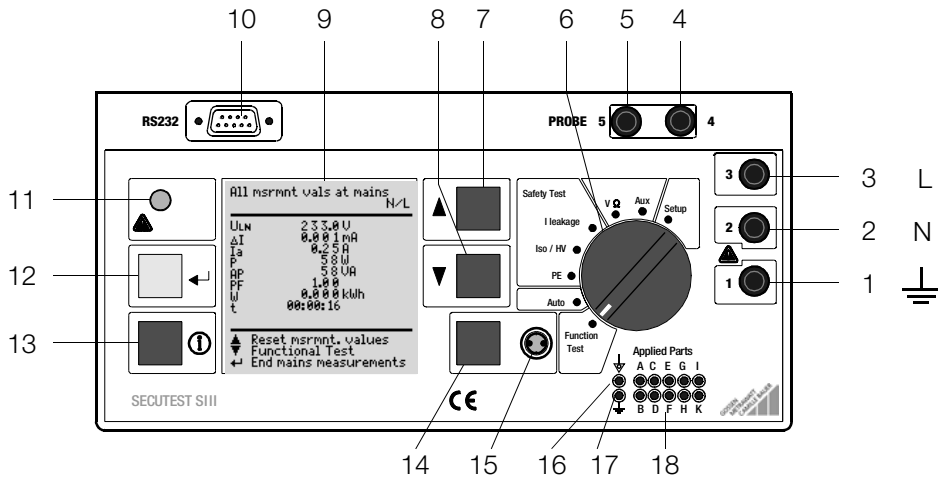


SECUTEST[®] SIII

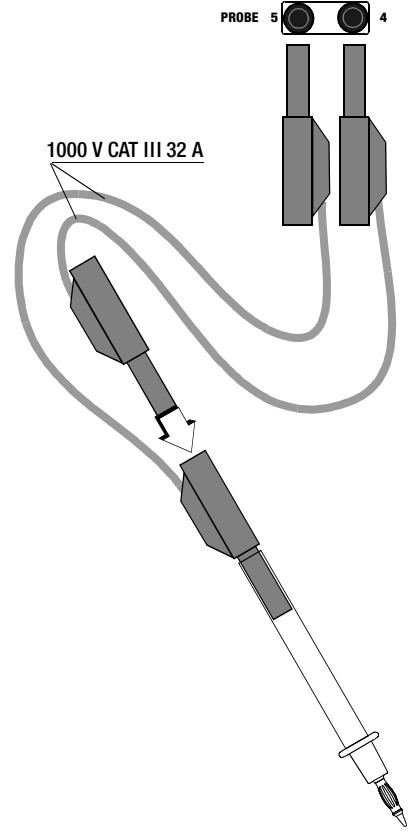
Test Instrument for Testing the Electrical Safety of Electrical Devices






3-349-111-03
4/5.02





Using the High-Current Cables, Feature G01



- 1 Jack for protective conductor at device under test
- 2 Jack for neutral conductor at device under test
- 3 Jack for phase conductor at device under test
- 4 Jack for connecting the probe
- 5 Jack for connecting the probe
- 6 Function selector switch
 - Function Test: Function test
 - Auto: Automatic test sequence according to selected standard
 - PE: Protective conductor test
 - Iso/HV: Insulation test / high-voltage test
 - I leakage: Leakage current measurement
 - V Ω : Multimeter functions
 - Aux: Auxiliary multimeter functions
 - Setup: Device configuration
- 7  scroll key for menu and parameter selection
- 8  scroll key for menu and parameter selection
- 9 LCD window
- 10 Socket connector for RS 232 interface
- 11 Signal lamp for mains connection error
- 12  key for entry and for starting test sequences and finger contact
- 13  help key (context sensitive)
- 14 Key next to the  symbol for switching test voltage to the test socket (only possible if symbol LED is blinking)
- 15 Signal lamp for the functions text
- 16 Functional earth (equipotential bonding), feature J01
- 17 Operational earth, feature J01
- 18 Connector jacks for application parts, feature J01
- 19 Push-buttons (left and right) for releasing the handle from its snap-in position
- 20 Earthing contact socket for service purposes (feature B01), e.g. for connecting a notebook or an A4 format printer
- 21 Standard outlet socket (test socket) for connecting the device under test
- 22 Push-buttons (left and right) for releasing the lid
- 23 Lid
- 24 Compartment for probe and accessories
- 25 Cover or printer module (feature E01)
- 26 Carrying handle and tilt stand
- 27 Test probe

Overview of Available Probe Types

Probe Type	Application	Special Features
Standard probe ¹⁾ (test probe with coil-cable and alligator clip)	Max. test current: 10 A	none
SC2 ³⁾	Max. test current: 10 A	Probe with cable (no coil-cable), 2 meters long
Option SC5 (feature KD01 or accessory)	Restriction with feature G01 ($I_K > 25$ A): short-circuit current < 25 A	Special probe in combination with "automatic recognition of measuring point change" function (see chapter 18)
2 high-current cables ²⁾ with 2 contact protected plug-on alligator clips, and one contact protected plug-on test probe	Test current: 25 A	4 square millimeter cross-section
Brush probe ³⁾ Can be plugged onto all above listed probes and test probes	Leakage current, protective conductor resistance	For contacting devices under test with rotating, vibrating, exposed conductive parts

¹⁾ Included with test instruments with 10 A test current (feature G00)

²⁾ Included with test instruments with 25 A test current (feature G01)

³⁾ Accessory

Using the High-Current Cables (1000 V CAT III 32 A)

Plug one cable into each of the probe sockets (4 and 5) with the contact protected plugs. Then plug the loose cable ends into each other. Perform testing on the desired component with the assembled plug unit and an attached test probe (1000 V CAT III, replacement part no. 3-610-128-01). An alligator clip can be used instead of the test probe if desired.

If you want to perform a 4-wire measurement, plug an alligator clip into each of the plugs and connect both to the device under test such that the path between the alligator clips is conductive.



Note

The cables plugged into the sockets (4 and 5) must be short circuited for testing with the probe, i.e. by plugging the ends of the cable together, or via a conductive surface at the device under test (4-wire measurement).

Remove any corrosion from the device under test.

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1 Applications

1.1 Table: Types of DUTs – Tests – Regulations

	Testing after Repairs					Periodic Testing				Type Tests and Routine Testing				
	DIN VDE 0701, part 1	DIN VDE 0701, part 200	DIN VDE 0701, part 240	DIN VDE 0701, part 260	DIN VDE 0751	IEC 60601 / DIN EN 60601	DIN VDE 0702	British Standard	DIN VDE 0751	IEC 60601/DIN EN 60601	DIN EN 60950	DIN EN 61010	DIN EN 60335	IEC 60601 / DIN EN 60601
Devices under test to be tested in accordance with the following regulations														
Electrical equipment						•	•				•			
Appliances and electric equipment	•						•					•		
Mains operated electronic devices		•					•							
Hand-held electric tools				•			•							
Extension cables	•						•							
Data processing devices			•				•				•			
Electrical medical devices, application parts					•	•		•	•					•



Attention!

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

Applicable Standards

German National	European	International
DIN EN 61010	EN 61010	IEC 61010
DIN EN 60601	EN 60601	IEC 60601
DIN EN 60335-1	EN 60335-1	IEC 60335-1
DIN EN 60950	EN 60950	IEC 60950

1.2 Table: Individual Measurements and Regulations

Individual Measurements per Regulation	Test current [A]	DIN VDE 0701 Part 1	DIN VDE 0701 Part 200	DIN VDE 0701 Part 240	DIN VDE 0701 Part 260	DIN VDE 0702	British Standard	DIN EN 60950	DIN EN 61010	DIN EN 60335	DIN VDE 0751	IEC 601/EN 60601
	Protective Conductor Resistance	0,2	•	•	•		•	•	•			
10							•				•	
25								•	•	•	•	•
Insulation Resistance		•	•		•	•	•					
Equivalent Leakage Current		•	•	•		•						
High-Voltage Test						•	•	•	•	•		AC
Equivalent (Device) Leakage Current										•	•	
Equivalent Patient Leakage Current											•	
Residual Current		•				•						
Contact Current		•				•						
Absence of Voltage (exposed conductive parts)				•								
Housing Leakage Current								•	•			•
Earth Leakage Current												•
Patient Leakage Current												•
Patient Auxiliary Current												•
Device Leakage Current											•	
Single Fault Conditions ^N _{PE}									•	•		•
Mains at Application Part												•

Key

- Required test

1.3 Table: Leakage Current Types

DIN VDE 0701-1	DIN VDE 0702-1	DIN VDE 0751-1 (2001)	DIN EN 60601-1	The following is measured:
Equivalent Leakage Current	Equivalent Leakage Current			PROBE (connected to protective conductor) to L & N
		Equivalent Device Leakage Current	I_{DL} interrupted from PE at DUT I_{EL} interrupted from N	PROBE (open protective conductor) to L & N
		Equivalent Patient Leakage Current		L & N to Patient Jacks
Contact Current/ Measurement for Absence of Voltage	Contact Current/ Measurement for Absence of Voltage		Housing Leakage Current NC	Probe to PE
		Patient Leakage Current NC	Patient Leakage Current NC	Patient Jack to PE
			Patient Auxiliary Current NC	Patient Jack to Patient Jack
	Protective Conductor Current, Direct		Earth Leakage Current NC	Protective Conductor to PE
		Device Leakage Current during Operation, Direct Measurement		Protective Conductor Interrupted, Probe + PAP to PE
Protective Conductor Current with Differential Current Measurement	Protective Conductor Current with Differential Current Measurement	Device Leakage Current during Operation, with Differential Current Measurement		See chapter 11.5

Key

NC = normal condition

PAP = patient application part

PE = Potential earthing \cong , system protective conductor

PE = Protective conductor of the DUT

1.4 List of Possible Options for SECUTEST® SIII Device Series

Feature	Design	Mains Connection for Respective Country	User Interface Language	Configuration (settings in the setup menu)	Printer Module SECUTEST® PSI	High-Voltage Testing HV-DC	AC Test Current 50/60 Hz for Protective Conductor Measurement	DC Test Current for Protective Conductor Measurement	including Patient Ports	Measurements per EN 60601 SECU 601 Option (Z853G)	Database	DBmed Option (Z853H)	Modern Operation	DFUmed Option (Z853K)	Remote Control	SC5 Special Cable (Z745K)	Direct Printing after each Measurement for Automatic Test Sequences ¹⁾ Read-Out via RS 232	Calibration Certificate in Accordance with DKD
	A	B	C	D	E	F	G	H	J	KA	KB	KC	KD	KE	L			
00	GMC	D	D	GMC	without	without	10 A ³⁾	200 mA ³⁾	without	without	without	without	without	without	without	without		
01	OEM	D + service socket	GB	OEM	with		25 A		with	with	with	with	with	with	with	with		standard version
02	UK	GB	F	OEM		max. 6,126 kV DC (\leq 4 kV AC) 4)												including measurements per MPG (see J01)
03		F	I															including H-V testing (see F02)
04		I	E															including measurements per MPG and H-V testing (see J01 & F02)
05		DK	CZ															
06		SA	NL															
07																		
08		China/AUS																
09		CH																
11		Adapter set ²⁾																
99				as requested														

¹⁾ Each measured value is documented in this case, as opposed to the results of a test sequence for which the poorest value for each given test is displayed.

²⁾ Adapter set for international use (feature B01 included)

³⁾ Standard, not dependent upon feature designation

⁴⁾ The combination of features F02 and B04 or B07 is not possible.

Example of complete type designation (article number) for SECUTEST® SIII: **M7010** B01 E01 K001 KE01 (only the designation of the basic instrument, i.e. M7010, and entries which deviate from 00 are required)

2 Safety Features and Precautions

The SECUTEST®SIII test instrument has been manufactured and tested in accordance with the following safety regulations:

IEC 61010-1 / DIN EN 61010-1 / VDE 0411-1,
DIN VDE 0404 and DIN VDE 0104 (features F01/02 only)

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

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

Tests may only be performed under the supervision 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 with a maximum of 230 V which 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 interruptions in cables or plugs etc.
- Grip the test probe firmly, for example after insertion into a jack socket. Tensioning at the coil cord may otherwise cause the test probe to snap back resulting in possible injury.



Attention!

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

The measuring and test instrument may not be used:

- If it demonstrates visible damage
- With damaged connector cables, measuring cables or patient ports
- If it no longer functions properly
- After extraordinary stresses 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!)



Test socket



Mark of approval from VDE test authority

2.1 Notes Regarding the High-Voltage Test

The KS13 cable set, or similar cable sets, may not be used for the high-voltage test. The high-voltage test may only be performed directly via the test socket!



Attention!

Do not hold the device under test in your hand during testing, especially when testing safety class II devices.
Make sure that the device under test does not make contact with any equipment or persons during testing.

Liability Exclusion

In the event of sparkover, PCs operated in proximity to the test instrument may “crash” resulting in data loss. All data and programs should be suitably backed up before high-voltage testing is performed, and computers should be shut down if necessary. A crash may occur even if no RS 232 connection has been established.

The manufacturer of the test instrument assumes no liability for direct or consequential damage to computers, peripherals or data which occurs during high-voltage testing.

The manufacturer assumes no liability for defects at the device under test which result from high-voltage testing. As a rule, defects can only occur at devices under test which are not in compliance with applicable standards, which were previously damaged or which have been improperly repaired, because high-voltage testing is required for type and routine testing by IEC 61010-1/EN 61010-1 / VDE 0411, part 1, as well as EN 60335, EN 60601 and EN 60950.

3 Initial Start-Up

3.1 Connection to the Mains (115 V / 230 V, 50 Hz / 60 Hz)

- Connect the mains plug at the test instrument to the mains power 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.

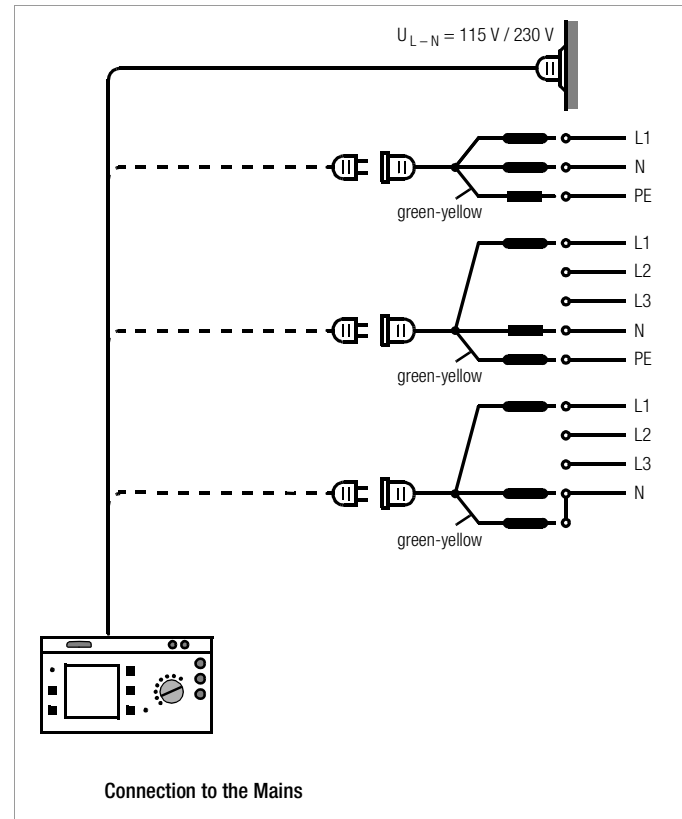


Attention!

The mains connection must be protected with a fuse or circuit breaker with a maximum rating of 16 A!



The pick-off clips at the ends of the cables from the adapter socket may only be connected in the absence of voltage!

Disconnection from mains power is only possible with the mains plug.



3.2 Automatic Recognition of Mains Connection Errors

The test instrument 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 (↔ key)	Text appears at LCD	Press ↔ key $U > 40 \text{ V}$	disabled
Protective conductor PE and phase conductor L reversed and/or neutral conductor N interrupted	 lamp lights up	Voltage at PE $> 65 \text{ V}$	impossible (no supply power)
Contact voltage at protective conductor PE to neutral conductor N or phase conductor L	Text appears at LCD	$U > 25 \text{ V}$	disabled, although disabling can be deactivated ¹⁾
Mains voltage too low	 lamp lights up	$U_{L-N} < 90/180 \text{ V}$	possible under certain circumstances

¹⁾ In SETUP – test sequence – IT system



Attention!

In either of the first two cases listed in the table above, immediately disconnect the test instrument from the mains and eliminate the error!



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 General Notes

4.1 Online Instructions

The performance of measurements and tests is quick and easy with the SECUTEST®SIII. Integrated online instructions inform the operator regarding all required connections, necessary work steps, operator errors, measurement results and more in all measuring modes. Information and test results appear at the dot matrix LCD in clear text.

4.1.1 Automatic Safety Class Selection

Depending upon the type of mains plug or the connection configuration for the device under test, the test instrument recognizes the respective safety class and recommends its use for the measurement to be performed.

4.1.2 Manual or Automatic Operating Sequences

Depending upon selections made in the setup menu (selector switch in the Auto position), the next measurement is started automatically after the current measurement has been completed, or can only be started after manual acknowledgement. The integrated online instructions are adequate for most tests and measurements. However, the contents of these operating instructions should nevertheless be read and observed.

4.2 Online Help

Online help can be queried and displayed at the LCD for all measuring and test functions, and for almost all settings. Schematic diagrams which illustrate proper connection of devices under test to the SECUTEST®SIII can be displayed as well.

⇨ Press the following key in order to query online help:



⇨ Press the same key again in order to exit online help.



Note

Online help can be queried during measurement by pressing and holding the help key.

4.3 Adjusting Contrast



Set the selector switch to Auto.



Select the "Setup" menu, "return" is highlighted.



Activate contrast adjustment.



Press and hold the ENTER key.



Adjust contrast.



Return to the menu.

Store the contrast setting to permanent memory with the save function in the setup menu.



4.4 Configuring Device Parameters, Setting Date and Time

Device parameters and functions which are valid for all selector switch positions can be activated or deactivated with the selector switch in the **Setup** position (see chapter 8 on page 16).


4.5 Configuring Measurement and Sequence Parameters

Measurement and sequence parameters, as well as functions, can be activated or deactivated in the **setup** menu (selector switch in the **Auto** position) for the respective test regulation. Refer to chapter 15.3 on page 33 for the significance of the various parameters.

4.6 Setting Limit Values

Upon delivery, the limit values set forth (at the point in time of issue) in applicable national and international standards are stored to the test instrument. Limit values for each of the respective standards can be queried and changed if required with the **setup** menu (selector switch in the **Auto** position), but changes can only be made which result in even stricter testing than is required by the respective standard.

Newly entered limit values become effective immediately. However, these are only stored to memory permanently after activating the **store** function in the **setup** menu.

If the limit values set forth in the standards for certain safety classes need to be restored despite individualized settings, the menu function **all values per standard** in the **limit values** sub-menu must be selected and acknowledged with the  key.

If the limit values set forth in the standards are changed, the instrument's device software can be updated via the RS 232 interface.

4.7 Saving the Settings

All of the settings and changes which have been entered to the **configure**, **limit values** (selector switch in the **Auto** position) and **zero point (temperature measurement)** (selector switch in the **Aux** position) menus, as well as the selected **contrast** setting are retained until the selector switch is turned, or the test instrument is disconnected from mains power. If settings and changes should be retained even after mains power has been interrupted, they must be saved in the **setup** menu for the respective test regulation or selector switch position.

5 Classification of Devices Under Test

5.1 Safety Classes

Devices assigned to all of the following safety classes are equipped with basic insulation, and provide for protection against electrical shock by means of various additional precautions as well.

Safety 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.

Safety Class II Devices

These devices are equipped with double insulation or reinforced insulation.

Safety Class III Devices

These devices are powered with safety extra-low voltage (SELV). Beyond this, no voltages are generated which exceed SELV. These devices may not be connected to the mains. They may only be connected to the test instrument at jacks 1 through 3.

Classification Parameter (in the Sequence ... menu)

The SECUTEST[®]SIII always performs testing in accordance with the strictest limit values of the respectively selected safety class. The test is failed if this limit value is exceeded.

However, higher limit values are allowed for certain devices under test.

If the classification parameter has been activated (= x), the user is asked if higher limit values are allowable for these devices. If the user responds with “Yes”, the DUT is reevaluated and the test may be passed.

Examples

If insulation resistance testing has been failed, equivalent leakage current must be measured in accordance with DIN VDE 0702 for DUTs with heating elements, or if interference suppression capacitors have been replaced.

A device under test demonstrating a value of 300 k Ω would fail the test if classification were deactivated (= $_$). However, if classification is activated

(= x) and if the user responds to the prompt with “Yes”, the device would pass the test.

Similar possibilities are included in DIN VDE 0701 part 200, and part 1.

If the device under test is connected via the jacks instead of the test socket, other limit values are used because higher power consumption is possible in this case (e.g. part 1 has an equivalent leakage current limit value of 1 mA per kW).

See table entitled “Maximum Allowable Limit Values for Equivalent Leakage Current in mA” on page 20.

5.2 Application Parts (electrical medical devices)

Type B Application Parts (body)

Devices of this type are suitable for both internal and external patient applications, except for use in direct proximity to the heart.

These devices provide for adequate protection against shock especially as regards:

- Reliable leakage current
- Reliable protective conductor connection if utilized

Devices of the following safety classes are allowable: I, II, III or devices with internal electrical power supply.

Type BF Application Parts (body float)

Same as type B, but with type F insulated application parts.

Type CF Application Parts (cardiac float)

Devices of this type are suitable for use directly at the heart. The application part may not be grounded.

Devices of the following safety classes are allowable: I, II or devices with internal electrical power supply.

6 Abbreviations

AE	Error condition: application part grounded	NC	Normal conditions
B, BF, CF	Classifications for application parts	P	Active power
OE	Operational earth	PA	Functional earth (equipotential bonding)
ΔI	Differential current, fault current	R	Resistance
I_{Lmax}	Maximum residual current (during function test)	R_{ISO} , R-ISO	Insulation resistance
$EGA_{A1/A2}$	Equivalent device leakage current with note A1/A2 (cross-reference within the standard)	R-ISO AWT-SL	Insulation resistance: application part to PE
$EGA_{FR\pm SL}$	Equivalent device leakage current for portable x-ray devices +SL: with additional protective conductor -SL: without additional protective conductor	R-ISO INT. KARD.	Insulation resistance: intercardiac (application in proximity to the heart)
EGA_{SCII}	Equivalent device leakage current for devices with additional safety class II components	R-ISO NL-SL	Insulation resistance: neutral/phase conductor to PE
HE	Error condition: housing grounded	R_{PE} , R-PE	Protective conductor resistance
I_L , I_{\approx} , I_{HL} , I_{probe}	Leakage current (differential, probe or contact current)	R-SL with clip	See chapter 13 on page 27
I_{Re}	Residual current	R-SL±mains	Protective conductor resistance limit value for +mains: device under test with mains cable -mains: device under test without mains cable (protective conductor resistance limit value for mains cable only = 0.1 Ω)
I_{EL} , I_{EDL}	Equivalent device leakage current	S	Apparent power
I_{EPL}	Equivalent patient leakage current	SELV	Safety extra-low voltage
I_{LC}	Device leakage current	SFC	Single-fault condition
I_{PMAP}	Mains to application part (patient leakage current measurement)	PE	Protective conductor
I_{PL}	Patient leakage current	$U_{AC/DC}$	AC/DC voltage
I_{PX}	Patient auxiliary current	U_{REF}	Reference voltage: voltage to which leakage current is related (as a rule nominal line voltage)
I_{PE}	Earth leakage current (current at protective conductor)	U-ISO	Test voltage for insulation measurement
IT-system	The IT system makes direct contact between active conductors and grounded parts: bodies within the electrical system are grounded.	U_{L-N}	Line voltage
I_{Lmax}	Maximum load current (during function test)	U_{MESS}	Voltage at which testing was executed. Displayed for all leakage current measurements.
I_Z	Current at clip-on meter	U_{probe}	Probe voltage
L	Phase conductor	t	On-time
PF	Power factor	Temp	Temperature
MedGV	German medical device ordinance	W	Electrical energy
MPG	German medical product law	ZVEH	General Association of German Electricians
MSELV	Medical safety extra-low voltage		
N	Neutral conductor		

7 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 device under test:
electrical equipment or not, with or without application parts
- The type of connector included with the DUT:
 - With plug (“to test socket” parameter), applies to EL1 adapter as well
 - Without plug, single or multi-phase connection (“to jacks” parameter)
 - No connection to tester (“permanent connection” parameter)Whether or not an adapter is used:
 - Adapter to socket (customer specific adapter)
 - AT3-med to socket, adapter for devices which are equipped with 5-pole, 16 A CEE plugs
 - AT3-III to socket, adapter for devices which are equipped with 5-pole, 32 A CEE plugs, see AT3-III operating instructions for test sequence.
- The DUT’s safety class (I, II or III)



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 jacks 1 through 3. If the instrument is equipped with feature B00, 01, 03 or 09, the instrument also recognizes whether or not the DUT has been 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.

If the test instrument is unable to automatically recognize how the DUT has been connected, the recommended connection setup should be double checked and determined manually if necessary.

- ⇨ Position the cursor at the second line in the start menu for the test sequence.
- ⇨ A selection of possible connection setups can be displayed by activating the key.
- ⇨ Select the desired connection setup with the cursor and acknowledge with the key.

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 the neutral conductor N inside the device under test.

Measuring Contact Current (absence of voltage)

Make sure that the contacted parts are not grounded.

High-Voltage Test



Attention!

The KS13 cable set, or similar cable sets, may not be used for the high-voltage test. The high-voltage test may only be performed directly via the test socket!

- ⇨ Connect the device under test to the test socket.
- ⇨ Safety class II only:
Connect the probe to jacks 4 and 5.



Attention!

Make sure that the application parts (feature J01) are not connected during the high-voltage test!

8 Configuring Device Parameters



Setup

General device parameters can be configured and saved with the selector switch in the **Setup** position.



Select a menu and acknowledge.

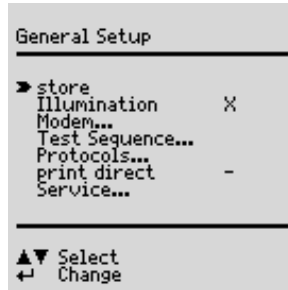


Select parameter and acknowledge, change setting and acknowledge.

Settings x / - ... = function activated / deactivated

Limit values ...

Illumination	Background illumination for the LCD. One of three different conditions can be selected with the up and down scroll keys: x: continuously on, -: off numbers 1 through 9: duration in minutes after which illumination is automatically deactivated.
Test time	Duration of a single test (0 ... 9 s, x = 10 s)
Reference voltage:	Voltage to which leakage current makes reference (as a rule nominal line voltage)
Earth fault:	During the short-circuit test, testing is also performed to determine whether or not a connection exists between L/N and PE (short-circuit to exposed conductive part). We assume that a short-circuit to an exposed conductive part exists in the event of leakage current greater than 15 mA from L/N to PE. This value should be increased for some DUTs (in particular high-current consumers), because greater leakage currents are present.



Mains pause

Line voltage is first applied to the test socket. However, testing does not begin until after the duration selected in seconds under “Mains pause” has elapsed.

Modem...

This function can be enabled with the help of an upgrade program (see chapter 17 on page 54).

Test Sequence ...

Settings x / -
Single-fault

= function activated / deactivated

If the single-fault condition has been activated, the test is interrupted as a failure as soon as an error occurs.

Auto Class PSI

Test results (passed or failed) for the various selector switch positions are automatically assigned to the 8 statistics channels.

inc. Service Error

Measurement results are compensated by taking service error into consideration (measuring error).

IT Network

Testing in IT systems can be performed by suppressing tests for U_{PE-N}. The U_{PE-N} test determines whether or not voltage is present at PE. (Leakage current measurement results may otherwise be distorted.)

Acst Sig, Seq

Acoustic signal is generated for: Incorrect connection of the DUT, error in the electrical supply system, next test step.

Acst Sig, Meas

Acoustic signal is generated for: Measured value fluctuations, test current polarity reversal

Auto R-PE

This function can be enabled with the help of an upgrade program, e.g. Z745K (see chapter 18 on page 55). An acoustic signal indicates whether or not the probe is connected to the protective conductor. The test sequence is run automatically.

Rapid signal frequency: probe connected
Slow signal frequency: next measuring point

Direct Print-Out

See chapter 20 on page 57.

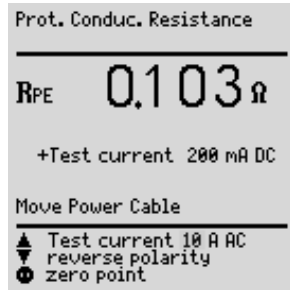
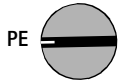
Reports ...

Reports which have been saved to memory can be selected from a list with an ID number and displayed (see chapter 19.1 on page 55).

Service ...

- Time and date settings
- Service functions (password required)

9 Measuring Protective Conductor Resistance



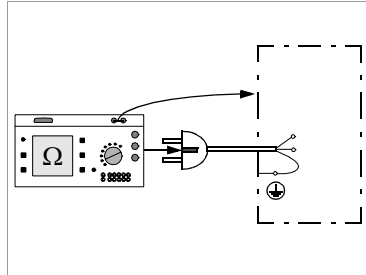
Definition

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 cable resistance if utilized

Resistance is measured:

- Between each *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.
- 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 cables*



Connecting Safety Class I Devices to the Test Socket

When the DUT is connected, resistance is measured between the protective conductor terminal at the test socket or at the PE jack and the probe connection at the DUT (contact with conductive parts of the housing).

- ⇨ In order to measure protective conductor resistance, contact a conductive part of the housing with the probe, which is connected to the protective conductor.

During measurement, the **connector cable** must only be moved in as far as 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.

Testing Extension Cables

See test sequence in chapter 15.7 on page 40.



Note

“Connection of the DUT: SC I/II” is not displayed when the test is performed individually, but rather only during the automatic test sequence.

Selecting Test Current and Polarity


Test current amperage (200 mA DC or 10 A AC / 25 A AC (feature G01)) as well as **polarity** can both be changed by pressing the or the key.

Testing with 10 A or 25 A Test Current (feature G01)

The test has a **maximum duration** of 30 s if 10 A or 25 A test current is used. After this time period has elapsed, the last measured value is frozen and “data hold, measurement stopped” appears at the display. If the test instrument becomes excessively warm, testing cannot be repeated until after a waiting period of 1 minute. When testing with 10 A or 25 A, the last measurement can be repeated if the test results in failure.

Differential Protective Conductor Resistance

Zero balancing is also possible for protective conductor measurement. With zero balancing, all subsequent measurements are adjusted with an offset such that 0Ω is displayed for a selected reference point which is connected to the protective conductor. When test points are contacted with the probe which are electrically connected to this reference point, differential resistance ΔR_{PE} between the reference point and the contacted test point is displayed.

The mains release key  must be activated during measurement in order to perform zero balancing. The acquired value can either be applied (the value remains in memory until the instrument is disconnected from mains power), permanently saved or deleted.

9.1 Maximum Allowable Limit Values for Protective Conductor Resistance for Connector Cables with a Length of up to 5 m

Test Standard	Test Current	Open-Circuit Voltage	R_{PE} Housing – Device Plug	R_{PE} Housing – Mains Plug
VDE 0701 Part 1	200 mA ---	max. 6 V		0.3Ω ¹⁾
VDE 0701 Part 200/240				
VDE 0702			0.3Ω	
British Standard	0.2Ω		0.2Ω	
EN 61010	10 A \sim ³⁾ to test socket only		0.2Ω	0.2Ω
EN 60335			0.2Ω	0.2Ω
EN 60950			0.1Ω	0.2Ω ²⁾
EN 60601			0.2Ω	0.3Ω
VDE 0751				R_{PE} , for each additional 5 m
VDE 0701 ⁴⁾ Part 260	10 A \sim ³⁾ to test socket only		max. 6 V	0.1Ω
VDE 0702	200 mA ---			0.1Ω

¹⁾ This value may not exceed 1Ω for permanently connected data processing systems (DIN VDE 0701, part 240).

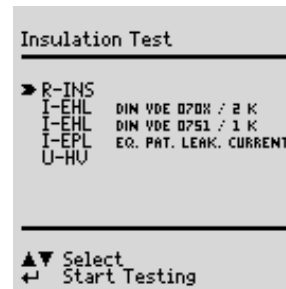
²⁾ Permanently connected cable

³⁾ Feature G01 25 A

⁴⁾ Does not apply per new standard DIN VDE 0701-1: 2000-09

10 Insulation Measurement

Iso / HV



10.1 Insulation Resistance R_{ISO}

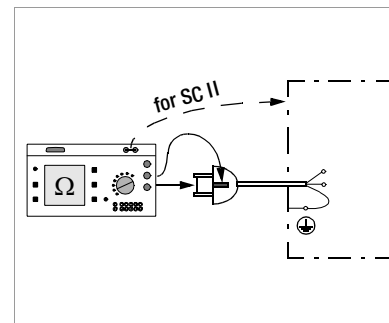
Definition

Safety Class I

Insulation resistance is measured between short-circuited mains terminals and the protective conductor.

Safety Classes II and III

Insulation resistance is measured between short-circuited mains terminals and external conductive parts which can be contacted with the probe.



Exception for Permanently Installed Safety 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 the neutral conductor N inside the device under test.
- ◇ Connect the probe to phase conductor L at the device under test in order to measure insulation resistance.

Sequence



Note

All switches at the device under test must be set to the ON position during measurement of insulation resistance. This also applies to temperature controlled switches and temperature regulators.

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



Note

When insulation is first started from the menu, nominal voltage is always set to 500 V. Open-circuit voltage is always greater than nominal voltage.

Minimum Allowable Limit Values for Insulation Resistance

Test Standard	Test Voltage	R _{iso}			
		SC I	SC II	SC III	Heat
VDE 0701 Part 1	500 V	1 MΩ	2 MΩ	0,25 MΩ	0.3 MΩ
VDE 0702		0.5 MΩ	2 MΩ	0,25 MΩ	—
VDE 0751 2001		2 MΩ	7 MΩ	—	—
		70 MΩ	70 MΩ	—	—

Notes Concerning Test Standard 0702

If the measured value is less than 0.5 MΩ for safety class I devices which include a heating element, equivalent leakage current must be measured as described in chapter 10.2 on page 20, and this test must be passed. The same applies to mains powered safety class II electronic devices if the required value of 2 MΩ is fallen short of.

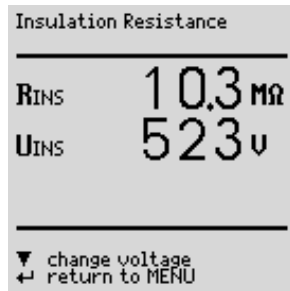
Insulation resistance must be measured at all exposed, conductive parts for safety class II and III devices, as well as for battery powered devices.

Batteries must be disconnected from their terminals during testing of battery powered devices.

R-ISO



Start measurement.



Nominal voltage is 500 V DC in this case.

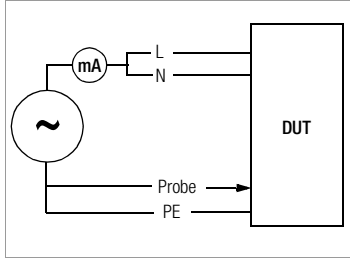
Nominal voltage can be adjusted within a range of 50 V to 550 V DC.

10.2 Equivalent Leakage Current

General

Measurement of equivalent leakage current is required for:

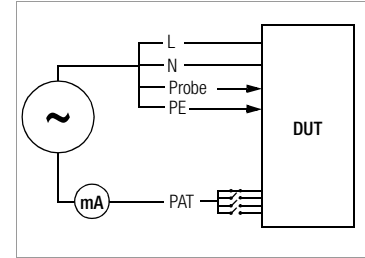
- DIN VDE 0701, after passing the insulation test
- Safety class I devices (DIN VDE 0702) for which radio interference suppression capacitors have been installed or replaced during the course of repair or modification, or which are equipped with heating elements, and for which an insulation resistance of less than $0.5 \text{ M}\Omega$ has been measured.
- Electrical devices (DIN VDE 0701, part 200) for which coupling capacitors are used, if an insulation resistance of less than $0.5 \text{ M}\Omega$ has been measured for safety class I devices, or less than $2 \text{ M}\Omega$ for safety class II devices.



Equivalent Patient Leakage Current I_{EPL} (DIN VDE 0751)

Test Setup

A high-impedance power supply is connected between each patient port and all exposed metal parts of the housing (which are connected to one another). The mains terminals are short-circuited, and connected to the same point on the housing.



Measurement

The current which flows over the insulation at the device under test is measured separately for each application part.

Measurement is always performed with an AC power supply with current limiting. Varying line voltages are taken into account.

Maximum Allowable Limit Values for Equivalent Leakage Current in mA

Test Standard	I_{EA}	I_{EGA}	I_{EPA}
VDE 0701-1: 2000	SC I: 3.5 1 mA/kW ¹⁾ SC II: 0.5		
VDE 0702: 1995	7.0 15 ²⁾		
VDE 0751: 2000		SC II	0.2
		SC I (parts within or 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_{EA} Equivalent leakage current

I_{EGA} Equivalent device leakage current

I_{EPA} Equivalent patient leakage current

SL Protective conductor

¹⁾ For devices with heating power of $\geq 3.5 \text{ kW}$

²⁾ For devices with heating power of $\geq 6 \text{ kW}$

³⁾ With and without line voltage applied to the application part

Equivalent Device Leakage Current I_{EDL} (DIN VDE 0751)

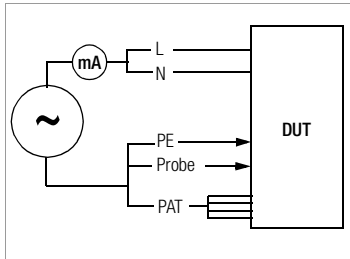
Measurement of equivalent device leakage current is required for:

- Electrical medical devices in accordance with DIN VDE 0751, part 1

Test Setup

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).

VDE 0751: The patient ports are short-circuited as well, and connected to the same point on the housing.



Measurement

The current which flows over the insulation at the device under test is measured.

Connection

Refer to the schematic diagrams included with the online help for connection instructions.

Connection Exception for Permanently Installed Safety Class I Devices

Current is measured between the probe, with which the L and N conductors must be contacted, and the protective conductor terminal PE at the device under test for permanently installed safety class I devices under test.



Attention!

Disconnect mains power before connecting the test instrument!

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

Sequence

Current is displayed during this type of equivalent leakage current measurement which would flow during leakage current measurement conducted in accordance with device regulations with 1.06-fold nominal voltage.

Leakage current measurement in accordance with the respective device regulations is usually not possible, because the device would have to be set up in an electrically isolated fashion, or connected to an earth isolated power supply to this end.

Equivalent Leakage Current I_{EL} DIN VDE 070x / 2 K



Select the **I-EL** measurement and start.

Equivalent leakage current is measured between short-circuited N and L, and the **protective conductor PE**.

Measuring circuit resistance is equal to 2 k Ω for VDE 0701/0702.

Equivalent Device Leakage Current I_{EDL} for VDE 0751 / 1 K



Select the **I-EDL** measurement and start

Equivalent device leakage current is measured between short-circuited N and L, and the **probe**.

Measuring circuit resistance is equal to 1 k Ω for VDE 0751 for the simulation of mean patient resistance.

Equivalent Patient Leakage Current I_{EPL} (VDE 0751)



Select the **I-EPL** measurement and start

Equivalent patient leakage current is measured between short-circuited N and L and the respective application part. Jacks A through K (application parts) are connected separately for each application part.

Groups of cables or sensors can be assigned to application parts in the test sequence start menu in accordance with DIN VDE 0751.

10.3 High-Voltage Test

Only safety class I and II devices can be tested, which can be connected to the test socket.

The high-voltage test is performed with direct voltage. In order to comply with requirements for alternating voltage, testing is performed with 1.5-fold direct voltage. This multiplier is applied automatically during testing. A selected nominal voltage of 3.5 kV thus results in a DC output voltage of 5.25 kV.

Output voltage is measured for the entire duration of the test, and its minimum value is determined. The minimum voltage value is indicated as the test result. If this value is less than the pre-selected test voltage, the test is failed.

The conversion factor must be taken into consideration for testing and calibration of the SECUTEST®SIII.

The device is designed such that special measures in accordance with DIN VDE 0104 (high-voltage test) need not be observed.

This is accomplished by means of the following characteristics:

1. Continuous short-circuit current is less than 3 mA (DC).
2. Discharge energy (at 5.25 kV) is less than 350 mJ.

In order to comply with high-voltage test regulations despite the minimal continuous short-circuit current, the charging capacitors are connected to the test socket (L, N) with relatively low-value protective resistors. This results in a peak short-circuit current value of approximately 5 A (at 5 kV), which causes plainly audible and visible sparking.

High-voltage testing can only be performed via the test socket. The protective conductor at the socket is grounded during the high-voltage test.



Caution: High-Voltage!

Touch **neither** the test socket **nor** the device under test during voltage testing!

A **high-voltage** of up to **5.5 kV** is present at the test socket output! A current may flow over your body, and although it does not reach life endangering levels, the resulting shock is plainly discernible.

Previous testing of the protective conductor is absolutely

essential for safety class I devices because if the protective conductor is interrupted, the high-voltage test does not charge all dielectric material and the scope of testing is thus insufficient.

Connection





- Insert the mains plug from the device under test into the test socket.
- Safety class II: Connect the probe to jacks 4 and 5.



Attention!


Make sure that the application parts (18) (feature J01) are not connected during high-voltage testing!

Individual Test

- Set the rotary selector switch to the Iso/HV position.
- Select the **U-HV** menu with the  key and acknowledge with the  key.
- If the device under test has not yet been switched on, a message to this effect appears at the display. Nominal voltage is then selected.
- Select the desired nominal voltage from the display with the   key. The instrument multiplies this nominal voltage by a factor of 1.5, which represents the actual test voltage (see chapter 10.3).
- Test voltage is applied to the test socket, and in turn the device under test, for as long as the ENTER key is held depressed. Activation of high-voltage is indicated with an acoustic signal.

High voltage test	
To Socket	
UHV DC	1.56 kV
appropriate AC Voltage	
UHV AC	1.03 kV
Test time:	056s

Currently measured minimum output voltage U_{HVAC} (measured value divided by 1.5), test voltage U_{DC} , and remaining test time are displayed.

- ⦿ Safety class II: Contact all exposed, conductive parts, simultaneously if possible, in order to avoid unnecessarily long test durations or repeats. Avoid contacting individual parts sequentially.
- ⦿ After the key is released, the equivalent AC voltage is displayed which occurred during testing. This voltage is indicated as the test result. If this value is less than the pre-selected nominal voltage, the test is failed.
- ⦿ If you want to repeat the test, press the  key. The test sequence is started over again with selection of nominal voltage.




Attention!

If sparkover should occur, the test is immediately interrupted and the voltage measured at the moment sparkover occurred is displayed as U_{HVAC} .

If the device is disconnected from the test socket during testing, even though this is prohibited, the test is immediately interrupted. The following message is displayed: "Caution, device under test is still charged!"

Testing as Part of a Test Sequence

- ⦿ Select the high-voltage menu under the setup function for the respective test regulation in order to set parameters for the high-voltage test.
- ⦿ Enter the desired AC nominal voltages for safety classes I and II (part 260: as well as test duration). The instrument multiplies the respective AC nominal voltage by a factor of 1.5, which represents the actual DC test voltage (see chapter 10.3).
Test voltage is determined based upon the selected, or the automatically recognized safety class.
- ⦿ Save the setup values to memory.
- ⦿ Start the high-voltage test by pressing the  key, if "manual sequence" has been selected in the setup menu.
- ⦿ Safety class II only: Contact the device under test with the probe.

Activation of high-voltage is indicated with an acoustic signal.

The selected nominal voltage of 3.5 kV results in a DC output voltage of maximum 5.25 kV (part 260: +0/-3%)

The high-voltage test is ended automatically after the test duration has elapsed.

U_{HVDC} : Equivalent test voltage in DC

U_{HVAC} : Measured DC value divided by 1.5

High voltage test	
To Socket	
U_{HVDC}	1.56 kV
appropriate AC Voltage	
U_{HVAC}	1.03 kV
Test time:	056s

If the value U_{HVAC} is less than pre-selected nominal voltage U_{AC} , the test is failed.



Note

In the event of sparkover, the voltage measured at the moment sparkover occurred is displayed in the test results as minimum value U_{HVAC} , along with the reason the test was failed.

11 Leakage Current Measurement

I leakage



Select the I_{xx} measurement and start.

Each time line voltage is applied to the test socket, L and N are reversed, if this function has been selected in the leakage current menu (see chapter 11 on page 24).

Leakage current is converted to reference voltage. Reference voltage must be adapted to the supply voltage range.

11.1 Earth Leakage Current I_{PE} (feature KA01 or SECU 601 option)

Current which flows from the power pack over the insulation to the protective conductor, and thus to earth.



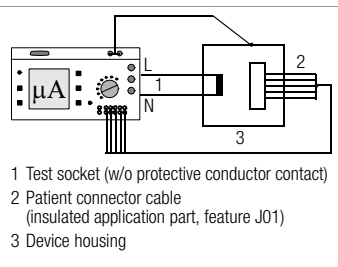
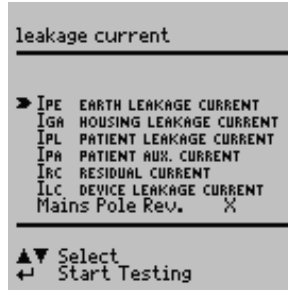
Attention!

The protective conductor is disabled during this measurement.

11.2 Housing Leakage Current I_{HL} (probe current, contact current)

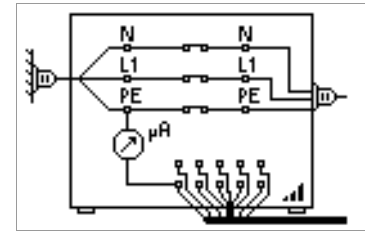
Current which flows from housing parts which are not connected to the protective conductor via an external conductive connection to earth or another part of the housing. Flow of current via the protective conductor is excluded in this case.

The AC component is measured. The DC component can also be measured if individual measurement is performed (instead of a test sequence).



11.3 Patient Leakage Current I_{PL}

Current which flows from an application part via the patient to earth. This current may be caused by an unintentional interference voltage at the patient, and may flow via the patient and an insulated, floating type F application part to earth. Useful patient current is excluded in both cases.



AC and DC components are measured.

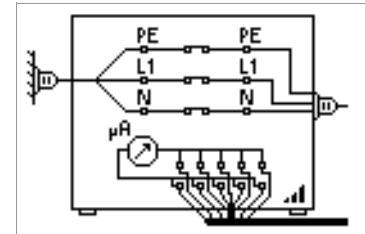


Note

Patient leakage current must also be measured if application parts are available. The displayed test voltage must be documented.

11.4 Patient Auxiliary Current I_{PX} (feature KA01 or SECU 601 option)

Current which flows within the patient between the electrodes of the application part. Use for intended purpose is assumed. Furthermore, the current should not cause any physiological effects. For example, this is the case for input current from amplifiers, or current used for impedance plethysmography.



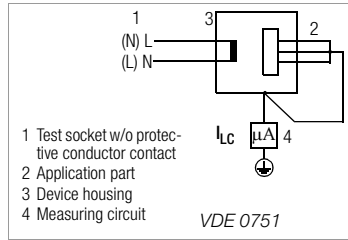
AC and DC components are measured.

11.5 Residual Current I_{RC}

Sum of instantaneous current values which flow via the L and N conductors at the device mains connection (also known as differential current). Residual 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.

11.6 Device Leakage Current I_{LC} per DIN VDE 0751

Device leakage current is the sum of all leakage currents from the housing, all accessible conductive parts and all application parts to PE. Measurement must be performed for both mains polarities and the largest value is documented.



Note

The highest device leakage current value and line voltage must be documented.



Attention!

The protective conductor is interrupted during this measurement.

Key for Tables

I_{SL}	Earth leakage current in the operating state (alternative: measurement of I_{EA})
I_{GA}	Housing leakage current (probe or contact current)
I_{DI}	Differential current
I_{LC}	Device leakage current
I_{PA}	Patient leakage current
I_{PH}	Patient auxiliary current

Maximum Allowable Limit Values for Leakage Current in mA

Test Standard	I_{SL}		I_{GA}		I_{DI}	I_{LC}	
	NC	SFC	NC	SFC			
VDE 0701 -1: 2000	SC I: 3.5 1 mA/kW *			0.5		SC I: 3.5 1 mA/kW * SC II: 0.5	
VDE 0701 -240				0.25			
VDE 0702: 1995				0.5		3.5	
VDE 0751: 2001						General	0.5
						Notes 1 & 3	2.5
						Note 2	5.0
						SC II	0.1
EN 60601		General	0.5	1			
		Notes 1 & 3	2.5	5	0.1	0.5	
		Note 2	5.0	10			

* For devices under test with heating elements

Note 1: Devices without any accessible conductive parts which are connected to the protective conductor, and which comply with I_{GA} and conceivably I_{PA} , e.g. electronic data processing devices with shielded power pack

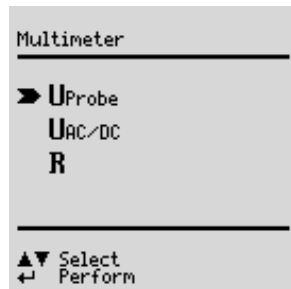
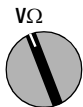
Note 2: Permanently connected devices with protective conductor

Note 3: Portable x-ray devices and devices with mineral insulation

Test Standard		I_{PA}						I_{PH}						
		Type B		Type BF		Type CF		Type B		Type BF		Type CF		
		NC	SFC	NC	SFC	NC	SFC	NC	SFC	NC	SFC	NC	SFC	
VDE 0751: 2001	Direct Current	0.01		0.01		0.01								
	Alt. Current	0.1		0.1	5 *	0.01	0.05 *							
EN 60601	Direct Current	0.01	0.5	0.01	0.05	0.01	0.05	0.01	0.5	0.01	0.05	0.01	0.05	
	Alt. Current	0.1	0.5	0.1	0.5 *	0.01	0.05 *	0.1	0.5	0.1	0.5	0.01	0.05	

* Only with line voltage at the application part

12 Multimeter Functions

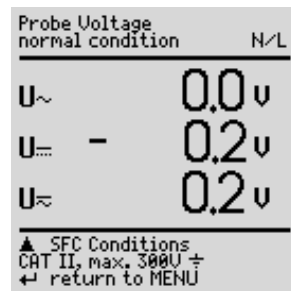


12.1 Probe Voltage U_{probe} – Max. 300 V

Voltage is measured between the mains PE terminal at the test instrument and the probe. In this case the probe can also be used as a phase finder. For IEC 61010: A selection can be made with the up scroll key as to whether testing will be conducted under normal conditions, or with interrupted protective conductor.



Start the U_{probe} measurement.

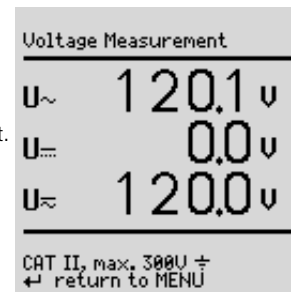


12.2 Alternating / Direct Voltage $U_{\text{AC/DC}}$ – Max. 253 V (option*)

Direct, alternating and pulsating voltages of up to 253 V can be measured between the N (2) and L (3) connector jacks.



Select the $U_{\text{AC/DC}}$ measurement and start.

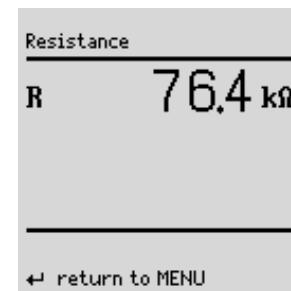


12.3 Resistance R (option*)

Resistance of up to 150 k Ω can be measured between the PE (1) and N (2) connector jacks.

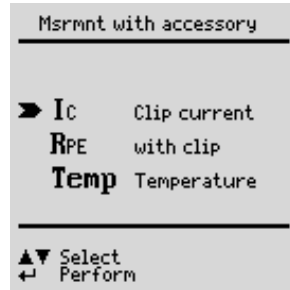


Select the R measurement and start.



* This measurement is not possible and is thus disabled by the software for devices including feature F02 due to overvoltage category II.

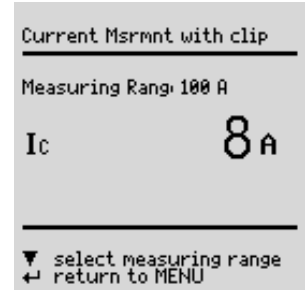
13 Measurements with Accessories



Start the I_z measurement.

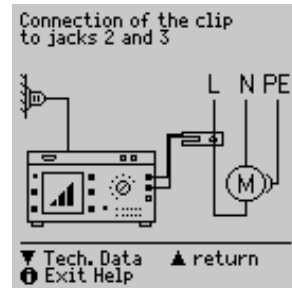


Select measuring range.



13.1 Alternating Current I_z with Clip-On Converter

Connection



Alternating current can be measured in two measuring ranges (1 mA ... 10 A ~, 1 A ... 100 A~) with a clip-on current-voltage converter connected to the N (2) and L (3) jacks (e.g. the WZ12C).

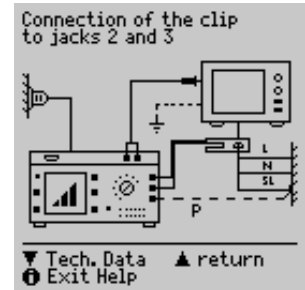
13.2 Protective Conductor Resistance R_{PE} via Clip-On Meter

Connection

Protective conductor resistance can be determined with the WZ12C clip-on current transformer.

25 A AC test current (feature G01): Use the Z864A shunt in addition to measuring range matching.

P: potential lead for 4-wire measurement

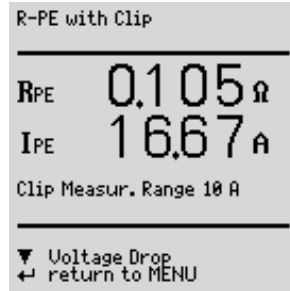


The potential lead must be connected to the outgoing protective conductor at the distributor.

Cable resistance is measured from the device under test to the SECUTEST®SIII without potential lead P. This value may deviate significantly from actual protective conductor resistance, because the lead is measured along with the SECUTEST®SIII installation. Resistance from the probe terminal to contact P at the protective conductor is measured with the potential lead.

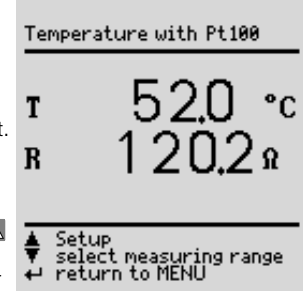


Select R_{PE} measurement and start.



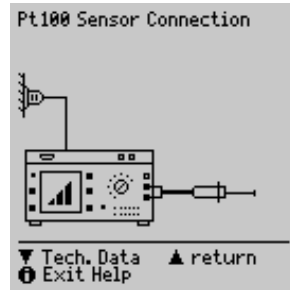
Select the **Temp** measurement and start.

Select Pt100 or Pt1000 by means of "select measuring range" with the ∇ key. The temperature unit of measure can be selected in the "TEMPERATURE" Δ setup menu. Selection can be made amongst $^{\circ}\text{C}$ (Celsius), $^{\circ}\text{F}$ (Fahrenheit) or Kelvin. Zero balancing is also accessible via the "TEMPERATURE" setup menu.



13.3 Temperature T with Pt100/1000 Sensor (option*)

Connection



Temperature can be measured within a range of $-200\text{ }^{\circ}\text{C}$ to $+850\text{ }^{\circ}\text{C}$ with a Pt100 or Pt1000 sensor (default setting) connected to the PE (1) and N (2) jacks.

Zero Balancing

Sensor cable resistance can be compensated for with this function:

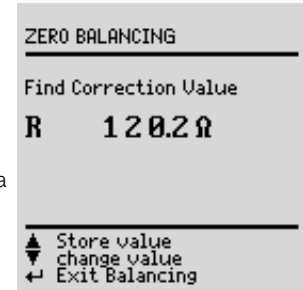
- Short circuit the ends of the sensor leads and determine resistance as shown below.

Zero Balancing



The determined value can be stored directly (Δ key), or changed first. The data entry menu is opened with the ∇ key.

- Change the measured value manually with the help of the Δ and ∇ keys.
- Press the \leftarrow key in order to acknowledge the selected value, and to display other menu functions at the bottom of the window.



Save the selected value by activating the "store value" key Δ before exiting the balancing function with the \leftarrow key.

The "delete value" command can only be accessed via the "change value" menu. The "no zero balancing" setting is saved at the same time by activating the ∇ key.

* This measurement is not possible and is thus disabled by the software for devices including feature F02 due to overvoltage category II.

14 Function Test



Function Test

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

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 safety class III devices).



Attention!

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



Note

Each time line voltage is applied to the test socket, phase conductor L and neutral conductor N are reversed, assuming that “polarity reversal = X” is selected in the **I leakage** switch setting.



Note

The function test is only possible if the device under test has been connected to the test socket (21).

Measurements

The function test includes the following measurements:

- Voltage U_{LN} between the L and N conductors
- Residual current ΔI
(corresponds to fault current between L and N)
- Load current I_L
- Active power P
- Apparent power S (calculated)
- Power factor PF ($\cos \varphi$ calculated, display $> 10 W$)
- Electrical energy W
- On-time t for U_{L-N} at socket (21)

The following values are also displayed for all selector switch positions except MENU after the function test has been completed:

- Maximum residual current ΔI_{max}
- Maximum load current I_{Lmax}
- Maximum active power P_{max}

Power factor is calculated from active power and apparent power.

Power factor corresponds to $\cos \varphi$ for sinusoidal quantities (line voltage and load current).



Attention!

Starting the Function Test

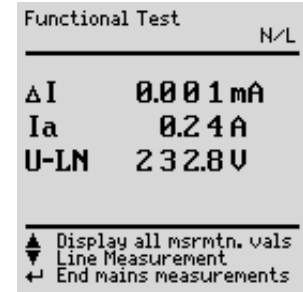
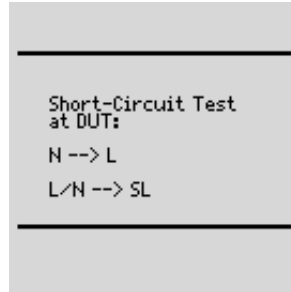
For reasons of safety, the device under test must be switched off before the function test is started. This precaution prevents inadvertent start-up of a device under test which may represent a hazard during operation, e.g. a circular saw or a disc grinder.


Ending the Function Test

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

Short-Circuit Test

- 1 Test for shorts between N and L.
- 2 Test to determine whether or not the N or L conductors are short-circuited to the protective conductor.




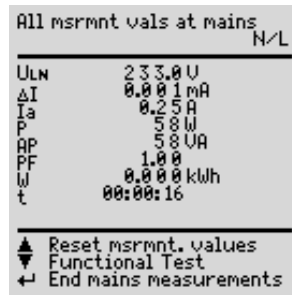
The test socket can be rendered voltage-free with the key (14), or the function test can be ended with the  key (12).



Note

A short-circuit at the device under test is recognized automatically by the test instrument. A message appears at the display (9), and the function test is disabled.

If the  lamp blinks (15), line voltage can be switched to the test socket with the key (14), and the measurement can be started. If the lamp (15) is lit continuously, line voltage is present at the test socket.



15 Measurements in Accordance with National and International Standards with Selector Switch in Auto Position

If measurements need to be performed in accordance with given standards which require specific tests, and if results need to be documented with a test report, an automatic test sequence is advisable instead of individual measurements.

- ◇ Connect the SECUTEST®SIII to mains power. A **mains connection test** is initialized (see chapter 3.2 on page 11).
- ◇ Connect the DUT to the test socket at the SECUTEST®SIII (see chapter 7 on page 15). The test instrument initializes **connection type recognition**.
- ◇ Set the selector switch to the Auto position. If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, **safety class recognition** is performed. Otherwise, the safety class must be specified manually. In the initial program window, move the cursor up with the \blacktriangle key into the third line and acknowledge with the \square key. A safety class can now be selected with the \blacktriangle and \blacktriangledown keys and acknowledged with the \square key.
- ◇ In order to select the **regulation** for which testing is to be performed, move the cursor up within the initial program window with the \blacktriangle key into the top line and acknowledge with the \square key. The desired standard can now be selected with the \blacktriangle and \blacktriangledown keys and acknowledged with the \square key. If you always want to test in accordance with a specific standard, this can be stored as the default standard in the setup menu. Otherwise, the selected standard only remains active until the SECUTEST®SIII is disconnected from mains power (factory default setting: VDE 0702).
- ◇ The test sequence can be configured in the **Setup...** menu, limit values can be changed if necessary and database options can be configured.
- ◇ The test sequence is started by selecting **Start test** and by acknowledging with the \square key (see "Test Sequences").

Tests which have already been included in chapters 9 through 14 are not described here again. The only exception is measurement of extension cables.

15.1 Test Sequences

Test sequences for the various standards are always run in the same order, assuming that the device under test has been properly connected and the mains connection test has been passed.

The test sequence can be run step by step with manual activation of each subsequent step if this function has been specified, or automatically. Step by step manual operation can be selected in the initial program window in the setup menu under "Sequence" ... "manual sequence".

- Visual inspection: If "visual inspection" has been activated in the initial program window under "Sequence". If a part is recognized as defective by the user, it must be identified as such by selecting it with the cursor and acknowledging with the \square key.
- Protective conductor measurement (for SC I devices under test only)
- Evaluation of protective conductor testing
- High-voltage test for DIN VDE 0701, part 260 and British Standard, EN 60950, EN 61010, EN 60335, EN 60601, if selected in the setup menu.
- Insulation resistance measurement
 - DIN VDE 0751: only if ISO-R is activated in the initial program window or in the setup menu or under "Sequence"
 - EN 60601: only if selected in the initial program window under test conditions
 - DIN VDE 0702: only if ISO-R is activated in the initial window
- Evaluation of insulation test
- Leakage current measurement (various single-fault conditions are run depending on classification)
- Evaluation of each individual leakage current measurement
- Evaluation of the overall test
- Perform function test if required:
 - The function test can be performed each time a safety test has been successfully completed. The blinking signal lamp indicates that the function test should be started. Beyond this, the function test can also be started from the **Function Test** selector switch position. See chapter 14 on page 29 regarding performance of the function test.
- Display test results (the worst measured values for the respective test sequence)
- Save test results and print if required

15.2 Setting Up Test Sequences

All of the possible sequence settings for all of the regulations are listed below.



Select the **Setup...** menu from the initial program window and acknowledge.

Sequence 1 (repair tests, periodic testing)


store All of the settings in the setup menu, i.e. the configuration of the measuring parameters and the current limit values can be saved with this command. These values remain active even after setting the selector switch to a different position, and after disconnection from mains power.

Sequence ... See page 33.

Limit Values ... See chapter 4.6 on page 12.

Database ... **Start with ID no.**

x: Before each measurement is started, an entry prompt appears requesting entry of an ID no. An individual number can be entered (max. 20 characters) with the keypad at the PSI module (optional), read in with a barcode scanner (optional) or directly selected from a list. If an incorrect entry is made:

Only complete lines can be deleted, and deletion is only possible with the  key at the instrument.

ID no. = test sequence (feature KB01 or DBmed option)

See chapter 16 on page 54.

Additional Parameters

R-PE with clip x: Protective conductor resistance can be determined with the help of the WZ12C current clip.

High-voltage x: A high-voltage test is conducted (prerequisite: feature F01).

Sequence 2 (type tests)

Type:

Sequences 1 and 2 differ primarily as regards the type parameter. The user can set up any desired type of device under test with sequence 2, for which the same limit values and measuring parameters always apply. Up to 99 different types can be defined. DUT types are predefined for sequence 1 (EN 60601).

Designations made up of alphanumeric characters (max. 10 characters) can be entered at the SECUTEST® PSI keypad, or at a PC with a terminal program. The test sequence, including all limit values, is saved together with the selected type. We recommend using the characters which identify the respective standard as the initial characters in the designation. If a type is queried from the initial program window which does not belong to the currently selected standard, these characters identify the test sequence as belonging to another standard.

Limit Values...

See chapter 4.6 on page 12.

Sequence ...

See page 33.

Store as

Default

All of the settings in the setup menu, i.e. the configuration of the measuring parameters and the current limit values can be saved with this command. These values remain active even after setting the selector switch to a different position, and after disconnection from mains power.

Delete

The type which has been selected in the initial program window can be deleted.

15.3 Configuring Measuring Parameters

Depending upon the test regulation, various measuring parameters can be configured for the test sequence (settings: x / – = function activated / deactivated). All of the possible parameters for all of the regulations are listed below. The **Sequence...** menu is accessed via the setup parameter in the initial program window for the respective regulation.




Select the **Sequence...** menu and acknowledge.



Select a parameter, acknowledge, change and acknowledge the change.

General Parameters

Visual inspection	This menu appears at the very beginning of the test sequence.
Manual sequence	Each test step must be acknowledged with the  key (see test sequence in chapter 8 on page 16 regarding test duration for automatic sequence).
Autostore	After testing is completed, test data are automatically stored to the SECUTEST [®] SIII (feature KB01 or Dbmed option), or the SECUTEST [®] PSI (accessory).
Mains polarity reversal	L an N are reversed each time line voltage is applied to the test socket.
Classification	Questions regarding classification appear if limit values are exceeded, see chapter 5 on page 13.
SC III U _V	Supply voltage is measured instead of insulation resistance for active devices under test.
R-ISO LN-SL	Insulation resistance measurement is performed between phase and neutral conductors, and the protective conductor.
HV test	A high-voltage test is performed (prerequisite: feature F01)

Additional Parameters for DIN VDE 0702/0751

Auto (test) method The instrument recognizes whether or not the device under test can be switched on:
Leakage or residual current, or insulation resistance and earth leakage current are measured accordingly.

Additional Parameters for EN 60601

R-PE with clip Protective conductor resistance can be determined with the help of the WZ12C current clip (for DIN VDE 0751 in setup).
No I-HL for SCI Housing leakage current is not tested for SCI.
Mains wait A waiting period between switching mains power on and starting the test can be entered here, e.g. in order to suppress the display of recorded values which occur during warm-up of the device under test.

Additional Parameters for DIN VDE 0751

Adapter for socket Limit values are activated for permanently connected devices. A device under test which is normally permanently installed can be connected to the test socket via an adapter. **No voltage may be applied to the test socket when this test method is used.**
First measured values A menu for the entry of the first measured value appears during the test sequence.
Patient auxiliary current Measurement is performed with patient auxiliary current
R-ISO AWT-SL Insulation resistance measurement is performed from an application part to the protective conductor.
R-SL AC > 10 A Protective conductor measurement with 200 mA DC or 10/25 A AC

15.4 Testing Devices in Accordance with DIN VDE 0701, Parts 1, 200 and 260

The following measurements can be performed in accordance with the above mentioned standard:

- Protective conductor measurement R_{PE} (*permanent connection or with plug*)
 - Part 1: Test current: ± 200 mA DC
 - Part 200: Test current: ± 200 mA DC
 - Part 260: Test current: 10 A AC (feature G01: 25 A AC test current)
- High-voltage test as supplement to part 260 (feature F01/02)
- Insulation resistance measurement R_{ISO}

Part 1

The following safety class I through III appliances and electric equipment can be tested in this selector switch position, for example:

- Devices with electric motors
- Electric heating devices
- Electric tools
- Light fixtures

SC I extension cables can also be tested (see chapter 15.7 on page 40).

Part 200

Mains powered, safety class I through III electronic devices, e.g. consumer electronics, can be tested in this selector switch position:

- Stereo equipment, televisions

The following maximum values for equivalent leakage current apply for mains powered electronic devices per DIN VDE 0701, part 200:

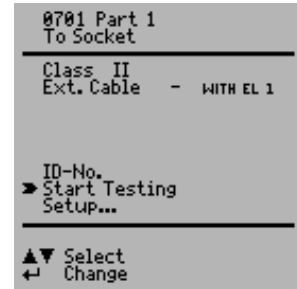
- Devices with single-phase power supply: 1 mA
- Devices with multi-phase power supply: 0.5 mA

Part 260

This selector switch position allows for testing of hand-held electric tools, for example:

- Disc grinders
- Hand-held circular saws

Check connection parameters and start test.



To Socket

This is the default setting. Refer to chapter 7 on page 15 for other types of connection.

Class

If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). Otherwise, the safety class must be specified manually.

Ext. Cable

x: Extension cables or connector cables which are longer than 5 m can be tested with the help of the EL1 adapter (optional), either separately or in combination with a device.

ID No.

See parameters database in chapter 15.2 on page 32.

Setup...

See chapter 15.2 on page 32 regarding setup of the measuring sequence.

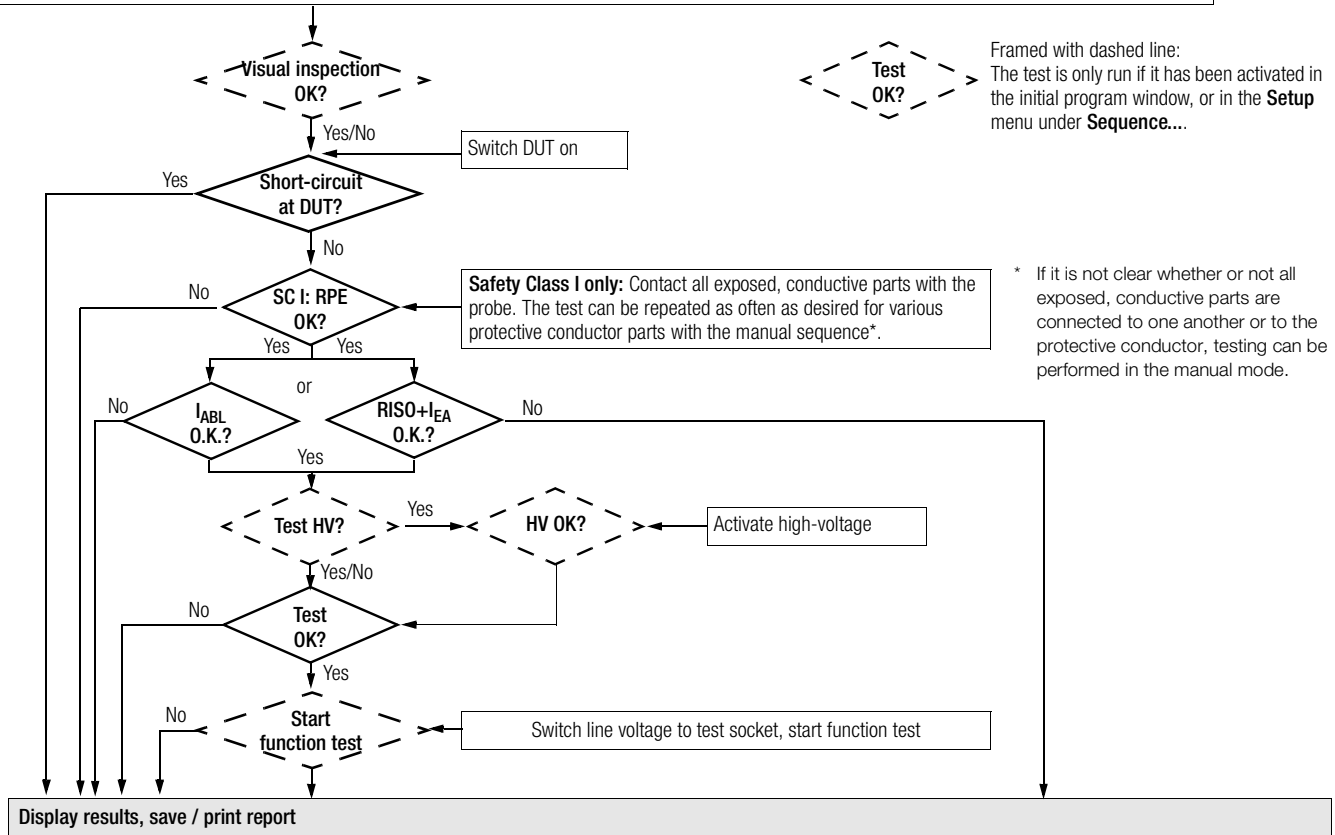


Note

Extension cables can only be tested in the VDE 0701 part 1 and VDE 0702 selector switch positions, if the EL1 accessory adapter is used (see chapter 15.7 on page 40).

Test Sequence per VDE 0701

Select connection, select test regulation **VDE 0701 part 1, 200 or 260**, classify DUT (SC I, II or III), **part 1: extension cable X/- (with/without)**
part 260: HV test X/- (with/without)



15.5 Testing Devices in Accordance with DIN VDE 0701, part 240

Testing safety class I and II **data processing equipment and office machines** as individual devices and in combination with one another.

The following measurements can be performed in accordance with the above mentioned standard:

- Protective conductor R_{PE} (*permanent connection or with plug*)
Test current: DC ± 200 mA
 - Housing leakage current I_{Δ}
 - According to DIN VDE 0701, part 240, the device protective conductor must be tested after maintenance, repair or modification of data processing equipment and office machines, and exposed, conductive parts must be tested for the absence of voltage. This applies to:
 - Safety class I devices for all exposed, conductive parts which are accessible to the user, and which are not connected to the protective conductor
 - Safety class II devices (totally insulated devices) for all exposed, conductive parts which are accessible to the user
- With the mains plug poled in both directions

Setting Up the Test Sequence

See chapter 15.4 regarding the test sequence.

Special Parameters

Combined Testing

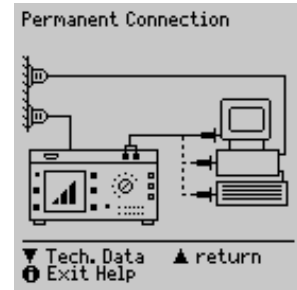
Safety class I and II devices can be tested individually or in combination. All protective conductor connections are tested first for interconnected safety class I devices, and then – as is also the case for interconnected safety class II devices – all exposed, conductive parts.

Connecting the Device Under Test

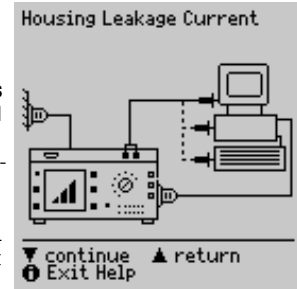
- ◇ Connect the test instrument and the DUT as described below:
 - Connect both devices to separate mains outlets.
The outlets to which the test instrument and the safety class I DUT are connected must share a common protective conductor!
 - Or connect the test instrument to the mains and the DUT to the test socket at the test instrument.

Data Processing / Office Machines

Permanently connected or with plug



To test socket at the instrument



The requirement for **testing with the mains plug poled in both directions** can be fulfilled by connecting the DUT to the test socket at the instrument, and by activating mains polarity reversal in the setup menu under “Sequence”. Each time the key (14) is activated, phase conductor L and neutral conductor N are reversed at the test socket.



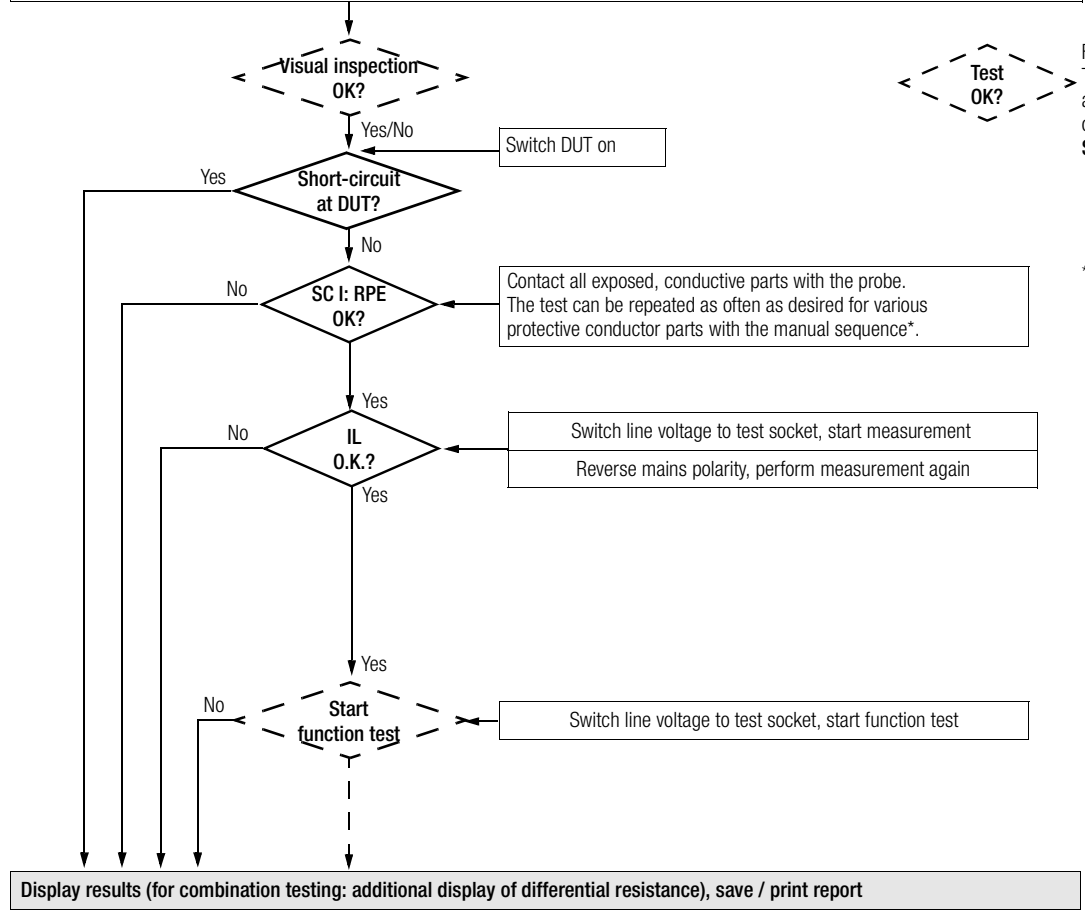
Attention!

Testing with mains polarity reversal or with the mains plug poled in both directions results in interruption of supply power to the affected data processing equipment or office machine. This test may thus only be conducted with the consent of the operator of the data processing equipment or office machine.

If the DUT is defective, the electrical system's RCCB may be tripped during testing which would also result in interruption of supply power to the affected equipment or office machine. The manufacturer of the test instrument assumes no liability for the loss of data or other damage which result from use of the test instrument.

Test Sequence per VDE 0701, part 240

Select connection, select test regulation **VDE 0701, part 240** classify DUT (SC I, II or III), **combination testing X/- (yes/no)**



Framed with dashed line:
The test is only run if it has been activated in the initial program window, or in the **Setup** menu under **Sequence....**

* If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.

15.6 Testing Devices in Accordance with DIN VDE 0702

The following measurements can be performed in accordance with the above mentioned standard:

- Protective conductor R_{PE} (*permanent connection or with plug*)
Test current: DC ± 200 mA
- Insulation measurement R_{ISO} (*can be deactivated, e.g. if danger exists that voltage sensitive components in data processing systems might be damaged*) plus equivalent leakage current

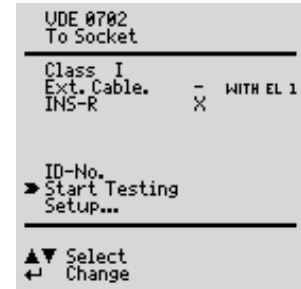
or

- Contact current for safety class II

or

- Differential current

Check connection parameters and start test.



To Socket

This is the default setting. Refer to chapter 7 on page 15 for other types of connection.

Class

If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). Otherwise, the safety class must be specified manually.

Ext. Cable

x: Extension cables or connector cables which are longer than 5 m can be tested with the help of the EL1 adapter (optional), either separately or in combination with a device.

ISO-R

x: Insulation resistance measurement is performed.

ID No.

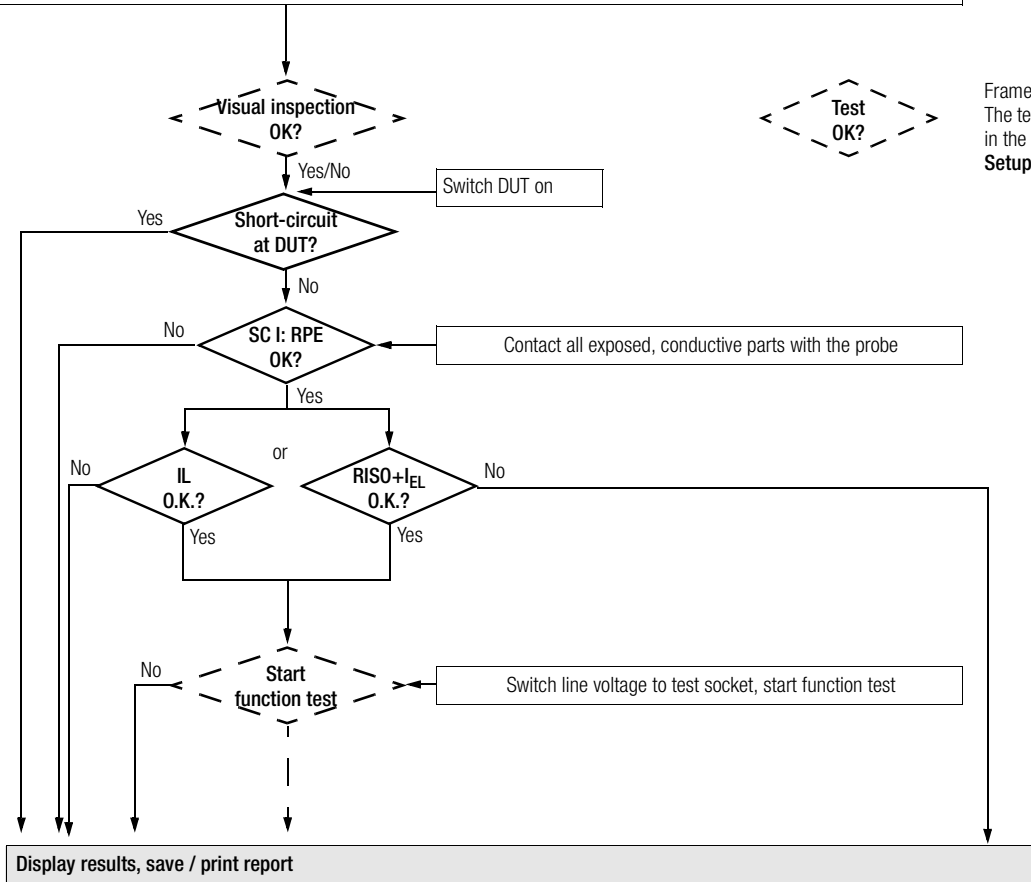
See parameters database in chapter 15.2 on page 32.

Setup...

See chapter 15.2 on page 32 regarding setup of the measuring sequence.

Test Sequence per VDE 0702

Select connection, select test regulation **VDE 0702** classify DUT (SC I, II or III), **extension cable X/- (with/without)**



Framed with dashed line:
The test is only run if it has been activated in the initial program window, or in the **Setup** menu under **Sequence...**

15.7 Testing Extension Cables for VDE 0701, Part 1, and VDE 0702 (optional EL1 adapter)

Extension Cables up to 5 m Long

Protective conductor resistance between the earthing contact at the mains plug and all exposed metal parts may not exceed 0.3Ω for protection class I devices. This value may not exceed 1Ω for permanently connected data processing systems (DIN VDE 0701, part 240).

Extension and Connector Cables Longer than 5 m

Per DIN VDE 0702, additional cable resistance of 0.1Ω is allowable as of a length of 5 m for each additional 7.5 m.

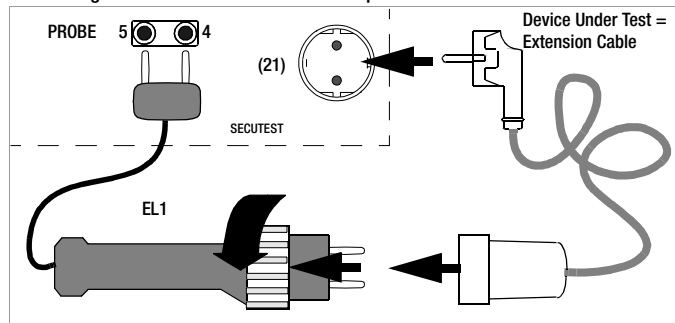
Resistance testing for cables longer than 5 m is thus advisable (see also limit values on page 18).



Note

The EL1 accessory adapter is required for testing for short-circuiting and interruption of single-phase extension cables.

Connecting the Extension Cable or the Multiple Outlet

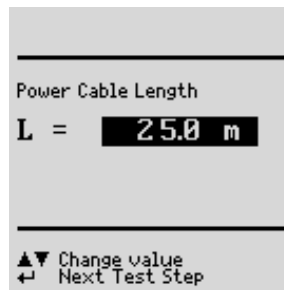


Note

The keys in the adapter's handle have no function.

Performing the Test

- Connect the extension cable to the EL1 adapter as shown in the figure above.
- Select the “Ext. Cable” test from the initial menu with the cursor and acknowledge with the key: Ext. Cable x WITH EL1.
- Select “Start Testing” with the key.
- Start the test sequence with the key.
- First perform and acknowledge visual inspection of the extension cable.
- Enter the length of the cable with the and keys. Acknowledge with the key.



15.8 Testing Multiple Outlets for VDE 0702 (optional EL1 adapter)

- Select **not** “WITH EL1” in the initial menu. The following must appear in the line: Ext. Cable – WITH EL1. “Manual sequence” must be selected.
- A visual inspection must always be performed. It may thus be necessary to unreel the cable from its drum or reel.
- Protective conductor resistance measurement: Contact the first outlet with the EL1 adapter. Each time you are ready to contact the next outlet, press the key to repeat the test.
- After measurement has been completed for all outlets, reinsert the test probe in order to continue with the performance of subsequent tests as described in chapter 15.6.

15.9 Testing in Accordance with the British Standard

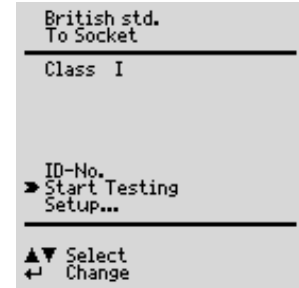
The following measurements can be performed in accordance with the above mentioned standard:

- Protective conductor R_{PE} (*permanent connection or with plug*)
Test current: 10 A AC (feature G01: 25 A AC test current)
- High-voltage test
- Insulation resistance measurement R_{ISO}

Hand-held electrical power tools can be tested, for example:

- Disk grinders
- Hand-held circular saws

Check connection parameters and start test.



To Socket

This is the default setting. Refer to chapter 7 on page 15 for other types of connection.

Class

If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). Otherwise, the safety class must be specified manually.

ID No.

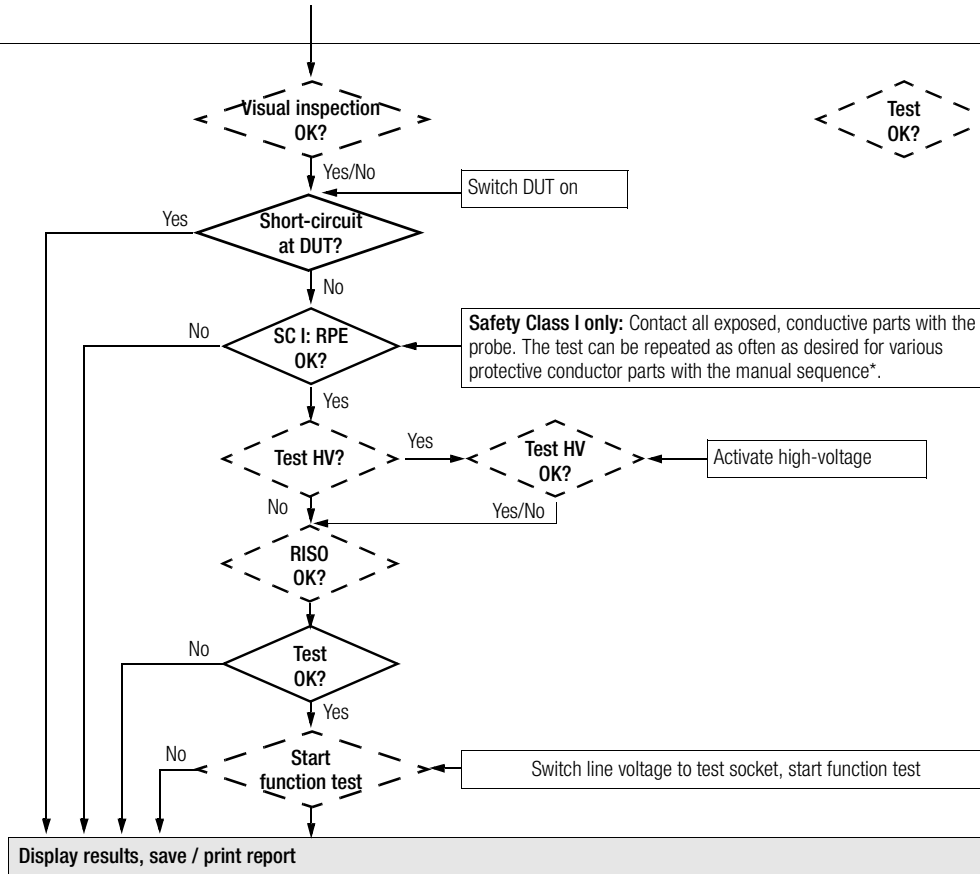
See parameters database in chapter 15.2 on page 32.

Setup...

Refer to chapter 15.2 on page 32 regarding setup of the measuring sequence.

Test Sequence per British Standard

Select connection, select test regulation **British Standard** classify DUT (SC I, II or III), configure: **HV test X/- (with/without)**



Framed with dashed line:
The test is only run if it has been activated in the initial program window, or in the **Setup** menu under **Sequence...**

* If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.

15.10 Testing in Accordance with DIN EN 60950

Tests for safety class I and II **data processing equipment and office machines**

The following measurements can be performed in accordance with the above mentioned standard:

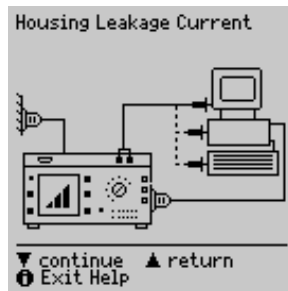
- Protective conductor measurement R_{PE} , test current: 25 A
- High-voltage test (feature F01/02)
- Housing leakage current \approx

According to DIN EN 60950, data processing equipment and office machines must be subjected to a device protective conductor test and a high-voltage test before they are brought into circulation. This applies to:

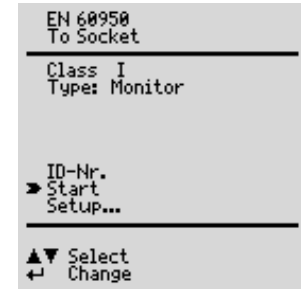
- Safety class I devices for all exposed, conductive parts which are accessible to the user, and which are not connected to the protective conductor
 - Safety class II devices (totally insulated devices) for all exposed, conductive parts which are accessible to the user
 - Housing leakage current
- With the mains plug poled in both directions

Connecting the Device Under Test

- ◇ Connect the test instrument to the mains, and the device under test to the test socket at the test instrument.



Check connection parameters and start test.



To Socket

This is the default setting. Refer to chapter 7 on page 15 for other types of connection.

Class

If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). Otherwise, the safety class must be specified manually.

Type

A specific DUT type can be selected from a list of devices under test, if these have been entered in the setup menu.

ID No.

An individual serial number (up to 10 characters) can be entered with the keypad at the PSI module (optional), or can be read in with a barcode scanner (optional).

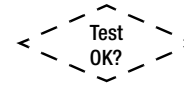
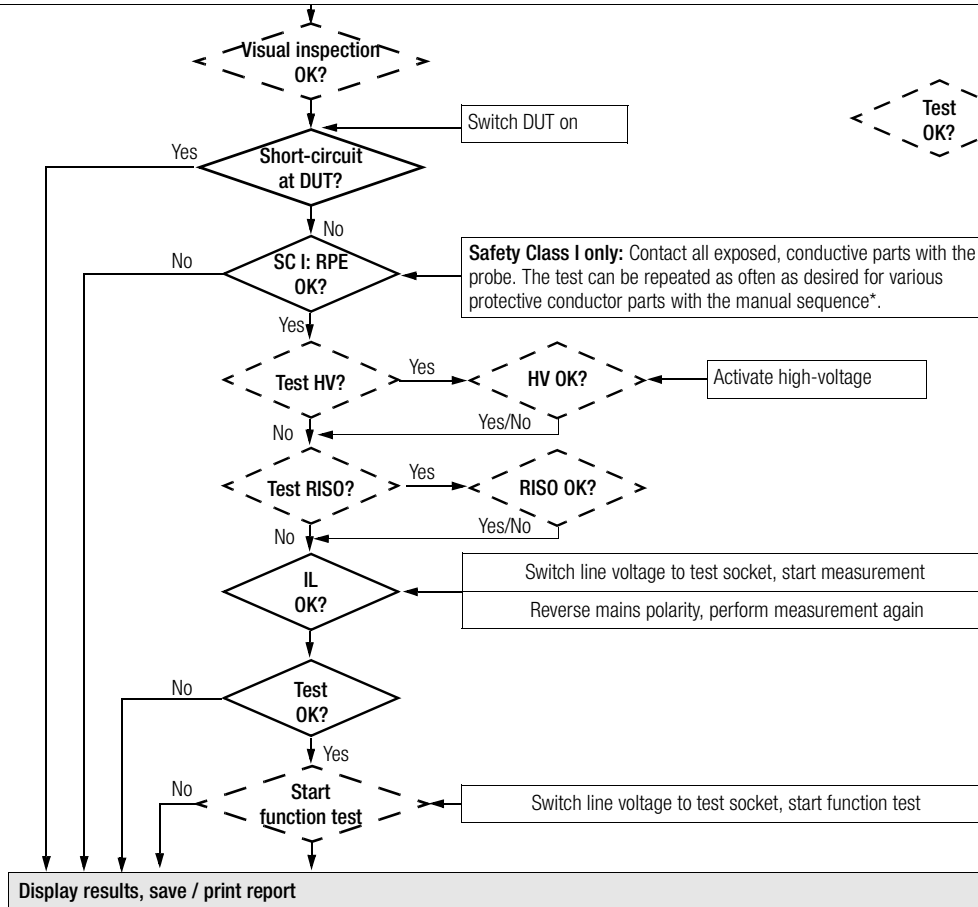
If an incorrect entry is made: Only complete lines can be deleted, and deletion is only possible with the key at the instrument.

Setup...

Refer to chapter 15.2 on page 32 regarding setup of the measuring sequence.

Test Sequence per EN 60950

Select connection, select test regulation **EN 60950** classify DUT (SC I, II or III), setup/sequence: **RISO / HV test X/- (with/without)**



Framed with dashed line:
The test is only run if it has been activated in the **Setup** menu under **Sequence...**

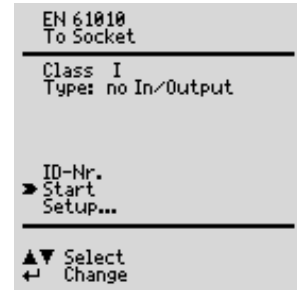
* If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.


15.11 Testing Devices in Accordance with EN 61010

The following measurements can be performed in accordance with the above mentioned standard. Connection must be made via the test socket:

- Protective conductor measurement R_{PE}
Test current: 10 A AC (feature G01: 25 A AC test current)
- High-voltage test
- Insulation measurement R_{ISO} (*can be deactivated*)
- Housing leakage current under normal conditions I_{HLNC} and single-fault condition I_{HLSF} with interrupted protective conductor

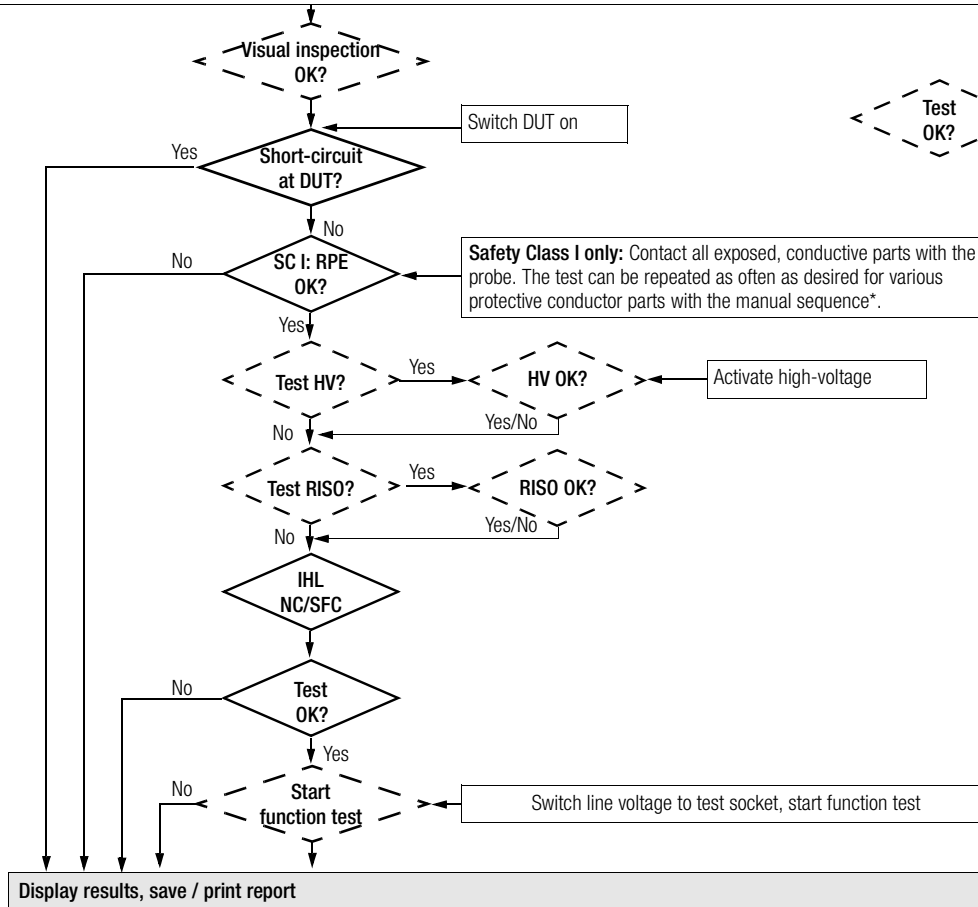
Check connection parameters and start test.



To Socket	This is the default setting. Refer to chapter 7 on page 15 for other types of connection.
Class	If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). Otherwise, the safety class must be specified manually.
Type	A specific DUT type can be selected from a list of devices under test, if these have been entered in the setup menu.
ID No.	An individual serial number (up to 10 characters) can be entered with the keypad at the PSI module (optional), or can be read in with a barcode scanner (optional). If an incorrect entry is made: Only complete line can be deleted, and deletion is only possible with the  key at the instrument.
Setup...	Refer to chapter 15.2 on page 32 regarding setup of the measuring sequence.

Test Sequence per EN 61010

Select connection, select test regulation **EN 61010** classify DUT (SC I, II or III), setup/sequence: **RISO / HV test X/- (with/without)**



Framed with dashed line:
Test is only run if it has been activated in the **Setup** menu under **Sequence....**

* If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.

15.12 Testing Devices in Accordance with EN 60335

The following tests can be performed in accordance with VDE 0700, part 500, (as part of DIN EN 50106:1998) in compliance with special rules for routine testing of devices for which EN 60335-1 and EN 60967 apply:

- Testing of the protective conductor connection by means of resistance measurement R_{PE} (*permanent connection or with plug*)
Test current: 10 A AC (feature G01: 25 A AC test current)
- Testing for dielectric strength by applying DC high-voltage (1.5-fold value) (feature F01/02)
- Function test

The following tests can be performed in accordance with EN 60335-1:1994:

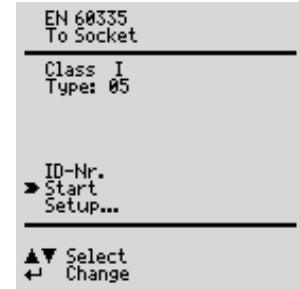
- Housing leakage current under normal conditions I_{HLNC} and single-fault condition I_{HLSF} with interrupted protective conductor
- Testing for dielectric strength by applying high-voltage (feature F01/02)


Additional testing options:

- Insulation resistance measurement R_{ISO}

Check connection parameters and start test.

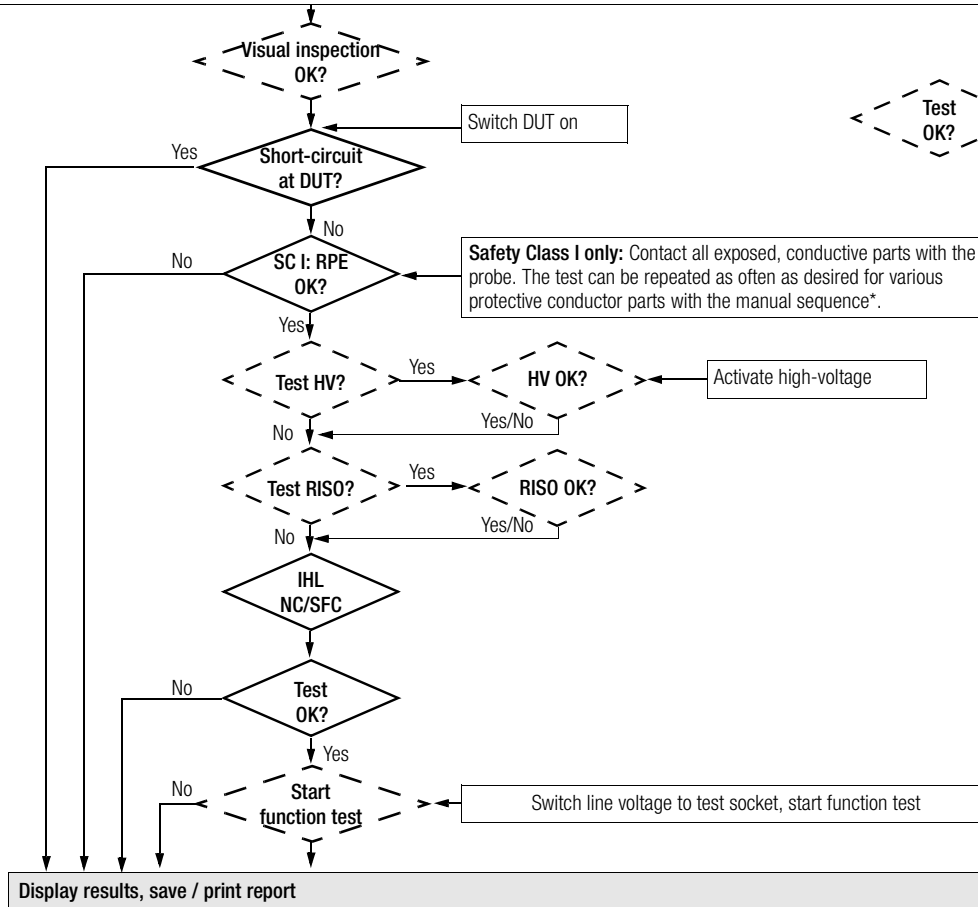
If desired, the test sequence can be adapted to the respective device under test in the following menu in **Setup...** under **Sequence...**



To Socket	This is the default setting. Refer to chapter 7 on page 15 for other types of connection.
Class	If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). Otherwise, the safety class must be specified manually.
Type	A specific DUT type can be selected from a list of devices under test, if these have been entered in the setup menu.
ID No.	An individual serial number (up to 10 characters) can be entered with the keypad at the PSI module (optional), or can be read in with a barcode scanner (optional). If an incorrect entry is made: Only complete line can be deleted, and deletion is only possible with the  key at the instrument.
Setup...	Refer to chapter 15.2 on page 32 regarding setup of the measuring sequence.

Test Sequence per EN 60335

Select connection, select test regulation **EN 60335** classify DUT (SC I, II or III), setup/sequence: **RISO / HV test X/- (with/without)**



Framed with dashed line:
Test is only run if it has been activated in the **Setup** menu under **Sequence...**

* If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.

15.13 Testing in Accordance with DIN VDE 0751

The following measurements can be performed in accordance with the above mentioned standard:

- Protective conductor measurement R_{PE} , test current: 200 mA DC, 10 A AC or 25 A AC
(feature G01: 25 A AC test current)
- Insulation measurement R_{ISO} (*can be additionally activated*)
 - R-ISO LN-SL (insulation resistance, LN to protective conductor)
 - R-ISO AWT-SL (insulation resistance, app. part to protective conductor)
- Equivalent device leakage current I_{EDL}
- Equivalent patient leakage current I_{EPL}
- Device leakage current (direct or differential current)
- Patient leakage current (direct or mains at application part)

Check connection parameters and start test.



```
UDE 0751
To Socket

-----
Class I
Type: GENERAL
AP-Typ:... (BF) 02

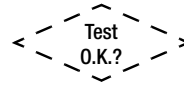
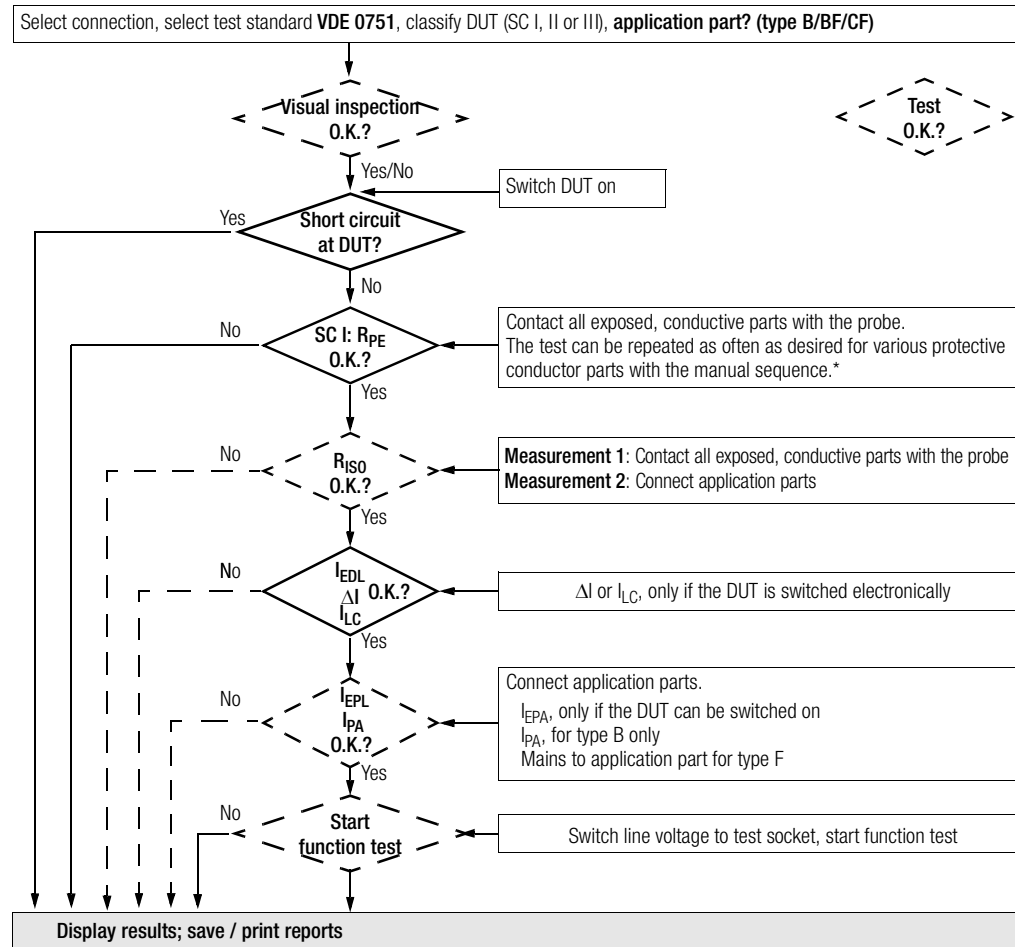
ID-No.
> Start Testing
Setup...

-----
▲▼ Select
← Change
```

- To Socket This is the default setting. Refer to chapter 7 on page 15 for other types of connection.
- Class If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). In all other cases, or if it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, the safety class can be selected manually.

- Type Select the device type (DUT) from the list. If “old devices” is selected, limit values from DIN VDE 0702 are used.
- App. prt. ... (BF): Application parts are recognized automatically, and can be manually changed as well:
Select the App. prt. ... line with the ▲ or ▼ key, acknowledge with the ↵ key and change with the ▲ or ▼ key.
02: The number of configured groups is displayed here. After selecting the App. prt. ... line with the ▲ or ▼ key, acknowledging twice with the ↵ key and then pressing the ▲ or ▼ key, the “Configure application parts” menu appears (see chapter 15.14 on page 52).
- ID No. See parameters database in chapter 15.2 on page 32.
- Setup... Refer to chapter 15.2 on page 32 regarding setup of the measuring sequence.

Test Sequence per VDE 0751



Framed with dashed line:
 The test is only run,
 – if it has been activated in the initial program window, or in the **Setup** menu under **Sequence**
 or
 – if possible at all

* If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.

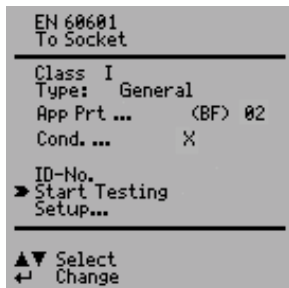
15.14 Testing in Accordance with EN 60601 (feature KA01 or SECU 601 option)

This option can be activated with the Z853G upgrade program.

The following leakage and auxiliary currents can be measured in accordance with the above mentioned standard in the operating mode, as well as under normal and single-fault conditions:

- Protective conductor measurement R_{PE} , test current: 10 A AC (feature G01: 25 A AC test current)
- Earth leakage current I_{PE}
- Housing leakage current I_{HL}
- Patient leakage current I_{PL} (with nominal voltage at application part)
- Patient auxiliary current I_{PX}

Check connection parameters and start test.



Class If the test instrument is equipped with features B00, 01, 03 or 09, and if the DUT has been connected to the test socket, safety class recognition is performed (SC I or SC II). In all other cases, or if it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, the safety class can be selected manually.

Type The DUT type can be selected from a list.

TCond. Various test conditions can be activated here, including insulation resistance measurement.

App prt... See below and on page 50.

ID No. See parameters database in chapter 15.2 on page 32.

Setup... Refer to chapter 15.2 on page 32 regarding setup of the measuring sequence.

Configure Application Parts

Entry is made here indicating whether or not the application parts are to be tested. Jacks A through K (for connection of cables or probes) can also be assigned to groups (application parts) for mutual testing.

App. Prt. ...



Selecting Preset Test Combinations

- Use the cursor to select test combinations with groups of 1, 2, 5 or 10 application parts and acknowledge with the key.

The groups are assigned automatically after the application parts have been selected.

Selecting User Defined Test Combinations

- Select the respective application part from the JACK column with the cursor and acknowledge with the key. You can set up a user defined group for each application part which includes 1 to 10 application parts with the cursor keys in the GR column (GRoup). Acknowledge your settings with the key.

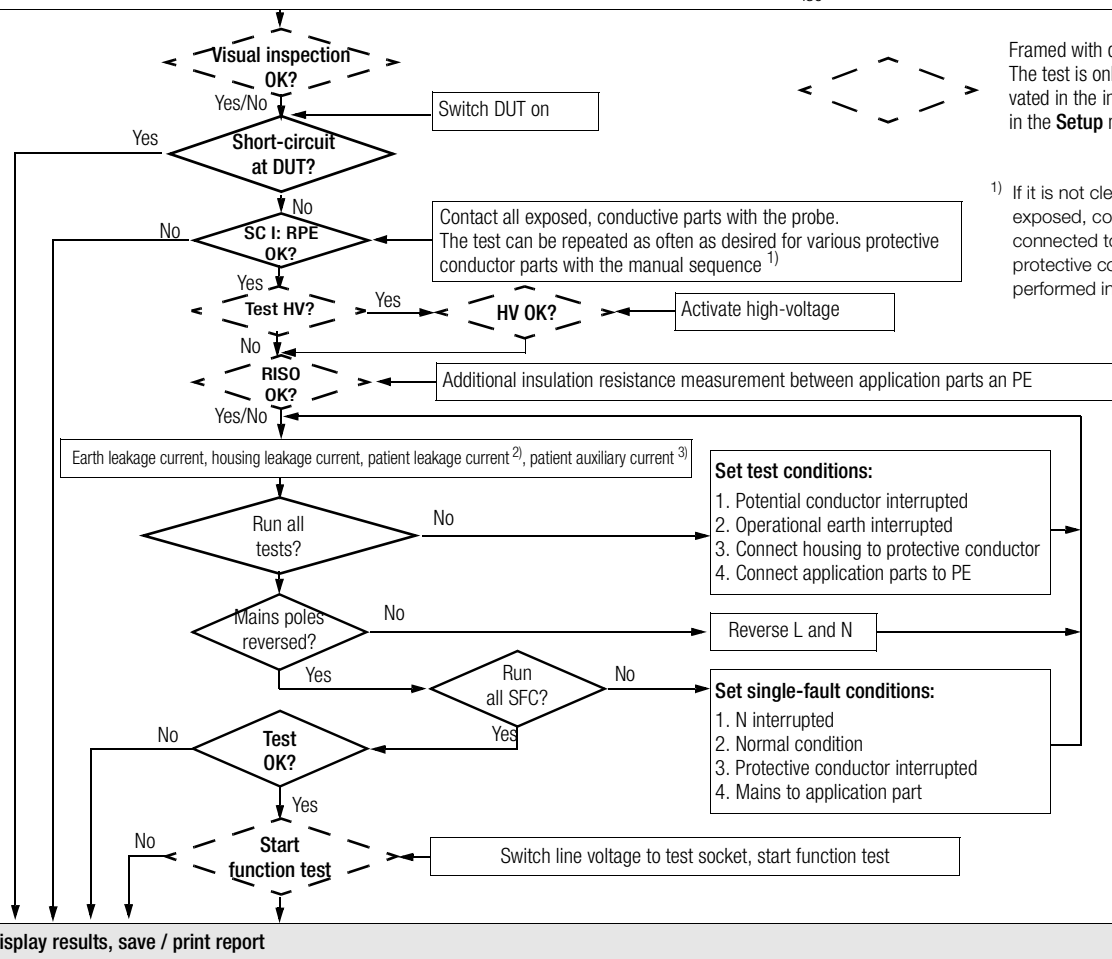
As long as at least one group number has been entered, the application parts test is preset in the “To Socket” window.

The application part type with the strictest limit value takes precedence in the initial window. All groups are set to this type. Various types can be assigned to the groups with “direct print” (adjustable option in the setup menu).

If testing is not to be performed with application parts, the group assignment must be cancelled with the “clear” function.

The TYPE is filled in automatically if the safety class has already been entered to the “To Socket” window.

Select connection, select test regulation **EN 60601** classify DUT (SC I, II or III), test conditions (amongst others R_{ISO} measurement), **application part?** (type B/BF/CF)



Framed with dashed line:
The test is only run if it has been activated in the initial program window, or in the **Setup** menu under **Sequence...**

1) If it is not clear whether or not all exposed, conductive parts are connected to one another or to the protective conductor, testing can be performed in the manual mode.

2) Test is only performed if at least one type BF or CF application part is connected.

3) Test is only performed if at least two type BF or CF application parts are connected.

16 Database (feature KB01 or DBmed option)

16.1 Setting Up Test Sequences with PC Software (not for EN 60950, EN 61 010, EN 60335)

This function must be activated with the help of upgrade software, e.g. the Z853H program.

Up to 99 test sequences can be uploaded for each of the selector switch positions from a PC via the serial port at the SECUTEST®SIII test instrument. After testing has been performed, the test results are saved to the same database, if a PSI module has not been connected. The maximum possible sum of test sequences and test results is 127.

Test results are stored to the PSI module if one has been connected.

The database can be used in different ways:
(see also chapter 15.2 on page 32)

1. Stored test results can be displayed
(select the ID no. and then activate the “from database” function).
The desired test sequence can be selected with the scroll keys.
2. If “ID no. = test sequence” has been activated in setup (X), the first two characters of the ID number determine the test sequence.

Example: ID number = 037890sk3r
Test sequence number 03 is executed.
Test sequence 03 is the test sequence which appears at the third position from the top the list.

If this number does not exist, the default sequence is executed.

3. Executed test sequences are stored to memory at the instrument as test results. The test results can also be displayed at a later point in time with the “test sequence settings” sub-menu in the “general setup” menu.



Note

The database can only be generated or deleted with the help of a PC with a terminal program, or appropriate application software.

16.2 Storing Test Results to the SECUTEST®SIII

This function must be activated with the help of upgrade software, e.g. the Z853H program.

If no PSI module has been connected, up to 99 reports can be stored to the test instrument. The reports can be viewed as required at the instrument and can be printed out, for example with the help of DA-II software or a terminal program.

The reports are sorted by time and date and are displayed with the ID number. If no ID number was assigned, date and time are automatically saved instead.

17 Modem Operation (feature KC01 or DFÜmed option)

This function must be activated with the help of upgrade software, e.g. the Z853H program. Two modems are required in addition to the test instrument and a PC.

Modem operation allows for the following functions:

- Transmission of report data via the telephone lines from the test instrument to a PC.
- Remote control of the test instrument from a PC, e.g. for starting measurements or reading out reports.
- Storage of 2 telephone numbers (with the selector switch in the MENU position and in the “Setup” menu), which can be dialed directly from the menu.
- Standby operation for accepting data query calls.

```
Modem Operation
-----
return
> 01910
0w01910
Accept Call
Interrupt Connection

Modem Setup...

----- offline -----
▲▼ Select
← Change
```

```
Modem Setup
-----
return
store
> No. 1 01910
No. 2 0w01910

----- offline -----
▲▼ Select
← Change
```

After a connection has been established, “online” appears in the footer instead of “off-line”.



Note

The telephone numbers can only be entered to the “Modem Setup” menu with a PSI module, or a PC with the help of a terminal program. The interface cable must be connected directly to the RS 232 port at the test instrument for modem operation. The jack at the PSI module is not suitable for this purpose.

18 Remote Control (feature KD01 or SC5 option)

This function must be activated with the help of upgrade software, e.g. the Z745K program.

The protective conductor measurement is expanded to include the function: “automatic recognition of measuring point change”.

During protective conductor measurement, the instrument recognizes whether or not the probe is in contact with the protective conductor, and indicates these two possible conditions by means of acoustic signals.

This function is helpful if several protective conductor connections need to be tested. The function can be activated in the “test sequence setup” menu with “auto measuring point” (see “changes to the switch position menu” above).

19 Printing with the Printer Adapter (accessory equipment DA-II)

Test instruments can be connected to commercially available printers with the DA-II printer adapter (Z745M), even if they are not equipped with a parallel port. Test reports etc. can thus be printed out on-site.

The only prerequisite is that the printer module is designed for direct report generation.

19.1 Printing Test Results in Report Form

Connecting a Centronics Printer

Connect the test instrument to a Centronics printer via the RS 232 port with the help of the DA-II adapter. The PSI module may not be connected.

Connecting a PC for Printing to File (Terminal program or option SECU 601)

Connect the PC to the RS 232 port at the test instrument with an interface cable. The PSI module may not be connected.

You can shift to the **Protocol** menu from any of the displayed test results (1st page) with the help of the key.

To Socket		CL I
Test Results		Part 1
	MEAS. VALUES	LIMIT VALUES
RSL	0.098 Ω	<1.000 Ω
RMS	0.033 MΩ	>0.500 MΩ
UINS	3.9 U	5.00 U
IEHL	6.90 mA	<7.00 mA

Passed!

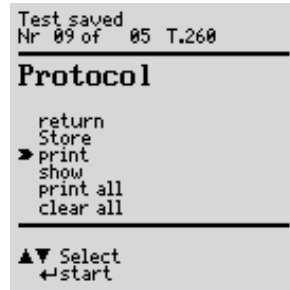
← New ▲▼ Page ● Fnc.

Measurement results for the current test can be stored to memory, the results of the current test can be printed out to the corresponding report form, previously stored test results can be queried (scroll: DBmed option, see chapter 16) and all saved measurement results can be printed out from this menu.

Depending upon cable connections, the print-out is forwarded:

- directly to Centronics printer (DA-II option)
- via Terminal program
- via SECU 601 update and enabling program

The matching report form is automatically selected for the standard selected with the selector switch.



The terminal program can now be configured:

Select the port to which the SECUTEST®SIII is connected and enter the following settings.



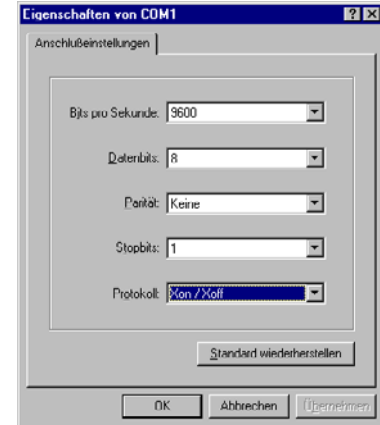
19.1.1 Print-Out via Terminal Program

As of Windows 95, the HyperTerminal terminal program is included with the Windows operating system. This allows the user to display and edit test reports at a PC. The terminal program must be configured prior to initial use.

Configuring HyperTerminal

Start the program: *Start* ▶ *Programs* ▶ *Accessories* ▶ *Hyper terminal* ▶ *HyperTerminal* or possibly *Communication* and then *HyperTerminal*:

Assign any desired name to the connection, e.g. **Secutest**. Subsequent terminal settings are saved under this name and can thus be utilized in the future. You can also select any desired display icon.



Starting HyperTerminal and Receiving a Report

If it has not yet been initialized, start HyperTerminal now:

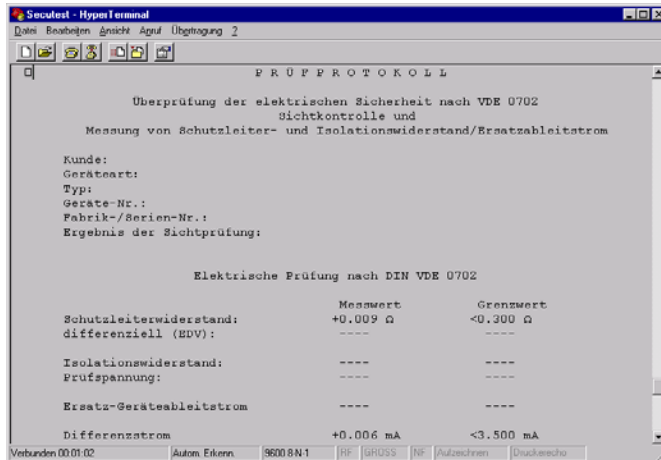
Start ▶ Programs ▶ Accessories ▶ HyperTerminal ▶ **secutest.ht**

Select "Print" in the SECUTEST®SIII report menu and acknowledge with the ENTER key. The test report is transferred to the terminal program.

The report template appears in the terminal program window with the corresponding measured values.

The displayed report can be read out to a printer by clicking the *Print* function in the *File* menu.

The test report can be saved using any desired file name with the *Record text* function in the *Transfer* menu.



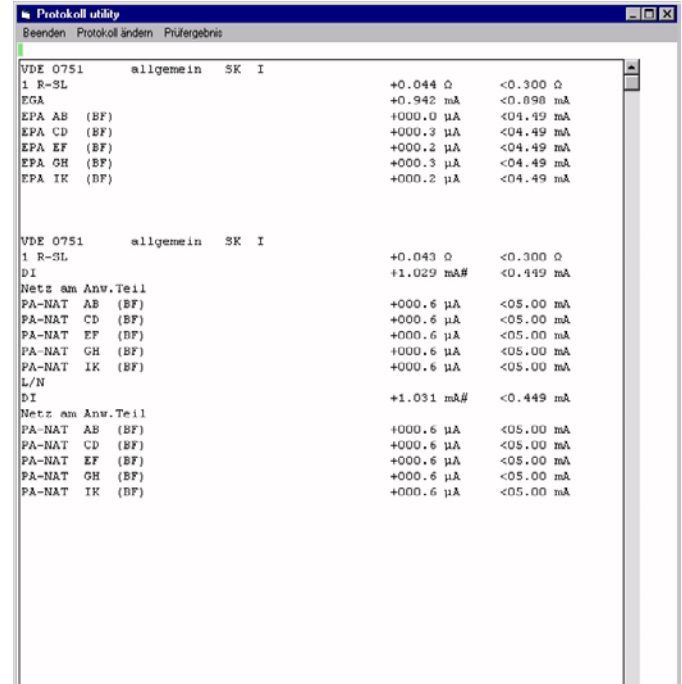
After saving the report as a *.txt file, it can be edited with any word processing program.

19.1.2 Report Print-Out via SECU 601 Update and Enabling Program

SECU 601 software can be used instead of a terminal program for printing out measurement data. Click the *Print* function in the *Test results* menu to this end.

20 Direct Print-Out (feature KE01, option SECU-dd)

After completion of each test (individual test or at the end of a test sequence), test results are read out directly via the RS 232 interface. If the SECUTEST®PSI has been connected, the results are printed directly to paper.



21 Characteristic Values

Function	Measured Quantity	Measuring Range / Nominal Range of Use	Resolution	Nominal Voltage U_N	Open-Circuit Voltage U_0	Nominal Current I_N	Short-Circuit Current I_K	Internal Resistance R_i	Reference Resistance R_{REF}	Measuring Error	Intrinsic Error	Overload Value	Capacity Duration								
Tests per DIN VDE 0701 / 0702	Device Protective Conductor Resistance R_{PE}	0.000 ... 2.100 Ω	1 m Ω	—	4.5 ... 9 V DC	—	> 200 mA DC	—	—	$\pm(5\% \text{rdg.} + 10 \text{ digits}) > 10 \text{ d}$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	253 V	cont.								
		2.11 ... 31.00 Ω	10 m Ω																		
	Insulation Resistance R_{ISO}	Part 260 0.000 ... 2.100 Ω		1 m Ω	—	< 6 V AC	—	> 10 A AC ⁴⁾ > 5 s	—	—	$\pm(5\% \text{rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	no protection ⁵⁾								
		0.050 ... 1.500 M Ω	1 k Ω	50 ... 500 V DC									1.0 • U_N ... 1.5 • U_N	> 1 mA	< 10 mA	—	—	$\pm(10\% \text{rdg.} + 10 \text{ digits})$	$\pm(10\% \text{rdg.} + 10 \text{ digits})$	253 V	cont.
		1.01 ... 10.00 M Ω	10 k Ω																		
	10.1 ... 310.0 M Ω	100 k Ω																			
	Equivalent Leakage Current I_{EL}	0.00 ... 21.00 mA	10 μ A	—	230 V ~ -20/+10 %	—	—	< 3.5 mA	> 72 k Ω	2 k Ω	$\pm(5\% \text{rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	253 V	cont.							
20.1 ... 120.0 mA		100 μ A																			
Contact Current (absence of voltage) I_{probe}	0 ... 3.500 mA	1 μ A	—	—	—	—	—	2 k Ω	—	$\pm(5\% \text{rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	253 V	cont. ₂₎								
Residual Current ΔI between L and N per DIN VDE 0702	0.00 ... 31.00 mA ~	10 μ A	—	—	—	—	—	—	—	$\pm(10\% \text{rdg.} + 10 \text{ digits}) > 10 \text{ digits}$	$\pm(5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	1)	1)								
Tests per DIN VDE 0751	Device Protective Conductor Resistance R_{PE}	0.000 ... 2.100 Ω	1 m Ω	—	< 6 V AC	—	> 10 A AC ⁴⁾ / > 5 s	—	—	$\pm(5\% \text{rdg.} + 10 \text{ digits}) > 10 \text{ d}$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	no protection ⁵⁾									
		0.0 ... 310.0 μ A	0,1 μ A																		
	Equivalent Device and/or Patient Leakage Current I_{EDL} and/or I_{EPL}	0.000 ... 2.100 mA	1 μ A	—	230 V ~ -20/+10 %	—	—	< 3.5 mA	> 72 k Ω	1 k Ω $\pm 50 \Omega$	$\pm(5\% \text{rdg.} + 10 \text{ digit})$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	253 V	cont. ₁₎₃₎							
		2.101 ... 21.00 mA	10 μ A																		
20.1 ... 120.0 mA	100 μ A																				
Tests per EN 60601 ⁷⁾	Device Protective Conductor Resistance R_{PE}	0.000 ... 2.100 Ω	1 m Ω	—	< 6 V AC	—	> 10 A AC ⁴⁾ / > 5 s	—	—	$\pm(5\% \text{rdg.} + 10 \text{ digits}) > 10 \text{ d}$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	no protection ⁵⁾									
		Leakage Current I_L ²⁾	0.0 ... 310.0 μ A									100 nA	110% of highest line voltage ⁵⁾	—	—	1 k Ω	—	$\pm(5\% \text{rdg.} + 10 \text{ digits})$	$\pm(2.5\% \text{rdg.} + 5 \text{ digits}) > 10 \text{ digits}$	253 V	cont. ₁₎₃₎
	All Leakage Current I_L	0.210 ... 3.600 mA	1 μ A																		
3.10 ... > 15.00 mA	10 μ A																				

1) As of 25 mA: shutdown by residual current measurement within 100 ms

2) Exception earth leakage current: only 0,000 ... 3,100 mA

3) Measuring circuit is highly resistive, indication at display

4) Measurement with AC test current is not possible at the sockets (1 through 3).

Feature G01: > 25 A: Short-circuit current is less than 25 A if the SC5 special cable

is used.

5) Test duration max. 40 s, protection against overheating: measurement cannot be restarted until a waiting period of 1 minute has elapsed.

6) Calculated value

7) AC and DC are measured for patient leakage current and patient auxiliary current.

Function	Measured Quantity	Measuring Range / Nominal Range of Use	Resolution	Open-Circuit Voltage U_0	Short-Circuit Current I_K	Internal Resistance R_i	Measuring Error	Intrinsic Error	Overload Capacity		
									Value	Duration	
Functions Test	Nominal Voltage U_{L-N}	103.5 V ... 126.5 V 207.0 ... 253.0 V ~	0.1 V	—	—	—	—	$\pm(2.5\%rdg.+5 \text{ digits})$	253 V	cont.	
	Load Current I_V	0 ... 16.00 A RMS	10 mA	—	—	—	—	$\pm(2.5\%rdg.+5 \text{ digits})$	20 A	10 min	
	Active Power P	0 ... 3700 W ⁷⁾	1 W	—	—	—	—	$\pm(5\% \text{ rdg.}+10 \text{ digits})$ > 20 digits	253 V	cont.	
	Apparent Power S	0 ... 4000 VA	1 VA	Calculated Value $U_{L-N} \cdot I_V$					$\pm(5\% \text{ rdg.}+10 \text{ digits})$ > 20 digits	20 A	10 min
	Power Factor PF, sinusoidal: $\cos \varphi$	0.00 ... 1.00	0.01	Calculated Value P / S, Display > 10 W					$\pm(10\% \text{ rdg.}+5 \text{ digits})$		
	Residual Current ΔI between L and N per DIN VDE 0702	0.00 ... 31.00 mA ~	10 μ A	—	—	—	$\pm(10\% \text{ rdg.}+10 \text{ d})$ > 10 digits	$\pm(5\% \text{ rdg.}+5 \text{ digits})$	1)	1)	
$U_{AC/DC}$	Voltage	0 ... 253.0 V ≡, ~ and ≐	0.1 V	—	—	—	—	$\pm(2.5\%rdg.+5 \text{ digits})$ > 10 digits	253 V	cont.	
	Low-Voltage SC III						$\pm(5\% \text{ rdg.}+10 \text{ d})$				
U_{probe}	Probe Voltage	0 ... 253.0 V ≡, ~ and ≐	0.1 V	—	—	—	—	$\pm(2.5\%rdg.+5 \text{ digits})$ > 10 digits	253 V	cont.	
R	Resistance	0 ... 150.0 k Ω	100 Ω	< 20 V –	1.1 mA	—	—	$\pm(1\% \text{ rdg.}+3 \text{ digits})$	253 V	cont.	
I_{clip}	Current via Clip-On Current-Voltage Converter WZ12C	0.000 ... 10.00 A ~	1 mA	—	—	1.5 M Ω	—	$\pm(3\% \text{ rdg.}+10 \text{ digits})$ > 10 digits	253 V	cont.	
		0 ... 100 A ~	1 A	—	—	1.5 M Ω	—	$\pm(3\% \text{ rdg.}+10 \text{ digits})$ without clip	253 V	cont.	
Temp	Temperature with Pt100 / Pt1000 Sensor	- 200 ... - 50 °C	1 °C	< 20 V –	1.1 mA	—	—	$\pm(2\% \text{ rdg.}+1 \text{ } ^\circ\text{C})$	10 V	cont.	
		- 50.1 ... + 300.0 °C	0.1 °C					$\pm(1\% \text{ rdg.}+1 \text{ } ^\circ\text{C})$	10 V	cont.	
		+300 ... +850 °C	1 °C					$\pm(2\% \text{ rdg.}+1 \text{ } ^\circ\text{C})$	10 V	cont.	

⁷⁾ Measured value P and calculated value S are compared, and the smaller value is displayed.

Reference Ranges

Line Voltage	115 / 230 V $\pm 0.2\%$
Line Frequency	50/60 Hz $\pm 0.1\%$
Waveshape	sine (deviation between effective and rectified value < 0.5%)
Ambient Temperature	+23 °C ± 2 K
Atmospheric Humidity	50% relative $\pm 5\%$
Load Resistors	linear

Nominal Ranges of Use

Line Voltage	103.5 V ... 126.5 V or 207 V ... 253 V
Line Frequency	50 Hz or 60 Hz
Line Voltage Waveshape	sine
Temperature	0 °C ... + 50 °C

Ambient Conditions

Storage Temperature	- 20 °C ... + 60 °C
Operating Temperature	- 10 °C ... + 50 °C
Accuracy Range	0 °C ... + 50 °C
Relative Humidity	max. 75%, no condensation allowed
Elevation	max. 2000 m
Deployment	indoors, outdoors: only under specified ambient conditions

Power Supply

Line Voltage	103.5 V ... 126.5 V or 207 V ... 253 V
Line Frequency	50 Hz or 60 Hz
Power Consumption	approx. 30 VA
for 10 A test current	approx. 95 VA, test duration max. 70 s
for 25 A test current	approx. 180 VA, test duration max. 70 s
for function test	continuous max. 3600 VA, power is conducted through the instrument only, switching capacity ≤ 16 A

RS 232 Data Interface

Type	RS 232C, serial, per DIN 19241
Format	9600, N, 8, 1
Connector	9-pin subminiature socket connector

Electrical Safety

Safety Class	I per IEC 61010-1/EN 61010-1/VDE 0411-1
Nominal Voltage	115/230 V
Test Voltage	3.7 kV, 50 Hz
Overvoltage Category	II
Contamination Level	2
Safety Shutdown	for residual current at device under test > 25 mA, disconnecting time < 100 ms probe current > 10 mA, < 1 ms

Electromagnetic Compatibility

Interference Emission	EN 61326-1
Interference Immunity	EN 61326/A1

Mechanical Design

Display	multiple dot matrix display, 128 x 128 pixels
Protection	housing: IP 40 terminals: IP 20 per DIN VDE 0470, part 1/EN 60529
Dimensions	test instruments without high-voltage module: LxWxH: 292 mm x 138 mm x 243 mm test instruments with high-voltage module: LxWxH: 292 mm x 138 mm x 300 mm
Weight	standard test instrument: approx. 4.5 kg instrument with HV test: approx. 5.24 kg instrument with 25 A PE test: approx. 5.5 kg instr. with 25 A PE & HV test: approx. 5.9 kg

High-Voltage Test (feature F02)

Transducer

Nominal Voltage, AC	U_{N-} adjustable	in 10 V steps in 100 V steps	0.5 ... 0.99 kV 1 ... 4.0 kV $((U_{N-} \cdot 1.5) \cdot 1.011) + 60$ V
Open-Circuit Voltage, DC	U_o		
Intrinsic Error, U_o	U_o		$\pm 1.5\%$
Nominal Current	per DIN VDE 0104		< 3.5 mA DC
Short-Circuit Current	discharge current		> 5 A at 6 kV
Resistance to Interference Voltage			none

Measuring

Measuring Range	Display Range	Intrinsic Error, U_o
0 ... U_{omax}	0.000 ... > 10.00 kV DC	$\pm 1.5\%$

22 RS 232 Interface

The RS 232 port is used to connect the SECUTEST®PSI module (accessory), which can be installed to the lid of the SECUTEST®SIII, to a PC or a barcode scanner.

22.1 Transmission of Measurement Results to the SECUTEST®PSI

Test results – except for results from individual measurements (selector switch in MENU position) and the function test – can be transmitted from the SECUTEST®SIII to the SECUTEST®PSI module, where they can be stored and printed out in the form of measuring, test and statistics reports at any time.

22.2 PC Connection

Connection to an IBM compatible PC is also possible. The PC is connected to the interface at the test instrument, or to the interface port at a previously installed SECUTEST®PSI module.

22.2.1 Software Evaluation of Measurement Results

Convenient software programs such as PC.doc-win or PS3 allow for easy preparation of measuring and test reports, as well as archiving of measured data.

22.2.2 Instrument Control via Interface Commands

All key functions included with the SECUTEST®SIII can be simulated with the help of interface protocols, and the following parameters can be queried:

- Type of measurement and measuring range
- Test setup
- Measurement sequence progress
- Detailed measuring results

22.3 Interface Definition and Protocol

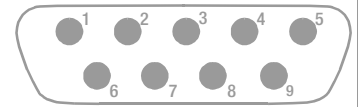
The interface included with the SECUTEST®SIII is in compliance with the RS 232 standard.

Technical Data:

Baud Rate	9600 baud, permanently set
Character Length	8 bits
Parity	none
Stop Bits	1
Data Protocol	per DIN 19244 X_ON / X_OFF protocol

Connector Pin Assignments, 9-Pin Subminiature Socket Connector:

- 1: External in + (for internal use only)
- 2: TXD (transmitter output)
- 3: RXD (receiver input)
- 4: External in +
- 5: GROUND
- 6: +5 V
(500 mA output, for barcode scanner only)
- 7: Ext. in –
- 8: Control output
- 9: +9 V
(1.5 A output, for PSI module only)



23 Appendix

23.1 Evaluation of Measured Values for Individual Measurements as well as for Calculated Quantities

In order to assure that the limit values for the individual measurements are always observed, device measuring error must be taken into consideration.

The table in the appendix allows for calculation of the required minimum display value for each respective measurement which must appear at the instrument in consideration of measuring error (under nominal conditions of use), in order to assure that the required limit value is not fallen short of (DIN VDE 0413, part 1). Intermediate values can be interpolated.

Measuring Error for Test Sequences

The test instrument takes respective measuring error into consideration during automatic test sequences, and corrected results are entered into the test report, as long as this function has been activated in the setup menu under "include service error".

Tables for the calculation of minimum display values for insulation resistance and maximum display values for protective conductor resistance, equivalent leakage current, probe current and residual current in consideration of device measuring error:

$R_{ISO} \text{ M}\Omega$		$R_{PE} \Omega$	
Limit Value	Minimum Display Value	Limit Value	Maximum Display Value
0.100	0.115	0.100	0.085
0.250	0.273	0.200	0.180
0.500	0.535	0.300	0.275
1.000	1.060	0.400	0.370
2.000	2.200	0.500	0.465
5.000	5.350	0.600	0.560
7.000	7.450	0.700	0.655
10.00	10.60 or 12.5 ¹⁾	0.800	0.750
20.00	23.00	0.900	0.845
75.00	83.50	1.000	0.940
		1.100	1.035

¹⁾ Depending upon resolution

$I_{EL} \text{ mA}$		$I_{probe} \text{ mA}$		$\Delta I \text{ mA}$	
Limit Value	Maximum Display Value	Limit Value	Maximum Display Value	Limit Value	Maximum Display Value
1.00	0.85	0.100	0.085	0.25	0.12
3.50	3.23	0.250	0.227	0.50	0.35
7.00	6.55	0.500	0.465	1.00	0.80
10.00	9.40	1.000	0.940	2.00	1.70
15.00	14.15	2.000	1.890	3.50	3.05
20.00	18.90	3.500	3.315	5.00	4.40
				7.00	6.20
				10.00	8.90
				15.00	13.40
				20.00	17.90
				25.00	22.40

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24 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.

25 Repair and Replacement Parts Service DKD Calibration Lab * and Rental Instrument Service

If service is required please contact:

GOSSEN-METRAWATT GMBH
Service-Center
Thomas-Mann-Strasse 20
90471 Nürnberg · Germany
Phone +49-(0)-911-8602-410/256
Fax +49-(0)-911-8602-253
E-Mail service@gmc-instruments.com

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

* **DKD** Calibration Laboratory for Electrical Quantities DKD – K – 19701

Accredited measured quantities: direct voltage, direct current values,
DC resistance, alternating voltage, alternating current values, AC active power,
AC apparent power, DC power, capacitance and frequency

26 Product Support

If support is required please contact:

GOSSEN-METRAWATT GMBH
Product Support Hotline
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