CPC 100

Multi-functional primary test system for substation commissioning and maintenance
CPC 100 – The revolutionary all-in-one test system

The patented test system replaces numerous individual testing devices and offers new, innovative testing methods. This makes testing with the CPC 100 a time-saving and cost-effective alternative for conventional testing methods. Despite its expansive capabilities, the CPC 100 is very simple to use.

Using the CPC 100, electrical tests on various assets can be performed:

- Current transformers
- Voltage transformers
- Power transformers
- Power lines
- High-voltage (HV) cables
- Grounding systems
- Rotating machines
- GIS systems
- Switchgear and circuit breakers
- IEC 61850 installations
- Protection relays

The powerful testing device provides up to 800 A or 2 kV (2 kA or 12 kV with accessories) with up to 5 kVA over a frequency range of 15 Hz to 400 Hz or 400 A_{dc}.

Its compact design (29 kg / 64 lbs) makes it easy to transport and ideal for on-site testing.

**Testing with variable frequency**

The CPC 100’s variable output frequency allows the use of test frequencies different from the mains frequency offering a very effective suppression of mains-related interference. Thus the CPC 100 is able to obtain very accurate results even in extremely noisy environments.

Another critical advantage to performing measurements at different frequencies is the opportunity this provides to gain more information about the asset under test.

The CPC 100 utilizes switched mode amplifiers and frequency shift techniques to generate its variable output frequency.
CPC 100 – The revolutionary all-in-one test system

- Micro ohmmeter
- 400 A_{DC}
- Ground resistance meter
- 2000 V
- Step up transformer
- 15 Hz - 400 Hz
- Winding resistance meter
- 800 A_{AC}, 2 kA (with booster)
- Protection relay tester (one phase V, I, f)
- Multimeter (V, I, R, Z, ...)
- Complex impedance meter (burdens, cables, lines and transformers)
- Vector group verification system for power transformers
- Power / dissipation factor measurement set
- Tester for Rogowski coils and other unconventional CTs / VTs (IEC 61850)
- Single phase wall outlet

29 kg / 64 lbs
The CPC 100 covers a lot of different applications in and around substations as well as at the manufacturer’s production site. Extended by a high number of valuable accessories the application range of the CPC 100 is further expanded. Thus it is the ideal instrument for all major applications in the area of primary testing.
Extended range with accessories

- **Coupling unit**
- **Switch box**
- **Tan Delta test set**
- **Current booster**
- **Resonance circuit**
- **Grounding box**
- **Handheld grounding tester**
- **Compensation reactor**
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Current transformer testing

Testing current transformers helps to detect:

**Installation related failures:**
> Transportation damages
> Wiring errors
> Manufacturing defects

**In-service related failures:**
> Degradation of accuracy class
> Shorted turns
> Magnetized core
> Burden failures in secondary circuit
> Insulation material failures

With the CPC 100 many standard electrical tests for CTs can be performed with one single device saving testing time and labor costs. Additionally, unconventional CTs, like Rogowski coils and IEC 61850 integrated systems, can also be tested.

**CT testing with the CPC 100**

Supplied from a single phase wall outlet, the CPC 100 can generate up to $800 \text{ A}_{\text{ac}}$ (2000 A with CP CB2 current booster) for injecting into the CT’s primary side and testing its ratio, polarity and burden.

For excitation curve measurement, the CPC 100’s output is connected to the secondary terminals of the core. Within an automatic test run, the CPC 100 measures the excitation curve and displays the knee point voltage and knee point current (according to the relevant IEC or IEEE / ANSI standard). The CPC 100 also automatically demagnetizes the CT core after the test.

Using the winding resistance measurement function also allows the user to calculate the accuracy limiting factor (ALF) for protection circuits and the instrument security factor (FS) for metering circuits.

The CT winding resistance and power / dissipation factor can also be measured.
Current transformer testing

> CT ratio (with burden)
  up to 800 A or 2000 A with CP CB2, 5 kVA output power

> CT burden
  up to 6 A<sub>ac</sub> | secondary

> CT excitation curve (knee point)
  up to 2 kV<sub>ac</sub>

> Polarity check with CPOL
  up to 800 A or up to 2000 A with CP CB2, 5 kVA output power

> Accuracy limiting factor (ALF) test

> CT ratio with voltage
  up to 130 V<sub>ac</sub> | bushing CTs

> CT winding resistance
  up to 6 A<sub>dc</sub>

> CT voltage withstand test
  up to 2 kV<sub>ac</sub>

> CT ratio Rogowski and CT ratio low power
  up to 800 A or up to 2000 A with CP CB2, 5 kVA output power

> Power / dissipation factor (tan δ) test
  up to 12 kV, 300 mA | with CP TD1

> IEC 61850 Sampled Values testing

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10 reasons to choose a CPC 100

Multi-functionality

With one easy-to-use system you can:

> Test several assets
  (for example CT, VT, CB, power transformer)

> Test different parts of an asset
  (for example core, windings, bushing, insulation)

> Perform numerous tests
  (for example ratio, polarity, burden, excitation current)

CP CB2 (current booster)  2 kA

With the CP CB2 primary injection of current up to 2 kA can be realized for CT testing.

CP TD1 (tan δ)  12 kV

For high-voltage CTs, insulation material tests are very important and can be easily done with the CP TD1 accessory.

CPOL (polarity checker)

The CPOL can check the correct polarity along the different connection points in the secondary wiring by analyzing the sawtooth signal injected into the CT’s primary side using the CPC 100.
Voltage transformer testing

The majority of VT failures occur due to electrical stresses or manufacturing and installation errors. Typically electrical stresses are caused by:

> Thunderstorms
> Ferro-resonances effects
> Over-voltages

Especially in high-voltage and extra high-voltage installations supervision of the VT insulation system is important to ensure that its dielectric characteristics have not degraded over time.

In case of (re-)commissioning of substations VT circuits should also be checked. Verifying the VT’s nameplate data helps to identify damages of the VT or wrong connections.

**VT testing with the CPC 100**

With a voltage output of up to 2000 V, the CPC 100 can be used to test VT ratio, polarity and burden.

By injecting voltage into the primary side, ratio can be measured. Thereby the phase angles of high-voltage output and voltage measurement input are also measured. Thus the correct VT polarity can be verified.

Applying voltage to the secondary VT circuits and measuring the load current in amplitude and phase allows the actual burden to be measured, ensuring that it is within the VT’s specification data.

**Disturbance-free measurement**

The VT’s secondary signal may be difficult to measure if it is small in amplitude — especially if neighboring parts of the substation are in operation. In case of strong disturbances, the user can select a frequency different to that of the power system and utilizes the “frequency selective measurement” function. Thus only the VT’s output signal with this particular frequency is measured while all other signals are filtered out.

With the wide frequency range excellent noise interference suppression can be achieved when testing in the harsh HV environment.
Voltage transformer testing

> VT ratio
  up to 2 kV<sub>ac</sub> | polarity and burden
> VT burden
  up to 130 V<sub>ac</sub> | secondary
> VT secondary voltage withstand test
  up to 2 kV<sub>ac</sub>
> Polarity check with CPOL
  up to 2 kV<sub>ac</sub>
> VT electronics
  up to 2 kV<sub>ac</sub>
> IEC 61850 Sampled Values testing
> Power / dissipation factor (tan δ) test
  up to 12 kV, 300 mA | with CP TD1

10 reasons to choose a CPC 100

Variable frequency

> Voltage and current injection with variable frequency
> Suppression of mains-related interference and disturbances
> Test results at different frequencies provide more detailed information about an asset (for example more information about the insulation condition)
> Variable frequency testing is necessary for some standardized and advanced diagnostic tests

For high-voltage VTs, insulation material tests are very important and can be easily done with the CP TD1 accessory.

The CPOL can check the correct polarity along the different connection points in the secondary wiring by analyzing the sawtooth signal injected into the VT’s primary side using the CPC 100.
Testing to assess the health of power transformers and to diagnose problems is of utmost importance to ensure the long-term and safe operation of these very expensive power assets.

With the CPC 100 power transformers and their ancillary components can be tested:

> Windings
> Tap changer
> Bushings
> Insulation
> Core
> Connection leads
> Surge arrestors

**Testing power transformers – Most common electrical tests with one device**

The CPC 100 provides an easy and accurate (4-wire connection) winding resistance measurement. Automatic measurement for tapped windings (by using CP SB1 with the on load tap changer) speeds up the measurement. The CPC 100 automatically discharges the inductive energy, which makes the measurement safe.

After switching off a transformer or after applying DC signals to a transformer, the core remains magnetized. This can cause problems for further diagnostic measurements or can lead to higher inrush currents. By using the CP SB1 switch box the integrated algorithm in the CPC 100 completely demagnetizes the transformer core.

For measuring ratio and excitation current, the CPC 100 provides a 2 kV output, delivering 2500 VA. The test voltage is generated digitally and the current is automatically measured within the CPC 100. This makes the measurement highly accurate, easy to set up, fast and safe.

For power / dissipation factor (PF / DF) measurement of power transformers and bushings, the CPC 100 is combined with the CP TD1. Measuring this factor over a broad frequency range – in addition to mains frequency – helps to better assess the insulation condition, for example detect whether the cellulose or the oil is contaminated by moisture.

The wide frequency range of 15 Hz to 400 Hz is needed for advanced tan δ tests, which give the user important information about the transformer aging.
Power transformer testing

- DC winding resistance
  up to 100 A DC

- Transformer demagnetization
  with CP SB1

- Dynamic load tap changer diagnostics
  (on load tap changer test)
  up to 100 A DC | optionally with CP SB1

- Transformer turns ratio (TTR) per tap
  up to 2 kVAC | including polarity and excitation current |
  IEC 61387-1 support for transformer with unconventional vector groups

- Automatically determination of the transformer’s vector group
  with CP SB1

- Leakage reactance / short circuit impedance
  up to 6 A AC

- Transformer, bushing: power / dissipation factor (tan δ)
  + insulation capacitance
  up to 12 kV, 300 mA | frequency from 15 Hz to 400 Hz | with CP TD1

- Insulating fluids: power / dissipation factor (tan δ)
  up to 12 kV, 300 mA | with CP TD1 and CP TC12

- Excitation current per tap
  up to 12 kV, 300 mA | with CP TD1

- Frequency response of stray losses (FRSL)

- Surge arrestors: leakage current and watt losses
  up to 12 kV, 300 mA | with CP TD1

Testing and reporting

- Offline test preparation possibilities
  (time-saving and less error-prone)

- CPC 100 software automatically guiding
  the user through the test

- Automated report generation

- Customizable test reports (for example different languages, customer logo)

Insulation condition assessment of transformers, bushings and insulation fluids (with the CP TC12).

The CP SB1 switch box is the connection between transformer and CPC 100. Connecting all phases simultaneously avoids wiring errors and the need to repeatedly climb the transformer. Automatic OLTC control speeds up testing.
HV cable and power line testing

For a reliable power supply, selective operation of protection relays is crucial. Over- and underreach can be avoided by having correct relay settings, and line data. Therefore it is necessary to determine line parameters, such as positive sequence impedance, zero sequence impedance or k-factors.

Calculating impedances and the k-factor is highly error-prone. Measuring line and ground impedance eliminates these errors and contributes to system reliability by providing proper relay settings.

Line parameter measurement
With the CPC 100 and the CP CU1 the impedance of cables and power lines can be measured accurately, quickly (in approximately two hours) and safely.

Line impedance and k-factor
The CPC 100 and the CP CU1 are used to inject current into the different phase-phase and phase-ground loops of a power line / cable, grounded at the other end, while measuring voltage, current and phase angle. From the measurement data of the different loops, line parameters are calculated. Variable frequency injection allows measurements to be made despite coupling from live parts or neighboring lines.

Mutual coupling
With this unique testing equipment, the mutual coupling factor of parallel lines can also be determined, allowing the correct parameterization of the mutual coupling algorithm of modern line protection relays.

Using variable output frequency, measurements with the CPC 100 are not influenced by mains frequency coupling. Precise and reproducible measurement results, even in noisy environments, are possible.
Cable and transmission line diagnosis

- Line impedance and k-factor
  up to 100 A | with CP CU1
- Mutual coupling
  up to 100 A | with CP CU1
- Positive or zero sequence impedance

10 reasons to choose a CPC 100

Weight and size

- Light-weight (29 kg / 64 lbs)
- Compact design
- Save costs on:
  - Transport
  - Handling
  - Storage

The CP CU1 allows the safe connection of the CPC 100 to a power line or HV cable. The impedance matching transformer within the CP CU1 ensures optimum power transfer from the CPC 100 to the power line.

The CP GB1 grounding box contains surge arrestors to ensure safe testing during unexpected events.
The grounding of a high-voltage electrical system helps to ensure the safety of personnel. Voltage rises in the neighboring area of electrical systems, caused by a system fault or lightning, can be extremely dangerous.

Conventional test solutions, which use power system frequencies, need enormous power and complicated methods to overcome the problems of interference. Varying the frequency and using narrowband digital filtering with the CPC 100 and CP CU1 reduces the required power and the equipment weight to a minimum.

Ground grid impedance

Using the current-voltage method, the challenge for good ground impedance ($Z_{\text{grid}}$) measurements is to inject sufficient measurement current into the soil at a remote location and to measure the voltage rise caused by this injection — and not by any other current in the ground.

The CPC 100 and CP CU1 test system meets this challenge. It injects current at non-network frequencies into the soil at a remote station via the existing power lines. It then selectively measures the voltage rise at the used frequencies. The measurements are performed according to international standards including DIN VDE 0101, CENELEC HD63751, IEEE Std 80-2000 and IEEE Std 81-1983.

Step and touch voltages

The step and touch voltages ($V_{\text{step}}$ and $V_{\text{touch}}$) of the local station can be measured with the CPC 100 itself or more conveniently with the HGT1 — a frequency selective voltmeter which minimizes wiring.

Using variable output frequency, measurements with the CPC 100 are not influenced by mains frequency coupling. Precise and reproducible measurement results, even in noisy environments, are possible.
Ground system analysis

- Ground grid impedance for large systems up to 100 A | with CP CU1
- Step and touch voltage up to 100 A | with CP CU1 and HGT1
- Ground grid impedance for small systems up to 6 A<sub>ac</sub>
- Soil resistivity up to 6 A<sub>ac</sub>
- Integrity check of grounding connection up to 400 A<sub>dc</sub>
- Reduction factor / current split factor
- Measure multiple current paths with Rogowski coil

10 reasons to choose a CPC 100

Safety

- Emergency switch-off button
- Ground connection check
- Overload detection
- Multiple isolated outputs
- Safety key lock
- Discharge circuit to de-energize DC test objects
- Strobe light
- 3-position safety switch
- Grounding box

The CP CU1 allows the safe connection of the CPC 100 to a power line or HV cable. The impedance matching transformer within the CP CU1 ensures optimum power transfer from the CPC 100 to the power line.

The CP GB1 contains surge arrestors to ensure safe testing during unexpected events.

The HGT1 is a handheld measurement device to measure step and touch voltages within HV stations and surrounding areas. With the HGT1 extremely long measurement cables can be avoided.
Rotating machines diagnosis

The most sensitive part in rotating machines is the insulation. The expected lifetime of a stator winding depends on the ability of the insulation to prevent winding faults.

High temperatures and high rates of temperature changes can generate micro-voids particularly at the interface between mica and resin, and between semiconductive layers and resin. Partial discharges in these voids will further increase the void size by erosion and complete breakdowns are inevitable.

Therefore, experts strongly recommend the checking of insulation for partial discharges during the whole lifecycle of motors and generators. In order to check the insulation a compensated high-voltage source is needed. The CPC 100, CP TD1 and CP CR500 test system can be utilized as a high-voltage source.

“Δ tan δ” test and tip-up test

As maintenance tools for entire windings, the “Δ tan δ” test and the tip-up test are used. Both tests are an indirect way of determining if partial discharges (PD) are occurring in a high-voltage stator winding.

An increase of the power factor / dissipation factor (tip-up) from the normal level indicates that the winding has significant PD activity, as this is indicative of this condition.

The CPC 100, CP TD1 and CP CR500 test system allow “Δ tan δ” and tip-up tests complying with the IEC 60894 and IEEE 286 specifications.

An acceptable power / dissipation factor offers assurance that the coil or the bar were properly fabricated with inherently low-loss materials.
Rotating machines diagnosis

> Power / dissipation factor (tan δ) tip-up test at 50 Hz / 60 Hz
  up to 12 kV | max. 1 µF / 4 A | with CP TD1 and CP CR500

> Power / dissipation factor test with variable frequency
  up to 12 kV | frequency from 15 Hz to 400 Hz | with CP TD1

> HV source for testing rotating machines
  up to 12 kV | max. 2 µF | with CP TD1 and CP CR500

10 reasons to choose a CPC 100

Product quality

> Durable case design for rough environments with test field accuracy
> Long lifetime due to high quality components
> Premium quality cables and clamps
> Comprehensive documentation (for example, user manual with connection diagrams, software help function, videos, application notes)

Insulation condition assessment of motors and generators. The CPC 100 plus CP TD1 can provide up to 12 kV and can also be used as a HV source.

The CP CR500 compensator reactor enables the CP TD1 to be used with test objects with large capacitance such as large motors and generators.
Gas-insulated switchgear testing

Testing gas-insulated switchgear to date
Gas-insulated switchgears (GIS) are compact and are, therefore, used in applications where space is limited. For commissioning of GIS a high-voltage (HV) withstand test is required in accordance with standards (IEC 62271-203).

To date the test voltage needed for a withstand test has been produced by a resonance circuit. This test system consists of an HV test transformer, a coupling capacitor and a power control unit. The HV test transformer and the coupling capacitor have to be connected directly to the GIS.

Weak points of this testing principle:
> The complete test system is difficult to transport, because it consists of very heavy and large components.
> It is difficult to use it at test sites with limited space, such as wind turbines.
> The HV test lead must be connected to, and disconnected from, the GIS system for testing. This normally includes a time-consuming venting and refilling process of the SF₆ gas.

Innovative GIS testing
With OMICRON’s CPC 100 + CP RC you can perform GIS tests without the need of a big HV transformer. This is possible because the system directly makes use of a specially designed “Power VT” for testing.

This Power VT is an integral part of the GIS and generates the required test voltage. CPC 100 injects power at the low-voltage (LV) side of the VT, producing the necessary voltage on the HV side. As you can directly connect the measuring system to the integrated VT of the GIS system it eliminates the need for draining and refilling any SF₆ gas.

The CPC 100 + CP RC system comprises several small and light-weight components (< 21 kg / 46 lbs) which can be transported by one person. With its modular design you can perform GIS tests even at test sites with limited space.

Auto-transformer CP AT1
The CP AT1 allows you to connect the mains supply of the CPC 100 to a three-phase 16 A power outlet, and delivers the required power for the test setup.

Control unit CPC 100
The CPC 100 supplies the required energy and acts as both measuring and controlling device.
GIS testing

> Withstand test
up to 235 kV | max 1.6 nF | with CP RC2
> High-voltage source for partial discharge measurements
up to 235 kV | max 1.6 nF | with CP RC2

10 reasons to choose a CPC 100

Expandability

> Further applications can be covered by adding additional hardware accessories
> By upgrading the software:
>  Additional tests can be performed
>  Additional assets can be tested

CPC 100 + CP RC2: testing GIS up to 145 kV rated voltage

CPC 100 + CP RC1: testing GIS up to 123 kV rated voltage

Isolation transformer CP TR
The CP TR provides a potential-free output signal and compensates the capacitive load.

Compensating reactor CP CR
With 4 mH (CP CR4) or 6 mH (CP CR6) the CP CR compensates the capacitance in a modular fashion.

Power VT
In addition to the measurement function of a VT the Power VT offers the possibility to generate high voltage for testing.
Switchgear and circuit breaker testing

Switchgear consists of busbars, circuit breakers (CB), disconnectors and earthing switches. There are various connections and contacts within the switchgear. Poorly maintained or damaged contacts can cause arcing, single phasing or even fire which can lead to the total loss of the asset.

Therefore, it is common practice to conduct contact resistance measurements to ensure that the connections have been made with the appropriate contact pressure.

Additionally, the insulation of CBs within the switchgear has to be tested. These assets are frequently exposed to HV stresses, switching currents and very high fault currents, which heat up the circuit breakers and impact on the insulation material.

Contact resistance measurement

The CPC 100 can measure contact resistance by injecting a current of up to 400 A\text{dc} into the contacts and measuring the voltage drop (using the 4-wire method). The resistance value can be compared to the value given by the manufacturer as well as to previous records.

Insulation testing of circuit breakers

For power / dissipation factor (\tan \delta) measurements of circuit breakers, the CPC 100 is combined with the CP TD1. Measuring this factor over a wide frequency range – in addition to mains frequency – helps to better assess the insulation condition.

Timing of CBs with overcurrent elements

For testing of CBs or load breaker switches with integrated overcurrent elements, the CPC 100 can inject AC primary currents up to 800 A (or 2000 A together with the current booster CP CB2), and measure the time from the start of the injection to the interruption of the current.

μΩ measurement with the CPC 100’s 400 A\text{dc} capabilities enables accurate contact resistance measurements on circuit breakers.
Switchgear / circuit breaker testing

- Contact resistance
  up to 400 A

- Bushing: power / dissipation factor (tan δ)
  + insulation capacitance
  12 kV, 300 mA | frequency from 15 Hz to 400 Hz | with CP TD1

- Overcurrent relays with primary injection (MV)
  up to 800 A or 2000 A with CP CB2, 5 kVA output power

- Circuit breaker: Power / dissipation factor (tan δ)
  up to 12 kV, 300 mA | frequency from 15 Hz to 400 Hz | with CP TD1

- Insulating fluids: power / dissipation factor (tan δ)
  up to 12 kV, 300 mA | with CP TD1 and CP TC12

10 reasons to choose a CPC 100

Support

- International technical support
- On-site support for issues concerning testing, start-up and maintenance
- Repair centers around the world
- Local support by worldwide sales partner network
- Consulting on the development of individual testing concepts
- Training classes around the globe

Insulation condition assessment of circuit breakers and insulation fluids (with CP TC12).
Commissioning and trouble shooting of protection systems

In order to work properly, protection and control systems have to be correctly integrated into the substation or power plant. Quantities from the primary system are transformed at the VTs and CTs – using their different cores – and so the voltage and current signals must be correctly connected to the protection relays, automation units and meters.

From these protection and control units, the trip signals are routed back to the primary apparatus, for example, the circuit breakers. A fault in any part of this system may result in a system failure – false tripping or a failure to trip.

To prevent such a failure, the system’s functionality can be verified by injecting into the primary side of the CT or VT and checking the measured values at the relay or automation unit. Finally, injecting current at the magnitude of a fault should result in the tripping of the circuit breaker, which allows the verification of the complete chain.

Commissioning protection systems

The CPC 100 allows the verification of the ratio and polarity of CTs and VTs – preventing wrong connections, especially in the case of tapped CTs. Injecting current or voltage into individual CTs / VTs and checking the reading at the relay ensures that phases are not mixed up and that the CT and VT ratio setting in the relay is correct.

The CPC 100 can also measure the burden on the CTs and VTs and, by determining the CT’s excitation curve, it ensures that the protection circuits are connected to the appropriate CT cores.

The CPC 100 can help to verify that the secondary wiring is correct. By injecting a sawtooth signal into the CT or VT, the operator verifies with a handheld device that the signal has the correct polarity at the connection points of the secondary systems.

With the CPC 100 primary faults can be simulated to check if overcurrent, differential or distance relays operate correctly. The total trip time including the CB operating time can also be measured in this test.

The CPC 100 can inject up to 800 A (2000 A with the CP CB2) or up to 2 kV as well as a sawtooth polarity check signal into CTs or VTs in the HV yard, hence performing testing on the whole system.
Protection installation testing

- CT ratio (with burden)
  up to 800 A or 2000 A with the CP CB2, 5 kVA output power
- CT burden
  up to 6 A AC secondary
- CT excitation curve (knee point)
  up to 2 kV AC
- VT ratio
  up to 2 kV AC, polarity and burden
- VT burden
  up to 130 V AC secondary
- Overcurrent relays with primary injection (MV)
  up to 800 A or 2000 A with the CP CB2, 5 kVA output power
- Polarity check with CPOL
  up to 800 A or 2 kV AC, 5 kVA output power
- Testing of the entire protection chain
  by primary fault current injection and live CB tripping

10 reasons to choose a CPC 100

Conformity to standards

- CPC 100 fulfills highest safety requirements
- CPC 100 is CE tested
- CPC 100 tests according to IEEE and IEC standards
- Measurements with the CPC 100 deliver reliable and repeatable results due to high signal and measurement accuracy
The standard for “Communication Networks and Systems for Power Utility Automation”, IEC 61850, utilizes network technologies for all types of information exchange.

Within IEC 61850, protocols for the transmission of instantaneous voltage and current values are specified. The sensors used in the transmission process can be conventional CTs and VTs as well as unconventional current and voltage sensors.

Sampled Values
A merging unit (MU) collects the measured current and voltage values from the current and voltage sensors. Then it merges the digitized values, which are called “Sampled Values” (SV), into a data stream published to the substation network.

Using this method, measured values (for example, the bus voltage for a busbar protection scheme) can easily be distributed to multiple bay devices.

Sampled Values testing with the CPC 100
The CPC 100 test system performs closed-loop testing whereby a test signal is injected on the primary side of the current / voltage sensors. The MU converts the sensor output into a SV stream which is published to the substation network. The CPC 100 then reads the data back from the network in order to perform a variety of different tests.

Automatic MU and channel detection is achieved by injecting a test signal with a specific wave form. An optimized and time-effective algorithm searches for the unique test pattern within all the available MUs on the network to identify the correct channel for testing.

The CPC 100’s SV test card operates according to the “Implementation Guideline for Digital Interface to Instrumental Transformers using IEC 61850-9-2” published by the UCA International User Group.
Sampled Values testing

- SV CT ratio test and polarity check
  up to 800 A or up to 2000 A, 5 kVA output power with the CP CB2
- SV VT ratio test and polarity check
  up to 2 kV AC
- Automatic MU detection
- Automatic voltage / current channel detection
- Frequency selective voltage / current meter
- Noise level measurement
- Amplitude response of the signal processing chain
  up to 800 A or up to 2 kV AC, frequency from 15 Hz to 400 Hz

10 reasons to choose a CPC 100

Prepared for the future

- Unconventional assets can be tested
  (for example Rogowski coils, low power CTs)
- Testing according to IEC 61850-9-2
  (for example Sample Values testing, Merging Unit testing)
- Future applications areas will be covered
  by new developed accessories and software

Closed-loop testing

The CPC 100 injects a sinusoidal test signal to perform tests such as the ratio test. Additionally, the CPC 100 generates specific periodic wave shapes to identify the correct MU and corresponding test channel.
Operation of CPC 100: front panel

Different ways to operate

OMICRON's CPC 100 offers different operating modes, to meet the personal preferences of the user:

- From the front panel: Selecting test cards directly
- From the front panel: Using pre-defined test templates
- Fully automated: Using Primary Test Manager™ (see next double page)

Operating from the front panel

1. Selecting test cards directly

Operating the CPC 100 manually provides the quickest results with minimal training and preparation – perfect for users who only operate the device occasionally. The user just selects the test card to be used, connects the CPC 100 to the asset and performs the test by pressing the green button.
2. Using pre-defined test templates

Additionally, pre-defined test templates help the user to perform frequently used tests conveniently and efficiently. A number of test cards (for example, power / dissipation factor, winding resistance, ratio measurement, etc.) are combined into one test template. An example is the template containing all the recommended measurements for testing a current transformer.

The test template can be seen as a test plan. It tells the user which measurements to make and provides the basis for the overall test report.

Test templates can be prepared in advance in the office on the PC – without the CPC 100 connected – and can then be executed on site, step by step. Users can also create their own test templates and define, which test cards they want to include.

The settings and results of all manual tests can be stored on a flash memory and transferred to a PC using a USB memory stick or ethernet connection.

Customized reporting: Microsoft Excel™

After transferring the test results to a PC, report templates in numerical and graphical form are available.

The measurement data – including settings and results as well as administrative information such as date and time, filename, etc. – can also be imported to these templates for customized reporting, graphical result evaluation and further analyses.

Microsoft Excel™ reports provide the basis for client-specific reporting and allow test reports to be adapted to utility or manufacturer specific formats. Further content, such as company logos, can also be added.

Test reports can then be printed in a variety of languages.
Primary Test Manager™ (PTM)

OMICRON’s PTM software supports the user’s workflow during diagnostic testing. The user can define and manage test objects, create test plans, perform measurements, and generate reports.

PTM manages the entire workflow during testing, guiding the user through the process step-by-step. Its main functions include:

1. Data management
2. Dynamic test plan generation
3. Guidance through test procedures
4. Comprehensive reporting
1. Data management
PTM facilitates the administration of the data of the asset to be tested. Its general data including the location, manufacturer, production date and serial number can be entered in addition to the electrical data which forms the basis for the dynamic generation of test procedures.

2. Dynamic test plan generation
Using the electrical data of the apparatus, PTM generates a plan of diagnostic measurements to be performed in accordance with industry standards, saving time and reducing the risk of errors.

3. Guidance through the testing procedure
During the measurement, the PTM allows the direct control of the test instrument from a PC or laptop. Clear wiring diagrams help to avoid errors when making the connections. At a glance, the user gets an overview of the progress of the test and the tasks remaining by following the execution of the steps in the test table. Additionally, test results can be compared and automatically assessed according to international standards and guidelines.

4. Comprehensive reporting
After the tests are completed, reports of any of the measurements made can be generated at any time. The content of the report is flexible – as components can be easily selected and deselected by mouse-clicks. In addition, a company logo, pictures and other test results can be added.
Front panel and connection possibilities

1. Grounding terminal
2. High AC voltage output 2 kV AC
3. External booster output
4. High DC current output 400 A DC
5. High AC current output 800 A AC
6. Mains power supply
7. Overcurrent protection
8. Power switch
9. 6 A or 130 V output
10. Current output 6 A DC
11. Current measuring input 10 A AC or DC
12. Voltage measuring input 300 V AC
13. Low level voltage measuring input 3 V AC
14. Voltage measuring input 10 V DC
15. Binary input for potential-free contacts or voltages up to 300 V DC
16. Safety key lock
17. Signal lights
18. Emergency stop button
19. Keys for the quick selection of applications
20. Keys for the quick selection of the desired view
21. LCD monitor
22. Soft-touch keys which change their function according to the selected application
23. Keys for selecting stacked test cards
24. Numerical keyboard
25. Advanced jog-dial hand wheel with “click” (Enter) function
26. Up / down keys for navigation and entering values
27. Test start / stop button
28. User manual
29. Serial interface for devices such as CP TD1
30. Plug to connect external safety functions
31. Socket for the connection of the CPC 100 to a network or direct connection to a PC’s network connector
32. USB memory stick connection
CPC 100 – Operating principle

Internal elements of the CPC 100
These key components make the CPC 100 outstanding:
> Control unit
> Power electronics unit
> Multiple range transformer
> Measurement unit
> Interface
Each of the above is engineered to operate effectively in harsh electrical and environmental conditions associated with the testing of HV apparatus.

Control unit
The “brain” of the CPC 100 consists of two signal processing units and an embedded computer providing:
> Application knowledge for all of the incorporated testing procedures
> Up-to-date, practical and efficient measurement functions
> Digital test voltage or current generation
  > Enables independence from the mains signal quality
  > Enables independence from the mains frequency
  > Assures a high level of reproducibility of measurements
> Safety functions such as ground connection checks, self diagnostics, overload, overcurrent and overtemperature management
  > Reduces the risks to the user and the test objects
  > Prevents damage to the CPC 100 and its accessories
> Data storage using onboard flash memory and external USB memory
  > Saves time through its automatic storage and reporting functions

Power electronic unit
Adjustable and controlled voltage or current source with variable frequency
> Supplied from a single phase wall outlet (110 V / 230 V, 50 Hz / 60 Hz)
  > The CPC 100 can be used everywhere in the substation or power plant
> DC intermediate circuit allows reactive power to be generated inside the unit
  > As only active power is taken from the supply socket, less current has to be taken from the wall socket
  > Longer injection times are possible
> Generation of voltage or current with variable frequency
  > Avoids mains frequency related noise
  > Performs accurate measurements in noisy environments
  > Tests apparatus with different frequency rating
    (for example, for factory tests in the supplier’s home country)
  > Generates different periodic wave shapes (sine wave, sawtooth, etc.)
  > Performs special measurements (polarity verification, IEC 61850 merging unit and channel detection)
Multi-range transformer
> Special multi-range 5 kVA transformer facilitates different test signal ranges
> Multiple isolated and protected outputs for safe operation
  > Avoids unwanted ground loops and makes measurements accurate and safe
> Automatic measurement of test signals, which are difficult or dangerous to measure (for example, 2 kV high-voltage or 800 A high-current output) using internal measurement and regulation loops
  > Delivers a constant output under variable test impedance conditions

Measurement unit
> RMS and phase-angle measurements:
  > Measures voltage, current, ratio, frequency, phase
  > Verifies polarity (for example, on CTs and VTs)
  > Calculates power (P, Q, S) and impedance (R, L, C, Z, X)
> Frequency selective measurements (measuring signals at the same frequency as the CPC 100 source signals)
  > Suppresses all disturbances, including mains frequency related noise
  > Measures small signals in electromagnetically disturbed environments
> Inputs are galvanically separated from each other
  > Avoids the wrong measurement results due to unintended ground loops
> All inputs are equipped with overvoltage and surges protection devices
  > Avoids damage to the CPC 100
> Connection of external sensors (CTs, VTs and current clamps) is supported by the CPC 100 software
> Advanced measurement capabilities (for example, integral of a signal for measuring Rogowski coil CTs)

Interface
> Easy and intuitive graphical user interface
  > Efficient, time-saving testing
> Different selectable language settings and test standards (for example, IEEE, IEC, etc.)
  > Users from different countries can effectively use the device
  > Reports can be generated in different languages
> Wiring connections to be made are indicated by LEDs
  > Quick wiring set-up
  > Avoids wiring errors
> Different operation modes: From the front panel with test cards or controlled by a PC
  > Each user can operate the CPC 100 according to personal preferences
Technical data CPC 100

CPC 100

Generator / Outputs

Current outputs

<table>
<thead>
<tr>
<th>Range</th>
<th>Amplitude</th>
<th>$t_{\text{max}}$</th>
<th>$V_{\text{max}}$</th>
<th>Power$_{\text{max}}$</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 A AC^2</td>
<td>0 ... 800 A</td>
<td>25 s</td>
<td>6.0 V</td>
<td>4800 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>0 ... 400 A</td>
<td>8 min.</td>
<td>6.4 V</td>
<td>2560 VA</td>
<td>15 Hz ... 400 Hz</td>
<td></td>
</tr>
<tr>
<td>0 ... 200 A</td>
<td>&gt; 2 h</td>
<td>6.5 V</td>
<td>1300 VA</td>
<td>15 Hz ... 400 Hz</td>
<td></td>
</tr>
<tr>
<td>6 A AC^2</td>
<td>0 ... 6 A</td>
<td>&gt; 2 h</td>
<td>55 V</td>
<td>330 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>3 A AC^2</td>
<td>0 ... 3 A</td>
<td>&gt; 2 h</td>
<td>110 V</td>
<td>330 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>400 A DC</td>
<td>0 ... 400 A</td>
<td>2 min.</td>
<td>6.5 V</td>
<td>2600 VA</td>
<td>DC</td>
</tr>
<tr>
<td>0 ... 300 A</td>
<td>3 min.</td>
<td>6.5 V</td>
<td>1950 VA</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>0 ... 200 A</td>
<td>&gt; 2 h</td>
<td>6.5 V</td>
<td>1300 VA</td>
<td>DC</td>
<td></td>
</tr>
<tr>
<td>6 A DC^2, 10</td>
<td>0 ... 6 A</td>
<td>&gt; 2 h</td>
<td>60 V</td>
<td>360 VA</td>
<td>DC</td>
</tr>
<tr>
<td>2000 A AC^4 with an optional current booster (CP CB2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Voltage outputs

<table>
<thead>
<tr>
<th>Range</th>
<th>Amplitude</th>
<th>$t_{\text{max}}$</th>
<th>$I_{\text{max}}$</th>
<th>Power$_{\text{max}}$</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 kV AC^3</td>
<td>0 ... 2 kV</td>
<td>1 min.</td>
<td>1.25 A</td>
<td>2500 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>0 ... 1 kV</td>
<td>&gt; 2 h</td>
<td>0.5 A</td>
<td>1000 VA</td>
<td>15 Hz ... 400 Hz</td>
<td></td>
</tr>
<tr>
<td>1 kV AC^3</td>
<td>0 ... 1 kV</td>
<td>1 min.</td>
<td>2.5 A</td>
<td>2500 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>0 ... 1 kV</td>
<td>&gt; 2 h</td>
<td>1.0 A</td>
<td>1000 VA</td>
<td>15 Hz ... 400 Hz</td>
<td></td>
</tr>
<tr>
<td>500 V AC^3</td>
<td>0 ... 500 V</td>
<td>1 min.</td>
<td>5.0 A</td>
<td>2500 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>0 ... 500 V</td>
<td>&gt; 2 h</td>
<td>2.0 A</td>
<td>1000 VA</td>
<td>15 Hz ... 400 Hz</td>
<td></td>
</tr>
<tr>
<td>130 V AC^10</td>
<td>0 ... 130 V</td>
<td>&gt; 2 h</td>
<td>3.0 A</td>
<td>390 VA</td>
<td>15 Hz ... 400 Hz</td>
</tr>
</tbody>
</table>

Internal measurement of outputs (Accuracy^2)

<table>
<thead>
<tr>
<th>Output</th>
<th>Range</th>
<th>Amplitude Reading Error</th>
<th>Amplitude Full scale Error</th>
<th>Phase Full scale Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 A AC</td>
<td>–</td>
<td>&lt; 0.10 %</td>
<td>&lt; 0.10 %</td>
<td>&lt; 0.10°</td>
</tr>
<tr>
<td>400 A DC</td>
<td>–</td>
<td>&lt; 0.20 %</td>
<td>&lt; 0.05 %</td>
<td>–</td>
</tr>
<tr>
<td>2 kV AC</td>
<td>2000 V</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
</tr>
<tr>
<td>1000 V</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.15°</td>
<td></td>
</tr>
<tr>
<td>500 V</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.20°</td>
<td></td>
</tr>
<tr>
<td>5 A</td>
<td>&lt; 0.20 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
<td></td>
</tr>
<tr>
<td>500 mA</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
<td></td>
</tr>
</tbody>
</table>

Inputs

Measuring inputs (Accuracy^2)

<table>
<thead>
<tr>
<th>Input</th>
<th>Imped.</th>
<th>Range</th>
<th>Reading</th>
<th>Full scale</th>
<th>Full scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>I AC / DC^4-7</td>
<td>&lt; 0.1 Ω</td>
<td>10 A AC</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
</tr>
<tr>
<td>1 A AC</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.15°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 A DC</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.08 %</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 A DC</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.08 %</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1 AC^4</td>
<td>500 kΩ</td>
<td>300 V</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
</tr>
<tr>
<td>30 V</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 V</td>
<td>&lt; 0.10 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300 mV</td>
<td>&lt; 0.15 %</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2 AC^4, 11</td>
<td>10 MΩ</td>
<td>3 V</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.08 %</td>
<td>&lt; 0.10°</td>
</tr>
<tr>
<td>300 mV</td>
<td>&lt; 0.08 %</td>
<td>&lt; 0.08 %</td>
<td>&lt; 0.10°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 mV</td>
<td>&lt; 0.10 %</td>
<td>&lt; 0.25 %</td>
<td>&lt; 0.15°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V DC^4-7</td>
<td>10 V</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.08 %</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>1 V</td>
<td>&lt; 0.03 %</td>
<td>&lt; 0.08 %</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 mV</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.10 %</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 mV</td>
<td>&lt; 0.05 %</td>
<td>&lt; 0.15 %</td>
<td>–</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional features of the measuring inputs

Automatic range switching (except Amplifier test card)
Galvanically separated potential groups: I AC/DC ; V1 & V2 ; V DC
AC frequency range: 15 Hz to 400 Hz (except Amplifier test card)
Protection of I AC/DC input: 10 A very fast acting (FF) fuse^4

Binary input for dry contacts or voltages up to 300 V DC^2

Trigger criteria: Toggling with potential-free contacts or voltages of up to 300 V
Input impedance: > 100 kΩ
Response time: 1 ms

Output to input synchronization

<table>
<thead>
<tr>
<th>Test cards Quick, Sequencer, Ramping</th>
<th>Amplifier test card</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>48 Hz ... 62 Hz</td>
</tr>
<tr>
<td>Synchronization inputs</td>
<td>V1 AC, V2 AC, I AC</td>
</tr>
<tr>
<td>Input magnitude</td>
<td>10 % of input range full scale</td>
</tr>
<tr>
<td>Output magnitude</td>
<td>5 % of output range full scale</td>
</tr>
<tr>
<td>Setting time</td>
<td>100 ms after 5 % of output range full scale is reached</td>
</tr>
<tr>
<td>Signal changes</td>
<td>No changes of frequency and phase. Magnitude changes without limitation. Output follows within 250 ms</td>
</tr>
<tr>
<td>Phase tolerance</td>
<td>0.5 ° within the limits as specified above</td>
</tr>
</tbody>
</table>
### Resistance measurement

**4-wire measurement with 400 A DC output and 10 V DC input**

<table>
<thead>
<tr>
<th>Current</th>
<th>Resistance</th>
<th>Voltage</th>
<th>Accuracy (full scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 A</td>
<td>10 μΩ</td>
<td>4 mV</td>
<td>Error &lt; 0.70 %</td>
</tr>
<tr>
<td>400 A</td>
<td>100 μΩ</td>
<td>40 mV</td>
<td>Error &lt; 0.55 %</td>
</tr>
<tr>
<td>400 A</td>
<td>1 μΩ</td>
<td>400 mV</td>
<td>Error &lt; 0.50 %</td>
</tr>
<tr>
<td>400 A</td>
<td>10 mΩ</td>
<td>4 V</td>
<td>Error &lt; 0.50 %</td>
</tr>
</tbody>
</table>

**4-wire measurement with 6 A DC output and 10 V VDC input**

<table>
<thead>
<tr>
<th>Current</th>
<th>Resistance</th>
<th>Voltage</th>
<th>Accuracy (full scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 A</td>
<td>100 mΩ</td>
<td>0.6 V</td>
<td>Error &lt; 0.35 %</td>
</tr>
<tr>
<td>6 A</td>
<td>1 Ω</td>
<td>6 V</td>
<td>Error &lt; 0.35 %</td>
</tr>
<tr>
<td>1 A</td>
<td>10 Ω</td>
<td>10 V</td>
<td>Error &lt; 0.25 %</td>
</tr>
</tbody>
</table>

**2-wire measurement with 10 V VDC input**

<table>
<thead>
<tr>
<th>Current</th>
<th>Resistance</th>
<th>Voltage</th>
<th>Accuracy (full scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5 mA</td>
<td>100 Ω</td>
<td></td>
<td>Error &lt; 0.60 %</td>
</tr>
<tr>
<td>&gt; 5 mA</td>
<td>1 kΩ</td>
<td></td>
<td>Error &lt; 0.51 %</td>
</tr>
<tr>
<td>&gt; 5 mA</td>
<td>10 kΩ</td>
<td></td>
<td>Error &lt; 0.50 %</td>
</tr>
</tbody>
</table>

### Power supply and mechanical data

- **Single-phase, nominal**
  - 100 V$_{ac}$ ... 240 V$_{ac}$, 16 A
- **Single-phase, permissible**
  - 85 V$_{ac}$ ... 264 V$_{ac}$ (L-N or L-L)
- **Frequency, nominal**
  - 50 Hz / 60 Hz
- **Power consumption**
  - < 3 500 VA (< 7 000 VA for a time < 10 s)
- **Connection**
  - IEC 320 / C20
- **Weight**
  - 29 kg / 64 lbs (case without protection cover)
- **Dimensions (W x H x D)**
  - 468 x 394 x 233 mm (18.4 x 15.5 x 9.2 in), cover, without handles.
- **EMC**
- **Safety**
  - EN 61010-1, IEC 61010-1, UL 61010-1, CE conform (2006 / 95 / EC)
- **Shock**
  - IEC / EN 60068-2-27, 15 g / 11 ms, half-sinusoid, each axis
- **Vibration**
  - IEC / EN 60068-2-6, frequency range from 10 Hz to 150 Hz, continuous acceleration 2 g (20 m/s$^2$ / 65 ft/s$^2$), 10 cycles per axis

### Environmental conditions for CPC 100 and CPC 100 accessories

<table>
<thead>
<tr>
<th>Condition</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating temperature</strong></td>
<td>-10 °C ... +55 °C / +14 °F ... +131 °F</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-20 °C ... +70 °C / -4 °F ... +158 °F</td>
</tr>
<tr>
<td><strong>Humidity range</strong></td>
<td>5 % ... 95 % relative humidity, no condensation</td>
</tr>
</tbody>
</table>
### Technical data CPC 100 accessories

#### CP TD1 – Tan-delta unit

**High-voltage output**

<table>
<thead>
<tr>
<th>U/f</th>
<th>0...12 kV AC</th>
<th>0...12 kV AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>300 mA</td>
<td>100 mA</td>
</tr>
<tr>
<td>S</td>
<td>3 600 VA</td>
<td>1 200 VA</td>
</tr>
<tr>
<td>t&lt;sub&gt;max&lt;/sub&gt;</td>
<td>&gt; 2 min.</td>
<td>&gt; 60 min.</td>
</tr>
<tr>
<td>f</td>
<td>15 Hz ... 400 Hz</td>
<td>15 Hz ... 400 Hz</td>
</tr>
</tbody>
</table>

**Internal measurement of voltage output / current inputs**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...12 000 V&lt;sub&gt;AC&lt;/sub&gt;</td>
<td>1 V</td>
<td>Error &lt; 0.3 % of reading + 1 V</td>
<td></td>
</tr>
<tr>
<td>0...5 A&lt;sub&gt;AC&lt;/sub&gt;</td>
<td>5 digits</td>
<td>Error &lt; 0.3 % of reading + 100 nA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 digits</td>
<td>Error &lt; 0.5 % of reading</td>
<td></td>
</tr>
</tbody>
</table>

**Capacitance Cp (equivalent parallel circuit)**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pF ... 3 μF</td>
<td>6 digits</td>
<td>Error &lt; 0.05 % of reading + 0.1 pF</td>
<td></td>
</tr>
<tr>
<td>1 pF ... 3 μF</td>
<td>6 digits</td>
<td>Error &lt; 0.2 % of reading</td>
<td></td>
</tr>
</tbody>
</table>

**Power factor PF / dissipation factor DF**

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...10 %</td>
<td>5 digits</td>
<td>Error &lt; 0.1 % of reading + 0.005 %</td>
<td></td>
</tr>
<tr>
<td>0...100 % (PF)</td>
<td>5 digits</td>
<td>Error &lt; 0.5 % of reading + 0.02 %</td>
<td></td>
</tr>
</tbody>
</table>

#### CP CU1 – Coupling unit

**Output ranges**

<table>
<thead>
<tr>
<th>Range</th>
<th>Current</th>
<th>Compliance voltage at &gt; 45 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 A</td>
<td>0...10 A&lt;sub&gt;max&lt;/sub&gt;</td>
<td>500 V&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>20 A</td>
<td>0...20 A&lt;sub&gt;max&lt;/sub&gt;</td>
<td>250 V&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>50 A</td>
<td>0...50 A&lt;sub&gt;max&lt;/sub&gt;</td>
<td>100 V&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>100 A</td>
<td>0...100 A&lt;sub&gt;max&lt;/sub&gt;</td>
<td>50 V&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

**Measuring transformers**

<table>
<thead>
<tr>
<th>Transformer</th>
<th>Ratio</th>
<th>Accuracy at 50 Hz / 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT</td>
<td>600 V : 30 V</td>
<td>Class 0.1</td>
</tr>
<tr>
<td>CT</td>
<td>100 A : 2.5 A</td>
<td>Class 0.1</td>
</tr>
</tbody>
</table>

**Inputs**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category</td>
<td>CAT III (IEC 61010-1)</td>
</tr>
<tr>
<td>Voltage range</td>
<td>0 ... 600 V&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>Current range</td>
<td>0 ... 30 A&lt;sub&gt;rms&lt;/sub&gt;</td>
</tr>
<tr>
<td>Frequency range</td>
<td>15 Hz ... 400 Hz</td>
</tr>
<tr>
<td>Fuse</td>
<td>30 A fast acting, automatic circuit breaker</td>
</tr>
</tbody>
</table>

**Output power**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum power</td>
<td>5000 VA (45 Hz ... 70 Hz), cos φ &lt; 1.0 for 8 s at 230 V&lt;sub&gt;AC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Continuous power</td>
<td>5000 VA (45 Hz ... 70 Hz), cos φ &lt; 0.4 for 8 s at 115 V&lt;sub&gt;AC&lt;/sub&gt;</td>
</tr>
<tr>
<td>0...1 600 VA</td>
<td></td>
</tr>
</tbody>
</table>

**Accuracy**

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy of absolute value</th>
<th>Accuracy of phase angle</th>
<th>V SENSE voltage</th>
<th>I OUT current</th>
<th>Current range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 ... 0.2 Ω</td>
<td>1.0 ... 0.5 %</td>
<td>1.5 ... 0.8 %</td>
<td>5 ... 20 V</td>
<td>100 A</td>
<td>100 A</td>
</tr>
<tr>
<td>0.2 ... 2 Ω</td>
<td>0.5 ... 0.3 %</td>
<td>0.8 ... 0.5 %</td>
<td>20 ... 50 V</td>
<td>100 ... 25 A</td>
<td>100 A</td>
</tr>
<tr>
<td>2 ... 5 Ω</td>
<td>0.3 %</td>
<td>0.5%</td>
<td>100 V</td>
<td>50 ... 20 A</td>
<td>50 A</td>
</tr>
<tr>
<td>5 ... 25 Ω</td>
<td>0.3 %</td>
<td>0.5%</td>
<td>100 ... 250 V</td>
<td>20 ... 10 A</td>
<td>20 A</td>
</tr>
<tr>
<td>25 ... 300 Ω</td>
<td>0.3 ... 1.0 %</td>
<td>0.5 ... 1.5 %</td>
<td>250 ... 500 V</td>
<td>10 ... 1.5 A</td>
<td>10 A</td>
</tr>
</tbody>
</table>

**Mechanical data**

| Dimensions (W x H x D) | 450 x 220 x 220 mm | 17.7 x 8.7 x 8.7 in |
| Weight                | 28.5 kg / 62.78 lbs |

#### CP CB2 – Current booster

**Output current**

<table>
<thead>
<tr>
<th>Output power at 2 000 A</th>
<th>up to 2 000 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy of current at 50 Hz / 60 Hz</td>
<td>Error &lt; ± 0.13 % (rd) ± 0.13 % (fs)</td>
</tr>
<tr>
<td>Phase tolerance at full scale</td>
<td>Error &lt; ± 0.25 %</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>186 x 166 x 220 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>16.0 kg / 35.3 lbs</td>
</tr>
</tbody>
</table>

**CP CB2 – Current booster**

<table>
<thead>
<tr>
<th>Output current</th>
<th>up to 2 000 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output power at 2 000 A</td>
<td>5 kVA</td>
</tr>
<tr>
<td>Accuracy of current at 50 Hz / 60 Hz</td>
<td>Error &lt; ± 0.13 % (rd) ± 0.13 % (fs)</td>
</tr>
<tr>
<td>Phase tolerance at full scale</td>
<td>Error &lt; ± 0.25 %</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>186 x 166 x 220 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>16.0 kg / 35.3 lbs</td>
</tr>
</tbody>
</table>
CP DB1 – Discharge box

6 A path
Switch closed 6 A continuous
Switch open The discharge process is faster by a factor of 4 compared to the CPC 100 6 A<sub>peak</sub>
100 A path
Switch closed 100 A continuous
Switch open The discharge process is faster by a factor of 10 compared to the CPC 100 100 A<sub>peak</sub> 2500 J<sub>th</sub>

CP CR500 – Compensation reactor

Inductors 2 × 40 H 2 × 80 H 1 × 40 H and 1 × 80 H

Current compensation
50 Hz 2 × 1 A 2 × 0.5 A 1 × 1 A + 1 × 0.5 A
60 Hz 2 × 0.8 A 2 × 0.4 A 1 × 0.8 A + 1 × 0.4 A

Capacitance compensation
50 Hz 2 × 250 nF 2 × 125 nF 1 × 250 nF + 1 × 125 nF
60 Hz 2 × 180 nF 2 × 90 nF 1 × 180 nF + 1 × 90 nF

On/off times at 25 °C
0.5 A on/off times: 6 min/6 min on/off times: 6 min/6 min on/off times: 6 min/6 min
1 A on/off times: 2 min/6 min on/off times: - on/off times: 2 min/6 min

Maximum test voltage 12 kV<sub>rms</sub> (≥ 50 Hz)

Dimensions (W × H × D) 455 × 275 × 220 mm / 17.9 × 10.8 × 8.7 in

Weight 36 kg / 79.4 lbs

CP SB1 – Switch box

AC input / V1 AC output Max. 300 V<sub>rms</sub>
DC input Max. 6 A<sub>DC</sub>
Transformer high and low voltage connections Max. 300 V<sub>rms</sub> between all connectors and ground
Supply Via serial interface from CPC 100 (+15 V)
Dimensions (W × H × D) 357 × 235 × 111 mm / 14.1 × 9.2 × 4.4 in
Weight 3.5 kg / 7.7 lbs

CP TC12 – 12 kV oil test cell

Cell type Three-electrode design with guard
Test gap 11 mm / 0.43 in
Capacitance of empty cell (air) Approx. 65 pF ± 10 %
Sample volume 1.2 liters ... 2 liters / 41 ... 68 fl. oz.
Max. RMS test voltage 12 kV
Inner dimensions (diameter × height) 172 mm × 180.8 mm / 6.8 x 7.1 in
Outer dimensions (W × H × D) 220 × 235.5 × 220 mm / 8.7 x 9.3 x 8.7 in
Weight Approx. 9.2 kg / 20 lbs

CPOL – Polarity checker

Measuring range Typical: 5 mV ... 300 V
Guaranteed: 50 mV ... 300 V
Nominal frequency Typical: 52.6 Hz, Possible: 40 Hz ... 60 Hz
Minimum slope ratio 25 % ... 90 % or via pulse width
Power consumption Key pressed: 25 mA
Key not pressed: 0 mA
Input impedance 400 kΩ
Batteries 4 × 1.5 V Micro LR03 AAA AM4 MN2400
Dimensions (W × H × D) 200 × 45 × 35 mm / 7.87 × 1.77 × 1.38 in
Weight 0.25 kg / 0.11 lb including batteries and bag

CP RC – Compensating reactor

Voltage output CP TR7 / CP TR8 CP CR4 / CP CR6 CP AT1
Current output 60 A 150 A 4.4 kVA
Apparent power on secondary side 13.2 kVA 33 kVA
Frequency 80 Hz ... 120 Hz 80 Hz ... 120 Hz 50 Hz / 60 Hz
Insulation class F F F
Weight 19 kg / 42 lbs 20.5 kg / 45 lbs 15.5 kg / 34 lbs
Dimensions (W × H × D) 262 × 277.5 × 222 mm / 10.31 × 10.9 × 8.74 in

HGT1 – Handheld grounding tester

Voltage input Max. 25 V<sub>rms</sub>
Power supply 1 × 3.7 V lithium polymer (Li-Po) battery
Dimensions (W × H × D) 90 × 180 × 45 mm / 3.5 × 7.1 × 1.8 in
Weight (including battery) 0.48 kg / 1 lb

CP GB1 – Grounding box

Nominal ac spark-over voltage < 1 000 V<sub>rms</sub>
Impulse spark-over voltage < 2 000 V<sub>peak</sub>
Short circuit proof with:
16 mm cylindrical or 20 mm ball studs 26.5 kA (< 100 ms) / 67 kA<sub>peak</sub>
25 mm ball studs 30 kA (< 100 ms) / 75 kA<sub>peak</sub>
> 15 Nm
Dimensions (Ø × H) 200 × 190 mm / 7.9 × 7.5 in
Weight 6.8 kg / 13.2 lbs (including grounding cable)

Inductors 2 × 40 H 2 × 80 H 1 × 40 H and 1 × 80 H
Current compensation
50 Hz 2 × 1 A 2 × 0.5 A 1 × 1 A + 1 × 0.5 A
60 Hz 2 × 0.8 A 2 × 0.4 A 1 × 0.8 A + 1 × 0.4 A
Capacitance compensation
50 Hz 2 × 250 nF 2 × 125 nF 1 × 250 nF + 1 × 125 nF
60 Hz 2 × 180 nF 2 × 90 nF 1 × 180 nF + 1 × 90 nF
On/off times at 25 °C
0.5 A on/off times: 6 min/6 min on/off times: 6 min/6 min on/off times: 6 min/6 min
1 A on/off times: 2 min/6 min on/off times: - on/off times: 2 min/6 min
Maximum test voltage 12 kV<sub>rms</sub> (≥ 50 Hz)
Dimensions (W × H × D) 455 × 275 × 220 mm / 17.9 × 10.8 × 8.7 in
Weight 36 kg / 79.4 lbs

Mechanical data
Dimensions (W × H × D) 357 × 235 × 147 mm / 14.0 × 9.2 × 5.8 in
Weight 4 kg / 8.8 lbs

Inductors 2 × 40 H 2 × 80 H
Current compensation
50 Hz 2 × 1 A 2 × 0.5 A 1 × 1 A + 1 × 0.5 A
60 Hz 2 × 0.8 A 2 × 0.4 A 1 × 0.8 A + 1 × 0.4 A
Capacitance compensation
50 Hz 2 × 250 nF 2 × 125 nF 1 × 250 nF + 1 × 125 nF
60 Hz 2 × 180 nF 2 × 90 nF 1 × 180 nF + 1 × 90 nF
On/off times at 25 °C
0.5 A on/off times: 6 min/6 min on/off times: 6 min/6 min on/off times: 6 min/6 min
1 A on/off times: 2 min/6 min on/off times: - on/off times: 2 min/6 min
Maximum test voltage 12 kV<sub>rms</sub> (≥ 50 Hz)
Dimensions (W × H × D) 455 × 275 × 220 mm / 17.9 × 10.8 × 8.7 in
Weight 36 kg / 79.4 lbs

Mechanical data
Dimensions (W × H × D) 357 × 235 × 147 mm / 14.0 × 9.2 × 5.8 in
Weight 4 kg / 8.8 lbs
# Ordering information

## CPC 100 Standard Package (order no. VE000611)

**Hardware**
- 1 × CPC 100

**Software**
- 1 × CP Quick card
- 1 × CP CT test cards
- 1 × CP VT test cards
- 1 × CP transformer test cards
- 1 × CP resistance test cards
- 1 × CPC editor software

**Cables and accessories**
- 1 × CPC 100 user manual
- 1 × Set of 2 standard high-current cables (6 m / 19.68 ft) or optional 1 × set of 2 high-current cables (9 m / 29.53 ft)
- 1 × Set of 2 standard high-voltage cables (2000 V, 6 m / 19.68 ft) or optional 1 × set of 2 high-voltage cables (2000 V, 10 m / 32.81 ft)
- 1 × Set of 6 standard measurement cables (6 m / 19.68 ft) or optional 1 × set of 6 measurement cables (10 m / 32.81 ft)
- 1 × Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
- 1 × Ethernet PC connection cable (3 m / 9.84 ft)
- 1 × Transport case with wheels for CPC 100
- 1 × Carry bag for CPC 100 accessories
- 1 × Set of 4 connection clamps for high voltage
- 1 × Low voltage adapter
- 1 × Power cord CPC
- 1 × CP SA1 Surge Arrestor box
- 1 × USB memory stick
- 1 × Set of 4 crocodile clamps
- 1 × CPC Toolset DVD (including 30-days trial licence for PTM Advanced)

## CPC 100 Enhanced Package (order no. VE000621)

**CPC 100 Standard Package plus:**

**Software**
- 1 × CP sequencer test card
- 1 × CP ramping test card
- 1 × CP GR – ground resistance test option includes testing software and hardware accessory (VEHZ0660)
- 1 × CPOL software and hardware accessory (VEHZ0650)
CP TD1 Upgrade Option (order no. VE000641)

Hardware
1 x CP TD1

Cables and accessories
1 x CP TD1 accessories set
1 x Set of 4 crocodile clamps
1 x Set of 12 solid terminal adapters
1 x Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
1 x Transport case with wheels for CP TD1 accessories set
2 x Hot collar band
1 x Transport case with wheels for CP TD1
1 x CP TD1 reference manual
1 x CP Trolley
1 x CPC Toolset DVD (including 30-days trial licence for PTM Advanced)

CP CU1 and CP GB1 Upgrade Option (order no. VEHZ0671)

Hardware
1 x CP CU1
1 x CP GB1

Cables and accessories
1 x 3-lead shorting cable (0.3 m / 11.81 in, 10 mm²)
1 x CP CU1 reference manual
1 x Set of 3 CP GB1 surge arrestors
1 x Short circuiting bar (4 mm / 0.16 in, 19 mm / 0.75 in)
1 x Booster connection cable (6 m / 19.68 ft, 3 x 1.5 mm²)
1 x Coax measurement cable (6 m / 19.68 ft)
1 x Set of 2 cables with Kelvin clamps (6 m / 19.68 ft, 6 mm²)
1 x Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
1 x Transport case CP CU1
1 x CPC Toolset DVD (including 30-days trial licence for PTM Advanced)

CP sequencer test card has to be ordered separately (order no. VESM0635)

CP SB1 Upgrade Option (order no. VEHZ0692)

Hardware
1 x CP SB1

Cables and accessories
1 x RS232 cable
1 x Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
1 x Set of 10 coaxial cables (15 m / 49.21 ft, 2.5 mm²) on cable drum (3 x red, 3 x blue, 2 x green, 2 x yellow)
4 x Set of 2 Kelvin clamps
1 x Transport case with wheels for CP SB1
1 x Set of 12 flexible terminal adapters
1 x CPC Toolset DVD (including 30-days trial licence for PTM Advanced)

Additional accessories: CP SB1 user manual, connection cables, backpack for accessories

For transformer demagnetization the CP Demag test card has to be ordered separately (order no. VESM0639)
Ordering information

**CP Transformer Test System (order no. VE000645)**

**Hardware**

1 × CPC 100
1 × CP TD1

**Software**

1 × CP Quick card
1 × CP transformer test cards
1 × CP sequencer test card
1 × CPC editor software

**Cables and accessories**

1 × Set of 2 high-current cables (9 m / 29.53 ft)
1 × Set of 2 high-voltage cables (2000 V, 10 m / 32.81 ft)
1 × Set of 6 measurement cables (10 m / 32.81 ft)
1 × Set of 4 connection clamps for high voltage
1 × Set of 4 crocodile clamps
1 × Ethernet PC connection cable (3 m / 9.84 ft)
1 × Low voltage adapter
1 × CP TD1 accessories set
1 × Set of 12 solid terminal adapters
1 × Transport case with wheels for CP TD1
1 × CP TD1 reference manual
1 × CPC 100 user manual
2 × Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
1 × Transport case with wheels for CPC 100
1 × Carry bag for CPC 100 accessories
1 × TH3631 temperature/humidity measurement unit
1 × CPC Toolset DVD (including 30-days trial licence for PTM Advanced)
1 × Transport case with wheels for CP TD1 accessories set
1 × CP SA1 surge arrestor box
1 × Power cord CPC
1 × USB memory stick
2 × Hot collar band
1 × CP trolley
CPC 100 Line Impedance Test System (order no. VE000602)

Hardware
1 × CPC 100
1 × CP CU1
1 × CP GB1

Software
1 × CP Quick card
1 × CP sequencer test card
1 × CPC editor software

Cables and accessories
1 × Ethernet PC connection cable (3 m / 9.84 ft)
1 × Transport case with wheels for CPC 100
2 × Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
1 × CPC 100 user manual
1 × USB memory stick
1 × 3-lead shorting cable (0.3 m / 11.81 in, 10 mm²)
1 × CP CU1 reference manual
1 × Set of 3 CP GB1 surge arrestors
1 × Short circuiting bar (4 mm / 0.16 in, 19 mm / 0.75 in)
1 × Booster connection cable (6 m / 19.68 ft, 3 × 1.5 mm²)
1 × Transport case for CP CU1
1 × Set of 2 cables with Kelvin clamps (6 m / 19.68 ft, 6 mm²)
1 × Coax measurement cable (6 m / 19.68 ft)
1 × CPC Toolset DVD (including 30-days trial licence for PTM Advanced)

The cables for the high current (800 AAC / 400 ADC) and for the high-voltage (2000 V) outputs are not included in the package. You can order them separately.

Step & Touch Voltage Set for CP CU1 (order no. VEHZ0625)

Hardware
1 × Handheld grounding tester HGT1 including accessories

Cables and accessories
2 × Foot electrode water cans
   (empty: 6 kg / 13.2 lbs each; filled: > 25 kg / 55.1 lbs each)
1 × Ground electrode
1 × CPC Toolset DVD (including 30-days trial licence for PTM Advanced)

Ground Impedance Set for CP CU1 (order no. VEHZ0622)

Hardware
1 × Rogowski coil with a length of 1.90 m / 75 in – 20 / 200 A ranges
1 × Handheld eTrexH GPS navigation device for evaluation of distance

Cables and accessories
6 × Cable reels (100 m / 328.08 ft, 0.75 mm², black)
3 × Ground electrode
## Ordering information

### Hardware

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Product</th>
<th>Description</th>
<th>CPC 100 Standard Package</th>
<th>CPC 100 Enhanced Package</th>
<th>Transformer Test System</th>
<th>Line Impedance Test System</th>
<th>CPC 100 TD/PF Test System</th>
<th>CP TD1 Upgrade Option</th>
<th>CP CU1 Upgrade Option</th>
<th>CP SB1 Upgrade Option</th>
</tr>
</thead>
</table>
| CPC 100   | > Multi-functional primary test system CPC 100  
> Quick test card (manual control of the test set)  
> Software and accessories according to CPC package overview  
> CPC Toolset DVD (including 30-days trial licence for PTM Advanced) | | | | | | | | | |
| VE000641  | CP TD1 Upgrade Option | > CP TD1 capacitance and tan δ test unit  
> CP TD1 connectors and cables for HV injection (20 m / 65.62 ft)  
> Foldable trolley with cable drum mountings  
> CP TD1 reference manual | | | | | | | | | |
| VEHZ0642  | CP CAL1 | > Calibration box to verify / calibrate any CP TD1 in the field | | | | | | | | |
| VEHZ0601  | CP TC12 | > 12 kV oil test cell for measuring permittivity and tan delta (power factor) of insulation liquids | | | | | | | | |
| VEHZ0692  | CP S81 switch box | > CP S81 for automated turns ratio and dynamic and static resistance measurement of 3-phase transformers  
> Manual, transport case, cables set and connection clamps | | | | | | | | |
| VEHZ0695  | CP DB1 discharge box | > CP DB1 discharge box to speed up the discharge process of a power transformer | | | | | | | | |
| VEHZ0602  | CP CR500 (2 × 40 H) | > Compensating reactor  
> Transport case and cable set | | | | | | | | |
<p>| VEHZ0604  | CP CR500 (2 × 80 H) | | | | | | | | | |
| VEHZ0605  | CP CR500 (1 × 40 H, 1 × 80 H) | | | | | | | | | |
| VEHZ0630  | CP CB2 current booster | &gt; Current booster to increase output current range to 2000 A | | | | | | | | |</p>
<table>
<thead>
<tr>
<th>Order no.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
</table>
| VEHZ0671 | CP CU1 + CP GB1 including accessories | > CP CU1 coupling unit to make k-factor, cable and ground impedance measurements  
> CP GB1 grounding box for additional isolation and protection  
> Kelvin clamps, CP CU1 reference manual, transport case and standard cables for connection and measurement |
| VEHZ0672 | CP GB1 with accessories | > CP GB1 grounding box  
> Surge arrestors, grounding studs, grounding socket clamp and grounding cable (2 m / 6.56 ft, 95 mm²) |
| VEHZ0629 | HGT1 | > HGT1 handheld grounding tester  
> Standard cables for connection and measurement  
> User manual |
| VEHZ0760 | CP RC1 resonance circuit | > Set to create high-voltage on capacitive loads by means of a power VT:  
> 1 × CP TR8 isolation transformer  
> 1 × CP CR4 compensation reactor  
> 1 × CP CR6 compensation reactor  
> HV resonance test system test card  
> Manual, transport case, cable set and terminal adapters |
| VEHZ0770 | CP RC2 resonance circuit | > Set to create high-voltage on capacitive loads by means of a power VT:  
> 1 × CP AT1 auto-transformer  
> 1 × CP TR7 isolating transformer  
> 3 × CP CR6 compensation reactor  
> HV resonance test system test card  
> Manual, transport case, cable set and terminal adapters |
| VEHZ0650 | CPOL polarity tester hardware | > Polarity tester hardware  
> Bag and batteries (4 × AAA) |
### Ordering information

#### Software, cables and accessories

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VESM0600</td>
<td>CP Quick card</td>
<td>Quick test card</td>
</tr>
<tr>
<td>VESM0610</td>
<td>CP CT test cards</td>
<td>Test cards: ratio (V), ratio (I), excitation curve, burden, winding resistance, voltage withstand test (2 kV), Rogowski coils, low power CTs</td>
</tr>
<tr>
<td>VESM0615</td>
<td>CP VT test cards</td>
<td>Test cards: ratio, burden, voltage withstand test (2 kV), electronic voltage transformers</td>
</tr>
<tr>
<td>VESM0620</td>
<td>CP transformer test cards</td>
<td>Test cards: winding resistance, tap changer check, ratio, voltage withstand test (2 kV), vector group check</td>
</tr>
<tr>
<td>VESM0639</td>
<td>CP Demag test card</td>
<td>Test card for demagnetization of a power transformer by using the CP SB1</td>
</tr>
<tr>
<td>VESM0625</td>
<td>CP resistance test cards</td>
<td>Test cards: contact resistance (μΩ – mΩ), winding resistance (μΩ – kΩ)</td>
</tr>
<tr>
<td>VESM0630</td>
<td>CP ramping test card</td>
<td>Programmable ramping generator and determination of thresholds</td>
</tr>
<tr>
<td>VESM0635</td>
<td>CP sequencer test card</td>
<td>Sequencer test card for testing with different states</td>
</tr>
<tr>
<td>VESM0640</td>
<td>CP GR</td>
<td>Ground resistance test option: includes testing software and hardware accessory (VEHZ0660)</td>
</tr>
<tr>
<td>VESM0645</td>
<td>CPOL</td>
<td>Polarity checking for CT / VT wiring including software and hardware accessory set (VEHZ0650)</td>
</tr>
<tr>
<td>VESM0660</td>
<td>CP amplifier test card</td>
<td>Test module to use the CPC 100 like an amplifier</td>
</tr>
<tr>
<td>VESM0670</td>
<td>CPC editor software</td>
<td>CPC editor software</td>
</tr>
<tr>
<td>VESM0637</td>
<td>CP SV-Ratio test card</td>
<td>CP SV-Ratio test card to test IEC 61850-9-2 Sampled Values CTs and VTs</td>
</tr>
<tr>
<td>VESM0636</td>
<td>CP 12kV High Voltage test card</td>
<td>Test card with the CP TD1 as high-voltage source either independently or together with the CP CR500</td>
</tr>
<tr>
<td>VESM0638</td>
<td>HV resonance test system test card</td>
<td>Testcard for generation of high voltage by means of resonance circuit</td>
</tr>
<tr>
<td>VESM0671</td>
<td>PTM Advanced software</td>
<td>PTM Advanced software</td>
</tr>
</tbody>
</table>

#### Cables and accessories

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEHK0610</td>
<td>High-current cable set for CP CB2</td>
<td>2 × 1.5 m / 4.92 ft, 95 mm² (black), 2 × 1.5 m / 4.92 ft, 95 mm² (red), 1 × 0.6 m / 1.97 ft, 95 mm²</td>
</tr>
<tr>
<td>VEHK0611</td>
<td>Connection cable to CPC 100 for CP CB2 / CU1</td>
<td>20 m / 65.62 ft, 3 × 2.5 mm²</td>
</tr>
<tr>
<td>VEHK0612</td>
<td>Standard high-current cable set</td>
<td>2 × 6 m / 19.68 ft, 70 mm² (800 A)</td>
</tr>
<tr>
<td>VEHK0613</td>
<td>Standard high-voltage cable set</td>
<td>2 × 6 m / 19.68 ft, 0.5 mm² (2000 V)</td>
</tr>
<tr>
<td>VEHK0614</td>
<td>Standard measurement cable set</td>
<td>6 × 6 m / 19.68 ft, 2.5 mm²</td>
</tr>
<tr>
<td>VEHK0615</td>
<td>Grounding cable (green/yellow)</td>
<td>1 × 6 m / 19.68 ft, 6 mm² with connection clamp</td>
</tr>
<tr>
<td>VEHK0617</td>
<td>Optional high-current cable set</td>
<td>2 × 9 m / 29.53 ft, 70 mm² (800 A)</td>
</tr>
<tr>
<td>VEHK0618</td>
<td>Optional high-voltage cable set</td>
<td>2 × 10 m / 32.81 ft, 0.5 mm² (2000 V)</td>
</tr>
<tr>
<td>Order no.</td>
<td>Product</td>
<td>Description</td>
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<tr>
<td>VEHK0619</td>
<td>Optional measurement cable set</td>
<td>6 x 10 m / 32.81 ft, 2.5 mm²</td>
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<tr>
<td>VEHK0680</td>
<td>Optional lightweight winding resistance measurement cables</td>
<td>2 x 20 m / 65.6 ft, 25 mm² for output 400 A DC</td>
</tr>
<tr>
<td>VEHK0616</td>
<td>Power cord CPC (EU, Middle East)</td>
<td>3 x 1.5 mm², 2.5 m / 8.20 ft, VII</td>
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<tr>
<td>VEHK0620</td>
<td>Power cord CPC (ZA, IN, NA)</td>
<td>3 x 1.5 mm², 2.5 m / 8.20 ft, ZA/3</td>
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<tr>
<td>VEHK0621</td>
<td>Power cord CPC (open end)</td>
<td>3 x 1.5 mm², 2.5 m / 8.20 ft, open ends</td>
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<tr>
<td>VEHK0622</td>
<td>Ethernet PC connection cable</td>
<td>3 m / 9.84 ft, twisted pair cat 5, RJ45 connector</td>
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<tr>
<td>VEHK0623</td>
<td>Low voltage adapter</td>
<td>4 mm / 1.57 in banana to low voltage plug</td>
</tr>
<tr>
<td>VEHK0624</td>
<td>Power cord CPC (GB, HK)</td>
<td>3 x 1.5 mm², 2 m / 6.56 ft, BS connector (for GB, HK)</td>
</tr>
<tr>
<td>VEHK0627</td>
<td>MV-cable set for CP CU1</td>
<td>3 x cables (2 m / 6.56 ft, 95 mm²) with clamps on both ends to connect the CP GB1 to MV-cable installations</td>
</tr>
<tr>
<td>VEHK0652</td>
<td>Coax measurement cable</td>
<td>6 m / 19.68 ft</td>
</tr>
<tr>
<td>VEHK0676</td>
<td>Cable set with Kelvin clamps</td>
<td>2 current cables (red and black) (6 m / 19.68 ft, 6 mm²) and banana sockets for measurement cables</td>
</tr>
<tr>
<td>VEHK0677</td>
<td>3-lead shorting cable</td>
<td>0.3 m / 11.81 in, 10 mm² with 6 mm / 0.24 in plugs</td>
</tr>
<tr>
<td>VEHK0678</td>
<td>Booster connection cable</td>
<td>6 m / 19.68 ft, 3 x 1.5 mm²</td>
</tr>
<tr>
<td>VEHK0690</td>
<td>Connection cables for CP SB1</td>
<td>Set of 10 coaxial cables (15 m / 49.21 ft, 2.5 mm²) on cable drum (3 x red, 3 x blue, 2 x green, 2 x yellow)</td>
</tr>
<tr>
<td>VEHP0061</td>
<td>Transport case for CPC 100</td>
<td>Transport case with wheels for CPC 100</td>
</tr>
<tr>
<td>VEHP0062</td>
<td>Transport case for CP TD1</td>
<td>Transport case with wheels for CP TD1</td>
</tr>
<tr>
<td>VEHP0063</td>
<td>Transport case for CP CU1 or CP CR500</td>
<td>Transport case with wheels for CP CU1 &amp; CP GB1 or CP CR500</td>
</tr>
<tr>
<td>VEHP0066</td>
<td>Transport case for CPC 100 accessories</td>
<td>Transport case with wheels for CPC 100 accessories</td>
</tr>
<tr>
<td>VEHP0067</td>
<td>Transport case for CP TD1 accessories</td>
<td>Transport case with wheels for CP TD1 accessories</td>
</tr>
<tr>
<td>VEHP0069</td>
<td>Carry bag for CPC 100 accessories</td>
<td>Carry bag for CPC 100 accessories</td>
</tr>
<tr>
<td>VEHP0071</td>
<td>Transport case for CP CB2</td>
<td>Transport case with wheels for CP CB2</td>
</tr>
<tr>
<td>VEHP0090</td>
<td>Transport case for CP SB1</td>
<td>Transport case with wheels for CP SB1</td>
</tr>
<tr>
<td>VEHS0006</td>
<td>Solid terminal adapters</td>
<td>Solid terminal adapters (12 pcs)</td>
</tr>
<tr>
<td>VEHS0009</td>
<td>Flexible terminal adapters</td>
<td>Flexible terminal adapters (12 pcs)</td>
</tr>
<tr>
<td>VEHS0010</td>
<td>Low voltage plug</td>
<td>Low voltage plug, spare plug for voltage input (0 ... 3 V)</td>
</tr>
<tr>
<td>VEHZ0021</td>
<td>100TX to 100FX-SC converter</td>
<td>100TX to 100FX-SC converter (optical – electrical)</td>
</tr>
<tr>
<td>VEHZ0600</td>
<td>CP TD1 accessories set</td>
<td>CP TD1 accessories set</td>
</tr>
<tr>
<td>VEHZ0610</td>
<td>Connection clamps for high-voltage</td>
<td>For connection with banana plugs, 4mm / 0.16 in (2 standard clamps and 2 Kelvin clamps)</td>
</tr>
<tr>
<td>VEHZ0611</td>
<td>Warning lamp set</td>
<td>Warning strobe set for CPC 100</td>
</tr>
<tr>
<td>VEHZ0613</td>
<td>CP TD1 C-Load</td>
<td>Reference C-Load for verification of power loss measurements with CP TD1</td>
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</table>

<table>
<thead>
<tr>
<th>Included</th>
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1 Order no. VE000640
2 Power cord is arbitrary
### Ordering information

#### Cables and accessories

<table>
<thead>
<tr>
<th>Order no.</th>
<th>Product</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>VEHZ0620</td>
<td>Crocodile clamps</td>
<td>Crocodile clamps for connection of the banana plugs, 4 mm / 0.16 in (2 x red and 2 x black)</td>
</tr>
<tr>
<td>VEHZ0622</td>
<td>Ground Impedance Set for CP CU1</td>
<td>Ground Impedance Set for CP CU1</td>
</tr>
<tr>
<td>VEHZ0623</td>
<td>Rogowski coil</td>
<td>Length 1.90 m / 6.23 ft, 20 / 200 A</td>
</tr>
<tr>
<td>VEHZ0624</td>
<td>Handheld eTreXH GPS navigation device</td>
<td>Handheld eTreXH GPS navigation device for evaluation of distance</td>
</tr>
<tr>
<td>VEHZ0625</td>
<td>Step &amp; touch voltage set for CP CU1</td>
<td>Pair of foot electrodes, handheld grounding tester HGT1, cables and ground electrode</td>
</tr>
<tr>
<td>VEHZ0627</td>
<td>Set of two foot electrodes</td>
<td>Set of two foot electrodes</td>
</tr>
<tr>
<td>VEHZ0635</td>
<td>Pulley for current booster</td>
<td>Pulley for current booster block and tackle including 25 m / 82.02 in rope and carabiners for easily lifting the booster CP CB2</td>
</tr>
<tr>
<td>VEHZ0640</td>
<td>CP trolley</td>
<td>Comfortable trolley for single person operation in the field with tan δ / power factor test system</td>
</tr>
<tr>
<td>VEHZ0644</td>
<td>TH3631</td>
<td>Unit for measurement of humidity and temperature of the air and on the surface of test objects</td>
</tr>
<tr>
<td>VEHZ0646</td>
<td>New e IFC-5 interface card</td>
<td>New e IFC-5 interface card for CPC 100</td>
</tr>
<tr>
<td>VEHZ0648</td>
<td>3-position remote safety switch</td>
<td>Remote safety switch (3-position) for CPC 100</td>
</tr>
<tr>
<td>VEHZ0660</td>
<td>Ground resistance accessory set</td>
<td>4 × electrodes, 1 × cable reel red (50 m / 164.04 ft), 1 × cable reel black (100 m / 328.08 ft)</td>
</tr>
<tr>
<td>VEHZ0665</td>
<td>CP SA1 surge arrestor box</td>
<td>Surge arrestor box for 100 A winding resistance measurement</td>
</tr>
<tr>
<td>VEHZ0666</td>
<td>CP trolley</td>
<td>Comfortable trolley for single person operation in the field with tan δ / power factor test system</td>
</tr>
<tr>
<td>VEHZ0667</td>
<td>400 A clamp-on ammeter / multimeter</td>
<td>400 A clamp-on ammeter / multimeter</td>
</tr>
<tr>
<td>VEHZ0668</td>
<td>Set of 3 CP GB1 surge arrestors</td>
<td>Replacement kit with 3 CP GB1 surge arrestors</td>
</tr>
<tr>
<td>VEHZ0670</td>
<td>Short circuiting bar</td>
<td>4 mm / 0.16 in, 19 mm / 0.75 in</td>
</tr>
<tr>
<td>VEHZ0671</td>
<td>Hot collar band</td>
<td>Hot collar band</td>
</tr>
<tr>
<td>VEHZ0672</td>
<td>16 mm / 0.63 in cyl. studs and clamp U1 for CP GB1</td>
<td>Studs and grounding socket clamp for CP GB1 for connection on 16 mm / 0.63 in cylindrical grounding studs</td>
</tr>
<tr>
<td>VEHZ0673</td>
<td>20 mm / 0.79 in ball studs and clamp U1 for CP GB1</td>
<td>Studs and grounding socket clamp for CP GB1 for connection on 20 mm / 0.79 in ball studs</td>
</tr>
<tr>
<td>VEHZ0674</td>
<td>25 mm / 0.98 in ball studs and clamp U2 for CP GB1</td>
<td>Studs and grounding socket clamp for CP GB1 for connection on 25 mm / 0.98 in ball studs</td>
</tr>
<tr>
<td>VEHZ0689</td>
<td>Kelvin clamps</td>
<td>4 × set of 2 Kelvin clamps</td>
</tr>
<tr>
<td>VESD0600</td>
<td>CPC 100 reference manual</td>
<td>CPC 100 reference manual</td>
</tr>
<tr>
<td>VESD0601</td>
<td>CPC 100 user manual</td>
<td>CPC 100 user manual</td>
</tr>
<tr>
<td>VESD0602</td>
<td>CP CU1 reference manual</td>
<td>CP CU1 reference manual</td>
</tr>
<tr>
<td>VESD0605</td>
<td>CP TD1 reference manual</td>
<td>CP TD1 reference manual</td>
</tr>
<tr>
<td>X0000089</td>
<td>CPC Toolset DVD</td>
<td>CPC Toolset DVD (including 30-days trial licence for PTM Advanced)</td>
</tr>
</tbody>
</table>

- **Included**: Included with the product
- **Not Included**: Not included

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1. Order no. VE000640
Excellence through education
OMICRON offers several training courses to become familiar with the CPC 100 and its accessories. Working in small groups customers practise using the CPC 100 primary test system and perform practical measurements on different test objects.

The training program provides customers with valuable expertise while serving real-life needs at the same time.

Expert trainers and dedicated training equipment with different test objects and models simulating every part of the substation in the classroom are the key to OMICRON’s customer-oriented professional development.

General training contents
> Operating philosophy of the CPC 100
> Applying the general test cards
> Working with the test cards
> Preparing tests and documenting the measurement results efficiently with the PC software
> Practical exercises on different assets
> Introduction to CPC 100 accessories

Scheduled training
The training courses regularly take place at the OMICRON Training Centers all around the world.

Customized training
In case of specific customer requirements OMICRON also offers customized on-site training courses. These training courses can take place at the customer’s premises or at the substation.

Webinars
This form of training reduces down time and expense for customers. Customers can sign in for OMICRON’s webinars and participate in an easy and comfortable way from their desk.

Detailed information about all training courses and dates offered can be found on the OMICRON website:
www.omicron.at/en/training/
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 140 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:

Diagnostic Testing Solutions for Power Transformers Brochure
CP CU1 Brochure
Primary Test Manager™ (PTM) Brochure

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