Insulation Quality Analyzer

MIC-15k1

index: WMGBMIC15K1

Insulation of cables

Transformers

Electric machines

Power objects

Electric rail vehicles

CAT IV 1000 V

IP67

BLUETOOTH

50°C HEAVY DUTY -20°C

Insulation analysis within wide range

15 kV
maximal measuring voltage

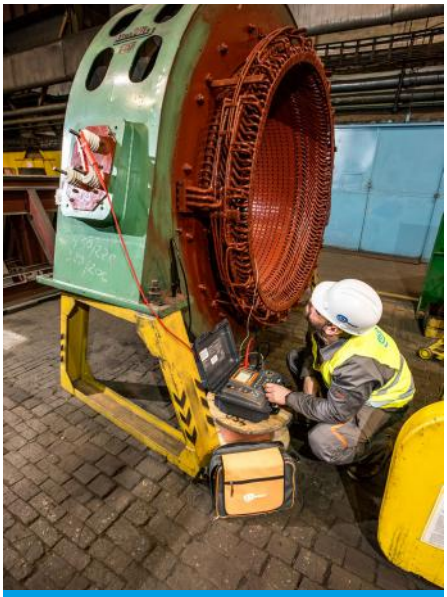
40 TΩ
maximal measurement range

partial discharges indicator

remote control by phone

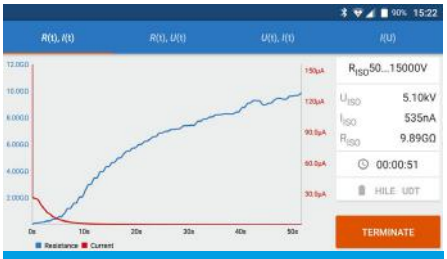
Features

- Partial discharge indicator **PDI**.
- Diagnostics of insulation systems based on standard measurements of **IR**, **DAR**, **PI**, **SV**, **RT**, **DD**.
- It allows testing the electrical durability of the tested object - **breakdown voltage indication**.
- High resistance to electromagnetic interferences guarantees uninterrupted work in power stations and in close proximity to high voltage transmission lines up to **1200 kV AC** and **500 kV DC**.
- The function of smooth voltage rise in time (RT - Ramp Test) allows to state the partial discharges in the facility and to carry out a partial location of their occurrence.
- Efficient converter with a **power of ~150 W** that enables insulation burnout, allowing for pinpointing the location of cables and wires short circuit using one of the following:
  - visual method (if power cables are visible along the entire length),
  - reflectometric methods, seismic-acoustic waves detector, or with A-frame to indicate direction of the fault (the conductor must be buried in the ground with earth direct contact).
- Compatible with external software.

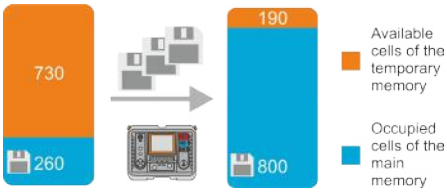


Professional diagnostic tool

For the most harsh operating conditions



Supported by a mobile application



Static and dynamic memory of measurements

Application

MIC-15k1 meter is designed to measure insulation resistance of power objects, i.e.:

- single- and multicore cables,
- transformers,
- motors and generators,
- capacitors, switches and other devices installed in power stations.

It is especially recommended for measurements in areas with very high electromagnetic disturbances, e.g. electrical substations with **1200 kV AC** and **500 kV DC**. Thanks to the 15 kV measuring voltage (in accordance with ANSI / NETA ATS-2009 TABLES 100.1) the meter can be used for measuring objects with a nominal voltage above 34.5 kV.

Capabilities of the device

Highly efficient HV inverter, with test voltage of **15 kV** and current **up to 10 mA**, suitable for measuring the insulation resistance **up to 40 TΩ**. 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 indicates the Dielectric Absorption Ratio **DAR**, 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 - Step Volatge) or smoothly (RampTest - RT).

- SV method ensures that a dielectric in good condition will provide the same results, regardless of the applied voltage.
- RT method allows to determine the characteristics of the insulating material. The meter smoothly increases the measuring voltage without exposing the object to so-called electrical stress. It records the time and voltage value at which the electrical breakdown of the insulation took place.

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

Burnout

A very useful solution is the function that allows to Burnout the damaged object. In case of **exposed cables**, it enables **visual identification** of the fault location. In the case of shielded cables, the method allows to generate a **seismic-acoustic wave** from the place of damage.

In special conditions, an energetic discharge will appear cyclically. By using the geophone it will be possible to precisely pinpoint the place where such a discharge occurs.

Burnout feature allows also locating transient faults (appearing, for example, only during rainfall) with the support of reflectometry, and in case of a short circuit (of a screen or return wire) to the ground - applying the method of measuring voltage drop (the A-frame).

Autosaving the measurement results

The device automatically saves the measurement results. The number of autosave points depends on the amount of data, which is saved within the main memory.

Data analysis

The **Sonel MIC Mobile** mobile app allows to observe the results during the measurement. The application can generate real-time graphs in various configurations. This allows to evaluate the condition of the object already during the tests.

The option of remote start and stop of the measurement is particularly useful. Thanks to it, the tests can be carried out remotely, eg. from a different room or inside the car, when there are difficult weather conditions for the user. Using the phone GPS, it is possible to precisely determine the place of measurement.

Thanks to the mobile application and the **Sonel Reader** software, the user can store previous measurements data and compare them with current results transferred from the meter's extensive memory. This solution allows to prepare a measurement report, track the progress of insulation degradation and plan renovation works.

Insulation resistance measurement

Measuring range according to IEC 61557-2
U_N = 15 000 V: 50 kΩ...40.0 TΩ
Measurement with DC and increasing voltage (SV) for U_{ISO} = 5 kV

Range	Resolution	Accuracy
0...999 kΩ	1 kΩ	±(3% m.v. + 10 digits)
1.00...9.99 MΩ	0.01 MΩ	
10.0...99.9 MΩ	0.1 MΩ	
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		

Ranges of measured resistance depending on the test voltage

Voltage U_{ISO}	Measuring range
50 V	200 GΩ
100 V	400 GΩ
250 V	1.00 TΩ
500 V	2.00 TΩ
1000 V	4.00 TΩ
2500 V	10.00 TΩ
5000 V	20.0 TΩ
10 000 V	40.0 TΩ
15 000 V	40.0 TΩ

Capacitance measurement

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

- Displaying measured capacity after R_{ISO} measurement
- For measurement voltages below 100 V the measurement error is not specified

„m.v." - measured value

Technical specification

type of insulation acc. to EN 61010-1 and IEC 61557	double
measurement category acc. to EN 61010-1	IV 1000 V (operating altitude ≤2000 m) IV 600 V (operating altitude ≤3000 m)
ingress protection acc. to EN 60529	IP67 (IP40 for closed case)
resistance to external interference voltages	up to 1550 V
resistance to external interference currents	up to 10 mA
advanced, digital filtering of interferences	10 / 30 / 60 / 100 / 200 seconds
test leads lock	yes
power supply	Li-Ion 14.8 V rechargeable battery from network 90 V ÷ 260 V, 50 Hz/60 Hz
dimensions	390 x 308 x 172 mm
weight	approx. 6.3 kg
storage temperature	-25°C...+70°C
operating temperature	-20°C...+50°C
humidity	20%...90%
operating altitude	≤3000 m
reference temperature	+23°C ± 2°C
reference humidity	40%...60%
display	graphical LCD
number of R_{ISO} measurements with battery power supply	min. 1000 acc. to EN 61557-2
data transmission	USB and Bluetooth
quality standard	ISO 9001 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

Standard accessories

Test lead 15 kV 1.8 m CAT IV 1000 V with crocodile clip, black

WAPRZ1X8BLKROE15KV

Test lead 15 kV 1.8 m CAT IV 1000 V with crocodile clip, red

WAPRZ1X8REKRO15KV

Test lead 15 kV 1.8 m CAT IV 1000 V with croco-dile clip, blue

WAPRZ1X8BUKRO15KV

Mains cable with IEC C13 plug

WAPRZ1X8BLIEC

L4 carrying case

WAFUTL4

W1 hanging straps

WAPOZSZE5

USB cable

WAPRZUSB

Calibration certificate

Optional accessories

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

3 m / 5 m / 10 m / 20 m

WAPRZ003BLKROE15KV
WAPRZ005BLKROE15KV
WAPRZ010BLKROE15KV
WAPRZ020BLKROE15KV

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

3 m / 5 m / 10 m / 20 m

WAPRZ003REKRO15KV
WAPRZ005REKRO15KV
WAPRZ010REKRO15KV
WAPRZ020REKRO15KV

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

3 m / 5 m / 10 m / 20 m

WAPRZ003BUKRO15KV
WAPRZ005BUKRO15KV
WAPRZ010BUKRO15KV
WAPRZ020BUKRO15KV

PRS-1 resist-ance test probe

WASONPRS1GB

Resistance calibra-tor SRP-10G0-10T0

WMXXSRP10G010T0

CS-5kV cali-bration box

WAADACS5KV

PC software: Sonel Reader

WAPROREADER

Calibration cer-tificate issued by an accredited laboratory

Please see available applications with "Virtual Instruments Applications". They al-low to check the functions of the meter and its interface before the purchase. Ap-plication user may set changes in device settings and perform all possible measure-ments as in reality.

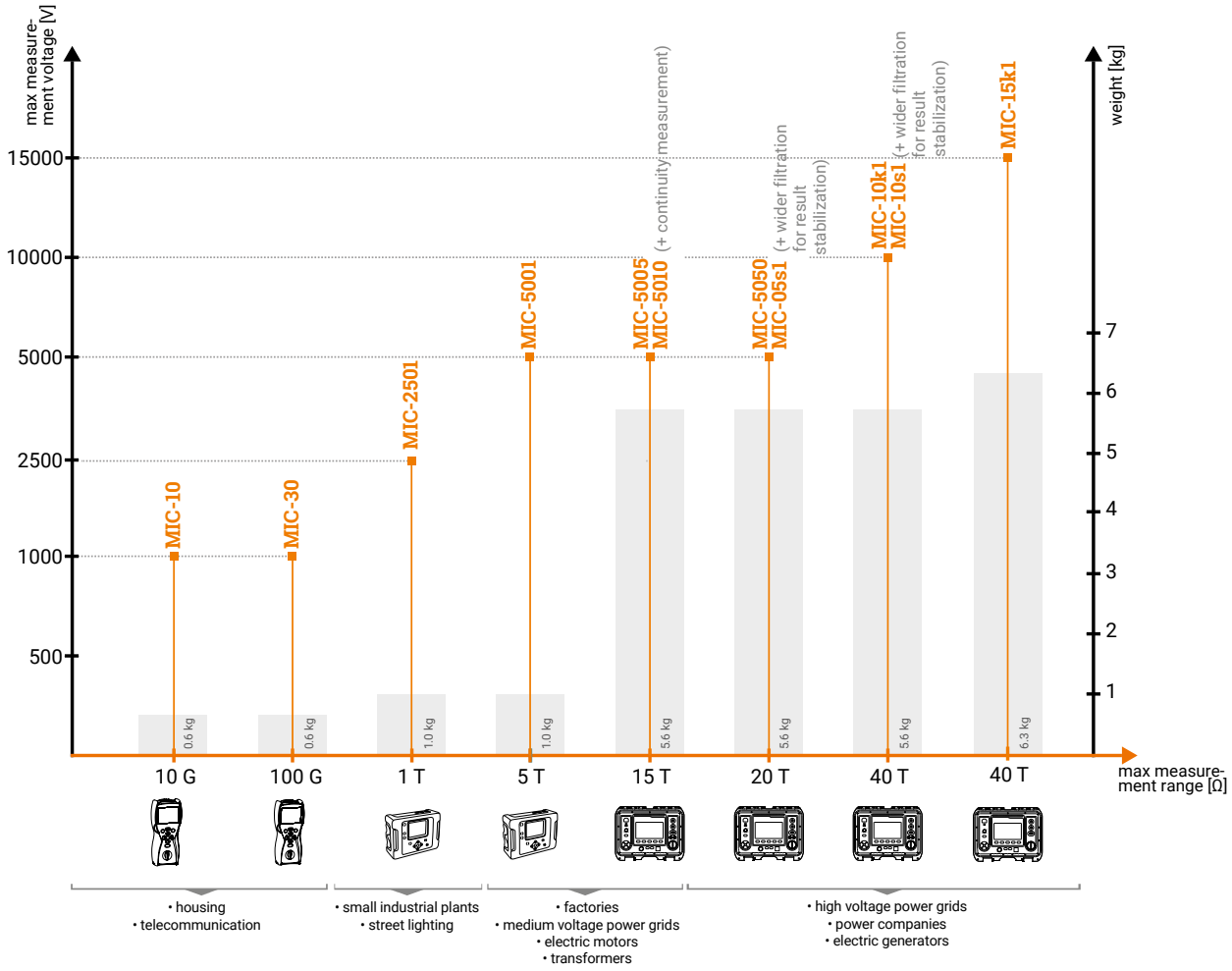
https://www.sonel.pl/en/virtual-instrument-applications

Times of charging and discharging the tested object at measuring voltage of 1.05 U_{ISO}

Meter	Measuring voltage			Capacitance	Charging the object		Discharging the object
	5 kV	10 kV	15 kV	[µF]	Current [mA]	Maximal time [s]	down to voltage of 50 V [s]
MIC-5005 / MIC-5010	√			1	1.2	4.3	0.4
					3	1.7	
MIC-5050 / MIC-05s1	√			1	1.2	4.3	0.4
					3	1.7	
					6	0.8	
MIC-10k1 / MIC-10s1	√			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	
					10	0.5	
		√		1	1.2	8.7	1.3
					3	3.5	
					5	2.1	
					7	1.5	
					10	1.0	
			√	1	1.2	13.1	1.4
					3	5.2	
					5	3.1	
					7	2.2	
					10	1.5	

Times of charging and discharging the tested object at measuring voltage of 1.025 U_{ISO}

Meter	Measuring voltage			Capacitance	Charging the object		Discharging the object
	5 kV	10 kV	15 kV	[µF]	Current [mA]	Maximal time [s]	down to voltage of 50 V [s]
MIC-5005 / MIC-5010	√			1	1.2	4.2	0.4
					3	1.7	
MIC-5050 / MIC-05s1	√			1	1.2	4.2	0.4
					3	1.7	
					6	0.8	
MIC-10k1 / MIC-10s1	√			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	
					10	0.5	
		√		1	1.2	8.5	1.3
					3	3.4	
					5	2.0	
					7	1.4	
					10	1.0	
			√	1	1.2	12.8	1.4
					3	5.1	
					5	3.0	
					7	2.1	
					10	1.5	


max measure-
ment voltage [V]
15000
10000
5000
2500
1000
500
MIC-10
MIC-30
MIC-2501
MIC-5001
MIC-5005
MIC-5010
(+ continuity measurement)
MIC-5050
MIC-05s1
(+ wider filtration for result stabilization)
MIC-10k1
MIC-10s1
(+ wider filtration for result stabilization)
MIC-15k1
weight [kg]
7
6
5
4
3
2
1
0.6 kg
0.6 kg
1.0 kg
1.0 kg
5.6 kg
5.6 kg
5.6 kg
6.3 kg
10 G
100 G
1 T
5 T
15 T
20 T
40 T
40 T
max measure-
ment range [Ω]
• housing
• telecommunication
• small industrial plants
• street lighting
• factories
• medium voltage power grids
• electric motors
• transformers
• high voltage power grids
• power companies
• electric generators

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