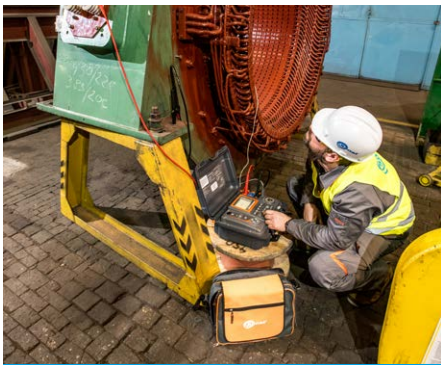




## Damage location and insulation measurements

### Features

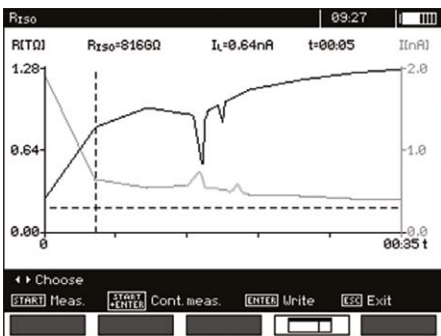
- Insulation resistance measurement
  - **MIC-10k1** | up to **40 TΩ**
  - **MIC-5050** | up to **20 TΩ**
- Measurement voltage - any in the range of
  - **MIC-10k1** | **50...10000 V**, 50...1000 V with steps of 10 V, 1...10 kV with steps of 25 V
  - **MIC-5050** | **50...5000 V**, 50...1000 V with steps of 10 V, 1...5 kV with steps of 25 V
- Continuous indication of measured insulation resistance or leakage current
- Automatic discharge of measured object capacitance voltage after the end of insulation resistance measurement
- Acoustic signalling of 5-second intervals to facilitate capturing time characteristics
- Adjustable measuring time - up to **99'59"**
- $T_1$ ,  $T_2$  and  $T_3$  test times for measuring one or two absorption coefficients from the range of 1...600 s
- Polarization index (PI), absorption coefficients  $Ab_1$ ,  $Ab_2$  and dielectric absorption ratio (DAR) measurement
- Indication of actual test voltage during measurement
- **1.2 mA**, **3 mA** or **6 mA** test current
- Insulation resistance measurement using two- or three-wire method
- Measurements with test leads up to 20 m
- Protection against measuring live objects
- Automatic measurement of multiple core cables with the optional **AutoISO-5000 adapter** (for MIC-10k1 max. measuring voltage 5 kV)
- Measurement of capacitance during the measurement of  $R_{ISO}$
- Measurement of temperature (with optional probe ST-1)
- Step voltage insulation resistance measurement (SV)
- Dielectric Discharge calculation (DD)
- Damage location (burnout)
- Digital filters for measurements with strong interferences
- It can work in an environment where electromagnetic interferences of 400 kV occur
- Measurement of DC and AC voltages within the range of 0...750 V



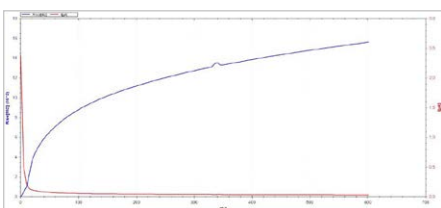
Professional diagnostic tool



Several measurements in one connection



Graphic interpretation of results



Dedicated PC software



For the toughest working conditions

## Application

MIC-10k1 / MIC-5050 meter is designed to measure the insulation resistance of electro-power objects, i.e. single- and multi-core cables, transformers, motors and generators, capacitors, switches and other devices installed in power stations. Furthermore, it is dedicated for measurements in areas with very high electromagnetic disturbances, e.g. electrical substations with 765 kV voltage or higher.

## Capabilities

Highly efficient HV inverter, with test voltage of 10 kV (MIC-10k1) / 5 kV (MIC-5050) and current of 6 mA, suitable for measuring the insulation resistance up to 40 TΩ (MIC-10k1) / 20 TΩ (MIC-5050). Achieving such a result makes these meters unrivalled devices. Three-wire resistance measurement, performed using a "GUARD" wire, eliminates surface leakage currents caused by contaminated insulation, thereby increasing the reliability of obtained results.

The meter measures temperature of tested object, which is necessary to determine the temperature correction factor for  $R_{ISO}$ . In addition, it indicates the absorption coefficient (DAR - Dielectric Absorption Ratio), Polarization Index (PI) and the value of Dielectric Discharge (DD). The device allows user to assess the condition of the insulation, by applying the test voltage incrementally in steps (SV). This solution ensures that a dielectric in good condition will provide the same results, regardless of the applied voltage. Deviations in obtained resistance values of approx. 25%, observed on the chart in the individual steps, may indicate the potential insulation defects.

MIC-10k1 / MIC-5050 has the unique ability to perform measurements on multi-core cables, within one connection step, using the AutoISO-5000 adapter. This solution reduces the duration of measurements on repetitive of objects, such as cables of street lighting systems. Inverter with a power of almost 60 W is able to intensify the point of cable damage, which facilitates finding the location of the fault using a reflectometric method e.g. with TDR-420 device.

Built-in digital filters, with averaging time of 10, 30, 60, 100, 200 sec. and "smart" solution guarantee stable measurement results in areas of strong electromagnetic interference.

## Data analysis

The device, with its backlight graphical screen may display a waveform of insulation resistance, voltage and current as a function of time. The operator, basing on the trend shown by the waveform, may quickly assess the insulation condition right after starting the measurement. This provides full control over the tested object and clear image of the tested insulation. In addition, with movable tags, the operator may trace the course of the measurement and check resistance values obtained for any time of the current measurement and of measurements made in the past.

After installing mobile application, as a part of the set the user receives Sonel Reader software for collecting historical data and comparing it with current results, transferred from the extensive memory of the meter. This solution helps user to prepare a measurements report, track the insulation degradation and plan the maintenance / repair works.

## Comparison

	MIC-10k1	MIC-5050
maximum measuring voltage	10 000 V	5000 V
maximum measuring range	40 TΩ	20 TΩ
resistance to external interference voltages	up to 1550 V	up to 1550 V
resistance to interference currents	up to 8 mA	up to 8 mA
advanced, digital interference filtration	10 / 30 / 60 / 100 / 200 seconds and SMART	10 / 30 / 60 / 100 / 200 seconds and SMART
test leads lock	✓	✓

## Insulation resistance measurement

- Measurement range acc. to IEC 61557-2

$$R_{ISOmin} = V_{ISOnom} / I_{ISOmax} = 5 \text{ M}\Omega \dots 40 \text{ T}\Omega \quad (I_{ISOmax} = 1.2 \text{ mA}, 3 \text{ mA or } (6 \pm 15\%) \text{ mA})$$

Range	Resolution	Accuracy
0...999 kΩ	1 kΩ	
1.00...9.99 MΩ	0.01 MΩ	
10.0...99.9 MΩ	0.1 MΩ	±(3% m.v. + 10 digits)
100...999 MΩ	1 MΩ	
1.00...9.99 GΩ	0.01 GΩ	
10.0...99.9 GΩ	0.1 GΩ	
100...999 GΩ	1 GΩ	±(3.5% m.v. + 10 digits)
1.00...9.99 TΩ	0.01 TΩ	±(7.5% m.v. + 10 digits)
10.0...20.0 TΩ*	0.1 TΩ	±(12.5% m.v. + 10 digits)
10.0...40.0 TΩ**		

\* - only for MIC-5050

\*\* - only for MIC-10k1

Values of measured resistance depending on measurement voltage

V <sub>ISO</sub> voltage	Range	Range for AutoISO-5000
50 V	200 GΩ	20.0 GΩ
100 V	400 GΩ	40.0 GΩ
250 V	1.00 TΩ	100 GΩ
500 V	2.00 TΩ	200 GΩ
1000 V	4.00 TΩ	400 GΩ
2500 V	10.00 TΩ	400 GΩ
5000 V	20.0 TΩ	400 GΩ
10 000 V	40.0 TΩ*	-

\* - only for MIC-10k1

## Capacitance measurement

Range	Resolution	Accuracy
0...999 nF	1 nF	±(5% m.v. + 5 digits)
1.00...49.99 μF	0.01 μF	

- Capacitance measurement result is displayed after the R<sub>ISO</sub> measurement
- For measuring voltages under 100 V capacitance measurement accuracy not specified

## Temperature measurement

Range	Resolution	Accuracy
-40.0...99.9°C	1°C	±(3% m.v. + 8 digits)

## Technical specification

type of insulation acc. to EN 61010-1 and IEC 61557	double
measurement category acc. to EN 61010-1	IV 600 V (III 1000 V)
ingress protection acc. to EN 60529	IP67 (IP40 for open case)
power supply	LiFePO4 13.2 V 5.0 Ah rechargeable battery 90 V...260 V, 50 Hz/60 Hz from electric grid
dimensions	390 x 308 x 172 mm 15.3" x 12.1" x 6.8"
weight	ca. 6.1 kg ca. 12.4 lb
storage temperature	-25°C...+70°C -13°F...+158°F
operating temperature	-20°C ...+50°C -4°F...+122°F
humidity	20%...90%
operating altitude	≤3000 m
reference temperature	+23°C ± 2°C
reference humidity	40%...60%
display	graphical LCD 5.6"
number of R <sub>ISO</sub> measurements acc. to EN 61557-2 with battery power supply	min. 1000
data transmission	USB and Bluetooth
memory of measurement results	990 cells (10 000 records / 8 MB)
quality standard	ISO 9001, ISO 14001, PN-N-18001 compliant
device meets the requirements of standards	EN 61010-1 and IEC 61557
the product meets EMC requirements (immunity for industrial environment)	with accordance to standards EN 61326-1 and EN 61326-2-2



Please see available applications with "Virtual Instruments Applications". They allow to check the functions of the meter and its interface before the purchase. Application user may set changes in device settings and perform all possible measurements as in reality.

<https://www.sonel.pl/en/virtual-instrument-applications>

## Standard accessories



**Test lead 15 kV 3 m  
CAT IV 1000 V with  
crocodile clip, black**

WAPRZ003BLKROE15KV



**Test lead 15 kV 3 m  
CAT IV 1000 V with  
crocodile clip, red**

WAPRZ003REKRO15KV



**Test lead 15 kV 3 m  
CAT IV 1000 V with  
crocodile clip, blue**

WAPRZ003BUKRO15KV



**USB cable**

WAPRZUSB



**Mains cable with  
IEC C13 plug**

WAPRZ1X8BLIECUSA



**L4 carrying case**

WAFUTL4



**Factory calibration  
certificate**

## Optional accessories



**Test lead 15 kV  
CAT IV 1000 V with  
crocodile clip, black  
1.8 m / 5 m / 10 m / 20 m**

WAPRZ1X8BLKROE15KV  
WAPRZ005BLKROE15KV  
WAPRZ010BLKROE15KV  
WAPRZ020BLKROE15KV



**Test lead 15 kV  
CAT IV 1000 V with  
crocodile clip, red  
1.8 m / 5 m / 10 m / 20 m**

WAPRZ1X8REKRO15KV  
WAPRZ005REKRO15KV  
WAPRZ010REKRO15KV  
WAPRZ020REKRO15KV



**Test lead 15 kV  
CAT IV 1000 V with  
crocodile clip, blue  
1.8 m / 5 m / 10 m / 20 m**

WAPRZ1X8BUKRO15KV  
WAPRZ005BUKRO15KV  
WAPRZ010BUKRO15KV  
WAPRZ020BUKRO15KV



**AutoISO-5000  
adapter**

WAADAAISO50



**PRS-1 resistance  
test probe**

WASONPRS1



**ST-1 temper-  
ature probe**

WASONT1



**CS-5kV  
calibration box**

WAADACS5KV



**Resistance calibra-  
tor SRP-10G0-10T0**

WMGBSRP10G010T0



**Calibration cer-  
tificate with  
accreditation**



**PC software:  
Sonel Reader**

WAPROREADER



**Sonel Reports PLUS  
software**

WAPROREPORTPLUS

Times of charging and discharging the tested object at measuring voltage of 1.05 U<sub>ISO</sub>

Meter	Measuring voltage			Capacitance [μF]	Charging the object		Discharging the object down to voltage of 50 V [s]
	5 kV	10 kV	15 kV		Current [mA]	Maximal time [s]	
MIC-5005 / MIC-5010	✓			1	1.2	4.3	0.4
					3	1.7	
MIC-5050	✓			1	1.2	4.3	0.4
					3	1.7	
					6	0.8	
MIC-10k1	✓			1	1.2	4.3	0.9
					3	1.7	
					6	0.8	
	✓	✓		1	1.2	8.7	1.0
					3	3.5	
					6	1.7	
MIC-15k1	✓			1	1.2	4.3	1.1
					3	1.7	
					5	1.0	
					7	0.7	
	✓	✓		1	10	0.5	1.3
					1.2	8.7	
					3	3.5	
					5	2.1	
	✓		✓	1	7	1.5	1.4
					10	1.0	
					1.2	13.1	
					3	5.2	
✓		✓	1	5	3.1	1.4	
				7	2.2		
				10	1.5		

Times of charging and discharging the tested object at measuring voltage of 1.025 U<sub>ISO</sub>

Meter	Measuring voltage			Capacitance [μF]	Charging the object		Discharging the object down to voltage of 50 V [s]
	5 kV	10 kV	15 kV		Current [mA]	Maximal time [s]	
MIC-5005 / MIC-5010	✓			1	1.2	4.2	0.4
					3	1.7	
MIC-5050	✓			1	1.2	4.2	0.4
					3	1.7	
					6	0.8	
MIC-10k1	✓			1	1.2	4.2	0.9
					3	1.7	
					6	0.8	
	✓	✓		1	1.2	8.5	1.0
					3	3.4	
					6	1.7	
MIC-15k1	✓			1	1.2	4.2	1.1
					3	1.7	
					5	1.0	
					7	0.7	
	✓	✓		1	10	0.5	1.3
					1.2	8.5	
					3	3.4	
					5	2.0	
	✓		✓	1	7	1.4	1.4
					10	1.0	
					1.2	12.8	
					3	5.1	
✓		✓	1	5	3.0	1.4	
				7	2.1		
				10	1.5		

