GOSSEN METRAWATT

GEOHM PRO and XTRA

Earth Tester (without/with GPS)

3-349-915-03
2/4.17

Table of Contents

1 Safety

GEOHM PRO and XTRA measuring instruments are used to conduct measurements whose results indicate the safety status of the tested system. Within this context, the following recommendations must be adhered to in order to ensure correct operation and the correctness of the obtained results:

- Before using the instrument, the operator must fully familiarize him or herself with the instructions and observe applicable safety regulations, as well as the manufacturer's recommendations.
- GEOHM PRO and XTRA measuring instruments are intended for measuring earth resistance, protective and equipotential bonding conductor connections and earth resistance in the ground, and for current measurement with clamp meter. Use of the instrument for any purpose other than those specified in these instructions may result in damage and represents a serious source of danger for the user.
- The instrument may only be operated by appropriately qualified persons who are also authorized to perform measurements in electrical systems. Handling of the instrument by unauthorized persons may result in damage to the device and represents a serious source of danger for the user.
- Use of these instructions does not eliminate the need to comply with work safety and fire prevention regulations which are applicable to the execution of this type of work. The responsible occupational safety officer must be consulted before beginning work with the instrument under special conditions, for example in an environment where the risk of explosion or fire prevails.
- The following are impermissible:
  ⇒ Use of an instrument which is damaged or whose function is fully or partially impaired
  ⇒ Use of an instrument with a cable whose insulation is damaged
  ⇒ Use of an instrument which has been stored for an excessively long period of time under unfavorable conditions (e.g. high humidity). **After moving the test instrument from a cold to a warm environment with high humidity, no measurements may be conducted until the instrument has warmed up to ambient temperature (approx. 30 minutes).**
- Before measurement, it must be assured that the cables are connected to the appropriate measurement sockets.
- It's impermissible to charge the integrated rechargeable batteries with any charger other than the one specified in the scope of delivery.
- The inputs of the measuring instrument are equipped with electronic overload protection, for example in case they're inadvertently connected to mains power:
  – For all input combinations
  – Up to 276 V for a period of 30 seconds
- Repairs may only be carried out by our service department (see address in section 13).
- This instrument fulfills all requirements specified in EN 61010-1 and EN 61557-1, 4 and 5.

Note:

The manufacturer reserves the right to change the appearance of the measuring instrument, as well as its equipment and its technical data.

Note:

The following message may appear if an attempt is made to install the drivers to the 64-bit version of Windows 8: "Install Failed".

Reason: Installation of drivers without digital signature is disabled as a standard feature in Windows 8.

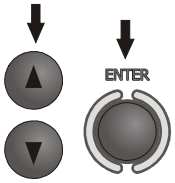
Solution: Deactivate digital signatures for the drivers in Windows.

2 Menu

The menu can be accessed regardless of the positon to which the rotary switch has been set.

1. 

Press the **MENU** key.

2. 

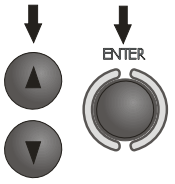
Select the desired item with the ▲ and ▼ keys. Acknowledge the selected option by pressing the **ENTER** key.

2.1 Data transmission

See section 5.

2.2 Measurement Settings

1. 

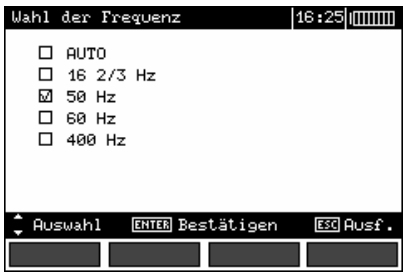
2. 

Select the desired item with the ▲ and ▼ keys. Acknowledge the selected option by pressing the **ENTER** key.

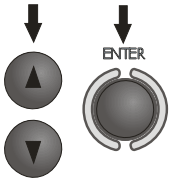
2.2.1 Line Frequency

Determining line frequency, which is a potential source of interference, is imperative for correct selection of the corresponding frequency of the measurement signal. Optimized interference filtering is only assured if measurement is conducted with the correctly selected measurement signal frequency. The measuring instrument is suitable for filtering out interference from 16⅔, 50, 60 and 400 Hz systems. The instrument is also equipped with a function for determining this parameter automatically (line frequency setting = AUTO) based on the results of an interference measurement which is conducted before earth resistance is measured. This function is active when interference voltage U_N is greater than or equal to 1 V. Otherwise, the measuring instrument uses the frequency value which was last selected in the menu.

①



②



Select a frequency with the ▲ and ▼ keys. Acknowledge your selection by pressing the **ENTER** key.

2.2.2 Calibrating C-3 Clamp Meters (Z592X)

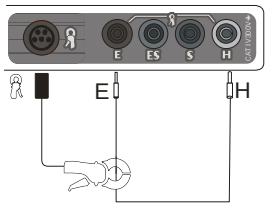
New clamp meters which have been procured for a previously purchased measuring instrument must be calibrated before initial use. They can also be calibrated at regular intervals in order to compensate for the influence of ageing of the components on measurement accuracy. This procedure is also necessary after replacing clamp meters.

①

Press the **ENTER** key after reading the initial information.

②

Follow the instructions which appear in the display shown below.



②

The following display appears after successful calibration:

The measuring instrument determines the correction factor for the connected clamp meters. This factor remains in memory even after the measuring instrument has been disconnected from supply power, until the next time the clamp meters have been successfully calibrated.

Note:

– It must be assured that the cable passes through the clamp jaws at the center when enclosed.

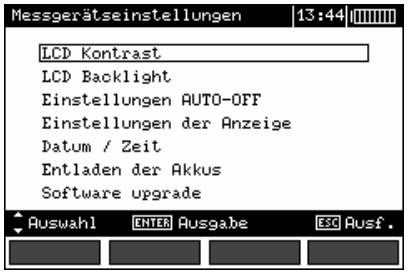
Additional Information Displayed by the Measuring Instrument

Message	Reason	Procedure
Error: Clamp meter not connected or H and E sockets short-circuited to the measurement cable.	The clamp meter is not connected.	Make sure that the clamp meter is connected to the instrument and that the conductor is enclosed, in order to trigger the flow of current in the measuring instrument.

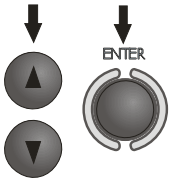
Message	Reason	Procedure
Error: Measurement cable not connected to H and E sockets! Calibration disabled.	No cable	Check the connection.
Error: Calibration coefficient not within the permissible range! Calibration disabled.	Bad calibration factor	Check the quality of the connections and/or replace the clamp meter.

2.3 Measuring Instrument Settings

①



②



Select the desired item with the ▲ and ▼ keys and acknowledge your selection by pressing the **ENTER** key.

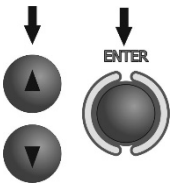
2.3.1 LCD Contrast

Adjust the contrast setting with the ▲ and ▼ keys and acknowledge by pressing the **ENTER** key.

2.3.2 LCD Illumination

1

2



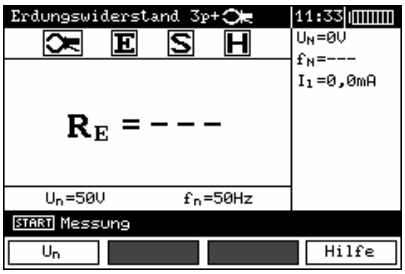
Set illumination time with the ▲ and ▼ keys and acknowledge by pressing the **ENTER** key.

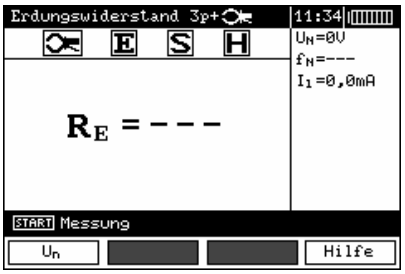
2.3.3 AUTO-OFF Settings

This setting specifies the time on non-use which elapses before the instrument is switched off. Select the duration or disable the auto-off function with the ▲ and ▼ keys and acknowledge by pressing the **ENTER** key.

2.3.4 Settings Display

This option makes it possible to show or hide the settings line. Use the ▲ and ▼ keys to show or hide the settings line (measuring parameters) and acknowledge by pressing the **ENTER** key.

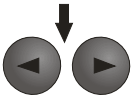




2.3.5 Date and Time

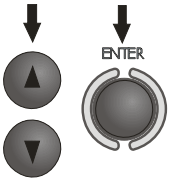
1

2



Set day, month, year, hour and minutes with the ◀ and ▶ keys.

3



Select the desired item with the ▲ and ▼ keys. Acknowledge your selection by pressing the **ENTER** key.

2.3.6 Discharging the Rechargeable Batteries

This procedure is described in detail in section 6.5.

2.4 Language Selection

- Select ****Language**** in the main menu with the ▲ and ▼ keys and press the **ENTER** key.
- Select the desired language with the ▲ and ▼ keys and acknowledge by pressing the **ENTER** key.

2.5 Information Concerning the Manufacturer

Select ****Manufacturer Information**** in the main menu with the ▲ and ▼ keys and press the **ENTER** key.

3 Measurements

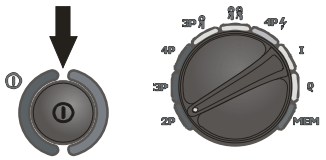
Note:

A progress bar is displayed for the duration of the measurement.

3.1 Continuity Measurement at Protective Conductors and Equalizing Leads (2-pole)

Note:
This measurement fulfills the requirements specified in EN 61557-4 (U < 24 V, I > 200 mA for R ≤ 10 Ω).

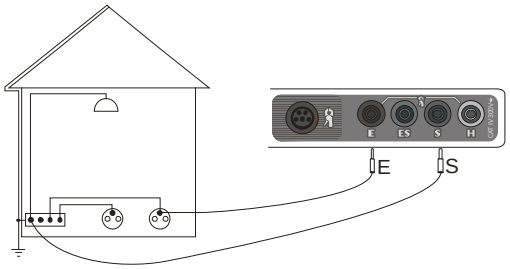
1

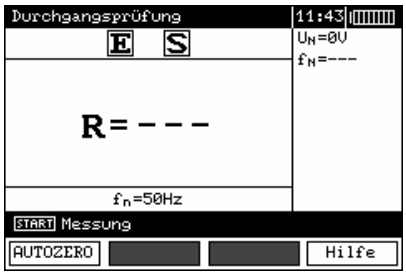


Switch the measuring instrument on. Set the function selector switch to the **2p** position.

2

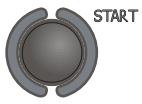
Connect terminals **S** and **E** to the device to be measured with cables.





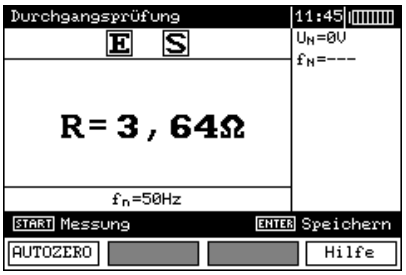
The measuring instrument is ready for measurement. Interference voltage and frequency values can be read from the auxiliary display. The line frequency selected in the menu is displayed in the settings line.

3



Press the **START** key in order to start the measurement.

4



Read the measurement results.

The results appears at the display for 20 seconds.
They can be retrieved again later by pressing the **ENTER** key.

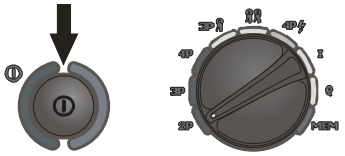
Additional Information Displayed by the Measuring Instrument

R > 19.9 kΩ	Measuring range exceeded
U_N > 40 V! and continuous acoustic signal	Voltage at the measuring terminals is greater than 50 V – measurement is disabled.
U_N > 24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
Noise	The value of the interference signal is too high – measurement results may be subject to additional uncertainty.

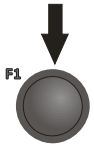
3.2 Calibrating the Measurement Cables

In order to eliminate any influence of measurement cable resistance on the measurement results, it can be compensated (automatic zeroing). The **2p** measuring function includes an **AUTOZERO** function to this end.

3.2.1 Activating Automatic Zeroing

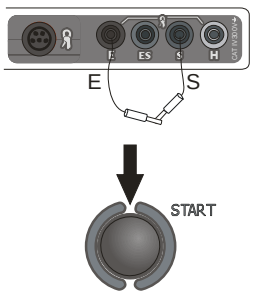
1. 

Switch the measuring instrument on. Set the function selector switch to the **2p** position.

2. 

Press the **F1** key.

3. Follow the instructions which appear at the display.

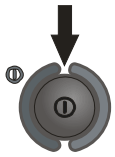
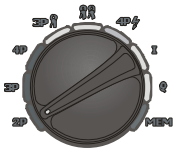


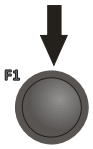
The following display appears after automatic zeroing has been completed:

4. 

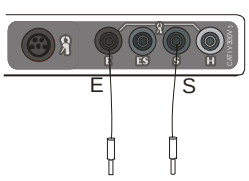
AUTOZERO appears at the right-hand side of the display in order to indicate activation of automatic zeroing.

3.2.2 Deactivating Automatic Zeroing

1.   Switch the measuring instrument on. Set the function selector switch to the **2p** position.

2.  Press the **F1** key.

3. Open the measurement cables. Press the **START** key.



After deactivation of automatic zeroing has been completed, **AUTOZERO** is cleared form the display.

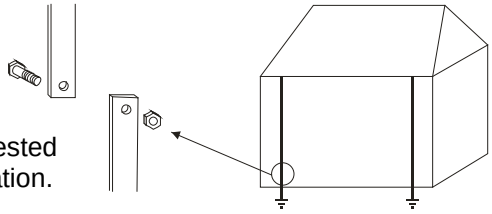
Note:

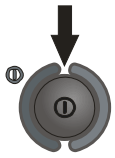
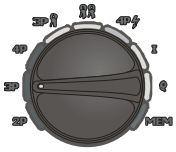
– Compensation only needs to be conducted once for the measurement cables. The value is retained by the measuring instrument even after it has been switched off.

3.3 3-Pole Measurement

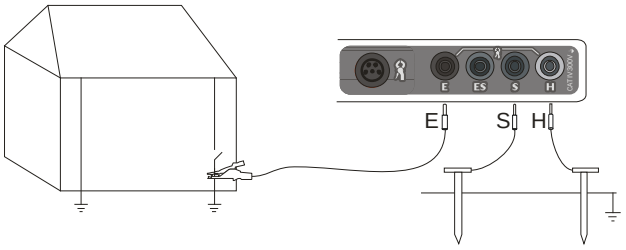
Earth resistance is measured primarily in accordance with the 3-pole method.

1. Disconnect the earthing to be tested from the installation.



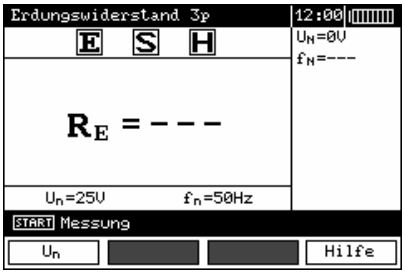
2.   Switch the measuring instrument on. Set the function selector switch to the **3p** position.

③



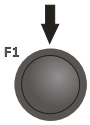
The current conducting electrode – driven into the ground – must be connected to the **H** socket at the measuring instrument. The voltage conducting electrode – driven into the ground – must be connected to the **S** socket at the measuring instrument.
The earthing to be tested must be connected to the **E** socket at the measuring instrument by means of a cable.
The earthing to be tested and the current and voltage conducting electrodes must be arranged in a straight line.

④



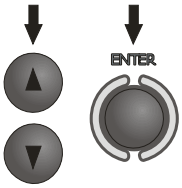
The measuring instrument is ready for measurement. Interference voltage and its frequency can be read from the auxiliary display. The line frequency selected in the menu is displayed in the settings line.

⑤



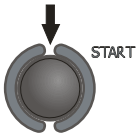
Press the **F1** key in order to change measuring voltage.

⑥



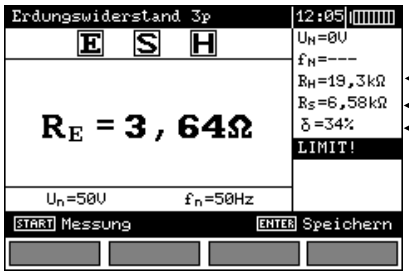
Select the desired measuring voltage with the ▲ or ▼ key and acknowledge your selection by pressing the **ENTER** key.

⑦



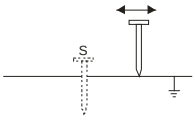
Press the **START** key in order to start the measurement.

(8) Read the results.



←Current electrode resistance
←Voltage electrode resistance
←Additional uncertainty caused by electrode resistance is displayed when δ > 30%.

The results appear at the display for 20 seconds. They can be retrieved again later by pressing the **ENTER** key.

(9) 

The measurements are repeated (points 3, 7 and 8) by shifting the voltage electrode several meters further away from or closer to the earthing to be measured. If the results of the R_E measurements differ from each other by more than 3%, the distance of the current electrode from the earthing to be measured must be increased and the measurements must be repeated.

Notes:

⚠

Measurement of earth resistance can be conducted when interference voltage does not exceed 24 V. Interference voltage is measured up to a level of 100 V, but it's identified as dangerous if it exceeds 40 V. The measuring instrument may not be connected to any voltage of greater than 100 V.

– Special attention must be paid to the quality of the connection of the test object with the measurement cable. Any paint, rust etc. must be removed from the contacts.

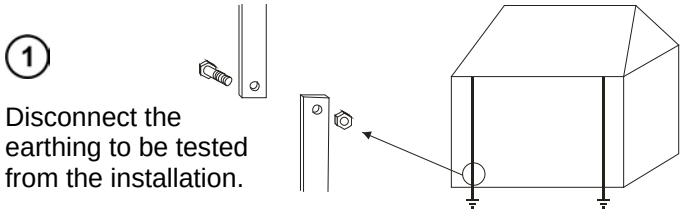
– If the resistance of the measuring probes is too great, measurement of earthing R_E is subject to additional uncertainty. Measurement becomes excessively uncertain when minimal resistance values are measured with probes which do not make good contact with the ground (this occurs when earthing is laid out properly but the upper layer of the ground is dry and is thus a poor conductor). In this case, the relationship of probe resistance to the resistance of the measured earthing is very high, as is the uncertainty of the measurement, which depends on this relationship. A calculation can be conducted in accordance with the formulas included in section 10.2, which makes it possible to estimate the influence of the measuring conditions. Contact between the probe and the ground can also be improved, for example by wetting the ground around the probe with water, driving the probe into the ground at another position or using probes with a length of 80 cm. The measurement cables must also be inspected to ensure that the insulation is not damaged and that the contacts between the cable, the banana plug and the probe are not corroded or loose. Achieved measuring accuracy is adequate in most cases. Nevertheless, the operator must always be aware of the degree of measurement uncertainty.
– If the resistance of probes **H** and **S**, either combined or individually, exceeds 19.9 kΩ, a corresponding message appears at the measuring instrument: "**Resistance of electrodes R_H and R_S greater than 19.9 kΩ! Measurement aborted!**"

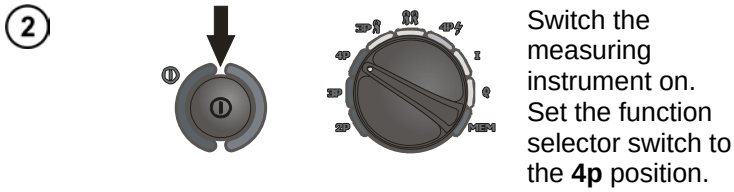
– Calibration conducted by the manufacturer takes the resistance of the included 2.2 m measurement cable into account.

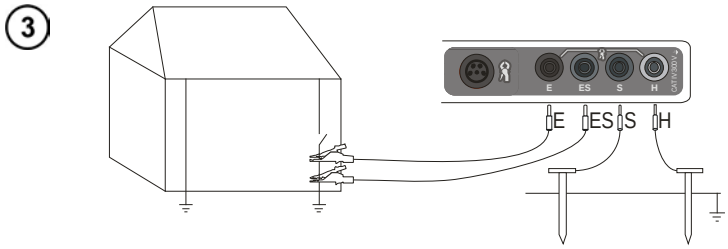
R_E > 19.9 kΩ	Measuring range exceeded
U_N > 40 V! and continuous acoustic signal	Voltage at the measuring terminals is greater than 40 V – measurement is disabled.
U_N > 24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
LIMIT!	Uncertainty of resistance at the electrodes > 30% (the measured values are used in order to calculate uncertainty)
Noise	The value of the interference signal is too high – the measurement result may be subject to additional uncertainty.

3.4 4-Pole Measurement

The 4-pole method is recommended for the measurement of earth resistances with very small values. It permits the elimination of influence on the measurement results caused by the resistance of the measurement cables. Use of the function intended for this measurement (see section 3.9) is recommended for determining earth resistance of the ground.

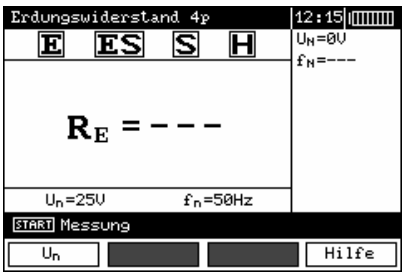






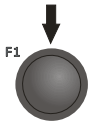
The current conducting electrode – driven into the ground – must be connected to the **H** socket at the measuring instrument. The voltage conducting electrode – driven into the ground – must be connected to the **S** socket at the measuring instrument.
The earthing to be tested must be connected to the **E** socket at the measuring instrument by means of a cable.
Socket **ES** must be connected to the earthing to be tested underneath cable **E**.
The earthing to be tested and the current and voltage conducting electrodes must be arranged in a straight line.

④



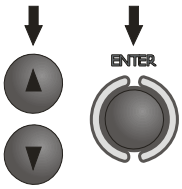
The measuring instrument is ready for measurement. Interference voltage and its frequency can be read from the auxiliary display. The line frequency selected in the menu is displayed in the settings line.

⑤



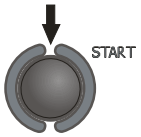
Press the **F1** key in order to change measuring voltage.

⑥



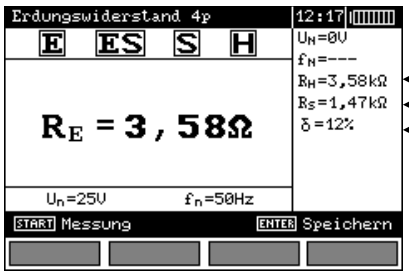
Select the desired measuring voltage with the ▲ or ▼ key and acknowledge your selection by pressing the **ENTER** key.

⑦



Press the **START** key in order to start the measurement.

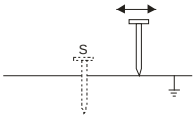
⑧ Read the results.



← Current electrode resistance
← Voltage electrode resistance
← Additional uncertainty caused by electrode resistance

The results appear at the display for 20 seconds. They can be retrieved again later by pressing the **ENTER** key.

9



The measurements are repeated (points 3, 7 and 8) by shifting the voltage electrode several meters further away from or closer to the earthing to be measured. If the results of the R_E measurements differ from each other by more than 3%, the distance of the current electrode from the earthing to be measured must be increased and the measurements must be repeated.

Notes:

⚠

Measurement of earth resistance can be conducted when interference voltage does not exceed 24 V. Interference voltage is measured up to a level of 100 V, but it's identified as dangerous if it exceeds 40 V. The measuring instrument may not be connected to any voltage of greater than 100 V.

– Special attention must be paid to the quality of the connection of the test object with the measurement cable. Any paint, rust etc. must be removed from the contacts.

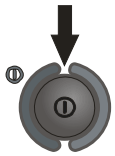
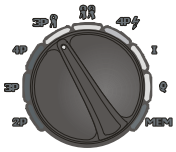
– If the resistance of the measuring probes is too great, measurement of earthing R_E is subject to additional uncertainty. Measurement becomes excessively uncertain when minimal resistance values are measured with probes which do not make good contact with the ground (this occurs when earthing is laid out properly but the upper layer of the ground is dry and is thus a poor conductor). In this case, the relationship of probe resistance to the resistance of the measured earthing is very high, as is the uncertainty of the measurement, which depends on this relationship. A calculation can be conducted in accordance with the formulas included in section 10.2, which makes it possible to estimate the influence of the measuring conditions. Contact between the probe and the ground can also be improved, for example by wetting the ground around the probe with water, driving the probe into the ground at another position or using probes with a length of 80 cm. The measurement cables must also be inspected to ensure that the insulation is not damaged and that the contacts between the cable, the banana plug and the probe are not corroded or loose. Achieved measuring accuracy is adequate in most cases. Nevertheless, the operator must always be aware of the degree of measurement uncertainty.

– If the resistance of probes **H** and **S**, either combined or individually, exceeds 19.9 kΩ, a corresponding message appears at the measuring instrument: "**Resistance of electrodes R_H and R_S greater than 19.9 kΩ! Measurement aborted!**"

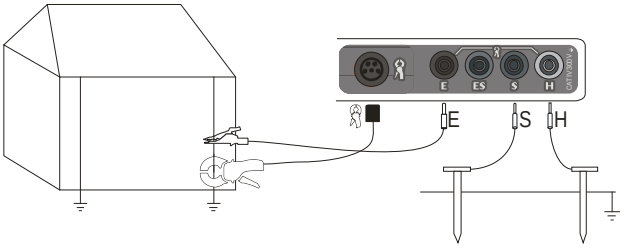
Additional Information Displayed by the Measuring Instrument

R_E>19.9 kΩ	Measuring range exceeded
U_N>40 V! and continuous acoustic signal 🔊	Voltage at the measuring terminals is greater than 40 V – measurement is disabled.
U_N>24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
LIMIT!	Uncertainty of resistance at the electrodes > 30% (the measured values are used in order to calculate uncertainty)
Noise	The value of the interference signal is too high – measurement results may be subject to additional uncertainty.

3.5 3-Pole + Clamp Meter Measurement

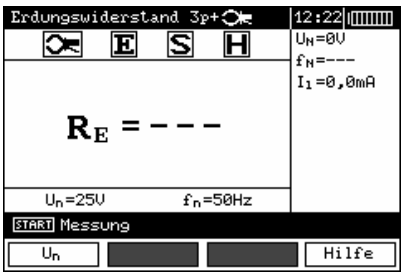
①  

Switch the measuring instrument on. Set the function selector switch to the **3p** position.

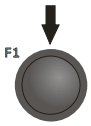
② 

The current conducting electrode – driven into the ground – must be connected to the **H** socket at the measuring instrument. The voltage conducting electrode – driven into the ground – must be connected to the **S** socket at the measuring instrument.
The earthing to be tested must be connected to the **E** socket at the measuring instrument by means of a cable.
The earthing to be tested and the current and voltage conducting electrodes must be arranged in a straight line.

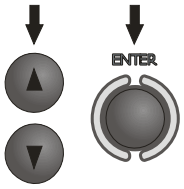
The clamp meter must be closed around the earthing to be tested underneath the connection point for cable **E**.



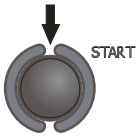
The measuring instrument is ready for measurement. Interference voltage and its frequency, as well as the RMS value of current flowing through the clamp meter, can be read from the auxiliary display. The line frequency selected in the menu is displayed in the settings line.

③ 

Press the **F1** key in order to change measuring voltage

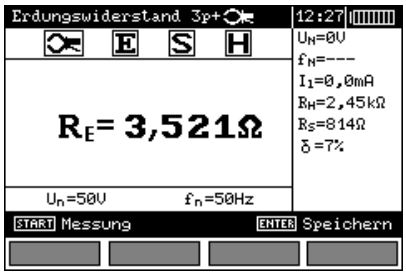
④ 

Select the desired measuring voltage with the ▲ or ▼ key and acknowledge your selection by pressing the **ENTER** key.

⑤ 

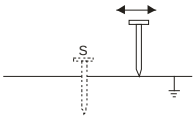
Press the **START** key in order to start the measurement.

⑥ Read the results.



Current electrode resistance
Voltage electrode resistance
Additional uncertainty caused by electrode resistance

The results appears at the display for 20 seconds. They can be retrieved again later by pressing the **ENTER** key.

⑦ 

The measurements are repeated (points 2 and 5) by shifting voltage electrode S several meters further away from or closer to the earthing to be measured. If the results of the R_E measurements differ from each other by more than 3%, the distance of the current electrode from the earthing to be measured must be increased and the measurements must be repeated.

Notes:

⚠
Flexible current clamps are not suitable for this measurement.

⚠
Measurement of earth resistance can be conducted when interference voltage does not exceed 24 V. Interference voltage is measured up to a level of 100 V, but it's identified as dangerous if it exceeds 40 V. The measuring instrument may not be connected to any voltage of greater than 100 V.

– The clamp meter is not included in the scope of delivery. Order information can be found in the data sheet.

– The clamp meter must be calibrated before initial use. It can also be calibrated at regular intervals in order to avoid the influence of ageing of the components on measurement accuracy. The **menu** includes an option for calibrating the clamp meter.

– Special attention must be paid to the quality of the connection of the test object with the measurement cable. Any paint, rust etc. must be removed from the contacts.

– If the resistance of the measuring probes is too great, measurement of earthing R_E is subject to additional uncertainty. Measurement becomes excessively uncertain when minimal resistance values are measured with probes which do not make good contact with the ground (this occurs when earthing is laid out properly but the upper layer of the ground is dry and is thus a poor conductor). In this case, the relationship of probe resistance to the resistance of the measured earthing is very high, as is the uncertainty of the measurement, which depends on this relationship. A calculation can be conducted in accordance with the formulas included in section 10.2, which makes it possible to estimate the influence of the measuring conditions. Contact between the probe and the ground can also be improved, for example by wetting the ground around the probe with water, driving the probe into the ground at another position or using probes with a length of 80 cm. The measurement cables must also be inspected to ensure that the insulation is not damaged and that the contacts between the cable, the banana plug and the probe are not corroded or loose. Achieved measuring accuracy is adequate in most cases. Nevertheless, the operator must always be aware of the degree of measurement uncertainty.

– If the resistance of probes **H** and **S**, either combined or individually, exceeds 19.9 kΩ, a corresponding message appears at the measuring instrument: "**Resistance of electrodes R_H and R_S greater than 19.9 kΩ! Measurement aborted!**"

– Calibration conducted by the manufacturer takes the resistance of the included 2.2 m measurement cable into account.

Additional Information Displayed by the Measuring Instrument

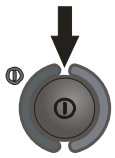
R_E > 1.99 kΩ	Measuring range exceeded
U_N > 40 V! and continuous acoustic signal	Voltage at the measuring terminals is greater than 40 V – measurement is disabled.
U_N > 24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
Noise	The value of the interference signal is too high – measurement results may be subject to additional uncertainty.
LIMIT!	Uncertainty of resistance at the electrodes > 30% (the measured values are used in order to calculate uncertainty)
I_L > max	Interference current is too high – measuring error may be greater than primary error.

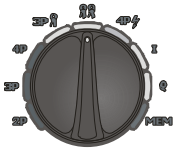
3.6 Measurement with Two Clamp Meters (Z592X/Y)

Measurement with two clamp meters is used where it's not possible to drive the electrodes into the ground.

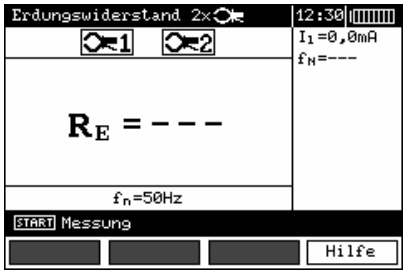
> **Caution!**
> The two clamp meter method can only be used for the measurement of multiple earthing.

1



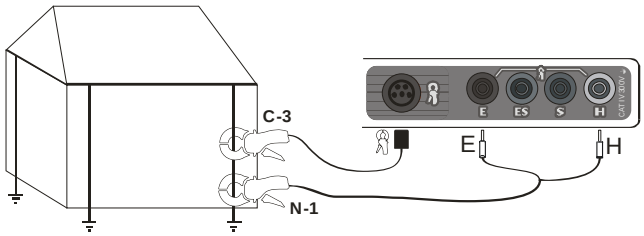


Switch the measuring instrument on. Set the function selector switch to the position.



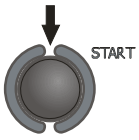
The measuring instrument is ready for measurement. Amperage of the current flowing through the clamp meters, as well as its frequency, can be read from the auxiliary display.

2



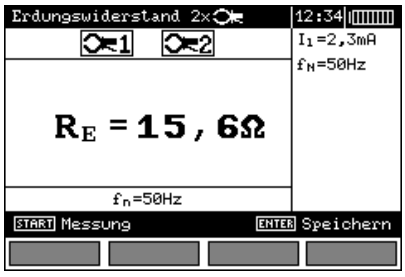
The clamps must be closed around the earthing to be tested at a distance of 30 cm from each other.
The emitting clamp meter must be connected to sockets **H** and **E**, and the receiving clamp meter must be connected to the clamp meter socket.

3



Press the **START** key in order to start the measurement.

4



Read the measurement results.

The results appear at the display for 20 seconds. They can be retrieved again later by pressing the **ENTER** key.

Notes:

⚠
Measurements can be conducted when interference current does not exceed a value of 3 A RMS and frequency is the same as the frequency value selected in the menu.

⚠
The flexible current transformer is not suitable for this measurement.

– The clamp meters are not included in the scope of delivery and must be purchased separately.
– The clamp meters must be calibrated before initial use. They can also be calibrated at regular intervals in order to avoid the influence of ageing of the components on measurement accuracy. The **menu** includes an option for calibrating the clamp meters.
– If clamp meter current is too low, a corresponding message is displayed at the measuring instrument: "**Measured current too low. Measurement not possible!**"

Additional Information Displayed by the Measuring Instrument

R_E > 149 kΩ	Measuring range exceeded
U_N>40 V! and continuous acoustic signal 🔊	Voltage at the measuring terminals is greater than 40 V – measurement is disabled.
U_N>24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
Noise	The value of the interference signal is too high – measurement results may be subject to additional uncertainty.

3.7 4-Pole Measurement ϟ (according to the pulse method)

The pulse method is used for measurement of dynamic impedance of lightning rod earthing. It may not be used for the measurement of protective earthing and operational earthing.

The considerable steepness of the edge of the test pulse has a significant influence on earthing impedance due to the inductivity of the earth. For this reason, earthing impedance depends on length, and on the steepness of the test pulse's edge.

The inductivity of the earthing causes shifting between the current peaks, as well as a resultant voltage drop. And thus earthings with low resistance (measured using the low-frequency method) which are located at a considerable from each other may have a significantly higher impedance value.

Pulse impedance is calculated with the following formula:

$$Z_E = \frac{U_S}{I_S}$$

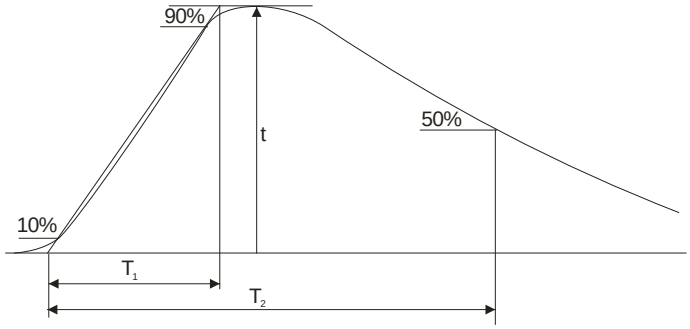
where U_S and I_S are the peak values of voltage and current respectively

Resultant earthing impedance is determined with the pulse method. And thus the control terminals may not be unscrewed.

It's advisable to lay the cables apart from each other so that the angle between them is at least 60°.

Note:
The measurement cables must be fully unwound. Measurement results may otherwise be distorted.

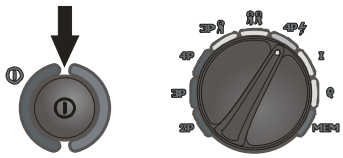
The figure below explains the meaning of the numbers which determine the pulse form (in accordance with EN 62305-1, Protection against lightning – Part 1: General principles).



t = amplitude of the current
T_1 = duration of the edge
T_2 = time until semi-peak

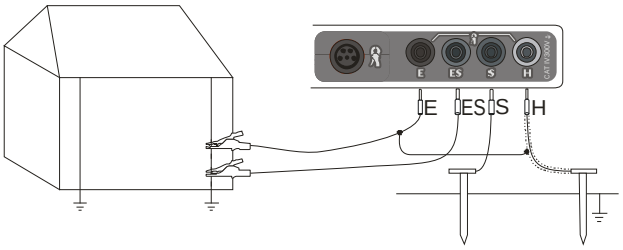
The pulse form determines the relationship T_1/T_2, for example 4/10 µs.

1



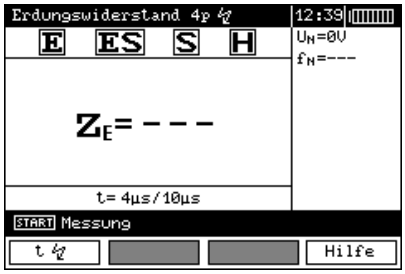
Switch the measuring instrument on. Set the function selector switch to the **4p** position.

2



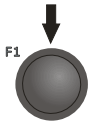
The current electrode, driven into the ground, must be connected to the **H** socket at the measuring instrument via a shielded cable.
The voltage electrode, driven into the ground, must be connected to the **S** socket at the measuring instrument.
The earthing to be tested must be connected to the **E** socket at the measuring instrument and to the shielding of the H cable.
The **ES** socket must be connected with a cable to the earthing to be tested underneath the **E** cable.
The earthing to be tested, as well as the current and voltage electrodes, must be arranged such that the angle between the measurement cables is at least 60°.

3



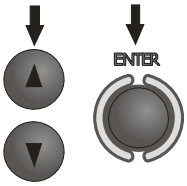
The measuring instrument is ready for measurement. Interference voltage and its frequency can be read from the auxiliary display. The line frequency selected in the menu is displayed in the settings line.

④



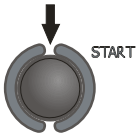
Press the **F1** key in order to change the form of the measuring pulse.

⑤



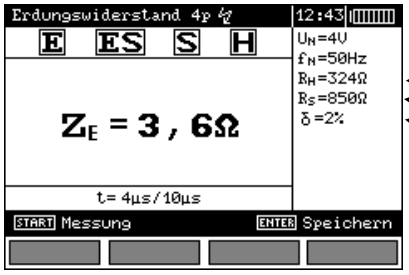
Select the desired pulse form with the ▲ and ▼ keys and acknowledge your selection by pressing the **ENTER** key.

⑥



Press the **START** key in order to start the measurement.

⑦ Read the results.



← Current electrode resistance
← Voltage electrode resistance
← Additional uncertainty caused by electrode resistance

The results appears at the display for 20 seconds. They can be retrieved again later by pressing the **ENTER** key.

Notes:

⚠

Measurement of earthing impedance can be conducted when interference voltage does not exceed 24 V. Interference voltage is measured up to a level of 100 V, but it's identified as dangerous if it exceeds 40 V. The measuring instrument may not be connected to any voltage of greater than 100 V.

– The 4/20 µs pulse form is possible with software version 2.04.

– R_H and R_S are measured in accordance with the low-frequency method.

– Special attention must be paid to the quality of the connection of the test object with the measurement cable. Any paint, rust etc. must be removed from the contacts.

– If the resistance of the measuring probes is too great, measurement of earthing Z_E is subject to additional uncertainty. Measurement becomes excessively uncertain when minimal resistance values are measured with probes which do not make good contact with the ground (this occurs when earthing is laid out properly but the upper layer of the ground is dry and is thus a poor conductor). In this case, the relationship of probe resistance to the resistance of the measured earthing is very high, as is the uncertainty of the measurement, which depends on this relationship. A calculation can be conducted in accordance with the formulas included in section 10.2, which makes it possible to estimate the influence of the measuring conditions. Contact between the probe and the ground can also be improved, for example by wetting the ground around the probe with water, driving the probe into the ground at another position or using probes with a length of 80 cm. The measurement cables must also be inspected to ensure that the insulation is not damaged and that the contacts between the cable, the banana plug and the probe are not corroded or loose. Achieved measuring accuracy is adequate in most cases. Nevertheless, the operator must always be aware of the degree of measurement uncertainty.

– If the resistance of probes **H** and **S**, either combined or individually, exceeds 1 kΩ, a corresponding message appears at the measuring instrument: "**Resistance of electrodes R_H and R_S greater than 1 kΩ! Measurement aborted!**"

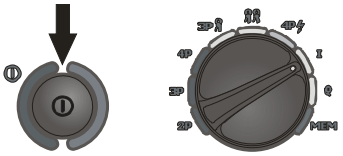
Additional Information Displayed by the Measuring Instrument

R_D > 199 Ω	Measuring range exceeded
U_N>40 V! and continuous acoustic signal	Voltage at the measuring terminals is greater than 40 V – measurement is disabled.
U_N>24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
LIMIT!	Uncertainty of resistance at the electrodes > 30% (the measured values are used in order to calculate uncertainty)
Noise	The value of the interference signal is too high –measurement results may be subject to additional uncertainty.

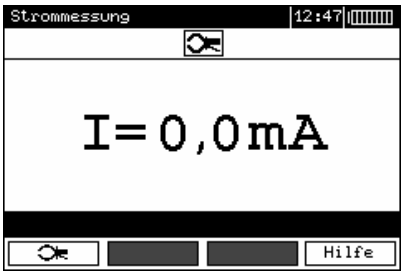
3.8 Current Measurement

This function makes it possible to measure the RMS current value when using a clamp meter. For example, it can be used to measure the flow of current in the system to be tested. Selection can be made between two different clamp types, the C-3 of the GEOMFLEX1, which differ with regard to diameter and current measuring ranges (see technical data).

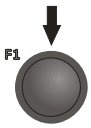
1



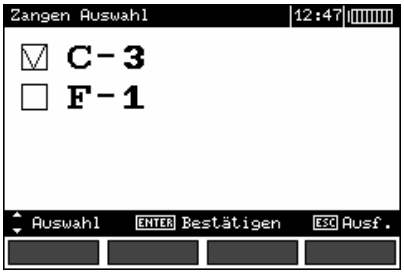
Switch the measuring instrument on. Set the function selector switch to the **I** position.



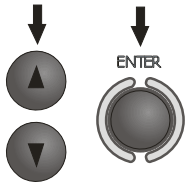
2



Press the **F1** key in order to select the desired clamp meter type.



3



Select the desired clamp meter type with the ▲ and ▼ keys and acknowledge your selection by pressing the **ENTER** key.

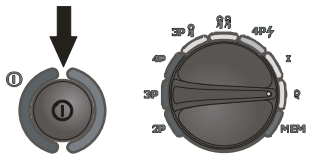
Notes:

– This measurement is conducted continuously without any option for storage.
– Only large currents of greater than 1 A can be measured with the GEOMFLEX1 flexible clamp meter.

3.9 Measuring Soil Resistivity

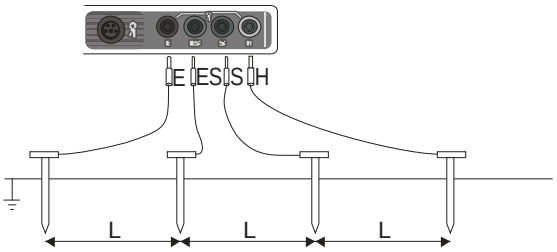
A special function has been provided for the measurement of earth resistance in the ground, which is used for planning earthing system projects and in the field of geology. This function is selected by turning the rotary switch to the ρ position. Metrologically, it's identical to the function for 4-pole measurement of earth resistance, but it also includes an additional procedure for recording the distance between the electrodes. The measurement result is the resistance value, which is calculated automatically with the formula $\rho = 2\pi L R_E$ that's also used for the measuring method according to Wenner. This method assumes that the electrodes are at equal distances from each other.

1

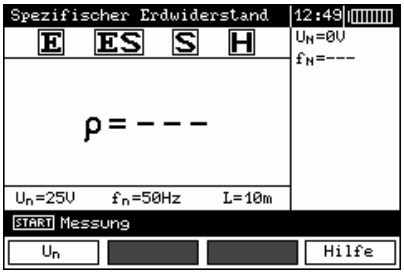


Switch the measuring instrument on. Set the function selector switch to the **ρ** position.

2

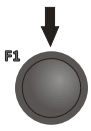


The four probes which have been driven into the ground at equal distances from each other must be connected to the measuring instrument in accordance with the illustration shown above.



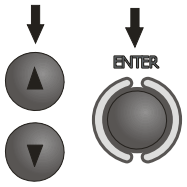
The measuring instrument is ready for measurement. Interference voltage and its frequency can be read from the auxiliary display. The following appear in the settings line:
measuring voltage, line frequency selected in the **menu** and the distance between the electrodes.

3



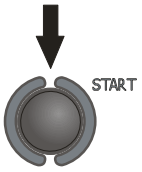
Press the F1 key in order to change measuring voltage.

④



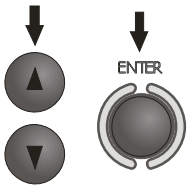
Select the desired measuring voltage with the ▲ and ▼ keys and acknowledge your selection by pressing the **ENTER** key.

⑤



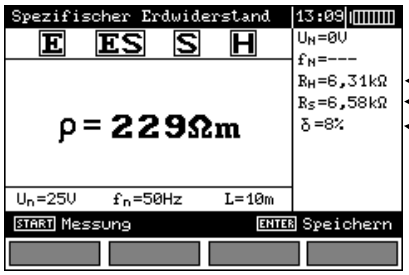
Press the **START** key in order to access the operating mode for selecting the distance between the probes.

⑥



Select the distance between the probes with the ▲ and ▼ keys and press the **ENTER** in order to start the measurement.

⑦ Read the measurement results.



← Current electrode resistance
← Voltage electrode resistance
← Additional uncertainty caused by electrode resistance

The results appears at the display for 20 seconds. They can be retrieved again later by pressing the **ENTER** key.

Notes:

⚠

Measurement of earth resistance can be conducted when interference voltage does not exceed 24 V. Interference voltage is measured up to a level of 100 V, but it's identified as dangerous if it exceeds 40 V. The measuring instrument may not be connected to any voltage of greater than 100 V.

– The calculations assume that the distances between the individual measuring electrodes are identical (Wenner method). If this is not the case, measurement must be performed in accordance with the 4-pole method and calculation must be executed manually.

– Special attention must be paid to the quality of the connection of the test object with the measurement cable. Any paint, rust etc. must be removed from the contacts.

– If the resistance of the measuring probes is too great, measurement of earthing R_E is subject to additional uncertainty. Measurement becomes excessively uncertain when minimal resistance values are measured with probes which do not make good contact with the ground (this occurs when earthing is laid out properly but the upper layer of the ground is dry and is thus a poor conductor). In this case, the relationship of probe resistance to the resistance of the measured earthing is very high, as is the uncertainty of the measurement, which depends on this relationship. A calculation can be conducted in accordance with the formulas included in section 10.2, which makes it possible to estimate the influence of the measuring conditions. Contact between the probe and the ground can also be improved, for example by wetting the ground around the probe with water, driving the probe into the ground at another position or using probes with a length of 80 cm. The measurement cables must also be inspected to ensure that the insulation is not damaged and that the contacts between the cable, the banana plug and the probe are not corroded or loose. Achieved measuring accuracy is adequate in most cases. Nevertheless, the operator must always be aware of the degree of measurement uncertainty.

– If the resistance of probes **H** and **S**, either combined or individually, exceeds 19.9 kΩ, a corresponding message appears at the measuring instrument: "**Resistance of electrodes R_H and R_S greater than 19.9 kΩ! Measurement aborted!**"

Additional Information Displayed by the Measuring Instrument

R_E > 999 kΩm	Measuring range exceeded
U_N>40 V! ! and continuous acoustic signal 🔊	Voltage at the measuring terminals is greater than 40 V – the keyboard is disabled.
U_N>24 V!	Voltage at the measuring terminals is greater than 24 V but less than 40 V – measurement is disabled.
LIMIT!	Uncertainty of resistance at the electrodes > 30% (the measured values are used in order to calculate uncertainty)
Noise	The value of the interference signal is too high –measurement results may be subject to additional uncertainty.

4 Memory

The GEOHM PRO and XTRA measuring instruments are equipped with a memory module for 990 resistance measurement results. The memory location to which an individual result is saved is called a memory cell and is designated “measurement” in the measuring instrument. The overall memory module is subdivided into 10 banks with 99 memory cells each. Each result can be saved to a cell in the desired memory bank with a selected number. The user can assign cell numbers to the individual measuring points and bank numbers to the individual objects as desired, can execute measurements in any desired order and repeat them without losing previous data.

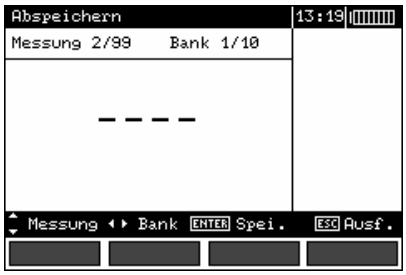
Measurement results are retained by the measuring instrument even after it has been switched off. Consequently, they can be read out at a later point in time or transferred to a computer. The number of the current cell and of the current bank remain unchanged as well.

We recommend clearing memory after reading out the data or before starting a new measurement series which will be saved to the same cells as the previous series.

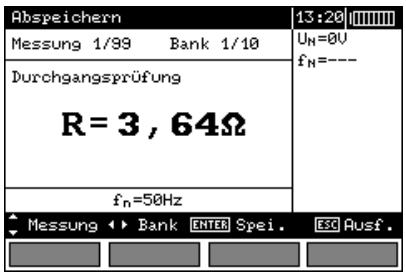
4.1 Saving Measurement Results

(1) 

Press the **ENTER** key after completing the measurement.



Vacant cell



Occupied cell

(2) Select the measurement (cell) with the ▲ and ▼ keys. Select the memory bank with the ◄ and ► keys. Press the **ENTER** key to save the measurement results.

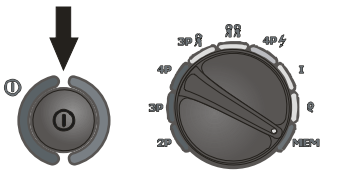
(3) The following warning appears if an attempt is made to save results to a occupied cell:

(4) After selecting the desired option with the ◄ and ► keys, press the **ENTER** key.

4.2 Clearing Memory

Note:

A progress bar is displayed for the duration of the memory clearing operation.

1. 

Switch the measuring instrument on. Set the function selector switch to the **MEM** position.

2. 
Select “Clear memory” with the ▲ and ▼ keys.

3. 

Press the **ENTER** key.

4. 
Select deletion of the entire memory, the memory bank or the measurement with the ▲ and ▼ keys.

5. Follow the instructions which appear at the measuring instrument.

4.3 Scrolling Through the Memory

① 

Select “Scroll through memory” with the ▲ and ▼ keys.

② 

Press the **ENTER** key.

③ Use the ◄ and ► keys to select the memory bank and the ▲ and ▼ keys to select the memory cell.

Note:

– When scrolling through memory, measurements and empty memory banks are not accessible. The entry “Measurement 1/20” means the first of twenty measurements – measurements 21 through 99 are empty an cannot be accessed. The same principle applies to the memory banks. If saving is discontinuous, measurements and empty memory banks are skipped when scrolling.

5 Data transmission

Note:

– No data transmission is possible while the batteries are being charged.

5.1 Features Package for Working in Combination with a Computer

A USB cable and appropriate programing are required in order for the measuring instrument to function together with a computer. If programming has not been purchased along with the measuring instrument, it can be obtained from either the manufacturer or an authorized sales representative.

5.2 Data Transmission via USB

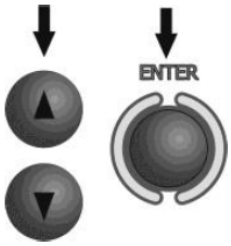
1 Set the rotary switch to the MEM position.
2 Connect the cable to the USB port at the computer and the measuring instrument's USB socket.
3 Start the program.

5.3 GPS Settings

The GEOHM XTRA is an expanded variant of the GEOHM PRO with an additionally integrated GPS module for storing the positions of test objects.

1

2



Select activation or deactivation of the GPS function with the ▲ and ▼ keys. Press the **ENTER** key to acknowledge your selection.

Notes:
Activation of the GPS function when measuring resistance (specific resistance) is indicated by the symbol in the upper left-hand corner of the display. A blinking symbol indicates that there's no GPS coverage.

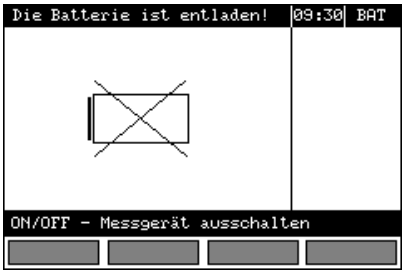
6 Measuring Instrument Power Supply

Note:
The GEOHM PRO and XTRA measuring instruments can only be operated with the included charger in order to recharge the internal battery.

6.1 Monitoring Supply Voltage

The battery charge level is indicated continuously by the symbol in the upper right-hand corner of the display:

Batteries fully charged
Batteries discharged
Batteries depleted



Batteries are extremely depleted – measurement is disabled.

Don't forget:

- When **BAT** appears at the display, battery voltage is too low and the batteries have to be recharged.
- Measurements conducted with the measuring instrument when supply voltage is too low are subject to additional measuring uncertainty which cannot be estimated by the user and thus cannot serve as the basis for testing for correct earthing.

6.2 Recharging the Battery – Operation with the Charger

GEOHM PRO and XTRA measuring instruments are operated with a rechargeable NiMH battery. The included charger makes it possible to recharge the battery and to operate the instrument via the mains. Power can also be supplied from a car cigarette lighter.

6.3 Changing the Fuse

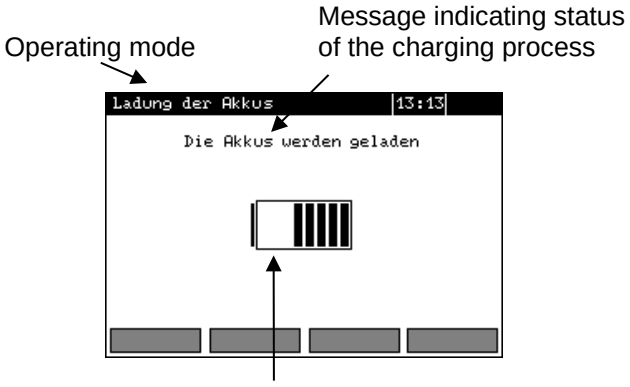
The fuse is changed at the front panel.

F2 (charging process): 2 A / 250 V, 5 x 20 mm
F1 (power supply): 1 A / 250 V, 5 x 20 mm

If the instrument or the battery charger doesn't work, check all of the fuses and replace blown fuses if necessary before sending the instrument to customer service. The fuses are in holders roughly at the middle of the compartment. Use a small tool to remove the fuses, for example a screwdriver.

6.4 Charging the Batteries

Charging begins when the power pack is connected to the measuring instrument depending on whether or not the measuring instrument is switched on. The display appears as shown below during the charging process. The batteries are charged using the “quick charge” algorithm – this process makes it possible to reduce charging time to roughly 4 hours. **Charging Finished** appears at the display when the charging process has been completed. The plug must be removed from the charger’s power pack in order to switch the instrument on.



Note:

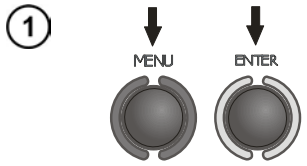
– Mains interference may cause premature interruption of the charging process. If charging time has been too short, the measuring instrument must be switched off and charging must be restarted.

Additional Information Displayed by the Measuring Instrument

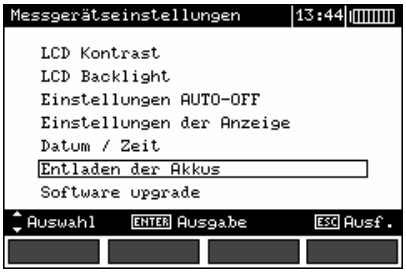
Message	Reason	Procedure
Poor battery pack contact	Excessive voltage at the battery pack during charging	Inspect the battery pack’s plug connector contacts. If no improvement ensues, replace the battery pack.
Battery pack temperature too low!	Ambient temperature is less than 10 °C.	Correct charging is not possible at these temperatures. Bring the measuring instrument to a heated room and restart the charging process. This message can also appear in the event of excessive depletion. Try switching the charger on several times in this case.
Pre-Charging failed!	The battery pack is damaged or severely depleted.	The following message appears at the moment the pre-charging process is restarted from the beginning: **Battery pack temperature too high!**, in which case the battery pack must be replaced.

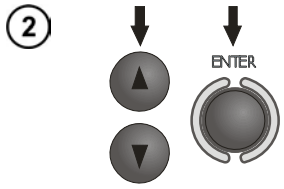
6.5 Discharging the Rechargeable Batteries

In order to ensure correct battery operation (display of the battery charge level) and to extend battery service life, the batteries should be recharged after complete discharging at regular intervals. In order to discharge the batteries:



Press the **MENU** key and select **Test Instrument Settings**.
Press the **ENTER** key.





Select **Discharge Batteries** with the ▲ and ▼ keys and then press the **ENTER** key.

Read and accept the text which is then displayed.

Discharging takes up to 10 hours depending on the battery pack's charge level and is indicated by the following display: **Discharging Process Status**.

6.6 General Rules for the Use of Rechargeable Nickel Metal Hydride Batteries (NiMH)

– When the instrument is not used for a lengthy period of time, the batteries must be removed and stored separately.

– The batteries must be stored in a cool, dry, well ventilated room and protected against direct sunlight. Ambient temperature must be kept at less than 30 °C during long periods of storage. If the batteries are stored at high temperatures for a lengthy period of time, chemical processes take place which could reduce their service life.

– NiMH batteries normally withstand 500 to 1000 recharging cycles. They don't achieve maximum power until after 2 to 3 charging and discharging cycles. The most important factor which influences rechargeable battery service life is the extent to which the battery is depleted. The greater the degree of depletion, the shorter the service life.

– The memory effect is minimal with rechargeable NiMH batteries. They can be recharged before being fully discharged (topped off) without any considerable consequences. It's nevertheless advisable to discharge them fully after several charging cycles.

– When in storage, rechargeable NiMH batteries are subject to self-discharging at a rate of roughly 30% per month. Storing the batteries at high temperatures can accelerate this process by a factor of two. In order to prevent excessive discharging of the batteries, after which they would have to be subjected to 2 or 3 complete charging and discharging cycles, they should be topped off from time to time (unused batteries as well).

– Modern, high-speed battery chargers detect excessively high or low battery temperatures and react correspondingly. An excessively low temperature should prevent the charging process from starting, because it could irreversibly destroy the battery. In contrast, a rising battery temperature indicates that charging should be ended and is a typical phenomenon. However, in addition to reducing battery service

life, charging at high ambient temperature also results in an accelerated rise in battery temperature, so that the battery is not charged to full capacity.

– One mustn't forget that in the case of quick charging, the batteries are only charged to about 80% of full capacity. Better results can be obtained by continuing to charge the batteries after quick charging: the charger is then switched to the trickle charge mode with minimal current and after a few hours, the batteries have been charged to full capacity.

– Rechargeable batteries may neither be charged nor used at extreme temperatures. Extreme temperatures reduce the service life for normal and rechargeable batteries. Setting up devices operated with rechargeable batteries in very warm location should be avoided. The nominal operating temperature should be maintained in any case.

7 Cleaning and Maintenance

Caution!
Only those maintenance procedures specified by the manufacturer in these instructions may be used.

The measuring instrument's housing can be cleaned with a soft, moist cloth and commercially available cleaners. Solvents and cleaning agents which could scratch the housing (powders, pastes etc.) may not be used.

The probes can be swabbed with water und wiped dry. Before placing into storage for a lengthy period of time, it's advisable to apply a film of any desired machine grease.

The reel and the cables can be cleaned with water and an appropriate cleaning agent, and wiped dry.

The measuring instrument's electronic system doesn't require any maintenance.

8 Storage

The following points much be observed when the measuring instrument is placed into storage:

- Disconnect all cables from the measuring instrument.
- Carefully clean the measuring instrument and all of its accessories.
- Long measurement cables must be rolled up on a reel.
- When placed into storage for a lengthy period of time, the batteries must be removed from the measuring instrument.
- The batteries should be topped off from time to time in order to prevent complete depletion during lengthy periods of storage.

9 Dismantling and Disposal

Inoperative electrical and electronic equipment must be collected separately, i.e. it must not be mixed with other trash.

Inoperative electronic equipment must be disposed of in accordance with the applicable regulations at collection points intended for this purpose.

None of the component of such devices may be dismantled by the user before disposal of the equipment at the collection point.

All local regulations regarding waste packaging materials and unusable batteries must be complied with.

10 Technical Data

- Specified accuracy makes reference to the terminals at the measuring instruments.
- Definition of primary measuring uncertainty: “rdg.” = reading, “d” = digit(s)

10.1 Primary Technical Data

Measurement of Interference Voltage U_N (RMS)

Range	Resolution	Primary Measuring Uncertainty
0 ... 100 V	1 V	±(2% rdg. + 3 d)

- Measurement for f_N 15 … 450 Hz
- Measurement frequency: at least 2 measurements per second

Measurement of Interference Frequency f_N

Range	Resolution	Primary Measuring Uncertainty
15 ... 450 Hz	1 Hz	±(1% rdg. + 2 d)

- Measurement of interference voltages > 1 V (f=--- appears for interference voltage < 1 V)

Resistance Measurement at Protective Conductors and Equalizing Leads (2-wire method)
Technical measuring method: in accordance with IEC 61557-4

Measuring range	Resolution	Primary Measuring Uncertainty
0.000 … 3.999 Ω *	0.001 Ω	±(2% rdg. + 4 d)
4.00 … 39.99 Ω	0.01 Ω	±(2% rdg. + 2 d)
40.0 … 399.9 Ω	0.1 Ω	
400 … 3999 Ω	1 Ω	
4.00 … 19.99 kΩ	0.01 kΩ	±(5% rdg. + 2 d)

* No accuracy is specified within a range of 0.000 ... 0.045 Ω.

Measurement of Earthing Resistance (3 or 4-wire method)
Technical measuring method: in accordance with IEC 61557-5

Measuring range	Resolution	Primary Measuring Uncertainty
0.000 … 3.999 Ω *	0.001 Ω	±(2% rdg. + 4 d)
4.00 … 39.99 Ω	0.01 Ω	±(2% rdg. + 2 d)
40.0 … 399.9 Ω	0.1 Ω	
400 … 3999 Ω	1 Ω	
4.00 … 19.99 kΩ	0.01 kΩ	±(5% rdg. + 2 d)

* No accuracy is specified for 3-wire measurement within a range of 0.000 ... 0.045 Ω.

Resistance Measurement at the Auxiliary Electrodes

Range	Resolution	Primary Measuring Uncertainty
0 ... 999 Ω	1 Ω	±(5% (R_E+R_H+R_S) + 8 d)
1.00 ... 9.99 kΩ	0.01 kΩ	
10.0 … 19.9 kΩ	0.1 kΩ	

Resistance Measurement of Multiple Earthing with the Help of Clamp Meters (3-wire method with clamp meters)

Technical measuring method: in accordance with IEC 61557-5

Measuring range	Resolution	Primary Measuring Uncertainty
0.000 … 3.999 Ω *	0.001 Ω	±(8% rdg. + 4 d)
4.00 ... 39.99 Ω	0.01 Ω	±(8% rdg. + 3 d)
40.0 ... 399.9 Ω	0.1 Ω	
400 ... 1999 Ω	1 Ω	

* No accuracy is specified within a range of 0.000 ... 0.045 Ω.

Loop Resistance Measurement with 2 Current Clamps

Range	Resolution	Primary Measuring Uncertainty
0.00 ... 19.99 Ω	0.01 Ω	±(10% rdg. + 3 d)
20.0 ... 149.9 Ω	0.1 Ω	±(20% rdg. + 3 d)

Measurement of Soil Resistivity, measuring method according to Wenner, $\rho = 2\pi LR_E$

Range	Resolution	Primary Measuring Uncertainty
0.0 ... 199.9 Ωm	0.1 Ωm	Depending on primary measuring uncertainty R_E in 4-pole system, but not less than ± 1 digit
200 ... 1999 Ωm	1 Ωm	
2.00 ... 19.99 kΩm	0.01 kΩm	
20.0 ... 99.9 kΩm	0.1 kΩm	
100 ... 999 kΩm	1 kΩm	

- Distance between measuring probes (L): 1 to 50 m

Current Measurement (rms)

Range	Resolution	Primary Measuring Uncertainty
0.1 ... 99.9 mA [1]	0.1 mA	±(8% rdg. + 5 d)
100 ... 999 mA [1]	1 mA	±(8% rdg. + 3 d)
1.00 ... 4.99 A [1.2]	0.01 A	±(5% rdg. + 5 d) [1] not specified [2]
5.00 ... 9.99 A [1, 2]	0.01 A	±(5% rdg. + 5 d)
10.0 ... 99.9 A [1, 2]	0.1 A	
100 ... 300 A [1, 2]	1 A	

[1] Current clamps (diameter: 52 mm) – C-3

[2] Current clamps, flexible – GEOHMFLEX1

- Frequency range: 45 ... 400 Hz

Earthing Resistance Measurement According to the Pulse Method

Range	Resolution	Primary Measuring Uncertainty
0.0 ... 99.9 Ω	0.1 Ω	±(2.5% rdg. + 3 d)
100 … 199 Ω	1 Ω	

- Burst pulse form: 4/10 µs, 8/20 µs or 10/350 µs
- Pulse measuring current: 1 A
- Voltage at the peak: 1500 V

Further Technical Data

a) Type of insulation ..... Double per EN 61010-1 and IEC 61557
b) Measuring category ..... CAT III 600 V per EN 61010-1
c) Housing protection per EN 60529 ..... IP 54
d) Max. AC + DC int. voltage at which measurement is conducted ..... 24 V
e) Max. measured interference voltage ..... 100 V
f) Max. interference current at which earthing resistance measurement is conducted using the clamp meter method ..... 3 A_{RMS}
g) Measuring current frequency ..... 125 Hz for 16⅔, 50 and 400 Hz systems, ... as well as 150 Hz for 60 Hz systems
h) Measuring voltage and current, 2-pole .... U < 24 V_{RMS}, I ≥ 200 mA for R ≤ 2 Ω
i) Measuring voltage for 3-pole, 4-pole ..... 25 or 50 V
j) Measuring current (short-circuit current) for 3-pole, 4-pole ..... > 200 mA
k) Max. measuring electrode resistance ..... 20 kΩ
l) Indication of too little clamp current fo r ..... ≤ 0.5 mA
m) Measuring instrument power supply ..... Battery pack: NiMH, 4.8 V, 4.2 Ah
n) Battery charger parameters ..... 100 V … 240 V, 50 Hz … 60 Hz
o) Number of measurements for R, 2-pole ..... > 1500 (1 Ω, 2 meas. per min.)
p) Number of measurements for R_E ..... > 1200 (R_E= 10 Ω, R_H=R_S=100 Ω, ... 2 meas. per min.)
q) Time required for resistance measurements with 2-pole method . < 6 seconds
r) Time required for resistance measurements using other methods, as well as earth resistance ..... < 8 seconds
s) Dimensions ..... 288 x 223 x 75 mm
t) Measuring instrument weight with batteries ..... Approx. 2 kg
u) Operating temperature ..... -10 ... +50 °C
v) Temperature range within which battery can be charged ..... +10 °C ... +40 °C
w) Temperatures at which charging process stops ..... < +5 °C and ≥ +50 °C
x) Reference temperature ..... 23 ± 2 °C
y) Storage temperature ..... -20 °C ... +80 °C
z) Relative humidity ..... 20 ... 85%
aa) Nominal relative humidity ..... 40 ... 60%
bb) Elevation ..... < 2000 m
cc) Quality standard . Development, project planning and production per ISO 9001
dd) The test instrument fulfills EMC requirements per ..... EN 61326-1:2006 and EN 61326-2-2:2006.

10.2 Additional Data

Data concerning additional measuring uncertainty are helpful for the most part when a measuring instrument is used under non-standardized conditions or in measuring laboratories for calibration.

10.2.1 Influence of Series Interference Voltage on Resistance Measurement for the Functions 3-Pole, 4-Pole and 3-Pole + Clamp Meters

R	Additional Measuring Uncertainty [Ω]
0.00 … 9.99 Ω	$\pm(0.0025R_E + 0.012)U_z$
10.0 Ω … 1.99 kΩ	$\pm(0.0005R + 0.02)U_z$

10.2.2 Influence of Series Interference Voltage on Resistance Measurement for the ρ Function

$$\Delta_{add}\ [\Omega] = \pm 2.5*(10^{-3}*R_E + 10^{-6}*R_H*U_Z)*U_Z$$

Where $R_E = \rho/2\pi L$

10.2.3 Influence of the Auxiliary Electrodes on Earthing Resistance Measurement for the Functions 3-Pole, 4-Pole and 3-Pole + Clamp Meters

R_H,R_S	Additional Measuring Uncertainty [%]
$R_H \le 1$ kΩ and $R_S \le 1$ kΩ	Within the limits of primary measuring uncertainty
$R_H > 1$k Ω or $R_S > 1$ kΩ or R_H i $R_S > 1$ kΩ	$\pm\left(\frac{R_S}{R_S+1M}\cdot 200+\frac{R_H^{\ 3}}{R_E}\cdot 4\cdot 10^{-11}+3\cdot 10^{-3}\cdot R_H\right)$

R_E[Ω], R_S[Ω] und R_H[Ω] are the values displayed by the instrument.

10.2.4 Influence of the Auxiliary Electrodes on Earthing Resistance Measurement for the ρ Function

R_H,R_S	Additional Measuring Uncertainty [%]
$R_H \le 1$ kΩ i $R_S \le 1$ kΩ	Within the limits of primary measuring uncertainty
$R_H > 1$ kΩ or $R_S > 1$ kΩ Or R_H i $R_S > 1$ kΩ	$\delta_{dod}=\frac{R_H\cdot(R_S+30000\Omega)}{R_E}\cdot 3{,}2\cdot 10^{-7}$

R_E[Ω], R_S[Ω] und R_H[Ω] are the values displayed by the instrument.

10.2.5 Influence of the Auxiliary Electrodes on Earthing Resistance Measurement According to the Pulse Method

R_H	Z_E	Measuring Uncertainty [%]
$R_H \le 150$ kΩ	0.0 … 199 Ω	Within the limits of primary measuring uncertainty
$R_H > 150$ Ω	0.0 … 4.9 Ω	$0.04(R_H-100)/Z_E$
	5.0 … 199 Ω	$0.007(R_H-100)$

Z_E[Ω] und R_H[Ω] are the values displayed by the instrument.

10.2.6 Influence of Interference Current on the Measurement Results for Earthing Resistance, 3-Pole + Current Clamp

The GEOHM PRO measuring instrument can perform measurements as long as any existing interference current does not exceed a value of 3 Arms and frequency coincides with the value selected in the menu.

R_E	U_{wy}	Measuring Uncertainty [Ω]
≤ 50 Ω	25 V	$5*10^{-3}*R_E*I_{Int}^2$
	50 V	$2.5*10^{-3}*R_E*I_{Int}^2$
> 50 Ω	25 V	$70*10^{-6}*R_E^2*I_{Int}^2$
	50 V	$50*10^{-6}*R_E^2*$ IInt2

Performance of measurements is disabled at a value of > 3 A.

10.2.7 Influence of Interference Current on the Measurement Results for Earth Resistance with the Help of Two Clamp Meters

The GEOHM PRO measuring instrument can perform measurements as long as any existing interference current does not exceed 3 Arms and frequency coincides with the value selected in the menu.

R_E	Measuring Uncertainty [Ω]
0.00 ... 4.99 Ω	Within the limits of primary measuring uncertainty
5.00 ... 19.9 Ω	$0.005 * R_E^2 * I_{Int}^3$
20.0 ... 149.9 Ω	$0.06 * R_E^2 * I_{Int}^3$

Performance of measurements is disabled at a value of > 3 A.

10.2.8 Influence of the Relationship of Resistance Measured with the Clamp Meters at Branches with Multiple Earthing to the Resultant Resistance (3-pole + clamp meters)

R_C	Measuring Uncertainty [Ω]
≤ 99.9 Ω	$0.003\ R_C / R_W^2$
> 99.9 Ω	$0.06\ R_C / R_W^2$

R_C[Ω] is the resistance which is measured between the branches' clamp meters and displayed by the instrument, and R_W[Ω] is the value of the resistance resulting from multiple earthing.

10.2.9 Additional Measuring Uncertainty per IEC 61557-4 (2-pole)

Influencing Quantity	Designation	Additional Measuring Uncertainty
Position	E_1	0%
Supply voltage	E_2	0% (bAt does not appear)
Temperature	E_3	R ≤ 3.999 Ω: ±0.3 digits per °C
		R > 3.999 Ω and < 1 kΩ: ±0.2 digits per °C
		R ≥ 1 kΩ: ±0.07% per °C ±0.2 digits per °C

10.2.10 Additional Measuring Uncertainty per IEC 61557-5 (3-pole, 4-pole, 3-pole + clamp meters)

Influencing Quantity	Designation	Additional Measuring Uncertainty
Position	E_1	0%
Supply voltage	E_2	0% (bAt does not appear)
Temperature	E_3	R ≤ 3.999 Ω: ±0.3 digits per °C
		R > 3.999 Ω and < 1 kΩ: ±0.2 digits per °C
		R ≥ 1 kΩ: ±0.07% per °C ±0.2 digits per °C
Series interference voltage	E_4	In accordance with the formulas in section 10.2.1 (U_z = 3 V / 50, 60, 400, 16⅔ Hz)
Resistance of the electrodes and the auxiliary earth electrodes	E_5	In accordance with the formulas in section 10.2.2

11 Instrument Reset (default settings)

- Press and hold the OFF key for a lengthy period of time. The GEOHM PRO or GEOHM XTRA is restored to its default settings.

12 Scope of Delivery

1 GEOHM PRO: earth tester without GPS modem
1 GEOHM XTRA: earth tester with GPS modem
1 carrying pouch
1 measurement cable, 1.2 m, red
1 measurement cable, 2.2 m, black
2 alligator clips, red/black
2 Measurement cables, 25 m, red and green
1 Measurement cable, 50 m, blue
4 Earth spikes, 30 cm
1 USB cable
1 automotive charging cable
1 screw terminal
1 power pack
1 set of operating instructions
1 calibration certificate

13 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.

14 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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