

CMS 356

Voltage and Current Amplifier



Highly versatile and user friendly

The CMS 356 is a voltage and current amplifier for signals provided by any signal source, such as a digital real-time power system simulator, or a CMC test set. The high-amplitude and high-power current outputs make it suitable for testing modern numerical relays and high-burden electromechanical relays.

The outputs of the voltage amplifier and the current amplifier are galvanically separated from each other and also from the mains. Configuration and monitoring of the device status of the CMS 356 amplifier can be performed via the easy-to-use web interface.

6 Low level analog outputs

6 Low level analog inputs



Voltage outputs:
4 x 300 V or 1 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

Amplifier for power system simulations

For hardware-in-the-loop tests, the CMS 356 is the link between a real-time power system simulator and the protection relay. The signals received from the power system simulator are amplified and fed into voltage and current transformer inputs of the devices under test. The Sampled Values amplifier feature of the CMS 356 and its digital interface significantly increase test setup flexibility.

Expansion of CMC test sets

When test requirements exceed the specifications of a CMC test set itself, the CMS 356 provides additional output channels or output channels with higher amplitudes and power (for example for testing busbar differential protection, transformer differential protection or synchronizer devices).

The CMS 356 is controlled through the low level interface of CMC test sets. With the LLO-2 option, the CMC test sets provide 12 low level output channels.



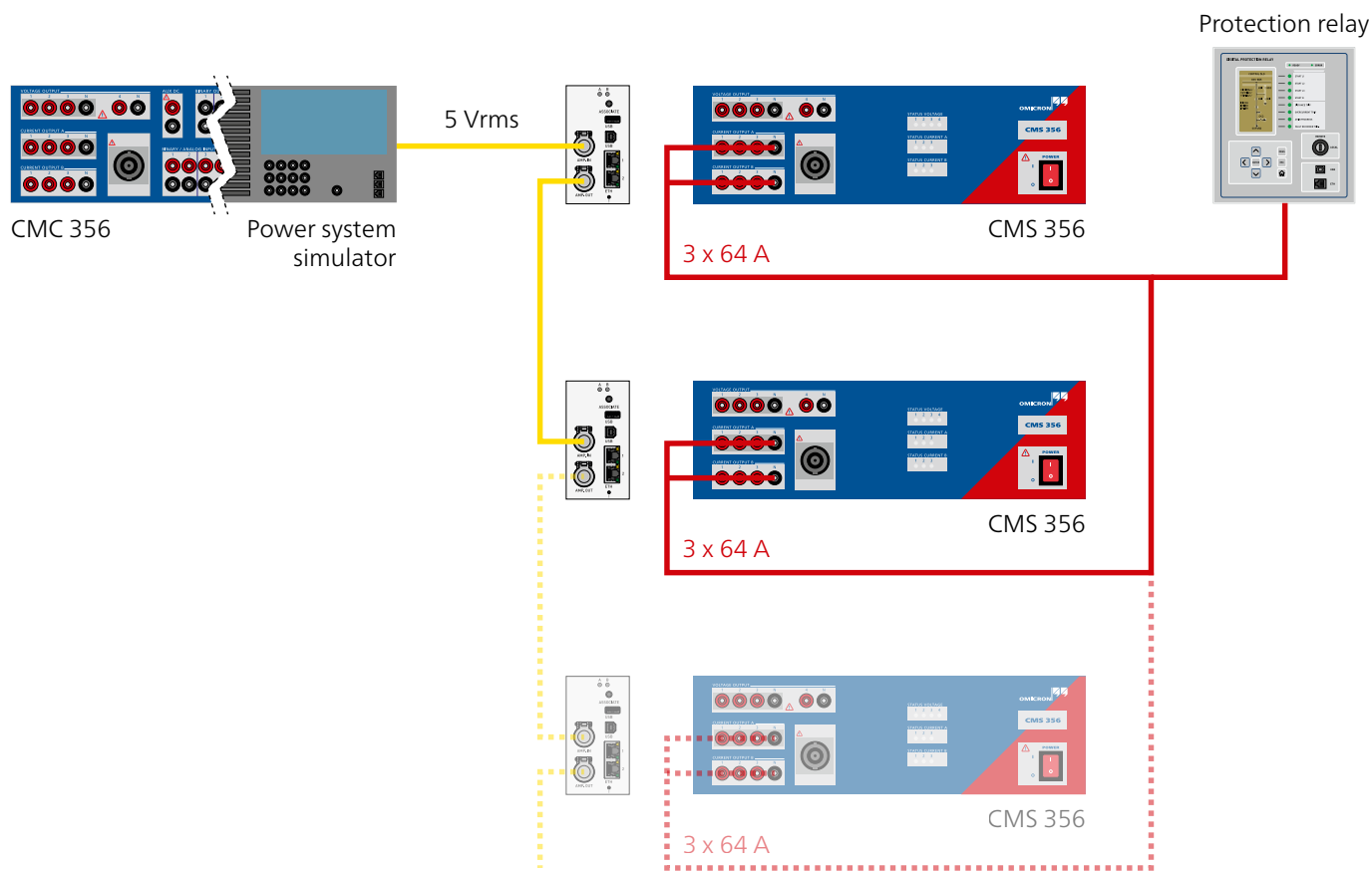
Your benefits

- > Numerous output configurations (3 x 300 V + 3 x 64 A or 6 x 32 A, ...)
- > Parallel connection of several CMS 356 amplifiers for even higher current amplitudes
- > Digital connection to power system simulators using Sampled Values
- > Easy-to-use web interface

www.omicronenergy.com/CMS356

Parallel connection of multiple CMS 356 amplifiers

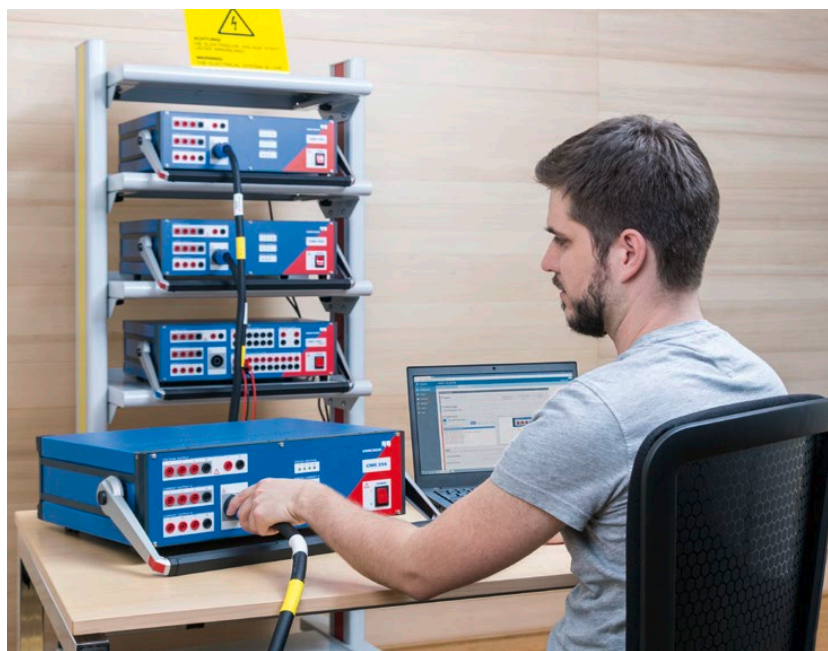
For even higher current amplitudes (for example, greater than 3×64 A), users can comfortably connect multiple CMS 356 amplifiers in parallel to the same device under test. For example, by connecting two CMS 356 units, 3×128 A or 6×64 A are possible; with three CMS 356 units, 3×192 A. This makes it possible to meet the requirements of very demanding tasks such as the performance evaluation of protection devices according to IEC 60255 standards (-121, -187-1, ...).



OMICRON offers a future-proof IEC 60255 testing solution for performance evaluation of your relays. It includes:

- > More than 200 000 predefined test shots for IEC 60255-121 and IEC 60255-187-1
- > Automated documentation, evaluation and display of test results

For more information, please visit:
www.omicron.energy/iec60255



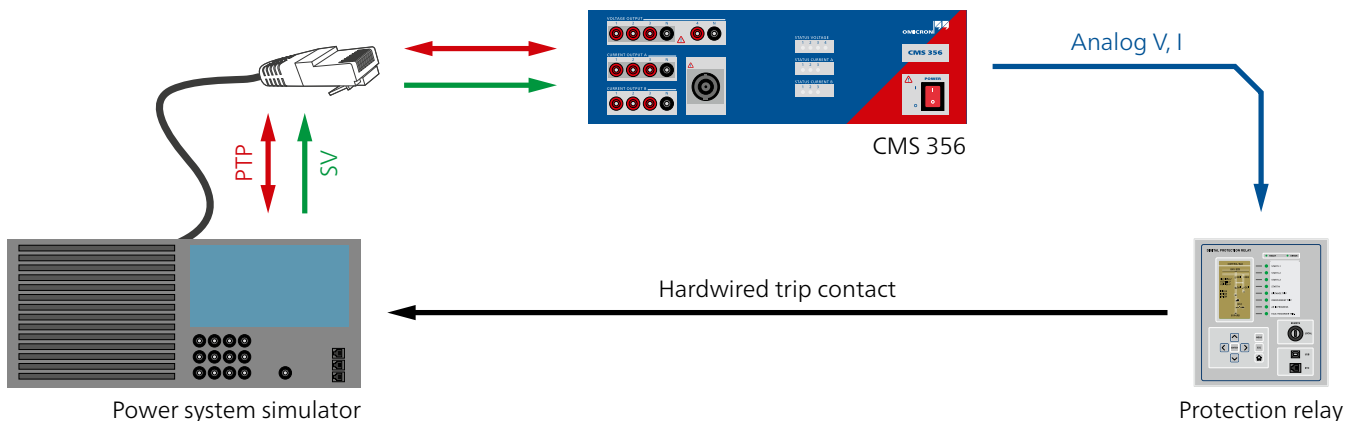
Powerful link in power system simulations

The CMS 356 amplifier supports a digital connection via an Ethernet port to a real-time simulator for testing protection devices. The instantaneous digital values that are transmitted by the simulator as Sampled Values are amplified by the CMS 356 into analog voltage and current signals before being output to the protection device that needs to be tested.

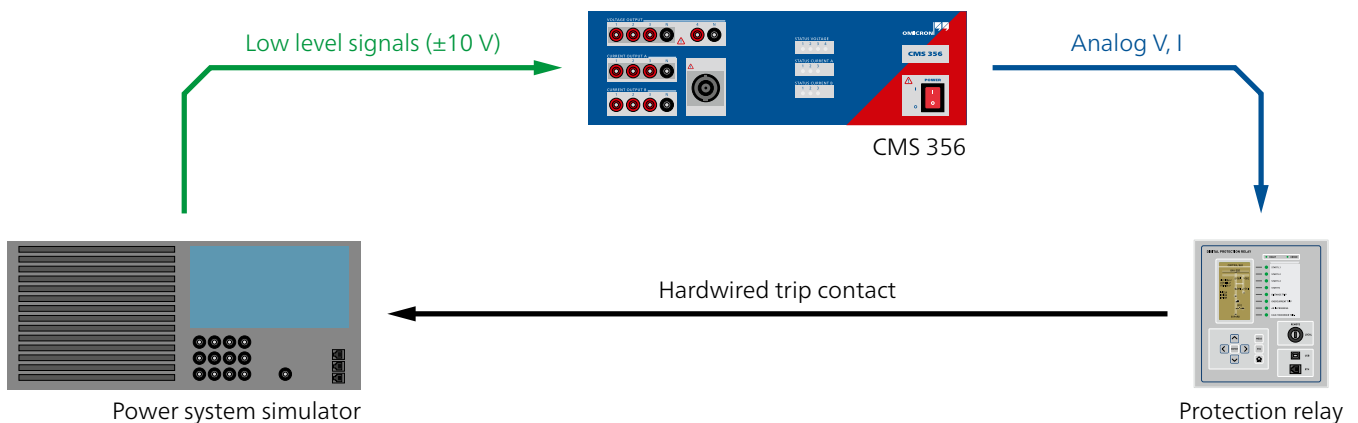
The CMS 356's functionality as a Sampled Values amplifier outstandingly increases test setup flexibility: Usually, a CMS 356 is controlled via analog low-level signals (for example, ± 10 V). However, these signals require special cables, which are limited in length and must always be connected directly to the outputs of the simulator. Yet with the CMS 356's ability to act as a Sampled Value amplifier, these restrictions completely disappear.

The CMS 356 amplifier can process up to two streams of IEC 61850 Sampled Values via its Ethernet interface and it can be used to control the voltage and current outputs. The real-time simulator and amplifier are time synchronized with each other for the reliable and stable generation of output signals, which takes place via the Ethernet connection using the IEEE 1588 Precision Time Protocol (PTP).

Closed-loop test setup with digital interface:

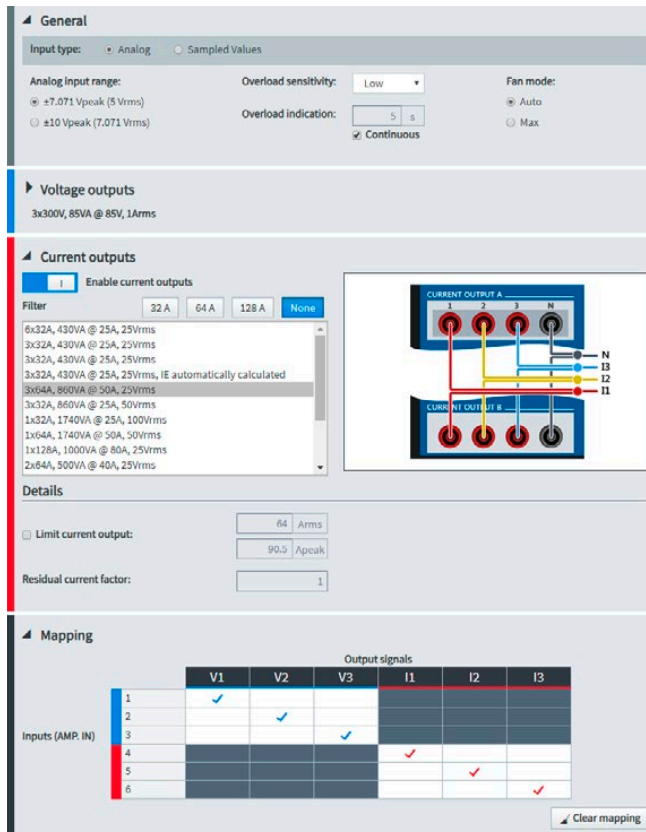


Closed-loop test setup with low-level interface:



Easy to use web interface

The operation, configuration and status monitoring of the CMS 356 are easily possible via the web interface with any standard web browser. The current states of the current and voltage outputs as shown on the front panel of the CMS 356 are visualized. In addition, the configuration settings and message history of the amplifier can be tracked. Thus, users are always up to date, even if the amplifier and the operating PC (or workstation) are physically separated.



Easy and intuitive: The “Configuration” page provides the interface to configure the CMS 356 amplifier. The panes can be simply collapsed and expanded. When collapsed, they provide a clear overview and summary of the settings. When expanded, they show detailed settings information, and changes can be made:

General settings: The input type (analog or Sampled Values) and range as well as the overload sensitivity are configured here.

Voltage outputs/Current outputs: All possible configurations for voltage/current outputs are shown here. To make wiring easier the output connections for the selected configuration are visualized in the figure.


Mapping: The Mapping table shows a list of available logical output signals according to the selected configurations. Each output signal can be mapped to an input by just checking the corresponding cell. Users only need to map the output signals required for the test.








Time-saving: For frequent and recurring tasks, pre-configurations are already stored as standard. These configurations can, of course, be adapted to individual requirements and can be stored on the amplifier as well as shared with other users.

CMS 356 accessories

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

| | Description | Order No. |
|---|---|--|
|  | Country-specific power cord 2.5 m / 8.2 ft Ethernet patch cable 1.5 m / 4.9 ft Ethernet patch cable 3 m / 9.8 ft USB connection cable 2 m / 6.6 ft Leads with 4 mm safety plugs (6 x red, 6 x black) 2 m / 6.6 ft Flexible terminal adapters (12 x black) Flexible test lead adapters with retractable sleeve (6 x red, 6 x black) Low-level connection cable CMC-CMS 356 1 m / 3.3 ft Generator combination cable 3 m / 9.8 ft Soft bag | VEHK0022 VEHK0622 VEHK0025 VEHK0112 VEHS0009 VEHK0024 VEHK0003 VEHK0154 VEHP0012 |

Optional accessories¹

| | Description | Order No. |
|---|--|-----------|
|  | Wiring accessory package For connecting test objects to CMS 356 amplifiers, consisting of: <ul style="list-style-type: none"> > 6 + 6 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 > 4 + 4 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 | VEHZ0060 |
|  | Low level connection cable with open ends To connect a third-party signal source to the low-level analog inputs ("AMP. IN") of a CMS 356 amplifier. 5 m (16.4 ft) long | VEHK0312 |
|  | Mounting kit for 19-inch rack For integrating CMC test sets and CMS amplifiers in 19-inch racks. | VEHZ0026 |
|  | Mini Wi-Fi USB Adapter For wireless control of the CMS 356. | VEHZ0095 |
|  | Transport case Heavy-duty transport case with wheels and extendable handle. | VEHP0021 |

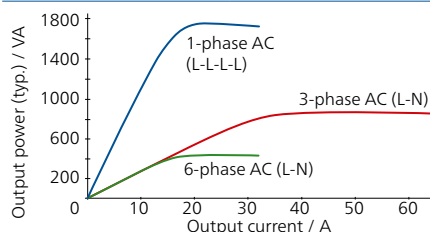
¹ Non-exhaustive list. For the complete list please visit our website: www.omicronenergy.com/cms356

Overview of technical specifications¹

CMS 356

Current amplifier

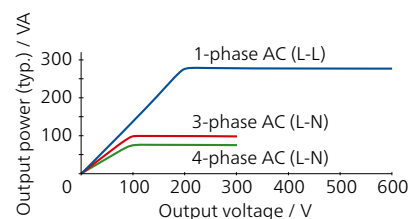
| | | |
|--------------------|--------------------|--|
| Setting range | 6-phase AC (L-N) | 6 x 0 ... 32 A |
| | 3-phase AC (L-N) | 3 x 0 ... 64 A (Group A II B) |
| | 1-phase AC (LL-LN) | 1 x 0 ... 128 A (Group A II B) |
| | DC (LL-LN) | 1 x 0 ... ±180 A (Group A II B) |
| Power ² | 6-phase AC (L-N) | 6 x 430 VA typ. at 25 A 6 x 250 W guar. at 20 A |
| | 3-phase AC (L-N) | 3 x 1000 VA typ. at 25 A 3 x 600 W guar. at 20 A |
| | 1-phase AC | 1 x 1740 VA typ. at 25 A 1 x 1100 W guar. at 20 A |



| | |
|---|--|
| Accuracy ³ | Error < 0.1 % rd. ⁴ + 0.04 % rg. ⁴ typ. Error < 0.3 % rd. + 0.1 % rg. guar. |
| Distortion (THD+N) ⁵ | < 0.1 % typ., < 0.3 % guar. |
| Resolution | 1 mA |
| Max. compliance voltage (L-N)/(L-L)/(L-L-L-L) | 35 Vpk / 70 Vpk / 140 Vpk |

Voltage amplifier

| | | |
|--------------------|------------------|--|
| Setting range | 4-phase AC (L-N) | 4 x 0 ... 300 V |
| | 1-phase AC (L-L) | 1 x 0 ... 600 V |
| | DC (L-N) | 4 x 0 ... ±300 V |
| Power ² | 3-phase AC (L-N) | 3 x 100 VA typ. at 100 ... 300 V 3 x 85 VA guar. at 85 ... 300 V |
| | 4-phase AC (L-N) | 4 x 75 VA typ. at 100 ... 300 V 4 x 50 VA guar. at 85 ... 300 V |
| | 1-phase AC (L-L) | 1 x 300 VA typ. at 100 ... 300 V 1 x 225 VA guar. at 85 ... 300 V |



| | |
|---------------------------------|---|
| Accuracy (at 0 ... 300 V) | Error < 0.06 % rd. ⁴ + 0.02 % rg. ⁴ typ. Error < 0.16 % rd. + 0.04 % rg. guar. |
| Distortion (THD+N) ⁵ | 0.03 % typ., < 0.1 % guar. |
| Ranges | 150 V / 300 V |
| Resolution | 5 mV / 10 mV in range 150 V / 300 V |

Amplifiers, general

| | |
|---|--|
| Bandwidth (-3 dB) | > 2.5 kHz typ., > 1 kHz guar. |
| Propagation delay (with input type "analog") | 500 μs (error < ±2 μs typ., ±5 μs guar.) |
| Output delay (with input type "Sampled Values") | Configurable, setting range: 1000 – 6000 μs |

Analog inputs

| | |
|-------------------------------------|---|
| Number | 6 |
| Input impedance | 47 kΩ |
| Input voltage range (selectable) | ±10 Vpk (7.071 Vrms) ±7.071 Vpk (5 Vrms) |
| Amplification at 5 Vrms input range | Voltage output: 60 V/V Current output: 6.4 A/V |
| Galvanic isolation input/output | Yes |

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 Typical AC values valid for inductive loads (for example, electromechanical relays)

³ Rload: 0 ... 0.5 Ω

⁴ rd. = reading, rg. = range

⁵ THD+N: at nominal values, 50/60 Hz and 20 kHz measurement bandwidth



IEC 61850

Subscribing

| | |
|--------------------|--|
| Sampled Values | IEC 61850-9-2 ("9-2LE") IEC 61869-9 |
| Number of streams | 2 |
| Sampling frequency | 4000 Hz – 1 sample per packet 4800 Hz – 1 sample per packet 5760 Hz – 1 sample per packet 12800 Hz – 8 samples per packet 15360 Hz – 8 samples per packet 4800 Hz – 2 samples per packet 14400 Hz – 6 samples per packet |

Time synchronization

CMS 356 to external reference

| | |
|-------------------------------|---|
| Precision Time Protocol (PTP) | IEEE 1588-2008 IEEE C37.238-2011 (Power Profile 1.0) IEEE C37.238-2017 (Power Profile 2.0) IEC/IEEE 61850-9-3:2016 (Power Utility Profile 1.0) |
|-------------------------------|---|

Internal system clock

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

Power supply

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

Environmental conditions

| | |
|------------------------------------|--|
| Operation temperature ¹ | 0 ... +50 °C / +32 ... +122 °F |
| Storage temperature | -25 ... +70 °C / -13 ... +158 °F |
| Humidity range | Relative humidity 5 ... 95 %, non-condensing |
| Vibration | IEC 60068-2-6 (20 m/s ² at 10 ... 150 Hz) |
| Shock | IEC 60068-2-27 (15 g/11 ms half-sine) |
| Acoustics – noise emission | ISO 7779 |
| Idle – full load | 47 – 55 dB(A) |

Equipment reliability

EMC Emission

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

EMC Immunity

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

Safety

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

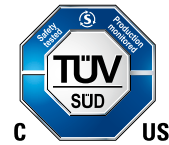
Mechanical tests

| | |
|------------------------|--|
| International / Europe | IEC 60068-2-6 (20 m/s ² at 10 ... 150 Hz), IEC 60068-2-27 (15 g/11 ms half-sine) |
|------------------------|--|

Miscellaneous

| | |
|--|---|
| Weight | 16.3 kg / 35.9 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 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

¹ For an operational temperature above +30 °C / +86 °F a duty cycle of down to 50 % may apply

We create customer value through ...

— Quality —

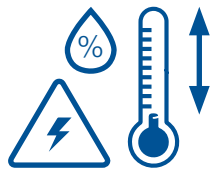
You can rely



on the highest
safety and security
standards

Superior reliability
through up to

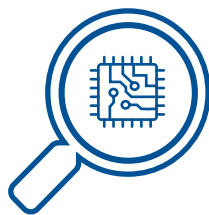
72



hours burn-in tests before delivery

100%

routine testing of all
test set components



ISO 9001
TÜV & EMAS
ISO 4001
OHSAS 18001

Compliance with
international standards



— Innovation —



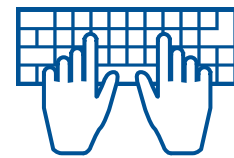
... a product portfolio geared
to my needs

More than

200

developers

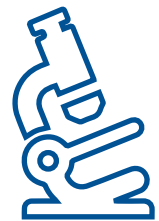
keep our solutions up-to-date



More than

15%

of our annual sales gets reinvested
in research and development



Save up to

70%

testing time through templates,
and automation



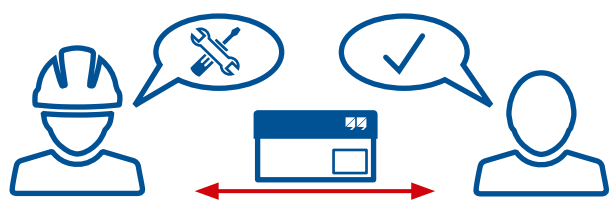
— Support —



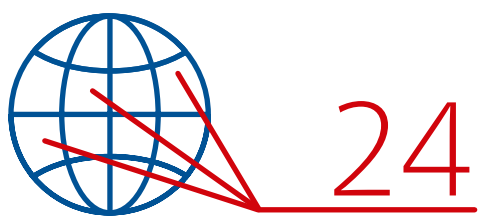
Professional technical support at any time



Loaner devices help to reduce downtime

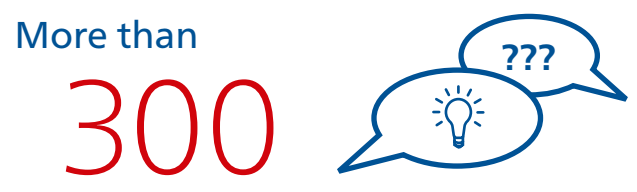


Cost-effective and straight-forward repair and calibration



offices worldwide for local contact and support

— Knowledge —



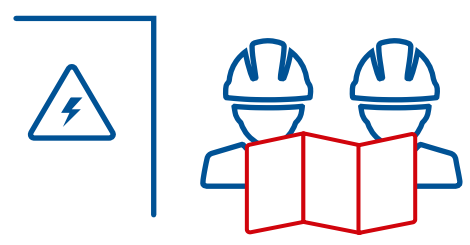
More than 300 Academy and numerous hands-on trainings per year



Frequent 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 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

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