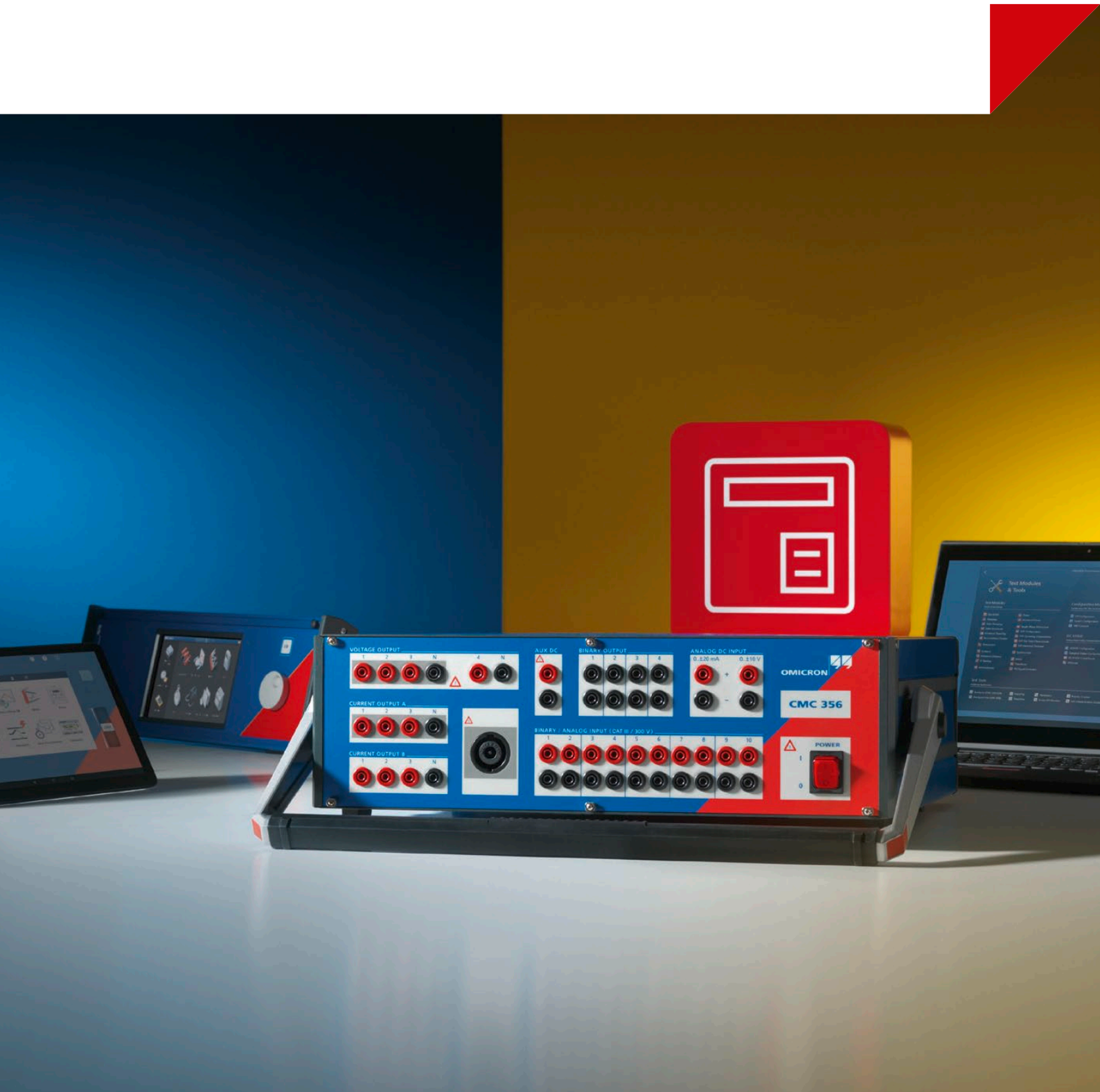
CMC 356

The Universal Relay Test Set and Commissioning Tool



Universal relay test set and commissioning tool

The CMC 356 is the top choice for applications which require the highest level of versatility, output amplitude, and power. It has six powerful current sources, with great dynamic range, making the test set a universal solution for testing all generations and types of protection relays – from high burden electromechanical to IEC 61850 compatible relays.

Commissioning engineers will particularly appreciate its ability to validate the correct wiring of current transformers, as well as ratio measurements through primary injection of high currents up to 128 A.

Safe and future-proof

The six current and four voltage output channels of the CMC 356 are continuously and independently adjustable in amplitude, phase and frequency. All outputs are protected against over-temperature, accidental short-circuits, external high-voltage transient signals and are monitored in case of overload.

The integrated network interface supports comprehensive testing in IEC 61850 environments using optional GOOSE simulation and subscription as well as Sampled Values simulation functionality. It is also possible to retrieve, evaluate and log the IED Client/Server SCADA communication according to IEC 61850.

DC supply:
0 ... 264 V

Voltage outputs:
4 x 300 V or 2 x 600 V

Current outputs:
6 x 32 A / 6 x 430 VA or
3 x 64 A / 3 x 860 VA or
1 x 128 A / 1 x 1000 VA

Generator combination socket:
3 x 300 V and 3 x 32 A

Varied applications

By utilizing the EnerLyzer software option, the ten binary inputs of the CMC 356[1] can also function as analog measurement inputs. The test set can then be used as a portable 10-channel multimeter, transient and trend recorder, harmonic signal analyzer and much more.

Up to 12 independent channels of low-level signals are available on the rear of the test set, which can be used to test relays with non-conventional sensor inputs (for example, Rogowski coils) or to control external amplifier units.

Connectivity options

The CMC 356 is designed to work with OMICRON's most powerful software tools. Users can control the test set using either a Windows PC/laptop or an Android tablet and connect via Ethernet/USB cable or Wi-Fi (through the optional mini wireless USB adapter).

Time synchronized applications according to IEEE 1588 are possible, for example, via CMGPS 588. The GPS controlled time reference with integrated antenna works as a Precision Time Protocol (PTP) grandmaster clock and is optimized for outdoor usage.

Organize your tests

For centralized planning, tracking and managing of all engineering, testing and maintenance activities in the power industry, the ADMO software[2] ensures that the workflows of asset and operations managers, testers, and protection engineers are structured and coordinated. Key data will be kept up-to-date and available to all employees at all times.

4 x binary outputs

Option ELT-1
DC measuring inputs:
0 ... 10 V and 0 ... 20 mA

10 x multifunctional inputs: binary (dry/wet)
Option ELT-1: analog measurement, EnerLyzer

16.8 kg / 37.0 lbs
450 x 145 x 390 mm / 17.7 x 5.7 x 15.4 in

Your benefits

- Powerful current sources for testing high-burden electromechanical relays
- High current amplitudes for 5 A relay testing
- High accuracy and versatility for testing digital and static relays of all types
- Integrated network interface for testing IEC 61850 IEDs

www.omicronenergy.com/CMC356

[1] When equipped with the ELT-1 hardware option
[2] ADMO light is included with every Test Universe package

Control options tailored to your needs

"Ideal solution for ..."

Manual settings-based testing with CMControl

CMControl P is the entry-level CMC operation platform specifically designed for easy manual settings-based testing of protection and measurement devices.

- Simple and fast testing with intuitive user guidance
- Reduced testing efforts, increased productivity
- No special training required

www.omicronenergy.com/cmcontrol

"... fast and easy manual testing with low initial effort"

Advanced settings-based testing with Test Universe

Test Universe is made for advanced testing and offers a wide range of application-optimized test modules. Customized templates allow users to achieve a high degree of automation and standardization.

- Fully automated settings-based protection testing
- Flexible test plans
- Function specific modules

www.omicronenergy.com/testuniverse

"... frequent and recurring testing, a wide application range and greater depth of testing"

Innovative system-based testing with RelaySimTest

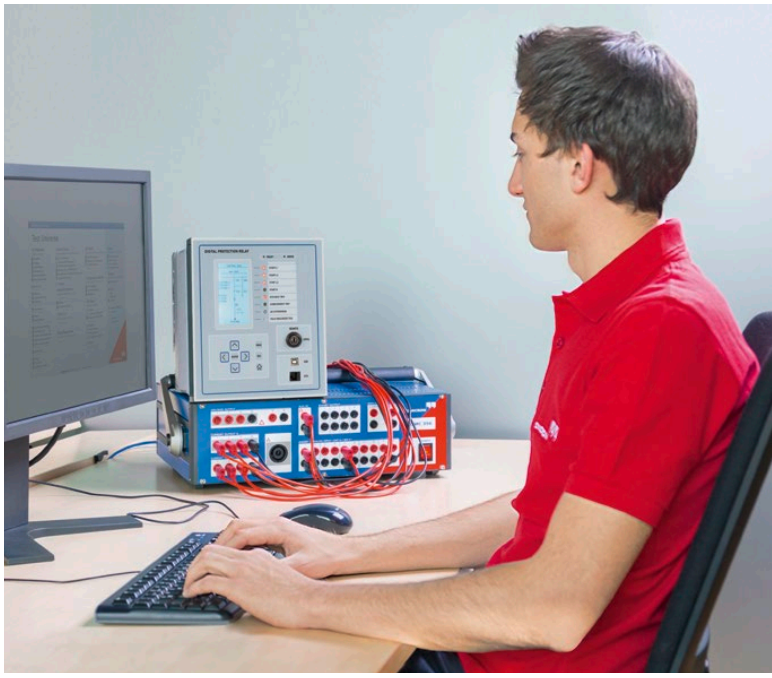
The innovative system-based testing approach of **RelaySimTest** allows the verification of the whole protection system with a higher testing quality than ever before.

- Logic and scheme testing with outstanding troubleshooting capabilities
- Supports easy end-to-end testing
- Independent of relay type and settings

www.omicronenergy.com/relaysimtest

"... logic testing, scheme testing and troubleshooting tasks"

Achieve the highest level of system reliability **using a combination** of settings-based and system-based testing.



Use the full potential of your CMC with ...

... Protection Testing Library (PTL)

The PTL provides predefined test templates for more than 400 protection relays from various manufacturers. The templates can be adapted and extended. Studies have shown that utilizing fully automated templates **can reduce testing time by up to 70%** compared to manual testing.

- Saves time and effort compared to manual creation of test plans
- Manual or automatic transfer of relay settings directly from the relay manufacturer's software
- Test templates and relay parameter converters (XRIO) customizable for individual requirements

www.omicronenergy.com/ptl

... EnerLyzer

EnerLyzer transforms a CMC into a multifunctional measuring, transient recording, and analysis device. A CMC test set with EnerLyzer can be used for conventional testing and for measuring simultaneously.

- 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)

www.omicronenergy.com/enerlyzer

Testing software packages and add-ons

A wide range of testing software is available consisting of Test Universe modules and additional tools. We have bundled typical testing requirements into useful software packages, but each package can of course be adapted to individual needs.

Essential offers a good introduction with basic functions and modules; can serve as a base for custom compiled packages

Standard contains all modules that are typically used for settings-based testing of protection devices

Enhanced like Standard, specifically extended by functions for system-based testing and transient simulation as well as for free programming

Complete covers all functions and software modules that are offered for controlling CMC test sets

			Packages					Add-ons		
			Essential	Standard	Enhanced	Complete		Measurement Equipment Testing	IEC 61850 Basic	IEC 61850 Advanced
Test Universe modules	OMICRON Control Center[1]	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	■	■	■	■				
	TransPlay	Playback of COMTRADE files, recording of binary input status	■	■	■	■				
	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	■	■	■	■				
	Pulse Ramping	Determining magnitude, phase, and frequency thresholds by ramping definitions	□	■	■	■				
	Overcurrent[2]	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	□	■	■	■				
	Single-Phase Differential	Single-phase tests of the operating characteristic and the inrush blocking	□	■	■	■				
	Advanced Differential	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)	□	■	■	■				
	Advanced TransPlay	Playback and processing of COMTRADE, PL4, or CSV files	□	■	■	■				
	Transient Ground Fault[3]	Simulation of ground-faults in isolated or compensated networks	□	□	■	■				
	Synchronizer	Automatic testing of synchronizing devices and synchro-check relays	□	□	■	■				
	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	□	□	□	■			■	■
	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	□	□	□	■				■
Additional tools	CMControl P App	Quick and easy manual testing of protection and measurement devices	□	■	■	■				
	RelaySimTest[3]	System-based protection testing by simulating realistic power system events	□	□	■	■				
	Adv. Transformer Features	Advanced transformer features for differential protection in RelaySimTest	□	□	□	■				
	CM Engine	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[4]	Asset and maintenance management for protection systems	■	■	■	■				
	IEDScout	Universal software tool for working with IEC 61850 IEDs							■	■

Contained in all packages: Binary I/O Monitor, AuxDC Configuration, ISIO Connect (for ISIO 200), Polarity Checker (for CPOL2).

[1] Includes licenses for Pause Module, ExeCute, TextView
[2] Includes license for Overcurrent Characteristics Grabber
[3] RelaySimTest license also includes the licenses for Transient Ground Fault and NetSim
[4] ADMO light is limited to 50 assets but can be upgraded to a full ADMO version at any time

■ Contained
□ Optionally available

CMC 356 accessories

The following accessories are included with the CMC 356 standard delivery but can also be ordered separately.

	Description	Order No.
	> Country-specific power cord 3 m / 9.8 ft	
	> Ethernet patch cable 1.5 m / 4.9 ft	E1664300
	> Ethernet patch cable 3 m / 9.8 ft	E1664400
	> USB connection cable 2 m / 6.6 ft	B1021101
	> Leads with 4 mm safety plugs (6 x red, 6 x black) 2 m / 6.6 ft	P0006168
	> Flexible terminal adapters (12 x black)	E0439201
	> Jumper flexible (4 x black) 6 cm / 2.4 in	E0439300
	> Flexible test lead adapters with retractable sleeve (6 x red, 6 x black)	P0006167
	> Grounding cable with battery clamp and M6 cable lug 6 m / 19.7 ft	B0349701
	> Soft bag	E0074602

Optional accessories[1]

	Description	Order No.
	CMC wiring accessory package For connecting test objects to CMC test sets, consisting of: > 12 flexible test lead adapters for connections to narrow terminals > 12 flexible test lead adapters with retractable sleeve for connections to non-safety sockets > 4 flexible jumpers for paralleling current outputs or shorting neutrals of binary inputs > 8 crocodile clips for contacting pins or screw bolts > 12 flexible terminal adapters for screw-type terminals > 20 cable lug adapters for M4 (0.15 in) screws > 10 cable lug adapters for M5 (0.2 in) screws > 10 cable ties 150 mm / 5.9 in long > 1 accessory bag	B1764601
	Mini wireless USB adapter For wireless control of the CMC 356.[2]	E1636800
	Generator combination cable Connection between the generator combination plug of the CMC 356 to the test object.	B1328100
	Transport case Heavy-duty transport case with wheels and extendable handle.	B0679403
	CMGPS 588 GPS controlled time reference with integrated antenna. It is optimized for outdoor usage and works as a PTP grandmaster clock according to IEEE 1588-2008, IEEE C37.238 (Power Profile), IEC 61850-9-3 (Utility Profile).	P0006433
	TWX1 For testing traveling wave protection relays and fault locators. Transient signals and traveling wave pulses are automatically calculated. TWX1[2] is operated by RelaySimTest.	P0006385
	CPOL 2 polarity checker For checking a series of terminals for correct wiring. The signal can be injected into the primary side of a CT. Thus, the correct polarity of CT wiring can be included in the test.	P0006331

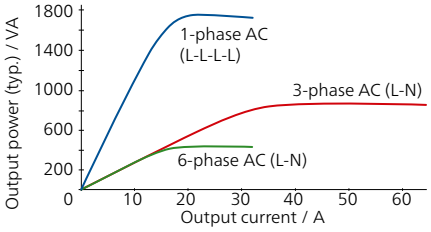
[1] Non-exhaustive list. For the complete list please visit our website: www.omicronenergy.com/cmc356
[2] Requires a CMC test set with NET-2 interface board.
Wi-Fi is subjected to technical and legal constraints. For more information please contact your local OMICRON office or sales partner.

Overview of technical specifications [1]

CMC 356

Current amplifier

Setting range	6-phase AC (L-N)	6 x 0 ... 32 A
	3-phase AC (L-N)	3 x 0 ... 64 A (Group A II B)
	1-phase AC (LL-LN)	1 x 0 ... 128 A (Group A II B)
	DC (LL-LN)	1 x 0 ... ±180 A (Group A II B)
Power	6-phase AC (L-N)	6 x 430 VA typ. at 25 A 6 x 250 W guar. at 20 A
	3-phase AC (L-N)	3 x 860 VA typ. at 50 A 3 x 500 W guar. at 40 A
	1-phase AC (L-L-L-L)	1 x 1740 VA typ. at 25 A 1 x 1100 W guar. at 20 A



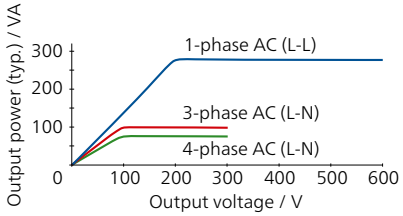
Accuracy	Error < 0.05 % rd. [2] + 0.02 % rg. [2] typ. Error < 0.15 % rd. + 0.05 % rg. guar.
Distortion (THD+N) [3]	< 0.05 % typ., < 0.15 % guar.
Resolution	1 mA
Max. compliance voltage (L-N)/(L-L)/(L-L-L-L)	35 Vpk / 70 Vpk / 140 Vpk

Amplifiers, general

Frequency	Range sine signals [4]	10 ... 1000 Hz
	Range harmonics / interharmonics	Voltage: 10 ... 3000 Hz [5] Current: 10 ... 1000 Hz
	Range transient signals	DC ... 3.1 kHz [5]
	Resolution	< 5 µHz
Phase	Resolution	0.001°
	Error at 50 / 60 Hz	Voltage: 0.02° typ., < 0.1° guar. Current: 0.05° typ., < 0.2° guar. [3]
Bandwidth (-3 dB)		3.1 kHz

Voltage amplifier

Setting range	4-phase AC (L-N)	4 x 0 ... 300 V
	2-phase AC (L-L)	2 x 0 ... 600 V
	DC (L-N)	4 x 0 ... ±300 V
Power	4-phase AC (L-N)	4 x 75 VA typ. at 100 ... 300 V 4 x 50 VA guar. at 85 ... 300 V
	3-phase AC (L-N)	3 x 100 VA typ. at 100 ... 300 V 3 x 85 VA guar. at 85 ... 300 V
	1-phase AC (L-L)	1 x 275 VA typ. at 200 ... 600 V 1 x 250 VA guar. at 200 ... 600 V



Accuracy (at 0 ... 300 V)	Error < 0.03 % rd. [2] + 0.01 % rg. [2] typ. Error < 0.08 % rd. + 0.02 % rg. guar.
Distortion (THD+N) [3]	0.015 % typ., < 0.05 % guar.
Resolution	5 mV / 10 mV in range 150 V / 300 V
Ranges	150 V / 300 V

Low level outputs

Number of outputs	6 (12 with Option LLO-2)
Setting range	0 ... ±10 Vpk

Auxiliary DC supply

Voltage ranges, max. current	0 ... 264 VDC, 0.2 A 0 ... 132 VDC, 0.4 A 0 ... 66 VDC, 0.8 A

Binary inputs

Number	10 (5 potential groups)
Trigger criteria	Toggling of potential-free contacts or DC voltage compared to threshold voltage
Ranges	20 V / 300 V If equipped with ELT-1 [6]: 100 mV / 1 V / 10 V / 100 V / 600 V
Sample rate	10 kHz (resolution 100 µs)

Binary outputs

Type	4 relay 4 transistor
Relay breaking capacity	Imax: 8 A / Pmax: 2000 VA at 300 VAC Imax: 8 A / Pmax: 50 W at 300 VDC

[1] The full technical specifications are available on request. All data specified are guaranteed, except where indicated otherwise. OMICRON guarantees the specified data for one year after factory calibration, within 23 °C ±5 °C / 73 °F ±10 °F in the frequency range from 10 to 100 Hz and after a warm-up phase > 25 minutes

[2] rd. = reading, rg. = range

[3] THD+N: Values at 50/60 Hz, 20 kHz measurement bandwidth

[4] For current outputs amplitude derating at > 380 Hz

[5] Amplitude derating at > 1000 Hz

[6] The ELT-1 hardware option turns the ten binary inputs into multi-functional analog AC and DC voltage measuring inputs and adds two DC measuring inputs (0 … 10 V / 0 … 20 mA) for transducer testing

DC measuring inputs (If option ELT-1 is equipped [1])

Measuring range voltage	0 ... ±10 V
Measuring range current	0 ... ±1 mA, 0 ... ±20 mA

Analog AC + DC measuring inputs (If option ELT-1 is equipped [1,2])

Type	AC + DC analog voltage inputs (current measurement with external current clamps or shunt resistors)
Number	10
Nominal input ranges (RMS values)	100 mV / 1 V / 10 V / 100 V / 600 V
Amplitude accuracy	Error < 0.06 % typ., < 0.15 % guar.

IEC 61850 [3]

Publishing

GOOSE	360 virtual binary outputs, 128 GOOSEs
Sampled Values	IEC 61850-9-2 („9-2LE"), IEC 61869-9

Subscribing

GOOSE	360 virtual binary inputs, 128 GOOSEs

Maximum number of streams

Publishing	RelaySimTest: 4, Test Universe: 3 (1 stream: 4 V + 4 I)

Time synchronization

Internal system clock

Frequency drift	< 0.37 ppm / 24 h < 4.6 ppm / 20 years

CMC 356 to external reference

Absolute timing accuracy (voltage/ current)	< 1 µs typ., < 5 µs guar.
To external voltage	Reference signal on binary input 10: 10 ... 300 V / 15 ... 70 Hz
Precision Time Protocol (PTP)	IEEE 1588-2008 IEEE C37.238 (Power Profile) IEC 61850-9-3 (Utility Profile)

CMC 356 to test objects

IRIG-B, PPS, PPX	Via CMIRIG-B, TICRO 100

[1] The ELT-1 hardware option turns the ten binary inputs into multi-functional analog AC and DC voltage measuring inputs and adds two DC measuring inputs (0 … 10 V / 0 … 20 mA) for transducer testing

[2] Up to three inputs can be used for measuring RMS values, frequency, and phase angle without the EnerLyzer software license. Full functionality requires EnerLyzer software license

[3] The GOOSE and Sampled Values functionality require software licences for the respective configuration modules

[4] For an operational temperature above +30 °C /+86 °F a duty cycle of down to 50 % may apply

Power supply

Nominal input voltage	100 ... 240 VAC, 1-phase (50/60 Hz)

Environmental conditions

Operation temperature [4]	0 ... +50 °C / +32 ... +122 °F
Storage temperature	-25 ... +70 °C / -13 ... +158 °F
Humidity range	Relative humidity 5 ... 95 %, non-condensing

Equipment reliability

Electromagnetic interference (EMI)

International / Europe	IEC/EN 61326-1, IEC/EN 61000-6-4, IEC/EN 61000-3-2/3, CISPR 32 (Class A)/EN 55032 (Class A)
North America	47 CFR 15 Subpart B (Class A) of FCC

Electromagnetic susceptibility (EMS)

International / Europe	IEC/EN 61326-1, IEC/EN 61000-6-2/5, IEC/EN 61000-4-2/3/4/5/6/8/11/16/18

Safety

International / Europe	IEC/EN 61010-1, IEC/EN 61010-2-030
North America	UL 61010-1, UL 61010-2-030, CAN/CSA-C22.2 No. 61010-1, CAN/CSA-C22.2 No. 61010-2-030

Mechanical tests

Vibration	IEC 60068-2-6
Shock	IEC 60068-2-27

Miscellaneous

Weight	16.8 kg / 37.0 lbs
Dimensions (W x H x D, without handle)	450 x 145 x 390 mm / 17.7 x 5.7 x 15.4 in
PC connection	2 PoE (Power over Ethernet) ports USB Type-B port (PC) USB Type-A port (optional Wi-Fi adapter for wireless control)

Certifications

Developed and manufactured under an ISO 9001 registered system

We create customer value through ...

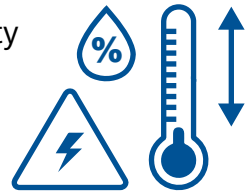
Quality

You can rely on the highest safety and security standards

Superior reliability with up to

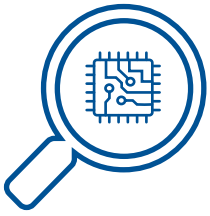
72

hours burn-in tests before delivery



100%

routine testing for all test set components



ISO 9001
TÜV & EMAS
ISO 14001
OHSAS 18001

Compliance with international standards

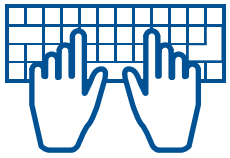
Innovation

... a product portfolio tailored to my needs

More than

200

developers keep our solutions up-to-date



More than

15%

of our annual sales is reinvested in research and development

Save up to

70%

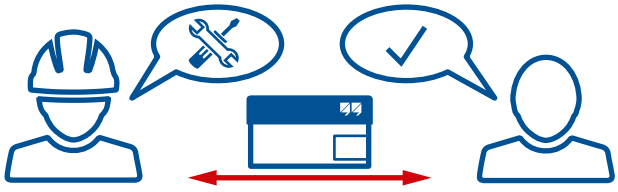
testing time through templates, and automation

Support

24/7

Professional technical support at any time

Loaner devices help to reduce downtime



Cost-effective and straight-forward repair and calibration

25

offices worldwide for local contact and support

Knowledge

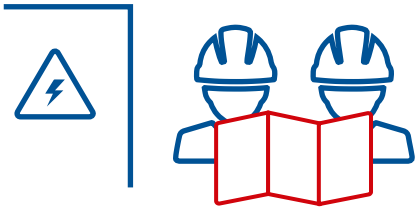
More than

300

Academy and numerous hands-on trainings per year

Frequently OMICRON hosted user meetings, seminars and conferences

to thousands of technical papers and application notes



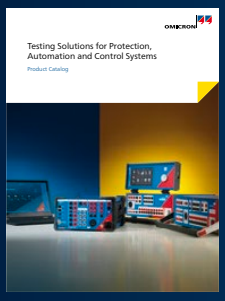
Extensive expertise in consulting, testing and diagnostics

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

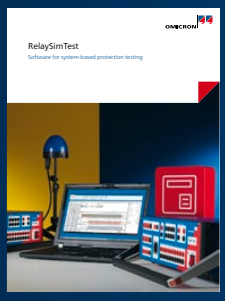
Within the OMICRON group, we research and develop innovative technologies for all fields in electric power systems. When it comes to electrical testing for medium- and high-voltage equipment, protection testing, digital substation testing solutions, customers all over the world trust in the accuracy,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

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

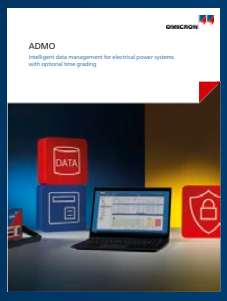
The following publications provide further information on the solutions described in this brochure:



Product catalog



RelaySimTest



ADMO

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

www.omicronenergy.com

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