

METRALINE **z**^{CHECK}

Loop Resistance Measuring Instrument

3-349-697-03
2/4.13



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This device is equipped with double or reinforced insulation.



Danger of injury due to electrical current, warning regarding dangerous electrical voltage



Warning concerning a source of danger (attention, observe documentation!)



EC mark of conformity:
This instrument fulfills all requirements of applicable European directives.

Before using the instrument, it must be assured that it is safe.
Do not use if:

- Visible damage is apparent
- The battery compartment lid is missing
- The device has been stored under unfavorable conditions for a lengthy period of time
- The device has been handled impermissibly, e.g. has been dropped from a height of 1 meter or more
- The test instrument does not function as described in these operating instructions (if this is the case, we recommend resetting the device as described in section 3.6 on page 7).

CAUTION

- Do not touch electrically conductive parts, test probes etc. when the device is switched on and voltage might still be conducted by a test probe – DANGER OF INJURY!
- Only use test probes which are included with the instrument or are available as accessories.
- The device must be switched off and no voltage may be applied when exchanging accessories.
- It is absolutely essential to adhere to all safety precautions, regulations and standards when performing measurements.
- No keys may be pressed when connecting the instrument to a device under test.
- The test instrument may not be subjected to the influence of aggressive substances, gases, vapors, liquids or dust.
- The test instrument may only be used under the conditions listed in the technical data in section 4 on page 8.
- If the device is moved from a colder to a warmer room, condensation may occur, in which case a brief period of acclimatization is advisable.
- We recommend removing the batteries during lengthy periods of storage.
- **Testing without tripping of RCCB:** During measurement, the RCCB may be tripped unintentionally. This may be attributable to a high degree of sensitivity towards short current peaks, especially with those variants with $I_{\Delta N} = 10 \text{ mA}$ and 30 mA , or the RCCB may be defective or a certain leakage current may flow through the measured electrical circuit which, in addition to the current that is produced by the test instrument, trips the RCCB.
- Two relatively strong magnets are integrated into the test instrument. Avoid close proximity to magnetically sensitive objects such as watches, credit cards and the like.
- The illustrations in these operating instructions are drawings and may therefore deviate from reality.

1 Introduction

1.1 Scope of Delivery

- 1 Test instrument with mobile test probe
- 4 Batteries (AAA)
- 1 Pouch
- 1 Condensed operating instructions
- 1 CD ROM with operating instructions in available languages
- 1 Factory calibration certificate

1.2 Optional accessories

- 4 ea. rechargeable AAA NIMH batteries (Z507B)
- 1 battery charger (Z507A)

1.3 Safety Precautions

Read the operating instructions thoroughly and carefully before using your instrument. Follow all instructions contained therein. Make sure that the operating instructions are available to all users of the instrument.

Exclusion of Liability

When **testing systems with RCCBs**, the latter may switch off. This may occur even though the test does not normally provide for it. Leakage currents may be present which, in combination with the test current of the test instrument, exceed the shutdown threshold value of the RCCB. PCs which are operated in proximity to such RCCB systems may switch off as a consequence. This may result in inadvertent loss of data. Before conducting the test, precautions should therefore be taken to ensure that all data and programs are adequately saved and the computer should be switched off if necessary. The manufacturer of the test instrument assumes no liability for any direct or indirect damage to equipment, computers, peripheral equipment or data bases when performing the tests.



- Use original accessories only.
- Max. permissible voltage between test probe and ground is 300 V!
- Maximum permissible voltage between the test probes is 300 V!

Opening of Equipment / Repair

The equipment may be opened only by authorized service personnel to ensure the safe and correct operation of the equipment and to keep the warranty valid.

Even original spare parts may be installed only by authorized service personnel.

In case the equipment was opened by unauthorized personnel, no warranty regarding personal safety, measurement accuracy, conformity with applicable safety measures or any consequential damage is granted by the manufacturer.

1.4 General Device Description

The test instrument is enclosed in a compact housing with a patented means of retaining the test probes.

The high-contrast, four-color OLED display assures excellent legibility. When performing measurements under unfavorable light conditions, measuring point illumination can be switched on – white LED at the front.

The following measurements can be performed with the **Metraline Z^{check}**:

- Fault loop impedance with short-circuit current
- Fault loop impedance with short-circuit current without tripping the RCCB for measurements of RCCBs with a nominal current of 100 mA or 300 mA
- Line impedance with short-circuit current
- Line voltage
- Phase detection

The Metraline **Z^{check}** allows for the evaluation of measured impedance in consideration of type, nominal current and disconnection time. A table with the parameters of various protective devices is included in device memory (see section 5 on page 9 in these operating instructions).

1.5 Applicable Standards

Measurement	EMC	Safety
EN 61557-1	EN 55022 class B	EN 61010-1
EN 61557-3	EN 61326-1	EN61010-031

1.6 Environment

The shipping package is made of recyclable cardboard. Batteries must be disposed of in accordance with applicable regulations.



This device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet

2 Device Description

2.1 Housing

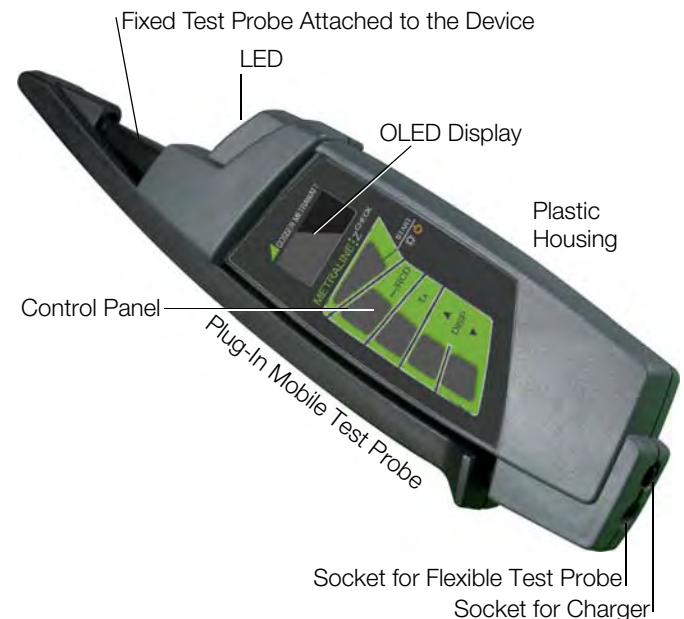


Figure 2.1: Top View

For transport purposes, the movable test probe can be attached to the housing and retained by a magnet such that both metal tips are simultaneously recessed and protected.

In order to charge batteries which have been inserted into the instrument, the flexible test probe's connector plug must be removed and the slide must be pushed to the left, so that the socket at the right is made accessible and the charger can be plugged into it.

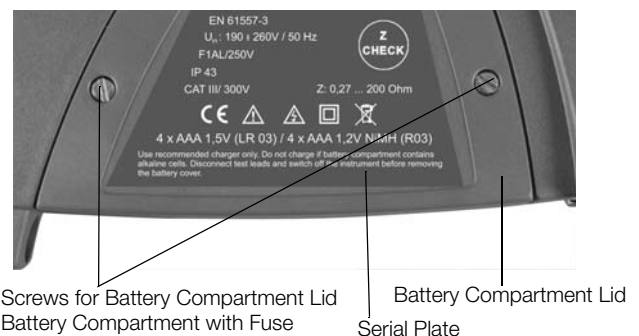


Figure 2.2: Detail View of the Back Panel with Battery Compartment Lid

2.2 Control Panel

- 1 Graphic OLED Display
- 2 **START** key:
 - **Switch on:**
Press and hold until the display lights up.
 - **Start measurement:**
Press and hold until measurement starts.
 - **Measurement point illumination:**
Press briefly to switch illumination on and off.
 - **Switch off:**
Press twice briefly to switch the instrument off.
- 3 **~ / RCD** key
Measuring function selection: with/without RCCB
- 4 The **T_A** key is used to select the value from the table of protective devices, which is used to adjust disconnection time for evaluating measured values.
- 5 **DISP ▲** and **DISP ▼** keys for selecting the protective device for the evaluation of measured values

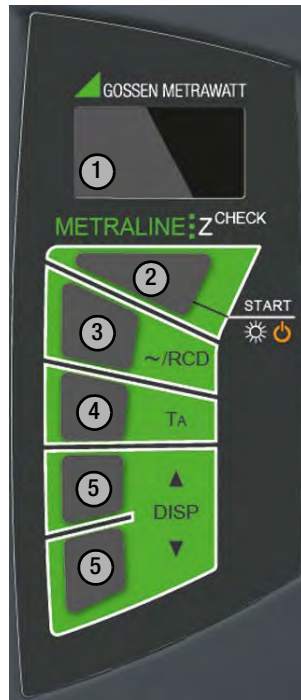


Figure 2.3: Control Panel and OLED Display

Data can be represented at the OLED display in two different ways:

- **Brief representation:** Measured quantities appear at the display with large numbers, but no evaluation of the measurement data is included.
- **Detailed representation:** Measured quantities appear at the display along with information from the protective devices database, as well as the symbol for “corresponds / does not correspond with the measured impedance”.

Phase and battery level are displayed in both modes.

Refer to the description in section 3.5 on page 7



Figure 2.4: Example of Brief Representation

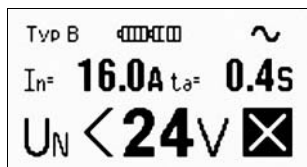


Figure 2.5: Example of Detailed Representation

The information which appears at the display varies depending on the selected function.

2.3 Initial Start-Up

After inserting the batteries in accordance with section 6.1 on page 10, the measuring instrument is ready for operation.

3 Performing Measurements

3.1 Switching the Instrument On and Off, Energy-Saving Mode, Automatic Shutdown

The instrument is switched on by pressing and holding the **START** key. Briefly press the **START** key twice in order to switch the instrument off, during which no voltage may be applied to the test probes! The instrument is switched to the standby mode after several seconds (reduced brightness), if none of the keys has been pressed and no voltage is applied to the test probes. The instrument is switched out of the standby mode (i.e. back to full brightness) by pressing any key or applying voltage to the test probes. The instrument is shutdown automatically if it has remained inactive for about 1 minute, i.e. if no keys have been

pressed and no voltage has been applied to the test probes during this time.

3.2 Instructions and Principles with Validity for All Measurements

- The desired functions and parameters are selected with the **~ / RCD**, **T_A**, **DISP ▲** and **DISP ▼** keys. Measurement is triggered by pressing the **START** key. All selected functions or parameters remain valid until they are changed.
- If a voltage of **< 24 V** or **> 260 V** is applied to the test probes, corresponding information appears at the display and measurement cannot be triggered by pressing the **START** key.
- If a voltage within a range of **24 V** to **190 V** is applied to the test probes, the **START** key is disabled and “< 190 V” is displayed.



Figure 3.1: Voltage < 24 V (brief representation)



Figure 3.2: Voltage < 24 V (detailed representation)

- If the test instrument displays voltage applied to the test probes after the **START** key has been pressed, although no measurement ensues and the blown fuse symbol appears at the display, the fuse must be replaced.

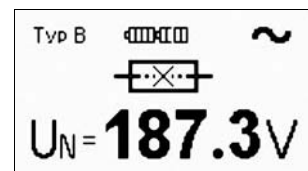


Figure 3.3: Blown Fuse Example (detailed representation)

- If voltage within a range of 190 V to 260 V is applied to the test probes, the momentary measured value appears at the display and measurement can be triggered by pressing the **START** key.



Figure 3.4: Voltage Measurement (brief representation)

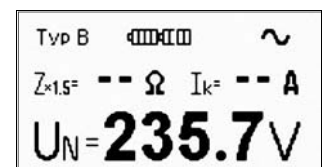


Figure 3.5: Voltage Measurement (detailed representation)

- If battery voltage is too low (only the red field is lit up in the battery symbol), measurement cannot be started. After pressing the **START** key, the depleted battery symbol appears for about 1 second (see figure below). Replace the batteries as described in section 6.1 on page 10.

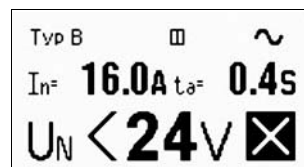


Figure 3.6: Low Battery Voltage (detailed representation)



Figure 3.7: Display After Pressing START (detailed representation)

- If several impedance measurements are performed one after the other, internal warming of the instrument is displayed by means of the red indicator – “T” symbol. As temperature increases, the field is gradually filled in and becomes wider.



Figure 3.8: High Temperature Display (brief representation)



Figure 3.9: High Temperature Display (detailed representation)

When the maximum permissible internal temperature has been exceeded, the “T” symbol is replaced with the “STOP” symbol. If the **START** key is pressed and held for approximately 1 second, overheating is displayed and any further measurements are disabled. Allow the instrument to cool down!



Figure 3.10: Overheating Display – STOP Symbol



Figure 3.11: Overheating Display After Pressing the Start Key

- Securely contact the device under test with the test probes. Afterwards, check to see whether or not the displayed line voltage value is stable. Always assure good contact during measurement in order to prevent distortion of the measurement results.
- The test instrument evaluates deviation while measurement is being performed. If considerable interference occurs within the measured system during measurement which would lead to inaccurate impedance measurement results, impedance does not appear at the display and the instrument is switched to voltage measurement after measurement has been completed. The measurement must be repeated!
- If line voltage is unstable while measurement is being performed, or if other electrical circuits parallel to the measured circuit are in use, measurement results may be distorted and permissible measuring error may be exceeded.

3.3 Measurement of Fault Loop Impedance and Line Impedance

3.3.1 Measurement in Circuits without RCD – ~ Function

The “~” function is suitable for measuring fault loop impedance in electrical circuits without RCCBs, as well as line impedance.

- After switching the instrument on, connect it between **L** and **PE** in order to measure fault loop impedance, and between **L** and **N** to measure line impedance.

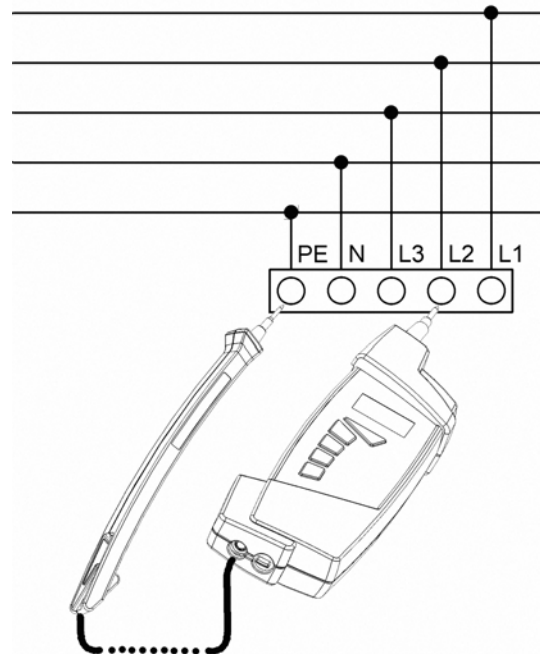


Figure 3.12: Connection Example: Loop Impedance Measurement, L2-PE

- After the voltage value has settled in, briefly press the **START** key in order to trigger measurement. Assure good contact between the test probes and the device under test while measurement is being performed!

Results after completion of the measurement:

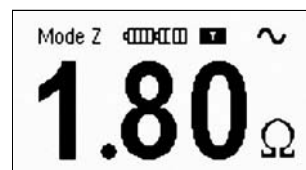


Figure 3.13: Sample Results for Impedance Measurement (brief representation)



Figure 3.14: Sample Results for Impedance Measurement (detailed representation)

Key:

Z Measured impedance (Ω)

Z x 1.5 Multiplier for measured impedance Z (Ω)

Ik Short-circuit current calculated as: $I_{SC} = 230 / (Z \times 1.5)$ (A)

- Remove the instrument.

3.3.2 Displaying Further Measured/Calculated Values

Stated briefly: The following are displayed, one after the other, by pressing the **DISP ▲** and **DISP ▼** keys:

- Short-circuit current
- 1.5 times measured impedance
- Impedance corrected by a value equal to measuring error
- Measured impedance



Figure 3.15: Short-Circuit Current



Figure 3.16: 1.5 Times Impedance

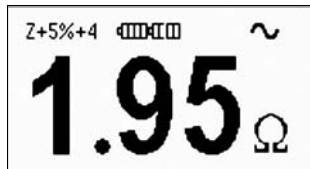


Figure 3.17: Impedance + Measuring Error



Figure 3.18: Measured Impedance

In detail: Impedance corrected by a value equal to measuring error is displayed by pressing the **DISP ▲** key, and only the measured value without correction is displayed by pressing the **DISP ▼** key.

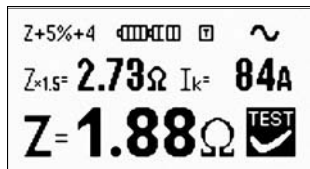


Figure 3.19: Measured Impedance + Measuring Error



Figure 3.20: Measured Impedance

3.3.3 Measurement in Electrical Circuits with RCD

Testing Without Tripping the RCCB

Select the “RCD” function if loop impedance needs to be measured via an RCCB, without causing it to trip.

- After switching the instrument on, connect it between **L** and **N** in order to measure line impedance.
- After the voltage value has settled in, briefly press the **~ / RCD** key, which starts measurement of line impedance without tripping the RCD. This is important if loop impedance needs to be measured via an RCCB.
- Assure good contact between the test probes and the device under test while measurement is being performed!



Attention!

This function is only possible for RCCB's (RCD's) with $I_{\Delta N} \geq 100$ mA. It cannot be guaranteed for 10 mA and 30 mA, see also Safety Precautions in chapter 1.3.

The results appear at the display, and the “~” symbol is replaced with the “RCD” symbol at the same time.

Testing With Tripping of the RCCB

- Connect the test probe from **N** to **PE** (see example in figure 3.12).
- Start the measurement by pressing the **START** key. Assure good contact between the test probes and the device under test while measurement is being performed!

After the measurement has been completed, the results are displayed as follows:

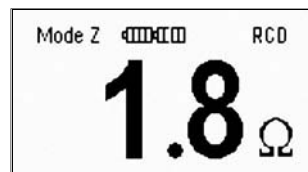


Figure 3.21: Impedance Downstream from an RCCB (brief)

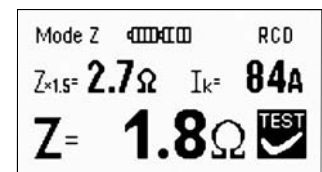


Figure 3.22: Impedance Downstream from an RCCB (detailed)

Key:

Z Measured impedance (Ω)

Z x 1.5 Multiplier for measured impedance Z (Ω)

Ik Short-circuit current calculated as: $I_k = 230 / (Z \times 1.5)$ (A)

- Several seconds after the measurement cables have been removed from the device under test, the test instrument is switched back to the “~” function. In order to perform further loop impedance measurements, the entire procedure in accordance with section 3.3.3 on page 6 must be repeated.
- In order to display additional measured/calculated values, proceed as described in section 3.3.2 on page 6, “Displaying Further Measured/Calculated Values”.

Note: Contact **PE with the mobile test probe**. Press the **START** key. If no voltage is present, loop impedance measurement is not started. Assure that the test probes make good contact with **L** and **PE**.

Make certain that:

- **L** and **PE** are contacted
- **PE** is securely connected

3.4 Automatic Evaluation of Measured Impedance

Automatic evaluation is only possible with the detailed representation.

- Protective device parameters are stored to memory or to the database. Type, nominal current I_n and disconnection time t_a appear at the top of the display (see example in figure 2.5). After pressing the T_A key for the first time, disconnection time t_a and the smallest short-circuit current I_{Fmin} required for shutdown appear at the bottom of the display.

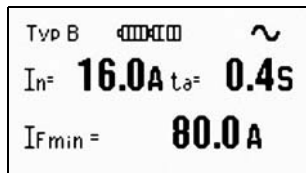


Figure 3.23: Display of Smallest Short-Circuit Current for Shutting Down a B16 Breaker

- Another protective device type and nominal current can be selected immediately after activating the T_A key by pressing and holding the **DISP ▲** or **DISP ▼** key. After selection, wait about 5 seconds, after which the initial status for voltage measurement is displayed.
- Another disconnection time can be selected immediately after activating the T_A key by pressing the T_A key once again. After selection, wait about 5 seconds, after which the initial status for voltage measurement is displayed.
- If the **TEST** symbol is displayed along with the results of the impedance measurement after its completion, short-circuit current calculated from impedance is greater than the minimum short-circuit current required for triggering the selected protective device. However, if calculated short-circuit current is less than this value, the **TEST X** symbol is displayed.

3.5 Further Device Functions

Phase Detection

If the **TEST X** symbol appears in the lower right-hand corner of the display (see figures 2.4 and 2.5), and if a phase is contacted with the fixed test probe, the symbol is changed to **L**. The other test probe may not be connected anywhere or make any contact at all!



Figure 3.24: Phase Display (brief)

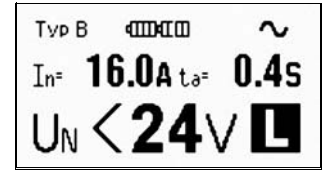


Figure 3.25: Phase Display (detailed)



Note

As usual, the test instrument must be gripped in the hand!
In order to obtain a correct display, the fixed test probe must remain connected to the phase for at least 2 seconds.
Phase voltage to ground must be $\geq 190\text{ V}$ / 48 to 52 Hz, because the display will otherwise be incorrect.

Measuring Point Illumination with White LED

The LED can be switched on and off by briefly pressing the **START** key.

No voltage may be applied to the test probes.

Selecting Brief or Detailed Representation, Information on Firmware Version

- Press the **START** key to switch the instrument on while pressing and holding the **~ / RCD** key. The version number appears at the display, for example V 1.0.0, along with corresponding symbols for the desired representation.

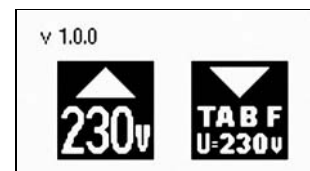


Figure 3.26: Selecting Brief or Detailed Representation, Firmware Version

- Select the representation mode with the **DISP ▲** (brief) or **DISP ▼** (detailed) key. After selection, the instrument is switched back to normal operation.

3.6 Device Reset Function

If the test instrument does not function as described in these instructions, we recommend a device reset. The test instrument must be switched off and neither of the test probes may be connected to a DUT. If device functions are still incorrect after switching the instrument back on again, remove the batteries as described in section 6.1 on page 10, wait at least 10 seconds and then reinsert the batteries (or replace them with new ones). If the test instrument still does not function as described, remove the batteries and contact our service department.

4 Technical Data

4.1 Individual Device Functions

Fault Loop Impedance / Line Impedance

Nominal Range per EN 61557-3: 0.27 Ω to 200 Ω

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
0.00 to 4.99 Ω	0.01 Ω	$\pm(3\% \text{ rdg.} + 5 \text{ D})$	$\pm(4\% \text{ rdg.} + 7 \text{ D})$
5.0 to 49.9 Ω	0.1 Ω	$\pm(3\% \text{ rdg.} + 3 \text{ D})$	$\pm(4\% \text{ rdg.} + 4 \text{ D})$
50 to 200 Ω	1 Ω	$\pm 3\% \text{ rdg.}$	$\pm 4\% \text{ rdg.}$

Voltage range: 190 to 260 V / 48 to 52 Hz

Load resistance: 50 Ω (variable number of pulses at 10 ms)

Fault Loop Impedance Without Tripping the RCCB

Nominal Range per EN 61557-3: 0.8 Ω to 200 Ω

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
0.0 to 4.9 Ω	0.1 Ω	$\pm(5\% \text{ rdg.} + 2 \text{ D})$	$\pm(6\% \text{ rdg.} + 2 \text{ D})$
50 to 200 Ω	1 Ω	$\pm 7\% \text{ rdg.}$	$\pm 8\% \text{ rdg.}$

Voltage range: 190 to 260 V / 48 to 52 Hz

Load resistance: 50 Ω (variable number of pulses and pulse width)

Short-Circuit Current

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
0 to 999 A	1 A	Depending on measuring error for loop impedance $\pm 1 \text{ D}$	Depending on measuring error for loop impedance $\pm 1 \text{ D}$
1.0 to 9.9 kA	0.1 kA		
10 to 23 kA	1 kA		

Alternating Voltage (TRMS)

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
24 to 260 V	1 V ¹ 0.1 V ²	$\pm(2\% \text{ rdg.} + 2 \text{ D})$	$\pm(3\% \text{ rdg.} + 3 \text{ D})$

Frequency range: 48 to 52 Hz

¹ Display for brief representation

² Display for detailed representation

Key:

- a) The measuring uncertainties specified here for fault loop impedance, line impedance and short-circuit current are only valid if line voltage is stable during measurement and if no other electrical circuits parallel to the measured circuit are in use.
- c) rdg. means reading, i.e. measured value, D = digits (i.e. number of the decimal place with the least significance)

4.2 General Data

Reference Conditions

Temperature	23 $\pm$ 2° C
Relative humidity	40 to 60%
Line voltage	230 V $\pm$ 2% / 50 Hz $\pm$ 1%
Device position	any

Ambient Conditions

Operating Conditions

Operating temperature	0 to 40° C
Relative Humidity	max. 85 %, no condensation allowed
Line voltage	190 to 260 V / 48 to 52 Hz
Device position	any

Storage Conditions

Temperature	-10 to 70° C
Relative Humidity	max. 90% at -10 to +40° C max. 80% at +40 to +70° C
Device position	any

Power Supply

Batteries 4 ea. AAA (LR03), 1.5 V alkaline or 1.2 V NIMH (with at least 750 mAh)

Number of measurements with batteries at 800 mAh:
approx. 3,000 measurements

Electrical Safety

Measuring category with safety cap applied to measuring probe: CAT III 300 V
without safety cap applied to measuring probe: CAT II 300 V

Pollution degree 2

Protection class II

Fuse SIBA ceramic fuse
6.3 mm x 32 mm, F1 A/600 V
switching capacity 50 kA at 600 V

Mechanical Design

Display	OLED, multicolored, graphic
Protection	IP 43
Dimensions	approx. 260 x 70 x 40 mm
Weight	approx. 0.36 kg with batteries

5 Table of Protective Devices Stored to the Instrument

Fuse Type NV

Nominal Current (A)	Disconnecting Time [s]				
	35m	0.1	02	0.4	5
	Min. Short-Circuit Current (A)				
2	32.5	22.3	18.7	15.9	9.1
4	65.6	46.4	38.8	31.9	18.7
6	102.8	70	56.5	46.4	26.7
10	165.8	115.3	96.5	80.7	46.4
16	206.9	150.8	126.1	107.4	66.3
20	276.8	204.2	170.8	145.5	86.7
25	361.3	257.5	215.4	180.2	109.3
35	618.1	453.2	374	308.7	169.5
50	919.2	640	545	464.2	266.9
63	1217.2	821.7	663.3	545	319.1
80	1567.2	1133.1	964.9	836.5	447.9
100	2075.3	1429	1195.4	1018	585.4
125	2826.3	2006	1708.3	1454.8	765.1
160	3538.2	2485.1	2042.1	1678.1	947.9
200	4555.5	3488.5	2970.8	2529.9	1354.5
250	6032.4	4399.6	3615.3	2918.2	1590.6
315	7766.8	6066.6	4985.1	4096.4	2272.9
400	10577.7	7929.1	6632.9	5450.5	2766.1
500	13619	10933.5	8825.4	7515.7	3952.7
630	19619.3	14037.4	11534.9	9310.9	4985.1
710	19712.3	17766.9	14341.3	11996.9	6423.2
800	25260.3	20059.8	16192.1	13545.1	7252.1
1000	34402.1	23555.5	19356.3	16192.1	9146.2
1250	45555.1	36152.6	29182.1	24411.6	13070.1

Fuse Type gG

Nominal Current (A)	Disconnecting Time [s]				
	35m	0.1	02	0.4	5
	Min. Short-Circuit Current (A)				
2	32.5	22.3	18.7	15.9	9.1
4	65.6	46.4	38.8	31.9	18.7
6	102.8	70	56.5	46.4	26.7
10	165.8	115.3	96.5	80.7	46.4
13	193.1	144.8	117.9	100	56.2
16	206.9	150.8	126.1	107.4	66.3
20	276.8	204.2	170.8	145.5	86.7
25	361.3	257.5	215.4	180.2	109.3
32	539.1	361.5	307.9	271.7	159.1
35	618.1	453.2	374	308.7	169.5
40	694.2	464.2	381.4	319.1	190.1

Fuse Type B

Nominal Current (A)	Disconnecting Time [s]				
	35m	0.1	02	0.4	5
	Min. Short-Circuit Current (A)				
6	30	30	30	30	30
10	50	50	50	50	50
13	65	65	65	65	65
16	80	80	80	80	80
20	100	100	100	100	100
25	125	125	125	125	125
32	160	160	160	160	160
40	200	200	200	200	200
50	250	250	250	250	250
63	315	315	315	315	315

Fuse Type C

Nominal Current (A)	Disconnecting Time [s]				
	35m	0.1	02	0.4	5
	Min. Short-Circuit Current (A)				
05	5	5	5	5	2.7
1	10	10	10	10	5.4
1.6	16	16	16	16	8.6
2	20	20	20	20	10.8
4	40	40	40	40	21.6
6	60	60	60	60	32.4
10	100	100	100	100	54
13	130	130	130	130	70.2
16	160	160	160	160	86.4
20	200	200	200	200	108
25	250	250	250	250	135
32	320	320	320	320	172.8
40	400	400	400	400	216
50	500	500	500	500	270
63	630	630	630	630	340.2

Fuse Type K

Nominal Current (A)	Disconnecting Time [s]				
	35m	0.1	02	0.4	
	Min. Short-Circuit Current (A)				
05	7.5	7.5	7.5	7.5	
1	15	15	15	15	
1.6	24	24	24	24	
2	30	30	30	30	
4	60	60	60	60	
6	90	90	90	90	
10	150	150	150	150	
13	195	195	195	195	
16	240	240	240	240	
20	300	300	300	300	
25	375	375	375	375	
32	480	480	480	480	

Fuse Type D

Nominal Current (A)	Disconnecting Time [s]				
	35m	0.1	02	0.4	5
	Min. Short-Circuit Current (A)				
05	10	10	10	10	2.7
1	20	20	20	20	5.4
1.6	32	32	32	32	8.6
2	40	40	40	40	10.8
4	80	80	80	80	21.6
6	120	120	120	120	32.4
10	200	200	200	200	54
13	260	260	260	260	70.2
16	320	320	320	320	86.4
20	400	400	400	400	108
25	500	500	500	500	135
32	640	640	640	640	172.8

6 Maintenance

6.1 Device Power Supply



Caution: Dangerous Voltage!

Dangerous voltage in battery compartment!

Disconnect the test probes from the device under test and switch the instrument off before removing the battery compartment lid.

The instrument may not be placed into service if the battery compartment lid has not been inserted and secured with the screws.

Either alkaline batteries or rechargeable NiCD/NiMH batteries may be used to supply the instrument with electrical power (4 each, size: AAA, type: LR03).

The battery charge level is continuously displayed (see section 3.2 on page 4).

If too little voltage is indicated, replace the batteries.



Note

We recommend removing the batteries during lengthy periods of non-use (e.g. vacation). This prevents excessive battery depletion or leakage, which may result in damage to the instrument under unfavorable conditions.

6.1.1 Inserting and Replacing the Batteries

Loosen the two screws at the back of the instrument and remove the battery compartment lid. Insert the batteries assuring correct polarity!



Figure 6.1: Correct Battery Polarity

Always replace all 4 batteries at once, and use high quality batteries. Replace the battery compartment lid and retighten the screws.

6.1.2 Recharging the Batteries



Attention!

Use only the charger (Z507A) which is offered as an optional accessory for this instrument to charge the **batteries** inserted in the instrument.

Make sure that the following conditions have been fulfilled before connecting the charger to the charging socket:

- rechargeable batteries have been inserted with correct polarity, **no** normal batteries
- The test instrument has been disconnected from the measuring circuit at all poles
- The instrument must remain off during charging.

Recharging of the batteries begins as soon as the charger is connected to the mains and to the charging socket (see figure 6.1). Charging takes 5 hours and 30 minutes (integrated safety timer) if the batteries have been fully depleted.

Safety Precautions

- Do not attempt to recharge alkaline batteries: they may leak, explode etc. The test instrument may be severely damaged or destroyed as a result.
- After initially charging new batteries and after rechargeable batteries have not been used for a lengthy period of time (several months), operating hours after charging may be significantly less than usual. If this is the case, repeat the charging procedure several times. Autonomous, intelligent charging stations execute charging/discharging cycles of this sort automatically (see instructions included with the charging station). This procedure increases the capacity of the batteries, thus making longer periods of operation possible between charging cycles.
- If no improvement is achieved in this way, one or more of the rechargeable batteries may no longer fulfill the original specifications. If this is the case, the defective rechargeable battery should be identified, e.g. with the help of the voltage measurement, and replaced.
- Battery capacity is gradually reduced as a result of long and frequent use. When you notice that this is the case, all of the rechargeable batteries should be replaced.

6.1.3 Replacing the Fuse



Attention!

The fuse may only be replaced with the fuse type specified in section "Technical Data". If any other fuse is inserted, this may result in damage to the instrument and/or danger for the user!

6.2 Cleaning

Use a soft cloth and soapy water for cleaning. Do not place the test instrument back into service until its surface is completely dry.



Attention!

Do not use cleaning agents which contain benzine or alcohol! Prevent liquids from penetrating into the test instrument's interior.