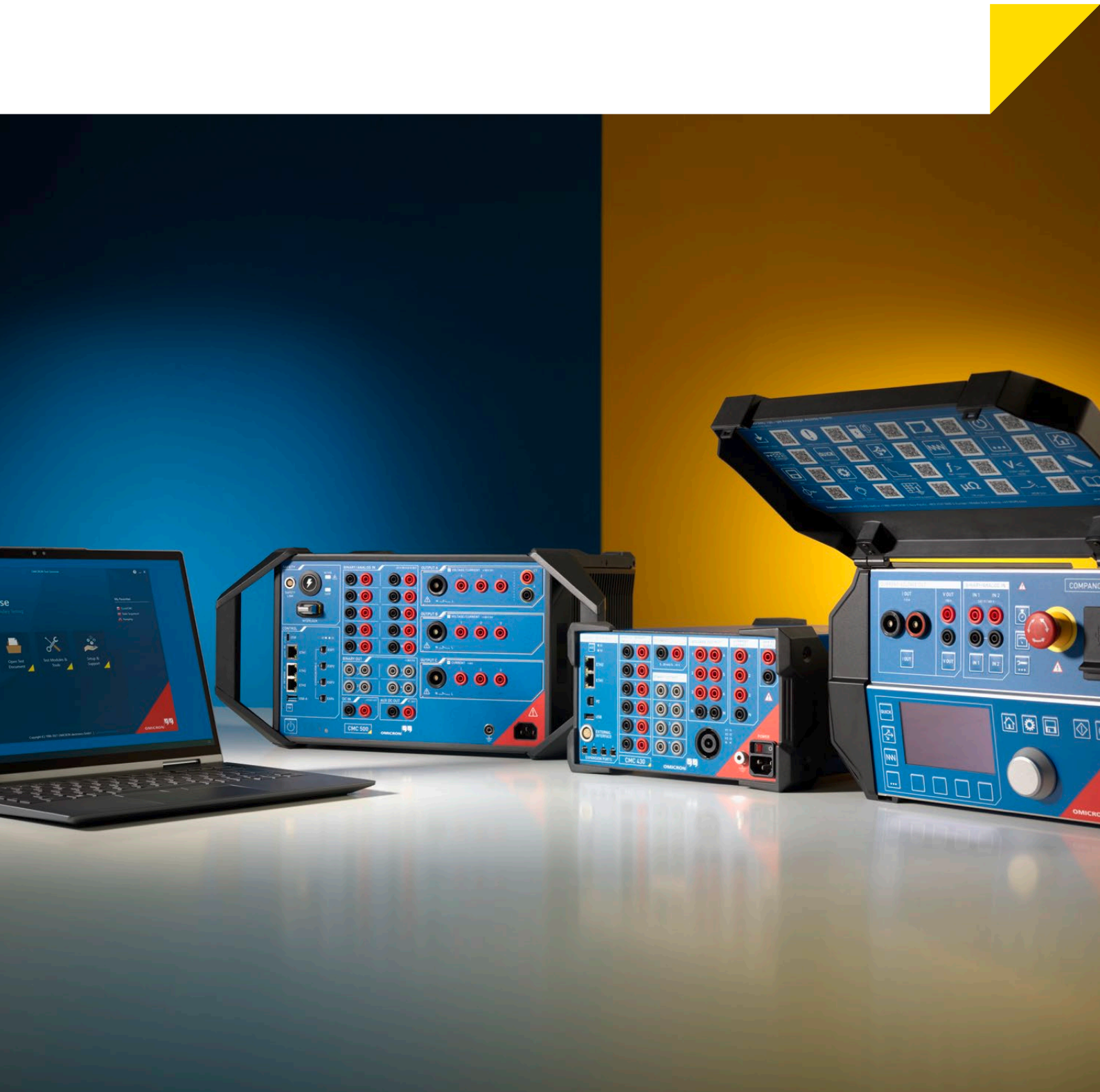




# Testing Solutions for Protection, Automation and Control Systems

Product Catalog



## **The company**

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OMICRON is an international company serving the electrical power industry with leading testing solutions. The application of OMICRON products allows users in more than 170 countries to test their protection, measurement, and primary equipment with complete confidence.

### **Continuous innovation**

For more than 40 years, innovations from OMICRON have set new standards in secondary injection testing. The CMC test equipment led the way with many advances such as the first use of the phasor diagram, the first IEC 61850 implementation and many more, while RIO, the Relay Interface of OMICRON, and its successor, XRIO, established yet another industry standard. With the patented OMICRON Control Center technology, automated testing of protective relays was revolutionized. With the future-oriented system-based protection testing approach, users can easily achieve a particularly high depth of testing.

### **Excellent knowledge base**

OMICRON's engineers understand the needs of their customers and continue to develop solutions for the world's power systems. Regular user meetings provide platforms for the exchange of information and experiences. OMICRON shares this expertise through its membership of many international standardization bodies. The provision of extensive expert knowledge and worldwide application oriented training helps customers to achieve cost effective testing and commissioning.

### **First class quality**

Customers rely on the company's ability to provide products of the highest quality which OMICRON is constantly striving to achieve. The commitment and unique spirit of a team of excellent employees is the company's greatest asset. Winning the "Great Place to Work" award represents international recognition of the standards it attains in its working environment.

### **Extraordinary customer support**

With an extensive network of company offices, distributors and representatives around the world, OMICRON is always accessible to its customers for individual attention. Extraordinary customer support and long term customer relationships ensure trust and successful co-operation.

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# CMC Test Set Overview

Making use of leading-edge technology in both development and quality assurance, OMICRON sets new standards for advanced secondary testing equipment in terms of flexibility, accuracy, portability and reliability. Depending on their requirements in this field of application, users can choose the ideal device from the CMC test set family<sup>1</sup>.

Various operating options are available for the CMC devices:

- > The high-performance PC software **Test Universe** offers an enormous range of functions with its numerous application-optimized test modules and the Protection Testing Library (PTL). Flexible combination options in test plans allow for a high degree of time-saving automation.
- > With **RelaySimTest**, users can easily achieve a high depth of testing due to its system-based approach with an integrated network simulation.
- > With **CMControl P**, an option for manual testing is provided which is ideally suitable for quick and easy testing.
- > **CMC Swift** is designed for convenient and wireless control of a CMC test set with a mobile device.
- > For special fields of application, users can develop their own operating programs for CMC test sets with the programming interface **CMEngine**.

The control of the CMC test set is established via wired Ethernet, USB or Wi-Fi<sup>2</sup>.

## CMC 500 – Modular multi-phase protection relay and commissioning test set



The CMC 500 is the perfect choice for efficiently tackling current challenges in the field of protection technology, such as an aging infrastructure, the necessary expansion of power grids, and the increasing skills shortage. This lightweight, robust test set delivers a consistently high level of testing quality and allows for a full validation of the protection system in minimal time. The versatile solution is unmatched when it comes to safety, cybersecurity, and future viability. The CMC 500 fits individual needs and applications perfectly. The device is available in five different variants consisting of four powerful and precise generator modules. Up to ten currents and seven voltages as well as ten measuring inputs (binary and analog) are available for testing purposes. Each variant can be configured with purely binary measuring inputs (available soon) and an additional DC measuring input as an option.

- > 6 x 60 A / 450 W + 4 x 30 A / 200 W
- > 1 x 450 A / 3195 W
- > 7 x 300 V / 115 W

Specification values vary by device variant

<sup>1</sup> Find detailed ordering information and package descriptions on [www.omicronenergy.com](http://www.omicronenergy.com).

<sup>2</sup> Wi-Fi is subjected to technical and legal constraints. For more information please contact your local OMICRON office or sales partner.

### CMC 430 – Ultra-portable protection test set and calibrator



The CMC 430 is the preferred choice for test engineers in cases where transportability is a priority and three currents up to 12.5 A and six 150 V voltage outputs are sufficient. With its low weight of just 8.7 kg (19.2 lb) and the robust design with protected edges, the device is perfect for indoor and outdoor use. With an extraordinarily high precision, it is also an ideal source-based calibrator for all kinds of measurement devices such as energy meters, transducers, PQ meters, and PMUs. The CMC 430 combines its outstanding performance as a relay tester and calibrator with hybrid measurement and recording facilities (analog, binary, IEC 61850 GOOSE messages and Sampled Values).

- > 3 x 12.5 A / 96 VA
- > 1 x 37.5 A / 150 VA
- > 6 x 150 V
- > Error < 0.015 % (rd.) + 0.005 % (rg.) typ.



### CMC 310 – Compact protection test set for easy manual testing

The CMC 310 is specifically designed for manual three-phase testing of protection and measurement devices with CMControl P. The lightweight and compact design makes the CMC 310 particularly suitable for testing distribution and industrial systems.

- > 3 x 32 A / 430 VA
- > 1 x 64 A / 860 VA
- > 3 x 300 V



### CMC 850 – Protection test set dedicated to IEC 61850

The CMC 850 focuses specifically on IEC 61850 systems. It communicates with the test object using the real-time protocols GOOSE and Sampled Values. The test set is operated either with the Test Universe software or with RelaySimTest. Because of its focus on IEC 61850 applications, the device is particularly small and lightweight.

# Operating Options



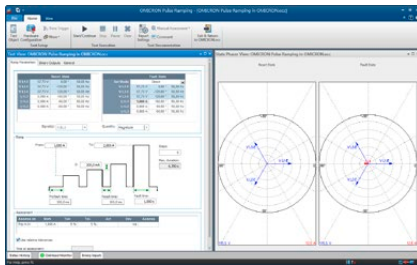
## Test Universe

The powerful Test Universe PC software releases the full potential of the CMC test sets<sup>1</sup>. It offers a wide range of application-optimized test modules, enabling the user to achieve a high degree of automation and standardization. Users have access to OMICRON's extensive test template library, or they can create comprehensive test plans themselves or order customized templates from OMICRON.

### Testing of specific protection and measurement functions

Test Universe provides a variety of automated testing possibilities in dedicated modules especially designed for individual test object functions, e.g. for testing overcurrent relays, distance relays, or differential relays.

In these modules, a specific graphic representation of the protection device's characteristic (I/t diagram, impedance plane, etc.) allows the graphical definition of test specifications as well as the visualization of the test results directly in the relay's characteristic diagram. Tailor-made test modules are also available for meters, transducers and power quality meters/analyzers.



### General functionality

For creating and performing special tests not covered by the function related modules, the Test Universe software also comprises generic test modules.

Such tests, for instance, can be:

- > sequences of output states – controlled by time or the reaction of the relay under test with assessments based on time measurements
- > linear or pulsed ramping of electrical quantities with assessment based on the level of starting or resetting
- > manual testing by direct setting and output of voltage and current values, phase angles, frequencies, etc. either numerically or in the phasor diagram.

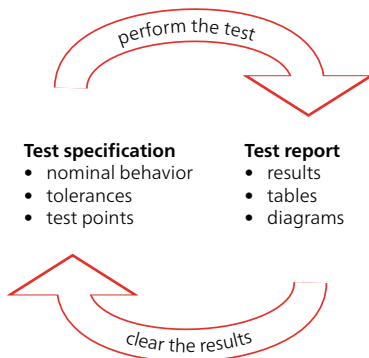
Besides the generic test modules, OMICRON offers a wide variety of additional software that works with the CMC test sets (e.g. IEC 61850 testing solutions).

### OMICRON Control Center – Test plans for multifunctional test objects

In order to test the many functions of digital relays, the OMICRON Control Center (OCC) technology allows the combination of individual test modules into an overall test plan. When performing a test, each embedded module will be executed sequentially and an overall test report including the results of all the functions tested is created automatically.

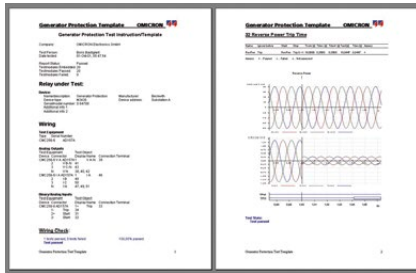
Since the test documents hold the complete test specification – i.e. the nominal behavior (settings) of the test object, the tolerances and the test points, with which this shall be verified – such a document is the basis for the repetition of the same test at a later time by reloading it, clearing the results of the previous test, replaying the test plan and saving the new results.

Thereby tests, which have been created once, can be repeated for maintenance testing. This assures a constant testing quality, facilitates comparison of results, and saves time when performing routine tests. Existing tests can also be adapted easily to test similar test objects.



<sup>1</sup> CMC 500, CMC 430, and CMC 850

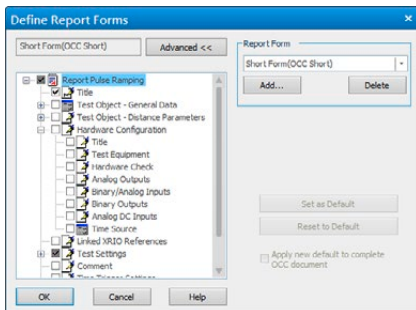




## Automatic reporting

All test modules of the Test Universe software have a common element – the reporting function: each module provides a fully formatted test report. Depending on the module the results come from, data is entered in tabular and/or graphical form. If several modules are used within the OCC to comprise a test, each module adds its specific piece of data to the overall report. After testing is finished, test results and assessments are entered automatically to complete the report. Reports can easily be printed, stored, or exported to standard office applications using Rich Text format (RTF) and TXT format.

Customizing test reports based on individual requirements is easy. The visible content of test reports can be defined independently from the recorded data, by just selecting or deselecting items from the list. Recorded data will always remain available in the test file, regardless of whether the user chooses to include them in the reports. Defined report settings are quickly and easily generated, saved with a form name, and reloaded at a later time; company specific elements like logos etc., can easily be included.



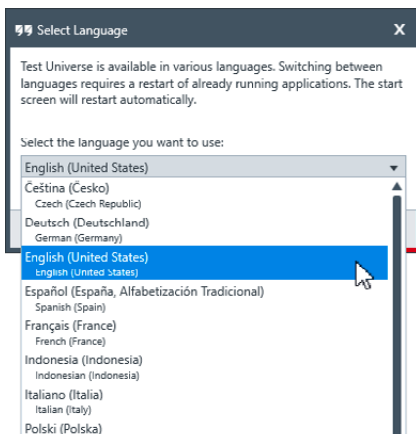
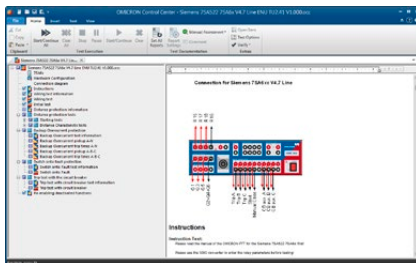
Exporting test results: Besides the standard export formats TXT and RTF for further use of the data, such as in Microsoft Word, OMICRON Control Center documents provide the following two export formats for more extensive external post-processing of test data: the well-known CSV format and XML (Extensible Markup Language). CSV and XML Data Export are also available in all test modules in stand-alone mode. XML is a text-based data format that supports a non-proprietary method of interfacing the test data with any third-party database (e.g. Microsoft Access, Microsoft SQL Server).

## Protection Testing Library

For mastering the challenge of testing modern multifunctional relays, OMICRON provides a library of protection testing templates, the Protection Testing Library (PTL). This library offers customers access to test plans preconfigured for the most common relays types of various manufacturers (ABB, Alstom, Areva, GE, Reyrolle, Schneider, SEL, Siemens, Toshiba, etc.), which include

- > relay modeling – i.e. calculation of the characteristics (such as zone diagram, ...) and tolerances from the relay settings – taking into account the technical characteristics as specified in the relay manual
- > import filter for importing setting values from the relay's software or from setting calculation tools
- > test routine for common relay functions.

This not only helps to save the time normally needed to manually create the relay characteristics and test templates but also let users benefit from OMICRON's testing know-how on how to model and test specific relays and their functions in the Test Universe software. New templates are continuously being added to the PTL and are available for customers to download from the OMICRON website.

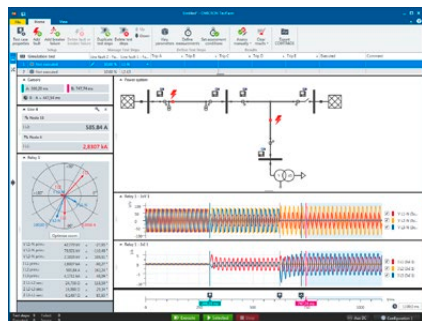


## Languages

Test Universe is available in 16 standard languages. Changing the system language is possible at any time just by selecting the requested language in the "language selection". All languages are automatically installed; no installation of any additional software components is required.

Especially in international projects, clients many times wish to get a report in a different language than the commissioning engineer's preferred working language. This is easily possible for all available standard languages. When the system language is changed and an existing test document is re-opened, the test report is automatically switched to the new system language set.

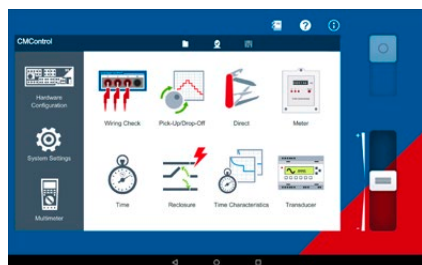
# Operating Options



## RelaySimTest

RelaySimTest is a software solution for system-based protection testing with OMICRON test equipment that takes a novel, future-oriented approach: the test is independent of relay type and relay manufacturer and the often very extensive parameter settings. Instead, it completely focuses on the correct behavior of the protection system. This is made possible by simulating realistic events in the power system. With RelaySimTest's flexible grid editor, power networks can be simulated intuitively.

Compared to conventional test methods (such as settings-based testing with Test Universe), RelaySimTest can detect errors in the settings, logic and design of the protection system much better. This allows testers to verify the correct behavior of their protection system faster and with a higher testing quality than ever before. Complementary to testing with Test Universe, RelaySimTest contributes to a more reliable power system.



## CMControl P

CMControl P is a control option for CMC test sets which is specifically designed for easy manual testing of protection and measurement devices. It is available as an App for Windows PC or Windows tablets and as a dedicated front panel control device. The included test tools with integrated fault models guarantee quick and convenient tests. Due to its intuitive user interface and innovative user guidance there is no need for special training.

CMControl P can be ordered with a CMC test set either standalone or in combination with a Test Universe package (see pages 9 and 29).



## CMC Swift

CMC Swift is a control option for CMC test sets designed for convenient and wireless operation. With CMC Swift, you can output analog voltages and currents via your CMC and feed in or measure binary signals. Wiring and control system checks, as well as pickup and trip tests of protective functions, can be performed quickly and easily.

Thanks to its intuitive user interface, no special training is required. CMC Swift offers maximum freedom and comfort, allowing you to perform simple checks without the need for a laptop. It is also perfectly suited for polarity and wiring checks, especially when used with the CPOL3 accessory.

You can download the CMC Swift app from the App Store (for iOS) or Google Play Store (for Android).



# Test Universe Package Overview

For the combination of CMC test sets (CMC 500, CMC 430) and Test Universe software, four different packages as well as optional add-ons are offered, which are tailored to diverse focal points of use. Each of these packages contains a selection of software modules that can be either used independently from each other for single tests or be embedded into test plans for automated testing:

		Packages			
		Essential	Standard	Enhanced	Complete
<b>Essential</b>	offers a good introduction with basic functions and modules; can serve as a base for custom compiled packages				
<b>Standard</b>	contains all modules that are typically used for settings-based testing of protection devices				
<b>Enhanced</b>	like Standard, specifically extended by functions for system-based testing and transient simulation as well as for free programming				
<b>Complete</b>	covers all functions and software modules that are offered for controlling CMC test sets				
A package can be extended at any time by ordering additional single modules or optional add-ons.					
Test Universe modules	OMICRON Control Center <sup>1</sup>	Automation tool, document-oriented test plan, template and report form	■	■	■
	QuickCMC	Convenient manual testing in the Test Universe environment	■	■	■
	State Sequencer	Determining operating times and logical timing relations by state-based sequences	■	■	■
	Harmonics	Generation of signals with superimposed harmonics	■	■	■
	CB Configuration	Module for setting the CB simulation	■	■	■
	Ramping	Determining magnitude, phase, and frequency thresholds by ramping definitions	■	■	■
	TransPlay	Playback of Comtrade files, recording of binary input status	■	■	■
	Advanced TransPlay	Playback of Comtrade files, recording of binary input status, processing options and automatic assessment	□	■	■
	Pulse Ramping	Determining magnitude, phase, and frequency thresholds by ramping definitions	□	■	■
	Overcurrent <sup>2</sup>	Automatic testing of positive/negative/zero sequence overcurrent characteristics	□	■	■
	Distance	Impedance element evaluations using single-shot definitions in the Z-plane	□	■	■
	Advanced Distance	Impedance element evaluations using automatic testing modes	□	■	■
	VI Starting	Testing of the voltage dependent overcurrent starting function of distance relays	□	■	■
	Autoreclosure	Testing of the autoreclosure function with integral fault model	□	■	■
	Advanced Differential <sup>3</sup>	Comprehensive three-phase differential relay testing (four modules)	□	■	■
	Annunciation Checker	Verification of the correct marshalling and wiring of protection devices	□	■	■
	Power	Testing with visualization and assessment in the P-Q plane (basic)	□	■	■
	Advanced Power	Testing with visualization and assessment in the P-Q plane (enhanced)	□	■	■
	Transient Ground Fault <sup>4</sup>	Simulation of ground-faults in isolated or compensated networks	□	□	■
	Synchronizer	Automatic testing of synchronizing devices and synchro-check relays	□	□	■
IEC 61850	Meter	Testing of single and multifunction energy meters	□	□	■
	Transducer	Testing of measurement transducers	□	□	■
	PQ Signal Generator	Simulation of power quality phenomena according to IEC 61000-4-30 and IEC 62586	□	□	■
	IEC 61850 Client/Server	Automatic SCADA testing in accordance with IEC 61850	□	□	■
Additional tools	GOOSE Configuration	Testing with GOOSE according to IEC 61850	□	□	■
	Sampled Values Configuration	Testing with Sampled Values according to IEC 61850-9-2 ("9-2 LE") and IEC 61869-9	□	□	■
	IEDScout	Universal software tool for working with IEC 61850 IEDs	□	□	□
	CMControl P App <sup>5</sup>	Quick and easy manual testing of protection and measurement devices	□	■	■
	CMC Swift <sup>6</sup>	Easy and intuitive tool for simple protection and wiring checks	□	■	■
	RelaySimTest <sup>4</sup>	System-based protection testing by simulating realistic power system events	□	□	■
	Adv. Transformer Features	Advanced transformer features for differential protection	□	□	■
	Motor Features	Motor features for asynchronous motor simulation	□	□	■
	CMEngine	Programming interface for controlling CMC test sets with user specific software	□	□	■
	EnerLyzer	Analog measurements and transient recording with CMC test sets	□	□	■
	TransView	Transient signal analysis for COMTRADE files	□	□	■
	ADMO light <sup>7</sup>	Asset and maintenance management for protection systems	■	■	■

Contained in all packages: OCC Batch, AuxDC Configuration, ISIO Connect (for ISIO 200), Polarity Checker (for CPOL3).

<sup>1</sup> Includes licenses for Pause Module, ExeCute, TextView

<sup>2</sup> Includes license for Overcurrent Characteristics Grabber

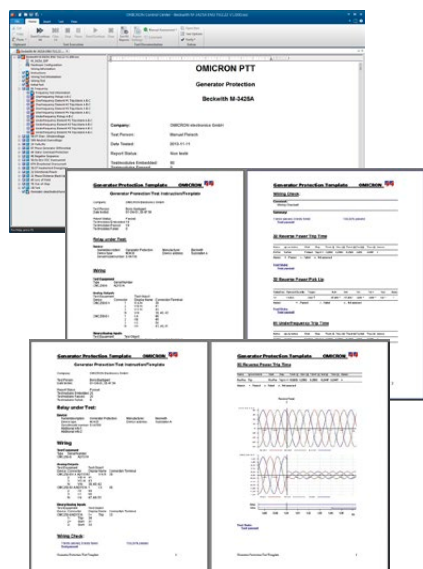
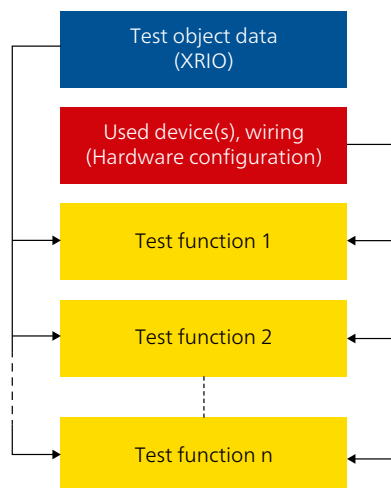
<sup>3</sup> Includes Single-Phase Differential

<sup>4</sup> RelaySimTest license also includes the licenses for Transient Ground Fault and NetSim

<sup>5</sup> Valid for CMC 430

<sup>6</sup> Valid for CMC 500

<sup>7</sup> ADMO light is limited to 50 assets but can be upgraded to a full ADMO version at any time



## OMICRON Control Center

Essential Standard Enhanced Complete

OMICRON's Test Universe software modules feature comprehensive functionality for conventional testing. With the patented OMICRON Control Center (OCC) technology (Patent Nos. EP 0904548 B1 and US 6418389 B2), they can be combined to test plans within a single document in a unique manner. Such test plans can easily be built, maintained and distributed.

Basically, an OCC document comprises the following elements:

Test object data	Defined in XRIO format, a powerful test object environment to describe/model all test object parameters and settings. Test object data can be entered manually or be imported. XRIO converters make the setting transfer from the relay to the test software fast and easy.
Information on the device(s), outputs and inputs, wiring connections	Specified in the Hardware Configuration. Present throughout a test plan for all embedded test functions/modules.
Test modules with test settings (test points, etc.)	Number and type of embedded test modules depending on the kind of the tests to be performed. Tests automatically adapt to changed test object settings, as these are transferred from the overall test object definition. With the LinkToXRIO technology, the user has access to all relay parameters – including user-defined additional settings – and can use them for the definition of the test points and assessment conditions.
Optional: Graphics, instruction texts, etc.	Guide the tester through the testing process according to test specifications (connection diagrams, check instructions, etc.) supported by Pause Module, Text View, ExeCute.
Report (after testing)	Automatically created test report, containing all test results in secure format with exact data. Automatic assessment of the test points according to tolerances. Customizable to meet the organization's requirements. Test results can be exported in RTF, TXT, CSV, and XML format.

## Re-usability

OMICRON Control Center documents can easily be used as templates for the same or similar test objects: Simply copying the OCC file, deleting the results of the previous test and restarting will perform the test again with the exact same settings, configuration, and test specifications. For similar tests, where only the settings differ (e.g. in substations with several feeders), simple copying of the OCC file and adjustment of the parameters is all that is required. Thus, testing times can be significantly reduced.

## Pause Module, Text View, ExeCute

Essential Standard Enhanced Complete

The following useful tools run within OCC and support the automation of test plans:

### Pause Module

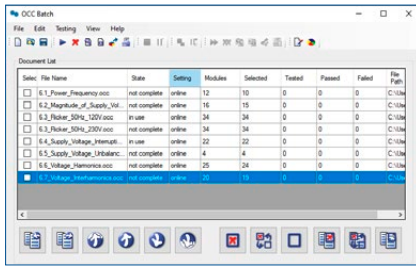
Allows the setting of breakpoints in automatic tests. Test designers can specify instructions to be displayed as pop-up messages (e.g. inclusion of a wiring diagram).

### Text View

Allows for embedding and displaying a text file or log file during an automatic text execution.

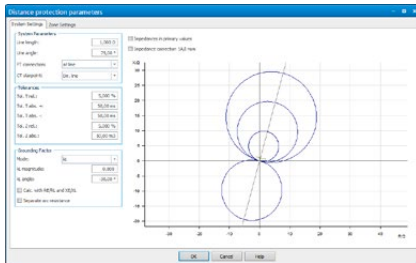
### ExeCute

Allows for execution of external applications (programs) along with file or data parameters during Control Center execution for an automatic test using an OCC document (e.g. automatic change of the relay settings during type testing).



## OCC Batch

This tool allows to run a number of Control Center (OCC) documents sequentially. It is particularly useful to perform acceptance testing with a high number of test plans.



## Test object definition with XRIO

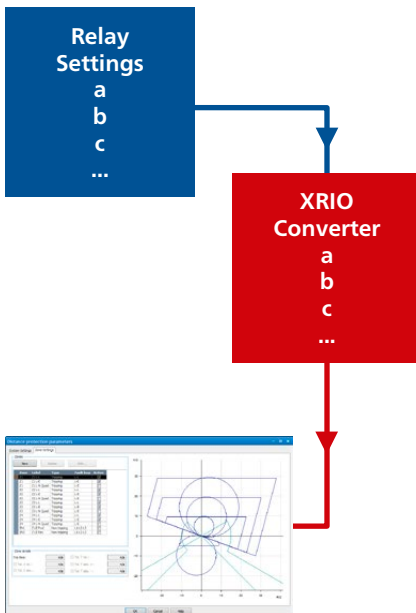
All the relevant data for a device to be tested is kept in the XRIO (eXtended Relay Interface by OMICRON) format. The corresponding data can either be manually entered or alternatively be imported. Test object parameters can also be exported, making them available for other test plans.

## LinkToXRIO

LinkToXRIO allow test modules the direct use of a defined test object parameter for testing. If a certain parameter changes, the test plans using it do not need to be modified. The test plans will perform their specified test then using the modified parameter.

## XRIO converters

XRIO converters allow for the efficient conversion of the data available in the relays' own parameter structure. The growing library of relay-specific XRIO converters provides data models of the protection characteristics and tolerances (e.g. impedance zones, I/t diagram shape, etc.) based on the protection parameters and technical details documented in the manual of the particular protection device.



## PTL – Protection Testing Library



OMICRON's innovative test software technology with the OMICRON Control Center, XRIO, and LinkToXRIO enables all users to create relay specific test templates that adapt to the actual parameterization of the relay. This is the technological basis of the Protection Testing Library (PTL). The library gives the protection engineers the possibility to benefit from the work that OMICRON spends to model multifunctional protection devices and to build test plans, and thus from the resulting testing know-how.

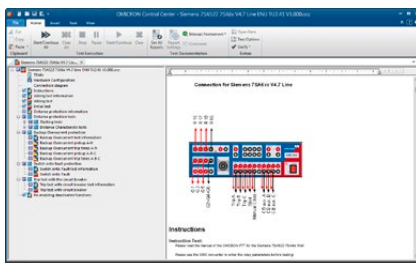
This library provides OMICRON customers free access to prepared test plans and relay models (XRIO Converters) as well as parameter import filters for specific protection devices. Any user can easily extend or customize the test plans or XRIO converters to meet individual requirements.

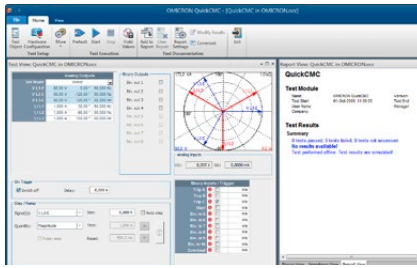
The PTL is extended and maintained on a constant basis. The library for example provides access to templates and XRIO converters for line, power transformer, and generator protection relays. Specific relay types of ABB, Alstom, GE, Mitsubishi, Reyrolle, Schneider, SEL, Siemens, Toshiba, and other manufacturers are supported.

## Benefits:

- > Save work and time: save the time it normally would take to manually create the relay characteristics and test templates. The relevant relay parameters can be readily entered into the XRIO converter to view and test against that particular relay's characteristics.
- > Parameter import: relay parameters can be transferred manually or automatically (e.g. by using the parameter import filters for the different relay types).
- > Knowledge source: often relays have special behavior that makes testing challenging and time consuming. By using PTL files users benefit from OMICRON's application know-how.
- > No programming: the PTL test templates do not require any programming or scripting.
- > Open system: the PTL templates and XRIO converters are completely open. In this way, users can adapt a template to exactly match their needs.

The PTL is integral part of the Test Universe software standard delivery and available for free download in the Customer Portal of the OMICRON website.





## QuickCMC

### Quick and easy PC controlled manual testing

- > Simultaneous control of all available test signals (voltage and current outputs) of the CMC test set in magnitude, phase, and frequency
- > Steady state, step or ramp function for all quantities
- > Fault Calculator providing different operation modes
- > Timing measurements
- > Vector view and impedance plane

QuickCMC provides an easy and intuitive user interface, while also offering powerful functions for performing PC controlled manual tests for all kinds of protection relays, measurement transducers and other equipment.

### Output functions

Output quantities can either be entered in the classical way as voltages and currents, or by using input modes for absolute or relative impedance values, powers or symmetrical components. They may be defined numerically, or by dynamically positioning the elements in the phasor diagram or the interactive impedance plane with the mouse.

### Fault Calculator

QuickCMC includes the Fault Calculator which automatically converts the entered values to determine the correct output quantities (voltage, current and phase angle) for single-, two- and three-phase faults, power flow, or symmetrical components. The residual voltage and current is also automatically calculated and generated. According to the selected mode, the values are displayed graphically in the vector or impedance view, as well as numerically in a table.

Channels where no fault model is assigned can be set without any restriction (unbalanced signal generation, variable frequency for each individual channel, etc.). The Unit Manager function allows for easy toggling between the handling of values in primary/secondary, absolute/relative, or seconds/cycles.

### Step or Ramp Mode

Step or Ramp Mode operation is provided for finding limiting values, such as pick-up and drop-off, or starting of a relay. In Step Mode, the selected quantities (currents, voltages, impedances, power, etc.) are increased or decreased by a specified value with a mouse click. In Ramp Mode, the defined step is repeated until an input toggles (e.g. when the relay trips). The pulse ramping functionality allows easy testing of protection elements with overlapping characteristics (e.g. testing the high level current threshold).

### Input/measuring functions

The test set's binary inputs can be used to monitor dry or wet contacts and make corresponding time measurements. In addition, virtual binary input signals (assigned to GOOSE messages) are supported.<sup>1</sup> The time measurement may alternatively trigger on the external interruption of the generated currents, allowing direct assessment of CB contacts. The output values of a transducer connected to the analog DC inputs can also be displayed.

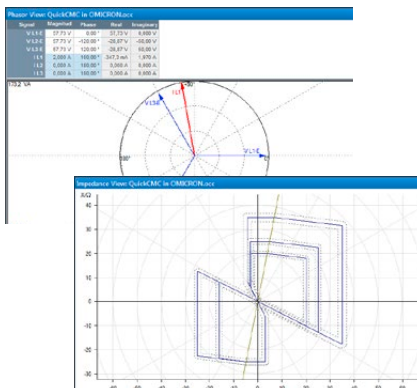
### Reporting

Results of tests with QuickCMC can be stored for later use. Similar to all other testing modules in the Test Universe software, the report style and content can be customized. In addition, the QuickCMC reporting feature provides a "notepad" function, so that individual comments may be added to the report.

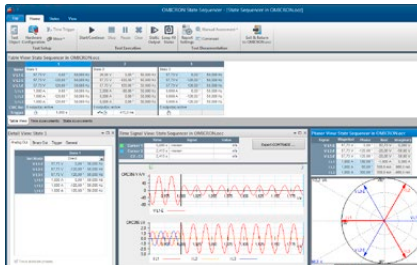
Analog Outputs			
Set Mode	Fault values		
Fault Type	L1-L2-L3		
V Fault	57,73 V	90,00 °	50,000 Hz
I; I Fault	2,000 A	10,00 °	50,000 Hz
Angle(V-I)		80,00 °	

Analog Outputs			
Set Mode	Z%-I const.		
Fault Type	L1-E		
Z%	10 %	Line length	
Phi Z	4,00 °	Link to line angle	
ITest	2,000 A		

Analog Outputs			
Set Mode	Powers		
S1 ( P1 , Q1 )	50,00 W	-16,67 var	50,000 Hz
S2 ( P2 , Q2 )	50,00 W	-16,67 var	50,000 Hz
S3 ( P3 , Q3 )	50,00 W	-16,67 var	50,000 Hz
Sv ( P , Q )	150,0 W	-50,00 var	50,000 Hz
V L1-E	57,73 V	0,00 °	50,000 Hz
V L2-E	57,73 V	-120,00 °	50,000 Hz
V L3-E	57,73 V	120,00 °	50,000 Hz



<sup>1</sup> GOOSE Configuration module is required



## State Sequencer

State Sequencer is a very flexible test module for determining operating times and logical timing sequences. A state is defined by the output conditions (voltages and currents, binary outputs) and a condition for the transition to the next state. Several individual states can be put together consecutively in order to define a complete test sequence. The transition from one state to the next may take place after a fixed time, triggered by a manual input, after the occurrence of a trigger condition at the binary inputs of the CMC, or after a PTP, GPS or IIRIG-B trigger (e.g. for synchronized end-to-end testing with multiple CMCs). Looping of the sequence or static output of individual states is also possible.

### Definition of individual states

Within one state, all configured test signals (voltage and current outputs) of the used test device can be set independently in amplitude, phase, and frequency. Besides the direct input of the individual voltages and currents, the integrated Fault Calculator allows the automatic calculation of the test quantities. These can be entered as fault values, power values, symmetrical components, or impedances (with constant test current, constant test voltage or constant source impedance model). For distance relays, test points can directly be defined in the interactive impedance plane showing the nominal characteristic of the test object.

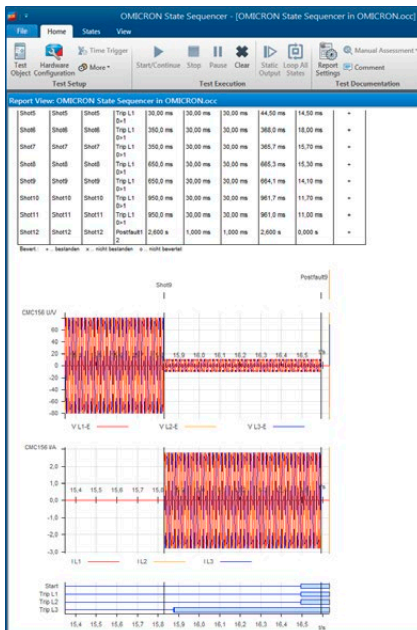
### Measurement

Time measurement conditions can be defined to check the correct operation of the relay. Individual response times and tolerances can be specified for each measurement condition, allowing a fully automatic assessment of the results. If the measured time is within the tolerance range, the test is "passed"; otherwise, it is "failed".

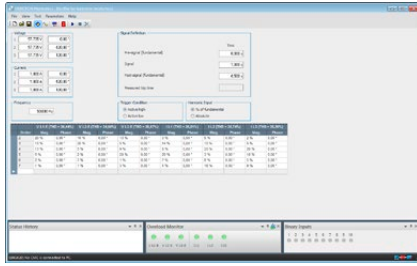
Apart from timing measurements (always triggered by an event, e.g. a trip) state assessment(s) can be made. A state assessment is positive, if defined states at the relay outputs connected to the binary inputs are logically true throughout a certain state.

### Assessment and reporting

The measurement conditions are displayed in a table. After a test execution this table also contains the actual measured times and deviations and the automatic assessment of the results. The last column contains the "passed" or "failed" information. All of the time signals (voltages, currents and binary inputs) can be displayed graphically to aid in studying the reaction of the relay. Signals can be enabled individually, with the ability to zoom in on specific points in time. Data cursors facilitate scrolling through the time signals to find the values at specific times.







## Harmonics

Essential   Standard   Enhanced   Complete

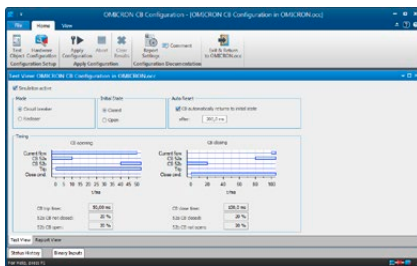
Harmonics generates test signals consisting of a fundamental voltage or current signal and superimposed harmonics. Signals with a frequency of up to 3 kHz (i.e. 60<sup>th</sup> harmonic at 50 Hz or 50<sup>th</sup> harmonic at 60 Hz) may be generated.

Harmonics allows defining the fundamental of three voltage and three current signals, and – superimposed on those – any combination of even and odd harmonics. The harmonics thereby can be entered either in percentages or absolute values. Harmonic signals can be output directly or exported as COMTRADE files.

Harmonics features both a static output mode and a sequence mode. In sequence mode a sequence consisting of three states can be injected:

1. Pre-signal: fundamental wave
2. Signal: fundamental wave and harmonics
3. Post-signal: fundamental wave

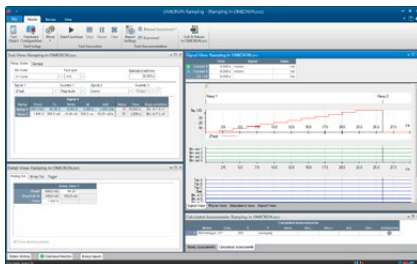
A timer starts at the moment of harmonic injection and stops on a trigger event. The response time is indicated.



## CB Configuration

Essential   Standard   Enhanced   Complete

CB Configuration simulates the auxiliary contacts of a circuit breaker (CB) or recloser during a test (for relays requiring a connection and operation of those contacts for proper functioning). Depending on the available binary inputs and outputs, it is possible to simulate one-pole and three-pole operation of the CB. The set time response of the circuit breaker is visualized in the test view of the module. The actual simulation is controlled by the CMC firmware, allowing real-time responses of the simulated auxiliary CB contacts (52a, 52b) to trip and close commands.



## Ramping

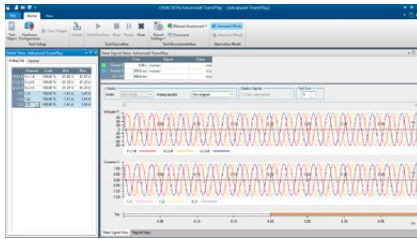
Essential   Standard   Enhanced   Complete

Ramping determines threshold values, such as minimum pick-up or switching hysteresis (e.g. pick-up/drop-off ratio). It generates ramps of magnitude, phase, or frequency for the current and voltage outputs. Automated tests can be performed with ramps that allow testing of both simple and complex functions. The flexibility of this module allows two synchronized simultaneous ramps of different variables (including ramping two components of the same output signal, e.g. magnitude of fundamental and harmonic) with any number of ramp segments.

Features:

- > Automated testing using ramp sequences
- > Simultaneous ramps for two independent variables and functions (e.g. V/Hz)
- > Definition of an arbitrary number of consecutive ramp segments
- > Visual control of the output values (time signal view)
- > Test repetition feature with statistic calculations
- > Ratio calculations of the two ramp values, e.g. pick-up/drop-off ratio
- > Unique step-back feature for quick and accurate testing
- > Display of the test results with automatic result assessment





## TransPlay

Essential   Standard   Enhanced   Complete

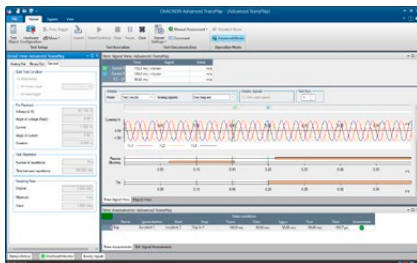
TransPlay<sup>1</sup> enables the CMC to test with transient signals. Transient signal data, obtained from fault recorders, CMC test sets with EnerLyzer, or network simulation programs, can be loaded, viewed, and replayed with TransPlay. The reaction of the protection device tested with such signals is recorded, can be assessed, and a test report is generated.

This makes it an ideal tool for:

- > troubleshooting with fault records
- > relay evaluation with transient files (e.g. EMTP calculations)
- > end-to-end testing

TransPlay support the following file formats:

IEEE COMTRADE (IEEE C37.111-1991/1999 and 2013) respectively IEC 60255-24, PL4 and CSV.



## Advanced TransPlay

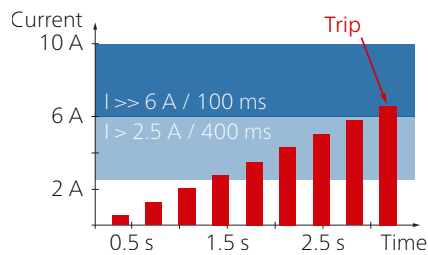
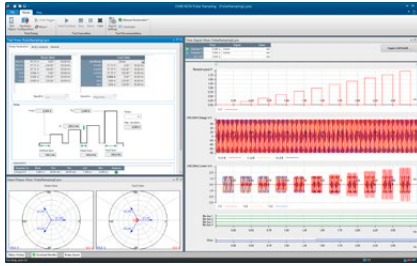
Essential   Standard   Enhanced   Complete

Advanced TransPlay<sup>2</sup> offers additional features, e.g.:

- > Marking of events
  - Markers can be set to point out significant events in the recording, such as fault inception, starting, tripping, etc. These markers are the basis for time measurements.
- > Automatic Assessment
  - Automatic assessment of the relay behavior is done based on time measurements of binary input triggers. Absolute and relative time measurements are possible:
    - Absolute time measurements determine for instance starting or trip times of the relay during signal playback.
    - Relative measurements compare the relay's reaction during playback to a defined reference.
- > Processing of transient signals to be replayed
  - It is possible to change e.g., amplitudes of the signal or to repeat parts of the signal, e.g., for extending a pre-fault time.
- > Binary output signals
  - Advanced TransPlay can replay the binary signals in a fault recording via the CMC's binary outputs. Additional binary signals (e.g., carrier send/received signals from communication-based schemes) can be added.
- > Time Synchronization
  - Playback can be synchronized via PTP, GPS, IRIG-B protocol or by a time pulse applied to a binary input.
- > Repetition mode
  - The individual results for each repetition, as well as average and standard deviation values (statistic functions), are displayed.

<sup>1</sup> The TransPlay features are available in the (Advanced) TransPlay test module when the Standard Mode is selected

<sup>2</sup> The Advanced TransPlay features are available in the (Advanced) TransPlay test module when the Advanced Mode is selected; this mode requires the corresponding license



## Pulse Ramping

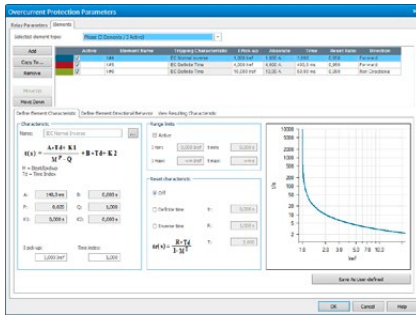
With Pulse Ramping, quick, accurate and thorough determination of pick-up values of multifunctional relays is easily done. Pulse Ramping allows for testing a protection element pick-up value without disabling associated functions. This eliminates a potential source of error. The use of Pulse Ramping also avoids high continuous testing current for electromechanical relays with high instantaneous settings.

Typical applications: Pick-up testing of

- > multifunctional relays with overlapping elements
- > overcurrent relays with multiple elements
- > generator and motor protection
- > rate of change relays (including  $df/dt$ )

Application example Overcurrent:

Often overcurrent protection is realized with two stages; a standard stage with a longer tripping time and a high set stage with a very short trip time. With Pulse Ramping, a test of the pick-up value of the high set stage can be done easily: the pulse length is set shorter than the standard stage tripping time and so pulse ramps do not force a trip of this stage.



## Overcurrent

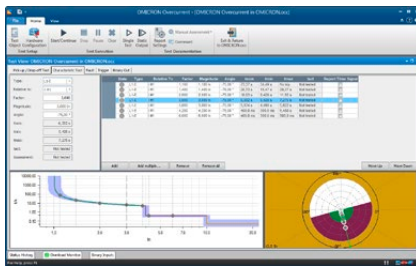
Essential   Standard   Enhanced   Complete

Overcurrent is used for automatic testing of directional and non-directional overcurrent relays with auto-assessment of the trip time characteristic, the directional boundaries of the current stages, and the pick-up/drop-off ratio. With its flexible directional boundary definition it is also perfect for testing the characteristic of steady-state ground fault relays.

The test module supports directional sector definition and any number of line, ground, positive sequence, negative sequence, and zero sequence elements. For each element the trip characteristic can be individually selected and displayed in the I/t diagram and the directional diagram.

In Overcurrent, the set of test shots can be defined concurrently for all desired fault loops. This is possible for the following fault types:

- > Line-to-line fault
- > Line-to-ground fault
- > Line fault with suppressed residual current (for individual phase testing without ground starting)
- > Negative sequence
- > Zero sequence

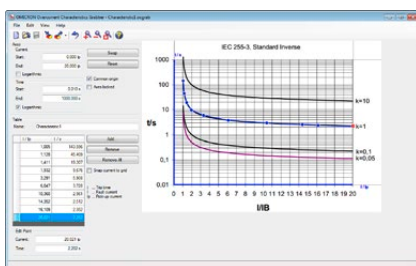


The software overlays the characteristics of each of the elements in both the I/t diagram and the directional diagram. This includes all of the elements which respond to the type of fault applied. For each test shot an assessment of the relay's performance is made based on the allowable tolerances for the measurement of the current and the operating time.

### Key features

- > Unrestricted characteristic element definition (characteristic type, directional sector)
- > Assessment for each test shot considering all active elements
- > Simultaneous availability of all element types and characteristics
- > Testing of all fault types and loops together in one test module
- > Definition of test point sequences (in terms of fault type, current magnitude variation, and current angle variation)
- > Testing of the pick-up/drop-off characteristic with automatic assessment
- > Testing with or without load current
- > Automatic reporting

The time characteristics can either be entered directly in current/time tables or based on a wide range of pre-defined relay and recloser characteristics. Hierarchically structured templates for the following relay characteristics are included: inverse-time characteristics as defined by IEC 60255-4 (BS 142), IAC type characteristics, and relay specific curves based on the IEEE equation (PC37.112). Variants of these characteristics support commonly used relay types. Additional variants may be added to the template file, including curves digitized with the Overcurrent Characteristics Grabber (see below). PTL test templates add relay-specific support by mapping the relay settings to the Overcurrent module parameters and providing sample test sequences.

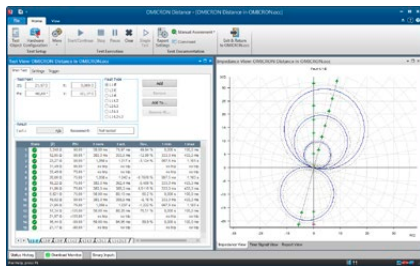


## Overcurrent Characteristics Grabber

Essential   Standard   Enhanced   Complete

The Overcurrent Characteristics Grabber tool is a supplement to the Overcurrent test module. It helps to extract inverse-time overcurrent relay tripping characteristics from graphical representations. This is most helpful in cases where the characteristic is not known by a given formula but only by a graphical representation, e.g. an image in a relay manual.

This tool loads a scanned image of the characteristics and guides the user through scaling of the I and t axes and successive digitizing of I/t data pairs along the displayed tripping characteristic curve. The resulting characteristics curve value table then is transferred to the Overcurrent test module for performing tests with automatic assessments.



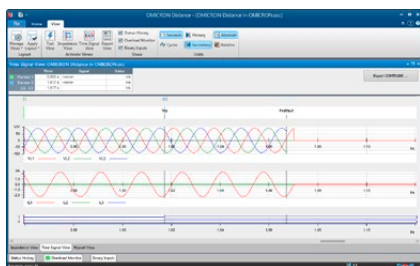
## Distance

Essential Standard Enhanced Complete

Distance provides the functionality to define and perform tests of distance relays by impedance element evaluations using single-shot definitions in the Z-plane with graphical characteristic display.

### Definition of relay characteristics

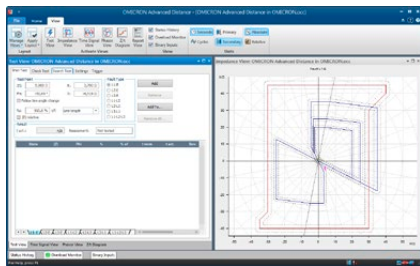
The nominal relay characteristics and settings can quickly and easily be defined by a graphical characteristic editor. Starting, trip, extended, and no-trip zones are defined by using pre-defined elements. A complete overview of all defined zones is provided. The standard XRIO interface (see page 11) makes it possible to directly import the relay data from the relay's parameter setting software (if supported by the relay manufacturer). The impedance settings for the zones can be entered and displayed in primary or secondary values.



### Definition of tests

Tests are defined in the impedance plane by entering the test points to a test point table. This table is divided according to the different fault loops (A-N, B-N, C-N, A-B, etc.). Test points can be defined for several fault loops at the same time (e.g. for all single-phase loops), or for every fault loop separately.

When a test is performed, the test point lists of the individual fault loops are processed sequentially. The reaction of the relay is compared to the specified nominal settings and an automatic assessment is made ("passed" or "failed"). The results are displayed graphically in the impedance plane, as well as numerically in the test point table. For a more in-depth analysis of the results, the voltages and currents related to a test point and the relay's reaction can be graphically displayed. Time measurements between different points can be made using cursors.



## Advanced Distance

Essential Standard Enhanced Complete

In addition to the base functionality of Distance, Advanced Distance provides the following advanced functionality:

- > Search and Check tests of the zone reaches
- > Test settings relative to zone reaches and line angle ("relative shots")
- > Constant source impedance test model
- > Load current superimposition

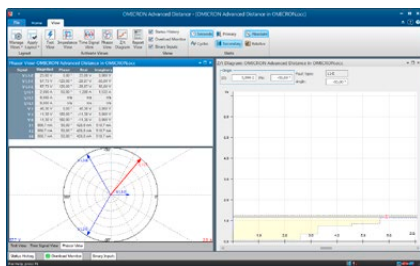
### Shot test, Search test, and Check test

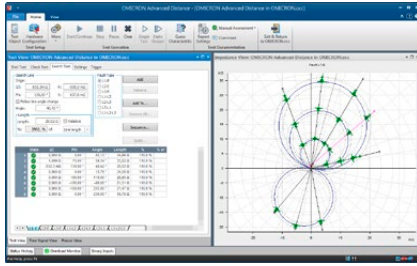
In a Shot test, single test points are added to a test point table and are automatically processed (see Distance).

In a Search test, zone reaches are determined automatically. Zone transitions are searched along search lines specified in the impedance plane, using an optimized algorithm. It is possible to define a series of search lines. All defined search lines are stored in a table for automatic processing.

In a Check test, test points are automatically set at the tolerance boundaries of zones. The setup is done with test lines (check lines) similar to a search test, but test points are only set at the intersections of the check lines with the zone tolerances. The Check test is an efficient overall test of the relay with minimum testing time. This gives a quick verification of whether the specifications are met, particularly for routine tests.

Adding test points and test lines to the tables is possible in a variety of ways. Parameters can be precisely defined by numerical inputs, or specified directly in the characteristic diagram. A magnetic cursor supports the choosing of meaningful values. Mouse commands, context menus and keyboard shortcuts facilitate data input.



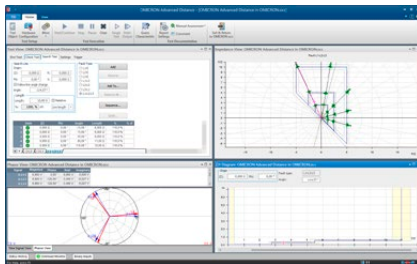


## Advanced Distance (continued)

A test in Advanced Distance can have any combination of Shot, Search, or Check tests. At test execution, the whole test settings are executed sequentially. This versatile system offers a wide range of testing possibilities. Using this, it is easy to comply with a wide variety testing philosophies and regulations.

### Relative test definitions

A powerful feature is the possibility to make test point definitions relative to the nominal characteristic of the distance relay (e.g. 90 % of zone 1, 110 % of zone 1, 90 % of zone 2,...). Test points are not entered in absolute R, X, Z, or angle values, but are referred to zone reaches and the line angle instead. This feature allows the creation of re-usable test templates, which adapt themselves to the actual relay settings.



### Constant source impedance model

Besides the constant test current and constant test voltage models, Advanced Distance provides the constant source impedance test model which is useful in special cases where parameters such as SIR (Source Impedance Ratio) are important.

### Load current

To verify special behavior of certain relays which occurs only when a pre-fault (load) current is present (e.g. accelerated tripping performance), a load current can be superimposed.

### Testing multiple fault loops in one test module

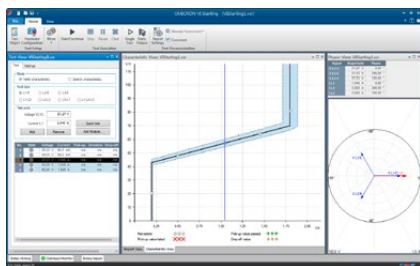
Advanced Distance provides special support by performing the tests for multiple fault loops (L-N, L-L and L-L-L) within one test module. For all test modes (Shot, Search, Check) multiple tabs are provided with a separate test point table for every fault type. Test settings can either be entered fault-loop-specific or defined simultaneously for multiple fault types.

### Distance Characteristic Guesser

If the nominal characteristic of a relay should be unknown or the actual characteristic shape is to be documented, a guesser function allows the automatic generation of an approximated characteristic based on the results of a Search and/or Shot test. The calculated characteristic can be saved and further used as the relay's nominal characteristic.

### Z/t Diagram

This view shows the graded trip time curve over the impedance along a certain line. The actual line is determined in the impedance plane or by a selection in the test tables. It is also possible to define test points and to view the assessments in the diagram.



## VI Starting

Essential ☐ Standard ☒ Enhanced ☒ Complete ☒

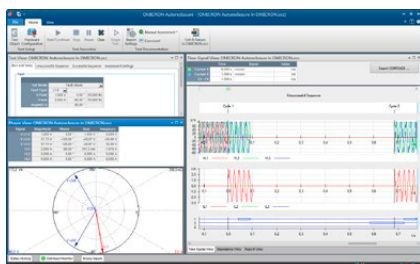
VI Starting tests the voltage dependent overcurrent starting characteristic used in many distance relays. Additionally, it is a perfect tool for many tests on overcurrent and undervoltage functions. For any specified test point, it detects the pick-up value, the drop-off value, and the ratio.

### Benefits

- > Automatic finding of characteristics
- > Automatic testing according to specified characteristics
- > Automatic determination of pick-up and drop-off values
- > Separate characteristics for phase-to-ground and phase-to-phase starting
- > Intuitive operation with graphical representation of the test
- > Clear representation of results in tabular and graphical form

### Features

- > Easy fault specification with fault type and fault quantities
- > Generation of realistic test quantities with models for phase-to-ground, two-phase and three-phase faults
- > Phasor view with additional numeric display of the test quantities



## Autoreclosure

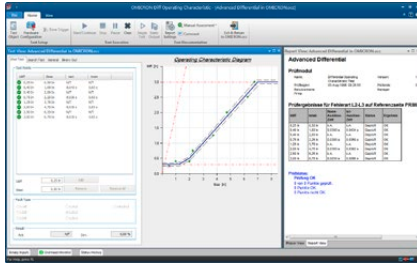
Essential ☐ Standard ☒ Enhanced ☒ Complete ☒

Configuration of the test sequences for the autoreclosure (AR) function of protection relays is both effective and time saving. Autoreclosure automatically sets up test conditions for successful and unsuccessful sequences. Essential criteria, like the three-phase final trip at the end of an unsuccessful sequence are automatically evaluated as well.

Overcurrent, distance, or line differential relays with autoreclosure function can be tested. The faults are specified by entering the fault type and fault quantities. This is supported by the integrated Fault Calculator which calculates the output voltages and currents for the different fault types. For testing the autoreclosure function of distance protection, the fault can be specified in the impedance plane.

The test sequence is displayed over time and a list of events with assessments is reported.





## Advanced Differential

Essential   Standard   Enhanced   Complete

Advanced Differential is a set of test modules which form a complete testing solution for differential schemes. It is particularly suitable for transformer differential schemes with up to three windings and up to nine currents to be injected.<sup>1</sup>

Extensive modeling of the protected object (e.g. power transformer), the secondary equipment (CTs, CT connection) and the relay characteristics provides the data for the calculations required to facilitate testing. The automatic calculation of the test currents eliminates the most time consuming and error-prone manual tasks. Testing the correct operation of the relay becomes simple, time saving, and cost efficient.

This test solution provides:

- > Testing with all fault types (L-N, L-L, L-L-L)
- > Shot tests at pre-defined test points or search tests
- > All shots synchronizable to PTP, GPS or IRIG-B for end-to-end testing (e.g. line differential protection)
- > Evaluation and assessment of results against nominal characteristics and tolerances
- > Report generation including graphical representation of the results in the characteristic diagrams
- > No blocking of voltage related functions required (important for testing of multifunctional relays)

For transformers, automatic calculation of currents to be injected are based on:

- > Transformer data (nominal data, vector group)
- > CT ratios and connections
- > Fault type
- > Fault/supply side (primary, secondary, etc.)
- > Load current
- > Magnitude and phase correction

For the protective relay, the assessment of the measured values is based on:

- > Operating characteristic
- > Bias calculation
- > Zero sequence elimination

The modules can control up to nine currents for comfortable testing of three-winding transformer protection.

For non-transformer applications, such as testing generator differential protection, the current calculations are done without the transformer model. Furthermore, Advanced Differential includes a module for single phase testing applications, e.g., for older electromechanical relays.

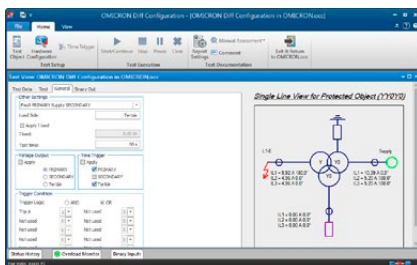
Details of the test modules in Advanced Differential:

### Diff Configuration

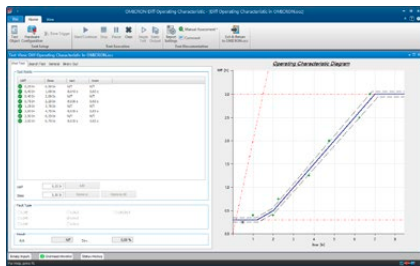
This module simulates through-faults to verify that the protection is stable for faults outside the protected zone. Since investigation of the stability may require the observation of multiple measurements, the module gives the tester the option to check the readings before proceeding with the test. The actual values read from the relay under the fault conditions (operating or restraint currents of the different phases) can be entered in the report for full documentation.

Diff Configuration tests:

- > Secondary wiring and interposing transformers (electromechanical and numerical relays)
- > Correct parameter setting of digital relays (specification of protected object)
- > Zero-sequence elimination



<sup>1</sup> To make full use of the typical applications of Advanced Differential a CMC test system providing at least six current outputs or sampled values streams is required.



## Advanced Differential (continued)

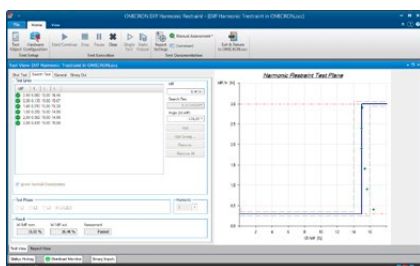
### Diff Operating Characteristic

Diff Operating Characteristic module tests whether the operating characteristic of the relay distinguishes correctly between internal and external faults.

The currents injected into the relay are calculated from  $I_{diff}/I_{bias}$  value pairs specified in the  $I_{diff}/I_{bias}$  plane. This relates directly to how manufacturers commonly specify the operating characteristic. The correct reaction of the relay, either trip or no trip, is assessed against the specified characteristic.

### Diff Trip Time Characteristic

This module tests the dependency of the trip time from the magnitude of the differential current.

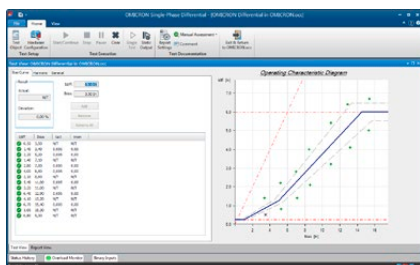


Diff Trip Time Characteristic measures tripping times at specified differential currents. The actual test currents for the specified differential currents are automatically calculated. The test points are defined in the trip time characteristic diagram and the measurements are assessed against this characteristic.

### Diff Harmonic Restraint

Diff Harmonic Restraint tests blocking functions based on harmonics such as inrush, CT saturation or overexcitation. The test points are defined in the harmonic restraint characteristic diagram, where the differential current is drawn over the harmonic content of the test current.

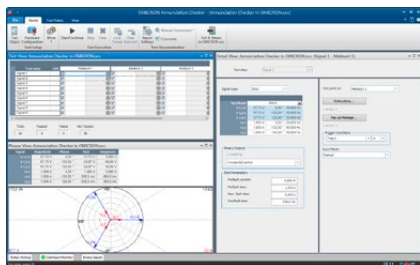
For simulating different inrush conditions, the initial phase shift between fundamental and harmonics can be specified.



### Single-Phase Differential

Single-Phase Differential provides a compact testing solution for transformer, line, generator, and busbar differential protection relays. It performs single-phase tests of the operating characteristic (pick-up value, slope test) and the inrush blocking function (harmonic restraint test).

Variable tap settings, as for some older electromechanical relays (e.g. Westinghouse HU, or GE BDD) can be addressed. For the operating characteristic test, test points are defined in the  $I_{diff}/I_{bias}$  plane. A graphic user interface makes the test definition easy.



## Annunciation Checker

Essential ☐ Standard ☒ Enhanced ☒ Complete ☒

Today's protection devices emit dozens of different status signals or measured analog values. Each signal can be displayed at various locations.

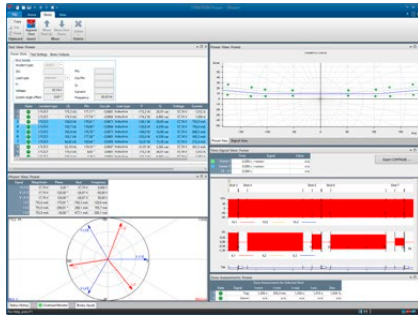
Annunciation Checker helps the commissioning engineer to verify that the allocation of each message to its expected location (marshalling) and the wiring has been done correctly. A test specification can be created prior to the test and can also be flexibly adapted while a test runs. The test specification is done in a signal/location grid.

Signals stimulate a protective device and are generated as shots or steady states. The test engineer can navigate through the test grid in any order (e.g. signal by signal or location by location). Each cell of the grid corresponds to a signal indicator at a certain location. The response of the indicator is evaluated automatically. The test results are summarized in a tabular test report.

Annunciation Checker is a typical commissioning tool used in conjunction with the central SCADA operator. It provides a work plan (points list) and a good source of documentation.

## Power / Advanced Power

The test modules Power and Advanced Power are used wherever the visualization and assessment in the complex P-Q plane is helpful or essential. Testing applications include load shedding based on power or frequency criteria, stability functions like Q-V protection, power swing blocking, and rotating machinery protection.

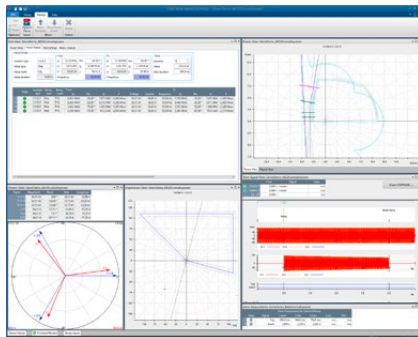


### Power

Essential ☐ Standard ☒ Enhanced ☒ Complete ☒

The module Power supports basic shot testing and assessment in the P-Q / S- $\phi$  domain.

- > Complex power view P-Q
- > Absolute primary, secondary, or, relative power data
- > P-Q axis switching in views
- > Complex power zones/elements
- > Additional voltage and current threshold for automatic test assessment
- > Constant voltage or constant current mode
- > Binary output control for pre-incident, incident and reset states
- > Improved tolerance handling with absolute and relative magnitude tolerance plus angle tolerance
- > Shots defined as P-Q or S- $\phi$  or S-cos  $\phi$  (ind/cap)

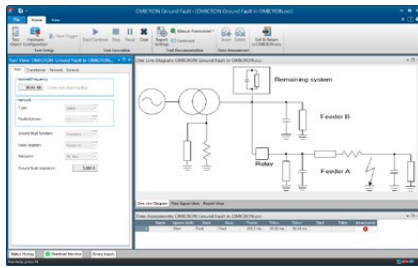


### Advanced Power

Essential ☐ Standard ☒ Enhanced ☒ Complete ☒

In addition to all of the features found in the module Power, Advanced Power also offers dynamic and more sophisticated testing features such as smooth ramps and trajectories through characteristics, mapping of impedance zones into the P-Q plane, frequency variation and more.

- > Complex power ramps
  - > Contiguous (gap-free) ramp segments for power swing trajectories, etc.
  - > Linear P-Q ramps (along a straight line in the P-Q plane)
  - > Linear S- $\phi$  ramps (along an arc defined in the P-Q plane)
  - > Smooth or step ramps with time-linear change in P, Q, S or  $\phi$  (1 ms resolution)
  - > Ramp assessment according to timing and/or thresholds and/or according to defined protection zone boundaries
  - > Linear frequency change supported (e.g. generator acceleration / deceleration)
- > Impedance (R-X) view
  - > Test object characteristics defined in the R-X plane, such as loss of field and distance protection, may be transformed into and shown in the P-Q power view
  - > Impedance transformation depending on operating mode (const. voltage or const. current)
- > Frequency setting per test state
- > Test repetition with statistical analysis
- > Mirrored/scaled currents for a second current tripe to avoid pick-up of differential elements



## Transient Ground Fault

Essential ☐ Standard ☐ Enhanced ☒ Complete ☒

Transient Ground Fault tests the directional decision of transient or steady-state ground fault relays in grids with isolated or compensated grounding. It produces the transient voltages and currents during a ground fault from a fault simulation with a pre-defined network model. The network simulation provides testing with realistic current and voltage waveforms. The model simulates a spur line. The calculated quantities are determined by the parameters of the line and the feeding network.

For testing the directional decision of steady-state ground fault relays, the steady-state fault quantities after the decay of the transient process can be continuously output. To allow for the testing of relays in both the forward and the reverse direction, the fault can be applied on different feeders.

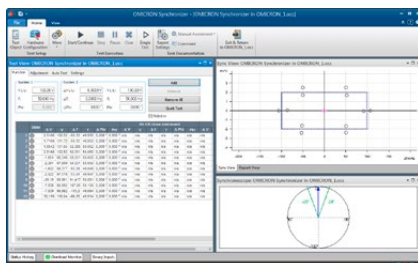
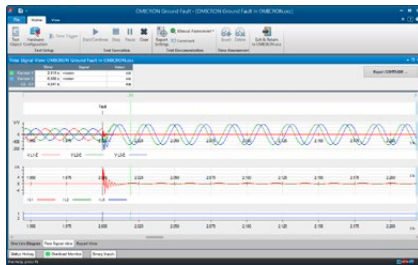
The module performs an automatic assessment of the measured data based on the user's specific application. The output signals are shown in a separate view. They can also be displayed or printed with the automatically generated test report. The test execution can be manually initiated or synchronized by using an external trigger signal.

The module is of particular assistance when

- > setting the relay
- > checking the relay's directional characteristic

Both three-phase systems and two-phase systems (e.g. for railway applications) can be simulated.

For a comprehensive simulation of ground faults, we recommend to use RelaySimTest (see page 30). A Transient Ground Fault license is included in a RelaySimTest license.



## Synchronizer

Essential ☐ Standard ☐ Enhanced ☒ Complete ☒

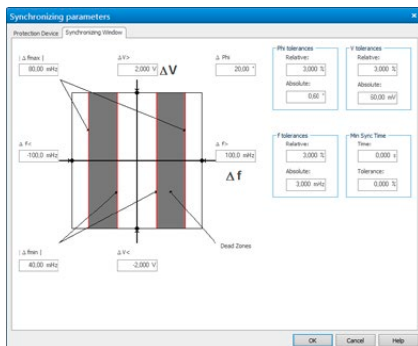
Synchronizer simulates two systems to be synchronized: System 1 representing the mains is fixed in magnitude and frequency, system 2 is controlled in magnitude and frequency and represents the generator or system to be synchronized.

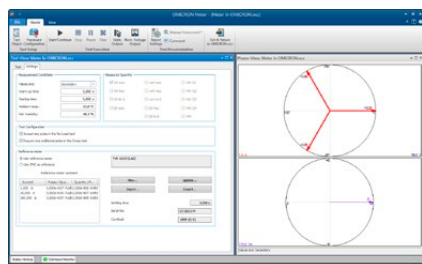
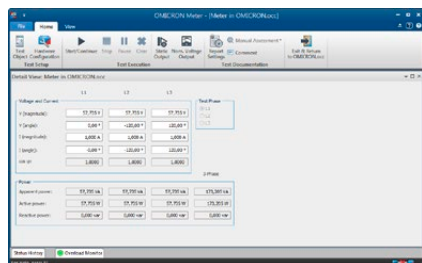
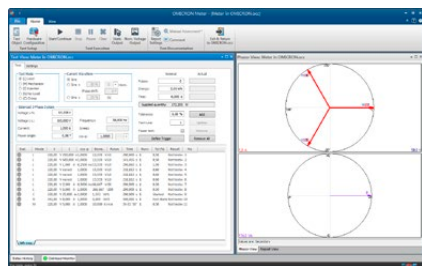
Using the module in single-phase to single-phase mode (each system represented by one voltage) is possible with any CMC test set.

The software automatically detects the circuit breaker closing command from the synchronizing device or synchro-check relay and, taking the CB closing time into account, evaluates if the synchronization takes place inside the synchronizing window. The control of the second output is variable following different test modes. The frequency and magnitude can be changed linearly depending on the ramping time constants of the generator.

For synchronizing devices with automatic adjustment functions, the adjustment control commands ( $f\uparrow$ ,  $f\downarrow$ ,  $V\uparrow$ ,  $V\downarrow$ ) may be used to control the second voltage output. To simulate the real system as closely as possible, dynamic generator models are available. The binary contact sequences of the adjustment commands, and the changes of voltage and frequency, can be monitored graphically in order to follow the progress of the synchronization.

An implemented synchronoscope displays the rotating voltage vector of system 2 respectively the moment of synchronization.





## Meter

Essential   Standard   Enhanced   Complete



Until now, the usual method for testing of energy meters has been to use a stabilized, but not very accurate, power source, in combination with a high-precision reference meter. OMICRON's approach significantly simplifies meter testing. By using state-of-the-art hardware technology, OMICRON provides test sets that are so accurate and stable, that the signal source itself becomes the reference and make a reference meter unnecessary.

The CMC 430 with its high-precision voltage and current outputs – not only provides the test signals, but also has inputs for the meter pulses allowing closed-loop testing. To this end, optical scanning heads for capturing pulses emitted by the meters (infrared LEDs) are available.

Meter allows for manual or automated testing of energy meters. Each line of the test table represents a test point, which can be run in one of the following modes:

- > Load test: Accuracy of measurement unit (time power method)
- > Mechanism test: Accuracy of entire meter including display
- > Gated Mechanism test: Testing internal meter registers
- > Injection test: Quick check (wiring, sense of rotation)
- > No-load test: No start-up at zero load
- > Creep test: Start-up at low loads

In the columns of the table the individual test parameters, the set assessment criteria (tolerance, nominal behavior), and the result of the test, including the assessment (passed or failed) are displayed. For multifunctional meters, or meters with two directions of rotation, a table per test function is available (multiple tabs). Test lines can be repeated several times. In this case the standard deviation is displayed together with the meter error, which allows conclusions of the correctness of the test itself. Single test steps (e.g. those assessed as failed) can be repeated after a test run is finished, without the need for repeating the whole test.

The test quantities are displayed graphically by means of the voltage, current and power phasor diagrams. The test can be performed with any balanced or unbalanced load for single-phase meters (or a single measurement element of a 3-phase meter), 3-wire meters, and 4-wire meters.

For testing the behavior of meters with harmonics or DC components, the following current signal waveforms are available: Sine, Sine + Harmonics, Sine + DC

In a detail view, all parameters can be specified independently for each phase. Apparent, active and reactive power is indicated for each phase and the whole rotary system. Testing of the following meter functions is supported:

- > Wh importing/exporting
- > VARh importing/exporting
- > VAh
- > I<sup>2</sup>h and V<sup>2</sup>h (load/no-load losses of transformers)
- > Qh (quantity hour)

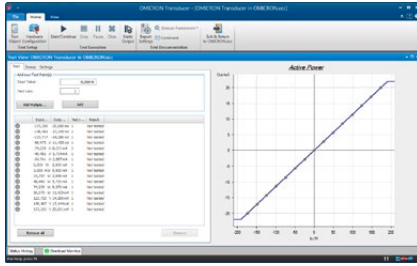
The results of an automatic test are clearly summed up in a tabular test report (one line per test point). For a manual test, generating any test quantities, without defining a complete test procedure, can quickly check the correct functioning of meters. In this mode the constant of a meter can also be determined, in case it is not known or if there are doubts about it.

Also operation in conjunction with an external reference meter is possible: When testing with a reference meter, the CMC is used as a current and voltage source. During a load test, the pulses of the meter under test as well as those of the reference meter are registered. The latter form the reference for error calculation.

Furthermore, testing against a 0.02 or 0.01 % reference before a test is run, using the same test points, can eliminate errors of the CMC by loading correction values.

<sup>1</sup> CMC 500 with DC IN transducer inputs, CMC 430

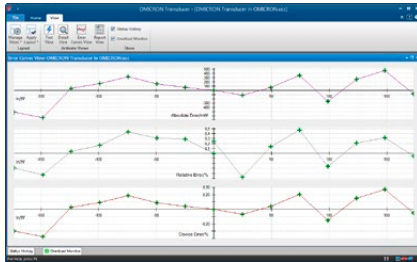




## Transducer

Transducer enables a CMC<sup>1</sup> for manual or automatic testing of any measurement function of transducers, such as:

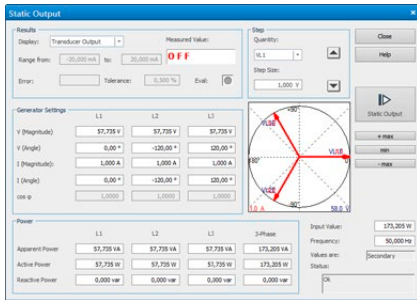
- > Real power (single- or three-phase)
- > Reactive power (single- or three-phase)
- > Apparent power (single- or three-phase)
- > Frequency
- > Current
- > Voltage (phase-to-ground, phase-to-phase)
- >  $\cos \varphi$
- > Phase angle (V-I, V-V, I-I)
- > DC quantities (current, voltage, power)
- > Signed average of currents



The module supports testing of the following types of characteristics:

- > Linear
- > Compound
- > Quadratic
- > Symmetrical or non-symmetrical

The "manual test" mode is used, if a measurement transducer is to be re-adjusted. Every desired input quantity can be generated for the transducer. Furthermore, it is easy to switch between significant points of a characteristic, where the error of the transducer is shown at a certain input value.



An automatic test includes the sequential output of a pre-defined test point table, as well as the documentation and assessment of the results. Here, the test points represent the input value of the measurement transducer. In addition, the behavior at changing input voltage or frequency can be performed as an option.

The error of a transducer is determined by comparing the theoretical signal and the actually measured output signal. Relative, absolute and device errors are derived and graphically displayed in a diagram. If multiple test runs are performed, the average error is indicated.

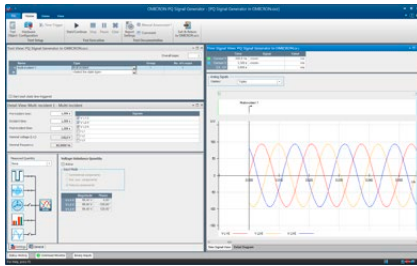
Single test points or test sequences can be added to the test point table. The table includes: input value, output value, device error and assessment (test passed or failed).

During the automatic test run all test points are processed in a sequence. The transfer characteristic including all test points (passed or failed) is displayed graphically. If remote displays should be checked during the test run, the test can also be controlled manually.

Measuring transducers for three-wire (Aaron circuit) as well as four-wire systems can be tested. Currents as well as voltages can be generated as pure sine signals or superimposed with harmonics or DC components. New generation transducers often no longer have classical mA or VDC output. They rather transmit the measured data via transfer protocol or/and visualize values at a display. The mode "open loop testing" supports testing this type of transducer. For testing classical transducers with mA or VDC outputs a CMC with DC measuring inputs is required.

<sup>1</sup> CMC 500 with DC IN transducer inputs, CMC 430





## PQ Signal Generator

The need to verify the functionality and accuracy of power quality meters/analyzers requires appropriate calibration equipment. PQ Signal Generator turns a CMC 430 with its high-precision voltage and current outputs – into a calibration tool that generates all kinds of power quality phenomena according to IEC 61000-4-30:

- > Power frequency
- > Power supply voltage
- > Flicker
- > Dips & Swells
- > Voltage interruption
- > Transient voltages
- > Voltage unbalance
- > Harmonics
- > Interharmonics
- > Rapid voltage changes

PQ Signal Generator features a powerful and easy to use interface, that also allows to combine different power quality phenomena for comprehensive testing.

Based on tables 1 and 2 of the IEC 61000-4-15:2010 standard, the module provides a selection of predefined test points for short-term flicker severity  $P_{st}$  and instantaneous flicker sensation  $P_{inst}$ .

Voltage and current signals with superimposed harmonics (up to the 60th harmonic at 50 Hz or 50th harmonic at 60 Hz) and interharmonics up to 3 kHz can be generated. Harmonic magnitudes can be entered either in absolute values or in percentages of the fundamental value. For advanced applications, even fluctuating harmonics can be generated. If only one interharmonic is used the frequency resolution for this is 1 mHz, moreover any combination of interharmonics with whole-number Hertz values can be set up.

An example of the module's versatility is the generation of cyclic notches. The notch depth and the angle of occurrence can be adjusted independently; the minimum gap-width for notches is 300  $\mu s$ . This function can provide the possibility to simulate the system perturbation of a thyristor-controlled motor.

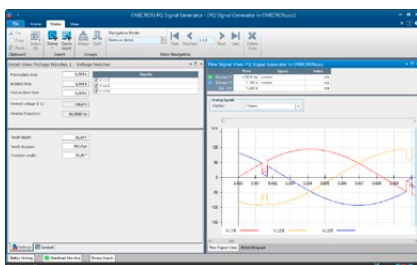
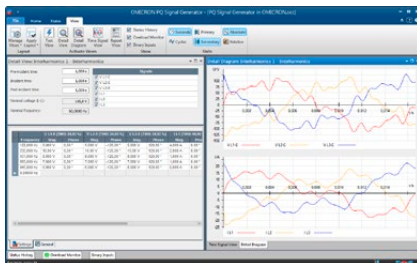
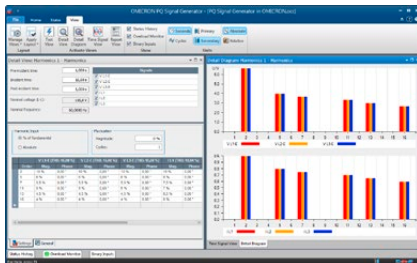
PQ Signal Generator allows the creation of comprehensive test sequences. Test steps can be grouped and run repeatedly in a user-definable number of loops. If the test object provides a binary output, it can be used for automatic assessment of the test results. If no alarm contact is available, manual assessment can also be performed.

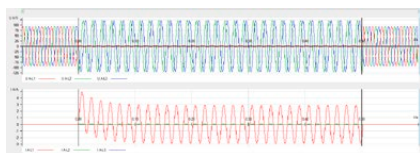
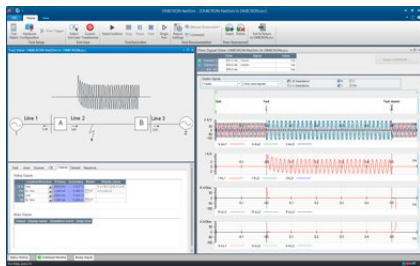
PQ Signal Generator enables the CMC test set to support testing in accordance with IEC 62586. This standard defines the test methods to verify compliance with IEC 61000-4. An extensive testing library is available to provide support in performing most type tests required by these standards.

In the past, the testing of PQ related equipment required a high level of investment in separate testing equipment. With PQ Signal Generator, the testing of PQ analyzers can be performed with the CMC test set quickly and easily.

## Measurement Equipment Testing Package

The modules Meter, Transducer, and PQ Signal Generator can also be ordered as a package (P0000411).





## NetSim

Essential Standard Enhanced Complete



NetSim enables users of Test Universe to test the behavior of protective devices in the event of a realistic fault by means of transient signals. Standard network configurations with simple parameter settings allow fast, rudimentary simulations with a limited set of test cases.

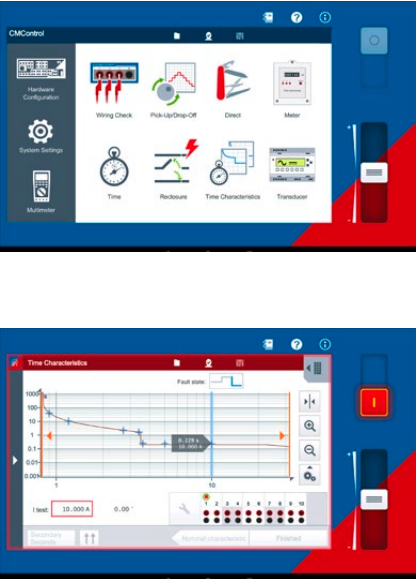
Application examples:

- > Relay testing under real-life conditions
- > Evaluation of relay settings for difficult protection applications
- > Testing of advanced protection algorithms
- > Faults on single and parallel lines (including mutual coupling), stub lines, three terminal lines
- > End-to-end testing with PTP, GPS or IRIG-B time synchronization
- > Network oscillation/power swing (synchronous and asynchronous)
- > Testing of differential protection including CT saturation

Further functions:

- > Automatic repetition of tests with varying parameters
- > Impedance view including distance zones
- > Additional COMTRADE export of simulated waveforms

For comprehensive system-based testing, we recommend to use RelaySimTest (see page 30). A NetSim license is included in a RelaySimTest license.



CMControl P – Easy manual testing

CMControl P is a control option for CMC test sets which is specifically designed for easy manual testing of protection and measurement devices. It is available as an App for Windows PC or Windows tablets and as a dedicated front panel control device. The included test tools with integrated fault models guarantee quick and convenient tests:

- > Wiring Check: is used to quickly verify the wiring and the measuring inputs of the device under test and also supports the use of the CPOL3 polarity checker
- > Pick Up/Drop Off: for checking thresholds of protective relays
- > Direct: all of the test set's outputs can be controlled individually
- > Meter: to calibrate electricity meters and to perform start-up and no-load tests
- > Time: trip times or other timings of a protective relay can be verified
- > Reclosure: the number of cycles and cycle times of a reclosure function can be checked
- > Time Characteristics: test relays with multiple timing stages or particular time characteristics
- > Transducer: to verify and automatically assess the accuracy of a transducer<sup>1</sup>
- > Multimeter: the multifunctional inputs of CMC test sets can be used for analog measurement<sup>1</sup>

CMControl P App

The CMControl P App runs on a standard Windows PC or Windows tablet to control your CMC test set. A dedicated mini Wi-Fi USB adapter enables wireless control of CMC test sets.<sup>2</sup>

- Download the free demo App:
- > for your Windows PC or Windows tablet from the OMICRON Customer Portal

CMControl P front panel control

The robust front panel control device CMControl P is available in two sizes and can either be attached to the CMC test set or be used as a flexible handheld control. It offers a 7" touch screen and a magnetic rear for attaching to steel surfaces.

Ordering information

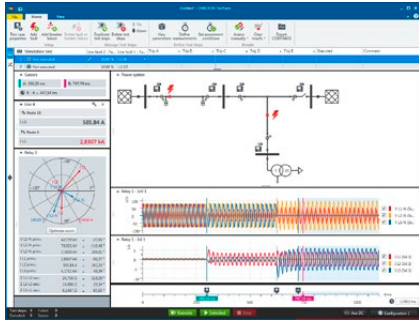
CMControl P can be ordered with a CMC test set either standalone or in combination with a Test Universe package. In the Standard, Enhanced, and Complete package, a license for CMControl P app is included (see page 9).



	CMControl P App	CMC <sup>3</sup> + CMControl P App	CMC <sup>3</sup> + CMControl P
CMC 500	-	-	-
CMC 430	P0000344	P0005881	-
CMC 310		P0005873	P0005872

For more detailed information, please visit [www.omicronenergy.com/cmcontrol-p](http://www.omicronenergy.com/cmcontrol-p) or refer to the CMControl P product brochure.

<sup>1</sup> CMC 430  
<sup>2</sup> Wi-Fi is subjected to technical and legal constraints. For more information please contact your local OMICRON office or sales partner.  
<sup>3</sup> Without Test Universe



## RelaySimTest – System-based protection testing

Essential   Standard   Enhanced   Complete

RelaySimTest is a software solution for system-based protection testing with OMICRON test equipment that takes a novel, future-oriented approach: the test is independent of relay type and relay manufacturer and the often very extensive parameter settings. Instead, it completely focuses on the correct behavior of the protection system. This is made possible by simulating realistic events in the power system.

Compared to conventional test methods (such as settings-based testing with Test Universe), RelaySimTest can detect errors in the settings, logic and design of the protection system much better. This allows testers to verify the correct behavior of their protection system faster and with a higher testing quality than ever before. Complementary to testing with Test Universe, RelaySimTest contributes to a more reliable power system.

### Simple and flexible operation

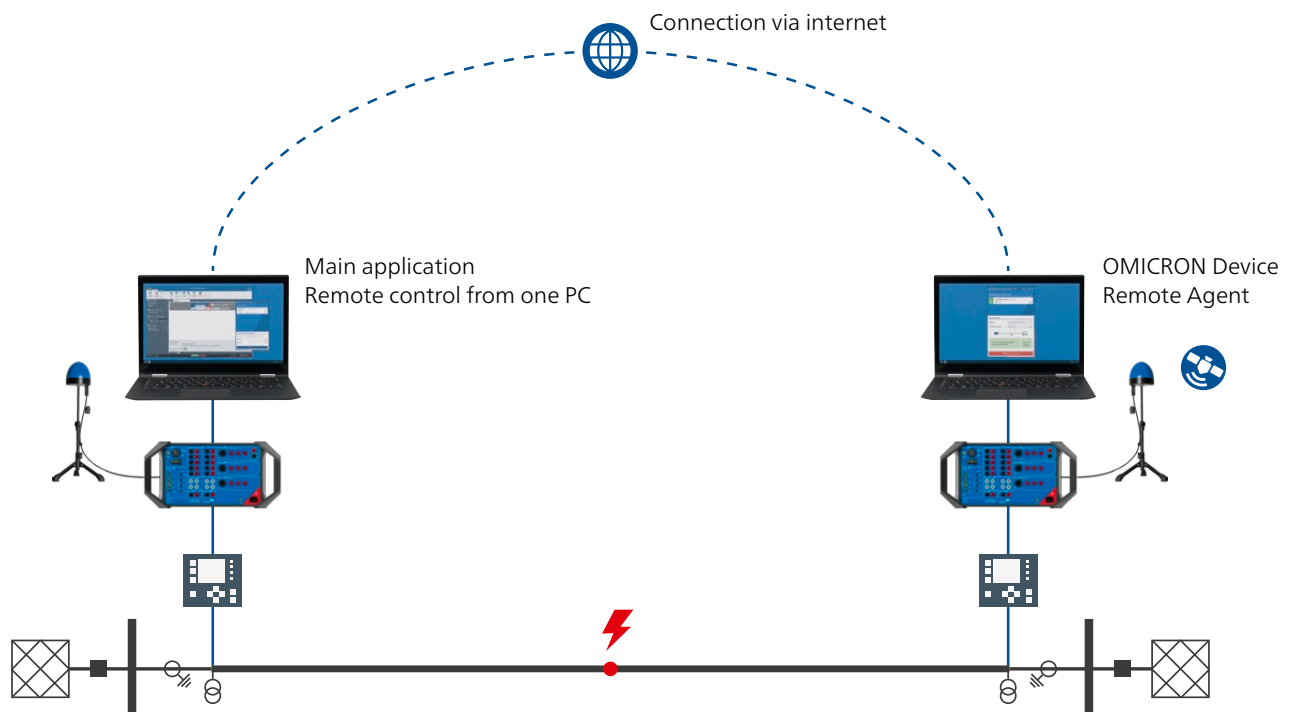
Predefined test templates give you a quick and easy start in standard testing situations. Thanks to the flexible network editor, even complex power systems can be simulated. The correct behavior of the protection system can be easily checked in all scenarios by placing faults and circuit-breaker events. The calculated test signals can be analyzed in advance and then executed via the test device.

### Remote testing

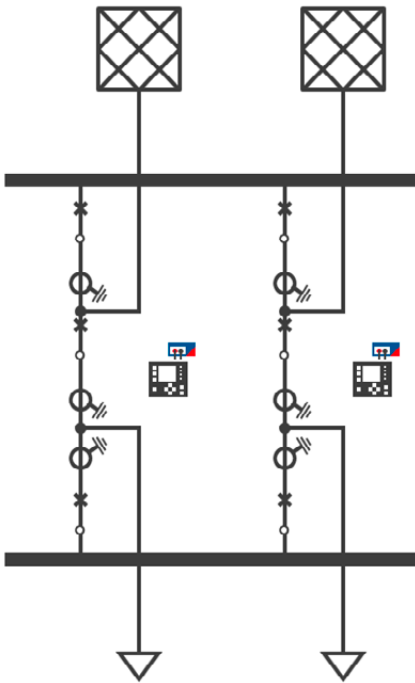
For example, testing a line protection is very simple: RelaySimTest automatically calculates the test signals and then starts its time-synchronized execution from one PC. The test equipment can be synchronized by a PTP Grandmaster Clock (e.g. CMGPS 588) or by a CMIRIG-B. Subsequently, all of the protection system's reactions are evaluated centrally. This not only makes execution faster and easier, but also aids you in troubleshooting. Test equipment can also be controlled from a PC at remote locations via an Internet connection.

### Logic and scheme testing

The indispensable test of logic in protection systems usually involves a complex sequence of states triggered by trip and close commands. Thanks to the patented "Iterative Closed-Loop" method, RelaySimTest can automatically build the test sequence according to the trip and close commands. Testing, for example the coordination of an auto-reclose function in the system, becomes simple and transparent.



## Application areas



### Substation

- > Busbar protection: Any type of busbar topology can be modeled. Simultaneous injection to any number of field units. Simulation of disconnector position and faults on every node including dead-zone faults in the coupling field.
- > Breaker-and-a-half: Test with six current-inputs. No need to re-wire during the test. Check coordination of both relays e.g. for breaker-failure protection.
- > Insulated and compensated networks: Testing of the protection system for transient and intermittent earth faults and evolving faults.
- > Transformer differential protection: Simulation of 2- and 3-winding transformers, tap changer and phase shifter. This validates the configuration of transformer protection.

### Transmission

- > Teleprotection and line differential: Test the protection including its communication channels. Control the test setup from one end without having to coordinate each test over the phone.
- > Auto-reclosing: Simple testing of auto-reclosing sequences independent of reclosing attempts and single or three pole tripping. Simultaneous coordination testing for multiple relays.
- > Three-terminal lines: Control each test set from three or more terminals on one end without having to coordinate each test on the phone.
- > Parallel lines with mutual coupling: Simulate mutual coupling between line segments as they occur in your real-world topology. Test for over- and under reach when parallel lines are in operation or grounded.
- > Power swing & out-of-step: Test the tripping or blocking of the protection during out-of-step and power-swing condition. Combine power swings with fault and breaker events.
- > Series-compensated lines: Test complex zone coordination on series compensated lines including their effect on time grading.

### Distribution

- > Distribution Automation loop scheme: Inject to every single recloser control unit in the loop scheme simultaneously. Tests the full operation sequence from fault isolation to service restoration.
- > Reverse blocking schemes and selectivity testing

### Lab and factory testing

- > Performance tests in accordance with IEC 60255-121
- > Pre-qualification of new relay types

**Note:** All test applications can be combined flexibly.

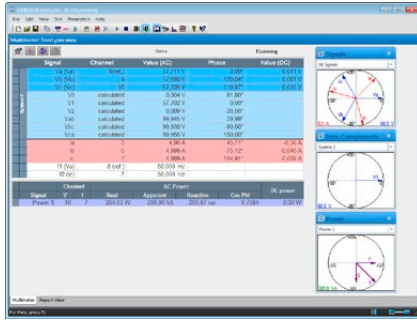
### Supported test sets and accessories

- > CMC 500, CMC 430, CMC 850, ARCO 400
- > CMGPS 588 and CMIRIG-B (for time-synchronized injection)
- > Binary extension ISIO 200

Item no.	Delivery contents
P0006620	One license for RelaySimTest
P0006621	Package for distributed testing, including two licenses for RelaySimTest plus two CMGPS 588
P0006611	RelaySimTest license for ARCO 400, enables synchronized distributed scheme testing for recloser controls

A RelaySimTest license also includes the licenses for Transient Ground Fault and NetSim (see page 28).

For more detailed information, please visit [www.omicronenergy.com/relaysimtest](http://www.omicronenergy.com/relaysimtest) or refer to the RelaySimTest product brochure.



## EnerLyzer

EnerLyzer transforms the CMC test set into a multifunctional measuring, recording and analysis device. Each of its binary inputs can be configured as an analog measuring input and can then directly measure voltages as high as 600 VRMS. Currents are acquired via the measuring shunts or current clamps. The CMC test set can be used for conventional testing and simultaneously for measuring with EnerLyzer.

### Broad range of applications

EnerLyzer offers a wide range of views and analysis tools: both direct and derived measurands can be displayed as numerical values (multimeter view) or in phasor diagrams. The harmonic analysis facilitates the quick and easy examination of the harmonic content and shows the total harmonic distortion (THD) value. The CMC can also be used as a multichannel transient recorder. TransView (see page 33) is included to enable a more detailed analysis of the transient values recorded in this way. These tools allow faults to be localized quickly and easily and the corresponding system parameters to be evaluated.

Typical applications:

- > Troubleshooting during commissioning or maintenance testing of protective devices
- > Recording of transients during switching operations
- > Analysis of transformer inrush events (for example, analysis of harmonics to adjust the blocking)
- > Analysis of starting characteristics of motors (current/voltage curves, determining start-up times)
- > Measurement and analysis during generator synchronization with synchro-check function
- > Diagnosis of timing characteristics of circuit breakers and their auxiliary contacts
- > Analysis of system perturbations and power quality (for example, THD, harmonics)
- > General measurement functions (for example, plausibility checks for voltages, currents, power)

Depending on the CMC type, two different versions of EnerLyzer are offered:



## EnerLyzer (CMC 500<sup>1</sup>, CMC 430)

### Hybrid measurement functionality

EnerLyzer provides comprehensive functionality for carrying out measurements in digital substations. Sampled Values (IEC 61850-9-2) and conventional signals can be measured simultaneously and displayed together along a common time line.

### Oscilloscope view and real-time trend analysis

Instantaneous values and trend curves are displayed in real time; any faults are immediately apparent. Measured quantities are displayed clearly in a number of ways (numerical values, trend curves or as phasor diagrams) and in a range of views. The measurement view can be customized as required.

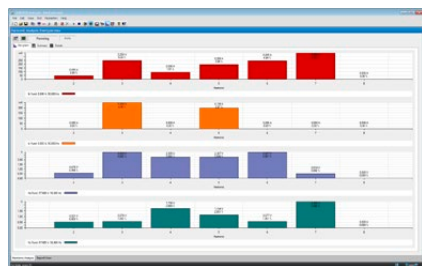


### Transient recording and analysis

The maximum sampling frequency is 40 kHz. This sampling frequency permits recordings of up to 20 minutes duration. These recordings can then be analyzed immediately in EnerLyzer. Simple or complex trigger conditions can be defined for the recording of faults or inrush phenomena in the electrical power system. The recorded data can be exported in CSV or COMTRADE format (C37.111-1991/1999 and 2013), if a more detailed investigation needs to be carried out.

<sup>1</sup> Analog input option required.





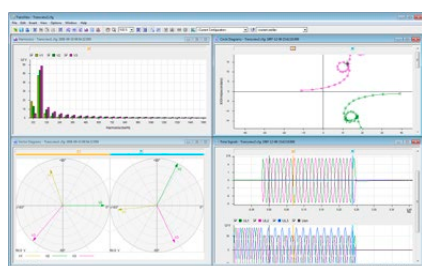
## EnerLyzer Classic

### Trend recording

Important quantities (for example, RMS of currents and voltages, frequency or power) are displayed in a chart as a function of time. Selecting longer measuring rates enables an analysis to be carried out over longer periods (for example, weeks, if the measuring rate is in seconds). The recorded data can be exported in CSV format for further processing.

### Transient recorder

The maximum sampling frequency is 28 kHz, while the maximum recording duration depends on the number of channels being used and the selected sampling frequency (one channel at 3 kHz produces a recording time of more than five minutes). The recordings are stored in COMTRADE file format (C37.111-1991/1999) and can be analyzed in TransView.



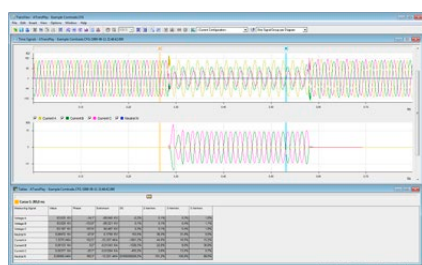
## TransView

Essential ☐ Standard ☐ Enhanced ☐ Complete ☒

TransView is used to visualize and analyze analog and binary signals that have been recorded by the transient recorders (relay-internal recording, CMC test set with optional EnerLyzer / EnerLyzer Classic, DANE0 400, fault recorder). The software processes the recorded data graphically and uses the measurement data to compute additional electrical power system quantities, such as impedances, power vectors, RMS, etc.

The values are displayed either as primary or secondary values in a range of views:

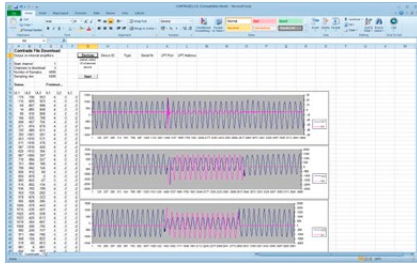
- > Time signals: Analog and binary signals are displayed as a function of time. Analog quantities can be displayed as instantaneous or RMS values.
- > Phasor diagrams: This view shows the measured and calculated quantities (for example, symmetric components) as complex vectors at defined points in time.
- > Locus diagrams: This view shows complex quantities in the form of locus diagrams. Impedance locus diagrams can be shown together with the trip zones of distance relays. Zone settings can be imported using the XRIO format.
- > Harmonics: This view shows the RMS of the harmonics of selected quantities as bar graphs. The harmonics are determined using a full-cycle DFT (Discrete Fourier Transformation).
- > Value table: The Table view shows the values of several signals at the marker positions. The signals are arranged as rows, where the individual columns contain the respective values.



TransView enables a number of recordings to be analyzed simultaneously, for example, those from both ends of a line. TransView supports data in COMTRADE format (IEEE C37.111-1991/1999 and 2013).

Note: TransView can be used

- > As part of EnerLyzer Classic (no separate order necessary)
- > As part of Test Universe (without EnerLyzer Classic / EnerLyzer) [P0006837]
- > As a stand-alone application without CMC or Test Universe [P0006602]



## CMEngine – Programming interface

Essential   Standard   Enhanced   Complete



CMEngine is a programming interface with open-source documentation. It provides access to the entire functionality of the CMC test set hardware and enables programs to be written to meet customer-specific requirements. Amongst other things, CMC test sets and their associated amplifiers and accessories can be integrated into a dedicated test environment and controlled by whichever applications you are running.

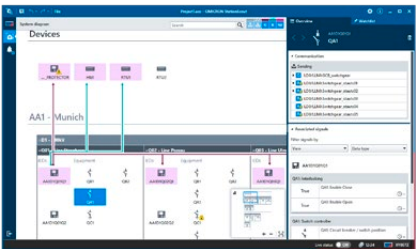
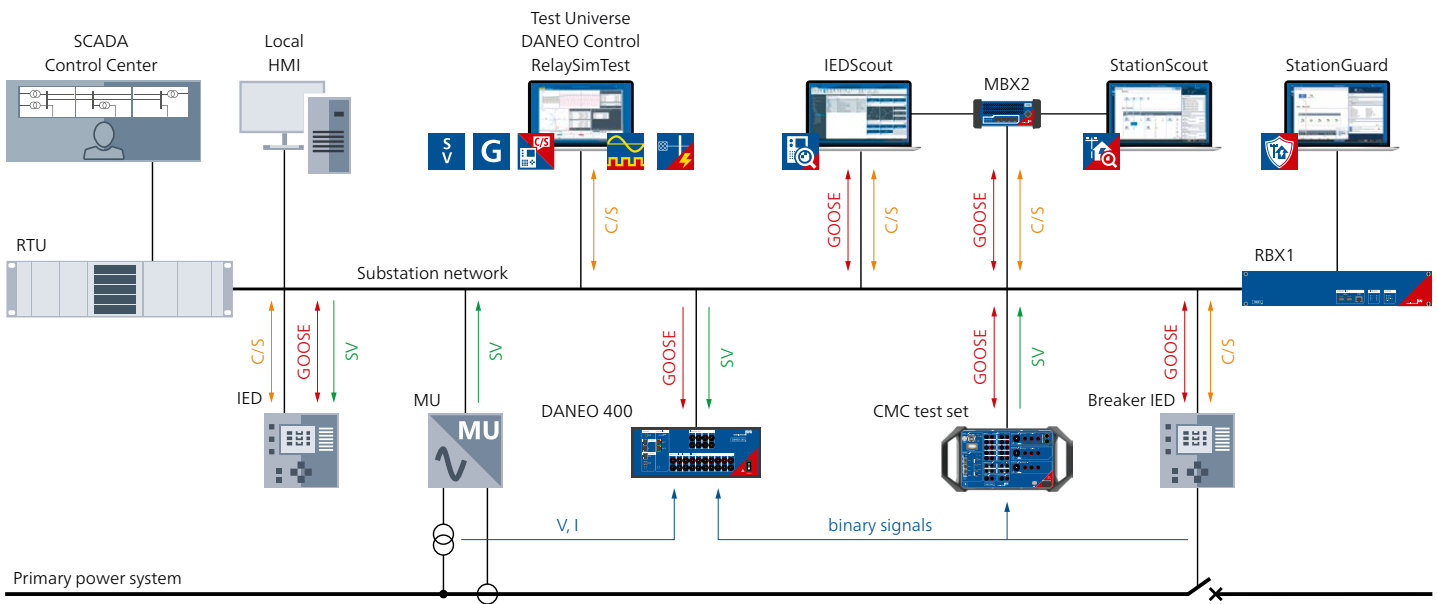
Programs can be written in one of the standard programming languages, such as C/C++, Visual Basic, C# or LabView. With CMEngine, the CMC test set can also be controlled by standard programs that support Microsoft Automation (for example, Microsoft Excel).

Typical applications include factory acceptance testing by protection equipment manufacturers. In fixed test installations, where test objects are subjected not only to electrical but also to thermal or mechanical tests, a volume production's test engineer benefits from the ability to use the same user interface for all applications. Using CMEngine also increases the degree of automation and hence the level of efficiency.

### Advantages

- > Interface for interacting with CMC test sets
- > Direct access to all hardware functionality
- > Programming with standard programming languages or a batch application (CMEngine CLI)
- > Integration of CMC test sets to a proprietary testing environment
- > Creation of special waveforms

OMICRON offers protection and SCADA engineers a set of advanced solutions for testing in IEC 61850 environments. The individual tools complement one another and cover a wide range of requirements: while Test Universe and RelaySimTest are used specifically for protection testing, further products mentioned in this section, such as StationScout, IEDScout and DANE0 400, focus on communication. They allow users to observe, track and analyze the behavior of data packets in the communication network and the data flow for protection, automation and control.

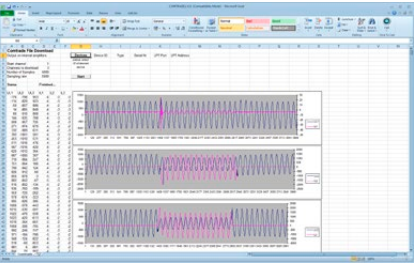


StationScout

Testing automation, control, and SCADA communication in Digital Substation Automation System (DSAS) is as time-consuming as testing the protection, verifying the RTU/Gateway mappings – or often even more. StationScout simplifies the testing and reduces the required effort significantly. Running on the new digital substation platform MBX2, StationScout visualizes and analyzes the communication in an SAS in an unprecedented way. The topology is determined from the engineering data in SCL (System Configuration Language) and displayed intuitively for the SCADA engineer. Along with importing IEC 104 RTU/Gateway mappings, time spent for verifying the mappings is reduced dramatically. StationScout supports designers and testing engineers throughout the entire life cycle of an SAS with a combination of simulation and testing functions.

Item no.	Delivery contents
P0009385	<b>StationScout Smart Overview License</b> StationScout software for manual testing of Substation Automation Systems
P0009386	<b>StationScout Commissioning License</b> StationScout software for testing and commissioning of Substation Automation Systems

StationScout can be used with the cyber-secure platforms MBX2 or RBX1. For more detailed information, please visit [www.omicronenergy.com/stationscout](http://www.omicronenergy.com/stationscout) or refer to the StationScout product brochure.

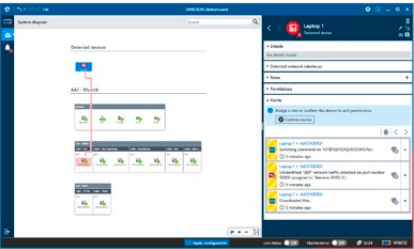


## IEDScout

Essential   Standard   Enhanced   Complete

IEDScout is the perfect tool for looking into IEC 61850 devices. It works with devices of all vendors and can be used for analysis and simulation of IEDs. While StationScout (see page 35) is used for getting an overview of the Substation Automation System and testing its logic and communication functions, IEDScout allows testing the IEC 61850 functionality of a single IED. Its application area ranges from IED development, factory acceptance testing, and commissioning to troubleshooting.

Item no.	Delivery contents
P0006493	IEDScout for PC
P0009384	IEDScout on platform MBX2
P0001331	IEDScout on platform RBX1



## StationGuard

StationGuard monitors the network to detect cyber threats and functional problems on the station and process bus. It derives a system model of all communication by importing substation's SCL file. Devices not included in the SCL file can be described easily using a set of function templates. StationGuard analyzes all communication on the network and it will raise an alarm if one device communicates with a protocol or in a way that does not comply with the functional model. Through the use of this functional communications model, StationGuard not only detects cyber threats in substation networks, but also configuration errors, excessive GOOSE network or processing delays, and time synchronization issues.

Item no.	Delivery contents
P0006779	<b>StationGuard</b> Cybersecurity and functional monitoring for substations.
	<b>StationGuard Subscription</b> Each StationGuard device is associated with a service contract for new features, security updates and expert support.

StationGuard can be used together with the cyber-secure hardware platforms RBX1 for permanent installation or MBX2 for mobile usage and as a virtual machine VBX1. For more detailed information, please visit [www.stationguard.com](http://www.stationguard.com) or refer to the StationGuard product brochure.



## MBX2

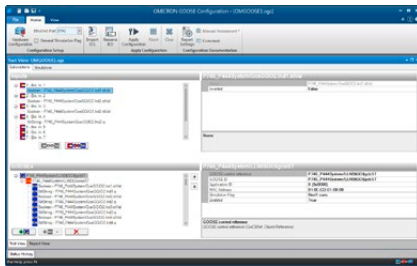
The industrial-grade MBX2 hardware is equipped with encrypted storage, a cryptoprocessor module, and secure firmware. The MBX2 is the cyber secure interface connecting the computer running IEDScout, StationScout or StationGuard to the substation network.



## RBX1

The 19-inch platform RBX1 is tailor-made to be installed in substations. It is equipped with optical (SFP) Ethernet interfaces and power supplies for different DC voltage ranges and with a secure cryptoprocessor to securely store certificates and encryption keys.

## IEC 61850 protection testing



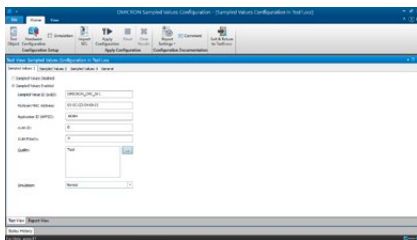
### GOOSE Configuration

Essential ☐ Standard ☐ Enhanced ☐ Complete ☒

This license enables a CMC test set for communication with the GOOSE messages on the Substation Network.

The mapping and the setup is done in Test Universe and RelaySimTest. Configuration parameters can be imported from SCL files.

Once GOOSE messages are configured in the Test Universe GOOSE configuration module, the CMC test set interacts with the status data in GOOSE messages as if they were wired to the binary inputs and outputs of the CMC: received (subscribed) GOOSE messages actuate the binary inputs and binary output state changes initiate GOOSE message publication. This allows for easy usage of GOOSE messages in all relevant Test Universe modules.



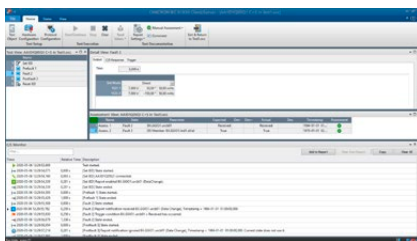
### Sampled Values Configuration

Essential ☐ Standard ☐ Enhanced ☐ Complete ☒

This license enables a CMC test set to simulate merging units publishing Sampled Values streams according to IEC 61869-9 and IEC 61850-9-2 Ed2.1.

Configuration parameters can be imported from SCL files. Test Universe supports up to 3 streams, RelaySimTest up to 4 streams.

In Test Universe Sampled Values are configured and mapped in the Hardware Configuration and then used by all modules of an OCC test plan. This facilitates reusing test plans when switching between Sampled Values and conventional voltage and current sources.



### IEC 61850 Client/Server

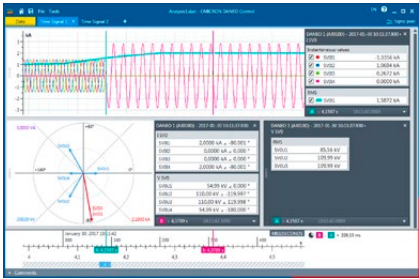
Essential ☐ Standard ☐ Enhanced ☐ Complete ☒

The Test Universe IEC 61850 Client/Server module performs protection testing by utilizing IEC 61850 SCADA (MMS) reports. This allows for the verification that the IED issues the correct reports to the SCADA system. The module has access to the entire data model of the IED and may interrogate any data attribute during testing. The module also controls the IED's operation mode to isolate the IED under test.

### IEC 61850 Packages

The IEC 61850 modules and tools are available in convenient combinations, depending on the intended application.

Package	IEC 61850 C/S	GOOSE Configuration	Sampled Values Configuration	IEDScout for PC	IEDScout on MBX2
IEC 61850 Package 1 P0006594	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
IEC 61850 Advanced P0006595	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
IEC 61850 Package 2 P0009745	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
IEC 61850 Advanced + MBX2 P0006599	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>



## DANE0 400

DANE0 400 is a multimeter and fault recorder for IEC 61850 and conventional signals (voltages, currents, hardwired binary status signals). The hybrid measuring system measures both types of signals and provides information to assess their proper coordination. Information relating to operational status and communication helps operators to monitor the processes in the installation.

A measuring system containing multiple DANE0 400 devices will provide a time-coordinated picture of the signals from a distributed protection and automation system. All data acquisition devices are precisely time-synchronized. DANE0 400 devices are configured and controlled using the DANE0 Control PC software. The integrated web interface provides access to dedicated functions.



Item no.	Delivery contents
P0006500	<b>DANE0 400 Basic</b> Signal analyzer for power utility automation systems. Measuring and recording conventional (analog and binary) signals.
P0006501	<b>DANE0 400 Standard</b> Hybrid signal analyzer for power utility automation systems. Measuring and recording conventional (analog and binary) signals and traffic from power utility communication networks (GOOSE and Sampled Values).

For more detailed information, please visit [www.omicronenergy.com/daneo400](http://www.omicronenergy.com/daneo400) or refer to the DANE0 400 product brochure.

## ISIO 200



ISIO 200 is a simple, versatile binary input/output extension for Substation Automation Systems (SAS). In the case of CMC test sets it extends the binary inputs and outputs, while as a standalone component in an SAS it receives or outputs additional binary signals.

For more information, see page 47.





## Asset and maintenance management solution for protection systems

ADMO is an easy-to-use database software for the central planning, management and documentation of all testing and maintenance activities for protection systems. Users can optimize their maintenance strategy, comply with standards (e.g. NERC PRC-005-2 for power suppliers in North America), and successfully pass audits.

In addition to protective relays, ADMO also allows users to manage communication systems, control circuitry, current and voltage transformers, circuit breakers, station DC supplies, energy meters, and transformers. It stores locations, asset data, maintenance cycles, and all associated test documents, providing a clear overview of all maintenance work that is due as well as the current maintenance status of individual facilities. Stored test documents and maintenance information can be accessed quickly.

### Key features

- > Central and well-structured management of test documents, maintenance and commissioning tests, and protection settings
- > Maintenance status overview of the complete protection system and of primary assets such as current transformers
- > Efficient workflows for field testing and setting management
- > Tracking and analysis of network disturbance events
- > Easy-to-use visualization and versioning of protection coordination; maintenance of time grading schedules (ADMO Time Grading)
- > Convenient analysis of ADMO data with web application InSight for optimized asset life cycle management, investment and human resources planning
- > Support of modern IT security requirements

### InSight<sup>1</sup>

InSight is the powerful answer to the ever-growing complexity of systems and assets with regards to data analysis. It analyzes and evaluates asset and maintenance activity data from ADMO and enables data-driven decision-making. This enables you to develop intelligent maintenance strategies, optimize planning activities, and to reduce the risk of compliance-related liabilities and fines.

### ADMO Box

ADMO Box helps you to cooperate with your contractors in an efficient and straightforward way. It allows easy, secure, and time-saving outsourcing of asset management operations ensuring all data is in place. Your service provider can start off with maintenance right away – no need for time-consuming preparation, no need for an ADMO installation or a license.

### Test Set Management

ADMO's Test Set Management section enables users to easily organize test sets. They can add the test sets they use for their maintenance tasks, store test set specific data, schedule test set calibration, and keep track of repair events. The Test Set Management section is included in all Test Universe packages. The Test Set Management section is included in all Test Universe packages (see page 9).

### ADMO licence options

ADMO is available as a Client Server Edition, which allows multiple users to work with ADMO simultaneously and to retrieve asset and maintenance data at any time in the field and in the office. The data is stored and updated on a central SQL server, which makes it available across the entire network. An offline copy of the ADMO database also enables users to access test documents when a network connection is not available.

### ADMO light

All Test Universe packages (see page 9) include a free license of ADMO light, which offers full functionality but is limited to 50 assets. ADMO light can be upgraded to a full ADMO version at any time.












[www.omicronenergy.com/admo](http://www.omicronenergy.com/admo)

<sup>1</sup> InSight is only available to customers with an ADMO service support contract

# Accessories










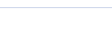
## Standard CMC test set accessories

The following accessories are part of the CMC standard delivery but can also be ordered separately.

	Description	Item no.	CMC 500	CMC 430	CMC 310	CMC 850
	Country-specific power cord with C13 connector, 2.5 m (8 ft)	P0000279	1	1	1	1
	Ethernet patch cable, 1.5 m (5 ft), RJ45 To connect CMC test sets with Ethernet connection to PC or network	E1664300		1	1	2
	Ethernet patch cable, 3 m (10 ft), RJ45 To connect CMC test sets with Ethernet connection to PC or network	E1664400	1	1		2
	USB connection cable, 2 m (6.6 ft), A/C To connect CMC test set with USB connection to a PC	P0007555	1			
	USB connection cable, 2 m (6.6 ft), A/B To connect CMC test set with USB connection to a PC	B1021101		1	1	
	Test leads with 4 mm (0.16 in) safety plugs, 3 m (10 ft) 1000 V, CAT II / 32 A (8 x red, 4 x black)	P0007815 P0007816	12			
	Test leads with 4 mm (0.16 in) safety plugs, 2 m (6.6 ft) 1000 V, CAT II / 32 A (6 x red, 6 x black)	E0201800 E0201900		12	12	
	Flexible terminal adapters	E0439201	12	12	12	
	Test lead jumpers, 6 cm (2.4 in)	E0439300	8			
	Flexible test lead adapters with retractable sleeve, 5 cm (2.0 in) 600 V (6 x red, 6 x black)	E0542801 E0542901		12	12	
	Grounding cable with battery clamp and plug 1 x 6 mm², 6 m (20 ft)	B1889700	1			
	Grounding cable with battery clamp and cable lug M6 (0.24 in) 1 x 6 mm², 6 m (20 ft)	B0349701		1	1	
	Accessory bag	P0007627	1			
	Soft bag for device	see page 42		1	1	1

## CMC wiring accessory package

P0010657

	Description	Specs.	Quantity	Item no.
	Flexible test lead adapters with 4 mm (0.16 in) safety plug for connections to narrow terminals	600 V, CAT II / 32 A	12	E2106200
	Flexible test lead adapters with retractable sleeve, 5 cm (2 in) for connections to non-safety sockets	600 V, CAT II / 32 A	6 red, 6 black	E0542801 E0542901
	Flexible jumpers for paralleling current triples up to 32 A or shorting neutrals of binary inputs	1000 V, CAT II / 32 A	8	E0439300
	Crocodile clips for contacting pins or screw bolts	1000 V, CAT II / 32 A	4 red, 4 black	E0343100 E0343600
	Flexible terminal adapters for screw-type terminals	1000 V, CAT II / 32 A	12	E0439201
	Solid terminal adapters for screw-type terminals	1000 V, CAT II / 32 A	12	E0202200
	Cable lug adapters for M4 (0.15 in) screws	1000 V, CAT II / 20 A	20	E0542600
	Cable lug adapters for M5 (0.2 in) screws	1000 V, CAT II / 20 A	10	E0542700
	Test lead to ground test objects, e.g. in a lab environment	1000 V, CAT II / 32 A	1	P0010292
	Cable ties (velcro fastener) black, 150 mm (6 in)		10	E0544100
	Accessory bag		1	P0007627



### Three-phase generator cable

CMC 500      CMC 430      CMC 310      CMC 850

Simplifies three-phase connections between any of the CMC 500 analog output modules and the test object.

- > Connector type on both ends: Ø 4 mm (0.16 in) safety plugs
- > 4 x 2.5 mm<sup>2</sup>, 3 m (10 ft)
- > Rated voltage: 600 V, CAT II
- > Rated current: 3 x 30 A continuous / 3 x 60 A with duty cycle (2 s on / 10 s off)

Color codes	yellow, green, violet, blue	red, yellow, blue, black
Item no. (Config)	P0008045 (YGVB)	P0008045 (RYBB)



### Generator combination cable

CMC 500      CMC 430      CMC 310      CMC 850

Simplifies the connection of voltages and currents from the generator combination socket to the test object.

- > 1st end: combination plug (8-pole)
- > 2nd end: Ø 4 mm (0.16 in) safety plugs
- > 8 x 2.5 mm<sup>2</sup>, 3 m (10 ft)
- > Rated voltage: 300 V, CAT III
- > Rated current: 3 x 32 A continuous

Color codes	yellow, green, violet, blue	red, yellow, blue, black
Item no.	B1328000	B1328100



### Safety test leads with fuse

P0010656

CMC 500      CMC 430      CMC 310      CMC 850

The safety test leads with fuse are used to avoid danger if a mistake in the test setup causes a short circuit in the secondary wiring of a voltage transformer. Short circuits could happen due to mistakes during the test setup, e.g.

- > Forgot to open the VT miniature circuit breaker (MCB) or disconnect terminal blocks before the wiring
- > Connected the test set to the wrong side of the VT MCB or the disconnect terminal blocks

# Accessories

## Transport cases

These sturdy transport cases with hard-foam interior are designed for heavy transport stress and suitable for unattended shipping.

For	CMC 500	CMC 430	CMC 310, DANEO 400
			
Description	Heavy-duty transport case with wheels and extendable handle	Heavy duty transport case with wheels, pluggable end plates, and extendable handle	Heavy-duty transport case with wheels and extendable handle
Dimension (W x H x D)	667 x 429 x 421 mm (26.3 x 16.9 x 16.6 in)	476 x 476 x 502 mm (18.7 x 18.7 x 19.7 in)	570 x 490 x 415 mm (22.4 x 19.3 x 16.3 in)
Weight	10.8 kg (23.8 lb)	17.6 kg (38.8 lb)	8.4 kg (18.5 lb)
Capacity	Test set, accessories	Test set, accessories	Test set, CMControl-3, accessories
Item no.	P0007932	B1636100	B0679500

## Soft bags and trolley

The soft bags and the trolley/backpack provide simple dust and surface protection when carrying the test set, but are not suitable for unattended shipping.

For	CMC 500	CMC 430	CMC 310	CMC 850	CMC 430, CMC 310
					
Description	Soft bag for device	Soft bag for device with compartments for accessories	Soft bag for device with* or without CMControl-3	Bag for device with compartments for accessories	Trolley/Backpack with wheels, extendable handle and shoulder straps
Included in standard delivery	no	yes	yes	yes	no
Item no.	P0007626	E1635901	E0659401* E0650201	E1805500	E1636000



## Mounting kit for 19-inch racks

P0010658

CMC 500 CMC 430 CMC 310 CMC 810

This mounting kit replaces the test set handle and allows the integration in 19-inch racks. The test set requires 5 rack units (5U) in height.

### Mini wireless USB adapter

E1636800



CMC 500      CMC 430      CMC 310      CMC 850

For wireless control of a test set:

Supported standards      IEEE 802.11b/g/n  
 Dimensions (W x H x D)      14.9 x 7.1 x 18.5 mm (0.6 x 0.3 x 0.7 in)

### CMGPS 588 – GPS controlled time synchronization unit

P0006433



CMC 500      CMC 430      CMC 310      CMC 850

The CMGPS 588 is an antenna-integrated, GPS controlled time reference optimized for outdoor usage. It works as a Precision Time Protocol (IEEE 1588/PTP) grandmaster clock and does not require any configuration work. It is automatically ready for operation within a very short time after powering the CMGPS 588 via Power over Ethernet (PoE). The distance between the CMGPS 588 and the CMC can be extended up to 95 m (312 ft) by using extension cables (one 15 m (49 ft) standard ethernet cable plus two 40 m (131 ft) rugged ethernet cable reels).

[www.omicronenergy.com/cmgps588](http://www.omicronenergy.com/cmgps588)

### CMIRIG-B – IRIG-B interface

P0006386



CMC 500      CMC 430      CMC 310      CMC 850

CMIRIG-B is an interface box enabling the connection of devices sending or receiving the IRIG-B protocol or PPS signals with CMC test sets. CMGPS 588 can optionally be used as time reference.

[www.omicronenergy.com/cmrig-b](http://www.omicronenergy.com/cmrig-b)

### OTMC 100p – PTP grandmaster clock

P0006508



CMC 500      CMC 430      CMC 310      CMC 850

The OTMC 100p is a GPS synchronized IEEE 1588/PTP grandmaster clock for time synchronizing IEDs and test devices via station LANs. The Power Profile (IEEE C37.238 :2017) and the Power Utility Profile (IEC/IEEE 61850-9-3:2016) are supported.

[www.omicronenergy.com/otmc100](http://www.omicronenergy.com/otmc100)

### TICRO 100 – PTP time converter

P0000604



CMC 500      CMC 430      CMC 310      CMC 850

TICRO 100 is a Precision Time Protocol time converter for deriving a high variety of time codes from IEEE 1588/PTP packages received by Ethernet. This allows for the easy synchronization of non-PTP capable equipment to the grandmaster of an IEEE 1588/PTP infrastructure.

[www.omicronenergy.com/ticro100](http://www.omicronenergy.com/ticro100)

## EMCON 200 – Ethernet media converter

P0006504



CMC 500    CMC 430    CMC 310    CMC 850

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 IEEE 1588/PTP is maintained. The network cable provides the power supply for the EMCON 200 using PoE (Power over Ethernet).

[www.omicronenergy.com/emcon200](http://www.omicronenergy.com/emcon200)

## TWX1 – Testing traveling wave relays

P0006385



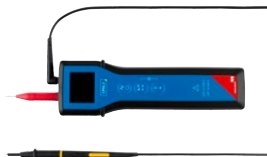
CMC 500<sup>1</sup>    CMC 430<sup>2</sup>    CMC 310    CMC 850

TWX1 is the ideal field-testing solution for testing traveling wave protection relays and fault locators. Transient signals and traveling wave pulses are automatically calculated. TWX1 is operated by RelaySimTest.

[www.omicronenergy.com/twx1](http://www.omicronenergy.com/twx1)

## CPOL3 – Polarity and wiring checker

P0009398



CMC 500    CMC 430    CMC 310    CMC 850

CPOL3 Polarity and wiring checker checks a series of terminals for correct wiring.

It offers the following functionalities and features:

- > True RMS voltage display
- > "Oscilloscope" mode to provide additional safety
- > Polarity check of current transformers and voltage transformers (CTs and VTs)
- > Polarity check of terminals and wiring connected to CTs and VTs
- > Replaces the test method that used batteries and conventional multimeters (avoids core saturation and subsequent maloperation of the protection)
- > Quick and easy assessment with green/red indication

[www.omicronenergy.com/cpol3](http://www.omicronenergy.com/cpol3)

<sup>1</sup> Recommended: USX or USH test set variant with a type S convertible output module for the current outputs

<sup>2</sup> Recommended: Decoupling box TWL1 to improve the traveling wave timing accuracy



## LLX1 – Testing devices with sensor inputs

P0006381



CMC 500    CMC 430    CMC 310    CMC 850

LLX1 is the ideal solution for testing protection and measurement devices with inputs for voltage and current sensors.

In addition to simulating the phase voltages and currents, LLX1 is also capable of simulating residual voltage and current for dedicated inputs.

A wide range of cables are available for easily connecting LLX1 to different devices that have specific connectors and pinouts:

Item no.	Cable type	Suitable for	Connector type
B1960000	LAB1	ABB Relion 615, 620 (w. SIM0002) ABB REX640 (w. SIM1901)	RJ45
B1960100	LAB2	ABB REF542plus	2x Twin-BNC
B2139500	LAB3	ABB CSU-2	RJ45
B1960300	LSE1	Schneider Electric Sepam	RJ45
B1960500	LSE2	Schneider Electric Easergy Schweitzer Engineering Laboratories SEL-751	2x RJ45
B1960200	LSI1	Siemens Siprotec 4 Compact	RJ45
P0008935	LST1	Devices acc. to IEC 61869-10/-11, e.g. ABB Relion 615, 620 (w. SIM0005) ABB REX640 (w. SIM1902) Siemens 7SY82 Sprecher Automation SPRECON-EDIR	RJ45

Non-exhaustive list of available cables. For the complete list please visit our website:

[www.omicronenergy.com/llx1](http://www.omicronenergy.com/llx1)



## LLX2 – Low level interface for external amplifiers

P0006382

CMC 500    CMC 430    CMC 310    CMC 850

LLX2 provides a standard low level interface for controlling external amplifiers such as the CMS 356 and other low level accessories with a 16-pin LEMO-type connector.



## LLX3 – Versatile low level outputs

P0006383

CMC 500    CMC 430    CMC 310    CMC 850

LLX3 provides low level outputs using standard 4 mm sockets. This makes LLX3 a flexible solution for further applications such as experimental setups.

## CMLIB A – Low level signal connector

P0006378

CMC 500 CMC 430 CMC 310 CMC 850



CMLIB A is used for connecting the low level signal outputs of a CMC for measurement or controlling purposes. It can also be used to connect the inputs of a CMS 356 with third party signal sources.

Connection cables can be ordered separately

- > BNC to BNC cable (E0306400)
- > BNC to 4 mm (0.16 in) banana cable (E0224500)
- > Test cables for Schneider Electric Easergy relays with sensor inputs (B1734800)

## RIB1 – Low level isolation box

P0006393

CMC 500 CMC 430 CMC 310 CMC 850



RIB1 is used to isolate the SELV low voltage signals from CMC test sets. It is connected between the low level outputs of the test set and the device under test and provides a reinforced insulation to the low level outputs of a CMC test set.

## CMLIB 7Sx8 – Interface adapter

P0006380

CMC 500 CMC 430 CMC 310 CMC 850



The CMLIB 7Sx8 is an interface adapter for connecting Siemens Siprotec 4 Compact protection relays fitted with sensor inputs (e.g. Siprotec 7SJ81) to the low level outputs of CMC test sets. CMLIB 7Sx8 converts the low-level output signals of the CMC into differential (balanced) signals. In addition, the adapter also provides the simulated voltage system.

## CMLIB REF6xx – Interface adapter

P0006379

CMC 500 CMC 430 CMC 310 CMC 850



The CMLIB REF6xx is an interface adapter for connecting ABB Relion protection relays fitted with sensor inputs (e.g. REF615 or REX640) to the low level outputs of CMC test sets. For Rogowski sensor simulation, CMLIB REF6xx converts the low-level output signals of the CMC into differential (balanced) signals. In addition, the adapter also provides the simulated voltage system.

## REF 54x – Cable connector for REF 54x

B0559600

CMC 500 CMC 430 CMC 310 CMC 850



This connection cable is tailored to connect the sensor inputs of ABB protection relays of the REF 54x series (except REF542 SCU) to the low level outputs of a CMC test set.

## ISIO 200 – Binary I/O terminal

P0006498

CMC 500    CMC 430    CMC 310    CMC 850



ISIO 200 is used to extend CMC test sets with eight binary inputs and eight binary outputs, each in two potential groups. It communicates using IEC 61850 GOOSE messages and is configured via the integrated web interface.

The accompanying module ISIO Connect allows for the use of up to three ISIO 200 devices. Applications with more than three ISIO 200 are supported by the GOOSE configuration module (separate license required).

[www.omicronenergy.com/isio200](http://www.omicronenergy.com/isio200)

## RXB1 – Binary output extension

P0006392

CMC 500    CMC 430    CMC 310    CMC 850



RXB1 is used to extend CMC test sets with binary relay outputs 5 to 8. Each extended binary output channel consists of a normally open (N.O.) and a normally closed (N.C.) contact.

## VBO3 – Voltage transformer

P0006276

CMC 500    CMC 430    CMC 310    CMC 850



VBO3 is a three-phase voltage transformer which extends the range of application of a CMC up to 600 V (L-N).

Voltage range primary	0 ... 300 V, 3-phase
Voltage range secondary	0 ... 600 V, 3-phase
Nominal frequency	50/60 Hz
Nominal power	33 VA per phase

## CMTAC 1 – AC to DC trigger rectifier

P0006278

CMC 500<sup>1</sup>    CMC 430<sup>1</sup>    CMC 310    CMC 850


Renewable energy systems such as wind energy plants often do not have battery arrangements for the provision of an auxiliary DC supply. In these installations the use of AC signals for the binary outputs has become an alternative.

By means of a CMTAC 1 the AC signal is converted to DC in order to connect such an output to a binary input of a CMC test set.

<sup>1</sup> Can trigger on AC voltages without CMTAC 1



Current clamp

P0008992

CMC 500<sup>1</sup>

CMC 430

CMC 310

CMC 850

Active AC and DC current clamp with voltage output for current measurements with EnerLyzer.

Measurement range:

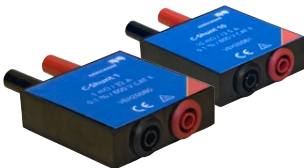
5 mA ... 60 A AC / 80 A DC

Max. wire diameter:

11.8 mm

Power supply:

9 V battery (included) or Micro-B USB port (USB charger not included)



C-Shunt

CMC 500<sup>1</sup>

CMC 430

CMC 310

CMC 850

C-Shunt is a precision shunt for current measurements with EnerLyzer. It can be directly inserted into the binary/analog inputs of a test set.

	C-Shunt 1	C-Shunt 10
Maximum current	32 A continuous	12.5 A continuous
Electrical resistance	0.001 Ω	0.01 Ω
Resistance tolerance	0.1 %	0.1 %
Item no.	B0620201	B0620301



ARC 256x – Arc flash initiator

P0006279

CMC 500

CMC 430

CMC 310

CMC 850

For testing arc flash protection systems, the ARC 256x simulates an arc flash by means of a xenon flash tube.

<sup>1</sup> CMC 500 with analog input option



## Optical scanning head for relay testing

P0009603

CMC 500 CMC 430 CMC 310 CMC 850

LEDs indicate some status information relevant to testing a protection relay, but its binary outputs do not. With the help of the scanning head, such a signal can be converted into a binary signal and used in a test sequence, e.g., for assessment or a trigger condition. The scanning head comes in a set with the ASH1 scanning head adapter for connecting it to the test set's binary input.



## Optical scanning heads for meter testing

CMC 500 CMC 430 CMC 310 CMC 850

### Scanning head for meters with optical pulse LEDs

The OSH 256 is an optical scanning head used to detect the status of optical pulse LEDs in energy meters. It can be attached to smooth surfaces with a suction cup or a reusable adhesive rubber compound. It is suitable for a wavelength range of 550 nm to 1000 nm. When using the scanning head with the CMC 500 or CMC 430, the ASH1 adapter for connecting to the binary inputs is required.

Description	Suitable for	Item no.
OSH 256 + ASH1	CMC 500, CMC 430	P0009600
OSH 256	CMC 310, CMC 850	P0006391



### Scanning head for meters with magnetic attachment

The SH 2015 is an optical scanning head for detecting the status of optical pulse LEDs in energy meters. It provides a ring magnet for attaching the unit to the meter and is suitable for wavelengths between 610 nm and 1000 nm. When using the scanning head with the CMC 500 or CMC 430, the ASH1 adapter for connecting to the binary inputs is required.

Description	Suitable for	Item no.
SH 2015 + ASH1	CMC 500, CMC 430	P0009601
SH 2015	CMC 310, CMC 850	P0006389



### Scanning head for electromechanical meters with rotor marks

The optical TK 326 scanning head is suitable for scanning the rotor marks of electromechanical meters. Additionally, it can be used to detect the status of optical pulse LEDs in a wavelength range of 450 nm to 950 nm. When using the scanning head with the CMC 500 or CMC 430, the ASH1 adapter for connecting to the binary inputs is required.

Description	Suitable for	Item no.
TK 326 + ASH1	CMC 500, CMC 430	P0009602
TK 326	CMC 310, CMC 850	P0006390



## CMLIB B set

P0006377

CMC 500 CMC 430 CMC 310 CMC 850

CMLIB B provides additional connection terminals to support advanced test setups:

- > Tests with reference meters which require two pulse inputs
- > Access to binary transistor outputs of a CMC test set

# Further Testing Solutions

In addition to the products described in this brochure, the following OMICRON devices are also relevant for applications in protection and measurement equipment testing:



## **CMS 356**

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The CMS 356 is a 6-phase current and 4-phase voltage amplifier that can be used in combination with CMC test sets or in conjunction with digital real time power system network simulators.

[www.omicronenergy.com/cms356](http://www.omicronenergy.com/cms356)



## **COMPANO 100**

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COMPANO 100 is the easy-to-use, lightweight and battery operated testing tool for all types of basic testing tasks in electrical energy systems, for example, in utilities (generation, transmission, and distribution), railway systems and industry.

[www.omicronenergy.com/compano100](http://www.omicronenergy.com/compano100)



## **ARCO 400**

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The universal, rugged and lightweight three-phase testing solution with smart test adapters for any type of recloser control provides the fastest and easiest way to test all of the controller's functions. Additionally, GPS-synchronized tests of distribution automation schemes are also possible.

[www.omicronenergy.com/arco400](http://www.omicronenergy.com/arco400)

You will find more detailed information regarding these products on [www.omicronenergy.com](http://www.omicronenergy.com) or in the respective product brochures.

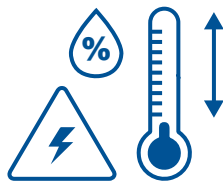


# We create customer value through ...

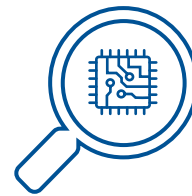
## Quality



Highest safety and security standards

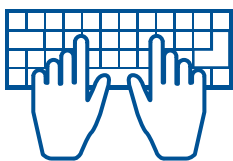


Up to 72 hours burn-in tests



100% routine testing for all components

## Innovation



>200 developers keep our solutions up-to-date



Reinvestment >15% in R&D

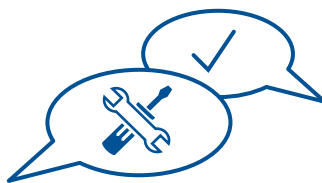


Up to 80% time saving through automation

## Support



Professional technical support



Cost-effective repair & calibration



23 offices worldwide

## Knowledge



>300 Academy trainings per year



OMICRON hosted training & events



Free papers & application notes

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 1250 employees provides solutions with 24/7 support at 23 locations worldwide and serves customers in more than 170 countries

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