

# **PROFITEST H+E XTRA**

## **PROFITEST H+E XTRA C**

EV Diagnostics Tester for DC Charging Stations for CCS, CHAdeMo  
and AC per DIN EN 61851-1/22/23/24 (VDE 0122-1/2-2/2-3/2-4),  
ISO 15118-1, DIN SPEC 70121

3-447-098-03  
2/6.21



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# 1 Safety Instructions

## 1.1 General

- Carefully and completely read and adhere to the operating instructions for the tester, as well as the operating instructions for the associated instrument.
- The documents can be found at <http://www.gossenmetrawatt.com>. Retain these documents for future reference.
- Carefully and completely read and adhere to the product documentation for optional accessories. Retain these documents for future reference.
- Use only the specified accessories (included in the scope of delivery or listed as options) with the tester.
- The tester and the accessories may only be used for the tests/measurements described in the documentation for the tester. Safety of the operator, as well as that of the tester, is only assured when it's used for its intended purpose.
- Only use the tester and its accessories within the limits of the specified technical data and conditions (ambient conditions, IP protection code, measuring category etc.).

## 1.2 Personnel Qualifications

- Tests/measurements may only be executed by a qualified electrician. The user must be instructed by a qualified electrician concerning performance and evaluation of the tests/measurements.

## 1.3 Handling the Tester

- Observe the five safety rules in accordance with DIN VDE 0105-100:2015-10, VDE 0105-100:2015-10, Operation of electrical installations – Part 100: General requirements (1. Shut down entirely. 2. Secure against restart. 3. Assure absence of voltage at all poles. 4. Ground and short circuit. 5. Cover neighboring live components, or make them inaccessible.).
- Observe and comply with all safety regulations which are applicable for your work environment.
- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the tester.
- The functioning of active medical devices (e.g. pacemakers, defibrillators) and passive medical devices may be affected by voltages, currents and electromagnetic fields generated by the tester and the health of their users may be impaired. Implement corresponding protective measures in consultation with the manufacturer of the medical device and your physician. If any potential risk cannot be ruled out, do not use the tester.
- Do not use the tester in humid environments, where condensation occurs or in environments with explosive gases.
- Never plug in wet connector plugs.
- Never unplug connector plugs during charging. This could result in electric shock and damage to the EVSE or EV simulator.
- Do not reverse the polarity.
- Connect the test setups correctly in order to prevent injury to persons and damage to the equipment.

## 1.4 Damaged Instrument

- The measuring and test instrument may not be placed into service:
  - If external damage is apparent
  - If connector cables or measuring adapters are damaged
  - If it no longer functions flawlessly
  - After long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature)
  - If any changes have been made to the tester itself or to the accessories.
- If the tester or its accessories don't function flawlessly, permanently remove the tester/accessories from operation and secure them against inadvertent use.
- If the tester or accessories are damaged during use, for example if they're dropped, permanently remove the tester/accessories from operation and secure them against inadvertent use.

## 1.5 Precautions for Transport and Storage

- Before closing the test case lid, remove all power, measurement and signal cables from the tester's front panel connector sockets and store them separately to avoid pinching and damaging the cables and scratching the display panel.

## 1.6 Data Backup

- Back up your stored data at regular intervals.

## 2 Applications

Please read this important information!

### 2.1 Intended Use / Use for Intended Purpose

The PROFITEST H+E XTRA diagnostics tester is used to check the functional performance of electric charging stations for DC-CCS with COMBO 2 inlet.

The PROFITEST H+E XTRA C diagnostics tester is used to check the functional performance of electric charging stations for DC-CCS, CHAdeMo and AC type 2.

In combination with the PROFITEST PRIME instrument, the PROFITEST H+E XTRA and PROFITEST H+E XTRA C diagnostics testers are used to evaluate and verify the effectiveness of protection against electric shock and protection by means of automatic shutdown at AC/DC charging stations in the event of overcurrent.

The tester described in these instructions is laid out for voltage up to 1000 V<sub>DC</sub>.

The required measuring categories must be observed.

### 2.2 Use for Other than Intended Purpose

Use of the tester for any purposes other than those described in these operating instructions is contrary to use for intended purpose.

### 2.3 Liability and Guarantee

Gossen Metrawatt GmbH assumes no liability for property damage, personal injury or consequential damage resulting from improper or incorrect use of the product, in particular due to failure to observe the product documentation. Furthermore, all guarantee claims are rendered null and void in such cases.

Nor does Gossen Metrawatt GmbH accept any liability for data loss.

### 2.4 Opening the Tester / Repairs

The tester may only be opened by the manufacturer in order to ensure flawless, safe operation and to assure that the guarantee isn't rendered null and void. Even original replacement parts may only be installed by the manufacturer.



Unauthorized modification of the tester is prohibited.

If it can be ascertained that the device has been opened by unauthorized persons, no guarantee claims can be honored by the manufacturer with regard to personal safety, measuring accuracy, compliance with applicable safety measures or any consequential damages.

## 3 Documentation

### 3.1 Identifiers

The following identifiers are used in this documentation:

Identifier	Meaning
 <b>Attention!</b> Warning	Safety information that must be complied with
 <b>Note!</b> Important	Important information which must be taken into consideration and complied with
✓ Prerequisite	A condition etc. which must be fulfilled before a given action can be taken
1. Procedural step	Steps of a procedure which must be completed in the specified order
↳ Result	Result of a procedural step
• Enumeration	Bullet lists
– Enumeration	
Figure 1:Caption	Description of the content of a figure
Table 1:	Description of the content of a table
Footnote	Comment
GUI	Elements of the graphical user interface, e.g. menus, buttons and screen displays

### 3.2 Definition of Terms

Term	Definition
CCS	Abbreviation for “combined charging system” – an international charging standard for electric vehicles
CHAdeMO	Abbreviation for “CHArge de MOve – a charging standard for electric vehicles
EV	Abbreviation for “electric vehicle”
EVSE	Abbreviation for “electric vehicle supply equipment”, i.e. a charging station
IMD	Abbreviation for “insulation monitoring device”

## 4 Getting Started

1. Read and adhere to the product documentation. In particular observe all safety information in the documentation, on the tester and on the packaging.
  - ⇒ “Safety Instructions” 1
  - ⇒ “Applications” 2
  - ⇒ “Documentation” 3
2. Familiarize yourself with the tester.
  - ⇒ “The Tester” 5
  - ⇒ “User Interface” 9
3. Install and familiarize yourself with the software.
  - ⇒ “Toolbox Software” 13
4. Start up the tester.
  - ⇒ “Initial Startup” 15
5. Execute measurements and tests.
  - ⇒ “Measuring and Testing” 17



## 5 The Tester

### 5.1 System Description

#### 5.1.1 Use as Diagnostics Tester for Electric Charging Stations

Each time a charging station is serviced, final testing is required in order to confirm that functionality, electrical safety and personal protection are assured.

Either an actual EV or a PROFITEST H+E XTRA/PROFITEST H+E XTRA C mobile tester is required to this end. After servicing multi-charger systems, testing for CCS and CHAdeMO can be performed with as single test instrument during the same service call or maintenance procedure.

With their CCS units, the PROFITEST H+E XTRA and the PROFITEST H+E XTRA C serve as diagnostic testers with EV simulation, as well as DC source and load. Within just one minute, the testers indicate whether or not a charging station is functioning correctly, without any need for specific knowledge of the CCS charging protocol. Problems in the communication protocol are directly apparent.

- The PROFITEST H+E XTRA can be used for electric charging stations with DC-CCS connections.
- The PROFITEST H+E XTRA C can be used for electric charging stations with DC-CCS, CHAdeMO and AC connections.

#### 5.1.2 Use for Testing the Effectiveness of Protective Measures at Electric Charging Stations

Protection against electric shock must be ensured for electrical installations. Specific requirements in accordance with DIN VDE 0100 must also be met for DC installations because insulation faults can cause a non-extinguishing arc, resulting in an increased risk of fire.

The effectiveness of protection against electric shock and protection by means of automatic shutdown at AC/DC charging stations in the event of overcurrent can be verified by the PROFITEST H+E XTRA or the PROFITEST H+E XTRA C in combination with the PROFITEST PRIME. In this case, the actual measurement is performed by the PROFITEST PRIME test instrument. The PROFITEST H+E XTRA or the PROFITEST H+E XTRA C functions as and adapter in this case.

In accordance with DIN VDE 0100-410, permissible touch voltage  $U_T$  is  $\leq 120$  V DC.

### 5.2 Instrument Characteristics

#### 5.2.1 PROFITEST H+E XTRA

- Diagnostics tester for checking the functional performance of electric charging stations for DC-CCS with COMBO 2 inlet
- Automatic test sequence / simulation of a DC EV per DIN SPEC 70121 and ISO 15118-1
- Load test with max. 5 A at 300 V DC
- Detection of insulation faults
- 4 mm safety sockets for DC+, DC- and PE for connecting a PROFITEST PRIME test instrument in order to test the effectiveness of protective measures
- Storage of measured values
- Software for generating test reports

#### 5.2.2 PROFITEST H+E XTRA C

- Diagnostics tester for checking the functional performance of electric charging stations for DC-CCS, CHAdeMO and AC type 2
- Automatic test sequence / simulation of a DC EV per DIN SPEC 70121 and ISO 15118-1, CHAdeMO 1.2 (and lower) and AC EV per IEC 61851-1
- Load test with max. 5 A at 300 V DC
- Detection of insulation faults
- 4 mm safety sockets for DC+, DC-, PE, L1, L2, L3 and N for connecting a PROFITEST PRIME test instrument in order to test the effectiveness of protective measures
- Storage of measured values
- Software for generating test reports

### 5.3 Scope of Delivery

Please check for completeness.

	Article No. M525N	Article No. M525M
1	PROFITEST H+E XTRA in hard case	PROFITEST H+E XTRA C in hard case
1	Mains cable	Mains cable
1	USB cable	USB cable
1	Toolbox software	Toolbox software
1	Operating instructions	Operating instructions

### 5.4 Optional Accessories

AC/DC adapter for connection to a car cigarette lighter

### 5.5 Prerequisites for Use

A PC or notebook is required for configuration and for downloading reports.

### 5.6 Instrument Overview

#### 5.6.1 Front

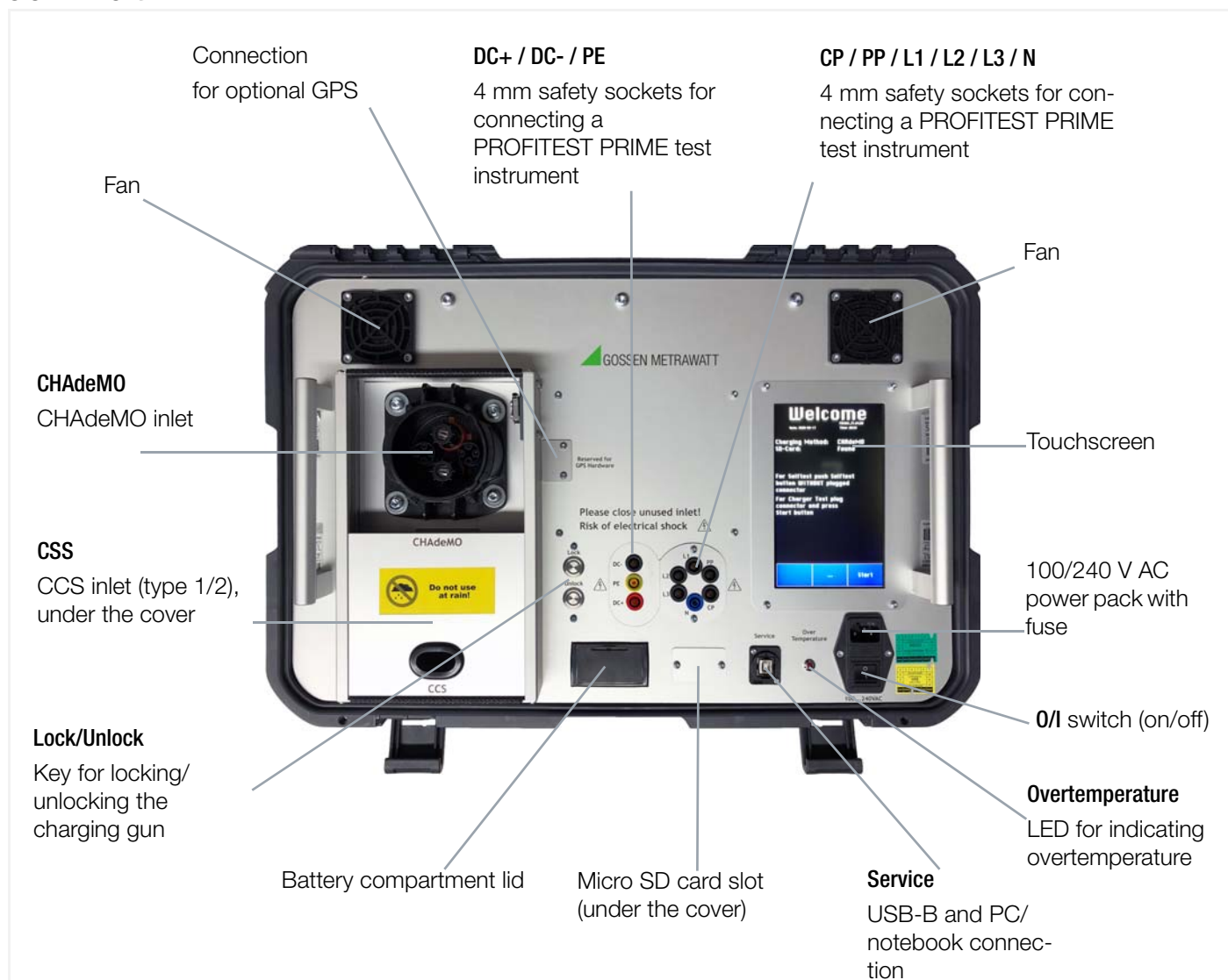


Figure 2: Front Panel

## 5.6.2 Symbols on the Tester and the Included Accessories



Warning concerning a point of danger  
(attention, observe documentation!)



Warning regarding electrical voltage



Double insulation (protection category II)



European conformity marking



The tester may not be disposed of with household trash ⇒ “Returns and Environmentally Sound Disposal” 47.

## 5.7 Relevant Standards

The tester has been manufactured and tested in accordance with the following safety regulations:

EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use – General requirements
EN 60529	Test instruments and test procedures Degrees of protection provided by enclosures (IP code)
EN 61326-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
EN 61000-4-2	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
EN 61000-4-3	Electromagnetic compatibility (EMC) Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4	Electromagnetic compatibility (EMC) Part 4-4: Electrical fast transient/burst immunity test
EN 61000-4-5	Electromagnetic compatibility (EMC) Part 4-5: Testing and measurement techniques – Surge immunity test
EN 61000-4-6	Electromagnetic compatibility (EMC) Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-11	Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests

## 5.8 Technical Data

<b>Power Supply</b>	Supply voltage	100 ... 240 V AC (can be connected to a 12 V DC cigarette lighter with the help of an adapter*) * Not included with the instrument
	Batteries (internal clock)	2 ea. AA, LR6, 1.5 V
<b>Voltage Consumption</b>	Max. 500 VA, inrush current higher	
<b>Inrush Current</b>	DC-CCS	Approx. 8.3 A
	CHAdEMO	Approx. 10.7 A
<b>Ambient Conditions</b>	Operating temperature	-15 ... +40 °C
	Storage temperature	-20 °C ... +60 °C
	Relative humidity	Max. 75%, no condensation allowed
	Elevation	Max. 2000 m

<b>Electrical Safety</b>	Measuring category	CAT III 300 V
<b>Mechanical Design</b>	Protection	IP67 with closed lid IP30 with open lid
	Housing (W × H × D)	Approx. 60 × 30 × 40 cm
	Weight	Approx. 15 kg
	Display	Color TFT
<b>Data Interfaces</b>	Data storage medium	Micro SD card
	Connection to PC or notebook	USB-B port
<b>Communication</b>	Display panel CSV report stored in the instrument	

## 5.9 Characteristic Values

### 5.9.1 Test/Analysis Standards

CHAdEMO	Versions 0.9.1, 1.0.0, 1.0.1, 1.1 and 1.2
DC-CCS	DIN SPEC 70121 or ISO 15118-1
AC	EN 61851-1

### 5.9.2 DC-CCS Measurement

<b>Voltage Measurement</b>	Range	0 ... 1000 V
	Resolution	± 1 V
	Accuracy	± 1 V, not calibrated
<b>Current Measurement</b>	Range	0 ... 6 A
	Resolution	± 100 mA
	Accuracy	± 0.5A, not calibrated

### 5.9.3 AC Measurement

Measurement of voltage values in all three phases and N

### 5.9.4 EV Simulation

<b>Simulated battery voltage</b>	230 ... 260 V DC output
<b>Current</b>	Approx. 6 A DC
<b>Duration</b>	Approx. 20 s

### 5.9.5 Insulation Fault Injection (INS test) for DC-CCS

	Explanation	Value
<b>HDC+</b>	High insulation resistance value between DC+ and PE	475 kΩ ± 1%
<b>LDC+</b>	Low insulation resistance value between DC+ and PE	95 kΩ ± 1%
<b>HDC-</b>	High insulation resistance value between DC- and PE	475 kΩ ± 1%
<b>LDC-</b>	Low insulation resistance value between DC- and PE	95 kΩ ± 1%

## 6 User Interface

### 6.1 Menu Layout and Navigation

The tester is equipped with a touch-sensitive screen (touchscreen) for entering measuring conditions and displaying measurement results.

Tap any button on the screen in order to trigger the respective action or open a menu.

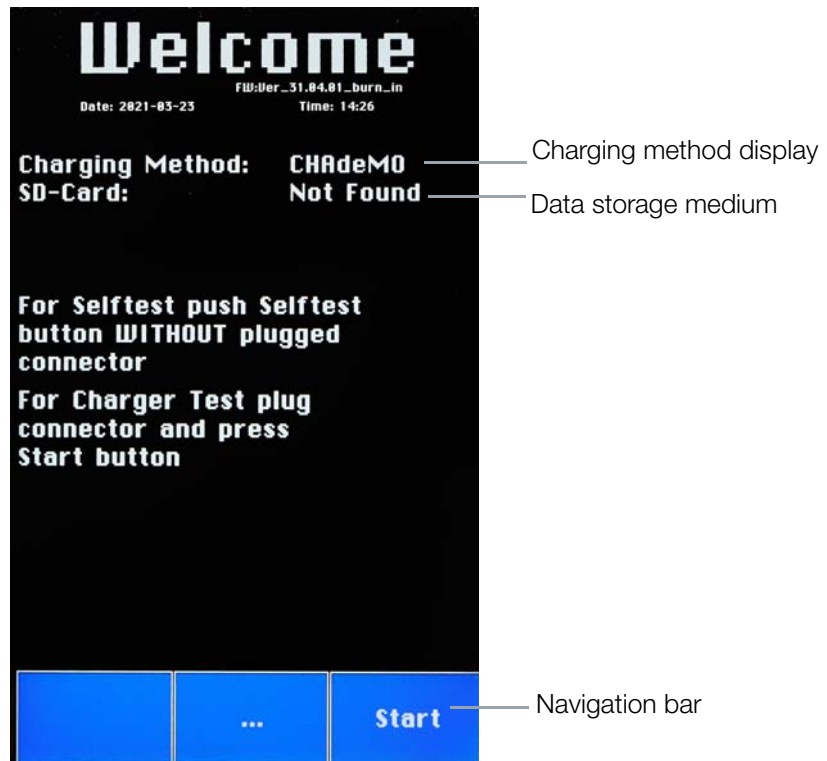


Figure 3: Initial Window at the Display Panel

Navigation Bar, Right	Function
Start	Initiate action

Navigation Bar, Middle	Submenu	Function
Continue		Acknowledge entry or continue action
...		Open submenu
	Self-test	Self-test for checking the voltage level of internal battery emulation
	Zero offset	Offset correction of the current and voltage sensors
	Settings	General settings

Navigation Bar, Left	Submenu	Function
Back		Return to the next higher menu level
Abort		Abort current action
Testcases		Set test parameters
	None	No parameters set
	HDC+	HDC+ measurement
	HDC-	HDC- measurement
	LDC+	LDC+ measurement
	LDC-	LDC- measurement
	PE-PP-CUT	PE-PP-Cut measurement
	CP-Short	CP-Short measurement

## 6.2 Settings Menu

General settings can be selected in the **Settings** menu.

✓ The **Settings** menu is selected. The currently selected standard is shown at the display.

1. Tap **Settings**.  
All available submenus are opened.
2. Tap the button for the desired submenu.  
↳ The desired submenu is displayed.



The following options are available:

Submenu	Function
Standards Priority	Specify standards sequence ⇄ 10
Format SD	Format the SD card ⇄ 11
Time Zone	Select a time zone ⇄ 11

### 6.2.1 Specifying the Standards Sequence

The order of the standards which are required for the EVSE can be changed in the **Standards Priority** submenu.

✓ The **Standards Priority** submenu is selected.

1. Tap the button for the desired standard or sequence of standards.  
↳ The desired standard or sequence of standards is set.



The following options are available:

Submenu	Function
DIN only	Only the DIN standard is displayed.
ISO only	Only the ISO standard is displayed.
DIN first, ISO second	The DIN standard is displayed first and the ISO standard is displayed second.
ISO first, DIN second	The ISO standard is displayed first and the DIN standard is displayed second.

### 6.2.2 Formatting the SD Card

The SD card can be formatted after opening the **Format SD** submenu.

1. Select the **Format SD** submenu.  
A security prompt is displayed:  
**Do you really want to format the SD card?**
  2. Tap **Abort** in order to cancel the operation.  
Tap **Continue** in order to acknowledge formatting.
- ↳ Die SD card is formatted. The operation may take several minutes.

### 6.2.3 Selecting a Time Zone

The displayed time zone can be changed in steps of one hour in the **Time Zone** submenu.

- ✓ The **Time Zone** submenu is selected.
1. Tap **→** to set the time zone ahead by one hour.  
Tap **←** to set the time zone back by one hour.  
Tap **Summertime** in order to switch to daylight saving time.  
Tap **Wintertime** in order to switch to standard time.
- ↳ The desired time zone is set.



### 6.3 Offset Correction

Offset correction of the current and voltage sensors can be executed in the **Zero Offset** submenu.

- ✓ The tester is connected to the power supply.
  - ✓ No chargers or other connectors are connected to the tester.
1. Select **Zero Offset**.
  2. Tap **Start**.  
A message is displayed:  
**Be sure to unplug the EVSE connector before starting a self-test or calibration!**
  3. Make sure that no chargers are connected to the tester.
  4. Tap **CONTINUE**.



#### Attention!

Danger of electric shock!  
Do not touch the inlets.

A warning is displayed:

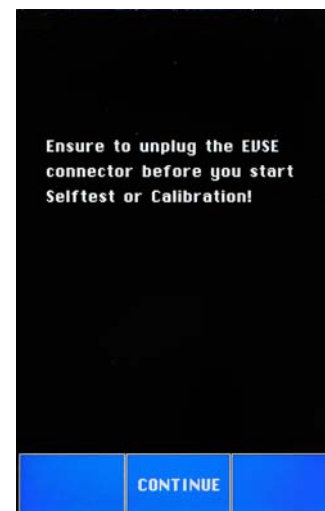
**High Voltage! Don't touch the inlets. Risk of electrical shock!**

Testing is executed and stops automatically after a few seconds.

In the event of successful offset correction: **DONE** appears.

In the event of unsuccessful offset correction: **Failed** appears.

5. Tap **Continue** in order to exit offset correction.



## 6.4 Self-Test

Offset correction of the current and voltage sensors can be executed in the **Zero Offset** submenu.

✓ The tester is connected to the power supply.

Testing can be executed in the **Self-Test** menu in order to determine whether or not the voltage level for internal battery emulation is correct.

✓ The tester is connected to the power supply.

✓ No chargers or other connectors are connected to the tester.

1. Select **Self-Test**.

2. Tap **Start**.

A message is displayed:

**Be sure to unplug the EVSE connector before starting a self-test or calibration!**

3. Make sure that no chargers are connected to the tester.

4. Tap **CONTINUE**.

Testing is executed and stops automatically after a few seconds.

**PASSED** appears.

5. Tap **Continue** in order to exit the self-test.





## 7 Toolbox Software

All measurement results and time information for completed tests are saved to the tester's SD card. These data can be visualized with **Toolbox** software and read out for transfer to a PC or notebook.



### Note!

No tests can be performed with the instrument while you're working with **Toolbox**.

### 7.1 Using Toolbox

#### 7.1.1 Downloading and Installing Toolbox

You can register your instrument and download related software in the personal area of **myGMC**. Information regarding installation and use of **Toolbox** can be found in the online manual.

1. Access the website at <https://www.gmc-instruments.de/services/mygmc/>.
2. Create a **myGMC** account.
3. Register your instrument in the personal area of **myGMC**.  
A download link for **Toolbox** software is made available in the personal area of **myGMC**.
4. Click the download link.  
**Toolbox** software and a file (ComemsoToolboxHelp.chm) are downloaded.
5. Click the ComemsoToolboxHelp.chm file.  
The online manual opens.

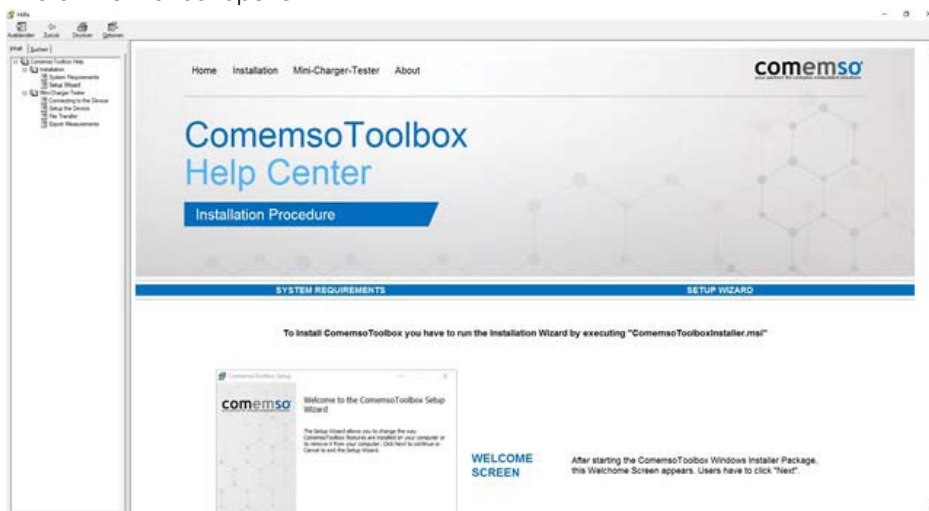


Figure 4: Online Manual for Toolbox Software

6. Install **Toolbox** as described in the online manual.  
↳ The software is installed and can be used.

#### 7.1.2 Connecting Toolbox to the Tester



### Note!

Be sure to execute the work steps in the correct order. Switch the tester on first, and then connect the cable. If you perform these steps in reverse order, the tester is started in the bootloader mode which is used to update the firmware.

1. Switch the tester on.
2. Connect the USB-B port labelled **Service** on the tester to a USB-B cable.
3. Connect the USB cable to your PC or notebook.
4. Start **Toolbox**.
5. At the software's user interface, select the computer COM port to which you have connected the USB cable.
6. Click **Connect to Device**.  
↳ The tester is connected to **Toolbox**.

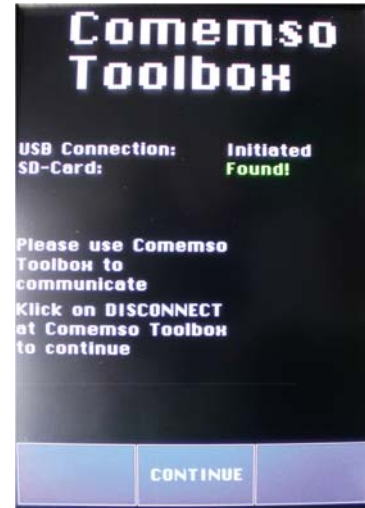
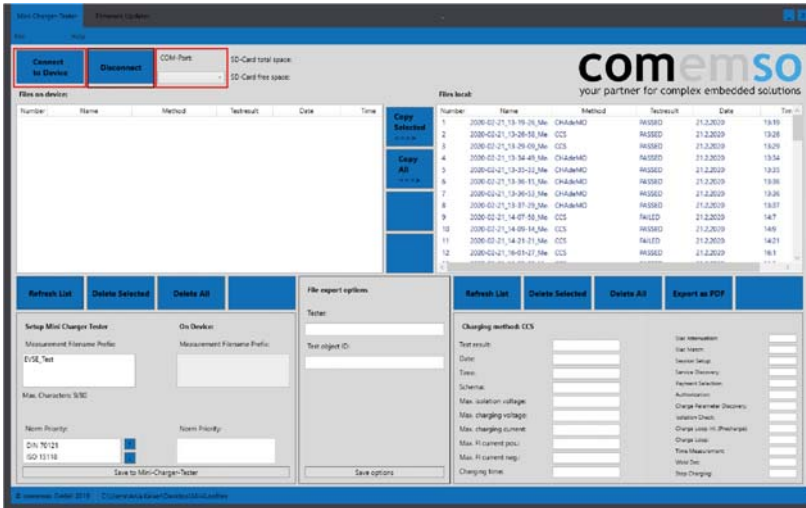


Figure 5: Toolbox User Interface, Confirmation of Connection at the Tester's Display Panel

### 7.1.3 Disconnecting Toolbox from the Tester

1. Click **Disconnect** in **Toolbox**.
- ↳ The connection between the tester and **Toolbox** is terminated.

### 7.1.4 Updating the Firmware

Follow the instructions provided by **Toolbox** in order to update the firmware:

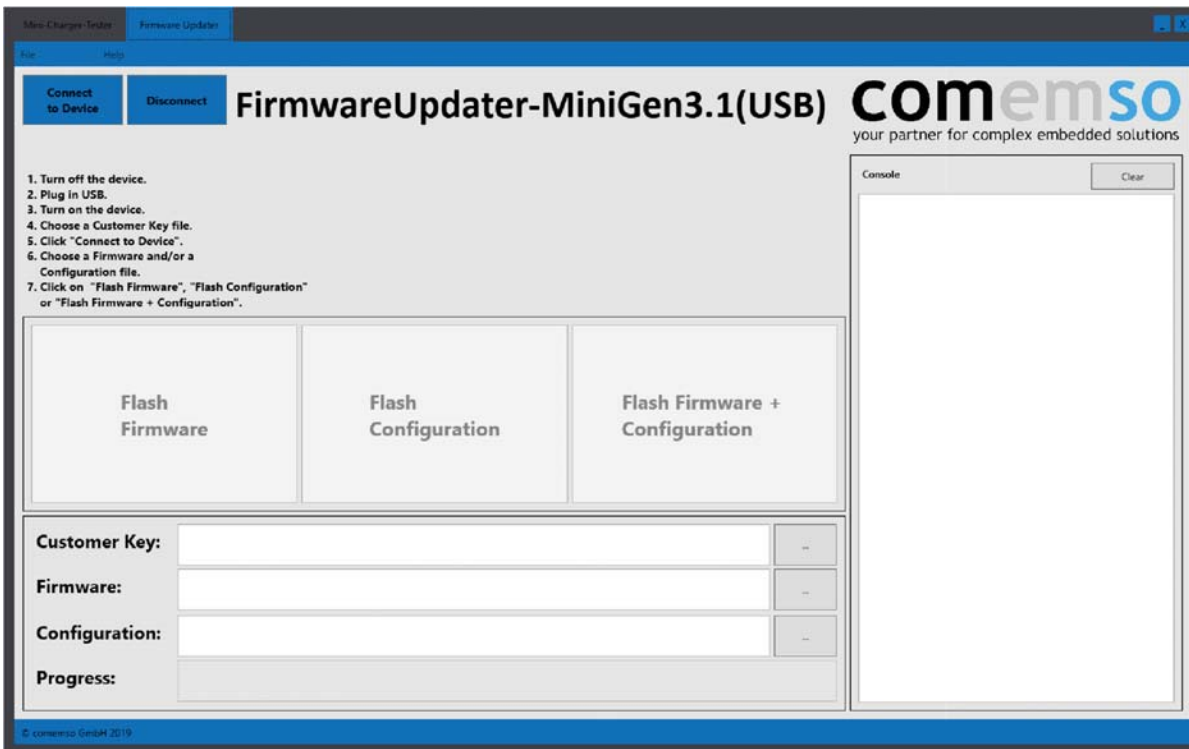


Figure 6: Toolbox Firmware Updater

## 8 Initial Startup

### 8.1 Inserting the SD Card

1. Remove the screws from the SD card slot cover and lift the cover off.
2. Insert a formatted SD card.
3. Set the cover onto the SD card slot and secure it with the screws.

### 8.2 Inserting the Battery

The tester's internal clock is powered by a battery. Use a battery as specified in the technical data. ⇨ "Technical Data" 

1. Open the battery compartment lid.
2. Insert the battery.
3. Close the battery compartment lid.

### 8.3 Connecting the Power Supply

Power is supplied by a 100/240 V AC power pack with fuse and mains switch.

1. Arrange the tester such that it's freely accessible with the user interface pointing upwards.
2. Connect the power pack's plug to the connector socket on the tester.
3. Connect the power pack to a mains outlet.



#### Note!

The PROFITEST H+E XTRA and the PROFITEST H+E XTRA C can also be connected to a car cigarette lighter via a 12 V DC to 230 V AC inverter (not included). An inverter with a power rating of at least 1 kW and a purely sinusoidal signal is recommended.

### 8.4 Preparing for Measurement

The measurement setups must be connected correctly in order to obtain reliable test results and to prevent injury to persons and damage to equipment.

#### 8.4.1 Preparing the CCS Connection for Measurement



#### Attention!

Danger of electric shock!

CHAdEMO and CCS charging stations may not be tested simultaneously. For this reason, the inlet cover on the tester only permits access to one of the two inlets at any given time.

Do not remove the cover!

1. Slide the inlet cover to its upper position.
- ↳ The CCS inlet is accessible. The CHAdEMO inlet is covered.  
The protocol for testing with CCS is selected automatically.

#### 8.4.2 Preparing the CHAdEMO Connection for Measurement (XTRA C only)



#### Attention!

Danger of electric shock!

CHAdEMO and CCS charging stations may not be tested simultaneously. For this reason, the inlet cover on the tester only permits access to one of the two inlets at any given time.

Do not remove the cover!

1. Slide the inlet cover to its bottom position.
- ↳ The CHAdEMO inlet is accessible. The CCS inlet is covered.  
↳ The protocol for testing with CHAdEMO is selected automatically.

### 8.5 Switching the Tester On

- ✓ CCS or CHAdEMO is selected.

1. Set the **0/I** switch to the **I** position in order to turn the tester on.
- ↳ The initial screen appears.

## **8.6 Switching Between CCS and CHAdeMO (XTRA C only)**

1. Press the **Lock/Unlock** key in order to remove the charging gun.
2. Remove the charging gun associated with the now unwanted connection type.
3. Set the **O/I** switch to the **O** position in order to turn the tester off.
4. Slide the inlet cover to the desired new position.
5. Set the **O/I** switch to the **I** position in order to turn the tester back on again.
6. Connect the tester to the charging gun of the desired new connection type.

## 9 Measuring and Testing

### 9.1 General



#### Attention!

Electric shock!  
Never unplug connector plugs during charging.



#### Attention!

Damage to the tester's electronics!  
Do not reverse the polarity.



#### Attention!

Do not use the tester in the rain!  
Never plug in wet connector plugs.



#### Attention!

Data loss!  
Always create a backup copy of your measurement data.



#### Attention!

Overheating!  
If the housing's temperature exceeds 70 °C, the system is switched off automatically. The **Overtemperature** LED lights up red.  
Leave the tester on for active cooling in order to speed up the cooling process. As soon as the LED goes out, the tester can be used again.

### 9.2 Range of Applications

The following measurements can be performed with the tester:

	PROFITEST H+E XTRA	PROFITEST H+E XTRA C	PROFITEST H+E XTRA or PROFITEST H+E XTRA C in Combination with PROFITEST PRIME
<b>Testing the functional performance of charging stations</b>			
DC-CCS	x	x	
AC		x	
CHAdemo		x	
PE-PP-Cut and CP-Short		x	
<b>Testing of the effectiveness of protective measures at electric charging stations</b>			
$R_{LO}$ – measurement of low-resistance protective conductor continuity			x
$Z_{LOOP}$ – measurement of DC-loop resistance $Z_{LOOP}$			x
IMD – testing of selected limit values in combination with the electrical system			x

Table 7: Measurements with the PROFITEST H+E XTRA and the PROFITEST H+E XTRA C

The tester checks the charging station’s functional performance, not its compliance with the standard. In order to obtain reliable test results, make sure that the charging station complies with the standard.

A charging station which doesn’t comply with the standard can lead to the following discrepancies during testing:

The tester may respond more tolerantly or more strictly within the standard than the EV. And thus charging an EV with an EVSE might work, whereas testing the same charging station with the tester might not.

### 9.3 Measurements at DC-CCS Charging Stations

#### 9.3.1 Test Setup

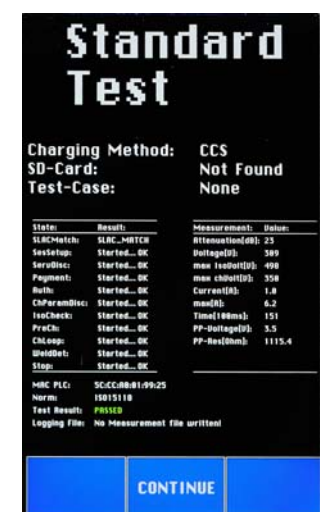
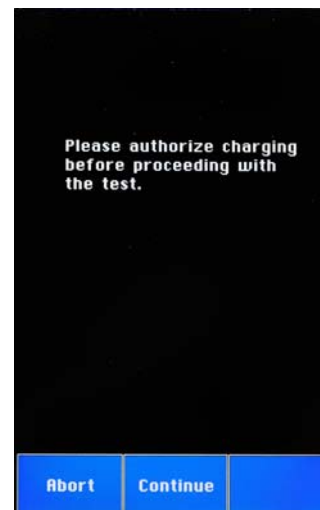
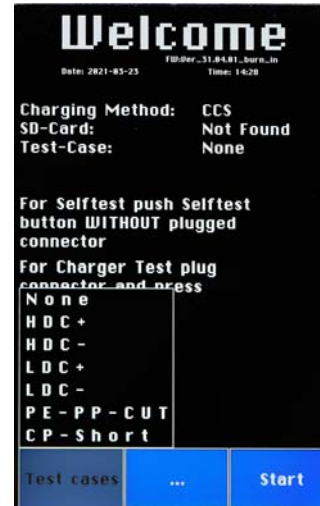
- ✓ The charging station is switched on.
  - ✓ The tester is connected to the power supply.
  - ✓ The tester is switched on.
  - ✓ The initial screen appears.
1. Insert a charging gun with CCS plug into the CCS inlet.  
The LED on the **Lock/Unlock** key lights up green.  
Press **Lock/Unlock** in order to unlock the charging gun.



**Note!**

The charging gun is automatically locked during the test procedure and cannot be pulled out.

2. Tap ... .
3. Tap **Settings**.
4. Tap **Standards Priority**.
5. Select the desired standard or sequence of standards (see section 6.2.1 on page 10).
6. Tap **Testcases** and select **None**.
7. Tap **Start**.
8. Tap **Continue**.  
The following message appears at the display panel:  
**Please authorize charging before proceeding with the test.**
9. Authorize yourself at the charging station.  
The function test is started.  
The various steps of the test procedure and information concerning the test are displayed.  
The tester simulates an EV with DC load and DC source. The charging process stops automatically after a few seconds.  
The measurement results are displayed.
10. Tap **CONTINUE** in order to return to the main menu.



### 9.3.2 Measurement Results Display

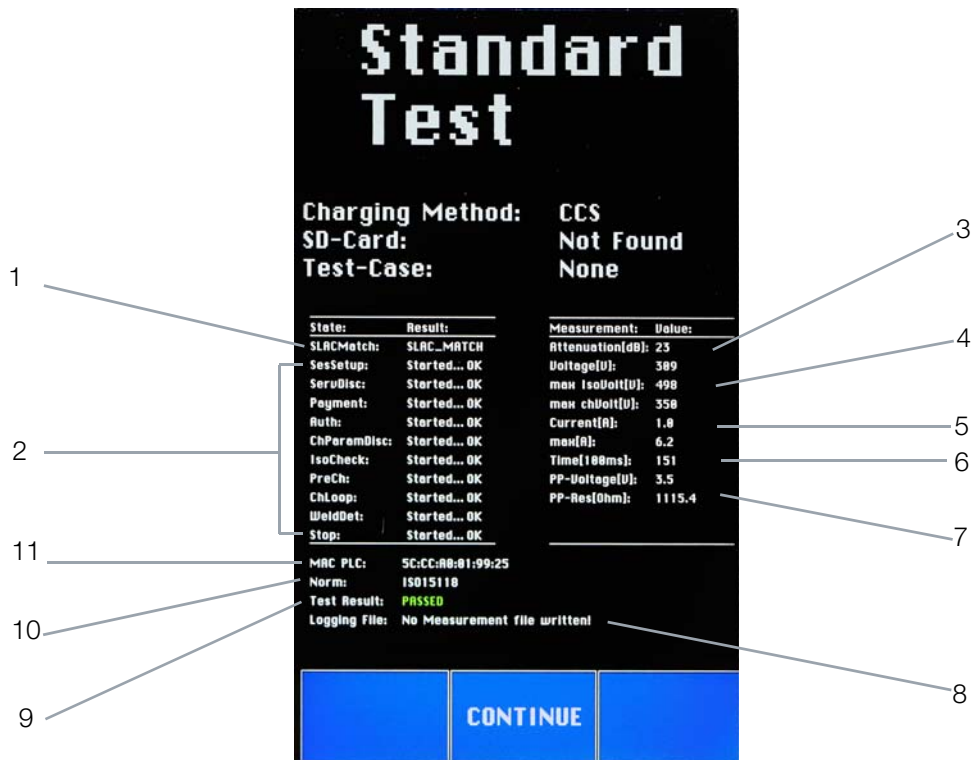
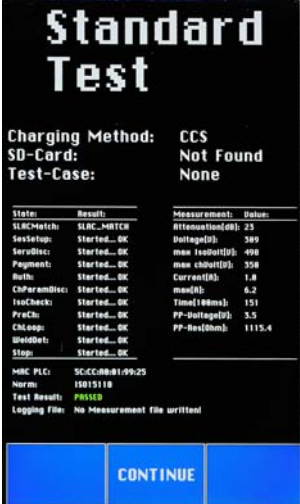
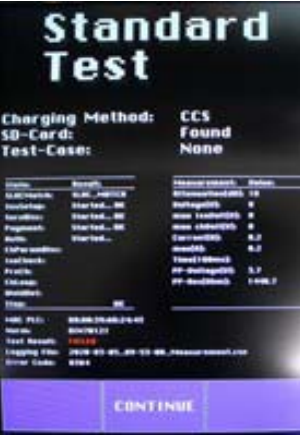


Figure 7: Measurement Results at the Display Panel

No.	Display	Meaning
1	SLAC-Match	<b>SLAC-Match</b> means that the tester is connected to a charging station. This query serves the purpose of communication before the actual test in order to establish connection to the charging station, after which testing of the charging station is started.
2	SesSetup, ServDisc, Payment, Auth, ChParamDisc, IsoCheck, PreCh, ChLoop, WeldDet, Stop	Indicates executed DC-CCS test phases. Green: The corresponding test phase has been successfully completed. Any given test has only been successfully completed if <b>PASSED</b> appears at the display.
3	Attenuation [dB]	Signal strength along the communication path Attenuation during SLAC may not exceed 45 dB. In the event of attenuation of greater than 45 dB: determine whether or not any damaged cables or interfering factors are located within the measuring environment and make sure that the PLC modem in the charging station is correctly connected to the CP signal.
4	Voltage [V]	Voltage
	Max. IsoVolt [V]	Maximum voltage during the insulation test
	Max. IsoVolt [V]	Maximum voltage during the charge loop
5	Current [A]	Actual DC current during the charging process
	max [A]	Maximum charging current during the entire charging process
6	Time [100ms]	Time after which the charging process was completed. The time is set to 0 before ChargeLoop starts.
7	PP-Voltage [V]	Voltage measured at the PP signal
	PP-Res [Ohm]	Resistance is calculated based on voltage measured at the PP signal. This value depends on the manufacturer. Take this value from the standard.
8	Logging File	Log file in which the test results are stored
9	Test Result	Test results
10	Standard	The standard in accordance with which the test is performed is displayed here. These settings can be changed in the settings menu (see section 6.2.1 on page 10).
11	MAC PLC	MAC address of the connected charging station

### 9.3.3 Test Results

Test Result	Explanation	Screenshot
<p>PASSED</p>	<ul style="list-style-type: none"> <li>– Load during ChargeLoop (charging process) is greater than 3 A.</li> <li>– The charging station functions and, in principle, the EV can draw current.</li> </ul>	
<p>FAILED</p>	<p>The tester can't be charged during the ChargeLoop (no power during DC charging) or the simulation is interrupted prior to the ChargeLoop.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> <li>– The EVSE/charger is faulty. Refer to the table in section 10.4.1 with regard to troubleshooting.</li> <li>– The tester is faulty. Refer to the table in section 10 with regard to troubleshooting.</li> </ul> <p>The test result is <b>FAILED</b> although the test was fully completed:</p> <ul style="list-style-type: none"> <li>– No error code is displayed.</li> <li>– Too little current (see Current [A] max).</li> <li>– Check the charging station's power supply.</li> </ul>	



### 9.3.4 Insulation Fault Injection

Insulation fault injection is an EVSE safety test for checking the detection of insulation faults. This function can be selected at the display panel.

Insulation fault injection is only possible with DC-CCS. Insulation fault injection is not possible for CHAdeMO because there's no PE between the charger and the EV (in accordance with the specification).

- ✓ The charging station is switched on.
- ✓ The tester is connected to the power supply.
- ✓ The tester is switched on.
- ✓ The initial screen appears.

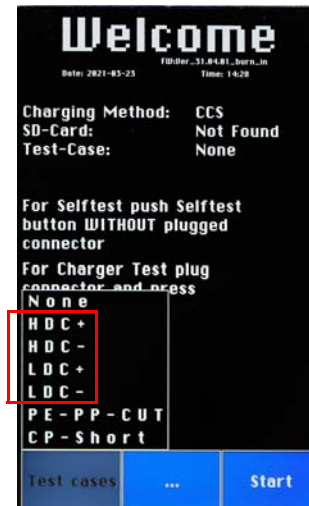
1. Insert a charging gun with CCS plug into the CCS inlet.  
The LED on the **Lock/Unlock** key lights up green.  
Press **Lock/Unlock** in order to unlock the charging gun.



#### Note!

The charging gun is automatically locked during the test procedure and cannot be pulled out.

2. Tap **Testcases** and select the desired test parameter (**HDC+**, **HDC-**, **LDC+** or **LDC-**).
3. Tap **Start**.
4. Tap **CONTINUE**.  
The following message appears at the display panel:  
**Please authorize charging before proceeding with the test.**
5. Authorize yourself at the charging station.  
The function test is started.  
The various steps of the test procedure and information concerning the test are displayed.  
The tester simulates an EV with DC load and DC source. The charging process stops automatically after a few seconds.  
The tested ISO value appears at the tester's display panel. The value is not listed in the CSV test report.
6. Tap **CONTINUE** in order to return to the main menu.



## 9.4 Measurements at AC Charging Stations (XTRA C only)

### 9.4.1 Test Setup and Measurement Results

- ✓ The charging station is switched on.
- ✓ The tester is connected to the power supply.
- ✓ The tester is switched on.
- ✓ The initial screen appears.

1. Tap **Start**.

2. Tap **CONTINUE**.

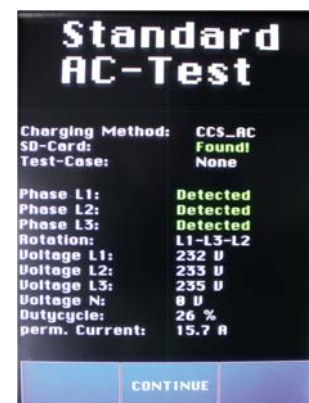
The following message appears at the display panel:  
**Please authorize charging before proceeding with the test.**

3. Authorize yourself at the charging station.

The function test is started.

The tester measures the voltage values of all three phases and N. The duty cycle indicates maximum power that can be supplied by the charging station. The **perm. Current** value is calculated from this value.

4. Tap **CONTINUE** in order to return to the main menu.



## 9.5 Testcases PE-PP-Cut and CP-Short (XTRA C only)

The PROFITEST H+E XTRA C additionally includes testcases PE-Cut and CP-Short. PE-PP-Cut and CP-Short can be executed with AC and DC-CCS.

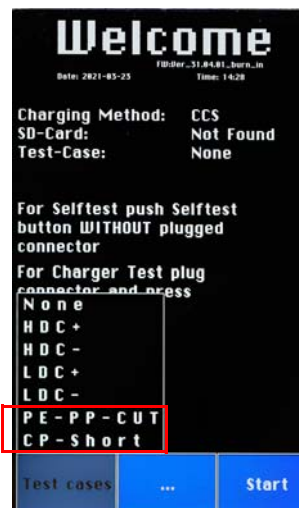
- ✓ The charging station is switched on.
  - ✓ The tester is connected to the power supply.
  - ✓ The tester is switched on.
  - ✓ The initial screen appears.
1. Insert a charging gun with CCS plug into the CCS inlet.  
The LED on the **Lock/Unlock** key lights up green.  
Press **Lock/Unlock** in order to unlock the charging gun.



### Note!

The charging gun is automatically locked during the test procedure and cannot be pulled out.

2. Tap ... .
3. Tap **Settings**.
4. Tap **Standards Priority**.
5. Select the desired standard or sequence of standards (see section 6.2.1 on page 10).
6. Tap **Testcases** and select **PE-PP-Cut** or **CP-Short**.
7. Tap **Start**.
8. Tap **CONTINUE**.  
The following message appears at the display panel:  
**Please authorize charging before proceeding with the test.**
9. Authorize yourself at the charging station.  
The function test is started.  
The various steps of the test procedure and information concerning the test are displayed.  
CP Short switches directly to PE.  
PE-Cut interrupts the PE connection.  
In both cases, the charging station is expected to detect the error and interrupt the charging process.
10. Tap **CONTINUE** in order to return to the main menu.



## 9.6 Measurements at CHAdeMO Charging Stations (XTRA C only)

### 9.6.1 Test Setup

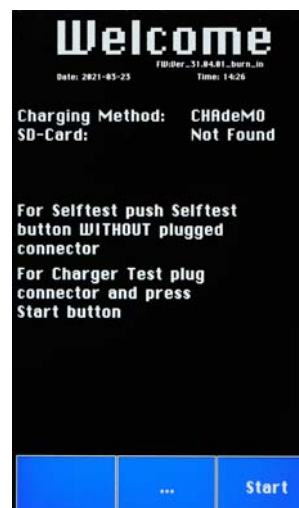
- ✓ The charging station is switched on.
  - ✓ The tester is connected to the power supply.
  - ✓ The tester is switched on.
  - ✓ The initial screen appears.
1. Insert a charging gun with CHAdeMO plug into the CHAdeMO inlet.  
The LED on the **Lock/Unlock** key lights up green.  
Press **Lock/Unlock** in order to unlock the charging gun.



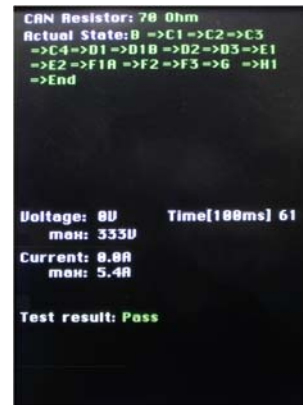
### Note!

The charging gun is automatically locked during the test procedure and cannot be pulled out.

2. Tap ... .
3. Tap **Settings**.
4. Tap **Standards Priority**.
5. Select the desired standard or sequence of standards (see section 6.2.1 on page 10).
6. Tap **Start**.



7. Tap **CONTINUE** at the tester.  
The following message appears at the display panel:  
**Please authorize charging before proceeding with the test.**
8. Authorize yourself at the charging station.  
↳ The function test is started.  
The various steps of the test procedure and information concerning the test are displayed.  
The tester simulates an EV with DC load and DC source. The charging process stops automatically after a few seconds.  
The measurement results are displayed.



### 9.6.2 Measurement Results Display

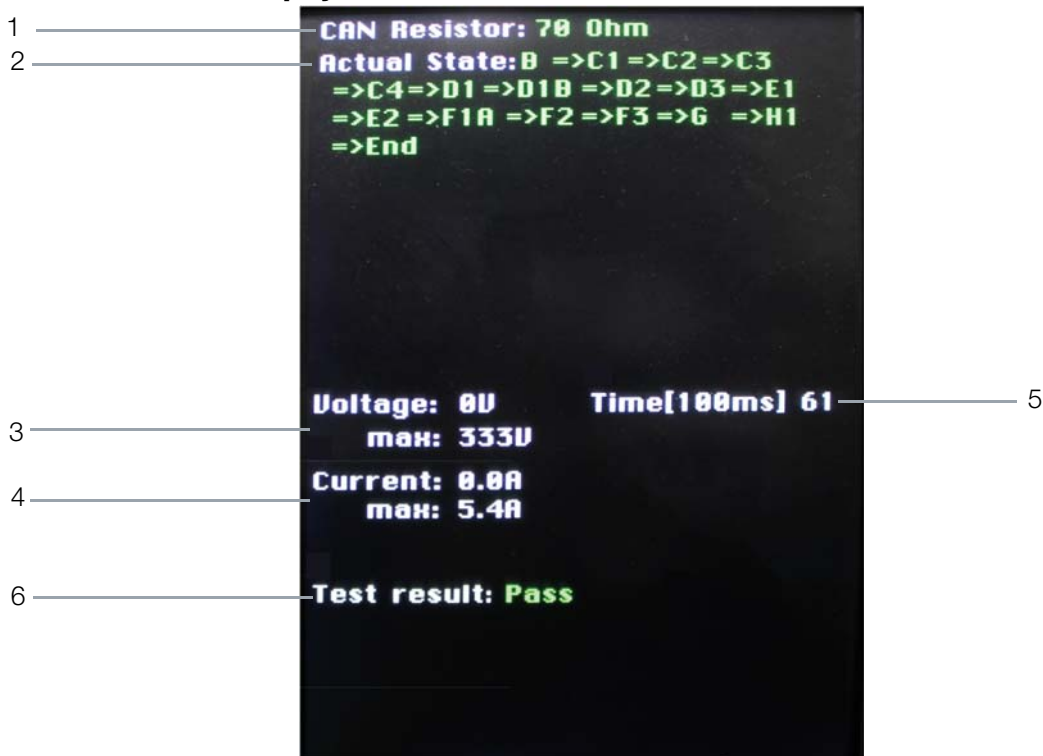




Figure 8: CHAdeMO, Measurement Results Display

No.	Display	Meaning
1	<b>CAN Resistor</b>	CAN resistor for CAN communication Setpoint: ~ 60 Ω (± 10 Ω) If the tester is started without connecting the CHAdeMO plug, this value is ~120 Ω and indicates the tester's instead of the charging station's resistance.
2	<b>Actual State</b>	States overview of the CHAdeMO protocol Green states: States in correct order Red states: States in wrong order or an unknown state prevails (signal combination which isn't described in the CHAdeMO specification)
3	<b>Voltage</b>	Actual DC voltage during the charging process
	<b>max</b>	Maximum DC voltage during the entire charging process (except insulation test voltage)
4	<b>Current</b>	Actual DC current during the charging process
	<b>max</b>	Maximum charging current during the entire charging process
5	<b>Time [100ms]</b>	Time after which the charging process was completed.
6	<b>Test Result</b>	Test results

### 9.6.3 Test Results

Test Result	Explanation	Screenshot
<p><b>PASSED</b></p>	<ul style="list-style-type: none"> <li>- DC load in state E2 (charging) is greater than 3 A.</li> <li>- The charging station functions and, in principle, the EV can draw current.</li> </ul> <p>All state errors after state E2 are ignored as far as the results are concerned. Errors after state E2 indicate that it's possible to charge with the charging station, but the charging station makes a shut-down error.</p>	
<p><b>FAILED</b></p>	<p>The tester can't be charged during E2 (no power during DC charging) or the simulation is interrupted prior to state E2.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> <li>- The EVSE/charger is faulty. Refer to the table in section 10.4.2 with regard to troubleshooting.</li> <li>- The tester is faulty. Refer to the table in section 10 with regard to troubleshooting.</li> </ul>	

## 9.7 Measurements in Combination with the PROFITEST PRIME

The effectiveness of protection against electric shock and protection by means of automatic shutdown at AC/DC charging stations in the event of overcurrent can be verified by the PROFITEST H+E XTRA or the PROFITEST H+E XTRA C in combination with the PROFITEST PRIME.

- Measurement of low-resistance protective conductor continuity
- Measurement of DC loop resistance (internal resistance or  $Z_{LOOP}$ )
- Testing of the IMD's triggering threshold, shutdown in the event that specified limit values are exceeded
- Insulation measurement between two DC charging stations
- Touch voltage measurement
- Residual voltage measurement









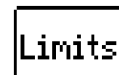

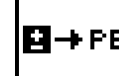




Qualified electricians can use the PROFITEST PRIME to perform all of the necessary measurements in this regard, in consideration of all safety precautions.

Measuring inputs in the form of 4 mm safety sockets are provided on the front of the PROFITEST H+E XTRA/PROFITEST H+E XTRA C adapter for measuring and checking the required functions.

The measurement results are displayed at the display panel on the PROFITEST PRIME. Read and observe the operating instructions for the PROFITEST PRIME for detailed information on working with the instrument.

### 9.7.1 PROFITEST PRIME User Interface

Measurements for checking the effectiveness of protective measures of charging stations are performed with the PROFITEST PRIME. The PROFITEST H+E XTRA or PROFITEST H+E XTRA C tester assumes the function of an adapter in this case. Parameters are configured and measurement is performed using the control keys and the rotary function switch on the PROFITEST PRIME. Descriptions of the most important controls and displays for navigating through the menu of the PROFITEST PRIME are provided below. Read and observe the operating instructions for the PROFITEST PRIME for detailed information on working with the instrument.

Illustration	Designation	Function
	Rotary selector switch	Rotary selector switch for selecting measuring functions
	ESC	Return from the submenu
	MEM	Access the memory structure Measurement can be stopped by pressing the <b>MEM</b> key.
	HELP	The following information can be displayed for each switch position and basic function after it has been selected with the rotary selector switch: wiring diagram, measuring range, nominal range of use and measuring uncertainty, as well as nominal value
	ON/START	The measuring sequence for the function selected in the menu is started by pressing this key on the control panel. Exception: voltage measurement U or Ures.
	$I_{\Delta N} / I$	The following sequences are triggered by pressing this key on the control panel: <ul style="list-style-type: none"> <li>Starts the tripping test after measurement of touch voltage for RCCB testing (<math>I_{\Delta N}</math>).</li> <li>The <b>ROFFSET</b> measurement is started within the <math>R_{LO}</math> function.</li> </ul>
	ROFFSET ON/OFF	<b>ON</b> position: <b>ROFFSET</b> activated <b>OFF</b> position: <b>ROFFSET</b> deactivated
	SAVE VALUE	Press briefly: the display is switched to the memory menu or the structure view, where the desired storage location has to be selected. Press and hold: The measured value is saved to the most recently used location in the structure diagram.
	LIMITS	Opens the limit value settings menu.
	tON	Opens the test duration settings menu.
	POL/PE	Opens the test signal settings menu.
	$R_{LO}$ LIMITS EDIT	Switches back and forth between the menu for the freely adjustable range and the menu for the automatically calculated value
	Increase test resistance	Increases test resistance
	Reduce test resistance	Reduces test resistance
	MW/PA	Switches from the measured values display to the measurement parameters display

## 9.8 Measurement Setup and Procedure in Combination with the PROFITEST PRIME

- ✓ The PROFITEST H+E XTRA or the PROFITEST H+E XTRA C and the PROFITEST PRIME are switched on.
  - ✓ The charging gun is plugged into the PROFITEST H+E XTRA/PROFITEST H+E XTRA C.
1. Connect the measuring probes to the sockets on the PROFITEST PRIME in accordance with the test setup.
  2. Connect the measuring probes to the measuring inputs (4 mm safety sockets) on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C.
  3. Select the type of measurement using the rotary selector switch on the PROFITEST PRIME.
  4. Tap **Start** on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C.
  5. Tap **CONTINUE** on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C.  
The following message appears at the display panel on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C:  
**Please authorize charging before proceeding with the test.**
  6. Authorize yourself at the charging station.  
The test procedure is started at the PROFITEST H+E XTRA/PROFITEST H+E XTRA C.

### Note!

Observe the measurement display at the PROFITEST H+E XTRA/PROFITEST H+E XTRA C. Measurement cannot be activated at the PROFITEST PRIME until voltage and current from the charging station are switched on and displayed at the display panel. Measuring time at the PROFITEST H+E XTRA/PROFITEST H+E XTRA C amounts to no more than 25 seconds.

7. As soon as the values for voltage [V] and current [A] are displayed at the display panel on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C, press the **ON/START** key on the PROFITEST PRIME.
- ↳ The measured values for the measurement type selected at the PROFITEST PRIME appear at the display panel on the PROFITEST PRIME.

## 9.9 $R_{LO}$ 0.2 A – Measuring Low-Value Resistance with 0.2 A Test Current

### 9.9.1 General

In accordance with IEC 60364-6/DIN VDE 0100-600, the continuity of protective conductors (including the equipotential bonding conductor via the main grounding busbar and the additional equipotential bonding conductor) and active conductors in final ring circuits must be tested.

#### Measuring Method

Continuity of conductors is ascertained by means of a constant test current and voltage drop at the device under test.

### Note!

If direct voltage is used as the test voltage, DIN EN 61557-4 specifies performance of the measurement with polarity reversal. And thus measurement must be performed with (automatic) polarity reversal of the measuring voltage or with the flow of current first in one direction (+ pole to PE) and then in the other (– pole to PE).

### 9.9.2 Selecting the Measuring Function at the PROFITEST PRIME

1. Set the rotary selector switch to  $R_{LO}$  0.2A.



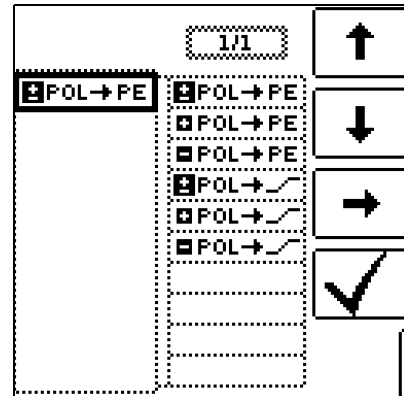
### 9.9.3 Invoking the Help Function at the PROFITEST PRIME

1. Press the **HELP** key in order to view the displays and information about the measurement.
2. After successful measurement: press the **HELP** key in order to display the corresponding cable lengths for different cable cross sections according to the measured value.
3. Press the **ESC** key in order to exit the help function.

## 9.9.4 Setting Parameters at the PROFITEST PRIME

### Setting the Test Signal

1. Press the **POL/PE** key.  
The settings menu for the test signal is displayed.
2. Use the **↑↓** keys to navigate and select the desired test signal.
3. Acknowledge your selection by pressing the **✓** key.

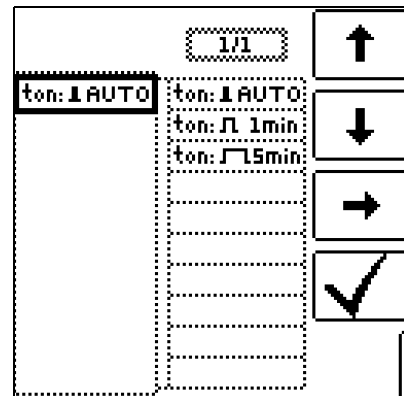


The following criteria are available for the test signal:

Symbol	Polarity	Symbol	Function
±	Automatic polarity reversal	POL→ PE	Constant
+	Positive		
-	Negative		
±	Automatic polarity reversal	POL→~	Ramp sequence
+	Positive		
-	Negative		

### Selecting a Test Duration

1. Press the **tON** key.  
The settings menu for test duration is displayed.
2. Use the **↑↓** keys to navigate and select the desired test duration.
3. Acknowledge your selection by pressing the **✓** key.

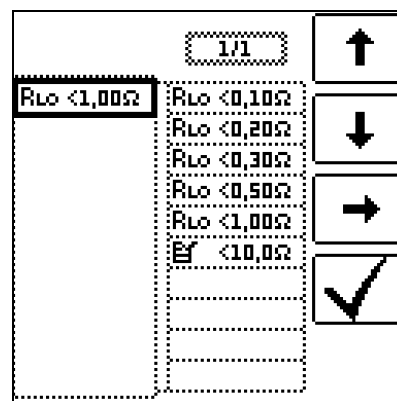


The following measuring times are available:

Display	Test Duration
<b>AUTO</b>	Measurement is ended after the measured value has been acquired. (Long-term measurement is possible by pressing and holding <b>ON/START</b> .)
<b>1 min</b>	Test duration of 1 minute
<b>5 min</b>	Test duration of 5 minutes

### Setting the Resistance Limit Value

1. Press the **Limits** key.  
The settings menu for test duration is displayed.
2. Use the **↑↓** keys to navigate and select the desired limit value.
3. Acknowledge your selection by pressing the **✓** key.  
↳ The limit value is displayed above the measured value.



The following limit values are available:

Display	Limit Value
$R_{LO} < 0.10 \Omega$	Resistance limit value: $< 0.10 \Omega$
$R_{LO} < 0.20 \Omega$	Resistance limit value: $< 0.20 \Omega$
$R_{LO} < 0.30 \Omega$	Resistance limit value: $< 0.30 \Omega$
$R_{LO} < 0.50 \Omega$	Resistance limit value: $< 0.50 \Omega$
$R_{LO} < 1.00 \Omega$	Resistance limit value: $< 1.00 \Omega$
$< 10.0 \Omega$	Resistance limit value: $< 10.0 \Omega$

If measured values occur which exceed the selected limit value, the red **UL/RL** LED lights up.

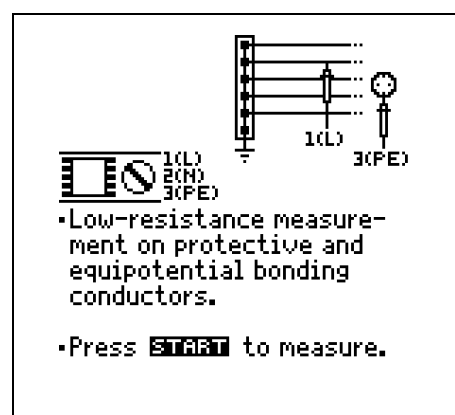
### 9.9.5 Measuring ROFFSET at the PROFITEST PRIME

#### Attention!

The low-resistance measurement may only be conducted at voltage free devices under test or system components. Contact the measuring point first and then start the measurement!

#### Connection

- Probe 1(L)
- Probe 3(PE)

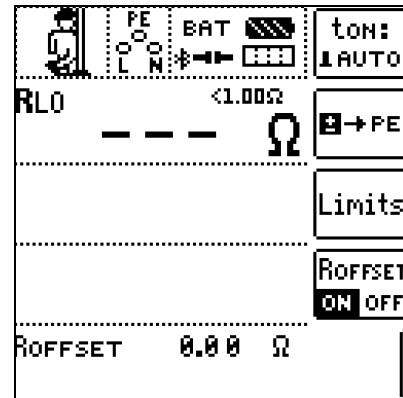


The **ROFFSET** function provides the user with the opportunity of deducting the resistance of extension cords in advance which are used in addition to the probe cables, in order to avoid distorted measurements. As a result of calibration, this value is deducted from the measurement result.



## Starting the Measurement

1. Press the **ROFFSET ON** key.  
The **ROFFSET** function is activated.  
**ROFFSET** = 0.00Ohm appears at the display.
2. Select the test signal with which you intend to conduct the measurement.
3. Short circuit the measurement cables.
4. Press the **I<sub>ΔN</sub>** key.  
An intermittent acoustic signal is generated and a warning is displayed.
5. Press the **ON/START** or **ESC** key in order to cancel the operation.
6. Press the **I<sub>ΔN</sub>** key again in order to start the operation.  
↳ Measurement is started.



- If the test signal is changed or the function is deactivated, the ascertained **ROFFSET** value is deleted.
- If an error message appears, the last acquired valid value is retained.
- As a result of the utilized 4-wire technology, resistance of the probe cables does not have to be calculated into the measurement results.

### **Note!**

If offset measurement is stopped upon appearance of a pop-up error window ( $R_{\text{offset}} > 10 \text{ W}$  or difference between  $R_{\text{LO}+}$  and  $R_{\text{LO}-} > 10\%$ ), the last measured offset value is retained. Inadvertent deletion of a previously ascertained offset value is thus practically ruled out. The respectively smaller value is otherwise stored to memory as an offset value. The maximum offset value is 10.0 W. Negative resistances may result due to the offset value.

### **Note!**

Extension cords: Only use this function when working with extension cords. When different extension cords are used, the above described procedure must always be repeated.

## 9.9.6 Measuring $R_{\text{LO}}$ 0.2 A at the PROFITEST PRIME

### **Attention!**

The low-resistance measurement may only be conducted at voltage free devices under test or system components. Contact the measuring point first and then start the measurement!

### **Attention!**

Measurement results may be distorted due to parallel connected impedances and equalizing current.

### **Attention!**

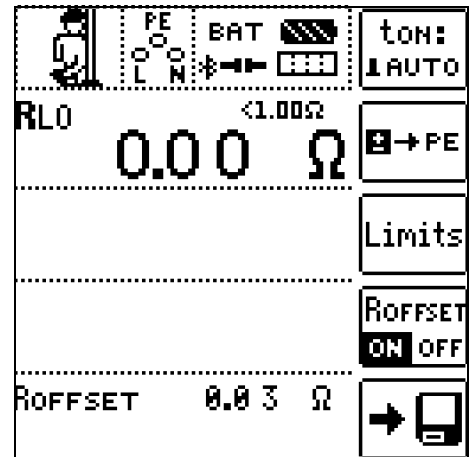
Observe correct sequence!

Always contact the DUT with the test probes before pressing the **ON/START** key. If the object is energized, measurement is automatically disabled.

If the DUT is not contacted until after the **ON/START** key has been pressed, the device fuse is blown.

**Starting the Measurement**

1. Press and hold the **ON/START** key.  
A long-term measurement is conducted.
2. Press the **SAVE VALUE** key in order to store the measurement results.



**Automatic Polarity Reversal**

After the measuring sequence has been started, the instrument performs the measurement with automatic polarity reversal, first with current flow in one direction, and then in the other. In the case of long-term measurement, polarity is switched once per second.

If the difference between  $R_{LO+}$  and  $R_{LO-}$  is greater than 10% with automatic polarity reversal,  $R_{LO+}$  and  $R_{LO-}$  values are displayed instead of  $R_{LO}$ . The respectively larger value,  $R_{LO+}$  or  $R_{LO-}$ , appears at the top and is saved to the database as the  $R_{LO}$  value.

The measured values are displayed after test time has elapsed in accordance with the following table:

Polarity Selection	Display	Condition
+ pole to PE	$R_{LO+}$	None
- pole to PE	$R_{LO-}$	None
± Pole to PE	$R_{LO}$	If $\Delta R_{LO} \leq 10\%$
	$R_{LO+}$ $R_{LO-}$	Where $\Delta R_{LO} > 10\%$

All four values are always saved:  $R_{LO}$ ,  $R_{LO+}$ ,  $R_{LO-}$  and  $R_{offset}$ .

**Evaluating Measurement Results**

Differing results for measurements in both directions indicate voltage at the DUT (e.g. thermovoltages or unit voltages).

Measurement results can be distorted by parallel connected impedances in load current circuits and by equalizing current, especially in systems which make use of "overcurrent protection devices" (previous neutralization) without an isolated protective conductor. Resistances which change during measurement (e.g. inductance), or a defective contact, can also cause distorted measurements (double display).

In order to assure unambiguous measurement results, causes of error must be located and eliminated.

In order to find the cause of the measuring error, measure resistance in both current flow directions.

The instrument's batteries are exposed to excessive stress during insulation resistance measurement. For measurement with current flow in one direction, only press and hold the **ON/START** key as long as necessary for the measurement.

**Note!**

Measuring Low-Value Resistance

Measurement cable and 2-pole measuring adapter resistance is compensated for automatically thanks to the 4-wire method and thus do not effect measurement results. However, if an extension cord is used its resistance must be measured and deducted from the measurement results. Resistances which do not demonstrate a stable value until after a "settling in period" should not be measured with automatic polarity reversal, but rather one after the other with positive and negative polarity. Examples of resistances whose values may change during measurement include:

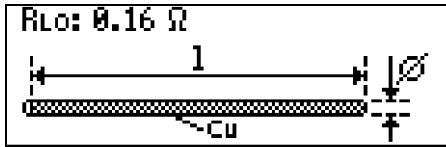
- Incandescent lamp resistance with changing values caused by warming due to measuring current
- Resistances with a large conductive component
- Contact resistance
- Line reactors

### Calculation of Cable Lengths for Common Copper Conductors

1. Press the **HELP** key after the resistance measurement.
  - ↳ The corresponding cable lengths for common cross-sections are calculated and displayed.

If results vary for the two different current flow directions, cable length is not displayed. In this case, capacitive or inductive components are apparently present which would distort the calculation.

This table only applies to cables made with commercially available copper conductors and cannot be used for other materials (e.g. aluminum).

R <sub>LO</sub> : 0.16 Ω			
			
Ø	l	Ø	l
[mm <sup>2</sup> ]	[m]	[mm <sup>2</sup> ]	[m]
0.14:	1	2.5:	20
0.25:	2	4.0:	32
0.50:	4	6.0:	48
0.75:	6	10.0:	80
1.00:	8	16.0:	127
1.50:	12	25.0:	199

### Evaluating Measured Values

See tables in section 14.1.1.

## 9.10 R<sub>LO</sub> 25 A – Measuring Low-Value Resistance with 25 A Test Current

### 9.10.1 General

#### Measuring Method

Continuity of protective conductor systems is determined by feeding a test current with line frequency and measuring the resultant voltage drop.

Testing must be conducted between the PE terminal and various points within the protective conductor system.

Due to the high amperage of the utilized test current, this type of measurement is above all suitable for precise continuity testing of especially low-resistance protective conductor systems, i.e. in the case of large cross-sections and/or short cable lengths.

This type of measurement necessitates mains auxiliary power and the mains switch must be set to the ON position.

Mains auxiliary power is checked to make sure it's right before measurement is started. Permissible line voltages are 115 and 230 V, and permissible line frequencies are 50 and 60 Hz.

### 9.10.2 Selecting the Measuring Function at the PROFITEST PRIME

1. Set the rotary selector switch to **R<sub>LO</sub> 25A**.



### 9.10.3 Invoking the Help function at the PROFITEST PRIME

1. Press the **HELP** key in order to view the displays and information about the measurement.
2. After successful measurement: press the **HELP** key in order to display the corresponding cable lengths for different cable cross sections according to the measured value.
3. Press the **ESC** key in order to exit the help function.

The measurement is aborted if voltage is present at the test probes when measurement is started.\* A corresponding error message appears at the display.

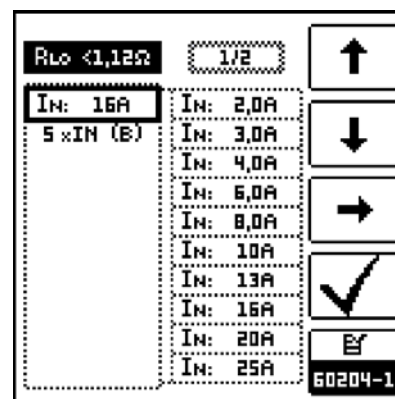
\* This warning might also appear if continuity of the protective conductor connection is impaired, because in this case external voltages have been capacitively induced.

### 9.10.4 Setting Parameters at the PROFITEST PRIME

The limit value for low-value resistance of the protective conductor to be measured is configured at this point.

The limit value can either be set as desired within a range of 0 to 9.99 Ω or calculated automatically according to the selected overcurrent protection device. Automatic calculation is based on the selected nominal current and the characteristics of the utilized overcurrent protection device.

If the limit value is exceeded, the **UL/RL LED** lights up red.



### 9.10.5 Setting the Limit Value at the PROFITEST PRIME

The limit value setting for protective conductor resistance is based on the cross-section of phase conductor L and, if applicable, neutral conductor N, and not the cross-section of protective conductor PE. This is necessary because cables with phase conductor cross-sections of greater than 16 square mm are equipped with protective conductors of reduced cross-section, and selection on the basis of protective conductor cross-section would not be unequivocal.

A rated current (nominal current) is assigned to the phase conductor cross-section for the respectively utilized overcurrent protection device (see table).

Due to the fact that according to DIN EN 60204-1 (VDE 0113-1): 2019-06-01 overcurrent protection devices with varying tripping characteristics are permissible for each phase conductor cross-section, different types are offered during limit value selection.

1. Press the **HELP** key in order to access the table.
2. Ascertain the phase conductor cross-section of your connector cable.
3. If applicable, check to see whether or not the nominal current of the utilized overcurrent protection device is allocated to the phase conductor cross-section.

If an overcurrent protection device with low nominal current is used, you can determine the limit value on the basis of the phase conductor current assigned to this nominal current.

4. Select the limit value according to nominal current and the tripping characteristics of the utilized overcurrent protection device.  
If your machine/system includes components with different power cable cross-sections (e.g. fans, pumps etc.), and if these are equipped with their own overcurrent protection devices, observe the following when testing the protective conductors of these components:

Select the limit value in accordance with the cable cross-section of these components or the overcurrent protection devices installed for them.

Limit value for PE test based on conductor cross-section and nominal current of the protective device.		
∅L[N]	∅PE	IN
1.5mm <sup>2</sup>	1.5mm <sup>2</sup>	16A
2.5mm <sup>2</sup>	2.5mm <sup>2</sup>	20A
4.0mm <sup>2</sup>	4.0mm <sup>2</sup>	25A
6.0mm <sup>2</sup>	6.0mm <sup>2</sup>	32A
10mm <sup>2</sup>	10mm <sup>2</sup>	50A
16mm <sup>2</sup>	16mm <sup>2</sup>	63A

[3/5]

Limit value for PE test based on conductor cross-section and nominal current of the protective device.		
∅L[N]	∅PE	IN
25mm <sup>2</sup>	16mm <sup>2</sup>	80A
35mm <sup>2</sup>	16mm <sup>2</sup>	100A
50mm <sup>2</sup>	25mm <sup>2</sup>	125A
70mm <sup>2</sup>	35mm <sup>2</sup>	160A
95mm <sup>2</sup>	50mm <sup>2</sup>	200A
120mm <sup>2</sup>	70mm <sup>2</sup>	250A

[4/5]

### Setting the Limit Value at the PROFITEST PRIME

1. Press the **LIMITS** key in order to open the menu for the limit value sitting.
2. Press the corresponding keys in order to navigate within the menu, and to select and acknowledge the parameters.
3. Press the **R<sub>LO</sub> LIMITS EDIT** key in order to switch back and forth between the menu for the freely adjustable range and the menu for the automatically calculated value.

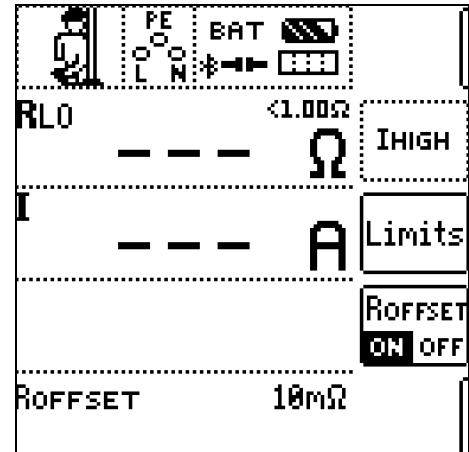
The **LIMITS** menu is exited and its mode is changed.

4. Press the **LIMITS** key again in order to return to the toggled menu.

### 9.10.6 Measuring ROFFSET at the PROFITEST PRIME

The **ROFFSET** function makes it possible to deduct the resistance of extension cords in advance which are used in addition to the probe cables, in order to avoid distorted measurement results. This value is deducted from the measurement result.

1. Press the **ROFFSET ON** key.  
The **ROFFSET** function is activated.  
**ROFFSET = 0.00Ohm** appears at the display.
2. Select the test signal with which you intend to conduct the measurement.
3. Then short circuit measurement cables.
4. Press the **I<sub>ΔN</sub>** key.  
An intermittent acoustic signal is generated and a warning is displayed.
5. Press the **ON/START** or **ESC** key in order to cancel the operation.
6. Press the **I<sub>ΔN</sub>** key again in order to start the operation.  
↳ Measurement is started.



### Test Duration – Measuring Times

Test duration is limited to 10 s. Use for intended purpose specifies at test duration of no more than 10 seconds and pause of at least 30 seconds. If this repetition rate is exceeded, the instrument may overheat in which case measurement is disabled.

### 9.10.7 Measuring R<sub>LO</sub> 25 A at the PROFITEST PRIME

#### Connection

- Probe 1 (L)
- Probe 3 (PE)



#### Note!

Mains auxiliary power is required for this type of measurement. The **0/I** switch must be set to I (on).



#### Attention!

Only perform measurements on voltage free system components.



#### Attention!

The measurement cables may not be rolled up.  
Be sure to fully extend the measurement cables before performing protective conductor testing.

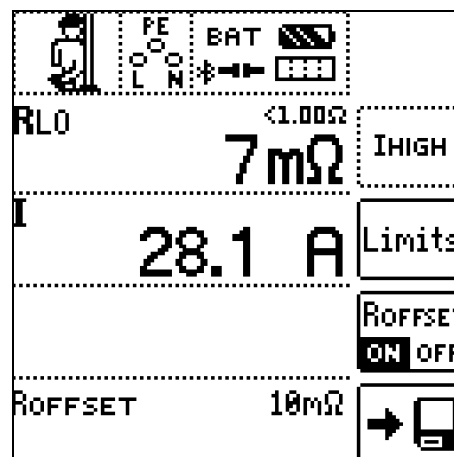


#### Attention!

Measurement results may be distorted due to parallel connected impedances and equalizing current.

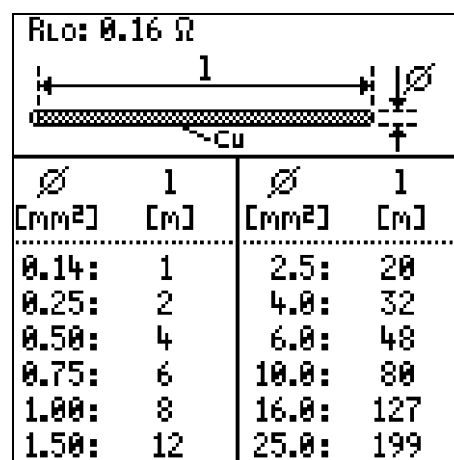
**Measuring Procedure**

- ✓ The parameters have been set.
- 1. Connect the probes.  
 Test current is applied.  
 Measurement is ended as soon as the measured value is stable or after 10 seconds.  
 The following measured values are displayed:  
 $R_{LO}$ : resistance  
 I: test current
- 2. Press the **SAVE VALUE** key in order to store the measurement results.



**Calculation of Cable Lengths for Common Copper Conductors**

- 1. Press the **HELP** key after the resistance measurement.
- ↳ The corresponding cable lengths for common cross-sections are calculated and displayed.



If results vary for the two different current flow directions, cable length is not displayed. In this case, capacitive or inductive components are apparently present which would distort the calculation.

This table only applies to cables made with commercially available copper conductors and cannot be used for other materials (e.g. aluminum).

**Note!**  
**Minimum Cross-Section**

The cross-section of the device under test must be observed when the  $R_{LO}(25A)$  measurement is used. As opposed to machines in accordance with DIN EN 60204, system components are frequently laid out with a significantly smaller cross-section.

Due to the high amperage of the test current, small cross-sections may result in undesired warm-up or damage under certain circumstances.

**Evaluating Measured Values**

See tables in section 14.1.1.

## 9.11 Z<sub>LOOP</sub> AC/DC – Measuring Line/Loop Impedance

Testing of breaking requirements for overcurrent protective devices, measurement of loop impedance and determination of short-circuit current

### 9.11.1 General

Testing of overcurrent protective devices includes visual inspection and measurement. Use the PROFITEST PRIME to perform measurements.

#### Measuring Method

Depending on how contact is established, the PROFITEST PRIME permits measurement of loop impedance from DC+ to DC-. Loop impedance  $Z$  is measured and short-circuit current  $I_K$  is ascertained in order to determine whether or not the breaking requirements for protective devices have been fulfilled.

Loop impedance is the resistance within the current loop (DC+ to DC-, DC+ to PE, DC- to PE) when a short-circuit to an exposed conductive part occurs. Short-circuit current magnitude is determined by the loop impedance value. Short-circuit current  $I_K$  may not fall below a predetermined value set forth by DIN VDE 0100, so that reliable tripping of the protective device is assured.

For this reason, the measured loop impedance value must be less than the maximum allowable value. Tables containing permissible display values for loop impedance and minimum short-circuit current display values for ampere ratings can be found in the specifications included in the standards. Maximum device error in accordance with VDE 0413 must also be taken into consideration.

In the case of the following line voltages, test current is greater than or equal to 10 A AC/DC:

- 120 V (-0%)
- 230 V (-0%)
- 400 V (-0%)
- 690 V (-0%)

If dangerous touch voltage occurs during measurement (> UL), safety shutdown occurs.

The test instrument calculates short-circuit current  $I_K$  based on measured loop impedance **Z<sub>LOOP</sub>** and line voltage. Short-circuit current calculation is made with reference to nominal line voltage for line voltages which lie within the nominal ranges for 120 V, 230 V, 400 V or 690 V systems. If line voltage doesn't lie within these nominal ranges, the instrument calculates short-circuit current  $I_K$  based on prevailing line voltage and measured loop impedance **Z<sub>LOOP</sub>**.

#### UL-N Display (UN/fN)

If the measured voltage value lies within a range of  $\pm 10\%$  of the respective nominal line voltage of 120 V, 230 V, 400 V or 690 V, the respectively corresponding nominal line voltage is displayed.

In the case of measured values outside of the  $\pm 10\%$  tolerance, the actual measured value is displayed.

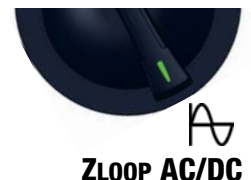


#### Note!

Loop impedance should be measured for each electrical circuit at the farthest point, in order to ascertain maximum loop impedance for the system.

### 9.11.2 Selecting the Measuring Function at the PROFITEST PRIME

1. Set the rotary selector switch to Z<sub>LOOP</sub> AC/DC.

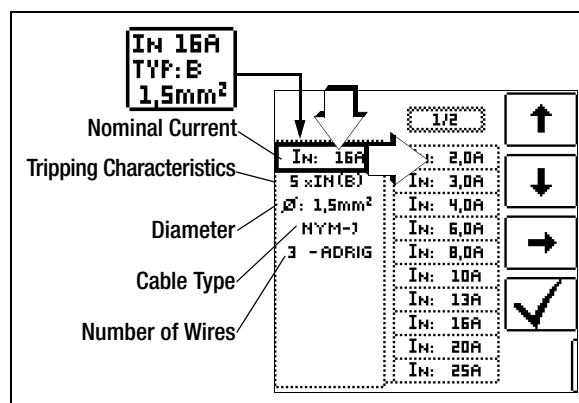


### 9.11.3 Invoking the Help function at the PROFITEST PRIME

1. Press the **HELP** key in order to view the displays and information about the measurement.
2. Press the **ESC** key in order to exit the help function.

### 9.11.4 Setting Parameters at the PROFITEST PRIME

1. Press the **HELP** key.  
The settings menu for measuring parameters is displayed.
2. Press the **→** key in order to scroll to the desired page.
3. Use the **↑↓** keys to navigate and select the desired test parameters.
4. Acknowledge your selection by pressing the **✓** key.



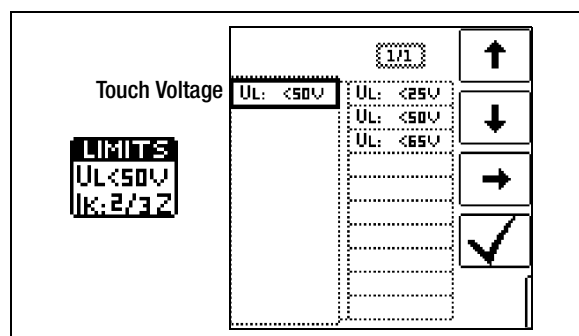
The following parameters are available:

Display	Parameter
2 ... 160 A, 9999 A	Nominal current
A, B/L, C/G, D, E, H, K, GL/GG, factor	Tripping characteristics
1.5 ... 70 mm <sup>2</sup>	Diameter*
NY ... -H07	Cable type*
2 ... 10-wire	Number of wires*

\* Parameters which are only used for report generation and do not influence the measurement

### Sinusoidal Parameter (full-wave), Setting for Circuits Without RCD

1. Press the **HELP** key.  
The settings menu for parameters is displayed.
2. Use the **↑↓** keys to navigate and select the desired test parameters.
3. Acknowledge your selection by pressing the **✓** key.



The following touch voltage values are available:

Display	Parameter
UL < 25 V UL < 50 V UL < 65 V UL < 120 V	Touch voltage

### IK Parameter

Short-circuit current **IK** is used to test shutdown by means of an overcurrent protective device. In order for an overcurrent protective device to be tripped on time, short-circuit current **IK** must be greater than tripping/breaking current **Ia** (see section 14.1.3 on page 51).

1. Press the **LIMITS** key.  
The settings menu for parameters is displayed.
2. Use the **↑↓** keys to navigate and select the desired test parameters.
3. Acknowledge your selection by pressing the **✓** key.

The following parameters are available for short-circuit current **IK**:

Display	Parameter
IK: Ia	The measured value displayed for <b>ZLOOP</b> is used without any correction to calculate <b>IK</b> .
IK: Ia+Δ%	The measured value displayed for <b>ZLOOP</b> is corrected by an amount equal to the test instrument's measuring uncertainty in order to calculate <b>IK</b> .

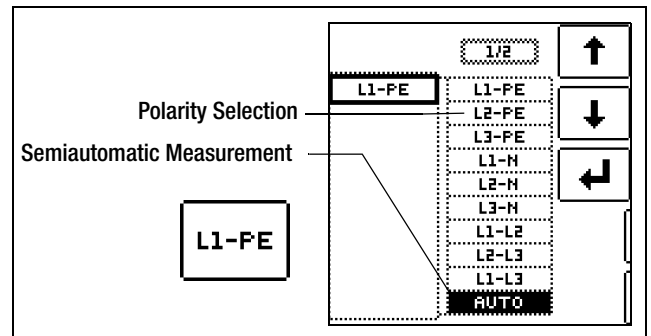


<b>IK:</b> $\frac{2}{3} Z$	In order to calculate <b>IK</b> , the measured value displayed for <b>ZLOOP</b> is corrected by an amount corresponding to all possible deviations (these are defined in detail by VDE-0100-600, as $Z_{s(m)} \leq \frac{2}{3} \times U_0/I_a$ ).
<b>IK:</b> $\frac{3}{4} Z$	$Z_{s(m)} \leq \frac{3}{4} \times U_0/I_a$

- Z** Loop Impedance  
**IK** Short-circuit current  
**U** Voltage at the test probes, "U<sub>N</sub>" is displayed if voltage U<sub>max</sub>. deviates from nominal voltage by 10%  
**f** Frequency of the applied voltage, "f<sub>N</sub>" is displayed if frequency f<sub>max</sub>. deviates from nominal frequency by 1%  
**Fla** Tripping current (see data sheet for circuit breakers / fuses)  
**Δ%** Test instrument inherent error

### Polarity Parameter

- Press .  
The settings menu for polarity selection is displayed.
- Use the **↑↓** keys to navigate and select the desired test parameters.
- Acknowledge your selection by pressing the **✓** key.



The following polarity values are available:

Display	Parameter
L1-PE L2-PE L3-PE L1-N L2-N L3-N L1-L2 L2-L3 L1-L3 L-N AUTO	Polarity selection*           Semiautomatic measurement

\* Selecting the **Lx-PE** reference or **AUTO** is only relevant with regard to report generation.

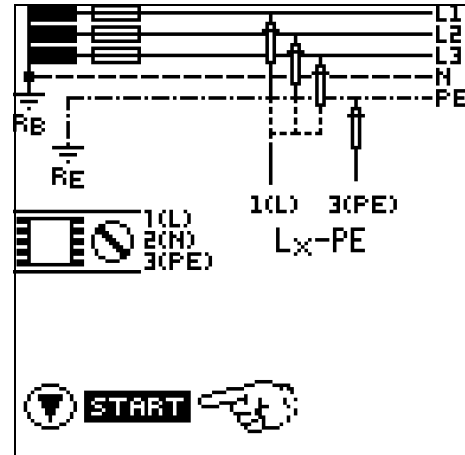
### 9.11.5 Measuring $Z_{\text{LOOP}}$ AC/DC at the PROFITEST PRIME

#### Attention!

During loop impedance measurement, it must always be kept in mind that an upstream RCD might be tripped! Appropriate safety precautions should be implemented such as preparing a data backup and possibly shutting down consuming devices prior to testing.

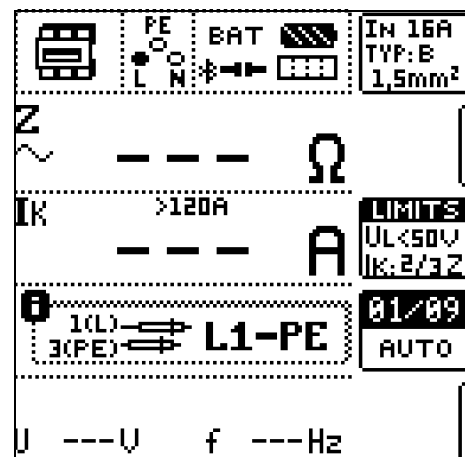
#### Connection

1. Press the **HELP** key.



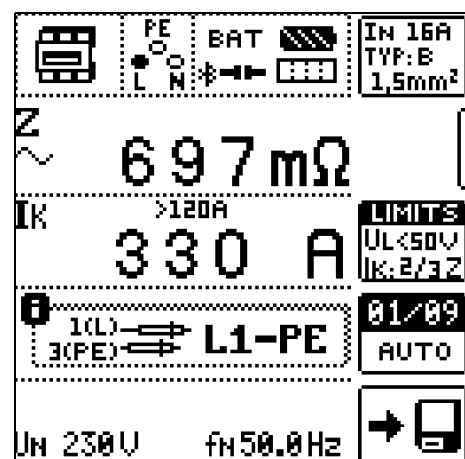
#### Starting the Measurement

- ✓ The parameters have been set.
  - ✓ The probes are connected.
1. Start the measurement at the PROFITEST H+E XTRA/PROFITEST H+E XTRA C (see section 9.8 on page 26).
  2. As soon as the values for voltage [V] and current [A] are displayed at the display panel on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C, press the **ON/START** key on the PROFITEST PRIME.
- ↳ Measurement is started and is executed automatically.



#### Saving the Measured Value

- ✓ The measurement has been completed.
  - ✓ The measured value is displayed.
1. Press the **SAVE VALUE** key.



## Evaluating Measured Values

The maximum allowable loop impedance **ZLOOP** which may be displayed after allowance has been made for maximum operating measurement error (under normal measuring conditions) can be determined with the help of table in section 14.1.2. Intermediate values can be interpolated.

The maximum allowable nominal current for the protective device (fuse or circuit breaker) for a line voltage of 230 V after allowance has been made for maximum measuring error can be determined with the help of table in section 14.1.3 based on measured short-circuit current (corresponds to DIN VDE 0100-600).

## Displaying the Fuse Table

✓ Measurement has been performed.


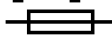
1. Press the **HELP** key.

↳ Permissible fuse types are displayed.

The table shows maximum allowable nominal current dependent on fuse type and breaking requirements.

### Key

<b>Ia</b>	breaking current
<b>Ik</b>	short-circuit current
<b>In</b>	nominal current
<b>tA</b>	time to trip

Ik: 199 A			
Ik: 2/3Z			
	In	gL/gG 	In
A :	40A	<5s :	25A
B/L :	25A	<0.4s :	16A
E :	20A	<0.2s :	16A
C/G :	13A	<1s :	20A
D :	6.0A		
K :	8.0A		
H :	50A		

## 9.12 IMD – Testing Insulation Monitoring Devices at the PROFITEST PRIME

### 9.12.1 General

Insulation monitoring devices (IMDs), insulation fault locators (IFLs) and earth fault detecting systems (EDS) are used in IT systems, for example in the field of e-mobility for DC charging at charging stations in order to monitor insulation resistance. If the required insulation resistance is fallen short of, a message is read out. The PROFITEST PRIME test instrument provides you with the option of testing responsiveness.

### Measuring Method

A single-pole insulation fault is simulated by introducing various resistances between the phase and protective conductors and tripping of the IMD is induced. Time to trip is acquired manually and the response characteristics are evaluated. Test resistance can be set within a range of 15 kΩ to 2.51 MΩ in 65 steps.

### 9.12.2 Selecting the Measuring Function at the PROFITEST PRIME

1. Set the rotary selector switch to **IMD**.



IMD

### 9.12.3 Invoking the Help Function at the PROFITEST PRIME

1. Press the **HELP** key in order to view the displays and information about the measurement.
2. Press the **ESC** key in order to exit the help function.

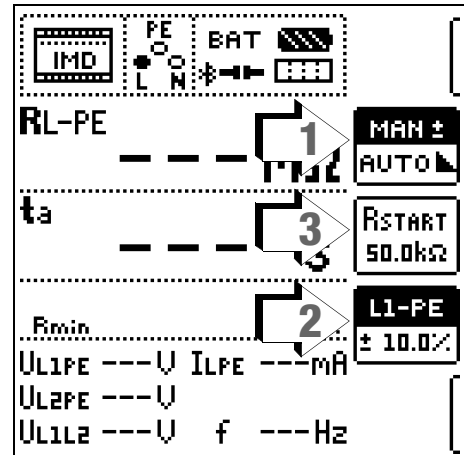
### 9.12.4 Setting Parameters at the PROFITEST PRIME

The measurement parameters can be set in the submenus which are described below:

Measuring procedure (1)

Resistance RSTART (3)

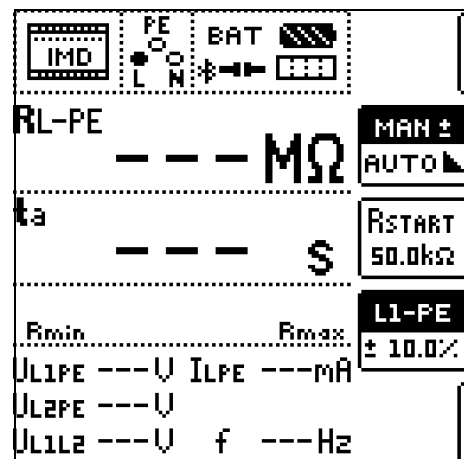
Conductor relationship / resistance range (2)



#### Measuring Procedure (1)

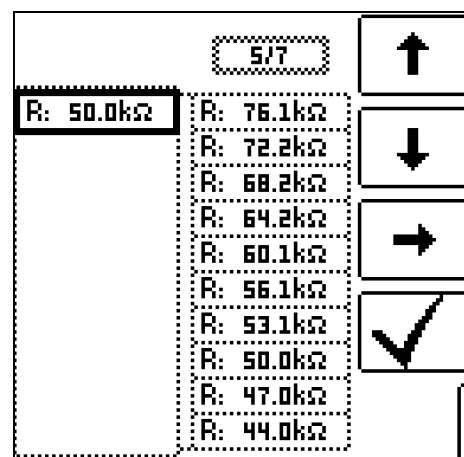
**MAN** Resistance is changed manually by tapping the softkeys.

**AUTO** Resistance is changed automatically every 2 seconds beginning with RSTART.



#### Resistance RSTART (3)

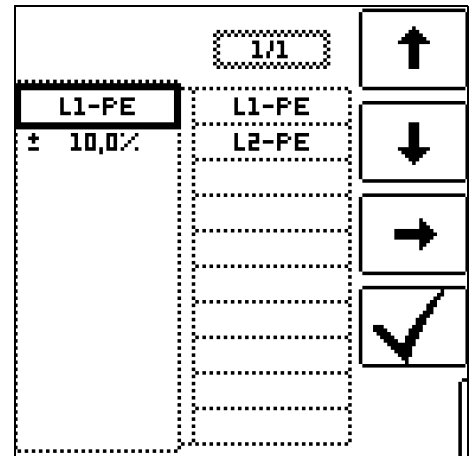
Numerous parameters are available for setting resistance RSTART, with which measurement is begun.



**Conductor Relationship / Resistance Range (2)**

- Conductor relationship** The corresponding conductor relationship can be selected for documentation of the measuring point.
- Resistance range** A range of values can be selected for testing the display of resistance at the IMD.

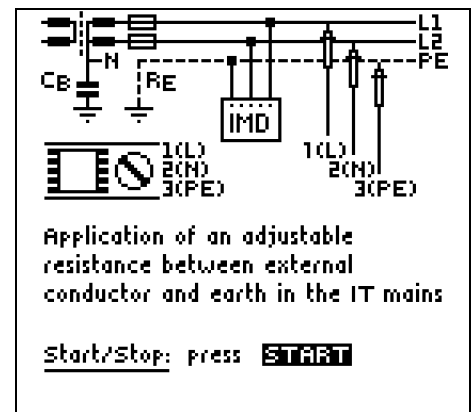
The parameter is set as a percentage with reference to the resistance momentarily introduced by the test instrument.  
Upper and lower limit values are displayed in the measuring view.



**9.12.5 Measuring IMDs at the PROFITEST PRIME**

**Connection**

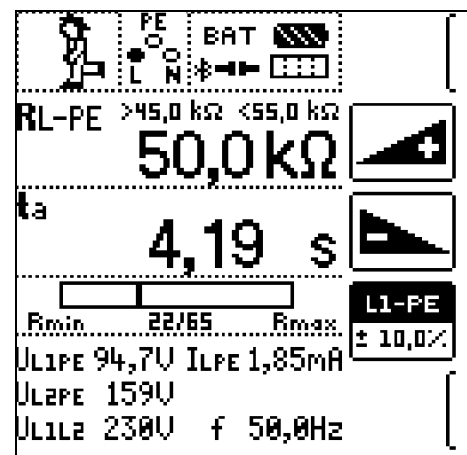
- L1: Probe 1 (L) DC+
- L2: Probe 2 (N) DC-
- PE: Probe 3 (PE)



When selecting test resistance, don't forget that an excessively high test current could damage sensitive system components.

**Measuring Procedure**

- ✓ The parameters have been set.
  - ✓ The probes are connected.
- Start the measurement at the PROFITEST H+E XTRA/PROFITEST H+E XTRA C (see section 9.8 on page 26).
  - As soon as the values for voltage [V] and current [A] are displayed at the display panel on the PROFITEST H+E XTRA/PROFITEST H+E XTRA C, press the **ON/START** key on the PROFITEST PRIME.  
A resistance is introduced between the phase and protective conductors and time measurement is started.
  - Manual testing **MAN** is selected: Tap **Increase Test Resistance** or **Reduce Test Resistance** in order to increase or reduce test resistance **RL-PE**.  
Automatic testing **AUTO** is selected: the resistance value is changed automatically.  
Time to trip **ta** is restarted each time resistance is changed.
  - Press the **IΔN** key in order to change the conductor relationship.



- In order to end measurement, press the **ON/START** key as soon as the IMD indicates that insulation resistance has been fallen short of.

The measured values are displayed.

Measurement can be aborted by pressing the **ON/START** or **ESC** key.

**Measured Values**

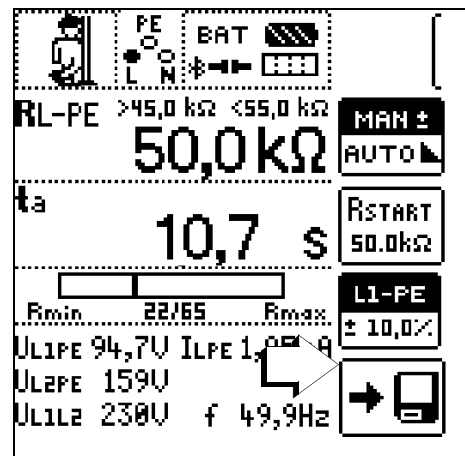
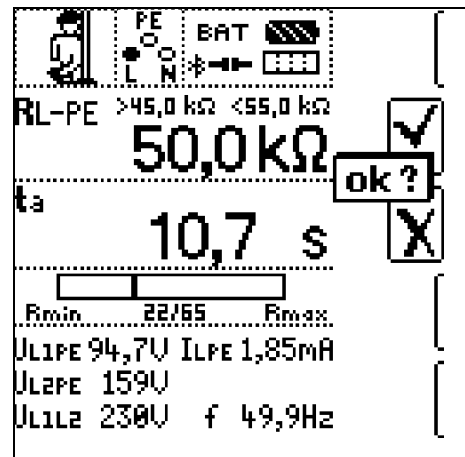
- RI-PE** Active test resistance with upper and lower limit values
- ta** Response time (during which the momentary resistance is applied until the measurement is ended)
- Rmin - Rmax** Status display indicating momentary resistance with reference to the number of possible resistances
- UI1-PE** Momentary voltage at the test probes between phase conductor L1 and protective conductor PE
- UI2-PE** Momentary voltage at the test probes between phase conductor L2 and protective conductor PE
- UI1-I2** Momentary voltage at the test probes between phase conductors L1 and L2
- I1-PE** Test current flowing through the active resistance
- f** Frequency of the applied voltage

Measurement has now been completed.

**OK?** is displayed as an evaluation prompt.

If evaluation is **NOT OK**: the **UL/RL** LED lights up red.

- Press the **SAVE VALUE** key in order to store the measurement results.



**9.12.6 Evaluating Measured Values at the PROFITEST PRIME**

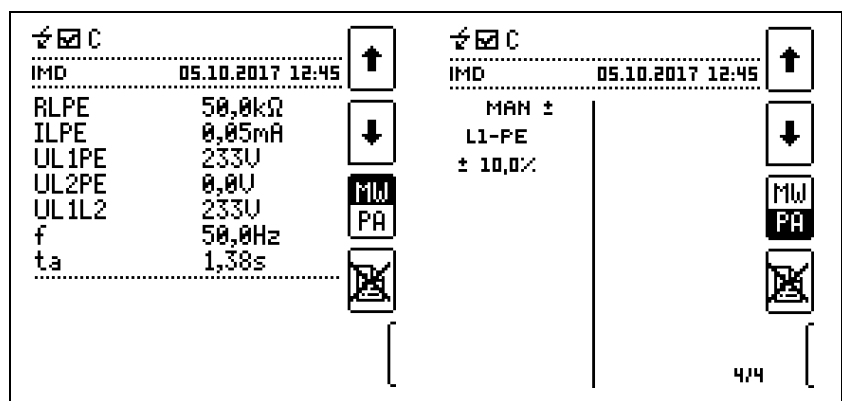
In order to evaluate the measurement, it must first be stopped. This applies to manual as well as to automatic measurement.

- Press the **ON/START** or **ESC** key.
- ↳ The stopwatch is stopped and the evaluation window appears.

**9.12.7 Retrieving Stored Measured Values at the PROFITEST PRIME**

The measured value cannot be saved to memory and included in the test report until it has been evaluated.

- Press the **MW/PA** key in order to switch from the measured values display to the display of the parameters selected for the measurement.



## 10 Error Diagnosis

### 10.1 General Information

In order to ensure a correctly functioning test procedure, be sure to follow all of the steps included in the test setup (see section 9.3.1 on page 18 and section 9.6.1 on page 22). Make sure that the cables aren't damaged and that they function flawlessly. Make sure that the cables are connected correctly.

If an error occurs during AC measurement, no values are displayed. No error message is displayed.

### 10.2 Incorrect Firmware

If the wrong firmware is installed to the tester, the following warning appears at the initial screen:

**Warning: HW revision default called. Charge current set to 6 A.**

If this warning appears, please contact our support department. We'll send you a new configuration file.

### 10.3 Aborting the Charging Process

If an error occurs before testing has been completed, search for a solution in the following tables.

#### 10.3.1 DC-CCS

Not Reached (successfully)	Possible Cause	Required Action
<b>SLAC_MATCH</b>	<ul style="list-style-type: none"> <li>– Poor connection or no connection at all of the PLC signal to CP inside the EVSE.</li> <li>– Check attenuation [dB]: must lie within a range of 10 to 45 dB.</li> <li>– &gt; 45 dB = no connection</li> <li>– &lt; 10 dB = PLC chip configured incorrectly</li> <li>– No value = PLC chip configured incorrectly or damaged</li> </ul>	Check connection of your PLC modules to the CP electronics in the EVSE.
<b>Setup</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> </ul>	Consult with the EVSE manufacturer's software development team.
<b>ServDisc</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> </ul>	Consult with the EVSE manufacturer's software development team.
<b>Payment</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> </ul>	Consult with the EVSE manufacturer's software development team.
<b>Auth</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> <li>– Damaged RFID card reader / interrupted connection inside the EVSE</li> </ul>	Check the RFID card reader for correct electrical functioning. Otherwise, consult the EVSE manufacturer's software development team.
<b>ChParamDisc</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> </ul>	Consult with the EVSE manufacturer's software development team.
<b>IsoCheck</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> <li>– Insulation fault (electrical fault inside the EVSE, DC+ or DC- connected to PE in one way or the other)</li> <li>– Incorrect tester setting (ISO test on but not intended)</li> </ul>	If the ISO rotary test selector switch is set to LDC+/LDC-, termination is desired. Otherwise check the IMD first, as well as wiring with regard to earth discharge and the DC+/DC- wires. Finally, software parameters configuration might be involved, in which case the EVSE manufacturer's development team should be contacted.
<b>PreCh</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> <li>– Inadequate voltage</li> </ul>	Check the EVSE's power module. Otherwise, consult the EVSE manufacturer's software development team.
<b>ChargeLoop</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> <li>– Inadequate power</li> </ul>	Check the EVSE's power module. Otherwise, consult the EVSE manufacturer's software development team.
<b>Stop</b>	<ul style="list-style-type: none"> <li>– Message parameters configured incorrectly</li> </ul>	Consult with the EVSE manufacturer's software development team.

Table 2: DC-CCS, Error Diagnosis

### 10.3.2 PWM Detect

If a voltage of 0 V occurs at any time during the charging process, the test result may be **PASSED**. However, a warning appears in the CSV test report.

### 10.3.3 PWM Duty Cycle

If duty cycle measurement wasn't successful at the beginning of the charging process, measurement is stopped. The following error message is displayed after 30 seconds:

#### Test aborted: Duty cycle timeout

The error may be caused by any of the following conditions:

- The charging cable was disconnected from the tester during the charging process.
- Charging station communication doesn't comply with the standards.

### 10.3.4 CHAdeMO

Not Reached (successfully)	Possible Cause	Required Action
<b>C1</b>	Check the charging station's gun to determine whether or not <b>Charge Signal 1</b> amounts to 12 V. If <b>Charge Signal 1</b> isn't 12 V, the charging station has a defect.	Check the 12 V source and the switching relay.
<b>C2 &gt; Unknown State</b>	The charger doesn't comply with the standard.	Consult with the EVSE manufacturer's software development team.
<b>C3</b>	Incorrect start signals from the charger. CAN messages are missing or start with incorrect content.	Consult with the EVSE manufacturer's software development team.
<b>D1-B</b>	<b>CAN message ID 109</b> is not received, or is displayed with incorrect content or incorrect charging signal combination.	Consult with the EVSE manufacturer's software development team.
<b>D2</b>	<b>Charge Signal 2 B</b> is missing	Check the 12 V source and the switching relay.
<b>D2 &gt; E1 &gt; E2</b>	Inadequate battery voltage	Check the connection between the charger and the tester. Start a self-test at the tester.
<b>E2</b>	<b>CAN message ID 109</b> is not received, or is displayed with incorrect content or incorrect charging signal combination.	Consult with the EVSE manufacturer's software development team.

Table 3: CHAdeMO, Error Diagnosis

## 10.4 "Failed" Test Result

### 10.4.1 DC-CCS

If the result is **FAILED**, an error code appears in the bottom right-hand corner. This four place code is subdivided into two character strings:

String 1	String 2
00	00

- String 1 indicates which message within the communication chain has been affected by an error.
- String 2 indicates why an error has occurred.

The following tables explain the error codes.

String 1	Fault localization
00	No error in this message (this message is not displayed)
01	Problem with TCP connection
02	Tester queries EVSE for payment method and EVSE response – error in this message
03	Contract authentication
04	Detection of charging parameters
05	Cable inspection
06	Advance charge



07	Power output
08	Supported application protocol (charging per DIN or ISO standard?)
09	Initialization of the session
0 A	Service detection
0B	Current request
0C	Detection of welds

Table 4: DC-CCS, String 1 Error Codes

String 2	Fault localization
00	No error in this message (this message is not displayed)
01	Message couldn't be coded or transmitted (device error)
02	The message was not transmitted.
03	Received message couldn't be read.
04	The message was received but couldn't be read (faulty message).
05	Received message was not as expected.
06	No PWM signal detected
07	Lost protocol (not clear whether DIN or ISO standard applies), charging process ended

Table 5: DC-CCS, String 2 Error Codes

Example:

When testing a DC-CCS charging station, the **FAILED** test result and error code **0104** are displayed. Error code **0104** means that a message was received in TCP communication but couldn't be read.



#### **Note!**

If error **FFFF** is displayed, an error has occurred in the test process's last state. This may be one of the errors listed above or another error which hasn't yet been specified.

### **10.4.2 CHAdeMO**

If the result is **FAILED**, an error code appears in the bottom right-hand corner. Refer to the CHAdeMO standard specification and look up the cause of the error. Observe the note concerning the tester's range of applications (see section 9.2 on page 17).

### **10.5 EVSE to EV Works, but EVSE to Product Doesn't**

If the test result is **FAILED** although your charging station was previously capable of charging a real EV, make sure that your charging station complies with the standard.

Observe the note concerning the tester's range of applications (see section 9.2 on page 17).

## 11 Service and Support

### 11.1 Product Support

If required please contact:

Gossen Metrawatt GmbH

#### Product Support Hotline

Phone +49-911-8602-0

Fax +49 911-8602-709

E-mail [support@gossenmetrawatt.com](mailto:support@gossenmetrawatt.com)

### 11.2 Repair and Replacement Parts Service Calibration Center and Rental Instrument Service

If required please contact:

GMC-I Service GmbH

#### Service Center

Beuthener Str. 41

90471 Nürnberg, Germany

Phone +49-911-817718-0

Fax +49 911-817718-253

E-mail [service@gossenmetrawatt.com](mailto:service@gossenmetrawatt.com)

Web [www.gmci-service.com](http://www.gmci-service.com)

This address is only valid in Germany.

Please contact our representatives or subsidiaries for service in other countries.

#### 11.2.1 Competent Partner

Gossen Metrawatt GmbH is certified in accordance with DIN EN ISO 9001.

Our **DAkKS calibration laboratory** is accredited by the Deutsche Akkreditierungsstelle GmbH (national accreditation body for the Federal Republic of Germany) under registration number D-K-15080-01-01 in accordance with DIN EN ISO/IEC 17025.

Accredited quantities: direct voltage, direct current value, direct current resistance, alternating voltage, alternating current value, AC active power, AC apparent power, DC power, capacitance, frequency and temperature.

We offer a complete range of expertise in the field of metrology: from test reports and factory calibration certificates right on up to DAkKS calibration certificates.

An on-site DAkKS calibration station is an integral part of our service department. If errors are discovered during calibration, our specialized personnel is capable of completing repairs using original replacement parts.

As a full service calibration laboratory, we can calibrate instruments from other manufacturers as well.

Our spectrum of offerings is rounded out with free test equipment management.

### 11.3 Training

We recommend user training in order to make the best possible use of your instrument. Please contact:

Gossen Metrawatt GmbH

#### Training Division

Phone +49 911-8602-935

Fax +49 911-8602-724

E-mail [training@gossenmetrawatt.com](mailto:training@gossenmetrawatt.com)

Web: [www.gossenmetrawatt.com](http://www.gossenmetrawatt.com)

## 12 CE Declaration

The device fulfills all requirements of applicable EU directives and national regulations. We confirm this with the CE mark. The CE declaration is available upon request.

## 13 Returns and Environmentally Sound Disposal

This device is subject to directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE) and its German national equivalent implemented as the Waste Electrical and Electronic Equipment Act (ElektroG) on the marketing, return and environmentally sound disposal of electrical and electronic equipment. The device is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German Waste Electrical and Electronic Equipment Act).



The symbol at the left indicates that this device and its electronic accessories must be disposed of in accordance with applicable legal regulations, and not together with household trash. In order to dispose of the instrument, bring it to a designated collection point or contact our product support department (⇒ 46).

This instrument is also subject to directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and its German national equivalent implemented as the Battery Act (BattG) on the marketing, return and environmentally sound disposal of batteries and accumulators.



The symbol at the left indicates that batteries and rechargeable batteries must be disposed of in accordance with applicable legal regulations. Batteries and rechargeable batteries may not be disposed of with household trash. In order to dispose of the batteries or rechargeable batteries, remove them from the instrument and bring them to a designated collection point.

Segregated disposal and recycling conserves resources and protects our health and the environment.

Current and further information is available on our website at <http://www.gossenmetrawatt.com> under the search terms "WEEE" and "environmental protection".

## 14 Appendix

### 14.1 Tables for Determining Maximum and Minimum Display Values in Consideration of Maximum Measuring Uncertainty

#### 14.1.1 $R_{LO}$ Display Values

RLO 0.2A		RLO 25A			
Measured Quantity: RLO		Measured Quantity: RLO			
Limit values [Ω]	Max. Display Values [Ω]	Limit Values [mΩ]	Max. Display Values [mΩ]	Limit Values [Ω]	Max. Display Values [Ω]
0.10	0.07	10	7		
0.20	0.17	20	17	2.00	1.90
0.30	0.26	30	26	3.00	2.86
0.40	0.36	40	36	4.00	3.82
0.50	0.46	50	46	5.00	4.78
0.60	0.55	60	55	6.00	5.74
0.70	0.65	70	65	7.00	6.70
0.80	0.74	80	74	8.00	7.66
0.90	0.84	90	84	9.00	8.62
1.00	0.94	100	94	10.0	9.40
2.00	1.90	200	190	11.0	10.3
2.00	1.90	300	286	12.0	11.3
3.00	2.86	400	382	13.0	12.2
4.00	3.82	500	478	14.0	13.2
5.00	4.78	600	574	15.0	14.2
6.00	5.74	700	670	16.0	15.1
7.00	6.70	800	766	17.0	16.1
8.00	7.66	900	862	18.0	17.0
9.00	8.62	1000	940	19.0	18.0
10.0	9.40			20.0	19.2
20.0	19.0				
30.0	28.6				
25.0	23.8				
40.0	38.2				
50.0	47.8				
60.0	57.4				
70.0	67.0				
80.0	76.6				
90.0	86.2				

Table 6:  $R_{LO}$  Display Values

### 14.1.2 Z<sub>LOOP</sub> Display Values


Z <sub>LOOP</sub> 			
Measured Quantity: Z			
Limit Values [mΩ]	Min. Display Values [mΩ]	Limit Values [Ω]	Min. Display Values [Ω]
50	35	1.50	1.37
100	80	2.00	1.84
200	170	2.50	2.31
300	260	3.00	2.78
400	350	3.50	3.25
500	440	4.00	3.72
600	530	4.50	4.19
700	620	5.00	4.66
800	710		
900	800		
1000	890		

Table 7: Z<sub>LOOP</sub> Display Values, 1


Z <sub>LOOP</sub> DC+ 			
Measured Quantity: Z			
Limit Values [mΩ]	Min. Display Values [mΩ]	Limit Values [Ω]	Min. Display Values [Ω]
250	175	1.50	1.32
300	216	2.00	1.77
400	298	2.50	2.22
500	380	3.00	2.67
600	462	3.50	3.12
700	544	4.00	3.57
800	626	4.50	4.02
900	708	5.00	4.47
1000	870	5.50	4.92
		6.00	5.37
		6.50	5.82
		7.00	6.27
		7.50	6.72
		8.00	7.17
		8.50	7.62
		9.00	8.07
		9.50	8.52

Table 8: Z<sub>LOOP</sub> Display Values, 2



$Z_{\text{LOOP}}$ 		$Z_{\text{LOOP}}$ 	
Measured Quantity: Z			
Limit Values [Ω]	Min. Display Values [Ω]	Limit Values [Ω]	Min. Display Values [Ω]
0.50	0.35	0.6	0.4
1.00	0.80	1.0	0.8
2.00	1.70	2.0	1.7
3.00	2.60	3.0	2.6
4.00	3.50	4.0	3.5
5.00	4.40	5.0	4.4
6.00	5.30	6.0	5.3
7.00	6.20	7.0	6.2
8.00	7.10	8.0	7.1
9.00	8.00	9.0	8.0
10.0	9.0	10.0	8.9
11.0	9.9	20.0	17.9
20.0	18.2	30.0	26.9
30.0	27.4	40.0	35.9
40.0	36.6	50.0	44.9
50.0	45.8	60.0	53.9
60.0	55.0	70.0	62.9
70.0	64.2	80.0	71.9
80.0	73.4	90.0	80.9
90.0	82.6	100	90
		200	182
		300	274
		400	366
		500	458
		600	550
		700	642
		800	734
		900	826

Table 9:  $Z_{\text{LOOP}}$  Display Values, 3

### 14.1.3 Minimum Short-Circuit Current Display Values for Determining Nominal Current of Various Fuses and Breakers for Systems with Nominal Voltage $U_N = 230\text{ V}$

Nominal Current $I_N$ [A]	Low Resistance Fuses in Accordance with the DIN VDE 0636 Series of Standards				With Circuit Breaker and Line Switch							
	Characteristic gL, gG, gM				Characteristic B/E (formerly L)		Characteristic C (formerly G, U)		Characteristic D		Characteristic K	
	Breaking Current $I_A$ 5 s		Breaking Current $I_A$ 0.4 s		Breaking Current $I_A$ $5 \times I_N$ ( $< 0.2\text{ s}/0.4\text{ s}$ )		Breaking Current $I_A$ $10 \times I_N$ ( $< 0.2\text{ s}/0.4\text{ s}$ )		Breaking Current $I_A$ $20 \times I_N$ ( $< 0.2\text{ s}/0.4\text{ s}$ )		Breaking Current $I_A$ $12 \times I_N$ ( $< 0.1\text{ s}$ )	
	Limit Value [A]	Min. Display [A]	Limit Value [A]	Min. Display [A]	Limit Value [A]	Min. Display [A]	Limit Value [A]	Min. Display [A]	Limit Value [A]	Min. Display [A]	Limit Value [A]	Min. Display [A]
2	9.2	10	16	17	10	11	20	21	40	42	24	25
3	14.1	15	24	25	15	16	30	32	60	64	36	38
4	19	20	32	34	20	21	40	42	80	85	48	51
6	27	28	47	50	30	32	60	64	120	128	72	76
8	37	39	65	69	40	42	80	85	160	172	96	102
10	47	50	82	87	50	53	100	106	200	216	120	128
13	56	59	98	104	65	69	130	139	260	297	156	167
16	65	69	107	114	80	85	160	172	320	369	192	207
20	85	90	145	155	100	106	200	216	400	467	240	273
25	110	117	180	194	125	134	250	285	500	578	300	345
32	150	161	265	303	160	172	320	369	640	750	384	447
35	173	186	295	339	175	188	350	405	700	825	420	492
40	190	205	310	357	200	216	400	467	800	953	480	553
50	260	297	460	529	250	285	500	578	1000	1.22 k	600	700
63	320	369	550	639	315	363	630	737	1260	1.58 k	756	896
80	440	517									960	1.16 k
100	580	675									1200	1.49 k
125	750	889									1440	1.84 k
160	930	1.12 k									1920	2.59 k

Table 10: Minimum Short-Circuit Current Display Values for Determining Nominal Current of Various Fuses and Breakers for Systems with Nominal Voltage  $U_N = 230\text{ V}$

#### Example

Display value of 90.4 A → next lower value for circuit breaker characteristic B from table: 85 A → nominal current ( $I_N$ ) of the protective device: max. 16 A

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