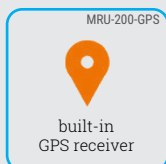
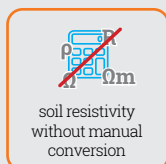
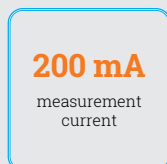


## **Annexure 20: Supporting related to TFR Meter**



## Multifunctional earthing and soil resistivity meter

### Measurement methods

- **Impulse method** – measurement of lightning protection systems with a measuring impulse ramp of 4/10  $\mu$ s, 8/20  $\mu$ s, 10/350  $\mu$ s
- **3- and 4-wire method** – measurement of earthing systems using auxiliary probes
- **3-wire method with clamps** – measurement of earthing systems with multiple earth electrodes
- **Two-clamp method** – measurement of earthing system when the auxiliary probes cannot be used
- **Soil resistivity** – Wenner method
- **Resistance of earth and compensatory conductors** measured using current  $\geq 200$  mA with auto-zero function – meets the requirements of EN 61557-4
- **Measurement of leakage current**

### Additional features

- **Built-in GPS receiver** – recording results with location coordinates (MRU-200-GPS)
- Measurement of resistance of auxiliary electrodes  $R_s$  and  $R_H$
- Measurement of interference voltage
- Measurement of interference frequency
- Measurement in the presence of interference voltage generated by power networks with frequency of 16 2/3 Hz, 50 Hz, 60 Hz, 400 Hz
- Selection of maximum measuring voltage (25 V and 50 V)
- Automatic calculation of soil resistivity in ohm-meters ( $\Omega$ m) and ohm-feet ( $\Omega$ ft)
- Memory of 990 measurement results (10 banks of 99 cells each)
- Calibration of clamp used
- Real time clock (RTC)
- Data transmission to the computer and mobile devices
- Battery indication





## Application

MRU-200 and MRU-200-GPS meters were created for **the most difficult working conditions**. They generate a measuring current exceeding 200 mA, which provides effective measurements of grounding of energy objects such as transformer stations and power stations.

Thanks to the methods using clamps, it is **not necessary to disconnect the control connectors**, which is sometimes a very tedious operation. This plays a special role when performing works on objects exposed to weather conditions, where the connecting elements are sometimes corroded or tarnished.

The graphical user interface provides clear readings and explicit messages. This translates into quick, trouble-free service.



## Impulse method

MRU-200 and MRU-200-GPS may be used to test earthing of **lightning protection systems**, as these meters are able to simulate the conditions occurring during a lightning strike – they generate currents with a standardized pulse leading edge and a time to half-peak. Available **impulse ramps** include 4/10  $\mu$ s, 8/20  $\mu$ s, 10/350  $\mu$ s.

## Compatible with ERP-1 adapter

ERP-1 adapter allows user to test earthing systems using flexible clamps. This is particularly useful, e.g. in case of lattice towers – there is no need to switch off the line or disconnect control connectors. Proprietary algorithm allows user to check the current direction in the individual measurements and facilitates damage detections, e.g. corroded steel strip (hoop).



## Capabilities

The measuring methods available in the device allow for comprehensive control of working and protective grounding. The calibration function of the test leads eliminates the influence of their resistance on the result. However, this is just the beginning.

- **The four-lead method** provides very accurate measurement of the expected small values of resistance – eliminates the resistance of the test leads connecting the meter to grounding.
- **Measurement of the continuity** of protective connections and equipotential bondings with a current exceeding 200 mA meets the requirements of EN 61557-4 standard.
- Before performing the measurement, the meter checks whether the tested object is a subject to excessive **interference voltage**, which may indicate additional problems.



## Memory and results

The results can be saved to the device's memory. It is divided into **10 banks of 99 cells**, each corresponding to one measurement. These results can be easily transferred to the **Sonel Reader** software for archiving or subsequent analysis and research.

**Bluetooth** wireless interface may be used to transfer measurement results to PC software or to a mobile phone with dedicated app – **Sonel MRU Mobile**. This provides not only data archiving function, but further data transfer – directly from the measurement site via an e-mail.

## Technical specifications

Measurement functions	Measurement range	Display range	Resolution	Accuracy ±(% m.v. + digits)
<b>Interference voltage</b>	0 V...100 V	0 V...100 V	1 V	±(2% m.v. + 3 digits)
<b>Connection and equipotential bonding resistance</b>	0.045 Ω...19.99 kΩ acc. to EN 61557-4	0.000 Ω...19.99 kΩ	from 0.001 Ω	from ±(2% m.v. + 2 digits)
<b>Earth resistance</b>				
3- and 4-wire method	0.100 Ω...19.99 kΩ acc. to EN 61557-5	0.000 Ω...19.99 kΩ	from 0.001 Ω	from ±(2% m.v. + 2 digits)
3-wire + clamp method	0.120 Ω...1999 Ω acc. to EN 61557-5	0.000 Ω...1999 Ω	from 0.001 Ω	±(8% m.v. + 3 digits)
two-clamp method	0.00 Ω...149.9 Ω	0.00 Ω...149.9 Ω	from 0.01 Ω	from ±(10% m.v. + 3 digits)
impulse method 4/10 μs, 8/20 μs, 10/350 μs pulse	0.0 Ω...199 Ω	0.0 Ω...199 Ω	from 0.1 Ω	±(2.5% m.v. + 3 digits)
auxiliary electrodes resistance	0 Ω...19.9 kΩ	0 Ω...19.9 kΩ	from 1 Ω	±(5% (R <sub>E</sub> +R <sub>H</sub> +R <sub>S</sub> ) + 8 digits)
<b>Earth resistivity</b>	0.0 Ωm...999 kΩm	0.0 Ωm...999 kΩm	from 0.1 Ωm	Depends on the accuracy of the R <sub>E</sub> 4p measurement. but not less than ±1 digit
<b>Leakage current</b>	0.1 mA...300 A	0.1 mA...300 A	from 0.1 mA	from ±(5% m.v. + 5 digits)
<b>Safety and work conditions</b>				
<b>Measuring category according to EN 61010</b>				III 600 V / IV 300 V
<b>Ingress protection</b>				IP54
<b>Type of insulation according to EN 61010-1 and IEC 61557</b>				double
<b>Dimensions</b>				288 x 223 x 75 mm
<b>Weight</b>				ca. 2 kg
<b>Operating temperature</b>				-10...+50°C
<b>Storage temperature</b>				-20...+80°C
<b>Humidity</b>				20...90%
<b>Nominal temperature</b>				23 ± 2°C
<b>Reference humidity</b>				40%...60%
<b>Memory and communication</b>				
<b>Memory of measurement results</b>				990 results
<b>Data transmission</b>				USB, Bluetooth
<b>GPS position accuracy (MRU-200-GPS)</b>				3 m
<b>Other information</b>				
<b>Quality standard – development, design and production</b>				ISO 9001
<b>The product meets the EMC (emission for industrial environment) requirements according to standards</b>				EN 61326-1 EN 61326-2-2

Standard accessories



**Test lead 2.2 m (banana plugs) black**

WAPRZ2X2BLBB



**Test lead 1.2 m (banana plugs) red**

WAPRZ1X2REBB



**Crocodile clip 1 kV 20 A black / red**

WAKROBL20K01  
WAKRORE20K02



**Test lead 25 m for earth resistance measurements (on a reel, banana plugs) blue / red**

WAPRZ025BUBBSZ  
WAPRZ025REBBSZ



**Test lead 50 m for earth resistance measurements (on a reel, banana plugs, shielded) yellow**

WAPRZ050YEBBSZE



**USB cable**

WAPRZUSB



**4x earth contact test probe (30 cm)**

WASONG30



**cramp with banana socket**

WAZACIMA1



**Hanging straps**

WAPOZSZEKPL



**230 V mains power cable (IEC C7 plug)**

WAPRZLAD230



**Z7 Power supply adapter**

WAZASZ7



**Cable for battery charging from car cigarette lighter socket (12 V)**

WAPRZLAD12SAM



**L-2 carrying case**

WAFUTL2



**NiMH battery 4.8 V 4.2 Ah**




























WAAKU07



**Calibration certificate issued by an accredited laboratory (no accreditation)**



Optional accessories

	<b>ERP-1 adapter</b> WAADAERP1		<b>FS-2 flexible coil</b> (Ø 1260 mm), output level 100 mV / 1 A WACEGFS20KR		<b>FSX-3 flexible coil</b> (Ø 630 mm), output level 300 mV / 1 A WACEGFSX30KR
	<b>F-1A flexible coil</b> (Ø 360 mm) WACEGF1A0KR		<b>F-2A flexible coil</b> (Ø 235 mm) WACEGF2A0KR		<b>F-3A flexible coil</b> (Ø 120 mm) WACEGF3A0KR
	<b>C-3 current clamps</b> (Ø 52 mm) WACEGC30KR		<b>N-1 transmitting clamps</b> (Ø 52 mm, incl. 2-wire cable) WACEGN1BB		<b>Double-wire test lead 2 m for N-1 clamps</b> WAPRZ002DZBB
	<b>Crocodile clip</b> 1 kV 20 A red / blue / yellow WAKRORE20K02 WAKROBU20K02 WAKROYE20K02		<b>Test lead 1.2 m (banana plugs)</b> blue / yellow WAPRZ1X2BUBB WAPRZ1X2YEBB		<b>Pin probe 1 kV (banana socket)</b> black / red / blue / yellow WASONBU0GB1 WASONRE0GB1 WASONBLOGB1 WASONYE0GB1
	<b>AC-16 line splitter</b> WAADAAC16		<b>Earth contact test probe</b> 25 cm / 80 cm WASONG25 WASONG80		<b>L-3 carrying case (for 80 cm test probes)</b> WAFUTL3
	<b>Test lead on a reel red</b> 75 m / 100 m / 200 m WAPRZ075REBBSZ WAPRZ100REBBSZ WAPRZ200REBBSZ		<b>Test lead on a reel blue</b> 75 m / 100 m / 200 m WAPRZ075BUBBSZ WAPRZ100BUBBSZ WAPRZ200BUBBSZ		<b>Test lead on a reel yellow</b> 75 m / 100 m / 200 m WAPRZ075YEBBSZ WAPRZ100YEBBSZ WAPRZ200YEBBSZ
	<b>Test lead 30 m for earth resistance measurements (on a reel, banana plugs) red</b> WAPRZ030REBBSZ		<b>Test lead 15 m for earth resistance measurements (on a reel, banana plugs) blue</b> WAPRZ015BUBBSZ		<b>Test lead 50 m for earth resistance measurements (on a reel, banana plugs) yellow</b> WAPRZ050YEBBSZ
	<b>NiMH battery 4.8 V 3.2 Ah</b> WAAKU08		<b>Battery pack 4xLR14</b> WAPOJ1		<b>Test lead on a reel yellow, screened, 75 m / 100 m / 200 m</b> WAPRZ075YEBBSZE WAPRZ100YEBBSZE WAPRZ200YEBBSZE
	<b>XL3 carrying case (MRU)</b> WAWALXL3		<b>XL-8 carrying case (ERP-1)</b> WAWALXL8		<b>Test wire reel</b> WAPOZSZP1
	<b>Calibration certificate with accreditation</b>				



**SONEL INSTRUMENTS INDIA PRIVATE LIMITED**

Plot No.191,Maxworth Nagar 10th Street

S.Kolathur, Kovilambakkam,Chennai-600 117.

Phone No : 044 2268 2346 Email : sales@sonel.in

**CIN** : U74900TN2013FTC089751 **PAN** : AASCS6993H

**GST** : 33AASCS6993H1ZL

**1164**

**Quotation**

QUO 24-25-0446

---

**Warranty:** 1 Year

**Offer Validity:** 30 days

**Our Bank details for ECS:**

Beneficiary Name: Sonel Instruments India Pvt Ltd

Account No: 50200034024580

Bank name: HDFC Bank

Address: T.Nagar, Chennai

IFSC code: HDFC0002590

Cheque/Drafts payable to: Sonel Instruments India Pvt Ltd

Thanking You,

Sonel Instruments India Private Limited