

SAFETYTEST 1ST User Manual



Figure 1

Texts, drawings and technical information were prepared with great care. However, errors may still be present. The author and the manufacturer assume no direct or indirect liability for any incorrect or incomplete descriptions or any damages that may occur.

The user manual should be read carefully and completely before using the tester.

Warning markings in the manual and on the clamp are meant to warn of risks or dangers.

Warning markings in the manual on the tester and on the accessories have to be adhered to and describe the following:



General warning, warning of a danger!
See user manual!



Warning of hazardous electrical voltage!



Warning when exchanging fuses!



Warning of the risk of fire, e. g. when using improper fuses!

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1 General Safety and Warning Notes

The tester "Safetytest 1ST" was built and complies with the following safety standards.

DIN EN 61010-1 (VDE 0411 part 1),

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR
MEASUREMENT, CONTROL, AND LABORATORY USE

DIN VDE 0404 parts 1 and 2,

"Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen"

Immunity according to DIN EN 61326,

"Elektrische Betriebsmittel für Leittechnik und Laboreinsatz - EMV-Anforderungen"

In order to warrant the safe application of the tester the following warnings have to be adhered to:



All tests may only be carried out by a skilled electrician or under the supervision of a skilled electrician. The qualified person must be trained for the specific task.



The tester subject only to its intended use. The warning markings on the tester, the connecting cables and accessories have to be observed.



The tester may be used only on 230V AC main systems which are protected with max 16A circuit breakers or fuses.



Measurements may not be performed on unfused circuits.



Repairs and alterations to the tester may be carried out only by the manufacturer or by a service organization qualified by the manufacturer. Repairs on the supply leads or adapter cables may be carried out only by skilled electricians.



Only original spare parts supplied by the manufacturer may be used.



Fuses may be replaced only by the original fuses of the manufacturer.



If a safe application is not possible, e. g. due to:

- Visual defects,
- Improper storage,
- Improper transport,
- Failure of a phase control lamp,
- Failure of measurement functions,

the tester must be decommissioned! Repair may be done only by the manufacturer or a service organization authorised by the manufacturer.



Earth bond tests and touch current tests in power systems are only allowed in specific cases and when regarding the appropriate safety precautions.



Note that large voltages may appear on appliances during tests, e. g. by charged capacitors.



Only connect the appliance that is being tested to the power socket once the power system is safe!



NOTE! When connecting the appliance to mains, hazardous voltages may occur on a defective appliance or on conductive parts which are not connected to PE.

2 Application

The tester "SAFETYTEST 1ST" is used for testing the electrical safety of appliances.

3 Scope of Delivery and Accessories

3.1 Scope of Delivery (Standard):

- 1 probe lead for $R_{PE} + I_B$ (2 m) (Art.-Nr.: 0003330)
- 1 user manual (English) on CD incl. . (Art.-Nr.: 0019800)
- 1 protocol software SAFETYDOC DEMO
- 1 power cord 1,8 m (Art.-Nr.: 0004520)
- 1 connector cable 1ST (Art.-Nr.: 0009420)

3.2 Accessories (optional):

Accessories	Material Number
SAFETYTEST DI40 Differential current clamp/current clamp	6733040
Safety Clamp 4 mm black	0001002
Brush probe 4 mm black for effective protective conductor measurements	0001001
Test lead with test probe 4 mm yellow	6462210
Kelvin probe 2 x 4 mm socket 5 m	0002840
Mete rotary power 16A	0037510
Mete rotary power 32A	0037520
Barcode scanner	0001190
Barcode printer	0002620
Transponder reader	0001008
Carrying case for accessories	6124910

3.3 Software (Optional):

Remote control and database software safety-remote Nr. 0001004
Protocol- and table software Nr. 0001005

4 Connections, Display and Keyboard

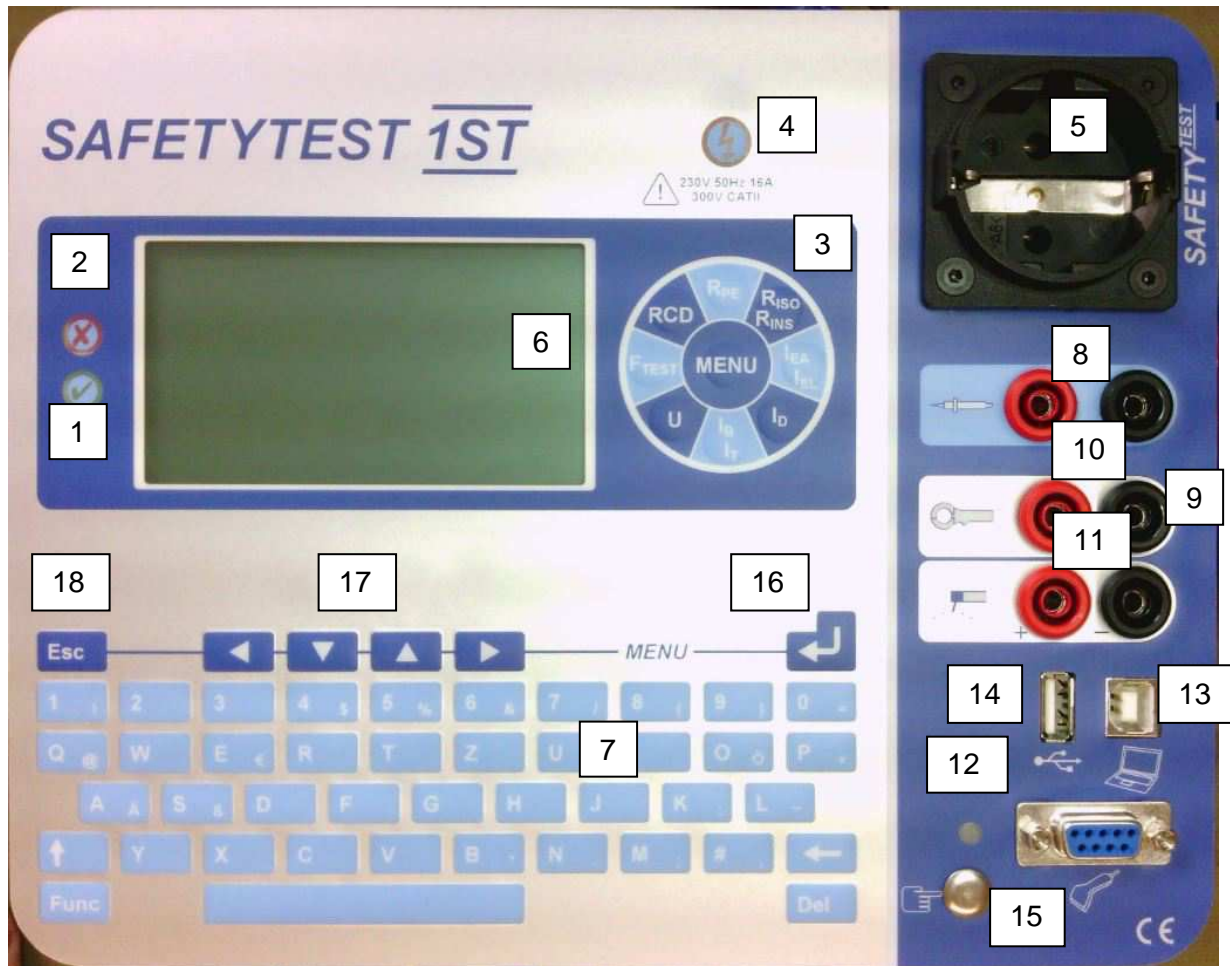


Figure 2

1. OK LED indicates a PASSED test result
2. FULT LED
3. Panel for individual measurements
4. Glow lamp indicating that mains is connected to the test socket
5. Test socket
6. LCD – display
7. Alphanumeric keypad
8. Connection sockets for the test probe (red + black)
9. Clamp connection and GND connection for voltage measurement over the probe connected to PE potential when mains is switched to the test socket
10. Clamp connection for the differential current clamp/ line current clamp
11. Welders electrode terminal
12. RS232 interface over an extension cable from the PC for connection of the barcode scanner, transponder scanner and serial line printer.
13. USB PC connection
14. Interface for Memory Stick
15. Finger contact
16. “Enter – key” to input and confirm the Menu
17. Navigation keypad to move the cursor
18. “ESC – key” to cancel measurements or to toggle into the previous Menu.

4.1 **Connections (Figure 2)**

Before connecting the tester to the mains, the appropriate warnings in chapter 1 have to be observed, as well as the warnings for connecting the leads and accessories attached. It is safe to use the instrument for its intended use only. The testing of the protective conductor potential takes place through using the fingercontact after the tester is connected.

4.2 **Mains connection "Input", Type Schuko**

The tester may be connected only to a power system of 230 V AC 40 – 60 Hz, protected by a circuit breaker of max 16 A.

4.3 **Measuring socket "GND" (Figure 2/9)**

Connection for the negative pole for temperature and voltage measurements and the current clamp.

4.4 **Measuring sockets "Probe" (Figure 2/8)**

Connection for the probe for earth bond and touch current measurements. Check the polarity when connecting the key probe!

4.5 **Schnittstelle PC-COM (Figure 2/11)**

Connection for a 9 pin D-sub connector for the serial interface RS 232 (19200, N, 8, 1) for:

Transferring data to and from the PC (alternative to using USB)

Firmware updates (limits, test sequences, measuring functions, languages,...) (alternative to using USB)

Barcode scanner

Transponder scanner

Printer - a separate power supply is needed.

Note: The interface may be connected to a USB port by using an optional USB-RS232 converter.

4.6 **Interface USB (Figure 2/12)**

Connection to a USB connector to communicate with the PC via a virtual Com interface. The driver of FTDI has to be installed and is available on the CD which comes with the tester. This took place during the installation of the software.

4.7 **Test sockets (Figure 2/4)**

Connection for a USB plug to connect a USB memory stick, a HID barcode, a transponder reader or a keyboard.

NOTE!!!

When connecting a faulty appliance to the test socket a hazardous voltage may occur when mains is applied on accessible conductive parts not connected to the protective earth and on the housing if the protective earth is out of order.

4.8 **Keyboard and Display**

The keyboard allows an easy way to perform all tests and the display shows all results.

4.9 Display (Figure 2/5)

The display has a resolution of 320x240 pixels and is backlit. The menus, help texts, measurement functions, limits, measured values and quantities are displayed as text messages. Several languages are possible.

5 Functional Description

5.1 Power Supply

The device is powered with mains (230V \pm 10%). The electronic measurements are supplied by an internal fuse.

5.2 Internal memory

The measurements are performed according to a menu and the results stored in the internal memory of the tester.

The inventory data and the measured values can be transferred to the PC. Inventory data and the test profile may also be transferred from the PC to the tester.

5.3 Interface RS232/USB

The Barcodescanner can be connected using the RS232 interface.

NOTE!!!

All contacts of the extension lead must be connected 1:1.

USB: The tester is connected to the PC via a standard USB type B interface cable. The FTDI is installed with the PC software.

The baud rate to the PC is 19200 baud.

The interface is galvanically isolated.

The firmware of the "SAFETYTEST 1ST" may be updated easily via the USB/COM interface.

An update allows you to get the latest testing sequences and change the display language,

The optional barcode scanner or the transponder scanner used for scanning ID numbers from the UUTs may be connected to the RS232 interface. Both are pre configured to 19200 baud.

5.4 Display and Keyboard

The display and keyboard are supplied by their own circuitry.

6 Testing the Mains Connection

The person responsible for the electrical installation is responsible for the safety of the power system to which the tester is connected.

The test of the installation is not part of the appliance test. However, it is important to know before testing if the electrical installation is safe.

The tester does not perform a complete test as required by DIN VDE 0100.

Nevertheless a few important measurements are made giving an indication of the mains connection, as for example:

- Testing of the protective earth potential using the fingercontact
- Mains PE against N voltage < 30V.
- Check if the N conductor is open circuit (the display does not light up).
- Display of the orange phase check glow lamp if mains is on (yellow light)
- Voltage measurement phase against N (range 1 to 260V AC)

Note:

- Through touching the the fingercontact, it is possible to determine whether the protective conductor is connected. This is not the case, if after touching the fingercontact the red LED lights up.
- If the mains connection is faulty a message "PE>30V!!" is displayed on the display. Further, the tester makes a loud beep sound. Further tests may only be performed after the power system has been repaired.
- If N/PE are exchanged the RCD of the installation switches off
- If no display appears PE may be hazardous live. Test this using the fingercontact. Disconnect tester from the mains and check on another mains socket. If the tester now works, get a specialist to check the faulty mains socket.
- Around an IT-network, the protective conductor is not on PE potential. If "PE>30V" appears. If the tester is connected through an isolation transformer, the PE is missing. "PE>30V" appears.

7 Connection Test



In the first Menu "Connection", the available mains voltage and the N and PE conductor terminal are displayed.

7.1 AC Connection

NOTE!!!

- If the voltage $L1 < 207 \text{ V}$ or $L1 > 253 \text{ V}$ no proper measurements can be made.

If the message "PE>30" appears it is most probable that the PE conductor is not connected to the mains power socket. It may also happen that the PE conductor is connected but that it is hazardous live (test using the fingercontact)! For checking the PE conductor refer to the chapter "Mains Connection" above.

8 Display and Menu Structure

The display allows a comfortable menu based testing sequence, shows all measuring functions, limits and values. The menu structure is documented in a separate document "SAFETYTEST 1ST-Menu Structure". It is kept up to date together with the software.

9 Taking the Tester into Operation

9.1 Visual check

- Observe the safety precautions of chapter 1.
- Check the mains connection, tester and accessories
- Observe all warning markings on the tester mains cord and accessories!

9.2 Connecting the tester to the mains system

- The tester is supplied from the mains input.

9.3 Starting the test

Follow the menu of the tester.

10 Testing Electrical Appliances

The tests required by the standards have been realised by the internal testing sequences. Before starting a test the appliance has to be classified in the profile menu.

After repair, modification and after repetitive testing electrical appliances have to provide a degree of safety to the user which is comparable of that of brand new appliances. Whether the safety is given can be tested according to the applicable standard. The following tests are to be performed in the given order. Each test step must have been passed before proceeding to the following step:

- Visual inspection
- Earth bond test
- For class I appliances test of the insulation resistance and or the earth leakage current or the substitute leakage current.
- For class II equipment as well as for accessible conductive parts not connected to PE of class I equipment, the insulation resistance and the touch current or the substitute leakage current.
- Functional Test

Notes:

Before performing a leakage test on class I appliances the earth bond test has to be passed.

Before performing a leakage current test on class II or III (except for IT appliances) an insulation resistance test of 500 V DC has to be passed. Accessible connections and generated SELV voltages have to be checked according to the SELV specifications.

10.1 *Qualification*

High requirements are set to the qualification of the skilled electrician. All tests have to be performed by a skilled electrician or under his supervision. The skilled electrician must follow the rules and standards required for his work. Also it is not allowed to omit any steps which would ensure a correct and safe use of the appliance. The liability of the skilled person responsible for testing is especially important if no complete test is possible (e. g. due to permanently installed equipment). If a complete test is impossible the responsible electrician assumes the liability and has to document this on the test report.

10.2 *Mains connection*

According to law the person responsible for the installation of the power system is responsible for the mains connection, not the manufacturer of the equipment to be connected.

The required tests on permanently installed equipment are often not possible due to technical reasons or due to the local conditions. If the equipment is not accessible the mains connections (L1, L2, L3, N and PE) have to be disconnected from mains. Therefore the connection should be refitted to a plug and socket connection according to IEC 60309-1 or a coupling should be inserted according to IEC 60309-1. The installation costs can be amortized due to a faster safety test.

NOTE!!!

Electrical appliances with a nominal current above 16A must be connected to all pole circuit breakers according to IEC 60947. These should be mounted at a height of approx 1,7 m. Plugs and sockets of equipment rated above 16A may not be connected or disconnected under load. Always open the circuit breaker first.

Equipment rated below 16A does not require a separate circuit breaker.

10.3 *Visual inspection*

The appliances are checked for externally visible damages, and, if possible, the suitability of the surrounding for their use e. g.:

- Damages to the housing
- Suitable place of installation
- Damages to the power cord
- Deficiencies on the strain relief
- Indications of overload or improper use
- Inappropriate alterations
- Missing protective covers
- Dirt and corrosion affecting safety
- Presence of required ventilators
- Open air vents
- Tightness
- Legibility of markings

Note:

Visible damages which might impel the mechanical or electrical safe use or which might lead to fire must be repaired immediately.

10.4 *Measurements*

See menu system

10.5 *Functional Test*

After performing the electrical test a functional test is required. A short test may be sufficient.

10.6 *Checking the Markings*

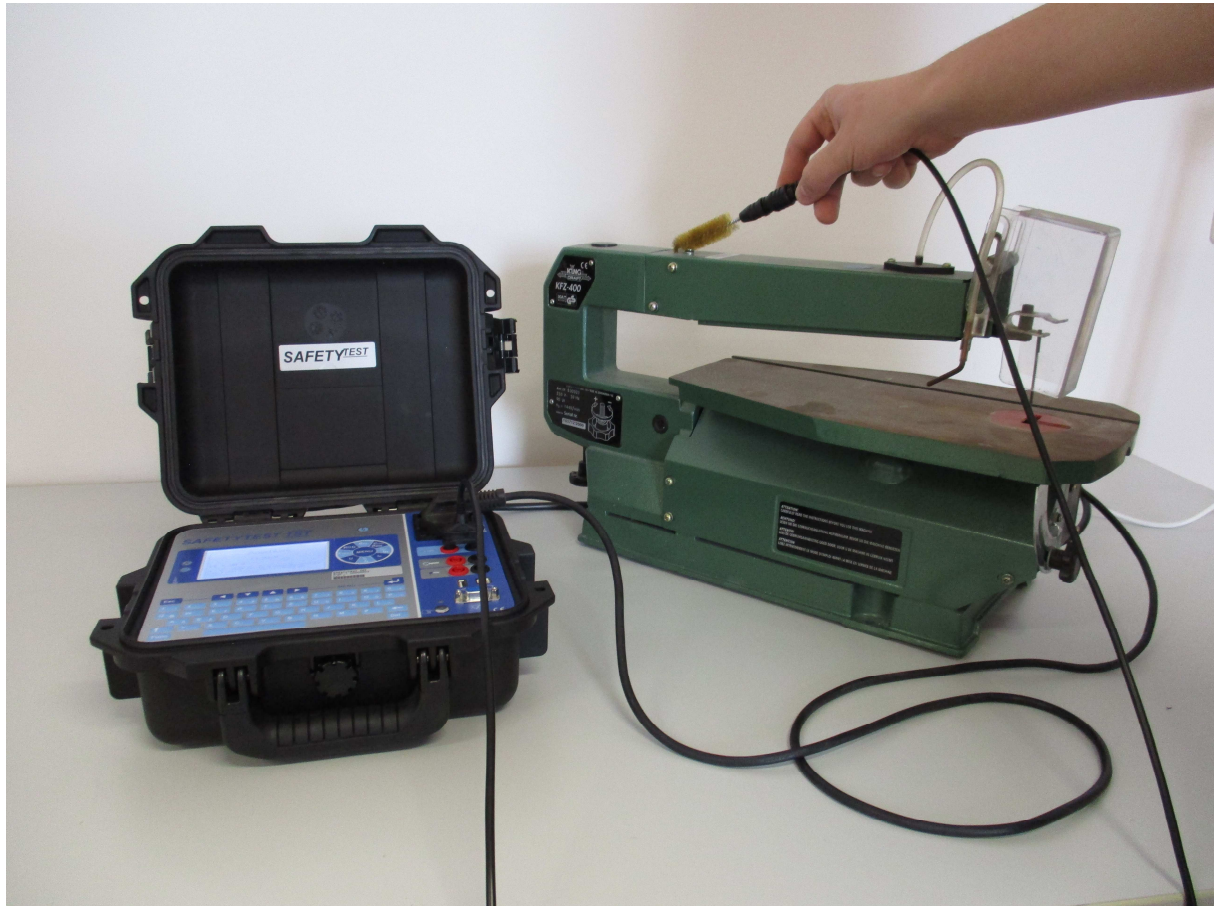
The presence of safety required markings must be checked and if necessary renewed or completed.

10.7 *Documentation of the test*

The passed test has to be documented. If an appliance is unsafe, this must be marked clearly on the appliance and the responsible body to be notified in writing. The measurement values and alterations performed are to be documented. The appliance should be marked by a sticker that for example states the following: "Tested according to VDE 0701-0702 and DGUV Standards 3" .

11 Connections, Pictures, Examples

11.1 *Earth bond test of AC appliances*



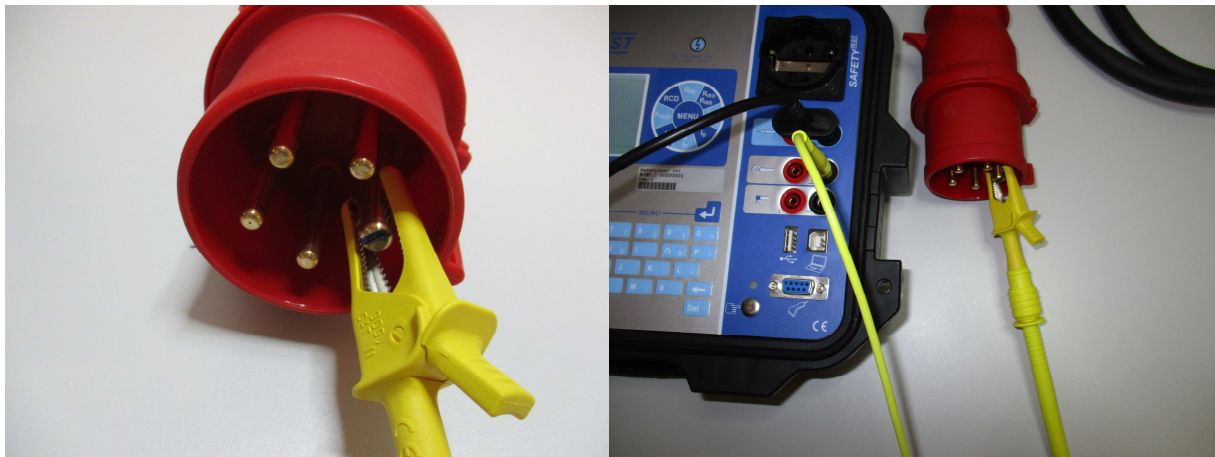
Protective conductor: Use the protective conductor probe to scan the housing parts and move the connection cord.

11.2 *Earth bond test of three phase equipment using a test lead*

Earth bond test: Use the probe to test all conductive parts connected to PE. Move the power cord.

Permanently connected equipment: Use the profile "Fixed equipment". Connect the tester to mains. Probe all conductive parts connected to PE. The earth bonding is tested via the PE connection of the tester, the installation and the connection of the unit under test. Therefore the limit value is higher than the normal limit value.

11.3 *Earth bond test of three phase equipment using the extension lead adapter*



Testing sequence: „CI with Clamp“. Connect the test lead to the yellow connection on the tester and the large earth pin on the CEE connector. Probe all earthed parts of the appliance under test.

11.4 *Accessible conductive parts not connected to PE*



Testing sequence: „CI with Clamp“. Connect the extension lead adapter to the tester and plug the appliance into the CEE socket. Probe all earthed parts of the appliance under test.

11.5 *Exposed insulated conductive parts*

Testing conductive parts not connected to PE: Use the probe to test these parts. If there are rotating or moving parts test these in motion. The best way is to use the optional brass brush probe. Use protective glasses.



Insulation resistance test LN-PE, Substitute leakage test: Connect appliance to test socket. Switch on the appliance. The test is done without applying mains.

11.6 *Insulation resistance test LN-PE of three phase equipment using the extension lead adapter*

11.7 *Earth leakage test of AC appliances with plug*



Testing sequence: „CI with Ins test“. Connect the extension lead adapter to the tester and plug the appliance into the CEE socket. Turn on the appliance under test.

11.8 *Earth leakage test on three phase equipment using the three phase adapter*

Earth leakage test, functional test: Connect the appliance to the test socket. The appliance is tested with mains applied to it.

11.9 *Extension lead test*



Connect the adapter to a CEE socket of the installation. Connect the appliance to the socket of the adapter. Use the current clamp to encompass L1, L2, L3 and N without PE. Connect the current clamp to the tester.

Measurement in menu "CI I with Clamp" or "Fixed Connection"

11.10 *Extension cable testing*



As an option several extension lead sets are available for single and three phase equipment. Three phase adapters: Connect the AC plug into the tester. Connect the extension lead between the adapters. Connect the probe to the banana socket of the extension lead adapter plug. Start the extension lead test. The following tests are performed:

- earth bond continuity of the extension lead
- insulation between L1, L2, L3, N and earth
- continuity and phase rotation of the extension lead.



During the PRCD-S test, the Schuko plug is inserted into the test socket of the tester. The other side of the extension cord is inserted into the panel plug on the right-hand side of the tester or an adapter as shown in the figure above. Start extension lead test. Choose PRCD-S and adjust tripping current before starting.

11.11 Testing Welding appliances

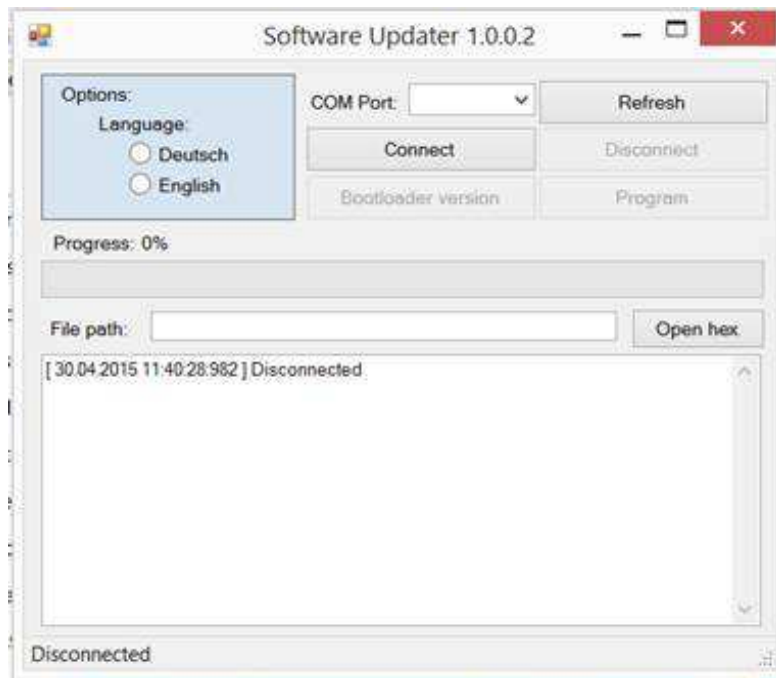


During the testing of welding equipment, both electrodes, as shown in the figure, are attached to the tester. The power cord of the welding equipment is attached to the power socket of the tester. Select "VDE 0544-4" in the menu, set it to the open-circuit voltage and start the test. Follow the testing procedures.

12 Updating the Firmware

Connect the tester to the USB interface of the PC.

Start the PC program Bootloader.



Select the COM port in the menu

Select the menu „Open Hex File“

Disconnect the power plug from the tester.

Select the “Connect” button. The green “Progress” bar will slowly be filled.

Connect the tester to the power. The green “Progress” bar will be filled.

Select the “Program” button.

After completing the programming of the tester, disconnect it from the power and reconnect it again.

13 Error messages, Removing Faults

13.1 *The display remains dark*

Note: Possibly there is no N connection on the mains socket. Possibly one of the fuses of the tester has blown.

13.2 *Touch current display is 0,000 mA*

This is no error but the safe condition.

13.3 *Contact current measurement larger than 0,5 mA*

Note! Do not touch the appliance under test; there is a hazardous voltage on the accessible parts!!!

Disconnect the appliance from mains!!!

Perform an insulation resistance measurement between the accessible conductive parts and mains of the unit under test. While performing the insulation resistance measurement all switches and contactors have to be closed or bridged in order to test all parts of the isolation. The measurement value should exceed 2 MΩ. After the insulation resistance measurement perform a substitute leakage measurement. Then do a touch current measurement. The current must be less than 0,5 mA.

13.4 *Leakage current measurement shows "F" as a result*

The tester regards the heating power when performing the test. A value of 1 mA/kW is established as the limit. Check the measurement value to the allowed limits.

If it exceeds the value, disconnect the unit under test from mains.

Do an insulation resistance measurement LN-PE.

All switches have to be closed, internal contactors bridged.

Also measure the capacitance between LN and PE.

Check the mains voltages with a Multimeter.

If the tester display is incorrect send it in for servicing.

14 Spare Parts

ACHTUNG!!!

Observe the warnings of chapter 1!

Use only spare parts supplied by the manufacturer, see chapter 1!

The tester may be serviced only by the manufacturer or by a service shop authorised by the manufacturer.

15 Technical Data

Mains connection: AC 230V +/- 10%.

Switching current: Mains Integrated relay 16A.

Temperature: 0°C – 40°C.

Measurements (Error max. 1% of +5% of measured value):

PE conductivity: 0,000 Ohm ...4,000 Ohm. OC voltage 6V, Current 200mA DC.

Insulation resistance measurement: 0,00MOhm...20,00MOhm

Oper. circuit voltages 500V, 1000V, Short circuit current 1,5 mA.

Equivalent leakage current: 0,00mA ...20,00 mA, Open circuit voltage approx. ca. 230V.

Differential current: 0,00mA...20,00mA. Filter characteristic according to DIN VDE 0404 for correct evaluation of the harmonic currents.

Contact current: 0,000mA ... 4,000mA

Phase voltage: 0,0V...440,0V

Phase current: 0,00A ... 20,00 A

Power: 0W ... 4 kW. Evaluation up to the 15th harmonic.

Power standby (option): 0,000W...9,999W, Current max. 50 mA

PE monitor: Voltage N-PE > 30V.

Integrated leakage current power off: Differential current > approx. 20 mA.

Clamp measurement:

Ratio 2000:1

Differential current 0,00 ... 20,00 mA

Line current: 0...40,00 A

RCD (optional): 10 mA, 30 mA, 100mA, 300mA, 500mA tripping current and time

Open circuit voltage Welding current circuit with electronic potentiometer: 0 ... 150V

Test sequences:

Standard EN 62638/EN 62353

- Class I active / passive (Powered / without mains)
- Class II
- Class III
- Fixed connection
- Extension lead
- Single measurements

Interface:

RS232 for PC, Barcodereader and printer.

USB Type A for PC, Can be remote controlled.

USB Type A for memory stick and HID connector

Memory, Real time clock:

approx. 100000 measurement sequences with time and date.

16 Disposal

The disposal of a decommissioned tester must be carried out by the customer according to the national regulations.

17 Guarantee

The tester "SAFETYTEST 1ST" is subject to a strict quality assurance system.

A calibration certificate with the documentation of the test results is delivered together with the tester.

This certificate should always be available.

The guarantee period is for 12 months after delivery. Manufacturing defects and material defects are covered by the guarantee.

Transport costs to the manufacturer are born by the sender. For normal transports within Germany to the customer the manufacturer pays. Special transport costs, e. g. express delivery have to be borne by the customer.

Transport and costs for use of substitute equipment must be carried by the customer.

Damages due to dropping or improper use are exempted from the guarantee as well as parts underlying wear and tear like sockets, plugs, fuses, batteries, mechanical parts.

If defects occur after the guarantee period, the service department will repair the articles quickly.