, providing a deeper look into the condition of windings. In addition, OMICRON PD monitoring systems provide adjustable measurement frequency at any time to maximize the signal-to-noise ratio.

Synchronous, multi-channel PD data acquisition

The outputs of the sensors are each connected by a short coaxial cable to the corresponding 3-channel data acquisition unit, which collects and processes PD signals from all sensors synchronously. In addition, the OMS 600 allows suppression of noise signals and evaluation of singular PD sources within the stator winding. This data allows reliable identification of phase-to-ground and phase-to-phase PD phenomena.

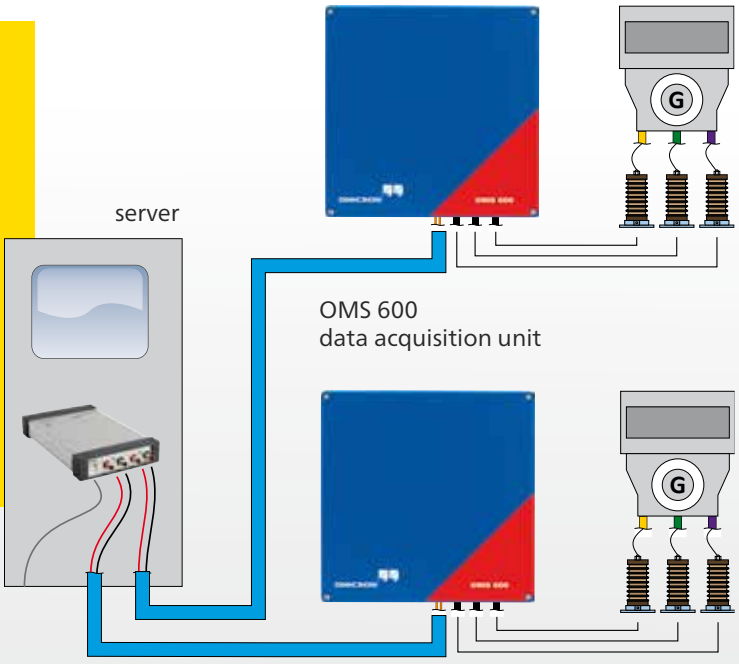
The collected PD data is sent from each acquisition unit in digital format via fiber optic cable to the central monitoring server. This server performs the real-time data processing as well as comprehensive analysis and reporting of PD data. All channels of the plant's turbo generators can be observed simultaneously using the OMICRON monitoring software.

Monitoring is conducted at customer-defined intervals. Once a defined threshold is reached, the software triggers the monitoring system to make and record a measurement. Data and statistical information of PD events, such as apparent charge value, number, polarity, time and phase angle position of PD occurrences can be visualized, recorded and stored for further processing.

OMS 600

> Synchronous multi-channel PD data acquisition
> PD source separation through advanced technology like 3PARD and 3CFRD
> Denoising using several gating methods
> Optical isolation between partial discharge acquisition unit and server
> High capacitance of coupling capacitors

www.omicron.at/oms600



OMS 600 – OMICRON's continuous PD monitoring system installed at two turbo generators in the AES thermal power plant in Galabovo.

Remote data access

The software supports remote access via a web-based TCP/IP connection. This allows operators to remotely configure and control the system's acquisition units. It also enables access to the stored data and quick reaction to problem alerts from any remote location. As part of the project, this remote analysis is performed by OMICRON. Detailed reports are provided to AES by OMICRON PD experts.

"OMICRON's solution provides AES with comprehensive online PD monitoring with superior technology and advanced warning of bad trends in our winding insulation," says Ivan M. Ivanov. "The technology monitors the complete winding using a wide frequency range for PD analysis. The remote check and reports made by OMICRON experts provide excellent professional support for our engineers."

»The remote check and reports made by OMICRON experts provide excellent professional support for our engineers.«

Ivan M. Ivanov
Chief of Electricians at AES 3C Maritza East 1

AES Corporation

AES provides affordable, sustainable energy to 27 countries through its diverse portfolio of distribution businesses as well as thermal and renewable generation facilities. A workforce of over 27 000 employees is committed to operational excellence and meeting the world's changing power needs.

www.aes.com

The effects of the changes in Germany's energy policy are already being felt. Together with the photovoltaic systems installed in Southern Germany and various biogas facilities, the countless wind turbines along the North German coast should cover at least 35% of Germany's total energy requirements by 2020. REpower tested a new generation of high-performance offshore wind turbines at selected locations, although they were initially inland. Partial discharge (PD) experts used these turbines to investigate a new concept for PD testing.

REpower Systems

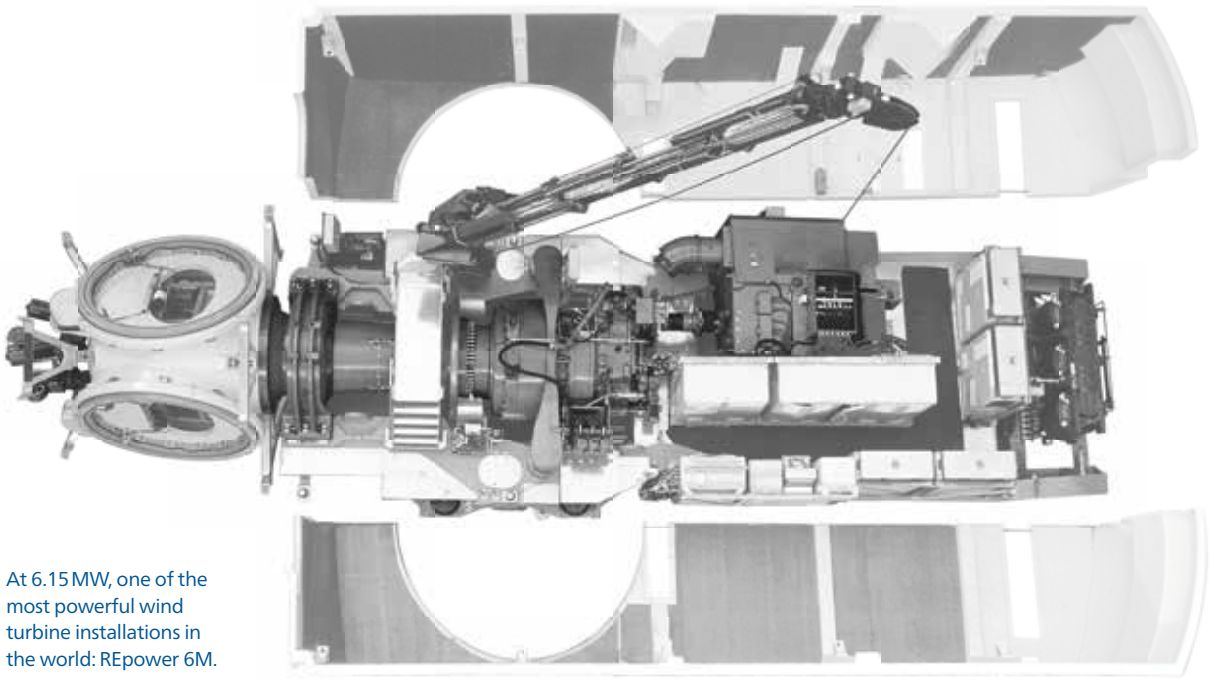
New energy concepts — new testing concepts

Testing online diagnostic methods for electrical high-voltage components in wind turbine installations

A wind turbine in the 6 MW performance class represents a complete small power plant. Aside from the generator, the electrical installation consists of switchgear, transformers, compensation equipment, converters, protective equipment, communication technology, medium-voltage cables, and much more. All of the individual components within the wind turbine need to interact perfectly with one another to guarantee a high degree of availability and profitability.

Condition assessment while in operation

The testing phase at REpower is complete. The 6 MW class has matured and is now being deployed commercially. Only the day-to-day questions of the system operators remain: "How can I demonstrate and document that the installation is in perfect condition while it is running?", "How can I perform a (re)commissioning test to be sure that the system is safe to use after revisions, downtimes due to faults or small repairs?" ▸



At 6.15 MW, one of the most powerful wind turbine installations in the world: REpower 6M.

Standardized electrical testing and diagnostic methods, such as a withstand voltage test or dissipation factor and partial discharge measurement, are in demand. However, these measurements often involve increased testing device efforts. The wind turbine must also be disconnected from the grid, which costs both time and money. It therefore makes sense to work on finding testing procedures using existing connections that allow the condition of cables, generators, and transformers to be determined while the installation is running.

Early fault detection

"It is in the interests of REpower to periodically check the condition of transformers and medium-voltage switchgear and cables with uncomplicated measurements. With this knowledge, faults within these components can be detected as early as possible. When service work can be planned more effectively, this also allows downtimes to be reduced. Reliable information on the condition of the components is extremely important, particularly in the offshore area," explains Ulrich Schiefelbein. He works in REpower's Life Cycle Engineering department, where among other things he focuses on trialing new testing systems that can be used for condition diagnostics in the field. For encapsulated energy supply systems, it is possible to use the voltage testing system's standardized capacitive LRM or HR interface 'VDS' (Voltage Detection Systems IEC 61243-5 / VDE 0682-415), e.g. for performing partial discharge measurements. A current research project done by Professor Kay Rethmeier from Kiel helps to clarify the possibilities and limitations of this method.

High level of interference

Unlike partial discharge measurements in shielded laboratories, systems that are in operation are often subject to strong electrical interference. This makes it harder to localize the measurement signals that are being searched for. The latest digital measurement technology and sophisticated software methods are initially used to prepare the measurement signal. Thus, even the weakest potential signals from inside the system can be captured and evaluated. Power-electronic components of drive systems and controllers in wind

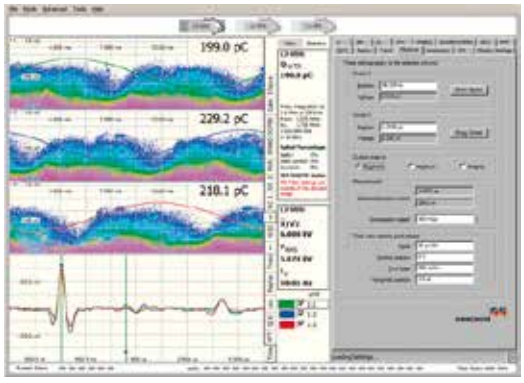
Ulrich Schiefelbein

Ulrich Schiefelbein is a Senior Component Expert for Energy Systems in the Life Cycle Engineering department of the wind turbine manufacturer REpower Systems SE at the Osterrönfeld site in Schleswig-Holstein, Germany.

turbine installations present a particular challenge here. The pulse width modulation (PWM) being used generates high-frequency signals with steep switching edges that display similar characteristics to partial discharges. Due to these characteristics, the signals interfere with the sensitive partial discharge measurements. Therefore, this measurement procedure, which is still in the testing phase, is not easy to apply and requires experience and expert knowledge. "Depending on the operating status of the wind turbine installation and switching status of the individual components, the measurement signal can potentially be lost altogether," explains Professor Rethmeier, who is keen to drive forward the development of the non-invasive partial discharge diagnostic method for wind turbine installations with his tests.

Potential for excellence

Professor Rethmeier is not only testing online PD decoupling via VDS interfaces on wind turbine installations. He also tests it on classic medium-voltage switchgear used by energy suppliers. Here, PD measurements have been performed successfully in industrial environments with EMC interference and PD faults have been localized accurately with medium-voltage cables connected, like Professor Rethmeier already presented to the scientific community at the VDE 2012 Electrotechnical Association's Specialist Diagnostic Convention. Therefore, the potential of the testing method presented by Professor Rethmeier is clear for all to see.



PD localization on the VDS sensor of an encapsulated medium-voltage installation using the TDR process via the connected medium-voltage cable.

Kay Rethmeier

Professor Kay Rethmeier is the Director of the Institute for Electrical Power Engineering at the Kiel University of Applied Science. He is also the Chairman of High-Voltage Engineering, Lightning Current Technology and EMC. His research activities focus on electrical diagnostic procedures, with particular emphasis on partial discharge measurement technology.

Products and technology

Serving two worlds

DANEO 400: Our new portable measurement system that measures, records, and analyzes all signals in a substation

In modern protection and automation systems with IEC 61850 communication, the activities in the communication network play a vital role. The proper function and coordination of both, the conventional signals (voltages, currents, hardwired binary status signals) and the messages exchanged on the communication network, are indispensable.

Our new DANEO 400 is a substation signal analyzer for conventional and network signals that measures signals from both of these worlds, and can thus provide information to assess the proper coordination. You can keep track of what is going on in the substation by obtaining information on the operational status and communication. Regardless of whether you are a SAS (Substation Automation System) vendor or builder, troubleshooter in maintenance departments of utilities, test engineer responsible for commissioning protection and control devices, or a communication networking specialist: you will benefit from this convenient and versatile system.

One device—multiple applications

DANEO 400 covers a wide range of tasks in different applications, such as Factory Acceptance Tests (FATs) and Site Acceptance Tests (SATs), end-to-end communication testing, troubleshooting, and commissioning.

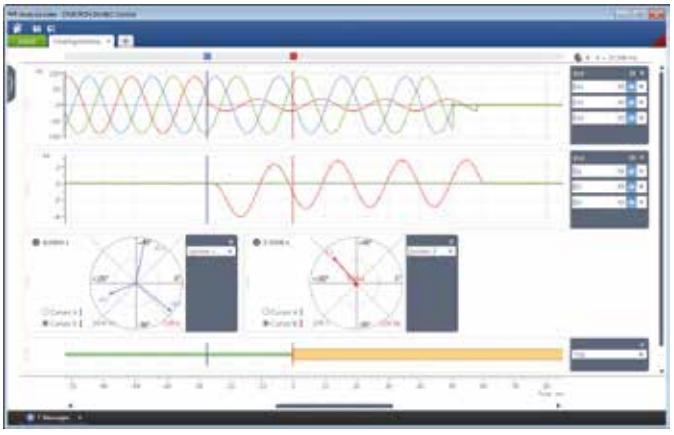
Due to its multiple, precise time synchronization, DANEO 400 can form a distributed measurement and recording system. Not only does it allow you to see the relationships between signals of a different nature, but it also facilitates time synchronized signal measurements at multiple locations in the SAS.

Moreover, the device can be left unattended on site. If a trigger occurs, the signals are recorded and the recordings are saved to a mass storage device. Then, the device re-arms itself and waits for the next trigger.

Furthermore, several network related functions are accessible via a web interface and can be used from any device with a suitable web browser. Therefore, you have immediate access to networking functions that will help you in improvised testing situations. This works even for protocols outside the context of IEC 61850.

DANEO 400 in FAT and SAT applications

The outcome of test cases performed during FATs and SATs can be verified, proofed, and documented with DANEO 400. In case of a malfunction, the device provides information for debugging. For both applications, saving the recorded data and documenting the measurements are especially relevant. DANEO 400 verifies SCL information with the actual configuration "as found" and checks if all GOOSE messages and SV streams are present on the network as described in the SCD file, which serves as the basis for the test. You can also measure the propagation delay for GOOSE and SV in the substation network and assess the network load.



Analysis of a power system event.

DANEO 400 for commissioning

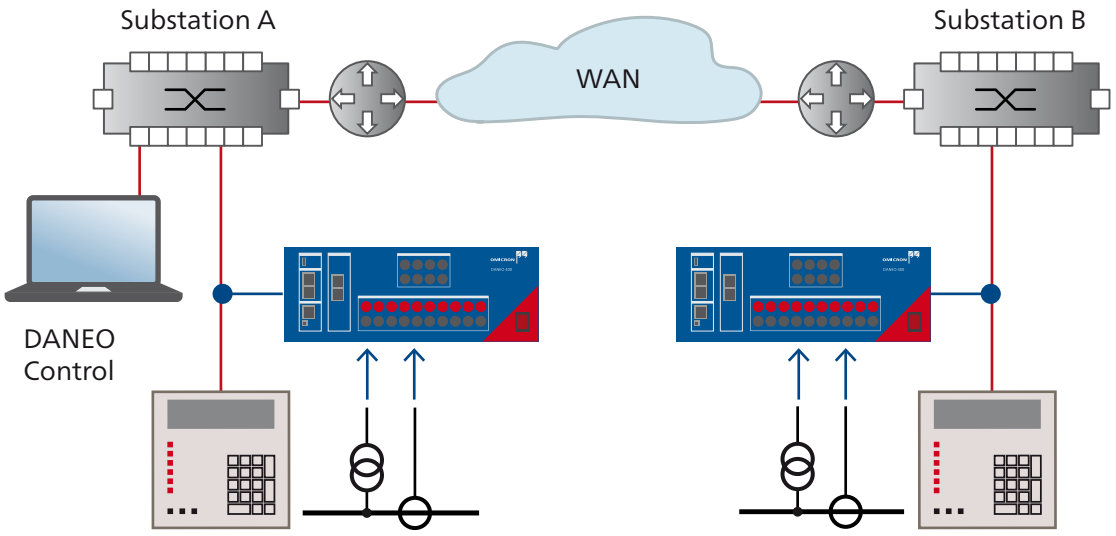
DANEO 400 is also a valuable tool for various applications in the field of commissioning.

As a test engineer in charge of commissioning protection and control devices, you can verify, proof and document that all the commissioned protection and control devices are working and communicating properly. If the devices do not perform as desired, DANEO 400 supports the debugging process.

As a communication engineer dedicated to the commissioning of the substation communication network, you can assess the performance of the substation communication network itself, even if there are no devices connected. Enhanced tests like the distributed measurement of packet timings in the communication network will be simplified as much as possible with it. Having the proper functions of the communication network verified is an important precondition for the optimum performance of a SAS.

DANEO 400 for distributed testing in a substation-to-substation scenario

To verify proper inter-substation communication, you can measure and assess the transfer of status information between substations with DANEO 400. The remote test sets are configured and controlled over the WAN. With DANEO 400 you measure the performance of the ▸



DANEO 400 for distributed testing in a substation-to-substation scenario.

DANEO 400

- Distributed recording with multiple units
- Time synchronized measurements
- Aggregated and time-aligned presentation of results
- Analog voltages and currents
- Hardwired binary signals
- IEC 61850 GOOSE
- IEC 61850 Sampled Values (9-2LE @ 0SPC)
- Any traffic on the substation communication network

communication path (by evaluating the propagation of the GOOSE messages) and the effective information transfer at process level (by assessing the changes in the analog and binary signals).

DANEO 400 for troubleshooting

Maintenance engineers have to trace problems in a substation that occur infrequently and under conditions which are not always known. The troubleshooter must react to a situation without any preparation and needs to be able to improvise without having access to the full documentation of the SAS. Nevertheless, there is often a lot pressure to resolve such issues and DANEO 400 can help give the engineer clues to what may be causing the SAS to malfunction.

For this application, the measuring device is wired up to the signals of interest (voltages, currents, binary status signals, substation communication traffic) and set up with a trigger condition. If large amounts of data are expected, an external hard drive can be connected for dumping the recordings.

When remote access is possible, the status of the device can be checked. If the bandwidth is appropriate, recordings can be downloaded for analysis.

www.omicron.at/daneo400

Fred Steinhauser
Product Manager

News

New features and optimized usability

CMControl P—V2.20

Our CMControl P software now offers a new Transducer Tool for testing transducers with linear operating characteristics (symmetrical or non-symmetrical). Furthermore, to enable easy tripping tests of rate-of-frequency relays, the new version comes with the 'df/dt' fault type in the 'Time' and 'Time Characteristics' test tools. In addition, you can now save test results with the touch of a button. This makes reporting even easier. Moreover, the new software version includes a lot of smaller improvements.

If you are already a CMControl user, you can download the new version from our Customer Area (login required) or easily update the CMControl P App on your tablet. The update for the new version is free-of-charge.

www.omicron.at/cmcontrolp

for Android™

News

Easy-to-use and future-proof

Our new CMC 310

With the new, lightweight and compact CMC 310, basic three-phase testing of protection and measurement devices will become easier than ever.
The versatile test set is operated by the CMControl P software which runs on the CMControl P unit or on an Android tablet. Its intuitive user interface and the test tools included are optimized for quick manual testing in the field.

Regardless of whether you use the CMC 310 for testing distribution systems, in the industrial environment or for SCADA testing—you will benefit from OMICRON's high quality standards, excellent service, and vast pool of knowledge and experience at an attractive price.
The CMC 310 is a flexible and future-proof testing solution. If automated testing is requested, a CMC 310 can be upgraded to a CMC 353 at any time which then can be operated by the PC based Test Universe software.

www.omicron.at/cmc310

Application

Find the fault

Comprehensive diagnosis of a hydropower generator

Generators are used for generating electrical energy. If they fail, this means a loss of production and therefore a loss of earnings for the operator. Maintenance and diagnostics of the system's functionality both play an important role in avoiding unforeseen failures. Following an extended period of inactivity, electrical diagnostic measurements were performed on an old hydropower generator with a rated voltage of 6400 V and an output power of 5400 kW to secure uninterrupted operation.

On generators, the main insulation of the stator winding is only a few millimeters thick. It is kept thin to fit as much copper as possible in the stator slot and to deliver the best possible performance while maintaining its compact outer dimensions. An arc of the main insulation during operation would have fatal consequences. Therefore, inspecting the winding insulation plays a very important role during diagnostic electrical measurements.

Moisture test

Before high test voltages are applied to the insulation, it is first important to ensure that it is dry. For this purpose, the insulation resistance is measured using DC voltage. If the insulation is in perfect condition, a relatively high current will flow after applying the DC voltage, but then it will drop off sharply. The ratio of the current after one minute to the current after ten minutes is known as the polarization index (PI). The PI is an important indicator for the insulation condition. If it is lower than two, high voltages should not be applied to the winding insulation, as there is a risk of an arc.

DIRANA was first used to measure the insulation currents and the PI. With phase U, after 10 minutes the insulation current was almost 1 000-times higher than with phases V and W. The PI of phase U was just 1.4, whereas the PI of the other phases was around 4.5. The low PI of phase U meant that a more detailed inspection of the insulation was necessary before any high-voltage tests could be performed.

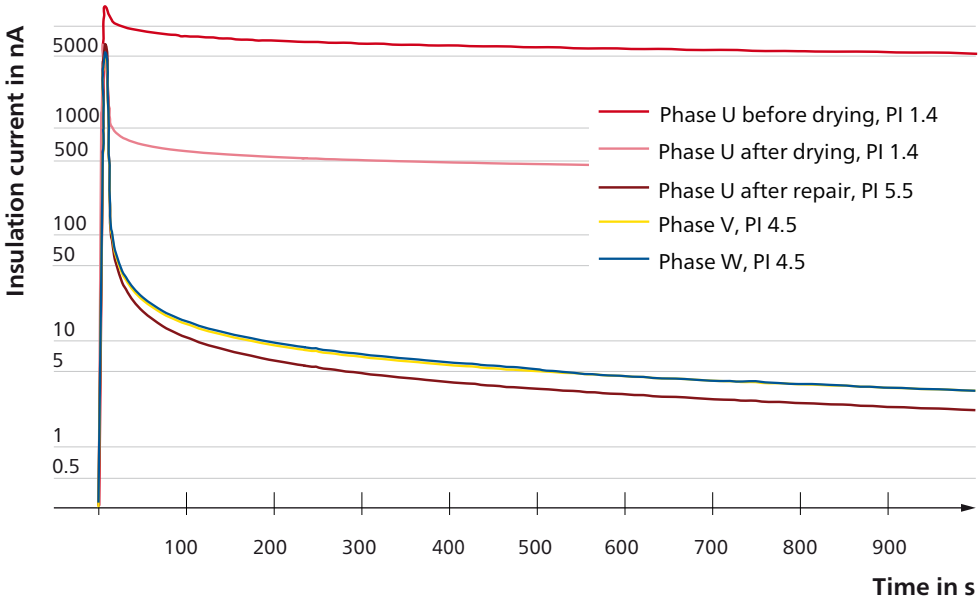
DIRANA

- > Cuts the typical testing time in half by combining time- and frequency-range methods (PDC and FDS)
- > Automatic water content determination without expert knowledge
- > Correct wiring thanks to detailed wiring diagrams
- > No overestimation of the water content due to unique compensation of aging products

www.omicron.at/dirana

DIRANA: more information in less time

By determining the dielectric response, DIRANA allows for a far more detailed diagnosis of the insulation than could ever be achieved by only using the PI. The dielectric response can be measured over time (PDC - polarization depolarization current) and over frequency (FDS – frequency domain spectroscopy). The PDC method measures the charge and discharge current over time. The FDS ▸



Insulation currents of the phases U, V and W.

method detects the capacitance and dissipation factor over a wide frequency range. DIRANA combines the two methods and thereby cuts the typical testing time in half.

When measuring the dielectric response, the extremely high dissipation factor of phase U with 294% at 10 mHz, compared with about 5% from the two other phases, was particularly striking. The sharp increase in capacitance of phase U from around 100 nF at 50 Hz to 287 nF at 10 mHz was also noticeable immediately.

Potential remedy: drying the windings

Due to the low PI of phase U, the generator's rotor was removed to clean the heavily soiled stator winding. However, when the insulation resistance test was performed again after cleaning, there were no observable improvements. Therefore, the windings were heated and dried using a DC current of around 250 A. When the heating was checked using a thermal image camera, it became clear that certain zones of the winding in phase W were warmer than the rest of the winding.

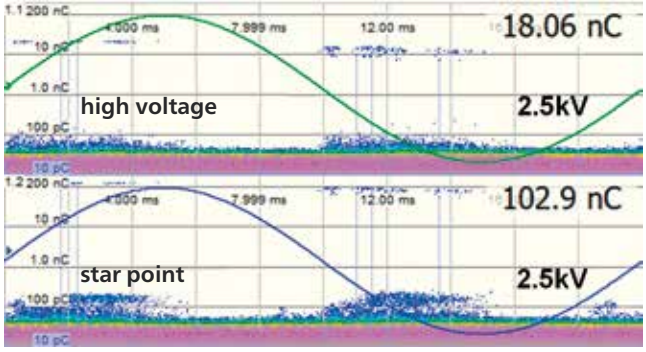
The winding resistance was then measured using the CPC 100 and a DC current of 100 A. The result indicated that the winding resistance of phase W was about 25% higher than the winding resistance of the other phases. When the winding was inspected, it was determined that various soldered connections in the winding head of phase W were broken. These damaged connections were then resoldered.

In addition to this, the insulation resistance and PI measurements were repeated. At 513 nA after 600 seconds, the insulation current was more than 10-times lower than the value recorded before the drying process. However, the PI of phase U remained the same at the low value of 1.4.

Partial discharge measurement using the MPD 600

A partial discharge measurement was performed to find the fault. One channel of an MPD 600 system was connected to the high-voltage side. Another one was connected to the star point of the U winding.

At a voltage of 2.5 kV, very severe partial discharges of more than 100 nC occurred at the star point. They could be localized acoustically using an ultrasonic detector. The picture on the left shows the fault location: a sharp-edged mounting clamp on the output to the star point.

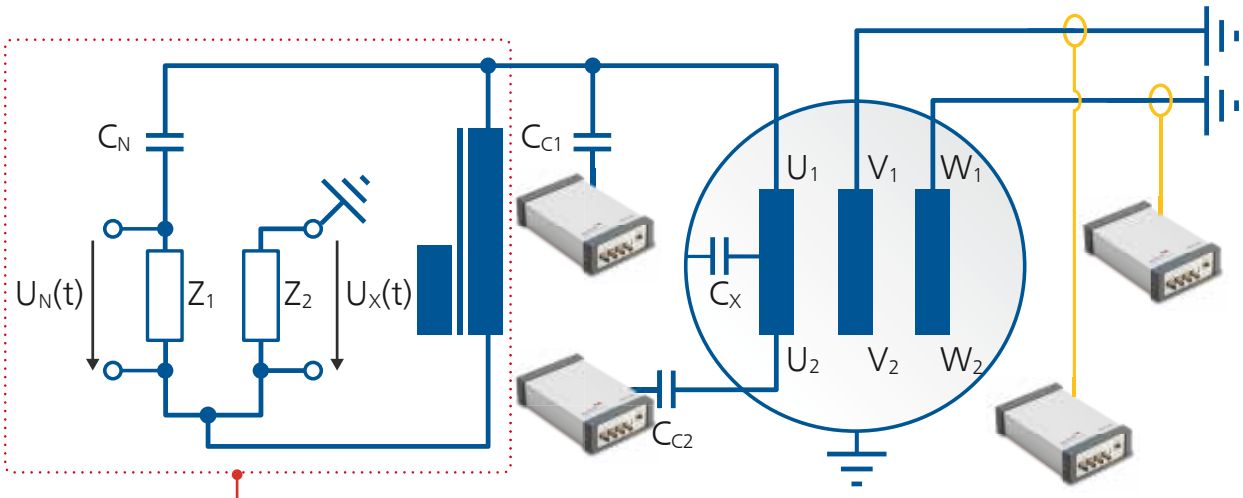


PD measurement of phase U at 2.5 kV.

PD fault location on the output to the star point.

Repairing the defective winding

However, the actual fault had still not been eliminated, which became obvious when the insulation current measurement was repeated using the DIRANA. Therefore, the windings were tested at their rated voltage (6 400 V). During this test, an arc occurred in phase U after about 10 seconds. The insulation resistance that was measured afterwards was so low that a current of 2 A could be fed into the fault location using the CPC 100. Thereby, the feed point of the current was alternated between the high-voltage side and the star point. The defective rod could be found using a clip-on ammeter. The winding was repaired by disconnecting the defective coil and connecting the ends of the remaining winding to one another. The insulation current was tested again. It was found to be at a similar level with the other two phases. The PI was 5.5 following the repairs, well above the critical value of 2.



Simultaneous capacitance, dissipation factor, and PD measurement using the CPC 100 + CP TD1 and MPD 600.

CPC 100 + CP TD1

> Improved insulation diagnostics thanks to variable frequency testing
> Lightweight and easy to transport thanks to trolley
> Automated testing with testing templates
> Reporting: detailed analyses with trend displays and graphics

www.omicron.at/cptd1

Total testing time following the repairs: 6 minutes

In the final step, all the relevant measurements for commissioning the repaired machine were performed simultaneously. The testing system used for the simultaneous measurement of capacitance, dissipation factor, and partial discharges makes this test extremely efficient. It consists of the CPC 100 universal testing device, together with the CP TD1 capacitance/dissipation factor testing system, and uses CP CR500 compensating reactors for reactive power compensation, and up to four MPD 600 systems, including MCC coupling capacitors and MCT high-frequency converters for partial discharge measurement. The entire test procedure (phase U against phase V, phase W, and stator) took only 6 minutes to complete. Since the test needs to be performed at various voltage levels, the test voltage was increased automatically in 10% steps of the rated voltage up to 120% and then reduced again in steps of 10% back down to zero. All data, such as voltage, current, frequency, capacitance, dissipation factor, and all PD levels and patterns were recorded and saved for all test voltage levels. So the amount of time, that would have been required to record all of this data manually, was reduced dramatically.

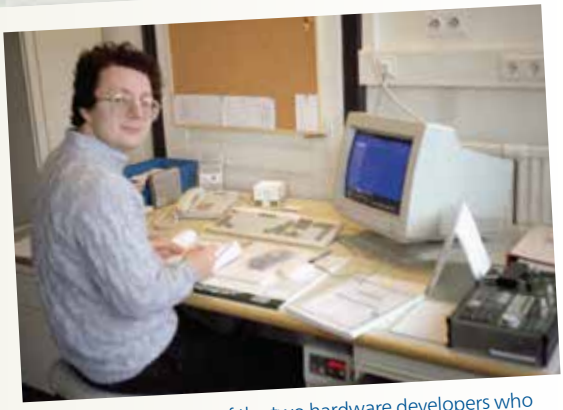
Passing these tests successfully demonstrated the machine's operational readiness following its repairs. The hydropower generator was able to be started up again.

Michael Krüger
Head of Engineering Services
Test & Diagnostics Solutions for Primary Assets

Background

It runs and runs and runs ...

How and why OMICRON's first testing device was created



Martin Pfanner, one of the two hardware developers who have been on board since the very beginning, during his second week at OMICRON.

24 years ago, testing devices for transducers and protective relays were larger and heavier, and the tests themselves took a lot longer to complete. Josef Lippl (employee at the energy utilities in Burgenland, Austria) and Rainer Aberer (founder of OMICRON) met one another in the fall of 1989. An exciting development then began to take shape.

In 1989, Mr. Lippl was given the task of checking all the measured values of the new grid control system. It quickly became clear that there were no suitable devices available for this on the market, so with great determination he set down the guidelines for the development of what would later become a ground breaking innovation. One key aspect of the device that was to be developed was that it must not weigh more than 30 kg (66 lbs), which motivated the first three developers to reject the request as impossible.

On 2 October 1989, the fourth contact then led to Rainer Aberer and his young enterprise, OMICRON. Although initially skeptical about the development, the task at hand soon stimulated Rainer's interest.

The right man in the right place

Rainer then got in touch with Martin Pfanner and Heinz Lampl, two of his former technical school colleagues. Keen to get started on this interesting project, they began working together on developing the hardware for the completely new kind of testing device in February 1990. As a software company, OMICRON had no use for soldering irons or resistors at this time, let alone hardware test benches. Everything first had to be procured before the team could get started.

A few weeks later, on 17 April 1990, the first components were ready for testing. At the heart of the system sat a digital signal processor (DSP), which was actually capable of far more than what was needed for the testing device, but in retrospect was the perfect choice.

Ing. Josef Lippl

Now semi-retired, he has worked in the fields of grid control technology, safety engineering, and held a position as the head of the metering operations group.

What is the story behind the name CMC 56?

The project name "Prüfgerät für Messwert-Umformer" (testing device for transducers) was first abbreviated to PMU 56. The 56 was taken from the digital signal processor, Motorola's XSP 56000 (see image). However, it soon became clear that this product could also appeal to other energy suppliers, so the product designation was translated into English. Unfortunately, the team made a mistake when translating the term "Messwertumformer", which is actually "transducer" in English, so the abbreviation CMC has since stood for "Calibrator for Measurement Converter".
To date, a total of close to 15 000 CMC devices have been manufactured and delivered to satisfied customers worldwide.

The first signals for the CMC 56 were generated using this board. OMICRON's history would likely have taken an entirely different course without the digital signal processor (the pale chip in the center of the photo).

Testing device for transducers

Harald Möller started work on developing the software for the first CMC 56 in the summer of 1990. It quickly became clear that, thanks to its DSP, this new type of testing device for transducers was also ideal for convenient testing of protective equipment. However, this potential application was not developed until later on.

On 17 October 1990, Mr. Lippl and Mr. Kalchbrenner performed the final acceptance test of the new testing device in Vorarlberg, Austria. Several minor adjustments still had to be made before the first CMC 56 was ready for actual use in Burgenland.

This same CMC 56 is still in use to this day, having required just a few minor repairs during its 23 years of service. The equipment in use at Energie Burgenland also includes OMICRON's CMC 156 and CMC 256-6 testing devices, as well as the CPC 100 primary testing device. The very first CMC 56 is soon to be replaced with a CMC 356.

Ing. Josef Kalchbrenner
Authorized signatory, technical operations manager and head of grid operations and construction.

Energie Burgenland

Energie Burgenland was formed in 2012 using the energy utilities BEWAG and BEGAS. Today its subsidiary Energie Burgenland Windkraft operates about 170 wind powered generators with a total power of 350 MW. Since mid 2013 the amount of energy that it generates from renewable sources is equal to the amount of energy consumed by the entire region of Burgenland. In total 712 MW of renewable energy are fed into the power supply network of Netz Burgenland Strom, another subsidiary of Energie Burgenland.

www.energieburgenland.at

Imagine if you had to ensure that measured values were recorded precisely within the microsecond at multiple locations, spread out over great distances. The electrical power industry is facing exactly this requirement with synchrophasor measurements and Sampled Values. However, with the Precision Time Protocol (PTP) as per IEEE 1588 it is very easy to achieve the required synchronization accuracy.

Application

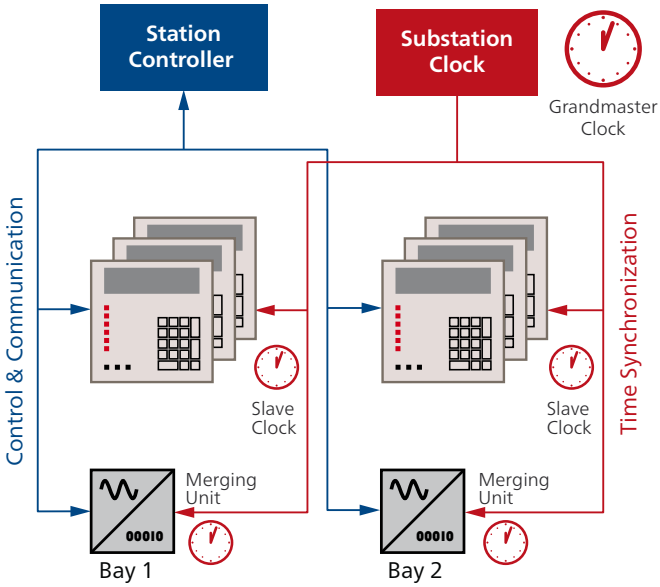
Right on time!

Precise time synchronization in Smart Grids with IEEE 1588

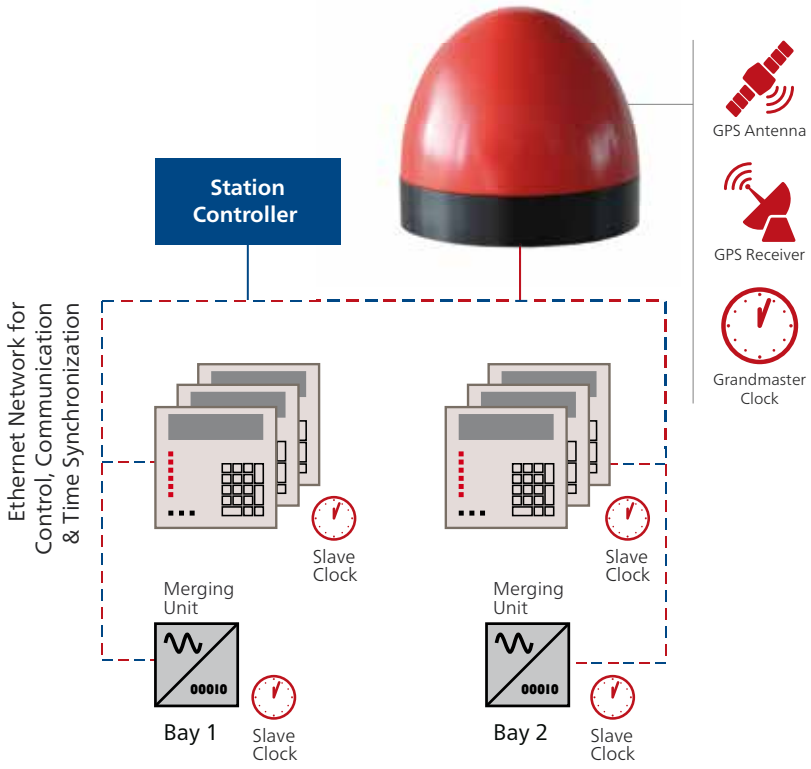
More than just precise: the challenges associated with time synchronization

There are a large number of measurements that demand absolute time precision in the field of measurement technology for energy supply systems and substations. Absolute time accuracy in the millisecond range is generally considered sufficient for time stamping and logging the data provided by protective relays. Yet if the phase of a signal needs to be determined precisely at a particular time, then this degree of accuracy is no longer adequate. In 50 Hz grids, a time deviation of 1 ms already represents a phase error of 18°. Therefore, an absolute system time precision of < 5 µs is required in order to measure phase angles at various locations with an accuracy of < 1°. An accuracy level of 1 µs is defined in IEC 61850-9-5 for measurements of this type (time performance class T5).

Until now, highly accurate measurements such as these have typically been performed using decentralized time references (GPS clocks). However, if the time reference signals of a central station clock are used instead, special requirements need to be met in order to achieve the necessary synchronization accuracy of < 1 µs. To this end, a second pulse (1 pps) is used and combined with a protocol for transmission of the absolute time (e.g. IRIG-B or NTP). The cable delay of about 5 ns per meter must also be taken into account and in this case, it needs to be compensated for manually.



Classic distribution of the time reference signal.



Time Synchronization via the IEC 61850 Station Bus.

Many benefits in a single protocol: PTP

The PTP protocol, which is distributed via Ethernet, allows for the precise synchronization of IEEE 1588-compatible measurement equipment and IEDs via the station network that is already being used for IEC 61850. As such, no additional cabling is required for time reference signals in a modern substation. Also, the delays between the station clock (referred to as the grandmaster clock in PTP jargon) and the measuring equipment that needs to be synchronized (slave clocks) are automatically compensated for. This is also the case in the event of changes to the signal paths of the synchronization packages in the network and the resulting signal delays.

The PTP protocol also offers other advantages. For example, if multiple station clocks are present in the network, the best master clock algorithm (BMCA) is used to determine the best station clock for grandmaster, which then provides the valid time signal for all the slave clocks. If the current grandmaster clock fails for any reason, the next best station clock is then assigned to be the grandmaster automatically. The IEEE 1588 standard allows default settings to be defined through the use of so-called profiles as a way of securing interoperability between devices from different manufacturers.

The IEEE C37.238 'power profile' was defined in 2011 for the electrical power industry. When defining this profile, particular emphasis was placed on the trouble-free use of the PTP protocol in IEC 61850 infrastructures. Furthermore, a 'steady state performance' was defined, based on the idea that the maximum deviation between the slave clock and the grandmaster clock must not exceed 1 µs with 15 intermediate Ethernet switches.

The benefits of the PTP protocol packaged in high-precision solutions: OTMC 100*p* and CMGPS 588

We use the PTP protocol for two innovative products. The OTMC 100*p* antenna integrated PTP grandmaster clock was designed for fixed installations in electrical power systems. For the CMC range, the CMGPS 588 provides a precise time reference for the time-synchronized testing of protective equipment. In both products, the GPS antenna, the GPS receiver, and the actual PTP time reference are all combined in a single ▸

housing. This allows the CMGPS 588 and the OTMC 100*p* to be connected directly to the Ethernet network. Therefore the coaxial antenna cable that was previously required is no longer needed. Even when using standard network cables, a distance of 100 m between the PTP grandmaster clock and the Ethernet switch does not present any problems. And when using optical Ethernet, distances of up to 2 km can be bridged. This can offer massive advantages, for example in cavern power plant applications.

There is a lot involved in using the PTP protocol together with IEC 61850. However, we have summarized all the important facts for you in a document entitled "Implementation and Transition Concepts for IEEE 1588 Precision Timing in IEC 61850 Substation Environments".

www.omicron-lab.com/ieee1588

Bernhard Baumgartner
Business Manager OMICRON Lab

OTMC 100*p*

- Antenna integrated PTP grandmaster clock
- Precise time synchronization via PTP (IEEE 1588-2008) and NTP (RFC 5905)
- Specially developed for deployment in the electrical power industry (IEEE C37.238-2011 power profile)

www.omicron-lab.com/otmc100p

News

CMGPS 588 Synchronization Unit

Optimized for outdoor usage

The CMGPS 588 synchronization unit is an antenna-integrated GPS controlled time reference. It works as a PTP grandmaster clock according to IEEE 1588-2008 / IEEE C37.238-2011.

You can use CMGPS 588 for operating CMC test sets with a NET-1B/C interface and the Test Universe 3.0. It supports the following applications:

- Synchronizing the starting point of a test procedure including two or more OMICRON CMC test sets
- Synchronizing the recording with real-time stamping of measurement samples

CMGPS 588 does not require any configuration work and is automatically ready for operation within a very short time after providing power supply via Power over Ethernet (PoE). The time synchronizatioan for CMC test sets is controlled in the OMICRON Test Universe software. The distance between the CMGPS 588 and the CMC can be extended up to 95 m (312 ft) by using extension cables.

www.omicron.at/cmgps588

Products and technology

Easy and efficient

OMICRON's innovative recloser testing solutions

Significant changes in the field of power systems have taken place recently. For example many municipal and cooperative utilities are adding reclosers and sectionalizers to their distribution grids and all utilities may be upgrading their controllers to meet new protection requirements. Therefore, more and more accurate and versatile digital controls are being employed and integrated in smart grid automation.

These developments do not only represent a demanding challenge to the test personnel testing reclosers and sectionalizers, but also to the test equipment being used: In the past, reclosers and sectionalizers were only equipped with an overcurrent and reclosing function, and test sets with a single current source were sufficient for testing them. But today, reclosers are equipped with many functions—this requires the test equipment to have frequency-variable 3-phase current and voltage sources. With our easy-to-use solutions for testing recloser and sectionalizer controls, you can tackle these new challenges conveniently.

Quick manual testing with the easy-to-use CMControl R

For quick manual tests in the field, the flexible CMControl R unit is the ideal choice for operating CMC test sets. Its innovative touch screen applications and specialized tools for testing recloser and sectionalizer controls are particularly easy to work with. The transflective display of the CMControl R is even easy to read in the sunlight. The CMControl R unit with the versatile and compact CMC 353 set offers an optimal solution for testing reclosers. Due to their high level of flexibility, the reliable CMC 356 and CMC 256plus test sets also excel in these areas. Therefore, companies can use all three of these test sets for testing reclosers and sectionalizers as well as protection relays.

With the CMControl R software, minimum current pickup values, overcurrent curves and reclosing logic for both phase-phase and phase-earth loops can be tested easily without any rewiring. Other functions like voltage or frequency loadshedding can also be verified. In addition, the CMControl R includes a tool for testing voltage-controlled restoration functions used in Automated Distribution Restoration (ADR). During the tests, the CMC test set simulates the switch with all statuses. Even reclosers with single phase tripping capabilities can be simulated and tested.

The test tools of the CMControl R provide diverse functionality:

Analog Output Check allows controlling of analog test quantities and operational measuring values.

The **Pick Up/Drop Off** tool is used to test the thresholds of recloser and sectionalizer controls.

The **Direct** tool enables individual configuration of all CMC outputs for special test tasks.

The **Tripping Sequence** tool tests the controller main functions: permanent fault, autoreclosure logic.

The **Trip Time Characteristics** tool checks the operation characteristics and the switch logic between the fast and the slow curve.

The **Restoration** tool allows testing of voltage controlled functions e.g. automated distribution restoration schemes

Highly automated testing with the powerful Test Universe software

For highly automated testing, a CMC test set can also be controlled via the Test Universe software while running on a Windows PC. With a CMC test set and the Test Universe software you can set up customized tests, which allow you to test complex recloser logic or Automatic Distribution Restoration (ADR) systems, where GPS- synchronized testing is necessary. Standard recloser parameters can be tested in an automated process. For this type of application we offer test object specific test templates in our Protection Testing Library (PTL) that are dedicated to the recloser controls of various manufacturers (e.g. Cooper, SEL, S&C). You can download the templates free-of-charge and customize them to meet your requirements.

For instance, PTL also includes an automatic test plan for the comprehensive testing of S&C's IntelliRupter® PulseCloser™ control module. The test plan uses standard modules of OMICRON's Test Universe PC software and can be customized easily by the user. Along with this test plan and its IntelliRupter interface box, we also offer a tailored plug-in solution for testing the settings, functions, and logic of the control unit with a CMC test set—for both the office and the field.

Recloser Control Interfacing Cables

For easy interfacing with the recloser control, we offer a wide range of cables with the recloser's connector on one end and labeled connectors that run to the CMC test set on the other end. The cables are available for recloser controls of various manufacturers like ABB, Cooper, GE, ICMI, SEL, Siemens, S&C, Tavrida. We are constantly expanding our portfolio of existing interfaces.

You can select the types of cables that are available in the start screen of the CMControl R. Inputs and outputs have been already pre-configured for you to save time during the test setup. For Test Universe users a template example is part of the cable package.

Stephan Geiger
Product Manager

News

Multiple roles—multiple languages

New features for our maintenance management software ADMO

ADMO offers significant improvements for protection maintenance—and particularly relevant for North America—support for successfully passing a NERC PRC-005 audit for customers where no specific tool support is available.

What's new in ADMO V2.20?

Medium-sized and large utilities using the ADMO Client-Server Edition can now define and distribute basic user roles to different members of the testing personnel. Various roles, such as Asset Manager, Read Only or Tester imply different permissions and regulate access rights. Customers will also have the option to buy additional 'Read-Only' licenses at a substantially reduced cost.

We have also optimized the performance of ADMO to support a larger number of assets:
3 000 assets can now be handled with the Standalone Edition and more than 10 000 assets with the Client-Server Edition.

Moreover, ADMO has been localized to Spanish, French and German.

Upcoming features in ADMO V2.30

ADMO V2.30 will enable users of the Client-Server Edition to get read-only access without a server connection. This will allow testers to access all relevant documents (e.g. asset information, test templates) in the field.

Since protection relays are key assets of the protection system, ADMO will also offer an additional table view with protection specific asset information. This will permit users to evaluate this data and export it for reporting and analysis purposes. In addition, V2.30 will include several improvements for maintenance management and data handling in general, for example, the ability to set asset type specific data for multiple assets at once.

Voltage transformers can be found in many locations within energy supply networks. Their duties include protecting supply networks and accurately recording primary voltage levels for power determination. However, in order to perform these duties correctly, they require regular tests and calibration, based on operator directives or national regulations. For the first time ever, OMICRON's new VOTANO 100 combines mobility with the highest level of accuracy in a single system.

Products and technology

Portable accuracy

OMICRON presents: the new mobile voltage transformer testing system VOTANO 100

Until now, precise testing of the transformation ratio accuracy of voltage transformers was a major undertaking. Highly accurate measurement solutions are complex systems, made up of various devices that are calibrated and extremely accurate. This includes a high-voltage source, a reference transformer, a set of standard burdens, measuring bridges for comparative purposes, and a computer to evaluate all of the measured data. Transporting all of this equipment to the testing location can often be very awkward. The time and costs involved are immense. Smaller testing solutions typically lack the necessary accuracy or are incapable of taking all of the different burdens into account. Therefore, the only viable alternative is often to

Initial on-site measurements with VOTANO 100 at ESKOM in South Africa.

remove the voltage transformer and send it to a testing institute for accurate calibration. However, this is also time- and cost-intensive.

Precise mobile testing

VOTANO 100 combines mobility and accuracy, thereby reducing testing efforts to a minimum. The basis for this successful combination is the examination of the voltage transformer as an electrical model that is captured and then mathematically simulated by VOTANO 100. This model was developed on the basis of the successful CT Analyzer.

Safe and lightweight package

The VBO1 voltage booster comes with VOTANO 100. It supplies the primary side of the transformer with a maximum reference voltage of 4 kV for the transformation ratio measurement. The VBO1 is positioned near the test object, while the test engineer operates VOTANO 100 in a secure area outside of the high-voltage environment. The compact dimensions guarantee easy and convenient transport. The combined total weight of both devices is less than 15 kg (33 lbs).

In a single pass, winding resistance, short-circuit impedances, transformation ratio, and the magnetic characteristics curve of inductive and capacitive voltage transformers are determined. During this process, VOTANO 100 assesses voltage transformers with up to five secondary windings—both for no-load and standard load operating conditions.

Ultimate accuracy

The measurement method offers an impressive degree of accuracy. Indeed, VOTANO 100 achieves a measurement tolerance of 0.05%. This allows voltage transformers with class 0.1 accuracy to be precisely calibrated on site with regard to their transformation ratio and phase error.

With VOTANO 100, OMICRON is unveiling a unique new development: a high-precision mobile voltage transformer testing system that is easy to use right where it is needed—in the field.

www.omicron.at/votano100

VOTANO 100

- > High measurement accuracy: class 0.1 transformers
- > Guided testing procedure: duration < 20 minutes
- > Small and lightweight: total weight < 15 kg
- > Maximum safety: testing outside the high-voltage environment
- > Automatic assessment to international standards

News

Support for the resonance circuit

CP RC2 for high-voltage testing of gas-insulated switchgear

Voltage withstand tests need to be performed during commissioning and after maintenance work on gas-insulated switchgear (GIS). You can perform these tests as per IEC 62271-203 on GIS systems with an integrated Power VT using the CPC 100 and the CP RC package. The combination of the CPC 100 and CP RC1 allows GIS systems up to a rated voltage of 123 kV to be tested. However, the new CP RC2 package allows testing up to a rated voltage of 145 kV.

CP AT1 auto-transformer

CPC 100 control unit

CP TR7 isolating transf

The modular CP RC2 package consists of an isolating transformer, compensating reactors, an auto-transformer and a control unit. The total weight of the package is less than 150 kg (330 lbs). As such, it is only about one tenth of the weight of a conventional GIS testing system. Each individual component can be carried by one person.

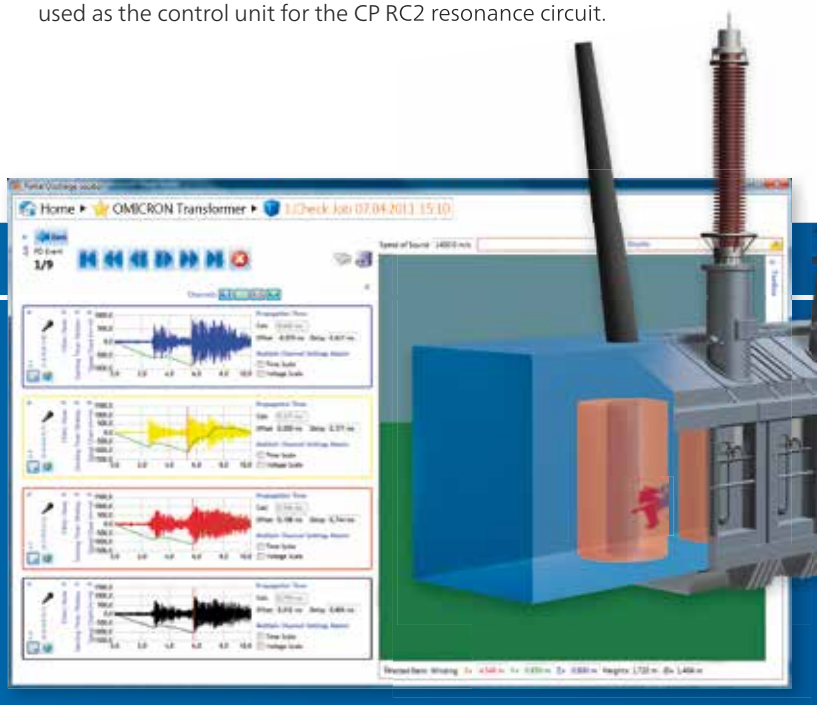
The system is powered via the new CP AT1 auto-transformer using a standard 16 A 3-phase socket. OMICRON's CPC 100 is used as the control unit for the CP RC2 resonance circuit.

News

More efficient partial discharge localization

The new PDL 650 software version 1.2

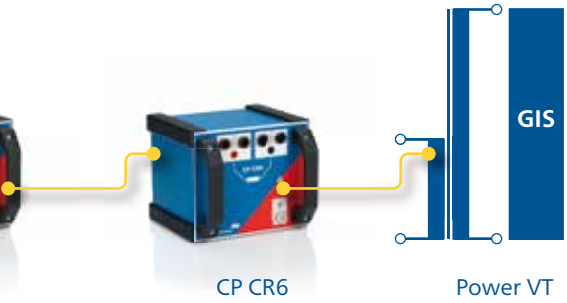
OMICRON's PDL 650 localizes partial discharges (PD) in transformers. The PDL software uses the time difference of acoustic PD signals to calculate the fault location and then presents it in an easy-to-understand 3D model. The new software version 1.2 increases testing efficiency and the way in which tests and test objects are managed. Additionally, the 3D modeling functions have been extended and the overview improved.



Fast localization of partial discharge faults: the PDL software calculates the position of the PD fault and shows it in a 3D model of the transformer.

Efficient testing

Triggering acoustic fault localization via electrical PD signals allows the fault location to be localized easily and efficiently, particularly in environments with a lot of interference. With the new software version, the PDL 650 channels themselves can be used for electrical triggering in place of the MPD 600. An improved algorithm for calculating intersecting lines also allows for more precise relative fault localization.



The Power VT that has already been integrated in the GIS replaces the testing transformer that would otherwise be necessary. This also saves transport costs and space when setting up the apparatus. In addition to this, it is not necessary to empty and refill the SF_6 gas when testing with the CPC 100 and CP RC.

www.omicron.at/cprc

Improved overview
The PDL software has undergone a facelift. It now guides you through the testing procedure even more intuitively than before. The new filter function allows you to quickly find tests that have already been completed and test objects that have been defined. Test results are presented more clearly and it is much easier to interpret time signals and 3D models thanks to the improved zoom function.

Adapted to your requirements
New modeling elements allow you to adapt your transformer models with even more precision in order to meet your specific requirements. The new PDL 650 software version 1.2 is available for download free-of-charge from our website's Customer Area.

www.omicron.at/pdl650

News

Longer output times

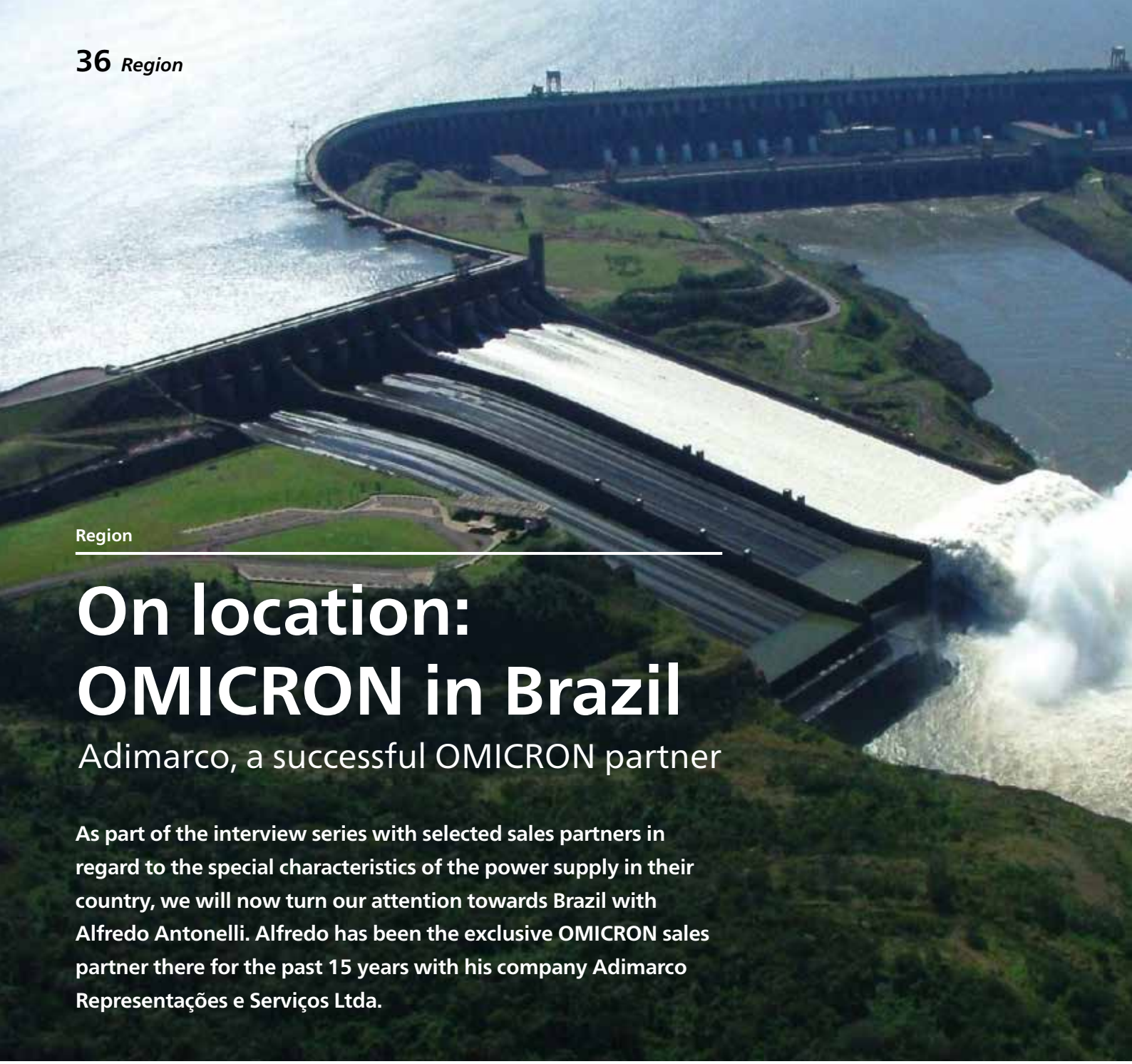
New version of CP CR500 compensating reactor for CP TD1

The combination of the CP CR500 compensating reactor and the CPC 100 + CP TD1 allows you to test the insulation quality of generators, motors, cables, and other high-capacitance assets. This portable testing solution is used for dissipation factor and tip-up tests as per IEC 60894 and IEEE 286. It can, however, also be used as a high-voltage source for partial discharge measurements.

The CP CR500 compensating reactor is available with an inductance of 40 H and 80 H. For dissipation factor and tip-up tests, capacitances of up to 1 000 nF can be compensated – either at nominal frequency (50 Hz/60 Hz) or variable frequency (15 Hz to 400 Hz). When used as a high-voltage source, multiple CP CR500 units connected in parallel can compensate capacitances of up to 2 µF (12 kV).

The new version of the CP CR500 compensating reactor allows for longer current output times. 0.5 A can now be output for a maximum of 40 minutes, and 1 A can be output for a maximum of 7 minutes.

www.omicron.at/cpcr500



Region

On location: OMICRON in Brazil

Adimarco, a successful OMICRON partner

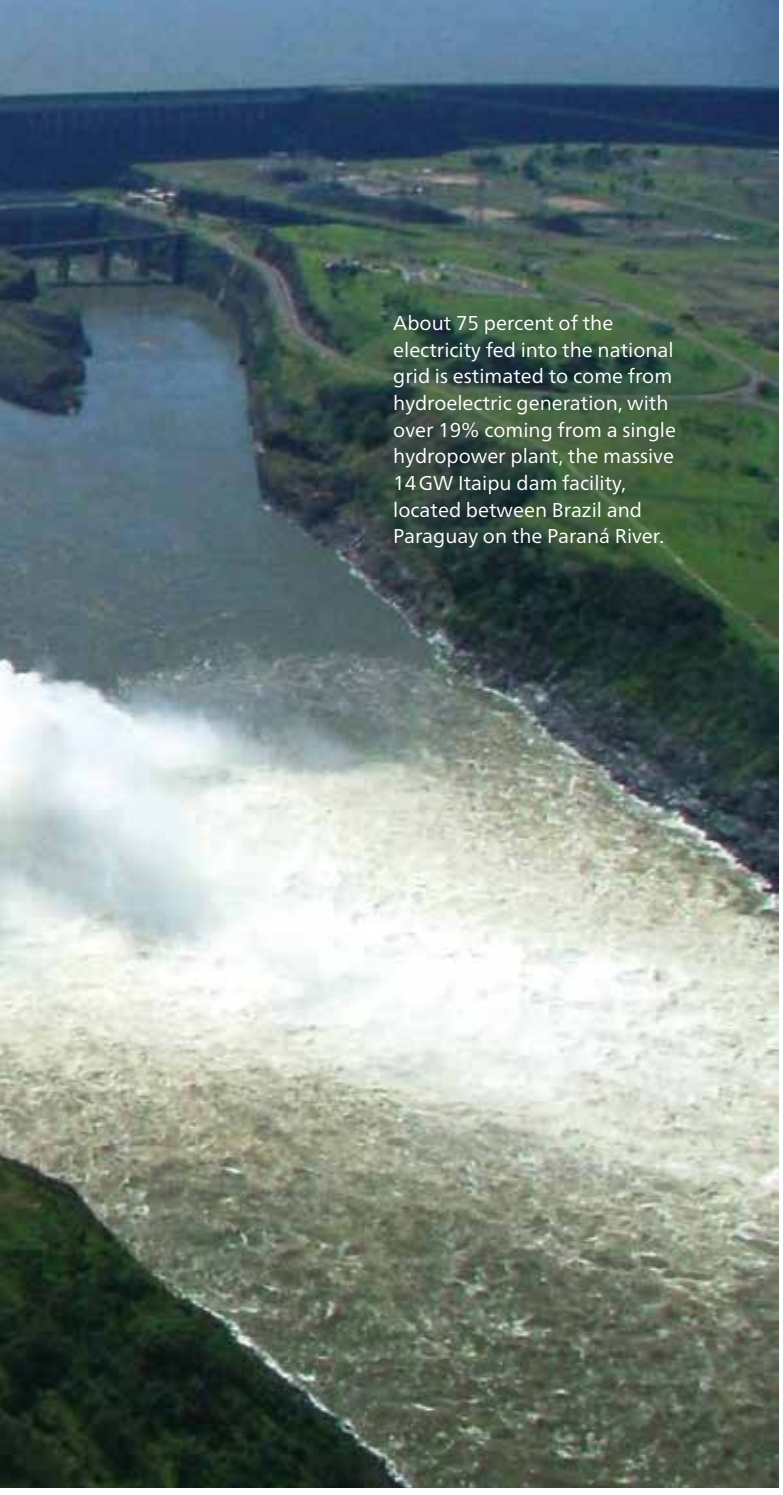
As part of the interview series with selected sales partners in regard to the special characteristics of the power supply in their country, we will now turn our attention towards Brazil with Alfredo Antonelli. Alfredo has been the exclusive OMICRON sales partner there for the past 15 years with his company Adimarco Representações e Serviços Ltda.

»Brazil just recently became the sixth largest economy in the world and received a lot of international exposure since.«

Alfredo Antonelli, OMICRON sales partner Brazil

OM: What are the key characteristics of the grid in Brazil?

AA: The main factor that you need to consider about the grid in Brazil is its relation to the size of the country. Brazil is the fifth largest country in the world, both in its geography and its population, with over 193 million people. Its vast physical size and its many independent and remote zones have created special conditions in Brazil which have made the installation of an effective grid a very complicated endeavor. One example is the Amazonas region which covers more than 1.5 million km (0.6 million mi). The hostile



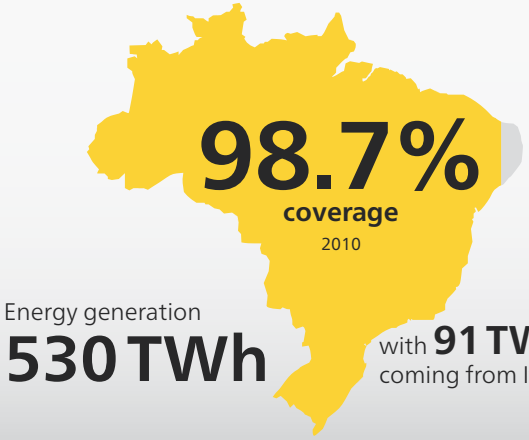
About 75 percent of the electricity fed into the national grid is estimated to come from hydroelectric generation, with over 19% coming from a single hydropower plant, the massive 14 GW Itaipu dam facility, located between Brazil and Paraguay on the Paraná River.

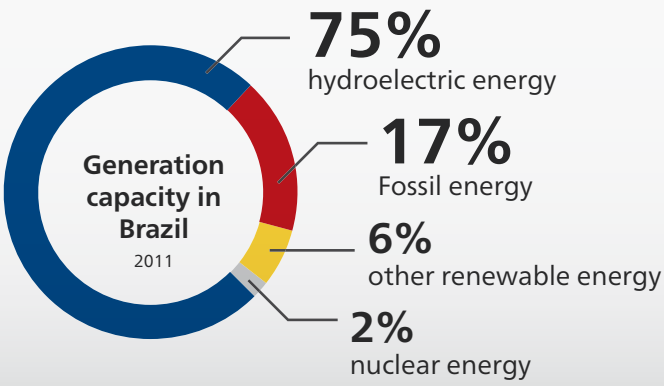
Adimarco's team supports its customers with local trainings, a certified repair service and technical conferences on a regular basis.

environment means that construction of 500 kV power lines can only be done by helicopter and consequently the maintenance is extremely difficult. Following a major blackout in 2001, work started on making the grid fully interconnected and although Brazil has a large capacity for hydroelectric generation, the long distances always demand special conditions. This is evident in the case of the Itaipu Dam on the Paraná River located on the border of Paraguay where the installed generation capacity of the plant is 14 GW and annual generation is over 98 TWh; supplying 90% of the electricity consumed by Paraguay and 19% of that consumed by Brazil. The excess production that Paraguay does not require is exported directly to the Brazilian side, from there two 600 kV HVDC lines, each approximately 800 km (500 mi) long, carry the majority of the energy to the São Paulo/Rio de Janeiro region where the terminal equipment converts the power to 60 Hz.

OM: What are the hot topics for the energy supply market in Brazil?

AA: Traditionally Brazil has suffered under a very poor maintenance philosophy which has seen great projects reduced to ineffective solutions in a very short time. Major efforts are under way by the government and private sectors to correct this, however progress is slow as it is largely a cultural issue. One factor that has been helpful is the international exposure that Brazil has received since it recently became the sixth largest economy in the world and now many of the biggest international manufacturers in the electrical sector are present there. Other key areas of interest are with regards to renewable energy sources with a rapid expansion of its wind generation capacity and also small and medium hydroelectricity plants. Brazil is also one of the pioneers in research and development for tidal generation thanks to its 7 500 km (4 700 mi) of Atlantic coastline.





Sources: The World Bank www.worldbank.org, Empresa de Pesuisa Energética www.epe.gov.br

OM: Alfredo, you are OMICRON's sales partner in Brazil. Which products do your customers request the most?

AA: For many years the protective relay testing equipment (CMC series) was the main area of interest, however in the last few years OMICRON's expanding range of testing solutions for power transformers and current transformers have created a lot of demand.

OM: What services does Adimarco offer its customers?

AA: Naturally we offer the entire range of OMICRON products but the key to our initial success came from being able to provide local training in Portuguese. We made a commitment to this policy right from the start when promoting OMICRON's products and today this same policy has grown even stronger since we now have an extensive team of Technical Engineers and Instructors. Customers in Brazil know that they will receive fantastic solutions from OMICRON and outstanding support from Adimarco.

OM: Finally, with Brazil preparing for the football World Cup and the Olympics what changes do you think will take place in the electrical sector?

AA: The additional attention that Brazil will receive on the international stage will drive the investments in infrastructure for a period of time and that will obviously include the reinforcement of the electricity network. This will not only be evident in new installations but also in the improved level of maintenance and we are confident that the events will not only be a great success, but will also add long-term value to the electrical sector.

At the Itaipu dam, one of world´s largest hydroelectric dams, the CPC 100 with CP TD1 was used for an impressive demo.

Adimarco

Adimarco Representações e Serviços Ltda. was founded in 1988 by Alfredo Antonelli in Rio de Janeiro, Brazil. The company became OMICRON's exclusive sales partner in Brazil in 1998. In addition to product sales, they also offer an extensive range of local training, an OMICRON-certified repair service and they present papers at technical conferences on a regular basis.

www.adimarco.com.br

Classroom with view of hands-on training area.

Transformer and substation maintenance training.

Reviewing transformer nameplate in the classroom before testing.

Outside OMICRON Academy building.

Hands-on protective relay training area.

Personalized training specific to your needs.

Region Americas

OMICRON Academy Training—Houston

Earn Continuing Education Units (CEUs) and Professional Development Hours (PDHs) by attending classes

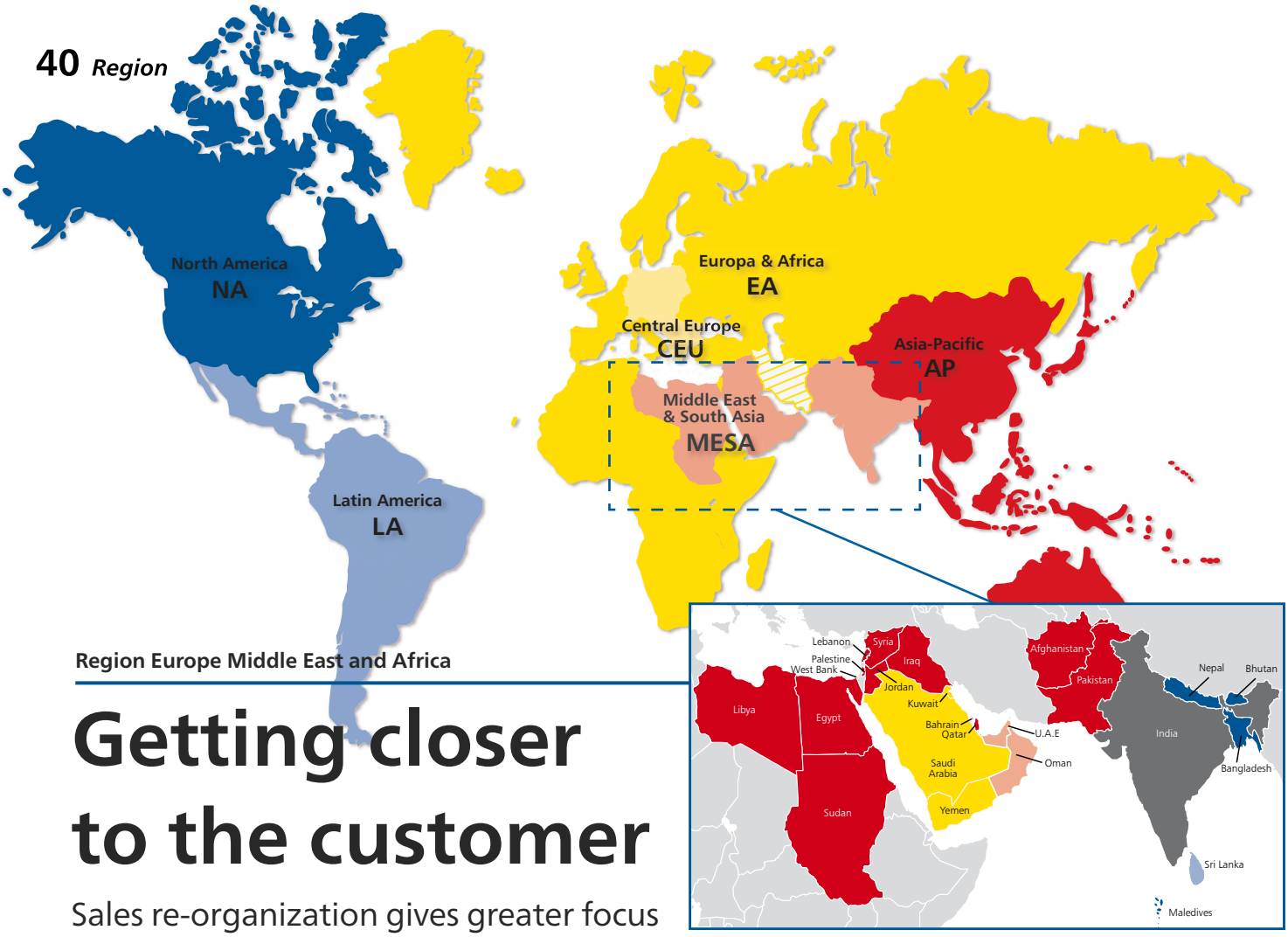
This year, OMICRON opened its state-of-the art 5,100-square-foot Training Center in Houston known as the OMICRON Academy. It consists of a modern classroom seating up to 60 people comfortably and a unique hands-on area which is fully air-conditioned with everything indoors so there is no dependency on weather.

Other highlights of the "hands-on" area include:

- 10 MVA power transformer to perform all typical electrical power transformer tests as well as advanced diagnostics
- 69 kV SF_6 circuit breaker on the high side and a 15 kV vacuum breaker on the low side for circuit breaker testing
- Training area for partial discharge (PD) testing
- Hands-on relay protection lab for up to 16 people
- Training area for distribution automation including apparatus from various manufacturers

For a list of courses, and registration, visit

www.omicronusa.com/training



Region Europe Middle East and Africa

Getting closer to the customer

Sales re-organization gives greater focus

OMICRON prides itself on its customer service that largely depends on having a close relationship with its customers. To achieve this, the organization of the sales regions is important.

Traditionally, the company has arranged its sales organization in three regions covering; Europe, Middle East and Africa (EMEA); the Americas and Asia Pacific to keep the time zones reasonably close. As the company has grown it has opened local offices in numerous countries to reduce the physical distance to the market and to address linguistic needs, particularly in EMEA. One area where the growth in the business is particularly evident has been the Middle East and, with its increasing importance and cultural differences, it became increasingly difficult to manage from Europe.

In order to address this, it was decided to re-organize the regions by taking the South Asian countries from Asia Pacific and adding them to EMEA's Middle Eastern countries to create Middle East South Asia (MESA). At the same time additional regions were created in Latin America and predominantly German speaking, Central Europe. The remaining part of EMEA, Europe and Africa, became the sixth region.

MESA comprises 24 countries in Asia and Africa with a combined area of 14.2 million km^2 and a total population of 1.88 billion people. It ranges from Libya in the West to the Indian/Burmese border in the East and in 2012 achieved 14% of OMICRON's worldwide sales, with an order intake that has almost doubled in five years. The region has two bases; one in New Delhi – the capital of the largest market; and one in Bahrain – a short drive from the region's second biggest market, Saudi Arabia.

The two teams possess a wealth of experience spanning the entire OMICRON product range. The total flying time between Bahrain and New Delhi is only 3.5 hours. Hence, it takes a relatively short amount of time to take advantages of the synergies within the new region by transferring the expertise of one of the teams to assist in the territories of the other, whenever there is a need.

English is a common language throughout the region but fluency in Arabic and Hindi within the team, allows for better communication with customers for whom their knowledge of English is sometimes not in great depth.

Region Asia-Pacific

Working closely together

OMICRON events and trainings enable to increase practical knowledge and common know-how