SONEL MRP-201

index: WMGBMRP201

CAT III
600 V
CAT IV
300 V
IP67

Testing RCD breakers of AC, A and B types:

- testing of general, short delay and selective RCDs for the rated current values $I_{\Delta n}$ =10, 30, 100, 300, 500 mA,
- measurement of triggering current I_A and trip time t_A for currents 0,5 $I_{\Delta n}$, 1 $I_{\Delta n}$, 2 $I_{\Delta n}$, 5 $I_{\Delta n}$,
- simultaneous measurement of triggering current I_A and trip time t_A,
- measurement of R_E and U_B without RCD tripping,
- AUTO RCD test function (automatic measurement of subsequent selected parameters without triggering),
- automatic measurement for all current shapes for RCDs of type AC, A and B.

MRP-201 measures all kinds of RCDs (general, short delay, selective - type AC, A, B).

Additional functions of the meter:

- measurement of AC voltage and frequency,
- checking the correctness of the connection of PE conductor,
- memory of measurement results (990 cells, 10 000 entries),
- communication with PC using Bluetooth interface,
- backlit keyboard.

The instrument meets the requirements set forth in the standards:

- EN 61010-1 (general and particular requirements related to safety)
- EN 61010-031 (general and particular requirements related to safety)
- EN 61326 (electromagnetic compatibility)
- EN 61557 (requirements for measurement instruments)
- HD 60364-6 (performance of measurements - checking)
- HD 60364-4-41 (performance of measurements - shock protection)
- PN-E 04700 (performance of measurements - commissioning tests)

MRP-201 has two kinds of automatic measurement mode, especially useful when measuring type A and B circuit breakers.

Other technical specifications:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- power supply ..... alkaline batteries (AA, 4 pcs) or rechargeable batteries set (option)
- weight ..... 0.7 kg
- dimensions ..... 220 x 102 x 61 mm

Nominal operating conditions:

- operating temperature ..... -10...+50°C
- storage temperature ..... -20...+70°C

Standard accessories:

WS-05 adapter with UNI-SCHUKO angular plug	WAADAWS05
M-6 carrying case	WAFUTM6
Crocodile clip, yellow, 1 kV, 20 A	WAKROYE20K02
Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB
Test lead 1.2 m, blue, 1 kV (banana plugs)	WAPRZ1X2BUBB
Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB
Pin probe, red 1 kV (banana socket)	WASONREOGB1
Pin probe, blue 1 kV (banana socket)	WASONBUOGB1
M-1 hanging straps	WAPOZSZE4
4x R6 battery	
Factory calibration certificate	

RCD trigger test and response time measurement t_A

Measurement range according to IEC 61557:
0 ms...to the upper limit of the displayed value

RCD type	Rated current multiplication factor	Range	Resolution	Accuracy
General or short delay	0.5 $I_{\Delta n}$	0...300 ms	1 ms	±(2% m.v. + 2 digits)
	1 $I_{\Delta n}$			
	2 $I_{\Delta n}$	0...150 ms		
	5 $I_{\Delta n}$	0...40 ms		
Selective	0.5 $I_{\Delta n}$	0...500 ms		
	1 $I_{\Delta n}$			
	2 $I_{\Delta n}$	0...200 ms		
	5 $I_{\Delta n}$	0...150 ms		

- residual current setting accuracy:
  for 1 $I_{\Delta n}$, 2 $I_{\Delta n}$ and 5 $I_{\Delta n}$: 0...8%;
  for 0.5 $I_{\Delta n}$: -8...0%,
- operating voltage range: 180...270 V
- operating frequency range: 45...65 Hz

RCD tripping current I_A for sine AC current

Measurement range acc. to IEC 61557-6: **(0.3...1.0)$I_{\Delta n}$**

Selected rated RCD current	Range	Resolution	Measuring current	Accuracy
10 mA	3.0...10.0 mA	0.1 mA	0.3 $I_{\Delta n}$...1.0 $I_{\Delta n}$	±5% $I_{\Delta n}$
30 mA	9.0...30.0 mA			
100 mA	30...100 mA	1 mA		
300 mA	90...300 mA			
500 mA	150...500 mA			

- start of the measurement from the positive or negative half sine period of the test current
- test current flow time at f = 50.0 Hz max. 7510 ms

Measurement of RCD tripping current I_A for unidirectional pulsed residual current and unidirectional pulsed current with a 6 mA DC offset

Measurement range acc. to IEC 61557-6:
(0.15...1,4)$I_{\Delta n}$ for $I_{\Delta n}$>30 mA
(0.15...2)$I_{\Delta n}$ for $I_{\Delta n}$=10 mA

Selected rated RCD current	Range	Resolution	Measuring current	Accuracy
10 mA	1.5...20.0 mA	0.1 mA	0.15 $I_{\Delta n}$ ...2.0 $I_{\Delta n}$	± 10% $I_{\Delta n}$
30 mA	4.5...42.0 mA			
100 mA	15...140 mA	1 mA	0.15 $I_{\Delta n}$ ...1.4 $I_{\Delta n}$	± 10% $I_{\Delta n}$
300 mA	45...420 mA			

- start of the measurement from the positive or negative half sine period of the test current
- test current flow time at f = 50,0 Hz max. 14 710 ms

RCD tripping current I_A for the residual DC current

Measurement range acc. to IEC 61557-6: **(0.2...2)$I_{\Delta n}$**

Selected rated RCD current	Range	Resolution	Measuring current	Accuracy
10 mA	2.0...20.0 mA	0.1 mA	0.2 $I_{\Delta n}$ ...2.0 $I_{\Delta n}$	±10% $I_{\Delta n}$
30 mA	6...60 mA	1 mA		
100 mA	20...200 mA			
300 mA	60...600 mA			

- Measurement possible for positive or negative residual current
- test current flow time at f=50,0 Hz max. 4500 ms.

Solar radiation and temperature meter

SONEL IRM-1

index: WMGBIRM1

IP65

LoRa

LI-ION BATTERY

Features

- Measurement of solar radiation and temperature.
- The LoRa interface for communication with a master meter - offers a larger range than the Bluetooth technology!
- Automatic data synchronization with a master meter with reSYNC function.
- Built-in compass and inclination sensor.
- Built-in recorder that can be used to record solar radiation before constructing PV systems, as well as to measure the shading of existing systems.
- Large measurement memory: 999 cache memory cells and 5000 recorder records available (one-time recording) with the option of overwriting them (continuous recording).

Measured parameters

- Solar radiation intensity (irradiance) in W/m² or BTU/ft²h.
- PV panel temperature in °C or °F.
- Ambient temperature in °C or °F.
- Inclination angle of panels
- Orientation of the panels with the built-in compass.

Simple and compact

IRM-1, small, but indispensable for testing PV systems. By measuring solar radiation values, as well as panel and ambient temperatures, it provides the necessary data to convert the results into STC conditions. A built-in recorder with a memory of 5000 records enables the instrument to be used as a tool in the PV plant design process, as well as to diagnose panel shading problems.

Communication and software

Measurement data from the IRM-1 can be transferred to a computer via the USB port. In addition, the device has a built-in wireless **LoRa interface** (Long Range) for automatic data exchange with the master meter - even over long distances.

Electrical safety:

- housing protection rating according to EN 60529 ..... IP65

Other technical specifications:

- power supply of the meter ..... Li-Ion 3.7 V 1.3 Ah rechargeable battery
- weight ..... ca. 0.2 kg
- dimensions ..... 134 x 79 x 28 mm
- display ..... LCD
- memory
  - cache memory ..... 1000 cells
  - recorder ..... 5000 records
- transmission of results ..... LoRa®

Standard accessories:

IRM-1 mounting&measuring set	WASONTPVCKPL
5 V power supply with USB 2.0 output and a detachable micro-USB cable	WAZASZ24
M-14 carrying case	WAFUTM14
Factory calibration certificate	

Irradiance measurement

Measuring range: **100 W/m²...1400 W/m², 32 BTU/ft²h...444 BTU/ft²h**

Display range	Resolution	Accuracy
0...1400 W/m²	1 W/m²	±(0.5% m.v. + 2 digits)
0...444 BTU/ft²h	1 BTU/ft²h	

PV and ambient temperature measurement

Display range	Resolution	Accuracy
-20.0...100.0°C	0.1°C	±(1% m.v. + 5 digits)
-4.0...212.0°F	0.1°F	

Inclination angle measurement

Display range	Resolution	Accuracy
-90...+90°	1°	±2°

Determination of position direction - compass

Display range	Resolution	Accuracy
0...360°	1°	±5°

Photovoltaic meter

SONEL PVM-1530

IP65
closed cover
CAT III
1500 V DC
TOUCH SCREEN
BATERÍA Li-Ion
WiFi
BLUETOOTH

PVM-1530

IRM-1 IRM-1 IP65 LoRa LI-ION BATTERY

CMP-1015-PV CAT IV 600 V IP40 BLUETOOTH

PVM-1530 Pro

PVM-1530 Max

Features

- **It can be used for category 1 measurements according to EN 62446-1.**
- **Allows the measurement of the I-U curve for category 2 according to EN 62446-1 and EN 61829.**
- **It allows the measurement of photovoltaic panels, including bifacial and high-efficiency panels.**
- **Ability to define measurement procedures.**
- **It converts measured parameters into STC conditions according to EN IEC 60891 by cooperation with the IRM-1 solar radiation and temperature meter.**
- **reSYNC** function – automatic completion of results with environmental parameters and their conversion to STC conditions after restoring connection with IRM-1.
- The attachable radio interface ensures cooperation with the IRM-1 meter over long distances.
- Built-in Bluetooth and Wi-Fi for communication with external devices.
- Large structured memory of measurements.
- Large touchscreen for good visibility in bright sunlight.

Measured parameters

- Measurement of I-U and P-U characteristics. Conversion to STC conditions.
- The open circuit voltage of the PV panel or a chain of panels, up to 1500 V DC.
- RMS voltage of the AC network up to 1000 V with frequency measurement.
- Short circuit current of a PV panel or chain of panels - up to 40 A DC.
- Insulation resistance of PV panels - measuring voltage of 250, 500, 1000, 1500 V DC, simultaneous measurement of two values: R_{ISO+} and R_{ISO-}.
- Insulation resistance of AC circuits - measuring voltage 250, 500, 1000 V DC.
- Resistance of protective conductors and equipotential bonding with ± 200 mA current.
- Measurement of PV panels operating current and AC current - all with CMP-1015-PV meter.
- AC/DC power measurement.
- Test of bypass diodes, automatic polarity detection.
- Test of blocking diodes with 1000, 1500 V DC voltage.

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and EN IEC 61557
- measurement category ..... CAT III 1500 V DC according to EN IEC 61010-2-030
- housing protection rating according to EN 60529 ..... IP65

Other technical specifications:

- power supply ..... Li-Ion 7.2 V 9.8 Ah rechargeable battery
- weight ..... ca. 8.8 kg
- dimensions ..... 390 x 308 x 172 mm
- display ..... LCD 7" 1280 x 720
- memory ..... 9999 entries
- transmission of results ..... USB, RJ-45, Bluetooth, Wi-Fi

Choose the best set for your needs

PVM-1530 Max
Set of meters for measuring photovoltaic installations (PVM-1530, 2x IRM-1, CMP-1015-PV)
index: WMGBPVM1530MAX

PVM-1530 Pro
Set of meters for measuring photovoltaic installations (PVM-1530, IRM-1, CMP-1015-PV)
index: WMGBPVM1530PRO

PVM-1530
Photovoltaic meter
index: WMGBPVM1530

The meter is a part of the **Sonel MeasureEffect™** platform. It is a comprehensive system that enables you to take measurements, store and manage data, and provides multi-level control of your instruments.

MeasureEffect™

PVM-1530: cat 1 measurements and I-U characteristics

The PVM-1530 is a pioneering meter for photovoltaic installations up to 1500 V with such a substantial number of measurement functions. Their selection is done via a touch screen. The screen is large, colorful and with strong backlight so that operation in full sunlight is not a problem. Extensive structural memory significantly reduces the time for preparing post-measurement documentation.

Tightness and durability

The meters perform well in harsh environmental conditions. The PVM-1530's housing is rugged and tight when closed to easily ensure that the meter is protected during measurement.

Communication and software

Measurement data from the PVM-1530 can be transferred to a computer via Bluetooth wireless communication. Saving the downloaded data to popular formats and printing ensured by **Sonel Reader**. In order to generate a report on electric shock protection use the optional software: **Sonel Reports Plus**.

Trouble? reSYNC!

It may happen that in the course of measurements the PVM-1530 moves away from the IRM-1 so far, that communication between them is lost. If the measurements are continued, then after the connection is restored, the results will be automatically **supplemented with environmental parameters**, which in the meantime were recorded by the IRM-1 in its **temporary memory**, and converted into STC conditions.

Choose the best set for your needs

PVM-1530	IRM-1	CMP-1015-PV

PVM-1530 Max

Photovoltaic meter, two solar radiation and temperature meters and clamp meter

PVM-1530 Pro

Photovoltaic meter, solar radiation and temperature meter and clamp meter

PVM-1530

Photovoltaic meter

Standard accessories:		**PVM-1530 Max**	**PVM-1530 Pro**	**PVM-1530**
		WMGBPVM1530MAX	WMGBPVM1530PRO	WMGBPVM1530
PVM-1530 photovoltaic meter		1	1	1
IRM-1 solar radiation and temperature meter		2	1	
CMP-1015-PV clamp meter		1	1	
IRM-1 mounting&measuring set	WASONTPVCKPL	2	1	
LORA-S1 USB adapter for data transmission	WAADAUSBLORA	1	1	
MC4-banana sockets adapter 1.5 kV (set of 2 pcs.)	WAADA5KVMC4KPL	1	1	1
Cable 2 m with MC4 plugs (set of 2 pcs.)	WAPRZ002MC4KPL	1	1	1
Test lead 3 m blue 5 kV (banana plugs)	WAPRZ003BUBB5K	1	1	1
Test lead 3 m yellow CAT III 1500 V (banana plugs)	WAPRZ003YEBB1K5V	1	1	1
Test lead 1.8 m, red, 5 kV (banana plugs)	WAPRZ1X8REBB	1	1	1
Test lead 1.8 m, black, 5 kV (banana plugs)	WAPRZ1X8BLBB5K	1	1	1
Set of test leads (CAT IV, M)	WAPRZCMP2	1	1	
Black "crocodile" clip 1 kV 20 A	WAKROBL20K01	2	2	2
Pin probe, black 5 kV (banana socket)	WASONBLOGB2	2	2	2
Temperature measurement probe (type K)	WASONTEMK	1	1	
Type K temperature probe adapter	WAADATEMK	1	1	
Li-Pol battery 7.4 V 1200 mAh	WAAKU30	1	1	
5 V power supply with USB 2.0 output and a detachable micro-USB cable	WAZASZ24	2	1	
Battery charger	WAZASZ25	1	1	
Battery charger power supply	WAZASZ26	1	1	
L-4 carrying case	WAFUTL4	1	1	1
M-3 carrying case	WAWALM3	1	1	
USB cable	WAPRZUSB	1	1	1
230 V mains cable (IEC C13 plug)	WAPRZ1X8BLIEC	1	1	1
Key for MC4 connectors	WAPOZKEYMC4	1	1	1
Fuse 0.5 A, 1000 V AC/DC, 6.3x32 mm	WAPOZB05A1000V	1	1	1
Factory calibration certificate - PVM-1530		1	1	1
Factory calibration certificate - IRM-1		2	1	
Factory calibration certificate - CMP-1015-PV		1	1	

DC voltage measurement

Test range: **0 V...1500 V DC**

Display range	Resolution	Accuracy
0.0…1500.0 V	0.1 V	±(0.5% m.v. + 2 digits)

AC voltage measurement - True RMS

Test range: **0 V...1000 V AC**

Display range	Resolution	Accuracy
0.0…1000.0 V	0.1 V	±(2% m.v. + 6 digits)

Frequency measurement

Test range: **10,0...100,0 Hz**

Display range	Resolution	Accuracy
0.0…100.0 Hz	0.1 Hz	±(0.5% m.v. + 2 digits)

Short circuit current I_{sc} measurement

Display range	Resolution	Accuracy
0.00…30.00 A for 1500 V DC 0.00…40.00 A for 1000 V DC	0.01 A	±(1% m.v. + 2 digits)

Insulation resistance measurement - PV module / PV installation

Test range according to EN IEC 61557-2:
U_{ISO} = 250 / 500 / 1000 / 1500 V DC: **250 kΩ...500 MΩ**

Insulation resistance measurement

Test range according to EN IEC 61557-2:
U_{ISO} = 250 V DC: **250 kΩ...200 MΩ**
U_{ISO} = 500 V DC: **500 kΩ...500 MΩ**
U_{ISO} = 1000 V DC: **1000 kΩ...1.000 GΩ**

Active power measurement – AC and DC voltage

Display range	Resolution	Accuracy
0.0…999.0 kW	0.01 kW	Depends on the accuracy of voltage and current measurement

Low-voltage measurement of circuit continuity and resistance

Testing of protective conductor continuity with ±200 mA current
Measuring range according to EN IEC 61557-4: **0.11...1999 Ω**

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

- Voltage on open terminals: 4...24 V
- Output current at R≤2 Ω: min. 200 mA
- Automatic calibration of test leads
- Measurements for both current polarities

I-U curve

- Measurement of I_{SC}, I_{mpp} – ranges and accuracies as in section "Short circuit current I_{SC} measurement"
- Measurement of U_{OC}, U_{mpp} – ranges and accuracies as in section "DC voltage measurement"

SONEL PVM-1021

PVM-1021

IRM-1

PVM-1021 Pro

Choose the best set for your needs

PVM-1021 Pro
Photovoltaic meter and solar radiation and temperature meter
index: WMGBPVM1021PRO

PVM-1021
Photovoltaic meter
index: WMGBPVM1021

Features

- **It can be used for category 1 measurements according to EN 62446-1.**
- **AUTO mode for performing a sequence of measurements after one press of the START button.**
- **It converts measured parameters into STC conditions according to EN IEC 60891 by cooperation with the IRM-1 solar radiation and temperature meter.**
- **reSYNC function** – automatic completion of results with environmental parameters and their conversion to STC conditions after restoring connection with IRM-1.
- The built-in LoRa radio interface ensures cooperation with the IRM-1 meter over long distances.
- Built-in Bluetooth module for communication with a computer.
- Large measurement memory: 100 objects with 40 cells each.
- Backlit display and buttons.

Measured parameters

- The open circuit voltage of the PV panel or a chain of panels, up to 1000V DC.
- RMS voltage of the AC network up to 600 V with frequency measurement.
- Short circuit current of a PV panel or chain of panels - up to 20 A DC.
- Insulation resistance of PV panels - measuring voltage of 250, 500 or 1000 V DC, simultaneous measurement of two values: R_{ISO+} and R_{ISO-}.
- Insulation resistance of AC circuits - measuring voltage 250, 500 or 1000 V DC.
- Resistance of protective conductors and equipotential bonding with ± 200 mA current. Low-current resistance measurement, audible and visual signalling.
- Measurement of PV panels operating current and AC current - all with external clamp.
- AC/DC power Measurement.
- Diode test with 200 mA current, automatic polarity detection. Test of blocking diodes with 1000V DC voltage.

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and EN IEC 61557
- measurement category ..... CAT III 1000 V according to EN IEC 61010-2-030
- housing protection rating according to EN 60529 ..... IP54

Other technical specifications:

- power supply ..... alkaline batteries (AA, 4 pcs) or rechargeable batteries set (option)
- weight ..... ca. 1,3 kg
- dimensions ..... 244 x 169 x 71 mm
- display ..... graphical LCD
- memory ..... 4059 entries
- transmission of results ..... Bluetooth

Great capabilities in a small casing

The PVM-1021 is a compact photovoltaic system meter with a substantial number of measurement functions. The functions are selected with a rotary switch. Additional parameters are set with buttons located on the housing. All buttons and the graphic display are backlit, which greatly facilitates operation in shaded places, e.g. when taking measurements under ground-mounted PV systems. Large memory significantly shortens preparation of documents after the measurement.

Tightness and durability

The meters perform well in harsh environmental conditions. Protection against the ingress of dust and water is provided by the housing rated at **IP54**. This is especially important for measurements on photovoltaic systems, which are outdoor installations.

Communication and software

Measurement data from the PVM-1021 can be transferred to a computer via Bluetooth wireless communication. Saving the downloaded data to popular formats and printing ensured by **Sonel Reader**. In order to generate a report on electric shock protection use the optional software: **Sonel Reports Plus**.

Trouble? reSYNC!

It may happen that in the course of measurements the PVM-1021 moves away from the IRM-1 so far, that communication between them is lost. If the measurements are continued, then after the connection is restored, the results will be automatically **supplemented with environmental parameters**, which in the meantime were recorded by the IRM-1 in its **temporary memory**, and converted into STC conditions.

DC voltage measurement

Display range	Resolution	Accuracy
0.0…1000.0 V	0.1 V	±(0.5% m.v. + 2 digits)

AC voltage measurement - True RMS

Display range	Resolution	Accuracy
0.0…600.0 V	0.1 V	±(2% m.v. + 6 digits)

Short circuit current I_{SC} measurement

Display range	Resolution	Accuracy
0.00…20.00 A	0.01 A	±(1% m.v. + 2 digits)

Insulation resistance measurement - PV module / PV installation

Test range according to EN IEC 61557-2:
U_{ISO} = 250 / 500 / 1000 V DC: **250.0 kΩ...300.0 MΩ**

Insulation resistance measurement

Test range according to EN IEC 61557-2:
U_{ISO} = 250 V DC: **250.0 kΩ...2.000 GΩ**
U_{ISO} = 500 V DC: **250.0 kΩ...5.000 GΩ**
U_{ISO} = 1000 V DC: **500.0 kΩ...9.999 GΩ**

Active power measurement – AC and DC voltage

Display range	Resolution	Accuracy
0.00…100.00 kW	0.01 kW	±(6% m.v. + 5 digits)

Low-voltage measurement of circuit continuity and resistance

Testing of protective conductor continuity with ±200 mA current
Measuring range according to EN IEC 61557-4: **0.11...1999 Ω**

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

- Voltage on open terminals: 4 V < U_{OC} < 8 V
- Output current at R≤2 Ω: min. 200 mA
- Automatic calibration of test leads
- Measurements for both current polarities

Standard accessories:		PVM-1021 Pro	PVM-1021
		WMGBPVM1021	WMGBPVM1021
PVM-1021 photovoltaic meter		1	1
IRM-1 solar radiation and temperature meter		1	
IRM-1 mounting&measuring set	WASONTPVCKPL	1	
Test lead 1.2 m, black, 1 kV (banana plugs)	WAPRZ1X2BLBB	1	1
Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB	1	1
Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB	1	1
Black "crocodile" clip 1 kV 20 A	WAKROBL20K01	1	1
Red "crocodile" clip 1 kV 20 A	WAKRORE20K02	1	1
Yellow "crocodile" clip 1 kV 20 A	WAKROYE20K02	1	1
Test probe with banana socket; 1 kV; red	WASONREOGB1	1	1
MC4-banana sockets adapter (set of 2 pcs.)	WAADAMC4	1	1
C-PV clamp	WACEGCPVOKR	1	1
Hanging strap	WAPOZPAS6	1	1
L-4 carrying case	WAFUTL4	1	1
5 V power supply with USB 2.0 output and a detachable micro-USB cable	WAZASZ24	1	
AA 1.5 V battery		4	4
AAA 1.5 V battery		2	2
Factory calibration certificate - PVM-1021		1	1
Factory calibration certificate - IRM-1		1	

MPI / MRP / PVM
Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	PVM-1021 photovoltaic meter	WMGBPVM1021																					1	1	•
	PVM-1530 photovoltaic meter	WMGBPVM1530																		1	1	1			
	IRM-1 solar radiation and temperature meter	WMGBIRM1	1	1	•	•														2	1	•	1	•	1
	CMP-1015-PV clamp meter + standard accessories	WMGBCMP1015PV																		1	1	•			
	Optional accessories for CMP-1015-PV	-																		•	•				
	AC-16 line splitter	WAADAAC16	•	•	•	•	•	•			•		•	•						•	•	•	•	•	
	AEV-100 adapter	WAADAAEV100																1							
	AGT-16C three-phase socket adapter 16 A	WAADAAGT16C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AGT-16P three-phase socket adapter 16 A	WAADAAGT16P	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AGT-16T industrial socket adapter 16 A	WAADAAGT16T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AGT-32C three-phase socket adapter 32 A	WAADAAGT32C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AGT-32P three-phase socket adapter 32 A	WAADAAGT32P	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AGT-32T industrial socket adapter 32 A	WAADAAGT32T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AGT-63P three-phase socket adapter 63 A	WAADAAGT63P	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	
	AutoISO-1000C adapter	WAADAAISO10C	•	•	•	•	•	•		•	•		•	•											
	AutoISO-2500 adapter	WAADAAISO25							•			•													
	EVSE-01 adapter	WAADAEVSE01	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
	PVM-1 adapter	WAADAPVM1	1	1	1	1																			
	IRM-1 mounting&measuring set (solar radiation meter mounting kit for PV panels + probe for measuring the temperature of PV panels and the ambient temperature)	WASONTPVCKPL	1	1	•	•														2	1		1		1

MPI / MRP / PVM
Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	Solar radiation measurement set (IRM-1 solar radiation and temperature meter + IRM-1 mounting&measuring set + Z-24 power supply + LORA-S1 adapter for data transmission + M-14 carrying case)	WMGBIRM1MPI	•	•	•	•																			
	TWR-1J - RCD breaker testing adapter	WAADATWR1J	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•						
	WS-01 adapter with START button with UNI-Schuko plug	WAADAWS01															•		•						
	WS-03 adapter with START button with UNI-Schuko plug	WAADAWS03	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
	WS-04 adapter with UNI-Schuko plug	WAADAWS04	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•								
	WS-05 adapter with UNI-Schuko plug	WAADAWS05													•	•	•		1						
	WS-06 adapter (miniDIN-4P plug)	WAADAWS06	•	•	•	•	•	•	•	•	•														
	WS-07 adapter for measuring Z(L-N)	WAADAWS07													•	•	•								
	WS-09 adapter (pin probe)	WAADAWS09	•	•	•	•	•	•	•	•															
	Voltage adapters with M4/M6 thread (set of 4 pcs.)	WAADAM4M64	1	1	1	1	1	1																	
	MC4-banana sockets adapter (set of 2 pcs.)	WAADAMC4	1	1	1	1																	1	1	
	MC4-banana sockets adapter 1.5 kV (set of 2 pcs.)	WAADA5KVMC4KPL																		1	1	1			
	MC4 splitter for power measurement in PV systems (set of 2 pcs.)	WAADAMC4SKPL	•	•	•	•																	•	•	
	MC4 splitter for power measurement in PV installations 1500 V (set of 2 pcs.)	WAADAMC4SV2KPL																		•	•	•			
	Cable 2 m with MC4 plugs (set of 2 pcs.)	WAPRZ002MC4KPL																		1	1	1			
	Adapter for C-PV clamp	WAADACPV	1	1	1	1																			
	Double-wire test lead 2 m, for N-1 clamps (banana plugs)	WAPRZ002DZBB	•	•	•	•	•	•	•	•	•														
	F-1A flexible coil (Ø360 mm)	WACEGF1AOKR	•	•	•	•	•	•			•														
	F-2A flexible coil (Ø235 mm)	WACEGF2AOKR	•	•	•	•	•	•			•														
	F-3A flexible coil (Ø120 mm)	WACEGF3AOKR	3	•	3	•	3	•			•														

MPI / MRP / PVM

Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	N-1 transmitting clamp (Ø52 mm)	WACEGN1BB	•	•	•	•	•	•	•	•	•														
	C-3 current clamp (Ø52 mm)	WACEGC3OKR	•	•	•	•	•	•	•	•	•		•	•											
	C-4A current clamp (Ø52 mm)	WACEGC4AOKR	•	•	•	•	•	•																	
	C-5A current clamp (Ø39 mm)	WACEGC5AOKR	•	•	•	•	•	•																	
	C-6A current clamp (Ø20 mm)	WACEGC6AOKR	•	•	•	•	•	•			•														
	C-7A current clamp (Ø24 mm)	WACEGC7AOKR	•	•	•	•	•	•																	
	C-PV clamp	WACEGCPVOKR	1	1	1	1																	1	1	
	Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01	1	1	1	1	1	1				1						•		2	2	2	1	1	
	Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02	1	1	1	1	1	1	1	1	1	•	1	1	1	1	•		•	•	•	•	1	1	
	Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02	1	1	1	1	1	1	1	1	1	•	•	•	•	•	•	•	•	•	•	•			
	Crocodile clip, yellow, 1 kV, 20 A	WAKROYE20K02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	•	•	•	1	1	
	Crocodile clip, black, 11 kV, 32 A	WAKROBL32K09							1			1													
	Crocodile clip, red, 11 kV, 32 A	WAKRORE32K09							•			•													
	Test lead 1.2 m, black, 1 kV (banana plugs)	WAPRZ1X2BLBB																1					1	1	
	Test lead 1.2 m, black, 1 kV with markers (banana plugs)	WAPRZ1X2BLBBN	1	1	1	1	1	1																	
	Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1				1	1	
	Test lead 1.2 m, blue, 1 kV (banana plugs)	WAPRZ1X2BUBB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
	Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	
	Test lead 3 m yellow CAT III 1500 V (banana plugs)	WAPRZ003YEBB1K5V																		1	1	1			
	Test lead 5 m, red, 1 kV (banana plugs)	WAPRZ005REBB	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•						
	Test lead 10 m, red, 1 kV (banana plugs)	WAPRZ010REBB	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•						

MPI / MRP / PVM
Set of standard and optional accessories

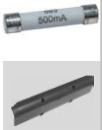
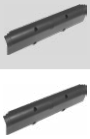
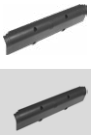
1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	Test lead 20 m red 1 kV (banana plugs)	WAPRZ020REBB	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•						
	Test lead 30 m, red, 1 kV (banana plugs)	WAPRZ030REBBN													1			•							
	Test lead 15 m, blue, 1 kV (banana plugs)	WAPRZ015BUBBN													1			•							
	Test lead 15 m, blue (on a reel)	WAPRZ015BUBBSZ	1	1	1	1	1	1	1	1	1	1	1	•	•										
	Test lead 25 m, red (banana plugs, on a reel)	WAPRZ025REBBSZ	•	•	•	•	•	•	•	•	•	•	•	•	•										
	Test lead 25 m, blue (banana plugs, on a reel)	WAPRZ025BUBBSZ	•	•	•	•	•	•	•	•	•	•	•	•	•										
	Test lead 30 m, red (banana plugs, on a reel)	WAPRZ030REBBSZ	1	1	1	1	1	1	1	1	1	1	1	•	•										
	Test lead 50 m, yellow (banana plugs, on a reel)	WAPRZ050YEBBSZ	•	•	•	•	•	•	•	•	•	•	•	•	•										
	Test lead 1.8 m, black, 5 kV (banana plugs, shielded)	WAPRZ1X8BLBB							1			1													
	Test lead 1.8 m, black, 5 kV (banana plugs)	WAPRZ1X8BLBB5K																		1	1	1			
	Test lead 1.8 m, red, 5 kV (banana plugs)	WAPRZ1X8REBB							1			1								1	1	1			
	Test lead 3 m blue 5 kV (banana plugs)	WAPRZ003BUBB5K																		1	1	1			
	BNC transmission cable	WAPRZBNC																1							
	PRS-1 resistance test probe	WASONPRS1	•	•	•	•	•	•	•	•	•	•	•	•											
	LP-1 light meter probe (miniDIN-4P plug)	WAADALP1	•	•	•	•	•	•	•	•	•														
	LP-1 light meter probe for MPI (set, WS-06 plug)	WAADALP1KPL	•	•	•	•	•	•	•	•	•														
	LP-10A light meter probe (miniDIN-4P plug)	WAADALP10A	•	•	•	•	•	•	•	•	•														
	LP-10A light meter probe for MPI (set, WS-06 plug)	WAADALP10AKPL	•	•	•	•	•	•	•	•	•														
	LP-10B light meter probe (miniDIN-4P plug)	WAADALP10B	•	•	•	•	•	•	•	•	•														
	LP-10B light meter probe (set, WS-06 plug)	WAADALP10BKPL	•	•	•	•	•	•	•	•	•														
	Foldable pin probe, 1 kV, 2 m (banana socket)	WASONSP2M	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•						

MPI / MRP / PVM

Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	Pin probe, black 1 kV (banana socket)	WASONBLOGB1																1		•	•	•	•	•	
	Pin probe, red 1 kV (banana socket)	WASONREOGB1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	•	•	•	1	1	
	Pin probe, blue 1 kV (banana socket)	WASONBUOGB1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	•	•	•	•			
	Pin probe, yellow 1 kV (banana socket)	WASONYEOGB1	1	1	1	1	1	1	1	1	1	1	1	•	1	1	•	1	•	•	•	•	•	•	
	Pin probe, black 5 kV (banana socket)	WASONBLOGB2							•			•								2	2	2			
	Pin probe, red 5 kV (banana socket)	WASONREOGB2							1			1													
	Probe for measuring the temperature of PV panels and the ambient temperature	WASONTPVC	•	•	•	•																	•		•
	Earth contact test probe (rod), 25 cm	WASONG25													2			•							
	Earth contact test probe (rod), 30 cm	WASONG30	2	2	2	2	2	2	2	2	2	2	2	•	•										
	Earth contact test probe (rod), 80 cm	WASONG80V2	•	•	•	•	•	•	•	•	•	•	•	•	•										
	Cramp (banana socket)	WAZACIMA1	•	•	•	•	•	•	•	•	•	•	•	•	•										
	CS-1 cable simulator	WAADACS1	•	•	•	•	•	•	•	•	•	•	•	•											
	CS-5kV calibration box	WAADACS5KV							•			•													
	Fuse 0.5 A, 1000 V AC/DC, 6.3x32 mm	WAPOZB05A1000V																		1	1	1			
	NiMH battery 4.8 V 4.2 Ah	WAAKU07									1	1	•	•											
	Li-Ion battery 11.1 V 3.4 Ah	WAAKU15	1	1	1	1	1	1	1	1															
	Battery container	WAPOJ1									•	•	1	1											
	Z-7 power supply	WAZASZ7	1	1	1	1	1	1	1	1	1	1	•	•											
	Z-24 5 V power supply with USB 2.0 output and a detachable micro-USB cable	WAZASZ24	1	1																2	1		1		1
	230 V mains cable (IEC C7 plug)	WAPRZLAD230	1	1	1	1	1	1	1	1	1	1	•	•											
	230 V mains cable (IEC C13 plug)	WAPRZ1X8BLIEC																		1	1	1			

MPI / MRP / PVM

Set of standard and optional accessories

1, 2, 4 - number of standard accessories
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Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	230 V mains cable (16 A 5P socket)	WAPRZZAS16P																1							
	Three-phase mains cable (16 A 5P socket)	WAPRZZAS16P3F																•							
	MPI charging set (charger + battery)	WAKPLLADMPI520									•	•	•	•											
	AZ-2 power supply adapter (IEC C7 plug/banana connectors)	WAADAAZ2	•	•	•	•	•	•	•	•															
	Cable for battery charging from car cigarette lighter socket (12 V)	WAPRZLAD12SAM	1	1	1	1	1	1	1	1	1	•	•	•											
	EV charging cable 2.2 m (type 2 male/type 2 female)	WAKABEVT2T2																1							
	Test wire reel	WAPOZSZP1	•	•	•	•	•	•	•	•	•	•	•	•											
	Test wire H-frame	WAPOZSZP3	•	•	•	•	•	•	•	•	•	•	•	•											
	Strap	WAPOZPAS6																					1	1	
	L-2 hanging straps (set)	WAPOZSZEKPL	1	1	1	1	1	1	1	1	1	1	1	1											
	M-1 hanging straps	WAPOZSZE4													1	1	1		1						
	M-1 hanging hook straps	WAPOZUCH1													1	1	1		•						
	Magnetic hanging strap	WAPOZUCH6													•	•	•								
	Cover (universal)	WAPOZUCH12	•	•	•	•	•	•	•	•	•	•	•	•											
	Solar radiation meter mounting kit for PV panels	WAPOZUCHPV	•	•	•	•																	1		1
	Clamp for mounting the solar radiation meter to the solar panels	WAZACPV	•	•	•	•																	•		•
	Key for MC4 connectors	WAPOZKEYMC4	•	•	•	•														1	1	1	•	•	
	L-2 carrying case	WAFUTL2	•	•	1	1	1	1	1	1	1	1	1	•											
	L-3 carrying case for a 80 cm rods	WAFUTL3	•	•	•	•	•	•	•	•	•	•	•	•	•										
	L-4 carrying case	WAFUTL4											•	1				1		1	1	1	1	1	

MPI / MRP / PVM

Set of standard and optional accessories

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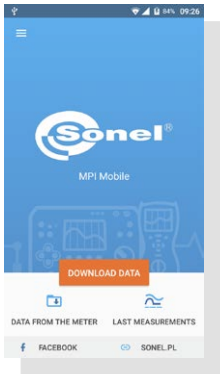
Photo	Name	Index	MPI-540-PV Solar	MPI-540-PV Solar Start	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start	MPI-536	MPI-535	MPI-530/530-IT	MPI-525	MPI-520	MPI-520 Start	MPI-507	MPI-506	MPI-502F	EVSE-100	MRP-201	PVM-1530 Max	PVM-1530 Pro	PVM-1530	PVM-1021 Pro	PVM-1021	IRM-1
	L-19 backpack	WAFUTL19	1	1	•	•	•	•	•	•															
	M-6 carrying case	WAFUTM6													1	1	1		1						
	M-13 carrying case	WAFUTM13	•	•	1	1																			
	M-14 carrying case	WAFUTM14																							1
	XL-12 hard carrying case	WAWALXL12			•	•	•	•	•	•															
	XL-13 hard carrying case	WAWALXL13									•														
	S-4 armband case for mini Bluetooth keyboard	WAFUTS4									•														
	USB cable	WAPRZUSB	1	1	1	1	1	1	1	1	1	1	1	1				1		1	1	1			
	LORA-S1 USB adapter for data transmission	WAADAUSBLORA	1	1	•	•														1	1				
	OR-1 USB wireless receiver	WAADAUSBOR1										•	•	•					1						
	Touchscreen pen	WAPOZTPEN	1	1	1	1	1	1	1	1															
	PC software: Sonel Reports Plus	WAPROREPORTSPLUS	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	PC software: Sonel Reader	WAPROREADER	1	1	1	1	1	1	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

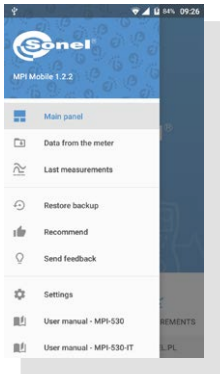
SONEL MPI MOBILE

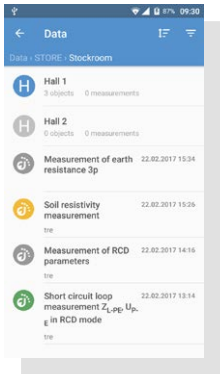
A mobile version of the program cooperating with a multifunctional Sonel instrument: **MPI-530-IT** / **MPI-530** meters of electrical system parameters. It can be downloaded from **Google Play**.

With the application you can **connect directly to the device** via Bluetooth and download the measurement data from the meter. After reading the measurements from the instrument, they can be easily and quickly **viewed**, but also **sent from the measurement place** to a person who can help interpret the data or perform a measurements documentation.

To each measurement we can add, voice memo, note, GPS data, or photo. From the application level we also have **access to the meter's user manual**.







Insulation resistance meters

MIC-15k1
MIC-10k1
MIC-5050

MIC-5010
MIC-5005
MIC-5001

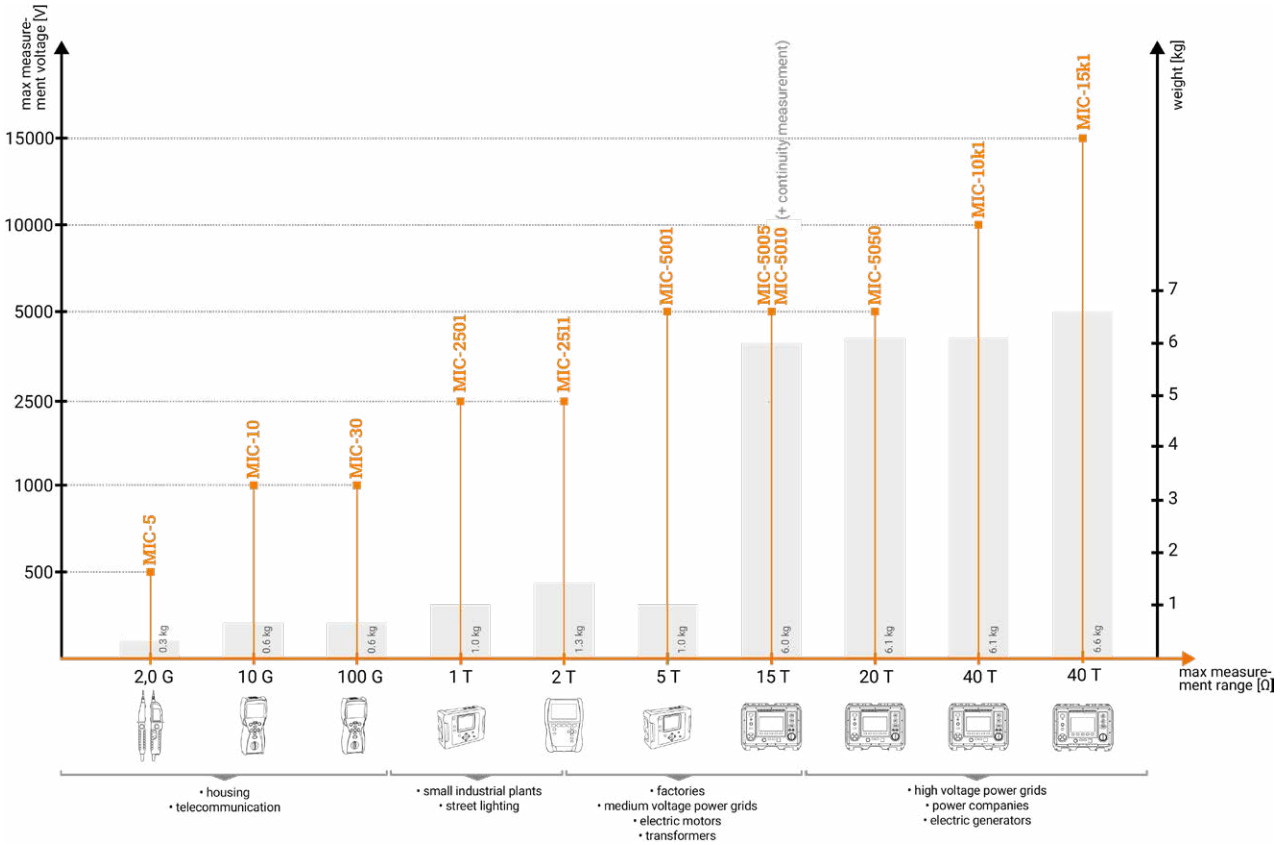
MIC-2511
MIC-2501

MIC-30
MIC-10

MIC-5
MIC-RS

Comparison of insulation resistance meters

	 MIC-15k1	 MIC-10k1	 MIC-5050	 MIC-5010	 MIC-5005	 MIC-5001	 MIC-2511	 MIC-2501	 MIC-30
Measurement voltage [V]	50…15 000	50…10 000	50…5000	50…5000	50…5000	50…5000	10…2500	100…2500	50…1000
Measuring range	50 kΩ…40 TΩ	10 kΩ…40 TΩ	20 kΩ…20 TΩ	20 kΩ…15 TΩ	20 kΩ…15 TΩ	50 kΩ…5 TΩ	50 kΩ…2 TΩ	50 kΩ…2 TΩ	50 kΩ…100 GΩ
Short-circuit current I_{sc}	1.2 / 3 / 5 / 7 mA	1.2 / 3 / 6 mA	1.2 / 3 / 6 mA	1.2 / 3 mA	1.2 / 3 mA	1.5 mA	≤2 mA	1 mA	1 mA
Setting of 3 measurement times for calculation of Ab1, Ab2, PI, DAR	1…600 s	1…600 s	1…600 s	1…600 s	1…600 s	1…600 s	1…600 s	1…600 s	1…600 s
Maximum setting of measurement time	99'59"	99'59"	99'59"	99'59"	99'59"	10'	60'	10'	10'
Measurement of insulation resistance using the three-terminal method	√	√	√	√	√	√	√	√	√
Measurement of 2 absorption coefficients	√	√	√	√	√	√	√	√	√
Measurement of leakage current during insulation resistance measurement	√	√	√	√	√	√	√	√	√
Automatic discharging of object after measurement	√	√	√	√	√	√	√	√	√
Built-in quick charger	√	√	√	√	√	√	√	√	–
Power supply	rechargeable battery	rechargeable battery	rechargeable battery	rechargeable battery	rechargeable battery	rechargeable battery	rechargeable battery	rechargeable battery	AA batteries or rechargeable batteries
Low-voltage resistance measurement	–	–	–	–	–	–	√	–	√
Continuity test with current ≥200mA (resolution 0.01Ω)	–	–	–	√	–	–	√	√	√
Automatic measurement of 3-, 4- and 5-core cords by means of AutoISO adapters	–	AutoISO-5000	AutoISO-5000	–	–	–	AutoISO-2511	–	–
Voltage measurement	0…600 V	0…750 V	0…750 V	0…600 V	0…600 V	0…750 V	0…1500 V	0…750 V	0…600 V
Temperature measurement	–	√	√	–	–	–	√	–	–
Plotting of insulation resistance and leakage current characteristics	in mobile application	√	√	in mobile application	in mobile application	√	√	√	–
Automatic in-socket measurement	–	–	–	–	–	–	–	–	√
Capacitance measurement	√	√	√	√	√	–	√	–	√
Memory (number of records)	990 autosave	10 000	10 000	990	990	990	9999	990	990
Data transmission	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	USB	USB	USB	Bluetooth
Dimensions [mm]	390 x 308 x 172	390 x 308 x 172	390 x 308 x 172	390 x 308 x 172	390 x 308 x 172	200 x 180 x 77	234 x 169 x 70	200 x 180 x 77	200 x 150 x 60
Weight [kg]	6.6	6.1	6.1	6.0	6.0	1.0	1.3	1.0	0.6











MIC-10	MIC-5	MIC-RS	MPI-540-PV MPI-540 MPI-535	MPI-536	MPI-530-IT MPI-530	MPI-525	MPI-520	MPI-507 MPI-506	
50, 100, 250, 500, 1000	250, 500	50...1000	50, 100, 250, 500, 1000	10, 50, 100, 250, 500, 1000, 1500, 2500	50, 100, 250, 500, 1000	50, 100, 250, 500, 1000, 2500	50, 100, 250, 500, 1000	100, 250, 500	Measurement voltage [V]
50 kΩ...10 GΩ	250 kΩ...1.999 GΩ	500 kΩ...2.000 GΩ	50 kΩ...9,99 GΩ	10 kΩ...9.99 GΩ	50 kΩ...9,99 GΩ	50 kΩ...9,99 GΩ	50 kΩ...3 GΩ	100 kΩ...600 MΩ	Measuring range
1 mA	<1.4 mA	≤2 mA	<2 mA	<2 mA	<2 mA	<2 mA	<2 mA	<2 mA	Short-circuit current I_{sc}
–	–	–	–	1...600 s	–	1...600 s	–	–	Setting of 3 measurement times for calculation of Ab1, Ab2, PI, DAR
–	–	–	–	5'	–	5'	–	–	Maximum setting of measurement time
√	–	–	–	–	–	–	–	–	Measurement of insulation resistance using the three-terminal method
–	–	–	–	√	–	√	–	–	Measurement of 2 absorption coefficients
–	–	–	–	–	–	–	–	–	Measurement of leakage current during insulation resistance measurement
√	√	√	√	√	√	√	√	√	Automatic discharging of object after measurement
–	–	–	√	√	√	√	√	–	Built-in quick charger
AA batteries or rechargeable batteries	AAA batteries or rechargeable batteries	external, isolated 24 V DC	rechargeable battery	rechargeable battery	rechargeable battery or batteries	rechargeable battery or batteries	batteries or rechargeable batteries	batteries or rechargeable batteries	Power supply
√	√	√	√	√	√	√	√	√	Low-voltage resistance measurement
√	–	–	√	√	√	√	√	√	Continuity test with current ≥200mA (resolution 0.01Ω)
–	–	–	–	AutoISO-2500	–	AutoISO-2500	–	–	Automatic measurement of 3-, 4- and 5-core cords by means of AutoISO adapters
0...600 V	0...600 V	–	0...500 V	0...500 V	0...500 V	0...500 V	0...500 V	0...500 V	Voltage measurement
–	–	–	–	–	–	–	–	–	Temperature measurement
–	–	–	–	√	–	–	–	–	Plotting of insulation resistance and leakage current characteristics
–	–	–	√	–	√	–	√	√	Automatic in-socket measurement
√	–	√	–	–	–	–	–	–	Capacitance measurement
–	–	–	100 000	100 000	10 000	990	990	990	Memory (number of records)
–	–	RS-232 / RS-485 MIC-RS-SCP / Modbus	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	USB, Bluetooth	Data transmission
220 x 100 x 60	275 x 82 x 36	55 x 130 x 215	288 x 223 x 75	288 x 223 x 75	295 x 223 x 75	288 x 223 x 75	288 x 223 x 75	220 x 102 x 61 mm	Dimensions [mm]
0.6	0.3	0.8	2.5	2.5	2.2	2.2	2.2	0,8	Weight [kg]

In addition to specific meters you can also purchase:

Adapter for measuring insulation resistance

SONEL AutoISO-2500

index: WAADAAISO25

Insulation resistance measurements:

- insulation measurement of 3-, 4- and 5-wire cables and wires using test voltage up to 2.5 kV
- optional for **MPI-536, MPI-525**

Adapter for measuring insulation resistance

SONEL AutoISO-2511

index: WAADAAISO2511

Insulation resistance measurements:

- insulation measurement of 3-, 4- and 5-wire cables and wires using test voltage up to 2.5 kV
- optional for **MIC-2511**

Adapter for measuring insulation resistance

SONEL AutoISO-5000

index: WAADAAISO50

Insulation resistance measurements:

- insulation measurement of 3-, 4- and 5-wire cables and wires using test voltage up to 5 kV
- optional for **MIC-10k1, MIC-5050**

Probe for measurement of floor and wall resistances

SONEL PRS-1

index: WASONPRS1

- Sonel PRS-1 tripod measuring probe, with the shape of an equilateral triangle, has been manufactured according to the guidelines given in standards HD 60364-6 and EN 1081
- optional for **MIC** and **MPI** meters

Probe for measuring resistance in zones with ESD protection

SONEL PRS-2 / PRS-2 KIT

index: WASONPRS2 / WASONPRS2KIT

- 2x double-sized ring-shape measurement probe (counter-electrode)
- circular probe (counter-electrode)
- 2x pressure weight
- insulating plate
- 3x test lead 1.2 m
- test lead 10 m on a reel
- distance line 25 cm
- **PRS-2 KIT** | L-7 carrying case
- optional for **MIC-2511**

Set for measuring resistance in zones with ESD protection

SONEL PRZ-2

index: WASONPRZ2

- set: **PRS-1** + **PRS-2 KIT**
- optional for **MIC-2511**

SONEL PRZ-2 MIC

index: WASONPRZ2MIC

- set: **PRS-1** + **PRS-2** + **case with space for meter**
- optional for **MIC-2511**

Insulation Quality Analyzer

SONEL MIC-15k1

index: WMGBMIC15k1

CAT IV 1000 V

CAT IV 600 V

IP67

BLUETOOTH

50°C HEAVY DUTY -20°C

15 kV
maximum measuring voltage

40 TΩ
maximum measurement range

partial discharges indicator

remote control by phone

Measurement of insulation resistance:

- **up to 40 TΩ**,
- measurement voltages selected within the range of **50...15 000 V**,
- **remote start and stop of the measurement** via Sonel MIC Mobile application,
- measurement voltage adjustment during the measurement,
- **measurement of polarization and depolarization currents (PDC)**,
- continuous readings of measured insulation resistance and leakage current,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- measurement time setting - up to 99'59",
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1...600 s,
- reading of actual measurement voltage during measurement,
- measurement current **1.2 mA**, **3 mA**, **5 mA** or **7 mA**,
- protection against measurement of live object,
- digital filters for measurements with strong disturbances (**10 s, 30 s, 60 s, 100 s, 200 s**).

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - measurements with lead lengths up to 20 m,
  - measurement of capacitance during measurement of R_{ISO},
  - measurement of leakage current during measurement of R_{ISO},
- measurement with step voltage (SV),
- dielectric discharge (DD) test,
- measurement with RampTest (RT) method,
- damage location (burning function, current of **11 mA**),
- measurement of surface and volume resistance (Sr),
- partial discharge indicator,
- measurement of polarization and depolarization currents (PDC).

Additional functions of the meters:

- high immunity to disturbances - in compliance with standard EN 61326,
- setting the limits of minimal insulation resistance,
- measurement of direct and alternating voltages within the range of 0...600 V,
- **autosaving the measurement results to the dynamic memory of the device,**
- 990-cell memory (11,880 entries)
- data transmission to PC via USB connection or Bluetooth®,
- supports external wireless Bluetooth® keyboard (optional),
- backlit keyboard and display,
- power supply from rechargeable battery packs or power grid,
- charging during measurement,
- the instrument meets the requirements laid down by standard EN 61557.

VIRTUAL INSTRUMENTS

We invite you to use the **virtual instruments** application. Thanks to it you can familiarize yourself with features of a selected device, its interface and capabilities.

The application gives you the opportunity to change the selected meter's configuration and perform measurements in a way you would in reality.

www.sonel.com › Knowledge centre › Virtual instrument applications

Standard accessories:

L-4 carrying case	WAFUTL4
W-1 hanging straps	WAPOZSZE5
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, shielded, black	WAPRZ003BLKROE15KV
Test lead 15 kV 3 m CAT IV 1000 V with crocodile clip, blue	WAPRZ003BUKRO15KV
USB cable	WAPRZUSB
Mains cable with IEC C13 plug	WAPRZ1X8BLIEC
Factory calibration certificate	

Measurement of insulation resistance

Measuring range in compliance with EN 61557-2:
$R_{ISOmin} = U_{ISOnom} / I_{ISOmax}$ = 50 kΩ...40 TΩ (I_{ISOmax} =1.2 mA, 3 mA, 5 mA, 7 mA)

Display 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		

Values of measured resistance depending on measuring voltage

Display range	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	10.0 TΩ
5000 V	20.0 TΩ
10000 V	40.0 TΩ
15000 V	40.0 TΩ

Electrical safety:

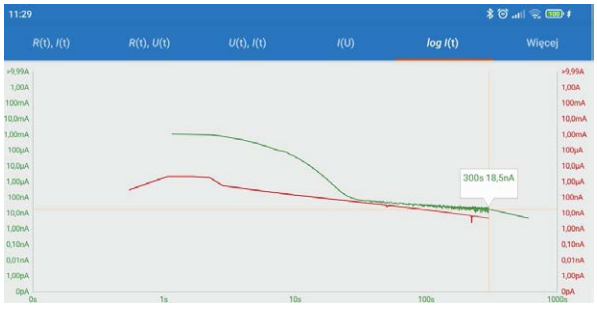
- type of insulation ..... double, as per EN 61010-1 and EN 61557
- measurement category
  ..... CAT IV 1000 V (operating altitude ≤2000 m) acc. to EN 61010-1
  ..... CAT IV 600 V (operating altitude ≤3000 m) acc. to EN 61010-1
- housing protection rating acc. to EN 60529 ..... IP40
  ..... (IP67 with closed housing cover)

Nominal operating conditions:

- operating temperature range ..... -20...+50°C
- storage temperature ..... -25...+70°C
- humidity ..... 20...90%
- elevation above sea level ..... ≤3000 m
- reference temperature ..... +23°C ± 2°C
- reference humidity ..... 40...60%

Other technical specifications:

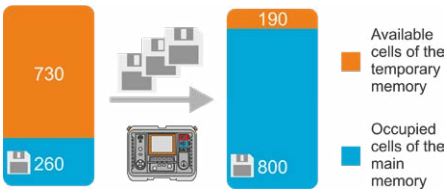
- power supply ..... built-in Li-FePO4 rechargeable battery 13.2 V 5.0 Ah
  ..... from network: 90 V ÷ 260 V 50/60 Hz
- weight ..... approx. 6.6 kg
- dimensions ..... 390 x 308 x 172
- transmission of results ..... USB link or Bluetooth®



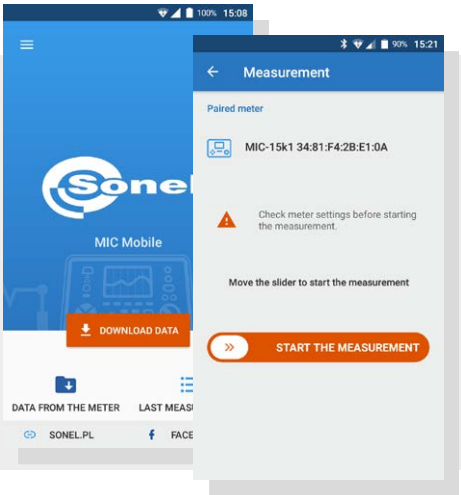
PDC measurements (Sonel MIC Mobile)

For all 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 **800 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.

**The measuring voltage equals 15 kV ± 10%, which gives max. 16,5 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** (measurement time **60...5999 s**).

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.

SONEL MIC MOBILE

Mobile version of the program cooperating with insulation resistance meters: **MIC-15k1**, **MIC-10k1, MIC-5050, MIC-5010**, **MIC-5005**.

With the application, you can **connect directly to the device** via Bluetooth and download measurement data from the meter. After reading the measurements from the device, they can be easily and quickly **viewed**, and also **sent from the place of measurement** to the person who can help in the interpretation of data or make a measurement report. Additional functionalities will be useful: assigning a photo, text or voice note to a given measurement.

There is a possibility to start and stop the measurement remotely. You can also convert the **k20 temperature coefficient**. The application can be downloaded from **Google Play**.

SONEL MIC-10k1 / MIC-5050

index: WMGBMIC10K1 / WMGBMIC5050

CAT III 1000 V

CAT IV 600 V

EN 61557-2

BLUETOOTH

MIC-10k1

40 TΩ

maximum measurement range

Measurement of insulation resistance:

- **MIC-10k1 | up to 40 TΩ**,
- **MIC-5050 | up to 20 TΩ**,
- measurement voltages selected within the range of:
  - **MIC-10k1 | 50...10 000 V**: 50...1000 V in steps of 10 V, 1...10 kV in steps of 25 V,
  - **MIC-5050 | 50...5000 V**: 50...1000 V in steps of 10 V, 1...5 kV in steps of 25 V,
- **remote start and stop of the measurement** via Sonel MIC Mobile application,
- **charts plotted on display during measurements,**
- **correction of insulation resistance result to reference temperature,**
- continuous readings of measured insulation resistance and leakage current,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- measurement time setting - up to 99'59",
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1...600 s,
- reading of actual measurement voltage during measurement,
- measurement current **1.2 mA**, **3 mA** or **6 mA**,
- protection against measurement of live object,
- digital filters for measurements with strong disturbances (**10 s, 30 s, 60 s**).

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - measurements with lead lengths up to 20 m,
  - automatic measurement of all resistance combinations of 3-, 4- and 5-core cords and power cords by means of the optional **AutoISO-5000** adapter (for MIC-10k1 at voltage up to 5 kV),
  - measurement of capacitance during measurement of R_{ISO},
  - measurement of leakage current during measurement of R_{ISO},
- measurement with step voltage (SV),
- dielectric discharge (DD) test,
- damage location (burning function, current of **6 mA**),
- low-voltage measurement of continuity using current of ≥200 mA (R_{CONT}).

Additional functions of the meters:

- high immunity to disturbances - in compliance with standard EN 61326,
- stable measurement in 765 kV substations
- adjustable limits of minimum insulation resistance R_{ISO} and maximum resistance R_{CONT},
- **temperature measurement (with the use of the optional ST-1 temperature probe),**
- measurement of direct and alternating voltages within the range of 0...750 V,
- memory storing up to 10,000 results of each type of measurement, including descriptions of measurement points, objects, client names,
- data transmission to PC via USB connection, Bluetooth® or capability of data transfer via USB flash drives,
- easy-to-read, backlit 5.6" LCD graphic display,
- backlit keyboard,
- power supply from rechargeable battery packs or power grid,
- charging during measurement,
- the instrument meets the requirements laid down by standard EN 61557.

VIRTUAL INSTRUMENTS

We invite you to use the **virtual instruments** application. Thanks to it you can familiarize yourself with features of a selected device, its interface and capabilities.

The application gives you the opportunity to change the selected meter's configuration and perform measurements in a way you would in reality.

www.sonel.com › Knowledge centre › Virtual instrument applications

Standard accessories:

L-4 carrying case	WAFUTL4
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, shielded, black	WAPRZ003BLKROE15KV
Test lead 15 kV 3 m CAT IV 1000 V with crocodile clip, blue	WAPRZ003BUKRO15KV
USB cable	WAPRZUSB
Mains cable with IEC C13 plug	WAPRZ1X8BLIEC
Factory calibration certificate	

Measurement of insulation resistance

Measuring range in compliance with EN 61557-2:

$R_{ISOmin} = U_{ISOnom} / I_{ISOmax}$ =5 MΩ...40 TΩ (I_{ISOmax} =1.2 mA, 3 mA or (6 ± 15%) mA)

Display 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)
MIC-5050 | 10.0...20.0 TΩ	0.1 TΩ	±(12.5% m.v. + 10 digits)
MIC-10k1 | 10.0...40.0 TΩ		

Values of measured resistance depending on measuring voltage

Display range	Measuring range	Measuring 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	10.0 TΩ	400 GΩ
5000 V	20.0 TΩ	400 GΩ
MIC-10k1 | 10000 V	40.0 TΩ	-

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- measurement category ..... CAT IV 600 V (CAT III 1000 V) according to EN 61010-1
- housing protection rating according to EN 60529 ..... IP40 (IP67 with closed housing cover)

Nominal operating conditions:

- operating temperature range ..... -20...+50°C
- storage temperature ..... -25...+70°C
- humidity ..... 20...90%
- elevation above sea level ..... ≤3000 m
- reference temperature ..... +23°C ± 2°C
- reference humidity ..... 40...60%

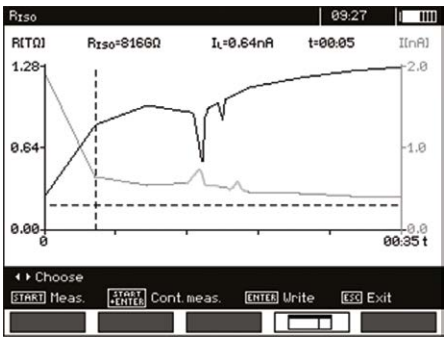
Other technical specifications:

- power supply ..... built-in Li-Ion rechargeable battery 13.2 V 5.0 Ah from network: 90 V ÷ 260 V 50/60 Hz
- weight ..... approx. 6.1 kg
- dimensions ..... 390 x 308 x 172 mm
- display ..... graphic LCD 5.6"
- transmission of results ..... USB link or Bluetooth®

Professional diagnostic tool

Designed for the most demanding objects

Several measurements in one connection



Graphic interpretation of results

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.

Features of the device

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 (MIC-10k1) / 30 W (MIC-5050) 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 or Sonel Reader software, the user can collect historical data and compare 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 of meters

	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 meters

SONEL MIC-5010 / MIC-5005

index: WMGBMIC5010 / WMGBMIC5005

CAT III 1000 V

CAT IV 600 V

EN 61557-2

BLUETOOTH

15 TΩ
maximum measurement range

Measurement of insulation resistance:

- measurement voltage selected within the range of **50...5000 V**: 50...1000 V selected in steps of 10 V, 1000 V...5000 V selected in steps of 25 V,
- **remote start and stop of the measurement** via Sonel MIC Mobile application,
- continuous reading of measured insulation resistance or leakage current,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- measurement time setting - up to 99'59",
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1...600 s,
- reading of actual measurement voltage during measurement,
- measurement current **1.2 mA** or **3 mA**,
- protection against measurement of live objects,
- digital filters for measurements with strong disturbances (**10 s, 30 s, 60 s**).

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - measurements with lead lengths up to 20 m,
  - measurement of capacitance during measurement of R_{ISO},
  - measurement of leakage current during measurement of R_{ISO},
- measurement with step voltage (SV),
- dielectric discharge (DD) test,
- **MIC-5010** | low-voltage measurement of continuity using current of ≥200 mA (R_{CONT}).

Additional functions of the meters:

- high immunity to disturbances - in compliance with standard EN 61326,
- adjustable limits of minimum insulation resistance R_{ISO} and maximum resistance R_{CONT},
- measurement of direct and alternating voltages within the range of 0...600 V,
- 990-cell memory (11,880 entries) with the capability of wireless data transmission to a PC (via Bluetooth® or via USB cable),
- power supply from rechargeable battery packs, built-in quick charger,
- backlit keyboard and display,
- instruments meet the requirements laid down by standard EN 61557.

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- measurement category ..... CAT IV 600 V (CAT III 1000 V) according to EN 61010-1
- housing protection rating according to EN 60529 ..... IP40 (IP67 with closed housing cover)

Nominal operating conditions:

- operating temperature range ..... -20...+50°C
- storage temperature ..... -25...+70°C
- humidity ..... 20%...90%
- elevation above sea level ..... ≤3000 m
- reference temperature ..... +23°C ± 2°C
- reference humidity ..... 40...60%

Other technical specifications:

- power supply of the meter ..... built-in LiFePO4 rechargeable battery 13.2 V 5.0 Ah
- weight ..... approx. 6.0 kg
- dimensions ..... 390 x 308 x 172 mm
- display ..... segmented LCD
- transmission of results ..... USB link or Bluetooth®

Standard accessories:

L-4 carrying case	WAFUTL4
Crocodile clip, black, 11 kV, 32 A	WAKROBL32K09
Crocodile clip, red, 11 kV, 32 A	WAKRORE32K09
Crocodile clip, blue, 11 kV, 32 A	WAKROBU32K09
Test lead 1.8 m, black, 11 kV (banana plugs, shielded)	WAPRZ1X8BLBBE10K
Test lead 1.8 m, red, 11 kV (banana plugs)	WAPRZ1X8REBB10K
Test lead 1.8 m, blue, 11 kV (banana plugs)	WAPRZ1X8BUBB10K
USB cable	WAPRZUSB
Mains cable with IEC C13 plug	WAPRZ1X8BLIEC
Pin probe, black 11 kV (banana socket)	WASONBLOGB11
Pin probe, red 11 kV (banana socket)	WASONREOGB11
W-1 hanging straps	WAPOZSZE5
Factory calibration certificate	

Measurement of insulation resistance

Measuring range in compliance with EN 61557-2:
$R_{ISOmin} = U_{ISOnom} / I_{ISOmax}$ = 50 kΩ...15 TΩ (I_{ISOmax} =1.2 mA or 3 mA)

Display 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...15.0 TΩ	0.1 TΩ	±(10% m.v. + 10 digits)

- Temperature stability of voltage better than 0.2% /°C

The MIC-10k1, MIC-5050, MIC-5010 and MIC-5005 meters are capable of operating in the presence of very large disturbances at substations and switching stations.

Values of measured resistance depending on measuring voltage

Voltage	Measured resistance
250 V	500 GΩ
500 V	1.00 TΩ
1000 V	2.00 TΩ
2500 V	5.00 TΩ
5000 V	15.0 TΩ

MIC-5010 | Test of the continuity of protective conductors and equipotential bonding with current >200 mA

Measuring range according to EN 61557-4: 0.12...999 Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(2% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...999 Ω	1 Ω	±(4% m.v. + 3 digits)

- Voltage on open terminals: 4...24 V
- Output current at R < 15 Ω: I_{min} > 200 mA (I_{SC}: 200...250 mA)
- Compensation of test lead resistance
- Current flows in two directions, mean resistance value displayed

Capacitance measurement

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

- Capacitance measurement result displayed after measurement of R_{ISO}

"m.v." = "measured value"

Instruments meet the requirements set forth in the standards:

- EN 61010-1 (general and particular requirements related to safety)
- EN 61010-031 (general and particular requirements related to safety)
- EN 61326 (electromagnetic compatibility)
- EN 61557 (requirements for measurement instruments)
- HD 60364-6 (performance of measurements - checking)
- HD 60364-4-41 (performance of measurements - shock protection)
- PN-E 04700 (performance of measurements - commissioning tests)

Insulation resistance meter

SONEL MIC-5001

index: WMGBMIC5001

CAT III 600 V

CAT IV 300 V

IP65

Measurement of insulation resistance:

- measurement voltage within the range of **50…5000 V**: 50…500 V selected in steps of 50 V, 500…5000 V selected in steps of 100 V,
- continuous reading of measured insulation resistance or leakage current,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1… 600 s,
- reading of actual measurement voltage during measurement,
- measurement current **1.5 mA**,
- protection against measurement of live objects,
- two- or three-lead method of insulation resistance measurement.

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - measurement of leakage current during measurement of R_{ISO},
- measurement with RampTest (RT) method.

Additional functions of the meter:

- measurement of direct and alternating voltages within the range of 0…750 V,
- 990-cell memory (11,880 entries), data transmission to PC via USB cable,
- power supplied by rechargeable battery,
- the meter can be powered and charged from an external power adapter or from a car lighter socket,
- backlit display,
- instruments meet the requirements laid down by standard EN 61557.

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and IEC 61557
- measurement category ..... CAT IV 600 V (CAT III 1000 V) according to EN 61010-1
- housing protection rating according to EN 60529 ..... IP65

Other technical specifications:

- power supply of the meter ..... SONEL NiMH LSD 9.6 V 2 Ah rechargeable battery pack 12 V, 2.5 A external power supply
- meter weight ..... approx. 0.9 kg
- dimensions ..... 200 x 180 x 77 mm
- display ..... segmented LCD
- memory ..... 990 cells, 11,880 entries
- transmission of results ..... USB
- operating humidity ..... 20…90%

Standard accessories:

M-8 carrying case	WAFUTM8
Black "crocodile" clip 11 kV 32 A	WAKROBL32K09
Red "crocodile" clip 11 kV 32 A	WAKRORE32K09
Blue "crocodile" clip 11 kV 32 A	WAKROBU32K09
Shielded test lead with banana plugs; 5 kV; 1.8 m; black	WAPRZ1X8BLBB
Test lead with banana plugs; 5 kV; 1.8 m; red	WAPRZ1X8REBB
Test lead with banana plugs; 5 kV; 1.8 m; blue	WAPRZ1X8BUBB
USB data transmission cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
Test probe with banana socket; 5 kV; black	WASONBLOGB2
Test probe with banana socket; 5 kV; red	WASONREOGB2
Z-7 power supply	WAZASZ7
Factory calibration certificate	

Insulation resistance measurement (two-lead)

Measuring range according to IEC 61557-2:

$R_{ISOmin} = U_{ISOnom} / I_{ISOmax} \leq 5\ T\Omega\ (I_{ISOmax} = 1\ mA)$

Display range	Resolution	Accuracy
0.0…999.9 kΩ	0.1 kΩ	±(3% m.v. + 20 digits)
1.000…9.999 MΩ	0.001 MΩ	
10.00…99.99 MΩ	0.01 MΩ	
100.0…999.9 MΩ	0.1 MΩ	
1.000…9.999 GΩ	0.001 GΩ	
10.00…99.99 GΩ	0.01 GΩ	
100.0…999.9 GΩ	0.1 GΩ	
1.000…5.000 TΩ	1 GΩ	±(4% m.v. + 50 digits)

Measured resistance values depending on measurement voltage

Voltage U_{ISO}	Measuring range
up to 100 V	50 GΩ
200…400 V	100 GΩ
500…900 V	250 GΩ
1000…2400 V	500 GΩ
2500 V	2500 GΩ
5000 V	5000 GΩ

Insulation resistance measurement in Ramp Test mode

Display range	Resolution	Accuracy
0.0…999.9 kΩ	0.1 kΩ	±(5% m.v. + 40 digits)
1.000…9.999 MΩ	0.001 MΩ	
10.00…99.99 MΩ	0.01 MΩ	
100.0…999.9 MΩ	0.1 MΩ	
1.000…9.999 GΩ	0.001 GΩ	
10.00…99.99 GΩ	0.01 GΩ	
100.0…999.9 GΩ	0.1 GΩ	
1.000…4.999 TΩ	0.001 TΩ	

Breakdown voltage measurement in Ramp Test mode

Range	Resolution	Selected U_{ISO}	Accuracy
25.0 …99.0 V	0.1 V	≤600 V	±(5% m.v. + 10 digits)
100 … 600 V	1 V	≤600 V	±(5% m.v. + 4 digits)
25 … 999 V	1 V	>600 V	±(5% m.v. + 5 digits)
1.00 … 5.00 kV	10V	>600 V	±(5% m.v. + 4 digits)

Measurement of direct and alternating voltage

Range	Resolution	Accuracy
0…299.9 V	0.1 V	±(3% m.v. + 2 digits)
300…750 V	1 V	

- frequency range: 45…65 Hz

Insulation resistance meter

SONEL MIC-2511

CAT III 1000 V

CAT IV 600 V

IP65

Li-Ion BATTERY

TOUCH SCREEN

SPD

testing surge protecting devices

Measurement of insulation resistance:

- measurement voltage within the range of **10…2500 V**:
  - selected from 10 V, 25 V, 100 V, 250 V, 500 V, 1000 V, 2500 V,
  - 10…2500 V selected in steps of 10 V or any value (e.g., 1918 V),
- insulation resistance measurements with a voltage of 10 V of the supervisory loop of fire alarm systems,
- testing surge protecting devices (SPD AC/DC) distinguished by type: varistor / spark gap,
- **charts plotted on display during measurements,**
- measurements in electrostatic protected areas (EPA),
- **correction of insulation resistance result to reference temperature,**
- continuous reading of measured insulation resistance or leakage current,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1… 600 s,
- reading of actual measurement voltage during measurement,
- measurement current **≤2 mA**,
- protection against measurement of live objects.

Measurement functions:

- visual test,
- insulation resistance measurement:
  - two- or three-lead method,
  - capacitance measurement during measurement of R_{ISO},
  - measurement of leakage current during measurement of R_{ISO},
- measurement with step voltage (SV),
- dielectric discharge (DD) test,
- measurement with RampTest (RT) method,
- separate functions for measuring DAR and PI coefficients,
- low-voltage measurement of continuity using current of ≥200 mA (R_{CONT}),
- low-voltage measurement of resistance (R_X).

Additional functions of the meter:

- adjustable limits of minimum and maximum resistance,
- **temperature measurement (with the use of the optional ST-1 temperature probe),**
- measurement of direct and alternating voltages within the range of 0...1500 V,
- 9999-entry memory, data transmission to PC via USB cable,
- power supplied by rechargeable battery,
- backlit keyboard,
- the instrument meets the requirements laid down by standard EN IEC 61557.

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and EN IEC 61557
- measurement category ..... CAT IV 600 V (CAT III 1000 V) according to EN IEC 61010-2-030
- housing protection rating according to EN 60529 ..... IP65

Other technical specifications:

- power supply of the meter ..... Li-Ion 10.8 V 3.5 Ah rechargeable battery
- weight ..... ca. 1.3 kg
- dimensions ..... 234 x 169 x 71 mm
- display ..... LCD 5" 800 x 480
- memory ..... 9999 entries
- transmission of results ..... USB

Choose the best set for your needs

MIC-2511 EPA

Insulation resistance meter **with set for measurements in EPA zones**
index: WMGBMIC2511EPA

MIC-2511

Insulation resistance meter
index: WMGBMIC2511

The meter is a part of the **Sonel MeasureEffect™** platform. It is a comprehensive system that enables you to take measurements, store and manage data, and provides multi-level control of your instruments.

MeasureEffect™

Measurement of insulation resistance

Measuring range acc. to EN IEC 61557-2 for $R_{ISOmin} = U_{ISOnom}/I_{ISOmax} \leq 2\ T\Omega$ ($I_{ISOmax} = 1.6\ mA$)

Display range	Resolution	Accuracy
0.0...999.9 kΩ	0.1 kΩ	±(3% m.v. + 20 digits)
1.000...9.999 MΩ	0.001 MΩ	
10.00...99.99 MΩ	0.01 MΩ	
100.0...999.9 MΩ	0.1 MΩ	
1.000...9.999 GΩ	0.001 GΩ	
10.00...99.99 GΩ	0.01 GΩ	
100.0...999.9 GΩ	0.1 GΩ	
1.000...2.000 TΩ	0.001 TΩ	

Values of measured resistance depending on measuring voltage

Voltage	Measured resistance
10 V	10 GΩ
25 V	20 GΩ
50 V	50 GΩ
100 V	100 GΩ
250 V	250 GΩ
500 V	500 GΩ
1000 V	1,00 TΩ
2500 V	2,00 TΩ

Capacitance measurement

Display range	Resolution	Accuracy
0...999 nF	1 nF	±(5% m.v. + 5 digits)
1.00...9.99 µF	0.01 µF	

Test of the continuity of protective conductors and equipotential bonding with 200 mA current

Measuring range according to EN IEC 61557-4: 0.10...999 Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(2% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...999 Ω	1 Ω	±(4% m.v. + 3 digits)

Measurement of direct and alternating voltage

Display range	Resolution	Accuracy
0...1500 V	1 V	±(3% m.v. + 2 digits)

- frequency range: 45...65 Hz

Standard accessories:		**MIC-2511 EPA**	**MIC-2511**
		WMGBMIC2511EPA	WMGBMIC2511
Kit for measuring resistance in zones with ESD protection with space for meter	WASONPRZ2MIC	√	
Li-Ion 10.8 V 3.5 Ah rechargeable battery	WAAKU29	√	√
M-6 carrying case	WAFUTM6		√
Black "crocodile" clip 11 kV 32 A	WAKROBL32K09	√	√
Red "crocodile" clip 11 kV 32 A	WAKRORE32K09	√	√
Blue "crocodile" clip 11 kV 32 A	WAKROBU32K09	√	√
Shielded test lead with banana plugs; 5 kV; 1.8 m; black	WAPRZ1X8BLBB	√	√
Test lead with banana plugs; 5 kV; 1.8 m; red	WAPRZ1X8REBB	√	√
Test lead with banana plugs; 5 kV; 1.8 m; blue	WAPRZ1X8BUBB	√	√
USB data transmission cable	WAPRZUSB	√	√
230 V mains cable (IEC C7 plug)	WAPRZLAD230	√	√
Test probe with banana socket; 5 kV; black	WASONBLOGB2	√	√
Test probe with banana socket; 5 kV; red	WASONREOGB2	√	√
Hanging strap	WAPOZPAS6	√	√
Type C USB cable	WAPRZUSBC	√	√
Z-32 power supply	WAZASZ32	√	√
Factory calibration certificate		√	√

Kit for measuring resistance in zones with ESD protection with space for meter

Insulation resistance meter

SONEL MIC-2501

index: WMGBMIC2501

CAT IV 600 V | CAT III 1000 V | IP65

Measurement of insulation resistance:

- measurement voltage within the range of **100...2500 V**: 100...2500 V selected in steps of 100 V,
- continuous reading of measured insulation resistance or leakage current,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1... 600 s,
- reading of actual measurement voltage during measurement,
- measurement current **1 mA**,
- protection against measurement of live objects.

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - measurement of leakage current during measurement of R_{ISO},
- low-voltage measurement of continuity using current of ≥200 mA (R_{CONT}).

Additional functions of the meter:

- measurement of direct and alternating voltages within the range of 0...750 V,
- 990-cell memory (11,880 entries), data transmission to PC via USB cable,
- power supplied by rechargeable battery,
- the meter can be powered and charged from an external power adapter or from a car lighter socket,
- backlit display,
- the instrument meets the requirements laid down by standard EN 61557.

Electrical safety:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- measurement category ..... CAT IV 600 V (CAT III 1000 V) according to EN 61010-1
- housing protection rating according to EN 60529 ..... IP65

Other technical specifications:

- power supply of the meter ..... SONEL NiMH LSD 9.6 V rechargeable battery pack
  external power supply 12 V, 2.5 A
- meter weight ..... approx. 0.9 kg
- dimensions ..... 200 x 180 x 77 mm
- display ..... segmented LCD
- memory ..... 990 cells, 11,880 entries
- transmission of results ..... USB

Standard accessories:

M-8 carrying case	WAFUTM8
Black "crocodile" clip 11 kV 32 A	WAKROBL32K09
Red "crocodile" clip 11 kV 32 A	WAKRORE32K09
Blue "crocodile" clip 11 kV 32 A	WAKROBU32K09
Shielded test lead with banana plugs; 5 kV; 1.8 m; black	WAPRZ1X8BLBB
Test lead with banana plugs; 5 kV; 1.8 m; red	WAPRZ1X8REBB
Test lead with banana plugs; 5 kV; 1.8 m; blue	WAPRZ1X8BUBB
USB data transmission cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
Test probe with banana socket; 5 kV; black	WASONBLOGB2
Test probe with banana socket; 5 kV; red	WASONREOGB2
Z-7 power supply	WAZASZ7
Factory calibration certificate	

Measurement of insulation resistance

Measuring range acc. to EN 61557-2 for $R_{ISOmin} = U_{ISOnom}/I_{ISOmax} \leq 1\,T\Omega$ ($I_{ISOnom} = 1\,mA$)

Display range	Resolution	Accuracy
0.0...999.9 kΩ	0.1 kΩ	±(3% m.v. + 20 digits)
1.000...9.999 MΩ	0.001 kΩ	
10.00...99.99 MΩ	0.01 kΩ	
100.0...999.9 MΩ	0.1 kΩ	
1.000...9.999 GΩ	0.001 GΩ	
10.00...99.99 GΩ	0.01 GΩ	
100.0...999.9 GΩ	0.1 GΩ	

"m.v." = "measured value"
U_{ISO} - measurement voltage.

Values of measured resistance depending on measuring voltage

Voltage	Measured resistance
up to 100 V	50 GΩ
200...400 V	100 GΩ
500...900 V	250 GΩ
1000...2400 V	500 GΩ
2500 V	1000 GΩ

You can charge the meter during the measurement using any Power Bank 12 V / 2 Ah with a 5.5 mm / 2.1 mm power supply.

Test of the continuity of protective conductors and equipotential bonding with 200 mA current

Measuring range according to EN 61557-4: 0.10...999 Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(2% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...999 Ω	1 Ω	±(4% m.v. + 3 digits)

- Voltage on open terminals: 4...24 V
- Output current at R<2 Ω: I_{SC} >200 mA
- Compensation of test lead resistance
- Current flows in two directions, mean resistance value displayed

Measurement of direct and alternating voltage

Display range	Resolution	Accuracy
0...299.9 V	0.1 V	±(3% m.v. + 2 digits)
300...750 V	1 V	

- frequency range: 45...65 Hz

Insulation resistance meter

SONEL MIC-30

index: WMGBMIC30

CAT III 1000 V

CAT IV 600 V

IP67

BLUETOOTH

Measurement of insulation resistance:

- measurement voltage within the range of **50…1000 V**: selected from 50, 100, 250, 500, 1000 V or 50…1000 V selected in steps of 10 V,
- continuous reading of measured insulation resistance or leakage current,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- timing of measurement times T_1, T_2 and T_3 for measurement of one or two absorption coefficients (Ab1, Ab2 or DAR, PI) within the range of 1… 600 s,
- readings of actual measurement voltage during measurement,
- measurement current **1 mA**,
- protection against measurement of live objects.

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - automatic measurement in sockets by means of UNI-Schuko adapter with the capability of configuring pairs of measured conductors,
  - capacitance measurement during measurement of R_{ISO},
  - measurement of leakage current during measurement of R_{ISO},
- low-voltage measurement of continuity using current of ≥200 mA (R_{CONT}),
- low-voltage measurement of resistance (R_X).

Additional functions of the meter:

- measurement of direct and alternating voltages within the range of 0…600 V,
- 990-cell memory (11,880 entries) with the capability of wireless data transmission to a PC via Bluetooth®,
- backlit keyboard and display,
- the instrument meets the requirements laid down by standard EN 61557.

Other technical specifications:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- power supply of the meter ..... 4 LR6 batteries or Ni-MH AA rechargeable batteries
- display ..... segmented LCD

The instrument meets the requirements set forth in the standards:

- EN 61010-1 (general and particular requirements related to safety)
- EN 61010-031 (general and particular requirements related to safety)
- EN 61326 (electromagnetic compatibility)
- EN 61557 (requirements for measurement instruments)
- HD 60364-6 (performance of measurements - checking)
- HD 60364-4-41 (performance of measurements - shock protection)
- PN-E 04700 (performance of measurements - commissioning tests)

MIC-30 makes it possible to perform automatic resistance measurement for all combinations or for any pair of conductors in the socket.

Standard accessories:

M-6 carrying case	WAFUTM6
Blue "crocodile" clip 1 kV 20 A	WAKROBU20K02
Shielded test lead with banana plugs; 1 kV; 1.2 m; black	WAPRZ1X2BLBBE
Test lead with banana plugs; 1 kV; 1.2 m; red	WAPRZ1X2REBB
Test lead with banana plugs; 1 kV; 1.2 m; blue	WAPRZ1X2BUBB
Test probe with banana socket; 1 kV; black	WASONBLOGB1
Test probe with banana socket; 1 kV; red	WASONREOGB1
Meter strap (type M-1)	WAPOZSZE4
M-1 housing holder - hanger	WAPOZUCH1
Factory calibration certificate	

Measurement of insulation resistance

Measuring range according to EN 61557-2 for

- Un=50 V: **50 kΩ…250.0 MΩ**
- Un=100 V: **100 kΩ…500.0 MΩ**
- Un=250 V: **250 kΩ…2.000 GΩ**
- Un=500 V: **500 kΩ…20.00 GΩ**
- Un=1000 V: **1000 kΩ…100.0 GΩ**

Display range	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	0.001 MΩ	
10.00…99.99 MΩ	0.01 MΩ	
100.0…250.0 MΩ | U_n = 50 V	0.1 MΩ	
100.0…500.0 MΩ | U_n = 100 V		
100.0…999.9 MΩ | U_n ≥ 250 V		
1.000…2.000 GΩ | U_n=250 V	0.001 GΩ	
1.000…9.999 GΩ | U_n≥ 500 V	0.001 GΩ	±(4% m.v. + 6 digits) [±(6% m.v. + 6 digits)]*
10.00…20.00 GΩ | U_n≥ 500 V **	0.01 GΩ	
10.00…99.99 GΩ | U_n = 1000 V		
100.0 GΩ | U_n = 1000 V	0.1 GΩ	

*for WS-04 adapter

**for WS-04 adapter, range up to 10 GΩ

- measurements with voltage up to 500 V for WS-04 lead

Capacitance measurement

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

- Capacitance measurement result displayed after measurement of R_{ISO}
- For measurement voltages below 100 V and measured resistance of less than 10 MΩ, the error of capacitance measurement is unspecified

Test of the continuity of protective conductors and equipotential bonding with 200 mA current

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

Display range	Resolution	Accuracy
0.00…19.99 Ω	0.01 Ω	±(2% m.v. + 3 digits)
20.0…199.9 Ω	0.1 Ω	
2000…1999 Ω	1 Ω	±(4% m.v. + 3 digits)

Insulation resistance meter

SONEL MIC-10

index: WMGBMIC10

CAT III
1000 V

CAT IV
600 V

IP67

Measurement of insulation resistance:

- measurement voltage within the range of **50…1000 V**: selected from 50, 100, 250, 500, 1000 V,
- continuous reading of measured insulation resistance,
- automatic discharge of the measured object's capacitance upon completion of insulation resistance measurement,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- readings of actual measurement voltage during measurement,
- measurement current **1 mA**,
- protection against measurement of live objects.

Measurement functions:

- insulation resistance measurement:
  - two- or three-lead method,
  - capacitance measurement during measurement of R_{ISO},
- low-voltage measurement of continuity using current of ≥200 mA (R_{CONT}),
- low-voltage measurement of resistance (R_X).

Additional functions of the meter:

- measurement of direct and alternating voltages within the range of 0…600 V,
- backlit keyboard and display,
- the instrument meets the requirements laid down by standard EN 61557.

Besides measuring insulation resistance, MIC-10 is capable of performing continuity tests of protective conductors and equipotential bonding in accordance with standard EN 61557.

The instrument meets the requirements set forth in the standards:

- EN 61010-1 (general and particular requirements related to safety)
- EN 61010-031 (general and particular requirements related to safety)
- EN 61326 (electromagnetic compatibility)
- EN 61557 (requirements for measurement instruments)
- HD 60364-6 (performance of measurements - checking)
- HD 60364-4-41 (performance of measurements - shock protection)
- PN-E 04700 (performance of measurements - commissioning tests)

Other technical specifications:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- power supply of the meter ..... 4 alkaline batteries or Ni-MH rechargeable batteries - size AA
- display ..... segmented LCD

Standard accessories:

M-6 carrying case	WAFUTM6
Black "crocodile" clip 1 kV 20 A	WAKROBL20K01
Test lead with banana plugs; 1 kV; 1.2 m; black	WAPRZ1X2BLBB
Test lead with banana plugs; 1 kV; 1.2 m; red	WAPRZ1X2REBB
Test probe with banana socket; 1 kV; black	WASONBLOGB1
Test probe with banana socket; 1 kV; red	WASONREOGB1
Meter strap (type M-1)	WAPOZSZE4
M-1 housing holder - hanger	WAPOZUCH1
Factory calibration certificate	

Measurement of insulation resistance

Measuring range according to EN 61557-2 for

- U_n=50 V: **50 kΩ…250.0 MΩ**
- U_n=100 V: **100 kΩ…500.0 MΩ**
- U_n=250 V: **250 kΩ…2.000 GΩ**
- U_n=500 V: **500 kΩ…5.000 GΩ**
- U_n=1000 V: **1000 kΩ…10.00 GΩ**

Display range	Resolution	Accuracy
0.0…999.9 kΩ	0.1 kΩ	±(3% m.v. + 8 digits)
1.000…9.999 MΩ	0.001 MΩ	
10.00…99.99 MΩ	0.01 MΩ	
100.0…250.0 MΩ | U_n = 50 V	0.1 MΩ	
100.0…500.0 MΩ | U_n = 100 V		
100.0…999.9 MΩ | U_n ≥ 250 V		
1.000…2.000 GΩ | U_n = 250 V	0.001 GΩ	
1.000…5.000 GΩ | U_n = 500 V	0.001 GΩ	±(4% m.v. + 6 digits)
1.000…9.999 GΩ | U_n = 1000 V		
10.00 GΩ | U_n = 1000 V	0.01 GΩ	

Capacitance measurement

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

- Capacitance measurement result displayed after measurement of R_{ISO}.
- For measurement voltages below 100 V and measured resistance of less than 10 MΩ, the error of capacitance measurement is unspecified.

Test of the continuity of protective conductors and equipotential bonding with 200 mA current

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

Display range	Resolution	Accuracy
0.00…19.99 Ω	0.01 Ω	±(2% m.v. + 3 digits)
20.0…199.9 Ω	0.1 Ω	
2000…1999 Ω	1 Ω	±(4% m.v. + 3 digits)

Insulation resistance meter

SONEL MIC-5

index: WMGBMIC5

CAT III 1000 V

CAT IV 600 V

IP65

BUILT-IN FLASHLIGHT

Measurement of insulation resistance:

- measurement voltage within the range of **250…500 V**: selected from 250, 500 V,
- continuous indication of measured resistance,
- automatic discharge of tested object's capacitance after measurement of insulation resistance,
- sound signalling of five-second time intervals, facilitating capture of time characteristics,
- measurement current **up to 1.4 mA**,
- protection against measurement of live objects.

Measurement functions:

- insulation resistance measurement using two-lead method,
- low-voltage measurement of resistance (R_x).

Additional functions of the meter:

- measurement of direct and alternating voltages within the range of 0…600 V,
- backlit display,
- the instrument meets the requirements laid down by standard EN 61557.

The instrument meets the requirements set forth in the standards:

- EN 61010-1 (general and particular requirements related to safety)
- EN 61010-031 (general and particular requirements related to safety)
- EN 61326 (electromagnetic compatibility)
- EN 61557 (requirements for measurement instruments)
- HD 60364-6 (performance of measurements - checking)
- HD 60364-4-41 (performance of measurements - shock protection)
- PN-E 04700 (performance of measurements - commissioning tests)

Other technical specifications:

- type of insulation ..... double, as per EN 61010-1 and EN 61557
- power supply of the meter ... 2 LR03 alkaline batteries or Ni-MH rechargeable batteries - size AAA
- display ..... segmented LCD

Standard accessories:

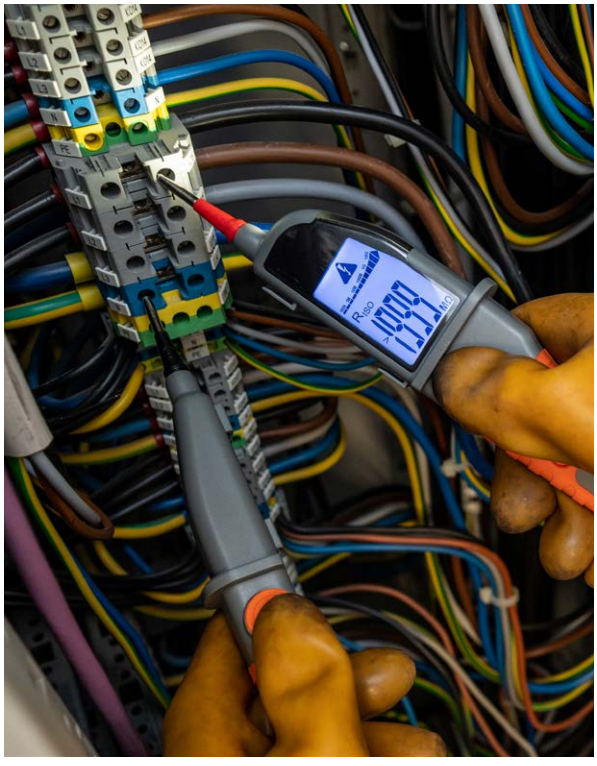
Φ4 mm screw tip (set of 4 pcs.)	WAPOZN4MMK
4 mm applied tip (set of 2 pcs.)	WAPOZO4MMK
2x AAA / LR03 alkaline battery	
Declaration of verification	

Measurement of insulation resistance

Measuring range according to EN 61557-2 for

- U_n=250 V: **250 kΩ...1.000 GΩ**
- U_n=500 V: **500 kΩ...1.999 GΩ**

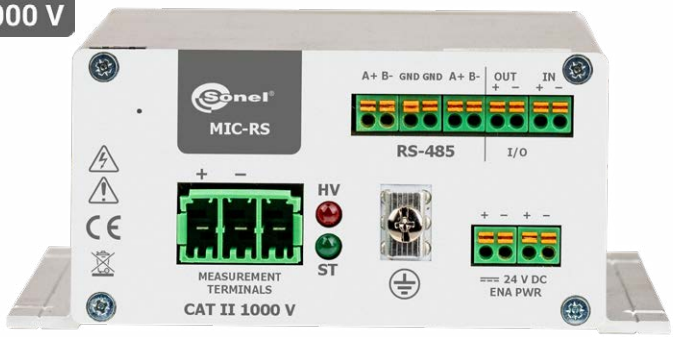
Display range	Resolution	Accuracy
1...249 kΩ | U_n = 250 V 1...499 kΩ | U_n = 500 V	1 kΩ	not defined
250...1999 kΩ | U_n = 250 V 500...1999 kΩ | U_n = 500 V	1 kΩ	±(3% m.v. + 8 digits)
2.00...19,99 MΩ	0.01 MΩ	
20.0...199,9 MΩ	0.1 MΩ	
200...1000 MΩ | U_n = 250 V 200...1999 MΩ | U_n = 500 V	1 MΩ	



SONEL MIC-RS

CAT II
1000 V

version with
RS-485 interface



RS-232 / RS-485
interface

MIC-RS-SCP / MODBUS
communication protocol

Choose the best variant for your needs

MIC-RS: RS-232, MIC-RS-SCP
Meter with RS-232 interface and MIC-RS-SCP communication protocol
index: WMGBMICRS232

MIC-RS: RS-232, Modbus
Meter with RS-232 interface and Modbus communication protocol
index: WMGBMICRS232M

MIC-RS: RS-485, Modbus
Meter with RS-485 interface and Modbus communication protocol
index: WMGBMICRS485M

It is possible to prepare a version of the meter with the interface and communication protocol requested by the customer.

Measurement of insulation resistance:

- measurement voltage within the range of **50...1000 V**,
- automatic discharge of tested object's capacitance after measurement of insulation resistance,
- measurement current **≤2 mA**,
- protection against measurement of live objects.

Measurement functions:

- insulation resistance measurement using two-lead method,
- low-voltage measurement of resistance (R_X).

Additional functions of the meter:

- RS-232 or RS-485 interface,
- data transmission to a controlling device through the MIC-RS-SCP or Modbus communication protocol,
- external power supply,
- the instrument meets the requirements laid down by standard EN 61557.

The instrument meets the requirements set forth in the standards:

- EN 61010-1 (general and particular requirements related to safety)
- EN 61010-031 (general and particular requirements related to safety)
- EN 61326 (electromagnetic compatibility)
- EN 61557 (requirements for measurement instruments)
- HD 60364-6 (performance of measurements - checking)
- HD 60364-4-41 (performance of measurements - shock protection)
- PN-E 04700 (performance of measurements - commissioning tests)

Other technical specifications:

- type of insulation ..... basic, as per EN 61010-1 and EN 61557
- power supply of the meter ..... external, isolated, 24 V DC

Measurement of insulation resistance

Measuring range according to EN 61557-2 for

- U_n=500 V: **500 kΩ...2.00 GΩ**
- U_n=1000 V: **1000 kΩ...9.99 GΩ**

Display range	Resolution	Accuracy
1.00...9.99 kΩ	0.01 kΩ	not defined
10.0...99.9 kΩ	0.1 kΩ	
100...249 kΩ	1 kΩ	
250...999 kΩ	1 kΩ	±(3% m.v. + 8 digits)
1.00...9.9 MΩ	0.01 MΩ	
10.0...99.9 MΩ	0.1 MΩ	
100...2000 MΩ	1 MΩ	

Capacitance measurement

Display range	Resolution	Accuracy
0...9.9 µF	0.1 nF	±(5% m.v. + 6 digits)

Standard accessories:

Factory calibration certificate

Application

The instrument is dedicated for companies and sites, in which continuous or random assessment of the insulation resistance is required as part of production. It is also perfect for automated production systems.

The meter can be installed in the distribution board, at the operator's station (assembly or quality control bench), in the control cabinet or even in the rack enclosure. The measurement is performed by means of clamps, used to connect the test leads of the system, in which the instrument is installed.

Features

The meter is designed for building in/permanent installation. It plays a Secondary/Slave role, meaning that it executes the commands issued by the Main/Master control device and it does not initialise the transmission on its own. It enables measuring the insulation resistance with the test voltage of up to 1000 V.

The scope set of functions of the meter is tailored to specialised applications. With the **AutoRange** function, available in two versions, the instrument can switch the test voltage dynamically and adjust it to the current conditions.

There are two measurement modes available: **automatic** (continuous) and **manual** (one-time). Under automated testing, the meter can be programmed to measure the capacity or not. In addition, **the user may define the default function** of the device as the measurement of insulation resistance (R_{ISO}), or low resistance (R_X).

Response and communication

The functionality of the instrument is extended by digital input and output. This enables the meter to respond to the events in the system, in which it operates.

The meter is operated from the Main/Master control device by means of the **MIC-RS-SCP serial communication protocol** or **Modbus protocol**. It enables, for example, starting and stopping the measurement of resistance, reading the measurement result or changing the configuration of the instrument.

MIC
Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MIC-15k1	MIC-10k1	MIC-5050	MIC-5010	MIC-5005	MIC-5001	MIC-2511 EPA	MIC-2511	MIC-2501	MIC-30	MIC-10	MIC-5
	AGT-16C three-phase socket adapter 16 A (PEN)	WAADAAGT16C										•	•	
	AGT-16P three-phase socket adapter 16 A	WAADAAGT16P										•	•	
	AGT-16T industrial socket adapter 16 A	WAADAAGT16T										•	•	
	AGT-32C three-phase socket adapter 32 A (PEN)	WAADAAGT32C										•	•	
	AGT-32P three-phase socket adapter 32 A	WAADAAGT32P										•	•	
	AGT-32T industrial socket adapter 32 A	WAADAAGT32T										•	•	
	AGT-63P three-phase socket adapter 63 A	WAADAAGT63P										•	•	
	AutoISO-2511 adapter	WAADAAISO2511							•	•				
	AutoISO-5000 adapter	WAADAAISO50		•	•									
	WS-04 adapter with UNI-Schuko angular plug	WAADAWS04										•		
	WS-11 adapter (pin probe)	WAADAWS11										•		
	AZ-3 power supply adapter (mains plug/banana sockets)	WAADAAZ3							•	•				
	Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01										•	1	•
	Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02										•	•	•
	Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02										1	•	
	Crocodile clip, black, 11 kV, 32 A	WAKROBL32K09		•	•	1	1	1	1	1	1			
	Crocodile clip, red, 11 kV, 32 A	WAKRORE32K09		•	•	1	1	1	1	1	1			
	Crocodile clip, blue, 11 kV, 32 A	WAKROBU32K09		•	•	1	1	1	1	1	1			
	Test lead 1 kV (banana plugs) black 1.2 m	WAPRZ1X2BLBB											1	
	Test lead 1 kV (banana plugs, shielded) black 1.2 m	WAPRZ1X2BLBBE										1	•	
	Test lead 1 kV (banana plugs, shielded) black 5 m	WAPRZ005BLBBE										•	•	
	Test lead 1 kV (banana plugs) red 1.2 m	WAPRZ1X2REBB										1	1	

MIC
Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MIC-15k1	MIC-10k1	MIC-5050	MIC-5010	MIC-5005	MIC-5001	MIC-2511 EPA	MIC-2511	MIC-2501	MIC-30	MIC-10	MIC-5
	Test lead 1 kV (banana plugs) red 5 m	WAPRZ005REBB										•	•	
	Test lead 1 kV (banana plugs) blue 1.2 m	WAPRZ1X2BUBB										1	•	
	Test lead 1 kV (banana plugs) blue 5 m	WAPRZ005BUBB										•	•	
	Test lead 5 kV (banana plugs, shielded) black 1.8 m	WAPRZ1X8BLBB						1	1	1	1			
	Test lead 5 kV (banana plugs, shielded) black 3 / 5 / 10 m	WAPRZ003BLBBE5K WAPRZ005BLBBE5K WAPRZ010BLBBE5K						•	•	•	•			
	Test lead 5 kV (banana plugs) red 1.8 m	WAPRZ1X8REBB						1	1	1	1			
	Test lead 5 kV (banana plugs) red 3 / 5 / 10 m	WAPRZ003REBB5K WAPRZ005REBB5K WAPRZ010REBB5K						•	•	•	•			
	Test lead 5 kV (banana plugs) blue 1.8 m	WAPRZ1X8BUBB						1	1	1	1			
	Test lead 5 kV (banana plugs) blue 3 / 5 / 10 m	WAPRZ003BUBB5K WAPRZ005BUBB5K WAPRZ010BUBB5K						•	•	•	•			
	Test lead 11 kV (banana plugs, shielded) black 1.8 m	WAPRZ1X8BLBBE10K		•	•	1	1							
	Test lead 11 kV (banana plugs, shielded) black 3 / 5 / 10 / 20 m	WAPRZ003BLBBE10K WAPRZ005BLBBE10K WAPRZ010BLBBE10K WAPRZ020BLBBE10K		•	•	•	•							
	Test lead 11 kV (banana plugs) red 1.8 m	WAPRZ1X8REBB10K		•	•	1	1							
	Test lead 11 kV (banana plugs)red 3 / 5 / 10 / 20 m	WAPRZ003REBB10K WAPRZ005REBB10K WAPRZ010REBB10K WAPRZ020REBB10K		•	•	•	•							
	Test lead 11 kV (banana plugs) blue 1.8 m	WAPRZ1X8BUBB10K		•	•	1	1							
	Test lead 11 kV (banana plugs) blue 3 / 5 / 10 / 20 m	WAPRZ003BUBB10K WAPRZ005BUBB10K WAPRZ010BUBB10K WAPRZ020BUBB10K		•	•	•	•							
	Test lead 15 kV with crocodile clip, shielded, black 1.8 m	WAPRZ1X8BLKROE15KV	•	•	•	•	•							
	Test lead 15 kV with crocodile clip, shielded, black 3 m	WAPRZ003BLKROE15KV	1	1	1	•	•							
	Test lead 15 kV with crocodile clip, shielded, black 5 / 10 / 20 m	WAPRZ005BLKROE15KV WAPRZ010BLKROE15KV WAPRZ020BLKROE15KV	•	•	•	•	•							
	Test lead 15 kV with crocodile clip, red 1.8 m	WAPRZ1X8REKRO15KV	•	•	•	•	•							
	Test lead 15 kV with crocodile clip, red 3 m	WAPRZ003REKRO15KV	1	1	1	•	•							
	Test lead 15 kV with crocodile clip, red 5 / 10 / 20 m	WAPRZ005REKRO15KV WAPRZ010REKRO15KV WAPRZ020REKRO15KV	•	•	•	•	•							
	Test lead 15 kV with crocodile clip, blue 1.8 m	WAPRZ1X8BUKRO15KV	•	•	•	•	•							

MIC
Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MIC-15k1	MIC-10k1	MIC-5050	MIC-5010	MIC-5005	MIC-5001	MIC-2511 EPA	MIC-2511	MIC-2501	MIC-30	MIC-10	MIC-5
	Test lead 15 kV with crocodile clip, blue 3 m	WAPRZ003BUKRO15KV	1	1	1	•	•							
	Test lead 15 kV with crocodile clip, blue 5 / 10 / 20 m	WAPRZ005BUKRO15KV WAPRZ010BUKRO15KV WAPRZ020BUKRO15KV	•	•	•	•	•							
	PRS-1 resistance test probe	WASONPRS1	•	•	•	•	•	•	•	•	•	•		
	Probe for measuring resistance in zones with ESD protection (2 pcs.)	WASONPRS2							•	•				
	Probe for measuring resistance in zones with ESD protection (kit with a case)	WASONPRS2KIT							•	•				
	Set for measuring resistance in zones with ESD protection (kit with a case and PRS-1 probe)	WASONPRZ2							•	•				
	Kit for measuring resistance in zones with ESD protection with space for meter (kit with a case and PRS-1 probe)	WASONPRZ2MIC							1	•				
	ST-1 temperature probe	WASONT1		•	•				•	•				
	Pin probe, black 1 kV (banana socket)	WASONBLOGB1									•	1	1	
	Pin probe, red 1 kV (banana socket)	WASONREOGB1									•	1	1	
	Pin probe, blue 1 kV (banana socket)	WASONBUOGB1									•	•	•	
	Pin probe, black 5 kV (banana socket)	WASONBLOGB2						1	1	1	1			
	Pin probe, red 5 kV (banana socket)	WASONREOGB2						1	1	1	1			
	Pin probe, black 11 kV (banana socket)	WASONBLOGB11				1	1							
	Pin probe, red 11 kV (banana socket)	WASONREOGB11				1	1							
	Φ4 mm screw tip (set of 4 pcs.)	WAPOZN4MMK												1
	4 mm applied tip (set of 2 pcs.)	WAPOZO4MMK												1
	CS-1 cable simulator	WAADACS1	•	•	•	•	•	•	•	•	•	•	•	•
	CS-5kV calibration box	WAADACS5KV	•	•	•	•	•	•	•	•	•	•	•	•
	Li-Ion 10.8 V 3.5 Ah rechargeable battery	WAAKU29							1	1				
	Z-7 power supply	WAZASZ7						1			1			

MIC
Set of standard and optional accessories

1, 2, 4 - number of standard accessories
• - optional accessories

Photo	Name	Index	MIC-15k1	MIC-10k1	MIC-5050	MIC-5010	MIC-5005	MIC-5001	MIC-2511 EPA	MIC-2511	MIC-2501	MIC-30	MIC-10	MIC-5
	Z-32 power supply	WAZASZ32							1	1				
	230 V mains cable (IEC C7 plug)	WAPRZLAD230						1			1			
	230 V mains cable (IEC C13 plug)	WAPRZ1X8BLIEC	1	1	1	1	1							
	Cable for battery charging from car cigarette lighter socket (12 V)	WAPRZLAD12SAM						•			•			
	Hanging strap	WAPOZPAS6							1	1				
	M-1 hanging straps	WAPOZSZE4										1	1	
	W-1 hanging straps	WAPOZSZE5	1	•	•	1	1		•	•				
	M-1 hanging hook straps	WAPOZUCH1										1	1	
	Magnetic hanging strap	WAPOZUCH6										•	•	
	L-4 carrying case	WAFUTL4	1	1	1	1	1							
	L-7 backpack	WAFUTL7	•	•	•	•	•							
	L-14 carrying case	WAFUTL14	•	•	•	•	•							
	M-6 carrying case	WAFUTM6							•	1		1	1	
	M-8 carrying case	WAFUTM8						1			1			
	M-15 carrying case	WAFUTM15							•	•				
	S-2 carrying case	WAFUTS2												•
	L-7 carrying case for PRS-2	WAWALL7							•	•				
	USB cable	WAPRZUSB	1	1	1	1	1	1			1			
	Type C USB cable	WAPRZUSBC							1	1				
	PC software: Sonel Reports Plus	WAPROREPORTSPLUS	•	•	•	•	•	•	•	•	•	•		
	PC software: Sonel Reader	WAPROREADER	•	•	•	•	•	•	•	•	•	•		

Fault loop impedance meters

MZC-340-PV
MZC-330S
MZC-320S
MZC-310S

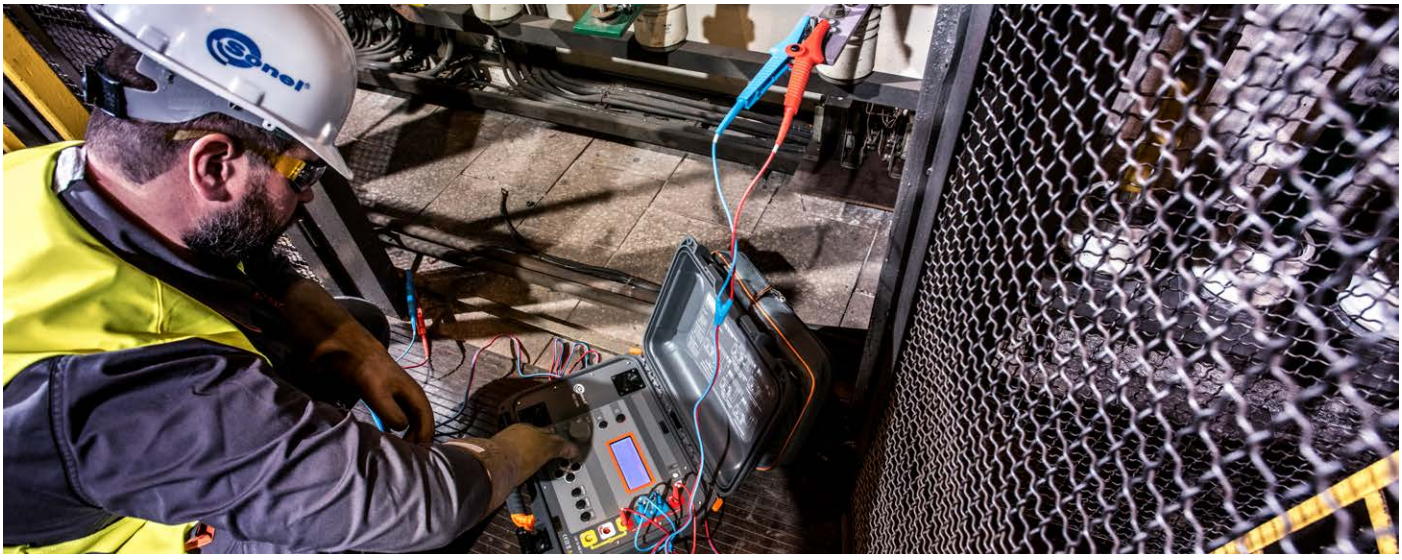
MZC-306

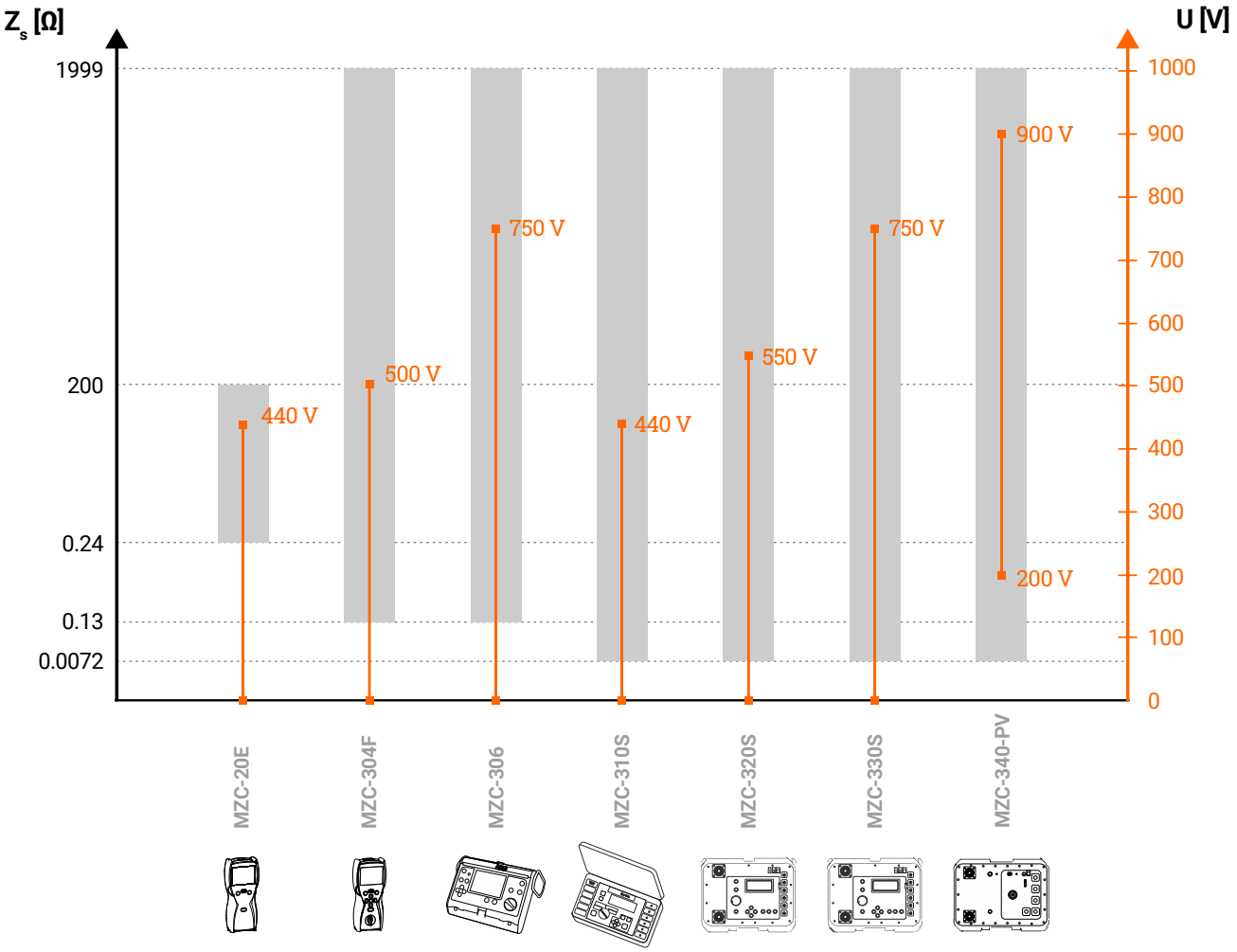
MZC-304F
MZC-20E

Comparison of fault loop impedance meters

					
	MZC-340-PV	**MZC-330S**	**MZC-320S**	**MZC-310S**	**MZC-306**
Rated voltage [V]	220/380 230/400 240/415 290/500 400/690 460/800	110/190 115/200 127/220 220/380 230/400 240/415 290/500 400/690	110/190 115/200 127/220 220/380 230/400 240/415 290/500	220/380 230/400	110/190 115/200 127/220 220/380 230/400 240/415 290/500 400/690
Operating voltage range [V]	200…900	100…750	100…550	187…440	100…750
Display range [Ω]	0…1999	0…1999	0…1999	0…199.9	0…1999
Maximum resolution [Ω]	0.001	0.001	0.001	0.001	0.01
Maximum resolution for measurement with 15 mA current [Ω]	–	–	–	–	0.01
Max. measurement current [A]	130/280	130/280	130/280	160/280	12.2…36.7
Measuring range according to EN 61557 [Ω]	0.0072…1999	0.0072…1999	0.0072…1999	0.0072…199.9	0.13…1999
Display of fault loop resistance and reactance	√	√	√	√	√
Calculation of prospective fault current on the basis of rated voltage	√	√	√	√	√
Calculation of prospective fault current on the basis of measured voltage	–	–	–	–	–
Memory (number of each type of measurement)	990	990	990	990	990
4-lead method	√	√	√	√	–
Measurement of prospective touch and shock voltage	√	√	√	√	–
Selection of test lead length	–	√	√	√	√
In-socket measurement by means of adapter - plug	–	–	–	–	Option
Triggering of measurements by adapter	–	–	–	–	Option
Triggering of measurements via Wi-Fi	√	√	√	–	–
Alternating voltage measurement	√	√	√	√	√
Dimensions [mm]	429 x 328 x 236 mm	390 x 308 x 172	390 x 308 x 172	295 x 222 x 95	288 x 223 x 75
Weight [kg]	9.0	6.5	6.5	2.2	2.2

						
MZC-304F	**MZC-20E**	**MPI-540-PV MPI-540 MPI-536 MPI-535**	**MPI-530-IT MPI-530**	**MPI-525 MPI-520**	**MPI-507 MPI-506 MPI-502F**	
220/380 230/400 240/415	220/380 230/400 240/415	110/190 115/200 127/220 220/380 230/400 240/415	110/190 115/200 127/220 220/380 230/400 240/415	110/190 115/200 127/220 220/380 230/400 240/415	220/380 230/400 240/415	Rated voltage [V]
180…460	180…440	95…440	95…440	95…440	180…460	Operating voltage range [V]
0…1999	0…200	0…1999.9	0…1999	0…1999	0…1999	Display range [Ω]
0.01	0.01	0.001	0.001	0.01	0.01	Maximum resolution [Ω]
0.01	0.01	0.01	0.01	0.01	0.01	Maximum resolution for measurement with 15 mA current [Ω]
7.6/13.3	15.3/26.7	23/44	23/44	23/44	7.6/13.3	Max. measurement current [A]
0.13…1999	0.24…200	0.50…1999	0.13…1999	0.13…1999	0.13…1999	Measuring range according to EN 61557 [Ω]
√	√	√	√	√	√	Display of fault loop resistance and reactance
√	√	√	√	√	√	Calculation of prospective fault current on the basis of rated voltage
√	–	√	√	–	–	Calculation of prospective fault current on the basis of measured voltage
990	–	100 000	10 000	990	990	Memory (number of each type of measurement)
–	–	–	–	–	–	4-lead method
–	–	–	–	–	–	Measurement of prospective touch and shock voltage
√	√	√	√	√	√	Selection of test lead length
√	–	√	√	√	√	In-socket measurement by means of adapter - plug
Option	–	√	√	√	Option	Triggering of measurements by adapter
–	–	–	–	–	–	Triggering of measurements via Wi-Fi
√	√	√	√	√	√	Alternating voltage measurement
220 x 102 x 61	220 x 102 x 61	288 x 223 x 75	288 x 223 x 75	288 x 223 x 75	220 x 102 x 61	Dimensions [mm]
0.6	0.5	2.5	2.2	2.2	0.6	Weight [kg]




Z_s [Ω]
U [V]
1999
200
0.24
0.13
0.0072
1000
900
800
700
600
500
400
300
200
100
0
440 V
500 V
750 V
440 V
550 V
750 V
900 V
200 V
MZC-20E
MZC-304F
MZC-306
MZC-310S
MZC-320S
MZC-330S
MZC-340-PV

High-current fault loop impedance meter

SONEL MZC-340-PV

index: WMGBMZC340PV

900 V
maximum network voltage

0.1 mΩ
maximum resolution

CAT IV 1000 V | IP67 | WiFi

Fault loop impedance measurement:

- **measurement of very low short circuit loop impedances (with resolution 0.1 mΩ) with a current of 130 A at 230 V; maximum 305 A at 550 V AC and 250 A at 900 V AC,**
- measurements in installations with rated voltages: 220/380 V, 230/400 V, 240/415 V, 290/500 V, 400/690 V, 460/800 V (from 200 V up to 900 V) and frequencies 45...65 Hz,
- ability to perform measurements in short circuit system: phase-phase, phase-PE, phase-N,
- differentiation between the phase voltage and the inter-phase voltage while calculating the short circuit current,
- 4p (four-pole) method, test leads do not require calibration (measurement with current up to 305 A),
- measurement of resistance (R_S) and reactance (X_S) components.

Additional functions of the meter:

- **remote control**,
- touch voltage and touch shock voltage measurement with resistor 1 kΩ),
- AC voltage measurement in range 0...900 V,
- frequency measurement 45.0...65.0 Hz,
- memory of 990 measurement results, data transmission via USB and Wi-Fi,
- power supply: rechargeable battery,
- the device meets the requirements of EN 61557 standard.

Electric security:

- type of insulation ..... double, according to EN 61010-1 and IEC 61557
- measurement category ..... IV 1000 V acc. to EN 61010-1
- protection class acc. EN 60529 ..... IP67 (IP20 with front cover open)

Other technical specifications:

- power supply ..... built in Li-Ion 7.2 V / 9.8 Ah rechargeable battery
- resistor limiting the current: for 4 pole method (4p) ..... 1.8 Ω for U≤550 V
  2.5 Ω for U>550 V
- number of short circuit loop measurements ..... min. 5000 (2/min)
- temperature coefficient ..... ±0,1% of measured value/°C
- dimensions ..... 429 x 328 x 236 mm
- weight ..... 9.0 kg

Nominal operating conditions:

- operating temperature range ..... -10...+40°C

Standard accessories:

Doble-wire test lead 3 m (10 / 25 A) CAT IV 1000 V U1/I1	WAPRZ003DZBBU1I1CATIV
Doble-wire test lead 3 m (10 / 25 A) CAT IV 1000 V U2/I2	WAPRZ003DZBBU2I2CATIV
2x Kelvin clamp 1 kV 25 A CAT IV 1000 A	WAKROKELK07
2x high-current pin probe 1 kV CAT IV 1000 V (banana sockets)	WASONSPGB2
230 V mains cable (IEC C7 plug)	WAPRZLAD230
Z-19 power supply adaptor	WAZASZ19
M-6 carrying case	WAFUTM6
USB cable	WAPRZUSB
Factory calibration certificate	

High-current measurement of fault loop parameters (4-lead I_{max} = 305 A)

High-current measurement of fault loop impedance Z_S:
measuring range according to EN 61557-3: **7.2 mΩ...1999 mΩ**

Display range	Resolution	Accuracy
0...199.9 mΩ	0.1 mΩ	±(2% m.v. + 2 mΩ)
200...1999 mΩ	1 mΩ	

Short circuit current indication

Measuring range according to IEC 61557
for U_n = 230 V **115.0 A...32.9 kA** for U_n = 400 V **200 A...55.5 kA**
for U_n = 500 V **250 A...69.4 kA** for U_n = 690 V **345 A...95.8 kA**
for U_n = 800 V **400 A...111.1 kA**

Display range	Resolution	Accuracy
110.0...199.9 A	0.1 A	Calculated on the basis of error for fault loop
200...1999 A	1 A	
2.00...19.99 kA	0.01 kA	
20.0...199.9 kA	0.1 kA	

Touch voltage measurements U_{ST} and shock voltage U_T

Display range	Resolution	Accuracy
0...100 V	1 V	±(10% m.v. + 2 digits)

The MZC-310S, 320S, 330S and 340-PV meters are the only meters on the market that also enable touch voltage or shock voltage measurement, which can be employed during safety assessment of a tested system.

High-current fault loop impedance meters

SONEL MZC-330S / MZC-320S

index: WMGBMZC330S / WMGBMZC320S

MZC-330S
750 V
maximum network voltage

0.1 mΩ
maximum resolution

CAT IV 600 V **IP67**

Fault loop impedance measurement:

- **measurement of very low short circuit loop impedances (with resolution 0,1 mΩ) with a current of 130 A at 230 V; maximum 300 A at 690 V (500 V in MZC-320S),**
- **measurement with a current of 24 A at 230 V, maximum 37 A at 690 V (maximum 27 A at 500 V in MZC-320S) with resolution 0,01 Ω,**
- measurements in installations with rated voltages: 110/190 V, 115/200 V, 127/220 V, 220/380 V, 230/400 V, 240/415 V, 290/500 V and 400/690 V (MZC-330S only) and frequencies 45...65 Hz,
- ability to perform measurements in short circuit system: phase-phase, phase-PE, phase-N,
- differentiation between the phase voltage and the inter-phase voltage while calculating the short circuit current,
- ability to change the length of test lead (measurement with 2p method),
- 4p (four-pole) method, test leads do not require calibration (measurement with current up to 300 A),
- measurement of resistance (R_s) and reactance (X_s) components.

Additional functions of the meter:

- **remote control via Wi-Fi:** triggering the measurement, saving the result to the meter's memory, downloading the results from the instrument's memory,
- touch voltage and touch shock voltage measurement with resistor 1 kΩ),
- AC voltage measurement in range 0...750 V (0...550 V in MZC-320S),
- frequency measurement 45.0...65.0 Hz,
- memory of 990 measurement results, ability to transfer the data to a PC via USB and Wi-Fi,
- power supply: rechargeable battery,
- the device meets the requirements of EN 61557 standard.

Electric security:

- type of insulation ..... double, according to EN 61010-1 and IEC 61557
- measurement category ..... IV 600 V acc. to EN 61010-1
- protection class acc. EN 60529 ..... IP67 (IP20 with front cover open)

Other technical specifications:

- power supply ..... built in Li-Ion 7.2 V / 8.8 Ah rechargeable battery
- resistor limiting the current: for 4 pole method (4p) ..... 1.8 Ω for U≤550 V
  2.5 Ω for U>550 V (MZC-330S)
  for two pole method (2p) ..... 9.4 Ω for U≤253 V
  19 Ω for U>253 V
- number of short circuit loop measurements ..... min. 4000 (2/min)
- temperature coefficient ..... ±0,1% of measured value/°C
- dimensions ..... 390 x 308 x 172 mm
- weight ..... 6.5 kg

Nominal operating conditions:

- operating temperature range ..... -10...+40°C

Standard accessories:

Test lead 1.2 m, black, 1 kV (banana plugs)	WAPRZ1X2BLBB
Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB
Pin probe, black 1 kV (banana socket)	WASONBLOGB1
Pin probe, yellow 1 kV (banana socket)	WASONYEOGB1
Doble-wire test lead 3 m (10 A / 25 A) U1/I1	WAPRZ003DZBBU1I1
Doble-wire test lead 3 m (10 A / 25 A) U2/I2	WAPRZ003DZBBU2I2
4x crocodile clip, black, 1 kV, 32 A	WAKROBL30K03
2x Kelvin clamp, 1 kV, 25 A	WAKROKELK06
2x high-current pin probe 1 kV (banana sockets)	WASONSPGB1
230 V mains cable (IEC C7 plug)	WAPRZLAD230
Z-19 power supply adaptor	WAZASZ19
L-14 carrying case	WAFUTL14
USB cable	WAPRZUSB
Factory calibration certificate	

High-current measurement of fault loop parameters (4-lead I_{max} = 300 A)

High-current measurement of fault loop impedance Z_s:
measuring range according to EN 61557-3: **7.2 mΩ...1999 mΩ**

Display range	Resolution	Accuracy
0...199.9 mΩ	0.1 mΩ	±(2% m.v. + 2 mΩ)
200...1999 mΩ	1 mΩ	

Short circuit current indication

Measuring range according to IEC 61557
for U_n = 230 V **115.0 A...32.9 kA** for U_n = 400 V **200 A...55.5 kA**
for U_n = 500 V **250 A...69.4 kA** for U_n = 690 V **345 A...95.8 kA (MZC-330S)**

Display range	Resolution	Accuracy
115.0...199.9 A	0.1 A	Calculated on the basis of error for fault loop
200...1999 A	1 A	
2.00...19.99 kA	0.01 kA	
20.0...199.9 kA	0.1 kA	
200 kA... *	1 kA	

*max 690 kA for **MZC-330S**, max 500 kA for **MZC-320S**

Touch voltage measurements U_{ST} and shock voltage U_T

Display range	Resolution	Accuracy
0...100 V	1 V	±(10% m.v. + 2 digits)

Short circuit loop parameters measurement using standards current (2p, I_{max}=37 A)

Measuring range according to IEC61557: **0,13 Ω...199,9 Ω** for test leads length 1,2 m

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

The MZC-310S, 320S, 330S and 340-PV meters are the only meters on the market that also enable touch voltage or shock voltage measurement, which can be employed during safety assessment of a tested system.