CPC 100

Multi-functional Primary Test System for Substation Commissioning and Maintenance
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 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.
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.

**CPC 100 Applications**

- Current transformer testing (page 6 / 7)
- Voltage transformer testing (page 8 / 9)
- Power and distribution transformer diagnosis (page 10 / 11)
- Grounding system analysis (page 14 / 15)
- Switchgear / circuit breaker testing (page 20 / 21)
- Commissioning protection systems (page 22 / 23)
- Sampled Values testing (page 24 / 25)
Extended Range with accessories

- Coupling unit
- Grounding box
- Switch box
- Tan Delta test set
- Current booster
- Isolation transformer
- Compensation reactor

- HV cable and power line analysis (page 12 / 13)
- Grounding system analysis (page 14 / 15)
- Power and distribution transformer diagnosis (page 10 / 11)
- Switchgear / circuit breaker testing (page 20 / 21)
- Rotating machine diagnosis (page 16 / 17)
- Voltage transformer testing (page 6 / 7)
- Current transformer testing (page 8 / 9)
- Sampled Values testing (page 24 / 25)
- Gas Insulated Switchgear testing (page 18 / 19)
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 A 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 AC | secondary

- **CT excitation curve (knee point)**
  up to 2 kV AC

- **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 AC | bushing CTs

- **CT winding resistance**
  up to 6 A DC

- **CT voltage withstand test**
  up to 2 kV AC

- **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**

1. **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)

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**CP CB2 (Current booster)**

2 kA

**CP TD1 (tan δ)**

12 kV

**CPOL (Polarity checker)**

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

For high-voltage CTs, 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 CT’s primary side using the CPC 100.
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 AC 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.
Voltage transformer testing

- **VT ratio**
  up to 2 kV AC | polarity and burden

- **VT burden**
  up to 130 V AC | secondary

- **VT secondary voltage withstand test**
  up to 2 kV AC

- **Polarity check with CPOL**
  up to 2 kV AC

- **VT electronics**
  up to 2 kV AC

- **IEC 61850 Sampled Values testing**

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

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**10 reasons to choose a CPC 100**

2. **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

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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

The comprehensive CPC 100 PC software guides the user through every test and provides support with wiring diagrams.

**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 (by using CP SB1) for tapped windings with on load tap changer, speeds up the measurement. The CPC 100 automatically discharges the inductive energy, which makes the measurement safe.

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 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

> 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 kV AC | including polarity and excitation current

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

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

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

> Insulating fluids: power / dissipation factor (tan \(\delta\))
  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

10 reasons to choose a CPC 100

3. 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)
For a reliable power supply, selective operation of protection relays is crucial. Over- and under-reach 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**

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### 10 reasons to choose a CPC 100

1. 
2. 
3. 
4. **Weight and Size**
   > Light-weight (29 kg / 64 lbs)
   > Compact design
   > Save costs on:
     > Transport
     > Handling
     > Storage
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10.

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**CP CU1** (Coupling unit)

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.

**CP GB1** (Grounding box)

The CP GB1 grounding box contains surge arrestors to ensure safe testing during unexpected events.
Substation Grounding Analysis

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 ($Z_{grid}$) 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 HD637S1, IEEE Std 80-2000 and IEEE Std 81-1983.

**Touch and step voltages**

The touch and step voltages ($V_{touch}$ and $V_{step}$) of the local station can be measured with the CPC 100 itself or more conveniently with the CP AL1 – a handheld 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 CP AL1

- **Ground grid impedance for small systems**
  up to 6 A AC

- **Soil resistivity**
  up to 6 A AC

- **Integrity check of grounding connection**
  up to 400 A DC

- **Reduction factor / current split factor**

- **Measure multiple current paths with Rogowski coil**

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10 reasons to choose a CPC 100

<table>
<thead>
<tr>
<th>Reason</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Emergency switch-off button</td>
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<td>2.</td>
<td>Ground connection check</td>
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<td>3.</td>
<td>Overload detection</td>
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<td>4.</td>
<td>Multiple isolated outputs</td>
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<td>5.</td>
<td>Safety key lock</td>
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<td>6.</td>
<td>Discharge circuit to de-energize DC test objects</td>
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<td>7.</td>
<td>Strobe light</td>
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<td>8.</td>
<td>3-position safety switch</td>
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<td>9.</td>
<td>Grounding box</td>
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<td>10.</td>
<td>Safety</td>
</tr>
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**CP GB1 (Grounding box)**

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

**CP AL1 (FFT Voltmeter)**

The CP AL1 is a handheld measurement device to measure touch and step potentials within HV stations and surrounding areas. With the CP AL1 extremely long measurement cables can be avoided.

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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 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 / 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 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

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### 10 reasons to choose a CPC 100

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<td>Durable case design for rough environments with test field accuracy</td>
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<td>Premium quality cables and clamps</td>
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Gas Insulated Switchgear (GIS) are compact and are, therefore, used in applications where space is limited. For commissioning of GIS a HV withstand test is required according to the standards (IEC 62271-203).

The test voltage needed for a withstand test has traditionally been produced by a resonance circuit. This test system consists of a HV test transformer and a coupling capacitor, which have to be connected to the GIS, as well as a resonant coil and a power control unit. This test system is often difficult to transport and requires a certain amount of space on site, which can be problematic at small locations such as wind turbines.

Additionally conventional external HV tests normally include a time-consuming venting and refilling process. The SF₆ gas has to be drained and refilled when connecting, testing and disconnecting the HV test lead to the GIS system.

A new approach to GIS testing

For this application a specially designed VT, called “Power VT”, is needed within the GIS to handle the required power. It is used to generate HV on the HV side, by injecting power into the LV side using the CPC 100.

In order to inject enough power into the secondary side of the VT, the transferred impedance needs to be compensated.

As the GIS is a capacitive load, the majority of the power on the LV side can be delivered using compensation reactors (CP CR). The remaining power is delivered by the CPC 100 at frequencies from 90 to 120 Hz.

Thus the HV withstand test can be performed without the need of a big HV transformer. The CPC 100, CP TR8 and CP CR are small and can be transported by one person. This makes HV withstand testing possible even at locations with limited space for measurement equipment.
The CP TR8 is an isolation transformer with built-in compensating characteristics (8 mH).

The CP CR is the main compensating reactor (4 mH or 6 mH). The inductance of the compensating reactor forms a resonant circuit with the GIS capacitance at the LV side of the VT.

GIS testing

> Withstand test
> up to 200 kV | max 1.5 nF | with CP TR8 and CP CR

10 reasons to choose a CPC 100

7. 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
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 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 δ) 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.

\[ \mu \Omega \] measurement with the CPC 100’s 400 A DC capabilities enables accurate contact resistance measurements on circuit breakers.
Switchgear / circuit breaker testing

- **Contact resistance**
  up to 400 A DC

- **Bushing: power / dissipation factor (tan δ)**
  + insulation capacitance
  12 kV, 300 mA | frequency from 15 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 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

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**10 reasons to choose a CPC 100**

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**8. 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

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**CP TD1 (tan δ)**

12 kV

Insulation condition assessment of circuit breakers and insulation fluids (with CP TC12).
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

- **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

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10 reasons to choose a CPC 100

9. **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 to 400 Hz

10 reasons to choose a CPC 100

10. 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

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.
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 connection schemes 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.

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 de-selected by mouse-clicks. In addition a company logo, pictures and other tests 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
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 / 230 V, 50 / 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
CPC 100

Generator / Outputs

Current outputs

<table>
<thead>
<tr>
<th>Range</th>
<th>Amplitude</th>
<th>$t_{\text{min}}$</th>
<th>$t_{\text{max}}$</th>
<th>Power</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 A AC</td>
<td>0 to 800 A</td>
<td>25 s</td>
<td>5.5 A</td>
<td>6.0 V</td>
<td>4000 VA</td>
</tr>
<tr>
<td>0 to 400 A</td>
<td>8 min.</td>
<td>5.3 A</td>
<td>5.3 A</td>
<td>6.4 V</td>
<td>2560 VA</td>
</tr>
<tr>
<td>0 to 200 A</td>
<td>&gt; 2 h</td>
<td>5.3 A</td>
<td>5.3 A</td>
<td>6.5 V</td>
<td>1300 VA</td>
</tr>
<tr>
<td>6 A AC</td>
<td>0 to 6 A</td>
<td>&gt; 2 h</td>
<td>55 V</td>
<td>76 V</td>
<td>330 VA</td>
</tr>
<tr>
<td>3 A AC</td>
<td>0 to 3 A</td>
<td>&gt; 2 h</td>
<td>110 V</td>
<td>110 V</td>
<td>330 VA</td>
</tr>
<tr>
<td>400 A DC</td>
<td>0 to 400 A</td>
<td>2 min.</td>
<td>6.5 V</td>
<td>2600 VA DC</td>
<td></td>
</tr>
<tr>
<td>0 to 300 A</td>
<td>3 min.</td>
<td>6.5 V</td>
<td>1950 V DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 200 A</td>
<td>&gt; 2 h</td>
<td>6.5 V</td>
<td>1300 V DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 A DC</td>
<td>0 .. 6 A</td>
<td>&gt; 2 h</td>
<td>60 V</td>
<td>360 VA DC</td>
<td></td>
</tr>
</tbody>
</table>

Voltages are AC or DC as indicated.

Voltage outputs

<table>
<thead>
<tr>
<th>Range</th>
<th>Amplitude</th>
<th>$t_{\text{max}}$</th>
<th>$t_{\text{min}}$</th>
<th>Power</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 kV AC</td>
<td>0 to 2 kV</td>
<td>20 s</td>
<td>6.0 V</td>
<td>4800 VA</td>
<td>15 to 400 Hz</td>
</tr>
<tr>
<td>0 to 1 kV</td>
<td>1 min.</td>
<td>1.25 A</td>
<td>1.25 A</td>
<td>6.4 V</td>
<td>2560 VA</td>
</tr>
<tr>
<td>0 to 1 kV</td>
<td>&gt; 2 h</td>
<td>0.5 A</td>
<td>0.5 A</td>
<td>6.5 V</td>
<td>1300 VA</td>
</tr>
<tr>
<td>1 kV AC</td>
<td>0 to 1 kV</td>
<td>1 min.</td>
<td>2.5 A</td>
<td>2500 VA</td>
<td>15 to 400 Hz</td>
</tr>
<tr>
<td>500 V AC</td>
<td>0 to 500 V</td>
<td>1 min.</td>
<td>5.0 A</td>
<td>2500 VA</td>
<td>15 to 400 Hz</td>
</tr>
<tr>
<td>0 to 500 V</td>
<td>&gt; 2 h</td>
<td>2.0 A</td>
<td>2.0 A</td>
<td>1000 VA</td>
<td>15 to 400 Hz</td>
</tr>
<tr>
<td>130 V AC</td>
<td>0 to 130 V</td>
<td>&gt; 2 h</td>
<td>3.0 A</td>
<td>390 VA</td>
<td>390 VA</td>
</tr>
</tbody>
</table>

Internal measurement of outputs (Accuracy$^6$)

<table>
<thead>
<tr>
<th>Output</th>
<th>Range</th>
<th>Reading</th>
<th>Amplitude</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 A AC</td>
<td>-</td>
<td>-</td>
<td>Error &lt; 0.10 %</td>
<td>Error &lt; 0.10 %</td>
</tr>
<tr>
<td>400 A DC</td>
<td>-</td>
<td>-</td>
<td>Error &lt; 0.20 %</td>
<td>Error &lt; 0.05 %</td>
</tr>
<tr>
<td>2 kV AC</td>
<td>0 to 2 kV</td>
<td>-</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.05 %</td>
</tr>
<tr>
<td>1 kV AC</td>
<td>0 to 1 kV</td>
<td>-</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.15 %</td>
</tr>
<tr>
<td>500 V AC</td>
<td>0 to 500 V</td>
<td>-</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.20 %</td>
</tr>
<tr>
<td>5 A</td>
<td>-</td>
<td>-</td>
<td>Error &lt; 0.20 %</td>
<td>Error &lt; 0.10 %</td>
</tr>
<tr>
<td>500 mA</td>
<td>-</td>
<td>-</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.10 %</td>
</tr>
</tbody>
</table>

Measuring inputs (Accuracy$^7$)

<table>
<thead>
<tr>
<th>Input</th>
<th>Imped.</th>
<th>Range</th>
<th>Reading</th>
<th>Amplitude</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>I AC/DC</td>
<td>&lt; 0.1 Ω</td>
<td>10 A AC</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.10 °</td>
</tr>
<tr>
<td>V1 AC</td>
<td>500 kΩ</td>
<td>300 V</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.10 °</td>
</tr>
<tr>
<td>V2 AC</td>
<td>10 MΩ</td>
<td>3 V</td>
<td>Error &lt; 0.03 %</td>
<td>Error &lt; 0.08 %</td>
<td>Error &lt; 0.10 °</td>
</tr>
<tr>
<td>V DC</td>
<td>10 V</td>
<td>Error &lt; 0.03 %</td>
<td>Error &lt; 0.08 %</td>
<td>Error &lt; 0.15 °</td>
<td></td>
</tr>
<tr>
<td>1 V</td>
<td>Error &lt; 0.03 %</td>
<td>Error &lt; 0.08 %</td>
<td>Error &lt; 0.15 °</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 mV</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.10 %</td>
<td>Error &lt; 0.15 °</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 mV</td>
<td>Error &lt; 0.05 %</td>
<td>Error &lt; 0.15 °</td>
<td>Error &lt; 0.15 °</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Additional features of the measuring inputs

1. Automatic range switching (except Amplifier test card)
2. Galvanically separated potential groups: I AC/DC ; V1 & V2 ; V DC
3. AC frequency range: 15 to 400 Hz (except Amplifier test card)

Protection of I AC/DC input: 10 A very fast acting (FF) fuse

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

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

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 mΩ</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 μΩ</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>&lt; 5 mA</td>
<td>100 Ω</td>
<td></td>
<td>Error &lt; 0.60 %</td>
</tr>
<tr>
<td>&lt; 5 mA</td>
<td>1 kΩ</td>
<td></td>
<td>Error &lt; 0.51 %</td>
</tr>
<tr>
<td>&lt; 5 mA</td>
<td>10 kΩ</td>
<td></td>
<td>Error &lt; 0.50 %</td>
</tr>
</tbody>
</table>
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 - 62 Hz</td>
</tr>
<tr>
<td>Synchronization inputs</td>
<td>V1 AC (automatic range switch)</td>
</tr>
<tr>
<td>V1 AC, V2 AC, I AC (fixed to maximum range)</td>
<td></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>Settling time</td>
<td>100 ms after 5 % of output range full scale is reached</td>
</tr>
<tr>
<td></td>
<td>1000 ms after 5 % of output range full scale is reached</td>
</tr>
<tr>
<td>Signal changes</td>
<td>All quantities must be ramped within 20 signal periods</td>
</tr>
<tr>
<td></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>

Power supply and mechanical data

- Single-phase, nominal: 100 V AC to 240 V AC, 16 A
- Single-phase, permissible: 85 V AC to 264 V AC (L-N or L-L)
- Frequency, nominal: 50 / 60 Hz
- Power consumption: < 3500 VA (< 7000 VA for a time < 10 s)
- Connection: IEC320 / C20
- Dimensions (W x H x D): 468 x 394 x 233 mm (18.4 x 15.5 x 9.2 in), cover, without handles.
- Weight: 29 kg / 64 lbs (case without protection cover)
- Safety: EN 61010-1, EN 60950, IEC 61010-1, produced and tested in an EN ISO 9001 certified company
- Prepared for: IEEE 510, EN 50191, VDE 104
- Shock: IEC68-2-27 (operating), 15 g / 11 ms, half-sinusoid
- Vibration: IEC68-2-6 (operating), 10 to 150 Hz, acceleration 2 g continuous (20 m/s²); 10 cycles per axis

Environmental conditions for CPC 100 and CPC 100 accessories

- Operating temperature: -10 °C to +55 °C / +14 °F to +131 °F
- Storage temperature: -20 °C to +70 °C / -4 °F to +158 °F
- Humidity range: 5 to 95 % relative humidity, no condensation

All input / output values are guaranteed for one year within an ambient temperature of 23 °C ± 5 °C / 73 °F ± 9 °F; a warm-up time longer than 25 min., and in a frequency range of 45 to 60 Hz or DC. Accuracy values indicate that the error is smaller than ± (value read x reading error + full scale of the range x full scale error).

1. With a mains voltage of 230 V using a 2 x 6 m high-current cable at an ambient temperature of 23 °C ± 5 °C / 73 °F ± 10 °F.
2. The power and maximum voltage may be reduced above 60 Hz or below 50 Hz.
3. Output can be synchronized with V1 AC in Quick, Sequencer, Ramping and Amplifier test cards.
4. The inputs and outputs are protected with lightning arrestors between the connector and against the protective earth. In the event of application of energy exceeding a few hundred Joule the lightning arrestors apply a permanent short-circuit to the input / output.
5. The power and amplitude may be reduced above 200 Hz or below 50 Hz.
6. 98 % of all units have an accuracy better than specified as “typical”.
7. This input is galvanically separated from all other inputs.
8. V1 and V2 are galvanically coupled but separated from all other inputs.
9. There are power restrictions for mains voltages below 190 V AC.
10. Fuse-protected.
11. When using the CTRogowski test card, the 3 V V2 AC input uses an additional software based integration method. In the range of 50 Hz < f < 60 Hz, this results in a phase shift of 90 ° as well as an additional phase error of ± 0.1 ° and an additional amplitude error of ± 0.01 %. For frequencies in the range of 15 Hz < f < 400 Hz, the phase error is not specified, and the amplitude error can be up to ± 0.50 % higher.
### Technical Data CPC 100 Accessories

#### CP TD1 – Tan-Delta

**High-voltage output**

<table>
<thead>
<tr>
<th>U/f</th>
<th>I</th>
<th>S</th>
<th>t&lt;sub&gt;min&lt;/sub&gt;</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 12 kV AC</td>
<td>300 mA</td>
<td>3600 VA</td>
<td>&gt; 2 min.</td>
<td>15 to 400 Hz</td>
</tr>
<tr>
<td>0 to 12 kV AC</td>
<td>100 mA</td>
<td>1200 VA</td>
<td>&gt; 60 min.</td>
<td>15 to 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 to 12000 V AC</td>
<td>1 V</td>
<td>Error &lt; 0.3 % of reading + 1 V</td>
<td>Ix &lt; 8 mA, V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
<tr>
<td>0 to 5 A AC</td>
<td>5 digits</td>
<td>Error &lt; 0.3 % of reading + 100 nA</td>
<td>Ix &lt; 8 mA, V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
<tr>
<td></td>
<td>5 digits</td>
<td>Error &lt; 0.5 % of reading</td>
<td>Ix &gt; 8 mA, V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</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 to 10 Arms</td>
<td>500 Vrms</td>
</tr>
<tr>
<td>20 A</td>
<td>0 to 20 Arms</td>
<td>250 Vrms</td>
</tr>
<tr>
<td>50 A</td>
<td>0 to 50 Arms</td>
<td>100 Vrms</td>
</tr>
<tr>
<td>100 A</td>
<td>0 to 100 Arms</td>
<td>50 Vrms</td>
</tr>
</tbody>
</table>

**Measuring transformers**

<table>
<thead>
<tr>
<th>Transformer</th>
<th>Ratio</th>
<th>Accuracy at 50 / 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>V SENSE</td>
<td>CAT III (IEC 61010-1)</td>
</tr>
<tr>
<td>BOOSTER</td>
<td>CAT I</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 to 70 Hz), cosφ &lt; 1.0 for 8 s at 230 V AC</td>
</tr>
<tr>
<td></td>
<td>5000 VA (45 to 70 Hz), cosφ &lt; 0.4 for 8 s at 115 V AC</td>
</tr>
<tr>
<td>Continuous power</td>
<td>0 to 1600 VA</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&lt;sub&gt;OUT&lt;/sub&gt; current</th>
<th>Current range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 to 0.2 Ω</td>
<td>1.0 to 0.5 %</td>
<td>1.5 to 0.8 °</td>
<td>5 to 20 V</td>
<td>100 A</td>
<td>100 A</td>
</tr>
<tr>
<td>0.2 to 2 Ω</td>
<td>0.5 to 0.3 %</td>
<td>0.8 to 0.5 °</td>
<td>20 to 50 V</td>
<td>100 to 25 A</td>
<td>100 A</td>
</tr>
<tr>
<td>2 to 5 Ω</td>
<td>0.3 %</td>
<td>0.5 °</td>
<td>100 V</td>
<td>50 to 20 A</td>
<td>50 A</td>
</tr>
<tr>
<td>5 to 25 Ω</td>
<td>0.3 %</td>
<td>0.5 °</td>
<td>100 to 250 V</td>
<td>20 to 10 A</td>
<td>20 A</td>
</tr>
<tr>
<td>25 to 300 Ω</td>
<td>0.3 to 1.0 %</td>
<td>0.5 to 1.5 °</td>
<td>250 to 500 V</td>
<td>10 to 1.5 A</td>
<td>10 A</td>
</tr>
</tbody>
</table>

**Mechanical data**

<table>
<thead>
<tr>
<th>Dimensions (W x H x D)</th>
<th>450 x 220 x 220 mm / 17.7 x 8.7 x 8.7 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>28.5 kg / 62.78 lbs</td>
</tr>
</tbody>
</table>

### CP CB2 – Current booster

**Output current**

up to 2000 A

**Output power at 2000 A**

5 kVA

**Accuracy of current at 50 / 60 Hz**

Error < ± 0.13 % (rd) ± 0.13 % (fs)

**Phase tolerance at full scale**

Error < ± 0.25 %

**Dimensions (W x H x D)**

186 x 166 x 220 mm / 7.3 x 6.5 x 8.7 in

**Weight**

16.0 kg / 35.3 lbs

### 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 to 3 μF</td>
<td>6 digits</td>
<td>Error &lt; 0.05 % of reading + 0.1 pF</td>
<td>Ix &lt; 8 mA, V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
<tr>
<td></td>
<td>6 digits</td>
<td>Error &lt; 0.2 % of reading</td>
<td>Ix &gt; 8 mA, V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</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 to 10 % (capacitive)</td>
<td>5 digits</td>
<td>Error &lt; 0.1 % of reading + 0.005 %</td>
<td>f = 45 to 70 Hz, I &lt; 8 mA, V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
<tr>
<td>0 to 100 (0 to 10000 %)</td>
<td>5 digits</td>
<td>Error &lt; 0.5 % of reading + 0.02 %</td>
<td>V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
</tbody>
</table>

### Impedance

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kΩ to 1,200 MΩ</td>
<td>6 digits</td>
<td>Error &lt; 0.5 % of reading</td>
<td>V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
</tbody>
</table>

### Phase angle

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>-90 ° to +90 °</td>
<td>4 digits</td>
<td>Error &lt; 0.01 °</td>
<td>V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
</tbody>
</table>

### Quality factor

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1000</td>
<td>5 digits</td>
<td>Error &lt; 0.5 % of reading + 0.2 %</td>
<td>V&lt;sub&gt;ref&lt;/sub&gt; = 300 V to 10 kV</td>
</tr>
<tr>
<td>&gt; 1000</td>
<td>5 digits</td>
<td>Error &lt; 5 % of reading</td>
<td></td>
</tr>
</tbody>
</table>

### Inductance

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 H to 1000 kH</td>
<td>6 digits</td>
<td>Error &lt; 0.3 % of reading</td>
<td></td>
</tr>
</tbody>
</table>

### Watts / Power (P, Q, S)

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
<th>Accuracy</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 3.6 kW / kVA / kvar</td>
<td>5 digits</td>
<td>0.5 % reading + 1 mW / mVA / mvar</td>
<td></td>
</tr>
</tbody>
</table>

### Mechanical data

<table>
<thead>
<tr>
<th>Dimensions (W x H x D)</th>
<th>450 x 330 x 220 mm / 17.7 x 13 x 8.7 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>26 kg / 57.32 lbs</td>
</tr>
</tbody>
</table>
CP DB1 – Discharge box

<table>
<thead>
<tr>
<th>Path</th>
<th>Switch closed</th>
<th>Switch open</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 A</td>
<td>6 A continuous</td>
<td>The discharge process is faster by a factor of 4 compared to the CPC 100.</td>
</tr>
<tr>
<td>100 A</td>
<td>100 A continuous</td>
<td>The discharge process is faster by a factor of 10 compared to the CPC 100.</td>
</tr>
</tbody>
</table>

Overtemperature protection: 85 °C / 185 °F
Overvoltage protection: 200 V / 30 kA between connectors

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

CP SB1 – Switch box

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

CP TC12 – 12 kV oil test cell

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

CPOL - Polarity checker

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>Nominal frequency</th>
<th>Minimum slope ratio</th>
<th>Power consumption</th>
<th>Input impedance</th>
<th>Batteries</th>
<th>Dimensions (W x H x D)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical: 5 mV to 300 V Guaranteed: 50 mV to 300 V</td>
<td>Typical: 52.6 Hz Possible: 40 to 60 Hz</td>
<td>25 to 90 % or via pulse width</td>
<td>Key pressed: 25 mA Key not pressed: 0 mA</td>
<td>400 kΩ</td>
<td>4 x 1.5 V Micro LR03 AAA AM4 MN2400</td>
<td>200 x 45 x 35 mm / 78.7 x 17.7 x 13.8 in</td>
<td>0.25 kg / 0.11 lb including batteries and bag</td>
</tr>
</tbody>
</table>

CP CR500 – Compensation reactor

<table>
<thead>
<tr>
<th>Inductors</th>
<th>Capacitance compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 40 H</td>
<td>50 Hz 2 x 1 A 2 x 500 mA 1 x 1 A + 1 x 500 mA</td>
</tr>
<tr>
<td>2 x 80 H</td>
<td>60 Hz 2 x 800 mA 2 x 400 mA 1 x 1 A + 1 x 400 mA</td>
</tr>
<tr>
<td>1 x 40 H and 1 x 80 H</td>
<td>50 Hz 2 x 250 nF 2 x 125 nF 1 x 250 nF + 1 x 125 nF</td>
</tr>
<tr>
<td>2 x 1 A + 1 x 500 mA</td>
<td></td>
</tr>
</tbody>
</table>

CP AL1 – FFT Voltmeter with adapter

<table>
<thead>
<tr>
<th>Connections</th>
<th>Power supply</th>
<th>Dimensions (W x H x D)</th>
<th>Weight (including batteries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>XLR Input and RCA Input</td>
<td>3 x 1.5 V batteries (AAA/LR6 alkaline type)</td>
<td>86 x 205 x 42 mm / 3.35 x 8.07 x 1.57 in</td>
<td>0.45 kg / 0.98 lbs</td>
</tr>
</tbody>
</table>

CP GB1 – Grounding box

<table>
<thead>
<tr>
<th>Nominal ac spark-over voltage</th>
<th>Impulse spark-over voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1000 VMAX</td>
<td>&lt; 2000 VMAX</td>
</tr>
</tbody>
</table>

Short circuit proof with:
- 16 mm cylindrical or 20 mm ball studs: 26.5 kA (< 100 ms) / 67 kApeak
- 25 mm or 1 in ball studs: 30 kA (< 100 ms) / 75 kApeak
Torsional moment for changing arrestors: > 15 Nm
Dimensions (Ø × H): 200 x 190 mm / 7.9 x 7.5 in
Weight: 6.8 kg / 13.2 lbs (including grounding cable)

CP RC – Compensating reactor

<table>
<thead>
<tr>
<th>CP TR8</th>
<th>CP CR6</th>
<th>CP CR4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage output</td>
<td>Current output</td>
<td>Apparent power on secondary side</td>
</tr>
<tr>
<td>220 V</td>
<td>60 A</td>
<td>13.2 kVar</td>
</tr>
<tr>
<td>220 V</td>
<td>150 A</td>
<td>33 kVar</td>
</tr>
<tr>
<td>220 V</td>
<td>150 A</td>
<td>33 kVar</td>
</tr>
</tbody>
</table>
Frequency: 90 to 120 Hz
Insulation class: F
Dimensions (W x H x D): 262 x 277.5 x 222 mm / 10.31 x 10.9 x 8.74 in
Weight: 20.5 kg / 45 lbs
### CPC 100 Standard Package (Order No. VE000611)

The package consists of the following items:

#### Hardware
- CPC 100

#### Software
- VESM0600 CP Quick Card
- VESM0610 CP CT test cards
- VESM0615 CP VT test cards
- VESM0620 CP transformer test cards
- VESM0625 CP resistance test cards
- VESM0670 CPC editor software

#### Cables and accessories
- VESD0601 CPC 100 User manual
- VEHK0612 or VEHK0617 Standard high-current cable set (2 x 6 m / 19.68 ft) or optional high-current cable set (2 x 9 m / 29.53 ft)
- VEHK0613 or VEHK0618 Standard high-voltage cable set (2000 V, 2 x 6 m / 19.68 ft) or optional high-voltage cable set (2000 V, 2 x 10 m / 32.81 ft)
- VEHK0614 or VEHK0619 Standard measurement cable set (6 x 6 m / 19.68 ft) or optional measurement cable set (6 x 10 m / 32.81 ft)
- VEHK0615 Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
- VEHK0622 Ethernet PC connection cable (3 m / 9.84 ft)
- VEHP0061 Transport case with wheels for CPC 100
- VEHP0069 Carry bag for CPC 100 accessories
- VEHZ0610 Connection clamps for high voltage
- VEHK0623 Low voltage adapter
- VEHK0616,20,21,24 Power cord CPC
- VEHZ0665 CP SA1 Surge Arrestor box
- VEHZ0666 USB Memory Stick
- VEHZ0620 Crocodile clamps
- X0000089 CPC Tool Set DVD

### CPC 100 Enhanced Package (Order No. VE000621)

CPC 100 Standard Package plus:

#### Software
- VESM0635 CP sequencer test card
- VESM0630 CP ramping test card
- VESM0640 CP GR – ground resistance test option includes testing software and hardware accessory (VEHZ0660)
- VESM0645 CPOL software and hardware accessory (VEHZ0650)
CP TD1 upgrade option (Order No. VE000641)

Hardware
CP TD1

Cables and accessories
VEHZ0600 CP TD1 accessories
VEH02060 Crocodile clamps
VEHS0006 Solid terminal adapters (12 pcs)
VEHK0615 Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
VEHP0067 Transport case with wheels for CP TD1 accessories
VEHZ0678 Hot collar band
VEHP0062 Transport case with wheels for CP TD1
VESD0606 CP TD1 Reference manual
VEHZ0640 CP Trolley
X0000089 CPC Tool Set DVD

CP CU1 and CP GB1 upgrade option (Order No. VEHZ0671)

Hardware
CP CU1
CP GB1

Cables and accessories
VEHK0677 3-lead shorting cable (0.3 m / 11.81 in, 10 mm²)
VESD0671 CP CU1 Reference Manual
VEHZ0676 Set of 3 x CP GB1 surge arrestors
VEHZ0677 Short circuiting bar (4 mm / 0.16 in, 19 mm / 0.75 in)
VEHK0678 Booster connection cable (6 m / 19.68 ft, 3 x 1.5 mm²)
VEHK0652 Coax measurement cable (6 m / 19.68 ft)
VEHK0676 Cable set with Kelvin clamps (6 m / 19.68 ft, 6 mm²)
VEHK0615 Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
VEHP0063 Transport case CP CU1
X0000089 CPC Toolset DVD

CP Sequencer test card has to be ordered separately (Order No. VESM0635)

CP SB1 upgrade option (Order No. VEHZ0692)

Hardware
CP SB1

Cables and accessories
VEHK0030 RS232 cable
VEHK0615 Grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
VEHK0690 Set of coaxial cables (15 m / 49.21 ft, 2,5 mm²) on cable drum (red, blue, green, yellow)
VEHZ0691 Kelvin clamps (4 x 2 pcs)
VEHP0090 Transport case with wheels for CP SB1
VEHS0009 Flexible terminal adapters (12 pcs)
X0000089 CPC Toolset DVD

Additional accessories: CP SB1 Reference Manual, connection cables, backpack for accessories
Ordering Information

CP Transformer Test System (Order No. VE000645)
The test system consists of the following items:

**Hardware**
- CPC 100
- CP TD1

**Software**
- VESM0600 CP Quick Card
- VESM0620 CP transformer test cards
- VESM0635 CP sequencer test card
- VESM0665 CP TD1 test card
- VESM0670 CPC editor software

**Cables and accessories**
- VEHK0617 Optional high-current cable set (2 x 9 m / 29.53 ft)
- VEHK0618 Optional high-voltage cable set (2000 V, 2 x 10 m / 32.81 ft)
- VEHK0619 Optional measurement cable set (6 x 10 m / 32.81 ft)
- VEHZ0610 Connection clamps for high voltage
- VEHZ0620 Crocodile clamps
- VEHK0622 Ethernet PC connection cable (3 m / 9.84 ft)
- VEHK0623 Low voltage adapter
- VEHZ0600 CP TD1 accessories
- VEHS0006 Solid terminal adapters (12 pcs)
- VEHP0062 Transport case with wheels for CP TD1
- VESD0606 CP TD1 Reference manual
- VESD0601 CPC 100 User manual
- VEHK0615 2 x grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
- VEHP0061 Transport case with wheels for CPC 100
- VEHP0069 Carry bag for CPC 100 accessories
- VEHZ0644 TH3631 temperature/humidity measurement unit
- VEHP0067 Transport case with wheels for CP TD1 accessories
- X0000089 CPC Toolset DVD
- VEHZ0665 CP SA1 Surge Arrestor box
- VEHK0616,20,21,24 Power cord CPC
- VEHZ0666 USB Memory Stick
- VEHZ0678 Hot collar band
- VEHZ0640 CP Trolley
CPC 100 Line Impedance Test System (Order No. VE000602)
The test system consists of the following items:

**Hardware**
- CPC 100
- CP CU1
- CP GB1

**Software**
- VESM0600 CP Quick Card
- VESM0635 CP sequencer test card
- VESM0670 CPC editor software

**Cables and accessories**
- VEHK0622 Ethernet PC connection cable (3 m / 9.84 ft)
- VEHP0061 Transport case with wheels for CPC 100
- VEHK0615 2 x grounding cable (green / yellow) (6 m / 19.68 ft, 6 mm²)
- VESD0601 CPC 100 User manual
- VEHK0678 Booster connection cable (6 m / 19.68 ft, 3 x 1.5 mm²)
- VEHK0676 Cable set with Kelvin clamps (6 m / 19.68 ft, 6 mm²)
- VEHK0677 3-lead shorting cable (0.3 m / 11.81 in, 10 mm²)
- VEHZ0676 Set of 3 CP GB1 surge arrestors
- VEHZ0677 Short circuiting bar (4 mm / 0.16 in, 19 mm / 0.75 in)
- VEHK0652 Coax measurement cable (6 m / 19.68 ft)
- VEHZ0666 USB Memory Stick
- VESD0671 CP CU1 Reference Manual
- VEHP0063 Transport case CP CU1
- X0000089 CPC Toolset DVD

**Step & Touch Voltage Set for CP CU1 (VEHZ0625)**

**Hardware**
- VEHZ0626 FFT Voltmeter CP AL1 including CP AL1 Adapter and accessories

**Cables and accessories**
- VEHZ0627 Pair of foot electrode water cans (empty: 6 kg / 13.2 lbs each; filled: > 25 kg / 55.1 lbs each)
- X0000089 CPC Toolset DVD

**Ground Impedance Set for CP CU1 (VEHZ0622)**

**Hardware**
- VEHZ0623 Rogowski coil with a length of 1.90 m / 75 in - 20 / 200 A ranges
- VEHZ0624 Handheld eTrexH GPS navigation device for evaluation of distance

**Cables and accessories**
- 6 cable reels (100 m / 328.08 ft, 0.75 mm², black) and 3 ground electrodes
## Hardware

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Product</th>
<th>Description</th>
</tr>
</thead>
</table>
| CPC 100   | 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 including: Primary Test Manager (PTM), CPC editor, test templates, User manual  

<table>
<thead>
<tr>
<th>CPC 100 Standard Package</th>
<th>CPC 100 Enhanced Package</th>
<th>Transformer Test System</th>
<th>Line Impedance Test System</th>
<th>CP TD1 upgrade option</th>
<th>CP CU1 upgrade option</th>
<th>CP SB1 upgrade option</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

| VE000641 | CP TD1 upgrade option | - CP TD1 capacitance and tan δ test unit  
- CP tan δ test card software  
- 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 SB1 Switch box    | - CP SB1 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  
| VEHZ0620 | CP CR500 (2 x 40 H)  | - Compensating reactor  
- Transport case and cable set  
| VEHZ0604 | CP CR500 (2 x 80 H)  | -  
| VEHZ0605 | CP CR500 (1 x 40 H, 1 x 80 H) | -  
| VEHZ0630 | CP CB2 Current booster | - Current booster to increase output current range to 2000 A  

1 Order No. VE000640
**Order Information**

<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, user 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) |
| VEHZ0626  | FFT Voltmeter CP AL1 | - FFT Voltmeter CP AL1  
- CP AL1 Adapter |
| VEHZ0760  | CP RC Resonance circuit | - Set to create high-voltage on capacitive loads by means of a power VT:  
- CP TR8 transformer for CP RC  
- CP CR4 compensation reactor  
- CP CR6 compensation reactor  
- HV resonance test system test card  
- Manual, transport case, cables set and terminal adapters |
| VEHZ0761  | CP TR8 Transformer for CP RC | - Isolating transformer with 8 mH |
| VEHZ0762  | CP CR4 Compensation reactor | - CP CR4 Compensation reactor for CP RC reactor with 4 mH |
| VEHZ0763  | CP CR6 Compensation reactor | - CP CR6 Compensation reactor for CP RC reactor with 6 mH |
| VEHZ0650  | CPOL Polarity tester hardware | - Polarity tester hardware  
- Bag and batteries (4 x AAA) |

**Order No. VE000640**
### Software

<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>CPC TD1 upgrade option</th>
<th>CPC CU1 upgrade option</th>
<th>CPC SB1 upgrade option</th>
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<tr>
<td>VESM0600</td>
<td>CP Quick Card</td>
<td>Quick test card</td>
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<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>
<td>X</td>
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<td>CP VT test cards</td>
<td>Test cards: ratio, burden, voltage withstand test (2 kV), electronic voltage transformers</td>
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<td>CP transformer test cards</td>
<td>Test cards: winding resistance, tap changer check, ratio, voltage withstand test (2 kV)</td>
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<td>VESM0625</td>
<td>CP resistance test cards</td>
<td>Test cards: contact resistance (μOhm to mOhm), winding resistance (μOhm to kOhm)</td>
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<td>CP ramping test card</td>
<td>Programmable ramping generator and determination of thresholds</td>
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<td>VESM0635</td>
<td>CP sequencer test card</td>
<td>Sequencer test card for testing with different states</td>
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<td>CP TD1 test card</td>
<td>Test cards: capacitance and dissipation / power factor</td>
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<td>CP GR</td>
<td>Ground resistance test option: includes testing software and hardware accessory (VEHZ0660)</td>
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<td>VESM0645</td>
<td>CPOL</td>
<td>Polarity checking for CT / VT wiring including software and hardware accessory set (VEHZ0650)</td>
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<td>CP amplifier test card</td>
<td>Test module to use the CPC 100 like an amplifier</td>
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<td>VESM0637</td>
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<td>CP SV-Ratio test card to test IEC 61850-9-2 sampled values CTs and VTs</td>
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<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>
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<td>VESM0638</td>
<td>HV resonance test system test card</td>
<td>Testcard for generation of high voltage by means of resonance circuit</td>
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### Cables and accessories

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<tr>
<th>Order No.</th>
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<th>CPC CU1 upgrade option</th>
<th>CPC SB1 upgrade option</th>
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<tbody>
<tr>
<td>VEHK0610</td>
<td>High-current cable set for CP CB2</td>
<td>2 x 1.5 m / 4.92 ft, 95 mm² (black), 2 x 1.5 m / 4.92 ft, 95 mm² (red), 1 x 0.6 m / 1.97 ft, 95 mm²</td>
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<td>Connection cable to CPC 100 for CP CB2 / CU1</td>
<td>20 m / 65.62 ft, 3 x 2.5 mm²</td>
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<td>Standard high-current cable set</td>
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<td>VEHK0613</td>
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<td>VEHK0614</td>
<td>Standard measurement cable set</td>
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1 Order No. VE000640
### Cables and accessories

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<th>Line Impedance Test System</th>
<th>CP TD1 upgrade option</th>
<th>CP CU1 upgrade option</th>
<th>CP SB1 upgrade option</th>
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<tr>
<td>VEHK0615</td>
<td>Grounding cable (green / yellow)</td>
<td>1 x 6 m / 19.68 ft, 6 mm² with connection clamp</td>
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<td>VEHK0618</td>
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<td>3 x 1.5 mm², 2.5 m / 8.20 ft, VII</td>
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<td>VEHK0621</td>
<td>Power cord CPC (open end)</td>
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<td>VEHK0622</td>
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<td>3 m / 9.84 ft, twisted pair cat 5, RJ45 connector</td>
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<td>VEHK0623</td>
<td>Low voltage adapter</td>
<td>4 mm / 15.74 in banana to low voltage plug</td>
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<td>VEHK0624</td>
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<td>3 x 1.5 mm², 2 m / 6.56 ft, BS connector (for GB, HK)</td>
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<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>
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<td>VEHK0652</td>
<td>Coax measurement cable</td>
<td>6 m / 19.68 ft</td>
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<td>VEHK0676</td>
<td>Cable set with Kelvin clamps</td>
<td>Red and black current cable (6 m / 19.68 ft, 6 mm²) and banana sockets for measurement cables</td>
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<td>VEHK0690</td>
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<td>VEHPO063</td>
<td>Transport case CP CU1 or CP CR500</td>
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<td>Connection clamps for high-voltage</td>
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<td>VEH50611</td>
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<td>Warning strobe set for CPC 100</td>
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<td>VEH50613</td>
<td>CP TD1 C-Load</td>
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1 Order No. VE000640  
2 Power cord is arbitrary
## Ordering Information

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<th>CP SB1 upgrade option</th>
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<tbody>
<tr>
<td>VEH0620</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>
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<td>Rogowski coil</td>
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<td>Handheld eTrexH GPS navigation device for evaluation of distance</td>
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<td>Step &amp; touch voltage set for CP CU1</td>
<td>Pair of foot electrodes, frequency selective voltmeter CP AL1 with adapter, cables and ground electrode</td>
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<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>
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<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>
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<tr>
<td>VEHZ0644</td>
<td>TH3631</td>
<td>Unit for measurement of humidity and temper-ature of the air and on the surface of test objects</td>
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<tr>
<td>VEHZ0646</td>
<td>New e IFC-5 interface card</td>
<td>New e IFC-5 interface card for CPC 100</td>
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<tr>
<td>VEHZ0648</td>
<td>3-position remote safety switch</td>
<td>Remote safety switch (3-position) for CPC 100</td>
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<tr>
<td>VEHZ0660</td>
<td>Ground resistance accessory set</td>
<td>4 x electrodes, 1 x cable reel red (50 m / 164.04 ft), 1 x cable reel black (100 m / 328.08 ft)</td>
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<td>VEHZ0665</td>
<td>CP SA1 Surge Arrestor box</td>
<td>Surge arrestor box for 100 A winding resistance measurement</td>
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<td>VEHZ0666</td>
<td>USB Memory Stick</td>
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<tr>
<td>VEHZ0675</td>
<td>400 A Clamp-on Ammeter /Multimeter</td>
<td>400 A Clamp-on Ammeter / Multimeter</td>
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<tr>
<td>VEHZ0676</td>
<td>Set of 3 CP GB1 surge arrestors</td>
<td>Replacement kit with 3 CP GB1 surge arrestors</td>
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<tr>
<td>VEHZ0677</td>
<td>Short circuiting bar</td>
<td>4 mm / 0.16 in, 19 mm / 0.75 in</td>
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<tr>
<td>VEHZ0678</td>
<td>Hot collar band</td>
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<td>VEHZ0681</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>
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<td>VEHZ0682</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>
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<td>VEHZ0683</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>
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<tr>
<td>VEHZ0691</td>
<td>Kelvin clamps</td>
<td>Kelvin clamps (2 pcs)</td>
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<td>VESD0600</td>
<td>CPC 100 Reference manual</td>
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<td>VESD0601</td>
<td>CPC 100 User manual</td>
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<td>VESD0671</td>
<td>CP CU1 Reference manual</td>
<td>CP CU1 Reference manual</td>
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<td>VESD0606</td>
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<td>CP TD1 Reference manual</td>
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<td>X0000089</td>
<td>CPC Tool Set DVD</td>
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</table>

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: http://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. Broad application knowledge and extraordinary customer support provided by offices in North America, Europe, South and East Asia, Australia, and the Middle East, together with a worldwide network of distributors and representatives, make the company a market leader in its sector.

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

For a complete list of available literature please visit our website.

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