

# 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

Analog / binary inputs

Binary outputs



# protection testing 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?

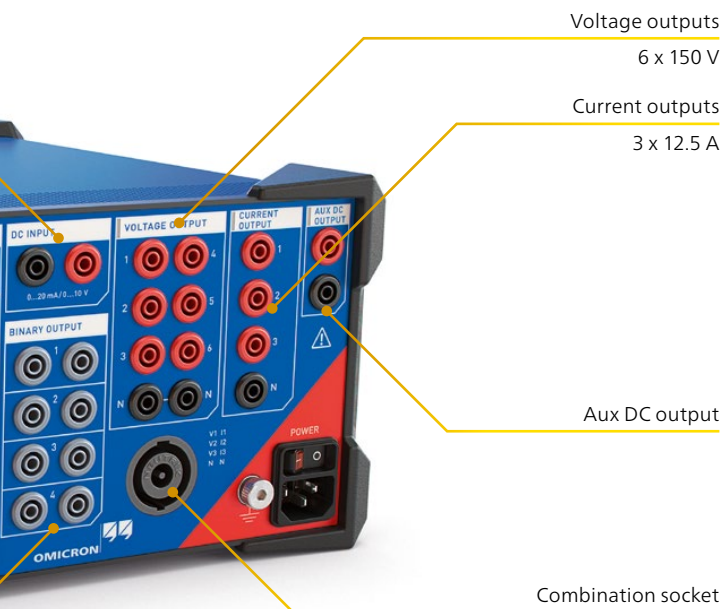
Based on 25 years of practical experience, OMICRON has designed a brand new addition to its family. The CMC 430 combines many innovative ideas and impresses in terms of excellence in electrical engineering in combination with ultimate ease of use. Technicians now have a great option: working with the 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 and three currents up to 12.5 A are sufficient. 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).

The product meets the safety and health requirements as shown in the technical specification section "Safety", certified by TÜV SÜD AMERICA INC.



## Your benefits

- > Ultra-portable  
**(8.7 kg / 19.2 lbs)**
- > Convenient on-site handling
- > Six voltage outputs
- > Relay test set **and** calibrator
- > 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 RelaySimTest, 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.

The apps support two applications. The CMControl P App enables quick testing of protection and measurement devices. The CMControl R App is adapted to the typical processes for testing recloser and sectionalizer controls.

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

**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.

# Select your suitable Test Universe package

A package can be extended at any time by ordering additional single modules or optional add-ons.

		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 foundation for individually 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							
OMICRON Control Center	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	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	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				■			■
CMControl P App	Quick and easy manual testing of protection and measurement devices	■	■	■				
RelaySimTest	System-based protection testing by simulating realistic power system events			■	■			
CM Engine	Programming interface for controlling CMC test sets with user specific software			■	■			
EnerLyzer / EnerLyzer Live	Analog measurements and transient recording with CMC test sets				■			
TransView	Transient signal analysis for COMTRADE files				■			
ADMO	Asset and maintenance management for protection systems							
	Test set management							

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

# CMC 430 accessories

	Description	Order No.
	<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>	VEHP0028
	<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>	VEHP0029
	<p><b>Soft bag</b> For simple dust and surface protection of a CMC 430, also usable as accessory bag (included in standard delivery).</p>	VEHP0030
	<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 C37.238-2011 Power Profile.</p>	VEHZ3004
	<p><b>CMIRIG-B</b> Interface box enabling the CMC 430 to send or receive the IRIG-B protocol or PPS signals. CMIRIG-B performs the level conversion between the CMC and the sources or receivers. CMGPS 588 can optionally be used as the source of a synchronizing trigger pulse or PPS signal.</p>	VEHZ1150
	<p><b>TICRO 100</b> For time conversion from IEEE/PTP to PPX, IRIG-B, DCF77. With holdover functionality for usage as time source in cases where no access to GPS is available. <a href="http://www.omicron-lab.com/ticro-100">www.omicron-lab.com/ticro-100</a></p>	OL000311
	<p><b>ISIO 200</b> Binary I/O Terminal (8 inputs, 8 outputs) with IEC 61850 Interface.</p>	VESC1600
	<p><b>C-Probe 1 Current Clamp</b> C-Probe 1 is an active AC and DC current probe with voltage output.</p>	VEHZ4000
	<p><b>C-Shunt</b> C-Shunt 1 is a precision shunt (0.001 <math>\Omega</math>) for 32 A continuous. C-Shunt 10 is a precision shunt (0.01 <math>\Omega</math>) for 12.5 A continuous.</p>	VEHZ0080 VEHZ0081

# CMC 430 accessories

	Description	Order No.
	<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>	VEHZ0702
	<p><b>ARC 256x</b> For testing arc flash protection systems.</p>	VEHZ0092
	<p><b>SEM 1</b> For the status detection of optical pulse LEDs of electronic energy meters. It is suitable for a wavelength range of 550 nm to 1000 nm. SEM 1 consists of the OSH 256 passive optical scanning head and an adapter cable for direct connection to the external interface connector.</p>	VEHZ1158
	<p><b>SEM 2</b> For scanning of all known rotor marks of Ferraris meters and optical pulse outputs of electronic meters. It is suitable for a wavelength range of 450 nm to 950 nm. SEM 2 consists of the photoelectric scanning head TK 326 and an adapter cable for direct connection to the external interface connector.</p>	VEHZ1157
	<p><b>SEM 3</b> For pulse detection of electronic meters. The scanning head includes a ring magnet to attach the unit to solid-state-meters. It is suitable for a wavelength range of 610 nm to 1000 nm. SEM 3 consists of the photoelectric scanning head SH 2015 and an adapter cable for direct connection to the external interface connector.</p>	VEHZ1156
	<p><b>SER 1</b> For scanning the status indication LEDs of protection relays. SER 1 consists of the OSH 256R passive optical scanning head and the interface box IFB 256 for connecting its binary outputs to one of the binary inputs of the CMC 430.</p>	VEHZ1155
	<p><b>Generator combination cable</b> Connection between the generator combination plug of the CMC 430 to the test object.</p>	VEHK0103
	<p><b>Mini Wi-Fi USB Adapter<sup>1</sup></b> For wireless control of the CMC 430.</p>	VEHZ0095
	<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; 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>	VEHZ0060

<sup>1</sup> Wi-Fi is subjected to technical and legal constraints. For more information contact your local OMICRON sales department.



# Technical specifications<sup>1</sup>



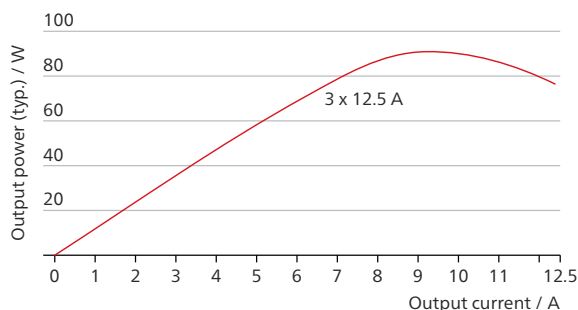
## CMC 430

### Current amplifier

Number of outputs	3
Ranges	Range 1: 0 ... 1.25 A Range 2: 0 ... 12.5 A
Configurations	3 x 12.5 A; 90 W at 9 A (typical) 1 x 12.5 A; 180 W at 9 A (typical) 1 x 37.5 A; 250 W at 24 A
Max. compliance voltage (L-N/L-L)	17 Vpk/34 Vpk
Adjustable resolution (AC)	100 µA

### 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

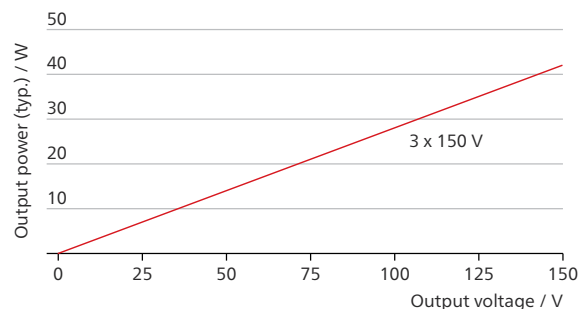


### Voltage amplifier

Number of outputs	6
Range	0 ... 150 V
Configurations	6 x 42 W at 150 V (typical) 3 x 45 W at 150 V (typical) V <sub>E</sub> automatically calculated 1 x 84 W at 300 V (L-L) (typical) 3 x 84 W at 300 V (without common N) (typical)
Adjustable resolution (AC)	100 µV

### 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



### Trigger on overload

Supported generators	Current generators
Timer accuracy	1 ms or better

### General amplifier specifications

Frequency range	Sine signals	DC ... 1000 Hz
	Harmonics, Inter-harmonic, Transients	DC ... 3000 Hz
Adjustable resolution	1 mHz	
Accuracy/drift	±4.6 ppm of set value (20 years)	
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	
Protection	All current and voltage outputs are fully overload and short circuit proof and protected against external high-voltage transient signals and over temperature	

<sup>1</sup> Unless otherwise stated all specifications are valid after 30 min. warm-up at 23 °C ±5 °C / 73 °F ±10 °F under symmetrical conditions and ohmic load

<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<sup>1</sup>

## CMC 430

### Analog / binary inputs

Binary functions	
Number of inputs	6, each fully isolated
Measurement category	600 V / CAT II, 300 V / CAT III, 150 V / CAT IV
Ranges	10 mV, 100 mV, 1 V, 10 V, 100 V, 600 V
Sampling frequency	10 kHz (resolution 100 µs)
Max. measuring time	Infinite
Input configurations	0 ... ±600 V <sub>DC</sub> (threshold to be set), potential-free, DC and AC trigger, counter

Analog functions	
Number of inputs	6, each fully isolated
Measurement category	600 V / CAT II, 300 V / CAT III, 150 V / CAT IV
Sampling frequency	10 kHz, 40 kHz (configurable)
Overload indication	yes
Phase / frequency accuracy	0.02° (2 years) 15 .. 70 Hz 0.01 % (2 years)

Range	Frequency	1 Year <sup>2</sup>	2 Years <sup>2</sup>
10 mV	10 Hz .. 1 kHz	0.26 + 0.08	0.30 + 0.08
100 mV	10 Hz .. 1 kHz	0.15 + 0.04	0.18 + 0.05
1/10/100 V	10 Hz .. 1 kHz	0.08 + 0.03	0.11 + 0.04
	1 kHz .. 4 kHz	0.11 + 0.04	0.14 + 0.05
	4 kHz .. 10 kHz	0.19 + 0.06	0.23 + 0.06
600 V	10 Hz .. 1 kHz	0.10 + 0.04	0.13 + 0.05
	1 kHz .. 4 kHz	0.13 + 0.05	0.16 + 0.06
	4 kHz .. 10 kHz	0.24 + 0.07	0.28 + 0.07
Analogue measurement quantities	I, V (AC/DC, RMS and instantaneous), φ, f; P, Q, S, harmonics (up to 64 <sup>th</sup> ), df/dt		
Hybrid <sup>3</sup> recording while analog outputs are active	With software option EnerLyzer Live		

### Counter inputs

Number	2
Max. counting frequency	100 kHz
Max. input voltage	±30 V
Threshold voltage	6 V (2 V hysteresis)
Pulse width	> 3 µs

### Binary outputs

Relay type	4 potential free relay contacts, software controlled
Break capacity AC	300 V / 8 A / 2000 VA
Break capacity DC	300 V / 8 A / 50 W
Transistor type	4 open collectors (15 V / 5 mA)

### DC measuring input

Voltage mode	
Ranges	±10 mV, ±100 mV, ±1 V, ±10 V
Accuracy <sup>2</sup> (10 V range)	0.03 + 0.01 (1 year) 0.04 + 0.01 (2 years)
Current mode	
Ranges	±1 mA, ±20 mA
Accuracy <sup>2</sup>	0.04 + 0.01 (1 year) 0.05 + 0.02 (2 years)

### Auxiliary DC

Voltage ranges	12 ... 264 V <sub>DC</sub>
Power	Inrush (< 2 s) 120 W / 2 A Continuous 50 W / 0.8 A
Accuracy	< 5 % of set value + 0.25 V

### IEC 61850

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	4 streams (IEC 61850; IEC 61869-9)

General	
Maximum number of streams (publishing or subscribing)	4 (1 stream: 4 V + 4 I)

<sup>1</sup> Unless otherwise stated all specifications are valid after 30 min. warm-up at 23 °C ±5 °C / 73 °F ±10 °F under symmetrical conditions and ohmic load

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

<sup>3</sup> Analog, binary, SV and GOOSE



## Time synchronization

### CMC 430 to external reference

CMIRIG-B, CMGPS 588	Synchronization accuracy typically 1 $\mu$ s or better guaranteed 5 $\mu$ s or better
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 / Part 9
CMC 430 to TICRO 100 in holdover mode (no access to GPS)	max. 25 $\mu$ s drift in 24 hours (with high precision oscillator OXCO-25)

### Internal system clock

Frequency drift	< 0.37 ppm / 24 h < 4.6 ppm / 20 years
All inputs and outputs (analog, binary, Sampled Values, and GOOSE) stay permanently in sync with the CMC 430 system clock.	

### 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
Permissible	85 ... 264 V, 45 ... 65 Hz

## Environmental conditions

Operating temperature	-25 ... +50 °C / -13 ... +122 °F
Storage and transportation temperature	-40 ... +70 °C / -40 ... +158 °F
Relative humidity	5 ... 95 %, non-condensing
Max. altitude for operating	4000 m
Max. altitude for non-operating	15000 m

## Weight and dimensions

Weight	8.7 kg / 19.2 lbs
Dimensions	270 x 150 x 380 mm / 10.6 x 5.9 x 15.0 in

## Miscellaneous

Hardware diagnostics	Self diagnostics upon each start-up
Galvanically separated groups	Mains, voltage amplifier, current amplifier, auxiliary DC supply, binary/analog input

## Interfaces

### Electrical / data

2 PoE ethernet ports	10/100/1000 Base-TX IEEE 802.3a compliant
1 USB Type-B port	USB 2.0 up to 480 Mbit/s
1 USB Type-A port	USB 2.0 up to 480 Mbit/s
1 External interface	For ARC 256x, SEM1, SEM2, SEM3, SER1, CMIRIG-B
4 Expansion ports	For future accessories such as low-level signal generation Up to 25 W power supply per port

### Visible / audible

LEDs for the indication of the status of analog output signals (voltage, current, Aux DC)

In addition a configurable beeper can be activated / deactivated

## Equipment reliability

### EMC Emission

International / Europe	IEC/EN 61326-1, IEC/EN 55022 (Class A), IEC/EN 61000-3-2/3
North America	FCC Subpart B of Part 15 (Class A), CISPR 22 (Class A)

### EMC Immunity

International / Europe	IEC/EN 61326-1, IEC/EN 61000-6-5
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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

International / Europe	IEC/EN 60721-3-7 (7M2) IEC/EN 60068-2-64 (30 min) IEC/EN 60068-2-27 IEC/EN 60068-2-31
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OMICRON is an international company serving the electrical power industry with innovative testing and diagnostic solutions. The application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered in the area of consulting, commissioning, testing, diagnosis and training make the product range complete.

Customers in more than 160 countries rely on the company's ability to supply leading-edge technology of excellent quality. Service centers on all continents provide a broad base of knowledge and extraordinary customer support. All of this together with our strong network of sales partners is what has made our company a market leader in the electrical power industry.

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.