



# GP-2 GeoTest

## Instruction Manual



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# 1. PRECAUTIONS AND SAFETY MEASURES

This instrument complies with European Community (EC) standards: EN61557-1, EN61557-5 and EN 61010-1.



**WARNING:** For your safety as well as that of the instrument you are recommended to follow the procedures described in this instruction manual and carefully read all the notes preceded by the symbol .

Before and during measurements please carefully heed the instructions below:

- ☞ Do not measure in wet or dusty places;
- ☞ Do not measure in the presence of gas, explosive materials or combustibles;
- ☞ Do not touch the circuit under test if no measurement is being taken;
- ☞ Do not touch exposed metal parts, unused terminals, circuits, etc...
- ☞ Do not use the instrument if it seems to be malfunctioning (i.e. if you notice deformations, breaks, leakage of substances, absence of messages on the display etc...);
- ☞ Be particularly careful when measuring voltages higher than 25V in potentially hazardous areas (such as building sites, swimming pools and so on) and higher than 50V in any area, in order to avoid the risk of electrical shocks.

The following symbols are used in this manual:



**Warning:** Should you fail to keep to the prescribed instructions you could damage the instrument and/or its components or endanger your personal safety.



Switch

## 1.1. PRELIMINARY INSTRUCTIONS

- ☞ This instrument has been designed for use in environments with pollution rating 2. It can be used for tests on installations of excess voltage category III max 250V (phase to earth).
- ☞ Always keep to the usual safety standards intended to:
  - protect you against dangerous currents;
  - protect the instrument against incorrect operation.
- ☞ Only the accessories supplied with the instrument guarantee compliance with the safety standards. Accordingly, they must be used only when in good condition and, if necessary, they must be replaced with identical factory parts.

- ☞ Use the instrument in TT, TN, IT system and industrial, civil, medical electrical plants, in normal conditions (contact voltage limit 25V) and in particular condition (contact voltage limit 50V).
- ☞ Do not take measurements on circuits exceeding the specified current and voltage limits.
- ☞ Do not take measurements under conditions exceeding the limits stated in paragraphs 9.2.1 and 9.2.2.
- ☞ Make sure that the batteries are properly installed.
- ☞ BEFORE connecting the alligator clips to the circuit under test, make sure that the switch is in the correct position.
- ☞ Make sure that the display shows the same function as that to which the switch is set.

## 1.2. DURING USE

Please read carefully:



### **WARNING:**

Should you fail to keep to the prescribed instructions you could damage the instrument and/or its components or endanger your personal safety.

- ☞ Before setting, or changing, the switch position, disconnect the alligator clips from the circuit under test.
- ☞ When the instrument is connected to the circuit under test, do not touch any unused terminal(s).
- ☞ Do not take resistance measurements in the presence of external voltages; even if the instrument is protected, any excessive voltage may cause unit malfunction.



### **WARNING:**

If, during use, the symbol  appears, suspend the test and replace the batteries (see paragraph 8.2). **The instrument is able to keep in memory any previously saved data for approximately 10 minutes.**

## 1.3. AFTER USE

- ☞ After use, move the switch to the OFF position.
- ☞ If you do not expect to use the instrument for more than 30 days, remove the batteries.

## 2. GENERAL DESCRIPTION

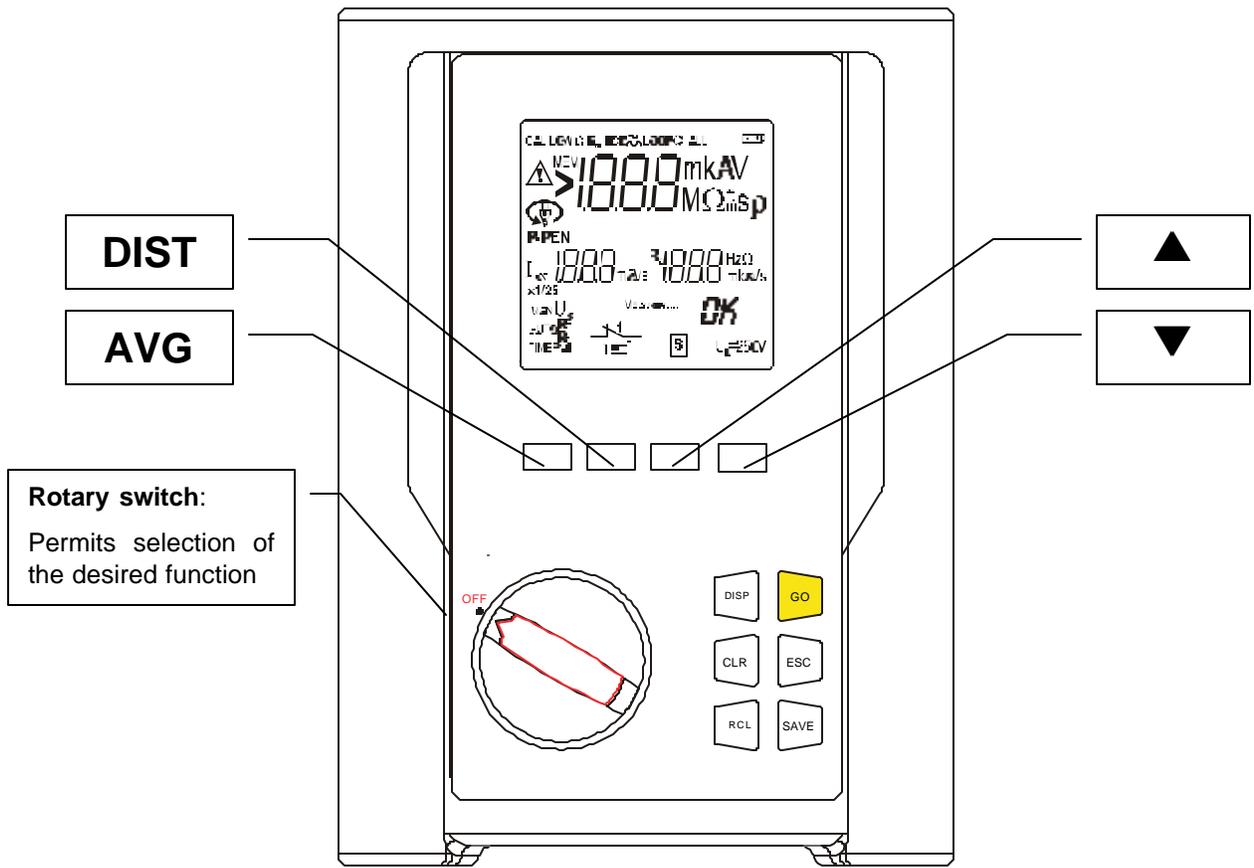
Thank you for purchasing a quality AMPROBE Test Instrument. This instrument will provide you with accurate and reliable measurements provided that it is used according to this manual's instructions

The GP-2 GeoTest is able to measure:

- ☞ **EARTH 2 WIRES:** 2 wires earth resistance
- ☞ **EARTH 3 WIRES:** 3 wires earth resistance
- ☞  **$\rho$ :** 4 wires earth resistivity

The GP-2 GeoTest uses the "Fall of potential" method of measurement for all of the above tests.

## 2.1. INSTRUMENT DESCRIPTION



**Figure 1: Front panel**

	 Displays the average value of the earth resistivity, calculated on the basis of all valid measurements taken.
	 Selects the distance "D" between the earth rods ( $\rho$ resistivity test).
	 Increases the value of the parameter D; Scrolls through the recorded test results; or Selects the unit m/ft.
	 Decreases the value of the parameter D; Scrolls through the recorded test results; or Selects the unit m/ft.
	 <b>Starts</b> a measurement.
	 Escape from (exit) the selected function or mode.
	 Saves test results.
	 Recall recorded test results.
	 Displays recorded data from the selected memory location.
	 Deletes: <ul style="list-style-type: none"><li>- the average value of the measurements and the number of the tests included in the average value calculations</li><li>- recorded test results from a specified memory location</li></ul>

## **3. PREPARING THE INSTRUMENT**

### **3.1. INITIAL CHECK**

This instrument has been carefully checked for proper electrical and mechanical function prior to shipment. All possible precautions have been taken in order to deliver it in the best possible condition.

Nevertheless, on receipt of the instrument we suggest that it be checked completely to make sure that no damage has occurred in transit. Should you find anomalies please contact the carrier immediately.

Please also make sure that the package contains all the accessories and parts listed in paragraph 9.3.1. In case of discrepancies please contact your dealer.

Should it be necessary to return the instrument, please refer to the instructions in paragraph 10.

### **3.2. POWER SUPPLY**

The instrument is powered by 6 size 'AA' 1.5V batteries ( LR6– AM3 – MN 1500) not included in the package.

For correct installation of the batteries see paragraph 8.2.

When the batteries are low the symbol  appears. For replacement see paragraph 8.2.

### **3.3. CALIBRATION**

The instrument complies with the standards mentioned in this manual. Its performance is guaranteed for one year from the date of purchase.

### **3.4. STORAGE**

To guarantee accurate measurements, after extended storage in severe environmental conditions please allow the unit to normalize to proper ambient conditions.(see environmental conditions listed at paragraph 9.2.1).

## 4. SWITCH FUNCTIONS

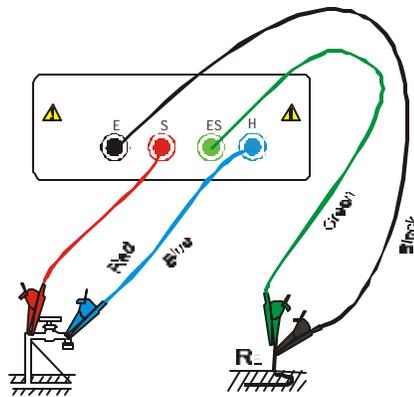
### 4.1. EARTH 2 WIRES

Whenever it is not possible to drive rods into the ground to take a 3-wire measurement, or in case of **TT installations** it is possible to use the simplified 2-wire method (Figure 2) which gives an excess (therefore safer) value.

To carry out the test a suitable *auxiliary rod* is necessary; a rod is “suitable” when its earth resistance is negligible and it is *independent* of the earth equipment under test.

In Figure 2 a water pipe has been used as *auxiliary rod*. However, any metal body driven into the ground can be used, provided that the above said requirements are met.

Although this test is not provided for by the CEI 64.8 standard at present, it gives a value, which many 3-wire comparison tests have proved to be revealing for earth resistance.

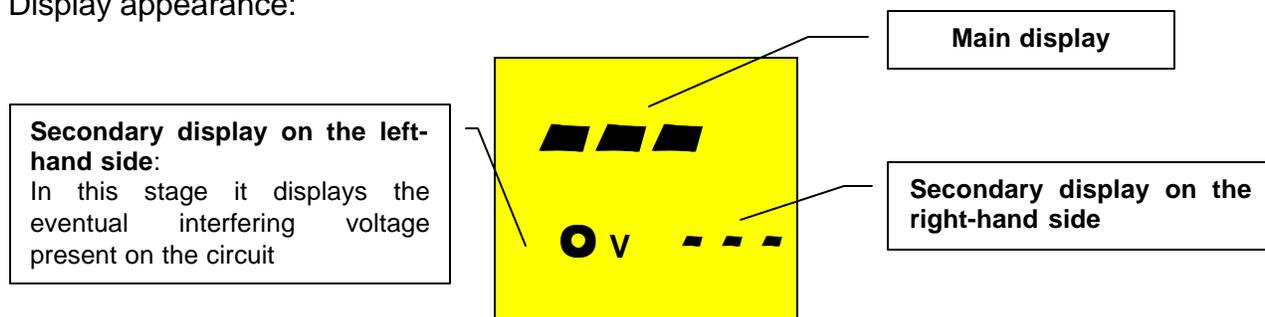


**Figure 2: 2 wire earth resistance measurement**

Measuring procedure:

- ☞ Insert the 4 connectors (black, red, blue and green) of the measuring cables into the corresponding input terminals of the instrument (E, S, H, ES).
- ☞ Connect the alligator clips as shown in Figure 2.
- ☞  Position the switch on **EARTH 2 WIRES**.

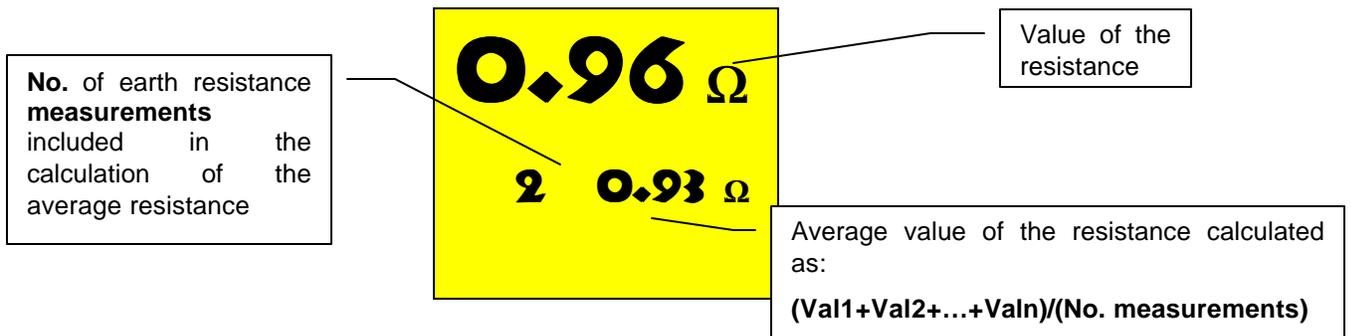
Display appearance:





Press **GO** to take the measurement and read the result on the display. At the end of the test, a screen similar to the following will be displayed.

**NOTE!** If you keep pressing **GO**, the instrument takes more measurements consecutively. When a new value is acquired, the symbol  $\Omega$  blinks on the main display, the instrument emits a short sound and the counter shown on the secondary display on the left-hand side is updated. This counter indicates the number of measurements calculated on the basis of the average resistance value.



**WARNING:**

When the message “**Measuring**” appears on the display, the instrument is measuring. **Do not disconnect the alligator clips during the measurement.**

Ex.: if the operator takes three measurements consecutively, the instrument will display:

- 1<sup>st</sup> measurement:  
main display = measured resistance value (Ex: 0.90Ω)  
secondary display on the left-hand side = 001 (no. of measurements = 1 means that 1 earth measurement has been taken)  
secondary display on the right-hand side = average of the measurements taken (in case just one measurement has been taken the average value is equal to the measured value, in this case 0.90Ω)
- 2<sup>nd</sup> measurement:  
main display = measured resistance value (Ex: 0.96Ω)  
secondary display on the left-hand side = 002 (no. of measurements = 2 means that 2 earth measurements have been taken consecutively)  
secondary display on the right-hand side = average of the measurements taken ((Val1+Val2)/no. of measurements = (0.90+0.96)/2 = 0.93Ω)
- 3<sup>rd</sup> measurement:  
main display = measured resistance value (Ex: 0.93Ω)

secondary display on the left-hand side = 003 (no. of measurements = 3 means that 3 earth measurements have been taken consecutively)  
secondary display on the right-hand side = average of the measurements taken  $((Val1+Val2)/no. of measurements = (0.90+0.96+0.93)/3 = 0.93\Omega)$

**NOTE!** A test with a result over 700Ω is not inserted in the calculation of average value.

**Example:**

1<sup>st</sup> measurement

Main display: 1,07Ω

Secondary display on the left-hand side: 1

Secondary display on the right-hand side: 1,07Ω

2<sup>nd</sup> measurement

Main display: 4,15Ω

Secondary display on the left-hand side: 2

Secondary display on the right-hand side: 2,61Ω

**3<sup>rd</sup> measurement (not inserted in the average value)**

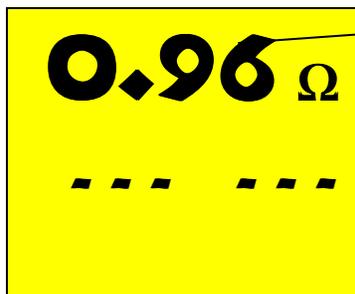
Main display: 1018Ω

Secondary display on the left-hand side: 2

Secondary display on the right-hand side: 2,61Ω

**CLR**

Press **CLR** if you want to cancel the average value of the resistance and the no. of measurements which are included in the calculation (displayed on the secondary displays on the right-hand side and on the left-hand side respectively). A screen similar to the following will be displayed:



Last value of resistance measured

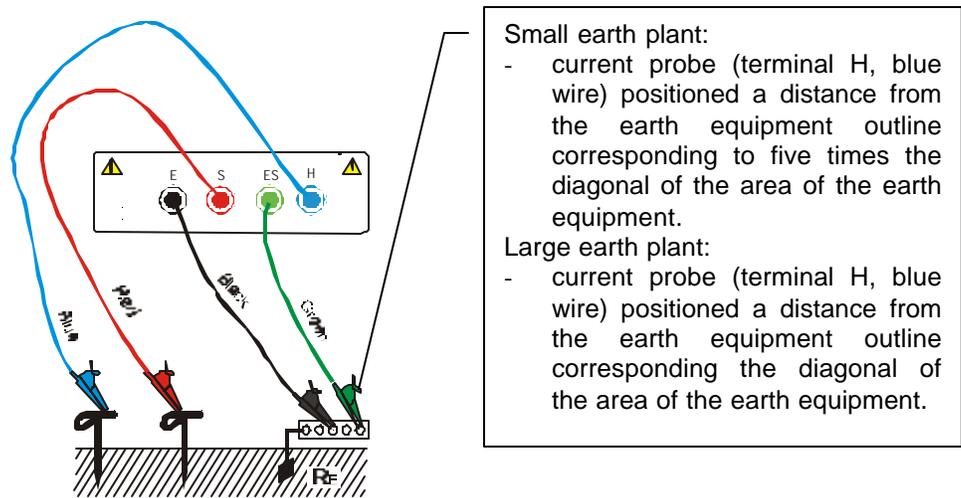
**SAVE**

The test results can be stored in memory by pressing **SAVE** (see paragraph 5.1).

**NOTE!** The resistance measurement is taken according to a 4-wire voltmetric method. Therefore, it is not affected by the resistance value of the cables used: it is not necessary to calibrate the cables or their extension.

## 4.2. EARTH 3 WIRES

The measurement is taken according to what is prescribed for CEI 64.8, IEC 781, VDE 0413, EN61557-5 standards.

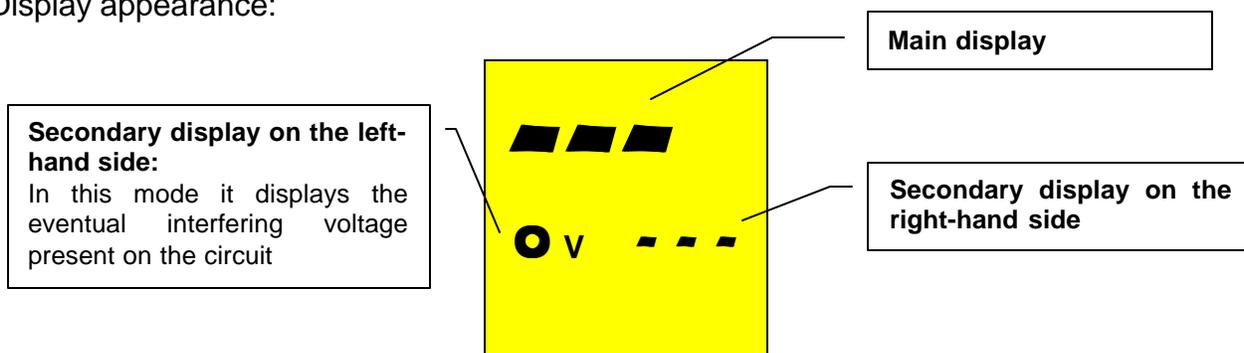


**Figure 3: 3 wires earth resistance measurement**

Measuring procedure:

- ☞ Insert the 4 connectors (black, red, blue and green) of the cables into the corresponding input terminals of the instrument (E, S, H, ES).
- ☞ Connect the alligator clips as shown in Figure 3.
- ☞  Position the switch to **EARTH 3 WIRES**.

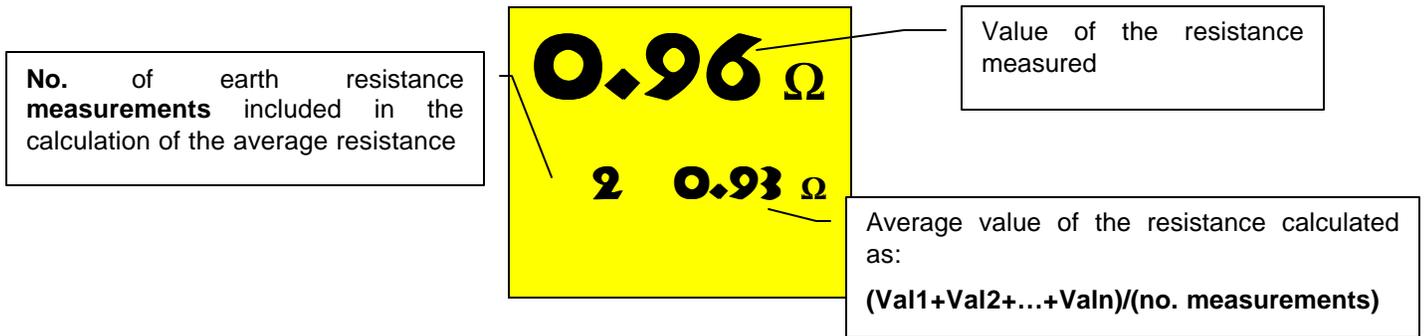
Display appearance:



Press **GO** to take the measurement and read the value on the display. At the end of the test, a screen similar to the one below will be displayed.

**NOTE!** If you keep pressing **GO**, the instrument takes more measurements consecutively. When a new value is displayed, the symbol  $\Omega$  blinks on the main display, the instrument emits a short sound and the counter shown on the

secondary display on the left-hand side is updated. This counter indicates the quantity of measurements included in the calculation of the average resistance value.



**WARNING:**

When the message “**Measuring**” appears on the display, the instrument is measuring. **Do not disconnect the alligator clips during the measurement.**

Ex.: if the operator takes three measurements consecutively, the instrument will display:

- 1<sup>st</sup> measurement:  
main display = measured resistance value (Ex: 0.90Ω)  
secondary display on the left-hand side = 001 (no. of measurements = 1 means that 1 earth measurement has been taken)  
secondary display on the right-hand side = average of the measurements taken (in case just one measurement has been taken the average value is equal to the measured value, in this case 0.90Ω)
- 2<sup>nd</sup> measurement:  
main display = measured resistance value (Ex: 0.96Ω)  
secondary display on the left-hand side = 002 (no. of measurements = 2 means that 2 earth measurements have been taken consecutively)  
secondary display on the right-hand side = average of the measurements taken  $((Val1+Val2)/no. of measurements = (0.90+0.96)/2 = 0.93Ω)$
- 3<sup>rd</sup> measurement:  
main display = measured resistance value (Ex: 0.93Ω)  
secondary display on the left-hand side = 003 (no. of measurements = 3 means that 3 earth measurements have been taken consecutively)  
secondary display on the right-hand side = average of the measurements taken  $((Val1+Val2)/no. of measurements = (0.90+0.96+0.93)/3 = 0.93Ω)$

**NOTE!** A test with a result over  $700\Omega$  is not inserted in the calculation of average value.

**Example:**

1<sup>st</sup> measurement

Main display:  $1,07\Omega$

Secondary display on the left-hand side: 1

Secondary display on the right-hand side:  $1,07\Omega$

2<sup>nd</sup> measurement

Main display:  $4,15\Omega$

Secondary display on the left-hand side: 2

Secondary display on the right-hand side:  $2,61\Omega$

**3<sup>rd</sup> measurement (not inserted in the average value)**

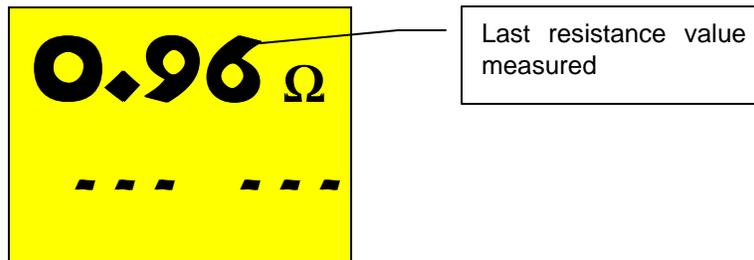
Main display:  $1018\Omega$

Secondary display on the left-hand side: 2

Secondary display on the right-hand side:  $2,61\Omega$

**CLR**

Press **CLR** if you want to cancel the average resistance value and the no. of measurements, which are included in the calculation (displayed on the secondary displays on the right-hand side and on the left-hand side respectively). A screen similar to the following will be displayed:



**NOTE!** The resistance measurement is taken according to a 4-wire voltmetric method. Therefore, it is not affected by the resistance value of the cable used: it is not necessary to calibrate the cables or their extension.

**SAVE**

The test results can be stored in memory by pressing **SAVE** (see paragraph 5.1)

### 4.3. "r" MODE (Resistivity of the Earth)

The measurement is taken according to CEI 64.8, IEC 781, VDE 0413, EN61557-5 standards.

#### 4.3.1. Selecting the units of measure



**WARNING** Whenever the units of measure are changed the instrument will perform a hard reset and all the data in the memory will be erased (see paragraph 6.1).

#### SELECT THE UNIT

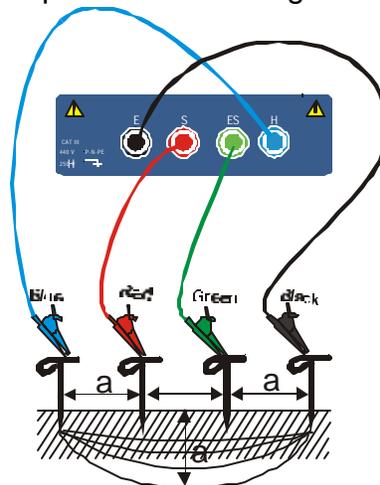
press and hold the "RCL" key and turn the rotary switch. The instrument will display a screen that permits selection of the correct measurement unit: m or ft (used to determine distance between the ground rods) with the ▲ or ▼ keys. Press the SAVE or ESC key to save the measurement unit selected.

**NOTE!** Regardless on the unit of distance **D** set up (either ft or m) the resistivity will be automatically calculated in OhmMeters!

#### 4.3.2. Operating Instructions

Measuring procedure:

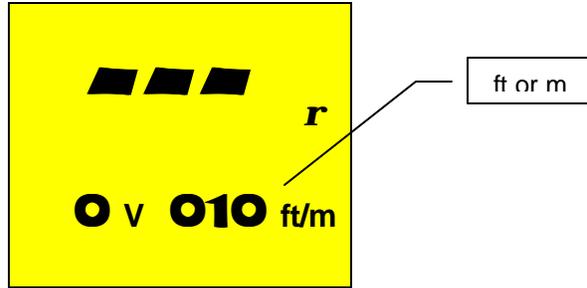
- ☞ Drive the 4 earth rods into the ground at the same distance **D**. The distance **D** between the rods is usually 3 to 30 ft (1 to 10 m).  
The distance **D** between the rods determines the depth at which the earth resistivity is measured. In order to identify the distance (and therefore depth) corresponding to the lowest resistivity value, the test must be repeated several times, positioning the rods at different distances. This depth will then have to be physically reached by the rods of the earth equipment.
- ☞ Insert the 4 connectors (black, red, blue and green) of the cables into the corresponding input terminals of the instrument (E, S, H, ES).
- ☞ Connect the alligator clips as shown in Figure 4.



**Figure 4: 4 wire earth resistivity measurement**

 Position the switch on **r**.

Display appearance:

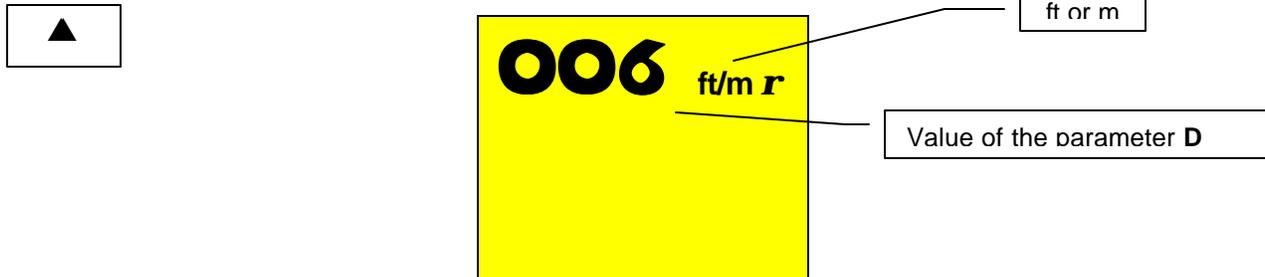


**DIST** To select the distance **D** between the rods. This parameter can be chosen from the following values (expressed in ft/m):

3, 6, 9, 12, 15, 18, 21, 24, 27, 30

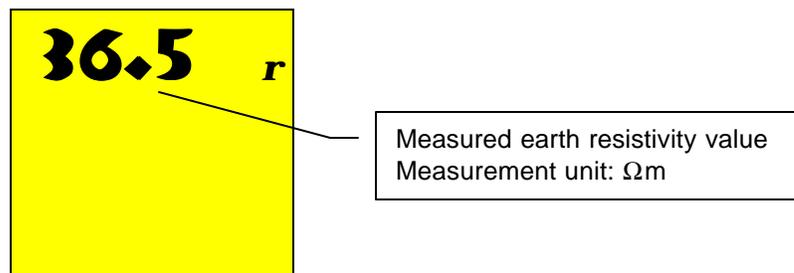
1, 2, 3, 4, 5, 6, 7, 8, 9, 10

 Press **▲** or **▼** to select the value of the parameter **D**:



**ESC** Press **ESC** to confirm the value previously set.

**GO** Press **GO** to take the measurement and read the value on the display. At the end of the test a screen similar to the one following will be displayed.



**NOTE!** Regardless on the unit of distance D, which is set up (either ft or m) the resistivity will be automatically calculated in OhmMeters!



**WARNING:** When the message “**Measuring**” appears on the display, the instrument is measuring. **Do not disconnect the alligator clips during the measurement.**

**NOTE!** If you keep pressing **GO**, the instrument takes more measurements consecutively. When a new value is acquired, the symbol  $\Omega\text{m}$  blinks on the main display, the instrument emits a short sound and, if the measured value is inserted in the calculation of the average resistivity value, the message “**Add**” appears on the secondary display on the right-hand side.

The earth resistivity value is an indispensable parameter to calculate the resistance value of the rods, which will be used for the earth equipment (see paragraph 11.2).

**AVG**

Use **AVG** to display the average resistivity value measured. This key is enabled only when the message “Add” appears on the secondary display on the left-hand side.

**NOTE!** The value of the resistivity corresponding to a resistance value over  $700\Omega$  is not inserted in the calculation of average value.

**Example:**

1<sup>st</sup> measurement

Main display: 6.6  $\Omega\text{m}$

Secondary display on the right-hand side: empty

2<sup>nd</sup> measurement

Main display: 26  $\Omega\text{m}$

Secondary display on the right-hand side: Add

Press AVG: main display: 16.4  $\Omega\text{m}$

secondary display on the left-hand side: 2

secondary display on the right-hand side: Add

**3<sup>rd</sup> measurement (not inserted in the average value)**

Main display: 6.3  $\text{k}\Omega\text{m}$

Secondary display on the right-hand side: Add

Press AVG: main display: 16.4  $\Omega\text{m}$

secondary display on the left-hand side: 2

secondary display on the right-hand side: Add

**ESC**

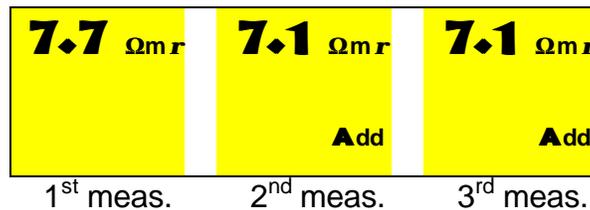
Use **ESC** to leave the screen showing the average value and return back to the screen corresponding to the last measurement taken.



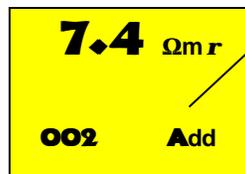
Press **SAVE** to store the test results in memory (see paragraph 5.1).

**Example:**

You position the rods at a distance **D** of 3 feet and take 3 resistivity measurements:



- a) 1<sup>st</sup> measurement: you see the measured value but not the message "Add".
- b) 2<sup>nd</sup> measurement: you see the message "Add". This means that the second measurement is included in the calculation of the average; by pressing **AVG** you will get also the average value calculated.



This screen appears after press in AVG

The "002" indicates that 7.4Ωm is the average value calculated as the average between the two values previously measured.

Press **ESC** to return back to the screen corresponding to the second measurement. Upon returning back to the second measurement, press **CLR** if you want to cancel the average value calculated and the corresponding counter.

- c) 3<sup>rd</sup> measurement: as with point b) above, but the average value is calculated as average between the three values measured.

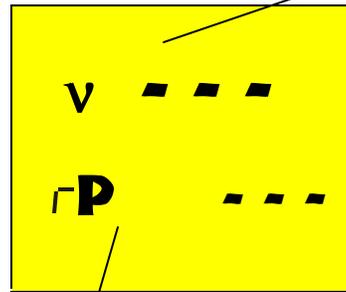


This screen appears after pressing AVG

The "003" indicates that 7.3Ωm is the average value calculated as average between the three values previously measured.

### 4.4. ANOMALOUS SITUATIONS WHICH CAN OCCUR DURING TESTS

☞ If the voltmetric circuit (red and green cables) is interrupted, when pressing **GO** the instrument will not read the minimum voltage, therefore a screen similar to the one beside appears. Make sure that the terminals are connected correctly and that the voltmetric rod (red conductor) has not been driven into a gravelly or scarcely conductive ground. If necessary, pour water around the rod.

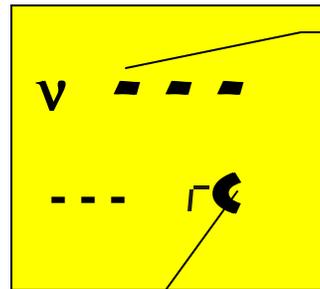


**WARNING**

rP indicates an high resistance value.

**SAVE** **THIS RESULT CANNOT BE SAVED.**

☞ If the amperometric circuit is interrupted, when pressing **GO** the instrument will not read the minimum current, therefore a screen similar to the one beside appears. Make sure that the terminals are connected correctly and that the amperometric rod (blue conductor) has not been driven into a gravelly or scarcely conductive ground. If necessary, pour water around the rod.

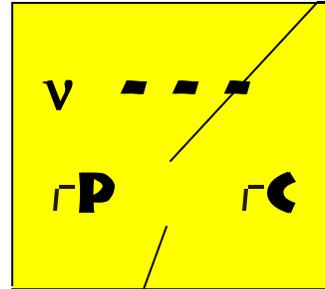


**WARNING**

rC indicates an high resistance value.

**SAVE** **THIS RESULT CANNOT BE SAVED.**

☞ In case **both the amperometric circuit and the voltmetric circuit are interrupted**, when pressing **GO** the instrument will not read the minimum current nor the minimum voltage, therefore a screen similar to the one beside appears. Make sure that the terminals are connected correctly and that the amperometric and voltmetric rods (blue and red conductors) have not been driven into a gravelly or scarcely conductive ground. If necessary, pour water around the rod.



**WARNING**

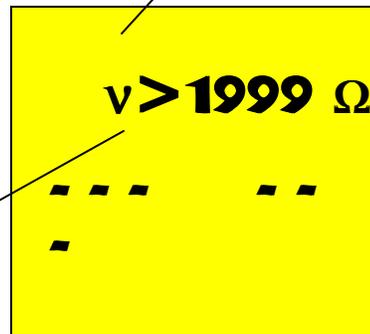
rC and rP indicate an high resistance value both for the voltmetric circuit and for the amperometric circuit.

**SAVE**

**THIS RESULT CANNOT BE SAVED.**

☞ If the resistance measurement is higher than the full scale of the instrument, when pressing **GO** the instrument performs the test and a screen similar to the one beside appears.

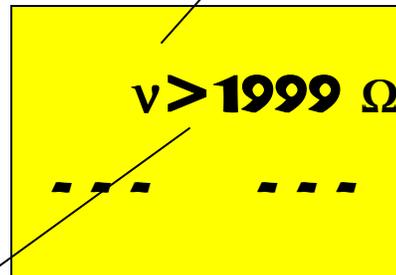
1999Ω is the full scale of the instrument.



**WARNING**

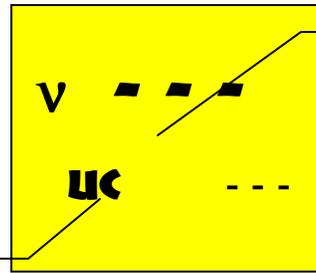
☞ If the resistivity measurement is higher than the quantity **1999x6.28x(distance between the rods selected)** when pressing **GO** the instrument performs the test and a screen similar to the one beside appears.

1999Ω is the full scale of the instrument.



**WARNING**

☞ If the instrument measures **an interfering voltage higher than 30V on the amperometric circuit**, it does not perform the test and a screen similar to the one beside appears.



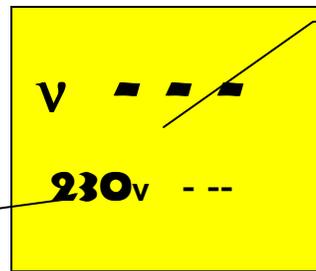
**WARNING**

UC indicates the presence of too high voltage on the amperometric circuit.

**SAVE**

**THIS RESULT CANNOT BE SAVED.**

☞ If the instrument measures **an interfering voltage higher than 5V on the voltmetric circuit**, it does not perform the test and a screen similar to the one beside appears.



**WARNING**

Interfering voltage measured.

**SAVE**

**THIS RESULT CANNOT BE SAVED.**

## 5. HOW TO SAVE, RECALL AND CANCEL DATA

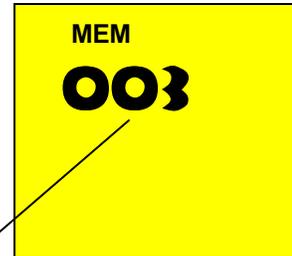
### 5.1. TO SAVE: "SAVE" KEY

If you want to save the test results:



Press **SAVE** once.

A screen similar to the one beside is displayed for 3 seconds, the instrument emits a sound, then the screen corresponding to the last measurement taken is displayed.



No. of memory location where the measure has been saved.

## 5.2. TO RECALL: "RCL" KEY

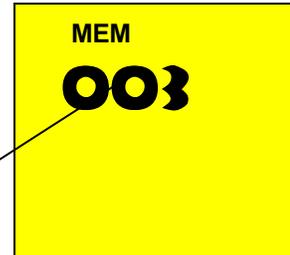
If you want to review the test results:



Press **RCL**.

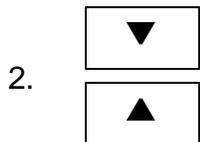
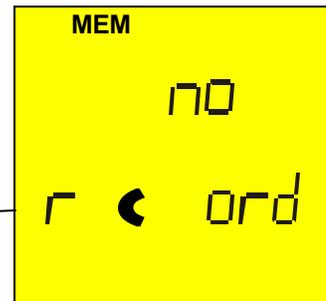
If the memory contains measurements, a screen similar to the one beside will be displayed.

No. of last memory location occupied.



If the memory is empty, a screen similar to the one beside will be displayed.

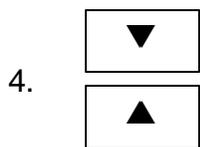
Message "rEc ord":  
the memory contains no values,  
therefore it is impossible to recall them.



Press ▼, ▲ to select the number of the memory location you wish to consult.



Press **DISP** to display the test result associated to the selected memory location.



Press ▼, ▲ to run over the saved results.



Press **DISP** again to review the memory locations again.



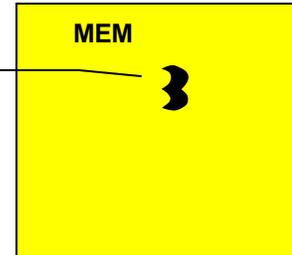
Press **ESC** at any time to leave the memory and return to the selected measuring function.

### 5.3. TO CANCEL: "CLR" KEY

If you want to delete the test results:

1.  Press **RCL**. A screen similar to the following will be displayed:

No. of the last memory location occupied.



2.   
 Press **▼**, **▲** to select the number of the memory location.

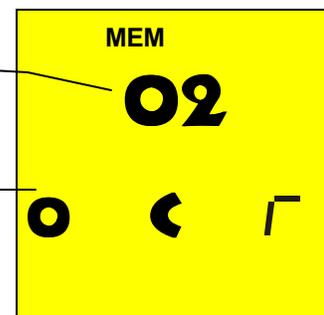
**NOTE!** when you cancel data the instrument cancels all the saved data from the **SELECTED** location up to the last memory location occupied.

3.  Press **DISP** to display the test result associated with the selected memory location. Press **DSP** again to review the memory locations.

4.  Press **CLR**. The secondary displays are blinking.

No. of last memory location which will be cancelled.

No. of the last memory location occupied. If you press CLR twice the instrument will cancel the memory locations from no. 2 to no. 8.



At this point you have two possibilities:

 Press **CLR** again to **cancel the test results from the selected location (main display) through the last location saved (secondary display on the left-hand side)**

 Press **ESC once** to abort the cancellation and return to the number of the memory location.



Press **ESC** again to return to the selected measuring function.

Ex.: 97 test results have been saved.

You want to clear from the 43<sup>rd</sup> to the 97<sup>th</sup> location.

- Press RCL.
- Select the 43<sup>rd</sup> memory location using ▼ and ▲.
- Press CLR. The symbol “ ◐ ◑ ” will blink on the secondary display on the right-hand. The number 43 will appear on the main display and the number 97 will appear on the secondary display on the left-hand side.
- Press CLR to erase saved data from the 43<sup>rd</sup> to the 97<sup>th</sup> location.

## 6. RESET AND DEFAULT PARAMETERS

This paragraph describes the HARD RESET procedure and the default parameters set when a HARD RESET procedure is performed.

### 6.1. HARD RESET

**NOTE! BEFORE RESETTING, TRANSFER ALL SAVED DATA TO A PC.**

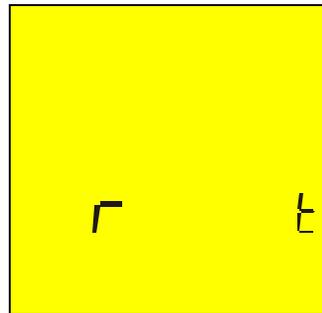
1. Depress and hold the **CLR** key while turning on the instrument by rotating the switch.

2.

This screen is displayed for 5 seconds.

**The reset has been performed.**

The screen corresponding to the selected function is displayed.



**NOTE!** As a consequence of the HARD RESET procedure **all the saved is deleted** and the parameter DST (distance between the rods, resistivity measurement) returns to the default value.

### 6.2. DEFAULT PARAMETERS

The default parameters automatically set when a HARD RESET procedure is performed are the following:

#### 6.2.1. Default parameters

Parameter	Default parameter set with the RESET procedure
Parameter DST = distance between the rods, resistivity measurement	DST = 1
Test results contained in the memory	Memory empty

## 7. CONNECTING THE INSTRUMENT TO A PC

Connect the instrument to a PC through the RS-232 port with the supplied cable.

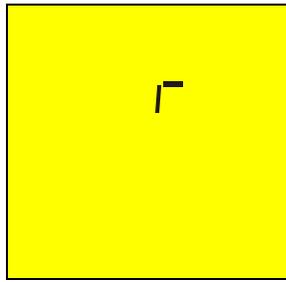
Refer to software manual for information how to set up software for download.

In order to transfer recorded data to a PC follow this procedure:



Position the **switch** on **RS232**.

Proceed as indicated in the manual of the management software.



**NOTE!** the transmission speed of the GP-2 is **9600 baud** (see software manual).

**NOTE!** On RS232, the instrument will switch off automatically 2 minutes after the last selecting command from a PC. .

## 8. MAINTENANCE

### 8.1. GENERAL

GP-2 GeoTest is a precision instrument. During its use and for its storage follow the recommendations and instructions contained in this manual in order to avoid possible damage or danger.

Never use the instrument in environments with a high humidity or temperature.

Do not expose the instrument to direct sunlight.

Always turn off the instrument after use. If you expect to not use it for extended periods, remove the batteries.

### 8.2. BATTERY REPLACEMENT

When the symbol  appears, the batteries must be replaced.



#### **WARNING:**

Only qualified technicians can perform this operation.  
Before replacing the fuse/fuses disconnect the alligator clips from circuit under voltage in order to avoid electrical shocks.  
**The tester is capable of keeping the values stored for approx. 10 minutes.**

1. Disconnect the cables from the input terminals.
2. Set the switch to the OFF position.
3. Remove the battery cover screws and then remove the cover.
4. Replace the batteries with 6 new ones of the same type: 1.5V– AA (– LR6– AM3 – MN 1500).
5. Reposition the cover and replace the screws.

### 8.3. CLEANING

Use a soft dry cloth to clean the instrument. Do not use wet clothes, solvents, water etc.

## 9. TECHNICAL SPECIFICATIONS

### 9.1. TECHNICAL FEATURES

#### Resistance measurement

Range (**) ( $\Omega$ )	Resolution ( $\Omega$ )	Accuracy (*)
0.01 ÷ 19.99	0.01	±(2% reading + 3 digits)
20.0 ÷ 199.9	0.1	
200 ÷ 1999	1	

(\*) If  $R_P > 100R_E$  and/or  $R_C > 100R_E$ ,  $R_P > 50k\Omega$  and/or  $R_C > 50k\Omega$ , if the instrument carries out the test the accuracy of the instrument is  $\pm(10\% \text{Reading})$

$R_P$  = resistance of the voltage circuit

$R_C$  = resistance of the current circuit

$R_E$  = earth resistance

(\*\*) Automatic selection of the range.

Measuring frequency 125Hz / 75Hz/ 41.66Hz

Measuring current 10mA

Open-terminal measuring voltage 25Vrms

Waveform of measuring voltage: sine wave

Interfering voltage:

- amperometric circuit: the measurement is taken with the stated accuracy if the interfering voltage is  $\leq 3V$ , while for interfering voltages between 3 and 30V inclusive, the accuracy decreases progressively; with an interfering voltage of about 30V the instrument does not perform the test.
- voltmetric circuit: the measurement is taken if the interfering voltage is  $\leq 3V$ ; in case of higher voltages the instrument does not perform the test.

## Resistivity measurement $\rho$

Range (**)	Resolution	Accuracy (*)
0.6-125.6 $\Omega\text{m}$	0.1 $\Omega\text{m}$	$\pm(2\% \text{ reading} + 3 \text{ digits})$
0.125 – 1.256 $\text{k}\Omega\text{m}$	0.001 $\text{k}\Omega\text{m}$	
1.25-19.99 $\text{k}\Omega\text{m}$	0.01 $\text{k}\Omega\text{m}$	
20.0 – 199.9 $\text{k}\Omega\text{m}$	0.1 $\text{k}\Omega\text{m}$	

(\*) If  $R_P > 100R_E$  and/or  $R_C > 100R_E$ ,  $R_P > 50\text{k}\Omega$  and/or  $R_C > 50\text{k}\Omega$ , if the instrument carries out the test the accuracy of the instrument is  $\pm(10\% \text{ Reading})$

$R_P$  = resistance of the voltage circuit

$R_C$  = resistance of the current circuit

$R_E$  = earth resistance

$\rho = 2\pi D R_E$  = calculated resistivity

(\*\*) Automatic selection of the range

Measuring frequency 125Hz / 75Hz/ 41.66Hz

Measuring current 10mA

Open-terminal measuring voltage 25Vrms

Waveform of measuring voltage: sine wave

Interfering voltage:

- amperometric circuit: the measurement is taken with the stated accuracy if the interfering voltage is  $\leq 3\text{V}$ , while for interfering voltages between 3 and 30V inclusive, the accuracy decreases progressively; with an interfering voltage of about 30V the instrument does not perform the test.

- voltmetric circuit: the measurement is taken if the interfering voltage is  $\leq 3\text{V}$ ; in case of higher voltages the instrument does not perform the test.

## Interfering voltage measurement

Range (V)	Resolution (V)	Accuracy
500	1	$\pm(2\% \text{ reading} + 2 \text{ digits})$

## Safety standards

This instrument complies with EN 61010, EN 61557-1, EN 61557-5 standards.

Insulation class 2, double insulation

Pollution 2

Maximum altitude 2000m

Surge voltage category CAT III 250V (phase to earth)

## General features

### Mechanical features

Dimensions: 222 (L) x 162 (W) x 57 (H) mm  
Weight (batteries included): about 1000g

### Power supply

Batteries: 6 batteries 1.5 V size AA ( LR6 — AM3 – MN 1500)

Low battery indication: The symbol  appears on the display when the battery voltage is low.

Battery life: about 300 measurements

Fusible Link: F 100 mA (not accessible to the operator)

Auto Power Off: the instrument will automatically switch off 2 minutes after last selecting a function or PC command.

### Display

Features: standard LCD 65mm x 65mm.

Memory: 999 memory locations

Interfaces: opto-insulated serial output RS232 to transfer data to a PC.

## 9.2. OPERATING CONDITIONS

### 9.2.1. Environmental conditions

Reference temperature:	73 ± 41 F	(23° ± 5°C)
Operating temperature:	14 ± 122 F	(-10°C ÷ 50 °C)
Relative humidity:	<80%	
Storage temperature:	-4 ± 140 F	(-20 ÷ 60 °C)
Storage humidity:	<70%	

### 9.2.2. EMC

This instrument has been designed in compliance with the EMS standards in force and its compatibility has been tested for:

Irradiated emissions:	EN55011
Immunity:	EN50140, EN 61000
Electrostatic discharges:	EN61000-4-2
R.F. range:	EN50140
Fast transient:	EN61000-4-4

## 9.3. ACCESSORIES

### 9.3.1. Standard and optional accessories

Standard accessories *	Code
- 1 carrying case containing: - 4 earth rods - 4 cables banana-crocodile	GP-2CON
Carrying case	GP-2CC
Optical serial cable	C2000
Software and manual	<a href="http://www.amprobe.com">www.amprobe.com</a>

## 10. SERVICE

### 10.1. WARRANTY

This instrument is guaranteed against any defects in material and manufacturing for one year, in compliance with the general sale terms and conditions. During the warranty period all defective parts may be replaced, but the manufacturer reserves the right to repair or replace the product.

If the instrument is to be returned, its transport expenses must at the customer's expense. Shipping instructions may be obtained by contacting the factory. A Return Material Authorization (RMA) number must be obtained from the factory prior to return.

A report should accompany the returned product, stating the reason(s) for return.

The unit should be packed in its original carton or equivalent; any damage that may be due to non-original packing shall be charged to the customer.

The manufacturer disclaims any responsibility for damages caused to people and/or objects.

The Warranty is not applicable in the following cases:

- Any repair and/or replacement of accessories and the battery (not covered by the guarantee).
- Any repair that might be necessary as a consequence of a misuse of the instrument or of its use with non-compatible devices.
- Any repair that might be necessary as a consequence of improper packaging.
- Any repair that might be necessary as a consequence of attempted service carried out by unauthorized personnel.
- Any change to the instrument carried out without the express authorization of the manufacturer.
- Use not intended for as per the instrument specifications or in the instruction manual.

The content of this manual cannot be reproduced in any form whatsoever without express authorization of the manufacturer.

**This product is patented and its trade mark registered. The manufacturer reserves the right to modify the product specifications without prior notification.**

### 10.2. SERVICE

If the instrument does not work properly, before returning, check the cables and replace them, if necessary.

Should the instrument still operate improperly, check that the operation procedure is correct and corresponds to the instructions given in this manual.

If the instrument is to be returned, its transportation is at the customer's expense. Shipping instructions may be obtained by contacting the factory. A Return Material Authorization (RMA) number must be obtained from the factory prior to return.

A report should accompany the returned product, stating the reason(s) for return. The unit should be packed in its original carton or equivalent; any damage that may be due to non-original packing shall be charged to the customer. The manufacturer disclaims any responsibility for damages caused to people and/or objects.

## 11. PRACTICAL REPORTS FOR ELECTRICAL TESTS

### 11.1. EARTH RESISTANCE MEASUREMENT

#### PURPOSE OF THE TEST

This test is carried out to make sure that the protective device is coordinated with the earth resistance value. You cannot take off hand a limit earth resistance value as a reference for the test result: occasionally you must make sure that the prescribed coordination is respected.

#### EQUIPMENT PARTS TO BE TESTED

The earth equipment and its working conditions. The test must be carried out without disconnecting the earth references.

#### ADMISSIBLE VALUES

The earth resistance value, however measured, must meet the following requirement:

$$R_E < 50 / I_a$$

where:  $R_E$ = measured resistance of the earth equipment. The value can be determined with the following tests:

- earth resistance with 3-wire voltmetric method
- loop impedance (see (\*))
- 2-wire earth resistance (see (\*\*))
- 2-wire earth resistance in the socket (see (\*\*))
- earth resistance given by the contact voltage  $U_t$  (see (\*\*)).
- earth resistance given by tripping time of RCDs (A, AC), RCD S (A, AC) (see (\*\*)).

$I_a$ = tripping time in 5s increments of the automatic switch; nominal tripping current of the RCD (in case of RCD S 2  $I_{\Delta n}$ ).

**50**= Limit safety voltage (reduced to 25V for special places).

(\*) In presence of an RCD the test must be carried out on the RCD upstream or downstream, bypassing it to avoid its intervention.

(\*\*) These methods, even if not yet prescribed for by the CEI 64.8 standard, give values which many 3-wire comparison tests proved to be revealing for earth resistance.

## EXAMPLE OF EARTH RESISTANCE MEASUREMENT

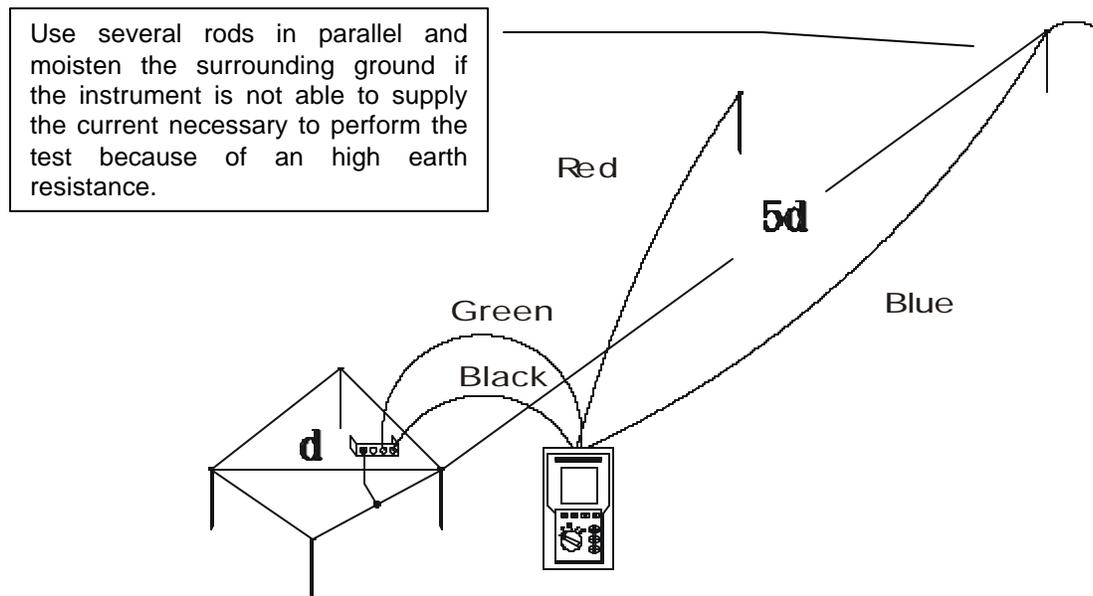
You must test equipment protected by a RCD at 30 mA. Measure the earth resistance according to one of the above-described methods. In order to check whether the resistance complies to the standards in force, multiply the value for 0.03A (30 mA). If the result is lower than 50V (or 25V for special places) the equipment is to be considered as coordinated as it meets the above stated requirement.

In case of RCDs at 30 mA (used for nearly the totality of civil equipment) the maximum earth resistance admitted is  $50/0.03=1666\Omega$ . This also permits use of the simplified methods described, which give an approximate value (although not extremely precise) for the calculation of the coordination.

## VOLTAMPEROMETRIC METHOD

### For small earth plant

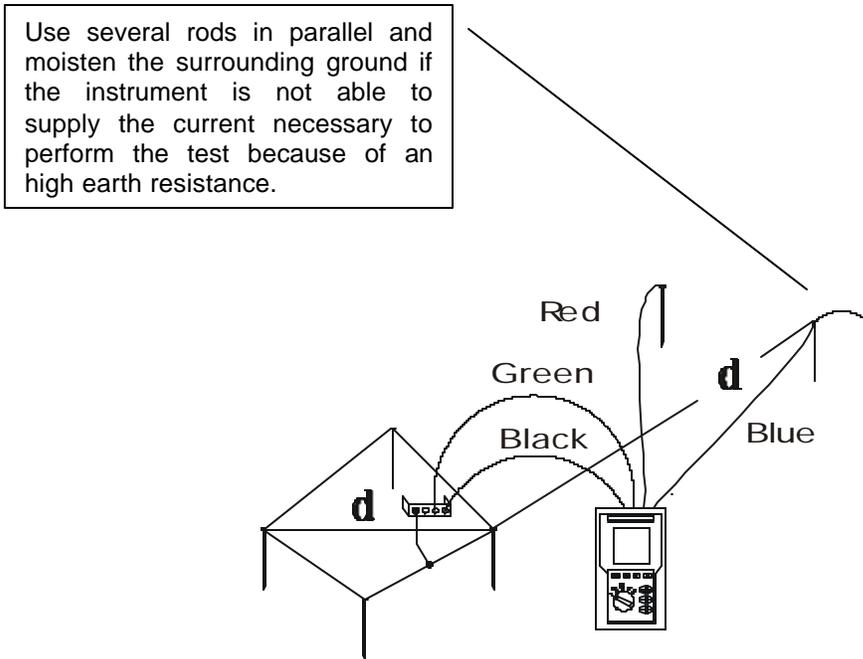
Let a current circulate between the earth rod and a current probe positioned at a distance from the earth equipment outline corresponding to five-times the diagonal of the area delimiting the earth equipment (see Figure 5). Position the voltage probe halfway between the earth rod and the current probe, then measure the voltage between the two.



**Figure 5: Earth resistance measurement (voltamperometric method for small earth plant)**

**For large earth plants**

This procedure is also based on the voltamperometric method, but it is mainly used when it is difficult to position the auxiliary current rod at a distance corresponding to five-times the diagonal of the area of the earth equipment. Position the current probe at a distance equal to the diagonal of the area of the earth equipment (see Figure 6). To make sure that the voltage probe is positioned outside the area affected by the rod under test, take more measurements, first positioning the voltage probe halfway between the rod and the current probe, then moving the probe both towards the earth rod and towards the current probe.



**Figure 6: earth resistance measurement (voltamperometric method for big earth plant)**

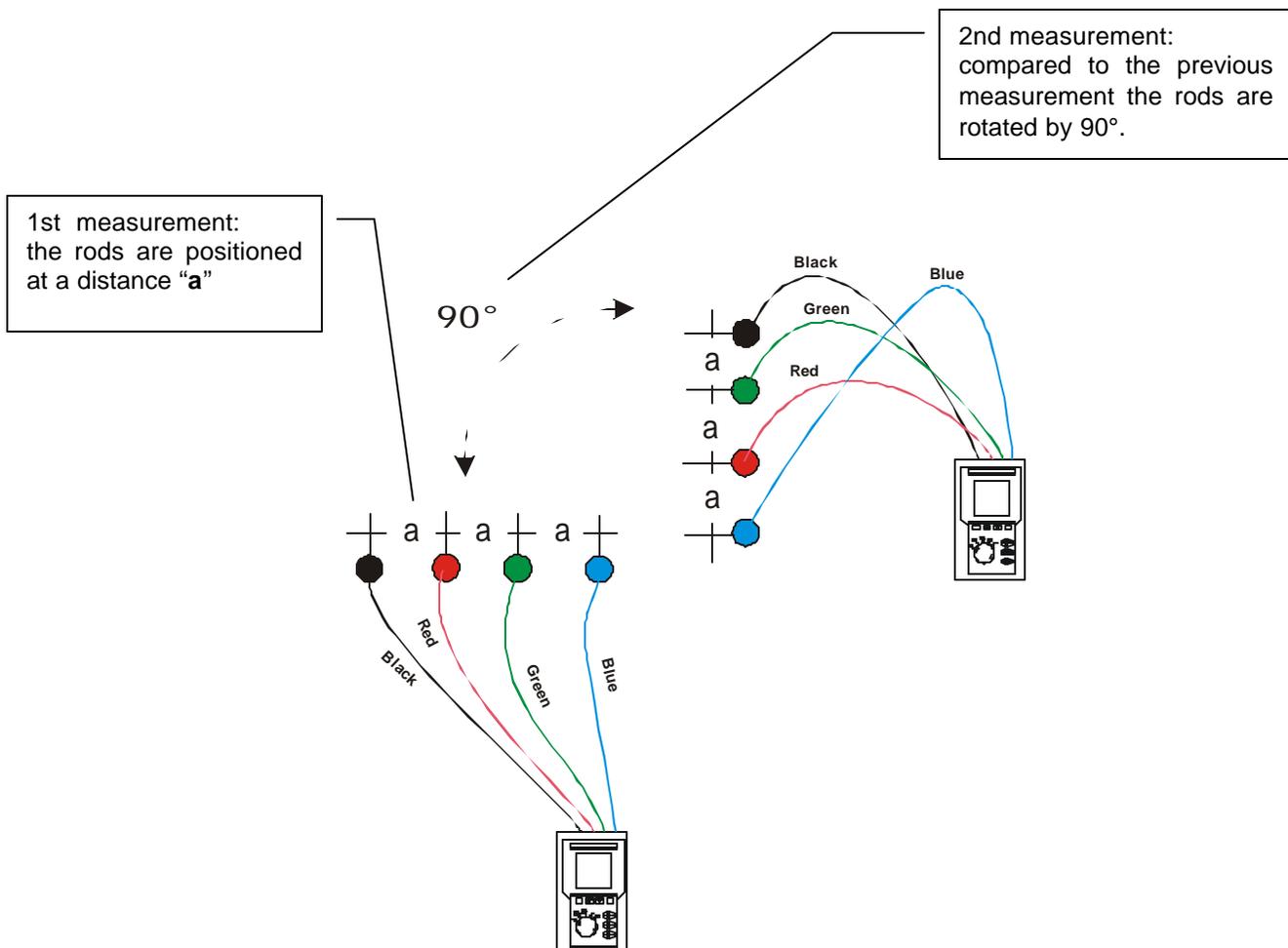
## 11.2. EARTH RESISTIVITY MEASUREMENT

### PURPOSE OF THE TEST

This test is intended to analyze the resistivity value of the ground in order to define the type of rods to be used.

### EQUIPMENT PARTS TO BE TESTED

For the resistivity test admissible values do not exist. The various values measured by positioning the rods at growing distances "a" must be quoted in a graph. According to the resulting curve, suitable rods will be chosen. As the test result can be affected by metal parts buried (such as pipes, cables or other rods), in case of doubt take a second measurement positioning the rods at an equal distance "a", but rotating their axis by 90°.



The resistivity value is calculated with the following formula:

$$\rho = 2\pi aR$$

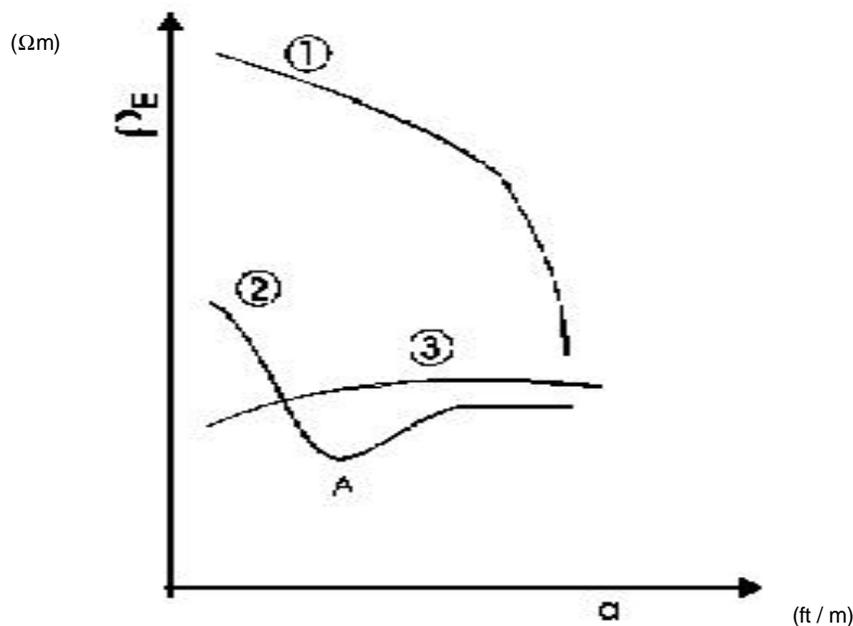
where:  $\rho$  = specific resistivity of the ground ( $\Omega\text{m}$ )  
 $a$  = distance between the rods (ft/m)  
 $R$  = resistance measured by the instrument ( $\Omega$ )

The measuring method allows definition of the specific resistance up to the depth approximately corresponding to the distance “a” between the rods. If you increase the distance “a” you can reach deeper ground layers and check the ground homogeneity. After several  $\rho$  measurements, at growing distances “a”, you can trace a profile like the following ones, according to the most suitable rod chosen:

**Curve1:** as  $\rho$  decreases only in depth, it is possible to use only a rod in depth.

**Curve2:** as  $\rho$  decreases only until the depth A, it is not useful to increase the depth of the rod beyond A.

**Curve3:** even at a superior depth,  $\rho$  does not decrease, therefore a ring rod must be used.



#### APPROXIMATE EVALUATION OF THE CONTRIBUTION OF INTENTIONAL RODS (64-12 2.4.1)

The resistance of a rod  $R_d$  can be calculated with the following formulas ( $\rho$  = average resistivity of the ground).

a) resistance of a vertical rod

$$R_d = \rho / L$$

L= length of the element touching the ground

b) resistance of an horizontal rod

$$R_d = 2\rho / L$$

L= length of the element touching the ground

c) resistance of linked elements

The resistance of a complex system with more elements in parallel is always higher than the resistance which could result from a simple calculation of elements in

parallel, especially if those elements are close and therefore interactive. For this reason, in case of a linked system the following formula is quicker and more effective than the calculation of the single horizontal and vertical elements:

$$Rd = \rho / 4r$$

r= radius of the circle which circumscribes the link.



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