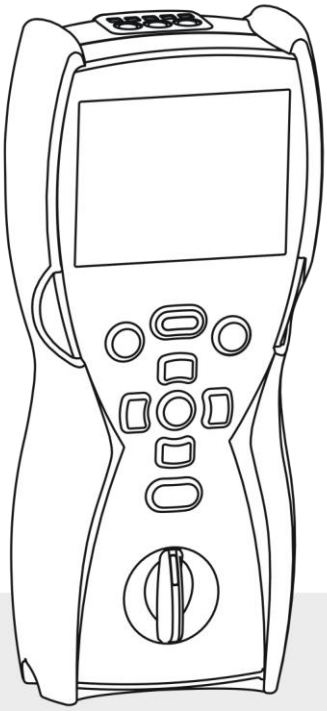


USER MANUAL

INSULATION RESISTANCE METER

MIC-10 • MIC-30

MIC-10 • MIC-30

SELECTOR SWITCH

Measurement function selection:

- **U⎓** - voltage measurement
- MIC-30 **50...1000V** - insulation resistance measurement with voltage selected within range 50...1000V
- **50V** - insulation resistance measurement with test voltage of 50V
- **100V** - insulation resistance measurement with test voltage of 100V
- **250V** - insulation resistance measurement with test voltage of 250V
- **500V** - insulation resistance measurement with test voltage of 500V
- **1000V** - insulation resistance measurement with test voltage of 1000V
- **R_{CONT}** - measurement of resistance of protective conductors and equipotential bonding with 200mA current
- **R_X** - measurement of resistance with current <15mA
- **R_{ZERO}** - test leads resistance compensation for R_{CONT} and R_X
- MIC-30 **MEM** - view and erase of memory and data transmission

USER MANUAL

INSULATION RESISTANCE METER
MIC-10 ● MIC-30

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

Version 2.03 20.11.2023

MIC-10 / MIC-30 meter is a modern, easy 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.

CONTENTS

1 Safety 4

2 Meter configuration 5

3 Measurements 6

3.1 Measurement of insulation resistance 6

3.1.1 Double-lead measurement (with a shielded lead) 6

3.1.2 Three-lead measurement (with a shielded lead) 10

3.1.3 MIC-30 Measurements with WS-04 adapter 10

3.2 Low-voltage measurement of resistance 12

3.2.1 Measurement of resistance of protective conductors and equipotential bonding with 200 mA current 12

3.2.2 Measurement of resistance 14

3.2.3 Compensation of test leads resistance 15

3.3 Voltage measurement 16

3.4 Remembering the last measurement result 16

4 MIC-30 Memory of measurement result data 17

4.1 Storing the measurement results in the memory 17

4.2 Viewing memory data 19

4.3 Deleting memory data 20

4.3.1 Deleting bank data 20

4.3.2 Deleting the whole memory 21

5 MIC-30 Data transmission 22

5.1 Computer connection accessories 22

5.2 Data transmission with Bluetooth module 23

5.3 Data transmission with OR-1 radio module 24

6 MIC-30 Firmware update 25

7 Power supply of the meter 26

7.1 Monitoring of the power supply voltage 26

7.2 Replacing battery/rechargeable batteries 26

7.3 General principles regarding using NiMH rechargeable batteries 27

8 Cleaning and maintenance 27

9 Storage 28

10 Dismantling and disposal 28

11 Technical specifications 28

11.1 Basic data 28

11.2 Other technical data 31

11.3 Additional data 32

11.3.1 Additional uncertainties according to IEC 61557-2 (R_{ISO}) 32

11.3.2 Additional uncertainties according to IEC 61557-4 (R_{CONT} 200mA) 32

12 Manufacturer 32

MIC-30 *The icon with the meter name is placed next to sections of the text that refer to specific features of the device. All other parts of the text relate to all types of the instrument.*

1 Safety

MIC-10 / MIC-30 meter is designed for performing check tests of protection against electric shock in mains systems. The meter is used for making measurements and providing results to determine safety of electrical installations. Therefore, in order to provide conditions for correct operation and the correctness of the obtained results, the following recommendations must be observed:

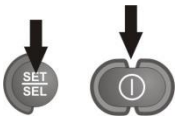
- Before you proceed to operate the meter, acquaint yourself thoroughly with the present manual and observe the safety regulations and specifications determined by the producer.
- Any application that differs from those specified in the present manual may result in a damage to the device and constitute a source of danger for the user.
- MIC-10 / MIC-30 meters must be operated only by appropriately qualified personnel with relevant certificates authorising the personnel to perform works on electric systems. Operating the meter by unauthorised personnel may result in damage to the device and constitute a source of danger for the user.
- During measurements of insulation resistance, dangerous voltage up to 1 kV occurs at the ends of test leads of the meter.
- Before the measurement of insulation resistance you must be sure that tested object is disconnected from the power supply
- During the measurement of insulation resistance do not disconnect test leads from the tested object before the measurement is completed (see par. 3.1.1); otherwise the capacitance of the object will not be discharged, creating the risk of electric shock,
- 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 with a high level of relative humidity, do not start measurements until the meter is warmed up to the ambient temperature (approximately 30 minutes).
- Displayed **BATT** symbol indicates insufficient voltage of power supply and the need to charge the accumulator or replace batteries.
- Symbols **Err*X***, where ***X*** is a number 1…9, indicate incorrect operation of the meter. If after restarting the device this situation is repeated - it indicates that the meter is damaged.
- Before measurement, choose a correct measurement function and make sure that test leads are connected to respective measuring terminals.
- Do not operate a meter with an open or incorrectly closed battery (accumulator) compartment or power it from other sources than those specified in the present manual.
- Meter inputs are electronically protected against overloads (caused by e.g. connecting the meter to a live circuit) up to 550V, for voltmeter up to 600V.
- Repairs may be carried out only by an authorised service point.

Note:
An attempt to install drivers in 64-bit Windows 8 and Windows 10 may result in displaying "Installation failed" message.
Cause: Windows 8 and Windows 10 by default blocks drivers without a digital signature.
Solution: Disable the driver signature enforcement in Windows.

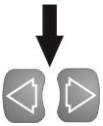
Note:
Due to continuous development of the meter's software, the actual appearance of the display, in case of some of the functions, may slightly differ from the display presented in this operating manual.

2 Meter configuration

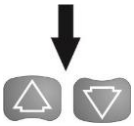
1



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

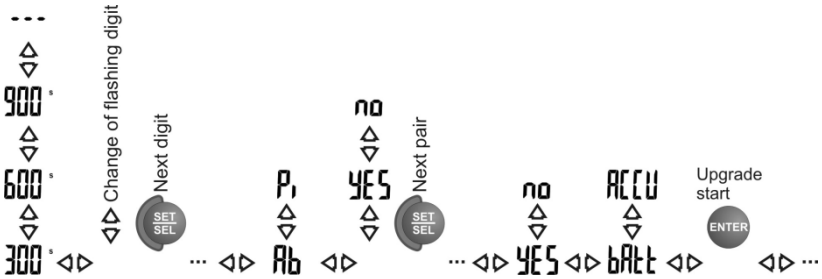


Use ◁ and ▷ buttons to go to the next parameter.



Use △ and ▽ buttons to change the parameter value. The value or symbol to be changed is flashing.
The YES symbol indicates an active parameter, the no - symbol indicates an inactive one.

2 Set the parameters according to the following algorithm:



Parameter	Auto-OFF	MIC-30 Change PIN	MIC-30 Absorption coefficients	MIC-30 Pairs of WS-04 adapter	Beep signalling pressed push-button	Selection of power supply source	MIC-30 Software update
Symbol(s)	OFF	P in	FAC	L-n, L-PE or n-PE	bEEP	SUPP	UPdt

3 ENTER

or

4 ESC

Press **ENTER** to validate the last change and go to the measurement function,

Press **ESC** to go the measurement function without validating the changes.

Notes:

- MIC-30 Each change DAR PI <-> Ab1Ab2 will set standard times t1, t2 and t3:
  - for PI and DAR t1=30s, t2=60s, t3=none,
  - for Ab1 and Ab2 t1=15s, t2=60s, t3=none.
- MIC-30 Description of a firmware update is presented in chapter 6.

3 Measurements

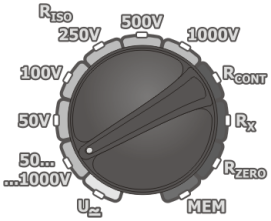
3.1 Measurement of insulation resistance

WARNING:
Measured object must not be live.

Note:
During measurement, especially of high resistances, make sure that test leads do not touch each other and the probe (crocodile clips), because such a contact may cause the flow of surface currents resulting in additional error in measurement results.

3.1.1 Double-lead measurement (with a shielded lead)

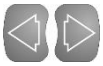
1



Set the rotary switch of function selection at one of $\mathbf{R_{ISO}}$ positions, selecting simultaneously measuring voltage (MIC-30 for position **50...1000V** - selected with 10V step). The meter is in the voltage measurement mode.

2

MIC-30 Press **SET/SEL** push-button to select time used for calculating the absorption coefficients - t1, t2, t3.
For the position of the selector **50...1000V**, an additional option is available to select the measuring voltage U_N.



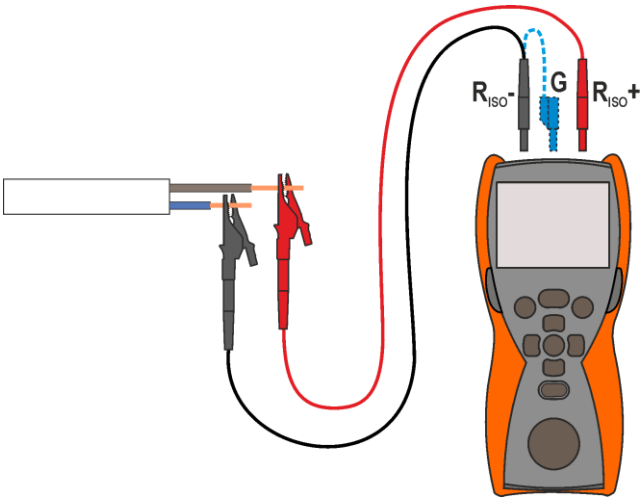
MIC-30 Use ◁ and ▷ the meter enters into the setting of U_N, t1, t2, t3.

MIC-30 Use △ and ▽ buttons to change the parameter value.

3

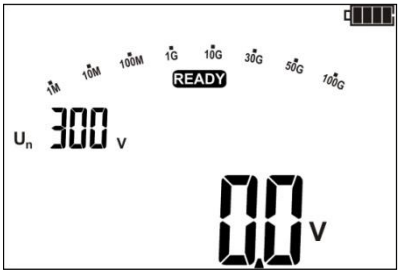
MIC-30 Press **ENTER** to confirm settings (confirmed by beep) or press **ESC** to leave without saving the changes.

4 Connect test leads according to the drawing.



The end of the shielded cable with two banana plugs may be connected only to the meter. Do not connect it to the tested object or to the network.

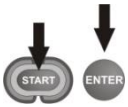
5



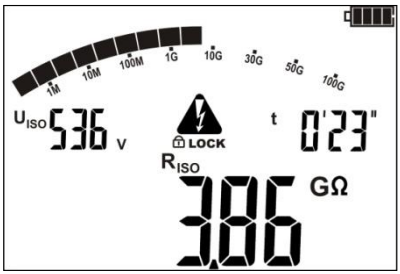
The meter is ready for measurement.

6

Press and hold **START** push-button.
The measurement is performed continuously until you release the button or the pre-set time is reached.



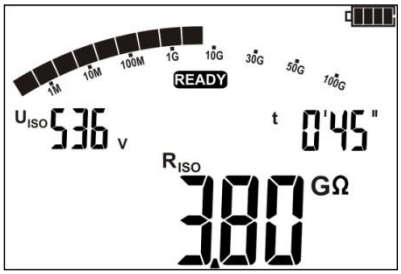
In order to maintain (lock) the measurement order to maintain the measurement, press **ENTER** while holding **START** - push-button pressed - the following symbol will be displayed **LOCK**. In order to interrupt the measurement, press **ESC** or **START**.



View of the screen during measurement.

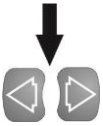
MIC-30 Using **SET/SEL** you may display the leakage current I_L instead of U_{ISO}.

7



After measuring is completed, read the result.

8



Use ◁ and ▷ to see:

MIC-10 the capacitance of the tested object,

MIC-30 individual components of the result in the following order:
$(R_{ISO} + U_{ISO}) \rightarrow (C + I_L) \rightarrow (Rt1 + It1) \rightarrow (Rt2 + It2) \rightarrow (Rt3 + It3) \rightarrow (Ab1(DAR) + U_{ISO}) \rightarrow (Ab2(PI) + U_{ISO}) \rightarrow (R_{ISO} + U_{ISO})$, where C – is the capacitance of the tested object.

Notes:

During measurements of insulation resistance, dangerous voltage up to 1 kV occurs at the ends of test leads of MIC-10 / MIC-30 meter.

It is forbidden to disconnect test leads before the measurement is completed. Failure to obey the above instruction will lead to high voltage electric shock and make it impossible to discharge the object tested.

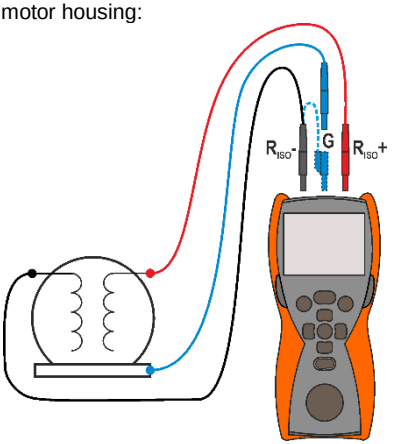
- MIC-30 Disabling t2 will also disable t3.
- MIC-30 Timer measuring the measurement time is started when U_{ISO} voltage is stabilized.
- Symbol **LIMIT I!** indicates working with current limiting (e.g. when charging an object).
- If the work with limited current lasts for 20 seconds, the measurement is interrupted.
- MIC-30 When the timer passes specific points (tx times) a long beep is emitted.
- MIC-30 If any of the measured values of partial resistance is out of range, the value of the absorption coefficient is not displayed – the display shows dashes.
- During the measurement LED is lit in orange.
- After completion of measurement, the capacitance of the object tested is discharged by shorting test terminals with the resistance of 100kΩ.
- Capacitance of the object is measured at the end of the measurement during the object discharge.
- If during the measurement, an external voltage is present, after 20 seconds the measurement is stopped, UdEt is displayed and two-tone beep is emitted, LED will lit in red.

Additional information displayed by the meter

	Test voltage is present on terminals of the meter.
	You must consult the manual.
READY	The meter is ready for measurement.
NOISE!	This inscription displayed after the measurement indicates noise in the system during the measurement. The measurement result may be affected by additional uncertainty.
LIMIT I!	Activation of current limit. The symbol displayed is accompanied by a continuous audio signal.
HiLE	Leakage current too high (breakdown of insulation during the measurement.)
dis	Discharging of the object tested after the measurement.
UdEt LED is lit in red, two-tone acoustic signal	The tested object is live. The measurement is blocked.
bAtt	Discharged batteries (rechargeable batteries).

3.1.2 Three-lead measurement (with a shielded lead)

In order to eliminate the influence of surface currents in the devices of up to 1kV, a three-lead measurement is used. For example, to measure the inter-winding resistance of a small motor, connect G socket of the meter with the motor housing:

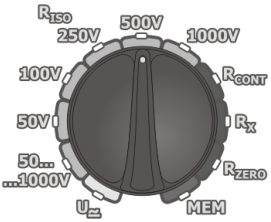


3.1.3 MIC-30 Measurements with WS-04 adapter

NOTE
Measurements with WS-04 are possible at the measurement voltage of 500V, for higher voltages the measurement is blocked.

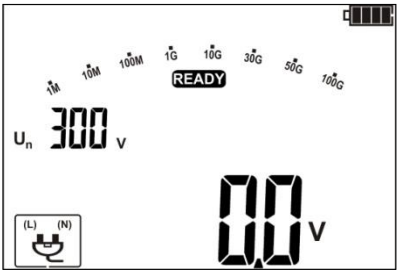
WS-04 provides automatic measurement of up to 3 combinations of test leads from N, L and PE. The adapter is ended at one side with a plug to be connected to the input terminals of the meter, while at the other side with a standard outlet plug with a grounding plug. Combinations of leads that are to be automatically tested, are defined in the meter settings, see Chapter 2.

1



Set the rotary switch of function selection at one of **R_{ISO}** positions, selecting simultaneously measuring voltage (position **50...1000V** - selected with 10V step). The meter is in the voltage measurement mode.

2

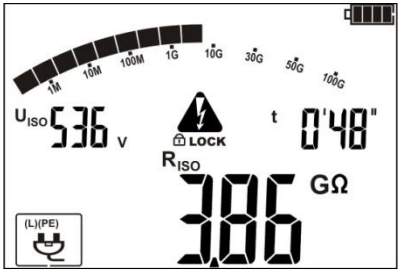


After inserting WS-04 into the socket, the screen displays a message indicating the detection of the adapter.

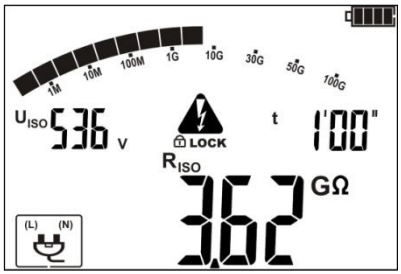
3. Set the measuring voltage U_N (applies only for **50...1000V** position of the switch), and times t1, t2, t3 as in double-lead measurement. These settings relate to the measurement of insulation resistance for each pair of leads selected in the main settings.

4. Connect WS-04 plug to the socket tested.

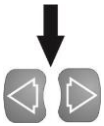
5. Start the measurement as in case of double-lead measurement.



The meter measures the insulation resistance for selected pairs of leads in the following order: L-N, L-PE, N-PE.

6. 

After measuring is completed, read the result.

7. 

Use ◁ and ▷ to view the individual components of the measurement as in double-lead measurement and for pairs L-N, L-PE, N-PE.

Note:

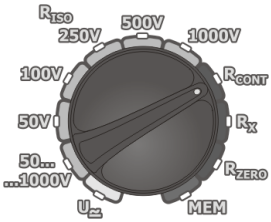
- In cases of errors HiLE, **LIMIT I!** the measurement is interrupted only for the current pair of leads and not for the entire measurement.
- In case of UdEt error the entire measurement is interrupted.
- Other comments and displayed symbols as for the double-lead measurement.

3.2 Low-voltage measurement of resistance

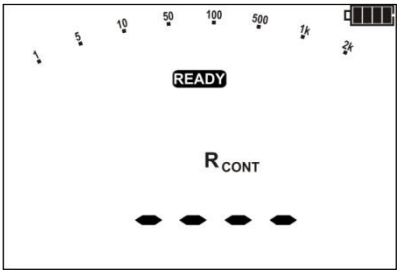
3.2.1 Measurement of resistance of protective conductors and equipotential bonding with 200 mA current

NOTE
The meter measures R_{CONT}:
MIC-10 unidirectionally,
MIC-30 bidirectionally (±200mA).

1



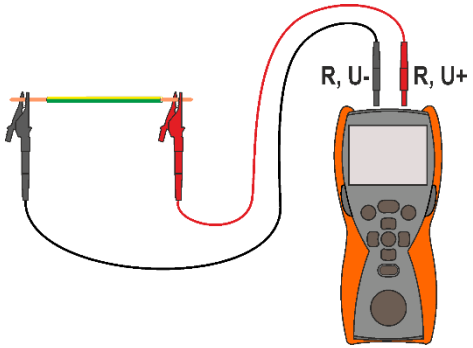
Set the rotary switch of function selection at **R_{CONT}** position.



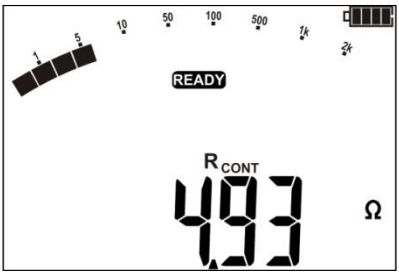
The meter is ready for measurement.

2

Connect the meter to the object tested.
The measurement starts automatically when the meter detects a resistance within the measurement range.
The measurement may be also triggered manually by pressing **START** push-button.



③



Read the result.

④

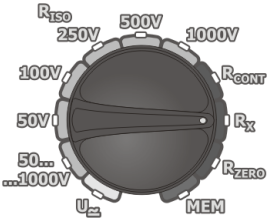
Press **START** push-button in order to start a next measurement without disconnecting test leads from the object.

Additional information displayed by the meter

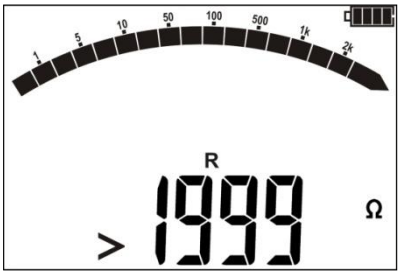
NOISE!	This inscription displayed after the measurement indicates noise in the system during the measurement The measurement result may be affected by additional uncertainty.
UdEt LED is lit in red, two-tone acoustic signal	The tested object is live. The measurement is blocked.
AUTO-ZERO	Resistance compensation completed for test leads The compensation resistance is taken into consideration when displaying result.

3.2.2 Measurement of resistance

1



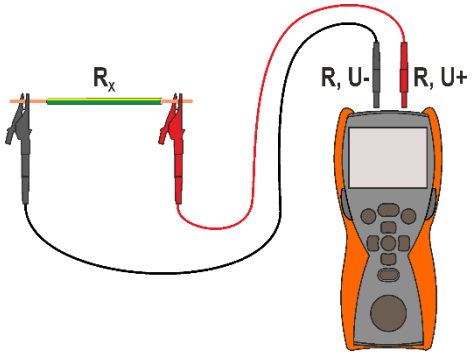
Set the rotary switch of function selection at **R_X** position.



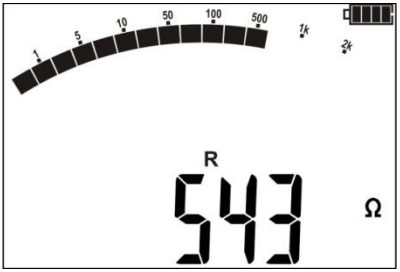
The meter is ready for measurement.

2

Connect the meter to the object tested. The measurement is continuous.



3



Read out the result.

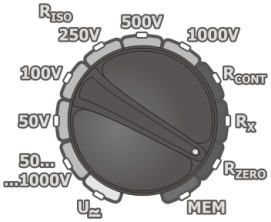
Note:

- For R <30Ω there is a continuous beep and LED lights green.

3.2.3 Compensation of test leads resistance

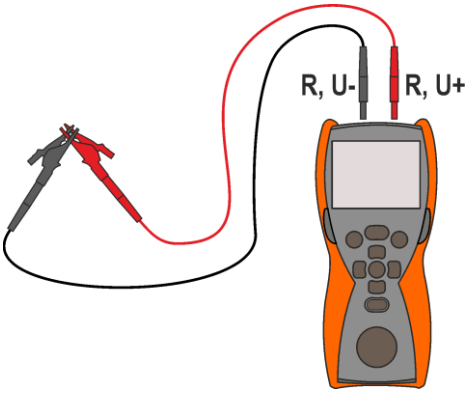
In order to eliminate the impact of the resistance of test leads on measurement result (R_{CONT} and R_X), the compensation (auto-zeroing) of resistance may be performed.

1



Set the rotary switch of function selection at **R_{ZERO}** position.

2

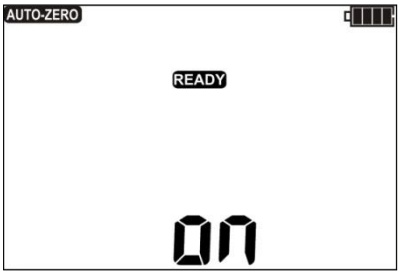


Short the test leads.

3

Press **START**.

4



AUTO-ZERO and ON are displayed, confirming the completion of test leads resistance compensation.

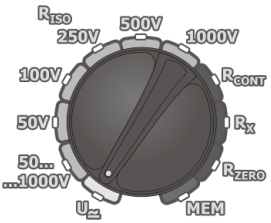
The compensation is available for R_{CONT} and R_X and is active even after the meter is switched off and on again.

5

In order to remove the compensation made (and return to default calibration), perform the above-mentioned activities with test leads open – messages AUTO-ZERO and ON disappear, the following message is displayed OFF.

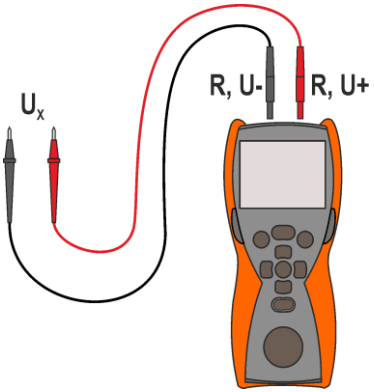
3.3 Voltage measurement

1



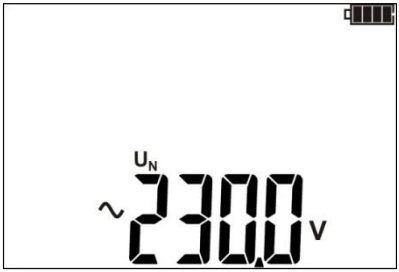
Set the rotary switch of function selection at **U** ∿ position.

2



Connect the meter to a voltage source.

3



Measurement is performed in a continuous manner.

Additional information displayed by the meter

> 600 V LED is lit in red, two-tone acoustic signal	Voltage is higher than acceptable. **Immediately** disconnect the test leads.

3.4 Remembering the last measurement result

Result of the latest measurement is remembered by the meter until a next measurement is started or measurement settings are changed or the measuring function is changed by means of the rotary switch. When you go to the initial screen of a given function (e.g. by using **ESC** button), you can recall this result automatically after pressing **ENTER**. Similarly, you can view the latest measurement result after turning off and then turning on the meter (if the position of function selector has not been changed).

4 MIC-30 Memory of measurement result data

MIC-10 / MIC-30 Meters are equipped with a memory for storing test results (990 cells, each of which may contain a set of measurements of R_{ISO} and R_{CONT}). The whole memory is divided into 10 memory banks with 99 cells in each bank. 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 can also perform measurements in any sequence and repeat them without losing other data.

Memory of measurement result data **is preserved** 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.

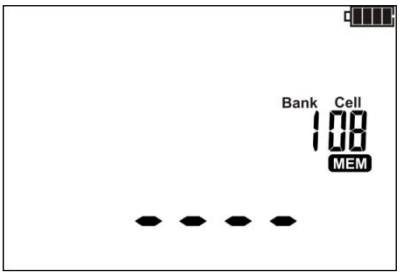
Notes:

- Results of measurements performed for all measuring functions can be stored in one memory cell, excluding **R_X** and **U**~.
- After entering the measurement result, the number of the cell is automatically incremented.
- 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.

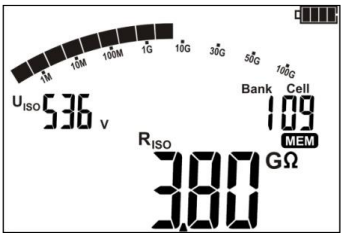
4.1 Storing the measurement results in the memory

1

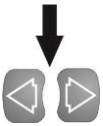
After completing measurement press **ENTER**.



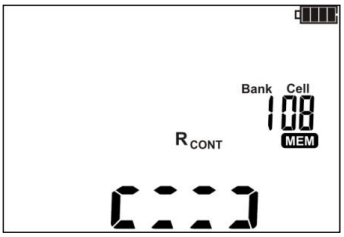
The cell is empty.



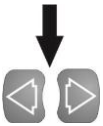
The cell is occupied by the same type of result, which is to be entered.



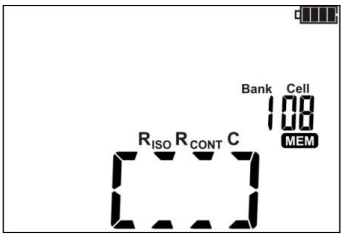
Use ◁ and ▷ to preview the results.



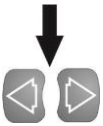
The cell is occupied by a different type of result, than the one which is to be entered.



Use ◁ and ▷ to preview the results stored in the memory cell.



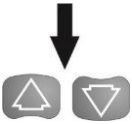
The cell is fully occupied.



Use ◁ and ▷ to view the results.

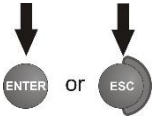
2

Use **SET/SEL** to select active cells or banks which may be changed.



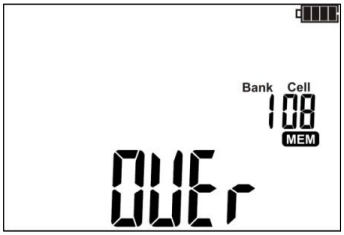
Use △ and ▽ to change the number of a cell or bank.

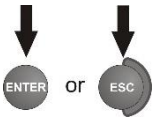
3



Press **ENTER**, to save the result in the memory or **ESC** to display the result without saving it. Saving is indicated by a triple beep and by a rectangle displayed on the main display field.

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



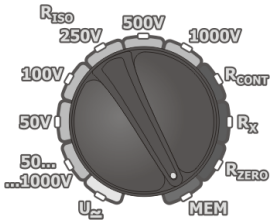
④ 

Press **ENTER**, to overwrite the result or **ESC**, to cancel saving.

Notes:

- Complete set of results (main result and supplementary results) for a given measuring function and preset measurement settings/conditions are stored in the memory (e.g. NOISE) .
- In a given cell you can not simultaneously save the measurement result of R_{ISO} obtained by double-lead method and the result obtained by using WS-04 adapter.

4.2 Viewing memory data

① 

Set the rotary switch of function selection at **MEM** position.

② 

Use **SET/SEL** to select active cells or banks which may be changed.

Use △ and ▽ to change the number of a cell or bank.

③ 

Use ◁ and ▷ to view the results.

Notes:

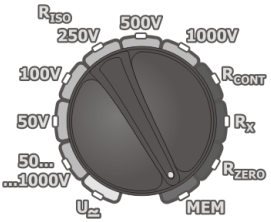
- While viewing R_{ISO} results, the field of timer / memory displays alternately bank and cell numbers and the time in which the result was entered into memory. This applies to all R_{ISO} and I_L measurements.

4.3 Deleting memory data

You can delete the entire memory or its individual banks.

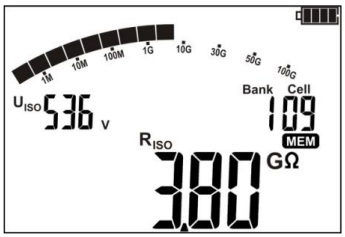
4.3.1 Deleting bank data

1

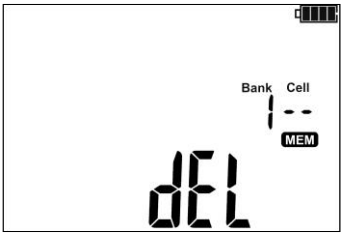


Set the rotary switch of function selection at **MEM** position.

2



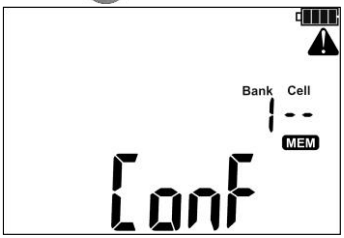
Set the bank number to be deleted
acc. to section 4.2.
St the cell number to "--".



The symbol dEL appears which indicates the readiness to delete.

3

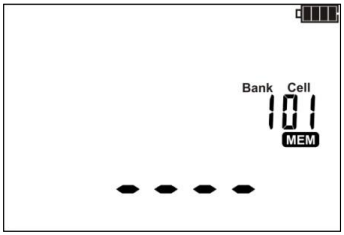
Press **ENTER** .



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

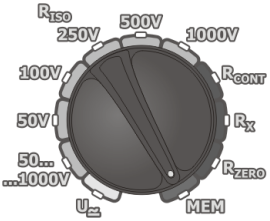
④

Press **ENTER** again.
After deleting the bank, the meter beeps three times and sets the cell number as "01".



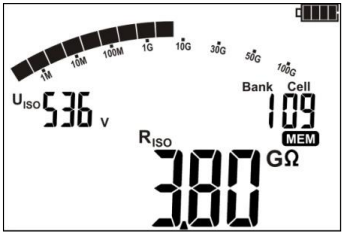
4.3.2 Deleting the whole memory

①

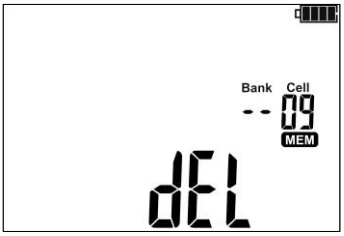


Set the rotary switch of function selection at **MEM** position.

②



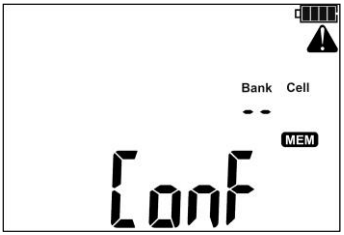
St the bank number to "--".



The symbol dEL appears which indicates the readiness to delete.

③

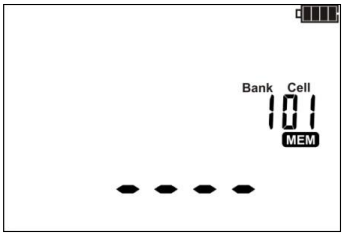
Press **ENTER** .



and ConF asking you to confirm deletion.

④

Press **ENTER** again.
After deleting the memory, the meter beeps three times and sets the bank and cell number as "1".



5 MIC-30 Data transmission

5.1 Computer connection accessories

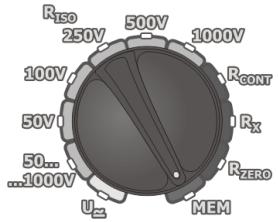
In order to ensure the communication of the meter with a computer, Bluetooth module is required with an additional software. A program that may be used for this purpose is **Sonel Reader**. It allows users to read and display the measurement data stored in the meter memory. This program may be downloaded free from the manufacturer's website. Information on the availability of other programs cooperating with the meter may be obtained from the manufacturer or its authorized distributors.

The software may be used for many devices manufactured by SONEL S.A. which are equipped with the USB interface and/or wireless module.

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

5.2 Data transmission with Bluetooth module

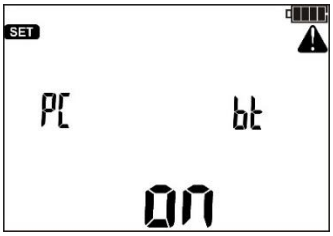
The feature is available in meters with serial number prefixes **E2** and **D6**.

1. 

Set the rotary switch of function selection at **MEM** position.

2. 

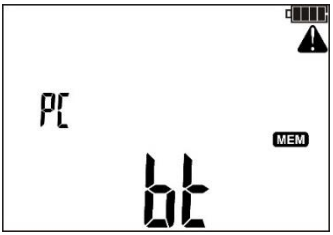
Press **SET/SEL** for 2 sec.



The meter displays the screen of wireless communication.

3. 

Press **ENTER** to start the transmission.



4. Connect Bluetooth module to the USB socket of the PC, unless it is integrated into the PC.

5. During the process of pairing the meter with a PC enter PIN code compatible with the PIN code of the meter defined in main settings.

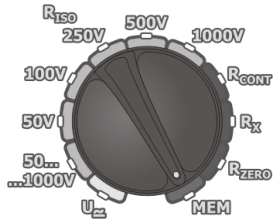
6. On the computer start data storing programme.

Press **ESC** to exit the transmission mode.

Standard pin for Bluetooth is "1234".

5.3 Data transmission with OR-1 radio module

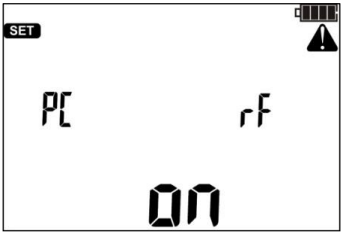
The feature is available in meters with serial number prefix **AO**.

1. 

Set the rotary switch of function selection at **MEM** position.

2. 

Press **SET/SEL** for 2 sec.



The meter displays the screen of wireless communication.

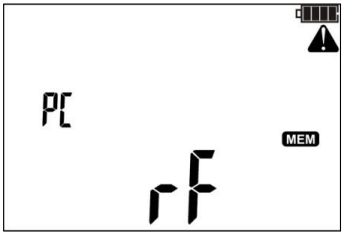
3. Connect OR-1 module to the USB socket of the PC.

4. Start data storing programme.

5. PIN code of an application must be compatible with the PIN code of the meter defined in main settings.

6. 

Press **ENTER** to start the transmission.



Press **ESC** to exit the transmission mode.

Standard pin for OR-1 is "123".

6 MIC-30 Firmware update

1. In main settings select the update mode option (Chapter 2). The meter displays the following screen.

2. 

Press **ENTER** to start transmission and perform updating according to the instructions of the application.

3. Connect Bluetooth module to the USB socket of the PC, unless it is integrated into the PC.

4. During the process of pairing the meter with a PC enter PIN code compatible with the PIN code of the meter defined in main settings.

5. Run a program for updating the firmware and perform updating according to the instructions of the application.

Notes:

NOTE!
Before updating the firmware, insert new batteries or fully charged rechargeable batteries.

- To exit the mode press **ESC**, this is possible until the meter starts the process of memory reprogramming - at that time all buttons are inactive.
- After completing the update the meter is automatically switched off.
- After switching on, the meter shortly displays the current number of internal software (firmware).

- If problems occur the meter displays **Err*X*** (***X*** – error code). Turn off and turn on the meter, all incomplete updates are deleted and the meter starts to operate on the previous software. If another updating attempt is not completed successfully, the meter should be returned to the manufacturer's service.

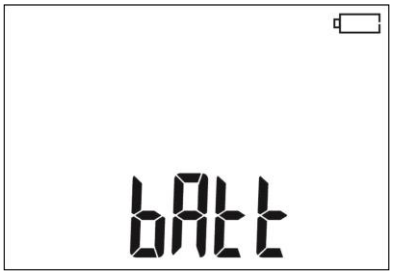
7 Power supply of the meter

7.1 Monitoring of 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:

Batteries/ rechargeable batteries charged

Batteries / rechargeable batteries almost discharged.



Batteries / rechargeable batteries fully discharged.
The meter switches off automatically.

7.2 Replacing battery/rechargeable batteries

MIC-10 / MIC-30 Meters are powered by four AA alkaline LR6 batteries or rechargeable batteries of NiMH type.

NOTE! Before removing the battery cover, disconnect the test leads.

To replace the batteries/ rechargeable batteries:
1. Disconnect the leads from the measuring circuit and turn off the meter,
2. Unscrew the 4 screws at the bottom of the housing and remove the cover,
3. Replace all batteries/ rechargeable batteries with new ones.
4. Put on the and tighten the cover.

Note:
Rechargeable batteries must be recharged in an external charger.

NOTE!
Do not use the meter when the battery compartment is removed or open. Do not power the meter from other sources than those mentioned in this manual.

7.3 General principles regarding using NiMH rechargeable batteries

- If you do not use the device for a prolonged period of time, then it is recommended to remove the rechargeable batteries and store them separately.

- Store the rechargeable batteries 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 rechargeable batteries are stored for a long time in a high temperature, then the occurring chemical processes may reduce their lifetime.

- NiMH batteries withstand normally 500-1000 charging cycles These batteries reach their maximum capacity after being formatted (2-3 charge/discharge cycles). The most important factor which influences the lifetime of rechargeable batteries is the level of their discharge. The deeper the discharge level of the batteries, the shorter their lifetime.

- The memory effect is limited in case of NiMH 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 NiMH batteries they are self-discharged at the rate of approximately 30% per month. Keeping rechargeable batteries at high temperatures may accelerate this process even 100%. In order to prevent excessive discharge of rechargeable batteries, after which it would be necessary to format them, it is recommended to charge them from time to time (even if they are not used).

- Modern fast chargers detect both too low and too high a temperature of rechargeable batteries and react to the situation adequately. Too low temperature should prevent starting the process of charging, which might irreparably damage rechargeable batteries. An increase of the temperature of the rechargeable batteries is a signal to stop charging and is a typical phenomenon. However charging at a high ambient temperature apart from reducing batteries' lifetime causes an accelerated increase of their temperature and the result is that the batteries are not charged to their full capacity.

- Please note that when the batteries are charged with a fast-charger they are charged only to approx. 80% of their capacity - better results can be achieved by continuing charging: the charger enters trickle-charging mode and during the next few hours batteries are charged to their full capacity.

- Do not charge or use rechargeable batteries in extreme temperatures. Extreme temperatures reduce the lifetime of batteries and rechargeable batteries . Avoid placing devices powered by rechargeable batteries in very hot environments. The nominal working temperature must be absolutely observed.

8 Cleaning and maintenance

NOTE!
Apply solely the maintenance methods specified by the manufacturer in this 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.).

The electronic system of the meter does not require maintenance.

9 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.
- In the case the meter is to be stored for a prolonged period of time, batteries/rechargeable batteries must be removed from the device.
- In order to prevent a total discharge of the rechargeable batteries in the case of a prolonged storage, charge them from time to time.

10 Dismantling and disposal

Used electrical and electronic equipment should be collected selectively, i.e. it must not be placed with another kinds of waste.

Used electronic equipment should be sent to a collection point in accordance with the Used Electrical and Electronic Equipment Act.

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

Observe the local regulations concerning disposal of packages and used batteries/rechargeable batteries.

11 Technical specifications

11.1 Basic data

⇒ The abbreviation "m.v." used in the specification of accuracy denotes a standard measured value.

AC / DC voltage measurement

Display range	Resolution	Accuracy
0.0...299.9 V	0.1 V	±(2% m.v. + 6 digits)
300…600V	1V	±(2% m.v. + 2 digits)

- Frequency range: 45...65Hz

Measurement of insulation resistance

- Voltage accuracy (R_{obc} [Ω] ≥ 1000*U_N [V]): 0…+10% of the selected value

Measurement range, according to IEC 61557-2 for U_N = 50V: 50kΩ…250.0MΩ

Display range for U_N = 50V	Resolution	Accuracy
0.0 ... 999.9 kΩ	0.1 kΩ	± (3% m.v. + 8 digits) MIC-30 [± (5% m.v. + 8 digits)] *
1.000 ... 9.999 MΩ	0.001MΩ	
10.00...99.99MΩ	0.01 MΩ	
100.0 ... 250.0 MΩ	0.1 MΩ	

* - for WS-04 adapter

Test range according to IEC 61557-2 for U_N = 100V: 100kΩ…500.0MΩ

Display range for U_N = 100V	Resolution	Accuracy
0.0 ... 999.9 kΩ	0.1 kΩ	± (3% m.v. + 8 digits) MIC-30 [± (5% m.v. + 8 digits)] *
1.000 ... 9.999 MΩ	0.001MΩ	
10.00...99.99MΩ	0.01 MΩ	
100.0 ... 500.0 MΩ	0.1 MΩ	

* - for WS-04 adapter

Test range according to IEC 61557-2 for U_N = 250V: 250kΩ…2.000GΩ

Display range for U_N =250V	Resolution	Accuracy
0.0 ... 999.9 kΩ	0.1 kΩ	± (3% m.v. + 8 digits) MIC-30 [± (5% m.v. + 8 digits)] *
1.000 ... 9.999 MΩ	0.001MΩ	
10.00...99.99MΩ	0.01 MΩ	
100.0 ... 999.0 MΩ	0.1 MΩ	
1.000 ... 2.000 GΩ	0.001 GΩ	MIC-10 ± (3% m.v. + 8 digits) MIC-30 ± (4% m.v. + 6 digits) MIC-30 [± (6% m.v. + 6 digits)] *

* - for WS-04 adapter

MIC-10 Test range according to IEC 61557-2 for U_N = 500V: 500kΩ…5.000GΩ

Display range for U_N = 500V	Resolution	Accuracy
0.0…999.9kΩ	0.1kΩ	± (3% m.v. + 8 digits)
1.000…9.999MΩ	0.001MΩ	
10.00…99.99MΩ	0.01MΩ	
100.0…999.0MΩ	0.1MΩ	
1.000…5.000GΩ	0.001GΩ	± (4% m.v. + 6 digits)

MIC-30 Test range according to IEC 61557-2 for U_N = 500V: 500kΩ…20.00GΩ

Display range for U_N = 500V	Resolution	Accuracy
0.0 ... 999.9 kΩ	0.1 kΩ	± (3% m.v. + 8 digits) [± (5% m.v. + 8 digits)] *
1.000 ... 9.999 MΩ	0.001MΩ	
10.00...99.99MΩ	0.01 MΩ	
100.0 ... 999.0 MΩ	0.1 MΩ	
1.000 ... 9.999 GΩ	0.001 GΩ	± (4% m.v. + 6 digits) [± (6% m.v. + 6 digits)] *
10.00 ... 20.00 GΩ	0.01 GΩ	

* - for WS-04 adapter

MIC-10 Test range according to IEC 61557-2 for U_N = 1000V: 1000kΩ…10.00GΩ

Display range for U_N = 1000V	Resolution	Accuracy
0.0...999.9kΩ	0.1kΩ	± (3% m.v. + 8 digits)
1.000...9.999MΩ	0.001MΩ	
10.00...99.99MΩ	0.01MΩ	
100.0...999.9MΩ	0.1MΩ	
1.000...9.999GΩ	0.001GΩ	± (4% m.v. + 6 digits)
10.00GΩ	0.01GΩ	

MIC-30 Test range according to IEC 61557-2 for U_N = 1000V: 1000kΩ…100.0GΩ

Display range for U_N = 1000V	Resolution	Accuracy
0.0 ... 999.9 kΩ	0.1 kΩ	± (3% m.v. + 8 digits)
1.000 ... 9.999 MΩ	0.001MΩ	
10.00...99.99MΩ	0.01 MΩ	
100.0 ... 999.9 MΩ	0.1 MΩ	
1.000 ... 9.999 GΩ	0.001 GΩ	± (4% m.v. + 6 digits)
10.00 ... 99.99 GΩ	0.01 GΩ	
100.0 GΩ	0.1 GΩ	

⇒ **Note:** For insulation resistance below R_{ISOmin} there is no accuracy specified because the meter works in the current limit mode in accordance with the following formula:

$$R_{ISO\,\min} = \frac{U_{ISOnom}}{I_{ISOnom}}$$

where:

R_{ISOmin} - minimum insulation resistance measured without limiting the current
U_{ISOnom} - nominal test voltage
IISOnom - nominal current (1mA)

MIC-30 **Measurement of leakage current**

Display range	Resolution	Accuracy
0…I_{Lmax}	mA, µA, nA	Calculated basing on resistance measurements

- I_{Lmax} – maximum current at short circuit of leads,
- resolution and units result from the measurement range of individual insulation resistance.

Measurement of capacitance

Display range	Resolution	Accuracy
1...999nF	1nF	± (5% m.v. + 10 digits)
1.00...9.99µF	0.01µF	

- Measurement of capacitance is made only during R_{ISO} measurement.
- For measurement voltages below 100V and when measured resistance is below 10MΩ, the measurement accuracy is not specified.

Low-voltage continuity and resistance measurement

Measurement of continuity of protective conductors and equipotential bondings with 200 mA current

Measuring range according to IEC 61557-4: 0.10…1999Ω

Display range	Resolution	Accuracy
0.00...19.99Ω	0.01Ω	±(2% m.v. + 3 digits)
20.0...199.9Ω	0.1Ω	
200...1999Ω	1Ω	±(4% m.v. + 3 digits)

- Voltage at open terminals: <8V
- Output current at R < 2Ω: I > 200mA
- Compensation of test leads resistance
- MIC-10 Current flowing unidirectionally
- MIC-30 Current flowing bidirectionally, average resistance is displayed

Low-current resistance measurement

Range	Resolution	Accuracy
0.0...199.9Ω	0.1Ω	±(3% m.v. + 3 digits)
200...1999Ω	1Ω	

- Voltage at open terminals: <8V
- Current at shorted terminals 5mA< I <15mA
- Acoustic signal and LED lit in green for measured resistance < 30Ω ± 10%
- Compensation of test leads resistance

11.2 Other technical data

a) type of insulation according to IEC 61010-1 and IEC 61557 ..... double
b) measurement category according to IEC 61010-1 ..... IV 600V (III 1000V)
c) protection class of enclosure acc. to IEC 60529 ..... IP67
d) power supply for the meter ..... 4 AA alkaline batteries or rechargeable batteries
e) dimensions ..... 220 x 100 x 60 mm
f) meter weight ..... approx 0.6 kg
g) storage temperature ..... -20...+70°C
h) operating temperature ..... -10...+50°C
i) humidity ..... 20...90%
j) reference temperature ..... +23 ± 2°C
k) reference humidity ..... 40...60%
l) altitude (above sea level) ..... <2000 m
m) display ..... LCD segment
n) MIC-30 memory of measurement results ..... 990 cells
o) MIC-30 data transmission ..... wireless link
p) quality standard ..... development, design and manufacturing are ISO 9001 compliant
q) the device meets the requirements of the IEC 61557 standard
r) the product meets the EMC requirements (immunity for industrial environment) according to the following standards ..... IEC 61326-1 and IEC 61326-2-2

Note:

MIC-30 SONEL S.A. hereby declares that the radio device type MIC-30 complies with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available at the following website address: https://sonel.pl/en/download/declaration-of-conformity/

11.3 Additional data

Data on additional uncertainties are useful mainly when the meter is used in non-standard conditions and for metrological laboratories for the purpose of calibration.

11.3.1 Additional uncertainties according to IEC 61557-2 (R_{ISO})

Significant parameter	Designation	Additional uncertainty
Position	E_1	0%
Supply voltage	E_2	0% (**BATT** is not lit)
Temperature 0...35°C	E_3	2%

11.3.2 Additional uncertainties according to IEC 61557-4 (R_{CONT} 200mA)

Significant parameter	Designation	Additional uncertainty
Position	E_1	0%
Supply voltage	E_2	0% (**BATT** is not lit)
Temperature 0...35°C	E_3	2%

12 Manufacturer

The manufacturer of the device and provider of warranty and post-warranty service:

SONEL S.A.
Wokulskiego 11
58-100 Świdnica
Poland
tel. +48 74 884 10 53 (Customer Service)
e-mail: customerservice@sonel.com
web page: www.sonel.com

NOTE
Service repairs must be performed solely by the manufacturer.

MEASURING MESSAGES

CAUTION!

Connecting the input terminals to voltages above 600V may cause damage to the meter and the risk of electrical injury to the user.

	Test voltage is present on terminals of the meter.
	You must consult the manual.
READY	The meter is ready for measurement.
NOISE!	Indicates noise in the system during the measurement. The measurement result may be affected by additional uncertainty.
LIMIT I!	Activation of current limit. The symbol displayed is accompanied by a continuous audio signal.
HiLE	Leakage current too high (breakdown of insulation during the measurement).
UdEt LED is lit in red, two-tone acoustic signal	The tested object is live. The measurement is blocked.
dis	Discharging of the object tested after the measurement.
Err	Internal error.
tEmP	The temperature inside the meter has risen above the allowable limit, the measurement is blocked.
AUTO-ZERO	Resistance compensation is active.
> 500V	Nominal voltage U_{ISO} is higher than 500V while WS-04 adapter is connected. The measurement is blocked.
	The charge level of the batteries:
	Batteries/ rechargeable batteries charged.
	Batteries / rechargeable batteries almost discharged.
bAtt	Batteries / rechargeable batteries fully discharged.

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