

# CP CR600

## User Manual



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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.

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## About this manual

This User Manual provides information on how to use the *CP CR600* safely, properly and efficiently. The *CP CR600* User Manual contains important safety rules for working with the *CP CR600* and gets you familiar with operating the *CP CR600*. Following the instructions in this User Manual will help you to prevent danger, repair costs and possible down time due to incorrect operation.

The *CP CR600* User Manual always has to be available on the site where the *CP CR600* is used. It must be read and observed by all users of the *CP CR600*.

Reading the *CP CR600* User Manual alone does not release you from the duty of complying with all national and international safety regulations relevant to working on rotating machines.

## Safety symbols used

In this manual, the following symbols indicate safety instructions for avoiding hazards.



### DANGER

Death or severe injury will occur if the appropriate safety instructions are not observed.



### WARNING

Death or severe injury can occur if the appropriate safety instructions are not observed.



### CAUTION

Minor or moderate injury may occur if the appropriate safety instructions are not observed.

### NOTICE

Equipment damage or loss of data possible

## Related documents

The following documents complete the information covered in the CP CR600 User Manual:

Title	Description
CPC 100 User Manual	Contains information on how to use the <i>CPC 100</i> test system and relevant safety instructions.
CPC 100 Reference Manual	Contains detailed hardware and software information on the <i>CPC 100</i> including relevant safety instructions.
CPC 100 PTM User Manual	Contains information on how to use the PTM together with the <i>CPC 100</i> .
CPC 80 User Manual	Contains information on how to use the <i>CPC 80</i> test system and relevant safety instructions.
TESTRANO 600 User Manual	Contains information on how to use the <i>TESTRANO 600</i> test system and relevant safety instructions.
CP TD12/15 User Manual	Contains information on how to use the <i>CP TD12/15</i> capacitance/dissipation factor testing device (tan delta) and relevant safety instructions.

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# 1 Safety instructions

## 1.1 Operator qualifications

Working on 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 CR600* and its accessories. Before starting to work, clearly establish the responsibilities.

Personnel receiving training, instructions, directions, or education on the *CP CR600* 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 the *CP CR600* 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 CR600* and its accessories, read the safety instructions in this User Manual carefully.

Do not turn on the *CP CR600* and do not operate the *CP CR600* 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 CR600* and its accessories is only permitted by qualified experts at OMICRON Service Centers (see "Support" on page 29).

### 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 Operating the measurement setup

**Note:** The *CP CR600* works in combination with the *CP TD12/15* as an add-on device to the *CPC 100*, *CPC 80*, or *TESTRANO 600* which controls the measurement. In this manual, the *CPC 100*, *CPC 80*, and *TESTRANO 600* are collectively named *Control device* if no specific device is referred to. Do not connect the *CP CR600* to any other device than the *CP TD12/15*.

- ▶ If you have a cardiac pacemaker, do not use the *CP CR600*! If you have another type of electronic medical implant consult your doctor before operating the *CP CR600*. Make sure there is no person with an electronic medical implant such as a cardiac pacemaker in the immediate vicinity.
- ▶ Before handling the *CP CR600* in any way, connect its equipotential ground terminal with a solid connection of at least 6 mm<sup>2</sup> cross-section to the ground terminal of the rotating machine under test.
- ▶ Make sure that the ground terminal of the device under test is in good condition, clean and free of oxidation.
- ▶ Before disconnecting the device under test from the *CP CR600*, ground all test object's connections.
- ▶ Do not open the *CP CR600* housing.
- ▶ Do not repair, modify, extend, or adapt the *CP CR600* or its accessories.
- ▶ Use only the *CP CR600* original accessories available from OMICRON.
- ▶ Use the *CP CR600* and its accessories only if they are in a technically sound condition.
- ▶ Make sure the use of the *CP CR600* 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.
- ▶ Do not insert objects (for example screwdrivers, etc.) into any input/output socket.
- ▶ Do not operate the *CP CR600* under ambient conditions that exceed the temperature and humidity limits listed in 5 "Technical data" on page 26.
- ▶ Make sure to position the test equipment on dry, solid ground.
- ▶ Make sure that all cable connectors are clean and dry before being tightly connected.
- ▶ Do not operate the *CP CR600* in the presence of explosives, gases or vapours.
- ▶ Opening the *CP CR600* invalidates all warranty claims.
- ▶ Do not use an extension cable on a cable reel to prevent an overheating of the cord; run out the extension cord.
- ▶ Stop using the *CP CR600* or any add-on device or accessory if they seem to function improperly. Please call the OMICRON hotline.
- ▶ Opening OMICRON devices 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.

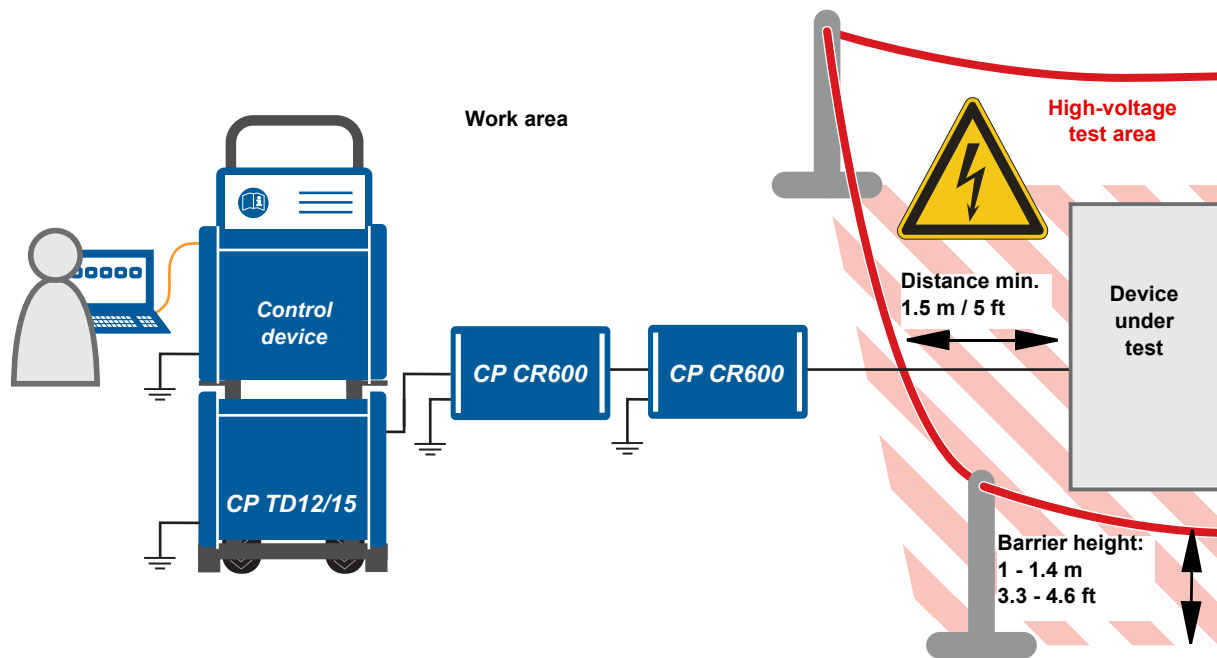


Figure 1-1: Separation of work area and high-voltage test area; the model (100 H, 50 H or 25 H) and number of required *CP CR600* units depends on the capacitance tested.

## 1.4 Orderly measures

The *CP CR600* User Manual or alternatively the e-book must always be available at the site where the *CP CR600* is operated.

The users of the *CP CR600* must read this manual before operating the *CP CR600* and observe the safety, installation, and operation instructions therein.

The *CP CR600* 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 CR600* 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.



## **1.5 Disclaimer**

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

## **1.6 Static charges**

Static charges on bushings or other apparatus such as rotating machines 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.

## **1.7 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.

## 1.8 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

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*.

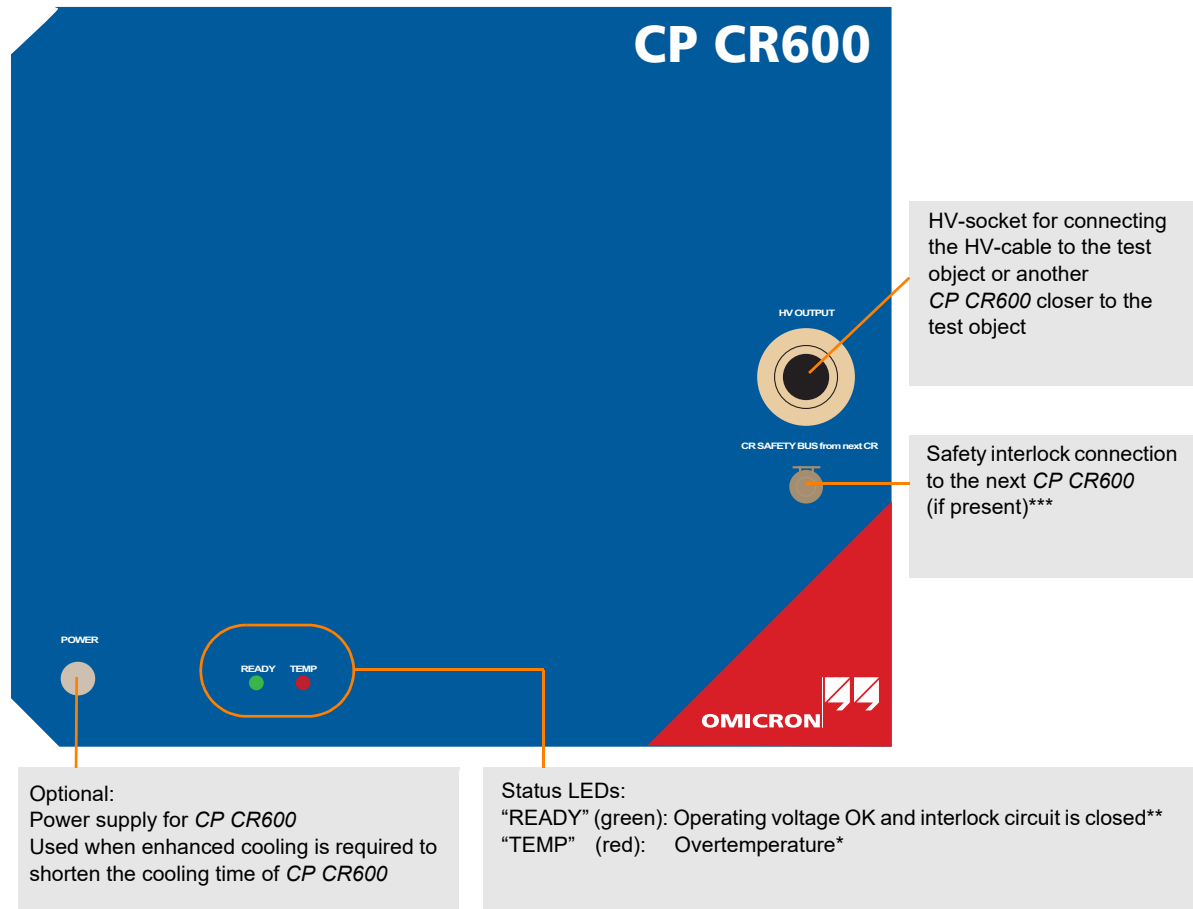
The *CP CR600* contains a single inductor. In parallel with the test object it forms a resonant circuit, which is able to compensate reactive power. The so established parallel resonance circuit allows the testing of every capacitance within the specified range at the rated frequency by using a *Control 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 detailed description of compensation values refer to Table 5-4: "Possible compensation ranges and combination of *CP CR600* models 50 Hz/15 kV" on page 27 and Table 5-5: "Possible compensation ranges and combination of *CP CR600* models 60 Hz/15 kV" on page 27.

## 2.2 Functional components of the *CP CR600*

### 2.2.1 Front panel



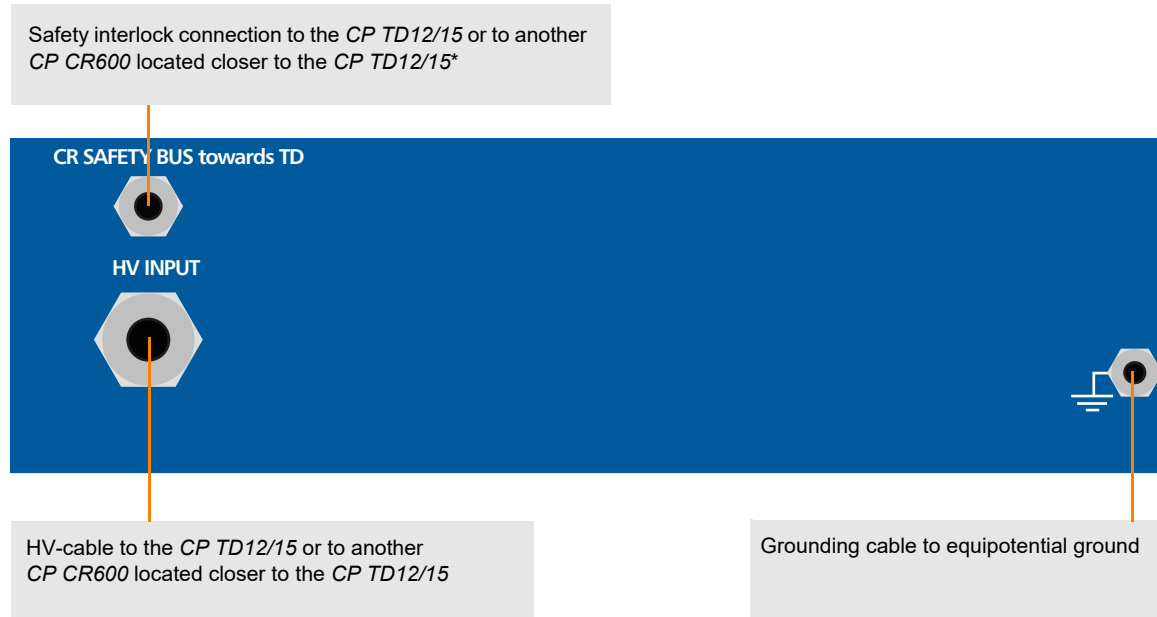
\* The red "TEMP" status LED lights up if the temperature of the inductor is too high in which case the *CP TD12/15* is deactivated. The test can be continued by restarting the test after the red "TEMP" status LED is no longer lighted.

\*\* The green "READY" status LED lights up if the operating voltage is available, if the high-voltage cable is connected to the *CP CR600*, and if the interlock circuit is closed.

\*\*\* For more details on the interlock function, refer to 2.3.4 "Safety and interlock functions" on page 15

Figure 2-2: Front panel

## 2.2.2 Side panel

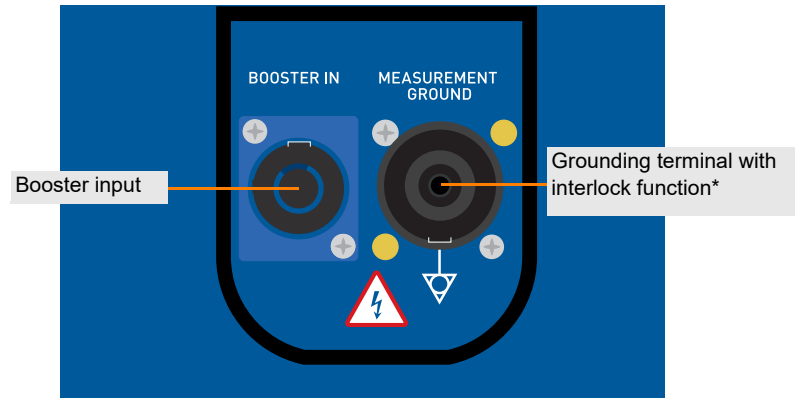


\* For more details on the interlock function, refer to 2.3.4 "Safety and interlock functions" on page 15.

Figure 2-3: Side panel

## 2.3 Functional components of the *CP TD12/15*

### 2.3.1 *CP TD12/15* grounding terminal and Booster input



\* For more details on the interlock function, refer to 2.3.4 "Safety and interlock functions" on page 15.

Figure 2-4: Grounding terminal and booster input of the *CP TD12/15* (on the left side of the device)

### 2.3.2 *CP TD12/15* serial interface connector and measuring inputs

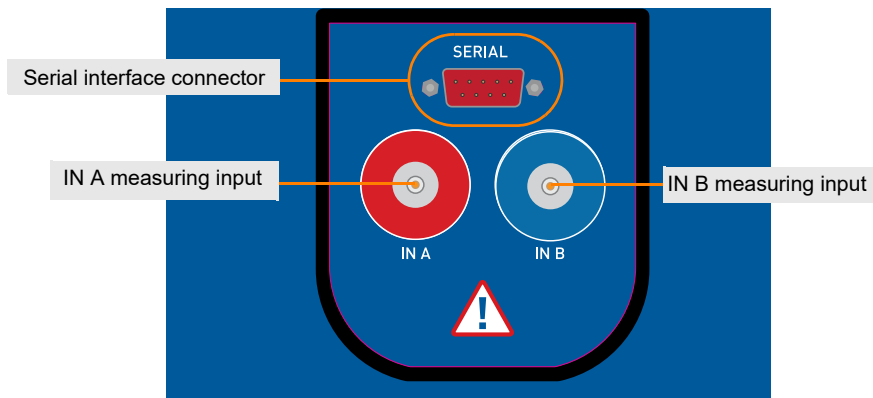
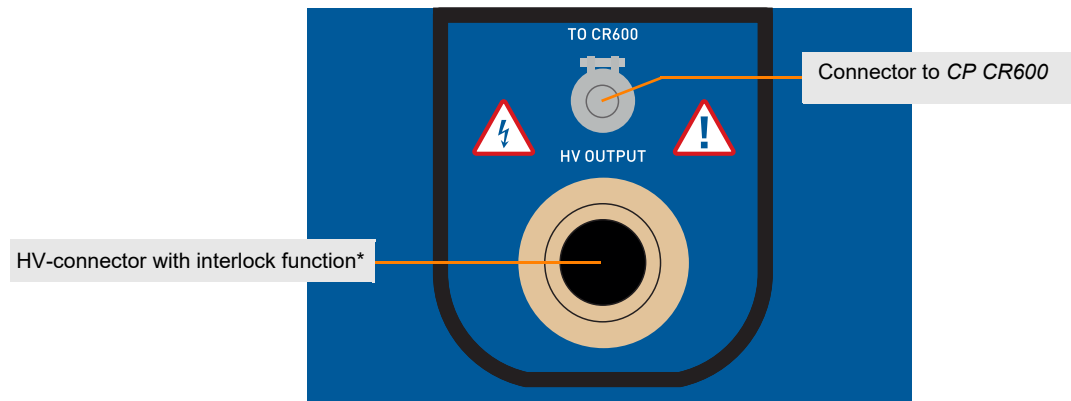


Figure 2-5: Serial interface and measuring inputs of the *CP TD12/15* (on the right side of the device)

### 2.3.3 CP TD12/15 high-voltage connector



\* For more details on the interlock function, refer to 2.3.4 "Safety and interlock functions" on page 15.

Figure 2-6: High-voltage connector of the CP TD12/15 (at the rear of the device)

### 2.3.4 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
- over-temperature of the CP CR600

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

## 2.4 Inductor inside the *CP CR600*

The essential part of the *CP CR600* compensation reactor is a single high-power inductor. The *CP CR600* is available in three variants with differing inductor value: 100 H, 50 H, and 25 H.

For detailed compensation values refer to Table 5-4: "Possible compensation ranges and combination of *CP CR600* models 50 Hz/15 kV" on page 27 and Table 5-5: "Possible compensation ranges and combination of *CP CR600* models 60 Hz/15 kV" on page 27.

The inductor is protected by an over-temperature sensor that interrupts or reconnects the safety circuit.

When the red status LED "TEMP" has switched off, the test can be restarted.

## 2.5 Cleaning



### WARNING

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

- Prior to cleaning disconnect the *CP CR600*.

- To clean the *CP CR600*, use a cloth dampened with isopropanol alcohol or water.



## 3 Operation

### 3.1 Measurement setup

#### 3.1.1 Setup of devices

The test setup consists of the *Control device* and *CP TD12/15* test system, the *CP CR600* compensating reactor(s) and the test object itself.

#### 3.1.2 Setup of devices with trolley (optional)

The equipment trolley holds the *Control device* and the *CP TD12/15*. Older trolley versions are equipped with a grounding bar with three knurled screws. Please connect properly.

### 3.2 Principle diagram of the test setup

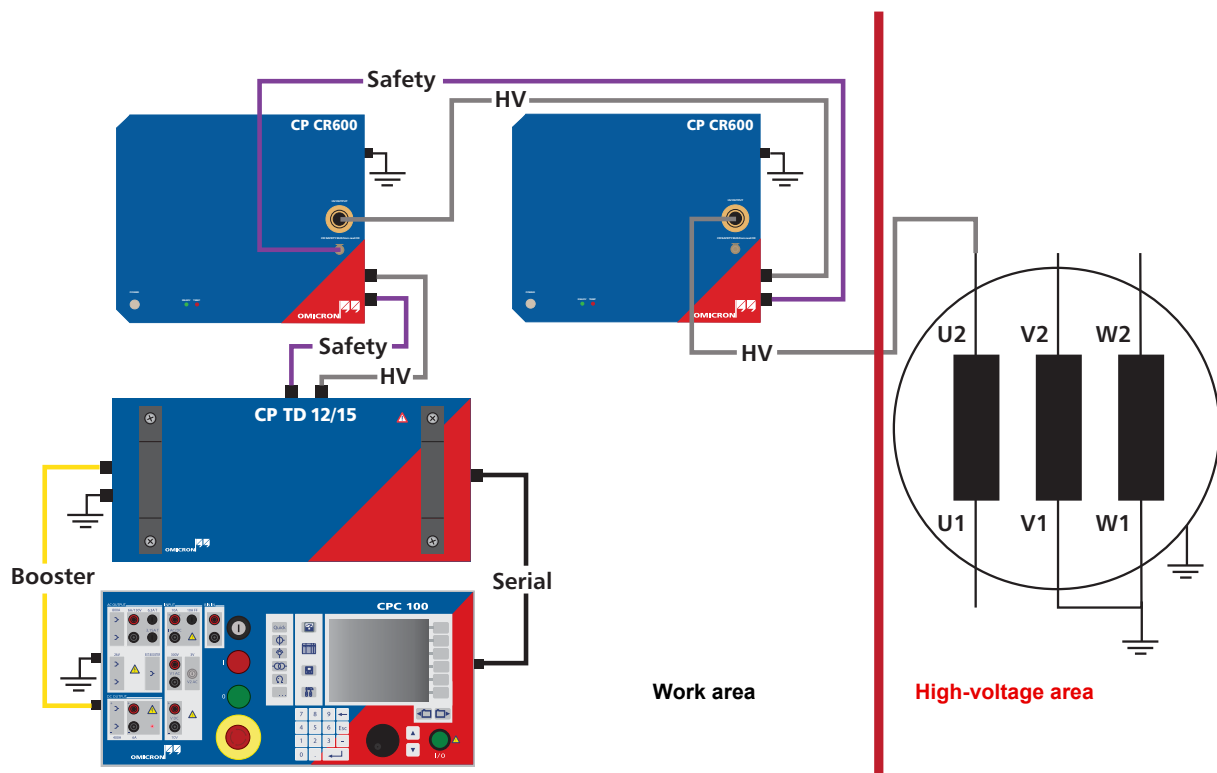


Figure 3-1: Example of a test setup using two *CP CR600*'s, one *CP TD12/15* and one *CPC 100*.

## 4 Application

### 4.1 Preparations on site



#### **DANGER**

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

Prior to connecting a test object to the *CP CR600*, 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 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 a suitable protection against other (possibly live) circuits.
- ▶ Protect others from accessing the dangerous area and 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 CR600* and the area of danger (that is, the test object), a second person with an additional Emergency Stop button is required.
- ▶ Additionally, when preparing the test object and installing the test setup, adhere to local laws and standards.

## 4.2 Connection

### 4.2.1 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 mm<sup>2</sup> cross-section.



1. Switch off the *Control device* using at 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. Verify the required type of the *CP CR600* (100 H, 50 H or 25 H) according to Table 5-4: "Possible compensation ranges and combination of *CP CR600* models 50 Hz/15 kV" on page 27 or Table 5-5: "Possible compensation ranges and combination of *CP CR600* models 60 Hz/15 kV" on page 27.
8. Connect the *CP CR600* Safety Bus cable to the *CP TD12/15* (see 3.2 "Principle diagram of the test setup" on page 17).
9. Connect the *CP CR600* to the test object with the long HV-cable.
  - ▶ Insert the HV-plug of the HV-cable carefully until you feel it "click" into end position. 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 the *CP TD12/15* to the *CP CR600* with the permanently installed HV-cable of the *CP CR600* (see 3.2 "Principle diagram of the test setup" on page 17).
11. If active cooling of the *CP CR600* is required, connect the power supply to the "Power" socket on the front panel of the *CP CR600*.
12. Make sure that the connectors are tightly fit before turning on the high voltage.
13. Remove the grounding set from the test object.
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.



**WARNING**

**Death or severe injury can occur if the appropriate safety instructions are not observed.**

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 safety 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.

## 4.2.2 Using multiple CP CR600 units

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 for each *CP CR600*.
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*'s according to Table 5-4: "Possible compensation ranges and combination of *CP CR600* models 50 Hz/15 kV" on page 27 or Table 5-5: "Possible compensation ranges and combination of *CP CR600* models 60 Hz/15 kV" on page 27.
8. Connect the *CP CR600* safety bus cable of the last unit to the next *CP CR600* and finally directly to the *CP TD12/15* (see 3.2 "Principle diagram of the test setup" on page 17).
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 carefully to the HV-cable socket until you feel it "click" into place. Now the HV-plug is locked. Confirm this by trying to gently pull them 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 a live wire and, due to the high voltage, life-hazardous.

10. Connect all *CP CR600* units with each other with the permanently installed HV-cable of the *CP CR600* (see 3.2 "Principle diagram of the test setup" on page 17).
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 3.2 "Principle diagram of the test setup" on page 17).
12. If active cooling of the *CP CR600* devices is required, connect a power supply to the "Power" socket on the front panel of each *CP CR600*.
13. Make sure that the connectors are tightly fit before turning on the high voltage.
14. Remove the grounding set from the test object.
15. Connect the *Control device* to the mains power supply using the provided cable.
16. Turn on the *Control device* at its mains power switch at the left-hand side.
17. 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.



**WARNING**

**Death or severe injury can occur if the appropriate safety instructions are not observed.**

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.

## 4.3 Measurement



### DANGER

#### Death or severe injury caused by high voltage or current

- ▶ If you have a cardiac pacemaker, do not use the *CP CR600*! If you have another type of electronic medical implant consult your doctor before operating the *CP CR600*.
- ▶ Before operating the *CP CR600*, make sure there is no person with an electronic medical implant in the immediate vicinity.

The following describes an example of how to perform the power and dissipation factor measurement with the TanDelta test card on the *CPC 100*. To establish the right compensation, the capacitance of the test object must be known. Refer to previous tests or measure the capacitance on site at lower voltage with the *CP TD12/15*. A suggestion for a possible *CP CR600* combination for 50 Hz and 60 Hz can be found in 3.2 "Principle diagram of the test setup" on page 17.

V	A	Hz	F	%	?

Figure 4-1: Example of TanDelta card with auto test points for an automated ramping.

To perform the power and dissipation factor measurement:

1. Open a **TanDelta** test card on the *Control device*.
2. Set test voltage to 500 V and determine the  $\tan\delta$ .
3. Auto test points can be used to test at different defined voltage steps to determine, for example, the  $\tan\delta$  tip up.
4. If measuring phase to ground, select the **GSTgA+B** mode at the "Mode" list box on the **TanDelta** test card (main page).
5. The measurement time can be influenced by changing the number of averaging measurements.



6. Start the test by pressing the green **I/O** (test start/stop) push-button on the *Control device* front panel.

- Note:**
- The test can be started only when the display has the Test Card View, provided that all preconditions are fulfilled.
  - A security function ensures, that after pressing the I/O button for the first time, outputs which may output  $\geq 1$  kV voltages are actually not switched immediately on. Instead, the following warning message will first appear on the Control device display:

DANGER: The device is about to inject high voltage. Activate the checkbox below and press I/O to start

- After ensuring that it is safe to actually switch the outputs on, press the I/O button again after which the outputs will be activated and the warning message will disappear from the *Control device* display.



If a potentially hazardous voltage and/or current level is applied to the *Control device* outputs, the red signal red light "I" starts flashing.

### NOTICE

Alternatively, the **High-Voltage Source** test card allows using the *CP TD12/15* as a high-voltage measuring source.

Refer to the CPC 100 User Manual, CPC 80 User Manual, Testrano 600 User Manual and CP TD12/15 User Manual for more information.

### NOTICE

Alternatively, measurements with the *Control device* in combination with the *CP TD12/15* and *CP CR600* can be performed using *Primary Test Manager* (PTM).

Refer to the CPC 100 PTM User Manual, and TESTRANO 600 User Manual for more information.



## 4.4 Disconnection

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 power supply used for enhanced cooling of the *CP CR600*.
8. Disconnect the serial cable from the *CP TD12/15*.
9. Disconnect the HV-cables 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*.

## 5 Technical data

### 5.1 Specifications

Table 5-1: CP CR600 specifications

Characteristic	Rating
Working voltage	15 kV
Frequency	50 - 400 Hz
Inductors	100 H with 105 H $\pm$ 5% 50 H with 52,5 H $\pm$ 5% 25 H with 26,3 H + 7% / - 2%

Table 5-2: Required variants of CP CR600 needed for testing EVERY capacitance value up to the indicated maximum value (the symbol "|" stands for "and/or", for a detailed list of combinations of all capacitance ranges see tables 5-4 and 5-5)

Connection configuration	Max. value at 50 Hz	Max. value at 60 Hz
100 H	up to 160 nF	up to 120 nF
100 H   50 H	up to 350 nF	up to 250 nF
100 H   50 H   25 H	up to 740 nF	up to 520 nF

**Note:** Other connection configurations are also possible. This could be useful if longer duty cycles have to be achieved.

Table 5-3: Typical On/Off times

Reactor type	Initial reactor temperature	On/Off times in minutes								
		0,45 A			0,9 A			1,8 A		
		T1 <sup>1</sup>	T2 <sup>2</sup>	T3 <sup>3</sup>	T1	T2	T3	T1	T2	T3
25 H	25 °C	45	130	22	20	90	8	5	60	2
50 H	25 °C	45	130	22	20	90	8	Maximum current is 0,9 A @ 15 kV 50 Hz		
100 H	25 °C	45	130	22	Maximum current is 0,45 A @ 15 kV 50 Hz					

1. T1 = initial output time
2. T2 = cooling time with fan (optional power supply attached to CR600)
3. T3 = output time after cooling phase

Table 5-4: Possible compensation ranges and combination of *CP CR600* models 50 Hz/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*).

**Note:** Other connection configurations are also possible. This could be useful if longer duty cycles have to be achieved.

Table 5-5: Possible compensation ranges and combination of *CP CR600* models 60 Hz/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).

**Note:** Other connection configurations are also possible. This could be useful if longer duty cycles have to be achieved.

## 5.2 Power supply specifications

Table 5-6: AC power supply specifications

Characteristic	Rating
Input	100...240 V AC/50...60 Hz/700...350 mA
Output	18 V DC/1.33 A

## 5.3 Mechanical data

Table 5-7: Mechanical data

Characteristic	Rating
Dimensions (W x H x D), with handles and mounted within the case	604 × 465 × 307 mm / 23.78 × 18.30 × 12.08 in
Weight	48 kg / 106 lb

## 5.4 Environmental conditions




Table 5-8: Climate

Characteristic	Rating
Temperature	Operating
	Storage and transportation
Max. altitude	

0...+55 °C / +32...+131 °F
–20...+70 °C / –4...+158 °F
2000 m

## 5.5 Standards

Table 5-9: Standards conformity

EMC, safety		
EMC	IEC/EN 61326-1 (industrial electromagnetic environment) FCC subpart B of part 15, class A	   C US
Safety	IEC/EN/UL 61010-1, IEC/EN/UL 61010-2-30	
Other		
Shock	IEC/EN 60068-2-27 (15 g/11 ms, half-sinusoid, 3 shocks in each axis)	
Vibration	IEC/EN 60068-2-6 (frequency range 10 Hz...150 Hz, acceleration 2 g continuous (20 m/s <sup>2</sup> /65 ft/s <sup>2</sup> ), 20 cycles per axis)	

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