

SOURCETRONIC  
*We love electrons*



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## TM25R

**High-frequency earth tester**

- User guide
- Technical specifications

# TM-25R

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*High-frequency earth tester*

## User guide

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## Safety warnings

As the line is energized and the tower grounding state is, provisionally unknown, the operator shall follow all the safety measures stated, avoiding the existence of step and touch voltages which are possibly dangerous. Refer to the company safety regulations for these matters.

***This equipment should be used only by a trained and competent person, strictly applying suitable safety rules.***

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## Used symbols



Caution, refer to User Guide



Equipment complies with current EU Directives



The rubbish bin with a line through it means that in the European Union, the product must undergo selective disposal for the recycling of electric and electronic material, in compliance with Directive WEEE 2002/96/EC.



Battery



Printer



Backlight

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## 1. Description

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Testing of the power transmission towers grounding (G) quality poses a serious problem as they are all electrically interconnected by means of Ground Wires which act as lightning rods, protecting the lines from atmospheric discharges.

Due to the existence of this connection, any attempt to measure a tower grounding (G) resistance using a conventional earth tester leads to wrong results as what is really being measured is all the shunt towers grounding (G) resistance (or, more precisely, its impedance at low frequency). Trying to disconnect the ground wire from an energized line is a risky operation due to the need for climbing to the tower highest part as well as for the proximity to the high-voltage conductors.

To make this kind of test feasible, which is of vital importance to ensure the transmission of the electrical power without interruptions, SOURCETRONIC **TM-25R** grounding resistance tester for high frequency has been developed. This is the appropriate tool for a fast, safe and reliable grounding resistance measurement in each tower of a working line transmission, without disconnecting the ground wire.

Its operation is based on the use of a high-frequency measurement current (25 kHz), for which ground wire inductive impedance - taking into account a typical length span is reasonably high, making it possible to reduce the effect of the adjacent towers under measurement. The equipment only measures the ground resistance of the surveyed tower, including its base. The extensive G systems, such as meshes, buried wires, metal pipes, etc, are measured only considering the closest section to the connection point, so that the measured value represents the performance, against a pulse signal similar to an atmospheric discharge.

Thus, values that better represent the system capacity to ground lightning currents than the ones obtained with low frequency conventional equipments, even when disconnecting the ground wire, are obtained.

The test is performed by making the known-value current flow through the earth diffusion resistance and an auxiliary electrode, called the current electrode, and by measuring the voltage produced between grounding and another auxiliary electrode, thrust into the ground in the area of the potential created by flowing current (Potential Plateau).

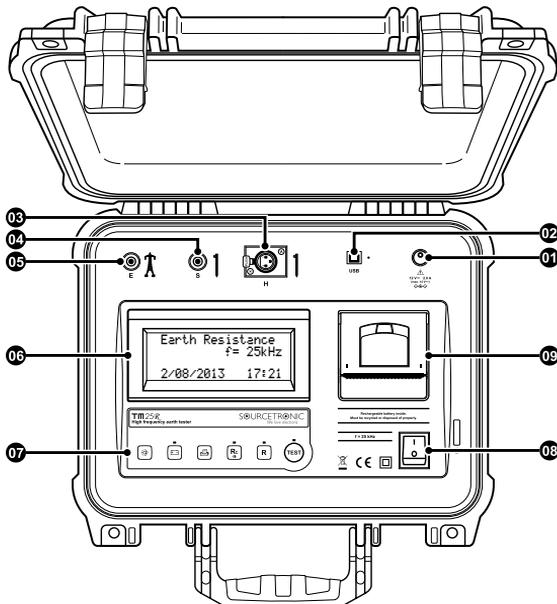
The equipment has a Bluetooth communication interface that allows remote operation through a Tablet running the BlueLogg application. With it you can save photos of the towers and the GPS coordinates of each. Also allows you to record voice annotations to each measurement

**TM-25R** is powered by a built-in rechargeable battery. It is a rugged, easy to carry, resistant to the hard weather and geographical features of the tropical and high-mountain regions, that is why it is described as an excellent product for field works under the most severe environmental conditions.

## 2. Control panel

All of the **TM-25R** buttons, keys, outputs and connections are located on the panel, and are easily accessible by the operator. The following graphics show the function of each one of the equipment's items.

### 2.1. Connections and items



01	Power supply input
02	USB interface
03	Current rod connector
04	Potential auxiliary rod connector
05	Tower support rod connector
06	Display
07	Keyboard
08	On/Off switch
09	Thermal printer

## 2.2. Keyboard



Key	Function	LED
	It prints the last test performed	–
	It shows the battery charge status on the display	The battery charger is operating
	Backlight - it activates the display light. After 10 seconds the backlight will auto-turn off in order to save the battery charge	–
	It selects the grounding resistance measurement function with inductive component compensation	It indicates selected function
	It selects grounding resistance measurement function (without compensation)	It indicates selected function
	The START key. Starts the test	A measurement is running

## 3. Power supply

The **TM-25R** has a built-in rechargeable battery. Furthermore, it can be powered by mains supply (AC Adapter).

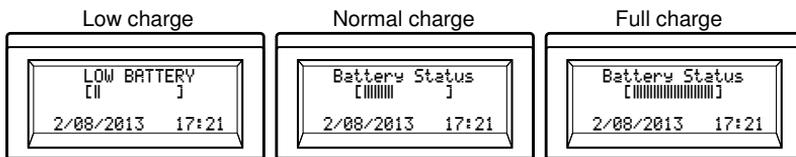
### 3.1. Battery / battery charger

#### 3.1.1. Battery description

The **TM-25R** uses a built-in rechargeable battery. This battery should be recycled at the end of its service life or placed in an appropriate site, in order to protect the environment.

#### 3.1.2. Battery status check

Before starting each test, it is recommended to check if the battery has enough charge. This can be done by pressing the  key. Note: It is not possible to verify the battery charge state during the measurement.



#### 3.1.3. Recharge procedure

This equipment has an internal battery charger with a smart circuit which adjusts the battery charge to the optimized parameters to ensure the maximum service life. To recharge the battery:

- Check if the **TM-25R** is off, and then connect it to the 110 V or 220 V mains supply (using the AC Adapter).
- The charging indicator (led over key ) will turn on red and will remain that way until the battery is totally charged. Then the light will remain green and keep in that way until the **TM-25R** is disconnected of the mains.

If the equipment is turned on, the charging procedure will be momentarily interrupted, with the mains supplying the operation of the **TM-25R** till it is again turned off.

## 4. Printer

Pressing the  key will print the results and parameters of the last test.

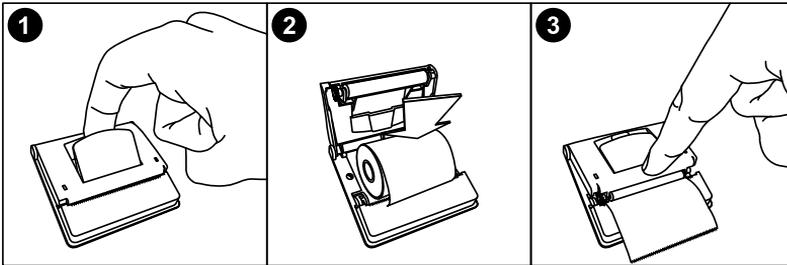
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**ATTENTION:** Don't pull the paper. The printer can be easily damaged.

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This printer uses 57 mm-wide thermal paper.

- 1 Pull the lever located on the lid.
- 2 Insert the paper reel as shown in the figure.
- 3 Keep the tip of the paper out of the printer and close the lid.



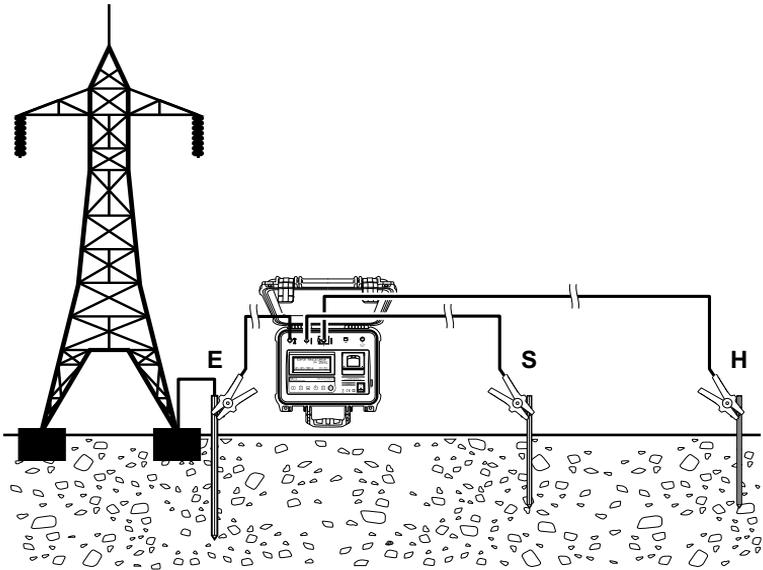
## 5. Connecting the TM-25R

### 5.1. Equipment location

The equipment shall be placed as close as possible to the tower support where the grounding is located, and it will be connected to the instrument **E** terminal.

### 5.2. Auxiliary rods set up

Auxiliary rods will be set up in the ground, making a straight line with the tower (point zero of measurements), perpendicular to the power transmission line. Initially, the auxiliary current rod must be at a 100 m distance and the probe (potential rod) at a 65 m distance. In order to establish a connection with the farthest rod, a black cable must be used together with the shielded cable (black) that must be connected to the equipment, to the **H** connector. The central rod (probe) will be connected to the equipment **S** terminal.



## 6. Measuring

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### 6.1. Selecting the type of measurement

The **TM-25R** measures grounding resistance with or without compensation of the inductive component.

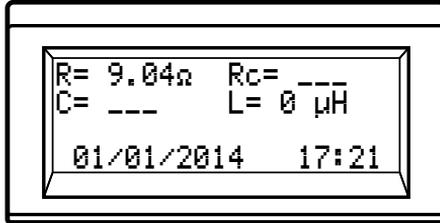
#### 6.1.1. Grounding resistance measurement

- Select the grounding resistance measurement by pressing the **R** key. When the equipment is switched on, this function is automatically selected.
- Press the **TEST** key to start the measurement.
- The led of the **TEST** key will shine for a few seconds and then the display will show the resistance value and the measurement unit.
- The measurement result will be recorded in the memory.

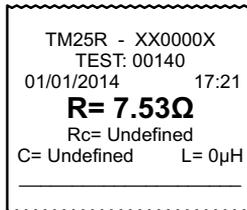
#### 6.1.2. Grounding resistance measurement function with inductive component compensation

- Select the function measurement with compensation by pressing the **R<sub>C</sub>** key.
- Press the **TEST** key to start the measurement.
- The led of the **TEST** key will turn on and after a few seconds the display will show the resistance with no compensation value. The compensation process starts immediately. During this process the display shows capacitance values that the system selects and the  $R_c$  value for each capacity, up to finding the lower value corresponding to the tuning. At the end of this process, the display shows the value of the resistance without compensation [R], the resistance measured with compensation [R<sub>C</sub>], the capacitance value [C] with which the tuning was obtained and the estimated value of the equivalent inductance of the system [L].
- The measurement result will be recorded in the memory.

**Note:** If the system tuning is not obtained (normally because the inductance of the grounding systems is not significant), this will be shown in the display.

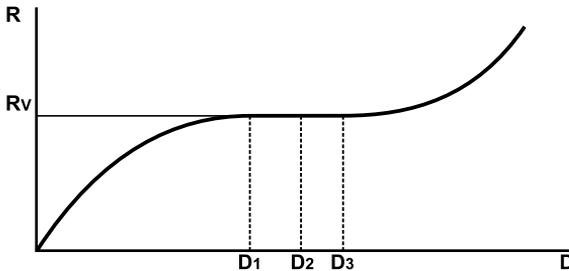


If the test is printed, the message “Undefined” for the values Rc and C, with L= 0 will be displayed.



## 6.2. Looking for the potential profile flat area

After getting the first Grounding Resistance Value, it is necessary to obtain the greatest amount of points to trace the potential profile curve. In order to do that, the potential rod (probe) should be always set up perpendicular to the traced line, in several intermediate points between the unknown electrode and the current rod, so as to obtain the kind of curve showed below.



Where R represents the resistance values obtained based on the D distance from the potential rod. At least 3 points are recommended. The inductive component must be compensated in each point. The Grounding Resistance Value will be the one obtained in the potential profile flat zone. Rv in the above mentioned picture. If 3 measurements with the same value or with an acceptable mistake made by the operator could not be obtained, (5% is an usual acceptable value), current electrode distance must be increased in, for example, 50 meters, and several measurements should be taken again with the probe until finding the potential profile flat zone. Check always the current.

## 6.3. Guard wire inductance

The guard wire inductance is a function of its diameter, and of the height and length of the span. Taking into account the typical values employed in the 13.3 kV - 33 kV - 132 kV lines, the guard wire presents, in all cases, an inductance in the 1.8  $\mu\text{Hy}/\text{m}$  order. Taking into account a 100 m span, the result (at 25 kHz) is an inductive reactance of approximately 30  $\Omega$ . These data make it possible to test the results of the measurements performed.

## 7. Abnormalities indications on the display

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If the **TM-25R** identifies any abnormality causing the measurements to be excessively inaccurate, or not possible at all, a warning message will be shown on the display, allowing the operator to identify and correct the problem.

### 7.1. Excessively high earth resistance

If the system's resistance is exceptionally high (above 300  $\Omega$ ), and therefore beyond the equipment range, the following message will appear: "**R > 300  $\Omega$** "

### 7.2. Excessively high resistance in the auxiliary rods

If, by any reason, there is no current between **S** and **H**, or if resistance on the H pole is too high, the display will show "**Check H-pole**". The reason may be a wrong connection or excessive high-diffusion resistance on the H pole. Check the installation to correct the problem. If the problem is being caused by excessive resistance, watering the rods or inserting several interconnected rods may reduce the resistance, allowing measurements to take place correctly. Also check battery charge status.

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**IMPORTANT:** Take into account that if the grounding resistance of the auxiliary electrodes used exceeds the maximum admissible by the instrument (2000  $\Omega$ ), the measurements taken will be affected by a significant error. If it is suspected that the measurement is affected by this condition, the grounding resistance of each auxiliary rod should be measured with a conventional earth tester so as to avoid reporting wrong values.

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## 8. Auto power-off

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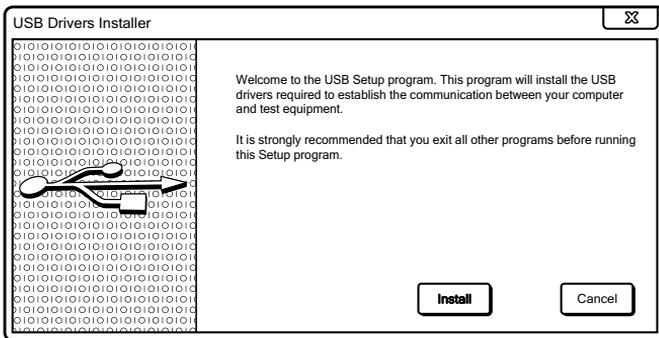
The **TM-25R** auto-turns off after 15 minutes of inactivity.

## 9. Software

### 9.1. USB Drivers

To install the USB drivers required for the communication between PC and equipment follow the instructions:

1. Connect the equipment in the PC using the USB cable.
2. If there is an available Internet connection, Windows will silently connect to the Windows Update website and install any suitable driver it finds for the device. If no suitable driver is automatically found then you need to insert the CD-ROM, supplied with the equipment, in the PC, run the executable “**usb-install.exe**” and click in “**Install**”.



### 9.2. ST-Logger software

This software makes communication between the equipment and a computer with Windows operative system easier. It makes possible to synchronize the date and time of the equipment internal clock with the computer date and clock, to transfer the stored data (as .TXT) and to clear the memory.

## 10. Technical specifications

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<b>Measurement ranges</b>	: 0 - 300 $\Omega$
<b>Operation frequency</b>	: 25000 Hz
<b>Test currents</b>	: 20 mA automatic
<b>Inductive component compensation</b>	: Through bank of capacitors integrated to the equipment Maximum capacity: 4.2 $\mu$ F Resolution: 10 nF
<b>Measurement accuracy</b>	: $\pm$ 2.5 % of reading $\pm$ 1 digit
<b>Display</b>	: Alphanumeric display (LCD)
<b>Max. earth resistance of auxiliary rods</b>	: 2000 $\Omega$ (current rod) 2000 $\Omega$ (voltage rod)
<b>Built-in memory</b>	: It allows for the storage of 2000 tests readings in its internal NVRAM memory.
<b>Interface</b>	: USB.
<b>Bluetooth</b>	: For remote control of the equipment through a tablet.
<b>Power supply</b>	: LiFePO4 12 V 6000 mA rechargeable battery or mains supply (AC Adapter).
<b>Battery charger</b>	: 12 V 2 A
<b>Operating temperature</b>	: -5°C to 50°C
<b>Storage temperature</b>	: -15°C to 65°C
<b>Humidity</b>	: Up to 95% RH (non condensing)
<b>Dimensions</b>	: 340 x 295 x 152 mm
<b>Equipment weight</b>	: Approx. 4.5 kg

## 10.1. Accessories

A set of accessories is provided with each earth tester. This set consists of the following:

4x	50 cm long steel core rods with copper coating
1x	Rod extractor
1x	70 m shielded cable
1x	50 m shielded cable
1x	30 m cable to current rod
1x	70 m cable to auxiliary potential rod
1x	50 m cable to auxiliary potential rod
1x	Cable adapter for current electrode
1x	AC Adapter
1x	Cable for connection to the unknown electrode (Tower)
1x	USB cable
1x	Case to carry accessories
1x	User guide

## 11. Warranty

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SOURCETRONIC warrants to the original purchaser that each equipment it manufactures will be free from defects in material and workmanship under normal use and service. The warranty period is valid for **12 months**, except the built-in rechargeable battery that has **6 months**, and begins on the date of shipment. The manufacturer's warranty does not apply to any product or accessories which, in the manufacturer's opinion, has been misused, altered, neglected, or damaged by accident or abnormal conditions of operation and handling.

To obtain warranty service, send the equipment, with a description of the difficult, shipping and insurance prepaid, to SOURCETRONIC. The manufacturer assumes no risk for damage in transit. SOURCETRONIC will, at its option, repair or replace the defective equipment free of charge. However, if SOURCETRONIC determines that the failure was caused by misuse, alteration, accident or abnormal condition or handling, you will be charged for the repair and the repaired equipment will be returned to you transportation prepaid.

This warranty is exclusive and is instead of all other warranties, express or implied, including but not limited to any implied warranty or merchantability or fitness for a particular purpose or use. SOURCETRONIC will not be responsible for any special, indirect, incidental, or consequential damages or loss of data, whether in contract, or otherwise.

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**Notes**

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