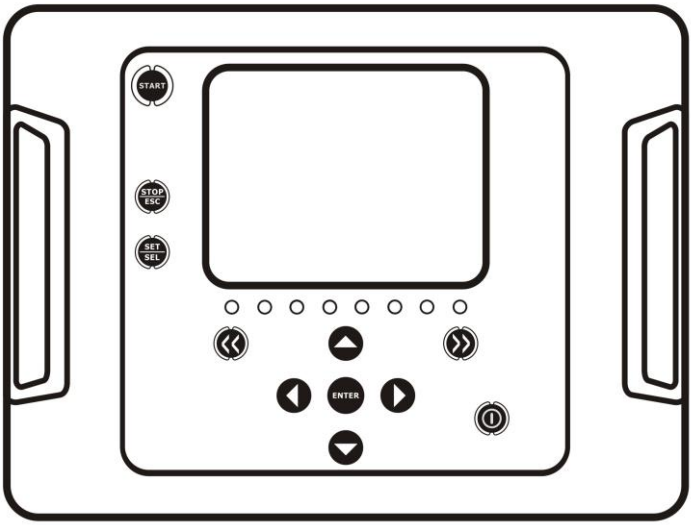


OPERATION MANUAL

EARTH RESISTANCE METER

MRU-30

MRU-30

Measuring terminals: **E**, **ES**, **S and H**

Clamp socket

START - starting the measurement procedure

ESC - return to previous screen, exit the function, stop the measurement

12V power socket and a USB socket on the side of the housing

SET/SEL - selection of additional meter's setttings

LED diodes indicating selected measurement function

ENTER - approving selected function

Functional keys (coursors) - shift/selection: right/left, up/down

Function switching buttons
Selecting the measurment function:

- **2P** - two-pole earth resistance measurement
- **3P** - three-pole earth resistance measurement
- **4P** - four-pole earth resistance measurement
- **3P** - three-pole with clamp earth resistance measurement
- - two clamp earth resistance measurement
- **RCONT 200mA** - measurement of earth connection and equipotential bonding (200mA)
- **ρ** - earth resistivity measurement
- **MEM** - Viewing and deleting memory data and data transmission

Turning power supply and screen backlit ON/OFF

OPERATING MANUAL

EARTH RESISTANCE METER
MRU-30

SONEL S. A.
Wokulskiego 11 Str.,
58-100 Świdnica, Poland

Version 1.02 June 2016

The MRU-30 meter is a modern, high quality, easy to use and safe measuring device. Please acquaint yourself with the present manual in order to avoid measuring errors and prevent possible problems related to operation of the meter.

TABLE OF CONTENTS

1 Safety

The MRU-30 meter has been designed to carry out measurements which results determine the safety conditions of the installation. Therefore, in order to provide conditions for correct operation and the correctness of the obtained results, the following recommendations must be observed:

- Before you proceed to operate the meter, acquaint yourself thoroughly with the present manual and observe the safety regulations and specifications determined by the producer.
- The MRU-30 meter has been designed for the purpose of measurements of earth connection and equipotential bonding, and also ground resistivity, Any application that differs from those specified in the present manual may result in a damage to the device and constitute a source of danger for the user.
- The device must be operated solely by appropriately qualified personnel with relevant certificates to carry out measurements of electric installation. Operation of the meter realized by unauthorized personnel may result in damage to the device and constitute a source of danger for the user.
- Using this manual does not exclude the need to comply with occupational health and safety regulations and with other relevant fire regulations required during the performance of a particular type of work. Before starting the work with the device in special environments, e.g. potentially fire-risk/explosive environment, it is necessary to consult it with the person responsible for health and safety.
- It is unacceptable to operate the following:
  - ⇒ A damaged meter which is completely or partially out of order,
  - ⇒ A meter with damaged test leads insulation,
  - ⇒ A meter stored for an excessive period of time in disadvantageous conditions (e.g. excessive humidity). **If the meter has been transferred from a cool to a warm environment of a high level of relative humidity, do not start doing measurements until the meter has been warmed up to the ambient temperature (approximately 30 minutes).**
- Before measurements may commence, make sure the test leads are connected to the appropriate measurement sockets.
- The meter can't be powered from other sources than those mentioned in this manual.
- The meter's inputs are electronically protected from power surge, as a result for example, of accidental connection to the power supply source:
  - for all input combinations – up to 276 V for 30 seconds.
- Manufacturer's calibration doesn't include the resistance of test leads. Displayed result is sum of the measured object and the test leads resistance.
- The device complies with the following standards: EN 61010-1 and EN 61557-1, -4, -5.

Note:

Manufacturer reserves the right to apply changes in the appearance, accessories and technical parameters of the meter. Due to continuous development of the meter's software, the actual appearance of the display, in case of some of the functions, may slightly differ from the display presented in this operating manual.

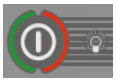
Note:

An attempt to install drivers in 64-bit Windows 8 may result in displaying 'Installation failed' message.

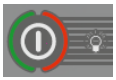
Cause: Windows 8 by default blocks drivers without a digital signature.

Solution: Disable the driver signature enforcement in Windows.

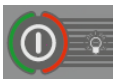
2 Turning the meter ON and activating screen backlit.

1 

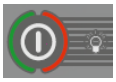
Turn on the meter with button.

2 

Short press button to turn the screen backlight on; press the button again to turn the backlight off.

3 

Switch off the meter by pressing and and holding button for approx. 2 sec.

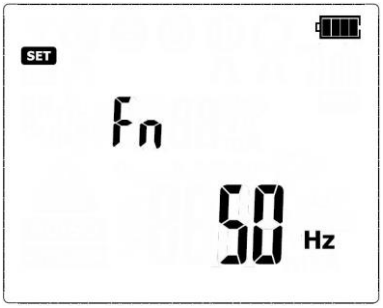
Emergency situations. 

Pressing button for approx. 7 seconds will turn off the meter in case of emergency.

3 Meter configuration

1 

Turn on the meter by pressing and keeping **SET/SEL** button pressed.



2 

When the **Fn** screen is displayed use ⬆ and ⬇ to set mains frequency – 50 Hz or 60 Hz (50 Hz is set as default).

3 

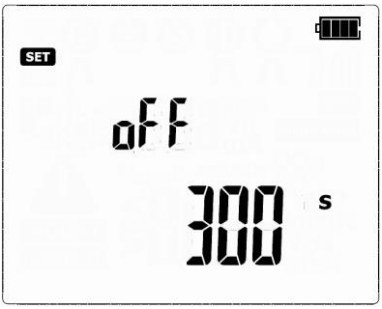
Use ⬅ and ➡ buttons to enter the screen with audio message settings: **bEEP**.

4 

Use ⬆ and ⬇ buttons to turn the audio messages ON (on) or OFF (off).

5 

Press ⬅ and ➡ to switch to auto off setting screen (Auto-OFF): **oFF**

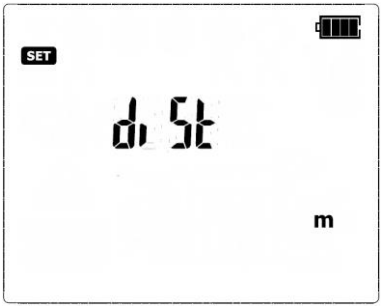


6 

Use ⬆ and ⬇ to set the time period after which the meter will turn off automatically (Auto-OFF): 300 s, 600 s, 900 s or none (dashes - Auto-OFF is disabled). This function turns off the meter automatically after the certain (set by user) period of time.

7 

Use ⬅ and ➡ buttons to enter the screen where the unit of length can be selected: **diSt**.



8

Use ⬆ and ⬇ buttons to set the unit of length: ‘m’ (meter) or ‘ft’ (feet) (‘m’ is set as default).

9

Use ⬅ and ➡ buttons to enter the screen with firmware update: **USB UPdt.**

10

Press **ENTER** to enter the update mode. The update process is described in point 7.

After changing the parameters, you may exit **SETUP** menu:

11

Press **ENTER** button to memorize settings (not applicable for Update screen)
or use **ESC** button to go to the measurement screen without confirming the changes.

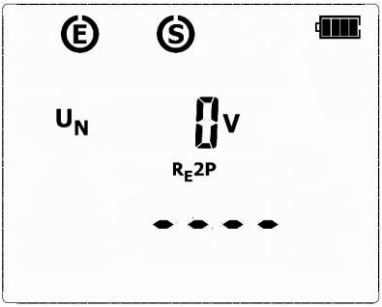
4 Measurements

Note:

During measurements the status bar is displayed.

4.1 Measurement of AC+DC interfering (noise) voltages

Note:
This measurement is active only when the meter is set for the following measurements, before starting them with the START button: 2P, 3P, 3P+C, R_{cont}, ρ.



In **2P, 3P, 4P, 3P+C, R_{cont}** and **ρ** modes, before starting the measurement with the **START** button, MRU-30 is monitoring the voltage present on the measurement points (between **E** and other sockets). The value of the interfering voltage is displayed on screen.

Additional information displayed by the meter

U_N >100V, >100V and a continuous sonic signal, '**NOISE!**' and ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal, '**NOISE!**' and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.
U_N xxV, >24V, '**NOISE!**' and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 24 V, but it's below 40 V,the measurement is blocked.
'**NOISE!**'	The value of the interfering signal is below 24 V, but it has too high value, so the result may be distorted by additional uncertainty.

4.2 Measurement of earth connection and equipotential bonding (2P)

1

Use **<<** or **>>** button to start the measurement **2P** (LED 

is on). The meter is in the mode of noise voltage measurement between measurement points.

2

Press **SET/SEL** button to select measurement voltage**.**

3

Use ⬆ and ⬇ button to set the measurement voltage value of 25 V or 50 V.

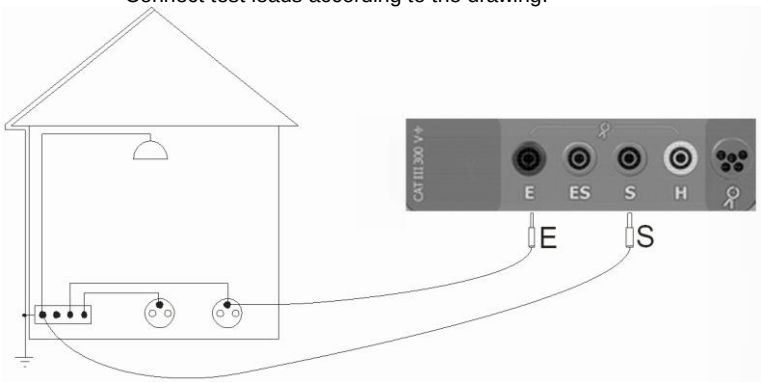
4

or

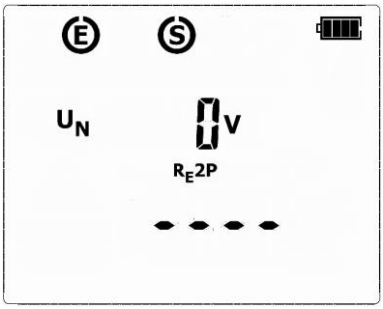
Press **ENTER** to confirm settings or press **ESC** to exit without saving the changes.

5

Connect test leads according to the drawing.



6

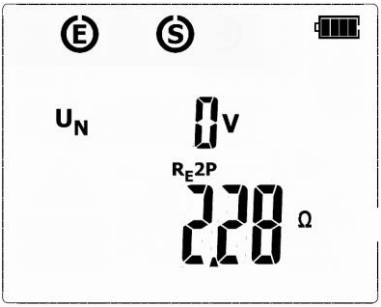


The meter is ready for measurement.

7

Press **START** to commence measurement.

8



After finishing the measurment, read out the result. The results of all the measurements that have been carried out will be displayed on screen.

The result is displayed for 20 s. It may be displayed again when **ENTER** is pressed.

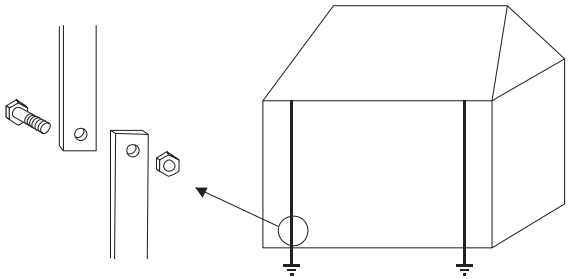
Additional information displayed by the meter

R>9999Ω	Measurement range exceeded.
U_N >100V, >100V and a continuous sonic signal 🔊, **'NOISE!'** and ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal 🔊, **'NOISE!'** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.
U_N xxV, >24V, **'NOISE!'** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 24 V, but it's below 40 V,the measurement is blocked.
'NOISE!'	The value of the interfering signal is below 24 V, but it has too high value, so the result may be distorted by additional uncertainty.

4.3 Measurement 3P

The basic type of the earth resistance measurement is three-pole measurement.

1 Disconnect the tested earth electrode for the object installation.



2

Use **<<** or **>>** button to start the measurement of **3P** (LED 

is on). The meter is in the mode of noise voltage measurement between measurement points.

3

Press **SET/SEL** button to select measurement voltage.

4

Use ⬆ and ⬇ button to set the measurement voltage value of 25 V or 50 V.

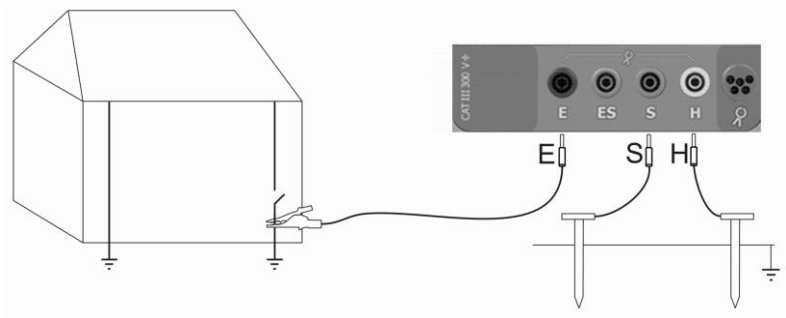
5

or

Press **ENTER** to confirm settings or press **ESC** to exit without saving the changes.

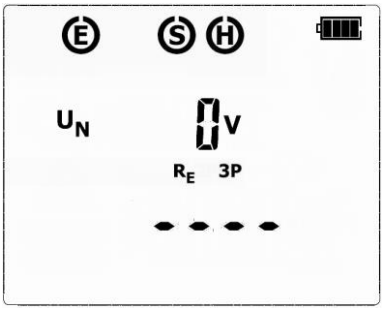
Connect test leads according to the drawing .

6



Connect the current electrode driven into ground to the **H** socket of the meter,
Connect the voltage electrode driven into ground to the **S** socket of the meter,
Connect the tested earth electrode to the **E** socket of the meter.
The tested earth electrode as well as the current electrode and voltage electrode should be aligned.

7

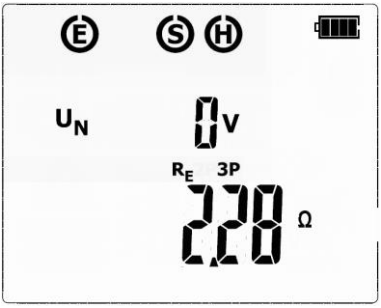


The meter is ready for measurement.

8

Press **START** to commence measurement.

9



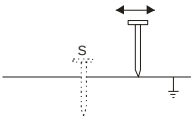
Read out the result. The results of all the measurements that have been carried out will be displayed on screen.

10

Use ⬅ and ➡ button to toggle between the measurement result components:
R_H – resistance of current electrode
R_S - resistance of voltage electrode
ER – additional uncertainty caused by the resistance of the electrodes
U_N – interfering (noise) voltage

The result is displayed for 20s. It may be displayed again when **ENTER** is pressed.

11



Repeat the measurements (see points 7, 8 and 9) moving the voltage electrode by a couple of meters: approaching it to and moving it away from the tested earth electrode.
If the R_E test results differ more than 3%, then it is necessary to significantly increase the distance between the current electrode from the earth electrode in question and repeat the measurement.

Note:

⚠

Earth resistance measurement may be carried out if the interference voltage does not exceed 24 V. The interference voltage is measured up to 100 V, but over 40 V it is signalled as hazardous.
Do not connect the meter to a voltage exceeding 100 V

- Pay particular attention to the quality of the connection of the tested object with the test leads – the contact area must be cleaned of paint, rust, etc.

- If the resistance of the measurement probes is too high, then the measurement of the RE earth electrode will be distorted by additional uncertainty. A particularly high measurement uncertainty is generated if we measure a low value of the earth resistance with probes of a loose contact with the soil (such a situation occurs often if the earth electrode is properly made and the upper layer of the ground is dry and characterized by a low conductivity). Then the relation between the probe re-

sistance and the resistance of the measured earthing is very high, and so is the case of the measurement uncertainty which depends on it. What may be done then is to perform, in accordance with the formulae specified in point 12.2, calculations, which will permit to evaluate the influence of the measurement conditions. It is also possible to improve the contact of the probe with the ground, for example by means of moistening of the place when the probe is driven, its driving into the ground in another place or using a 80-centimetre probe. Check also the test leads and make sure the insulation is not damaged and the contacts: test lead – banana plug – probe are not corroded or loosened. In most cases the achieved resolution of the measurement is sufficient, but it is necessary to be conscious of the uncertainty the measurement is burdened with.

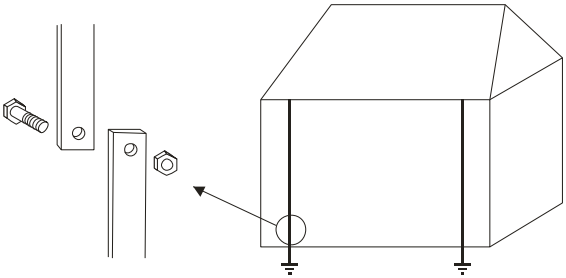
Additional information displayed by the meter

R_E>9999Ω	Measurement range exceeded.
U_N >100V, >100V and a continuous sonic signal 🔊, ‘**NOISE!’** or ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal 🔊, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.
U_N xxV, >24V, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 24 V, but it’s below 40 V,the measurement is blocked.
‘**NOISE!’**	The value of the interfering signal is below 24 V, but it has too high value, so the result may be distorted by additional uncertainty.
LIMIT! and **ER** along with % value	The uncertainty caused by resistance of the electrodes > 30%. (Uncertainties calculated on the basis of the measured values.)
LIMIT! and **R_H** or **R_S** along with Ω value	The resistance of H and S electrodes, or one of them exceeds 19,9 kΩ, the proper measurement is not possible.
Flashing symbols: E, S, H	Flashing symbols E or H or S, or both of them, or all three at the same time – one or two or three test leads are disconnected from the measurement sockets.

4.4 Measurement 4P

The four-pole method is recommended in the case of measurements of earth resistance of very low values. It permits to eliminate the influence of the test leads resistance over the result of the measurement. In order to evaluate the resistivity of the ground it is recommended to use the dedicated measurement function (point 4.9).

(1) Disconnect the tested earth electrode for the object installation.



2

Use **<<** or **>>** button to start the measurement of **4P** (LED  is on). The meter is in the mode of noise voltage measurement between measurement points).

3

Press **SET/SEL** button to select measurement voltage.

4

Use ⬆ and ⬇ button to set the measurement voltage value of 25 V or 50 V

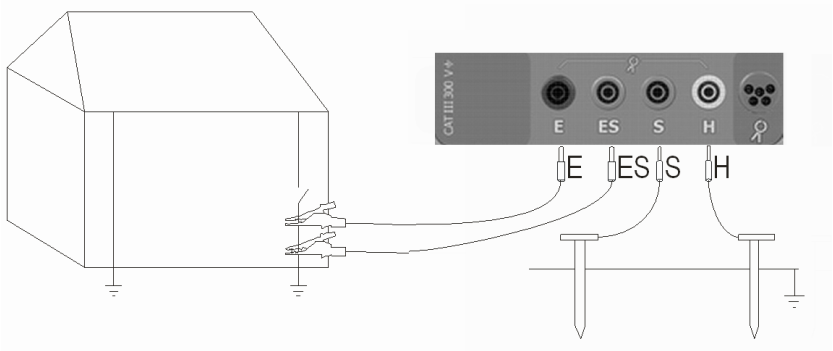
5

or

Press **ENTER** to confirm settings or press **ESC** to exit without saving the changes.

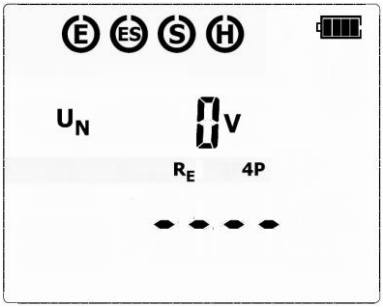
6

Connect test leads according to the drawing.



Connect the current electrode driven into ground to the **H** socket of the meter.
Connect the voltage electrode driven into ground to the **S** socket of the meter.
Connect the tested earth electrode to the **E** socket of the meter.
Connect the **ES** socket to the earth electrode In question below the **E** cable.
The tested earth electrode as well as the current electrode and voltage electrode should be aligned.

7

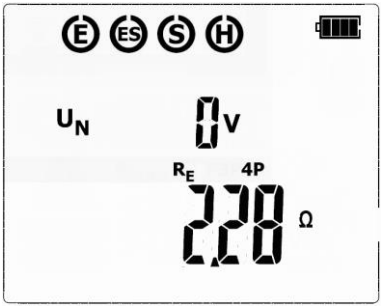


The meter is ready for measurement.

8

Press **START** to commence measurement.

9



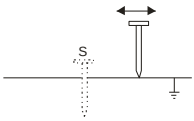
After finishing the measurment, read out the result. The results of all the measurements that have been carried out will be displayed on screen.

10

Use ⬅ and ➡ button to toggle between the measurement result components:
R_H – resistance of current electrode
R_S - resistance of voltage electrode
ER – additional uncertainty caused by the resistance of the electrodes
U_N – interfering (noise) voltage.

The result is displayed for 20 s. It may be displayed again when **ENTER** is pressed.

11



Repeat the measurements (see points 7, 8 and 9) moving the voltage electrode by a couple of meters: approaching it to and moving it away from the tested earth electrode.
If the R_E test results differ more than 3%, then it is necessary to significantly increase the distance between the current electrode from the earth electrode in question and repeat the measurement.

Note:

⚠

Earth resistance measurement may be carried out if the interference voltage does not exceed 24 V. The interference voltage is measured up to 100 V, but over 40 V it is signalled as hazardous.
Do not connect the meter to a voltage exceeding 100 V.

- Pay particular attention to the quality of the connection of the tested object with the test leads – the contact area must be cleaned of paint, rust, etc.
- If the resistance of the measurement probes is too high, then the measurement of the RE earth electrode will be distorted by additional uncertainty. A particularly high measurement uncertainty is generated if we measure a low value of the earth resistance with probes of a loose contact with the soil (such a situation occurs often if the earth electrode is properly made and the upper layer of the ground is dry and characterized by a low conductivity). Then the relation between the probe resistance and the resistance of the measured earthing is very high, and so is the case of the measurement uncertainty which depends on it. What may be done then is to perform, in accordance with the formulae specified in point 12.2, calculations, which will permit to evaluate the influence of the measurement conditions. It is also possible to improve the contact of the probe with the ground, for example by means of moistening of the place when the probe is driven, its driving into the ground in another place or using a 80-centimetre probe. Check also the test leads and make sure the insulation is not damaged and the contacts: test lead – banana plug – probe are not corroded or loosened. In most cases the achieved resolution of the measurement is sufficient, but it is necessary to be conscious of the uncertainty the measurement is burdened with.

Additional information displayed by the meter

R_E>9999Ω	Measurement range exceeded.
U_N >100V, >100V and a continuous sonic signal 🔊, ‘**NOISE!’** and ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal 🔊, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.
U_N xxV, >24V, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 24 V, but it’s below 40V, the measurement is blocked.
‘**NOISE!’**	The value of the interfering signal is below 24 V, but it has too high value, so the result may be distorted by additional uncertainty.
LIMIT! and **ER** along with % value	The uncertainty caused by resistance of the electrodes > 30%. (Uncertainties calculated on the basis of the measured values.)
LIMIT! and **R_H** or **R_S** along with Ω value	The resistance of H and S electrodes, or one of them exceeds 19,9 kΩ, the proper measurement is not possible.

Flashing symbols: E, ES, S, H	Flashing symbols E or H or S, or both of them, or all three at the same time, one or two or three test leads are disconnected from the measurement sockets.

4.5 Measurement 3P + clamp

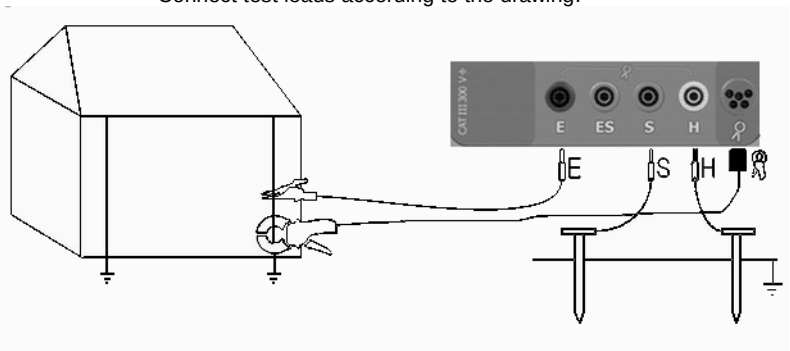
1. Use **<<** or **>>** button to start the measurement of **3P+** (LED 3P is on). The meter is in the mode of noise voltage measurement between measurement points and also it measures the current flowing through the clamp.

2. Press **SET/SEL** button to select measurement voltage.

3. Use ▲ and ▼ button to set the measurement voltage value of 25 V or 50 V.

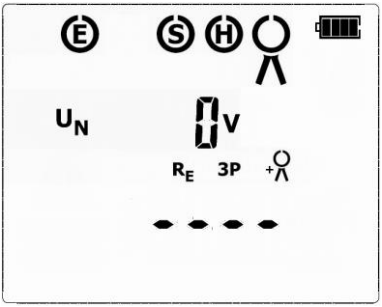
4. Press **ENTER** to confirm settings or press **ESC** to exit without saving the changes.

5. Connect test leads according to the drawing.



Connect the current electrode driven into ground to the **H** socket of the meter,
Connect the voltage electrode driven into ground to the **S** socket of the meter,
Connect the tested earth electrode to the **E** socket of the meter,
The tested earth electrode as well as the current electrode and voltage electrode should be aligned.
Attach the clamp around the tested earth electrode below the **E** cable connection.

6



The meter is ready for measurement.

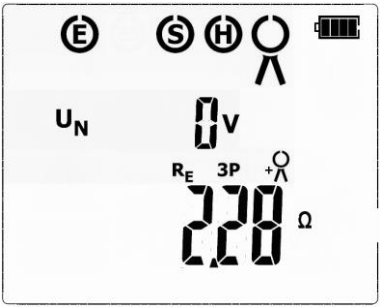
7

Use ⬅ and ➡ to toggle between the measurements:
U_N – interfering (noise) voltage,
I_L – leakage current measured by the clamp

8

Press **START** to commence measurement.

9



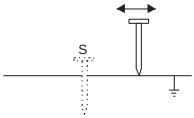
After finishing the measurment, read out the result. The results of all the measurements that have been carried out will be displayed on screen.

10

Use ⬅ and ➡ to toggle between the measurement result components:
R_H – resistance of current electrode
R_S - resistance of voltage electrode
ER – additional uncertainty caused by the resistance of the electrodes
U_N – interfering (noise) voltage
I_L – leakage current.

The result is displayed for 20 s. It may be displayed again when **ENTER** is pressed.

(11)



Repeat the measurements (see points 6, 8 and 9) moving the voltage electrode by a couple of meters: approaching it to and moving it away from the tested earth electrode.
If the R_E test results differ more than 3%, then it is necessary to significantly increase the distance between the current electrode from the earth electrode in question and repeat the measurement.

Note:

Earth resistance measurement may be carried out if the interference voltage does not exceed 24 V. The interference voltage is measured up to 100 V, but over 40 V it is signalled as hazardous.
Do not connect the meter to a voltage exceeding 100 V.

- The clamps are not the part of the meter's standard accessories, they are to be purchased separately.
- The clamp must be calibrated before it is used for the first time. It may be periodically calibrated in order to avoid the influence of the ageing elements upon the resolution of measurements. The clamp calibration option is described in point 4.7.
- Pay particular attention to the quality of the connection of the tested object with the test leads – the contact area must be cleaned of paint, rust, etc.
- If the resistance of the measurement probes is too high, then the measurement of the R_E earth electrode will be distorted by additional uncertainty. A particularly high measurement uncertainty is generated if we measure a low value of the earth resistance with probes of a loose contact with the soil (such a situation occurs often if the earth electrode is properly made and the upper layer of the ground is dry and characterized by a low conductivity). Then the relation between the probe resistance and the resistance of the measured earthing is very high, and so is the case of the measurement uncertainty which depends on it. What may be done then is to perform, in accordance with the formulae specified in point 12.2, calculations, which will permit to evaluate the influence of the measurement conditions. It is also possible to improve the contact of the probe with the ground, for example by means of moistening of the place when the probe is driven, its driving into the ground in another place or using a 80-centimetre probe. Check also the test leads and make sure the insulation is not damaged and the contacts: test lead – banana plug – probe are not corroded or loosened. In most cases the achieved resolution of the measurement is sufficient, but it is necessary to be conscious of the uncertainty the measurement is burdened with.

Additional information displayed by the meter

R_E>9999Ω	Measurement range exceeded.
U_N >100V, >100V and a continuous sonic signal 🔊, '**NOISE!'** and ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal 🔊, '**NOISE!'** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.

U_N xxV, >24V, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 24 V, but it’s below 40 V, the measurement is blocked.
‘**NOISE!’**	The value of the interfering signal is below 24 V, but it has too high value, so the result may be distorted by additional uncertainty.
LIMIT! and **ER** along with % value	The uncertainty caused by resistance of the electrodes > 30%. (Uncertainties calculated on the basis of the measured values.)
LIMIT! and **R_H** or **R_S** along with Ω value	The resistance of H and S electrodes, or one of them exceeds 19,9 kΩ, the proper measurement is not possible.
Flashing symbols: E, S, H	Flashing symbols E or H or S, or both of them, or all three at the same time – one or two or three test leads are disconnected from the measurement sockets.
Flashing clamp symbol	Current clamp disconnected or the current value measured by the clamp is too low.
I_L xxA , I>1A, ⚠	Interfering current exceeds 3A – the measurement is not possible.

4.6 Two-clamp measurement

Two-clamp measurement is applied where there is no possibility of using earth electrodes (rods).

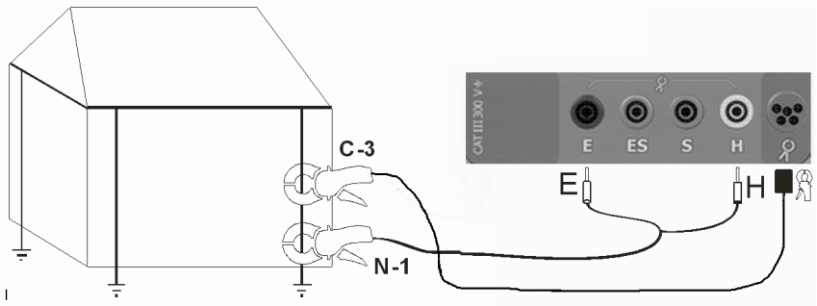
NOTE!
The two-clamp method may be used solely in the case of multiple earthing systems.

1

Use **<<** or **>>** button to start the measurement of (LED is on). The meter is in the mode of noise voltage measurement between measurement points and also it measures the current flowing through the receiving clamp.

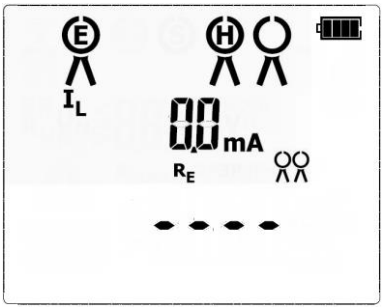
Connect test leads according to the drawing.

2



Connect the transmission clamp to sockets **H** and **E**, while the measurements clamp should be connected to the clamp socket ⚲.
Attach the transmission clamp and the measurement clamp around the tested earth electrode at least 30cm from each other.

3

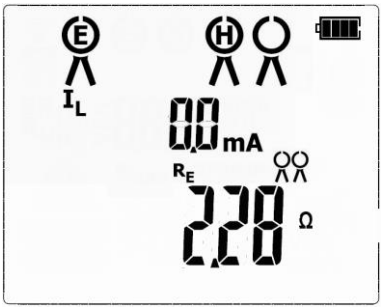


The meter is ready for measurement.

4

Press **START** to commence measurement.

5



Upon completing the measurement read out the result and the value of the leakage current.

The result is displayed for 20 s. It may be displayed again when **ENTER** is pressed.

Note:

Measurements may be performed in the presence of interference current not exceeding 3 A and whose frequency complies with the value set in the MENU.

- The clamps are not the part of the meter's standard accessories, they are to be purchased separately.

- The clamps must be calibrated before it is used for the first time. It may be periodically calibrated in order to avoid the influence of the ageing elements upon the resolution of measurements. The clamp calibration option is described in point 4.7.

Additional information displayed by the meter

R_E>99,9Ω	Measurement range exceeded.
Flashing clamp symbols	Transmitting clamp disconnected.
Flashing clamp symbol	Receiving clamp disconnected, or the measured current value is too low.
I_{IL} xxA , I>1A,	Interfering current exceeds 3A – the measurement is not possible.
U_N >100V, >100V and a continuous sonic signal, '**NOISE!**' and	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal, '**NOISE!**' and	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.

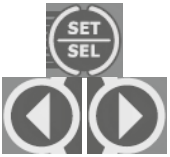
4.7 Calibration of the measurement clamp C-3

The additional C-3 clamp must be calibrated before the first use. It may be periodically calibrated in order to avoid the influence of the ageing elements on the measurements accuracy. The procedure of calibration must be carried out also after replacing clamp with the new one.

1

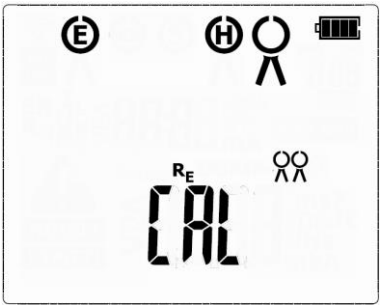
or:

While in mode (LED is on) press **SET/SEL** button to enter the screen where the clamps calibration can be performed.



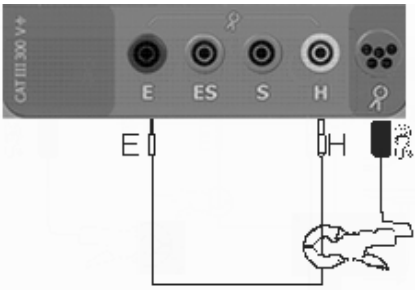
While is 3P+ mode (LED 3P is on) press **SET/SEL** button to enter the screen where test voltage can be selected, then use ⬅ and ➡ buttons to enter the screen where the measuring clamp calibration can be performed.

2



Flashing **CAL** message indicates the readiness to commence the clamp calibration procedure.

3



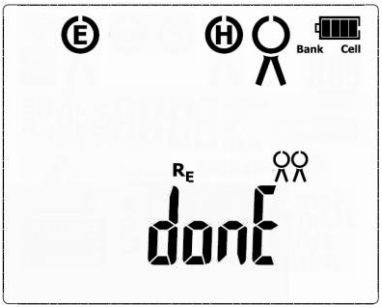
Bridge the **'E'** and the **'H'** terminals with the test lead and attach the clamp on in.

4

Press **START** button.

The meter has determined the correction factor for connected clamp. The factor is saved in the memory also when the power supply of the meter is off until the following successful calibration of the clamp has been performed.

3



When the **donE** is displayed on the screen, the clamp calibration procedure is completed.

6 

or 

After 20 second the meter will automatically return to the standby screen where the measurement can be started. Press **ESC** or **ENTER** to skip the waiting time and return to the standby screen immediately.

Note:

- Make sure the test lead passes centrally through the clamp.

Additional information displayed by the meter

Flashing symbols: E H and following message: **oPEn**	Flashing symbols E and H – calibration lead disconnected.
Flashing clamp symbol	Measurement clamp disconnected.

4.8 Measurement of earth connection and equipotential bonding (200mA)

Note:
The measurement complies with the requirements specified in the norm EN 61557-4 (U<24V, I>200mA and R≤10Ω).

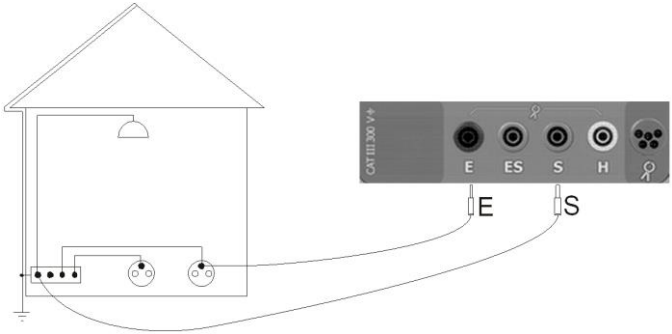
1 

Use **<<** or **>>** button to start the measurement of **$R_{CONT\ 200mA}$** (LED 

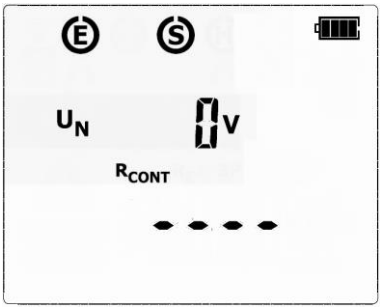
is on). The meter is in the mode of noise voltage measurement between measurement points.

Connect test leads according to the drawing.

2



3

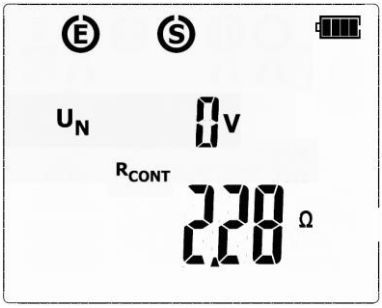


The meter is ready for measurement.

4

Press **START** to commence measurement.

5



Upon completing the measurement read out the result and the value of the interfering voltage.

The result is displayed for 20 s. It may be displayed again when **ENTER** is pressed.

Additional information displayed by the meter

R>1999Ω	Measurement range exceeded.
U_N >100V, >100V and a continuous sonic signal 🔊, '**NOISE!'** and ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.

U_N xxV, >40V and a continuous sonic signal ⚠, **'NOISE!'** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.
U_N xxV, >3V, **'NOISE!'** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 3 V, but it's below 40V,the measurement is blocked.
'NOISE!'	The value of the interfering signal is below 3 V, but it has too high value, so the result may be distorted by additional uncertainty.

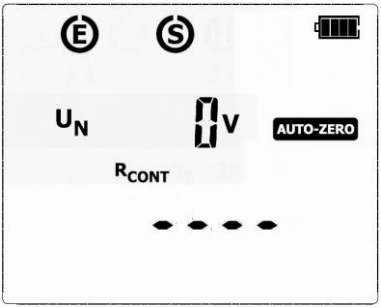
4.9 Calibration of the test leads for R_{CONT} measurement

In order to eliminate the influence of the resistance of the test leads over the result of the **R_{CONT}** measurement, it is advised to perform its compensation (auto-zeroing). This function is available while in **R_{CONT}** measurement mode.

1

In **R_{CONT}** mode (LED  is on) press **SET/SEL** to switch into test leads auto-zeroing mode.

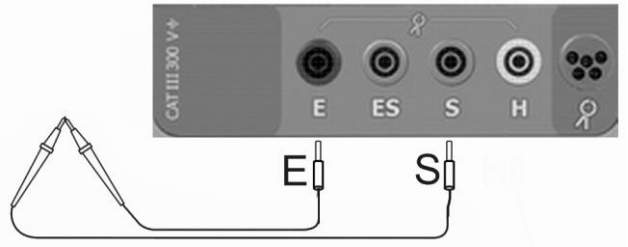
2



Flashing **AUTO-ZERO** message indicates the readiness to commence the test leads calibration procedure.

Connect test leads according to the drawing.
Short-circuit the test leads connected to 'E' and 'S' sockets.

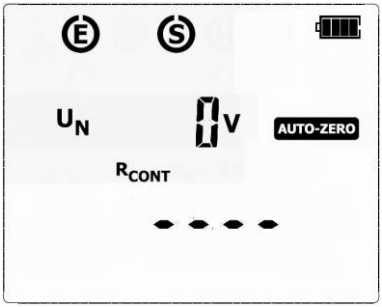
3



4

Press **START** button.

5



When **AUTO-ZERO** is displayed on the screen, the test leads calibration procedure is completed.

The result is compensated value, and the correction is available for **RCONT**. The compensation is also active after switching the meter off and on (it is indicated by the **AUTO-ZERO** being displayed on screen).

6

In order to delete compensation (restore default calibration) proceed with the above steps with open (not shorted) test leads. In the place where the result is expected **oFF** message will appear (test leads compensation is now deactivated). When the procedure is completed **AUTO-ZERO** message will disappear from the screen.

7

or

After 20 seconds the meter will automatically return to the standby screen where the measurement can be started. Press **ESC** or **ENTER** to skip the waiting time and return to the standby screen immediately.

4.10 Earth resistivity measurement

For the purpose of earth resistivity measurements – which are used as a preliminary measure for the project of earthing systems or in geology - there is a separate function: earth resistivity measurements ϱ. The function is metrologically identical as the four-pole earth resistance measurement, but it includes an additional procedure of storing of the distance between the electrodes. The result of the measurement is the resistance value which is calculated automatically in accordance with the following formula: $\rho = 2\pi L R_E$, which is used in the Wenner's measurement method. The method in question assumes equal distances between electrodes.

1

Use **<<** or **>>** buttons to switch into earth resistivity measurement mode ϱ (LED is on). The meter is in the mode of noise voltage measurement between measurement points and also it measures the current flowing through the receiving clamp.

2

Press **SET/SEL** button to switch into mode of selecting the distance between the electrodes.

3

Use ⬆ and ⬇ to set the distance between the electrodes. From 1 to 50 m, with 1 m step, or from 1 to 150 ft, with 1 ft step.

4

Use ➡ to switch into the mode for selecting test voltage.

5

Use ⬆ and ⬇ to set the measurement voltage value of 25 V or 50 V

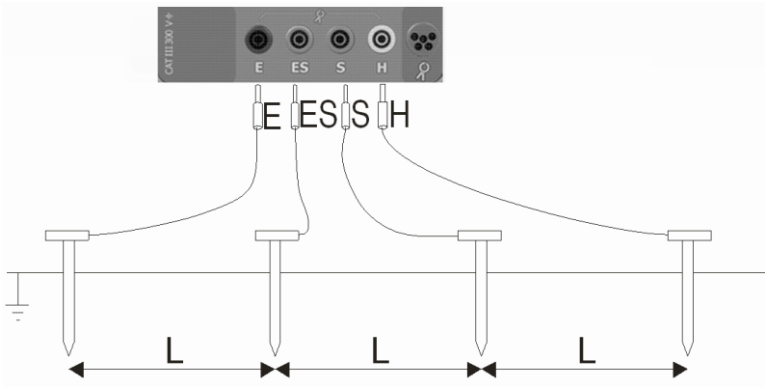
6

or

Press **ENTER** to confirm settings or press **ESC** to exit without saving the changes.

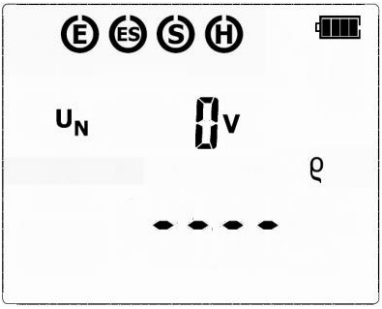
Connect test leads according to the drawing.

7



Connect the four aligned and equally spaced electrodes (rods), which are driven into the ground, to the meter, and do so In accordance with the diagram above:
Connect the current electrode driven into ground to the **H** socket of the meter,
Connect the voltage electrode driven into ground to the **S** socket of the meter,
Connect the voltage electrode driven into ground to the **ES** socket of the meter,
Connect the current electrode driven into ground to the **E** socket of the meter.

8

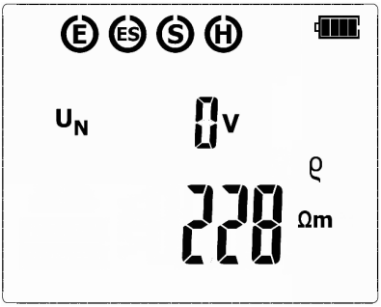


The meter is ready for measurement.

9

Press **START** to commence measurement.

10



After finishing the measurment, read out the result. The results of all the measurements that have been carried out will be displayed on screen.

11

Use ⬅ and ➡ to toggle between the measurement result components:
R_H – resistance of current electrode
R_S - resistance of voltage electrode
ER – additional uncertainty caused by the resistance of the electrodes
U_N – interfering (noise) voltage
.

The result is displayed for 20 s. It may be displayed again when **ENTER** is pressed.

Note:

⚠

Earth resistivity measurement may be performed if the interference voltage does not exceed 24V. The interference voltage is measured up to 100 V, but over 40V is it signalled as hazardous.
Do not connect the meter to a voltage exceeding 100 V

- Calculations are based upon the assumption that the distances between the specific measurement electrodes are equal (the Wenner's method). If this is not the case the earthing resistance measurement must be carried out by means of the four-pole method and calculations must be performed individually.

- Pay particular attention to the quality of the connection of the tested object with the test leads – the contact area must be cleaned of paint, rust, etc.

- If the resistance of the measurement probes is too high, then the measurement of the R_E earth electrode will be distorted by additional uncertainty. A particularly high measurement uncertainty is generated if we measure a low value of the earth resistance with probes of a loose contact with the soil (such a situation occurs often if the earth electrode is properly made and the upper layer of the ground is dry and characterized by a low conductivity). Then the relation between the probe re-

sistance and the resistance of the measured earthing is very high, and so is the case of the measurement uncertainty which depends on it. What may be done then is to perform, in accordance with the formulae specified in point 12.2, calculations, which will permit to evaluate the influence of the measurement conditions. It is also possible to improve the contact of the probe with the ground, for example by means of moistening of the place when the probe is driven, its driving into the ground in another place or using a 80 cm probe (rod). Check also the test leads and make sure the insulation is not damaged and the contacts: test lead – banana plug – probe are not corroded or loosened. In most cases the achieved resolution of the measurement is sufficient, but it is necessary to be conscious of the uncertainty the measurement is burdened with.

Additional information displayed by the meter

ϱ>xxxkΩm or **ϱ>xxxkΩft**	Measurement range exceeded, where xxx is maximum value that can be measured for the selected settings.
U_N >100V, >100V and a continuous sonic signal 🔊, ‘**NOISE!’** and ⚠	The voltage on the measurement points exceeds 100 V, the measurement is blocked.
U_N xxV, >40V and a continuous sonic signal 🔊, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 40 V, the measurement is blocked.
U_N xxV, >24V, ‘**NOISE!’** and ⚠	Where xx is the value of interfering voltage. The voltage on the measurement points exceeds 24 V, but it’s below 40 V, the measurement is blocked.
‘**NOISE!’**	The value of the interfering signal is below 24 V, but it has too high value, so the result may be distorted by additional uncertainty.
LIMIT! and **ER** along with % value	The uncertainty caused by resistance of the electrodes > 30%. (Uncertainties calculated on the basis of the measured values.)
LIMIT! and **R_H** or **R_S** along with Ω value	The resistance of H and S electrodes, or one of them exceeds 19,9 kΩ, the proper measurement is not possible.
Flashing symbols: E, ES, S, H	Flashing symbols E or ES or H or S, or two of them, or three, or all of them at the same time – one or two or three or four test leads are disconnected from the measurement sockets.

5 Memory of measurement results

The MRU-30 meter has memory divided into 10 banks of 99 cells each. Thanks to dynamic memory allocation, each of the memory cells can contain different quantity of single measurement results, depending on the needs. Optimal use of the memory can be ensured in this way. Each measurement result can be stored in a memory cell marked with a selected number and in a selected memory bank. Thanks to this, the user of the meter can, at his/her option, assign memory cell numbers to individual measurement points and the memory bank numbers to individual facilities. The user may also perform measurements in any chosen sequence and repeat them without losing other data.

Memory of measurement results **is not deleted** when the meter is switched off. Thanks to this, the data can be later read or sent to a computer. The number of a current memory cell or memory bank is not changed either.

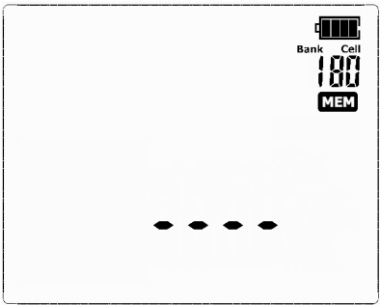
Note:

Results of single measurement can be stored in one memory cell.
- After entering the measurement result, the ID number of the cell is automatically increased.
- It is recommended to delete the memory after reading the data or before performing a new series of measurements that may be stored into the same memory cells as the previous ones.

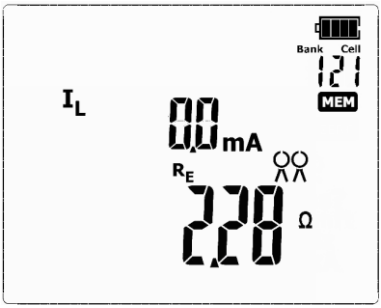
5.1 Storing the measurement results in the memory

1

After completing measurement press **ENTER**. The meter will turn into mode for test results storing.



The cell is empty.



The cell is occupied by the same type of result, which is to be entered.

2 

Use ⬅ and ➡ buttons to preview the results stored in the selected cell. If any.

To change the cell number or bank number:

3 

When the cell number is flashing, use ⬆ and ⬇ buttons to set the desired number of the cell.

4 

Press **SET/SEL** button – bank number is flashing.

5 

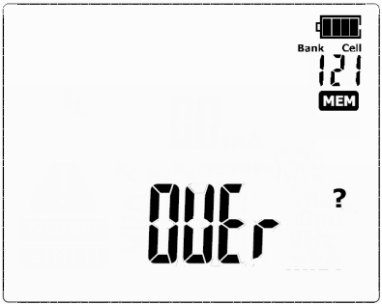
Use ⬆ and ⬇ buttons to set the desired number of the bank.

6 

After selecting the desired bank and cell, press **ENTER** button, to save the result in the memory. Recording is indicated by a triple beep sound.

Press **ESC** to return to the measurement screen without saving.

If you try to store data in an occupied memory cell, the following warning message will appear: **OVEr ?**:



7 

or 

Press **ENTER**, to overwrite the result or **ESC**, to cancel and select other cell or bank.

Note:

- After the measurement, its result is shown on the display for 20 s or until:
  - the measurement function is changed,
  - Auto-OFF function is activated,
  - the meter detects interference voltage> 40 V,
  - one of the following operations is performed:

- **ESC** button is pressed to exit to the voltmeter,
- next measurement is performed,
- an entry into the memory is introduced.

- After exiting to the voltmeter by pressing **ESC**, or after 20 s have gone by or after the test results have been stored into the memory, the last result may be recalled by pressing **ENTER**.

- Complete set of results (main result and supplementary results) for a given measuring function and preset measurement settings are stored in the memory.

5.2 Viewing memory data

1. 

   Use **<<** or **>>** to browse the memory: **MEM** (LED MEM is on).

2. 

   Use ⬅ and ➡ buttons to preview the test results components stored in the selected cell, if any exist.

To change the cell number or bank number:

3. 

   When the cell number is flashing, use ⬆ and ⬇ buttons to set the desired number of the cell.

4. 

   Press **SET/SEL** button – bank number is flashing.

5. 

   Use ⬆ and ⬇ buttons to set the desired number of the bank.

- Viewing test results components is disabled for **R_{CONT}** and **2P** measurements.

5.3 Deleting memory data

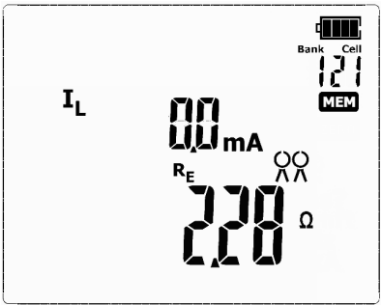
You can delete the entire memory or its individual cells or banks.

5.3.1 Deleting cell data

1. 

   Use **<<** or **>>** to browse the memory: **MEM** (LED MEM is on).

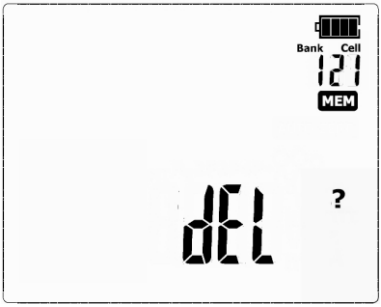
2



Set the cell number to be deleted acc. to point 5.2.

3

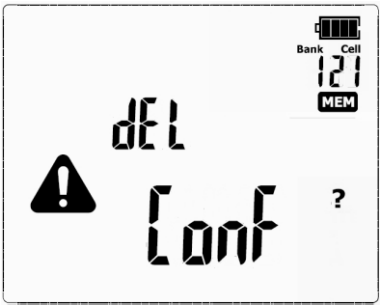
Press **ENTER** button.



then symbol dEL **?** will be displayed to indicate the readiness for deleting.

4

Press **ENTER** button.

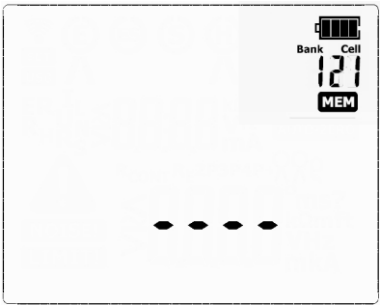


⚠ and **dEL ConF ?** symbols appear, asking you to confirm deletion.

5

or

Press **ENTER** button again to delete the selected cell.
After deleting the cell, the meter beeps three times. Press **ESC** to cancel and return to memory browsing more



The contents of the cell has been deleted.

5.3.2 Deleting bank data

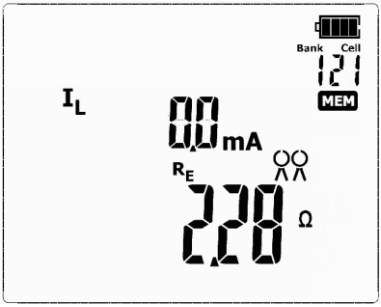
1

Use **<<** or **>>** to browse the memory:

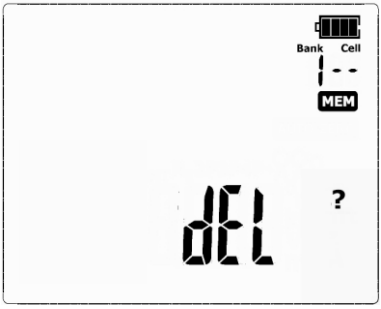
MEM (LED 

is on).

2



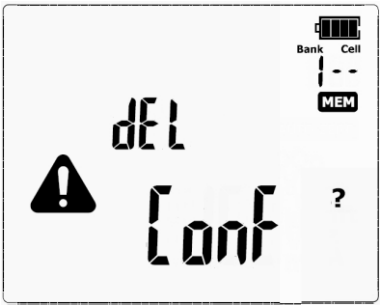
Set the bank number to be deleted acc. to point 5.2.
Set the **cell number** as '- -' (before "01') below screen will appear.



then symbol dEL **?** will be displayed to indicate the readiness for deleting.

3

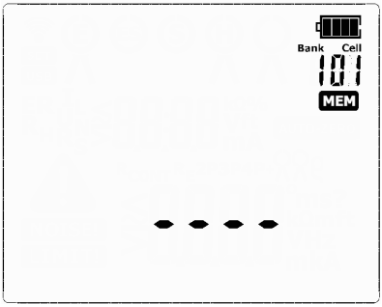
Press **ENTER** button.



⚠ and **dEL ConF ?** symbols appear, asking you to confirm deletion.

4  or 

Press **ENTER** button again to delete the selected bank.
After deleting the bank, the meter beeps three times. Press **ESC** to cancel and return to memory browsing mode**.**

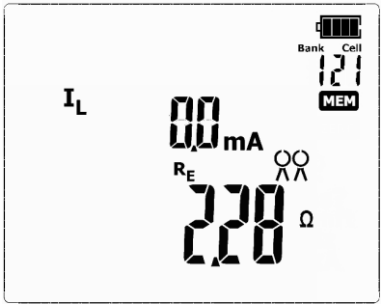


The content of the bank has been deleted.

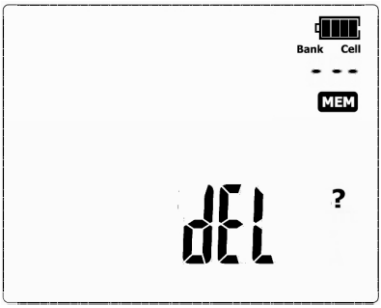
5.3.3 Deleting the whole memory

1 

Use **<<** or **>>** to browse the memory: **MEM** (LED  is on).

2 

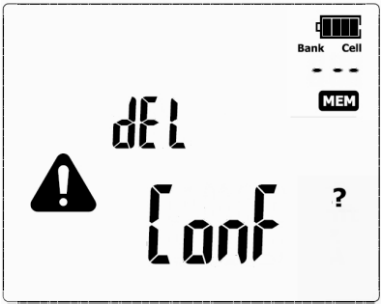
Set the **bank number** as '- -' (before '0')...



… the bank number will change into '- -', then symbol **dEL ?** will be displayed to indicate the readiness for deleting the whole memory.

3

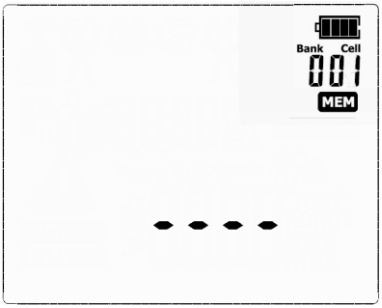
Press **ENTER** button.



⚠ and **dEL ConF ?** symbols appear, asking you to confirm deletion.

4

Press **ENTER** again.
After deleting the memory, the meter beeps three times. Press **ESC** to cancel and return to memory browsing mode**.**



The entire contents of the memory has been deleted.

6 Data transmission

6.1 Computer connection accessories

What is necessary in order to operate the meter with a computer is additional accessories, namely a USB cable and appropriate software. If the required accessories have not been purchased along with the meter, then they are available from the manufacturer or an authorized distributor.

The accessories may be used with other devices manufactured by SONEL S.A. which are equipped with the USB interface, or other (depending on the device).

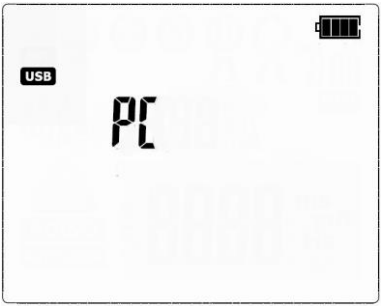
Detailed information regarding software is available from the manufacturer or an authorized distributor.

6.2 Data transmission through USB port

1 

Use **<<** or **>>** to switch into memory browsing mode: **MEM** (LED MEM is on).

2 Connect the cable to the USB port of the computer and the USB socket of the meter. The meter will display below message:

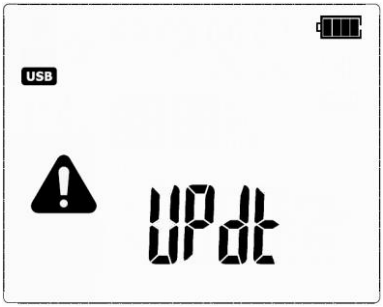


3 Start the program for communicating with the meter (processing results) and follow the commands of the software.

7 Firmware update

1. In accordance with the guidelines of Section 3 of this manual, enter the meter's firmware update mode: **UPdT**

2. Connect the cable to the USB port of the computer and the USB socket of the meter.



3. Run a program for updating the firmware and follow on-screen instructions.

8 Power supply of the meter

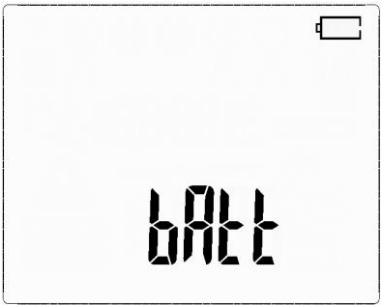
8.1 Monitoring the power supply voltage

The charge level of the batteries or rechargeable batteries is indicated by the symbol in the right upper corner of the display on a current basis:

rechargeable batteries are charged.

rechargeable batteries are nearly discharged.

No battery symbol on screen (with charger connected) indicates that the battery is either disconnected or corrupted.



Rechargeable batteries completely discharged.
The meter switches off automatically after 5 seconds.

8.2 Charging the rechargeable battery pack

CAUTION!
The MRU-30 meter is powered from SONEL battery pack, which includes NiMH 9.6 V batteries and it may be replaced only by the manufacturer's service department.

Battery charger is installed inside the meter and cooperates only with the manufacturer's rechargeable battery pack. The charger is powered by external power supply adapter. The device may be also powered from the car cigarette lighter socket (**12 V only**), using an optional charger.

Charging commences once the power supply has been connected to the meter regardless of the fact whether the meter is on or off, only the charging mode is different, as described below. When the meter is switched off - the charging process is indicated on the screen by displaying animated symbol of battery being charged; when the meter is switched off - the charging is indicated by blinking LED's of measurement functions (they blink consecutively in red).

Charging modes:

- the meter (user interface) is switched off: the battery pack is charged in 'quick charging' mode - the charging process takes approx. 4 hours. Completed charging is indicated by full battery symbol, **FULL** message and beep. In order to fully turn the device off, unplug the power charger.
- the meter (user interface) is switched on: the battery pack is charged in 'background charging' mode - the charging may be longer than the charging process of the device which is switched off. Completed charging is indicated by full battery symbol and beep. If the charging time exceeds 10 hours, the meter will automatically switch off for safety reasons.

In order to fully turn the device off, unplug the power charger and turn the meter off.

CAUTION!
Do not power the meter from sources other than those listed in this manual.

Note:

- Due to interferences in the mains, the process of battery pack charging may finish prematurely. When charging time is too short, turn off the meter and start charging again.

Additional information displayed by the meter

Message	Cause	Proceeding
Err ACU H°C	The temperature of the batteries is too high.	Wait for the batteries to cool down. Start the charging procedure again.
Err ACU L°C	The temperature of the batteries is too low.	Wait for the batteries to warm up. Start the charging procedure again.
Err ACU X (where X is an error digit indicator)	Emergency.	Try to start the charging procedure again. While trying to get the power supply from the car lighting socket, verify if the 12V voltage is present. If it doesn't help, contact the service, as the batteries may be corrupted.
No battery symbol (with connected battery charger)	Disconnected or corrupted batteries.	Contact the manufacturer's service department.

8.3 General principles of using Ni-MH batteries

- Store the accumulators in a dry, cool and well ventilated place and protect them from direct sunlight. The temperature of the environment in the case of prolonged storage should not exceed 30°C. If the accumulators are stored for a long time in a high temperature, then the occurring chemical processes may reduce their lifetime.
- Ni-MH batteries normally withstand 500-1000 charging cycles. The accumulators reach their maximum capacity after being formatted (2-3 charge and discharge cycles). The most important factor which influences the lifetime of the battery is the depth of discharge. The deeper the discharge of the battery, the shorter its lifetime.
- The memory effect is limited in the case of Ni-MH batteries. These batteries may be charged at any point with no serious consequences. However, it is recommended to discharge them completely every few cycles.
- During storage of Ni-MH batteries they are discharged at the rate of approximately 20% per month. Keeping them at high temperatures may accelerate this process even 100%. In order to prevent excessive discharge of batteries, after which it would be necessary to format them, it is recommended to charge the batteries from time to time (even if not in use).
- Modern fast chargers detect both too low and too high a temperature of batteries and react to the situation adequately. Too low a temperature should prevent the start of the process of charging, which might damage the battery irreparably. An increase of the temperature of the battery is a signal to stop charging and is a typical phenomenon. However charging at a high temperature of the environment apart from reducing the lifetime causes an accelerated increase of the temperature of the battery, which will be not charged to its full capacity.
- Remember that in the case of quick charging batteries are charged to approximately 80% of their capacity; better results may be obtained if the process of charging is continued: the charger goes then to the phase of charging with a low current and after next couple of hours the batteries are charged to their full capacity.
- Do not charge or use batteries in extreme temperatures. Extreme temperatures reduce the lifetime of batteries. Avoid placing devices powered from batteries in very hot environments. The nominal working temperature must be absolutely observed.

9 Cleaning and maintenance

NOTE!
Apply solely the maintenance methods specified by the manufacturer within the present manual.

The casing of the meter may be cleaned with a soft, damp cloth using all-purpose detergents. Do not use any solvents or cleaning agents which might scratch the casing (powders, pastes, etc.).

Clean the probe with water and dry it. Before the probe is stored for a prolonged period of time it is recommended to grease it with any machine lubricant.

The reels and test leads should be cleaned with water and detergents, and then dried.

The electronic system of the meter does not require maintenance.

10 Storage

In the case of storage of the device, the following recommendations must be observed:

- Disconnect all the test leads from the meter,
- Clean the meter and all its accessories thoroughly,
- Wind the long test leads onto the reels,
- In order to prevent a total discharge of the accumulators in the case of a prolonged storage, charge them from time to time.

11 Dismantling and disposal

Worn-out electric and electronic equipment should be gathered selectively, i.e. it must not be placed with waste of another kind.

Worn-out electronic equipment should be sent to a collection point in accordance with the law of worn-out electric and electronic equipment.

Before the equipment is sent to a collection point, do not dismantle any elements.

Observe the local regulations concerning disposal of packages, worn-out batteries and accumulators.

12 Technical specifications

- The specified accuracy applies to meter terminals.
- The abbreviation ‘m.v.’ in the basic uncertainty definition means the measured value.

12.1 Basic data

Interference voltage measurement U_N (RMS)

Range	Resolution	Basic uncertainty
0...100 V	1 V	±(5% m.v. + 2 digits)

- measurement for f_N 45…65 Hz
- frequency of measurements – minimum two measurements/s

Measurement of earth resistance (2P method)

Range	Resolution	Basic uncertainty
0,01 Ω…19,99 Ω	0,01 Ω	±(3% m.v. + 3 digits)
20,0 Ω…199,9 Ω	0,1 Ω	
200 Ω…1999 Ω	1 Ω	±5% m.v.
2000 Ω…9999 Ω	1 Ω	±8% m.v.

Measurement of earth resistance (3, 4-cable method)

The measurement method: technical, in accordance with IEC 61557-5.
Range of measurement in acc. with IEC 61557-5: 0,53Ω ... 9999Ω for 50 V test voltage.
Range of measurement in acc. with IEC 61557-5: 0,68Ω ... 9999Ω for 25 V test voltage.

Range	Resolution	Basic uncertainty
0,00 Ω...19,99 Ω	0,01 Ω	±(3% m.v. + 3 digits)
20,0 Ω…199,9 Ω	0,1 Ω	
200 Ω…1999 Ω	1 Ω	±5% m.v.
2000 Ω…9999 Ω	1 Ω	±8% m.v.

Measurement of the auxiliary electrode resistance

Range	Resolution	Basic uncertainty
0...999 Ω	1Ω	±(5% (R_S+R_E+R_H) + 8 digits)
1,00...9,99 kΩ	0,01kΩ	
10,0…19,9 kΩ	0,1kΩ	

Measurement of multiple earth resistance with clamp (three-cable with clamp)

Range	Resolution	Basic uncertainty
0,00...19,99 Ω	0,01Ω	±(3% m.v. + 3 digits)
20,0...199,9 Ω	0,1Ω	
200....1999 Ω	1 Ω	±5% m.v.
2000....9999 Ω	1 Ω	±8% m.v.

Measurement of multiple earth resistance with double clamp

Range	Resolution	Basic uncertainty
0,00...19,99 Ω	0,01Ω	±(10% m.v. + 8 digits)
20,0...99,9 Ω	0,1Ω	±(20% m.v. + 3 digits)

Measurement of leakage current in functions utilizing C-3 clamp

Range	Resolution	Basic uncertainty
0,1…99,9 mA	0,1 mA	±(8% m.v. + 5 digits)
100…999 mA	1 mA	±(8% m.v. + 3 digits)
1,00…5,00 A	0,01 A	±(5% m.v. + 5 digits)

- measurement for f_N 45…65 Hz

Measurement of earth connection and equipotential bonding (R_{cont})
The measurement method: technical, in accordance with IEC 61557-4
Range of measurement in accordance with IEC 61557-4: 0,13 Ω ...1999 Ω

Range	Resolution	Basic uncertainty
0,00...9,99 Ω	0,01 Ω	±(2% m.v. + 3 digits)
10,0…99,9 Ω	0,1 Ω	
100…1999 Ω	1 Ω	

Ground resistivity measurements
The measurement method: Wenner's, $\rho = 2\pi L R_E$

Range	Resolution	Basic uncertainty
0,00..9,99 Ωm	0,01 Ωm	Depends on the basic uncertainty of the R_E 4P measurement but not less than ±1 digit.
10,0..99,9 Ωm	0,1 Ωm	
100..999 Ωm	1 Ωm	
1,00..9,99 kΩm	0,01 kΩm	
10,0..99,9 kΩm	0,1 kΩm	
100..999 kΩm	1 kΩm	

- distance between measurement probes (L): 1...50 m or 1…150 ft

Other technical data

a) Type of insulation.....double, in accordance with EN 61010-1 and IEC 61557
b) Measurement category ..... III 300V in acc. with EN 61010-1
c) Protection class of enclosure in accordance with EN 60529 ..... IP65
d) Maximum interference voltage AC + DC at which a measurement may be performed ..... 24 V
e) Maximum measured interference voltage ..... 100 V
f) Maximum interference current at which a measurement of the earth resistance by means of the clamp method is performed ..... 3 A RMS
g) Frequency of the measurement current ..... 125 Hz for 50 Hz mains
..... 150 Hz for 60 Hz mains
h) Measurement voltage and current for R_{cont} ..... U<24 V, I>200 mA
i) Measurement voltage for 2p, 3p, 4p..... 25 or 50 V
j) Measurement current (short-circuit current) for 2p, 3p, 4p ..... > 20 mA
k) Maximum resistance of measurement electrodes ..... 20 kΩ
l) Signalling of insufficient clamp current for ..... ≤0,5 mA
m) Power supply of the meter .....rechargeable batteries type SONEL NiMH 9,6 V 2 Ah
n) Parameters of AC adapter for the battery charger.....100 V…240 V, 50 Hz…60 Hz
o) Number of measurements for R_{cont} ..... >3000 (1 Ω, 2 measurement/minute)
p) Number of measurements for R_E >2000 (R_E=10 Ω, R_H=R_S=100 Ω, 25V 50 Hz, 2 measurement/minute)
q) Rcont resistance measurement duration.....<4 s
r) Duration of a resistance and resistivity measurement by means of other methods .....<8 s
s) Dimensions.....200 x 150 x 73 mm (without test leads)
t) Weight with batteries ..... 1140 g
u) Working temperature .....-10°C..+50°C
v) Temperature range suitable for initiating battery charging.....+10 °C...+40°C
w) Temperatures at which battery charging is interrupted.....< 0°C and ≥ +50°C
x) Reference temperature .....23 ±2°C
y) Storage temperature .....-20..+60°C
z) Relative humidity .....20..85%
aa) Relative humidity nominal .....40..60%
bb) Altitude. .....< 2000 m
cc) Quality standard.....design and production in accordance with ISO 9001
dd) The product meets EMC requirements according to the following standards .....
..... EN 61326-1:2006 and EN 61326-2-2:2006

12.2 Additional data

Data regarding additional uncertainties are useful mainly in the case the meter is used under non-standard conditions as well as for measurement laboratories for the purpose of calibration.

12.2.1 Influence of the serial interference voltage U_Z on earth resistance measurements for functions 3P, 4P, 3P + clamp, ρ

R_E	U_N	Additional uncertainty [Ω]
0,00…10,00 Ω	25V	$\pm(0{,}001R_E+0{,}01)U_z+0{,}007U_z^2$
	50V	$\pm(0{,}001R_E+0{,}01)U_z+0{,}004U_z^2$
10,01..2000 Ω	25V, 50V	$\pm(0{,}001R_E+0{,}01)U_z+0{,}001U_z^2$
2001..9999 Ω	25V, 50V	$\pm(0{,}003R_E + 0{,}4)U_z$

12.2.2 Influence of the auxiliary electrodes on earth resistance measurements for functions 3P, 4P, 3P + clamp, ρ

R_H,R_S	Additional uncertainty [%]
$R_H \leq 5$ kΩ and $R_S \leq 5$ kΩ	$\pm\left(\frac{R_S}{R_S+100000}\cdot 150+\frac{R_H\cdot 0{,}004}{R_E}+1{,}5\cdot 10^{-8}\cdot R_H{}^2\right)$
$R_H > 5$ kΩ or $R_S > 5$ kΩ or R_H and $R_S > 5$ kΩ	$\pm\left(7{,}5+\frac{R_H\cdot 0{,}004}{R_E}+1{,}5\cdot 10^{-8}\cdot R_H{}^2\right)$

R_E[Ω], R_S[Ω] and R_H[Ω] are values which are displayed by the device.

12.2.3 Influence of the interference current I_Z on the result of the earth resistance measurement 3P+clamp

The MRU-30 meter may perform a measurement, if the value of the interference current does not exceed 3 A rms and the frequency complies with the value set in the MENU.

R_E	Additional uncertainty [Ω]
0,00..50,00 Ω	$\pm(0{,}03R_E\cdot I_Z{}^2)$
50,01..2000 Ω	$\pm(0{,}0009\cdot R_E\sqrt{R_E}\cdot I_Z{}^2)$
2001..9999 Ω	$\pm(9\cdot 10^{-7}\cdot R_E{}^2\cdot I_Z(I_Z+15))$

If the interference current exceeds 3 A the possibility of measurement is blocked.

12.2.4 Influence of interference current on the result of the earth resistance measurement using double clamps

The MRU-30 meter may perform a measurement, if the value of the interference current does not exceed 3 A rms and the frequency complies with the value set in the MENU.

R_E	Additional uncertainty [Ω]
0,00...10,00 Ω	$0{,}03R_E^2I_Z$
10,01...99,99 Ω	$0{,}0004R_E^2I_Z(I_Z+10)$

If the interference current exceeds 3 A the possibility of measurement is blocked.

12.2.5 Influence of the relation of the resistance measured with clamp for the multiple earthing branch to the resultant resistance (3P + clamp)

R_C	Additional uncertainty [Ω]
$\leq 50\Omega$	$\pm(0{,}003\frac{R_C}{R_W{}^2})$
$> 50\Omega$	$\pm(0{,}5\frac{R_C}{\sqrt{R_W}})$

R_C[Ω] is the value of the resistance measured with clamps for the branch displayed by the device, and R_W[Ω] is the value of the resultant multiple earth resistance.

12.2.6 Additional uncertainties in accordance with IEC 61557-5 (3p, 4p)

Influencing factor	Symbol	Additional uncertainty
Location	E_1	0%
Power supply voltage	E_2	0% (bAt not displayed)
Temperature	E_3	±0,2digits/°C for R<1 kΩ ±0,07%/°C ±0,digits/°C for R≥1 kΩ
Serial interference voltage	E_4	In accordance with formulas in 10.2.1 (U_N=3V 50/60Hz)
Resistance of electrodes and auxiliary earth electrodes	E_5	In accordance with formula in 10.2.3

13 Accessories

13.1 Standard accessories

- 30 cm probes (2 pieces) – **WASONG30**,
- 1.2-meter red test lead with banana plugs at both ends – **WAPRZ1X2REBB**,
- 2.2-meter black test lead with banana plugs at both ends – **WAPRZ2X2BLBB**,
- 25-meter red test lead on reel with banana plugs at both ends - **WAPRZ025REBBSZ**,
- 50-metre, yellow test lead on reel with banana plugs at both ends – **WAPRZ050YEBBSZ**,
- Black crocodile clip – **WAKROBL20K01**,
- Pin probe with banana connector, red – **WASONREOGB1**,
- Soft carrying case for the meter and accessories – **WAFUTM9**,
- Carrying case for the meter and accessories – **WAFUTL10**,
- USB cable – **WAPRZUSB**,
- Power supply adaptor Z7 – **WAZASZ7**,
- Calibtation certificate,
- Operating manual,
- Sonel CD with software and drivers.

13.2 Additional accessories

Furthermore, the manufacturer and authorized distributors offer the following elements which are not included in the basic accessories package:

WASONG80

- Earth contact test probe (rod); 80 cm

WACEGC3OKR

- Receiving clamp C-3

WACEGN1BB

- *Transmitting clamp N-1*

WAPRZLAD12SAM

- 12V car cigarette lighter plug for charging batteries

WAFUTL3

- *80cm test probe (rod) carrying case*

LSWPLMRU30

- Cramp – **WAZACIMA1**,

14 Manufacturer

The manufacturer of the device, which also provides warrantee and post-warrantee service is the following company:

SONEL S. A.
Wokulskiego 11 str.
58-100 Świdnica
Poland
tel. +48 74 858 38 60
fax +48 74 858 38 09
E-mail: export@sonel.pl
Web page: www.sonel.pl

Attention:
Service repairs must be carried out solely by the manufacturer.

15 Testing and Calibration Laboratory

SONEL S.A. Testing and Calibration Laboratory offers verification and calibration certificates for the following instruments used for measuring electrical and non-electrical parameters:

- Thermal imagers,
- Pyrometers,
- Insulation testers, earth resistance and resistivity testers, loop testers, RCD testers and installation testers,
- Testers for testing safety of electric appliances,
- Power quality analysers,
- Low resistance testers,
- Voltmeters, ammeters (including clamp types), resistance metres and multimeters,
- Lux meters.

Calibration certificate is a document which confirms the conformity of the manufacturer declared parameters with the national standard, with determination of measurement uncertainty.

According to the ISO 10012 standard - 1, Annex A, Sonel S.A recommends periodic application of metrological control for each instrument at least every **13 months**.

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Note:
In the case of instruments used for the tests related to protection against electric shock, the person performing the measurements should be absolutely sure that his/her instrument is in good working order. The measurements made with a malfunctioning tester can contribute to an incorrect assessment of protection of human health or even life.

NOTES

SONEL S.A.
Wokulskiego 11, St
58-100 Swidnica
Poland

+48 74 85 83 860
+48 74 85 83 800
fax +48 74 85 83 809

http://www.sonel.pl
e-mail: export@sonel.pl