

# CMC 430

Ultra-portable Protection Test Set and Calibrator



# Extremely light, precise, and flexible

## Demanding challenges in future protection testing

Time and cost pressure in the field of protection testing have reached a new level of intensity. This trend is expected to continue or even rise in the future. Concurrently, the requirements on testing equipment are ever increasing.

It's no longer just classic hardwired facilities that need to be commissioned or routinely tested. More and more communication based secondary protection and measurement equipment present new challenges to personnel and test sets. The calibration of energy meters, measuring transducers, PQ meters, and other measuring equipment also needs to be addressed at this point.



DC input

Communication and accessory ports

Interface for accessories / expansion mode

Analog / binary inputs

Binary outputs



# protection testing and calibration solution

## Lightening the load

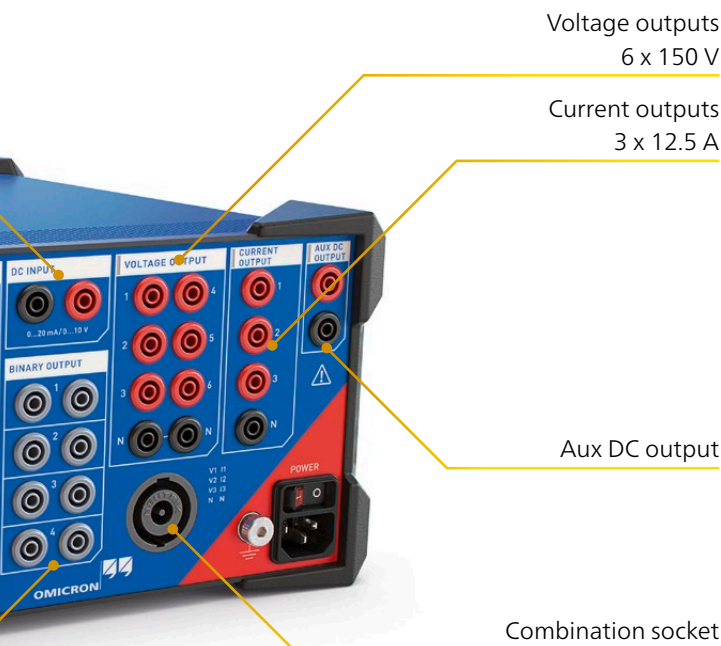
For testing modern protection and measurement devices, current and power requirements are often not very demanding, especially when 1 A CT secondaries are used. Why carry around bulky and heavy equipment? What if there was an integrated testing and calibration solution for practically all kinds of devices installed in secondary circuits?

Based on 25 years of practical experience, OMICRON has designed a brand new addition to its family. The CMC 430 combines many innovative ideas and impresses in terms of excellence in electrical engineering in combination with ultimate ease of use. Technicians now have a great option: working with the lightest, most flexible, and most precise protection test set in the world!

## Climbing to new heights in usability, versatility and performance

The CMC 430 is the preferred choice for test engineers in cases where excellent transportability is needed. Three current outputs provide up to 12.5 A per phase, for occasional six-phase tests two CMC 430 can be combined using the Expansion Mode. Its low weight of just 8.7 kg / 19.2 lbs, and robust design with its edge protection predisposes the device for every outdoor and indoor use.

Typically, this device is most suitable in environments where numerical and communication based protection prevails. With its 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 SV).



### Your benefits

- > Ultra-portable (**8.7 kg / 19.2 lbs**)
- > Convenient on-site handling
- > Six voltage outputs
- > Relay test set **and** calibrator
- > Six current outputs with two CMC 430 (Expansion Mode)
- > Hybrid measurement and recording

[www.omicronenergy.com/CMC430](http://www.omicronenergy.com/CMC430)

# Benefit from a variety of applications and different software tools

The CMC 430 is designed to work with OMICRON's most powerful software tools. You can control the device using either a Windows PC/laptop or an Android tablet and connect via Ethernet/USB cable or Wi-Fi.

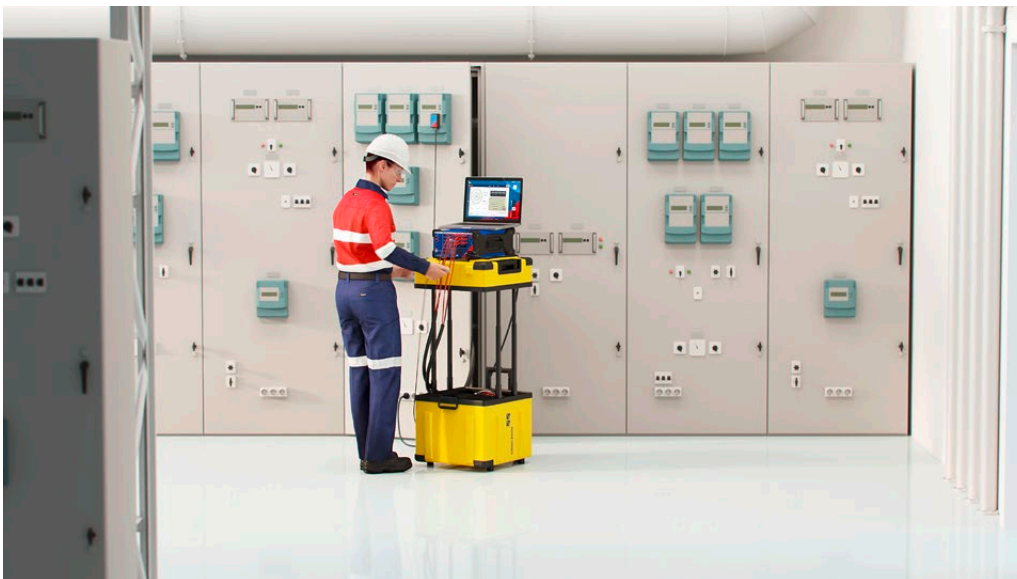
**Test Universe** is the most powerful and convenient software tool for basic parameter related testing of protection and measurement devices in power systems. It offers a wide range of comprehensive software options that are based on various packages in 16 languages.

The packages are tailored to specific operational requirements and contain a selection of Test Universe test modules. Each module is function-oriented and can operate either on a stand-alone basis or can be embedded in test plans for fully automated testing. Software for special applications completes the range.

Test Universe enables a variety of test approaches, from manual to fully automated and standardized tests, running on a PC or laptop. The OMICRON Control Center (OCC) allows the option to individually combine testing functions into an overall test plan. With the related Protection Testing Library (PTL), OMICRON provides a collection of prepared test plans for a vast number of relay-specific testing applications and test objects.

Test Universe also comprises generic test modules to create and perform special tests not covered by the function related modules. Furthermore, each module includes the automatic reporting function for fully formatted test reports.

For more information see page 6.



## Application areas

### Protection testing

CMC 430 enables easy and reliable testing of solid state relays, numerical relays, or IEC 61850 IEDs. With its six voltage outputs, it is ready for testing synchro-check and bay control systems

with six voltage inputs. With RelaySim-Test, the device performs distributed testing by simultaneously controlling multiple CMCs.

The **CMControl App** is an easy to use control alternative to Test Universe specifically designed for quick manual testing. It runs on either an Android tablet or on a Windows PC/ laptop. The menu navigation guides the user step by step through the test sequence. The test tools included and the integrated fault models are optimized for manual testing to quickly obtain reliable test results that can simply be saved.

For more information visit our website  
[www.omicronenergy.com/cmcontrol-p](http://www.omicronenergy.com/cmcontrol-p)

**RelaySimTest** is a unique software for protection and scheme testing using one or more CMC test sets. Its system-based testing approach validates the correct operation of the entire protection system by simulating realistic power system events. In addition to common tests, RelaySimTest also reveals settings, logic and design errors in the scheme, requiring only a minimum of test steps.

For distributed tests, such as teleprotection or line differential protection, multiple CMC 430s can be controlled from only one PC while remote devices are connected via a simple Internet connection and are time synchronized by CMGPS 588 or CMIRIG-B.

For more information visit our website  
[www.omicronenergy.com/relaysimtest](http://www.omicronenergy.com/relaysimtest)



### Calibration

The CMC 430 generates highly precise test signals for measurement device calibration, such as energy meters, transducers or PQ devices.

### Measurement

The CMC 430 provides two Ethernet ports and six analog/binary input channels. Along with its software option EnerLyzer Live, it supports

hybrid measurements of analog/binary signals, IEC 61850 GOOSE messages and SV as well as transient recording, while analog outputs are active.

# 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.

		Packages				Add-ons			
		Essential	Standard	Enhanced	Complete	Measurement Equipment Testing	IEC 61850 Basic	IEC 61850 Advanced	
<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								
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	■	■	■	■			
	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 <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	□	■	■	■			
	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 <sup>3</sup>	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 <sup>3</sup>	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 Live	Analog measurements and transient recording with CMC test sets	□	□	□	■			
	TransView	Transient signal analysis for COMTRADE files	□	□	□	■			
	ADMO light <sup>4</sup>	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).

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

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


<sup>3</sup> RelaySimTest license also includes the licenses for Transient Ground Fault and NetSim

<sup>4</sup> ADMO light is limited to 50 assets but can be upgraded to a full ADMO version at any time







■ Contained  
□ Optionally available

# CMC 430 accessories

The following accessories are part of the CMC 430 standard delivery but can also be ordered separately.

	Description	Item no.
	<ul style="list-style-type: none"> <li>&gt; Country-specific power cord 3 m / 9.8 ft.</li> <li>&gt; Ethernet patch cable 1.5 m / 4.9 ft.</li> <li>&gt; Ethernet patch cable 3 m / 9.8 ft.</li> <li>&gt; USB connection cable 2 m / 6.6 ft.</li> <li>&gt; Leads with 4 mm safety plugs (6 x red, 6 x black) 2 m / 6.6 ft.</li> <li>&gt; Flexible terminal adapters (12 x black)</li> <li>&gt; Flexible test lead adapters with retractable sleeve (6 x red, 6 x black)</li> <li>&gt; Grounding cable with battery clamp and M6 cable lug 6 m / 19.7 ft.</li> <li>&gt; Soft bag</li> </ul>	<p>E1664300 E1664400 B1021101 P0006168 E0439201 P0006167 B0349701 E1635901</p>




## Optional accessories<sup>1</sup>

	Description	Item no.
	<p><b>CMC wiring accessory package</b> For connecting test objects to CMC test sets, consisting of:</p> <ul style="list-style-type: none"> <li>&gt; 12 flexible test lead adapters for connections to narrow terminals</li> <li>&gt; 6 + 6 flexible test lead adapters with retractable sleeve for connections to non-safety sockets</li> <li>&gt; 4 flexible jumpers for paralleling current outputs or shorting neutrals of binary inputs</li> <li>&gt; 4 + 4 crocodile clips for contacting pins or screw bolts</li> <li>&gt; 12 flexible terminal adapters for screw-type terminals</li> <li>&gt; 20 cable lug adapters for M4 (0.15 in) screws</li> <li>&gt; 10 cable lug adapters for M5 (0.2 in) screws</li> <li>&gt; 10 cable ties 150 mm (5.9 in) long</li> <li>&gt; 1 accessory bag</li> </ul>	<p>B1764601</p>
	<p><b>Mini wireless USB adapter</b> For wireless control of the CMC 430.<sup>2</sup></p>	<p>E1636800</p>
	<p><b>Expansion port cable</b> Connect two CMC 430 for six current outputs (expansion mode). 1 m / 3.3 ft. 2.5 m / 8.2 ft.</p>	<p>B1630800 B1631500</p>
	<p><b>Generator combination cable</b> Connection between the generator combination plug of the CMC 430 to the test object.</p>	<p>B1328100</p>
	<p><b>Transport case</b> Heavy duty transport case with wheels, pluggable end plates, and extendable handle for effective protection against dust, dripping water, and mechanical damage of a CMC 430 and accessories, suitable for unattended shipping. The lid may be raised for use as a bench for a notebook while the CMC 430 stays in the case.</p>	<p>B1636100</p>
	<p><b>Trolley / Backpack</b> With wheels, extendable handle and shoulder straps for transportation of a CMC test set including accessories. For simple mechanical protection, not for unattended shipping.</p>	<p>E1636000</p>

<sup>1</sup> Non-exhaustive list. For the complete list please visit our website: [www.omicronenergy.com/cmc430](http://www.omicronenergy.com/cmc430)

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

# CMC 430 accessories <sup>1</sup>

	Description	Item no.
	<p><b>CMGPS 588</b> 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).</p>	P0006433
	<p><b>CPOL 2 polarity checker</b> 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.</p>	P0006331
	<p><b>LLX1 – Testing devices with sensor inputs</b> LLX1 is the ideal solution for testing protection and measurement devices with inputs for voltage and current sensors. A wide range of cables are available for easily connecting LLX1 to different devices that have specific connectors and pinouts. For a complete list please visit our website: <a href="http://www.omicronenergy.com/llx1">www.omicronenergy.com/llx1</a></p>	P0006381
	<p><b>LLX2 – Low level interface for external amplifiers and accessories</b> 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.</p>	P0006382
	<p><b>LLX3 – Versatile low level outputs with 4 mm sockets</b> LLX3 provides low level outputs using standard 4 mm sockets. This makes LLX3 a flexible solution for further applications such as experimental setups.</p>	P0006383
	<p><b>LLX4 – Low level outputs for recloser and sectionalizer controls</b> LLX4 is used in combination with OMICRON's test cables for recloser and sectionalizer controls that are equipped with sensor inputs.</p>	P0006384
	<p><b>VBO3 – Voltage transformer</b> VBO3 is a three-phase voltage transformer which extends the range of application of a CMC up to 600 V (L-N).</p>	P0006276
	<p><b>Current Clamp</b> Active AC and DC current clamp with voltage output.</p>	P0008992
	<p><b>OSH 256 + ASH1 set</b> For the status detection of optical pulse LEDs of energy meters. It is suitable for a wavelength range of 550 nm to 1000 nm. It consists of the OSH 256 optical scanning head and an the ASH1 adapter for connection to the binary inputs.</p>	P0009600

<sup>1</sup> Non-exhaustive list. For the complete list please visit our website: [www.omicronenergy.com/cmc430](http://www.omicronenergy.com/cmc430)



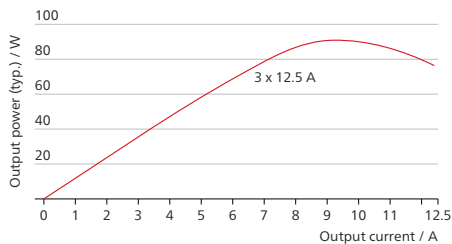
# Overview of technical specifications<sup>1</sup>

## CMC 430



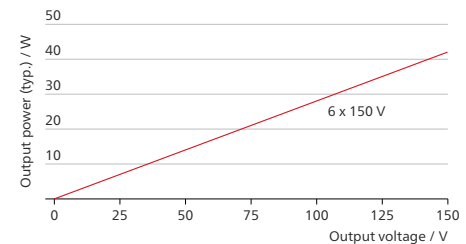
### Current amplifier

Setting range	3-phase AC (L-N)	3 x 0 ... 12.5 A
	1-phase AC (L-L)	1 x 0 ... 12.5 A
	1-phase AC (LLL-N)	1 x 0 ... 37.5 A
	DC (LLL-N)	1 x 0 ... ±37.5 A
Power	3-phase AC (L-N)	3 x 90 W typ. at 9 A 3 x 85 W guar. at 9 A
	1-phase AC (L-L)	1 x 180 W typ. at 9 A 1 x 170 W guar. at 9 A
	1-phase AC (LLL-N)	1 x 250 W typ. at 24 A
		1 x 200 W guar. at 24 A



### Voltage amplifier

Setting range	6-phase AC (L-N)	6 x 0 ... 150 V
	3-phase AC (L-L)	3 x 0... 300 V (without common N)
	DC (L-N)	3 x 0 ... ±212 V
Power	6-phase AC (L-N)	6 x 42 W typ. at 150 V 6 x 37.5 W guar. at 150 V
	3-phase AC (L-L)	3 x 42 W typ. at 150 V 3 x 37.5 W guar. at 150 V
		1-phase AC (L-L)



### Current magnitude accuracy

Range	typical <sup>2,3</sup>	1 year <sup>2</sup>	2 years <sup>2</sup>
10...100 Hz; I < 6 A	0.02 + 0.005	0.04 + 0.01	0.07 + 0.01
10...100 Hz; I > 6 A		0.08 + 0.01	0.11 + 0.01
Resolution		100 µA	
Max. compliance voltage (L-N/L-L)		17 Vpk / 34 Vpk	
Ranges		1.25 A / 12.5 A	

### Voltage magnitude accuracy

Range	typical <sup>2,3</sup>	1 year <sup>2</sup>	2 years <sup>2</sup>
10...100 Hz (V1-V3)	0.015 + 0.005	0.04 + 0.01	0.06 + 0.01
10...100 Hz (V4-V6)		0.07 + 0.01	0.11 + 0.01
Resolution		100 µV	

### General amplifier specifications

Frequency range	Sine signals	DC ... 1000 Hz
	Harmonics, Inter-harmonic, Transients	DC ... 3000 Hz
Resolution	< 5 µHz	
Phase accuracy 50/60 Hz (ref V1)	0.005° typ.	0.02° guar.
THD+N at 50/60 Hz	< 0.1 % at full scale	
Simulated Power/ Energy (1 Year)	0.1 % of set value at 50/60 Hz; PF = 1	
	50 V to 70 V at < 2 W 0.05 A to 6 A at < 0.3 Ohm	

### Auxiliary DC supply

Voltage range	12 ... 264 VDC
Power	Inrush (< 2 s) 120 W / 2 A Continuous 50 W / 0.8 A

### Binary inputs

Number	6 (each fully isolated)
Trigger criteria	Toggeling of potential-free contacts, AC or DC voltage compared to threshold voltage
Ranges	10 mV / 100 mV / 1 V / 10 V / 100 V / 600 V
Sampling rate	10 kHz (resolution 100 µs)
Max. measuring time	Infinite

### 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

<sup>1</sup> 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 > 30 minutes

<sup>2</sup> ± (% of set value + % of range) or better

<sup>3</sup> Typical values apply to 98 % of all devices immediately after a factory calibration (adjustment)

# Technical specifications

## DC measuring inputs

Measuring range voltage	$\pm 10$ mV, $\pm 100$ mV, $\pm 1$ V, $\pm 10$ V
Measuring range current	$\pm 1$ mA, $\pm 20$ mA

## Analog AC + DC measuring inputs

Number	6, each fully isolated
Sampling frequency	10 kHz, 40 kHz (configurable)
Nominal input ranges (RMS values)	10 mV / 100 mV / 1 V / 10 V / 100 V / 600 V
Amplitude accuracy (1 V/10 V/100 V)	0.08 + 0.03 (1 year <sup>1</sup> ) 0.11 + 0.04 (2 years <sup>1</sup> )
Analog measurement quantities	I, V (AC/DC, RMS and instantaneous), $\phi$ , f, P, Q, S, harmonics (up to 64 <sup>th</sup> ), df/dt
Hybrid <sup>2</sup> recording while analog outputs are active	With software option Enerlyzer Live

## IEC 61850<sup>3</sup>

### 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
Sampled Values	IEC 61850; IEC 61869-9

### Maximum number of streams

Publishing	RelaySimTest: 4, Test Universe: 3
Subscribing	2

## Time synchronization

### Internal system clock

Frequency drift	< 0.37 ppm / 24 h < 4.6 ppm / 20 years
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### CMC 430 to external reference

Absolute timing accuracy (voltage/current)	< 1 $\mu$ s typ., < 5 $\mu$ s guar.
To external voltage	Reference signal on binary input 6: 10 ... 600 V / 15 ... 70 Hz
Precision Time Protocol (PTP)	IEEE 1588-2008 IEEE C37.238-2011 (Power Profile) IEC 61869-9-3 (Utility Profile)

### CMC 430 to test objects

IRIG-B, PPS, PPX	Via CMIRIG-B, TICRO 100
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## Power supply

Nominal	100 ... 240 V, 50/60 Hz, 1000 W
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## Environmental conditions

Operation temperature	-25 ... +50 °C / -13 ... +122 °F
Storage temperature	-40 ... +70 °C / -40 ... +158 °F
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 61000-4-2/3/4/5/6/8/11
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### 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

Classification	IEC 60721-3-7
Vibration	IEC 60068-2-64
Shock	IEC 60068-2-27
Free fall	IEC 60068-2-31

## Miscellaneous

Weight	8.7 kg / 19.2 lbs
Dimensions	270 x 150 x 380 mm / 10.6 x 5.9 x 15.0 in
Interfaces	2 PoE ethernet ports 1 USB Type-B port 1 USB Type-A port 1 External interface 4 Expansion ports: For LLX1–LLX4 and expansion mode LED indication status of analog output signals Configurable beeper

## Certifications

Developed and manufactured under an ISO 9001 registered system



<sup>1</sup>  $\pm$  (% of reading + % of range) or better

<sup>2</sup> Analog, binary, SV and GOOSE

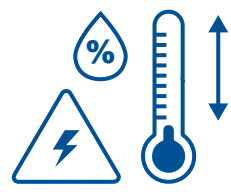
<sup>3</sup> The GOOSE and Sampled Values functionality require software licences for the respective configuration modules

# We create customer value through ...

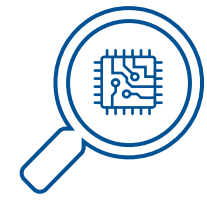
Quality



Highest safety and security standards

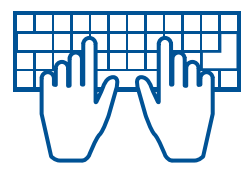


Up to 72 hours burn-in tests

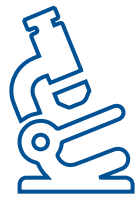


100% routine testing for all components

Innovation



>200 developers keep our solutions up-to-date



Reinvestment >15% in R&D

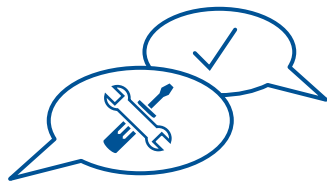


Up to 70% time saving through automation

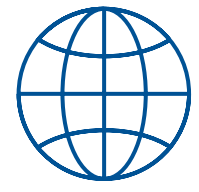
Support



Professional technical support



Cost-effective repair & calibration



25 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.

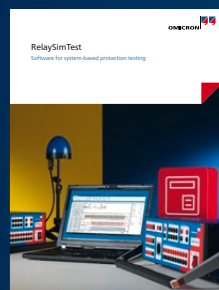
Within the OMICRON group, we research and develop innovative technologies for all fields in electric power systems. When it comes to electrical testing for medium- and high-voltage equipment, protection testing, digital substation testing solutions, and cybersecurity solutions, customers all over the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

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