

CPC

Getting Started



CPC Getting Started

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The product information, specifications, and technical data embodied in this manual represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this manual is useful, accurate and entirely reliable. However, OMICRON does not assume responsibility for any inaccuracies which may be present.

The user is responsible for every application that makes use of an OMICRON product.

OMICRON translates this manual from the source language English into a number of other languages. Any translation of this manual is done for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this manual shall govern.

1 Safety instructions

This document covers general safety instructions and information on the *CPC 100* and *CPC 80*.

- ▶ For detailed information refer to the documents listed below and the user documentation for the corresponding accessories.
- CPC 100 User Manual
- CPC 100 Reference Manual
- CPC 80 User Manual

1.1 Operator qualifications

Working on high-voltage assets can be extremely dangerous. Only authorized personnel who are qualified and skilled in electrical engineering and trained by OMICRON are allowed to operate the *CPC 100* and its accessories. Before starting to work, clearly establish the responsibilities.

Personnel receiving training, instructions, directions, or education on the *CPC* must be under constant supervision of an experienced operator while working with the equipment. The supervising operator must be familiar with the equipment and the regulations on site.

1.2 Safety standards and rules

1.2.1 Safety standards

Testing with the *CPC* must comply with the internal safety instructions and additional safety-relevant documents.

In addition, observe the following safety standards, if applicable:

- EN 50191 (VDE 0104) "Erection and Operation of Electrical Test Equipment"
- EN 50110-1 (VDE 0105 Part 100) "Operation of Electrical Installations"
- IEEE 510 "IEEE Recommended Practices for Safety in High-Voltage and High-Power Testing"

Moreover, observe all applicable regulations for accident prevention in the country and at the site of operation.

Before operating the *CPC* and its accessories, read the safety instructions in this Getting Started carefully. Do not turn on the *CPC* and do not operate the *CPC* without understanding the safety information in this manual. If you do not understand some safety instructions, contact OMICRON before proceeding.

- ▶ Observe all applicable regulations for accident prevention in the country and on the site of operation.
- ▶ If you do not understand the safety rules, contact OMICRON before proceeding.

1.2.2 Safety rules

Always observe the five safety rules:

- ▶ Disconnect completely.
- ▶ Secure against re-connection.
- ▶ Verify that the installation is dead.
- ▶ Carry out grounding and short-circuiting.
- ▶ Provide protection against adjacent live parts.

1.2.3 Safety accessories

OMICRON offers a range of accessories for added safety during the operation of our test systems. For further information and specifications, refer to the corresponding Supplementary Sheet or contact OMICRON Support (see "Support" on page 21).

1.3 Preparations on site

Prior to connecting a test object to the *CPC*, the following steps need to be carried out by an authorized employee of the utility:

- ▶ Turn off and disconnect the high voltage from the test object.
- ▶ Protect yourself and your working environment against an accidental re-connection of high voltage by other persons and circumstances.
- ▶ Verify that the installation is dead.
- ▶ Earth-connect and short-circuit the test object's terminals using a grounding set.
- ▶ Protect yourself and your working environment with a suitable protection against other (possibly live) circuits.

1.3.1 Static charges

Static charges on bushings or other apparatus such as transformer windings may be induced by test potentials. While the voltage may not be significant enough to do any damage, it can be a source for serious accidents due to falls caused by reflex action.

High static charges may also be encountered at the bushing capacitance taps if the covers are removed.

- ▶ Ground all test objects before handling.

1.3.2 Grounding

Operating the device without PE and ground connection is life-threatening and not permitted.

- ▶ Only operate the *CPC* with a mains power supply connected to protective earth (PE).
- ▶ Make sure that both the PE connection of the power supply and the ground connector of the *CPC* have a solid and low-impedance connection to the grounding system on site. This also applies to all other test devices and accessories in the test setup.
- ▶ Make sure that the grounding clamp has a good electrical contact to the grounding system on site and avoid connecting it to corroded or painted surfaces.
- ▶ Make sure that the grounding terminal connections of all grounded devices in use remain intact during the whole measurement procedure, and are not accidentally disconnected.
- ▶ Only use ground and supply cables provided by OMICRON.



Connect the *CPC* grounding terminal to the grounding system on site.

1.3.3 Power supply

Operating the *CPC* without PE and ground connection is life-threatening and not permitted.

- ▶ Only operate the *CPC* with a mains power supply connected to protective earth (PE).

Power supply from grounded grids (TN/TT)

Before a measurement is started, the *CPC* automatically verifies the PE connection in grounded grids (TN/TT).

- ▶ If this check fails, check the power cord and power supply.

If the error message persists, there is no intact connection to protective earth (PE).

This is life-threatening. In this case measurements are not permitted and cannot be performed.

Power supply from isolated grids (IT)

An IT grid is a grid structure where none of the active conductors are galvanically connected to ground. In an IT grid, only the PE is connected to ground.

In IT grids, the check fails – even if there is a PE connection. This can be the case when the *CPC* is powered by a generator. Since every operation mandates a PE connection for the operation of the *CPC*, you need to manually verify this.

If the *CPC* is supplied by a generator, the equipotential ground or PE of the generator has to be grounded properly.

- ▶ If this is not possible, measurements are not permitted and cannot be performed.

Additional information

Instead of supplying the *CPC* from phase-neutral (L1-N, A-N), it may also be supplied from phase-phase (for example, L1-L2; A-B).

- ▶ Make sure that the voltage does not exceed 240V AC.
- ▶ Make sure that the power supply is fuse-protected (16 A automatic circuit breaker).
- ▶ Do not use an extension cable on a cable reel to prevent an overheating of the cord; run out the extension cord.
- ▶ Keep extension cables as short as possible to prevent power loss.

If the power supply is $\leq 190V$ AC, the *CPC* cannot provide the full output power at the **800A AC** output. The same applies when an external current booster is used.

- ▶ Therefore, in order to gain the full output power, provide a sufficient power supply (190 V ... 240 V AC).

The **Ext. Booster** connector is **always** galvanically connected to mains and active.

This also applies when no external booster is selected, the green status light (0) is on, the outputs are turned off, or the Emergency Stop button is pressed.

- ▶ Handle the **Ext. Booster** connector with extreme caution.
- ▶ Only use booster cables supplied by OMICRON.
- ▶ Do not use booster cables that are frayed or damaged in any way.

1.4 Operating the measurement setup

- ▶ If the CPC 100 or any add-on device or accessory does not seem to function properly, do not use it anymore. Please call the OMICRON hotline.
- ▶ If you have a cardiac pacemaker, do not use the CPC! If you have another type of electronic medical implant, consult your doctor before operating the CPC. Make sure there is no person with an electronic medical implant such as a cardiac pacemaker in the immediate vicinity.
- ▶ Before handling the *CPC* in any way, connect its grounding terminal to the grounding system on site.
- ▶ Make sure that the grounding clamp has a good electrical contact to the grounding system on site and avoid connecting it to corroded or painted surfaces.
- ▶ Make sure that a test object's terminals that are to be connected to the CPC 100 do not carry any voltage potential. During a test, the only power source for a test
- ▶ Make sure that the ground terminal of the device under test is in good condition, clean and free of oxidation.
- ▶ Protect others from accessing the high-voltage test area and accidentally touching live parts by setting up a suitable barrier and, if applicable, warning lights.
- ▶ Do not enter the high-voltage test area if the red status light of the *CPC* is on since all outputs carry dangerous voltage or current.

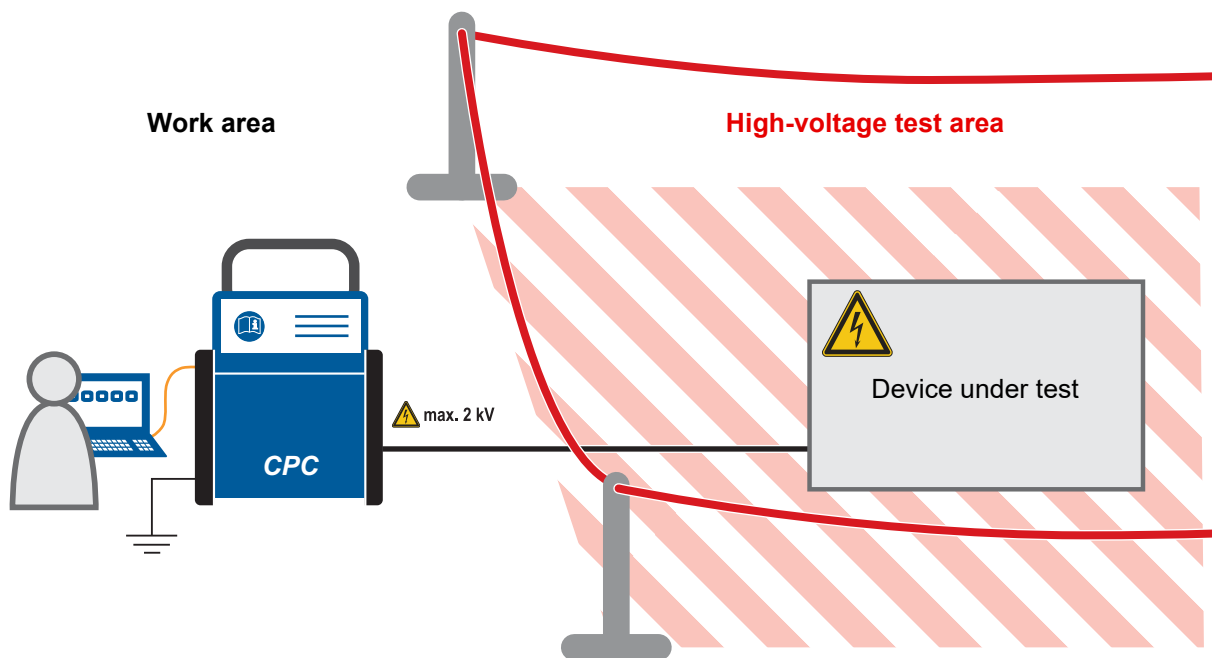


Figure 1-1: Separation of work area and high-voltage test area

- ▶ Do not open the *CPC* housing.
- ▶ Do not repair, modify, extend, or adapt the *CPC* or its accessories.
- ▶ Use only the original *CPC* accessories available from OMICRON.
- ▶ Use the *CPC* and its accessories only in a technically sound condition.
Make sure its use is in accordance with the regulations on site and the designated use described in this document.

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- ▶ Comply with the workflows described in this document. Avoid interruptions or distractions that could affect safety.
- ▶ Do not insert objects (for example, screwdrivers, etc.) into any input/output socket.
- ▶ Use dry and clean cables and connectors.
- ▶ Do not connect any cable to the test object without a visible grounding of the test object.
- ▶ Do not remove any cables from CPC 100 or the test object during a test.
- ▶ Always lock connectors properly.

Before performing tests using high voltage, observe the following instructions:

- ▶ Do not operate the *CPC* under ambient conditions that exceed the temperature and humidity limits specified in the respective user manual.
- ▶ Only use the *CPC* on dry, solid ground.
- ▶ Do not operate the *CPC* in the presence of explosives, gas or vapors.
- ▶ Unwind extension cables from their reel. Otherwise they will overheat.
- ▶ At their output sockets and especially in the cables connected to them, in operation the high-current 400A DC and 800A AC outputs generate a significant amount of heat (approx. 300 W/m at 800 A).
- ▶ After operation, wait for cables and clamps to cool down before touching them. If in doubt, wear gloves.
- ▶ Never use the test cards Quick and Resistance to measure the resistance of windings with a high inductance because turning off the DC source results in life-threatening voltage levels. For this kind of measurement only use the special winding resistance test card RWinding, TRTapCheck or OLTC-Scan.
- ▶ If you do not use the high-current outputs 400A DC or 800A AC, or the high-voltage output 2kV AC, disconnect any cable that may be plugged into these sockets.
- ▶ Before disconnecting a device under test from the *CPC*, ground all terminals.

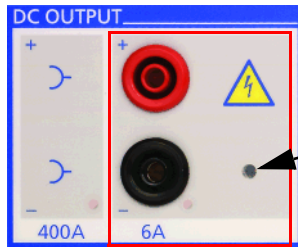
1.5 DC output to test objects with a high inductance

- ▶ Only use the dedicated test cards or tests in *Primary Test Manager* for DC measurements on assets with inductive characteristics.
- ▶ Never open the measuring circuit while current flows.
- ▶ After a measurement, wait until the test device has discharged completely.
- ▶ Ground all terminals of the test object before touching the test setup.
- ▶ Short-circuit the terminals before disconnecting the test leads.
- ▶ Disconnect cables not used for testing both from the test object and the test device.

1.5.1 Discharging after tests on objects with a high inductance

After a winding resistance measurement, the *CPC* monitors the reduction of the current and voltage levels to zero. During this discharge process, the red status light flashes.

In the **Demag** test card, the discharging process is displayed as a status message. In the other tests, a discharge dialog is displayed.



LED steady-on red: voltage on **6A DC** output > 2 V

Note: This indicator only applies to the **6A DC** output and *does not* include the **400A DC** output.

Note: When you disconnect a cable during the discharge process, even low voltage presents considerable danger as it suddenly increases to a very high level when the circuit is disconnected.

- ▶ Do not touch or disconnect any part of the test setup until the current and voltage levels have reduced to zero.
- ▶ If the measurement is interrupted due to, for example, an unexpected loss of supply voltage or erroneous behavior of the *CPC* do not touch the test setup until the energy has dissipated over time. Note that the length of time depends heavily on the device under test.

1.5.2 CPC 100 software version

In software versions prior to **4.20 SR2**, if an error occurs in the test device during a DC winding resistance measurement and the measurement is aborted, the *CPC* discontinues the monitoring of the discharge status before the test object might be completely discharged.

The *CPC* displays an error message and a green light in this case. This could erroneously be interpreted as a safe state, although the test setup might still carry potentially hazardous voltage/current.

The *CPC* will now continue to signal a red light when the described error occurs, to reduce the risk of misinterpretation. This improvement is included in software releases from **4.20 SR2** onwards.

- ▶ Ensure that all *CPC* devices in your organization have received an update to version **4.20 SR2** or higher.

We are happy to provide you with a list of the serial numbers that are linked to your organization.

- ▶ Contact OMICRON support for more information.

1.6 Orderly measures

The *CPC* Getting Started or alternatively the e-book always has to be available on the site where the *CPC* is operated.

The users of the *CPC* must read this manual before operating the *CPC* and observe the safety, installation, and operation instructions therein.

The *CPC* and its accessories may only be used in accordance with the user documentation (including but not limited to User Manuals, Reference Manuals, Getting Started manuals and manufacturer manuals).

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Opening the *CPC* or its accessories without authorization invalidates all warranty claims. Any kind of maintenance, calibration or repair on the device itself may only be carried out by persons authorized by OMICRON.

1.7 Disclaimer

If the equipment is used in a manner not described in the user documentation, the protection provided by the equipment may be impaired.

1.8 Compliance statement

Declaration of conformity (EU)

The equipment adheres to the guidelines of the council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) directive, the low voltage directive (LVD) and the RoHS directive.

FCC compliance (USA)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Declaration of compliance (Canada)

This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

1.9 Recycling



This test set (including all accessories) is not intended for household use. At the end of its service life, do not dispose of the test set with household waste!

For customers in EU countries (incl. European Economic Area)

OMICRON test sets are subject to the EU Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE directive). As part of our legal obligations under this legislation, OMICRON offers to take back the test set and ensure that it is disposed of by authorized recycling agents.

For customers outside the European Economic Area

Please contact the authorities in charge for the relevant environmental regulations in your country and dispose the OMICRON test set only in accordance with your local legal requirements.

2 Introduction

2.1 Designated use

2.1.1 CPC 100

The *CPC 100*, with its accessories or as a stand-alone unit, is a multi-purpose primary test set for commissioning and maintaining substation equipment. It performs current transformer (CT), voltage transformer (VT) and power transformer (TR) tests and is used for contact and winding resistance testing, polarity checks, and for primary and secondary protection relay testing.

2.1.2 CPC 80

The *CPC 80* is a control unit based on the *CPC 100* hardware concept. In contrast to the *CPC 100* the *CPC 80* only comes with the booster output. It is not equipped with any measurement inputs or directly usable outputs and therefore intended for use with *CPC* accessories for testing.

Currently the *CPC 80* is used in the following combinations:

- With the *CP TD* for dissipation/power factor testing
- As slave unit with a *CPC 100* as master
As mentioned above, dedicated accessories are required to allow for dedicated testing. The synchronization of *CPC* devices affects various applications as it allows for increased testing power.

2.2 Options for operation

- ▶ The *CPC 100* and *CPC 80* can be operated via either the front-panel control or *Primary Test Manager*.

3 Hardware overview

3.1 CPC 100 front panel

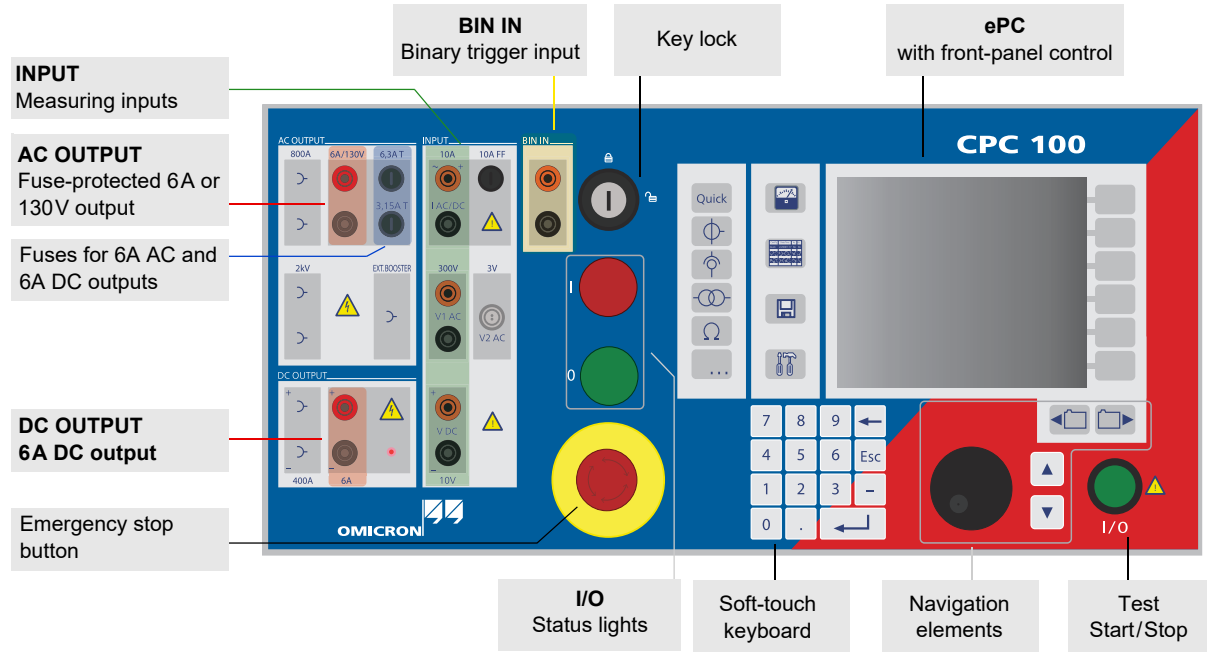


Figure 3-1: CPC 100 front panel

3.2 CPC 100 side panel

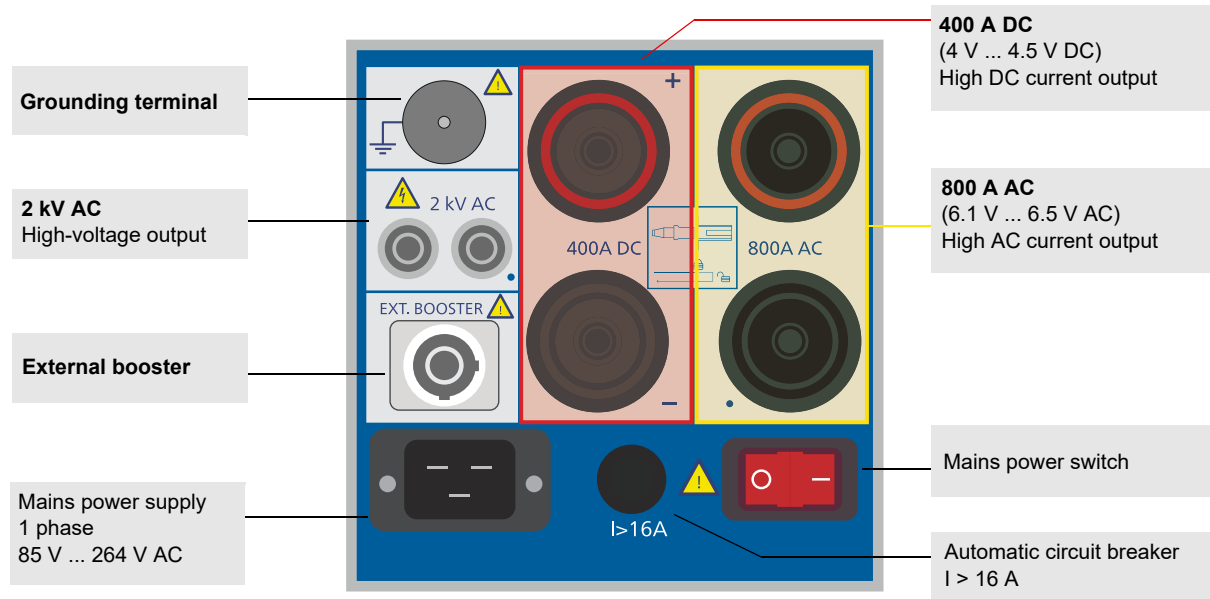


Figure 3-2: Left side view of the CPC 100

3.3 CPC 80 front panel

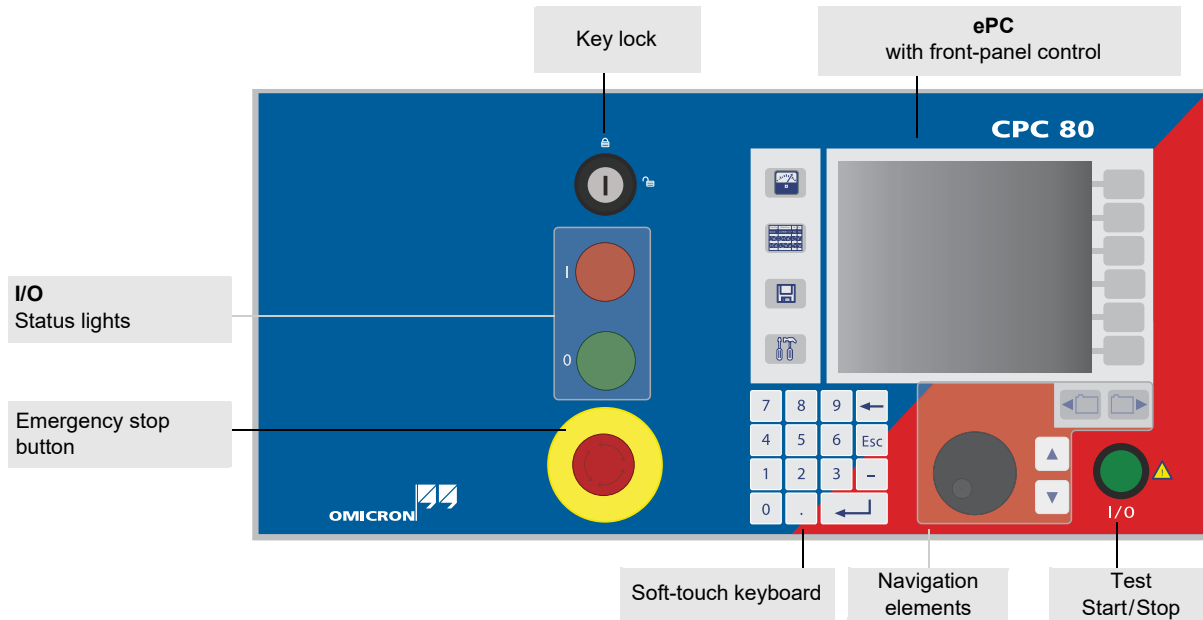


Figure 3-3: CPC 80 front panel

3.4 CPC 80 side panel

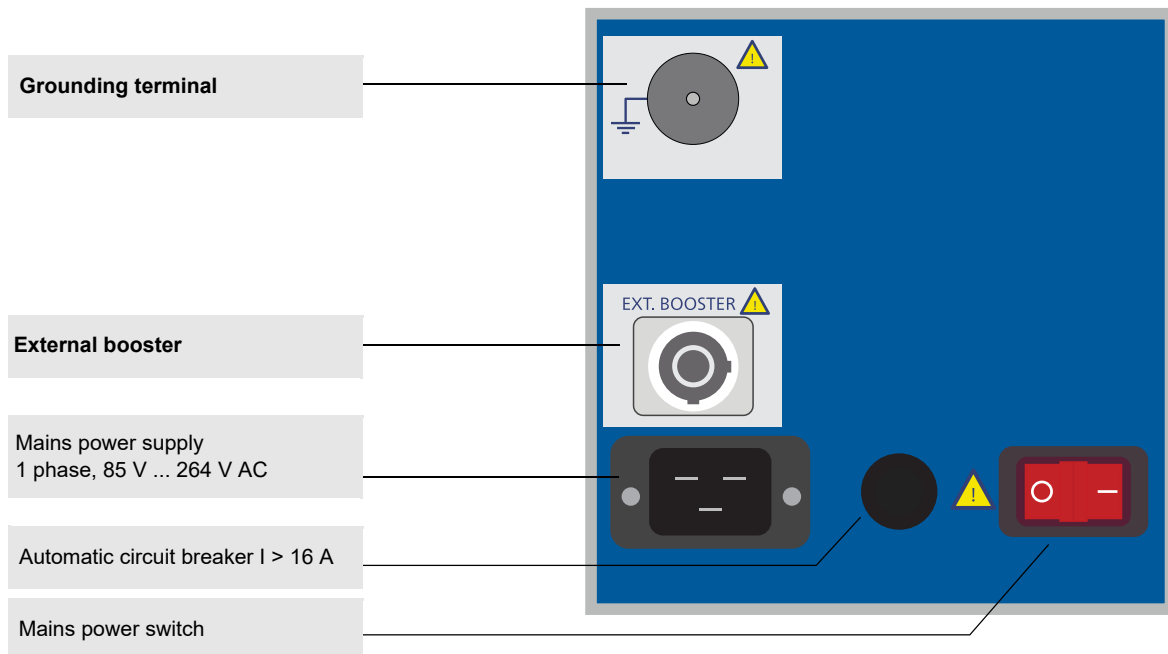

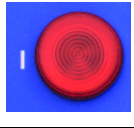




Figure 3-4: Left side view of the CPC 80

3.5 Status lights

Table 3-1: Status lights

	<p>1. Output is switched OFF</p>	<p>Green status light (0) on</p>	<p>Current/voltage source is inactive/off</p>
	<p>2. Output is switched ON and/or measurement process is active</p>	<p>Red status light (I) is flashing</p>	<p>Dangerous operating condition </p>
<p>If the <i>CPC 100</i> is supplied by mains and switched on, and <i>no</i> or <i>both</i> status lights are on, the unit might be defective.</p> <p>▶ Contact OMICRON support (see "Support" on page 21).</p>			<p>Dangerous operating condition </p>

- ▶ Always observe the status lights while working with the *CPC*.
- ▶ Do not cover the status lights during operation.

If no or both status lights are on, the unit is defective or not supplied by mains.

3.6 Emergency Stop button



Pressing the Emergency Stop button *immediately* shuts off all current and voltage outputs except for the **Ext. Booster** output.

A running test is terminated, the software does not accept any more entries and/or commands.

Once the reason for the Emergency Stop is cleared and the Emergency Stop button released, the test can be re-started by pressing the **I/O** (test start/stop) push-button while in Test Card View.

Figure 3-5: Emergency Stop button

DANGER



Death or severe injury caused by high voltage or current

The **Ext. Booster** connector is **always** galvanically connected to mains. This also applies when no external booster is selected, the green status light (0) is on, the outputs are turned off or the Emergency Stop button is pressed.

- ▶ Handle the **Ext. Booster** connector with extreme caution.
- ▶ Do not use any other booster cables than the ones supplied by OMICRON.
- ▶ Do not use booster cables that are frayed or damaged in any way.

WARNING



Death or severe injury caused by high voltage or current possible

Stopping a test does not shut off the *CPC 80* outputs instantaneously. First, the currently running test sequence finishes, then the test execution is stopped. Most test cards finish the running test sequence with a predefined ramp function.

- ▶ Therefore, in a hazardous situation never press "Stop Test".
- ▶ Instead, use Emergency Stop.

3.7 ePC Interfaces

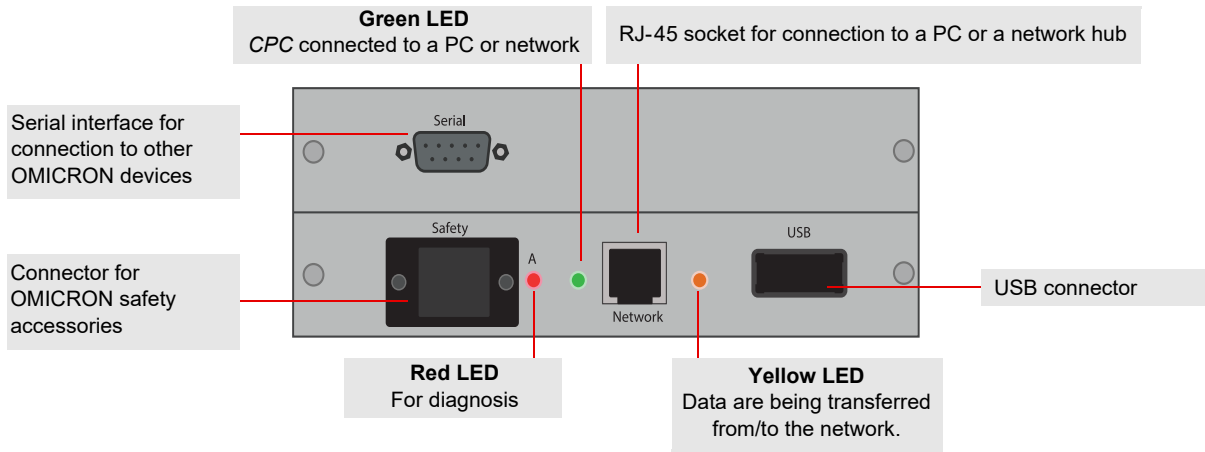


Figure 3-6: Connectors on the right side of the CPC 100 and CPC 80

4 Measurement setup

4.1 Connection and disconnection

4.1.1 Connecting the CPC

1. Verify that the substation is prepared accordingly and you comply with all safety regulations.

WARNING**Death or severe injury caused by high voltage or current possible**

- ▶ Connect the *CPC* grounding terminal to the substation ground.
- ▶ Use a wire with a cross-section of $\geq 6 \text{ mm}^2$.

2. Make sure that the power switch on the *CPC* side panel is turned off.
Press the Emergency Stop button.
3. Connect the *CPC* to the mains power supply using the provided cable.
4. With the test object grounded and shorted out, connect the *CPC* to the test object according to your requirements.
5. Set up a barrier to separate the high voltage area from the work area (see Figure 1-1: "Separation of work area and high-voltage test area" on page 9).

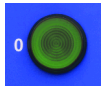
WARNING**Death or severe injury caused by high voltage or current possible**

- ▶ Do not enter the high voltage area during measurement.
- ▶ Remain in the work area.
- ▶ Before entering the high voltage area, follow step 12 to 15 later in this section.

6. Remove the grounding set from the test object.

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7. Turn on the *CPC* at its POWER switch at the left-hand side.



The green status light "0" lights up, showing that the current/voltage source is not active.

WARNING



Death or severe injury caused by high voltage or current possible

If none or both lights on the front panel are lit, the *CPC* is either not supplied by mains or it is defective.

- ▶ If the *CPC* is defective, do not use it.
- ▶ Contact OMICRON support.

Auto 8. Set up your test in the *CPC* software, and, where applicable, determine whether you want to perform an automatic or a manual test.

9. Once all test cards are prepared and the parameters set, make sure the key lock is in "unlocked" position (horizontal). Release the **Emergency Stop** button.



10. Start the test by pressing the **I/O** (test start/stop) push-button on the *CPC* front panel.

Note:

- A test can only be started in the Test Card View and with all preconditions met.
- If voltages ≥ 500 V are to be applied, after pressing the **I/O** (test start/stop) push-button for the first time a warning message appears on the screen. Only after the **I/O** (test start/stop) push-button is pressed a second time, the voltage is applied to the *CPC* output.
- An error message (313) appears if no PE connection can be detected on the power supply.

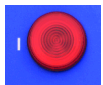
WARNING



Death or severe injury caused by high voltage or current possible

This is a safety-relevant message. If the reason for this message is that the PE is not connected, this can cause injury or possibly death of the operating staff.

- ▶ Make sure that both PE and grounding terminal are connected.



11. If a potentially hazardous voltage and/or current level is fed by the *CPC* outputs, the red status light "I" starts flashing.

4.1.2 Disconnecting the CPC



WARNING

Death or severe injury caused by high voltage or current possible

- ▶ Do not enter the high-voltage test area as long as the red light on the *CPC* front panel is flashing. If in doubt, press the **Emergency Stop** button.
- ▶ Do not touch any terminals and housing components without a visible ground connection.

1. After testing, switch off the *CPC* outputs immediately by pressing the **Start/Stop** button.
2. When the green light is on and the red light is off, turn the key to "lock" (vertical) and remove the key. If in doubt, press the **Emergency Stop** button.
3. After turning off the *CPC* outputs, earth-connect and short-circuit the test object's terminals again using a grounding set.
4. Remove the connection between the *CPC* and the test object.
5. Remove the barrier.

4.2 Cleaning



WARNING

Death or severe injury caused by high voltage or current possible

- ▶ Do not clean *CPC* when connected to the test object.
 - ▶ Disconnect the test object, accessories and connection cables before cleaning.
- ▶ Use a cloth dampened with isopropanol alcohol to clean *CPC* and its accessories.

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Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you!



24/7 Technical support – get support

www.omicronenergy.com/support

At our technical support hotline, you can reach well-educated technicians for all of your questions. Around the clock – competent and free of charge.

Make use of our 24/7 technical support hotlines:

Americas: +1 713 830-4660 or +1 800-OMICRON

Asia-Pacific: +852 3767 5500

Europe / Middle East / Africa: +43 59495 4444

Additionally, you can find our Service Center or Sales Partner closest to you at www.omicronenergy.com.



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