

CP TD12/15 (and CP TD accessories)

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

1.1 Operator qualifications

Working with or around high-voltage assets can be extremely dangerous. Only authorized personnel who are qualified, skilled and regularly trained in electrical engineering are allowed to operate the *CP TD12/15* and its accessories. Before starting to work, clearly establish the responsibilities.

Personnel receiving training, instructions, directions, or education on the *CP TD12/15* 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. The operator is responsible for the safety requirements during the whole test.

1.2 Safety standards and rules

1.2.1 Safety standards

Testing with *CP TD12/15* 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 *CP TD12/15* and its accessories, read the safety instructions in this User Manual carefully.

Do not turn on the *CP TD12/15* and do not operate the *CP TD12/15* without understanding the safety information in this manual. If you do not understand some safety instructions, contact OMICRON before proceeding.

Maintenance and repair of the *CP TD12/15* and its accessories is only permitted by qualified experts at OMICRON Service Centers (see "Support" on page 35).

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.

1.3 General

- ▶ Only use the *CP TD12/15* on dry, solid ground.
- ▶ Never connect or disconnect a test object while the outputs are active.
- ▶ When connecting cables to a control cabinet, be aware of uninsulated live components. Adhere to the safety instructions provided by the manufacturer.
- ▶ Make sure that a test object's terminals that are to be connected to the *CP TD12/15* do not carry any voltage potential. During a test, the only power source for a test object may be the *CP TD12/15*.
- ▶ Do not insert objects (for example, screwdrivers, etc.) into any input/output socket.

When measuring the ratio of voltage and power transformers make sure that the test voltage is connected to the corresponding primary winding, and the voltage of the secondary winding is the one that is measured. Accidentally mixing up the windings can generate life-threatening voltages within the transformer.

Life-threatening voltages can be induced on open windings!

- ▶ Make sure that when testing a current transformer by feeding a test current into its primary winding, all secondary windings are shorted.
- ▶ Do not operate the *CP TD12/15* under ambient conditions that exceed the temperature, humidity and altitude limits listed in the technical data.
- ▶ Do not operate the *CP TD12/15* in the presence of explosives, gases or vapors.
- ▶ Opening the *CP TD12/15* 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.
- ▶ Stop using the *CP TD12/15* or any add-on device or accessory if they seem not to function properly. Prevent the use of the devices and call the OMICRON hotline.

1.4 Operating the measurement setup

Note: The *CP TD12/15* works as an add-on device to the *CPC 100*, *CPC 80*, or *TESTRANO 600*, which are used to control the measurement. In this manual, these devices are collectively named *Control device* if no specific device is referred to. Do not connect the *CP TD12/15* to any other device than the *CPC 100*, *CPC 80*, or the *TESTRANO 600*.

- ▶ If you have a cardiac pacemaker, do not use the *CP TD12/15*! If you have another type of electronic medical implant consult your doctor before operating the *CP TD12/15*. Make sure there is no person with an electronic medical implant such as a cardiac pacemaker in the immediate vicinity.
- ▶ Before handling the *CP TD12/15* in any way, connect its measurement ground terminal with the supplied measurement ground cable to the ground terminal of the asset under test.
- ▶ Make sure that the ground terminal of the asset under test is in good condition, clean and free of oxidation.
- ▶ Before disconnecting the asset under test from the *CP TD12/15*, ground all asset's connections.
- ▶ Do not open the *CP TD12/15* housing.
- ▶ Do not repair, modify, extend, or adapt the *CP TD12/15* or its accessories.
- ▶ Use only the *CP TD12/15* original accessories available from OMICRON.

- ▶ Use the *CP TD12/15* and its accessories only in a safe manner and only if they are in a technically sound condition, mindful of the dangers while paying attention to the User Manual. Never use the device or its accessories unless they are in full working condition.
- ▶ Make sure the use of the *CP TD12/15* is in accordance with the regulations on site and the designated use described in this document.
- ▶ Comply with the workflows described in this document. Avoid interruptions or distractions that could affect safety.
- ▶ Do not enter the high-voltage area if the red status light of the *Control device* is on since all outputs can carry dangerous voltage or current!
- ▶ Always obey the five safety rules and follow the detailed safety instructions in the respective user manuals.

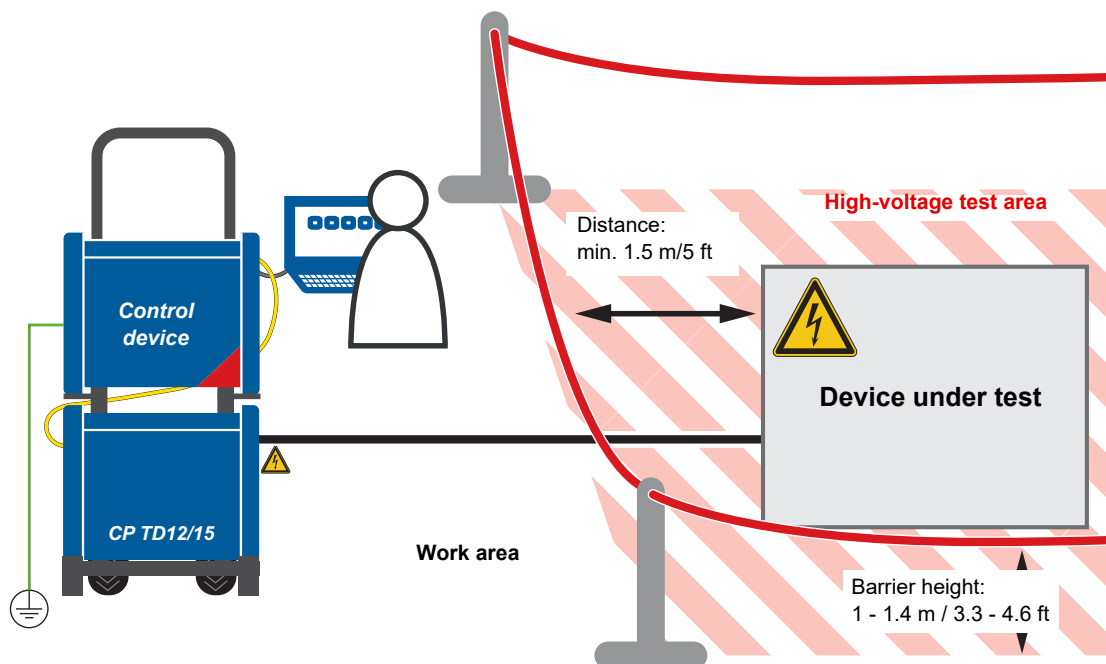


Figure 1-1: Example of the separation of work and high-voltage area

1.5 Handling cables

Before handling the cables:

1. If a test is running, end the test.
2. Verify that the test has ended by checking the status lights of the *Control device*:
The green status light must be on and at the same time the red status light must be off.

WARNING



Death or severe injury caused by high voltage or current possible

The green status light indicates that the outputs of the *Control device* are not activated.

- ▶ Even if you switched off the *Control device*, wait until the red status light is off. As long as this status light is on, there is still voltage potential on the output.

3. Lock the *Control device* to avoid any unauthorized execution of tests.

Note: For more details, refer to the corresponding User Manual of the *Control device*.

4. Ground and short-circuit the test object's terminals using a suitable grounding set.
5. Disconnect the booster cable from the *Control device*.
6. Disconnect the booster cable from the *CP TD12/15*.
 - ▶ The HV-cable must always be well attached and tightly connected to both the *CP TD12/15* and the test object. A loose connector or a connector falling off or into a test object carrying high-voltage is life-hazardous. Make sure the connectors are clean and dry before connecting.
 - ▶ Plug the HV-plug into the *CP TD12/15* until the plug is securely fastened. Confirm this by trying to gently pull it out.
 - ▶ At the test object, insert the HV-cable's plug carefully until you feel the plug "click" into place. Now it is locked. Confirm this by trying to pull it out. This should not be possible now.
Do not connect any cable to the test object without a visible grounding of the test object.
 - ▶ The HV-cable is double-shielded. However, the last 50 cm (20 inches) of this cable is not shielded. Therefore, consider this cable to be a live wire carrying life-hazardous high-voltage during testing!
 - ▶ When the *Control device* is switched on this part of the cable has to be in the high-voltage area due to an electric shock hazard!
 - ▶ Never remove **any** cables from the *CP TD12/15* or the test object during a test.
 - ▶ Keep clear from safety zones in which high voltages may occur. Set up a safety barrier or establish similar adequate means.
 - ▶ Both low-voltage measuring cables must always be well attached and tightly connected to the *CP TD12/15*'s measuring inputs IN A and IN B.
Make sure to insert the cables with the red and blue marker sleeves at the connector into the correspondingly colored measuring input: IN A = red, IN B = blue.
 - ▶ Use only original cables supplied by OMICRON.

1.6 Orderly measures

The CP TD12/15 Getting Started or alternatively the e-book must always be available at the operating site of the CP TD12/15.

The users of the CP TD12/15 must read this manual before operating the CP TD12/15 and observe the safety, installation, and operation instructions contained in the manual.

When setting the CP TD12/15 into operation, follow the instructions in 3 "Application" on page 18. The CP TD12/15 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). The manufacturer and the distributor are not liable for damage resulting from improper usage.

Opening the CP TD12/15 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 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.

1.8 Disclaimer

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

1.9 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.

1.10 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 CP TD12/15

The *CP TD12/15* works as an add-on device to the *CPC 100*, *CPC 80*, or *TESTRANO 600* which are used to control the measurement. In this manual, these devices are collectively named *Control device* if no specific device is referred to. Do not connect the *CP TD12/15* to any other *Control device* than the *CPC 100*, *CPC 80*, or the *TESTRANO 600*.

The *CP TD12/15* is a high-precision test system for on-site insulation tests of high-voltage assets such as power transformers, bushings, capacitors and rotating machines.

The internal switched mode power amplifier enables measuring at different frequencies without producing interference at the mains frequency. Automatic test procedures reduce the testing time to a minimum. Test reports are generated automatically.

When used with the *CPC 100*, *CPC 80*, or *TESTRANO 600*, the *CP TD12/15* comes with its own *CPC* test card named **TanDelta**, which provides highly accurate measurements of the capacitance C_x and the dissipation factor $\tan \delta$ (DF) or power factor $\cos \phi$ (PF), respectively.

Additionally, the *CP TD12/15* can measure the following quantities:

- Actual, apparent and reactive power
- Quality factor QF
- Inductance
- Impedance, phase angle
- Test voltage & current

The *CP TD12/15* can also be used as high-voltage source.

Any other use of the *CP TD12/15* not mentioned above is considered improper use, and will invalidate all customer warranty claims and exempt the manufacturer from liability.

2.1.2 CP CR600

The *CP CR600* is a compensating reactor designed to enable high-voltage tests and measurements of large generators and motors in combination with the *CP TD12/15*.

The *CP CR600* contains a single inductor. In parallel with the test object it forms a resonant circuit, which is able to compensate reactive power. The so established parallel resonance circuit allows the testing of every capacitance within the specified range at the rated frequency by using a *Control device* in combination with the *CP TD12/15*. The reactive power output of the *CP TD12/15* is reduced to a minimum and the *CP TD12/15* delivers mainly the effective power (12 kV or 15 kV and 300 mA) while the current within the resonance circuit can be much higher.

Depending on the capacitance the test setup may require one, two or more *CP CR600* devices. Correspondingly, there are three models of the *CP CR600* available, the only difference being the inductance of the internal inductor: 100 H, 50 H, and 25 H. For a more detailed description see the *CP CR600* User Manual.

All other use of the *CP CR600* not defined above is considered improper use which will invalidate the warranty and exempt the manufacturer from liability.

2.1.3 *CP TC12*



WARNING

Death or severe injury can occur if the appropriate safety instructions are not observed.
The maximum operating voltage for *CP TC12* is **12 kV**.

The *CP TC12* is an oil test cell to be used in combination with the *CP TD* for measuring the Dielectric Constant, Dissipation Factor / Tangent Delta and Power Factor of insulating liquids such as transformer oils.

The *CP TC12* consists of a metallic container representing the high-voltage electrode and a measuring electrode. During the test, the high-voltage electrode carries a voltage of up to 12 kV (maximum voltage).

All other use of the *CP TC12* not defined above is considered improper use which will invalidate the warranty and exempt the manufacturer from liability.

2.1.4 *BLI2*

The *BLI2* is a *CP TD* accessory for partial discharge measurements. It is used as blocking impedance to filter undesired PD from the voltage supply (*CP TD*) in the standard IEC measurement frequencies.

The *BLI2* is used on top of the MCC coupling capacitor.

- ▶ Only use the *BLI2* with the *Control Device (CPC 100 or Testrano 600)*, the *CP CR600* and *CP TD*.
- ▶ Always connect the *BLI2* directly in series to the *CP TD*'s output.

Depending on the coupling capacitor type, the *BLI2*'s M12 screw thread can be mounted with an adapter for M10 or M8 internal threads.

2.1.5 *CP CAL1*



WARNING

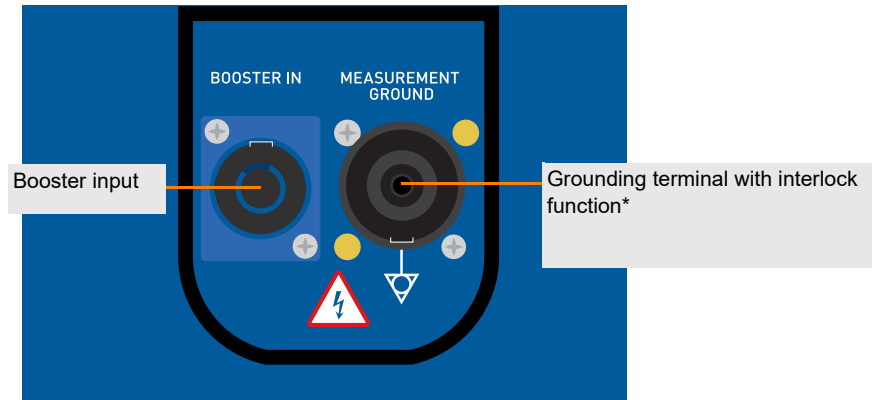
Death or severe injury can occur if the appropriate safety instructions are not observed.
The maximum operating voltage for *CP CAL1* is **12 kV**.

The *CP CAL1* is a calibration unit designated for calibrating the *CP TD*. The calibration is based on measurements of the known capacitance and dissipation factor values of a high-precision reference capacitor. The calibration procedure is controlled by the *CPC 100*, *CPC 80*, or *TESTRANO 600* test system. During the test, the high-voltage electrode carries a voltage of up to 12 kV (maximum voltage).

All other use of the *CP CAL1* not defined above is considered improper use which will invalidate the warranty and exempt the manufacturer from liability.

2.2 Functional components of the *CP TD12/15*

2.2.1 *CP TD12/15* Booster input and grounding terminal



* For more details on the interlock function, refer to 2.2.4 "Safety and interlock functions" on page 12.

Figure 2-1: *CP TD12/15* Booster input and grounding terminal (left side of the device)

2.2.2 *CP TD12/15* serial interface connector and measuring inputs

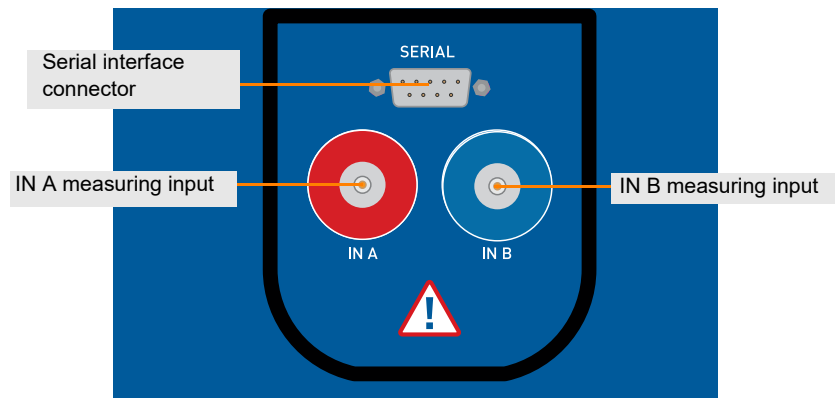
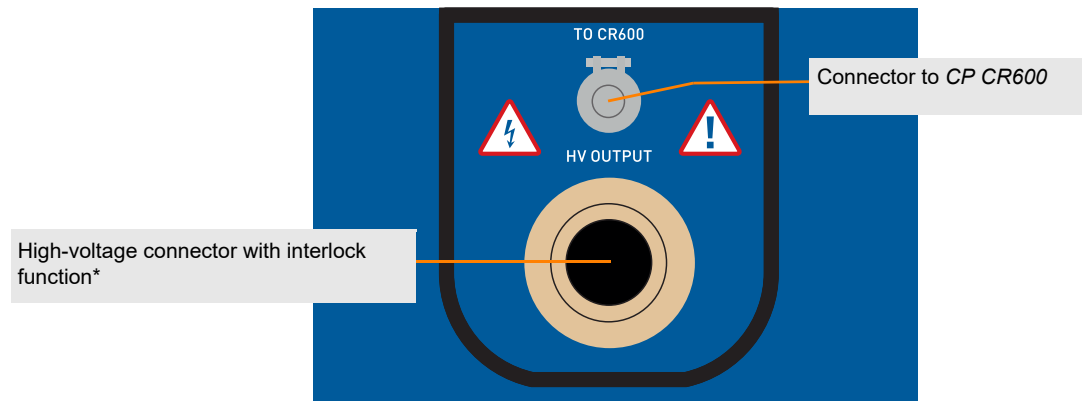


Figure 2-2: *CP TD12/15* serial interface and measuring inputs (right side of the device)

2.2.3 CP TD12/15 high-voltage output connector



* For more details on the interlock function, refer to 2.3 "Functional components of the CP CR600" on page 13.

Figure 2-3: High-voltage connector of the CP TD12/15 (rear of the device)

2.2.4 Safety and interlock functions

The CP TD12/15 has several internal and external safety functions to prevent dangerous situations. The CP TD12/15 will not work if a safety function detects a problem, such as:

- defect of the protective earth connection to the *Control device*
- missing measurement ground connection (cable not connected to device)
- bad measurement ground connection (measurement ground has no contact to protective ground)
- HV-cable is not connected to the CP TD12/15

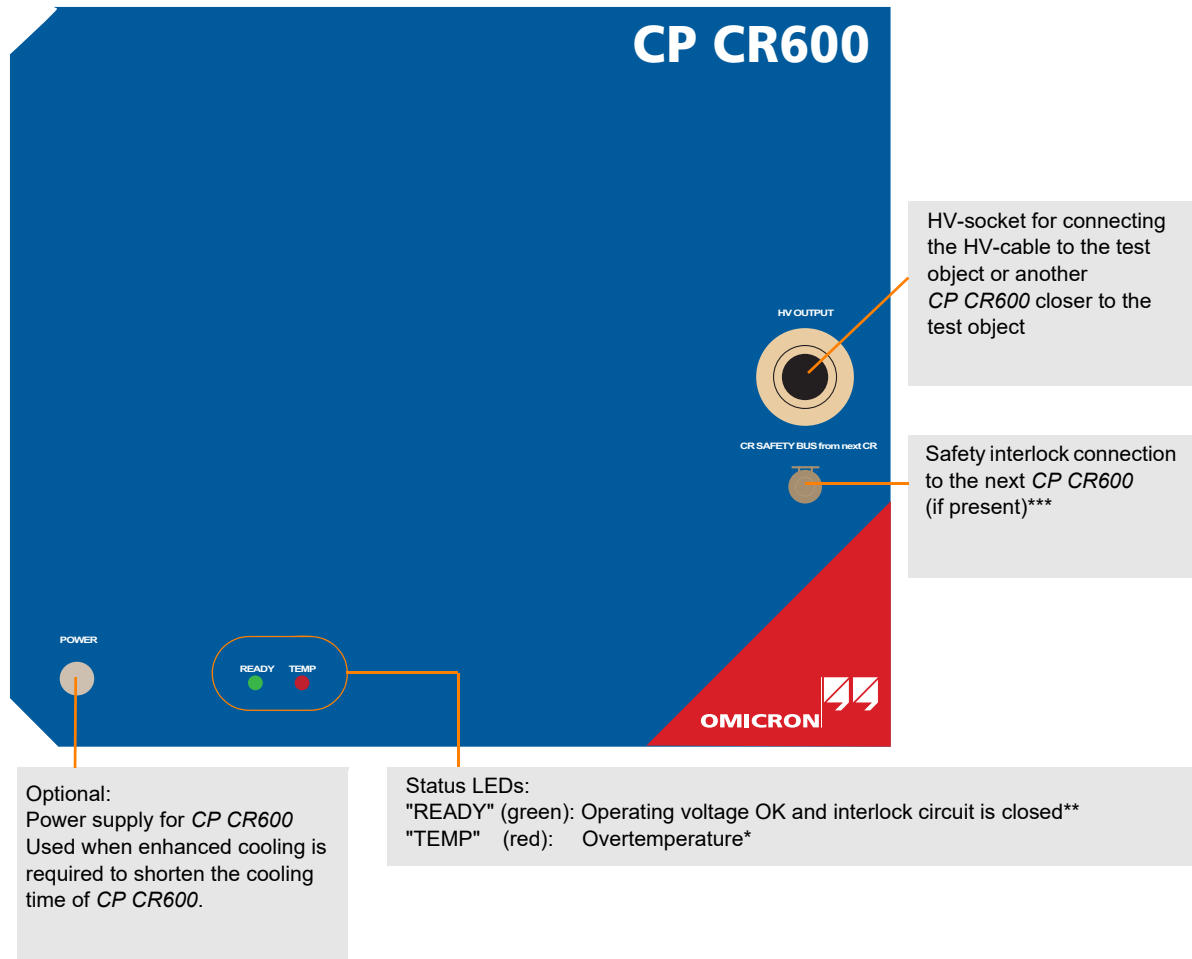
Additionally, the interlock function is active when an external CP CR600 is connected. The CP TD12/15 will not work if the interlock function detects one of the following problems:

- missing safety connection to the CP CR600
- HV-cable is not connected to the CP CR600
- overtemperature of the CP CR600

Note: If the interlock function prevents the CP TD12/15 from working, check all connections and options mentioned above.

2.3 Functional components of the *CP CR600*

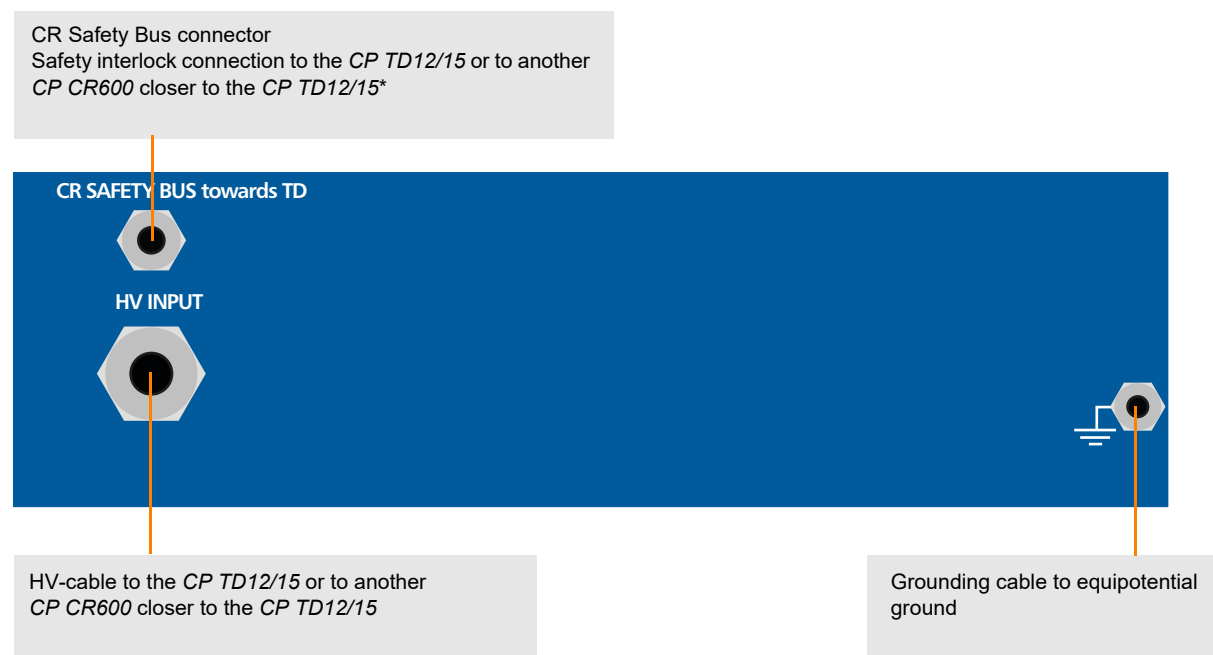
2.3.1 Front panel



- * The red "TEMP" status LED lights up if the temperature of the inductor inside the *CP CR600* is too high in which case *CP TD12/15* is deactivated. The test can be continued by restarting the test after the red "TEMP" LED is no longer lighted.
- ** The green "READY" status LED lights up if the operating voltage is available, if the high-voltage cable is connected to *CP CR600*, and the interlock circuit is closed.
- *** For more details on the interlock function, refer to 2.2.4 "Safety and interlock functions" on page 12

Figure 2-4: Front panel

2.3.2 Side panel



* For more details on the interlock function, refer to 2.2.4 "Safety and interlock functions" on page 12.

Figure 2-5: Side panel

2.4 Functional components of the *CP TC12*

Figure 2-6 shows the disassembled oil test cell.



Figure 2-6: Disassembled oil test cell *CP TC12*

2.5 Functional components of the *BLI2*

The *BLI2* provides the following connectors:

- **Input**
 - **INPUT:** 6 mm MC socket with interlock
- **Outputs** (internally connected)
 - **DEVICE U. TEST:** 4 mm MC socket
 - **COUPLING CAPACITOR:** M12 screw thread with adapters for M10 and M8 internal threads

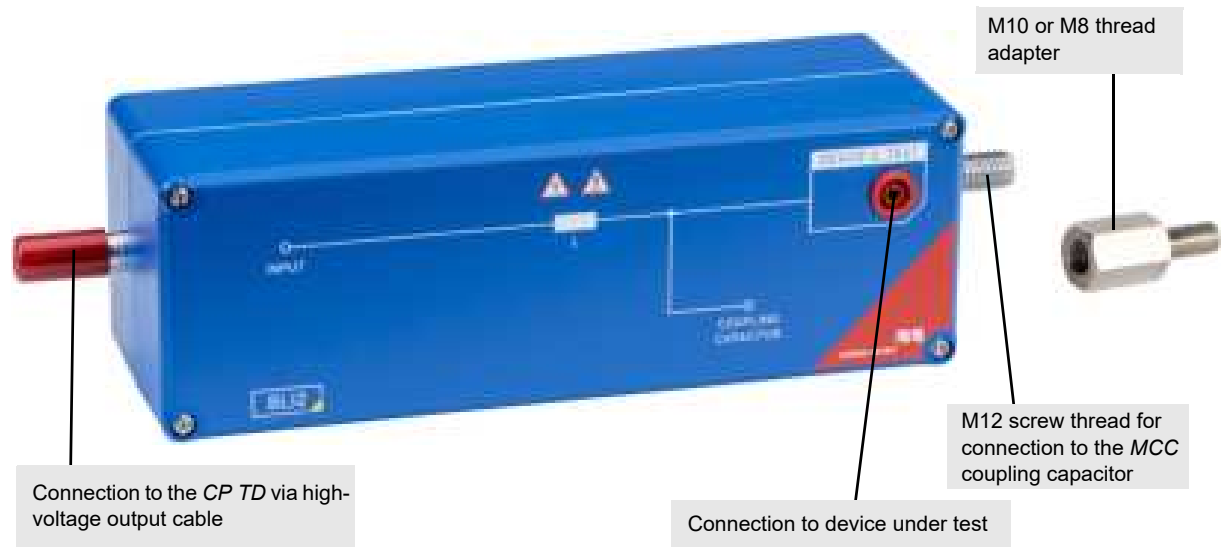


Figure 2-7: *BLI2* front view

2.6 Functional components of the *CP CAL1*

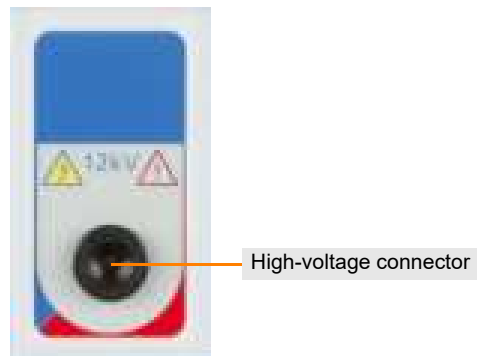


Figure 2-8: High-voltage connector of the *CP CAL1* (rear of the device)

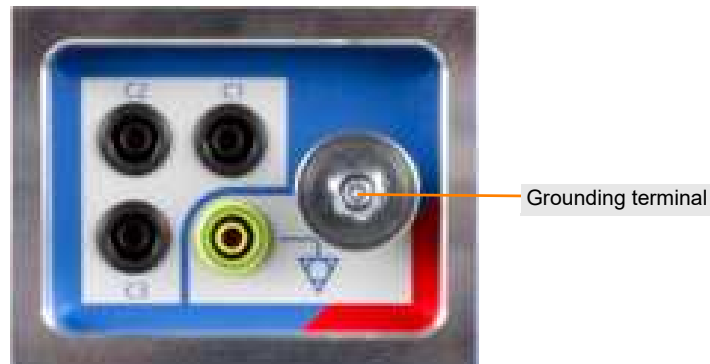


Figure 2-9: Low-voltage connectors of the *CP CAL1* (right side panel of the device)

2.7 Cleaning

WARNING



Death or severe injury caused by high voltage or current possible

► Disconnect the device before cleaning.

- To clean one of the devices described in this document, use a cloth dampened with isopropanol alcohol or water.

3 Application

3.1 Preparations on site



DANGER

Death or severe injury caused by high voltage or current

Prior to connecting a test object to the *CP TD12/15*, the following steps need to be carried out by an authorized and qualified employee of the utility:

- ▶ Turn off and disconnect the high voltage from the test object.
- ▶ Protect himself/herself and the working environment against an accidental re-connection of high voltage by other persons and circumstances.
- ▶ Verify a safe isolation of the test object.
- ▶ Ground and short-circuit the test object's terminals using a grounding set.
- ▶ Protect himself/herself and the working environment with suitable protection against other (possibly live) circuits.
- ▶ Protect others from accessing the dangerous area and from accidentally touching live parts by setting up a suitable safety barrier and, if applicable, warning lights.
- ▶ If there is a longer distance between the location of the *CP TD12/15* and the area of danger (i.e. the test object), a second person with an additional "Emergency Stop" button is required.

3.2 CP TD12/15

3.2.1 Connecting the CP TD12/15 to the Control device

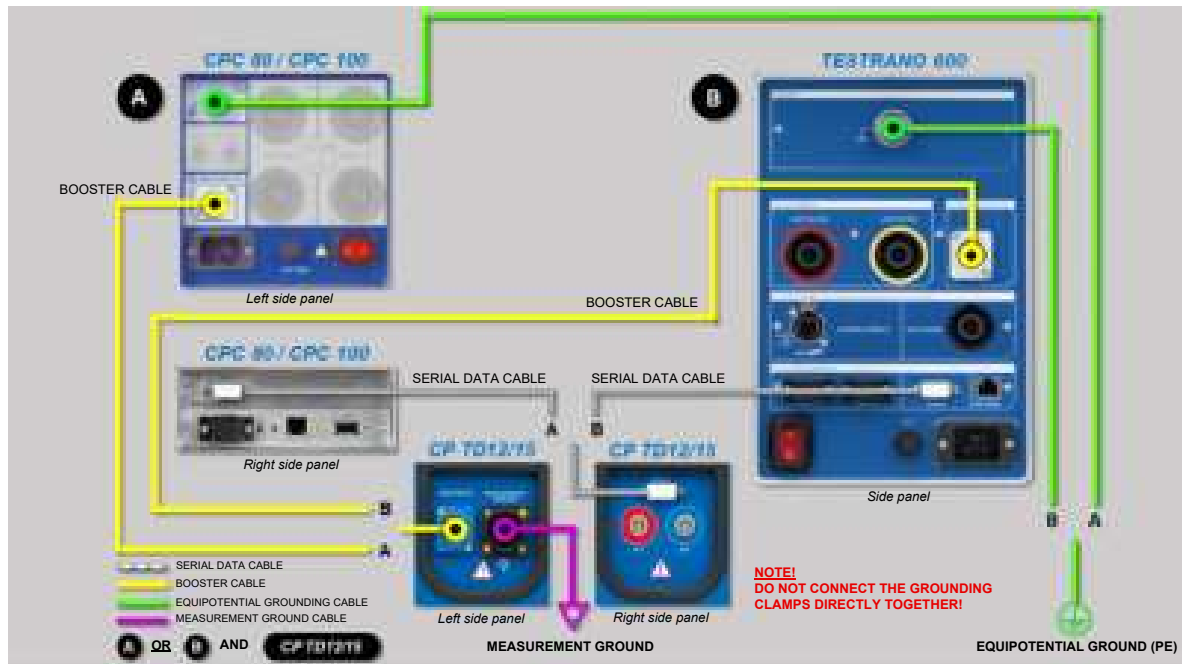


Figure 3-1: Connecting the CP TD12/15 to the CPC 100, CPC 80, or TESTRANO 600



DANGER

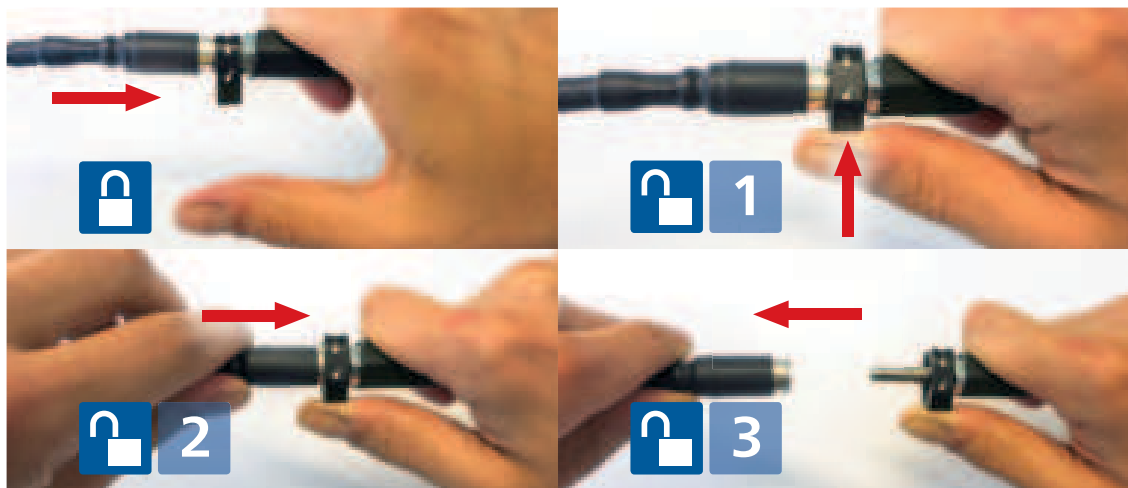
Death or severe injury caused by high voltage or current

- ▶ Never use the CP TD12/15 without connecting the measurement ground with the supplied cable.

CP TD12/15 Getting Started

1. Ensure that the *Control device* is switched off at the mains power switch.
2. Properly connect the *Control device* grounding terminal to substation ground.
3. Properly connect the *CP TD12/15* measurement ground to ground of the asset to be measured.
4. Make sure that all cable connectors are clean and dry before connecting them tightly.
5. Connect the *CP TD12/15*'s "BOOSTER IN" to the *Control device*'s "EXT. BOOSTER" with the booster cable.
6. Connect the *CP TD12/15*'s "SERIAL" to the *Control device*'s "SERIAL" with the serial cable.
7. Pull out the measuring cables from the cable drum and connect the test object to the *CP TD12/15*'s measuring inputs IN A and IN B.
8. Connect the HV-cable from the test object to the *CP TD12/15*'s HV-output.
 - ▶ Plug the HV-plug into the *CP TD12/15* until the plug is securely fastened. Confirm this by trying to gently pull it out.
 - ▶ At the test object, insert the HV-cable's plug carefully until you feel the plug "click" into place. Now they are locked. Confirm this by trying to pull them apart. This should not be possible now.

The images below show how to unlock the cable connection again. This is also shown on a label fixed to the HV-cable.



- ▶ After the HV-cable connection is established, use the strain relieve delivered with the HV-cable to fasten it to the test object.



DANGER

Death or severe injury caused by high voltage or current

The HV-cable is double-shielded and therefore safe. However, the last 50 cm (20 inches) of this cable is not shielded.

- ▶ Avoid any direct contact of this part of the cable to ground potential or to any objects.
- ▶ Due to the life-hazardous high-voltage consider this part of the cable live during testing.

9. Connect the *Control device* to the mains power supply using the provided cable.

WARNING

Death or severe injury caused by high voltage or current possible

- Establish a safety barrier to prevent entry into the high-voltage area.

10. Turn on the *Control device* by using its mains power switch.

11. The green status light lights up, showing that the *Control device*'s output does not carry a dangerous voltage or current yet.

WARNING

Death or severe injury caused by high voltage or current possible

- If none or both status lights are on, the unit is defective and must not be used anymore.

12. Verify that the PE connection of the *Control device* is properly made.

3.2.2 Disconnecting the *CP TD12/15*

1. End the test.
2. Verify that the test has ended by checking the status lights of the *Control device*:
The green status light must be on and at the same time the red status light must be fully switched off.

WARNING

Death or severe injury caused by high voltage or current possible

The green status light indicates that the outputs of the *Control device* are not activated.

- Even if you switched off the *Control device*, wait until the red status light is fully switched off. As long as this status light is on, there is still voltage potential on the output.

3. Lock the *Control device* to avoid any unauthorized execution of tests.

Note: For more details, refer to the corresponding User Manual of the *Control device*.

4. Ground and short-circuit the test object's terminals using a suitable grounding set.
5. Disconnect the booster cable from the *Control device*.
6. Disconnect the booster cable from the *CP TD12/15*.
7. Disconnect the serial cable from the *CP TD12/15*.
8. Disconnect the HV- and LV-cables from the *CP TD12/15* and the test object.
9. Disconnect the measurement ground from the test object and the *CP TD12/15*.

3.3 CP CR600

3.3.1 Connecting the CP CR600

Using a single CP CR600 unit



DANGER

Death or severe injury caused by high voltage or current

- ▶ Never operate the test setup without solid grounding.
- ▶ Place the *Control device*, the CP CR600, and the CP TD12/15 in the work area.
- ▶ Make sure that all units involved are connected to the common equipotential ground.
- ▶ Use ground connection cables of at least 6 mm² cross-section.

1. Switch off the *Control device* by using its mains power switch.
2. Properly connect the *Control device* grounding terminal to substation ground.
3. Properly connect the CP TD12/15 measurement ground to ground of the asset to be measured.
4. Properly connect the CP CR600 grounding terminal to ground with the grounding cable.
5. Connect the CP TD12/15's **BOOSTER IN** to the *Control device*'s **EXT. BOOSTER** with the booster cable.
6. Connect the CP TD12/15's **SERIAL** to *Control device*'s **SERIAL** with the data cable.
7. Calculate the required number and type of CP CR600 units needed.

Table 3-1: Possible compensation ranges and combination of CP CR600 models – 50 Hz/max. 15 kV

Capacitance	100 H	50 H	25 H
60...160 nF	X		
130...260 nF		X	
230...350 nF	X	X	
330...450 nF			X
420...550 nF	X		X
520...640 nF		X	X
620...740 nF	X	X	X

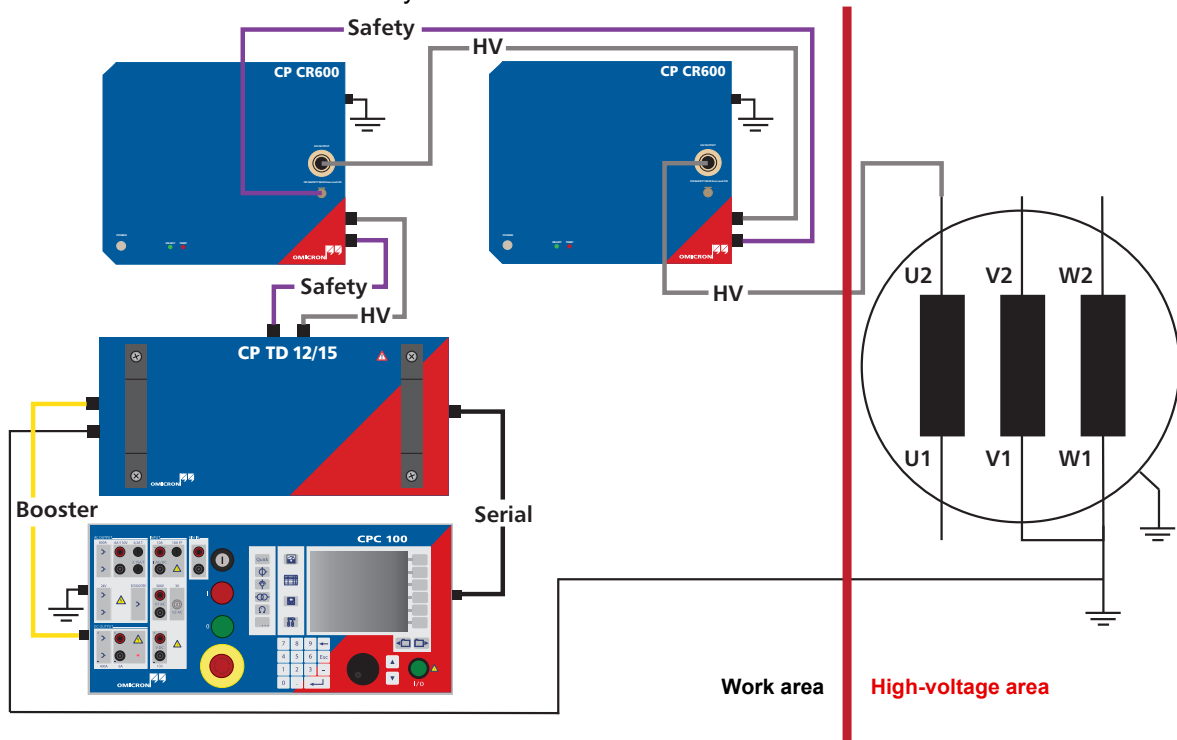
Note: The number of CP CR600 devices is represented as X as in the table above (X = 1 CP CR600).

Table 3-2: Possible compensation ranges and combination of *CP CR600* models – 60 Hz/max. 15 kV

Capacitance	100 H	50 H	25 H
50...120 nF	X		
85...190 nF		X	
150...250 nF	X	X	
220...320 nF			X
290...390 nF	X		X
350...460 nF		X	X
420...520 nF	X	X	X
490...590 nF			X X
560...660 nF	X		X X
620...720 nF		X	X X
690...790 nF	X	X	X X

Note: The number of *CP CR600* devices is represented as X in the table above (X = 1 *CP CR600*; X X = 2 *CP CR600* devices).

8. Connect the *CP CR600* CR Safety Bus cable to the *CP TD12/15*.

Figure 3-2: Example of a test setup using two *CP CR600*'s, one *CP TD12/15* and one *CPC 100*.

CP TD12/15 Getting Started

9. Connect the *CP CR600* to the test object with the long HV-cable.

- ▶ Insert the HV-plug of the HV-cable until you feel it "click" into place. Now the HV-plug is locked. Confirm this by trying to gently pull it out. This should not be possible now.
- ▶ At the test object, insert the HV-cable's plug carefully until feel it "click" into place. Now it is locked. Confirm this by trying to gently pull it out. This should not be possible now.

DANGER



Death or severe injury caused by high voltage or current!

The HV-cable is double-shielded. However, the last 50 cm (20 inches) of the HV-cable to the device under test has no shield.

- ▶ During a test, consider this cable to be a live wire, and due to the high-voltage, life-hazardous.

10. Connect the *CP TD12/15* to the *CP CR600* with the permanently installed HV-cable of the *CP CR600*.

11. If active cooling of the *CP CR600* is required, connect a power supply to the "Power" socket on the front panel of *CP CR600*.

12. Make sure that the connectors are tightly connected before turning on the high voltage.

13. Connect the *Control device* to the mains power supply using the provided cable.

14. Turn on the *Control device* using the mains power switch located at the left-hand side.

15. The green status light of the *Control device* lights up, showing that the *Control device* output does not carry a dangerous voltage or current yet.

16. Remove the grounding set from the test object.

WARNING



Death or severe injury caused by high voltage or current possible

- ▶ If none or both status lights of the *Control device* are on, the unit is defective and must not be used anymore.

WARNING



Death or severe injury caused by high voltage or current possible

- ▶ Establish a barrier to the high-voltage area.
- ▶ Make sure to keep the required distance. The required distance is 1.4 m to the test object with a barrier height of 1 m.

Using multiple CP CR600 units



DANGER

Death or severe injury caused by high voltage or current

- ▶ Never operate the test setup without solid grounding.
- ▶ Place the *Control device*, the CP CR600, and the CP TD12/15 in the work area.
- ▶ Make sure that all units involved are connected to the common equipotential ground.
- ▶ Use ground connection cables of at least 6 mm² cross-section.

1. Switch off the *Control device* at the mains power switch.
2. Properly connect the *Control device* grounding terminal to substation ground.
3. Properly connect the CP TD12/15 measurement ground to ground of the asset to be measured.
4. Properly connect the CP CR600 grounding terminal to ground with the grounding cable.
5. Connect the CP TD12/15's **BOOSTER IN** to the *Control device*'s **EXT. BOOSTER** with the booster cable.
6. Connect the CP TD12/15's **SERIAL** to *Control device*'s **SERIAL** with the data cable.
7. Calculate the required amount and type of the CP CR600 according to Table 3-1: "Possible compensation ranges and combination of CP CR600 models – 50 Hz/max. 15 kV" on page 22 or Table 3-2: "Possible compensation ranges and combination of CP CR600 models – 60 Hz/max. 15 kV" on page 23.
8. Connect the CP CR600 Safety Bus cable to the CP CR600 that is closest to the CP TD12/15 or directly to the CP TD12/15 (see Figure 3-2: "Example of a test setup using two CP CR600's, one CP TD12/15 and one CPC 100." on page 23).
9. Connect the test object to the CP CR600 that is closest to the test object with the long HV-cable.
 - ▶ Insert the HV-plug of the HV-cable until you feel it "click" click into place. Now the HV-plug is locked. Confirm this by trying to gently pull it out. This should not be possible now.
 - ▶ At the test object, insert the HV-cable's plug carefully until you feel it "click" into place. Now it is locked. Confirm this by trying to gently pull it out. This should not be possible now.



DANGER

Death or severe injury caused by high voltage or current

The HV-cable is double-shielded. However, the last 50 cm (20 inches) of the HV-cable to the device under test has no shield.

- ▶ During a test, consider this cable to be a live wire and, due to the high-voltage, life-hazardous.

10. Connect all CP CR600 devices with each other with the permanently installed HV-cable of the CP CR600 (see Figure 3-2: "Example of a test setup using two CP CR600's, one CP TD12/15 and one CPC 100." on page 23).
11. Connect the CP TD12/15 to the CP CR600 that is closest to the CP TD12/15 with the permanently installed HV-cable of the CP CR600 (see Figure 3-2: "Example of a test setup using two CP CR600's, one CP TD12/15 and one CPC 100." on page 23).
12. If active cooling of the CP CR600 devices is required, connect a power supply to the "Power" socket on the front panel of a CP CR600.
13. Make sure that the connectors are tightly fit before turning on the high voltage.

14. Connect the *Control device* to the mains power supply using the provided cable.
15. Turn on the *Control device* at its mains power switch at the left-hand side.
16. The green status light of the *Control device* lights up, showing that the *Control device* output does not carry a dangerous voltage or current yet.
17. Remove the grounding set from the test object.

Note: If none or both status lights are on, the unit is defective and must not be used anymore.



WARNING

Death or severe injury caused by high voltage or current possible

- ▶ If none or both status lights of the *Control device* are on, the unit is defective and must not be used anymore.



WARNING

Death or severe injury caused by high voltage or current possible

- ▶ Establish a barrier to the high-voltage area.
- ▶ Make sure to keep the required distance. The required distance is 1.4 m to the test object with a barrier height of 1 m.

3.3.2 Disconnection of CP CR600

1. End the test.
2. Verify that the test has ended by checking the status lights of the *Control device*:
The green status light must be on and at the same time the red status light must be off.

WARNING



Death or severe injury caused by high voltage or current possible

The green status light of the *Control device* indicates that the outputs of the *Control device* are not activated.

- Even if you switched off the *Control device*, wait until the red status light switches off. As long as this status light is on, there is still voltage potential on the output.

3. Lock the *Control device* to avoid any unauthorized execution of tests.

Note: For more details, refer to the corresponding User Manual of the *Control device*.

4. Ground and short-circuit the test object's terminals using a suitable grounding set.
5. Disconnect the booster cable from the *Control device*.
6. Disconnect the booster cable from the *CP TD12/15*.
7. Disconnect the optional external power supply for cooling.
8. Disconnect the serial cable from the *CP TD12/15*.
9. Disconnect the HV- and LV-cables from the *CP TD12/15*, the *CP CR600*, and the test object.
10. Disconnect the measurement ground from the test object, the *CP CR600*, and the *CP TD12/15*.

3.4 CP TC12

3.4.1 Connecting the CP TC12

WARNING



Death or severe injury caused by high voltage possible

The metallic container of the CP TC12 represents the high-voltage electrode. During the test, this part carries a voltage of up to 12 kV.

- ▶ Treat the area around the CP TC12 as "prohibition zone" according to EN 50191.
- ▶ Make sure that nobody can enter this prohibition zone during testing. Use walls or safety barriers for protection as shown in Figure 3-3 below. Keep a minimum of 150 cm (59 inches) from the test cell to the barriers in all directions, and make sure that the high-voltage warning signs are clearly visible.

Figure 3-3 shows a typical test setup with the CP TC12 connected to the CP TD1, for example. For a more detailed view, also see Figure 3-4 on the next page.

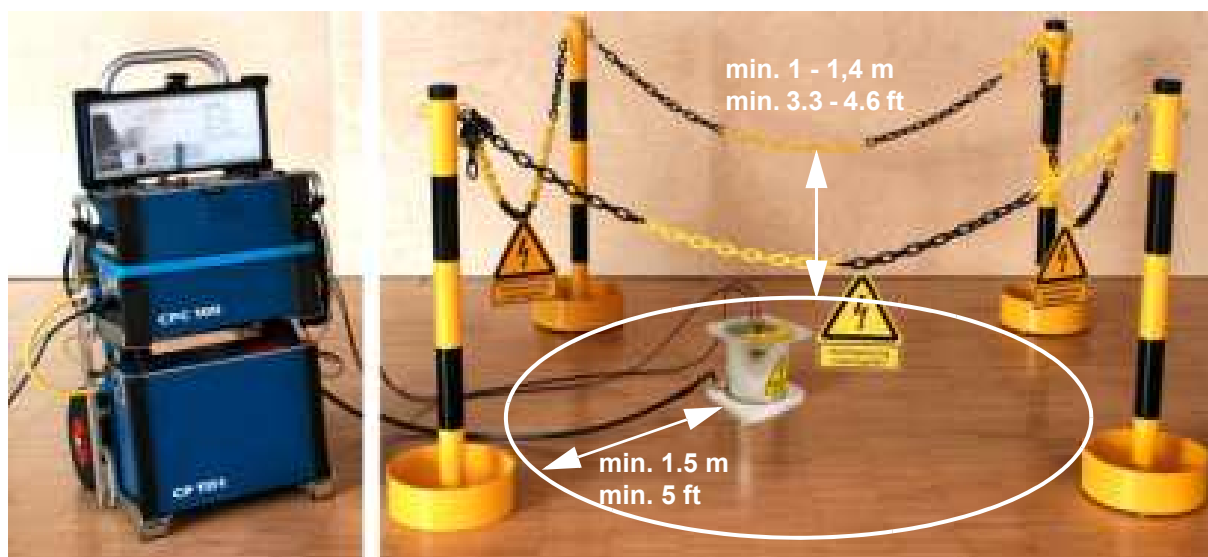


Figure 3-3: Typical test setup with CP TC12 connected to the CP TD1

1. Prepare the *Control device* and the *CP TD* as described under 3.2.1 "Connecting the CP TD12/15 to the Control device" on page 19 but make sure the *Control device* is not connected to mains yet.
2. Connect the **Measurement electrode** output of the *CP TC12* to the *CP TD*'s connector **IN A** (red plugs) using the banana cable.
3. Connect the **Guard** output of the *CP TC12* to the *CP TD*'s connector **IN B** (blue plugs) using the banana cable.

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

- ▶ To avoid electrical sparkover between the two *CP TD* connecting cables and the housing, make sure that the distance between the cables and the *CP TC12* housing is at least 10 cm (4 inches) at all times.

4. Connect the **High-voltage** input of the *CP TC12* to the *CP TD*'s **High-voltage** output using the HV-cable.
 - ▶ Plug the HV-plug into the *CP TD12/15* until the plug is securely fastened. Confirm this by trying to gently pull it out.
 - ▶ At the *CP TC12*, insert the high-voltage cable's plug carefully until you feel it "click" into place. Now they are locked. Confirm this by trying to pull them out. This should not be possible now.

DANGER**Death or severe injury caused by high voltage or current**

The HV-cable is double-shielded and therefore safe. However, the last 50 cm (20 inches) of this cable is not shielded.

- ▶ During testing, consider this cable to be a live wire, which is carrying life-hazardous high voltage.

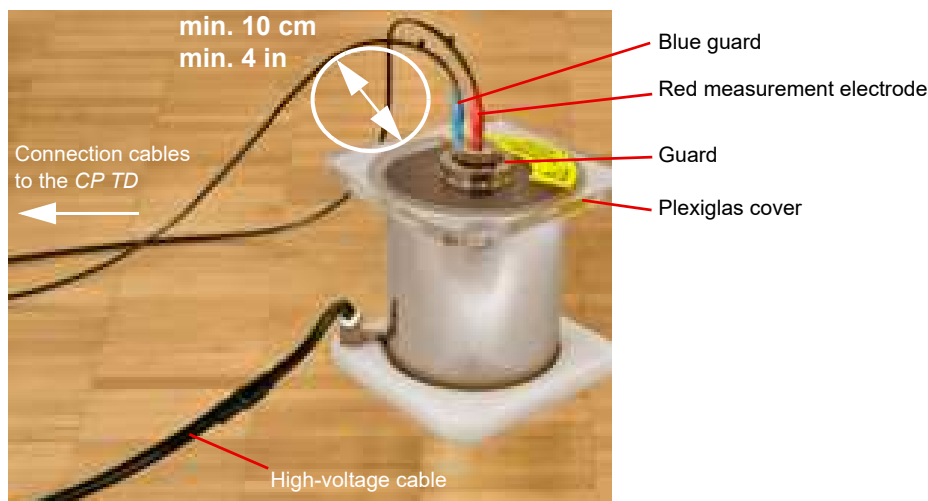


Figure 3-4: Oil test cell *CP TC12*

5. Make sure that the connectors are tightly connected before turning on the high voltage.

6. Erect a safety barrier as depicted in Figure 3-3: "Typical test setup with CP TC12 connected to the CP TD1" on page 28.
7. Connect the *Control device* to the mains power supply using the provided cable.
8. Turn on the *Control device* at its mains power switch at the left-hand side.
9. The green status light lights up, showing that the *Control device*'s output does not carry a dangerous voltage or current yet.

WARNING



Death or severe injury caused by high voltage or current possible

- If none or both status lights are on, the unit is defective and must not be used anymore.

3.4.2 Disconnecting the CP TC12

1. End the test.
2. Verify that the test has ended by checking the status lights of the *Control device*:
The green status light must be on and at the same time the red status light must be off.

WARNING



Death or severe injury caused by high voltage or current possible

The green status light indicates that the outputs of the *Control device* are not activated.

- Even if you switched off the *Control device*, wait until the red status light is switched off. As long as this status light is on, there is still voltage potential on the output.

3. Lock the *Control device* to avoid any unauthorized execution of tests.

Note: For more details, refer to the corresponding User Manual of the *Control device*.

4. Disconnect all cables from the CP TC12.

3.5 BLI2

3.5.1 Measurement setup

The voltage output of the *CP TD* is up to 15 kV (only with the *CP TD15*). Therefore, make sure to keep the required distance and to position the device in a safe area. According to EN 50191, the required distance to the high-voltage area is 1.5 m with a barrier height of 1 m.

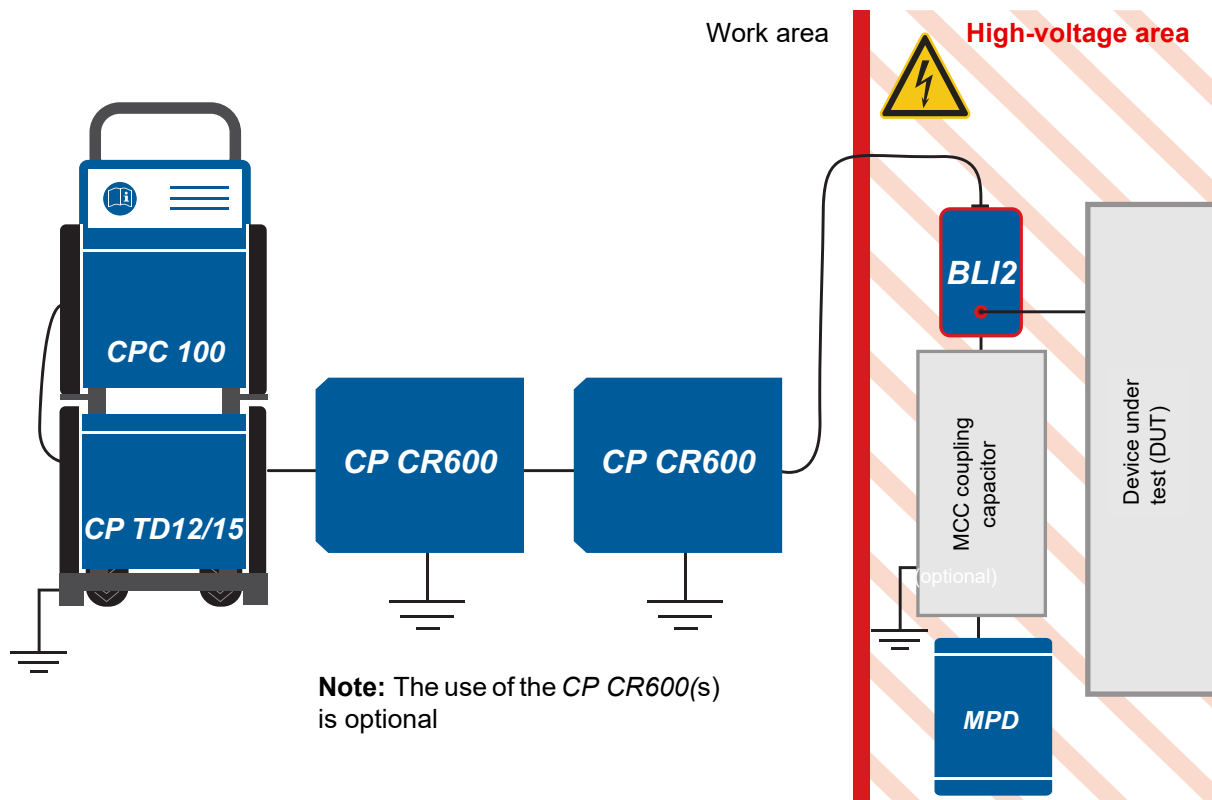


Figure 3-5: Example of a measurement setup with the *CPC 100*

3.5.2 Connection



DANGER

Death or severe injury caused by high voltage or current

- ▶ Do not touch the plug of the *CP TD* output cable when it is connected to the *CP TD*. The plug is not insulated.

5. Check all devices and cables for moisture and damages. Make sure that all connections are stable.
6. Press the **Emergency Stop** button on the front panel of the *Control device*. Continue with connecting only if the green warning light is on.
7. Ground the setup according to the safety rules (see 1 "Safety instructions" on page 3).

CP TD12/15 Getting Started

8. *Optional:* For coupling capacitors with M10 or M8 internal threads, screw the corresponding adapter onto the *BLI2*'s screw thread (see 2.5 "Functional components of the *BLI2*" on page 16).
 - ▶ Place the adapter on the *BLI2*'s M12 screw thread and turn clockwise.
 - ▶ Make sure the adapter is firmly and securely screwed onto the *BLI2*'s M12 screw thread.
9. Screw the *BLI2* onto the coupling capacitor.
 - ▶ Place the *BLI2*'s screw thread on the coupling capacitor and turn clockwise.
 - ▶ Make sure the *BLI2* is firmly and securely connected to the coupling capacitor.

NOTICE

Equipment damage

- ▶ Do not use the *BLI2* if the screw thread does not precisely fit the coupling capacitor.

10. Connect the **DEVICE U. TEST** output to the device under test.
11. *Option 1:*
 - a) Plug the high-voltage cable from the *CP TD1* into the **INPUT** of the *BLI2*.*Option 2:*
 - a) Connect one (or more) *CP CR600* to the **INPUT** of the *BLI2*.
 - b) Connect the high-voltage cable from the *CP TD* to the (first) *CP CR600*.
12. Protect others from accessing the high-voltage area and accidentally touching live parts by setting up a suitable barrier and, if applicable, warning lights.
13. Remove the grounding from the setup.
14. Conduct the measurement as described below.

3.5.3 Disconnection

1. Reduce the output voltage to zero.
2. Deactivate the *Control device* by pressing the **I/O** (test start/stop) push-button. The green status light indicates that the outputs of the *Control device* are not activated. As long as the red status light is lit, there is still voltage and/or current potential on one or more of the outputs.
3. Press the **Emergency Stop** button on the front panel of the *Control device*.
4. Plug off the high-voltage cable from the high-voltage output of the *Control device*.
5. Ground the setup according to the safety rules (see 1 "Safety instructions" on page 3).
6. Remove the safety barrier.
7. Disconnect the *BLI2*.

3.6 CP CAL1

3.6.1 Connecting the CP CAL1

1. Prepare the *Control device* and the *CP TD* as described under 3.2.1 "Connecting the CP TD12/15 to the Control device" on page 19 but make sure the *Control device* is not connected to mains yet.
2. Connect the *CP CAL1*'s connector **C1** with the *CP TD*'s connector **IN A** (red plugs) using the banana cable.
3. Connect the *CP CAL1*'s connector **EG** with the *CP TD*'s connector **IN B** (blue plugs) using the banana cable.
4. Connect the **High-voltage** input of the *CP CAL1* to the *CP TD*'s **High-voltage** output using the HV-cable.
 - ▶ Plug the high-voltage plug into the *CP TD12/15* until the plug is securely fastened. Confirm this by trying to gently pull it out.
 - ▶ At the *CP CAL1*, insert the high-voltage cable's plug carefully until you feel it "click" into place. Now they are locked. Confirm this by trying to pull them out. This should not be possible now.

DANGER



Death or severe injury caused by high voltage or current

The high-voltage cable is double-shielded and therefore safe. However, the last 50 cm (20 inches) of this cable is not shielded.

- ▶ During testing, consider this cable to be a live wire, which is carrying life-hazardous high voltage.

5. Erect a safety barrier as depicted in Figure 3-6 below.

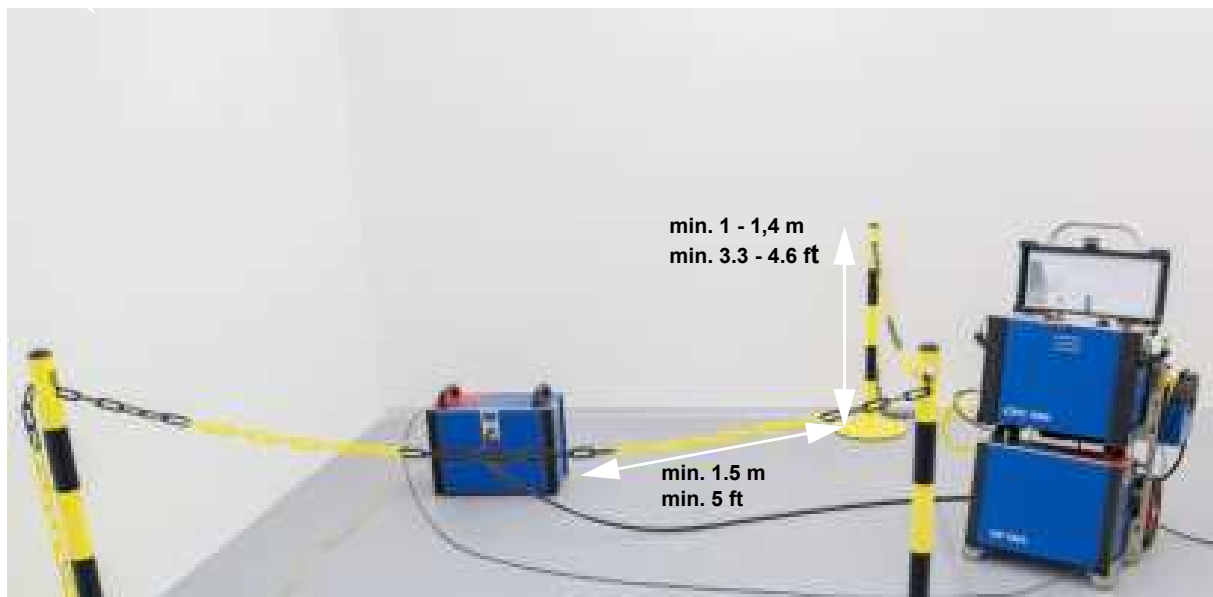


Figure 3-6: CP CAL1 calibration setup with safety barrier

3.6.2 Disconnecting the CP CAL1

1. End the test.
2. Verify that the test has ended by checking the status lights of the *Control device*:
The green status light must be on and at the same time the red status light must be off.

WARNING



Death or severe injury caused by high voltage or current possible

The green status light indicates that the outputs of the *Control device* are not activated.

- Even if you switched off the *Control device*, wait until the red status light is switched off. As long as this status light is on, there is still voltage potential on the output.

3. Lock the *Control device* to avoid any unauthorized execution of tests.

Note: For more details, refer to the corresponding User Manual of the *Control device*.

4. Disconnect all cables from the CP CAL1.

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