GOSSEN METRAWATT

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

3-349-443-03
3/2.12

Applications

Testing for the Electrical Safety of Electrical Medical Devices in Accordance with the German Medical Product Law (MPG) / MDD

The test instrument is used for quick and safe testing and measurement of repaired or modified electrical medical devices or their components (e.g. patient ports) in accordance with IEC 62353.

Observance of technical safety requirements allows the user of the test instrument to operate electrical medical devices in a hazard-free fashion. The safety of the patient is also assured through the use of tested electrical medical devices.

The device under test can be connected:

– to the test socket with or without adapter for various types of mains connection
– with an adapter for extension cables with or without multiple outlet sockets
– 10 application parts can be connected

Operation

There are two different operating modes.

- **Local:** measurements are conducted at the operating panel of the measuring instrument.
- **Remote:** measurements are controlled via PC.
  The user has the possibility to integrate all measurements into the individual operator interface at the PC and to define test sequences.
  For this purpose, all interface commands are documented in detail.

The following are measured:

- Protective earth resistance
- Insulation resistance
- Equipment leakage current
- Touch current
- Patient leakage current
  (AC/DC portions are measured separately)
- Applied parts leakage current

Measuring methods for leakage current measurements:
– Direct method
– Differential method
– Alternative method

Function Test with Power Analysis (also suitable for high power devices under test up to 16 A)

The device under test can be subjected to a function test with mains voltage via the integrated test socket.
The following are measured or automatically calculated during the function test:

- Line voltage (RMS)
- Load current / current consumption (RMS)
- Active and apparent power
- Power factor

Features

Universal test instrument for testing the electrical safety of:

- **Electrical medical devices**
  – per IEC 62353 / DIN VDE 0751-1:2008
  – for technical safety inspection in accordance with MPG/MDD
- **Electrical equipment** per DIN VDE 0701-0702
- **Data processing devices and equipment**
  – in accordance with DIN VDE 0701-0702
- **Periodic testing** per DIN VDE 0701-0702
- **USB data interface** for connecting a PC
- All measurements controllable via PC
- **Safety for the user** thanks to integrated personal protection and layout as a safety class II device

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Further Measuring Functions

Testing for Correct Mains Connection

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.

Mains Plug Polarity Reversal

Mains plug polarity need not be reversed manually. It is performed in the form of a mesurement upon request.

Short-circuit test – test for short-circuiting at the device under test

1 Test for short-circuiting of N and L
2 Test for short-circuiting of N or L to the protective earth

R < 1 Ω ⇨ short-circuit

Protective Earth Testing (4-pole Measurement)

with at least 200 mA test current

Insulation Test

by means of insulation resistance measurement

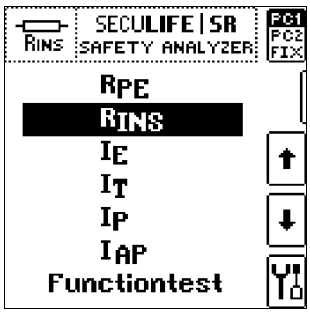
Leakage Current Test

by means of equipment leakage current, touch current, leakage current of applied parts with mains on applied parts based on the methods of direct, equivalent leakage current or differential current measurement.

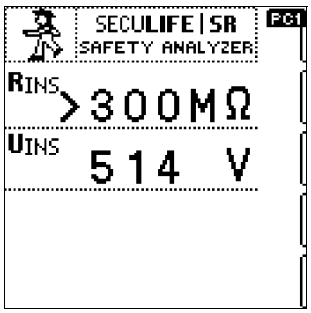
Operation at the Instrument, Examples

Softkeys enable the user to select measuring functions conveniently. Functions which are not available are automatically faded out.

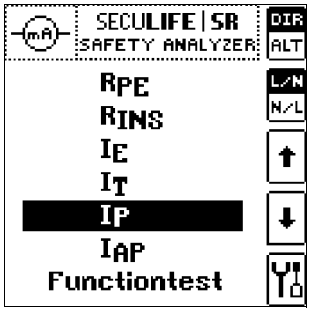
Selecting insulation measurement
– Selecting of protection class



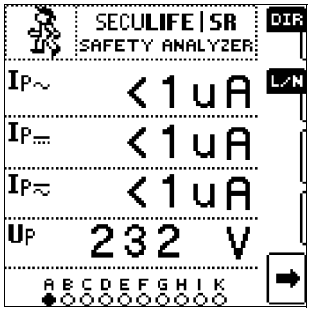
Display of insulation measurement
– Display of protection class



Selecting current of applied parts
– direct/equivalent leakage current measurement
– polarity reversal



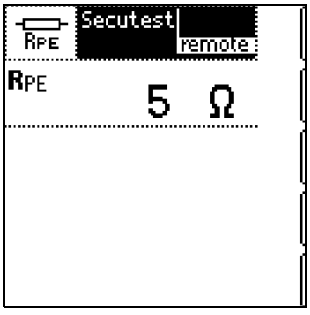
Display of current of applied parts
– Display of measurement type/ mains polarity
– Selecting application part



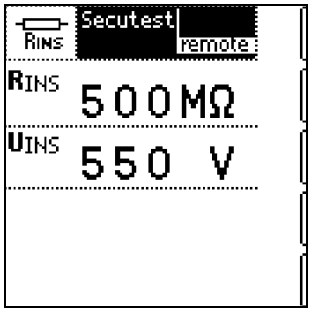
Monitoring Function With Active Interface, Examples

In interface mode, all softkeys are faded out and the device name is shown in inverse letters.

Protective earth resistance measurement active



Insulation resistance measurement active



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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	1 mΩ 10 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.
	auto: 0.01 ... 30.00 Ω 0.01 ... 3.30 Ω 0.1 ... 10.0 Ω	10 mΩ 10 mΩ 100 mΩ										
R_{INS} Insulation resistance	10 ... 300 kΩ	10 kΩ	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.
	0.01 ... 3.0 MΩ	10 kΩ										
	0.1 ... 30.0 MΩ	100 kΩ										
	1 ... 300 MΩ	1 MΩ										
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.
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)	—	—

[1] Remote control: 40 ... 200 Hz
[2] Remote control: 100 ... 500 V
[3] Remote control: 50 ... 400 Hz

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Reference Conditions

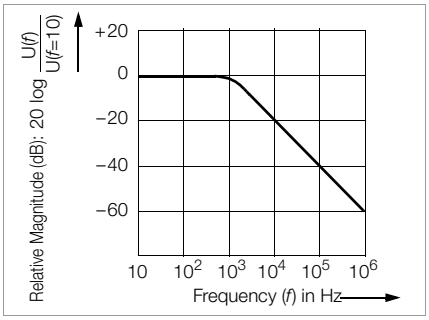
Line voltage	230 V ±0.2%
Line frequency	50 Hz ±0.1%
Waveshape	Sine (deviation between effective and rectified value < 0.5%)
Ambient temperature	+23 °C ±2 K
Relative humidity	40 … 60%
Load resistance	Linear

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 – Contact 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

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
4	≥ 1.0 mm dia.	4	Splashing water

Data Interface

USB Slave

Detailed interface description upon request

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Applicable Regulations and Standards

IEC 62353	Medical electric devices – Periodic tests and tests after the repair of medical electric devices
IEC 61010-1/EN 61010-1/ VDE 0411-1	Safety requirements for electrical equipment for measurement, control and laboratory use
IEC 61557/ EN 61557/ VDE 0413	Part 1: General requirements Part 2: Insulation resistance measuring instruments Part 4: Instruments for measuring resistance at ground cables, protective conductors and equipotential bonding conductors
DIN VDE 0404, part 1 part 3	Devices for technical safety testing of electrical equipment – general requirements
DIN VDE 0404, part 2	Devices for periodic testing
EN 60529 VDE 0470, part 1	Test instruments and test procedures Degrees of protection provided by enclosures (IP code)
DIN EN 61326-1 VDE 0843-20-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

Included

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

Accessories

AT16-DI three-phase 16 A differential current adapter
AT32-DI three-phase 32 A differential current adapter

For testing for the measurement of loop current using the differential current method.

SECU-cal 10 calibration adapter

The calibration adapter is used for testing the measuring safety of test and measuring instruments by measuring protective conductor resistance, insulation resistance and leakage current.

F2010 SECUSTAR carrying pouch

Carrying pouch for mobile use, with retaining clips for sensors

F2000 carrying pouch for SECULIFE | SR and accessories

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Order Information

Description	Type	Article Number
Basic Instrument		
Instrument for DUTs with a line frequency of 50/60 Hz, USB interface, earthing contact plug and outlet, probe cable with test probe, plug-on alligator clip, DKD calibration certificate, operating instructions	**SECULIFE | SR**	M692A
Same as above but USA version with user interface in English, test socket and mains power cable for USA	**SECULIFE | SR**	M692B
Sensors, Plug Inserts and Adapters		
3-phase 16 A differential current adapter	AT16-DI *	Z750A
3-phase 32 A differential current adapter	AT32-DI *	Z750B
Adapter for testing single-phase extension cables for protective conductor continuity and insulation continuity between the short-circuited live and neutral condutors and protective earth	EL1 *	Z723A
test adapter with single-phase and three-phase plug connectors up to CEE 32A – for all tests on single-phase and three-phase electrical devices without mains voltage per DIN VDE – for tests on single-phase and three-phase extension cables per DIN VDE	VL2 E *	Z745W
Adapter for connecting devices under test: 3-pole 16 A, 5-pole 16 A and 32 A, 5 ea. 4 mm jack	CEE-Adapter *	Z745A
Test probe with cable (no coil cord), 2 m, suitable for high-voltage test	SK2	Z745D
Test probe with cable (coil-cable), 2 meters long, suitable for high-voltage test	SK2W	Z745N
Probe cable 5 m for earth resistance measurement 5 m	SK5	Z745O
Probe for measuring protective conductor resistance, e.g. at rotating devices under test	Brush probe	Z745G

* with German socket and German connector plug
– ohter connections available on request

Description	Type	Article Number
Accessories		
SECUSTAR carrying pouch	BAGSTAR	Z700E
Universal carrying pouch	F2000	Z700D
Calibration adapter for test instruments per DIN VDE 0701-0702 with test report	SECU-cal 10	Z715A
Package of 2 retaining clips	Z753B	Z753B

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