GOSSEN METRAWATT

METRALINE ISO^{CHECK}

Insulation Resistance Tester

3-349-691-03
1/7.12

Table of Contents

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.

Meanings of Symbols on the Instrument


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 3.5 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 5 on page 7.
- 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 lengths periods of storage.
- 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.

- Use original accessories only.
- Maximum permissible voltage between test probe and ground is 300 V!
- Maximum permissible (externally applied) voltage between the test probes is 600 V!

1.4 Applications

The test instrument consists of a compact housing with a patented means of retaining the second test probe.

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 test instrument is capable of the following measurements:

– Insulation resistance with test voltages of 50 to 1000 V
– Surge protection devices with test voltages of 50 to 1000 V
– Direct and alternating voltages

1.5 Applicable Standards

Measurement	EMC	Safety
EN 61557-1	EN 55022 class B	EN 61010-1
EN 61557-2	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 at www.gossenmetrawatt.com by entering the search term “WEEE”.

2 Device Description

2.1 Housing

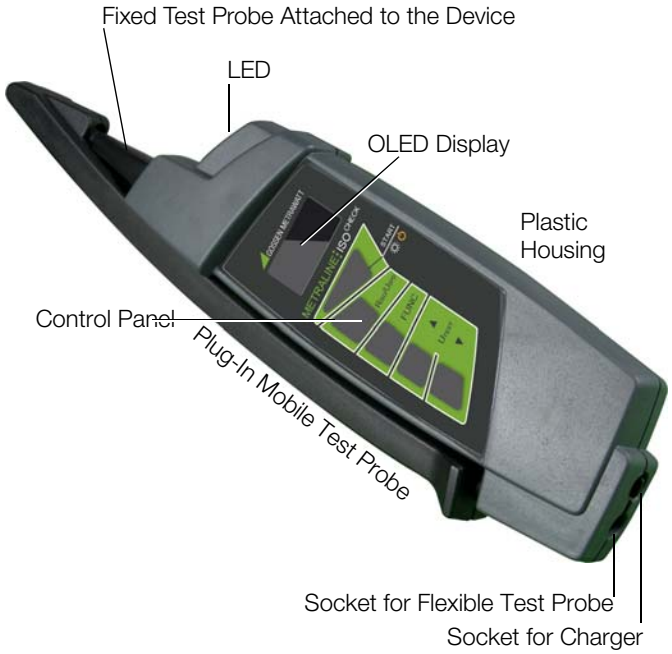


Figure 2.1: Top View

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.

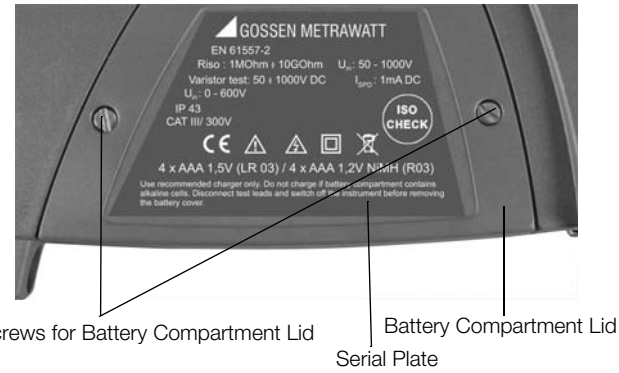


Figure 2.2: Detail View of the Back Panel with Battery Compartment Lid

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 **RISO/USPD KEY:**
For switching between insulation resistance and surge protection measurement

4 The **FUNC** key allows for selection of the desired type of surge protection when USPD is activated.

5 **UTEST ▲** key for selecting measuring voltage

6 **UTEST ▼** key for selecting measuring voltage

Figure 2.3: Control Panel and OLED Display

2.3 Initial Start-Up

After inserting the batteries in accordance with section 5.1 on page 7, 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 or parameters are selected with the **RISO/USPD**, **FUNC**, **UTEST ▲** and **UTEST ▼** keys. Measurement is triggered by pressing the **START** key. All selected functions or parameters remain valid until they are changed.
- If (interference) voltage of greater than 10 V is applied to the test probes, this is indicated at the display in the **UIN** field along with the measured value, as well as the "!" symbol. If this is the case, the **START** key is disabled.

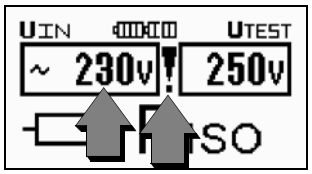


Bild 3.1 (Interference) Voltage Display

- 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 5.1 on page 7.

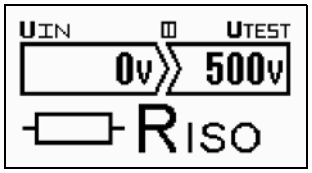


Figure 3.2: Low Battery Voltage

Figure 3.3: Low Battery Voltage: Display After Pressing the START Key

- ⇨ When measuring high insulation resistance, the measurement cables should be laid unobstructed in the room, or placed upon a material with good insulating properties.
- ⇨ Contact the device under test with the test probe before triggering measurement with the **START** key, thus causing any possible interference voltage to appear at the display.
- ⇨ Do not remove the test probes prematurely during the course of the measurement, because this may lead to distorted measurement results.

After insulation measurement has been completed, any remaining residual voltage is displayed as **UIN** , which may result from cable capacitance. Contact to the device under test must be maintained for as long as a capacitive DUT is being discharged via the test instrument's internal resistor. The falling voltage value can be observed directly at the **UIN** display. Do not disconnect the DUT until voltage **UIN** is less than 25 V!

3.3 Measuring Functions

Attention!

- Each time before measuring insulation resistance or surge protection, make sure that the device under test is voltage-free!
- Do not touch the device under test or the test probes during measurement, and for a short time thereafter as long the DUT is being discharged.
- The DUT may be charged with as much as 1000 V during measurement, for which reason contact to the DUT must be maintained after measurement has been completed until it is fully discharged! Residual voltage appears at the display along with the "!" warning symbol.
- Do not remove the test probes until voltage has dropped to a safe level and the "!" warning symbol has been cleared from the display.
- All consuming devices must be disconnected and the switches must be turned on when measuring insulation resistance between conductors.

3.3.1 Voltage Measurement

- ⇨ Connect the test instrument to the device under test.

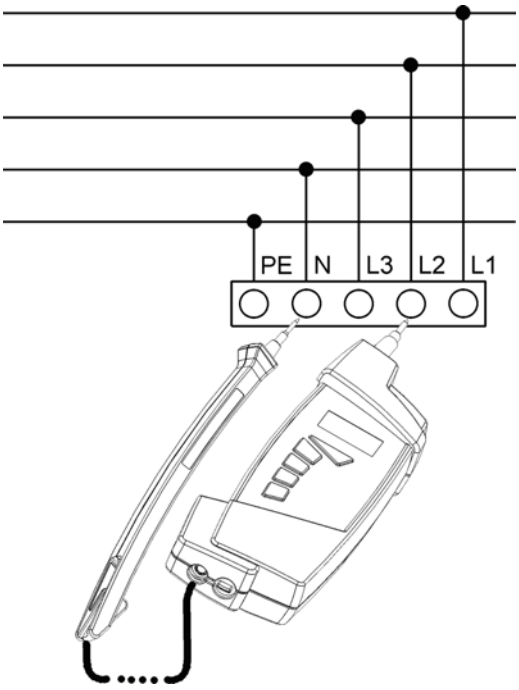


Figure 3.4: Connection Example for Voltage Measurement

- If a voltage of greater than about 10 V is present in the measured electrical circuit, its value is displayed in the **UIN** field and the "~" symbol appears for AC or polarity is displayed for DC. The "+" symbol lights up if the positive pole is connected to the fixed test probe, and "–" appears if the negative pole is connected to the fixed test probe. "!" appears at the same time as a warning. The **START** key is disabled!

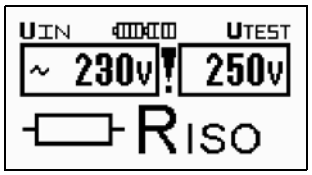


Figure 3.5: Display of (Interference) Voltage (Riso function)

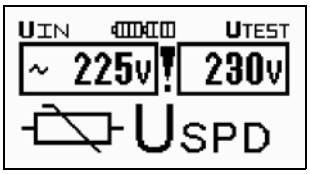


Figure 3.6: Voltage Measurement (USPD function)

3.3.2 Insulation Resistance Measurement

➪ Switch insulation measurement on by pressing the **R**ISO/**U**SPD key.

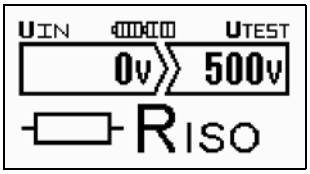


Figure 3.7: Setting Test Voltage

➪ Select the required measuring voltage with the help of the ▲ **U**TEST and ▼ **U**TEST keys. By briefly pressing the respective key, voltage is increased or decreased to one of the following nominal values: 50, 100, 250, 500 or 1000 V. The selected test voltage appears at the display in the **U**TEST field. For individualized value settings, press and hold either the ▲ **U**TEST or ▼ **U**TEST key until the value can be changed in 1 V steps within a range of 50 to 1000 V. The desired value is then selected by once again briefly pressing the respective key. Several seconds after one of these two keys has been activated for the last time, the test instrument is returned to the mode which allows for switching amongst nominal values of 50, 100, 250, 500, 1000 V only.

➪ Contact the device under test with both test probes.

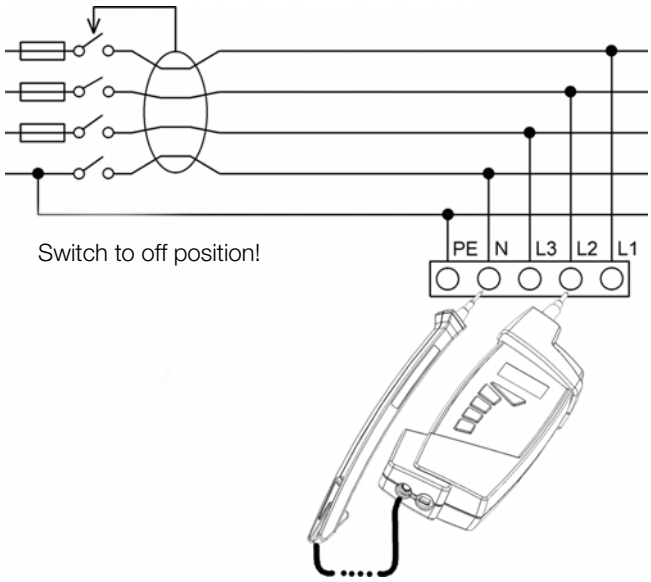


Figure 3.8: Connection Example

Note
If an interference voltage of greater than about 10 V is present in the measured electrical circuit, its value is displayed and the **START** key is disabled (see section 3.3.1 on page 4). Eliminate the source of interference voltage before continuing with the measurement.

➪ Trigger measurement by pressing the **START** key. Release the key as soon as measurement is started.
Rising measuring voltage is displayed by means of a bar graph (this may take several tens of seconds in the case of large capacitances). At the same time, the value appears at the display in the **U**IN field. The measuring cycle is ended automatically.

Note
If measurement needs to be continued for a longer period of time, the **START** key has to be pressed and held for the entire duration.
In contrast to this, the automatic cycle can be ended prematurely by briefly pressing the **START** key. No results are displayed in this case.

➪ Read the measured insulation resistance value.

Note
The device under test may not be disconnected from the test instrument as long as the "!" warning symbol is lit up. Discharging large capacitances may take several tens of seconds!

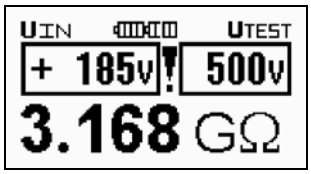


Figure 3.9: Sample Results for an Insulation Measurement (the DUT is being discharged)

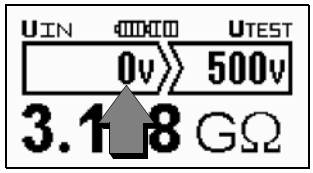


Figure 3.10: Insulation Measurement Results (the DUT has been fully discharged: UIN = 0 V)

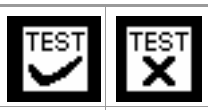
Note
Whistling or hissing noises may emanate from the test instrument during measurement.

3.3.3 Measurements at Varistors (surge protection devices)

For this measuring function, the test instrument generates a rising direct voltage within a range of 50 to 1000 V and, at the same time, measures current flowing through the device under test. As soon as current reaches a level of 1 mA, voltage is no longer increased and the voltage value for the so-called milliampere point appears at the display. In accordance with the respective function which has been selected with the **FUNC** key, results for overcurrent protection devices are also evaluated automatically and listed as shown in the following table.

Note
If the USER **DCMAX** function has been selected, the upper voltage limit for automatic results evaluation can be adjusted with the ▲ **U**TEST and ▼ **U**TEST keys.
If the USER **DCMIN** function has been selected, the lower voltage limit for automatic results evaluation can be adjusted with the ▲ **U**TEST and ▼ **U**TEST keys.

For actual measurement or evaluation, it doesn't matter which of these two functions is selected, i.e. either **DCMAX** or **DCMIN**.

	Symbol in the Display and its Meaning	
Selected function		
DC	Voltage at the milliampere point is measured	Voltage at the milliampere point is outside of the measuring range
USER **DCMAX** USER **DCMIN**	Voltage at the milliampere point is within the specified range	Voltage at the milliampere point is outside of the specified range
SPD LIST *	Voltage at the milliampere point is within the specified range for the selected type of surge protection device	Voltage at the milliampere point is outside of the specified range for the selected type of surge protection device

* Table for Surge Protection Device

If the **SPD LIST** function is selected (SURGE PROTECTION DEVICE TABLE), a specific type and manufacturer/distributor is suggested at the display, voltage at the milliampere point is displayed and further information may appear as well.
The required type of surge protection device can be selected with the ▲ **U**TEST and ▼ **U**TEST keys.

If the ⚠ symbol is included in the description of the surge protection device, the manufacturer's instructions must be observed for the respective device type.

The actual measurement is performed as follows:

➪ Select measurement of surge protection devices with the **RISO/USPD** key, and select the desired sub-function with the **FUNC** key (see also description above). Example:

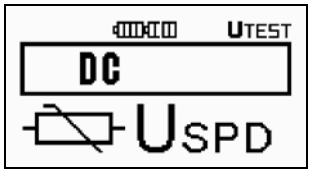


Figure 3.11: Surge Protection Device Measurement Menu, DC Function

➪ Connect the test probes to the surge protection device in accordance with the manufacturer's instructions.

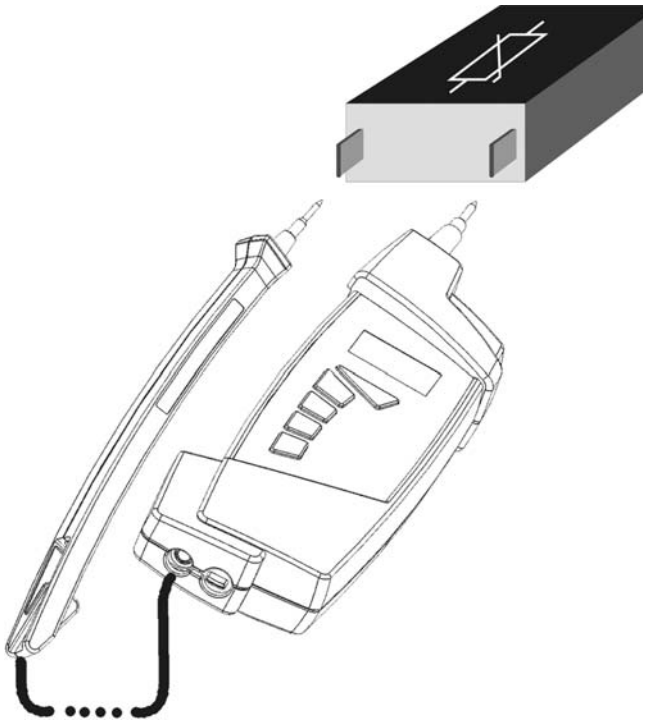


Figure 3.12: Connection Example

Note

If a voltage of greater than about 10 V is present at the measured surge protection device, its value is displayed and the **START** key is disabled (see section 3.3.1 on page 4). Eliminate the source of interference voltage before restarting the measurement.

➪ Trigger measurement by pressing the **START** key. Release the **START** key as soon as measurement is started. Rising current at the surge protection device is displayed by means of a bar graph. At the same time, the measuring voltage value appears at the display in the **UIN** field. Measurement is ended automatically.

➪ Read voltage measured at the milliampere point.

Note

The device under test may not be disconnected from the test instrument as long as the "!" warning symbol is lit up.

After insulation measurement has been completed, any remaining residual voltage is displayed as **UIN**, which may result from cable capacitance. Contact to the device under test must be maintained for as long as the capacitive DUT is being discharged via the test instrument's internal resistor. The falling voltage value can be observed directly at the **UIN** display. Do not disconnect the DUT until voltage **UIN** is less than 25 V!

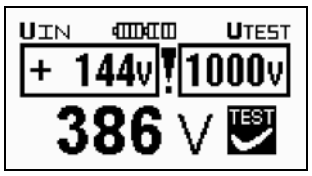


*Figure 3.13: Sample Results for the **USPD** Measurement (discharging is active: residual voltage = 144 V)*

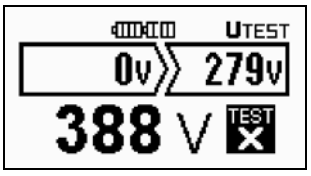


*Figure 3.14: Further Sample Results for the **USPD** Measurement (DUT is fully discharged: residual voltage = 0 V)*

Comments

- Before measuring surge protection devices, disconnect them from the installation.
- It's advisable to study the circuit before performing measurement. Surge protection devices are currently equipped with integrated interference suppression filters and the like, which may influence measurement results.

3.4 Further Device Functions

Select Language, Query Firmware Version

Before selecting a language or querying the firmware version, disconnect both test probes from the device under test / measuring circuit and switch the test instrument off.

➪ Press and hold the **RISO/USPD** key while switching the test instrument on.

The firmware version and other service information appears at the display, as well as the language selection menu.

➪ Select the desired language with the corresponding key (EN = English, CZ = Czech).

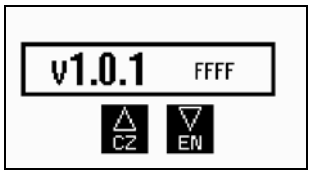


Figure 3.15: Language Selection Menu

The instrument is switched back to normal operation after a language has been selected.

Measuring Point Illumination with White LED

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

Note

No voltage may be applied to the test probes.

3.5 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 5.1 on page 7, 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 Measuring Functions

Insulation Resistance

Nominal Range per EN 61557-2: 0.100 MΩ – Rmax*

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
0.100 to 9.999 MΩ	0.001 MΩ	(2% rdg. + 10 d)	(3 % rdg. + 20 d)
10.00 to 99.99 MΩ	0.01 MΩ	(2% rdg. + 10 dd)	(3% rdg. + 20 d)
100.0 to 999.9 MΩ	0.1 MΩ	(2% rdg. + 10 d)	(3% rdg. + 20 d)
1.000 GΩ ... Rmax*	0.001 GΩ	(4% rdg. + 15 d)	(5% rdg. + 25 d)

* The Rmax value depends on the selected test voltage:

Nominal voltage of 50 to 99 V	Rmax = 1.999 GΩ
Nominal voltage of 100 to 249 V	Rmax = 3.999 GΩ
Nominal voltage of 250 to 1000 V	Rmax = 9.999 GΩ

Nom. measuring voltage	50 to 1000 V Adjustable in steps of 1 V
Measuring voltage	-0%/+10% of nominal voltage
Nom. measuring current	≥ 1 mA (where Umes > Unom)
Short-circuit current	< 3 mA
Automatic discharging of the DUT	Yes
Number of measurements	Approx. 250 (with new alkaline batteries)

Surge Protection

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
40 to 1050 V	1 V	(2% rdg. + 2 d)	(3% rdg. + 3 d)

Measuring method: Rising DC voltage when measuring the so-called milliampere point

Direct and Alternating Voltage (frequency range: 45 to 65 Hz)

Range	Resolution	Intrinsic Uncertainty	Measuring Uncertainty
0 to 600 V	1 V	(2% rdg. + 2 d)	(3% rdg. + 3 d)

Key

a) The TRMS value for alternating voltage is measured.
b) 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 ± 2° C
Relative humidity	40 to 60%
Device position	Any

Ambient Conditions

Operating Conditions

Operating temperature	0 to 40° C
Relative humidity	Max. 85%, no condensation allowed
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. 1,000 measurements (with 500 V test voltage on 500 kΩ)

Electrical Safety

Measuring category	CAT III / 300 V or CAT II / 600 V
Pollution degree	2
Protection class	II

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 Maintenance

5.1 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.

5.1.1 Inserting and Replacing the Batteries

Loosen the two screws for the battery compartment lid at the back of the instrument and remove the lid. Insert the batteries with correct polarity (refer to the embossed symbols at the bottom of the battery compartment).

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

5.1.2 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 2.1). Charging takes approximately 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.

5.2 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.

5.3 Recalibration

The measuring tasks performed with your instrument, and the stressing it's subjected to, influence aging of its components and may result in deviation from the specified levels of accuracy.

In the case of strict measuring accuracy requirements, as well as in the event of use at construction sites with frequent stress due to transport and considerable temperature fluctuation, we recommend a relatively short calibration interval of once per year. If your instrument is used primarily in the laboratory and indoors without considerable climatic or mechanical stressing, a calibration interval of once every 2 to 3 years is sufficient as a rule.

During recalibration at an accredited calibration laboratory (DIN EN ISO/IEC 17025), deviations from traceable standards demonstrated by your measuring instrument are documented. Ascertained deviations are used to correct display values during later use of the instrument.

We would be happy to perform DAkkS or factory calibration for you at our calibration laboratory. Further information is available at our website:

www.gossenmetrawatt.com (→ Company → DAkkS Calibration Center *or* → FAQs → General – Calibration Questions and Answers).

Recalibration of your instrument at regular intervals is essential for the fulfillment of requirements according to quality management systems per DIN EN ISO 9001.

* Examination of the specification, as well as adjustment, are not included in calibration. However, in the case of our own products, any required adjustment is performed and adherence to the specification is confirmed.

6 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 Nürnberg, 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.

7 Product Support

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

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