

SECUTEST | BASE, BASE10 and XTRA





Test Instruments for Measuring the Electrical Safety of Devices
per VDE 0701-0702, IEC 62353 and IEC 60974-4

3-349-752-03
2/2.14




Controls

Symbol display for devices connected to the USB master interface:

-  – For keyboard
-  – For scanner
-  – For printer
-  – For USB stick

LCD panel

 **Lightning symbol:**
mains to test socket

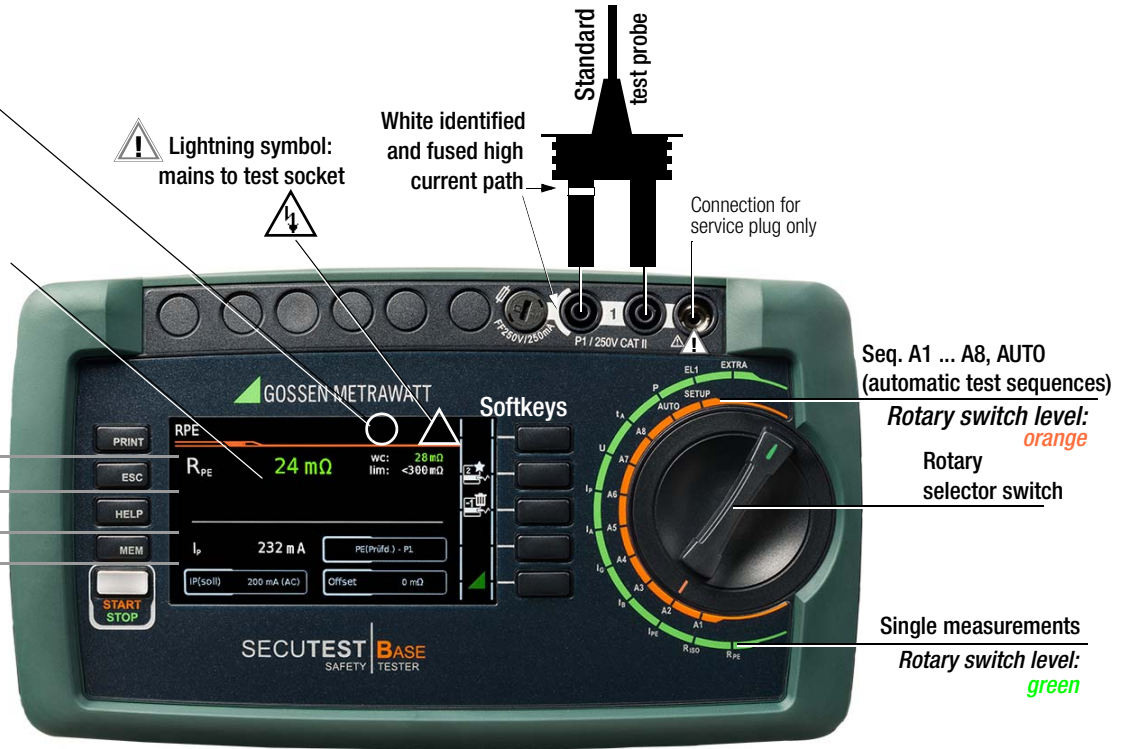
White identified and fused high current path

Standard test probe

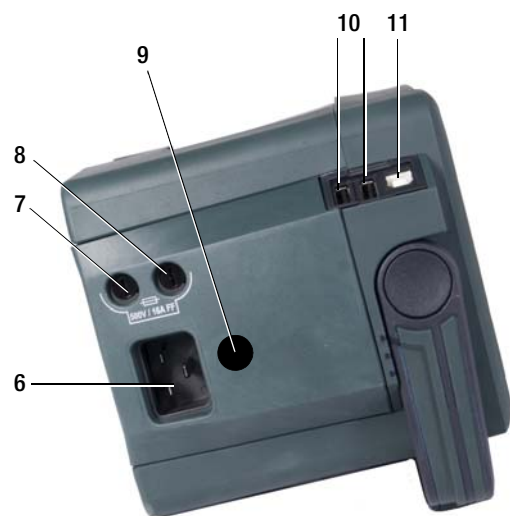
Connection for service plug only

Fixed Function Keys

- PRINT:** Print via USB
 - ESC:** Return
 - HELP:** Help images
 - MEM:** Data base function
 - START:** Start/stop
 - Single meas.
 - Test sequence
- Finger contact**



Terminals



No.	Meaning
1	Fuse link
2	Test probe connection (P1)
3	Connection (jack socket) – for service plug only!
4	Country-specific standard socket (test socket) for connecting devices under test
5	Carrying handle and tilt stand
6	Country-specific socket for mains power via inlet plug
7	Fuse link 1 for the mains connection
8	Fuse link 2 for the mains connection
9	Fuse link for 10 A protective conductor test (included additionally with SECUTEST BASE10 and XTRA with feature G01)
10	USB master for connecting keyboard, barcode scanner*, printer* and USB stick
11	USB slave for PC connection

* A list of suitable devices is included in the appendix (see section 14).

These operating instructions describe an instrument with software version 1.3.0

Overview of Features Included with SECUTEST BASE, BASE10 and XTRA Test Instruments

Switch Setting, Descrip. as of	Meas. Variant	Measuring Function	Test Current/Voltage
Single measurements, rotary switch level: green			
Measurements at voltage-free objects			
RPE Page 20		R_{PE}	Protective conductor resistance
		I	Protective conductor current (200 mA) SECUTEST BASE10/XTRA: 10 A ¹
RISO Page 22	PC I	RINS	Insulation resistance
	PC II	U_{INS}	Test voltage
Measurements at DUTs connected to line voltage			
IPE Page 24	DIR DIF ELC	$I_{PE\approx}$	Protective conductor current, TRMS
		$I_{PE\sim}$	AC component
		$I_{PE=}$	DC component
		U_{LN}	Test voltage
IB Page 28	DIR DIF ELC	$I_{T\approx}$	Touch current, TRMS
		$I_{T\sim}$	AC component
		$I_{T=}$	DC component
		U_{LN}	Test voltage
IG Page 30	DIR DIF ELC	$I_{E\approx}$	Device leakage current, TRMS
		$I_{E\sim}$	AC component
		$I_{E=}$	DC component
		U_{LN}	Test voltage
IA Page 32	DIR ELC	$I_{A\approx}$	Leakage current from the application part
		U_A	Test voltage
IP Page 34	DIR with test probe P1	$I_{P\approx}$	Patient leakage current, TRMS
		$I_{P\sim}$	AC component
		$I_{P=}$	DC component
		U_{LN}	Test voltage
U Page 35		U_{\approx}	Probe voltage, TRMS
		U_{\sim}	Alternating voltage component
		$U_{=}$	Direct voltage component
ta Page 36		t_B	PRCD time to trip for 30 mA PRCD
		U_{LN}	Line voltage at the test socket
P Page 37		Function test at the test socket	
		I	Current between L and N
		U	Voltage between L and N
		f	Frequency
		P	Active power
		S	Apparent power
		PF	Power factor
Probe measuring functions			
EL1		Extension cord test with EL1 adapter: continuity, short-circuit, reversed wires	
EXTRA		QR code: scanning the code allows for downloading of the current operating instructions from www.gossenmetrawatt.com and reading at a tablet PC.	
Automated test sequences, rotary switch level: orange			
Preconfigured (freely selectable) test sequences			
A1		VDE 0701-0702, passive meas. method, test socket	
A2		VDE 0701-0702, active measurement type, test socket	
A3		VDE 0701-0702, parameters config. for EDP (active)	
A4		IEC 62353 (VDE 0751), passive measurement type	
A5		IEC 62353 (VDE 0751), active measurement type	
A6		IEC 60974-4, connection type: test socket	
A7		IEC 60974-4, connection type: AT16-DI/AT32-DI	
A8		VDE 0701-0702, measurement type Extension Cord test (RPE, RINS), EL1 adapter	
AUTO		Freely selectable standard, connection and meas. type	
Device settings			
SETUP Page 10		Database	PS3 profile (select, delete, statistics)
		System info	Software/hardware version, serial no.
		Culture	Country, user interface language
		System	Date and time, volume, brightness

¹ 10 A R_{PE} measurements are only possible with line voltages of 115/230 V and line frequencies of 50/60 Hz.

Key

DIR = direct measurement,
DIF = differential current measurement,
ALT = alternative measurement (equivalent leakage current meas.)

Scope of Delivery

Standard Version (country-specific)

- SECUTEST BASE, SECUTEST BASE10 or SECUTEST XTRA test instrument
- Mains power cable
- Test probe, 2 m, not coiled
- USB cable, USB A to USB B, 1.5 m long
- Calibration certificate
- Condensed operating instructions
- Full operating instructions available on the Internet
- ETC report software available on the Internet

The most up-to-date version of ETC can be downloaded free of charge from the **mygmc** page of our website as a ZIP file, if you have registered your test instrument:

<http://www.gossenmetrawatt.com>

→ Products → Software → Software for Testers → Report Software without Database → ETC → [myGMC](http://www.gossenmetrawatt.com/mygmc)

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1 Application

1.1 Table: Types of DUTs – Tests – Standards

DUTs to be tested in accordance with the following standards	Testing after Repairs / Periodic Testing		
	DIN EN 62638, draft DIN VDE 0701-0702	IEC 62353:2007 DIN EN 62353:2008 (VDE 0751-1)	IEC 60974-4:2010 DIN EN 60974-4 VDE 0544-4:2011
Electric devices	•		
Work devices	•		
Mains operated electronic devices	•		
Hand-held electric tools	•		
Extension cords	•		
Household appliances	•		
Data processing devices	•		
Electrical medical devices, application parts		•	
Welding units			•



Attention!

The test instrument may not be used for measurements within electrical systems!

1.2 Table: Single Measurements and Regulations

Single measurements per regulation	DIN EN 62638, draft DIN VDE 0701-0702:2008	IEC 62353:2007 DIN EN 62353:2008 (VDE 0751-1)	IEC 60974-4:2010 DIN EN 60974-4:2011 VDE 0544-4:2011
Protective conductor resistance	•	•	•
Insulation resistance	•	•	•
Protective conductor current	•		
Primary leakage current			•
Device leakage current		•	
Touch current	•	•	
Current from welding circuits			•
Patient leakage current		•	
Leakage current from the application part		•	
Test methods			
Alternative measuring method (equivalent(device) leakage current)	•	•	
Differential current meas. method	•	•	•
Direct measuring method	•	•	•

Key

- Specified test

1.3 List of Available Test Instrument Variants

SECUTEST BASE and SECUTEST BASE10 Standard Models

Standard Model	Article Number	Features
SECUTEST BASE	M7050-V001	Schuko variant (test socket and mains plug), selectable user interface language (default setting: German), protective conductor test current: 200 mA, calibration certificate in D/GB/F, printed condensed operating instructions in German
SECUTEST BASE10	M7050-V002	Schuko variant (test socket and mains plug), selectable user interface language (default setting: German), protective conductor test current: 200 mA and 10 A, calibration certificate in D/GB/F, printed condensed operating instructions in German

Feature-Dependent SECUTEST XTRA Test Instrument Variants

Test instrument with 8 pre-set test sequences per standard and one freely configurable test sequence, selectable user interface language, country-specific test socket, probe cable with test probe, plug-on alligator clip, USB ports, calibration certificate, printed condensed operating instructions, operating instructions for test instrument and ETC report generating software on the Internet.

List of Features

Feature	Test socket and mains plug, country specific	Language for pre-set user interface	R-PE test current	Calibration certificate, language combination
M7050	B	C	G	P
00	Schuko	German	200 mA	D/GB/F
01	UK	English	10 A ¹⁾	D/GB/PL
02	CH	French		D/GB/IT
03	FR/CZ	Italian		
04	China	Spanish		
05	USA	Czech		
06	Off	Dutch		
07	DK	Polish		
08	Italy			

¹⁾ 10 A R_{PE} measurements are only possible with line voltages of 115/230 V and line frequencies of 50/60 Hz.

Designation	Article number	Features
SECUTEST XTRA	M7050 ...	Country-specific variant (test socket and mains plug), selectable user interface language, language selected as a feature is pre-set upon shipment, protective conductor test current: 200 mA or additionally 10 A depending on feature, calibration certificate with language combination depending on feature, printed condensed operating instructions in user interface language if available, otherwise GB

2 Safety Features and Precautions

SECUTEST BASE, **SECUTEST BASE10** and **SECUTEST XTRA** test instruments fulfill all requirements of applicable European and national EC directives. We confirm this with the CE mark. The relevant declaration of conformity can be obtained from GMC-I Messtechnik GmbH.

The test instruments are manufactured and tested in accordance with the following safety regulations: IEC 61010-1 / DIN EN 61010-1 / VDE 0411-1, DIN VDE 0404, DIN VDE 0413 parts 2 and 4, DIN EN 61557-16/VDE 0413-16 (draft).

The safety of the user, the test instrument and the device under test (electrical equipment or electrical medical device) is only assured when the instrument is used for its intended purpose.

Read the operating instructions carefully and completely before placing your test instrument into service. Follow all instructions contained therein. Make sure that the operating instructions are available to all users of the instrument.

Tests may only be performed by a qualified electrician, or under the supervision and direction of a qualified electrician. The user must be instructed by a qualified electrician concerning performance and evaluation of the test.



Note

Manufacturers and importers of electrical medical devices must provide documentation for the performance of maintenance by trained personnel.

Observe the following safety precautions:

- The instrument may only be connected to electrical systems (TN or TT) with a maximum of 240 V which comply with applicable safety regulations (e.g. IEC 60346, VDE 0100) and are protected with a fuse or circuit breaker with a maximum rating of 16 A.
- Measurements within electrical systems are prohibited.
- Be prepared for the occurrence of unexpected voltages at devices under test (for example, capacitors can be dangerously charged).
- Make certain that the measurement cables are in flawless condition, e.g. no damage to insulation, no cracks in cables or plugs etc.
- When using a test probe with coil cord (SK2W): Grip the tip of the test probe firmly, for example during insertion into a jack socket. Tensioning at the coil cord may otherwise cause the test probe to snap back resulting in possible injury.
- **Measurement of insulation resistance and equivalent leakage current (alternative leakage current measuring method)**
Testing is conducted with up to 500 V. Current limiting is utilized ($I < 3.5 \text{ mA}$), but if terminals L or N at the test socket (at the multimeter input) are touched, electrical shock may occur which could result in consequential accidents.
- **Leakage current measurement while connected to line voltage**
It is absolutely essential to assure that the device under test is operated with line voltage during performance of the leakage current measurement. Exposed conductive parts may conduct dangerous contact voltage during testing, and may not be touched under any circumstances (Mains power is disconnected if leakage current exceeds approx. 10 mA.)



Attention!

The function test may only be performed after the DUT has successfully passed the safety test!

Fuse Replacement

The fuses may only be replaced when the instrument is voltage-free, i.e. the instrument must be disconnected from mains supply power and may not be connected to a measuring circuit. The fuse type must comply with the specifications in the technical data or the labeling on the instrument.

Opening the Instrument / Repairs

The instrument may only be opened by authorized, trained personnel in order to ensure flawless operation and to assure that the guarantee is not rendered null and void.

Even original replacement parts may only be installed by authorized, trained personnel.

If it can be ascertained that the instrument has been opened by unauthorized personnel, 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.

Any warranty claims will be forfeited when the warranty seal has been damaged or removed.



Attention!

Before opening the housing, pull the main plug out of the outlet and wait for at least 5 minutes.

Switching Power Consumers

Be absolutely sure to adhere to the sequence specified below when switching the live device under test. This prevents excessive wear of the mains relays at the test instrument.

Before measurement:

- 1) **DUT:** Turn the DUT off via its own switch.
- 2) **Tester:** Switch line voltage to the test socket.
- 3) **DUT:** Turn the DUT on via its own switch.

After measurement:

- 4) **DUT:** Turn the DUT off via its own switch.
- 5) **Tester:** Deactivate line voltage to the test socket.

The test instrument may not be used:

- If external damage is apparent, for example if parts which conduct dangerous touch voltage are freely accessible, if the display is broken or defective (in which case dangerous voltage or mains connection errors might no longer be indicated)
- If the seal or sealing lacquer has been removed as the result of repairs or manipulation carried out by a non-authorized/certified service provider
- With damaged connection and/or measurement cables and patient ports, e.g. interrupted insulation or kinked cable
- If the instrument no longer functions flawlessly
- After extraordinary stressing due to transport

In such cases, the instrument must be removed from operation and secured against unintentional use.

Meanings of Symbols on the Instrument

The symbols on the instrument have the following meanings:



warning regarding dangerous electrical voltage



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



EC mark of conformity



This device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossen-metrawatt.com by entering the search term "WEEE".



Any warranty claims will be forfeited when the warranty seal has been damaged or removed.

3 General Operation

3.1 Measured Value Display

The following items appear at the display panel:

- The selected measuring function or standard
- Measurement values with abbreviations and units of measure
- Setting parameters such as type of connection and measurement type
- Symbols for softkey operation
- Wiring diagrams, notes regarding the test sequence and error messages

Green progress bars appear in the header for single measurements, and orange progress bars appear for test sequences. If the upper range limit is exceeded, the upper limit value is displayed and is preceded by the ">" symbol (greater than), which indicates measurement value overrun.



Note

The depiction of LEDs in these operating instructions may vary from the LEDs on the actual instrument due to product improvements.

Measured Value Storage

See section 8.2

3.2 Language, Keyboard Layout (culture parameter)

The desired user interface language, a country-specific keyboard layout and a language for the test sequences (measuring sequence parameter) can be selected with the rotary switch in the **SETUP** position (see section 4.4).



Note

If you would like to switch to a different language for the keyboard layout than the one already selected, you're prompted to scan the appropriate barcode.

3.3 Help Functions (HELP key and QR code)

Depending on the **rotary selector switch** position, appropriate wiring diagrams are displayed.

- ⇨ Press the **HELP** key in order to query online help.
- ⇨ Press the **ESC** key in order to exit online help.

As an alternative, you can download or access the current operating instructions from our website with a tablet PC by scanning the QR code with the selector switch set to EXTRA.

3.4 Entering Alphanumeric Characters

In addition to the softkey keyboard which can be accessed at the display, standardized USB keyboards can also be used to enter texts such as offsets, ID numbers, type designations and comments.

Reading in Barcodes

When the menu for alphanumeric entry via the softkey keyboard is opened at the display, any value read in by means of a barcode scanner is directly accepted.

See the appendix in section 14.2 concerning available accessory devices.



Note

We are unable to offer any guarantees regarding the use of scanning devices other than those listed in the appendix.

3.5 Printouts – Protocols

If you've connected a suitable printer (see list in appendix in section 14.1) via the USB master port, you can print out a test report for each executed single measurement or test sequence by pressing the **PRINT** key. The respective single measurement or test sequence must be previously selected in the memory menu with the help of the scroll keys.



Note

We are unable to offer any guarantees regarding the use of printers other than those listed in the appendix.



Attention!

An error message appears if the **PRINT** key is pressed without first having connected a printer. Connect the printer and acknowledge by pressing the key, or cancel printing by pressing the key.

3.5.1 Report Template

A report can be generated for the test sequences stored to the instrument. A report template is already included in the test instrument to this end. Depending on which test sequence has been executed, the designation of the standard in the report may change.

The report template includes the following items:

- ID number
- Designation
- Customer name
- Location
- Date
- Time
- Comment with 64 characters
- Standard designation / sequence name / manual test
- Measured values
- Limit values
- Evaluations
- Test equipment (serial number)



Note

The display which appears is not a print preview and does not reflect the actual appearance of the printout.

3.5.2 Report Tapes from Thermal Printers

Report tapes can be printed out with the Z721S thermal printer (accessory: Z722S thermal paper).

3.5.3 Printing via ETC

Alternatively, stored measurement data can be read into ETC report generating software at a PC and printed out as a report.

3.6 Printouts – Barcodes (from Firmware V1.3.0)

Provided you have connected a suitable barcode printer via the USB Master interface (see list in Appendix, section 14.1), you can print a barcode for each DUT with the **PRINT** key:

- ⇨ The printer information indicates whether the connected barcode printer is properly recognized by the test instrument: Setup (2/3) > Printer > Z721D > Printer information.
- ⇨ Enter the requested paper size (of the current tray in Z721D) and the coding in the setup menu: Setup (2/3) > Printer > Z721D > Printer settings
- ⇨ Switch to the database view (key **MEM**).
- ⇨ Select the requested DUT with the cursor keys.
- ⇨ Press the **PRINT** key.
- ⇨ The identification code is printed in barcode and text form. If it is not possible to convert the identification code into a barcode, a warning message is generated.

4 Initial Start-Up

4.1 Connecting the Test Instrument to the Mains

- See section 12 for nominal mains values (nominal ranges of use).
- Connect the test instrument to the mains cable via its inlet plug and insert the mains plug into an electrical outlet. The function selector switch can be set to any position. If a mains outlet (earthing contact outlet) is not available, or if only a 3-phase outlet is available, the adapter socket can be used to connect the phase conductor, the neutral conductor and the protective conductor. The adapter socket has three permanently attached cables and is included with the KS13 cable set.



Attention!

If connection is not possible via an earthing contact outlet: Shut down mains power first. Then connect the cables from the coupling socket to the mains using pick-off clips in accordance with the diagram. Disconnection from mains power is only possible with the mains plug.

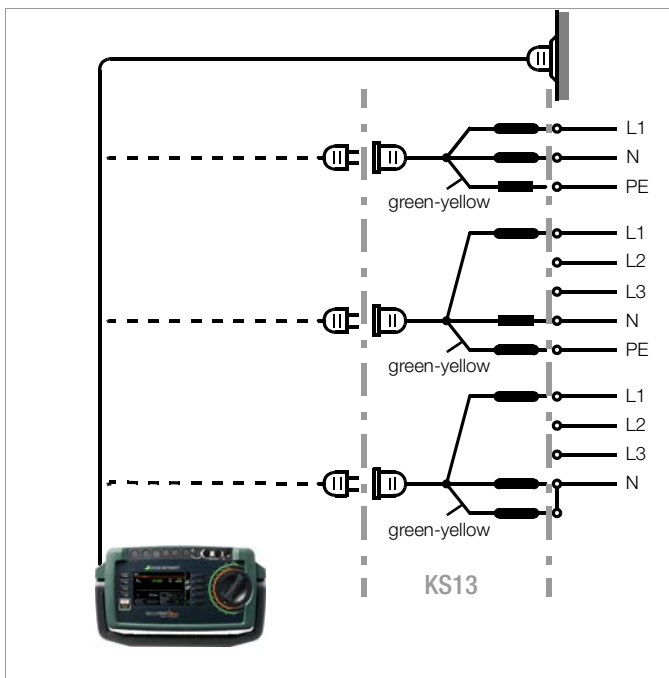


Figure 1 Connecting the Test Instrument to the Mains

4.2 Automatic Recognition of Mains Connection Errors

The device automatically recognizes mains connection errors if the conditions in the following table have been fulfilled. The user is informed of the type of error, and all measuring functions are disabled in the event of danger.

Type of Mains Connection Error	Message	Condition	Measurements
Voltage at protective conductor PE to finger contact (START/STOP key)	Display at the instrument	Press START/STOP button $U > 25 \text{ V}$	All measurements disabled
Protective conductor PE and phase conductor L reversed and/or neutral conductor N interrupted		Voltage at PE $> 100 \text{ V}$	Impossible (no supply power)
Line voltage $< 180 \text{ V} / < 90 \text{ V}$ (depending on mains)	Reference voltage adjustable in setup	$U_{L-N} < 180 \text{ V}$ $U_{L-N} < 90 \text{ V}$ (reference voltage adjustable in setup)	Conditionally possible ¹

¹ 10 A R_{PE} measurements are only possible with line voltages of 115/230 V and line frequencies of 50/60 Hz.



Attention!

If, while testing protective conductor potential, you determine that **the mains protective conductor is conducting voltage** (in accordance with the first two cases listed above), **no further measurements may be performed with the test instrument**. If this is the case, potentially dangerous voltage is also present at the accessible earthing contacts of the standard socket (test socket). Immediately disconnect the test instrument from the mains and arrange to have the fault eliminated at the mains connection.



Note

Voltage at the electrical system's protective conductor PE may result in distorted measurement values during testing for the absence of voltage, or during leakage voltage measurements.

4.3 Test Probe Connection (P1)

Insert the double plug from test probe P1 into socket 1 such that the plug with the white ring makes contact with the socket with the vertical bar.

The white ring identifies the terminal for the high current conductor which is safeguarded by the neighboring fuse link.



Note

Difficulty in contacting exposed conductive parts when using the standard probe with test tip

In order to assure good contact, surface coatings must be removed from devices under test with special tools at a suitable location.

The tip of test probe P1 is not suitable for scratching away paint, because this may impair its coating and/or mechanical strength. Brush probe Z745G may be more suitable than the test probe in certain individual cases.

4.4 Device Settings

SETUP



For the purpose of **initial start-up**, we recommend setting the following basic parameters in the order shown at the right:

Setup 2/3 > Culture > **Language** (for user interface)

Setup 2/3 > Culture > **Keyboard Layout** (for alphanumeric entries)

Setup 1/3 > System > **Date / Time** (for reports generating)

Setup 1/3 > System > **Brightness** (display brightness as %)

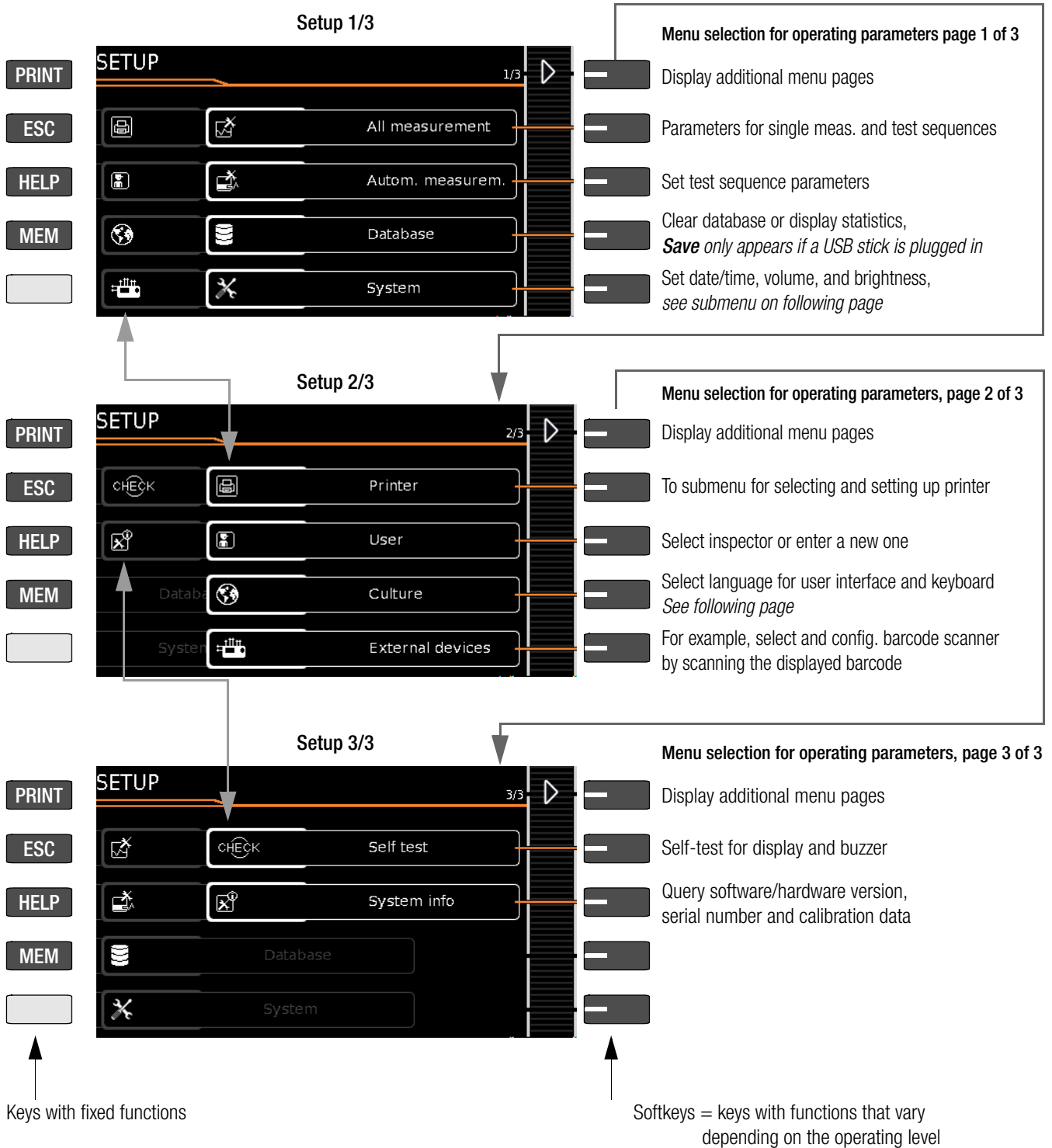


Figure 2 Device Settings, Main Menu Level – SETUP Switch Setting

The following parameters are advisable for **maintenance purposes**:
 SETUP 3/3 > Test > **Display / Buzzer** (for checking info and warning displays/signals)

SETUP 3/3 > System info > **Software version** for updates and **calibration data** for recalibration

See section 13.3 regarding downloading the latest software version.

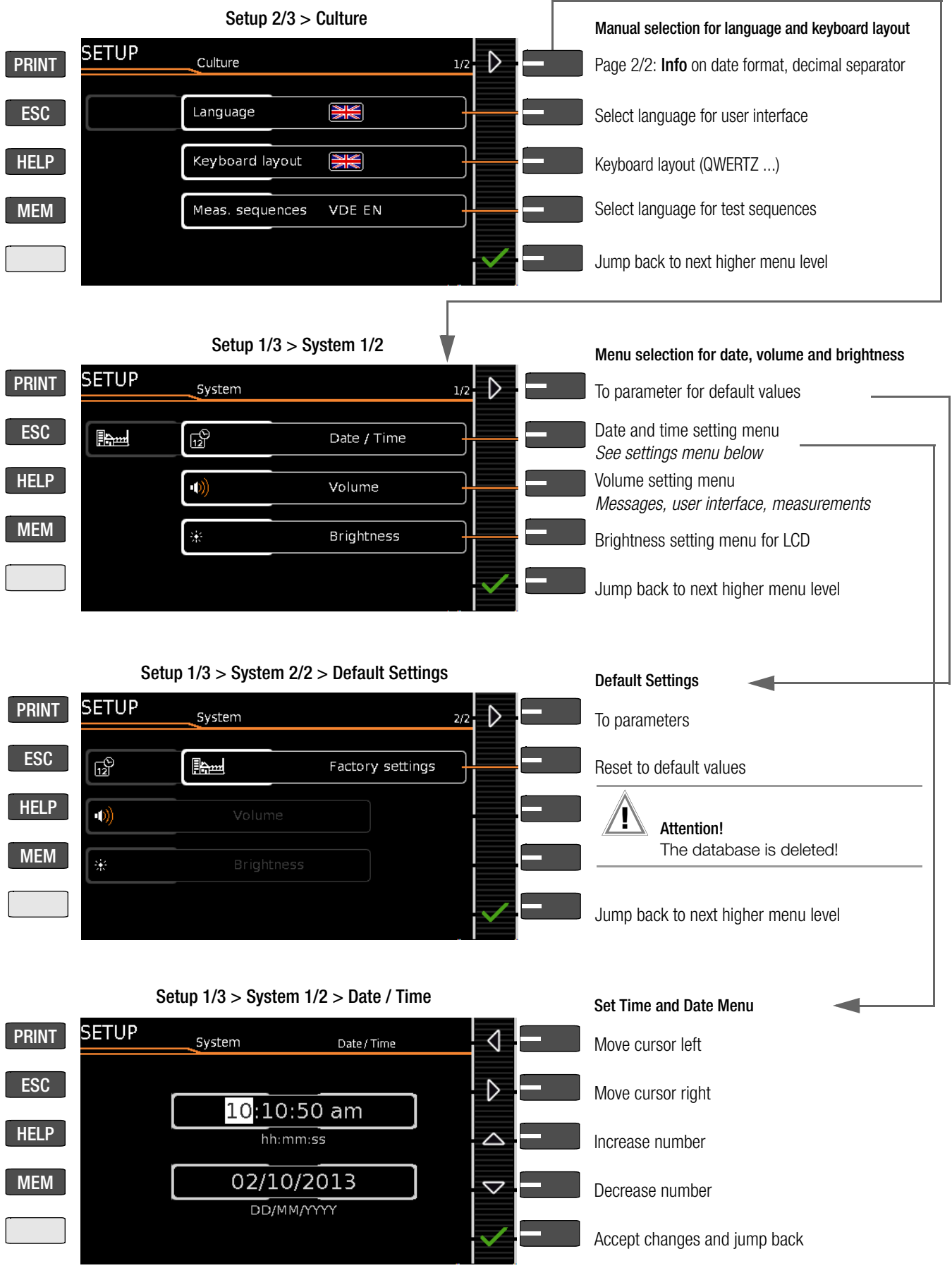


Figure 3 Device Settings, Submenu Level – SETUP Switch Setting



Note

The test instrument must be restarted after changing the language, the keyboard layout and/or the measurement sequences. Database structure and content remain unchanged.

5 Database

5.1 Creating Test Structures, General

A complete test structure with data regarding customers and devices under test be created in the test instrument. This structure makes it possible to assign single measurements or test sequences to devices under test belonging to various customers. Manual single measurements can be grouped together into a so-called "manual sequence".

Objects can be identified with the following parameters:

- **Customer** (ID, designation, street address, city and zip code)
- **DUT** (ID, designation, type, manufacturer, serial number, comment)

Key

ID = identification number

5.2 Transmitting and Saving Test Structures

The following types of transmission are possible for test structures and measurement data (from the test instrument):

- **Export:** Transfer a structure including measured values from the test instrument to the PC (ETC).
- **Store:** Storage of a database to a USB stick plugged on to the test instrument.
- **Restore:** Restore a database from a USB stick to the test instrument.

The test instrument and the PC must be connected with a USB cable in order to transfer structures and data.



Attention!

During data transmission via the USB port (USB connection to the PC or connection of a USB stick), neither the interface cable nor the USB stick may be disconnected.



Attention!

The test instrument may not be disconnected from supply power during transmission via the USB port. The memory structure in the test instrument might otherwise be destroyed.



Note

Data transfer to ETC should not be started during single measurements or test sequences.

5.3 Saving and Documenting Tests via ETC

Structures set up in, and measurement data saved to the test instrument can be imported to ETC report generating software via the USB port. Data can then be saved and reports can be generated.

The most up-to-date version of ETC can be downloaded free of charge from the **mygmc** page of our website as a ZIP file, if you have registered your test instrument:

<http://www.gossenmetrawatt.com>

→ Products → Software → Software for Testers → Report Software without Database → ETC → [myGMC](#)

Test Structure – Hierarchy of Object Levels

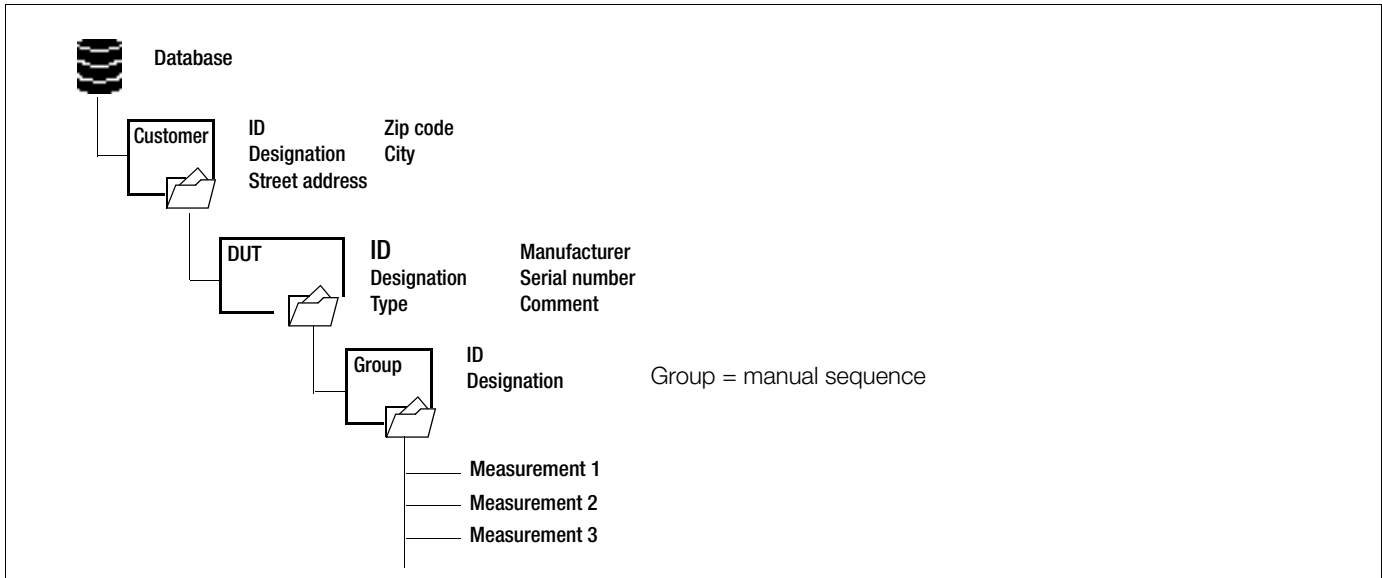


Figure 4 Database Structure

Overview of Keyboard Entries

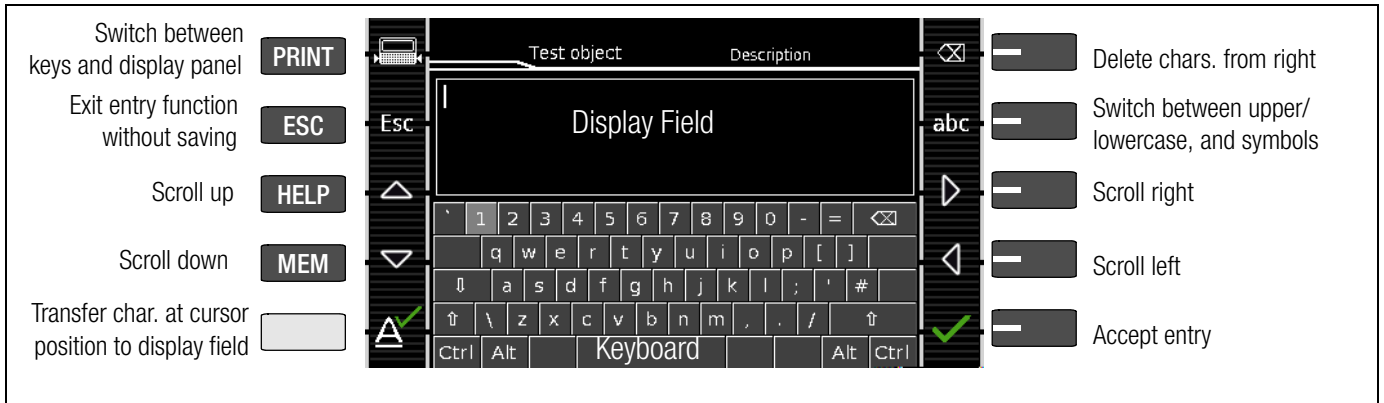





Figure 5 Keyboard Entry Functions

Keyboard Entries

After selecting **ID** or any other object parameter, a keyboard is displayed which allows for the entry of alphanumeric characters via the fixed function keys and the softkeys. Alternatively, entries can also be made with the help of a USB keyboard or barcode scanner which is connected to the instrument.

The keyboard layout can be matched to the language in SETUP: SETUP 2/3 > Culture > **Keyboard Layout** (for alphanumeric entries)

Procedure (example: entering a DUT designation):

- 1 Switch the keyboard to uppercase, lowercase or special characters with the abc key (Abc, ABC, Symb).
- 2 Select the desired alphanumeric character or a line break with the scroll keys (left, right, up and down).
The selection cursor can be accelerated by pressing and holding the respective scroll key.
- 3 After pressing the  key, the respective character appears in the display field.
- 4 Repeat steps 1 through 3 until the complete designation is shown in the display field.
- 5 The designation in the display field can be changed subsequently by hiding the bottom keyboard by pressing the  key. The cursor position can then be changed in order to delete individual characters.
- 6 After pressing the green checkmark, the selected character string is saved. 

5.4 Creating a Test Structure in the Test Instrument and Navigating within the Structure

Overview of the Meanings of the Symbols for Creating Objects – Navigation within Test Structures

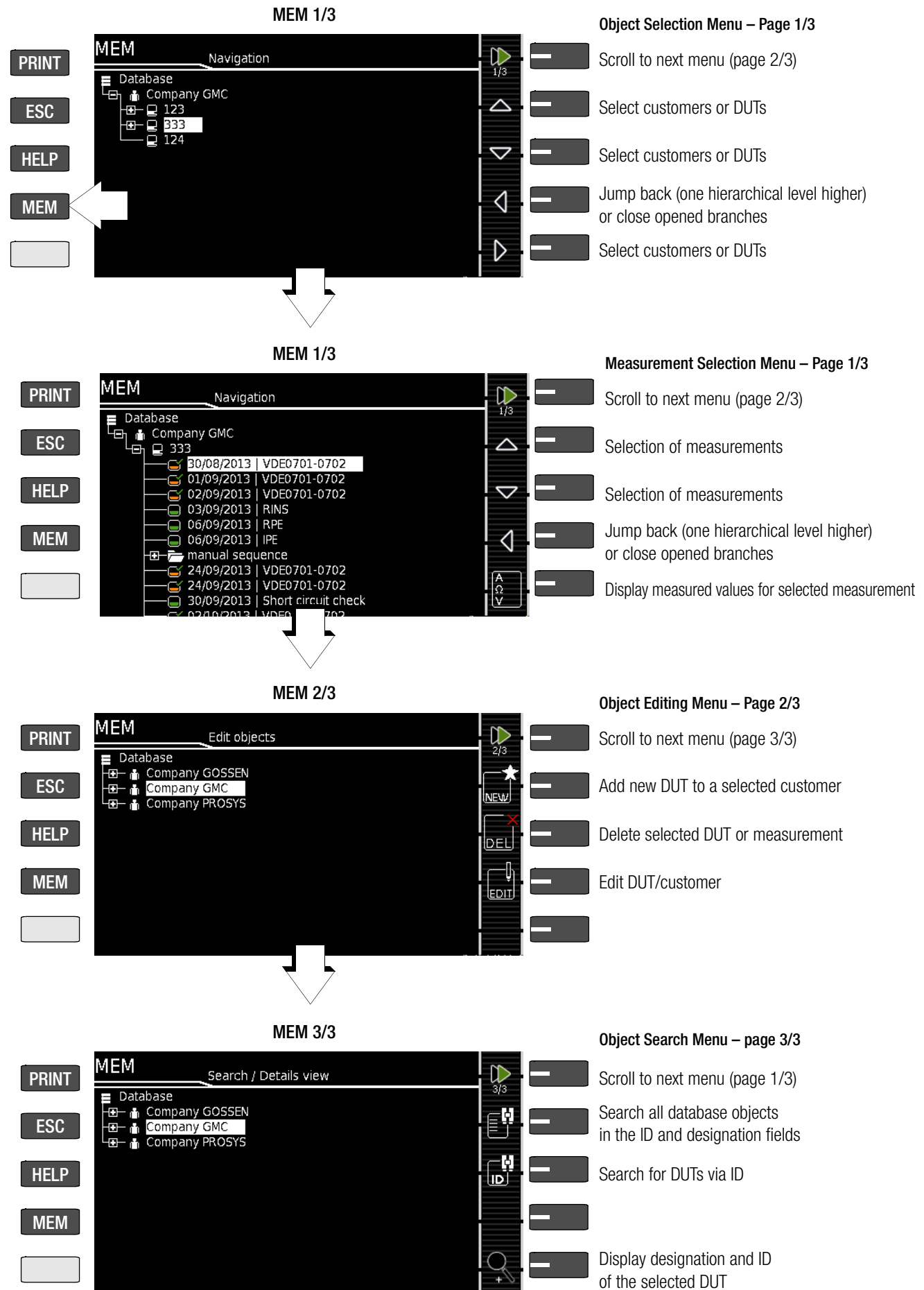


Figure 6 Overview of Navigation, Object Editing and Object Search in the Database

5.4.1 General Procedure for Creating Test Structures

After selection with the **MEM** key, all setting options for the creation of a tree structure are made available on three menu pages (1/3, 2/3 and 3/3). The tree structure consists of structure elements, referred to below as objects.

Select the position at which a new object will be added.

- ⇨ Use the ▲ or ▼ key in order to select the desired structure elements.
- ⇨ If a sublevel exists, you can switch to it by pressing the ► key, or you can open a branch.
- ⇨ The open branch is then closed, or you can switch to the next higher hierarchical level, by pressing the ◀ key.

Creating a New Object

- ⇨ Scroll to the second menu page (MEM 2/3) with the help of the ► key.
- ⇨ After pressing **NEW**, a new object or DUT can be created. Depending on the current position within the hierarchy, the respectively available object types are suggested. Depending on the object type, you'll have to enter at least an ID number and a designation via the keyboard. If not all of the mandatory entries are completed, an error message appears.
- ⇨ Then press the green checkmark in order to accept the entered values. The display jumps back up to the higher hierarchical level. ✓

Changing the Description or ID Number of a Previously Created Object

- ⇨ Scroll to the first menu page (MEM 1/3) with the help of the ► key.
- ⇨ Select the structure element whose designation will be changed.
- ⇨ Scroll to the second menu page (MEM 2/3) with the help of the ► key.
- ⇨ Press the **EDIT** symbol.
- ⇨ Select the parameter whose description will be changed. The keyboard appears automatically.
- ⇨ Change the displayed designation and acknowledge your entry.

5.4.2 Searching for Structure Elements

- ⇨ Scroll to the first menu page (MEM 1/3) with the help of the ► key.
- ⇨ Mark the structure element from which the search will be started.
- ⇨ Scroll to the third menu page (MEM 3/3) with the help of the ► key.
- ⇨ Press the text symbol in order to search for text.
- ⇨ Press the ID symbol in order to search for an ID number. There are three ways to enter search terms:
 - Via the softkeys
 - Via a connected USB keyboard
 - Via barcode or RFID scanner

The keyboard entry function is opened automatically in any case.

- ⇨ The search is started after the entered search term has been acknowledged.



Note

Only exact matches are displayed: no wildcards, case sensitive.

The found object is displayed inversely.

- ⇨ The designation and ID number can be shown or hidden by pressing the magnifying glass symbol.

5.4.3 Backing Up and Restoring the Database

Any database created in the test instrument (structure and measurement data) can be transmitted to a PC via the USB port and saved with the help of ETC software.

Alternatively, the database can be saved to a USB stick which is plugged in directly to the USB master port at the test instrument (see SETUP 1/3 > Database > Backup).



Attention!

During data backup via the USB port (USB connection to the PC or inserted USB stick), neither the interface cable nor the USB stick may be disconnected. If the USB stick is removed during the backup it may be rendered defective.



Attention!

The test instrument may not be disconnected from supply power during data backup via the USB port.

Restoring the Database

If the database in the test instrument has been inadvertently deleted, a database version which has been saved to a USB stick can be restored to the instrument.



Note

Restoring a database from a USB stick is only possible if the firmware revision level is unchanged. If the firmware has been updated between backup and restoring, the database is no longer valid and cannot be used.

Data can be restored from an ETC database even after a firmware update.

5.4.4 Deleting the Database

The database in the test instrument can be deleted in two different ways:

- **SETUP** switch setting, page 1/3 > Database > **Delete**
- Press the **MEM** key > scroll up with the scroll key until the database is selected > press the **DEL** softkey.

6 Connecting the Device Under Test

- ⇒ Connect the DUT in accordance with the schematic diagrams included in the online help function.

Connection of the DUT to the test instrument depends upon:

- **The type of DUT:**

- For direct connection to the test socket (PD)**

- Devices with single-phase connection, as well as extension cords via the **EL1** adapter (in which case the EL1 is connected to probe sockets P1)

- For permanent connection (to the mains)**

- by contacting the housing with the probe (for measurement of protective conductor resistance or with the direct measuring method for the touch current measurement)

- For connection via adapter**

- With *single-phase extension cords* via the **EL1** adapter (in which case the EL1 is connected to probe sockets P1)
 - With *single and 3-phase extension cords* via the **VL2E** adapter to the test socket
 - Devices with 5-pole, 16 A CEE plug via the **AT16-DI** differential current adapter to the test socket
 - Devices with 5-pole, 32 A CEE plug via the **AT32-DI** differential current adapter to the test socket

- **DUT protection class** (PC I, PC II or PC III) or any combinations of protection classes



Note

The DUT must be switched on for all tests. Switches, relays, temperature regulators etc. must all be taken into consideration.

The test instrument automatically recognizes whether or not the DUT is connected to the **test socket**. As a default setting, the program sequence assumes that the plug from the DUT has been connected to the test socket.

6.1 Residual Current Monitoring

For your safety, the test instrument is equipped with continuous residual current monitoring. If residual current exceeds a specified limit value, all measuring processes are stopped, and if line voltage is fed through the test socket it's disconnected. This limit value can be set to one of two levels in the **SETUP** switch position: Setup 1/3 > All Measurements > Residual Current > **10 mA/30 mA**

6.2 Specifying a Reference Line Voltage

The reference line voltage is the voltage to which the measured values for leakage current have been standardized.

The reference line voltage required for certain measurements can also be adjusted:

Setup 1/3 > All Measurements > **Ref. Voltage L-PE**

6.3 Manually Specifying the Connection Type for Single Measurements

If the test instrument is unable to detect the respective **connection type** (e.g. test socket), the suggested connection type must be examined and the connection type must be specified manually if necessary.

- ⇒ Select **parameter settings**.




- ⇒ After selecting the **measurement type**, a list of possible connection types is displayed.
- ⇒ Select a **connection type**.

Once a connection type has been selected, it remains active for all following tests until it's changed once again.

6.4 Manually Selecting a Connection Type / Protection Class for Automatic Test Sequences

If the test instrument is unable to detect the respective connection type or protection class, the suggested connection type must be examined and the connection type or protection class must be specified manually if necessary.

- ⇒ Press the **Sel** key shown to the right in order to display the **classification parameters**. 
- ⇒ After selecting the **protection class** or **connection type** parameter, a list of possible settings is displayed.
- ⇒ Select the respective parameter.
- ⇒ Acknowledge the **Class. Param.** (classification parameters) once again.
The connection type appears at the middle of the header.
The symbol for the respective protection class appears to the right of the connection type.

Once a connection type or a protection class has been selected, it remains active for all following tests until it's changed once again.

6.5 Special Conditions



Note

Protection Class II Devices with Protection Class I Mains Plugs

If the device under test is equipped with a protection class I plug although it complies with protection class II, protection class I is recognized by the test instrument. If this is the case, switch the protection class parameter from I to II.

Testing Several Protective Conductor Connections with the Function for "Automatic Detection of Measuring Point Changes"

During protective conductor measurement, the test instrument recognizes whether or not test probe P1 is in contact with the protective conductor, which is indicated by means of two different acoustic signals.

This function can be adjusted in the **SETUP** switch position in the **"Auto Measurements"** submenu via the **"Auto Measuring Point"** parameter.

Protective Conductor and Insulation Resistance Measurements for Permanently Installed Devices Under Test



Attention!

Deactivate the electrical system which supplies power to the device under test before connecting the test instrument!

- ⇒ Remove the mains fuses from the device under test and disconnect neutral conductor N inside the device under test.

Touch Current Measurement (absence of voltage)

Make sure that the contacted parts are not grounded.

6.6 Connection Tests Conducted by the Test Instrument

The following measurements are performed automatically when the DUT is connected to the test instrument.

- **Connection test** (detection of connection via either the test socket or the multimeter jack sockets)
- **Protection class detection** (with earthing contact connection only: detection of whether or not the protective conductor is connected)
- **Short-circuit test**
- **On test** (test of whether the device under test is switched on or off)
- **Probe test** (detection of whether or not test probe P1 is plugged in)
- **Electronic fuse** (test of whether or not the fuse in the DUT is tripped at a residual current of > 10 mA)
- **Measurement of starting current** (if starting current is greater than 16 A after 200 ms, the following message appears: "Use an external adapter or another measuring method")



Automatic Recognition of States when Connecting DUTs and Probes

Control function		Condition
Short-circuit test	Short-circuit / starting current	$R \leq 1.5 \Omega$
	No short-circuit (AC test)	$R > 1.5 \Omega$
On test	On (DUT passive)	$R < 250 \text{ k}\Omega$
	Off (DUT active)	$R > 300 \text{ k}\Omega$
Probe test	No P1 test probe	$R > 2 \text{ M}\Omega$
	Test probe P1 detected	$R < 500 \text{ k}\Omega$
Protection class detection	Protective conductor exists: PC I	$R < 1 \Omega$
	No protective conductor: PC II	$R > 10 \Omega$
Safety shutdown		
Triggered at following residual current value (selectable)		$> 10 \text{ mA} / > 30 \text{ mA}$
Triggered at following probe current values		
During leakage current measurement		$> 10 \text{ mA}$
During protective conductor resistance meas.		$> 250 \text{ mA}$
Connection test		
Checks whether the DUT is connected to the test socket. In the case of protection class I: checks whether the two protective conductor terminals are short-circuited.		
Protective conductor exists		$R < 1 \Omega$
No protective conductor		$R > 10 \Omega$
Insulation test		
DUT set up in a well-insulated fashion		$R \geq 500 \text{ k}\Omega$
DUT set up in a poorly insulated fashion		$R < 500 \text{ k}\Omega$




7 Notes on Saving Single Measurements and Test Sequences

At the end of each test, test results can be saved under an ID number which is unequivocally assigned to the respective DUT. Depending on the initial situation, i.e. whether or not a test structure or database is already available or an ID has already been entered, the following different procedures are used for saving:


Variant 1 – pre-selection of an existing ID










You've already set up a test structure in the test instrument. Open the database view before starting the measurement by pressing the **MEM** key. Then select the device under test or its ID within the test structure by pressing the respective scroll key. Exit the database view (MEM navigation) by pressing **MEM** and start the measurement. Press the Save as  key at the end of the measurement. The display is switched to the SAVE view. The ID appears with a green or orange background. Press the Save  key once again in order to complete the procedure.

Variant 2 – entry of an existing ID at the end of the test

You've already set up a test structure in the test instrument. You perform the measurement without first opening the database. No device under test was previously selected in the database. Press the Save as  key at the end of the measurement. The following message appears: "No DUT selected!" Press the **ID** key. The softkey keyboard appears. If you enter an ID here which is already in the database, the database view appears (MEM navigation) automatically, and the DUT's ID is displayed inversely. Acknowledge the entry by pressing the  key. The display is switched to the SAVE view. The ID appears with a green or orange background. Press the Save  key once again in order to complete the procedure.


Variant 3 – entry of a new ID at the end of the test

You haven't yet set up a test structure in the test instrument, or the ID is not included in the existing structure. Press the Save as  key at the end of the measurement. The following message appears: "No DUT selected!" Press the **ID** key in order to enter the DUT's ID. The softkey keyboard appears. If you enter an ID here which is **not yet** included in the database, a prompt appears asking you if you want to enter a new object.

- : If you press , the display is switched to the SAVE view. The ID appears with a green or orange background. Press the Save  key once again in order to complete the procedure.
- : If you press , the database view appears (MEM navigation). Go to the next page (**Edit objects 2/3**) by pressing , and then enter a new object. Press  to this end. All possible object types are displayed. Press "DUT". The newly entered ID appears in red to the right of the ID parameter. Acknowledge the entry by pressing the  key. The display is switched to the database view (MEM navigation). The newly entered device under test is displayed inversely in the structure. Press **MEM** in order to return to the SAVE view. The ID appears with a green background. Press the Save  key once again in order to complete the procedure.
- **ESC**: If you don't want to save any measured values, press **ESC** twice in order to go to the measuring view. If you press **ESC** again, a prompt appears asking whether or not you want to delete the measuring points in order to continue with the measurement without saving.

8 Single Measurements

8.1 General

- The desired measurement is selected with the help of the green pointer on the rotary switch and the green semicircle.
- The respective measurement is configured with the help of the softkeys. The parameter settings can be accessed by pressing the softkey with the symbol  shown at the right.
- No limit values can be specified for single measurements, and thus there's no evaluation.
- Checking is performed before each measurement in order to assure a trouble-free sequence, and to prevent any damage to the DUT.
- Single measurements can be saved to memory. The assignment of an ID number is possible to this end.
- Single measurements can be combined into measurement series.
- Mains power can be connected to the DUT with the desired polarity by making a pre-selection in the parameter settings.
- Measured values are checked for plausibility.

Measurement Status – Progress Bar

Measurement standstill (static line)

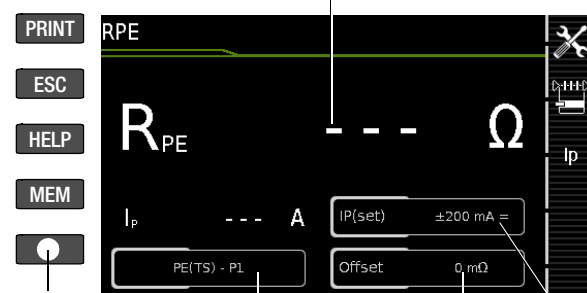


Measurement in progress (space is gradually filled in, pulsating)



Initial Display, Single Measurement

Momentary Measured Value



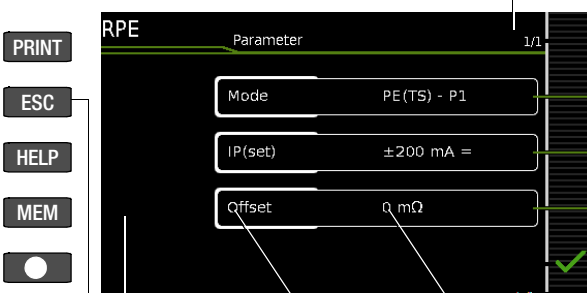
Select parameter settings
Delete measurement data

Measurement – Start – Stop

Test Current Offset Connection Type

Measuring Parameters Display, Single Meas.

Current/Maximum Number of Parameter Pages



Scroll through parameter pages
Select measuring parameter directly
Select measuring parameter directly
Select measuring parameter directly
Accept changes and jump back to initial display

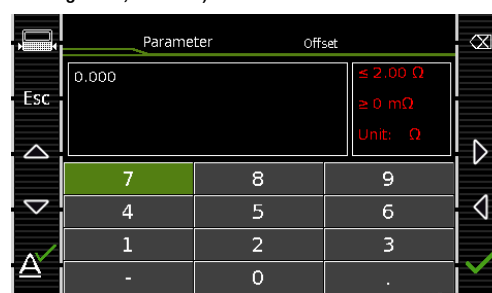
Parameters preview, next page Selectable parameter Selected parameter value

ESC: discard change and jump back to initial display

Switch between display and numeric entry

Numeric Entry (for parameters including UnInt, Offset ...)











Show keyboard / hide keyboard Discard entry and exit keyboard Scroll up Scroll down Accept character at cursor position



Delete character left of the cursor
Scroll right
Scroll left
Accept entry and exit keyboard

Figure 7 Configuring Single Measurements (parameters entry and display)







Meaning of Symbols in the User Interface – Single Measurements

Sym- bol	Softkey Variants, Single Measurements
	Set parameters
	Accept changed parameters, acknowledge memory location
	Acknowledge messages during tests/measurements or resume test sequence
	Abort measurement
	Direct selection key for selecting the measurement type
	Currently selected polarity: "L-N" Press key to change polarity
	Currently selected polarity: "N-L" Press key to change polarity
Ip	Direct selection key for selecting test current for protective conductor measurement
U+ U-	Direct selection key for changing voltage in 10 V steps for insulation measurement
	Start evaluation – record measured value. Each time this softkey is pressed, an additional measured value is saved and the number is increased by one.
ID	The ID number to which the measurement(s) will be stored can be entered here.
	Valid measured values have been obtained for a measurement. This measurement can be saved.
	Save measurement data as (with display of directory path / ID or new entry of an ID other than the preselected one)

8.2 Measurement Series and Storage







Single measurements can be combined into measurement series. The measured values can be saved by pressing the save key, or measurement series can be generated. These can be saved to a DUT (ID number) which has already been set up in the database (see section 5.4.1). The appearance of the save key changes depending on meaning.

Measuring Sequence with Pre-Selection of the DUT

- 1 Activate the database view (MEM navigation) by pressing the **MEM** key.
- 2 Select the DUT or its ID number for the following measurements with the scroll keys. 
- 3 Return to the measuring view by pressing the **MEM** key or the **START/STOP** key.
- 4 Start the test with the **START/STOP** key.  The symbol shown at the right appears and the zero indicates that no measurements have yet been recorded or saved to buffer memory.
- 5 Each time the key at the right is pressed, the respectively current measured value is saved to buffer memory and the number shown in the symbol is increased.  In this way, you always know how many measurements have already been recorded.
- 6 Stop the measurement by pressing the **START/STOP** key, unless a specified measuring time has been stipulated.  The **Save as** symbol appears (floppy disk icon with the number of measured values saved to the clipboard). 
- 7 If you press the save symbol now (floppy disk), the display is switched to the DUT in the database view for checking. 

- 8 After pressing the save symbol once again, acknowledgement of successful storage appears. At the same time, the display is switched to the measuring view.

Measuring Sequence with Subsequent Entry of the DUT

- 1 Start the measurement by pressing the **START/STOP** button.  The symbol shown at the right appears and indicates how many measurements have already been performed.
- 2 Stop the measurement by pressing the **START/STOP** key, unless a specified measuring time has been stipulated.  The save symbol (floppy disk with a number 1) appears and indicates that one valid measured value has been recorded, which can now be saved.
- 3 Press the **save symbol** (floppy disk). 
- 4 You are informed that you haven't selected a DUT in the database. 
- 5 There are two ways to subsequently select a DUT using an ID number which has already been set up in the database: 
 - Select the ID number with a **barcode scanner** or
 - Enter an ID number by pressing the **ID** key.
- 6 The cursor jumps to the location of the DUT with the selected ID number. You only need to acknowledge this position by pressing the green checkmark.
- 7 Press the save symbol (floppy disk).  A message appears indicating that the data have been successfully saved and the display is switched to the measuring view.



Note

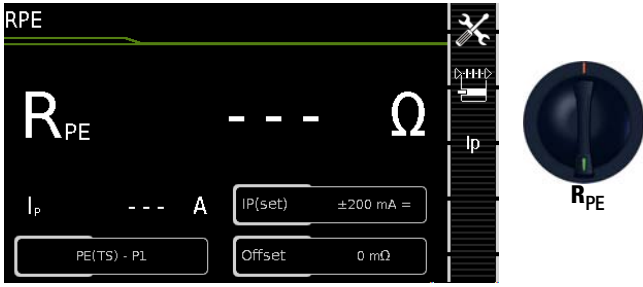
If the entered number cannot be found in the database (because it hasn't been set up), it can be entered immediately by pressing **Yes** when the prompt appears. However, the storage location cannot be selected in this case. The measurement is saved to the most recently selected hierarchy.



Note

Measurements and measurement series can only be saved after measurement has been completed. Measured values can only be added to intermediate buffer memory during a measurement. Customer, location and other entries cannot be changed in the memory menu. These have to be selected directly in the database and entered or changed.

8.3 Measuring Protective Conductor Resistance – RPE



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Measurements at voltage-free objects		
R _{PE}	R _{PE}	Protective conductor resistance
	I _p	Test current (200 mA) SECUTEST BASE10/XTRA: 10 A ¹

¹ 10 A R_{PE} measurements are only possible with line voltages of 115/230 V and line frequencies of 50/60 Hz.

Application, Definition, Measuring Method

Protective conductor resistance is the sum of the following resistances:

- Connector cable or device connector cable resistance
- Contact resistance at plug and terminal connections
- Extension cord resistance if applicable

Schematic Diagram

Protection Class I Devices, Connection to the Test Socket

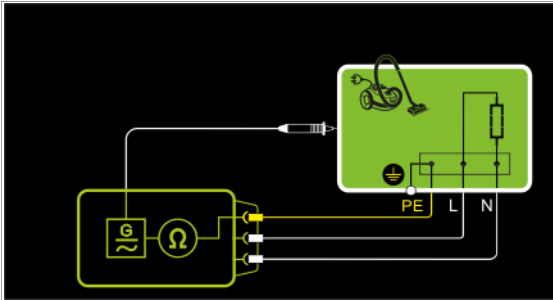


Figure 1/3: Protective conductor resistance is measured between the earthing contacts at the mains plug and the earthing contact connected to the housing by contacting the housing with test probe P1.

Schematic Diagram

Protection Class I Devices, Connection to the Test Socket Special Case: Line Voltage at Test Socket (for testing PRCDS)

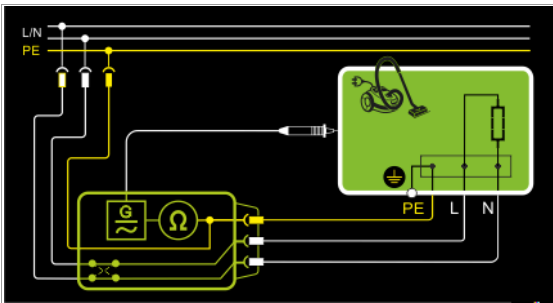


Figure 2/3: Protective conductor resistance is measured between the earthing contacts at the mains plug and the earthing contact connected to the housing by contacting the housing with test probe P1.

Schematic Diagram

Protection Class I Devices, Special Case: Permanently Installed DUTs

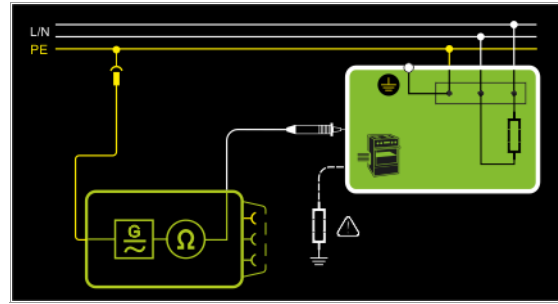


Figure 3/3: In the case of *permanently installed DUTs*, protective conductor resistance is measured between the mains power earthing contact and the earthing contact connected to the housing by contacting the housing with test probe P1.

Resistance is measured:

- Between each exposed *conductive part of the housing* and the earthing contacts at the mains and the device plug (if a removable mains connector cable is used), or the protective conductor terminal for permanently installed devices.
- As a 4-pole measurement
- Between the earthing contacts at the mains plug and the earthing contacts at the device plug for *device connector cables*
- Between the earthing contacts at the mains plug and the earthing contacts at the coupling socket for *extension cords*

Setting Measuring Parameters



Measuring Parameter	Meaning
Measurement type	
PE(PD) – P1	Testing is conducted between the two protective conductor terminals: at the test socket and test probe P1.
Active: PE(PD) – P1 ¹	Same as PE(PD) – P1 with line voltage at the socket (PRCDs)
PE(mains) – P1 <i>Permanently connected DUTs</i>	Testing is conducted between the ground terminal at the mains and test probe P1.
I(set)	
+200 mA DC	Test current: positive direct current
-200 mA DC	Test current: negative direct current
±200 mA (DC)	Test current: direct current whose polarity is reversed every 2 seconds
200 mA (AC)	Test current: alternating current
10 A	Test current: 10 A SECUTEST BASE10/XTRA only (feature G01):
f – only at 200 mA (AC)	
50 to 200 Hz	Test frequency
Offset	
> 0 to < 2 Ω ²	Zero balancing for a selected reference point

¹ SECUTEST BASE10/SECUTEST XTRA (feature G01):

measurement cannot be performed with 10 A AC for this measurement type.





² The selected offset value is permanently saved and used in measurements performed in the AUTO switch positions.

Test Sequence with Connection to the Test Socket

- ⇨ Set the rotary switch to the **R_{PE}** position.
- ⇨ Select measurement type or connection type, and test current. After pressing the **lp** key, you have direct access to the test current parameters: each time this key is pressed, the setpoint value shown in the measuring window is switched to the next value.
- ⇨ Connect the DUT to the test socket.
- ⇨ **Start the test:** press the **START/STOP** key.
- ⇨ Contact all conductive parts which are connected to the protective conductor with test probe P1.



During measurement, the **connector cable** must only be moved to the extent it is accessible during repair, modification or testing. If a change in resistance occurs during the manual test step of the continuity test, it must be assumed that the protective conductor is damaged, or that one of the connector contacts is no longer in flawless condition.

- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 

- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

Special Case: Testing Extension Cords

- ⇨ Set the measurement type parameter to "PE(PD) – P1".
- ⇨ Connect the EL1 adapter to the P1 sockets at the test instrument.
- ⇨ Connect the plug at the end of the extension cord to the test socket.
- ⇨ Connect the coupling socket at the end of the extension cord to the plug at the EL1 adapter.
- ⇨ Same test sequence as described above.

Further options for testing extension cords are included in the description of single measurements in the **EL1** switch position and under automatic test sequences in switch position A8.

Special case: permanently installed DUT

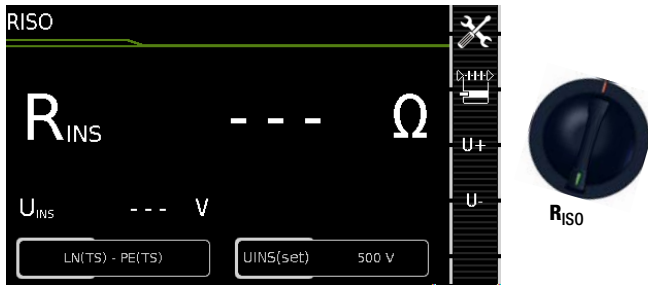
- ⇨ Contact all conductive housing parts with test probe P1.

Maximum Allowable Limit Values for Protective Conductor Resistance for Connector Cables with Cross-Sections of up to 1.5 sq. mm and Lengths of up to 5 m

Test Standard	Test current	Open-Circuit Voltage	R _{SL} Housing – Device Plug	R _{SL} Housing – Mains Plug	Mains power cable
VDE 0701-0702:2008 IEC 62353:2007 (VDE 0751-1)	> 200 mA _{DC}	4 V < U _L < 24 V		0.3 Ω + 0.1 Ω ¹ for each additional 7.5 m	
DIN EN 60974-4 VDE 0544-4:2009-06	or 10 A _~		0.2 Ω		
IEC 62353 (VDE 0751-1)	> 200 mA _{DC}		0.2 Ω	0.3 Ω	0.1 Ω

¹ Total protective conductor resistance: max. 1 Ω

8.4 Insulation Resistance Measurement – RISO



Switch Setting	Meas. Variant	Measuring functions
Single measurements, rotary switch level: green		
Measurements at voltage-free objects		
R _{ISO}	PC1	R _{INS} Insulation resistance
	PC2	U _{INS} Test voltage

Application, Definition, Measuring Method

Protection Class I Devices

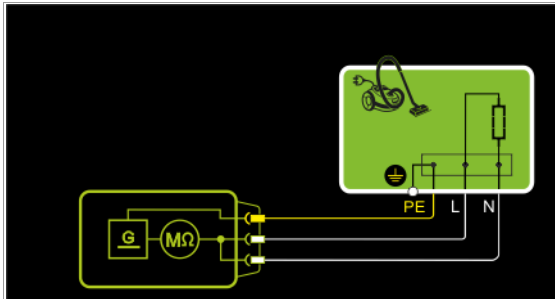


Figure 1/7: Insulation resistance is measured between short-circuited mains terminals (L-N) and protective conductor PE.

Protection Class II Devices with Exposed Conductive Parts

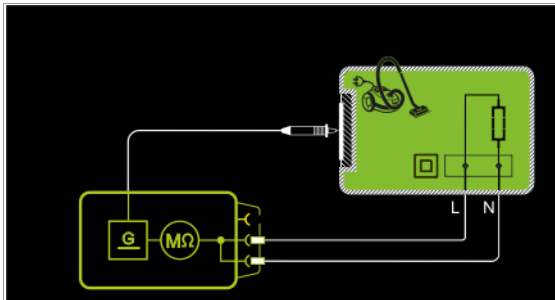


Figure 2/7: Insulation resistance is measured between short-circuited mains terminals (L-N) and external conductive parts which can be contacted with test probe P1 and are **not** connected to the housing.

Protection Class I Devices with Exposed Conductive Parts

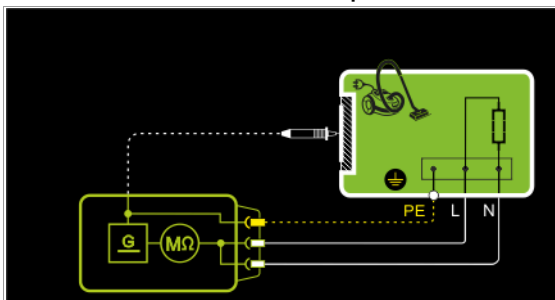


Figure 3/7: Insulation resistance is measured between short-circuited mains terminals (L-N) and external conductive parts which can be contacted with test probe P1 and are **not** connected to the housing, as well as protective conductor terminal PE at the housing.

Protection Class I Devices with Terminals for Application Parts

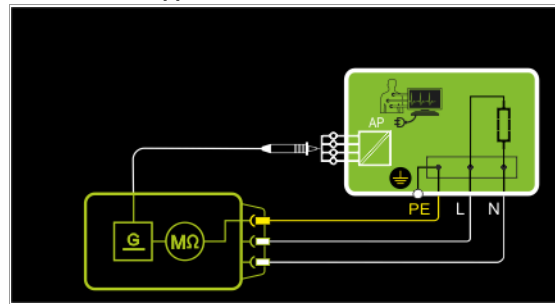


Figure 4/7: Insulation resistance is measured between protective conductor terminal PE and external, short-circuited application parts which can be contacted with test probe P1.

Protection Class II Devices with Outputs for Safety Extra-Low Voltage

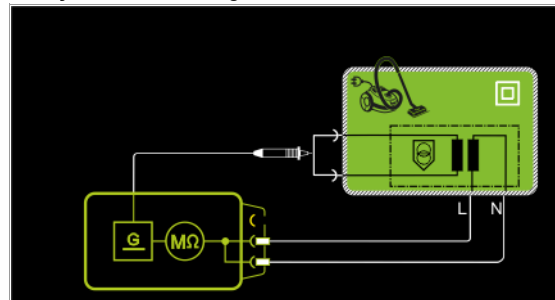


Figure 5/7: Insulation resistance is measured between short-circuited mains terminals (L-N) and the short-circuited safety extra-low voltage outputs which are contacted with probe P1.

Protection Class I Devices with Outputs for Safety Extra-Low Voltage and Exposed Conductive Parts

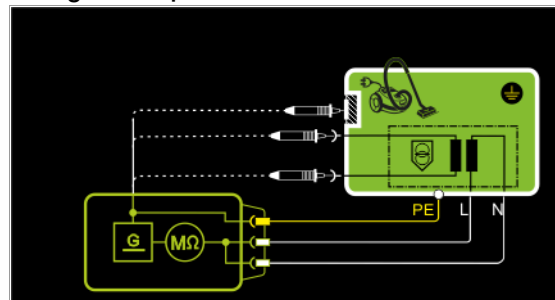


Figure 6/7: Insulation resistance is measured successively between short-circuited mains terminals (L-N) and the safety extra-low voltage outputs which can be contacted with test probe P1, as well as external conductive parts which are **not** connected to the housing.

Protection Class I and Safety Extra-Low Voltage Terminals

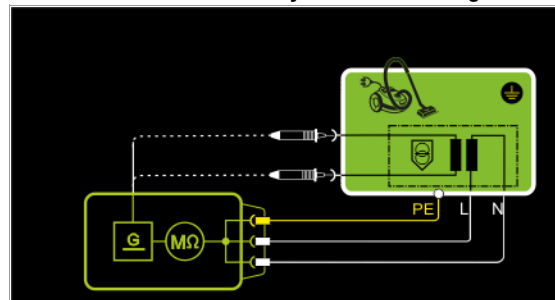


Figure 7/7: Insulation resistance is measured between short-circuited mains and PE terminals, and the safety extra-low voltage outputs which must be contacted one after the other with probe P1.

Special Case: Permanently Installed Protection Class I Devices



Attention!

Deactivate the electrical system which supplies power to the device under test before connecting the test instrument!

- Remove the mains fuses from the device under test and disconnect neutral conductor N inside the device under test.
- Connect test probe P1 to phase conductor L at the device under test in order to measure insulation resistance.

Setting Measuring Parameters



Measuring Parameter	Meaning
Measurement type	
LN(PD)-PE(PD)	PC I: Testing is conducted between short-circuited LN mains terminals at the test socket and the DUT's PE terminal
LN(PD)-P1	Testing is conducted between short-circuited LN mains terminals at the test socket and test probe P1.
PE(mains)-P1	Cable test: Testing is conducted between the ground terminal at the mains and test probe P1.
PE(PD)-P1	Testing is conducted between the PE terminal at the test socket and test probe P1.
LN(PD)-P1 // PE(PD)	Testing is conducted between short-circuited LN mains terminals at the test socket and test probe P1, including PE at the test socket.
Up(set)	
> 50 to < 500 V	Variable test voltage can be entered with the numeric keypad

Test Sequence



Attention!

Prerequisite for Testing

The measurement of insulation resistance may not be conducted on protection class I devices which have not passed the protective conductor resistance test.



Note

The insulation test cannot be performed for all DUTs, for example electronic devices, EDP equipment etc. Leakage current measurements must be performed for these DUTs (see section 8.5). Observe the notes in the service instructions.



Attention!

Touching the DUT During Measurement

Testing is conducted with up to 500 V, and although current is limited ($I < 3.5 \text{ mA}$), if the DUT is touched electrical shock may occur which could result in consequential accidents.



Attention!

Switch Settings at the DUT

All switches at the DUT must be set to the on position during measurement of insulation resistance, including temperature controlled switches and temperature regulators as well.

Measurement must be performed in all program steps for devices equipped with program controllers.

- Set the rotary switch to the R_{ISO} position.
- Select the measurement type and the test voltage.
- The **Up-** and **Up+** keys provide you with direct access to the test voltage parameters: each time this key is pressed, the setpoint value shown in the measuring window, $U_p(\text{set})$, is reduced or increased by 10 V.
- Connect the DUT to the test socket.
- **Start the test:** press the **START/STOP** key.



Note

The measurement is disabled if a voltage of greater than 25 V is measured between the terminals.

- The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer.



Attention!

Removing the Connector Cable

Do not remove the DUT's connector cable until the test has been stopped, in order to assure that the capacitors have been discharged.

- **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number.
- Read the measured values and compare them with the table of permissible limit values.
- Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.



Minimum Allowable Limit Values for Insulation Resistance

Test Standard	Test Voltage	R_{INS}				
		LN → PE	LN → Probe	Probe → PE	PC III	Heating
VDE 0701-0702:2008	500 V	1 MΩ	2 MΩ	5 MΩ	0.25 MΩ	0.3 MΩ *
DIN EN 60974-4 VDE 0544-4:2009-06		2 MΩ	5 MΩ	5 MΩ		

* With switched on heating elements (if heating power > 3 kW and $R_{INS} < 0.3 \text{ M}\Omega$: leakage current measurement is required)

Test Standard	Test Voltage	R_{INS}	
		PC I	PC II
IEC 62353 (VDE 0751-1)	500 V	2 MΩ	7 MΩ
		BF or CF	BF or CF
		70 MΩ	70 MΩ

Notes

Insulation resistance and/or leakage current must be measured by contacting all exposed, conductive parts with test probe P1 for protection class II and III devices, as well as for battery powered devices.

Batteries must be disconnected during testing of battery powered devices.

8.5 Measuring Leakage Current

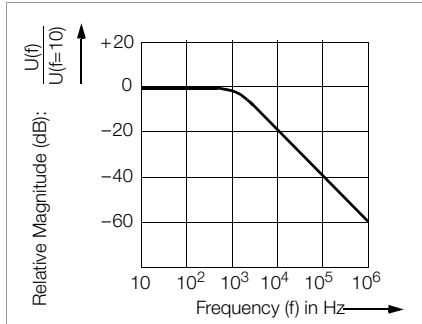


Attention!

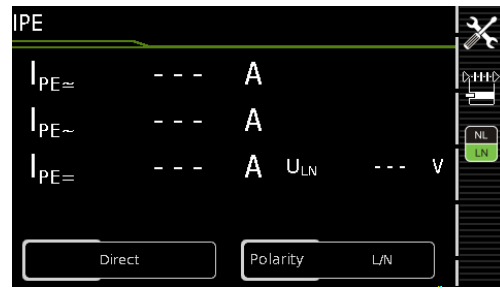
Measurement with DUT Connected to Line Voltage

It's absolutely essential to assure that the device under test is operated with line voltage during performance of **leakage current measurements with the direct or differential current method**. Exposed conductive parts may conduct dangerous contact touch during testing, and may not under any circumstances be touched. (Mains power is disconnected if leakage current exceeds approx. 10 mA.)

Frequency response in accordance with the figure to the right is taken into consideration for all leakage current measurements (**IPE, IT, IE, IP**) (direct, differential, alternative).



8.5.1 Protective Conductor Current – IPE



Switch Setting	Meas. Variant	Measuring functions
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
IPE	Direct Diff. Alt.	IPE~ Protective conductor current, RMS
		IPE~ AC component
		IPE= DC component
		U_LN Test voltage

Application

Protective conductor current must be measured for protection class I devices.

Definition of Protective Conductor Current (direct measurement)

Current which flows through the protective conductor in the case of housings which are isolated from ground.

Definition of Differential Current

Sum of instantaneous current values which flow via the L and N conductors at the device mains connection. Differential current is practically identical to fault current in the event of an error. Fault current: Current which is caused by an insulation defect, and which flows via the defective point.

Definition of Alternative Measuring Method (equivalent leakage current)

Equivalent leakage current is current which flows through the active conductors of the device which are connected to each other (L/N), to the protective conductor (SC1) or to the exposed, conductive parts (SC2).

Differential Current Measuring Method

The device under test is operated with mains power. The sum of the momentary values of all currents which flow through all active conductors (L/N) at the mains side of the device connection is measured. The measurements must be performed with mains plug polarity in both directions.

Alternative Measuring Method (equivalent leakage current)

A high-impedance power supply is connected between the short-circuited mains terminals and all exposed metal parts of the housing (which are connected to one another). Current which flows over the insulation at the device under test is measured.

Protective Conductor Current Measuring Method (direct measurement)

The device under test is operated with mains power. Current which flows through the PE conductor to earth at the mains side of the device connection is measured.



Note

Regardless of the currently selected connection type, all help images and schematic diagrams can be queried for the selected measuring function.

Direct Measuring Method:
DUT mains plug connected to the test socket

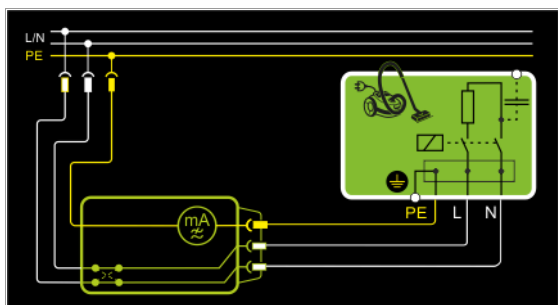


Figure 1/3: The DUT is operated with line voltage. Protective conductor current is measured between the protective conductor at the mains and the protective conductor terminal at the DUT via the DUT's mains cable.

Differential Current Measuring Method:
DUT mains plug connected to the test socket

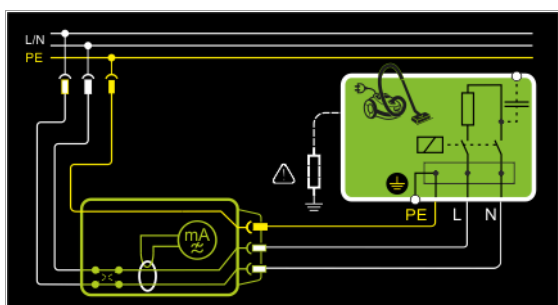


Figure 2/3: The DUT is operated with line voltage. Differential current is measured between mains conductors L and N (current clip concept).

Alternative Measuring Method (equivalent leakage current)
DUT mains plug connected to the test socket

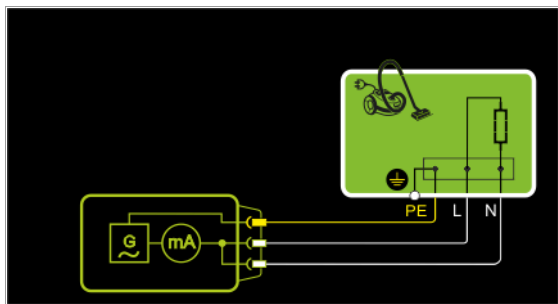


Figure 3/3: After activating test voltage, leakage current is measured via the DUT's mains cable between short-circuited mains conductors L and N and the protective conductor terminal at the DUT.

Setting Measuring Parameters for IPE



Measuring Parameter	Meaning
Measurement type	
Direct	Direct measuring method (via test socket)
Differential	Differential current measurement
Alternative	Equivalent leakage current measuring method
Polarity – for direct and differential measurement type only	
L/N or N/L	Selection of test voltage polarity
U(set) – for alternative measurement type only	
110 V, 115 V, 220 V, 230 V, 240 V	Selection of line voltage as test voltage
Frequency – for alternative measurement type only	
48 Hz to 400 Hz	Selection of line frequency as test frequency

Direct Selection – Setting the Measurement Type



Measuring Parameters	Meaning
Measurement type	
Direct	Direct measuring method (via test socket)
Differential	Differential current measurement
Alternative	Equivalent leakage current measuring method

Test Sequence for Direct Measuring Method

- ⇨ Set the rotary switch to the **I_{PE}** position.
- ⇨ Select the **Direct** measurement type:
 - By setting the parameters
 - or
 - Directly by pressing the key shown at the right
- ⇨ Connect the DUT's mains plug (protection class I) to the test instrument's test socket (see figure 1/4).
- ⇨ Make sure that the device under test is switched off.
- ⇨ **Start the test:** press the **START/STOP** key.
- ⇨ Switch the device under test on.
- ⇨ The measurement must be performed with mains plug polarity in both directions by pressing the **NL/LN** key.
- ⇨ Acknowledge the warning which indicates that line voltage will be connected to the test socket.
- ⇨ Switch the device under test on.
- ⇨ Contact all accessible conductive parts, one after the other, with test probe P1, which are not connected to the housing, as well as any output sockets for safety extra-low voltage if included.
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer.
- ⇨ Turn off the device under test.
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number.
- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.



Test Sequence with Differential Current Method

- ⇨ Set the rotary switch to the **I_{PE}** position.
- ⇨ Select the **Differential** measurement type:
 - By setting the parameters
 - or
 - Directly by pressing the key shown to the right
- ⇨ Connect the DUT's mains plug (protection class I) to the test instrument's test socket (see figures 2/4 and 3/4).
- ⇨ **Start the test:** press the **START/STOP** key.
- ⇨ The measurement must be performed with mains plug polarity in both directions by pressing the **NL/LN** key.
- ⇨ Acknowledge the warning which indicates that line voltage will be connected to the test socket.
- ⇨ Switch the device under test on.
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer.
- ⇨ Turn off the device under test.
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number.
- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.



Test Sequence for Alternative Measuring Method

- ⇨ Set the rotary switch to the I_{PE} position.
- ⇨ Select the **Alternative** measurement type:
 - By setting the parameters
 - or
 - Via the **MA** key
- ⇨ Set the **Up(set)** and **frequency** parameters.
- ⇨ Connect the DUT's mains plug (protection class I) to the test instrument's test socket (see figure 4/4).
- ⇨ **Start the test:** press the **START/STOP** key.
- ⇨ Switch the device under test on.
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer.
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number.
- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.



Maximum Permissible Limit Values for Leakage Current in mA

Test Standard	I_{PE}
VDE 0701-0702:2008	PC I: 3.5 1 mA/kW *
DIN EN 60974-4 VDE 0544-4:2009-06	5 mA

* For devices with heating power of greater than 3.5 kW

Note 1: Devices which are not equipped with accessible parts that are connected to the protective conductor, and which comply with requirements for touch current and, if applicable, patient leakage current, e.g. computer equipment with shielded power pack

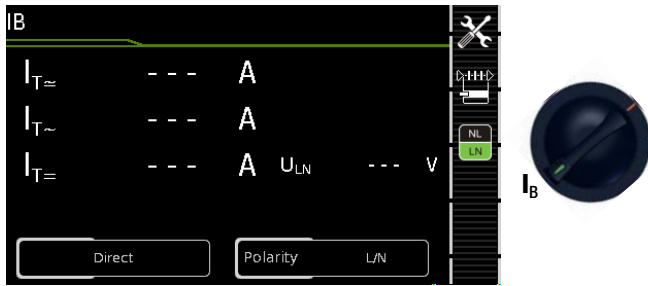
Note 2: Permanently connected devices with protective conductor

Note 3: Portable x-ray devices with mineral insulation

Key

I_{PE} Current in the protective conductor (primary leakage current)

8.6 Touch Current – IB



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
I _c	Direct	I _{T≈} Touch current, TRMS
	Diff.	I _{T~} AC component
	Alt.	I _{T=} DC component
		U _{LN} Test voltage

Application

Make sure that the contacted parts are not grounded.

Definition

Current which flows from housing parts which are not connected to the protective conductor via an external conductive connection to earth or another part of the housing. Flow of current via the protective conductor is excluded in this case.

The following designations are also common: housing leakage current, probe current

Direct Measuring Method:

DUT Mains Plug Connected to Test Socket
Test Probe P1 to P1 Terminals

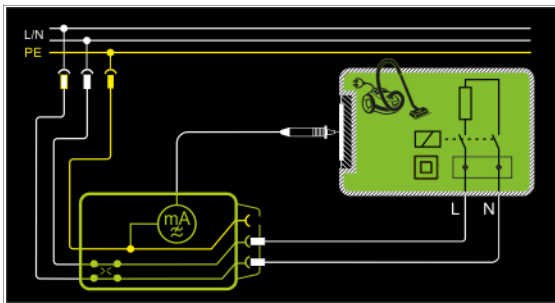


Figure 1/4: The DUT is operated with line voltage. Current which flows to the protective conductor via exposed conductive parts is measured by means of the probe. The measurements must be performed with mains plug polarity in both directions. Polarity is reversed with the **NL/LN** key. The TRMS, the AC or the DC component of the current is measured.



Note

regarding protection class I DUTs:

Parts may or may not be grounded.

Coincidental grounding only occurs in the event of an error.

Differential Current Method:

DUT Mains Plug Connected to Test Socket,
Test Probe P1 to P1 Terminals

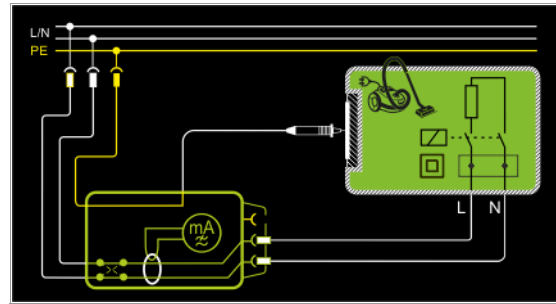


Figure 2/4: The DUT (PC2) is operated with line voltage. Differential current which flows via the two mains conductors is measured (current clamp measurement concept). The measurements must be performed with mains plug polarity in both directions. Polarity is reversed with the **NL/LN** key. The current's AC component is measured. Accessible conductive parts must be contacted with test probe P1.

Alternative Measuring Method (equivalent leakage current)

DUT Mains Plug Connected to Test Socket,
Test Probe P1 to P1 Terminals

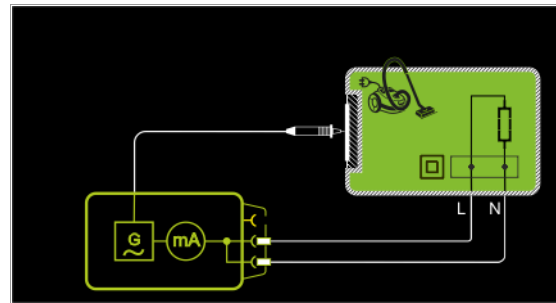


Figure 3/4: After activating test voltage, leakage current is measured between short-circuited mains conductors L and N (DUT mains plug) and accessible conductive parts (probe contact). The TRMS, the AC or the DC component of the current is measured.

Direct Measuring Method for Permanently Installed DUTs

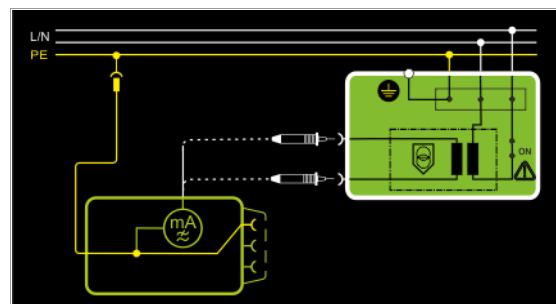


Figure 4/4: The DUT is operated with line voltage from a permanent installation. Leakage current is measured between the protective conductor at the mains and the output sockets for safety extra-low voltage at the DUT, one after the other, with the help of the test probe. Furthermore, accessible, conductive parts which are **not** connected to the housing must also be contacted.

Setting Measuring Parameters



Measuring Parameter	Meaning
Measurement type	
Direct	Direct measuring method (via test socket)
Differential	Differential current measurement
Alternative	Equivalent leakage current measuring method
Permanent connection	Permanently installed DUT
Polarity – for direct and differential measurement type only	
L/N or N/L	Selection of test voltage polarity
U(set) – for alternative measurement type only	
110 V, 115 V, 220 V, 230 V, 240 V	Selection of line voltage as test voltage
Frequency(set) – for alternative measurement type only	
48 Hz to 400 Hz	Selection of line frequency as test frequency

Direct Selection – Setting the Measurement Type



Measuring Parameter	Meaning
Measurement type	
Direct	Direct measuring method (via test socket)
Differential	Differential current measurement
Alternative	Equivalent leakage current measuring method
Permanent connection	Permanently installed DUT

Direct Selection – Setting Polarity – for Direct and Differential Only




Measuring Parameter	Meaning
Measurement type	
L/N or N/L	Selection of polarity of the line voltage applied to the test socket

Prerequisites for Touch Current Measurement

- Visual inspection has been passed.
- For protection class I devices: Protective conductor resistance testing has been passed.
- Insulation resistance testing has been passed.



Test Sequence for Direct and Differential Current Methods





- ⇨ Set the rotary switch to the **I_B** position.
- ⇨ Select the **Direct** or **Differential** measurement type:
 - By setting the parameters
 - or
 - Via the **MA** key
- ⇨ In the case of **direct and differential current measurement**, measurement must be performed with mains plug polarity in both directions. Select the respective polarity to this end by pressing the **NL/LN** key. 
- ⇨ Connect the DUT's mains plug (protection class II) to the test instrument's test socket (see figures 1/3 and 2/3).









Attention!

Testing is conducted in the presence of line voltage.

- ⇨ **Start the test:** press the **START/STOP** key. 
- ⇨ Acknowledge the warning which indicates that line voltage will be connected to the test socket. 
- ⇨ Contact all accessible conductive parts, one after the other, which are not connected to the housing with test probe P1.

- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 

- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

Test Sequence for Alternative Measuring Method

- ⇨ Set the rotary switch to the **I_B** position.
- ⇨ Select the **Alternative** measurement type:
 - By setting the parameters
 - or
 - Directly by pressing the key shown at the right 
- ⇨ Connect the DUT's mains plug (protection class II) to the test instrument's test socket (see figure 3/3).
- ⇨ Set the **Up(set)** and **frequency** parameters.
- ⇨ **Start the test:** press the **START/STOP** key. 
- ⇨ Contact all accessible conductive parts, one after the other, which are not connected to the housing with test probe P1.
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 

- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

Maximum Permissible Limit Values for Leakage Current in mA

Test Standard	I _T
VDE 0701-0702:2008	05
DIN EN 60974-4 VDE 0544-4:2009-06	10 mA

Key

I_T Touch current (leakage current from welding current)

8.6.1 Device Leakage Current – IG



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
IG	Direct	$I_{E\approx}$ Device leakage current, TRMS
	Diff.	$I_{E\sim}$ AC component
	Alt.	$I_{E=}$ DC component
		U_{LN} Test voltage

Application

Measurement of device leakage current is required for electrical medical devices in accordance with IEC 62353 (VDE 0751-1).

In the case of device leakage current as the sum of all leakage current, all probe contact points must be contacted simultaneously.

Definition

Device leakage current is the sum of all leakage currents from the housing, accessible conductive parts and application parts to PE.

Direct Measuring Method

DUT Mains Plug Connected to Test Socket Test Probe P1 to P1 Terminals

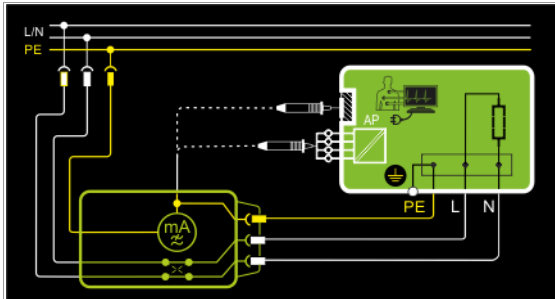


Figure 1/5: The DUT (PC1) is operated with line voltage. Protective conductor current is measured between the protective conductor at the mains (test instrument supply power) and the protective conductor terminal at the DUT via the DUT's mains cable. The measurements must be performed with mains plug polarity in both directions. Polarity is reversed with the **NL/LN** key. Accessible conductive parts which are not connected to the housing, as well as those which are connected to the housing, must be contacted with test probe P1.

If the DUT includes terminals for application parts, they must be short-circuited and contacted with test probe P1 as well.

Differential Current Measurement DUT Mains Plug Connected to Test Socket Test Probe P1 to P1 Terminals

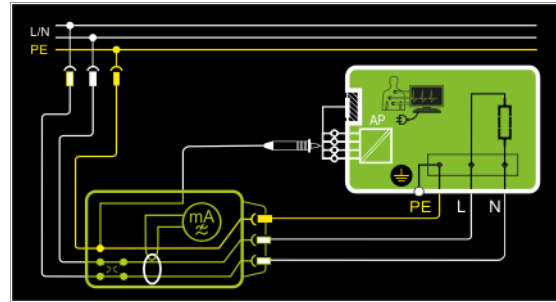


Figure 2/5: The DUT (PC1) is operated with line voltage. Differential current which flows via the two mains conductors is measured (current clamp measurement concept). The measurements must be performed with mains plug polarity in both directions. Polarity is reversed with the **NL/LN** key.

Short-circuited terminals for application parts or accessible conductive parts which are not connected to the housing must be contacted with test probe P1.

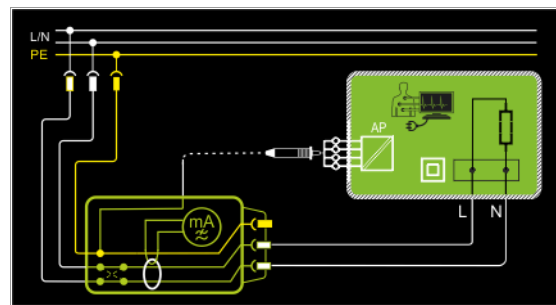


Figure 3/5: The DUT (PC2) is operated with line voltage. Differential current which flows via the two mains conductors is measured (current clamp measurement concept). The measurements must be performed with mains plug polarity in both directions. Polarity is reversed with the **NL/LN** key.

If the DUT includes terminals for application parts, they must be short-circuited and contacted with test probe P1.

Alternative Measuring Method (equivalent leakage current) DUT Mains Plug Connected to Test Socket Test Probe P1 to P1 Terminals

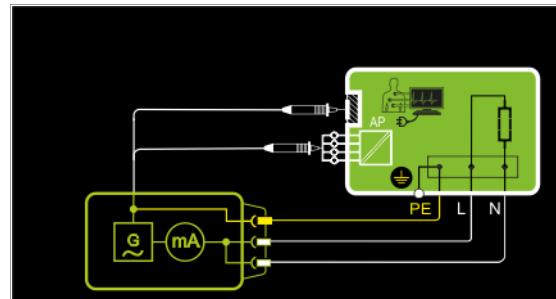


Figure 4/5: After activating test voltage, leakage current is measured between short-circuited mains conductors L and N (DUT mains plug) and accessible conductive parts (probe contact) which **are not connected to the housing**.

If the DUT includes terminals for application parts, they must be short-circuited and contacted with test probe P1 as well.

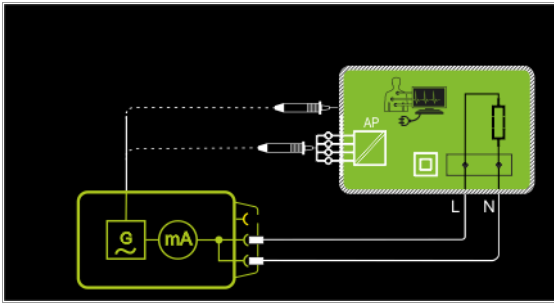


Figure 5/5: After activating test voltage, leakage current is measured between short-circuited mains conductors L and N (DUT mains plug) and accessible conductive parts (probe contact) which **are connected to the housing**.

If the DUT includes terminals for application parts, they must be short-circuited and contacted with test probe P1 as well.

Setting Measuring Parameters



Measuring Parameter	Meaning
Measurement type	
Direct	Direct measuring method (via test socket), optional probe contact
Differential	Differential current measurement
Alternative	Equivalent leakage current measuring method with probe contact
Polarity¹ – for direct and differential measurement type only	
L/N or N/L	Selection of test voltage polarity
U(set) – for alternative measurement type only	
110 V, 115 V, 220 V, 230 V, 240 V	Selection of line voltage as test voltage
Frequency(set) – for alternative measurement type only	
48 Hz to 400 Hz	Selection of line frequency as test frequency

¹ Measurement must be performed with mains polarity in both directions. The largest value is documented

Direct Selection – Setting the Measurement Type










Measuring Parameter	Meaning
Measurement type	
Direct	Direct measuring method (via test socket)
Differential	Differential current measurement
Alternative	Equivalent leakage current measuring method

Direct Selection – Setting Polarity – for Direct and Differential Only



Measuring Parameter	Meaning
Measurement type	
L/N or N/L	Selection of polarity of the line voltage applied to the test socket

Test Sequence

- Set the rotary switch to the I_G position.
- Connect the DUT in accordance with the selected measuring method.
- Set the parameters:
Select the **Direct**, **Differential** or **Alternative** measurement type.
- As an alternative, you can select the measurement type directly using the key shown at the right. 
- In the case of **direct and differential current measurement**, measurement must be performed with mains plug polarity in both directions. Select the respective polarity to this end by pressing the **NL/LN** key. 
- Start the test: press the **START/STOP** key. 
- After each reconnection to the mains, and as soon as the first test is started, a mains connection test is executed.
- **In the case of the direct or differential measurement type:** Acknowledge the warning which indicates that line voltage will be connected to the test socket. 
- The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 
- Read the measured values and compare them with the table of permissible limit values.
- Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

Maximum Allowable Limit Values for Equivalent Leakage Current in mA

Test Standard	I_{GA}	I_{EDL}
VDE 0701-0702	PC I: 3.5 / 1 mA/kW ¹ PC II: 0.5	
IEC 62353 (VDE 0751-1)		PC II 0.2 ²
		PC I (PE or parts connected to PE) 1
		Permanently connected devices with PE 10
		Portable x-ray devices with additional PE 5
		Portable x-ray devices without additional PE 2
		Devices with mineral insulation 5

I_{GA} Device leakage current

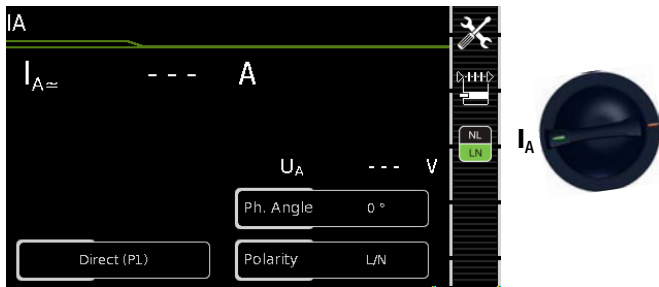
I_{EA} Equivalent leakage current

PE Protective conductor

¹ For devices with heating power ≥ 3.5 kW

² This limit value is not taken into consideration in the DIN EN 62353 (VDE 0751-1) standard.

8.6.2 Leakage Current from the Application Part – IA



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
IA	Direct	IA ≈ Current from the application part
	Alt.	UA Test voltage

Direct Measuring Method DUT Mains Plug (PC) Connected to Test Socket Probe to P1 Terminal

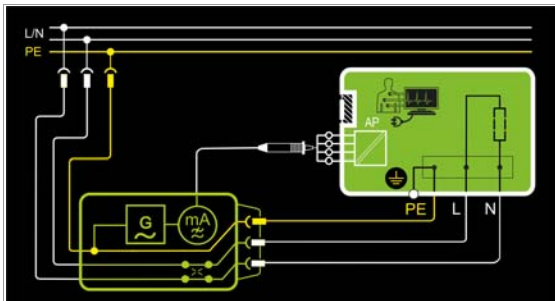


Figure 1/2: The DUT (PC1) is operated with line voltage. The measurements must be performed with mains plug polarity in both directions. Polarity is reversed with the **NL/LN** key. After activating **test voltage** and **line voltage**, leakage current is measured between the short-circuited terminals of the application parts and PE.

Alternative Measuring Method (equiv. patient leakage current) DUT Mains Plug (PC) Connected to Test Socket Probe to PROBE 1 Terminal

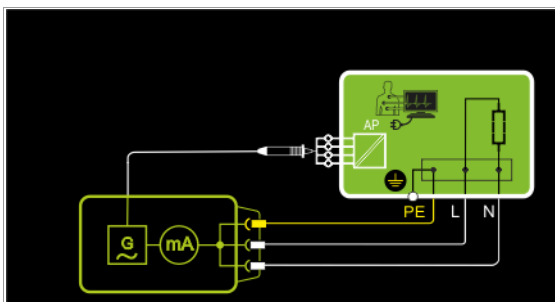


Figure 2/2: After activating **test voltage**, leakage current is measured between short-circuited conductors L-N-PE (DUT mains plug) and the short-circuited terminals of the application parts.

Setting Measuring Parameters



Measuring Parameter	Meaning
Measurement type	
Direct (P1)	Direct measuring method (via test socket) with test probe P1
Alternative (P1)	Equivalent leakage current measuring method (via test socket) with test probe P1
Phase angle – for direct only (P1)	
0 ° or 180 °	Selectable phasing for the internal generator relative to mains phasing
Polarity – for direct only (P1)	
L/N or N/L	Selection of polarity of the line voltage applied to the test socket
U(set) – for alternative only (P1)	
110 V, 115 V, 220 V, 230 V, 240 V	Selection of line voltage as test voltage
Frequency(set) – for alternative only (P1)	
48 Hz to 400 Hz	Selection of line frequency as test frequency

Direct Selection – Setting the Measurement Type






Measuring Parameter	Meaning
Measurement type	
Direct	Direct measuring method (via test socket)
Alternative	Equivalent leakage current measuring method





Direct selection – select polarity – for direct only (P1)



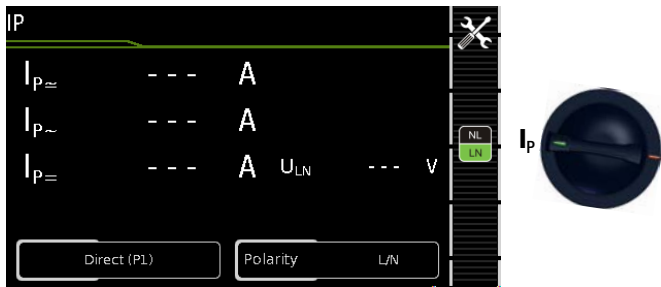
Measuring Parameter	Meaning
Measurement type	
L/N or N/L	Selection of polarity of the line voltage applied to the test socket

Test Sequence

- ⇨ Set the rotary switch to the I_A position.
- ⇨ Connect the DUT in accordance with the selected measuring method.
- ⇨ Set the parameters:
Select the **Direct** or **Alternative** measurement type:
- ⇨ In the case of **direct measurement**, measurement must be performed with mains plug polarity in both directions. Select the respective polarity to this end by pressing the **NL/LN** key. 
- ⇨ **Start the test:** press the **START/STOP** key. 
- ⇨ After each reconnection to the mains, and as soon as the first test is started, a mains connection test is executed.
- ⇨ **In the case of the direct measurement type (P1):** Acknowledge the warning which indicates that line voltage will be connected to the test socket. 

- ⇨ Contact the short-circuited application parts with the test probe.
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 

- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

8.6.3 Patient Leakage Current – IP



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
Ip	Direct with test probe P1	IP~ Patient leakage current, TRMS
		IP- AC component
		IP= DC component
		Up Test voltage

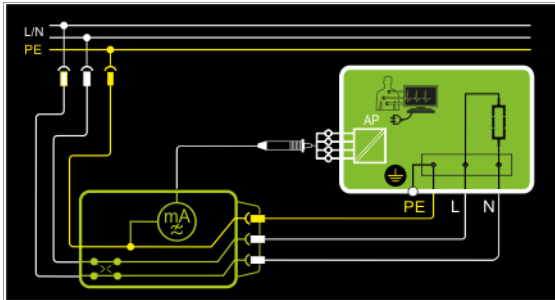
Definition

Patient leakage current is the current which flows to ground or PE from the patient ports at the running device via the patient. The AC and the DC component of the current is measured.

Direct Measuring Method

DUT Mains Plug Connected to Test Socket
Test Probe P1 to Sockets 1 and 2

Schematic Diagram










Direct Selection – Setting Polarity



Measuring Parameter	Meaning
Measurement type	
L/N or N/L	Selection of polarity of the line voltage applied to the test socket

Test Sequence

- ⇨ Set the rotary switch to the **Ip** position.
- ⇨ Connect the DUT to the test socket.
- ⇨ In the case of **direct measurement**, measurement must be performed with mains plug polarity in both directions. Select the respective polarity to this end by pressing the **NL/LN** key. 
- ⇨ **Start the test:** press the **START/STOP** key. 
- ⇨ After each reconnection to the mains, and as soon as the first test is started, a mains connection test is executed. 
- ⇨ Acknowledge the warning which indicates that line voltage will be connected to the test socket.
- ⇨ Contact the short-circuited inputs for the application parts with test probe P1. 
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 
- ⇨ Read the measured values and compare them with the table of permissible limit values.
- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

Maximum Allowable Limit Values for Leakage Current in mA

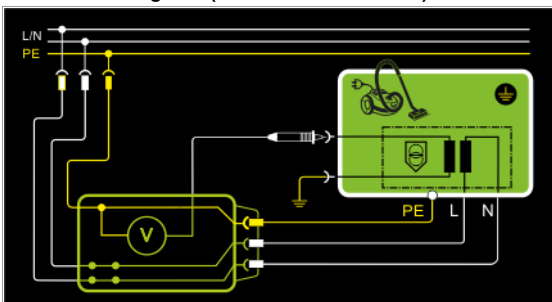
Test Standard		Ip		
		Type B	Type BF	Type CF
IEC 62353 (VDE 0751-1)	Direct current	0.01	0.01	0.01
	Alt. current	0.1	0.1	0.01
EN 60601	Direct current	0.01	0.01	0.01
	Alt. current	0.1	0.1	0.01

8.7 Probe Voltage – U

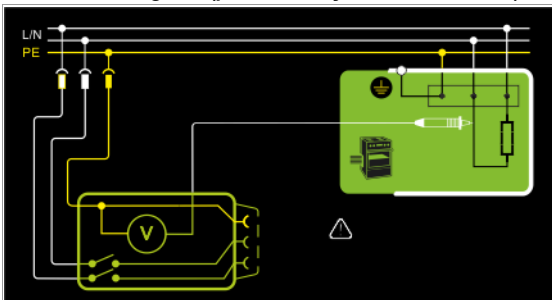


Switch Setting	Meas. Variant	Measuring functions
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
U	U~	Probe voltage, TRMS
	U~	Alternating voltage component
	U=	Direct voltage component

Schematic Diagram (mains to test socket)



Schematic Diagram (permanently connected DUTs)



Direct, alternating and pulsating voltages of up to 253 V can be measured. Two connection types are available, one of which has to be selected in the parameters menu.

Setting Measuring Parameters










Measuring Parameter	Meaning
Measurement type	
PE-P1	Meas. of voltages with reference to PE, test socket remains voltage-free, e.g. for perm. connected DUTs
PE-P1 (with mains)	Measurement of voltages with reference to PE, line voltage is applied to the test socket
L/N or N/L	Selection of test voltage pol. (for PE-P1 with mains only)

Direct Selection – Setting the Measurement Type

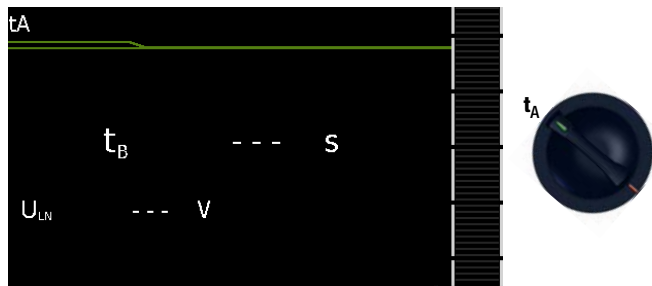


Measuring Parameter	Meaning
Measurement type	
PE-P1	Meas. of voltages with ref. to PE, test socket remains voltage-free, e.g. for perm. connected DUTs to be tested
PE-P1 (with mains)	Measurement of voltages with reference to PE, line voltage is applied to the test socket

Test Sequence

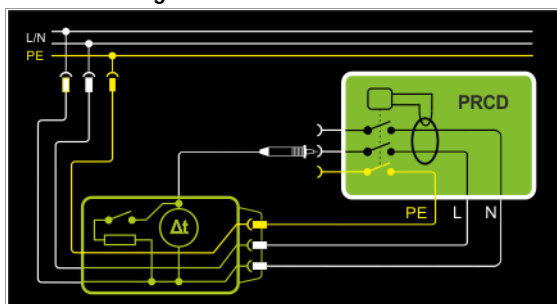
- ⇨ Set the rotary switch to the **U** position.
- ⇨ Connect the DUT's mains plug to the test instrument's test socket.
- ⇨ **Start the test:** press the **START/STOP** key. 
- ⇨ **PE-P1 (with mains):** Acknowledge the warning which indicates that line voltage will be connected to the test socket. 
- ⇨ Contact the ungrounded output for safety extra-low voltage with test probe P1.
- ⇨ Polarity can be set via direct selection immediately before measurement is started, without having to switch to the parameters menu. 
- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer. 
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number. 

- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right. 

8.8 Measuring Time to Trip for RCDs, Type PRCD – t_A



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
t _A		t _B PRCD time to trip for 30 mA PRCD
		U _{LN} Line voltage at the test socket

Schematic Diagram



Definition

According to DIN VDE 0100, part 610:2004, substantiation must be provided that RCCBs are tripped at nominal residual current within 400 ms (1000 ms for selective RCCBs).

PRCD: Portable residual current device (only those whose protective conductor is not deactivated)

Application

The PRCD under test is plugged into the test socket at the test instrument. The PRCD's phase conductor must be contacted with test probe P1 in order to trip the PRCD. This is usually the left-hand socket.

Test Sequence

- Set the rotary switch to the t_A position.
- Plug the PRCD into the test socket at the test instrument and connect the test probe to P1.

- **Start the test:** press the **START/STOP** key.



- Acknowledge the warning which indicates that line voltage will be connected to the test socket.



Execute the following steps when prompted to do so:



Note

Please note that test probe P1 is in continuous contact with the phase conductor from the point in time at which the PRCD is plugged in until it trips. Premature disconnection of the test probe may result in erroneous measured values.

- After each reconnection to the mains, and as soon as the first test is started, a mains connection test is executed.
- If the probe test has revealed that probe P1 was not connected: connect probe P1 as described above.
- Switch the PRCD on within 5 seconds or activate it (e.g. reset button on PRCD), so that the PRCD can be activated when energized with line voltage.
- Contact neutral conductor L at the PRCD with test probe P1 (ascertain by trial and error if necessary).
- The test is automatically ended and time to trip is displayed after the PRCD is tripped.



Note

If the PRCD was not switched on, or if N was contacted instead of L at the PRCD with test probe P1, an error message is displayed and "Error" appears at the display.

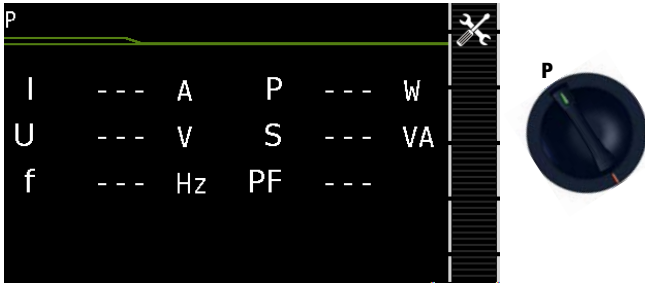
- The save symbol appears and prompts you to save the measured values to an ID number.



- Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.

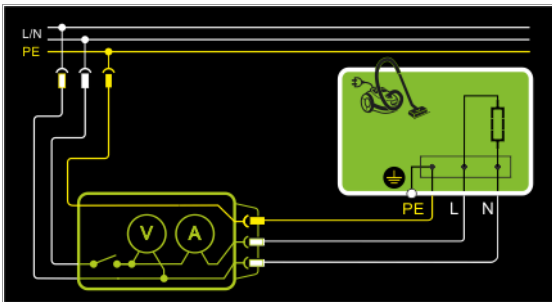


8.9 Function Test – P



Switch Setting	Meas. Variant	Measuring functions
Single measurements, rotary switch level: green		
Measurements at DUTs with line voltage		
P		Function test at the test socket
	I	Current between L and N
	U	Voltage between L and N
	f	Frequency
	P	Active power
	S	Apparent power
	PF	Power factor

Schematic Diagram



Setting Measuring Parameters

Measuring Parameter	Meaning
Polarity	
LN	Phase L – neutral conductor N
NL	Neutral conductor N – phase L

The device under test can be subjected to a function test with mains voltage via the integrated test socket.

The DUT is tested automatically for short-circuiting. The test socket is switched to mains outlet.

In addition to testing with the selector switch in the function test position, a function test can also be performed immediately after safety testing has been passed in accordance with the selected standard (not possible for protection class III devices).



Note

The function test can only be executed for DUTs which are connected to the test socket.

Test Sequence



Attention!

The function test may only be performed after the DUT has successfully passed the safety test.



Attention!

Refer to the safety precautions on page 7 with regard to **switching power consumers**.



Attention!

Starting the Function Test

For reasons of safety, the device under test must be switched off before the function test is started. This precaution prevents inadvertent start-up of a DUT which may represent a hazard during operation, e.g. a circular saw or a disc grinder.

Ending the Function Test

After completion of the function test, DUTs must be turned off with their own switch – especially devices with relatively high inductivity.

- Set the rotary switch to the **P** position.
- Connect the DUT's mains plug to the test instrument's test socket.
- **Start the test:** press the **START/STOP** key.



- Acknowledge the warning which indicates that line voltage will be connected to the test socket.



- The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer.



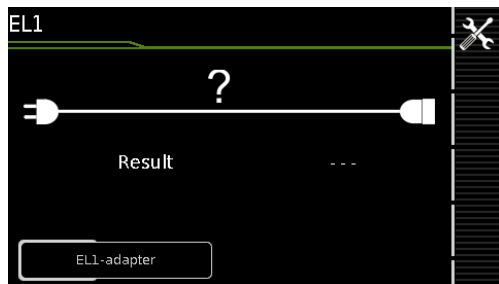
- **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number.



- Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.

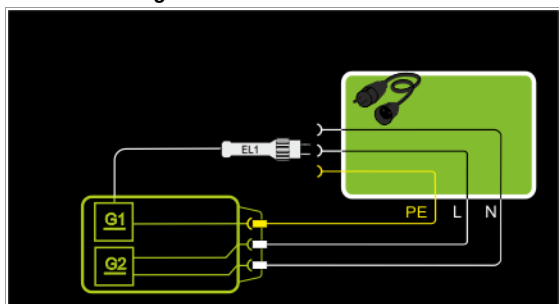


8.10 Testing Extension Cords – EL1



Switch Setting	Meas. Variant	Measuring Function
Single measurements, rotary switch level: green		
Probe measuring functions		
EL1		Extension cord with EL1 adapter Adapter for single-phase extension cords for testing: – Continuity – Short-circuit – Incorrect polarity (reversed wires)

Schematic Diagram



Setting Measuring Parameters



Measuring Parameter	Meaning
Measurement type	
Direct (P1)	Measurement with EL1 adapter for single-phase extension cords
	Measurement with VL2E adapter for 3-phase extension cords, parameter selection in preparation

See corresponding single measurements for the testing of RPE and RINS.



Note

See section 10, “Test Sequences in Accordance with Standards” (switch setting A8), with regard to testing extension cords per DIN VDE 0701-0702, for which RPE and RINS are measured.



Attention!

If the EL1 continuity test is conducted for an extension cord in combination with a “travel adapter”, results provided by the test instrument indicating the correctness of the extension cord’s polarity cannot be relied upon!

Test Sequence

- ⇨ Set the rotary switch to the **EL1** position.
- ⇨ Connect the EL1 adapter to the P1 sockets at the test instrument.
- ⇨ Connect the plug at the end of the extension cord to the test socket.
- ⇨ Connect the coupling socket at the end of the extension cord to the plug at the EL1 adapter.
- ⇨ **Start the test:** press the **START/STOP** key.



- ⇨ The measured values are displayed. The measured value recording symbol shown at the right appears. Each time this key is pressed, the currently displayed measured value is saved to the buffer.



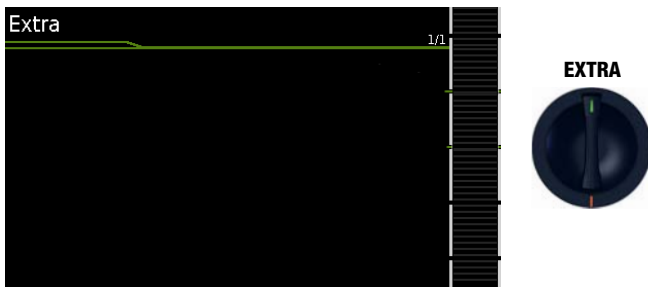
- ⇨ **Stop the test:** press the **START/STOP** key. The save symbol appears (floppy disk showing the number of measured values stored to buffer memory) and prompts you to save the measured values to an ID number.



- ⇨ Press the **ESC** key in order to discard the measured values stored to buffer memory and acknowledge by pressing the key shown at the right.



9 Special Functions – EXTRA



Switch Setting	Meas. Variant	Measuring Function
		Single measurements, <i>rotary switch level: green</i>
Probe measuring functions		
EXTRA		

QR code: Scanning the QR code allows you to download and read the current operating instructions from www.gossen-metrawatt.com, for example at a tablet PC.

10 Test Sequences

Default State

Switch Setting	Standard	Measuring Type	Connection Type	Sequence freely selectable, depending on the selected configuration (Protection Degree, Type, Applied Part)
Automated test sequences, rotary switch level: orange				
Preconfigured (freely selectable) test sequences				
A1	VDE 0701-0702	passive	test socket	short-circuit test.* – visual inspection* – RPE* – RINS* – IPE Alt. – function test*
A2	VDE 0701-0702	active	test socket	short-circuit test.* – visual inspection* – RPE* – RINS* – IPE LN – IPE NL – function test*
A3	VDE 0701-0702	EDV (active)	test socket	short-circuit test.* – visual inspection* – RPE* – RINS* – IPE LN – IPE NL – function test*
A4	IEC 62353 (VDE 0751)	passive	test socket	short-circuit test.* – visual inspection* – RPE* – RINS PC I* – RINS PC II+AWT* – RINS BF* – IE PC I – IA BF–function test*
A5	IEC 62353 (VDE 0751)	active	test socket	short-circuit test.* – visual inspection* – RPE* – RINS PC I** – RINS PC II+AWT* – RINS BF* – IE PC I – IA BF–function test*
A6	IEC 60974-4	active	test socket	short-circuit test.* – visual inspection* – RPE* – RINS PC I – RINS Weld. – RINS Wid.-PE – IPE LN – IT W1 LN – IT W2 LN – IPE NL – IT W1 NL – IT W2 NL – U(0) – function test* – visual inspection*
A7	IEC 60974-4	active	AT16/32-DI-Adap.	visual inspection* – RPE* – RINS PC I – RINS Weld. – RINS Wid.-PE – IPE NL – IT W1 NL – IT W2 NL – U(0) – visual inspection*
A8	VDE 0701-0702	ExtCord	EL1-adapter	short-circuit test.* – visual inspection* – RPE* – RINS* – continuity (EL1)
AUTO	Freely selectable	Freely selectable	Freely selectable	

* on condition that the respective sequence parameter has been preset to „on“

10.1 General

If the same sequence of single tests will be run frequently (one after the other with subsequent report generation), for example as specified in the standards, it's advisable to make use of test sequences (also called measuring sequences).

Limit values have been entered for test sequences in accordance with the standards. And thus a go/no-go evaluation takes place during measurement based on worst-case assessment. If the momentary measured value is displayed in green, it lies within the limit values specified in the standard. If the measured value appears orange at the display, it doesn't fulfill the requirements set forth in the standard. Even if the DUT fails just one single measurement, the test sequence is aborted and testing in accordance with the selected standard is failed.

Automatic test sequences are run in rotary switch positions AUTO, as well as A1 through A8.

Test sequences A1 ... A8 and AUTO have been pre-configured at the factory.

We recommend assigning frequently used test sequences to A1 ... A8 while performing special sequences which require frequent parameter modifications in switch position AUTO.

The measurements are evaluated automatically by the test instrument. Evaluation is based on the worst-case and, depending on settings, in consideration of measuring uncertainty.

Test Sequences in the AUTO Switch Position

The following test sequences are included as a standard feature with the SECUTEST BASE(10)XTRA in the AUTO switch position:

- **DIN VDE 0701-0702**
Recurrent test and test after repair and modification of electrical equipment
- **IEC 62353**
Medical electrical equipment – Recurrent test and test after repair of medical electrical equipment (application parts with test probe P1)
- **IEC 60974-4**
Arc welding equipment – Part 4: Periodic inspection and testing (voltage measurement with test probe P1 without electrical isolation) One pole of the voltage to be measured must be connected to PE at the mains.

The individual sequences are selected with the softkeys.

Specifications for the test sequences can be entered to the device in two different ways:

- **SETUP switch position:** general settings can be entered which apply to all test sequences (regardless of the respectively selected standard).
- **Switch positions AUTO and A1 through A8:** classification parameters and sequence parameters can be entered which only apply to the selected switch position.

General Settings (SETUP: auto measurements parameter)

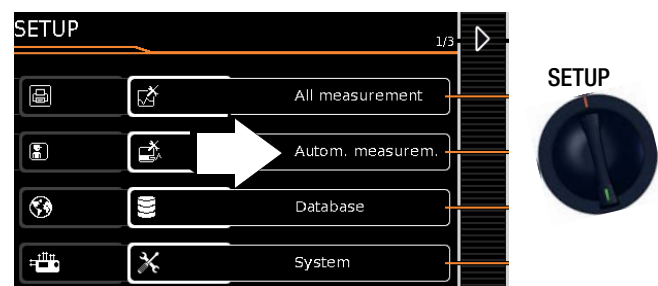
The following settings can be entered for all test sequences in the SETUP switch position on menu page 1/3 under the **auto measurements** parameter:

At the End of the Sequence

At the end of a sequence, either the save symbol appears in order to prompt storage, or the results list is displayed.

Consider Measuring Uncertainty

If **Yes** is selected, measuring uncertainty is taken into consideration when the measurement results are displayed. The final result which appears at the display is downgraded by an amount equal to measuring uncertainty.

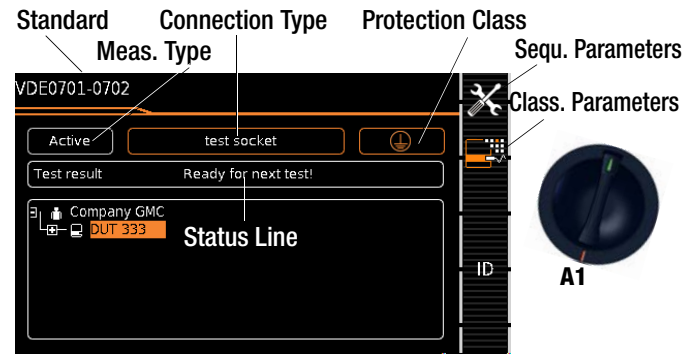


Meaning of Symbols in the User Interface – Test Sequence

Symbol	Softkey Variants, Test Sequence
	Test for Protection Class I Devices Exposed, conductive parts are connected to the protective conductor so that they are not charged with voltage if the basic insulation should fail.
	Test for Protection Class II Devices These devices are equipped with double insulation or reinforced insulation.
	Test for Protection Class III Devices These devices are supplied with safety extra-low voltage (SELV). Beyond this, no voltages are generated which exceed SELV.
	Adjust measuring parameters. <i>Currently no function – for future expansion</i>
	Set classification parameters
	Assess visual inspection or function test with OK or not OK (toggle key)
	Enter a comment, e.g. for the visual inspection or function test
	Edit a comment
	Continue test, next test step in the test sequence
	Accept changed parameter, return to memory view
	Stop test sequence
	Skip measurement
	Start evaluation – record measured value. Each time this softkey is pressed, an additional measured value is saved and the number is increased by one.
	Repeat measured value recording
	Delete measured value
	Display measured values
	Display details from the results list
	Hide details from the results list
	The ID number to which the measurement(s) will be stored can be entered here.
	Valid measured values have been obtained for a test sequence. This measurement can be saved.
	Save measurement data as (with display of directory path / ID or new entry of an ID other than the preselected one)

10.2 Selecting and Configuring a Test Sequence

Initial Page of a Sample Test Sequence



Classification Parameters – Automatic Recognition

If the settings of certain classification parameters are automatically recognized by the test instrument, it is signalled by an amber frame (as from firmware version V1.3.0; here: connection type test socket and protection class I). The description of these parameters, which depend on the switch position, is given below.

Classification Parameters, Switch Settings A1 through A8

Sequence Parameter	Setting Options / Meaning
1/2	
Standard	Permanently set
Protection class *	Selection of PC1, PC2, PC3 or combinations
Connection type *	Test socket / permanent / adapter
2/2	
Measurement type (MA)	Permanently set
Detected classification	No auto-detection: All classification parameters such as connection and protection class must be entered manually. Always accept: All classification parameters activated under "Auto-detection of" are detected automatically and accepted.
Auto-detection of	Any desired combinations for automatic detection of: – Connection – Protection class (PC)

Classification Parameters, AUTO Switch Setting

Sequence Parameter	Setting Options / Meaning
1/2	
Standard	Test standard / extension cord
Protection class *	PC1/PC2/PC3
Connection type *	Test socket / permanent / adapter
2/2	
Measurement type (MA)	Active or passive DUT (on test: on = passive, off = active)
Detected classification	No auto-detection: All classification parameters such as connection and protection class must be entered manually. Always accept: All classification parameters activated under "Auto-detection of" are detected automatically and accepted.
Auto-detection of	Any desired combinations for automatic detection of: – Connection – Protection class (PC)

* These parameters must be entered manually if they're not automatically detected, or if they're detected incorrectly.

Sequence Parameters (as from Firmware V1.3.0)

The sequence parameters of switch positions A1 ... A8 and AUTO allow for the following settings and are the same for all switch positions:

- Showing and hiding of selected test steps
- Selection of test current for RPE
- Measurements with or without polarity reversal
- Showing or hiding of test comments

Sequence parameter	Setting options / Meaning
RPE	Test step protective conductor resistance on: perform test step off: hide/skip
RINS PCI+II	Test step insulation resistance Protection class I and II on: perform test step off: hide/skip
RINS PCIII (SELV)	Test step insulation resistance Protection class III and/or safety extra low voltage (SELV) on: perform test step off: hide/skip
RPE IP	Select test current 200 mA~ 10 A~ (only SECUTEST BASE10 or SECUTEST XTRA)
IPE measurement type (active)	direct or differential
Visual inspection	on: perform at the start of the test sequence off: hide/skip
Function test	on: perform at the end of the test sequence off: hide/skip
Reverse polarity	on: perform measurements in both directions off: perform measurements without polarity reversal
Show test comments	on: show test comments off: hide test comments
Short-circuit check L-N	on: perform short-circuit detection off: hide/skip short-circuit detection

10.3 Connecting the DUT

- Connect the DUT to the test instrument in accordance with the selected test sequence.
 - Test socket
 - Permanent connection
 - AT16/32-DI adapter

Switch position: A1 ... A7, AUTO




Connection depends on the type of DUT.

Switch Position A8

For testing extension cords in accordance with standards: connection to the test socket via the following adapter:

- **EL1**: for single-phase extension cords

10.4 Selecting a DUT

- If no DUT has been selected in the initial display, enter its ID number, for example by means of a barcode scanner, after selecting **ID**.
- As an alternative, activate the database view with the **MEM** key: 
- Select the DUT for the test sequence with the scroll keys. 
- Return to the measuring view by pressing the **MEM** key. 

10.5 Checking Connection and Starting the Test Sequence

- Trigger the connection test and the test sequence by pressing the **START** key.



The following checks are run automatically before the test sequence is started:

- Probe test (whether or not test probe P1 is connected)
- Insulation test (whether or not the DUT is set up in a well-insulated fashion)
- On test and short-circuit test:
(Prerequisite: sequence parameter „short-circuit check L-N“ has been preset to „on“)
In order to be able to detect a short-circuit at the DUT, testing is conducted between L and N, as well as LN and PE.

If you have set the “**Detected classification**” parameter for the respective test sequence to “Always accept” and the “**Auto-detection of**” parameter to “Connection and PC” (before triggering **Start**), the following additional checks will be run before the test sequence is started:

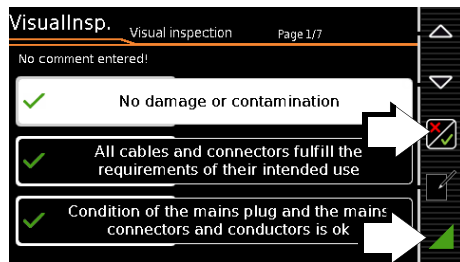


- Protection class detection for DUTs with protective conductor
- Connection check: whether or not the DUT is connected to the test socket. In the case of protection class I: whether or not the two protective conductor terminals are short-circuited.

10.6 Executing and Evaluate Test Steps

Manual evaluation of visual inspection

(Prerequisite: sequence parameter „visual inspection“ has been preset to „on“)



- Evaluate the visual inspection.
- If you mark even one visual inspection as not passed with the key shown at the right, the sequence is aborted and the test is evaluated as not passed.
- Resume the test sequence.

Test Steps with Manual Evaluation (e.g. R_{PE})



- Observe instructions which appear at the display, e.g. prompting to contact parts with test probe P1.

If the measured value appears green at the display, it lies within the limits specified by the standard.

- The measured value recording symbol appears in the softkey bar. The 0 indicates that no measured values have thus far been saved to buffer memory.
- Each time this key is pressed, the measuring or evaluation procedure is restarted.
- Initially, the digit blinks (here a 1 without symbol) until the measured value settles in. The evaluation cycle is visualized as follows: the progress bar starts at the left-hand edge of the display and moves to the right. When it reaches the rightmost position, evaluation has been completed and the symbol shown at the right appears with the current number.
- Depending on whether you want to delete the last value saved to the clipboard or all values, press the symbol with the wastebasket shown at the right an appropriate number of times.
- Proceed to the next measurement by pressing the key shown at the right.



Note

If the measured value appears red at the display, a limit value has been violated. If you nevertheless start the evaluation procedure, an error message appears. You have the option of repeating the evaluation procedure.

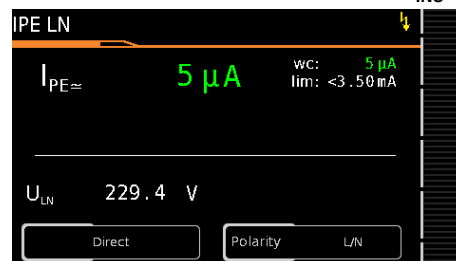


Note

Regarding the test sequence in switch position A6/A7:

Section 5.2 of DIN EN 90974-4 expressly stipulates that the cables have to be bent and twisted over their entire length during the measurement, in particular in proximity to the cable glands, in order to be able to detect any interruptions of the protective conductor.

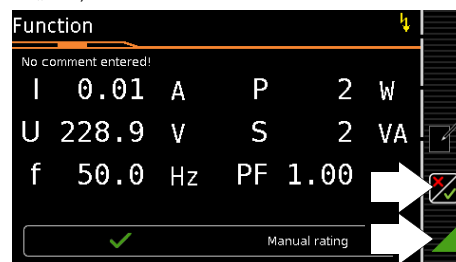
Test Steps with Automatic Evaluation (R_{INS} , I_{PE})



The measured value is ascertained automatically within a specified period of time. The evaluation cycle is visualized as follows: the progress bar starts at the left-hand edge of the display and moves to the right. When it reaches the rightmost position, evaluation has been completed. The test sequence is then automatically resumed.

Manual Evaluation of the Function Test

(Prerequisite: sequence parameter „function test“ has been preset to „on“)



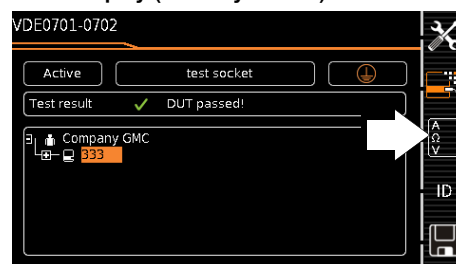
- Evaluate the function test:
- If you mark the function test as not passed with the softkey shown at the right, the sequence is aborted and the test is evaluated as not passed.
- If you evaluate the function test as passed, you can simply continue with the test sequence.

In either case you can enter a comment, which can be subsequently edited as well.

10.7 Ending the Test Sequence

“Sequence finished” appears at the display.

Initial Display (memory screen)



Display of the memory screen depends on the setting in the setup menu in the **SETUP** switch position:

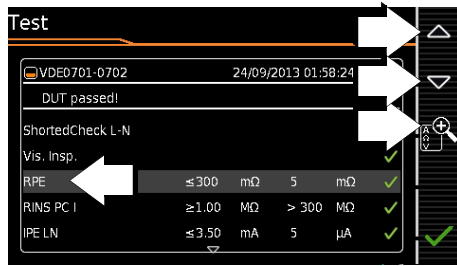
Setup 1/3 > Auto. measurements > At end of sequence > **Memory screen**.

If set to **Results list**, the above display is skipped and the results list shown below is displayed.

You can also access the results list by pressing the key shown at the right.



Results List Display

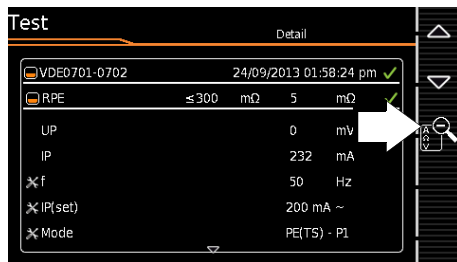


- ⇒ Select the desired test step with the scroll keys.
- ⇒ If you want to view details for the selected test step, press the **magnifying glass+** key.



Consideration of measuring error depends on the setting in the setup menu in the **SETUP** switch setting: Setup 1/3 > Auto. measurements > Error considered > **Yes**).

Display of Details for Individual Test Steps



- ⇒ The display is returned to the list of test steps by pressing the **magnifying glass-** key.
- ⇒ The memory screen is displayed again after acknowledging the list.



10.8 Saving Test Results

- ⇒ Save the results of a successful test sequence by pressing the **Save** key.



11 Warnings, Error Messages and Notes

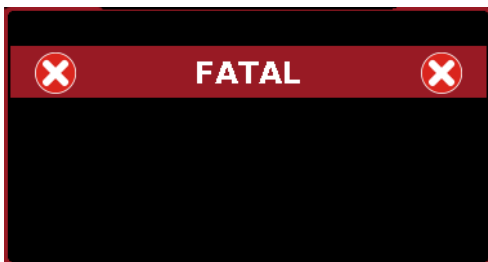
Error messages or notes regarding the individual tests or test sequences are displayed as popups.

Differentiation is made amongst 5 types of messages:

- Fatal error
- Error
- Warning
- Note – INFO
- Question

Fatal error

This message indicates an extraordinary error. Fatal errors have to be acknowledged or cleared by pressing the **OK** key, and the cause of error must be eliminated before the test or the test sequence can be resumed.

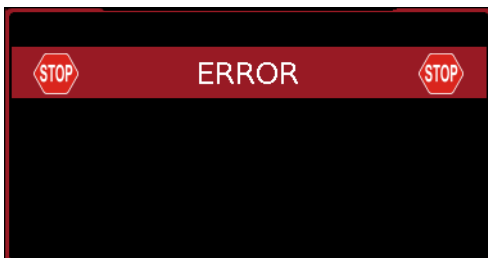


Error

This message indicates, for example, operator errors. These errors have to be acknowledged or cleared by pressing the **OK** key, and the cause of error must be eliminated before the test or the test sequence can be resumed.

Examples:

- Object cannot be created. General database error!



Warning

Warnings indicate hazards which, if not avoided, may result in severe injury. **Single test:** Warnings have to be acknowledged or cleared by pressing the **OK** key, before the test or the test sequence can be resumed.

Test sequence: The test sequence can be aborted or resumed without acknowledging.

Examples:

- Caution: Line voltage will be switched to the test socket!
- Caution: The polarity of line voltage at the test socket will be reversed!



Note – INFO

A note is either a piece of information regarding the functions executed by the test instrument or instructions which may have to be acknowledged or skipped by pressing the **OK** key.

Examples:

- Probe test
- Set up in a well-insulated fashion?
- On test
- Short-circuit test (L-N)
- Short-circuit test (LN-PE)
- Prompt: Contact with test probe P1 ...
- Prompt: Switch the DUT on/off with its own mains switch ...
- Prompt: Start up / shut down the DUT ...

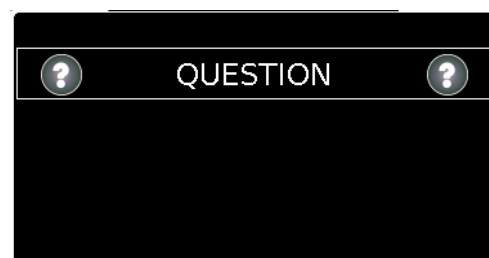


Question

Questions must be answered by pressing **Yes** or **No** before the single test or test sequence is resumed.

Example:

- Test object not found!
Create new object/database?



12 Characteristic Values

Function	Measured Quantity	Measuring Range / Nominal Range of Use	Resolution	Nominal Voltage U_N	Open-Circuit Voltage U_0	Nom. Current I_N	Short-Circuit Current I_K	Int. Resistance R_I	Ref. Resistance R_{REF}	Measuring Uncertainty ¹	Intrinsic Error ¹	Overload Capacity		
												Value	Time	
Tests, 62638 (DIN VDE 0701-0702) / IEC 62353 (VDE 0751)	Protective conductor resistance RPE	000 ... 999 m Ω	1 m Ω	—	< 24 V AC or DC	—	>200 mA AC or DC	—	—	$\pm(15\% \text{ rdg.} + 10 \text{ d})$ > 10 d	$\pm(10\% \text{ rdg.} + 10 \text{ d})$ > 10 d	264 V 250 mA <hr/> 16 A ⁵	Cont.	
		1.00 ... 9.99 Ω	10 m Ω											
		10.0 ... 30.0 Ω	100 m Ω											
	Insulation Resistance RINS	10 ... 999 k Ω	1 k Ω	50 ... 500 V DC	$1.0 \cdot U_N \dots$ $1.5 \cdot U_N$	> 1mA	< 2 mA	—	—	$\pm(5\% \text{ rdg.} + 4 \text{ d})$ > 10 d	$\pm(2.5\% \text{ rdg.} + 2 \text{ d})$ > 10 d	264 V	Cont.	
		1.00 ... 9.99 M Ω	10 k Ω											
		10.0 ... 99.9 M Ω	100 k Ω											
	Leakage current, alternative measurement ² IPE, IB, IG, IA	0.0 ... 99 μ A	1 μ A	—	50 ... 250 V~ -20/+10%	—	< 1.5 mA	> 150 k Ω	1 k Ω $\pm 10 \Omega$	$\pm(5\% \text{ rdg.} + 4 \text{ d})$ > 15 mA: $\pm(10\% \text{ rdg.} + 8 \text{ d})$	$\pm(2\% \text{ rdg.} + 2 \text{ d}) > 10 \text{ d}$ > 15 mA: $\pm(5\% \text{ rdg.} + 4 \text{ d})$	264 V	Cont.	
		100 ... 999 μ A	1 μ A											
		1.00 to 9.99 mA	10 μ A											
		10.0 to 30.0 mA	100 μ A											
	Leakage current, direct measurement ³ IPE, IB, IG, IA, IP	Only Ip: 0.0 ... 99.9 μ A	100 nA	—	—	—	—	1 k Ω $\pm 10 \Omega$	—	$\pm(5\% \text{ rdg.} + 4 \text{ d})$ > 10 d	$\pm(2.5\% \text{ rdg.} + 2 \text{ d})$ > 10 d	264 V	Cont.	
		0.0 ... 99 μ A	1 μ A											
		100 ... 999 μ A	1 μ A											
		1.00 to 9.99 mA	10 μ A											
	Leakage current, differential current meas. ⁴ IPE, IB, IG	0 ... 99 μ A	1 μ A	—	—	—	—	1 k Ω $\pm 10 \Omega$	—	$\pm(5\% \text{ rdg.} + 4 \text{ d})$ > 10 d	$\pm(2.5\% \text{ rdg.} + 2 \text{ d})$ > 10 d	264 V	Cont.	
100 ... 999 μ A		1 μ A												
1.00 to 9.99 mA		10 μ A												
10.0 to 30.0 mA		100 μ A												
Function Test	Line voltage U_{L-N}	100.0 ... 240.0 V~	0.1 V	—	—	—	—	—	—	—	$\pm(2\% \text{ rdg.} + 2 \text{ d})$	264 V	Cont.	
	Load current I_L	0 ... 16.00 A RMS	10 mA	—	—	—	—	—	—	—	$\pm(2\% \text{ rdg.} + 2 \text{ d})$	16 A	Cont.	
	Active power P	0 ... 3700 W	1 W	—	—	—	—	—	—	—	$\pm(5\% \text{ rdg.} + 10 \text{ d})$ > 20 d	264 V	Cont.	
	Apparent power S	0 ... 4000 VA	1 VA	Calculated value, $U_{L-N} \cdot I_V$							$\pm(5\% \text{ rdg.} + 10 \text{ d})$ > 20 d		20 A	10 min
	Power factor PF with sinusoidal waveform: $\cos\varphi$	0.00 ... 1.00	0.01	Calculated value, P / S, display > 10 W							$\pm(10\% \text{ rdg.} + 5 \text{ d})$			
U-PROBE	Probe voltage (phase search) $\overline{\sim}$, \sim and $\overline{\sim}$	0.0 ... 99.9 V	100 mV	—	—	—	—	—	—	—	$\pm(2\% \text{ rdg.} + 2 \text{ d})$	264 V	Cont.	
		100 to 300 V	1 V	—	—	—	—	—	—	—				
tA PRCD	Time to trip at 30 mA	0.1 ... 999 ms	0.1 ms	—	—	—	—	—	—	$\pm 5 \text{ ms}$				

¹ Specified values are only valid for the display at the test instrument.

Data transmitted via the USB port may deviate from these values.

² Known as equivalent leakage current or equivalent patient leakage current from previous standards

³ Protective conductor current, touch current, device leakage current, patient leakage current

⁴ Protective conductor current, touch current, device leakage current

⁵ Only with **SECUTEST BASE10** and **SECUTEST XTRA** with feature G01

Key: rdg. = reading (measured value), d = digit(s)

Test Times, Automated Sequence

Test time > 2 s, exception: device protective conductor resistance RPE: > 7 s. Test times are not checked or calibrated, but rather determined on the basis of processor cycle times.

Emergency Shutdown During Leakage Current Measurement

As of 10 mA of differential current (can also be set to 30 mA), automatic shutdown ensues within 100 ms.

Influencing Quantities and Influence Error

Influencing Quantity / Sphere of Influence	Designation per DIN VDE 0404	Influence error ± ... % rdg.
Change of position	E1	—
Change to test equipment supply voltage	E2	2.5
Temperature fluctuation	E3	Specified influence error valid starting with temperature changes as of 10 K:
0 ... 40 °C		2.5
Amount of current at DUT	E4	2.5
Low frequency magnetic fields	E5	2.5
DUT impedance	E6	2.5
Capacitance during insulation measurement	E7	2.5
Waveform of measured current	E8	
49 ... 51 Hz		2 with capacitive load (for equivalent leakage current)
45 ... 100 Hz		1 (for touch current)
		2.5 for all other measuring ranges

Reference Ranges

Line voltage	230 V AC ±0.2%
Line frequency	50 Hz ±2 Hz
Waveform	
Sine (deviation between effective and rectified value < 0.5%)	
Ambient temperature	+23 °C ±2 K
Relative humidity	40 ... 60%
Load resistance	Linear

Nominal Ranges of Use

Nominal line voltage	100 V ... 240 V AC
Nom. line frequency	50 Hz to 400 Hz
Line voltage waveform	Sinusoidal
Temperature	0 °C ... + 50 °C

Ambient Conditions

Storage temperature	- 20 °C ... + 60 °C
Operating temperature	- 5 °C ... + 40 °C
Accuracy range	0 °C ... + 40 °C
Relative humidity	Max. 75%, no condensation allowed
Elevation	Max. 2000 m
Deployment	Indoors, except within specified ambient conditions

Power Supply

Electrical System	TN or TT
Line voltage	100 V ... 240 V AC
Line frequency	50 Hz to 400 Hz
Power consumption	200 mA test: approx. 32 VA 10 A test: approx. 105 VA
for function test	Continuous max. 3600 VA, power is conducted through the instrument only, switching capacity ≤ 16 A, ohmic load

Electrical Safety

Protection class	I per IEC 61010-1/EN 61010-1/VDE 0411-1
Nominal voltage	230 V
Test voltage	2.3 kV AC 50 Hz or 3.3 kV DC (mains circuit / test socket to mains PE terminal, USB, finger contact, test probe P1, test socket)
Measuring category	250 V CAT II
Pollution degree	2
Safety shutdown	At DUT differential current of > 10 mA, shutdown time: < 100 ms, can also be set to > 30 mA with following probe current during: – Leakage current meas.: > 10 mA~/< 5 ms – Protective conductor resistance meas.: > 250 mA~/< 1 ms
Fuse links	Mains fuses: 2 ea. 500 V/16 A FF Probe fuse: 250 V/250 mA MT SECUTEST Base10: Additionally 1 ea. 500 V/16 A FF

Electromagnetic Compatibility

Product Standard DIN EN 61326-1

Interference Emission		Class
EN 55011		B
Interference Immunity	Test Value	Evaluation Criterion
EN 61000-4-2	Contact/atmos. – 4 kV/8 kV	A
EN 61000-4-3	3 V/m or 1 V/m	A
EN 61000-4-4	1 kV	B
EN 61000-4-5	1 kV or 2 kV	A
EN 61000-4-6	3 V/m	A
EN 61000-4-11	0.5/1/25 periods	A
	250 periods	C

USB Data Interface

Type	USB slave for PC connection
Type	2 ea. USB master for external keyboard, for barcode reader, for USB stick for data backup, for printer

Mechanical Design

Display	4.3" multi-display (9.7 x 5.5 cm), backlit, 480 x 272 pixels at 24 bit color depth (true color)
Dimensions	W x H x D: 295 x 145 x 150 mm Height with handle: 170 mm
Weight	Approx. 2.5 kg
Protection	Housing: IP 40 Test socket: IP 20 per DIN VDE 0470, part 1/EN 60529,

Table Excerpt Regarding Significance of IP Codes

IP XY (1 st digit X)	Protection Against Foreign Object Ingress	IP XY (2 nd digit Y)	Protection Against Penetration by Water
2	≥ 12.5 mm dia.	0	Not protected
4	≥ 1.0 mm dia.	0	Not protected

13 Maintenance

13.1 Housing Maintenance

No special maintenance is required for the housing. Keep outside surfaces clean. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives or solvents.

13.2 Testing the Color Display and the Buzzer (self-test parameter)

The color display can be tested for failure of individual segments and loss of color components on page 3/3 of the setup menu in the SETUP switch position under the self-test parameter.

Beyond this, the buzzer can be tested for 3 different frequencies.

13.3 Software Update (system info parameter)

The current firmware or software version can be queried via the system info parameter (setup 3/3).

The test instrument's firmware can be updated via the USB port with the help of a PC. Updating is only possible via the "Firmware Update Tool" application, which is integrated into the firmware. Calibration data are not overwritten during updating.

The most up-to-date version of the software (firmware) can be downloaded from the **mygmc** page of our website as a ZIP file, if you have registered your test instrument:

<http://www.gossenmetrawatt.com>

→ Products → Software → Software for Testers → Utilities → Firmware Update Tool → [myGMC](#)

Under this link you can also find an instruction manual for the **Firmware Update Tool**.



Attention!

The interface cable may not be disconnected while updating the firmware via the USB port.



Attention!

The test instrument may not be disconnected from supply power while updating the firmware via the USB port.

13.4 Backup Battery for Real-Time Clock

The backup battery (lithium cell) should be replaced no later than after 8 years. Replacement can only be executed by the service department.

If backup battery voltage is too low, the date and time assigned to the test data no longer correspond to the actual time of recording. This may also influence sorting in ETC report generating software.

The instrument's database itself is not affected by a depleted backup battery.

13.5 Fuse Replacement

The fuses may only be replaced when the instrument is voltage-free, i.e. the instrument must be disconnected from mains supply power and may not be connected to a measuring circuit.

The fuse type must comply with the specifications in the technical data or the labeling on the instrument.

13.6 Recalibration

The measuring tasks performed with your instrument, and the stressing it's subjected to, influence aging of its components and may result in deviation from the specified levels of accuracy.

In the case of strict measuring accuracy requirements, as well as in the event of use at construction sites with frequent stress due to transport and considerable temperature fluctuation, we recommend a relatively short calibration interval of once per year. If your instrument is used primarily in the laboratory and indoors without considerable climatic or mechanical stressing, a calibration interval of once every 2 to 3 years is sufficient as a rule.

During recalibration* at an accredited calibration laboratory (DIN EN ISO/IEC 17025), deviations from traceable standards demonstrated by your measuring instrument are documented. Ascertained deviations are used to correct display values during later use of the instrument.

We would be happy to perform DAkkS or factory calibration for you at our calibration laboratory. Further information is available at our website:

www.gossenmetrawatt.com (→ Company → DAkkS Calibration Center or → FAQs → Questions and Answers Regarding Calibration).

According to DIN VDE 0701-0702, only test instruments which are tested and calibrated at regular intervals may be used for testing.

Recalibration of your instrument at regular intervals is essential for the fulfillment of requirements according to quality management systems per DIN EN ISO 9001.

* Examination of the specification, as well as adjustment, are not included in calibration. However, in the case of our own products, any required adjustment is performed and adherence to the specification is confirmed.

13.7 Technical Safety Inspections

Subject your test instrument to technical safety inspections at regular intervals. We recommend the same interval for inspections as is also used for recalibration.

The SECUTEST... is designed as a totally insulated device in accordance with IEC 61010 and VDE 0404. The protective conductor is used for measuring purposes only, and is thus not accessible in the idle state. The protective conductor at the test socket can be tested as follows:

- ⇒ Connect the SECUTEST... to a multiple distributor.
- ⇒ Conduct a touch current measurement for permanently connected DUTs (nothing may be connected to the test socket).
- ⇒ Measure protective conductor resistance between the neighboring socket at the multiple distributor and the test socket.
- ⇒ The measured value may not exceed 0.3 Ω.

For technical reasons, insulation resistance between LN and PE inside the SECUTEST... is roughly 1 MΩ.

This must be taken into consideration during technical safety inspections or, instead of the insulation resistance measurement, the protective conductor current measurement must result in a value of less than 3.5 mA (or less than 7 mA if the equivalent leakage current method is used).

There are also 4 accessible conductive parts on the SECUTEST... at which the touch current measurement must result in a value of less than 0.5 mA:

- Connector for service plug (jack socket)
- USB ports
- Metallized start key
- Protective conductor bar in the test socket

13.8 Returns and Environmentally Sound Disposal

The instrument is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is not subject to the RoHS directive.

We identify our electrical and electronic devices (as of August 2005) in accordance with WEEE 2002/96/EC and ElektroG using the symbol shown at the right per DIN EN 50419.



These devices may not be disposed of with the trash.

Please contact our service department regarding the return of old devices (see address in section 15).

14 Appendix

The following devices have been tested for use with the test instrument. We are unable to offer any guarantees regarding use with other devices.

14.1 List of Suitable Printers

- Z721S thermal printer
- **Barcode printer Z721D** (as from firmware version V1.3.0)
Setting options in switch position SETUP
(Setup (2/3) > Printer > Z721D > Printer settings):
Paper Size: 6 mm, 9 mm, 12 mm, 18 mm, 24 mm, 36 mm
Coding: Code39, Code128, EAN13

14.2 List of Barcode Scanners

- H.G.L. 500-18
- H.G.L. 500-10

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15 Repair and Replacement Parts Service Calibration Center* and Rental Instrument Service

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This address is only valid in Germany. Please contact our representatives or subsidiaries for service in other countries.

* DAkkS calibration laboratory for electrical quantities, registration no. D-K-15080-01-01, accredited per DIN EN ISO/IEC 17025:2005
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

Competent Partner

GMC-I Messtechnik GmbH is certified per
DIN EN ISO 9001:2008.

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 17025:2005.

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

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

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

16 Product Support

If required please contact:

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