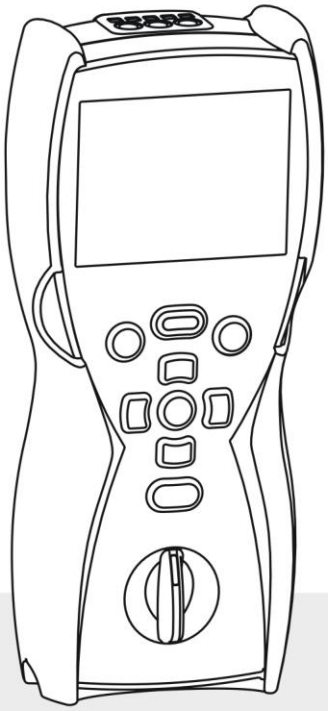


USER MANUAL

INSULATION RESISTANCE METER

MIC-10

MIC-10


Test leads connections
Start of measurement procedure
SET/SEL - enter the meter settings, select the digit to change
Shift/selection: right/left, up/down
Meter turn on and off (when pressed for 2 sec.), Backlight on and off
ESC - exit to the last screen, leave without saving changes
Approve
SELECTOR SWITCH
Measurement function selection:
- U≂ - voltage measurement
- 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
- RCONT - measurement of resistance of protective conductors and equipotential bonding with 200mA current
- Rx - measurement of resistance with current <15mA
- RZERO - test leads resistance compensation for RCONT i Rx
Sonel®
MIC-10
START
ESC
SET SEL
ENTER
LOCK
GΩ
RISO
500V
250V
100V
50V
RCONT
Rx
RZERO

USER MANUAL

INSULATION RESISTANCE METER
MIC-10

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

Version 1.06 06.03.2020

MIC-10 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

MIC-10 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:

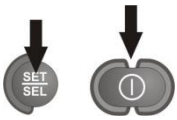
- Before you proceed to operate the meter, acquaint yourself thoroughly with the present manual and observe the safety regulations and specifications determined by the producer.
- Any application that differs from those specified in the present manual may result in a damage to the device and constitute a source of danger for the user.
- MIC-10 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); 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 block drivers without a digital signature.
Solution: Disable the driver signature enforcement in Windows.

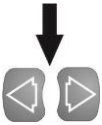
Note:
Due to continuous development of the meter's software, the actual appearance of the display, in case of some of the functions, may slightly differ from the display presented in this operating manual.

2 Meter Configuration

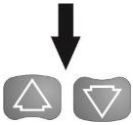
1



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

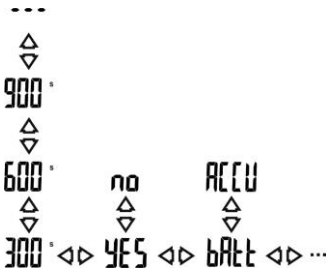


Use ◁ and ▷ buttons to go to the next parameter.



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	Beep signalling pressed push-button	Selection of power supply source
Symbol(s)	OFF	bEEP	SUPP

3

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

or

4

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

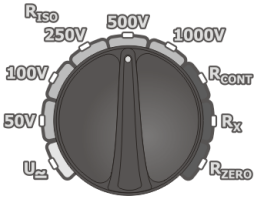
3 Measurements

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.

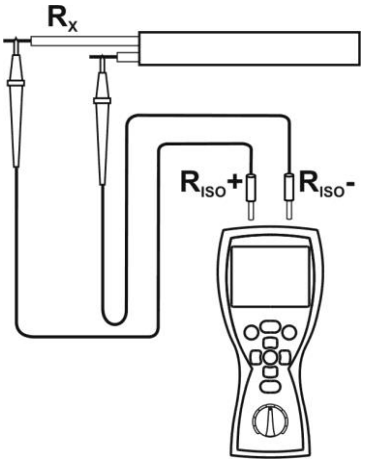
1



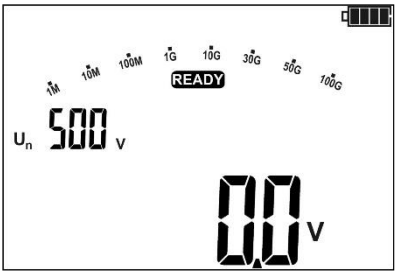
Set the rotary switch of function selection at one of $\mathbf{R_{ISO}}$ positions, selecting simultaneously measuring voltage. The meter is in the voltage measurement mode.

2

Connect test leads according to the drawing.



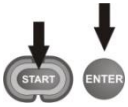
3



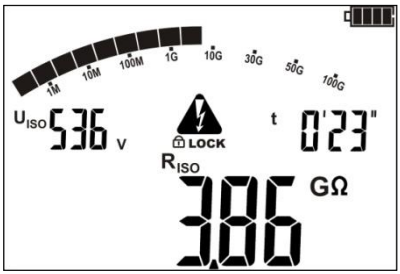
The meter is ready for measurement

4

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

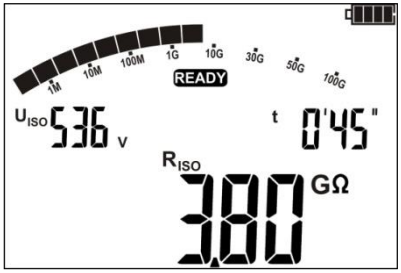


In order to maintain (lock) the measurement order to maintain the measurement, press **ENTER** while holding **START** - push-button pressed - the following symbol will be displayed **LOCK**. In order to interrupt the measurement, press **ESC** or **START**.



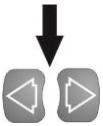
View of the screen during measurement.

5

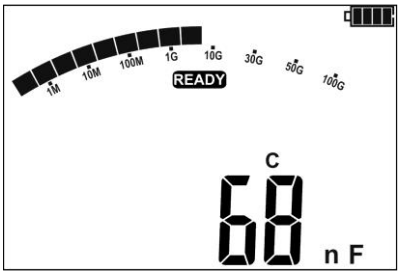


After measuring is completed, read the result.

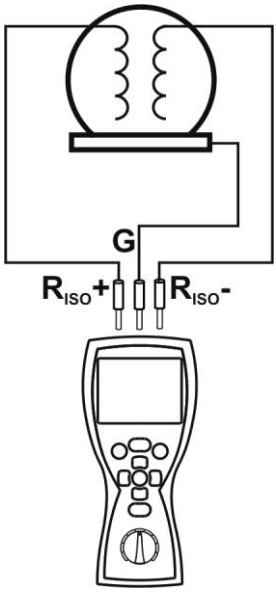
6



Use ◁ and ▷ to see the capacitance of the tested object.



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:



Notes:

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

- 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.
- Capacitance of the object is measured at the end of the measurement during the object discharge.
- After completion of measurement, the capacitance of the object tested is discharged by shorting test terminals with the resistance of 100kΩ.

Additional information displayed by the meter

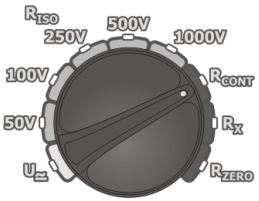
	Test voltage is present on terminals of the meter.
	You must consult the manual.
READY	The meter is ready for measurement.
NOISE!	This inscription displayed after the measurement indicates noise in the system during the measurement. The measurement result may be affected by additional uncertainty.
LIMIT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

3.2 Low-voltage measurement of resistance

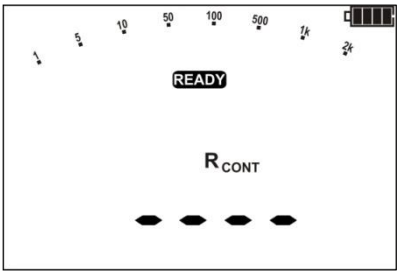
3.2.1 Measurement of resistance of protective conductors and equipotential bonding with 200 mA current

NOTE
MIC-10 meter measures R_{CONT} unidirectionally.

1



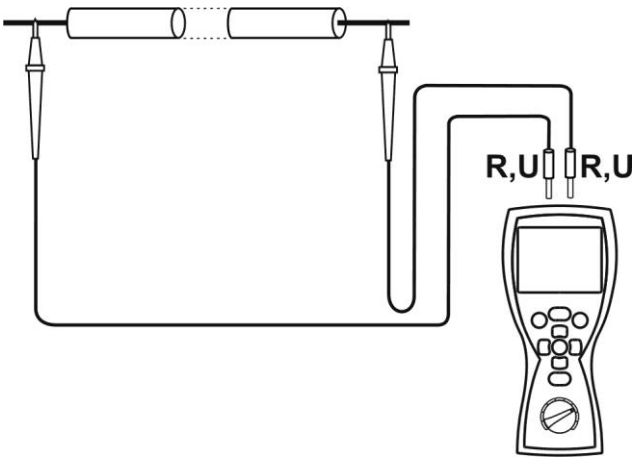
Set the rotary switch of function selection at **R_{CONT}** position.



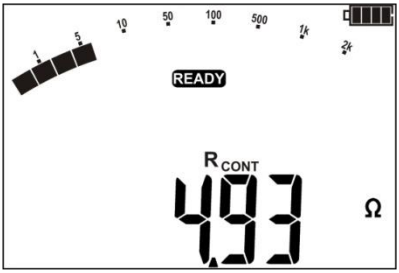
The meter is ready for measurement.

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

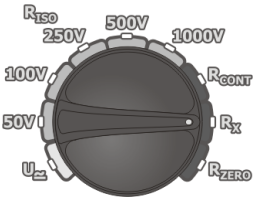
Press **START** push-button in order to start a next measurement without disconnecting test leads from the object.

Additional information displayed by the meter

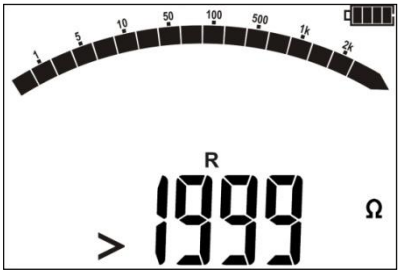
NOISE!	This inscription displayed after the measurement indicates noise in the system during the measurement The measurement result may be affected by additional uncertainty.
UdEt two-tone acoustic signal	The tested object is live. The measurement is blocked.
AUTO-ZERO	Resistance compensation completed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

3.2.2 Measurement of resistance

1

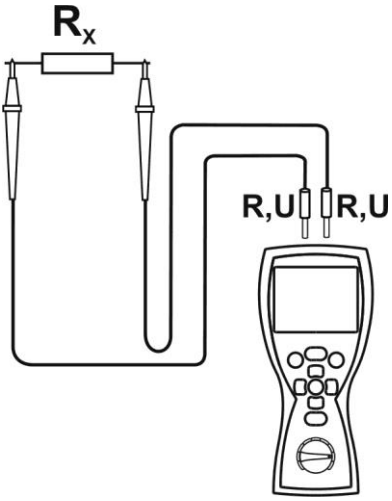


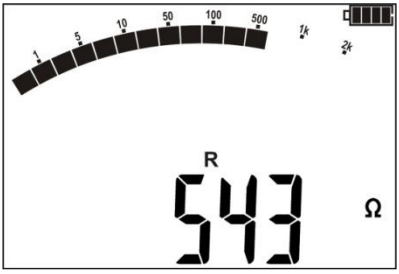
Set the rotary switch of function selection at $\mathbf{R_x}$ position.



The meter is ready for measurement.

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



3 

Read out the result.

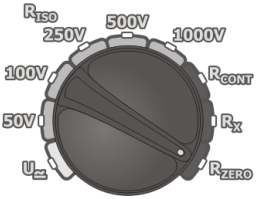
Note:

- For R <30Ω there is a continuous beep.

3.2.3 Compensation of test leads resistance

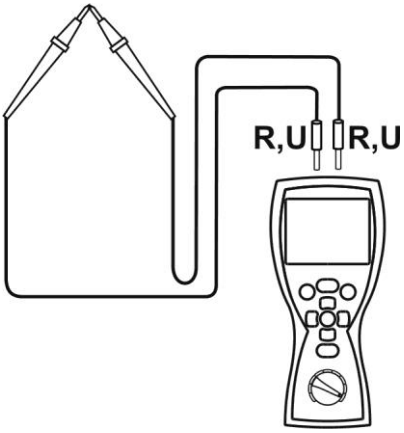
In order to eliminate the impact of the resistance of test leads on measurement result (R_{CONT} and R_X), the compensation (auto-zeroing) of resistance may be performed.

1



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

2

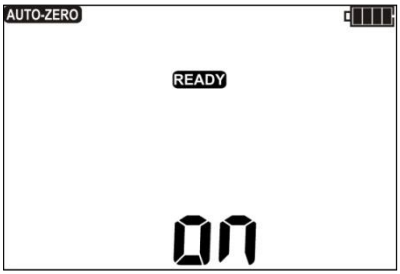


Short the test leads.

3

Press **START**.

4



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

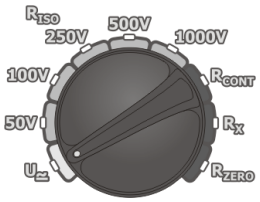
The compensation is available for R_{CONT} and R_X and is active even after the meter is switched off and on again.

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**.

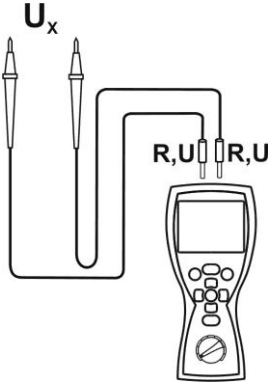
3.3 Voltage measurement

1



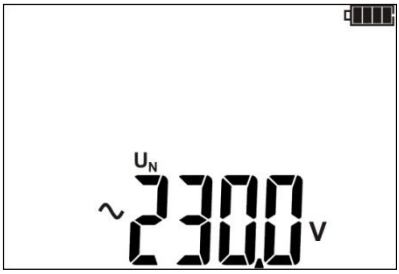
Set the rotary switch of function selection at **U** ∿ position.

2



Connect the meter to a voltage source.

3



Measurement is performed in a continuous manner.

Additional information displayed by the meter

> 600 V 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).

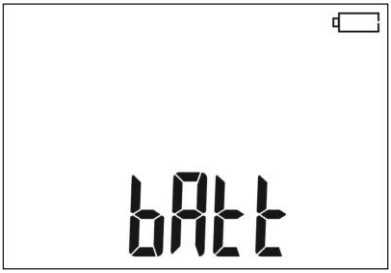
4 Power supply of the meter

4.1 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.

4.2 Replacing battery/rechargeable batteries

MIC-10 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.

4.3 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.

5 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.

6 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.

7 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.

8 Technical specifications

8.1 Basic data

⇒ Abbreviation "m.v." used in the specification of measurement uncertainty means a standard measured value.

AC / DC voltage measurement

Display range	Resolution	Measurement uncertainty
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	Measurement uncertainty
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 ... 250.0 MΩ	0.1 MΩ	

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

Display range for U_N = 100V	Resolution	Measurement uncertainty
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 ... 500.0 MΩ	0.1 MΩ	

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

Display range for U_N =250V	Resolution	Measurement uncertainty
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 ... 999.0 MΩ	0.1 MΩ	
1.000 ... 2.000 GΩ	0.001 GΩ	

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

Display range for U_N = 500V	Resolution	Basic uncertainty
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 ... 999.0 MΩ	0.1 MΩ	
1.000 ... 5.000 GΩ	0.001 GΩ	± (4% m.v. + 6 digits)

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

Display range for U_N = 1000V	Resolution	Basic uncertainty
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 GΩ	0.01 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
I_{ISOnom} - nominal current (1mA)

Measurement of capacitance

Display range	Resolution	Measurement uncertainty
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 error is not specified.

Low-voltage continuity and resistance measurement

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

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

Display range	Resolution	Measurement uncertainty
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_{SC}> 200mA
- Compensation of test leads resistance

Low-current resistance measurement

Range	Resolution	Measurement uncertainty
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_{SC}<15mA
- Acoustic signal for measured resistance < 30Ω ± 10%
- Compensation of test leads resistance

Other technical specification

a) type of insulation.....double, IEC 61010-1 and IEC 61557 compliant
b) measurement category..... IV 600V (III 1000V) according to IEC 61010-1
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) quality standard.....development, design and manufacturing are ISO 9001 compliant
o) the device meets the requirements of the IEC 61557 standard
p) the product meets the EMC requirements (immunity for industrial environment) according to the following standards.....IEC 61326-1 and IEC 61326-2-2

8.2 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.

8.2.1 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%

8.2.2 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%

9 Accessories

The current list of accessories can be found on the manufacturer's website.

9.1 Standard accessories

Standard set of MIC-10 equipment supplied by the manufacturer includes:

- MIC-10 – **WMGBMIC10**,
- 1.2 m cable CAT III 1000V – 2 pcs (red - **WAPRZ1X2REBB**, black - **WAPRZ1X2BLBB**),
- crocodile clip CAT III 1000V – 1 pc (black - **WAKROBL20K01**),
- blade probe CAT III 1000V – 2 pcs (black - **WASONBLOGB1,** red - **WASONREOGB1**),
- M-6 carrying case for the meter and accessories – **WAFUTM6**,
- calibration certificate,
- user manual,
- Set of 4xAA alkaline batteries 1.5 V,
- strap for carrying the meter – **WAPOZSZE4**,
- plastic hook (to hang the meter) – **WAPOZUCH1**.

9.2 Optional accessories

Additionally, the following items that are not included in the scope of standard equipment can be purchased from the manufacturer or the distributors:

WAPRZ1X2BUBB

- *1.2m cable CAT III 1000V blue*

WAKRORE20K02

- *crocodile clip CAT III 1000V red*
- *calibration certificate issued by an accredited laboratory*

WAKROBU20K02

- *crocodile clip CAT III 1000V blue*

WASONBUOGB1

- *test prod with banana socket - blue*

10 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 74 858 38 60
fax +48 74 858 38 09
E-mail: export@sonel.pl
Web page: www.sonel.pl

NOTE
Service repairs must be performed solely by the manufacturer.

11 Laboratory services

SONEL Testing and Calibration Laboratory has been accredited by the Polish Center for Accreditation (PCA) - certificate no. AP 173.

AP 173

Laboratory offers calibration for the following instruments that are used for measuring electrical and non-electrical parameters.

- **METERS FOR MEASUREMENTS OF ELECTRICAL PARAMETERS**
  - voltage meters,
  - current meters (including clamp meters),
  - resistance meters,
  - insulation resistance meters,
  - earth resistance and resistivity meters,
  - RCD meters,
  - short-circuit loop impedance meters,
  - power quality analyzers,
  - portable appliance testers (PAT),
  - power meters,
  - multimeters,
  - multifunction meters covering the functions of the above-mentioned instruments,
- **ELECTRICAL STANDARDS**
  - calibrators,
  - resistance standards,
- **METERS FOR MEASUREMENTS OF NON-ELECTRICAL PARAMETERS**
  - pyrometers,
  - thermal imagers,
  - luxmeters.

The **Calibration Certificate** is a document that presents a relation between the calibration standard of known accuracy and meter indications with associated measurement uncertainties. The calibration standards are normally traceable to the national standard held by the National Metrological Institute.

According to ILAC-G24 „Guidelines for determination of calibration intervals of measuring instruments", SONEL S.A. recommends periodical metrological inspection of the instruments it manufactures no less frequently than once every **12 months**.

For new instruments provided with the Calibration Certificate or Validation Certificate at the factory, re-calibration should be performed within **12 months** from the date of purchase, however, no later than **24 months** from the date of purchase.

ATTENTION !
The person performing the measurements should be absolutely sure about the efficiency of the device being used. Measurements made with an inefficient meter can contribute to an incorrect assessment of the effectiveness of health protection and even human life.

NOTES

WARNING AND ADDITIONAL MESSAGES DISPLAYED BY THE METER

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 ,two-tone acoustic signal	The tested object is live. The measurement is blocked.
diS	Discharging of the object tested after the measurement.
AUTO-ZERO	Resistance compensation is active.
 bAtt	The charge level of the batteries: Batteries/ rechargeable batteries charged. Batteries / rechargeable batteries almost discharged. Batteries / rechargeable batteries fully discharged.

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

+48 74 858 38 60
+48 74 858 38 00
fax +48 74 858 38 09

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