

SONEL MZC-310S

index: WMGBMZC310S



Fault loop impedance measurement:

- » measurement of very low short circuit loop impedances (with resolution 0,1 mΩ) with a current of 150 A at 230 V; maximum 280 A at 440 V,
- » measurement with a current of 23 A at 230 V, maximum 42 A at 440 V with resolution 0,01 Ω,
- » measurements in installations with rated voltages: 220/380 V and 230/400 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,
- » 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 280 A),
- » measurement of resistance (R_s) and reactance (X_s) components.

Additional functions of the meter:

- » touch voltage and touch shock voltage measurement with resistor 1 kΩ),
- » AC voltage measurement in range 0...440 V,
- » frequency measurement 45.0...65.0 Hz,
- » memory of 990 measurement results, ability to transfer the data to a PC via RS-232,
- » power supply: rechargeable battery (5x LR14).

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 LR14 alkaline batteries (size C, 5 pcs.)
- » current-limiting resistor for 4-lead measurement: 1.5 Ω, for 2-lead measurement: 10 Ω
- » number of fault loop measurements (alkaline batteries) at least 4000 (2/min.)
- » temperature coefficient $\pm 0,1\%$ of measured value/ $^{\circ}\text{C}$

Nominal operating conditions:

- » operating temperature range 0...+40 $^{\circ}\text{C}$

Standard accessories:

L-1 carrying case	WAFUTL1
4x crocodile clip, black, 1 kV, 32 A	WAKROBL30K03
2x Kelvin clamp, 1 kV, 25 A	WAKROKELK06
Test lead 1.2 m, black, 1 kV (banana plugs)	WAPRZ1X2BLBB
Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB
Double-wire test lead 3 m (10 A / 25 A) U1/I1	WAPRZ003DZBBU1I1
Double-wire test lead 3 m (10 A / 25 A) U2/I2	WAPRZ003DZBBU2I2
RS-232 serial transmission cable	WAPRZR232
Pin probe, black 1 kV (banana socket)	WASONBLOGB1
Pin probe, yellow 1 kV (banana socket)	WASONYEOGB1
2x high-current pin probe 1 kV (banana sockets)	WASONSPGB1
UNI-SONEL hanging straps	WAPZSZSE1
Factory calibration certificate	

High-current measurement of fault loop parameters (4-lead, $I_{\max} = 280 \text{ A}$)

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	$\pm(2\% \text{ m.v.} + 2 \text{ mΩ})$
200...1999 mΩ	1 mΩ	

Fault current readings

Measuring range according to EN 61557- 3:

for $U_n = 230 \text{ V}$ 115.0 A...32.0 kA

for $U_n = 400 \text{ V}$ 200 A...55.7 kA

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	
200kA... *	1 kA	

*230 kA for U_{L-N} 400 kA for U_{L-L}

Measurement of touch voltage U_{ST} and shock voltage U_T

Display range	Resolution	Accuracy
0...100 V	1 V	$\pm(10\% \text{ m.v.} + 2 \text{ digits})$

Measurement of fault loop impedance Z_s with standard current (2-lead, $I_{\max} = 42 \text{ A}$)

measuring range for 1.2 m test leads according to EN 61557: 0.13 Ω...199.9 Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(2\% \text{ m.v.} + 3 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	$\pm(3\% \text{ m.v.} + 3 \text{ digits})$



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.

Fault loop impedance meter

SONEL MZC-306

index: WMGBMZC306

750 V

maximum
network
voltage

**Z_{L-PE}
RCD**

measurements
without tripping
RCDs

CAT IV

600 V

CAT III

1000 V

IP54



Standard accessories:

WS-05 adapter with UNI-SCHUKO angular plug	WAADWS05
NiMH battery 4.8 V 4.2 Ah	WAAKU07
L-4 carrying case	WAFUTL4
Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02
Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02
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
USB cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
Pin probe, red 1 kV (banana socket)	WASONREOGB1
Pin probe, blue 1 kV (banana socket)	WASONBUOGB1
Pin probe, yellow 1 kV (banana socket)	WASONYEOGB1
L-2 hanging straps (set)	WAPZSZSEKPL
Z-7 power supply	WAZASZ7

Factory calibration certificate

Measurement of fault loop impedance Z_{L-PE} , Z_{L-N} , Z_{L-L}

Measuring range acc. to EN 61557-3 for 1.2 m test leads: **0.13...1999 Ω**

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(5% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	±(4% m.v. + 3 digits)
200...1999 Ω	1 Ω	

Nominal voltage: 100...440 V (for Z_{L-PE} and Z_{L-N}) or 100...750 V (for Z_{L-L})

Measurement of earth fault loop impedance Z_{L-PE} in RCD mode

Measuring range according to EN 61557-3 for 1,2 m leads: **0.43...1999 Ω**

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(6% m.v. + 10 digits)
20.0...199.9 Ω	0.1 Ω	±(6% m.v. + 5 digits)
200...1999 Ω	1 Ω	

Fault loop impedance measurement:

- » fault loop impedance measurement with 0.01 Ω resolution,
- » low-current impedance measurement in circuits protected by RCD ≥ 30mA with 0.01 Ω resolution (range of 100...440 V),
- » operates in networks with 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 (operating range 100...750 V),
- » operating frequency 45...65 Hz,
- » calculation of I_k fault current,
- » automatic differentiation between phase and phase-to-phase voltage,
- » possibility of applying an adapter terminated by a power network plug or 1.2, 5, 10, 20 m test leads,
- » measurement with swapped L and N conductors,
- » measurement of resistance (R_s) and reactance (X_s) components.

Additional functions of the meter:

- » contact electrode - quick testing of proper connection of PE conductor,
- » voltage measurement 0...750 V AC (0...250 V with resolution of 0,1 V),
- » memory of 990 measurement results, ability to transfer the data to a PC via USB,
- » power supply: batteries (4 x LR14) or rechargeable batteries.

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)



Meter calculates the value of prospective fault current in compliance with standard HD 60364-6.

Electrical safety:

- » type of insulation double, as per EN 61010-1 and EN 61557
- » test leads EN 61010-2-031

Other technical specifications:

- » meter power supply rechargeable battery pack or (optional) alkaline batteries
- » rechargeable battery or alkaline battery performance at least 5000 measurements (2/min)
- » display backlit LCD

Nominal operating conditions:

- » operating temperature range 0...+45°C
- » humidity 20...80%



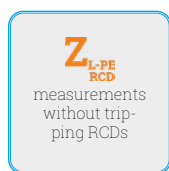
MZC-306 meter performs fault loop impedance measurements in industrial networks of any voltage up to 750 V.



Fault loop impedance meter

SONEL MZC-304F

index: WMGBMZC304F



Fault loop impedance measurement:

- » fault loop impedance measurement with 0.01 Ω resolution,
- » low-current impedance measurement in circuits protected by RCD ≥ 30mA with 0.01 Ω resolution (range of 180...270 V),
- » operates in networks with voltages 220/380 V, 230 V/400 V, 240/415 V (operating range 180...460 V),
- » operating voltage range: 180...270 V (for Z_{L-PE} and Z_{L-N}) and 180...460 V (for Z_{L-L}),
- » maximum measuring current: 7.6 A for 230 V (3x10 ms), 13.3 A for 400 V (3x10 ms),
- » operating frequency 45...65 Hz,
- » calculation of I_k fault current,
- » measurement with swapped L and N conductors,
- » measurement of resistance (R_s) and reactance (X_s) components,
- » low-voltage measurement of continuity of circuit and resistance.

Additional functions of the meter:

- » contact electrode - quick testing of proper connection of PE conductor,
- » voltage measurement 0...500 V,
- » frequency measurement 45.0...65.0 Hz,
- » memory of 990 measurement results, ability to transfer the data to a PC via Bluetooth,
- » power supply: batteries (4 x LR14) or rechargeable batteries (4 x NiMH).

Electrical safety:

- » type of insulation double, as per EN 61010-1 and EN 61557
- » test leads EN 61010-2-031
- » measurement category CAT III 600 V (CAT IV 300 V) according to EN 61010-1
- » housing protection rating according to EN 60529 IP67

Other technical specifications:

- » power supply of the meter pack of rechargeable batteries or alkaline batteries (size AA, 4 pcs.)
- » rechargeable battery life at least 5000 measurements (2/min)

Nominal operating conditions:

- » operating temperature range 0...+50°C
- » humidity 20...80%



The MZC-304F meter calculates the value of prospective fault current in compliance with standard HD 60364-6.

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
M-1 hanging hook straps	WAPOZUCH1
Factory calibration certificate	



The MZC-304F meter measures fault loop impedance with 0.01 Ω resolution, including in circuits protected by RCDs, without tripping them.

Measurement of fault loop impedance Z_{L-PE} , Z_{L-N} , Z_{L-L} , fault loop resistance and reactance

Measuring range for 1.2 m test leads according to EN 61557-3:
0.13 Ω...1999 Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(5% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	

Measurement of earth fault loop impedance Z_{L-PE} in RCD mode

Measuring range for 1.2 m leads according to EN 61557-3:
0.51 Ω...1999 Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(6% m.v. + 10 digits)
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	±(6% m.v. + 5 digits)

- » does not trip RCDs with $I_{\Delta n} \geq 30$ mA



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)



MZC-304F always measures total fault loop impedance as well as its components – resistance and reactance – regardless of the phase shift value.

SONEL MZC-20E

index: WMGBMZC20E



CAT III

300 V

IP67

Fault loop impedance measurement:

- » fault loop impedance measurement with 0.01 Ω resolution,
- » operates in networks with voltages 220/380 V, 230/400 V, 240/415 V (operating range 180...440 V),
- » operating frequency 45...65 Hz,
- » calculation of I_k fault current,
- » automatic differentiation between phase and phase-to-phase voltage,
- » possibility of applying test leads: 1.2 m, 5 m and longer,
- » measurement with swapped L and N conductors,
- » measurement of resistance (R_s) and reactance (X_s) components.

Additional functions of the meter:

- » voltage measurement 0...440 V AC,
- » power supply: batteries (4 x LR6) or rechargeable batteries (4 x NiMH).

Other technical specifications:

- » type of insulation double, as per EN 61010-1 and IEC 61557
- » measurement category CAT III 300 V according to EN 61010-1
- » housing protection rating according to EN 60529 IP67

Other technical specifications:

- » power supply of the meter LR6 alkaline batteries or Ni-MH rechargeable batteries (size AA, 4 pcs.)
- » dimensions 220 x 102 x 61 mm
- » meter weight with battery pack 509 g
- » storage temperature -20...+70 °C
- » operating temperature range -10...+50 °C
- » humidity 20...80%
- » reference temperature +23...± 2 °C
- » reference humidity 40...60%
- » elevation above sea level <2000 m
- » time until Auto-OFF max. 900 seconds
- » number of Z measurements (for rechargeable batteries) >5000 (2 measurements/minute)
- » display segmented LCD
- » quality standard development, design and production in compliance with ISO 9001
- » the instrument meets the requirements set forth in the standards IEC 61557
- » the instrument is compliant with standards EN 61326-1 and EN 61326-2-2

Standard accessories:

M-13 carrying case	WAFUTM13
Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02
Test lead 1,2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB
Test lead 1,2 m, blue, 1 kV (banana plugs)	WAPRZ1X2BUBB
Pin probe, red 1 kV (banana socket)	WASONREOGB1
Pin probe, blue 1 kV (banana socket)	WASONBUOGB1
M-1 hanging straps	WAPOZSZE4
M-1 hanging hook straps	WAPOZUCH1
Factory calibration certificate	

Measurement of fault loop impedance Z_s within the range of 0.24...200 Ω

Fault current I_k : 0.115±1769 A (U_n =230 V)

AC voltage measurement: 0÷440 V

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(2.5% m.v. + 5 digits)
20.0...99.9 Ω	0.1 Ω	±(2.5% m.v. + 3 digits)
100...200 Ω	1 Ω	±(3% m.v. + 3 digits)

- » Nominal operating voltage U_{n-LN}/U_{n-LL} : 220/380 V, 230/400 V, 240/415 V
- » Operating voltage range: 180...270 V (for Z_{L-PE} and Z_{L-N}) and 180...440 V (for Z_{L-L})
- » Nominal network frequency f_n : 50 Hz, 60 Hz
- » Operating frequency range: 45...65 Hz
- » Maximum measurement current: 15.3 A for 230 V (10 ms) and 26.7 A for 400 V (10 ms)

Readings of fault loop resistance R_s and fault loop reactance X_s :

Display range	Resolution	Accuracy
0.00...9.99 Ω	0.01 Ω	±(5% m.v. + 5 digits) of Z_s value

- » Calculated and displayed for $Z_s < 10 \Omega$

Readings of fault current I_k

Measuring ranges according to EN 61557 can be calculated on the basis of Z_s measurement ranges and nominal voltages

Display range	Resolution	Accuracy
1.15...9.99 A	0.01 A	Calculated on the basis of uncertainty for fault loop
10.0...99.9 A	0.1 A	
100...999 A	1 A	
1.00...9.99 kA	0.01 kA	
10.0...40.0 kA	0.1 kA	

Voltage measurement

Display range	Resolution	Accuracy
0...440 V	1 V	±(2.5% m.v. + 3 digits)

Measurement of fault loop impedance Z_s

Test lead	Z_s measuring range
1.2 m	0.24...200 Ω
5 m	0.26...200 Ω
10 m	0.28...200 Ω
20 m	0.35...200 Ω



Photo	Name	Index	MZC-340-PV	MZC-330S	MZC-320S	MZC-310S	MZC-306	MZC-304F	MZC-20E
	Control panel	WAPOZTAB08	•						
	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				•	•	•	•
	WS-01 adapter with START button with UNI-Schuko plug	WAADAWS01					•		
	WS-03 adapter with START button with UNI-Schuko plug	WAADAWS03						•	
	WS-04 adapter with UNI-Schuko plug	WAADAWS04						•	
	WS-05 adapter with UNI-Schuko angular plug	WAADAWS05					1	1	
	WS-07 adapter for measuring Z(L-N)	WAADAWS07						•	
	Kelvin clamp, 1 kV, 25 A	WAKROKELK06		2	2	2			
	Kelvin clamp, 1 kV, 25 A CAT IV 1000 A	WAKROKELK07	2						
	Crocodile clip, black, 1 kV, 32 A	WAKROBL30K03		4	4	4			
	Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02					1		1
	Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02					1	•	
	Crocodile clip, yellow, 1 kV, 20 A	WAKROYE20K02					•	1	

Photo	Name	Index	MZC-340-PV	MZC-330S	MZC-320S	MZC-310S	MZC-306	MZC-304F	MZC-20E
	Test lead 1.2 m, black, 1 kV (banana plugs)	WAPRZ1X2BLBB		1	1	1			
	Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB					1	1	1
	Test lead 1.2 m, blue, 1 kV (banana plugs)	WAPRZ1X2BUBB					1	1	1
	Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB		1	1	1	1	1	
	Test lead 5 m, red, 1 kV (banana plugs)	WAPRZ005REBB					•	•	•
	Test lead 5 m, yellow, 1 kV (banana plugs)	WAPRZ005YEBB		•	•	•			
	Test lead 10 m, red, 1 kV (banana plugs)	WAPRZ010REBB					•	•	•
	Test lead 10 m, yellow, 1 kV (banana plugs)	WAPRZ010YEBB		•	•	•			
	Test lead 20 m, red, 1 kV (banana plugs)	WAPRZ020REBB					•	•	•
	Test lead 20 m, yellow, 1 kV (banana plugs)	WAPRZ020YEBB		•	•	•			
	Test lead 5 kV (banana plugs, shielded) black 1.8 m	WAPRZ1X8BLBB	•						
	Doble-wire test lead 3 m (10 A / 25 A) U1/I1	WAPRZ003DZBBU1I1		1	1	1			
	Doble-wire test lead 3 m (10 A / 25 A) U2/I2	WAPRZ003DZBBU2I2		1	1	1			
	Doble-wire test lead 6 m (10 A / 25 A) U1/I1	WAPRZ006DZBBU1I1		•	•				
	Doble-wire test lead 6 m (10 A / 25 A) U2/I2	WAPRZ006DZBBU2I2		•	•				
	Doble-wire test lead 3 m (10 / 25 A) CAT IV 1000 V U1/I1	WAPRZ003DZBBU1I1	1						
	Doble-wire test lead 3 m (10 / 25 A) CAT IV 1000 V U2/I2	WAPRZ003DZBBU2I2	1						
	Foldable pin probe, 1 kV, 2 m (banana socket)	WASONSP2M					•	•	•
	High-current pin probe 1 kV (banana sockets)	WASONSPGB1		2	2	2			

MZC

Set of standard and optional accessories

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

Photo	Name	Index	MZC-340-PV	MZC-330S	MZC-320S	MZC-310S	MZC-306	MZC-304F	MZC-20E
	High-current pin probe 1 kV CAT IV 1000 V (banana sockets)	WASONSPGB2	2						
	Pin probe, black 1 kV (banana socket)	WASONBLOGB1		1	1	1			
	Pin probe, red 1 kV (banana socket)	WASONREOGB1					1	1	1
	Pin probe, blue 1 kV (banana socket)	WASONBUOGB1					1	1	1
	Pin probe, yellow 1 kV (banana socket)	WASONYEGB1		1	1	1	1		•
	Pin probe, black 11 kV (banana socket)	WASONBLOGB11		•					
	Pin probe, red 11 kV (banana socket)	WASONREOGB11				•			
	NiMH battery 4.8 V 4.2 Ah	WAAKU07					1		
	Battery container	WAPOJ1					•		
	230 V mains cable (IEC C7 plug)	WAPRZLAD230	1				1		
	Z-7 power supply	WAZASZ7					1		
	Z-19 power supply adaptor	WAZASZ19	1	1	1				
	Cable for battery charging from car cigarette lighter socket (12V)	WAPRZLAD12SAM					•		
	Reel for long test lead	WAPQZSZP1				•			
	Test wire H-frame	WAPQZSZP3				•			
	UNI-SONEL hanging straps	WAPQZSZE1				1			
	M-1 hanging straps	WAPQZSZE4				•		1	1

Photo	Name	Index	MZC-340-PV	MZC-330S	MZC-320S	MZC-310S	MZC-306	MZC-304F	MZC-20E
	L-2 hanging straps (set)	WAPQZSZEKPL					1		
	M-1 hanging hook straps	WAPQZUCH1						1	1
	Magnetic hanging strap	WAPQZUCH6					•		
	Cover (universal)	WAPQZUCH12					•		
	L-1 carrying case	WAFUTL1				1			
	L-2 carrying case	WAFUTL2				•			
	L-4 carrying case	WAFUTL4		•	•		1		
	L-7 backpack	WAFUTL7		•	•				
	L-14 carrying case	WAFUTL14		1	1				
	M-6 carrying case	WAFUTM6	1					1	
	M-13 carrying case	WAFUTM13							1
	USB cable	WAPRZUSB	1	1	1		1		
	RS-232 serial transmission cable	WAPRZRS232				1			
	USB/RS-232 converter	WAADAUSBRS232				•			
	PC software: Sonel Reports Plus	WAPROREPORTSPUS		•	•	•	•	•	
	PC software: Sonel Reader	WAPROREADER		•	•	•	•	•	

Earth resistance meters

MRU-200-GPS
MRU-200
MRU-120HD
MRU-120

MRU-30

MRU-21
MRU-12
MRU-10

Set of instruments for earth measurements

Earth resistance measurement according to 3-pole method	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Earth resistance measurement according to 4-lead method	✓	✓	✓	✓	—	✓	—	✓	✓	—
Measurement current in measurements of earthing resistance [mA]	200	200	200	20	20	20	20	20	20	20
Maximum resolution [Ω]	0.001	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Earth resistance measurement according to 3-pole method with additional clamp	✓	✓	✓	✓	—	—	—	✓	✓	—
Earth impedance measurement according to impulse method	✓	—	—	—	—	—	—	—	—	—
Earth resistance measurement according to two-clamp method	✓	✓	✓	✓	—	—	—	✓	✓	—
Leakage current measurement with hard clamp	✓	—	—	✓	—	—	—	✓	✓	MPI-520
Leakage current measurement with flexible coil	✓	—	—	—	—	—	—	✓	✓	✓
Measurement of resistance of earth connection and equipotential bonding according to standard EN 61557-4	✓	✓	✓	✓	✓	—	—	✓	✓	✓
Soil resistivity measurement	✓	✓	✓	✓	—	✓	—	✓	✓	—
Internal source of current	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Earth resistance measurement according to 2-lead method	—	—	—	✓	✓	✓	✓	—	—	—
Power supply	rechargeable battery / batteries	rechargeable battery	rechargeable battery / batteries	rechargeable battery	rechargeable battery / batteries	rechargeable batteries / batteries	rechargeable batteries / batteries	rechargeable battery	rechargeable battery / batteries	rechargeable battery / batteries
Charging from car lighter socket	✓	✓	✓	✓	—	—	—	✓	✓	OPTIONAL
Memory (records)	990	990	990	990	990	990	—	100 000	10 000	990
Measurement of disturbance voltages	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Resistance measurement of auxiliary electrodes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dimensions [mm]	288 x 223 x 75	390 x 310 x 180	288 x 223 x 75	200 x 180 x 74	288 x 223 x 75	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
Weight [kg]	2	4	2	1.1	1.4	0.7	0.7	2.5	2.2	2.2

Earth resistance measurements adapter

SONEL ERP-1

index: WAADAERP1 / WAADAERP1V2 / WAADAERP1V3



The adapter is compatible with meters:

- » MRU-200-GPS
- » MRU-200
- » MRU-120HD
- » MRU-120

The SONEL ERP-1 adapter, in combination with meters that can generate measurement current of 200 mA, serves for measuring of resistance of multiple groundings without disconnecting control connection clamps. The flexible, big diameter coil allows to measure earth resistance of e.g. transmission towers - including lattice poles - without shutting down the power line.

Ergonomic design of the adapter, its convenient housing and simple operation make earth resistance measurements on transmission towers and pylons quick and problem-free. The protection degree of the adapter is IP67, which makes it suitable for operation in muddy and rain conditions.

Standard accessories:

	WAADAERP1	WAADAERP1V2	WAADAERP1V3
FS-2 flexible coil (Ø 1260 mm)	WACEGFS20KR	✓	
FSX-3 flexible coil (Ø 630 mm)	WACEGFSX30KR		✓
M-6 carrying case	WAFUTM6	✓	✓
3x AA (LR6) 1.5 V battery		✓	✓
Declaration of verification		✓	✓

Optional accessories:

XL-8 hard carrying case	WAWALXL8
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Electrical specifications:

- » measuring range up to 5 A
- » operating frequency 125 Hz (in 50 Hz networks)
150 Hz (in 60 Hz networks)
- » power supply 3 x LR6 1.5 V battery or 3 x Ni-MH LR6 1.2 V rech. battery
- » measurement category CAT IV 300 V according to EN 61010-1

Other specifications:

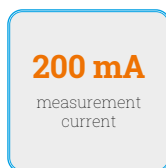
- » protection rating IP67
- » storage temperature -20...+80°C
- » relative humidity of storage 20...90%
- » operating temperature range -10...+50°C
- » operating humidity 20...85%
- » exterior dimensions 146 x 88 x 33 mm
- » weight with batteries / without batteries 340 g / 270 g

Application	Distinguishing feature								
Hard-to-reach measuring points • cataloguing the coordinates of measurement locations	Coordinates of the measurement points added to the measurement results	✓							
Military facilities • comprehensive measurements	Operation in 400 Hz networks	✓	✓						
Airport areas • comprehensive measurements	Operation in 400 Hz networks	✓	✓						
Lightning protection • earthing impedance measurements	Impulse method	✓	✓						
Gas stations • earthing impedance measurements • other earthing measurements	Impulse method	✓	✓						
Railway electric traction • comprehensive measurements for all types of earthing	Operation in 16 2/3 Hz networks	✓	✓						
Power poles • multiple earthing points • pole base measurements	• Measurement current: 200 mA • Using ERP-1	✓	✓	✓	✓				
Power stations • high disruptions • multiple lattice earthing	Measurement current: 200 mA	✓	✓	✓	✓				
Urban areas • system consisting of horizontal and vertical earth electrodes • impossible to insert auxiliary electrodes	2-clamp method	✓	✓	✓	✓	✓			
Soil tests • earthing design	Soil resistivity	✓	✓	✓	✓	✓		✓	
Commercial buildings • ring, foundation, lattice earthing	3-pole method	✓	✓	✓	✓	✓	✓	✓	✓
Residential buildings • ring, foundation earth electrodes • vertical earth electrode systems	3-pole method	✓	✓	✓	✓	✓	✓	✓	✓
Difficult measuring conditions • dust in the air • rain, snow	Casing resistant to weather conditions and mechanical damage			✓					
									
		MRU-200-GPS	MRU-200	MRU-120HD	MRU-120	MRU-30	MRU-21	MRU-12	MRU-10
		Measurement current 200 mA							



SONEL MRU-200 / MRU-200-GPS

index: WMGBMRU200 (with L2 case) / WMGBMRU200GPS (with L2 case)
WMGBMRU200XL3 (with XL3 case) / WMGBMRU200GPSXL3 (with XL3 case)



Earthing resistance measurements:

- » impulse method (without the need to disconnect measured earth electrodes) - three types of measurement impulse (4/10 μ s, 8/20 μ s, 10/350 μ s),
- » 3-pole method,
- » 4-lead method,
- » 3-pole method with additional clamp,
- » 3-pole method with ERP-1 adapter,
- » two-clamp method.

Soil resistivity measurements (Wenner method):

- » distances between electrodes can be input in meters (m) or feet (ft),
- » displaying the soil resistivity value in Ω m or Ω ft.

Measurement of resistance of earth connection and equipotential bonding:

- » with auto-zeroing function - with current ≥ 200 mA,
- » according to EN 61557-4.

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_{H1} ,
- » measurement of voltage and frequency of interference signal,
- » measurement in the presence of disturbance voltages in networks with frequency 16 $\frac{2}{3}$ Hz, 50 Hz and 60 Hz as well as 400 Hz (with automatic or manual selection of relevant measurement signal frequency),
- » selection of maximum measurement voltage (25 V and 50 V),
- » calibration of applied clamp,
- » full interoperability with ERP-1 adapter,
- » memory storing 990 measurements (10 banks with 99 cells each),
- » MRU-200-GPS | built-in GPS receiver,
- » real-time clock (RTC),
- » data transmission to computer (USB, Bluetooth).
- » reading of battery charge state, built-in quick charger.



MRU-200-GPS is the only earthing resistance and impedance meter with the function of determining the geographical coordinates of the location of measurement.



SONEL MRU MOBILE

Mobile version of the program supports ground resistance and ground resistivity meters MRU-200 and MRU-200-GPS. It can be downloaded from **Google Play**.

Standard accessories:

NiMH battery 4.8 V 4.2 Ah	WAAKU07
L-2 carrying case (only WMGBMRU200, WMGBMRU200GPS)	WAFUTL2
XL-3 carrying case (only WMGBMRU200XL3, WMGBMRU200GPSXL3)	WAWALXL3
Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01
Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02
Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB
Test lead 2.2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB
Test lead 25 m, red (banana plugs, on a reel)	WAPRZ025REBBSZ
Test lead 25 m, blue (banana plugs, on a reel)	WAPRZ025BUBBSZ
Test lead 50 m, yellow (banana plugs, on a reel, shielded)	WAPRZ050YEBBSZE
Cable for battery charging from car cigarette lighter socket (12 V)	WAPRZLAD12SAM
USB cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
4x earth contact test probe (rod), 30 cm	WASONG30
L-2 hanging straps (set)	WAPRZSZKPL
Cramp (banana socket)	WAZACIMA1
Z-7 power supply	WAZASZ7

Factory calibration certificate

Earthing resistance measurement - 3-pole and 4-lead method

measuring range according to EN 61557-5: 0.100 Ω ...19.99 k Ω

Display range	Resolution	Accuracy
0.000...3.999 Ω	0.001 Ω	$\pm(2\% \text{ m.v.} + 4 \text{ digits})$
4.00...39.99 Ω	0.01 Ω	$\pm(2\% \text{ m.v.} + 2 \text{ digits})$
40.0...399.9 Ω	0.1 Ω	
400...3999 Ω	1 Ω	$\pm(5\% \text{ m.v.} + 2 \text{ digits})$
4.00 k Ω ...19.99 k Ω	0.01 k Ω	

Resistance measurement of multiple earthing systems - 3-pole method with additional clamp

Display range	Resolution	Accuracy
0.000...3.999 Ω	0.001 Ω	$\pm(8\% \text{ m.v.} + 4 \text{ digits})$
4.00...39.99 Ω	0.01 Ω	$\pm(8\% \text{ m.v.} + 3 \text{ digits})$
40.0...399.9 Ω	0.1 Ω	
400...1999 Ω	1 Ω	

Measurement of multiple earthing systems - two-clamp method

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(10\% \text{ m.v.} + 3 \text{ digits})$
20.0...149.9 Ω	0.1 Ω	$\pm(20\% \text{ m.v.} + 3 \text{ digits})$

Measurement of earthing impedance - impulse method

Display range	Resolution	Accuracy
0.0...99.9 Ω	0.1 Ω	$\pm(2.5\% \text{ m.v.} + 3 \text{ digits})$
100...300 Ω	1 Ω	

The instrument meets the requirements set forth in standards:

- » EN 62305-1 (lightning protection)
- » 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
- » measurement category ... CAT IV 300 V (CAT III 600 V) acc. to EN 61010-1
- » number of measurements provided by set of batteries >1500

Nominal operating conditions:

- » operating temperature range -10...+50°C
- » storage temperature -20...+80°C
- » humidity 20...90%

SONEL MRU-120HD

index: WMGBMRU120HD



Earthing resistance measurements:

- » 3-pole method,
- » 4-lead method,
- » 3-pole method with additional clamp,
- » two-clamp method.

Soil resistivity measurements (Wenner method):

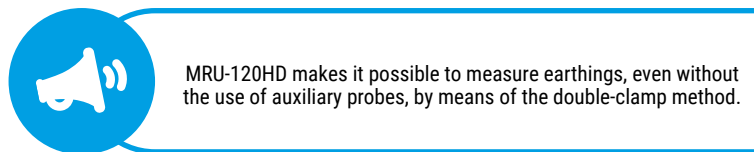
- » distances between electrodes can be input in meters (m) or feet (ft),
- » displaying the soil resistivity value in Ωm or Ωft .

Measurement of resistance of earth connection and equipotential bonding:

- » with auto-zeroing function - with current $\geq 200\text{ mA}$
- » in compliance with EN 61557-4.

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_H ,
- » measurement of voltage and frequency of interference signal,
- » measurement in the presence of disturbance voltages in networks with frequencies of 50 Hz and 60 Hz,
- » selection of maximum measurement voltage (25 V or 50 V),
- » interoperability with ERP-1 adapter,
- » memory storing 990 measurements (10 banks with 99 cells each),
- » real-time clock (RTC),
- » data transmission to computer (USB),
- » reading of battery charge status, built-in quick charger.



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
- » measurement category CAT IV 300 V (CAT III 600 V) acc. to EN 61010-1
- » number of measurements provided by set of batteries >1100

Nominal operating conditions:

- » operating temperature range -10...+50°C
- » storage temperature -20...+80°C
- » humidity 20...85%

Standard accessories:

L-4 carrying case	WAFUTL4
Test lead 4 m black 1 kV (banana plugs)	WAPRZ4X0BLBB
Test lead 4 m blue 1 kV (banana plugs)	WAPRZ4X0BUBB
Test lead 25 m, red (banana plugs, on a reel)	WAPRZ025REBBSZ
Test lead 25 m, blue (banana plugs, on a reel)	WAPRZ025BUBBSZ
Test lead 50 m, yellow (banana plugs, on a reel)	WAPRZ050YEBBSZ
USB cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
4x earth contact test probe (rod), 30 cm	WASONG30
2x clamp (banana socket)	WAZACIMA1
W-1 hanging straps	WAP0ZSZE5
Z-7 power supply	WAZASZ7
Factory calibration certificate	

Earthing resistance measurement - 3-pole and 4-lead method

measuring range according to EN 61557-5: 0.30 Ω ...19.9 k Ω

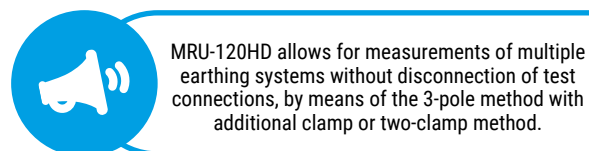
Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(2\% \text{ m.v.} + 2 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	
2.0...9.99 k Ω	0.01 k Ω	$\pm(5\% \text{ m.v.} + 2 \text{ digits})$
10.0...19.9 k Ω	0.1 k Ω	

Resistance measurement of multiple earthing systems - 3-pole method with additional clamp

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(8\% \text{ m.v.} + 3 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	

Measurement of multiple earthing systems - two-clamp method

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(10\% \text{ m.v.} + 3 \text{ digits})$
20.0...149.9 Ω	0.1 Ω	$\pm(20\% \text{ m.v.} + 3 \text{ digits})$



SONEL MRU-120

index: WMGBMRU120 (with L2 case) / WMGBMRU120XL3 (with XL3 case)



CAT III
600 V

CAT IV
300 V

IP54

200 mA
measurement current



Earthing resistance measurements:

- » 3-pole method,
- » 4-lead method,
- » 3-pole method with additional clamp,
- » two-clamp method.

Soil resistivity measurements (Wenner method):

- » distances between electrodes can be input in meters (m) or feet (ft),
- » displaying the soil resistivity value in Ωm .

Measurement of resistance of earth connection and equipotential bonding:

- » with auto-zeroing function - with current ≥ 200 mA
- » in compliance with EN 61557-4.

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_{sp} ,
- » measurement of voltage and frequency of interference signal,
- » measurement in the presence of disturbance voltages in networks with frequencies of 50 Hz and 60 Hz,
- » selection of maximum measurement voltage (25 V or 50 V),
- » interoperability with ERP-1 adapter,
- » memory storing 990 measurements (10 banks with 99 cells each),
- » real-time clock (RTC),
- » data transmission to computer (USB),
- » reading of battery charge status, built-in quick charger.



MRU-120 makes it possible to measure earthings, even without the use of auxiliary probes, by means of the double-clamp method.

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
- » measurement category CAT IV 300 V (CAT III 600 V) acc. to EN 61010-1
- » number of measurements provided by set of batteries >1100

Nominal operating conditions:

- » operating temperature range -10...+50°C
- » storage temperature -20...+80°C
- » humidity 20...85%

Standard accessories:

NiMH battery 4.8 V 3.2 Ah	WAAKU08
L-2 carrying case (only WMGBMRU120)	WAFUTL2
XL-3 carrying case (only WMGBMRU120XL3)	WAWALXL3
Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01
Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB
Test lead 2.2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB
Test lead 25 m, red (banana plugs, on a reel)	WAPRZ025REBBSZ
Test lead 25 m, blue (banana plugs, on a reel)	WAPRZ025BUBBSZ
Test lead 50 m, yellow (banana plugs, on a reel)	WAPRZ050YEBBSZ
USB cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
4x earth contact test probe (rod), 30 cm	WASONG30
Pin probe, red 1 kV (banana socket)	WASONREOGB1
L-2 hanging straps (set)	WAPRZSZEKPL
Cramp (banana socket)	WAZACIMA1
Z-7 power supply	WAZASZ7
Factory calibration certificate	

Earthing resistance measurement - 3-pole and 4-lead method measuring range according to EN 61557-5: 0.30 Ω ...19.9 k Ω

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(2\% \text{ m.v.} + 2 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	
2.0...9.99 k Ω	0.01 k Ω	$\pm(5\% \text{ m.v.} + 2 \text{ digits})$
10.0...19.9 k Ω	0.1 k Ω	

Resistance measurement of multiple earthing systems - 3-pole method with additional clamp

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(8\% \text{ m.v.} + 3 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	

Measurement of multiple earthing systems - two-clamp method

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(10\% \text{ m.v.} + 3 \text{ digits})$
20.0...149.9 Ω	0.1 Ω	$\pm(20\% \text{ m.v.} + 3 \text{ digits})$



MRU-120 allows for measurements of multiple earthing systems without disconnection of test connections, by means of the 3-pole method with additional clamp or two-clamp method.



SONEL MRU-30

index: WMGBMRU30



CAT III

300 V

IP65



soil resistivity
without manual
conversion

Earthing resistance measurements:

- » 3-pole method,
- » 4-lead method,
- » 3-pole method with additional clamp,
- » two-clamp method.

Soil resistivity measurements (Wenner method):

- » distances between electrodes can be input in meters (m) or feet (ft),
- » displaying the soil resistivity value in Ωm or Ωft .

Measurement of resistance of earth connection and equipotential bonding:

- » with auto-zeroing function - with current $\geq 200\text{ mA}$
- » in compliance with EN 61557-4.

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_H ,
- » measurement of interference voltage,
- » measurement in the presence of disturbance voltages in networks with frequencies of 50 Hz and 60 Hz,
- » selection of maximum measurement voltage (25 V or 50 V),
- » memory storing 990 measurements (10 banks with 99 cells each),
- » data transmission to computer (USB),
- » reading of battery charge status.

Other technical specifications:

- » type of insulation double, as per EN 61010-1 and EN 61557
- » measurement category CAT III 300V according to EN 61010-1
- » housing protection rating according to EN 60529 IP65
- » display segment LCD, backlit
- » dimensions 200 x 150 x 73 mm

Nominal operating conditions:

- » operating temperature range -10...+50°C
- » storage temperature -20...+60°C
- » humidity 20...90%



Standard accessories:

L-10 carrying case	WAFUTL10
M-9 carrying case	WAFUTM9
Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01
Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB
Test lead 2.2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB
Test lead 25 m, red (banana plugs, on a reel)	WAPRZ025REBBSZ
Test lead 50 m, yellow (banana plugs, on a reel)	WAPRZ050YEBBSZ
USB cable	WAPRZUSB
230 V mains cable (IEC C7 plug)	WAPRZLAD230
2x earth contact test probe (rod), 30 cm	WASONG30
Pin probe, red 1 kV (banana socket)	WASONREOGB1
Cramp	WAZACIMA1
Z-7 power supply	WAZASZ7
Factory calibration certificate	

Earthing resistance measurement - 3-pole and 4-lead method

measuring range according to EN 61557-5:2007: 0.53 Ω ...9999 Ω for 50 V

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(3\% \text{ m.v.} + 3 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	$\pm 5\% \text{ m.v.}$
2000...9999 Ω	1 Ω	$\pm 8\% \text{ m.v.}$

Resistance measurement of multiple earthing systems - 3-pole method with additional clamp

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(3\% \text{ m.v.} + 3 \text{ digits})$
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	$\pm 5\% \text{ m.v.}$
2000...9999 Ω	1 Ω	$\pm 8\% \text{ m.v.}$

Measurement of multiple earthing systems - two-clamp method

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	$\pm(10\% \text{ m.v.} + 8 \text{ digits})$
20.0...99.9 Ω	0.1 Ω	$\pm(20\% \text{ m.v.} + 3 \text{ digits})$



SONEL MRU-21

index: WMGBMRU21



CAT III	CAT IV	
600 V	300 V	

Earthing resistance measurement:

- » 3-pole method,
- » 2-pole method.

Resistance measurement - 2-pole method:

- » auto-zeroing of test leads

Measurement of resistance of earth connection and equipotential bonding:

- » meeting the requirements of EN 61557-4, with auto-zeroing function - with ≥ 200 mA current.

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_H ,
- » measurement of interference voltage,
- » measurement in the presence of disturbance voltages in the network,
- » selection of maximum measurement voltage (25 V or 50 V),
- » memory storing up to 990 results, data transmission to computer via USB cable,
- » reading of battery or rechargeable battery charge status,
- » power supply from batteries or rechargeable batteries,
- » automatic power down.

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
- » measurement category CAT IV 300V according to EN 61010-1
- » display segment LCD, backlit
- » number of measurements provided by set of alkaline batteries >1000 (5 Ω , 2/min)
- » dimensions 260 x 190 x 60 mm
- » weight including batteries 1.4 kg
- » this product meets EMC requirements in compliance with standards EN 61326-1 and EN 61326-2-2
- » power supply of the meter 4 x 1.5 V batteries or type C rechargeable batteries

Nominal operating conditions:

- » operating temperature range -10...+55°C
- » storage temperature -20...+70°C
- » humidity 20...90%

Standard accessories:

L-4 carrying case	WAFUTL4
Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01
Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02
Battery container	WAP0J1
Test lead 1.2 m, blue, 1 kV (banana plugs)	WAPRZ1X2BUBB
Test lead 15 m, blue (on a reel)	WAPRZ015BUBBSZ
Test lead 2.2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB
Test lead 30 m, red, (banana plugs, on a reel)	WAPRZ030REBBSZ
USB cable	WAPRZUSB
2x earth contact test probe (rod), 30 cm	WASONG30
L-2 hanging straps (set)	WAP0ZSZEKPL
Factory calibration certificate	

Earthing resistance measurement - 3-pole method

measuring range according to EN 61557-5:

0.50 Ω ...1.99 k Ω for 50 V; 0.68 Ω ...1.99 k Ω for 25 V

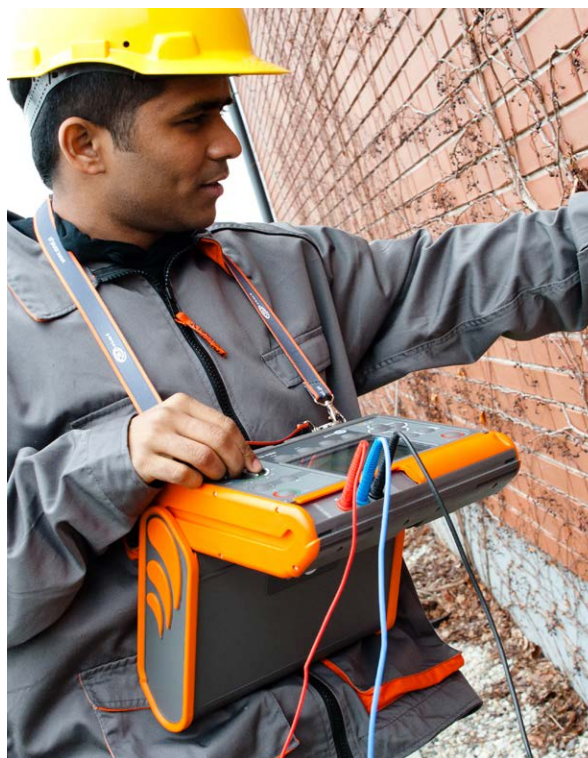
Display range	Resolution	Accuracy
0.00...9.99 Ω	0.01 Ω	$\pm(2\% \text{ m.v.} + 3 \text{ digits})$
10.0...99.9 Ω	0.1 Ω	
100...999 Ω	1 Ω	
1.00...1.99 k Ω	0.01 k Ω	

- » measurement current: >20 mA upon closing of circuit
- » frequency of measurement current: 125 Hz

Measurement of resistance of earth connection and equipotential bonding:

measuring range according to EN 61557-4: **0.13 Ω ...199 Ω**

Display range	Resolution	Accuracy
0.00...9.99 Ω	0.01 Ω	$\pm(2\% \text{ m.v.} + 3 \text{ digits})$
10.0...99.9 Ω	0.1 Ω	
100...199 Ω	1 Ω	



SONEL MRU-12

index: WMGBMRU12



Earthing resistance measurement:

- » 3-pole method,
- » 4-lead method,
- » 2-pole method.

Soil resistivity measurements (Wenner and Schlumberger method):

- » distances between electrodes can be input in meters (m) or feet (ft),
- » displaying the soil resistivity value in Ωm or Ωft .

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_{Hr} ,
- » measurement of interference voltage,
- » selection of maximum measurement voltage (25 V or 50 V),
- » memory storing up to 990 results,
- » data transmission to computer (Bluetooth).
- » reading of battery or rechargeable battery charge status,
- » automatic power down.

Other technical specifications:

- » type of insulation double, as per EN 61010-1 and EN 61557
- » measurement category CAT IV 150 V (III 300 V) according to EN 61010-1
- » housing protection rating according to EN 60529 IP65
- » power supply of the meter alkaline batteries or NiMH AA rechargeable batteries (4 pcs.)
- » display segment LCD, backlit
- » the meter meets the EMC requirements acc. to standards EN 61326-1 and EN 61326-2-2
- » dimensions 221 x 102 x 62 mm
- » weight with batteries 710 g

Nominal operating conditions:

- » operating temperature -10...+50°C
- » storage temperature -20...+60°C
- » reference temperature +23±2°C
- » humidity 20...90%

Standard accessories:

M-6 carrying case	WAFUTM6
Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01
Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02
Test lead 15 m, blue (banana plugs, on H-frame reel)	WAPRZ015BUBBN
Test lead 15 m, red (banana plugs, on H-frame reel)	WAPRZ015REBBN
Test lead 30 m, yellow (banana plugs, on H-frame reel)	WAPRZ030YEBBN
Test lead 2,2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB
Test lead 2,2 m, blue, 1 kV (banana plugs)	WAPRZ2X2BUBB
4x earth contact test probe (rod), 25 cm	WASONG25
M-1 hanging straps	WAPRZSZE4
M-1 hanging hook straps	WAPRZUCH1
4x AA battery, LR6	
Factory calibration certificate	

Earthing resistance measurement - 3-pole and 4-lead method

measurement range to IEC 61557-5:2007: 0.53 Ω ...9999 Ω for 50 V

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(3% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	±5% m.v.
2000...9999 Ω	1 Ω	±8% m.v.

- » Measurement current: under short circuit >20 mA, frequency 125 Hz or 150 Hz, voltage selectable 25 V or 50 V.
- » Maximum interference voltage, at which R_E measurement is performed, equals 24 V.

Earthing resistance measurement - 2-pole method

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(3% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	±5% m.v.
2000...9999 Ω	1 Ω	±8% m.v.

- » Measurement current: under short circuit >20 mA, frequency 125 Hz or 150 Hz, voltage selectable 25 V or 50 V.
- » Maximum interference voltage, at which R_E measurement is performed, equals 24 V.



Earthing resistance meter

SONEL MRU-10

index: WMGBMRU10

CAT IV
150 V

CAT III
300 V

IP67



Earthing resistance measurement:

- » 3-pole method,
- » 2-pole method.

Additional functions of the meter:

- » measurement of auxiliary electrode resistances R_s and R_H ,
- » measurement of interference voltage,
- » selection of maximum measurement voltage (25 V or 50 V),
- » reading of battery or rechargeable battery charge status,
- » automatic power down.

Other technical specifications:

- » type of insulation double, as per EN 61010-1 and EN 61557
- » measurement category CAT IV 150 V (III 300 V) according to EN 61010-1
- » housing protection rating according to EN 60529 IP67
- » power supply of the meter alkaline batteries or NiMH AA rechargeable batteries (4 pcs.)
- » display segment LCD, backlit
- » the meter meets the EMC requirements acc. to standards EN 61326-1 and EN 61326-2-2
- » dimensions 221 x 102 x 62 mm
- » weight with batteries approx. 660 g

Nominal operating conditions:

- » operating temperature -10...+50°C
- » storage temperature -20...+60°C
- » reference temperature +23±2°C
- » humidity 20...90%

Standard accessories:

M-6 carrying case	WAFUTM6
Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01
Test lead 15 m, red (banana plugs, on H-frame reel)	WAPRZ015REBBN
Test lead 30 m, yellow (banana plugs, on H-frame reel)	WAPRZ030YEBBN
Test lead 2,2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB
2x earth contact test probe (rod), 25 cm	WASONG25
M-1 hanging straps	WAPOZSZE4
M-1 hanging hook straps	WAPOZUCH1
4x AA battery, LR6	

Factory calibration certificate

Earthing resistance measurement - 3-pole method

measurement range to IEC 61557-5:2007: 0.53 Ω ...9999 Ω for 50 V

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(3% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	±5% m.v.
2000...9999 Ω	1 Ω	±8% m.v.

- » Measurement current: under short circuit >20 mA, frequency 125 Hz or 150 Hz, voltage selectable 25 V or 50 V.
- » Maximum interference voltage, at which R_E measurement is performed, equals 24 V.

Earthing resistance measurement - 2-pole method

Display range	Resolution	Accuracy
0.00...19.99 Ω	0.01 Ω	±(3% m.v. + 3 digits)
20.0...199.9 Ω	0.1 Ω	
200...1999 Ω	1 Ω	±5% m.v.
2000...9999 Ω	1 Ω	±8% m.v.

- » Measurement current: under short circuit >20 mA, frequency 125 Hz or 150 Hz, voltage selectable 25 V or 50 V.
- » Maximum interference voltage, at which R_E measurement is performed, equals 24 V.



Photo	Name	Index	MRU-200-GPS (L2)	MRU-200-GPS (XL3)	MRU-200 (L2)	MRU-200 (XL3)	MRU-120HD	MRU-120 (L2)	MRU-120 (XL3)	MRU-30	MRU-21	MRU-12	MRU-10	ERP-1
	ERP-1 adapter for earth resistance measurements	WAADAERP1	•	•	•	•	•	•	•					
	ERP-1 adapter for earth resistance measurements with FS-2 flexible coil	WAADAERP1V2	•	•	•	•	•	•	•					
	ERP-1 adapter for earth resistance measurements with FSX-3 flexible coil	WAADAERP1V3	•	•	•	•	•	•	•					
	F-1A flexible coil (Ø360 mm)	WACEGF1AOKR	•	•	•	•								•
	F-2A flexible coil (Ø235 mm)	WACEGF2AOKR	•	•	•	•								•
	F-3A flexible coil (Ø120 mm)	WACEGF3AOKR	•	•	•	•								•
	F-4A flexible coil (Ø630 mm)	WACEGF4OKR	•	•	•	•								•
	FS-2 flexible coil (Ø1260 mm)	WACEGFS2OKR	•	•	•	•								•
	FSX-3 flexible coil (Ø630 mm)	WACEGFSX3OKR	•	•	•	•								•
	N-1 transmitting clamp (Ø52 mm)	WACEGN1BB	•	•	•	•	•	•	•	•				
	C-3 current clamp (Ø52 mm)	WACEGC3OKR	•	•	•	•	•	•	•	•				
	Crocodile clip, black, 1 kV, 20 A	WAKROBL20K01	1	1	1	1	•	1	1	1	1	1	1	
	Crocodile clip, red, 1 kV, 20 A	WAKRORE20K02	1	1	1	1	•	•	•	•	•	•	•	
	Crocodile clip, blue, 1 kV, 20 A	WAKROBU20K02	•	•	•	•	•	•	•	•	1	1	•	
	Crocodile clip, yellow, 1 kV, 20 A	WAKROYE20K02	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 1.2 m, black, 1 kV (banana plugs)	WAPRZ1X2BLBB	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 1.2 m, red, 1 kV (banana plugs)	WAPRZ1X2REBB	1	1	1	1	•	1	1	1	•	•	•	

MRU

Set of standard and optional accessories

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

Photo	Name	Index	MRU-200-GPS (L2)	MRU-200-GPS (XL3)	MRU-200 (L2)	MRU-200 (XL3)	MRU-120HD	MRU-120 (L2)	MRU-120 (XL3)	MRU-30	MRU-21	MRU-12	MRU-10	ERP-1
	Test lead 1.2 m, blue, 1 kV (banana plugs)	WAPRZ1X2BUBB	•	•	•	•	•	•	•	•	1	•	•	
	Test lead 1.2 m, yellow, 1 kV (banana plugs)	WAPRZ1X2YEBB	•	•	•	•	•	•	•	•	•	•	•	
	Double-wire test lead 2 m, for N-1 clamps (banana plugs)	WAPRZ002DZBB	•	•	•	•	•	•	•	•				
	Test lead 2.2 m, black, 1 kV (banana plugs)	WAPRZ2X2BLBB	1	1	1	1	•	1	1	1	1	1	1	
	Test lead 2.2 m, red, 1 kV (banana plugs)	WAPRZ2X2REBB	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 2.2 m, blue, 1 kV (banana plugs)	WAPRZ2X2BUBB	•	•	•	•	•	•	•	•	•	1	•	
	Test lead 2.2 m, yellow, 1 kV (banana plugs)	WAPRZ2X2YEBB	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 4 m black 1 kV (banana plugs)	WAPRZ4X0BLBB	•	•	•	•	1	•	•	•	•	•	•	
	Test lead 4 m blue 1 kV (banana plugs)	WAPRZ4X0BUBB	•	•	•	•	1	•	•	•	•	•	•	
	Test lead 15 m, blue (on a reel)	WAPRZ015BUBBSZ	•	•	•	•	•	•	•	•	1	•	•	
	Test lead with banana plug; 15 m; red	WAPRZ015REBBN	•	•	•	•	•	•	•	•	•	1	1	
	Test lead with banana plug; 15 m; blue	WAPRZ015BUBBN	•	•	•	•	•	•	•	•	•	1	•	
	Test lead 25 m, red (banana plugs, on a reel)	WAPRZ025REBBSZ	1	1	1	1	•	1	1	1	•	•	•	
	Test lead 25 m, blue (banana plugs, on a reel)	WAPRZ025BUBBSZ	1	1	1	1	1	1	1	•	•	•	•	
	Test lead 30 m, red (banana plugs, on a reel)	WAPRZ030REBBSZ	•	•	•	•	•	•	•	•	1	•	•	
	Test lead with banana plug; 30 m; red	WAPRZ030REBBN	•	•	•	•	•	•	•	•	•	•	•	
	Test lead with banana plugs; 30 m; yellow	WAPRZ030YEBBN	•	•	•	•	•	•	•	•	•	1	1	

Photo	Name	Index	MRU-200-GPS (L2)	MRU-200-GPS (XL3)	MRU-200 (L2)	MRU-200 (XL3)	MRU-120HD	MRU-120 (L2)	MRU-120 (XL3)	MRU-30	MRU-21	MRU-12	MRU-10	ERP-1
	Test lead 40 / 60 / 80 m, yellow (banana plugs, on a reel)	WAPRZ040YEBBSZ WAPRZ060YEBBSZ WAPRZ080YEBBSZ	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 50 m, yellow (banana plugs, on a reel)	WAPRZ050YEBBSZ	•	•	•	•	1	1	1	1	•	•	•	
	Test lead 50 m, yellow (banana plugs, on a reel, shielded)	WAPRZ050YEBBSZE	1	1	1	1								
	Test lead 75 / 100 / 200 m, red (banana plugs, on a reel)	WAPRZ075REBBSZ WAPRZ100REBBSZ WAPRZ200REBBSZ	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 75 / 100 / 200 m, blue (banana plugs, on a reel)	WAPRZ075BUBBSZ WAPRZ100BUBBSZ WAPRZ200BUBBSZ	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 75 / 100 / 200 m, yellow (banana plugs, on a reel)	WAPRZ075YEBBSZ WAPRZ100YEBBSZ WAPRZ200YEBBSZ	•	•	•	•	•	•	•	•	•	•	•	
	Test lead 75 / 100 / 200 m, yellow (banana plugs, on a reel, shielded)	WAPRZ075YEBBSZE WAPRZ100YEBBSZE WAPRZ200YEBBSZE	•	•	•	•								
	Pin probe, black 1 kV (banana socket)	WASONBLOGB1	•	•	•	•	•	•	•	•	•	•	•	
	Pin probe, red 1 kV (banana socket)	WASONREOGB1	•	•	•	•	•	1	1	1	•	•	•	
	Pin probe, blue 1 kV (banana socket)	WASONBUOGB1	•	•	•	•	•	•	•	•	•	•	•	
	Pin probe, yellow 1 kV (banana socket)	WASONYEOGB1	•	•	•	•	•	•	•	•	•	•	•	
	Earth contact test probe (rod), 25 cm	WASONG25	•	•	•	•	•	•	•	•	•	4	2	
	Earth contact test probe (rod), 30 cm	WASONG30	4	4	4	4	4	4	4	2	2	•	•	
	Earth contact test probe (rod), 80 cm	WASONG80V2	•	•	•	•	•	•	•	•	•	•	•	
	Cramp	WAZACIMA1	1	1	1	1	2	1	1	1	•	•	•	
	NiMH battery 4.8 V 4.2 Ah	WAAKU07	1	1	1	1		•	•					
	NiMH battery 4.8 V 3.2 Ah	WAAKU08						1	1					

MRU

Set of standard and optional accessories

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

Photo	Name	Index	MRU-200-GPS (L2)	MRU-200-GPS (XL3)	MRU-200 (L2)	MRU-200 (XL3)	MRU-120HD	MRU-120 (L2)	MRU-120 (XL3)	MRU-30	MRU-21	MRU-12	MRU-10	ERP-1
	NIMH battery 4.8 V 4.2 Ah (replaceable in the SONEL S.A. service)	WAAKU28					1							
	Battery pack	WAP0J1									1			
	Z-7 power supply	WAZASZ7	1	1	1	1	1	1	1	1				
	230 V mains cable (IEC C7 plug)	WAPRZLAD230	1	1	1	1	1	1	1	1				
	Cable for battery charging from car cigarette lighter socket (12 V)	WAPRZLAD12SAM	1	1	1	1	•	•	•	•				
	Test wire reel	WAP0ZSZP1	•	•	•	•	•	•	•	•	•	•	•	
	Test wire H-frame	WAP0ZSZP3	•	•	•	•	•	•	•	•	•	•	•	
	L-2 hanging straps (set)	WAP0ZSZEKPL	1	1	1	1		1	1		1			
	M-1 hanging straps	WAP0ZSZE4										1	1	
	W-1 hanging straps	WAP0ZSZE5					1							
	M-1 hanging hook straps	WAP0ZUCH1										1	1	
	Cover (universal)	WAP0ZUCH12	•	•	•	•		•	•		•			
	L-2 carrying case	WAFUTL2	1	•	1	•		1	•					
	L-3 carrying case for a 80 cm rods	WAFUTL3	•	•	•	•	•	•	•	•	•	•	•	
	L-4 carrying case	WAFUTL4					1				1			
	L-7 backpack	WAFUTL7					•							
	L-10 carrying case	WAFUTL10								1				

MRU

Set of standard and optional accessories

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

Photo	Name	Index	MRU-200-GPS (L2)	MRU-200-GPS (XL3)	MRU-200 (L2)	MRU-200 (XL3)	MRU-120HD	MRU-120 (L2)	MRU-120 (XL3)	MRU-30	MRU-21	MRU-12	MRU-10	ERP-1
	L-19 backpack	WAFUTL19	•		•			•		•	•			
	M-6 carrying case	WAFUTM6										1	1	
	M-9 carrying case	WAFUTM9								1				
	XL-3 carrying case (accessories not included)	WAWALXL3	•	1	•	1		•	1					
	XL-8 carrying case	WAWALXL8												•
	USB cable	WAPRZUSB	1	1	1	1	1	1	1	1	1			
	PC software: Sonel Reports Plus	WAPROREPORTSPLUS	•	•	•	•	•	•	•	•	•	•		
	PC software: Sonel Reader	WAPROREADER	•	•	•	•	•	•	•	•	•	•		

SONEL MRU MOBILE



Mobile version of the program cooperating with ground resistance and ground resistivity meters **MRU-200** and **MRU-200-GPS**. It can be downloaded from **Google Play**.

Thanks to 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 a person who can help in interpretation of data or make a measurement report.

Thanks to the application, you can enrich the measurement with a photo, comments or voice memo. From the application level, we also have **access to the meter's manual** and help regarding various measurement methods.

Users who do not have a meter can use the set of **sample data** implemented in demo mode.

SONEL REPORTS PLUS



Sonel Reports Plus supports creation of documentation after testing of electrical installation. The software communicates with Sonel test instruments, downloads data from memory of the devices and creates necessary documentation. Many useful functions are included in order to help creating documentation of the measurements. Sonel Reports Plus supports the meter by reading, downloading and uploading test structure from/to test instrument.

- » Every report can contain description page.
- » Tree structure presents a clear picture of the tested building and its rooms. Test structure can be uploaded to the meter and downloaded from it together with test results.
- » User can print labels for test points.
- » For every room user can add picture or scheme of electrical installation.
- » Software contains library of fuses.
- » For every room user can create separate table with test results.

Temperature measurements

KT-1K / KT-670 / KT-650 / KT-560

KT-550 / KT-530 / KT-525 / KT-520 / KT-510

KT-256F / KT-256 / KT-128

DIT-500
DIT-200
DIT-120

Contactless temperature measurements



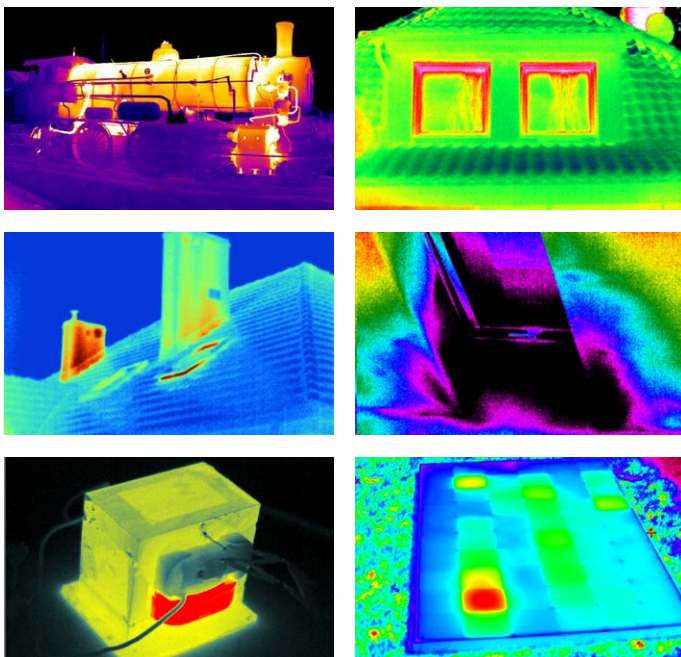
Thermal imaging is a process based on **processing infrared radiation**, that is the heat emitted by objects, **into a visible image**, making possible to assess temperature distribution on the surface of the observed object without contact.

This is important wherever it is necessary to measure temperature at inaccessible or hazardous locations and also allows for:

- » quick temperature measurement on surfaces of any size,
- » or lightning-fast location of heat escape points invisible to the naked eye related to failures in buildings' insulation and construction errors (thermal bridges for example).

In thermographic analysis, **contactless measurement in the infrared spectrum** is used to determine the temperature of a surface from a distance. Since all objects with a temperature above absolute zero emit thermal radiation of similar characteristics (called black-body radiation), by measuring the radiation and with knowledge of the emissivity coefficient of a given object, its temperature can be determined.

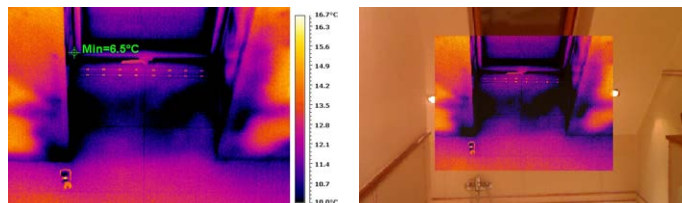
Professional radiometric thermal imaging cameras register temperature separately for each point of the image. For example, in the case of a camera with a 640 x 480 resolution, temperature is registered simultaneously for each of the 307200 points. This makes it possible to conduct detailed analysis of saved thermal images, which display different temperatures as different colors.



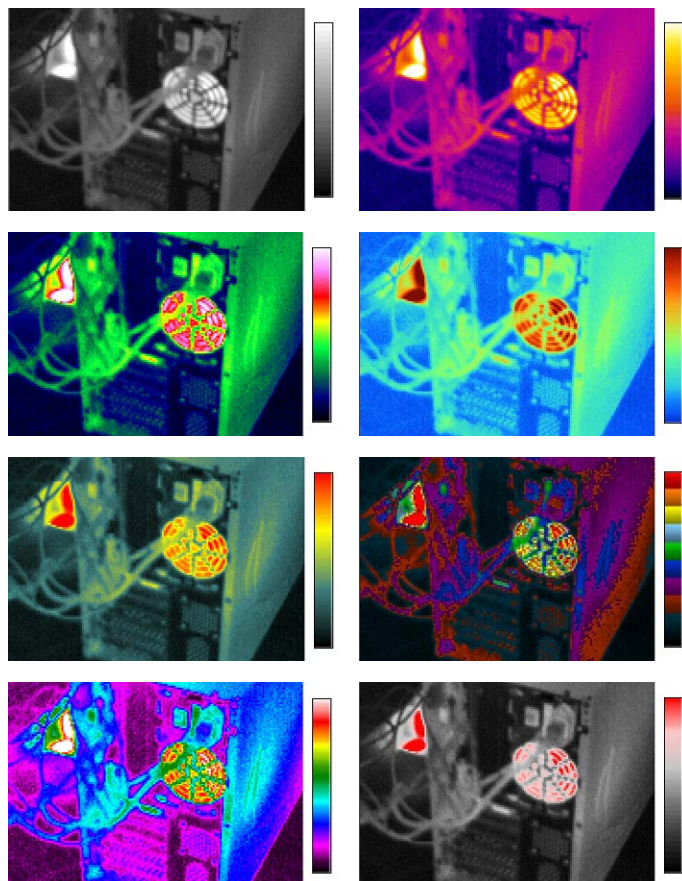
All information saved in a thermogram can be used by specialized software delivered with the thermal imaging camera. During analysis of a thermogram, points with maximum or minimum temperature can be determined, the emissivity coefficient of the whole thermogram or a part of it can be corrected, temperature can be read at any point of the thermogram, mean temperature can be calculated, temperature distribution can be presented in the form of histograms or isotherms, the thermal image can be combined with the real image, just as on the screen of the

camera, which makes it possible to precisely locate places with a specific temperature, and the color palette can be changed arbitrarily to best represent the temperature distribution.

One useful function of thermal imaging cameras is the **capability of taking real-life photographs** as well as **combined image modes** enabling combination of the real-life image with the thermal image and displaying an image in which the thermal image overlaps with the real-life image.



A thermal image is presented on-screen in the color palette selected by the user that best represents individual temperature ranges:



Infrared thermometers are also devices that serve for contactless temperature measurement, and they operate on the basis of **analysis of the thermal radiation** emitted by the tested object. These devices are applied whenever it is required to measure wide range of temperatures.

The main **parameters** characterizing an infrared thermometer are: measured temperature ranges, accuracy and **D:S ratio**, which is the ratio of the distance from the object to the diameter of the field for which the measurement is made.

Thanks to their design, pyrometers allow to measure temperature of small objects, also from great distance. The bigger D:S ratio is, the smaller objects can be measured from big distance.



THERMAL IMAGERS



INDUSTRIAL APPLICATION

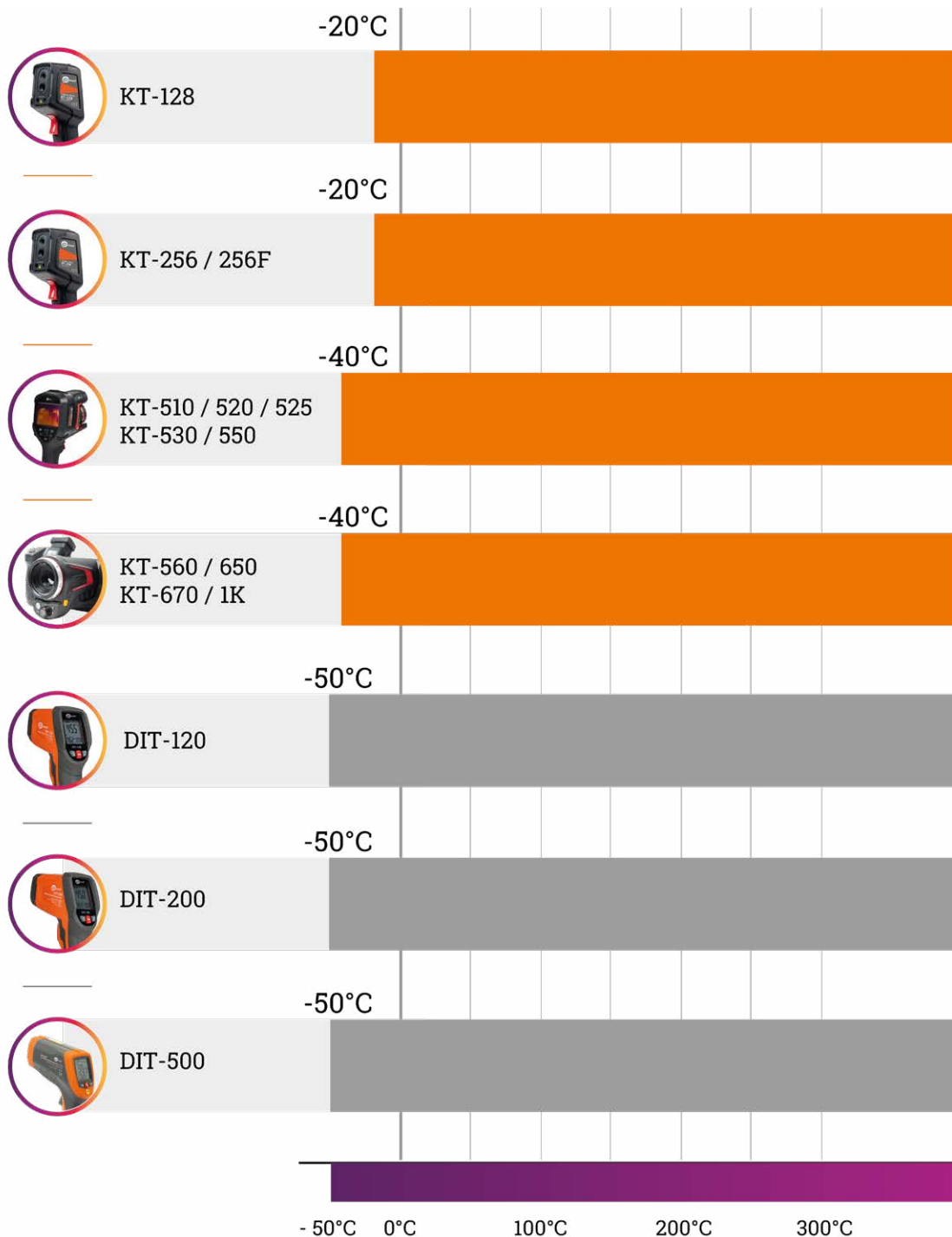
- » high accuracy
- » wide range

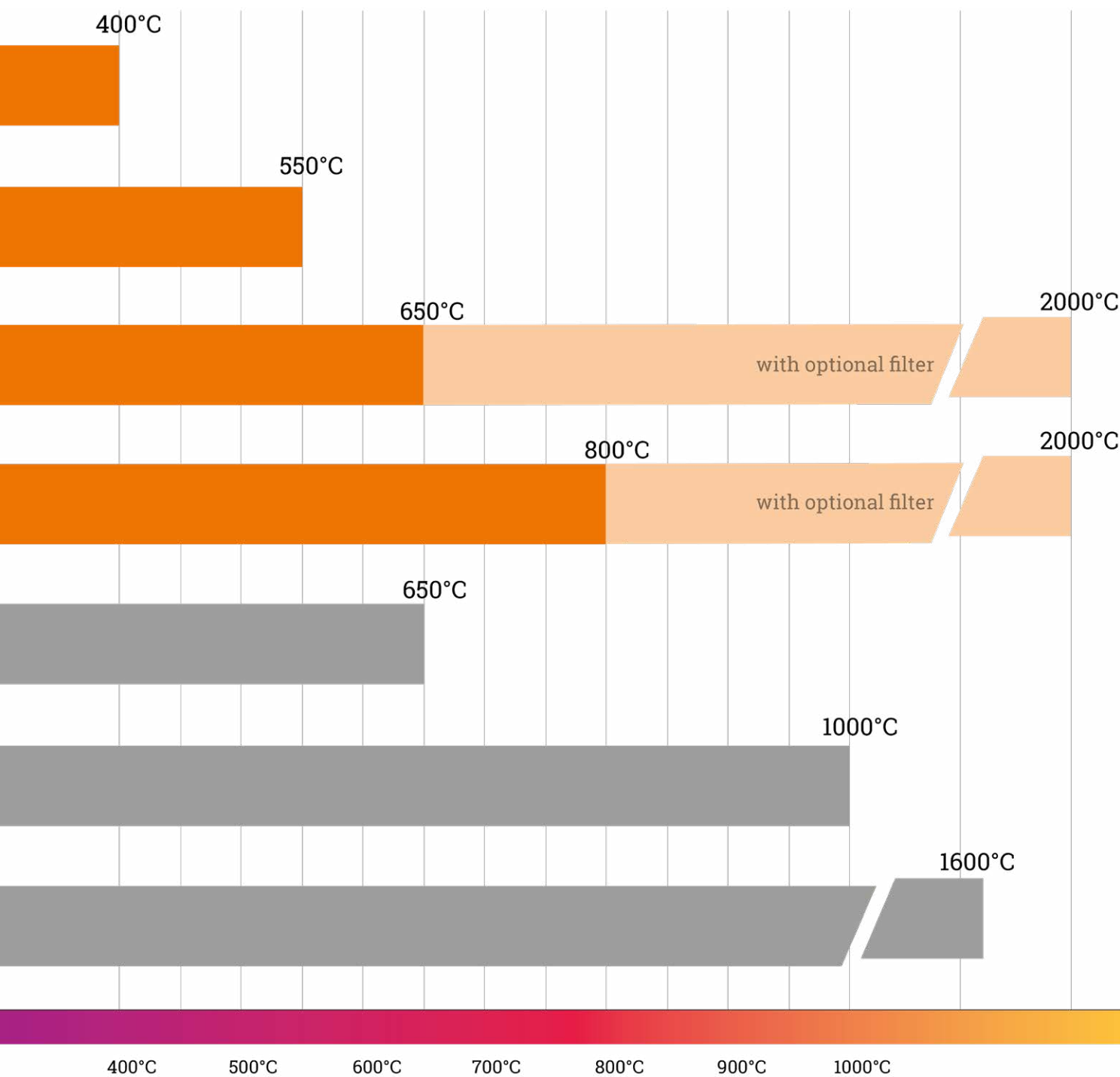
IR THERMOMETERS



INDUSTRIAL APPLICATION

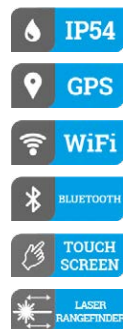
- » high accuracy
- » wide range





SONEL KT-1K / KT-670 / KT-650 / KT-560

index: WMGBKT1K / WMGBKT6701 / WMGBKT6501 / WMGBKT5601



	KT-560	KT-650	KT-670	KT-1K
Detector type	384 x 288 / 17 µm	640 x 480 / 17 µm		1024 x 768 / 12 µm
Spectral range		7.5~14 µm		
Frame rate		30 Hz		
Sensitivity	45 mK	40 mK	35 mK	≤30 mK
Lens (field of view / focal length / instantaneous field of view / min. focus distance)				
• standard	24.9° x 18.7° / 15 mm / 1.13 mrad / 0.4 m	24.6° x 18.5° / 25 mm / 0.68 mrad / 0.3 m		24.6° x 18.5° / 28 mm / 0.43 mrad / 0.3 m
• wide angle	48.1° x 35.9° / 7.78 mm / 2.19 mrad / 0.15 m	45.4° x 34.8° / 13 mm / 1.31 mrad / 0.15 m		-
• telephoto	11.2° x 8.4° / 33 mm / 0.52 mrad / 2 m	11.3° x 8.5° / 55 mm / 0.31 mrad / 1.5 m		-
• ultra-telephoto	7.3° x 5.5° / 50.7 mm / 0.34 mrad / 4 m	7.3° x 5.5° / 85 mm / 0.2 mrad / 4 m		-
• macro	23.3 mm x 17.5 mm / 67 mm / - / 60.7 µm	23.3 mm x 17.5 mm / 67 mm / - / 37.5 µm		-
• high temp	24.9° x 18.7° / - / -	24.6° x 18.5° / - / - / -		24.6° x 18.5° / - / - / -
Display		5", 1280 x 720 high brightness, capacitive LCD touchscreen		
Viewfinder		1280 x 960 LCOS		
Image mode		IR / Visual / Infracusion MIF/ PiP		
Zoom	1...10		1...35	
Temperature range		Range 1: -40°C...150°C Range 2: 100°C...800°C Optional: 700°C...2000°C		
Accuracy	±2°C or 2% of reading		±1°C or ±1% of reading	
Image analysis mode	12 points, 12 lines, 12 areas. Temperature readings: min., max., average. Isotherms. Temperature alarm. Smart stroke	16 points, 16 lines, 16 areas. Temperature readings: min., max., average. Isotherms. Temperature alarm. Smart stroke		30 points, 30 lines, 30 areas. Temperature indication: min, max, average. Isotherm. Temperature alarm. Smart stroke.
Palettes	8	10		12
Super-resolution	4x, 768 x 576	4x, 1280 x 960		2048 x 1536
Panoramic images	-		✓	
Emissivity coefficient	Set from 0.01 to 1.00			
Measurement correction	Auto-adjustable distance, relative humidity, ambient temperature (reflected)			
Image file format	JPG			
Notes on IR images	Additional visual photos, voice, text recognition, text typing			
Reports module	PDF reports			
Video file format	MP4 (without temp. information), IRGD (including temp. information)			
Built-in functions	Visual camera 13 MPix, LED flashlight, GPS, laser pointer, laser rangefinder, microphone, speaker, digital compass, light sensor.			
Wireless communication	Wi-Fi, Bluetooth			
Storage	Built-in memory (64 GB), SD card, cloud service			
Interfaces	SD card slot (max. 64 GB), LAN 1 Gb/s, micro HDMI, USB type C (data transfer only), tripod			
Power supply	Li-ion battery (4 h of continuous operation), built-in charger, AC adapter 110-230 V, 50/60 Hz			Li-ion battery (3 h of continuous operation), built-in charger, AC adapter 110-230 V, 50/60 Hz
Operating temperature range	-20°C...+50°C			
Storage temperature	-40°C...+70°C			
Humidity	≤95%			
Resistance to shocks / vibrations	30g 11 ms (IEC 60068-2-27)			
Housing	IP54			
Weight	approx. 1.4 kg (with battery)			approx. 1.5 kg (with battery)

Overview

Behold the **highest class of thermal imagers** that offers temperature measurements of substantial accuracy. Robustly designed and constructed, they are ideally suited for:

- » troubleshooting electrical installations, wiring, panels, motors, breakers, transformers, switchgear, and electrical equipment,
- » monitoring the thermal performance of industrial manufacturing processes,
- » identifying overheating of mechanical and electro-mechanical components,
- » inspecting buildings for insulation leaks, energy audits, HVAC/R equipment, water damage, and pests,
- » locating hidden heat sources (of people, animals, objects) in dark or low-light conditions.

The touchscreen as well as the lens swivel independently to view objects of interest that are difficult to access from any angle. The large number of functions, intuitive handling and excellent ergonomics make the KT-560/650/670/1K imagers perfect for **every advanced thermographer**.

Features

- » image files saved in JPG format (complete image data)
- » recording of IR videos (on SD memory card or computer hard disk)
- » built-in reports module
- » MIF image combining mode
- » extensive image analysis tools
- » built-in camera for capturing images within the visible light spectrum
- » built-in: GPS, digital compass, LED flashlight, laser pointer, laser rangefinder
- » interfaces: USB type C, Wi-Fi, Gigabit Ethernet, micro HDMI, SD memory card slot, Bluetooth
- » digital zoom



Imagers have built-in tools for analysis and generating reports on-site.

Standard accessories:		KT-560	KT-650	KT-670	KT-1K
2x Li-Ion battery 10.8 V 3.35 Ah	WAAKU18	✓	✓	✓	✓
Z-13 power supply adaptor	WAZASZ13	✓	✓	✓	✓
Z-14 external battery charger	WAZASZ14			✓	
Type C USB cable	WAPRZUSBC	✓	✓	✓	✓
LAN cable (RJ45)	WAPRZRJ45	✓	✓	✓	✓
Micro HDMI cable	WAPRZMIKROHDMI	✓	✓	✓	✓
SD card 64 GB	WAPZSD64	✓	✓	✓	✓
Shoulder harness	WAPZPAS3	✓	✓	✓	✓
XL-9 carrying case	WAWALXL9	✓	✓	✓	✓
Factory calibration certificate		✓	✓	✓	✓



Thermal imagers

SONEL KT-550 / KT-530

index: WMGBKT550 / WMGBKT530

SONEL KT-525 / KT-520 / KT-510

index: WMGBKT525 / WMGBKT520 / WMGBKT510



	KT-510	KT-520	KT-525	KT-530	KT-550
Detector resolution	256 x 192 / 12 μm	320 x 240 / 12 μm	384 x 288 / 12 μm	480 x 360 / 12 μm	640 x 480 / 12 μm
Spectral range	7.5~14 μm VOx				
Frame rate	30 Hz / 9 Hz				
Thermal sensitivity	≤45 mK				≤40 mK
Focus	Manual / Auto				
IFOV	1.70 mrad	1.36 mrad	1.13 mrad	0.91 mrad	0.68 mrad
Min. focus distance	0.1 m	0.1 m	0.15 m	0.15 m	0.15 m
Lens (field of view/focal length)	25° x 19° / 10.5 mm	25° x 19° / 10.5 mm	25° x 19° / 10.5 mm	25° x 19° / 17.7 mm	25° x 19° / 17.7 mm
Display	4.3", 800 x 480 high brightness, capacitive LCD touchscreen				
Image modes	IR / Visual / Infrarufusion MIF / PiP				
Digital zoom	1...8	1...8	1...10	1...16	1...20
Temperature range	Range 1: -40°C...150°C Range 2: 0°C...650°C				
• Standard	-	High temperature lens: 500°C...2000°C			
• Optional	-	High temperature lens: 500°C...2000°C			
Accuracy	±2°C or ±2% of reading				
Image analysis modes	5 points, 5 lines, 5 areas. Temperature indication: min, max, average. Isotherm. Temperature alarm. Smart stroke.	8 points, 8 lines, 8 areas. Temperature indication: min, max, average. Isotherm. Temperature alarm. Smart stroke.	10 points, 10 lines, 10 areas. Temperature indication: min, max, average. Isotherm. Temperature alarm. Smart stroke.	12 points, 12 lines, 12 areas. Temperature indication: min, max, average. Isotherm. Temperature alarm. Smart stroke.	16 points, 16 lines, 16 areas. Temperature indication: min, max, average. Isotherm. Temperature alarm. Smart stroke.
Palettes	16				
Super-resolution	2x, 512 x 384	2x, 640 x 480	2x, 768 x 576	2x, 960 x 720	2x, 1280 x 960
Panoramic images	√				
Emissivity coefficient	Selectable from 0.01 to 1.00				
Measurement adjustment	Auto-adjustable distance, relative humidity, ambient temperature (reflected)				
File format	JPG				
IR image annotations	Additional visual photos, voice, text recognition, text typing				
Reports module	PDF reports				
Video file format	MP4 (without temp. information), IRGD (including temp. information)				
Built-in features					
• Visual camera resolution	5 MPix	5 MPix	8 MPix	8 MPix	13 MPix
• Other features	LED flashlight, GPS, laser pointer, laser rangefinder (0.1...40 m), microphone, speaker, digital compass				
Wireless communication	Wi-Fi, Bluetooth				
Storage	Built-in memory (64 GB), SD card				
Interface	SD card slot (max. 256 GB), USB type C, tripod				
Power supply	Li-ion battery (5 h of continuous operation), built-in charger, AC adapter 110-230 V (50/60 Hz)			Li-Ion battery (4 h of continuous operation), built-in charger, AC adapter 110-230 V (50/60 Hz)	
Operating temperature	-20°C...+50°C				
Storage temperature	-40°C...+60°C				
Ingress protection	IP54				
Weight	ca. 1.15 kg (with battery)				

Features

Regardless of whether you take photos or record videos, the Sonel KT-510/520/525/530/550 cameras, equipped with modern detectors, a wide range of temperature measurement and high-quality lenses, ensure highly detailed images and accurate measurements. The cameras are available in several versions, thus enabling the appropriate configuration for the user's needs.

Modernity and comfort

A large display with innovative data processing electronics is protected by a solid housing, ensuring the perfect combination of high efficiency and comfortable work.

Moreover, the comfortable handle and easily accessible buttons make the operation highly ergonomic and optimal both for professional and less experienced thermographers.

Thermal imaging is not everything

Cameras are additionally equipped with visual lenses and related image mixing technologies: PIP, MIF. Support from the built-in LED torch and laser improves operational quality by facilitating photography and then image interpretation.

The picture is just the beginning

The built-in report module allows for the preparation and printing out of reports directly from the camera. Built-in communication interfaces ensure constant communication between the camera and the computer or mobile device, also over a wireless network. Thanks to state-of-the-art technologies and solutions, the cameras ensure full control and flexibility in various situations, and are an ideal tool for both novice users and professional thermographic inspectors.

Features

- » image files saved in JPG format (complete image data)
- » recording of IR videos (on SD memory card or computer hard disk)
- » built-in reports module
- » MIF image combining mode
- » extensive image analysis tools
- » built-in camera for capturing images within the visible light spectrum
- » built-in: GPS, digital compass, LED flashlight, laser pointer, laser rangefinder
- » interfaces: USB type C, Wi-Fi, Gigabit Ethernet, SD memory card slot, Bluetooth
- » digital zoom

Standard accessories:

		KT-550	KT-530	KT-525	KT-520	KT-510
2x 7.4 V 3.2 Ah Li-Ion rechargeable battery	WAAKU33	✓	✓	✓	✓	✓
Type C USB cable	WAPRZUSBC	✓	✓	✓	✓	✓
LAN cable (RJ45)	WAPRZRJ45	✓	✓	✓	✓	✓
Adapter for data transmission (USB-C/RJ45)	WAADAUSBCRJ	✓	✓	✓	✓	✓
Wristband	WAPOZPAS8	✓	✓	✓	✓	✓
64 GB SD card	WAPOZSD64	✓	✓	✓	✓	✓
Z-37 battery charger	WAZASZ37	✓	✓	✓	✓	✓
Z-38 external battery charger	WAZASZ38	✓	✓			
XL-16 hard carrying case	WAWALXL16	✓	✓	✓	✓	✓
Factory calibration certificate		✓	✓	✓	✓	✓



Thermal imager

SONEL KT-256F / KT-256 / KT-128

index: WMGBKT256F / WMGBKT256 / WMGBKT128



KT-128 • KT-256

Trigger

Temperature measurement with a single press



KT-256F

Autofocus trigger
Sharp image with a single press

Trigger
Temperature measurement with a single press



Simple thermography

KT-128 / 256 / 256F is a special camera. Economical, practical and handy, it is a powerful tool in everyday work. The camera is used for basic diagnostics. It is equipped with a matrix having a resolution of:

- » **KT-128** | 120 x 90 pixels,
 - » **KT-256 • KT-256F** | 256 x 192 pixels,
- supported by visual camera, laser pointer and additional features to fully meet the needs of users.

KT-256F | Autofocus

KT-256F is equipped with an automatic focus which ensures that your IR measurement pictures will always be sharp and crisp, no matter the distance.

Application

KT-128 / 256 / 256F is used always when the temperature of objects is important and may affect the operation of the equipment. Particularly useful in:

- » power engineering,
- » construction sector,
- » industry
- » HVAC.

Features

- » measuring range:
 - **KT-128** | -20°C...400°C
 - **KT-256 • KT-256F** | -20°C...550°C
- » quick start
- » fast temperature measurement
- » automatic signalling of exceeded alarm threshold
- » **KT-256F** | autofocus
- » saving IR images to SD card
- » built-in Li-Ion battery with:
 - **KT-128** | 5-hour working time
 - **KT-256 • KT-256F** | 16-hour working time
- » interfaces: USB type C, SD slot
- » can be set up on a tripod

Standard accessories:

		KT-128	KT-256	KT-256F
USB charger	WAZASZ20	✓	✓	✓
Type C USB cable	WAPRZUSBC	✓	✓	✓
16 GB microSD card	WAPOZMSD16	✓	✓	
32 GB microSD card	WAPOZMSD32			✓
Wristband	WAPOZPAS1	✓	✓	✓
Declaration of verification		✓	✓	✓

	KT-128	KT-256	KT-256F
Detector resolution	120 x 90 / 17 μm VOx	256 x 192 / 12 μm VOx	
Spectral range	7.5~14 μm		
Frame rate	25 Hz		
Sensitivity	60 mK	45 mK	
Focus	Fixed		Auto
Lens (field of vision / focal distance)	50° x 38°/2.28 mm	56° x 48°/3.2 mm	25° x 19°/7 mm
Spatial resolution (IFOV)	7.6 mrad	3.75 mrad	1.71 mrad
Display	2.4", 240 x 320 px, LCD		
Image mode	IR / Visual / PiP	IR / Visual / Infrarufusion MIF / PiP	
Temperature range	Range 1: -20°C...+150°C Range 2: 100°C....+400°C	Range 1: -20°C...+150°C Range 2: 100°C....+550°C	
Accuracy	±2°C or ±2% of reading (for ambient temperature 15°C...30°C, object temp. ≥0°C)		
Image analysis mode	Point. 3 areas. Temperature indication: min, max. Temp. alarm		
Palettes	6		
Emissivity	Selectable from 0.01 to 1.00 or from the list		
Measurement adjustment	Adjustable distance, ambient temperature (reflected)		
Image file format	JPG		
Built-in features	Visual camera 2 MPix, LED flashlight, laser pointer		
Interfaces	microSD card slot (max. 32 GB), USB type C, tripod		
Power supply	Li-Ion battery (operating time >5 hours), built-in charger (charging time <2.5 hour), AC adapter 110-230 V, 50/60 Hz	Li-Ion battery (operating time >16 hours), built-in charger (charging time <2.5 hour), AC adapter 110-230 V, 50/60 Hz	
Operating temperature	-10°C...+50°C		-15°C...+50°C
Storage temperature	-40°C...+70°C		
Housing	IP54		
Weight	ca. 0.35 kg	ca. 0.38 kg	

Software

SONEL THERMOANALYZE 3

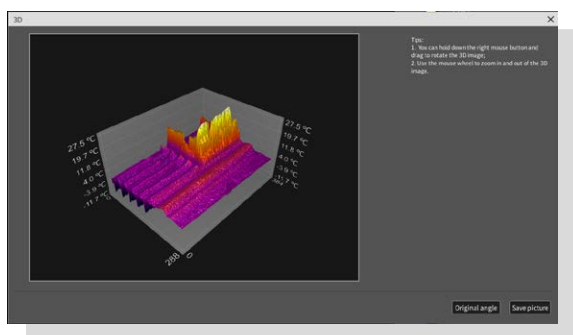
index: WAPROTHERMOANALYZE3



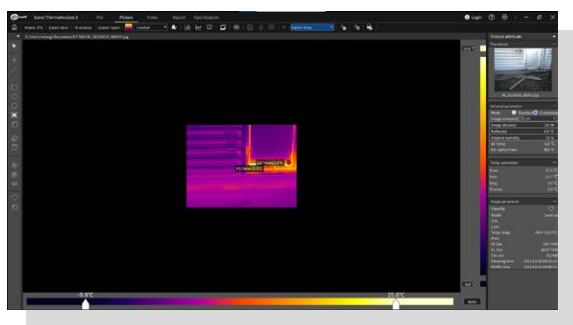
Software for analyses and reports, included with the set of thermal imagers.

Capability of correcting the emissivity coefficient throughout the entire thermogram or part of it – the coefficient can be corrected individually for each selected area.

Analyzed areas selection – drawing of a rectangular area, oval area, area of any shape.

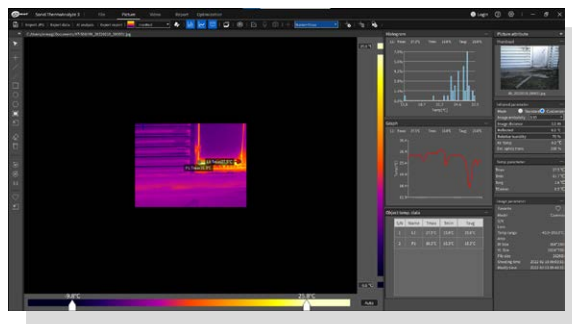


Temperature reading at any point – after scrolling the cursor over to the "Information" window, temperature readouts are displayed continuously along with current coordinates, and other recorded information is also available (maximum temperature, humidity, emissivity).

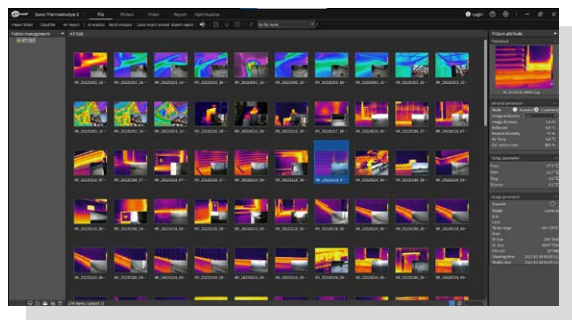


Infra Fusion technology – a thermogram is superimposed onto a part of the visible image, in any palette selected by the user. The thermogram is applied with the selected transparency, making it possible to optimally display and mark areas of interest, particularly when it is difficult to visually compare points on the thermogram with details on the visible image of the observed object.

Determination and reading of minimum, maximum and mean temperature for the entire area and in every marked area of interest. Selection of segment (straight line or polyline).



Easy report creation, "drag-and-drop" desired elements into the report – thermograms and the visible images corresponding to them.



All corrections applied and characteristic points are saved for further analysis at a later time. Selection of the visually optimal color palette (among 9 available in the application) for the best visualization of temperature changes. Configuration of the temperature range for the best imaging of temperature distribution (manual or automatic mode available).

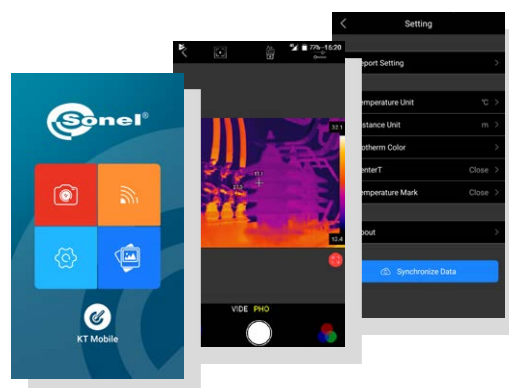
The software has an unlimited license - it can be used simultaneously on multiple devices.

The software is available on the website: www.sonel.com.

SONEL KT MOBILE



A mobile version of the program supporting Sonel thermal imaging cameras. With the application, you can get a preview of the actual image on your phone, and remotely perform a series of other activities by managing the camera from a mobile device. It can be downloaded from [Google Play](https://play.google.com/store/apps/details?id=com.sonel.kt_mobile).



Infrared thermometer

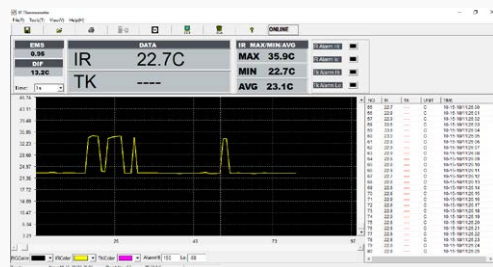
SONEL DIT-500

index: WMGBDIT500



SONEL IR THERMOMETER

A program dedicated for the PC. It is used to download results from the memory of the **DIT-500** pyrometer and to supervise continuous temperature measurements by downloading the results in real time.



Standard accessories:

Mini-USB data transmission cable	WAPRZUSBMNIB5
Temperature measurement probe (type K)	WASONTEMK
Mini tripod	WAPOZSTATYW
Carrying case	
9 V battery	
Factory calibration certificate	

Measurements

- » Precise non-contact temperature measurement.
- » Emissivity digitally adjustable from 0.10 to 1.00.
- » Resolution from 0.1°C and 0.1°F.
- » Laser pointer: double.
- » Input for type K temperature probe.

Additional functions

- » Displaying MAX, MIN, AVG, DIF temperatures.
- » Automatic Data Hold
- » Temperature unit selection: °C / °F.
- » High and Low alarm.
- » Backlit LCD display.
- » Auto power off.

Description

Professional and compact infrared (IR) thermometers are a solution for problems in every area where specific thermal conditions are required. The intuitive one-hand operation of the devices and the ergonomically designed gun-type housing allow for trouble-free daily work.

Applications

- » HVACR areas.
- » Electrical areas.
- » Mechanical areas.
- » Industry areas.

Special features

- » Temperature measurements in the range of **-50°C...1600°C**.
- » Operation with an external temperature probe - temperature measurement range **-50°C...1370°C**.
- » D:S ratio of **50:1**.
- » Data memory (LOG) for **100 measurements**.
- » Double laser pointer (marking the measurement area).
- » Transmission of current readings to computer via USB cable.

Technical specification

		DIT-500
		All advanced measurements in industrial environments
LCD display		segmented, with backlight
Spectral sensitivity		8~14 μm
Emissivity		digitally adjusted from 0.10 to 1.00
Semi-conductor laser diode	output power	<1 mW
	wavelength	630~670 nm
	class	class 2 (II) laser
Power supply		9 V alkaline battery NEDA 1604A or IEC 6LR61
Operating temperature range		0...50°C 32...122°F
Storage temperature		-20...+60°C -4...+140°F
Humidity		10...90%
Indication of range overflow		symbol "----"
Response time		150 ms
Weight		350 g
Dimensions		230 x 155 x 54 mm



SONEL DIT-200 / DIT-120

index: WMGBDIT200 / WMGBDIT120



Measurements

- » Precise non-contact temperature measurement.
- » Emissivity digitally adjustable from 0.10 to 1.00.
- » Resolution from 0.1°C and 0.1°F.
- » Laser pointer:
 - DIT-200 | circular,
 - DIT-120 | dual.
- » DIT-200 | Input for type K temperature probe.

Additional functions

- » Displaying MAX, MIN, AVG, DIF temperatures.
- » Automatic Data Hold
- » Temperature unit selection: °C / °F.
- » High and Low alarm.
- » Backlit LCD display.
- » Auto power off.

Description

DIT-120 and DIT-200 are pyrometers for professionals. Durable housing, ergonomic grip, buttons accessible with one finger - all this contributes to the comfort of the user. Technical parameters speak for themselves. The advanced laser pointer will precisely and unambiguously indicate the area of the performed measurement.

Applications

- » Temperature measurement of transformers.
- » Temperature control of busbars and connections.
- » Monitoring the condition of heating and cooling devices.
- » Temperature control of materials in metallurgical processes.
- » Checking the heating of rollers and bearings in transport conveyors.
- » ...and many others.

Special features

DIT-200

- » Temperature measurements in the range of **-50°C...1000°C**.
- » Operation with an external temperature probe - temperature measurement range **-50°C...1370°C**.
- » D:S ratio of **20:1**.
- » Circular laser pointer (marking the measurement area).

DIT-120

- » Temperature measurements in the range of **-50°C...650°C**.
- » D:S ratio of **12:1**.
- » Double laser pointer (marking the measurement area).

Standard accessories - DIT-200:

Temperature measurement probe (type K)	WASONTEMK
Holster	WAFUTS5
2x AAA 1.5 V battery	
Factory calibration certificate	

Standard accessories - DIT-120:

Holster	WAFUTS5
2x AAA 1.5 V battery	
Factory calibration certificate	

Technical specification

	DIT-200	DIT-120
LCD display	segmented, with backlight	
Spectral sensitivity	8~14 μm	
Emissivity	digitally adjusted from 0.10 to 1.00	
Semi-conductor laser diode	output power	<1 mW
	wavelength	630~670 nm
	class	class 2 (II) laser
Power supply	2x AAA 1.5 V battery	
Operating temperature range	0...50°C 32...122°F	
Storage temperature	-10...+60°C 14...+140°F	
Humidity	10...90%	
Indication of range overflow	symbol "----"	
Response time	150 ms	
Weight	242 g	231 g
Dimensions	170 x 50 x 95 mm	170 x 50 x 85 mm



KT / DIT

Set of standard and optional accessories

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

Photo	Name	Index	KT-1K	KT-670	KT-650	KT-560	KT-550	KT-530	KT-525	KT-520	KT-510	KT-256F	KT-256	KT-128	DIT-500	DIT-200	DIT-120
	Adapter for data transmission (USB-C/RJ45)	WAADAUSBCRJ					1	1	1	1	1						
	Adapter – converter HDMI / RCA	WAADAHDMIXRCP		•	•	•											
	Li-Ion battery 10.8 V 3.35 Ah	WAAKU18	2	2	2	2											
	Li-Ion battery 7.2 V 3.2 Ah	WAAKU33					2	2	2	2	2						
	MicroSD card 16 GB	WAP0ZMSD16											1	1			
	MicroSD card 32 GB	WAP0ZMSD32										1					
	SD card 64 GB	WAP0ZSD64	1	1	1	1											
	High temperature filter (up to 2000°C)	WAADAOF1		•	•	•											
	High temperature filter (up to 2000°C)	WAADAOF3					•	•	•	•							
	Wide-angle IR lens 6 mm (44°x34°)	WAADA06V5XX							•	•	•						
	Wide-angle IR lens 7.78 mm (48.1°x35.9°)	WAADA08V560				•											
	Wide-angle IR lens 10 mm (44°x34°)	WAADA010V5XX					•	•									
	Wide-angle IR lens 13 mm (45.4°x34.8°)	WAADA013V6701		•	•												
	Tele IR lens 17,5 mm (15°x11°)	WAADA018V5XX							•	•	•						
	Tele IR lens 29 mm (15°x11°)	WAADA029V5XX					•	•									

KT / DIT

Set of standard and optional accessories

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

Photo	Name	Index	KT-1K	KT-670	KT-650	KT-560	KT-550	KT-530	KT-525	KT-520	KT-510	KT-256F	KT-256	KT-128	DIT-500	DIT-200	DIT-120
	Tele IR lens 33 mm (11.2°x8.4°)	WAADA033V560				•											
	Tele IR lens 55 mm (11.3°x8.5°)	WAADA055V6701		•	•												
	Ultra tele IR lens 37,5 mm (7°x5°)	WAADA0375V5XX							•	•	•						
	Ultra tele IR lens 62.9 mm (7°x5°)	WAADA063V5XX					•	•									
	Macro IR lens 16,2 mm (3x)	WAADA016V5XX					•	•									
	Wristband	WAPOZPAS1										1	1	1			
	Shoulder harness	WAPOZPAS3	1	1	1	1											
	Wristband	WAPOZPAS8					1	1	1	1	1						
	Type C USB cable	WAPRZUSBC	1	1	1	1						1	1	1			
	USB cable MINI-B 5	WAPRZUSBMNIB5													1		
	MicroHDMI cable	WAPRZMIKROHDMI	1	1	1	1											
	LAN cable (RJ45)	WAPRZRJ45	1	1	1	1											
	Type K Temperature Probe	WASONTEMK													1	1	
	Temperature probe (type K, metal)	WASONTEMK2													•	•	
	Additional Pin Probe with banana plugs	WASONTEMP													•	•	

KT / DIT

Set of standard and optional accessories

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

Photo	Name	Index	KT-1K	KT-670	KT-650	KT-560	KT-550	KT-530	KT-525	KT-520	KT-510	KT-256F	KT-256	KT-128	DIT-500	DIT-200	DIT-120
	M-11 carrying case	WAFUTM11		•	•	•											
	M-13 carrying case	WAFUTM13													•		
	S-1 carrying case	WAFUTS1										•	•	•		•	•
	XL-9 carrying case	WAWALXL9	1	1	1	1											
	XL-16 carrying case	WAWALXL16					1	1	1	1	1						
	Z-13 power supply adaptor	WAZASZ13	1	1	1	1											
	Z-20 power supply adaptor	WAZASZ20										1	1	1			
	Z-37 power supply adaptor	WAZASZ37					1	1	1	1	1						
	Z-14 external battery charger	WAZASZ14	1	1	•	•											
	Z-38 external battery charger	WAZASZ38					1	1	•	•	•						
	Mini tripod	WAPOZSTATYW													1		

High voltage measurements

S-120 DC / S-110 DC / S-80 DC / S-50 DC / S-25 DC
S-57 VLF / S-44 VLF / S-36 VLF / S-24 VLF

UV-260

SONEL S-120 DC / S-110 DC / S-80 DC / S-50 DC / S-25 DC

index: WMGBS25DC / WMGBS50DC / WMGBS80DC / WMGBS110DC / WMGBS120DC

S-50 DC / S-80 DC / S-110 DC / S-120 DC

S-25 DC



Features

- » Easy operation
- » Robust construction, low weight
- » Integrated timer:
 - S-25 DC | max. 30 min (standard)
 - S-50 / 80 / 110 / 120 DC | max. 60 min (option)
- » Discharge device:
 - S-25 DC | integrated (S-25 DC),
 - S-50 / 80 / 110 / 120 DC | external ground-discharge rod
- » S-25 DC | Internal battery charger with deep discharge protection
- » Voltage measurement direct at HV output
- » Short-circuit-proof output:
 - S-25 DC | electronically limited output current
 - S-50 / 80 / 110 / 120 DC | protection by overcurrent tripping
- » Protective ground connection
- » S-25 DC | Mains-independent by internal rechargeable battery

Overview

The S-xx DC series devices are universal high voltage testers. They are extremely robust, but also lightweight, compact and easily portable thanks to a transport case on wheels (only for S-50 / 80 / 110 / 120 DC).

Capacitive loads, such as shielded power cables, will be properly and automatically discharged in case of an error or at the end of testing time by the integrated discharge device. Key switch, switch-on interlock and a protective ground circuit ensure maximum safety. S-25 DC stands out in particular. Not just with modest dimensions. Thanks to an internal rechargeable battery it enables mains-independent testing.

Fields of application

- » Testing at recommissioning of cable systems after maintenance and repair
- » Testing of newly installed cables and cable joints before commissioning
- » S-25 DC | Voltage testing at cable sheath
- » S-50 DC / 80 DC / 110 DC / 120 DC | Regular preventive cable testing
- » Testing of electrical equipment

Standard accessories - S-25 DC:

Protective bag	
Power cable	
Connection cables for external DC power supply	
Protective ground cable, 3 m	
Operation ground cable, 3 m	
High voltage connecting cable (shielded), 3 m	
Service pack	
Start keys	

Standard accessories - S-50 DC / S-80 DC / S-110 DC / S-120 DC:

Protective bag	
Discharge rod	
Protective ground cable, 3 m	
Operation ground cable, 3 m	
High voltage connecting cable, 2 m	
Service pack	
Start keys	

Optional accessories - S-25 DC:

Transport case	
Transport case with wheels	WAWALXXL1

Optional accessories - S-50 DC / S-80 DC / S-110 DC / S-120 DC:

Transport case	
Transport case with wheels	WAWALXXL2



	S-25 DC	S-50 DC	S-80 DC	S-110 DC	S-120 DC
Power supply	internal rechargeable battery mains, switchable 115 / 230 V, 50-60 Hz external DC voltage source 11...15 V DC		mains 230 V / 50 Hz (optional: 115 V / 60 Hz)		
Power consumption	max. 120 VA		max. 900 VA		
Output voltage	0...25 kV DC infinitely adjustable negative polarity ripple < 0,25%	0...50 kV DC infinitely adjustable negative polarity	0...80 kV DC infinitely adjustable negative polarity	0...110 kV DC infinitely adjustable negative polarity	0...120 kV DC infinitely adjustable negative polarity
Rated output current at max. output voltage	1.5 mA electronically limited	6 mA	5 mA	4 mA	3.5 mA
Battery operation at full load	45 min		-		
Discharge - integrated automatic discharge device	3000 J 9.6 µF at 25 kV	7500 J 6 µF at 50 kV	12 250 J 4 µF at 75 kV 3.5 µF at 80 kV	15 000 J 3 µF at 100 kV 2.5 µF at 110 kV	18 750 J 2.4 µF at 125 kV 2.6 µF at 120 kV
Voltage measuring range	0...30 kV	0...50 kV	0...80 kV	0...110 kV	0...130 kV
Current measuring ranges	0...200 µA / 0...2 mA manual or automatic switching between ranges		0...100 µA / 1 mA / 10 mA manual switching between ranges		
Operating temperature			-25...+55°C		
Storage temperature			-40...+70°C		
Weight	Operating unit	13.5 kg		13 kg	
	High voltage unit	-	17 kg	18.5 kg	20 kg
Dimensions	Operating unit	473 x 152 x 275 mm		370 x 200 x 280 mm	
	High voltage unit	-	210 x 380 x 310 mm	210 x 400 x 310 mm	210 x 420 x 310 mm



SONEL S-57 VLF / S-44 VLF / S-36 VLF / S-24 VLF

index: WMGBS57VLF / WMGBS44VLF (230 V) / WMPAS44VLF (110 V) / WMGBS36VLF / WMGBS24VLF



- » Extremely compact high-power VLF test device
- » Easily portable for 1-2 people
- » Simple operation: menu-assisted control with industrial class OLED display
- » Fully automatic test sequence
- » Integrated timer 1-300 min with automatic tripping
- » Integrated breakdown detection
- » Integrated fault time detection
- » Voltage measurement direct at HV output
- » Protective ground connection
- » High voltage start key interlock
- » Protective circuit / indication in accord. with EN 50191
- » Leakage current measurement during VLF test

Overview

The compact, robust and portable S VLF cable test sets are used for testing of medium voltage cables in accordance to the standards IEEE400, IEC 60502-2, CENELEC HD 620 & 621 and DIN VDE 0276/620 & 621. The test is carried out with a low strain practice with VLF (very low frequency) test voltage at 0.1 Hz frequency.

VLF test enables detection of damages of the insulation within shortest test time. The S VLF series device can test cables with extruded insulation (XLPE-, PE-, EPR-insulation) as well as cables with paper-oil insulation (PILC). Cable sheath testing with direct voltage is also possible.

Optional features

- » Data logging (USB stick) for VLF test sets
- » Frequency extension: 0.05 + 0.02 Hz
- » Customized test cables
- » Transport case

SONEL VLF TESTER SOFTWARE

index: WAPROVLFSTS

The programme **Sonel VLF Tester Software** generates a test report based on the individual recorded data files.

The first page of the generated report is an overview. The following pages describe the individual tests of the power cable system. The software is easy to use, so you can quickly create a PDF report that is attractive to the end user.

Insulation Testing:		[x] from (A)	[] from (R)
Desired Values:	Method: [x] VLF [] DC	Test Voltage: 36 kV	Test Time: 60 min
Measured Values	L1-L2 L3-E	L2-L1 L3-E	L3-L1 L2-E
Test Voltage (kV rms)	36.0 kV	36.0 kV	36.0 kV
Frequency (Hz)	0.1 Hz	0.1 Hz	0.1 Hz
DC Voltage (kV)	---	---	---
Test Time (min)	60:00 min	60:00 min	2:47 min
Breakdown after min	---	---	42.7 kV
Sheath Testing:		[x] from (A)	[] from (B)
Measured Values	*S ₁₁ →E	*S ₁₂ →E	*S ₁₃ →E
DC Voltage (kV)	---	---	---
Test Time (min)	---	---	---
breakdown	yes/no	---	---
Test Result:		Fault occurred!	
Comments to the Test:		Insulation Fault on L3, Repair or Replacement	

Standard accessories:

High voltage connecting cable (shielded) 5 m	
Bridging cables	
Connecting cable between high voltage unit and station ground	
Connecting cable between operation unit and protective ground	
Service pack	
Start keys	
Case	WAWALVLF

Optional accessories:

USB stick for data logging	WAADAHVVLFDL
Case with wheels	WAWALVLF2
Frequency extension 0.05 Hz + 0.02 Hz	WAADAHVVLFFE
Sonel VLF Tester Software	WAPROVLFSTS

