# IEC 61850 Testing Tools

OMICRON provides the most advanced IEC 61850 testing tools for protection engineers. The tools complement each other to serve different needs. The module IEC 61850 Client/Server tests the SCADA communication and the IED to test modes.

For protection testing utilizing IEC 61850 GOOSE and Sampled Values, corresponding functions "wire" CMC test sets [1] to the station network. With IEDScout, the data models and configurations of IEC 61850 compatible devices can be investigated. The usage of configuration information in standardized SCL (Substation Configuration Language) format is supported throughout the whole tool set. SVScout makes Sampled Values visible for the substation engineer and IED developer.
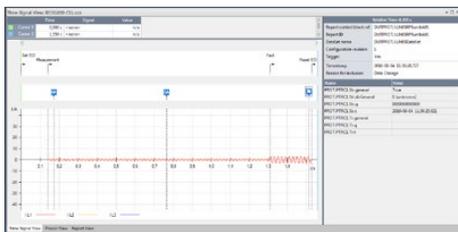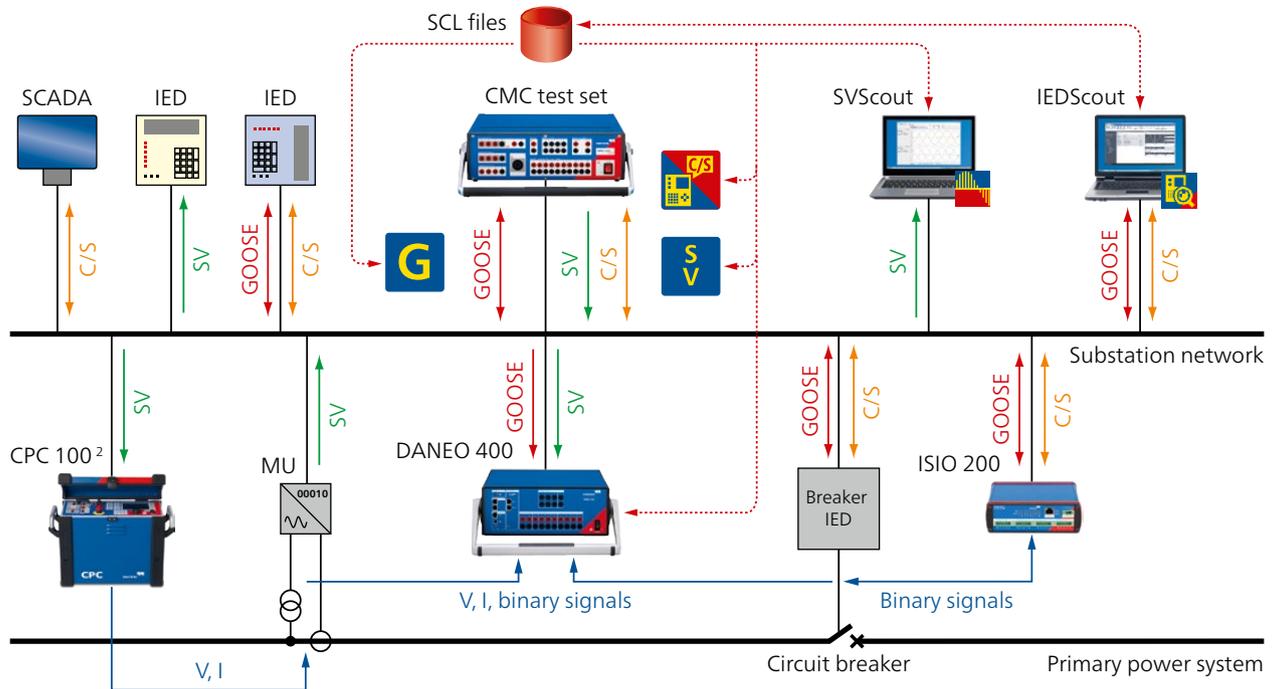
IEC 61850 Client/Server Module   VESM1186

The IEC 61850 Client/Server module combines protection testing and SCADA testing and offers new possibilities. It provides an easy and secure way to automatically set a protection device (IED) to test modes, testing the SCADA communication and to reset it to its original state when the test is finished. Testers can use these modes for several single protection stages, entire protection functions or the complete device. The testing modes ensure that outputs will not be activated and that the tested device does not send any unnecessary information to the control center during the test process.

The IEC 61850 Client/Server module provides the following features:
> Access each IED via network directly and securely
> Retrieve and store IEC 61850 Reports from the IED
> Load the IED's data model and use it for protection testing
> Prepare the complete test and assessment procedure in advance
> Execute automated protection testing with the focus on intended IED response
> Handle IED modes easily and clearly
> Reset the IED to its original operating mode after testing
> Generate reports, assessment and documentation automatically
> Quick, automated, reliable and secure testing of IEDs and SCADA communication

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[1] The GOOSE and Sampled Values functions are available for CMC 850, CMC 356, CMC 353, CMC 256plus, and CMC 430
[2] For further information about the CPC 100 and its applications please ask for our respective product brochure or visit our website.

This module makes the Test Universe software a client that directly communicates with the IEDs working as servers. Thus, Test Universe can access the entire data model of an IED and read it for protection testing. Testers can control the IED modes (test, test/blocked, off, on, on/blocked) very easily and prepare the IED for the testing procedure.

It operates stand-alone and includes all functions necessary to access an IED and to test its communication. Different settings according to particular testing requirements can be embedded at the relevant place, and as often as needed, in OCC testing processes created and controlled by Test Universe. The module is always self-contained wherever it is placed within an OCC-document.

IED's Reports contain valuable information. The module retrieves and forwards them to Test Universe for further protection testing or to verify the correct communication between the IED and SCADA, even without an active connection to the control center.

To assess the current state of an IED, or the results of the test process, the module loads the IEC 61850 engineering files to Test Universe to access any values from the IED. Even while the test is running, the module can read out, for example, each startup, directional information, ground fault message or measurement values fully automatically.

The integrated automatic assessment function compares the resulting values to the expected values and verifies if they are within the acceptable deviations. It verifies if each reaction of the IED was initiated correctly and shows all results in the Assessment View.

Logging every single step of the testing process as well as each IED response, the module finally documents the entire testing process in the C/S Monitor. These results can be stored by the Test Universe software and safely summarize the steps performed during the test and its results.
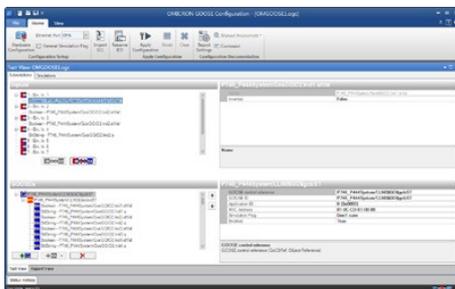
GOOSE

The GOOSE Configuration module configures the mappings and sets up the CMC test set for communicating with the GOOSE messages on the substation network. As with any OMICRON test module, it can be inserted multiple times in test plans to automatically configure the "wiring". To facilitate parameter entry and to avoid typing errors, the parameters can be imported from configuration files in the standardized SCL format.

CMC test sets operate with status data in GOOSE messages as if they were "wired" to the binary inputs and outputs of a CMC test set. Data attributes from received (subscribed) GOOSE messages actuate the binary inputs of the test set (for instance trip or start signals). Binary outputs actuate data attributes in simulated (published) GOOSE messages. By this generic approach, all test modules of the OMICRON Test Universe software can be used with GOOSE.

All IEC 61850 types and structures are allowed in a GOOSE dataset. Mappings are provided for Boolean, Bit-String, Enum, Integer, and Unsigned. The timing performance of the message exchange is according to Type 1A; Class P2/3 (IEC 61850-5, "Trip" – "most important fast message").

Sampled Values (SV)   VESM1184

The Sampled Values Configuration module is used to set up the generation of up to three[1] Sampled Values streams in the test set. It provides the communication parameters and enables the Sampled Values output. To facilitate parameter entry and to avoid typing errors, the parameters can be imported from configuration files in the standardized SCL format.

CMC test sets generate Sampled Values according to the "Implementation Guideline for Digital Interface to Instrument Transformers using IEC 61850-9-2", which is published by the UCA International Users Group. As this implementation guideline defines a subset of IEC 61850-9-2, it is commonly referred to with its nickname "9-2 Light Edition" or short "9-2 LE". The test set generates Sampled Values at a rate of 80 samples per cycle as intended for protection and metering applications. Nominal network frequencies of 50 Hz and 60 Hz are supported.

The published Sampled Values correspond to the analog voltages and currents generated at the voltage and current outputs of the test set. As the secondary values are still available, hybrid applications are supported. The scaling of the primary values represented by the Sampled Values is done with the existing VT and CT settings from the Test Object. By this generic approach, all test modules of the OMICRON Test Universe software can be used with Sampled Values.
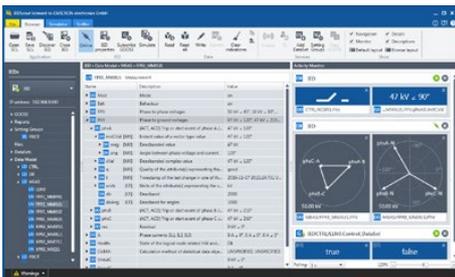
IEDScout   VESC1500

IEDScout is an ideal tool for protection and substation automation engineers working with IEC 61850 devices. It provides access to the IEDs (Intelligent Electronic Devices) and performs numerous useful functions when working with them. The user interface assists to find all relevant information of the IEDs.

IEDScout serves many applications with IEC 61850 devices, among them are:
Testing, Troubleshooting, Commissioning, IED Development

Benefits
> Supports standards IEC 61850 Ed. 1, IEC 61850 Ed. 2 and IEC 61400-25
> Works with IEC 61850 compatible IEDs from any vendor
> Investigates multiple IEDs simultaneously
> Supports unplanned and improvised testing situations, especially during commissioning and troubleshooting
> Fast analysis of SCL files and large data models
> Investigates data traffic in-depth – even between other clients and servers
> Working with IEC 61850 Setting Groups via the smart screen
> Downloading files, for example, COMTRADE disturbance recordings over IEC 61850 file transfer
> IED simulation including GOOSE and Reports

Try out the software 30 days for free.
Visit our website for details: www.omicronenergy.com/iedscout

IEC 61850 Package   VESM1185

Each of the IEC 61850 testing tools can be purchased and used separately but since the different testing tasks typically come together, OMICRON also has bundled the most common tools in a package. It consists of

> GOOSE Configuration module
> Sampled Values Configuration module
> IEDScout

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[1] CMC 850 or CMC 356, CMC 256plus with Option LLO 2: three Sampled Values streams
CMC 353, CMC 356, CMC 256plus without Option LLO 2: two Sampled Values streams
CMC 430: one Sampled Values stream

Test Set — SVScout

Sampled Values

V, I

00010

Merging Unit
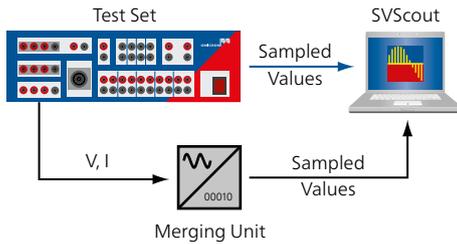
Sampled Values

SVScout

The OMICRON SVScout software makes Sampled Values visible for the substation engineer and IED developer. One important application of SVScout is testing merging units by comparing two SV streams. The accurate measurement of the merging unit's time synchronization is especially useful for developers.

SVScout subscribes to Sampled Values streams from merging units and displays the waveforms of the primary voltages and currents in an oscilloscope view. The data are displayed with their electrical units. Detailed values on the traces can be looked up and compared with each other utilizing the cursor functions. The RMS values and phase angles are calculated from the Sampled Values and displayed in a phasor diagram and a measurement table.
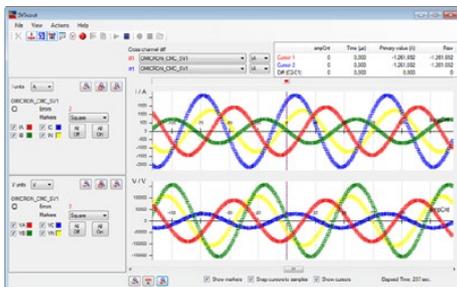
Captured Sampled Values can be saved in COMTRADE files for further in-depth analysis. Expert functions provide even more details on the received data, such as the detailed decoding of the quality codes.

Network traffic saved in PCAP files[1] can be opened in SVScout and analyzed as if it was received online.

When used with a special network adapter, the SVScout can provide accurate details about the time distribution and jitter of the data packets and, when synchronized with the merging unit, also about the propagation delay in the communication network.

Ordering Information

Order No.	Delivery contents
VESC1510	SVScout Standard
VESC1511	SVScout Enhanced (with special network adapter)

CMC 850 Package   VE008501

The CMC 850 is OMICRON's protection test set dedicated to IEC 61850. It focuses on the real-time communication methods of GOOSE and Sampled Values to interface with the devices under test. The test set works with the proven Test Universe software and offers even more useful functions embedded directly in the device.

The CMC 850 Package comprises optimized hardware and the key software components from the Test Universe software, making it "ready to go" for time synchronized testing with GOOSE and Sampled Values:
Hardware: CMC 850 device and CMIRIG-B interface unit for time synchronization
Software: IEDScout, GOOSE Configuration module, and Sampled Values Configuration module, QuickCMC, State Sequencer, and OMICRON Control Center.

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[1] File format for saving captured network traffic as produced by many network tools (e.g. Wireshark®)