Operating Instructions

GOSSEN METRAWATT

SECULIFE | SR

PC Controllable Instrument for Measuring Safety-Relevant Characteristic Values of Electrical (Medical) Devices

3-349-444-03
4/2.12

Scope of delivery

1 measuring instrument **SECULIFE | SR**
1 mains power cable
(at the measuring instrument: via 16 A inlet plug
– mains side: country-specific)
1 probe cable with test probe
1 plug-on alligator clip
1 CD-ROM with description of remote control

Accessories (sensors, plug inserts, adapters, consumable materials)

- Drum with 25 m probe extension cable
- ECG connections
- Test socket adapter
- Calibration adapter
- Brush probe
- PS3 Software
- Pouch, carrying case

The accessories available for your instrument are checked for compliance with currently valid safety regulations at regular intervals, and are amended as required for new applications. Currently up-to-date accessories which are suitable for your measuring instrument are listed at the following web address along with photo, order number, description and, depending upon the scope of the respective accessory, data sheet and operating instructions:

www.seculife.eu

or

www.gossenmetrawatt.com (→ Products → Electrical Testing → Testing of Electr. Medical Appliances)

Product Support

Technical Queries
(use, operation, software registration)
If required please contact:

GMC-I Messtechnik GmbH
Product Support Hotline
Phone: +49 911 8602-0
Fax: +49 911 8602-709
E-Mail support@gossenmetrawatt.com

Training

Training in Nuremberg, on-site training at customer facilities
(scheduling, prices, registration, travel, accommodation)
If required please contact:

GMC-I Messtechnik GmbH
Training Division
Phone: +49 911 8602-935
Fax: +49 911 8602-724
E-Mail: training@gossenmetrawatt.com

Recalibration Service

We **calibrate** and **recalibrate** all instruments supplied by GMC-I Messtechnik GmbH, as well as by other manufacturers, at our service center, for example after one year within the framework of your test equipment monitoring program, as well as prior to use etc. (address see below).

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

If required please contact:

GMC-I Service GmbH
Service Center
Thomas-Mann-Str. 20
90471 Nuremberg, Germany
Phone: +49 911 817718-0
Fax: +49 911 817718-253
E-Mail service@gossenmetrawatt.com
www.gmci-service.com

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

* **DKD** Calibration laboratory for measured electrical quantities, DKD–K–19701, accredited in accordance with DIN EN ISO/IEC 17025

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

Competent Partner

GMC-I Messtechnik GmbH is certified in accordance with DIN EN ISO 9001:2008.

Our DKD calibration lab is accredited by the Deutscher Kalibrierdienst (German Calibration Service) in accordance with DIN EN ISO/IEC 17025:2005 under registration number DKD–K–19701.

We offer a complete range of expertise in the field of metrology: from **test reports** and **factory calibration certificates**, right on up to **DKD calibration certificates**. Our spectrum of offerings is rounded out with free test equipment management. Our service department includes an **on-site DKD calibration bench**. If errors are discovered during calibration, our specialized personnel are capable of completing repairs using original replacement parts. As a full service calibration lab, we can calibrate instruments from other manufacturers as well.

Services

- Pick-up and delivery
- Express service (immediate, 24 hour and weekend service)
- Initial start-up and queries
- Device and software updates to current standards
- Replacement parts and repairs
- Help desk
- DKD calibration lab per DIN EN ISO/IEC 17025:2005
- Service contracts and test equipment management
- Rental Instrument Service
- Disposal of old instruments

1 Applications

The measuring instrument is intended for quick, safe measurement of repaired or modified electrical medical devices and their components (e.g. applications parts) in accordance with IEC 62353.

Adherence to technical safety requirements assures safe handling of electrical medical devices for users of the measuring instrument. The safety of the patient is also assured during use of tested electrical medical devices.

Use for Intended Purpose

- The measuring instrument can be used as a benchtop device which must be isolated and set up on a solid base while measurements are being performed.
- Only those measurements which are described in the following chapters may be performed with the measuring instrument.
- The measuring instrument, including the measuring probe, may only be used within the specified measuring category (see page 8, as well as the table below regarding significance).
- Overload limits may not be exceeded. See technical data on page 30 for overload values and overload limits.
- Measurements may only be performed under the specified ambient conditions. See page 32 regarding operating temperature range and relative humidity.
- The measuring instrument may only be used in accordance with the specified degree of protection (see page 33).

Measuring Categories and their Significance per IEC 61010-1

CAT	Definition
I	Measurements in electrical circuits which are not directly connected to the mains: *for example electrical systems in motor vehicles and aircraft, batteries etc.*
II	Measurements in electrical circuits which are electrically connected to the low-voltage mains: *via plug, e.g. in household, office and laboratory applications*
III	Measurements in building installations: stationary power consumers, distributor terminals, devices connected permanently to the distributor
IV	Measurements at power sources for low-voltage installations: *meters, mains terminals, primary overvoltage protection devices*

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

1.1 Classification of Devices Under Test

1.1.1 Protection Classes

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

Protection Class I Devices

Exposed, conductive parts are connected to the protective conductor so that they are not charged with voltage if the basic insulation should fail.

Protection Class II Devices

These devices are equipped with double insulation or reinforced insulation.

Protection 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.

Note: Only a visual inspection can be conducted for devices of this protection class with the **SECULIFE | SR**.

1.1.2 Applied Parts (electrical medical devices)

Type B Applied 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

Type BF Applied Parts (body float)

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

Type CF Applied Parts (cardiac float)

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

2 Safety Features and Precautions

This instrument fulfills the requirements of applicable European and national EC directives. This is confirmed by means of the CE mark. A corresponding declaration of conformity can be requested from GMC-I Messtechnik GmbH.

The **SECULIFE | SR** measuring 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
IEC 61577 / EN 61577 / VDE 0413 part 1, 2 and 3

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

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

Tests may only be performed by a qualified electrician, or under the supervision and direction of a qualified electrician. The user must be instructed by a qualified electrician in the execution and evaluation of tests.

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 supply systems with 230 V/240 V which conform to the valid safety regulations (e.g. IEC 60364, VDE 0100) and are protected with a fuse or circuit breaker with a maximum rating of 16 A.
- **Measurements within electrical systems are prohibited.**
- Be prepared for the occurrence of unexpected voltages at devices under test (for example, capacitors may be dangerously charged).
- Make certain that the measurement cables are in flawless condition, e.g. no damage to insulation, no cracks in cables or plugs etc.
- **Insulation Resistance Measurement** (alternative leakage current): Testing is conducted with up to 500 V. Current limiting is utilized (I < 10 mA), but if the terminals (L and N) are touched, electrical shock may occur which could result in consequential accidents.
- **Leakage Current Measurement**
  It is absolutely essential to assure that the device under test is operated with line voltage during performance of leakage current measurements. Exposed conductive parts may conduct dangerous contact voltage during testing, and may not under any circumstances be touched (mains power is disconnected if leakage current exceeds approx. 10 mA).
- **Function Test**

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

- **Power Consumers with High Inrush Current (> 16 A) – Function Test** (e.g. fluorescent tubes, halogen lamps, headlights etc.): Observe the following instructions in order to prevent excessive contact loads.

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.

The measuring 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

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

Meanings of Symbols on the Instrument

300 V CAT II Maximum permissible voltage and measuring category between connections 1 through 4, the test socket and ground

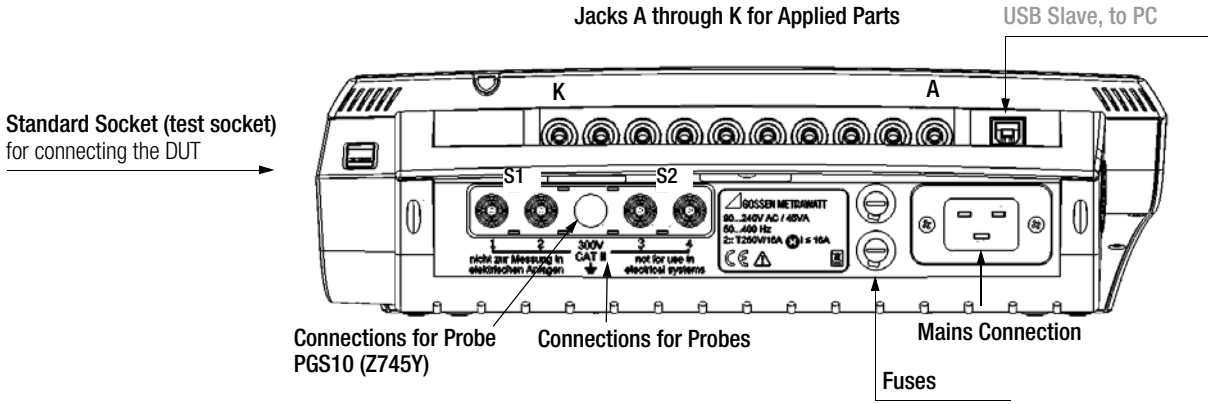
System with maximum 16 A nominal current

Warning regarding dangerous electrical voltage

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

The device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE.

3 Terminals



Connection	Application
Top Connections	
Standard socket	Test socket
Sockets A through K	Applied parts connection
USB-SI	USB slave, to PC
Bottom Connections	
Sockets 1 and 2	Test probe connection [1] (max. 300 V CAT II)
Sockets 3/4 (green)	Terminal for second test probe [2] (max. 300 V CAT II)
Inlet socket	Connection for supply power (90 to 240 V, 50 to 400 Hz)

[1] 4-wire measurement possible

[2] 4-wire measurement not provided for, see „Measuring and Storing an Offset Value when Using a 2nd Probe“ on page 15

Insert the double plug of the probe into sockets 1 and 2 such that the plug with the white ring makes contact with socket 1 (silver ring).

If 2 probes are used: If the first probe is, for example, the 25 m cable drum (1-2), the test point is contacted with the second probe (3-4).

Note

For a lot of measurements, the protective conductor of the test socket is not connected with the protective conductor of the mains terminal.

4 Initial Start-Up

4.1 Connection to the Mains (90 to 240 V, 50 to 400 Hz)

➪ Connect the mains plug at the measuring instrument to the mains power outlet.

4.1.1 Automatic Recognition of Mains Connection Errors

The measuring instrument's protective conductor connection is tested each time the start-stop key is pressed.

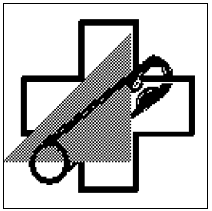
If a voltage of greater than 25 V is detected between the protective conductor and the finger contact, no measurements are possible. Disconnect the measuring instrument from the mains immediately in the event of a mains connection error, and arrange for the error to be corrected!

Note
Voltage at the mains protective conductor may cause erroneous measured values during the measurement of leakage current.

4.2 Switching the Measuring Instrument On

Initial Window

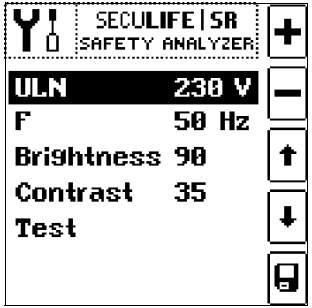
The initial window shown at the right appears in the event of mains connection.



4.3 Configuring Device Parameters – Setup Menu

All of the settings which are required for operation of the measuring instrument can be entered in the setup menu.

Selecting Nominal Line Voltage ULN



Measured values acquired by means of leakage current measurement are normalized to the selected ULN voltage value. Line voltage parameter ULN (100, 110, 115, 117, 120, 127, 220, 230, 240 or 250 V) can be selected with the ↑↓ keys, and adjusted with the +/– keys. The voltage value selected here is generated by the measuring instrument for alternative measurement.

Setting Nominal Frequency

The frequency selected here is generated by the measuring instrument for alternative measurement of leakage current. Nominal line frequency parameter F (50 or 60 Hz) can be selected with the ↑↓ keys, and adjusted with the +/– keys. This setting is irrelevant for direct measurement and differential current measurement.

Setting Brightness and Contrast

Brightness (1 ... **40** ... 100) and contrast (0 ... **40** ... 63) for the LCD panel can be selected with the ↑↓ keys, and adjusted with the +/– keys.

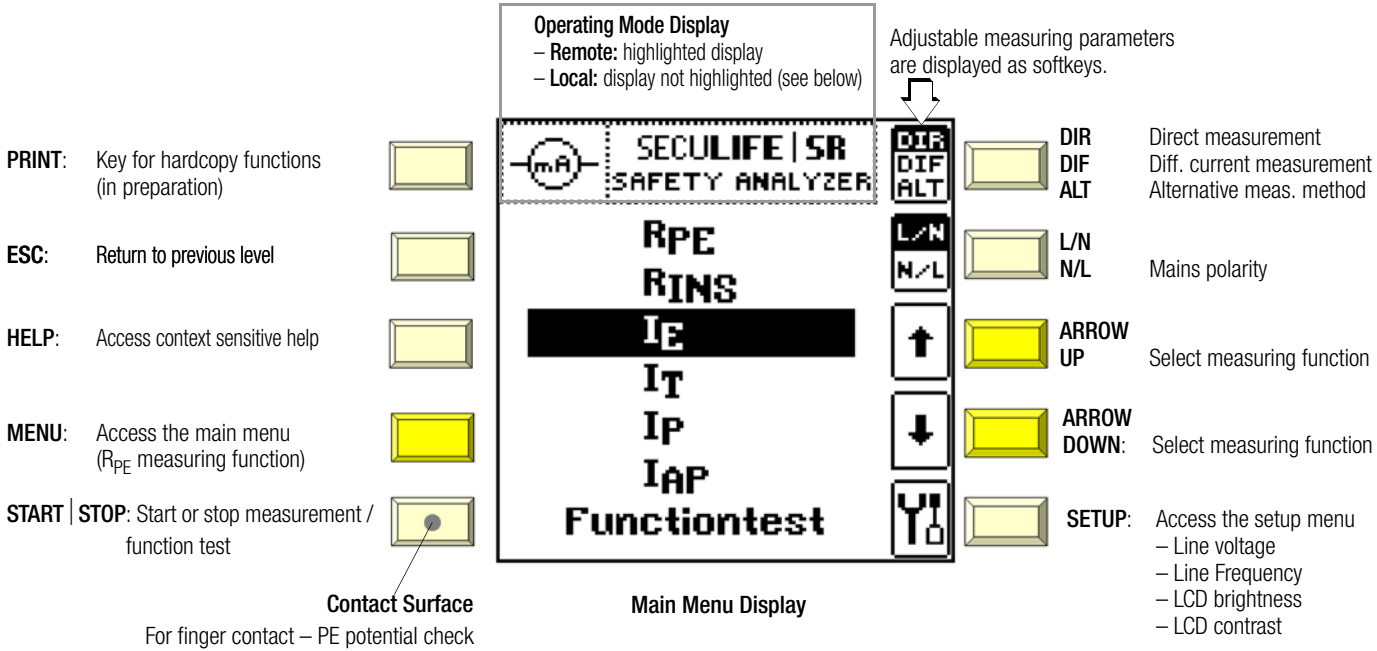
Activating Device Parameters

Changed values are permanently activated after acknowledging with the key. The display is then switched to the main menu. If the setup menu is exited with the ESC key, the changed values only remain active until supply power to the instrument is interrupted.

Function Test

For testing the keys, LCD segments and the acoustic warning signal.

5 Manually Triggered Measurements



Attention!
Remote control of the **SECULIFE | SR** should always be coordinated with the user who is in contact with the measuring instrument at the same time, for example in order to exclude the possibility of contact hazards.

5.1 General Procedure

- ➪ Select the main menu: **MENU** key.
- ➪ Select a menu function: ↑↓ keys.
- ➪ Depending upon the measuring function select either
  – Type of test current: **DIR** / **DIF** / **ALT** / **DL** key.
  or
  – Protection class and type of connection: **PC1** / **PC2** / **FIX** key.
- ➪ Connect the device under test in accordance with the previously selected type of test current.

Depending upon the type of test current, it may be necessary to use the probe.

The device under test is checked for short circuiting for all active measurements during which the mains are connected to the test socket (e.g. for leakage current measurements).

- ➪ Start the test with the **START** | **STOP** key.

During measurement, a symbol representing a runner appears at the upper left-hand corner instead of the measurement icon. 

During measurement and after the measurement has been completed, measurement data can be read from the display.

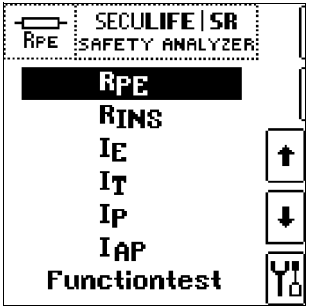
- ➪ If necessary, repeat the test with reversed mains power polarity: **L/N** → **N/L** key.
- ➪ The display is returned to the main menu by pressing the **ESC** key or the **MENU** key.

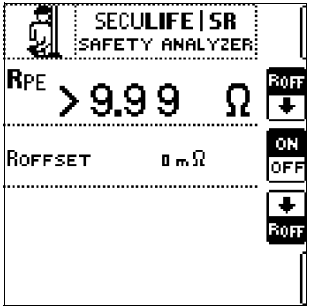
5.2 Overview

Abbreviation		Measurement Type Parameter			Description
		Measured Quantity / Method	Type of 'Connection	Sockets: Probe 1–2 AP A ... K	
Resistance Measurements					
R PE		Protective conductor resistance	PC1	● Probe 1–2	Page 14
R INS		Insulation resistance	PC1	—	Page 16
			PC2	● Probe 1–2	
			FIX		
Leakage Current Measurement					
I E Equipment leakage current	**DIR**	Direct measurement	Test socket	● AP A ... K Probe 1–2	Page 18
	DIF	Differential current measurement			
	ALT	Alternative measurement (alternative equipment leakage current)			
I T Touch current	**DIR**	Direct measurement	Test socket	● Probe 1–2	Page 20
	DIF	Differential Current Measurement			
	ALT	Alternative measurement (alternative equipment leakage current)			
	DL	Measurement with 2 probes (cable drum at 1–2)		Probe 1–2 Probe 3–4	
I P Patient leakage current	**DIR**	Patient leakage current, direct	Test socket	● AP A...K	Page 24
I AP Applied parts leakage current	**DIR**	Direct measurement (mains at applied part)	Test socket	● AP A...K	Page 26
	ALT	Alternative measurement (altern. patient leakage current)			
Functions Tests					
TEST		Voltage / Load current Active/apparent power P/A Power factor PF	Test socket		Page 28

AP = applied part; PC1/2 = protection class I/II; FIX = permanent connection

This page has been left blank to display the following measurements on opposite pages for better clarity.





Applications

Continuity and resistance of the protective conductor must be measured.

Definition

Protective conductor resistance is the resistance of the connection of a protection class I device (PC1) between any exposed conductive parts which are connected to the protective conductor and the protective contact at the mains plug or the mains side of the permanent connection.

Protective conductor resistance is the sum of the following resistances:

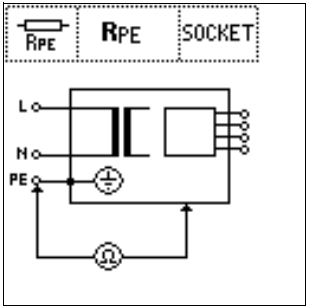
- Connector cable or device connector cable resistance
- Contact resistance of the plug and terminal connections
- Resistance of the extension cable

Measuring Method

Resistance is measured:

- Between each exposed *conductive part of the housing* which is connected to the protective conductor (probe contact) and the earthing contacts at the mains and the device plug (if a removable mains connector cable is used).
- Between the earthing contacts at the mains plug and the earthing contacts at the device plug for *device connector cables*

test socket connection



Note

The protective conductor of the test socket (which is not connected with the protective conductor of the mains terminal for this measurement) is permanently connected with sockets 3 and 4 to which a second probe can be connected.

Measuring and Storing an Offset Value when Using a 2nd Probe

When a second probe is used which is connected to sockets 3 and 4, 4-wire measurements are not provided for. However, the ohmic resistance of the cable for the second probe can be automatically deducted from the measuring result by determining an offset value. Please proceed as follows to this end:

- Connect the two probes to sockets 1 and 2 or 3 and 4, respectively. The probe extension cable or the probe cable drum must generally be connected with sockets 1 and 2. Contact both probes with the same reference point. This is equivalent to short-circuiting the two probes. The offset value established in this way is retained by pressing the key on the right (only for values < 2 Ω), displayed briefly and will be deducted from all future measuring results. You can store this offset value, see key below.

- After measuring the offset value, the latter can be permanently stored with the key on the right so that it is available after switching the instrument on again.

- Press the key on the right for loading a stored offset value.

Note
Only use this function if you work with extension cables. When using different extension cables, the procedure described above must principally be repeated.

Sequence

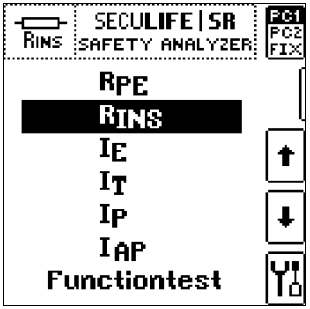
- Select the test: ↑↓ keys.
- Connect the DUT to the **test socket** and connect the probe.
- Start the test: Press the **START** | **STOP** key.
- **1 probe:** Contact one of the conductive parts of the housing which is connected to the protective conductor with the probe (socket 1–2).
- **2 probes:** A cable drum or extension cable (socket 1–2) is contacted with the reference point (e.g. overall earth electrode of a unit), the second probe (socket 3-4) is contacted with the test point.

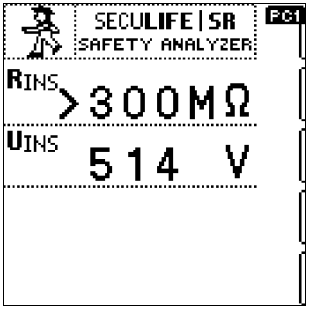
During measurement, the **connector cable** must only be moved to the extent that it is accessible during repair, modification or testing. If a change in resistance occurs during the manual test step of the continuity test, it must be assumed that the protective conductor is damaged, or that one of the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

- Measured values are displayed.
- End the test: Press the **START** | **STOP** key.
- Read the measured value and compare it with the table of permissible limit values.

Examples of Maximum Permissible Limit Values for Protective Conductor Resistance for Connector Cables with Lengths of up to 5 m

Test Standard	Test current	Open-Circuit Voltage	R_{PE} Housing – Device Plug	R_{PE} Housing – Mains Plug	Connector Cable
IEC 60601 IEC 61010 Production	Not defined		0.1 Ω	0.1 Ω	0.1 Ω
IEC 62353 (VDE 0751-1)	> 200 mA⎓	4 V < U_L < 24 V	0.2 Ω	0.3 Ω	0.1 Ω
VDE 0701-0702			—	0.3 Ω	+ 0.1 Ω for each additional 7.5 m





Applications

Insulation resistance must be measured for:

PC1: protection class I	Between L + N and PE
PC2: protection class II	Between L + N and user accessible conductive parts

In order to assure that all insulation which is exposed to line voltage is tested during this measurement, make sure that switches, temperature regulators etc. are closed.

Definition

Insulation resistance is active resistance between the electrical circuits of the device and its exposed conductive parts.

Measuring Method

Protection Class I (PC1)

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

Protection Class II (PC2)

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

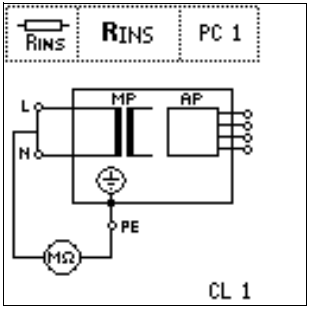
Connection of Permanently Installed Protection Class I Devices

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

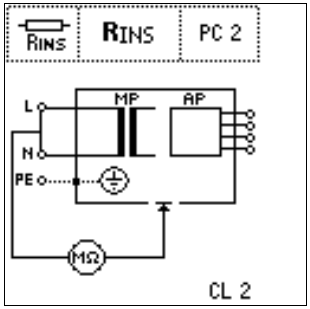
- ⇨ Remove the mains fuses from the device under test and disconnect neutral conductor N inside the device under test.
- ⇨ Connect the probe to phase conductor L at the device under test in order to measure insulation resistance.

Note
The PE contact of the test socket is connected with the protective conductor of the mains terminal.

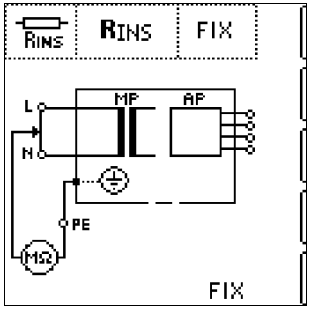
PC1 Connection



PC2 Connection



Permanent connection



Sequence

Protection class I devices: The protective conductor test must already have been passed as a prerequisite for the insulation resistance test.

- Select the test: ↑↓ keys.
- Select the protection class and the type of connection: **PC1 / PC2 / FIX**. key.
- Connect the DUT to the test socket, and connect the probe if necessary.

Note
All switches at the device under test must be set to the on position during measurement of insulation resistance, including temperature controlled switches and temperature regulators as well. Measurement must be performed in all program steps for devices equipped with program controllers.

- Start the test: Press the **START** | **STOP** key.

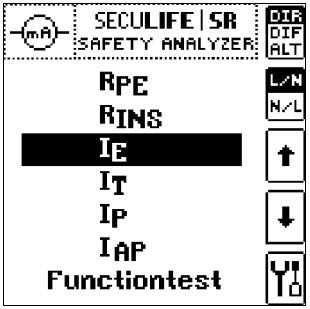
Attention!
Testing is conducted with up to 500 V. Current limiting is utilized (I < 10 mA), but if the terminals (L and N) are touched, electrical shock may occur which could result in consequential accidents.

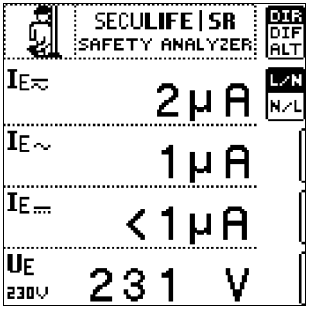
Note: Open-circuit voltage is always greater than nominal voltage.

- PC2 connection: Contact exposed conductive parts with the probe during measurement.
- All measured values are displayed.
- End the test: Press the **START** | **STOP** key.
- Read the measured value and compare it with the table of permissible limit values.

Examples of Minimum Permissible Limit Values for Insulation Resistance

Test Standard	Test Voltage	R_{ISO}			
		PC I	PC II	PC III	Heat
IEC 62353 (VDE 0751-1)	500 V	2 MΩ	7 MΩ		
		♥ 70 MΩ	♥ 70 MΩ		
VDE0701-0702		1 MΩ	2 MΩ	0.25 MΩ	0.3 MΩ





Applications

Equipment leakage current must be measured for all devices.

Definition of Equipment Leakage Current / Protective Conductor Current IEC 62353 (VDE 0751-1)

Current which flows from a power pack to ground via the protective conductor, and via exposed conductive parts of the housing and the applied parts.

Definition of Direct Measurement

Total amount of current which flows through the protective conductor, probe and applied parts in the case of housings which are isolated from ground.

Definition of Differential Current Measurement

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

Definition of Alternative Measurement (alternative equipment leakage current)

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

Direct Measurement Method

The device under test is operated with mains power. Current which flows through the PE conductor to earth at the mains side of the device connection is measured. The value which has been adjusted to nominal line voltage is displayed (see section 4.3).
The protective conductor is ineffective during measurement!

Differential Current Measurement Method

The device under test is operated with mains power. The sum of the momentary values of all currents which flow through all active conductors (L/N) at the mains side of the device connection is measured. The measurements must be performed with mains plug polarity in both directions. The value which has been adjusted to nominal line voltage is displayed (see section 4.3).

Alternative Measurement Method (alternative equipment leakage current)

The device under test is tested with the nominal voltage which has been selected in the setup menu. Current which would flow with this nominal voltage is displayed.

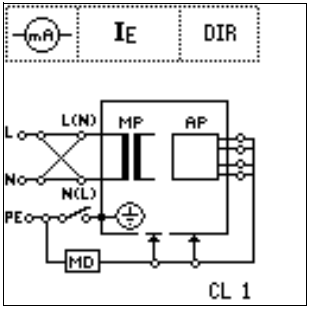
Type of Test Current Parameter

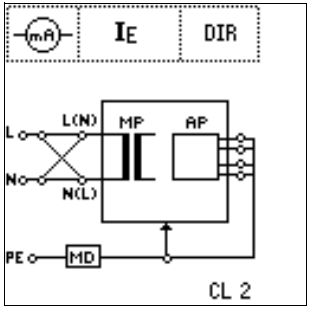
– **DIR** Protective conductor current, direct
– **DIF** Differential current
– **ALT** Alternative equipment leakage current

Mains Polarity Parameter

Polarity can be reversed for tests in accordance with the direct and differential current methods.

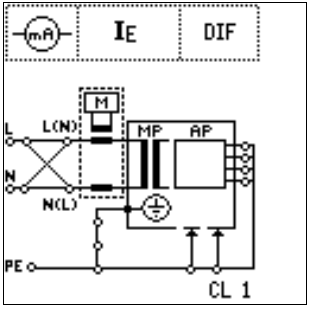
Equipment Leakage Current with the Direct Measurement Method

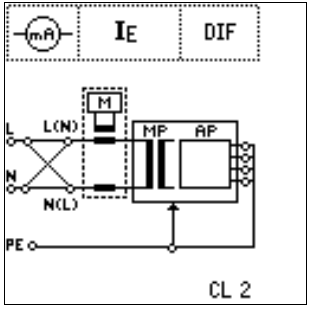




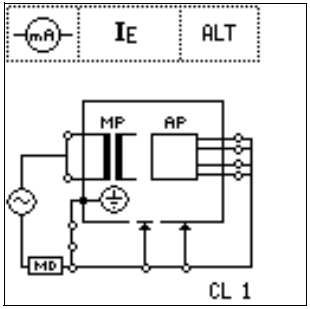
The protective conductor is ineffective during measurement!

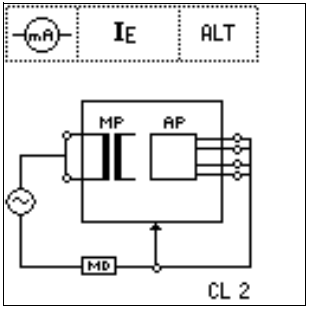
Equipment Leakage Current with the Differential Current Measurement Method





Equipment Leakage Current with the Alternative Measurement Method



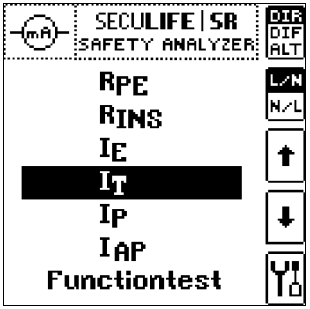


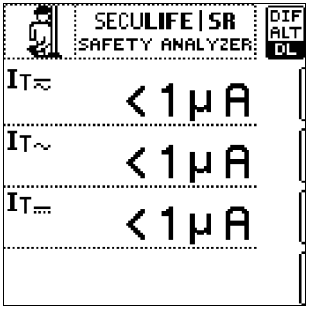
Sequence

- Select the test: ↑↓ keys.
- Connect the DUT to the test socket.
- Select type of test current: **DIR** / **DIF** / **ALT** key.
- Select mains polarity reversal: **L/N** / **N/L** key.
- Start the test: Press the **START** | **STOP** key.
- Measured values are displayed.
- End the test: Press the **START** | **STOP** key.
- Read the measured value and compare it with the table see bel.

Examples of Maximum Permissible Limit Values for Device Leakage Current / Protective Conductor Current

Test Standard	Protection Class	Direct / Differential Current Measurement	Alternative Measurement
IEC 60601 3rd ed.	PC1	5 mA	10 mA
IEC 62353 (VDE 0751-1)	PC1	0.5 mA	1 mA
	PC2	0.1 mA	0.5 mA
VDE 0701/702	PC1	3.5 mA	
	PC2	0.5 mA	





Applications

For protection class I devices, it may be necessary to separately measure leakage current from exposed conductive parts which are not connected to the protective conductor.

Only methods direct measurement and differential current measurement can be used for devices for which isolation in the power pack is not taken into consideration by the measurement (e.g. resulting from a relay which is only closed in the operating state).

Leakage current measurement may only be performed at protection class I devices after the protective conductor test has been passed.

The device must be measured in all intended functional states (e.g. switch positions) which influence leakage current. The highest acquired value, as well as the corresponding function if applicable, must be documented. The manufacturer's specifications must be adhered to.

Definition of Touch Current

Leakage current that flows from the housing or parts thereof – with the exception of the patient ports – with which the user or the patient may come into contact during use for intended purpose, to ground or another part of the housing via an external connection, except for the protective conductor.

Definition of Direct Measurement

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

Definition of Differential Current Measurement

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

Definition of Alternative Measurement (alternative equipment leakage current)

Alternative leakage current is current which flows through the active conductors of the device which are connected to each other (L/N), to the exposed, conductive parts.

Direct Measurement Method

The device under test is operated with mains power. Current which flows to the protective conductor via exposed conductive parts is measured. The measurements must be performed with mains plug polarity in both directions. The AC or the DC component of the current is measured. The value which has been adjusted to nominal line voltage is displayed (see section 4.3).

Note
Make sure that the contacted parts are not grounded.

Differential Current Measurement Method

The device under test is operated with mains power. The sum of the momentary values of all currents which flow through all active conductors (L/N) at the mains side of the device connection is measured. The measurements must be performed with mains plug polarity in both directions. The value which has been adjusted to nominal line voltage is displayed (see section 4.3).

Alternative Measurement Method

The device under test is tested with the nominal voltage which has been selected in the setup menu. Current which would flow with this nominal voltage is displayed.

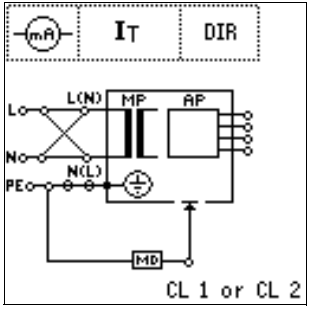
Type of Test Current Parameter

– **DIR** Touch current, direct (with probe)
– **DIF** Differential current, (with probe)
– **ALT** Alternative touch current, (with probe)
– **DL** Contact current with 2 probes (DL = **D**ual **L**ead)

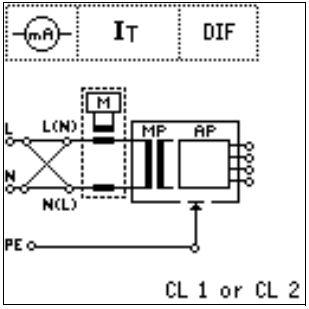
Mains Polarity Parameter (not for 2-probe Measurement)

Polarity can be reversed for measurements during which the mains are connected to the test socket.

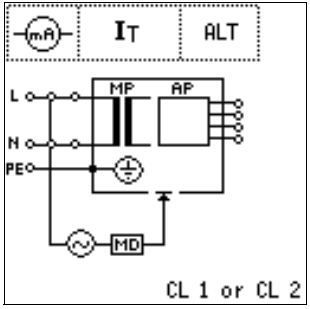
Direct Measurement Method



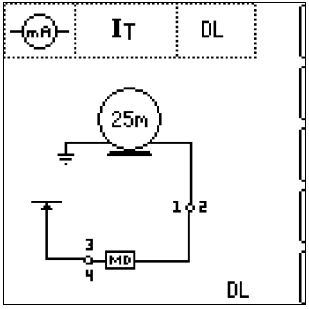
Differential Current Measurement Method



Alternative Measurement Method



2-probe Measurement Method



Sequence DIR / DIF / ALT

- Select the test: ↑↓ keys.
- Connect the DUT to the test socket, or connect the probe.
- Select type of test current: **DIR** / **DIF** / **ALT** key.
- Select mains polarity reversal: **L/N** / **N/L** key.
- Start the test: Press the **START** | **STOP** key.
- Measured values are displayed.
- End the test: Press the **START** | **STOP** key.
- Read the measured value and compare it with the table of permissible limit values.

Examples of Maximum Permissible Limit Values for Touch Current in mA

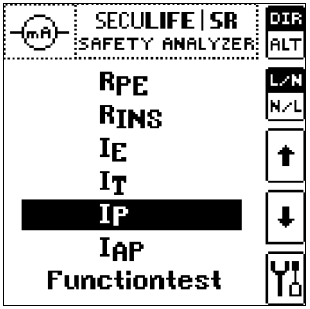
Test Standard	Protection Class	Direct / Differential Current Measurement	Alternative Measurement
IEC 62353 (VDE 0751-1)	PC2	0.1 mA	0.5 mA
VDE 0701-702	PC2	0.5 mA	

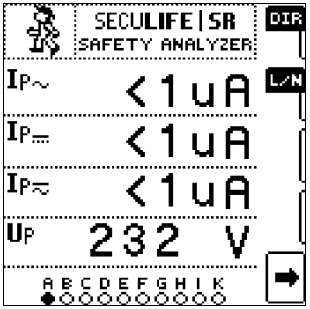
Procedure for DL – 2-probe Measurement

This measurement is performed with 2 probes. The measuring section is electrically isolated from the mains power supply of the instrument. Input resistance is 1 kΩ.

- Select test: key ↑↓
- Connect probe 1 (e. g. the 25 m cable drum) to sockets 1-2 and connect the probe tip with the reference measuring point.
- Select test current type: key **DL**
- Scan the test point with probe 2 (socket connectors 3-4).
- Start test: press key **START** | **STOP**.
- Measured values are displayed.
- Quit test: Press key **START** | **STOP**.
- Read off measured value and compare it with the table of permissible limit values.

This page has been left blank to display the following measurements on opposite pages for better clarity.





Applications

As a rule, measurement of leakage current from the applied part to PE must be performed in accordance with IEC 60601.

No separate measurement is normally required for type B applied parts. The applied parts are connected to the housing (see figures), and are also measured during housing leakage current measurement, to which the same permissible values apply.

Separate measurement of leakage current from type B applied parts only has to be performed if it is specified by the manufacturer (see accompanying documentation).

For type BF or CF applied parts, measurement is required for all interconnected patient ports used for a single function of the applied part, or measurement must be executed as specified by the manufacturer.

When testing measuring instruments with several applied parts, each must be connected, one after the other, and measuring results must be evaluated on the basis of the limit values. Applied parts which are not included in the measurement must be kept potential-free.

Definition of Patient Leakage Current

Current which flows from power packs and exposed conductive parts of the housing to the applied parts.

The AC and the DC component of the current is measured.

Direct Measurement Method

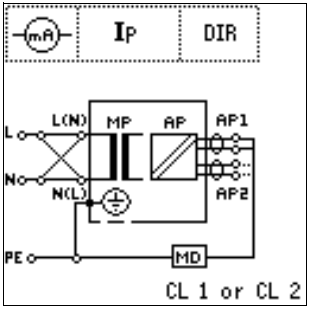
The device under test is operated with mains power. Current which flows through the applied parts to earth at the mains side of the device connection is measured. The value which has been adjusted to nominal line voltage is displayed (see section 4.3).

Type of Test Current Parameter

– **DIR** Patient leakage current, direct (applied parts plugged in)

Mains Polarity Parameter

Polarity can be reversed for measurements during which the mains are connected to the test socket.

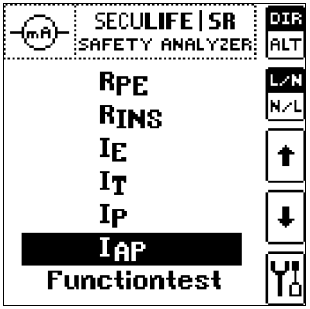


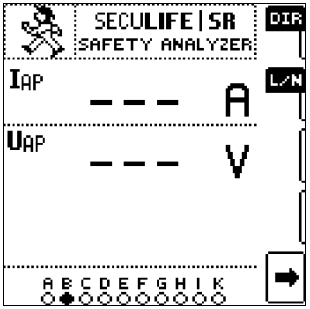
Sequence

- Select the test: ↑↓ keys.
- Connect the device under test to the test socket, and the applied parts to the patient ports. The test probe has to be connected but without applying electrical contact (potential-free).
- Select mains polarity reversal: **L/N** / **N/L** key.
- Select applied parts A through K: → key.
- Start the test: Press the **START** | **STOP** key.
- Measured values are displayed.
- End the test: Press the **START** | **STOP** key.
- Read the measured value and compare it with the table of permissible limit values.

Examples of Maximum Permissible Limit Values for Patient Leakage Current in mA

Test Standard		I_P					
		Type B		Type BF		Type CF	
		NC	SFC	NC	SFC	NC	SFC
EN 60601	DC	0.01	0.05	0.01	0.05	0.01	0.05
	AC	0.1	0.5	0.1	0.5	0.01	0.05
IEC 60601 3rd ed. Total Patient Leakage Current	DC	0.05	0.1	0.05	0.1	0.05	0.1
	AC	0.5	1	0.5	1	0.05	0.1





Applications

This measurement is only performed for types BF and CF applied parts. For type BF and CF applied parts, measurement is required for all interconnected patient ports used for a single function of the applied part, or measurement must be executed as specified by the manufacturer.

When testing measuring instruments with several applied parts, each must be connected, one after the other, and measuring results must be evaluated on the basis of the limit values shown in table 2. Applied parts which are not included in the measurement must be kept potential-free.

Definition of Leakage Current from the Applied Part

Current which flows from power packs and exposed conductive parts of the housing to the applied parts.

Definition of Direct Measurement

Current which is caused by an undesired interference voltage at the patient, and which flows from the patient to ground via the patient ports for a type BF or CF applied part.

Definition of Alternative Measurement

Alternative patient leakage current is current which flows through the conductors of the device which are connected to each other (L/N/PE) to the patient ports.

Prerequisites:

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

Direct Measurement Method (mains at applied part)

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

The device under test is operated with mains power in this case. The value which has been adjusted to nominal line voltage is displayed (see section 4.3).

Alternative Measurement Method (alternative patient leakage current)

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

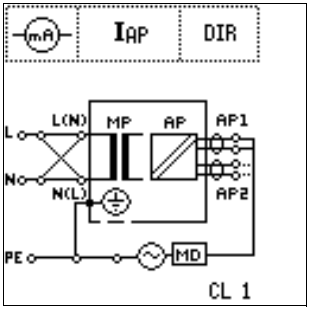
Measurement is always performed using an AC source with current limiting. Differing mains voltages are taken into consideration.

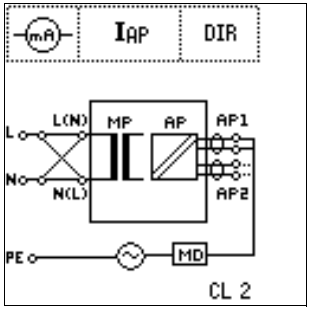
Type of Test Current Parameter

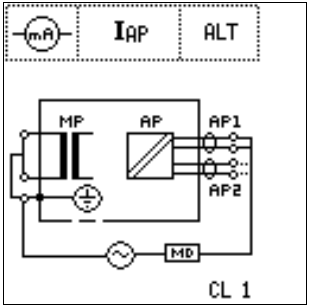
– **DIR** Mains at applied part (applied parts plugged in)
– **ALT** Eq. patient leakage current (applied parts plugged in)

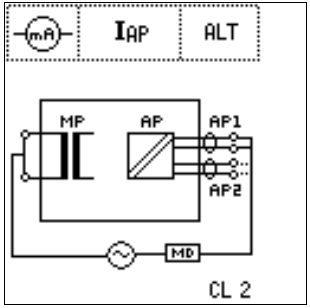
Mains Polarity Parameter

Polarity can be reversed for measurements during which the mains are connected to the test socket.







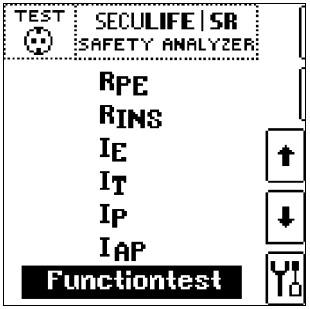


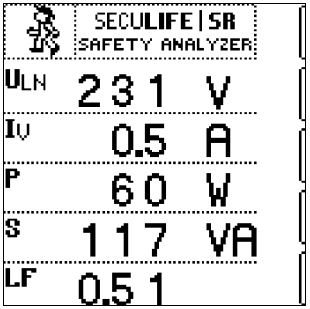
Note
Can only be used for types BF and CF applied parts.

- Select the test: ↑↓ keys.
- Connect the device under test to the test socket and the applied parts to the patient ports. The test probe has to be connected but without applying electrical contact (potential-free).
- Select type of test current: **DIR** / **ALT** key.
- Select mains polarity reversal: **L/N** / **N/L** key.
- Select applied parts A through K: → key.
- Start the test: Press the **START** | **STOP** key.
- Measured values are displayed.
- End the test: Press the **START** | **STOP** key.
- Read the measured value and compare it with the table of permissible limit values.

Examples of Maximum Permissible Limit Values for Leakage Current in mA

Test Standard	AP	Direct Measurement (mains at AP)	Alternative Measurement (alternative patient leakage current)
IEC 62353 (VDE 0751-1)	BF	5 mA	5 mA
	CF	0.05 mA	0.05 mA
IEC 60601	BF	5 mA	—
	CF	0.05 mA	—
IEC 60601 3rd ed. Total Patient Leakage Current	BF	5 mA	—
	CF	0.1 mA	—





Applications

Functions which are relevant with regard to device safety must be tested in accordance with the manufacturer's recommendations, if necessary with the support of a person who is familiar with operation of the measuring instrument or measuring system.

Refer to SECULIFE function testers and light analyzers for further function tests.

Measuring Method

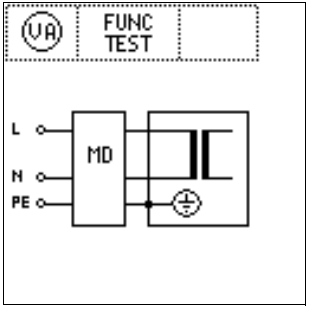
The device under test can be subjected to a function test with line voltage via the integrated test socket.

The function test includes the following measurements:

- Voltage U_{LN} between the L and N conductors
- Load current I_L
- Active power P
- Apparent power S (calculated)
- Power factor PF (calculated cos φ, display > 10 W)

Power factor is calculated from active power and apparent power. Power factor corresponds to cos φ for sinusoidal quantities (line voltage and load current).

Test Socket Connection



Prerequisites

- It is only permissible to execute the function test after the device under test has passed the safety test, i.e. all safety measurements must first be executed and passed.
- The device under test must be connected to the test socket. *If no device under test has been connected, momentary line voltage are measured if the measuring instrument is connected to the mains.*
- No short-circuits may exist at the DUT.

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.

Sequence

- ⇨ Select the test: ↑↓ keys.
- ⇨ Connect the DUT to the test socket.
- ⇨ Start the test: Press the **START** | **STOP** key.
- ⇨ All measured values are displayed.
- ⇨ End the test: Press the **START** | **STOP** key.

6 Technical Data

Measured Quantity	Measuring Range / Nominal Range of Use	Resolution	Additional Info	Open-Circuit Voltage U_0	Additional Info	Short-Circuit Current I_K	Int. Resist. R_I	Ref. Resist. R_{REF}	Measuring Error	Intrinsic Error	Overload Capacity Value	Overload Capacity Time
R_{PE} Protective earth resistance	man: 1 ... 999 mΩ man: 0.01 ... 9.99 Ω auto: 0.01 ... 30.00 Ω 0.01 ... 3.30 Ω 0.1 ... 10.0 Ω	1 mΩ 10 mΩ 10 mΩ 10 mΩ 100 mΩ	Electronic fuse + fuse link	4.0 ... 4.5 V AC TRMS	where I_{PE} = 200 mA~ where 48 Hz [1]	220 ... 270 mA AC TRMS	—	—	< ±10 % rdg. within a rage of 0.1 ... 10 Ω for IP = 200 mA	±(2.5% rdg. + 10 mΩ) within a rage of 0.1 ... 10 Ω where IP = 200 mA	240 V AC/DC	Cont.
R_{INS} Insulation resistance	10 ... 300 kΩ 0.01 ... 3.0 MΩ 0.1 ... 30.0 MΩ 1 ... 300 MΩ	10 kΩ 10 kΩ 100 kΩ 1 MΩ	Test voltage: 500 V DC [2]	$U_N < U < 1.2\ U_N$	Nominal current > 1 mA where R_{ISO} = 500 kΩ	2 mA	—	—	0.01 ... 100 MΩ: < ±10% rdg. > 100 MΩ < ±20% rdg. where UP = 500 V each	0.1 ... 30 MΩ: ±(2.5% rdg. + 1 d) > 30 MΩ ±(5 % rdg. + 1 d) where UP = 500 V each	240 V AC/DC	Cont.
Leakage Current Measurements – Direct Method (DIR/DL)												
I_E Equipment leakage current	10 ... 300 µA≅ 0.01 ... 3.00 mA at 0.1 ... 30.0 mA at	1 µA 10 µA 100 mA	= Protective earth current, direct (between L and N) Residual current monitoring, Mains shutdown: > 20 mA~ (25 ms)						0.5 ... 20.0 mA: < ±10% rdg.	20 ... 300 µA: ±(5% rdg. + 1 d) > 300 µA: ±(2.5% rdg. + 1 d)	240 V AC/DC	Cont.
I_T Touch current	10 ... 300 µA≅ 0.01 ... 3.00 mA at 0.1 ... 30.0 mA at	1 µA 10 µA 100 µA	Probe current monitoring: Probe shutdown: I_T > 10 mA~ (5 ms) Residual current monitoring Mains shutdown: I_{DIF} > 10 mA~ (25 ms)				1 kΩ ±10 Ω	—	0.02 ... 10 mA at: < ±10% rdg.	20 ... 300 µA at: ±(5% rdg. + 1 d) > 300 µA at: ±(2.5% rdg. + 1 d)	240 V AC/DC	Cont.
I_P Patient leakage current	2 ... 300 µA≅ 0.01 ... 3.00 mA at	1 µA 10 µA	Probe current monitoring: Probe shutdown: I_P > 10 mA~ (5 ms) Residual current monitoring Mains shutdown: I_{DIF} > 10 mA~ (25 ms)				1 kΩ ±10 Ω	—	0.01 ... 3 mA at: < ±10% rdg.	10 ... 300 µA at: ±(7.5% rdg. + 1 d) 0.30 ... 3.00 mA at ±(2.5% rdg. + 1 d)	240 V AC/DC	Cont.
I_{AP} Applied parts leakage current	10 ... 300 µA~ 0.01 ... 3.00 mA~ 0.1 ... 30.0 mA~	1 µA 10 µA 100 mA	Test voltage: 110/220/230/240 V AC	110 ... 240 V~ –15 / +10%	Frequency 50/60/200/400 Hz	< 1.5 mA	> 150 kΩ	1 kΩ ±10Ω	20 µA ... 15 mA AC: < ±10% rdg. > 15.0 mA AC: < ±15% rdg.	20 µA ... 15 mA AC: ±(5% rdg. + 1 d) > 15.0 mA AC: ±(10% rdg. + 1 d)	240 V AC/DC	Cont.

[1] Remote control: 40 ... 200 Hz

[2] Remote control: 100 ... 500 V

Measured Quantity	Measuring Range / Nominal Range of Use	Reso-lution	Addi-tional Info	Open-Circuit Voltage U_0	Addi-tional Info	Short-Circuit Current I_K	Int. Resist. R_I	Ref. Resist. R_{REF}	Measuring Error	Intrinsic Error	Overload Capacity Value	Overload Capacity Time
Leakage Current Measurements – Differential Method (DIF)												
I_E I_T Residual current between L and N	10 ... 300 µA~ 0.01 ... 3.00 mA~ 0.1 ... 30.0 mA	1 µA 10 µA 100 µA	= Protective earth current, direct Residual current monitoring Mains shutdown: > 20 mA~ (25 ms)						0.5 ... 20.0 mA: < ±10% rdg.	20 ... 300 µA: ±(5% rdg. + 1 d) > 300 µA: ±(2.5% rdg. + 1 d)	240 V AC/DC	Cont.
Leakage Current Measurements – Alternative Method: Alternative leakage current (ALT)												
I_E I_T I_{AP}	2 ... 300 µA~ 0.01 ... 3.00 mA~ 0.1 ... 30.0 mA~	1 µA 10 µA 100 µA	Test voltage: 110/220/230/240 V AC	110 ... 240 V~ –15 / +10%	Frequency 50/60 Hz [3]	< 1.5 mA	> 150 kΩ	1 kΩ ±10Ω	20 µA ... 15 mA AC: < ±10% rdg. > 15.0 mA AC: < ±15% rdg.	20 µA ... 15 mA AC: ±(5% rdg. + 1 d) > 15.0 mA AC: ±(10% rdg. + 1 d)	240 V AC/DC	Cont.
Function test												
U_{LN} Line voltage (RMS)	90 ... 240 V AC (50 ... 400 Hz)	0.1 V							±5.0% rdg.	±(2.5% rdg. + 1 d)	240 V AC	Cont.
I_V Load current (RMS)	0.02 ... 16.00 A AC (50 ... 400 Hz)	10 mA	Shutdown by mains relay at: I_V > 16 A~ where t > 0.5 s Shutdown by mains relay at: I_V > 4 A~ where internal temperature > 70 °C						±5.0% rdg.	±(2.5% rdg. + 1 d)	4 A	Cont.
P Active power	10 ... 4000 W	1 W	Measured value P and calculated value S are compared, and the smaller of the two is displayed. Shutdown at internal temperature > 70 °C						f < 100 Hz ±7.5% rdg. f ≥ 100 Hz ±10% rdg.	P > 10 W, PF > 0,5 f < 100 Hz ±(5% rdg. + 10 d) P > 10 W, PF > 0,5 f ≥ 100 Hz ±(7.5% rdg. + 10 d)	<1000 W <4000 W	Cont. 10 min
S Apparent power	10 ... 4000 W	1 VA	Calculated vale $U_{L–N}$ • I_V Shutdown at internal temperature > 70 °C						f < 100 Hz ±7.5% M f ≥ 100 Hz ±10% rdg.	P > 10 W f < 100 Hz ±(5% rdg. + 10 d) P > 10 W f ≥ 100 Hz ±(7.5% rdg. + 10 d)	<1000 W <4000 W	Cont. 10 min
LF Power factor with sinusoidal waveshape: cos φ	0.00 ... 1.00 inductive	0.01	Calculated value P / S, display as of P > 10 W						f < 100 Hz ±7.5% M f ≥ 100 Hz ±10% rdg.	P > 10 W, PF > 0.5 f < 100 Hz ±(5% rdg. + 10 d) P > 10 W, PF > 0.5 f ≥ 100 Hz ±(7.5% rdg. + 10 d)	—	—

[3] Remote control: 50 ... 400 Hz

Reference Conditions

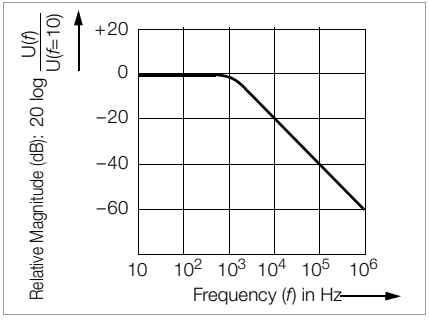
Line voltage	230 V ±0.2%
Line frequency	50 Hz ±0.1%
Waveshape	Sine (deviation between effective and rectified value < 0.5%)
Ambient temperature	+23 °C ±2 K
Relative humidity	40 … 60%
Load resistance	Linear

Ambient Conditions

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

Measuring Leakage Current

Frequency response is taken into consideration in accordance with the diagram to the right when leakage current is measured.



Influencing Quantities and Influence Error

Influencing Quantity / Sphere of Influence	Designation per IEC 61557	Influence Error ± … % of Measured Value
Test instrument position	E1	2.5 at I PE (diff)
Test instrument supply voltage	E2	1
Ambient temperature (0 °C ... +40 °C)	E3	1
DUT current consumption	E4	2.5
Low frequency magnetic fields	E5	3.0 at I PE (diff)
DUT impedance	I6	2.5
Conductance leakage capacity during insulation measurement	E7	0.5
Waveshape of the measured test current	E8	2.5 at I PA 1 Other measuring ranges

Power Supply

Broad Range Variable Power Pack

Line voltage	90 ... 240 V
Line frequency	50 Hz ... 400 Hz
Power consumption	
Internal consumption	< 20 VA
Permissible DUT power consumption	≤ 4000 VA
Permissible DUT power consumption, cont. operation	≤ 1000 VA
Permissible DUT current consumption, cont. operation	≤ 4 A~
Switching capacity	≤ 16 A, AC1 max. 20 A / 600 ms

Electrical Safety

Fuses	2 x FF (UR) 500 V/16 A AC; 6,3 mm x 32 mm; (Article number 3-578-215-01) 50 kA breaking capacity at 500 V AC
Safety class	Disconnection from mains per SC II
Nominal voltage	230 V
Test voltage	2.2 kV AC or 3.3 kV DC
Measuring category	300 V CAT II
Fouling factor	2
Safety Shutdown	With following differential current at DUT during: – Function test 10 mA~ / < 25 ms – Touch current meas. direct current meas. 10 mA~ / < 25 ms Residual current meas. 20 mA~ / < 25 ms – Protective conductor direct current meas. 10 mA~ / < 25 ms Residual current meas. 20 mA~ / < 25 ms with following probe current during: – Touch current meas. 10 mA~ / < 5 ms – Protective conductor resistance measurement 300 mA~ / < 1ms

Electromagnetic Compatibility, EMC

Interference Emission	EN 61326-1:2006 class B
Interference Immunity	EN 61326-1:2006

Mechanical Design

Display	monochrome backlit dot matrix display, 128 x 128 pixels
Dimensions	(W x D x H) 325 x 250 x 90 mm
Weight	approx. 2 kg
Protection	Housing: IP 40, connections: IP 20 per DIN VDE 0470 part 1/EN 60529

Table Excerpt Regarding Significance of the IP Code

IP XY (1st digit X)	Protection against penetration of solid particles	IP XY (2nd digit Y)	Protection against penetration by water
0	Not protected	0	Not protected
1	≥ 50.0 mm dia.	1	vertically falling drops
2	≥ 12.5 mm dia.	2	vertically falling drops with enclosure tilted 15°
3	≥ 2.5 mm dia.	3	spraying water
4	≥ 1.0 mm dia.	4	Splashing water

Data Interface

USB Slave

7 Maintenance and Calibration

7.1 Housing Maintenance

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

7.2 Replacing the Fuses

All fuses are accessible from the outside.

If a fuse should blow, eliminate the cause of overload before placing the instrument back into service!

Attention!
Disconnect the instrument from the measuring circuit before removing the fuse!

Attention!
Use specified fuses only!
If fuses with other blowing characteristics, other current ratings or other breaking capacities are used, the operator is placed in danger, and protective diodes, resistors and other components may be damaged.
The use of repaired fuses or short-circuiting the fuse holder is prohibited.

7.3 Recalibration

The respective measuring task and the stress to which your measuring instrument is subjected affect the ageing of the components and may result in deviations from the guaranteed accuracy.

If high measuring accuracy is required and the instrument is frequently used in field applications, combined with transport stress and great temperature fluctuations, we recommend a relatively short calibration interval of 1 year. If your measuring instrument is mainly used in the laboratory and indoors without being exposed to any major climatic or mechanical stress, a calibration interval of 2-3 years is usually sufficient.

During recalibration* in an accredited calibration laboratory (DIN EN ISO/IEC 17025) the deviations of your instrument in relation to traceable standards are measured and documented. The deviations determined in the process are used for correction of the readings during subsequent application.

We are pleased to perform DKD or factory calibrations for you in our calibration laboratory. Please visit our website at www.gossenmetrawatt.com (→ Services → DKD Calibration Center *or* → FAQs → Calibration questions and answers).

By having your measuring instrument calibrated regularly, you fulfill the requirements of a quality management system per DIN EN ISO 9001.

Standards DIN VDE 0701-0702 and IEC 63353 (VDE 0751) stipulate that only measuring instruments which are regularly tested and calibrated may be used for testing.

* Verification of specifications or adjustment services are not part of the calibration. For products from our factory, however, any necessary adjustment is frequently performed and the observance of the relevant specification is confirmed.

7.4 Manufacturer's Guarantee

The measuring instrument **SECULIFE | SR** is guaranteed for a period of 1 year after date of shipment. The manufacturer's guarantee covers materials and workmanship. Damages resulting from use for any other than the intended purpose, as well as any and all consequential damages, are excluded.

Calibration is guaranteed for a period of 12 months.

The manufacturer's guarantee expires when the seal has been damaged.

7.5 Return and Environmentally Sound Disposal

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

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

These devices may not be disposed of with the trash.

Please contact our service department regarding the return of old devices (see page 3).

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