OMICRON

IEC 61850: Thematic Introduction and Testing Solutions

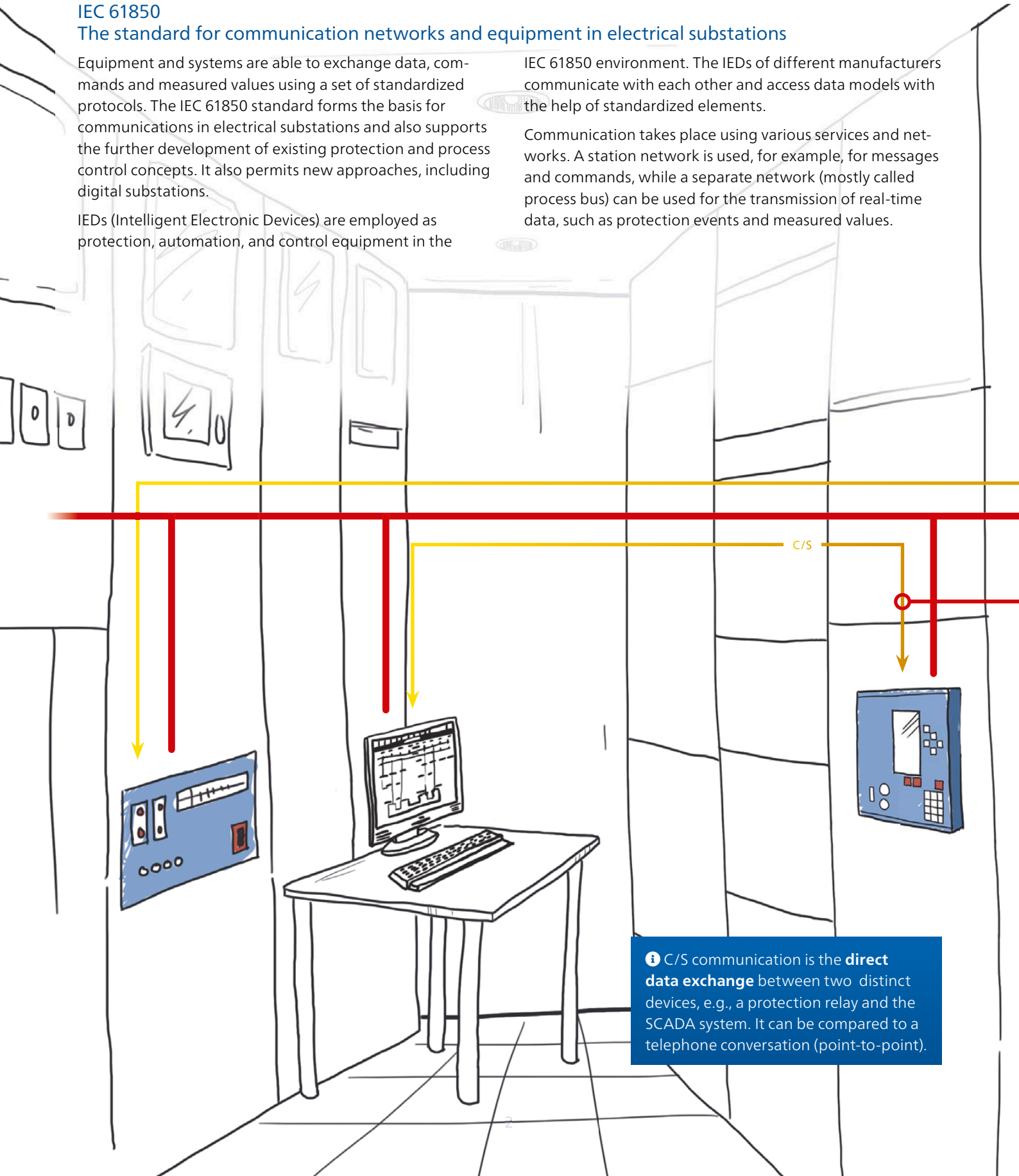
Introduction to IEC 61850

IEC 61850
The standard for communication networks and equipment in electrical substations

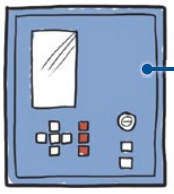
Equipment and systems are able to exchange data, commands and measured values using a set of standardized protocols. The IEC 61850 standard forms the basis for communications in electrical substations and also supports the further development of existing protection and process control concepts. It also permits new approaches, including digital substations.

IEDs (Intelligent Electronic Devices) are employed as protection, automation, and control equipment in the IEC 61850 environment. The IEDs of different manufacturers communicate with each other and access data models with the help of standardized elements.

Communication takes place using various services and networks. A station network is used, for example, for messages and commands, while a separate network (mostly called process bus) can be used for the transmission of real-time data, such as protection events and measured values.



C/S communication is the **direct data exchange** between two distinct devices, e.g., a protection relay and the SCADA system. It can be compared to a telephone conversation (point-to-point).



IEDs – Intelligent Electronic Devices

Protection relays, bay controllers, controllers, etc. are known as IEDs in the IEC 61850 environment. They receive commands and send data and measured values across the network. In the case of a report, for instance, the data model of an IED is accessed and up-to-date information about the station control system is transmitted.

IEDs from different manufacturers are able to communicate with each other (interoperability).

C/S

Station network

C/S – Client/Server

Process control communication

Communication between a client and a server takes place over a unicast connection that supports the *acknowledged* exchange of commands and messages.

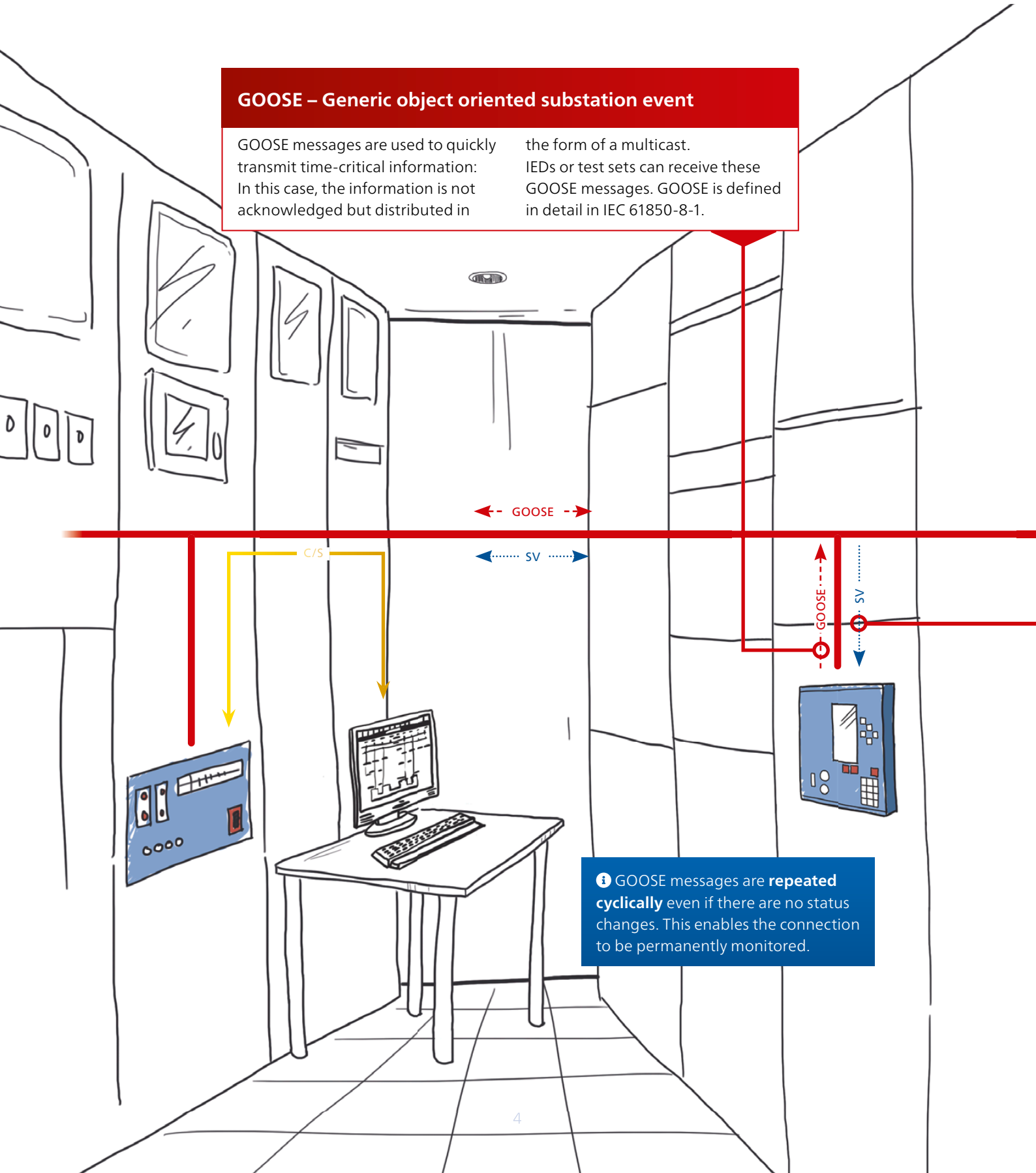
Example: An IED transmits data and in this sense acts as a server – the local station control system is then the connected client. The information contained in the dataset of the IED (e.g., values for excitations, triggers and position feedbacks) is transferred in a report to the SCADA system whenever a trigger condition (e.g., change in data) is met.

Communication with the SCADA system is based on TCP/IP. The services are mapped to the manufacturing messaging specification (MMS) protocol. This mapping is defined in IEC 61850-8-1. Mappings to other transport protocols, such as XMPP, are foreseen as defined in IEC 61850-8-2.

Real-time communication with GOOSE and Sampled Values

GOOSE – Generic object oriented substation event

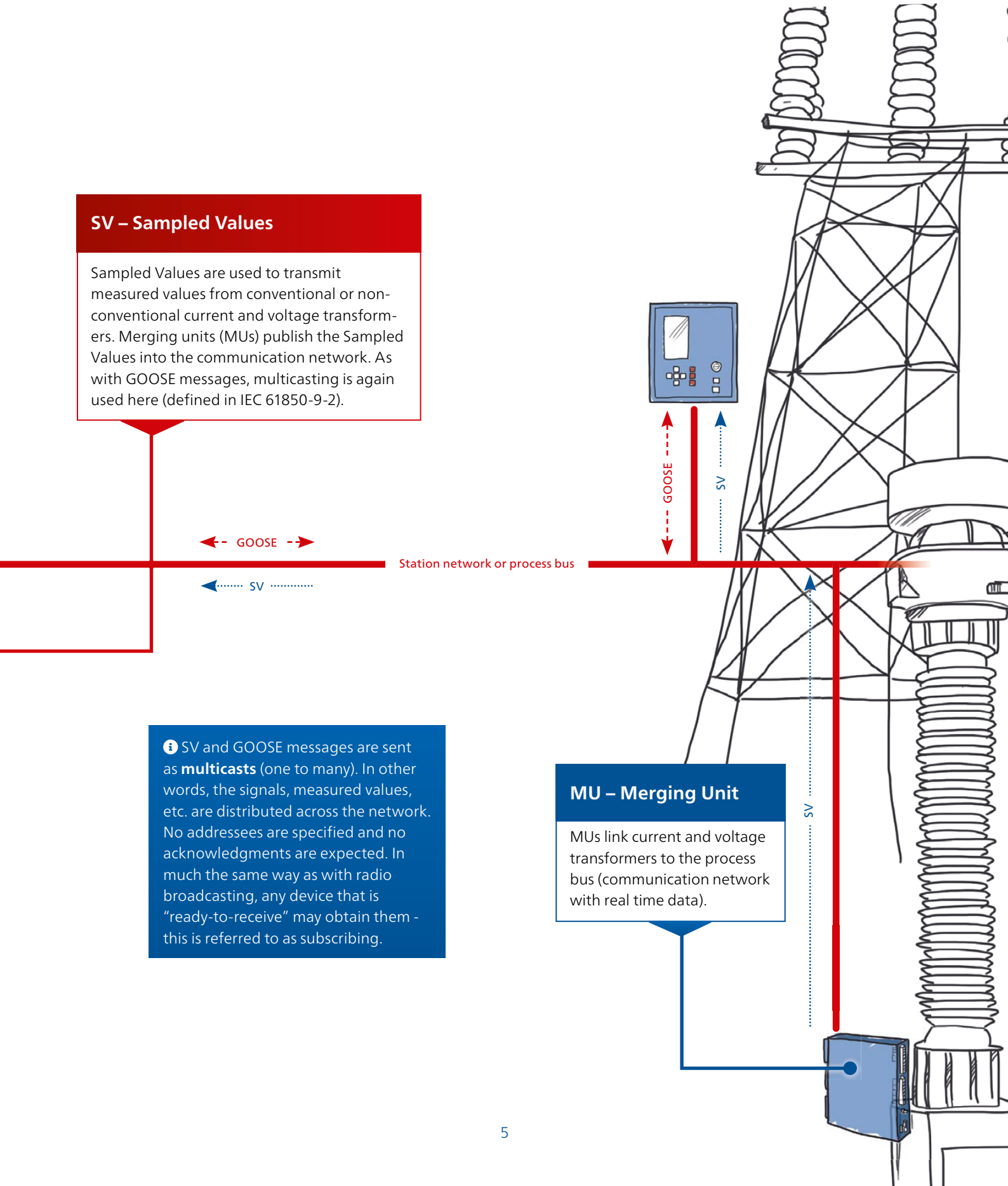
GOOSE messages are used to quickly transmit time-critical information: In this case, the information is not acknowledged but distributed in the form of a multicast. IEDs or test sets can receive these GOOSE messages. GOOSE is defined in detail in IEC 61850-8-1.



GOOSE messages are **repeated cyclically** even if there are no status changes. This enables the connection to be permanently monitored.

SV – Sampled Values

Sampled Values are used to transmit measured values from conventional or non-conventional current and voltage transformers. Merging units (MUs) publish the Sampled Values into the communication network. As with GOOSE messages, multicasting is again used here (defined in IEC 61850-9-2).



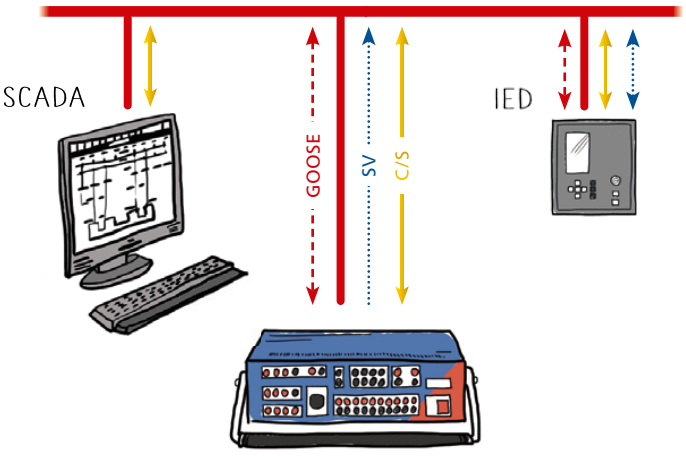
SV and GOOSE messages are sent as **multicasts** (one to many). In other words, the signals, measured values, etc. are distributed across the network. No addressees are specified and no acknowledgments are expected. In much the same way as with radio broadcasting, any device that is "ready-to-receive" may obtain them - this is referred to as subscribing.

MU – Merging Unit

MUs link current and voltage transformers to the process bus (communication network with real time data).

Test sets

The network technology employed opens up new opportunities, although it does demand innovative testing technology. Ever since the publication of IEC 61850, OMICRON has kept in step with the standard by constantly upgrading its testing solutions.



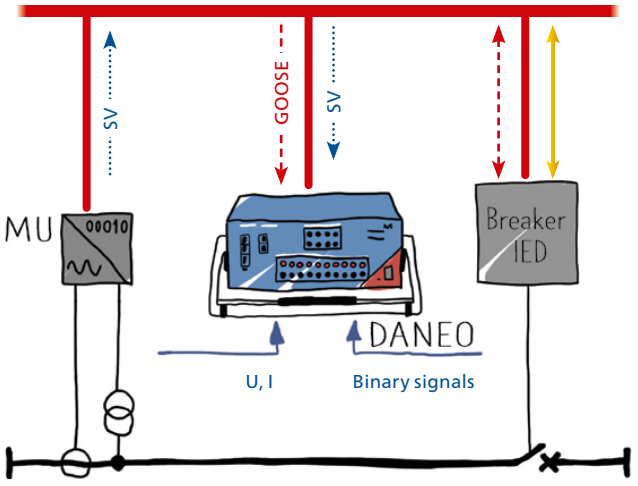
CMC family

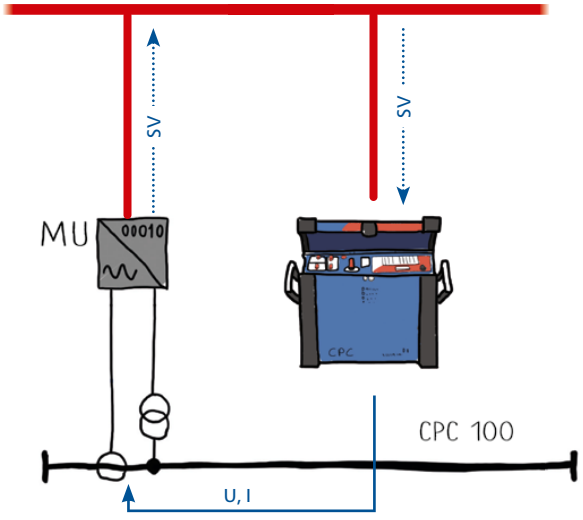
Versatile protection testing devices with powerful software

The CMC family meets the professional needs of test engineers in the field of protection technology. A range of reliable and flexible solutions are available – from compact protection test sets for simple applications, through ultra-precise calibration tools, to versatile commissioning tools. In addition to digital signals, the CMC 356, CMC 256plus, CMC 353 and CMC 430 protection tests sets can also output high-power analog signals.

The easy to use **configuration modules** of the Test Universe testing software permit CMC test sets to be controlled and facilitate testing with **GOOSE** and **Sampled Values**. The CMC sends and receives GOOSE messages and enables protection testing to be carried out in the same way as with binary signals. Sampled Values, which the CMC 430 is able to measure, can also be output. With the Test Universe Module **IEC 61850 Client/Server**, values from the data model can be read and SCADA reports can also be tested. Switching to test mode is possible.

RelaySimTest comprehensively supports the use of Sampled Values and GOOSE.





DANEO 400

Hybrid signal analyzer

The hybrid measuring system simultaneously analyses analog signals and messages across the communication network. This combination enables in-depth and flexible tests to be carried out.

Distributed measurements using several devices are precisely synchronized, allowing signal propagation delays to be measured very accurately. The analysis software carries out comprehensive evaluations of processes in the installation; the analyzer also features monitoring and observation functions.

CMC 850

Specifically for IEC 61850 tests

The CMC 850 was developed specifically for carrying out testing in digital transformer stations. No analog amplifiers are required, which means the test set is small and light. All values and data are transferred via GOOSE messages and Sampled Values.

CPC 100

Primary test set

Our universal test set for primary equipment also evaluates IEC 61850 Sampled Values. This tests the entire signal chain from the sensor to the IED.

Test software & accessories

StationScout

Testing IEC 61850 Substation Automation Systems (SAS)

StationScout simplifies the process of testing the automation, control, and SCADA communication in SAS utilizing IEC 61850.

StationScout visualizes and analyzes the communication relationships and depicts the system topology in an intuitive manner. The powerful MBX1 test set ensures a cybersecure separation of the test system from the SAS.

The extensive simulation and test functions support designers and testing engineers during the entire lifecycle of an IEC 61850 SAS.

IEDScout

Versatile tool when using IEDs

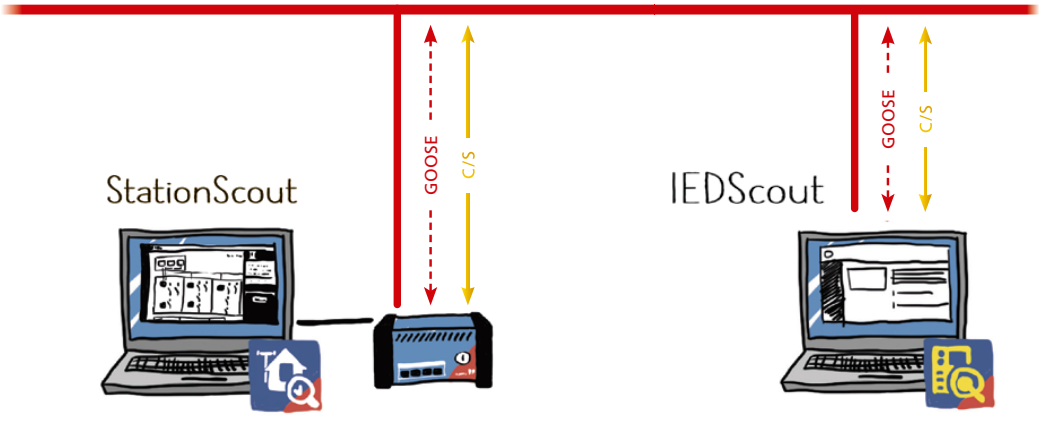
IEDScout provides a detailed inside view of IEC 61850 IEDs of all manufacturers for in-depth analysis. GOOSE and C/S traffic is presented in a clear manner.

The software is particularly suitable for testing, troubleshooting and commissioing. IEDScout also simulates IEDs.

SVScout

The "oscilloscope" for Sampled Values

SVScout subscribes to, displays and records Sampled Values. Numerous visualization features are provided for protection engineers and the manufacturers of merging units.



ISIO 200

Binary input / output extension

The compact ISIO 200 offers a flexible way of providing additional local binary inputs and outputs. It communicates with IEDs and CMC test sets using IEC 61850 GOOSE messages. A variety of data models can be activated. With a web interface and a complete IEC 61850 server, it also provides a direct link into the world of IEC 61850.

EMCON 200

PTP Ethernet media converter

EMCON 200 connects fiber glass- and copper-based networks (100 MBit/s and 1 GBit/s). SFP modules make the configuration as flexible as possible.

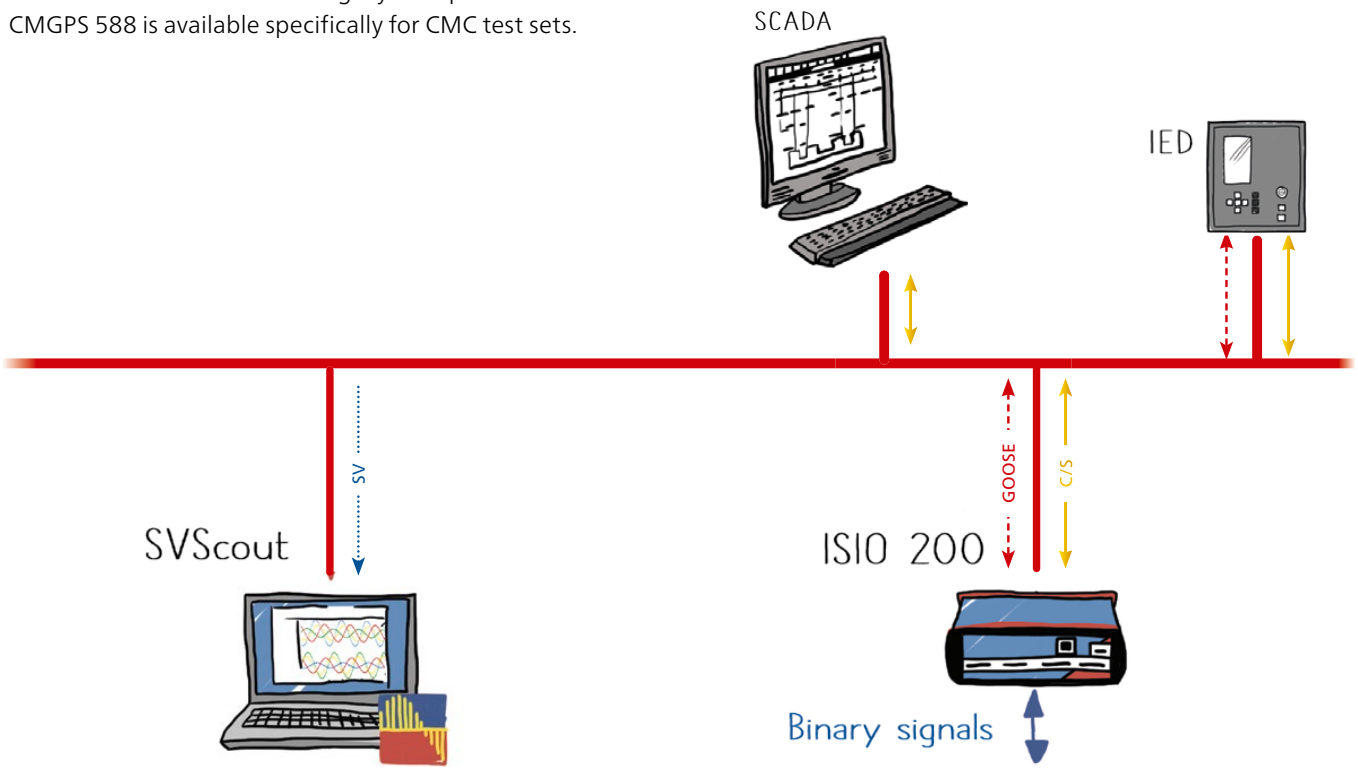
Time synchronization in networks with Precision Time Protocol (PTP) is maintained. The network cable supplies the power using Power over Ethernet (PoE).

Time synchronization

Precise with Precision Time Protocol (PTP)

The precise synchronization of IEDs and merging units is an essential aspect of modern station automation systems. PTP facilitates precise time synchronization using the existing network infrastructure.

The OTMC 100p Grandmaster Clock serves the IEEE 1588 PTP to the network according the Power Utility Profile defined in IEC 61850-9-3. Where required, the TICRO 100 converts PTP back to several legacy time protocols. The CMGPS 588 is available specifically for CMC test sets.



Support in the IEC 61850 World

Training courses and seminars

The OMICRON Academy offers a range of IEC 61850 training courses. The courses are built around real testing situations, and are ideal for technical staff from electrical utilities, industrial plants,equipment manufacturers and service companies.

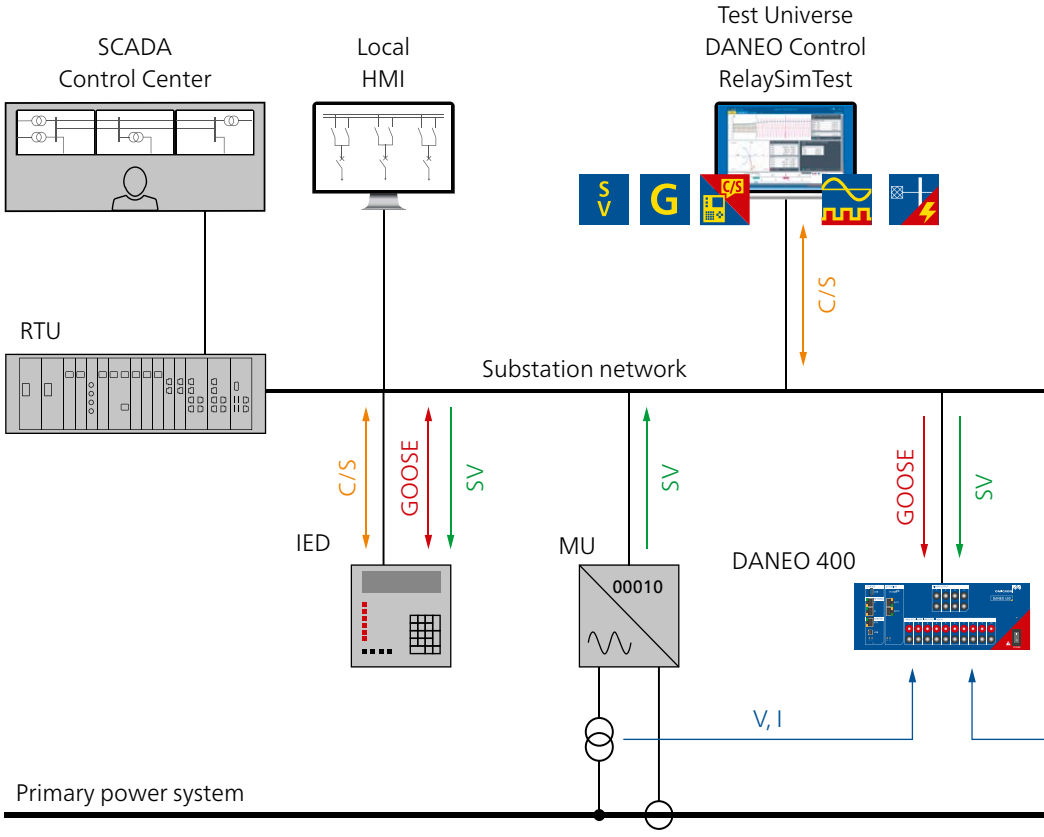
Contents range from basic knowledge of IEC 61850 concepts and protocols to commissioning and trouble-shooting of Digital Substations. The trainees learn to fully utilize the test equipment, perform efficient tests and how to interpret the test and measurement results.

For additional information, visit:
www.omicronenergy.com/academy

Webinars

Complementing the real-life events and Academy trainings, OMICRON offers online seminars.
These webinars are free of charge and, moreover, they are recorded. They are available on our website 24/7 and can be watched at any point in time, wherever and whenever it is preferred.

Find out about the next IEC 61850 webinars on our website:
www.omicronenergy.com/academy-webinars

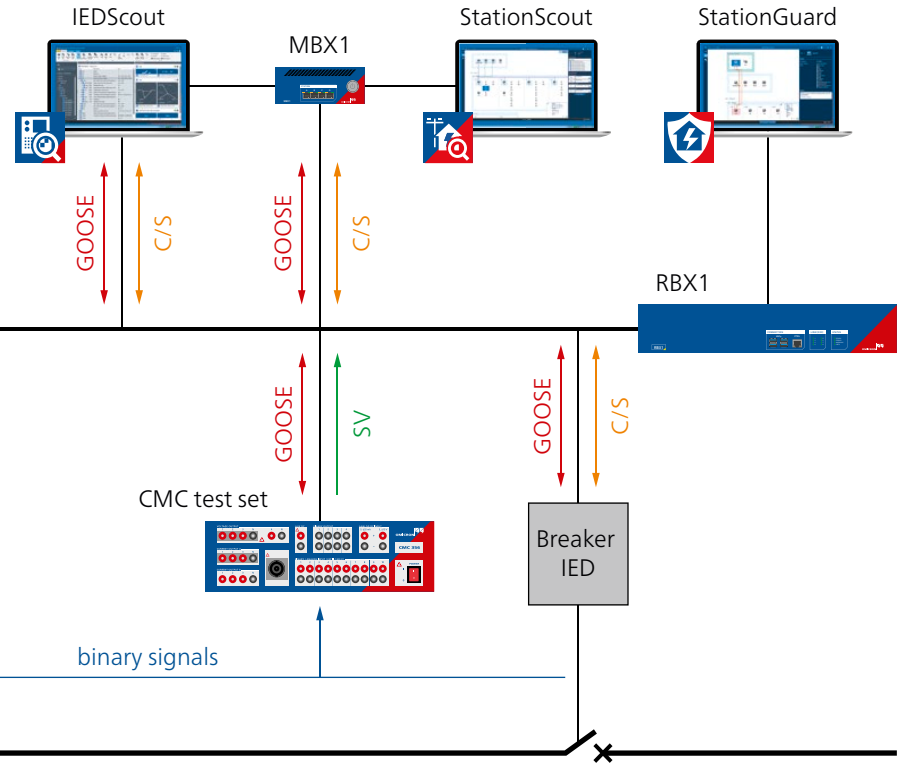


Power Utility Communication Tutorial & Workshop

The PUCTW is an event entirely focused on IEC 61850 and Digital Substations. The tutorial covers actual topics of the digitalization in the electrical power industry. The workshop delivers hands-on experience for the participants with real test and measurement equipment.

24/7 technical support

Should you require rapid assistance, you will receive excellent support from our highly trained and dedicated technicians, 24 hours a day, seven days a week. We pride ourselves on exceptional customer service and premium quality.



We create customer value through ...

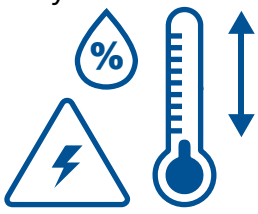
Quality

We always want you to be able to rely on our testing solutions. This is why our products have been developed with experience, passion and care and are continually setting ground-breaking standards in our industry sector.

You can rely on the highest safety and security standards

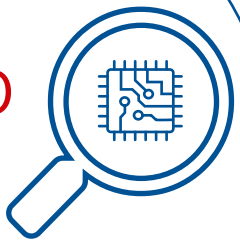
Superior reliability with up to

72



hours burn-in tests before delivery

100%



routine testing for all test set components

ISO 9001
TÜV & EMAS
ISO 14001
OHSAS 18001

Compliance with international standards

Innovation

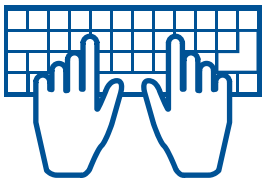
Thinking and acting innovatively is something that's deeply rooted in our genes. Our comprehensive product care concept also guarantees that your investment will pay off in the long run – e.g. with free software updates.

I need...

... a product portfolio tailored to my needs

More than

200



developers keep our solutions up-to-date

More than

15%

of our annual sales is reinvested in research and development

Save up to

70%

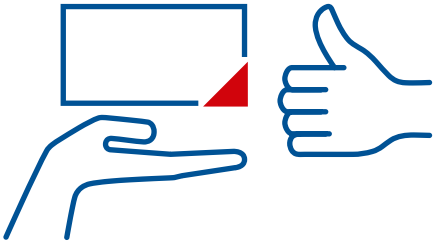
testing time through templates, and automation

We create customer value through ...

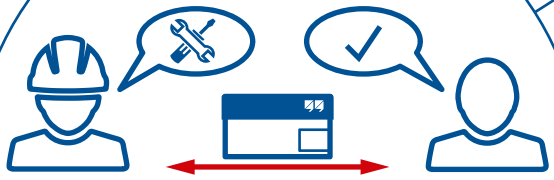
Support

When rapid assistance is required, we're always right at your side. Our highly-qualified technicians are always reachable. Furthermore, we help you minimize downtimes by lending you testing equipment from one of our service centers.

Professional technical support at any time



Loaner devices help to reduce downtime



Cost-effective and straight-forward repair and calibration

offices worldwide for local contact and support

Knowledge

We maintain a continuous dialogue with users and experts. Customers can benefit from our expertise with free access to application notes and professional articles. Additionally, the OMICRON Academy offers a wide spectrum of training courses and webinars.

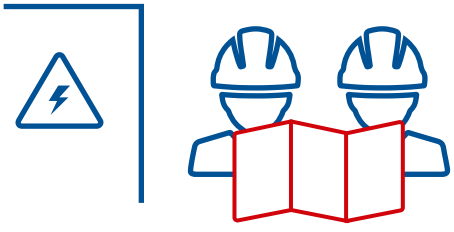
More than

300

Academy and numerous hands-on trainings per year

Frequently OMICRON hosted user meetings, seminars and conferences

to thousands of technical papers and application notes



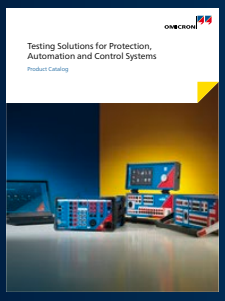
Extensive expertise in consulting, testing and diagnostics

OMICRON is an international company that works passionately on ideas for making electric power systems safe and reliable. Our pioneering solutions are designed to meet our industry's current and future challenges. We always go the extra mile to empower our customers: we react to their needs, provide extraordinary local support, and share our expertise.

Within the OMICRON group, we research and develop innovative technologies for all fields in electric power systems. When it comes to electrical testing for medium- and high-voltage equipment, protection testing, digital substation testing solutions, and cybersecurity solutions, customers all over the world trust in the accuracy, speed, and quality of our user-friendly solutions.

Founded in 1984, OMICRON draws on their decades of profound expertise in the field of electric power engineering. A dedicated team of more than 900 employees provides solutions with 24/7 support at 25 locations worldwide and serves customers in more than 160 countries

The following publications provide further information on the solutions described in this brochure:



Testing solutions for protection and measurement systems

For more information, additional literature, and detailed contact information of our worldwide offices please visit our website.

www.omicronenergy.com

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