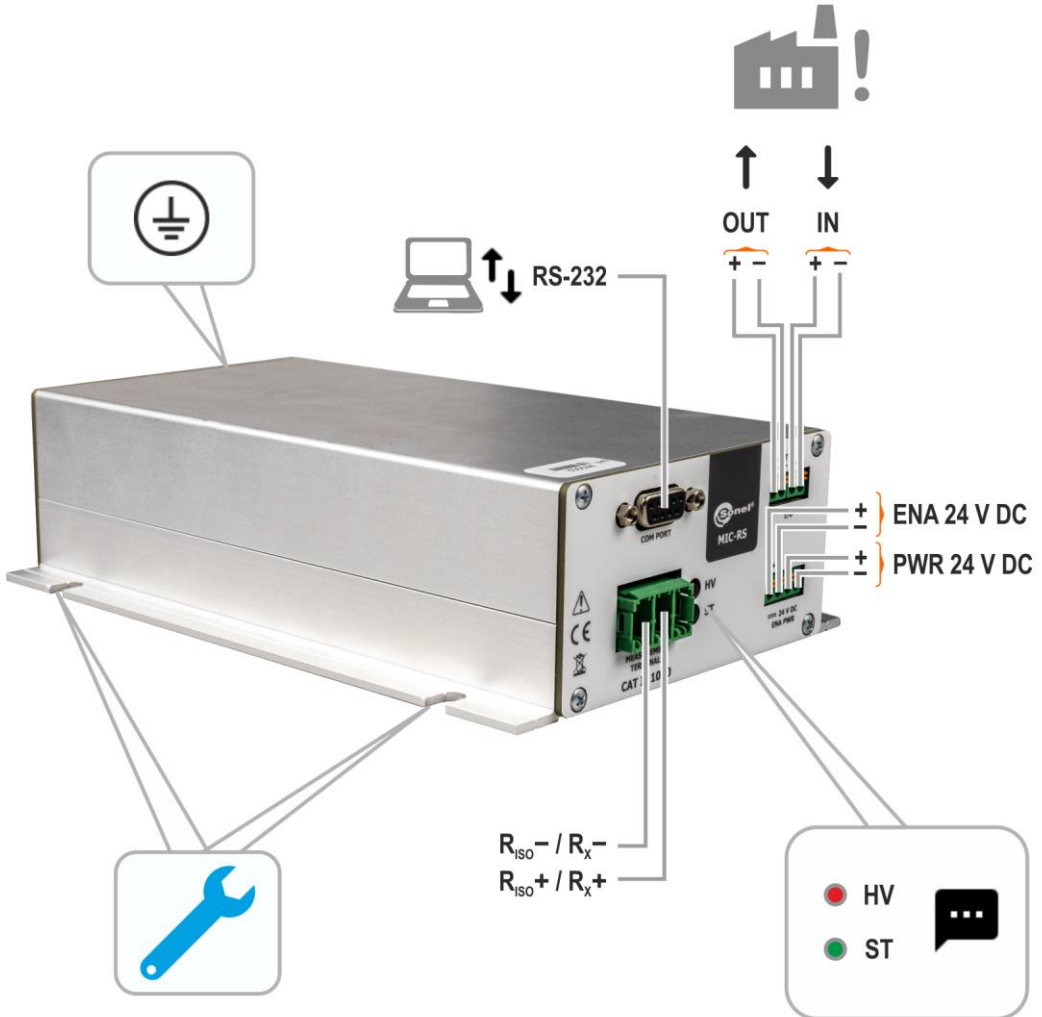


USER MANUAL

INSULATION RESISTANCE METER

MIC-RS





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INSULATION RESISTANCE METER MIC-RS



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The MIC-RS meter is designed and manufactured for general industrial applications. It is a modern, top quality measuring instrument which is easy and safe to use, provided that the principles presented in this manual are observed. In addition, becoming acquainted with the manual will help you avoid measuring errors and will prevent any possible problems with the operation of the meter.







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1 General information

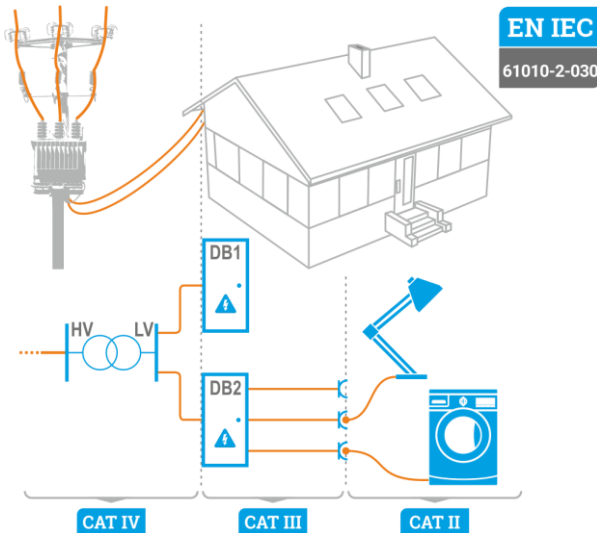
1.1 Safety symbols

The following international symbols are used in the device and/or in this manual:

	Warning. See explanation in the manual	 1000 V	Attention, risk of electric shock. The device generates a voltage of 1000 V		Protection class I PE terminal bonding required
	DC current/voltage		Declaration of Conformity with EU directives (Conformité Européenne)		Do not dispose of with other household waste

Measurement categories according to EN IEC 61010-2-030:

- **CAT II** – concerns measurements performed in circuits directly connected to low voltage installations,
- **CAT III** – concerns measurements performed in buildings installations,
- **CAT IV** – concerns measurements performed at the source of low voltage installation.



1.2 Behaviour of signalling LEDs



The LED is on continuously



The LED flashes slowly



The LED flashes rapidly

1.3 Safety

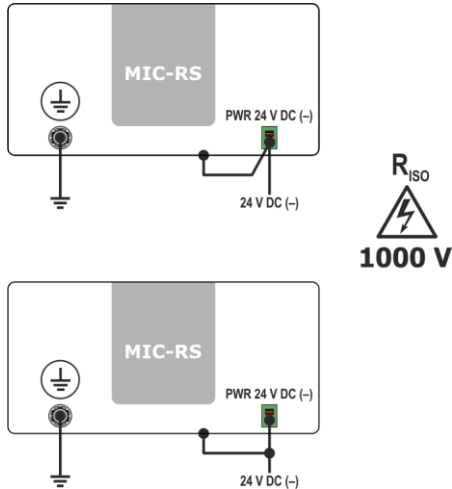
The MIC-RS is designed to measure insulation resistance of wiring, transformers and other electrical equipment, as well as general resistance testing. Therefore, in order to provide the conditions for correct operation and accuracy of obtained results, the following recommendations must be observed:

- **This device is intended for built-in/permanent installation. The system installer is liable for the safety of the system into which this device is integrated. The device shall only be installed and connected by authorized personnel.**
- Before you proceed to operate the meter, acquaint yourself thoroughly with the present manual and observe the safety regulations and recommendations of the manufacturer.
- Any application that differs from those specified in the manual may result in damage to the device and constitute a source of danger for the user.
- The meter must only be operated by appropriately qualified personnel with relevant certificates authorising the personnel to perform works on electric systems. Unauthorized use of the meter may result in its damage and may be a source of serious hazard to the user and bystanders.
- Before the measurement of insulation resistance you must be sure that the test object is disconnected from the power supply.
- During the measurement of insulation resistance do not disconnect test leads from the test object before the measurement is completed. Otherwise the capacitance of the object will not be discharged, creating the risk of electric shock.
- When measuring the resistance of a cable, ensure that the other end of the cable is protected against accidental contact.
- 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 with the person responsible for health and safety.
- It is unacceptable to operate:
 - ⇒ **Do not power on this meter without its PE terminal bonded to earth.**
 - ⇒ a damaged meter which is completely or partially out of order,
 - ⇒ a meter with damaged 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 has warmed up to the ambient temperature (approximately 30 minutes).
- The correct operation of the instrument and accessories must be checked regularly to avoid any hazard which may result from erroneous results.
- In a situation where the product works with other instruments or accessories, the lowest measurement category of the connected devices is used.
- Do not power the meter from sources other than those listed in this manual.
- Repairs may only be performed by an authorised service point.



WARNING

- First connect the PE wire of this device to the PE terminal at the installation site before proceeding with connection of other wiring.
- Never attempt to operate this device if not bonded to earth! Operation of the device without a earth bonding may result in electrocution hazards.
- Connect the power supply negative to the meter chassis either on the meter itself or the system to which this meter is wired.
- During measurements of insulation resistance, dangerous voltage up to 1.1 kV (1 kV + (0...10%)) occurs at the ends of test leads of the meter.



Due to continuous development of the meter's software, the actual appearance of the display for some features may slightly differ from that presented in this user manual.

2 Quick start

1



Install the meter in the permanent location for the system.

2



First connect the PE wire of this device to the PE terminal at the installation site before proceeding with connection of other wiring.

3

PWR 24 V (-)

Connect the power supply negative to the meter chassis either on the meter itself or the system to which this meter is wired.

4

PWR • ENA
IN • OUT
RS-232 • R_{ISO}

Wire the remaining connections.

5



Configure the main/master control unit and wire the meter to it.

6



Enter the meter configuration settings for the serial communication protocol, **MIC-RS-SCP**.

7



Start the measurements according to the **MIC-RS-SCP** guidelines and the specifications of your system.



WARNING

- Before attempting any measurement, make sure this device has been properly bonded to earth.
- The tested object must not be under voltage higher than 50 V.
- Take particular care during cable measurement. The risk of electric shock is present also after discharging their capacitance by the meter, as the voltage can be rebuilt automatically.
- During measurements, it is recommended to use electrical insulating personal protection equipment, which reduces the risk of touching the wires that may pose a threat to the user.



WARNING

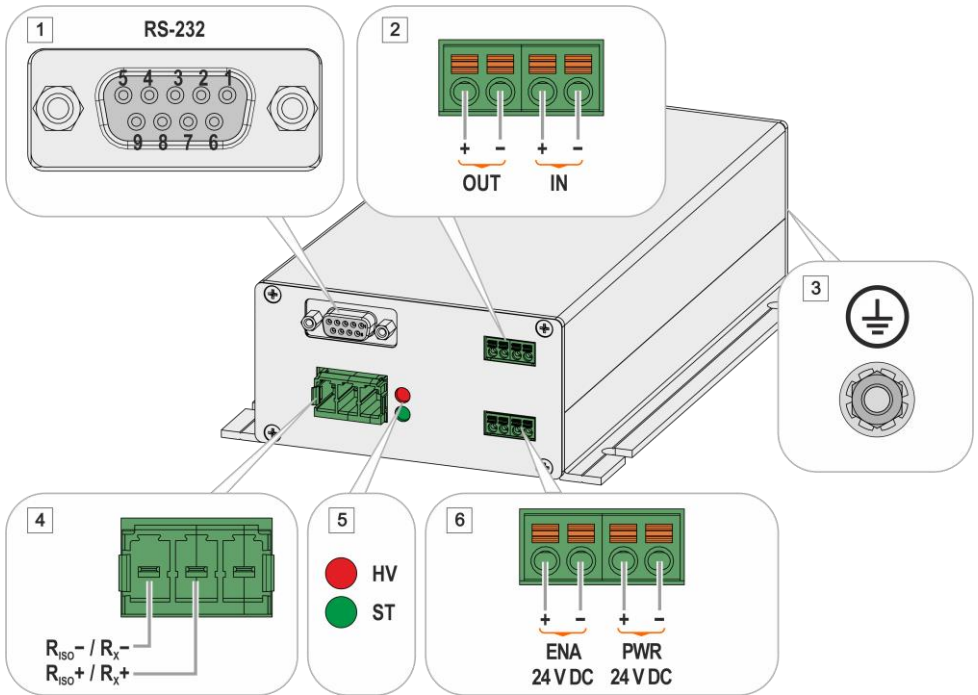
- During measurements of insulation resistance, dangerous voltage up to 1 kV + (0...10%) occurs at the ends of test leads of the meter.
- It is forbidden to disconnect test leads before the measurement is completed. Failure to obey the above instruction will lead to high voltage electric shock and make it impossible to discharge the tested object.
- Take particular care during cable measurement. After discharging their capacitance by the meter the voltage can be rebuilt automatically.



- The meter is a secondary/slave unit, which means it executes the commands from its main/master control unit and does not initiate a transmission on its own.
- Make sure for each measurement that **the test leads and crocodile clamps do not touch one another or any earthing**, otherwise the surface current may cause an additional error of the test result.

3 Interface and configuration

3.1 Enclosure



- 1 Communication interface
- 2 Programmable digital input (IN) and output (OUT) interfaces. They facilitate interfacing with peripherals by transmission and/or reception of auxiliary data.
- 3 PE terminal
- 4 Test lead connectors
- 5 LED indicators
 - HV – test terminals at live voltage
 - ST – meter status
- 6 External voltage
 - ENA – 24 V DC test circuit power
 - PWR – 24 V DC meter power (does not apply to the test circuit)

3.2 Installation instructions

- Before installing or removing this meter, isolate all external power supply (on all phases) for the system.
- Failure to tighten the fasteners may result in its detachment, electrical shorting, or defective operation of this meter.
- Over-tightening the fasteners may damage them and/or this meter, resulting in detachment, electrical shorting, or defective operation of the meter.
- Verify the interface type to be wired and connect the wiring according to the assignment. Incorrect wiring of the interface or mismatching a wire and an interface may result in failure of this meter and its control unit.
- All wiring shall be held securely in the receptacles. Loose wiring connections may result in:
 - ⇒ wiring damage;
 - ⇒ meter failure;
 - ⇒ malfunction of the meter due to poor electrical contact.
- Before:
 - ⇒ cleaning the meter;
 - ⇒ tightening the terminal screws;
 - ⇒ tightening the meter installation fasteners;isolate the system's external power supply. Failure may result in meter failure or malfunction.
- When disconnecting any wires from the meter, note the following:
 - ⇒ if the wire is plugged, pull it out by the connector housing and the meter enclosure to separate;
 - ⇒ if the wire is in a terminal strip, release the respective clamping screw or the spring release tab, as applicable.Failure may result in meter and/or wiring failure or malfunction.



WARNING

- **Do not touch any terminals when the power is live. Otherwise there is a hazard of electrical shock or meter malfunction.**
- **Incorrect output wiring connections or incorrect operation caused by a data communication error may expose the user to hazards.**




NOTE!

- Do not drop this device and protect it from strong shocks, otherwise you will risk its failure!
- Before touching this device, make sure you will touch a metal bonded to earth to discharge any electrical energy from your body. Failure may result in meter failure or malfunction.

3.3 Wiring tips

3.3.1 Earthing

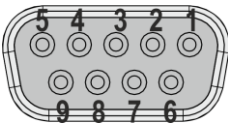
If the meter is mounted on a wall or in a frame, connect its PE terminal (marked with the PE symbol  on the enclosure) to the factory ground of the system in which it is to be operated, using a wire specified according to the local and national electrical codes.

3.3.2 Power, inputs and outputs

- The meter's power negative terminal (**PWR 24 V DC (-)**) must be galvanically connected to the meter chassis either on the meter or in the system the meter is integrated in.
- Connect the power cable to the plug-in receptacle block:
 - ⇒ Maximum core size: 1.5 mm²
 - ⇒ Insulation stripping length: 12 mm max.
- A flathead screwdriver measuring 0.4 x 2.5 mm is recommended for servicing the connectors.

3.3.3 Communication

- This device uses the following RS-232 interface receptacle: **2311765-1 9-pin D-sub (female) connector, with retaining screws**
- The communication between this meter and its control unit is provided via a RS-232 three-wire cable. The interface connection pinout is shown below.




Receptacle pin #	Signal	Signal designation	Signal transmission direction METER to MASTER
2	TxD	Data transmission	→
3	RxD	Data reception	←
5	GND	Data ground	↔

Communication parameters


- a) Baud rate 38400
 - b) Data bits 8
 - c) Parity even
 - d) STOP bits 1
 - e) Flow control none
- The data cable at the meter end must be terminated with a **9-pin D-sub male connector**. The other end of the data cable requires a connector compatible with the interface of the control unit (e.g. 9-pin D-sub male connector).
 - Make sure that the control unit is properly configured (by e.g. installing the necessary software) to be able to interpret user commands, send and receive messages to and from the meter, and display the meter's feedback.


4 Measurement indicators

Before the measurement

 **ST** Device on

During the measurement

 **HV** Live voltage on R_{ISO} / R_x terminals

 **ST** Device on

5 Data transmission

This meter requires the following to be interfaced with a PC:

- RS-232 data cable;
- **MIC-RS-SCP** serial communication protocol;
- supported software.

6 Power supply

The meter is powered with continuous 24 V DC.

7 Cleaning and maintenance



NOTE!

Use only 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 damage the casing (powders, pastes, etc.).

Clean the probe with water and dry it.

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

The electronic system of the meter does not require maintenance.

8 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 test leads.

9 Dismantling and utilisation

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 regulations valid in a given region.

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

Observe local regulations concerning disposal of packages, waste batteries and rechargeable batteries.

10 Technical data

10.1 Basic data

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

10.1.1 Measurement of insulation resistance

- Test voltages: 500 V, 1000 V
- Accuracy of generated voltage ($R_{\text{obc}} [\Omega] \geq 1000 \cdot U_{\text{n}} [V]$): 0...+5% or 0...+10% from the set value
- Detection of a dangerous voltage before commencing a measurement
- Insulation resistance testing of specimens with maximum capacitance of 20 μF
- Discharging the tested object

Measurement range acc. to EN IEC 61557-2: **500 k Ω ...2 G Ω** ($I_{\text{ISO}_{\text{nom}}} = 2 \text{ mA} + \langle -0.8...0 \rangle \text{ mA}$).

Reading range for UIISO = 500 V	Resolution	Accuracy
1.00 k Ω ...9.99 k Ω	0.01 k Ω	Unspecified
10.0 k Ω ...99.9 k Ω	0.1 k Ω	
100 k Ω ...249 k Ω	1 k Ω	
250 k Ω ...999 k Ω	1 k Ω	$\pm(3\% \text{ m.v.} + 8 \text{ digits})$
1.00 M Ω ...9.9 M Ω	0.01 M Ω	
10.0 M Ω ...99.9 M Ω	0.1 M Ω	
100 M Ω ...2000 M Ω	1 M Ω	

Measurement range acc. to EN IEC 61557-2: **1 M Ω ...2 G Ω** ($I_{\text{ISO}_{\text{nom}}} = 2 \text{ mA} + \langle -0.8...0 \rangle \text{ mA}$).

Reading range for UIISO = 1000 V	Resolution	Accuracy
1.00 k Ω ...9.99 k Ω	0.01 k Ω	Unspecified
10.0 k Ω ...99.9 k Ω	0.1 k Ω	
100 k Ω ...249 k Ω	1 k Ω	
250 k Ω ...999 k Ω	1 k Ω	$\pm(3\% \text{ m.v.} + 8 \text{ digits})$
1.00 M Ω ...9.9 M Ω	0.01 M Ω	
10.0 M Ω ...99.9 M Ω	0.1 M Ω	
100 M Ω ...2000 M Ω	1 M Ω	

10.1.2 Measurement of capacitance

Reading range	Resolution	Accuracy	Accuracy after calibration
0.0 μF ...9.9 μF	0.1 μF	$\pm(5\% \text{ m.v.} + 6 \text{ digits})$	Half the accuracy

- Measurement of capacitance is available only during R_{ISO} measurement (when discharging the object).

10.1.3 Low-voltage measurement of continuity and resistance

Measurement of resistance with low current

Reading range	Resolution	Accuracy
0.0...9.9 Ω	0.1 Ω	$\pm(3\% \text{ m.v.} + 10 \text{ digits})$
10...999 Ω	1 Ω	$\pm(3\% \text{ m.v.} + 4 \text{ digits})$

- Voltage at open terminals: 0...24 V
- Output current 200 mA
- Compensation of test leads resistance

10.2 Input and output signal ranges

10.2.1 Permitted signal values

Signal	Minimum	Maximum
Input (IN+, IN- terminals)	4 mA DC / 4.5 V DC	22 mA DC / 24 V DC
Output signal (OUT+, OUT- terminals)	0 mA DC	5 mA DC / 25 V DC

10.2.2 Signal characteristics

Signal	Characteristic	Designation	Value
Input (IN+, IN- terminals)	Minimum voltage on the IN+, IN- terminals, interpreted as High 1 (H) by the meter	U_{IN_Hmin}	4.5V (4mA) DC
	Maximum voltage on the IN+, IN- terminals, interpreted as High 1 (H) by the meter	U_{IN_Hmax}	24 V (22 mA) DC
Output signal (OUT+, OUT- terminals) Output type: Open collector	Output current for Low 0 (L)	I_{OUT_L}	0 mA DC
	Output current demand for High 1 (H)	I_{OUT_H}	5 mA DC
	Maximum voltage permitted on the terminals	U_{OUTmax}	25 V DC

10.3 Other technical data

- a) type of insulation acc. to EN 61010-1 and EN IEC 61557 basic
- b) measurement category acc. to EN IEC 61010-2-030
 - rated operating altitude ≤ 2000 m II 1000 V
- c) power supply external, isolated, 24 V DC
- d) dimensions 55 x 130 x 223 mm
- e) weight ca. 0.8 kg
- f) storage temperature $-20^{\circ}\text{C} \dots +70^{\circ}\text{C}$
- g) operating temperature $-5^{\circ}\text{C} \dots +50^{\circ}\text{C}$
- h) humidity 20% .. 80%
- i) reference temperature $+23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- j) reference humidity 40% .. 60%
- k) display none
- l) memory of measurement results none
- m) transmission of results RS-232
- n) quality standard development, design and manufacturing are ISO 9001, ISO 14001, ISO 45001 compliant
- o) the device meets the requirements of EN 61010-1, EN IEC 61557, EN IEC 61010-2-030
- p) the product meets EMC requirements (immunity for industrial environment) according to the following standards EN IEC 61326-1, EN IEC 61326-2-2

10.4 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.

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

Significant parameter	Designation	Additional uncertainty
Position	E1	0%
Temperature $0^{\circ}\text{C} \dots 35^{\circ}\text{C}$	E3	6%

10.5 Compliance with EMC and LV Directives

Compliance of the meter with EMC (2014/30/EU) and LVD (2014/35/EU) as an integral part of an installation/measurement system may require adaptation of the installation/system to the current requirements.

The CE marking on the front panel of the meter indicates compliance with EMC (2014/30/EU) and LVD (2014/35/EU) of the meter alone, not installed in any external installation/measurement system.

11 Manufacturer

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

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tel. +48 74 884 10 53 (Customer Service)
e-mail: customerservice@sonel.com
web page: www.sonel.com



NOTE!

Service repairs must be performed only by the manufacturer.

NOTES



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