E1612 EARTH TESTER

INSTRUCTION MANUAL

Metrohm®

Thank you for buying one of our products. For safety and full understanding of its benefits please read this manual before use. Technical support is available from 01923 441717 and support@martindale-electric.co.uk.

CONTENTS

1	**Introduction**	1
1.1	Inspection	1
1.2	Description	1
1.3	Accessories	1
1.4	Battery Installation	1
2	**Product Specific Safety Information**	2
2.1	Precautions	2
3	**Operation**	4
3.1	General	4
3.2	Low Battery Indication	4
3.3	Description of Terminals	4
3.4	Description of Press Buttons	4
3.5	Display and LED Indications	5
3.6	Earth Voltage Measurement	5
3.7	Earth Resistance Measurement	6
4	**Maintenance**	14
4.1	Battery Replacement	14
4.2	Fuse Replacement	14
4.3	Calibration	14
4.4	Cleaning	15
4.5	Repair & Service	15
4.6	Storage Conditions	15
5	**Warranty**	16
	Specifications	

GENERAL SAFETY INFORMATION: Always read before proceeding.

Warning
These instructions contain both information and warnings that are necessary for the safe operation and maintenance of this product. It is recommended that you read the instructions carefully and ensure that the contents are fully understood. Failure to understand and to comply with the warnings and instructions can result in serious injury, damage or even death.

In order to avoid the danger of electrical shock, it is important that proper safety measures are taken when working with voltages exceeding 30V AC RMS, 42V AC peak or 60V DC.

This product must only be used by a competent person capable of interpreting the results under the conditions and for the purposes for which it has been constructed. Particular attention should be paid to the Warnings, Precautions and Technical Specifications. Always check the unit is in good working order before use and that there are no signs of damage to it. Do not use if damaged.

Where applicable other safety measures such as use of protective gloves, goggles etc. should be employed.

Please keep these instructions for future reference. Updated instructions and product information are available at: www.martindale-electric.co.uk

REMEMBER: SAFETY IS NO ACCIDENT

MEANING OF SYMBOLS:

CE Equipment complies with relevant EU Directives

End of life disposal of this equipment should be in accordance with relevant Local Directives

Caution - risk of danger and refer to instructions

Caution - risk of electric shock

Equipment protected by double or reinforced insulation (Class II)

Earth (ground)

1. INTRODUCTION

1.1 Inspection

Examine the shipping carton for any sign of damage. Inspect the unit and any accessories for damage. If there is any damage then consult your distributor immediately.

1.2 Description

The E1612 is an earth resistance tester with the following features:

- Microprocessor controlled with advanced safety features
- Large LCD display
- Earth resistance auto ranging, 0-2kΩ in 4 ranges
- Earth voltage measurement: 0-30V AC
- 2, 3 & 4 pole test modes selectable.
- Auto power off
- Indoor and outdoor use

1.3 Accessories

The following accessories are supplied with the E1612:

- Set of test leads with integral crocodile clips (red 15m, black 10m, yellow 10m and green 5m)
- Carrying case
- Set of 4 x spikes
- Shoulder strap
- 8 x 1.5V alkaline AA batteries
- Spare F100mA 250V 5 x 20mm fuse
- Instructions

1.4 Battery Installation

Refer to Section 4.1 (Battery Replacement) for the battery installation instructions for the E1612.

2. PRODUCT SPECIFIC SAFETY INFORMATION

Measurement Category III (CAT III) is applicable to test and measuring equipment connected to the distribution part of the building's low-voltage MAINS installation.

Measurement Category IV (CAT IV) is applicable to test and measuring equipment connected at the source of the building's low-voltage MAINS installation.

2.1 Precautions

This product has been designed with your safety in mind, but please pay attention to the following warnings and cautions before use.

⚠Warnings

Before use check the unit for cracks or any other damage. Make sure the unit is free from dust, grease and moisture. Also check any associated leads and accessories for damage. **Do not use** if damaged.

Do not use if the battery/fuse cover is not fitted.

When this unit is used in combination with test leads, the measurement category of the combination is the lower measurement category of either this unit or the test leads used. Likewise if test lead accessories such as crocodile clips are also used, the measurement category will be the lowest measurement category in that combination.

Always test this unit on an appropriate proving device or a known voltage source before using it to determine if a hazardous voltage exists in a circuit to be tested.

Measuring/testing for a voltage that exceeds the specified limits of the earth resistance tester may damage the unit and expose the operator to a shock hazard. Always check the earth resistance tester's specified limits before use.

The earth resistance tester must only be used on CAT IV, CAT III and CAT II installations up to 300V to earth, and within the operating temperature and humidity range specified.

When using the integral lead/crocodile clip set provided always keep your fingers behind the crocodile clip finger guards.

⚠Cautions

Avoid severe mechanical shock or vibration and extreme temperature.

To avoid corrosion from leaking batteries, remove the batteries when not in use for an extended period.

3. OPERATION

3.1 General

⚠For safety and measurement accuracy only the lead set supplied with the E1612 should be used.

The measured results may be influenced by induction if measurements are made with the test leads twisted together. When making connections they should be separated.

3.2 Low Battery Indication

If **Battery: Low** is displayed on the LCD after the E1612 has been turned on, or at any time during use, replace the batteries (see section 4.1).

3.3 Description of Terminals

E/C1	Terminal for the earth electrode (black test lead)
ES/P1	Terminal for the probe placed nearest to the earth electrode (green test lead)
S/P2	Terminal for a probe (yellow test lead)
H/C2	Terminal for the auxiliary earth electrode (red test lead)

3.4 Description of Press Buttons

2P	Selects 2 pole earth resistance measurement mode
3P	Selects 3 pole earth resistance measurement mode
4P	Selects 4 pole earth resistance measurement mode
ACV	Selects AC voltage measuring function to check earth voltage
ON/OFF	Turns on/off the E1612
TEST/ STOP	Starts and stops earth resistance and earth voltage measurements.

3.5 Display and LED Indications

Battery: Low	Indicates the batteries need to be replaced. (See 4.1). The battery level in volts is normally indicated
Rc/Rc Error	The C1 or C2 leads are open circuit or the resistance in the C1 or C2 leads is greater than 10kΩ. Check the auxiliary earth spikes are connected correctly
P1 Line Fail!	The P1 lead is open circuit or the resistance in the P1 lead is greater than 20kΩ
P2 Line Fail!	The P2 lead is open circuit or the resistance in the P2 lead is greater than 20kΩ
Rp	The Rp LED indicates an earth resistance > 2kΩ. The LCD will display > 2kΩ
Vp Error	When making a '4P measurement', if the LCD shows 'Vp Error' short circuit C1 (black) and P1 (green)

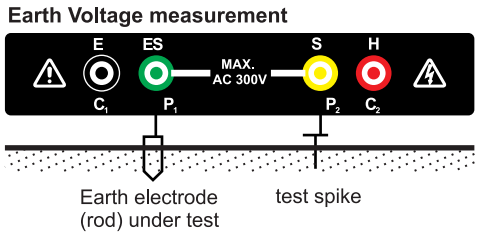
3.6 Earth Voltage Measurement

Connect the test leads as shown in figure 1 or on the inside of the E1612 lid.

On the E1612 press **ON/OFF** to turn the unit on, press **ACV** and **TEST/STOP**. The earth voltage will be displayed.

Note: An earth voltage greater than 10V may result in errors in the earth resistance measurement. Make sure that the earth voltage is less than 10V.

Figure 1



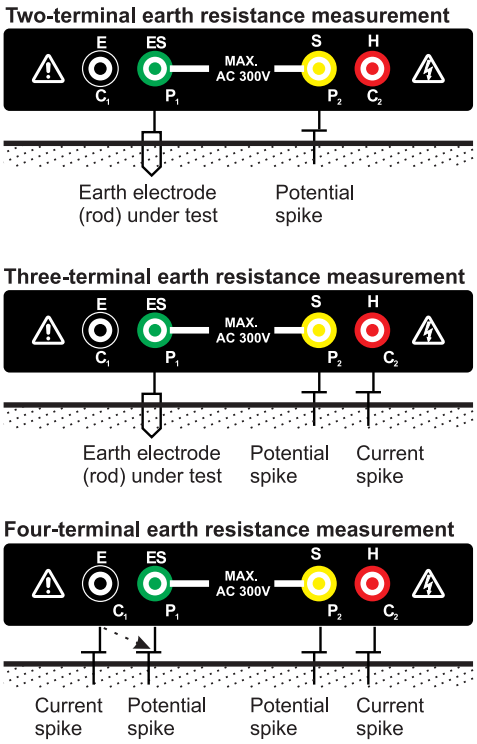
3.7 Earth Resistance Measurement

Connect the test leads as shown in figures 2, 3 and 4 or the inside of the E1612 lid for the earth resistance measurement type being made (2P, 3P or 4P). Also refer to IEE guidance note 3 for the positioning of spikes.

Press **2P**, **3P** or **4P** to select the measurement type, then **TEST/STOP.** The earth resistance will be displayed.

Note: When making a '4P measurement', if the LCD shows 'Vp Error', short circuit C1 (black) and P1 (green).

Figure 2, 3 and 4



IEE Guidance note 3 specifies the method for testing the resistance of earth electrodes, "before this test is undertaken, the earthing conductor to the earth electrode must be disconnected either at the

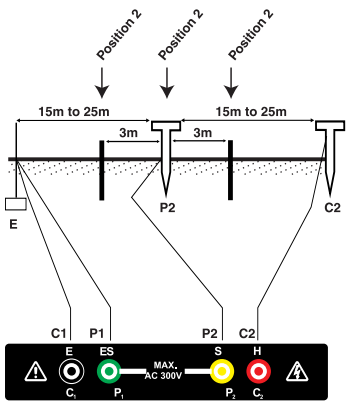
electrode or the main earthing terminal to ensure that all the test current passes through the earth electrode alone. This will leave the installation unprotected against earth faults."

⚠ SWITCH OFF SUPPLY BEFORE DISCONNECTING THE EARTH.

The test requires the use of two spikes (electrodes) and is carried out in the following manner:

Connection to the earth electrode is made using terminals C1 and P1 of a four terminal earth tester. To exclude the resistance of the test leads from the resistance reading, individual leads should be taken from these terminals and connected separately to the electrode as shown. If the test lead resistance is insignificant, the two terminals may be short-circuited at the tester and connection made with a single test lead. Connection to the temporary spikes is made as shown in figure 5.

Figure 5



Fall of potential method

The distance between the test spikes is important. If they are too close together, their resistance areas will overlap. In general, reliable results may be expected if the distance between the electrode under test and the current spike is at least ten times the maximum dimension of the electrode system, e.g. 30m for a 3m long electrode.

Three readings are taken; firstly the potential spike initially midway between the electrode and current spike, secondly at a position 10% of the electrode-to-current spike distance back towards the electrode and finally, at a position 10% of the distance towards the current spike.

By comparing the three readings, a percentage deviation can be determined. This is calculated by taking the average of the three readings, finding the maximum deviation of the readings from this average in ohms, and expressing this as a percentage of this average.

The accuracy of the measurement using this technique is typically 1.2 times the percentage deviation of the readings. It is difficult to achieve a measurement accuracy better than 2%, and inadvisable to accept readings that differ by more than 5%. To improve the accuracy of the measurement to acceptable levels, the test must be repeated with a larger separation between the electrode and the current spike.

If the temporary spike resistance is too high, measures to reduce the resistance will be necessary, such as driving the spikes deeper into the ground, or watering with brine to improve contact resistance. In no circumstances should these techniques be used to temporarily reduce the resistance of the earth electrode under test.

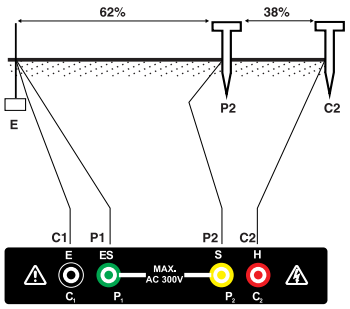
⚠ AFTER COMPLETION OF TESTING ENSURE THAT THE EARTHING CONDUCTOR IS RECONNECTED

The 62% Rule

The measurement technique is essentially the fall of potential method. If the readings using the method differ beyond the required accuracy then the 62% rule can be used. The 62% rule states that the true resistance of the earth electrode is equal to the measured resistance when the potential spike is positioned 62% of the distance between the earth electrode and the current spike, away from the earth electrode. This rule only applies when the earth electrode and both the current and potential spikes are in a straight line, the soil is homogeneous and the earth electrode has a small resistance area.

Bearing in mind these limitations this method can be used on small earth systems consisting of single rod or plate and on medium systems using several rods. The connections and layout for the 62% rule are shown in figure 6.

Figure 6



62%

For most purposes the current spike should be placed 30 to 50m from the earth electrode under test. The potential spike should be inserted in the ground at 62% of this distance, measured from the earth electrode and in a straight line with the earth electrode and current spike. For greater accuracy an average reading can be calculated by moving the current spike C2 10m either side of its original position, also moving the potential spike P2 relative to the earth electrode to maintain 62% of the distance between the earth and current electrodes, and making further measurements.

Soil Resistivity

The techniques for measuring soil resistivity are essentially the same whatever the purpose of the measurement, i.e. finding the best site to sink an electrode, geophysical prospecting or archaeological surveys. However the interpretation of the recorded data can vary considerably, especially where soils with non uniform resistivities are encountered. The added complexity caused by non uniform soils is common, and in only a few cases are soil resistivities constant with increasing depth. Earth resistivity not only varies with the type of soil but also with temperature, moisture content, salt content and compactness. Therefore it is essential that the soil resistivity is checked prior to siting an electrode and periodically thereafter.

The most common method of measuring earth resistivity is the equally spaced or Wenner Arrangement (see figure 7). With this method the electrodes are arranged in a straight line, equally spaced at intervals 'A' and driven to a depth not exceeding 0.1A. The tester is operated and a resistance measurement taken. The soil resistivity ρ can be calculated from the formula ρ=2πAR where 'A' is the distance between the test spikes and R is the resistance reading.

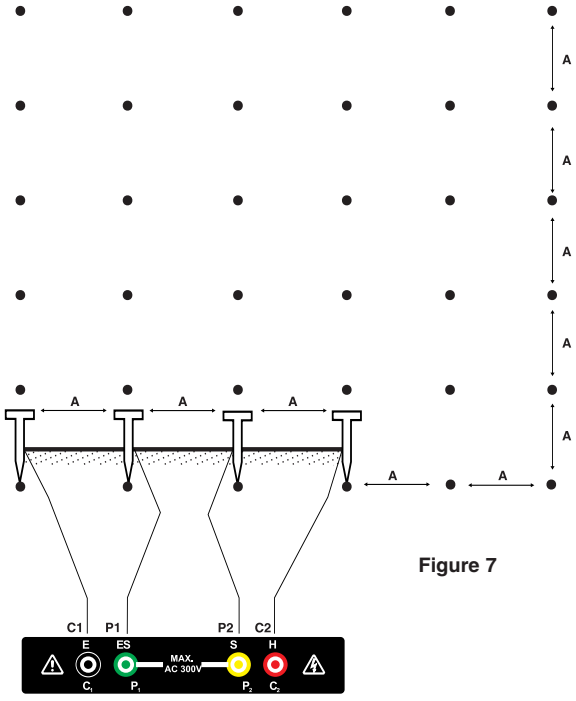


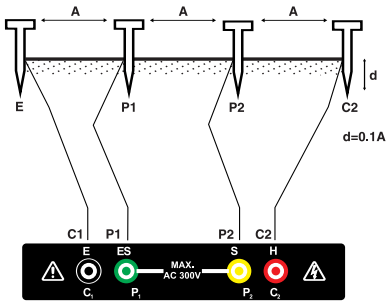
Figure 7

Finding the region of lowest resistivity

This gives approximately the average soil resistivity to the depth 'A'. If the spacing and depth of the test spikes are maintained and further readings are taken as shown in figure 8, the region of lowest resistivity can be found over a given area. Extra sets of readings taken with different test spike spacing's give a set

of resistivities which, when plotted against spacing, indicate whether there are distinct layers of soil or rock and this gives an idea of their respective resistivities and depth.

Figure 8



Wenner arrangement

4. MAINTENANCE

4.1 Battery Replacement

⚠ To avoid shock or injury, disconnect the earth resistance tester from any external circuits and remove the test leads before proceeding.

The battery compartment is underneath the unit and can be accessed by undoing the 2 screws.

Fit 8 new 1.5V AA alkaline batteries (IEC LR6, NEDA 15A).

Replace the battery cover and screws.

Note: Do not mix old and new batteries.

4.2 Fuse Replacement

⚠ To avoid shock, injury or damage to the earth resistance tester, disconnect it from any external circuits or components and remove the test leads and batteries before proceeding.

⚠ Replace only with the fuse specified.

The fuse is inside the battery compartment (see 4.1 for access).

Replace only with the original type F100mA 250V 5 x 20mm fuse.

Replace the battery cover and screws.

4.3 Calibration

To maintain the integrity of measurements made using your instrument, Martindale Electric recommends that it is returned at least once a year to an approved Calibration Laboratory for recalibration and certification.
Martindale Electric is pleased to offer you this service. Please contact our Service Department for details.
Email: service@martindale-electric.co.uk

Tel: 01923 650660

4.4 Cleaning

The unit may be cleaned using a soft dry cloth. Do not use moisture, abrasives, solvents, or detergents, which can be conductive.

4.5 Repair & Service

There are no user serviceable parts in this unit other than those that may be described in section 3. Return to Martindale Electric if faulty. Our service department will quote promptly to repair any fault that occurs outside the guarantee period.

Before the unit is returned, please ensure that you have checked the unit, batteries, fuse, leads and poor connections.

4.6 Storage Conditions

The instrument should be kept in warm dry conditions away from direct sources of heat or sunlight, and in such a manner as to preserve the working life of the unit. It is strongly advised that the unit is not kept in a tool box where other tools may damage it.

5. WARRANTY AND LIMITATION OF LIABILITY

This Martindale product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is 2 years and begins on the date of receipt by the end user. This warranty extends only to the original buyer or end-user customer, and does not apply to fuses, disposable batteries, test leads or to any product which, in Martindale's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation, handling or storage.

Martindale authorised resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Martindale.

Martindale's warranty obligation is limited, at Martindale's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to Martindale within the warranty period.

This warranty is the buyer's sole and exclusive remedy and is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability or fitness for a particular purpose. Martindale shall not be liable for any special, indirect, incidental or consequential damages or losses, including loss of data, arising from any cause or theory.

Since some jurisdictions do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any part of any provision of this warranty is held invalid or unenforceable by a court or other

decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision or other part of that provision.

Nothing in this statement reduces your statutory rights.

Metrohm®

Specification
E1612
Earth Tester

ELECTRICAL

Measuring Ranges: Earth Resistance: 2Ω, 20Ω, 200Ω & 2 kΩ
Earth Voltage: 0-300V AC

Measurement Frequency: 820Hz

Earth Resistance Resolution: 2Ω range: 0.01Ω
20Ω range: 0.1Ω
200Ω range: 1Ω
2kΩ range: 0.01kΩ

Earth Voltage Resolution: 1V

Metrohm®

Specification
E1612
Earth Tester

Accuracy: Earth Resistance: ± 2% rdg ± 3dgts
Earth Voltage: ± 2% rdg ± 3dgts

ENVIRONMENTAL

Temperature & Humidity: Operating: 0°C ~ 50°C ≤ 80% R.H.
Storage: -10°C ~ 60°C ≤ 80% R.H.

Altitude: up to 2000m

GENERAL

Power: 8 x 1.5V AA alkaline batteries (IEC LR6, NEDA 15A)
Auto Off time: Approx. 2¼ minutes

Dimensions: 250(L) x 190(W) x 110(D) mm
Weight: 1546g (batteries included) approx.

Includes: set of test leads with integral crocodile clips (red 15m, black 10m, yellow 10m and green 5m), carrying case, set of 4 x spikes, shoulder strap, 8 x 1.5V alkaline batteries LR6/AA, spare F100mA 250V 5 x 20mm fuse, instructions.

SAFETY

Conforms to BS EN 61557-5 CAT IV 300V
Class II, Double Insulation
Pollution Degree: 2

Test leads supplied conform to BS EN61010-031 CAT III 600V, 2A

EMC

Conforms to BS EN61326-2-2

Check out what else you can get from Martindale:

- 18th Edition Testers
- Accessories
- Calibration Equipment
- Continuity Testers
- Electricians' Kits
- Environmental Products
- Full Calibration & Repair Service
- Fuse Finders
- Digital Clamp Meters
- Digital Multimeters
- Labels
- Microwave Leakage Detectors
- Motor Maintenance Equipment
- Multifunction Testers
- Non-trip Loop Testers
- Pat Testers & Accessories
- Phase Rotation Testers
- Proving Units
- Socket Testers
- Thermometers & Probes
- Test Leads
- Voltage Indicators
- Specialist Metrohm Testers (4 & 5kV)
- Specialist Drummond Testers

Metrohm®

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