

**FLUKE®**

# 1621

## Earth Ground Tester

**Users Manual**

PN 2842206

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# **1621 Earth Ground Tester**

## **Introduction**

The Fluke 1621 Earth Ground Tester (the Product or Tester) is an easy-to-use instrument for measuring the resistance to earth ground of a specified earth ground electrode. The Tester can perform a 3-pole fall-of-potential test conforming to IEC 61557-5. The Tester can also perform ac resistance testing.

To further simplify and increase the probability of an accurate measurement in the 3-pole mode, the Tester measures the resistance of the probe and auxiliary electrode to verify that they are within prescribed limits. The Tester also tests for stray interference voltage (noise) and indicates if the value is too high to take a proper measurement.

The Tester features a lighted LCD display, automatic shut-off, and a limits mode for setting maximum resistance readings.

## **Unpacking**

Refer to *Accessories* while unpacking the Tester and its accessories from the shipping carton. Keep the packing material for future transport.

Check for missing parts and inspect the unit carefully for damage, like cracks, dents, or bent parts. If items are missing or any physical damage is apparent, call Fluke for assistance. Refer to *Service* for information on contacting Fluke.

## **Packing**

Use only the original packing material to ship the Tester.

## Safety Information

This measuring device is only to be installed and operated by qualified personnel in compliance with the safety precautions and regulations that follow. Additionally, the use of this equipment requires compliance with all legal and safety regulations pertaining to each specific application. Similar regulations apply to the use of accessories.

Qualified personnel are persons familiar with the setup, installation, starting, and operation of the device, and are formally qualified to perform such activities.

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.






### Warning

To prevent possible electrical shock, fire, or personal injury:

- Read all safety information before you use the Product.
- Do not alter the Product and use only as specified, or the protection supplied by the Product can be compromised.
- Operating electrical devices implies that parts of the device carry dangerous voltages.
- Assume that safe operation of the Product is *not* possible if the device shows visible damage.
- Assume that safe operation of the Product is *not* possible if the device has been exposed to unfavorable conditions (for example, storage beyond the permissible climatic limits without adaption to the ambient climate and dewing).
- Assume that safe operation of the Product is *not* possible if the device has been exposed to major strain during transport (for example, dropped from some height without visible external damage).
- Do not connect Product to hazardous voltage.
- Do not open the battery compartment when leads are connected.
- While a measurement is in progress, do not touch the earth electrode, auxiliary electrode, or probe.

## Symbols

These symbols are on the Product or in this manual.

	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.
	WARNING - RISK OF DANGER. Consult user documentation.
	Double Insulated
	Battery
	This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste.
<b>CAT II</b>	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.

## **Accessories**

The following accessories are shipped with your Product:

- Users manual
- Two measuring leads with alligator clips, 2 m (6 ft)
- One battery, 9 V alkaline (IEC 6LR61)
- One protective holster, yellow

For a list of optional accessories, see Table 1. To order an accessory, see *Service*.

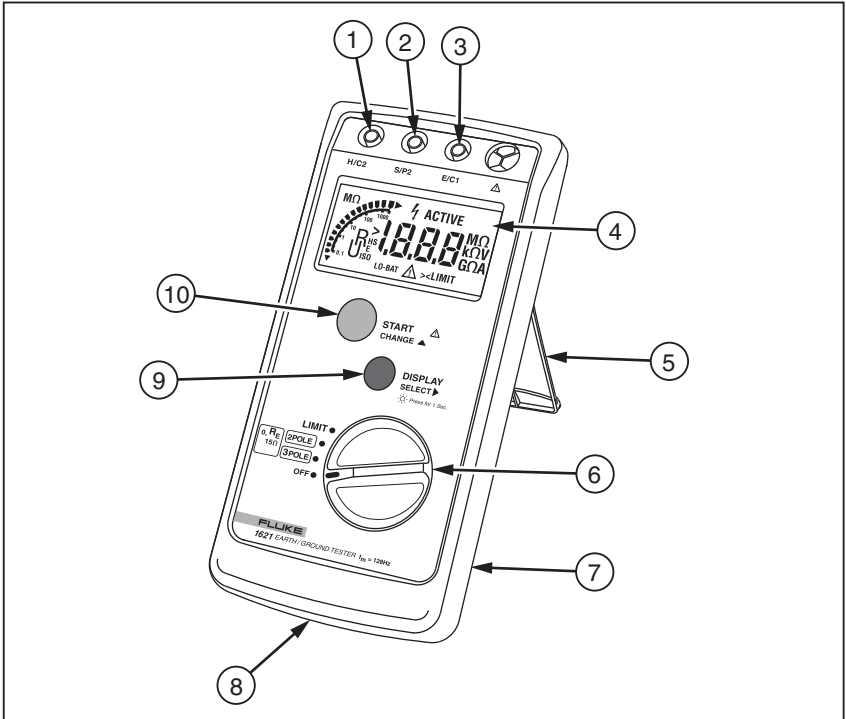
**Table 1. Optional Accessories**

<b>Description</b>	<b>Item/Part No.</b>
Ground/Earth Cable Reel 50 M Wire	2539117
Ground/Earth Cable Reel 25 M Wire	2539100
Ground/Earth Stake	2539121



## Features

Refer to Figure 1 and Table 2 for Tester features and functions.



evp01.eps

Figure 1. Features and Functions

**Table 2. Features and Functions**

<b>No.</b>	<b>Description</b>
①	H/C2 jack for connection to the auxiliary electrode
②	S/P2 jack for connection to the probe
③	E/C1 jack for connection to the earth ground electrode
④	LCD display (see “LCD Display”)
⑤	Stand (on back) to prop Tester upright
⑥	Rotary switch for selecting measurement function, limit mode and on/off
⑦	Holster that helps protect Tester from damage
⑧	Battery compartment (on back) for one 9 V battery
⑨	<b>DISPLAY</b> button for selecting measurement results and other functions
⑩	<b>START</b> button for triggering the measurement function and other functions

## Software

To check the software version, set the rotary switch to **OFF**, and then press and hold **START** and set the rotary switch to any On position (**3 pole, 2 pole** or **LIMIT**). The software version displays.

## LCD Display

The Tester features a lighted LCD display that shows measurement readings, messages and icons. Refer to Figure 2 and Table 3 for descriptions of the display's icons.

To turn on the display light, press and hold **DISPLAY** for 2 seconds. To turn off the light, press and hold **DISPLAY** again for 2 seconds. The light turns off automatically after 30 seconds.

To test the LCD display, set the rotary switch to **OFF**, and then press and hold **DISPLAY** and set the rotary switch to any On position (**3 pole, 2 pole** or **LIMIT**).

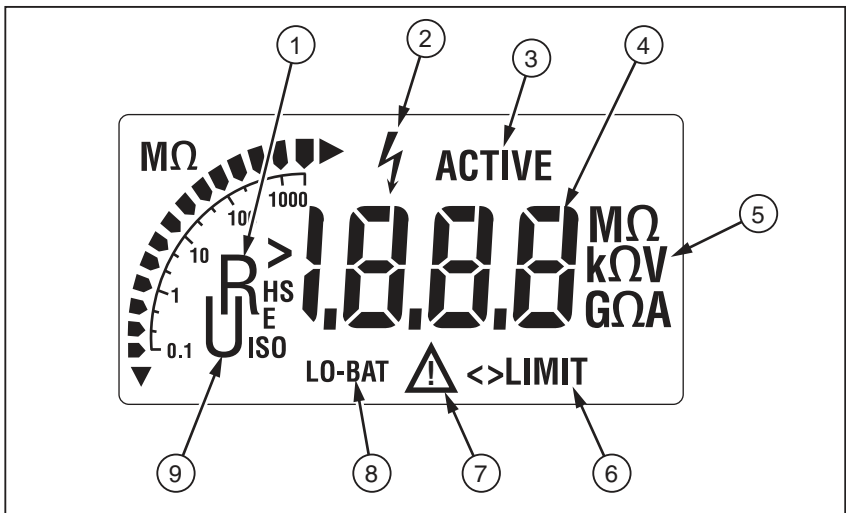


Figure 2. Display

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Table 3. Display

No.	Description
①	RH, RS and RE icons indicate the resistance type being displayed: RH = Auxiliary electrode resistance RS = Probe resistance RE = Earth ground electrode resistance
②	Hazardous voltage. Voltage >30 V dc or ac peak might be present.
③	ACTIVE icon indicates a measurement is in progress
④	Digits display measurement results and messages
⑤	k $\Omega$ icon indicates reading value is in kilohms (x1000)
⑥	>LIMIT icon indicates measurement value exceeds the set limit or that auxiliary electrode resistance or probe resistance value exceeds 199 k $\Omega$
⑦	$\Delta$ icon flashes if measurement value exceeds set limit or leakage voltage exceeds 20 V
⑧	LO-BAT icon indicates battery voltage is low
⑨	U icon indicates the displayed measurement is stray interference voltage (above 20 V)

### Interference Detection

The Tester automatically checks for interference voltage (noise) fault voltage above 20 V. Interference above 20 V greatly diminishes the accuracy of measurements. If the Tester detects interference voltage above 20 V, the measurement automatically stops, the  $\Delta$  icon flashes, the U icon displays, and the value of the stray voltage displays.

### Auto Shut-Off

The Tester has an auto shut-off feature that turns the device off after 10 minutes of inactivity. The Tester beeps to alert you that it is about to turn off. To disable auto shut-off, simultaneously press and hold **START** and **DISPLAY** while setting the rotary switch to any On position (**3 pole**, **2 pole** or **LIMIT**). To reset auto shut-off or to reset the Tester, turn off the Tester and then turn it on again.

## **Resistance Limit Mode**

The Tester has a resistance limit mode that allows you to set a maximum resistance reading. If a resistance reading exceeds the set limit, the Tester beeps and the >LIMIT icon displays. The limit can be set between 0  $\Omega$  and 1999  $\Omega$ .

To set the maximum resistance:

1. Set the rotary switch to **LIMIT**. If the limit mode is on, the Tester displays the stored limit setting. If the limit mode is off, the Tester displays OFF.
2. If the limit mode is off, press **START**. The Tester displays the stored limit setting.
3. Press **DISPLAY** to step through the digits to select the digit that you want to set. The first press of **DISPLAY** selects the leftmost digit. (The digit flashes when selected.) The second and third press of **DISPLAY** selects the second and third digits. The fourth press of **DISPLAY** selects the decimal point to set the resolution of the measurement.
4. With the digit selected that you want to set, press **START** to increment the value. The leftmost digit increments from 0 to 19. The other digits increment from 0 to 9. Or if you selected the decimal point, press **START** to move the decimal point to change the resolution of the measurement.
5. Repeat steps 3 and 4 until you have set the maximum resistance value. When you have finished, set the rotary switch to **OFF** for 5 seconds to store the value.

## Battery Installation

The Tester is shipped with a 9 V alkaline (LR61) battery, which you will need to install. When the battery voltage is low, the LO-BAT icon displays, and you will need to replace the battery.

To install or replace the battery:

1. Set the rotary switch to **OFF**, disconnect all test leads, and remove the Tester from its holster.
2. On the back of the Tester, use a small screwdriver to gently pry open the battery cover. If replacing the battery, remove the battery from its compartment.
3. Install the new battery to the battery clip as shown in Figure 3. Use a 9 V alkaline (LR61) battery or comparable.
4. Insert the battery into its compartment. Ensure the battery is oriented so that the wires from the clip face the bottom of the compartment. Snap the battery cover shut, insert the Tester into its holster, and install the test leads.

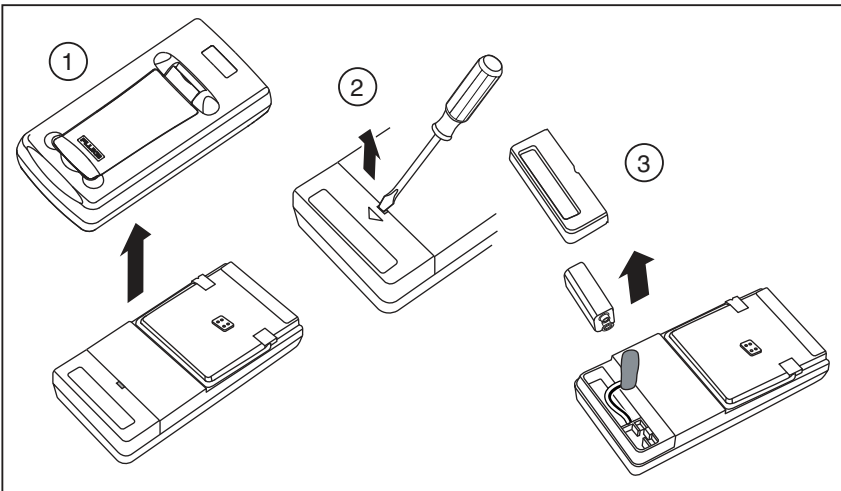


Figure 3. Battery Installation

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## Operating Instructions

### Warning

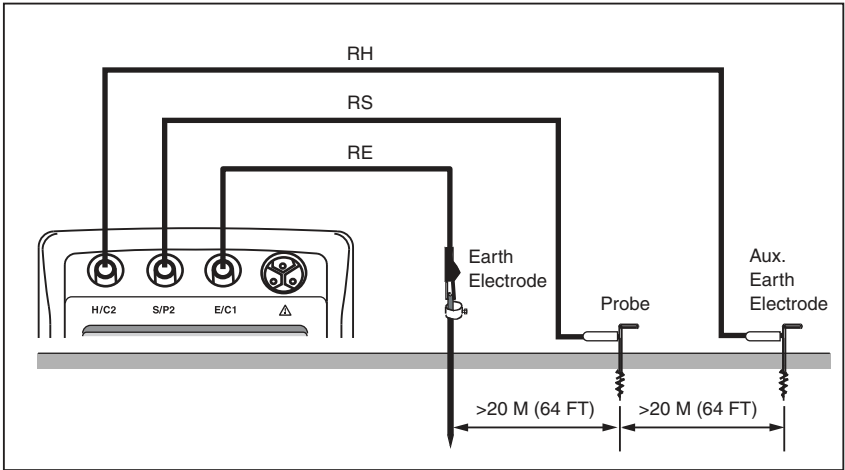
To avoid possible electric shock or personal injury, before powering up and operating the device, carefully read and follow all safety regulations described in *Safety Information*.

### 3-Pole Measurement

To perform a 3-pole measurement:

1. Insert the probe and auxiliary electrode stakes into the soil as shown in Figure 4. Ensure the probe stake is a minimum distance of 20 m (64 ft) from the earth ground electrode. Ensure the auxiliary electrode stake is a minimum distance of 20 m (64 ft) from the probe stake. Position the auxiliary electrode stake so it forms a straight line with the earth ground electrode and probe stake.
2. Set the rotary switch to **OFF**.
3. Install the test leads as shown in Figure 4. Connect the earth ground electrode to jack E/C1. Connect the probe to jack S/P2. Connect the auxiliary electrode to jack H/C2.
4. Set the rotary switch to **3 pole** and press **START**. The **ACTIVE** icon displays to indicate that the measurement is in progress.

When the measurement is finished, the earth ground electrode resistance ( $R_E$ ) automatically displays. To display the auxiliary electrode resistance ( $R_H$ ), press **DISPLAY**. To display the probe resistance ( $R_S$ ), press **DISPLAY** again.



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Figure 4. Three-Pole Measurement Setup

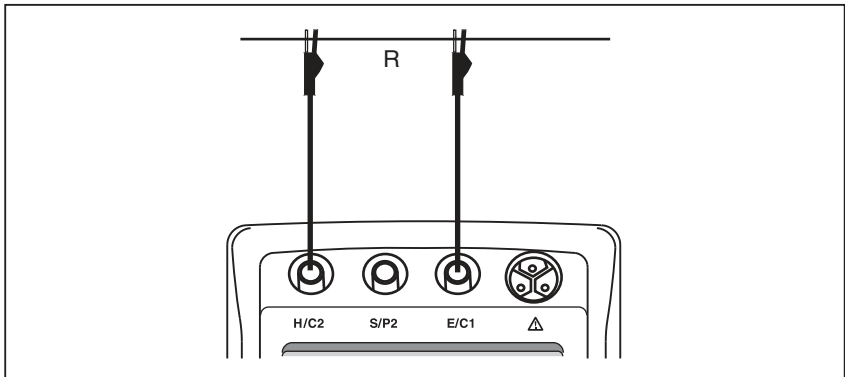


## **AC Resistance Measurement**

To perform an ac resistance measurement:

1. Set the rotary switch to **OFF**.
2. Plug a test lead into jack H/C2 and a test lead into jack E/C1. See Figure 5.
3. Connect the test leads to each end of the conductor under test. See Figure 5.
4. Set the rotary switch to **2 pole** and press **START**. The ACTIVE icon displays to indicate that the measurement is in progress.

When the measurement is complete, the resistance (R) automatically displays.



evp05.eps

**Figure 5. AC Resistance Measurement**


## **How to Clean**

Wipe the case with a damp cloth and mild detergent. Dirt or moisture in the terminals can affect readings.

## Troubleshooting

To troubleshoot your Tester, follow the steps in Table 4.

**Table 4. Troubleshooting**

Step	Description
1	<p><b>Auxiliary electrode resistance (RH) too high</b></p> <p>If the auxiliary electrode resistance is too high (exceeds 199 kΩ), it is not possible to drive the current necessary for reliable measurements. The measurement is blocked and the &gt;LIMIT icon displays.</p> <p><i>Hint: Verify that the auxiliary electrode stake is firmly embedded in the soil, and ensure that good connections exist between all connection points, like test leads, connectors and alligator clips.</i></p>
2	<p><b>Probe resistance (RS) too high</b></p> <p>If the probe resistance is too high (exceeds 199 kΩ), it is not possible to make an accurate measurement. The measurement is blocked and the &gt;LIMIT icon displays.</p> <p><i>Hint: Verify that the probe stake is firmly embedded in the soil, and ensure that good connections exist between all connection points, like test leads, connectors and alligator clips.</i></p>
3	<p><b>Is your resistance measurement performed with the specified operating uncertainty?</b></p> <p>If the probe resistance (RS) or auxiliary electrode resistance (RH) is too high to perform a measurement with the specified operating uncertainty, the flashing  is displayed additionally to the measurement values.</p> <p><i>Hint: Verify that the probe stake and the auxiliary electrode are firmly embedded in the soil and ensure that good connections exist between all connection points, such as test leads, connectors and alligator clips.</i></p>
4	<p><b>Is your resistance measurement result reliable?</b></p> <p>To ensure the most reliable resistance measurements, the probe stake and auxiliary electrode stake must be outside the potential gradient area of each other and the earth ground electrode. (Refer to the "Addendum" for information regarding potential gradient areas.)</p> <p>The probe should be a minimum distance of 20 m (64 ft) from the earth ground electrode, and the auxiliary electrode should be a minimum distance of 20 m (64 ft) from the probe.</p> <p>For some soil conditions, these distances may not be sufficient. To be sure, take several measurements, increasing the distance with each subsequent measurement until the measurements are approximately the same.</p>
5	<p><b>Weak battery</b></p> <p>If the battery is weak (&lt;6.5 V), the supply voltage may break down during measurement. LO-BAT icon displays.</p> <p><i>Hint: Replace the battery. Use one 9 V alkaline (LR61) battery.</i></p>

## Specifications

### Note

*Fluke reserves the right to modify specifications without notice for the purpose of product improvement.*

Measuring functions:	3-pole earth ground resistance, 2 pole AC resistance of a conductor Interference voltage
Intrinsic error:	Refers to the reference temperature range and is guaranteed for 1 year
Measuring rate:	2 measurements / second
Battery condition:	LO-BAT is displayed if voltage drops below 6.5 V
Voltages:	
Between jacks H/C2 and E/C1:	250 V <sub>eff</sub> maximum (effective voltage)
Between jacks S/P2 and E/C1:	250 V <sub>eff</sub> maximum
Temperature ranges:	
Working:	-10 °C to +50 °C (+14 °F to +122 °F)
Operating:	0 °C to +35 °C (+32 °F to +95 °F)
Storage:	-20 °C to +60 °C (-4 °F to +140 °F)
Reference:	+23 °C ± 2 °C (+73 °F ±4 °F)

### Note

*The chart of four temperature ranges for the Tester exists to satisfy European Standards requirements; the instrument can be used over the full working temperature range by using the temperature coefficient to calculate accuracy at the ambient temperature of use.*

Temperature Coefficient:	±0.1 % of range per degree Kelvin
Safety:	IEC 61010-1, 600VCATII, pollution degree 2

Maximum Deviations:

Parameter	Influence Factor	Deviation influence
E <sub>1</sub>	Position	0 %
E <sub>2</sub>	Supply Voltage	0 %
E <sub>3</sub>	Temperature E <sub>3</sub>	2.3 %
E <sub>4</sub>	Serial Interference Voltage (20 V)	0.6 %
E <sub>5</sub>	Probe- and Auxiliary probe Resistance	10 %

Test voltage: 3.7 kV

Dimensions: 113 x 54 x 216 mm (4.5 x 2.1 x 8.5 in), including holster

Weight: 850 g (1.9 lb), including standard accessories,  
Volume approximately 600 cm<sup>3</sup>

### **R<sub>E</sub> Resistance Measurement**

Measuring method: Current-voltage measurement with improved cross-talk attenuation, no compensation of measuring lead resistance, with probe (3-pole) or without probe (2-pole) as per IEC 61557-5

Open circuit voltage: 23 to 24 V ac

Short circuit current: >50 mA ac

Measuring frequency: 128 Hz

Maximum permissible overload:

250 V<sub>eff</sub>

Measuring Range	Resolution	Display Range	Intrinsic Uncertainty	Operating Uncertainty IEC 61557*
0.15 Ω to 20 Ω	0.01 Ω	0 Ω to 19.99 Ω	±(6 % of measured value + 5D)	±(18 % of measured value + 5D)
200 Ω	0.1 Ω	20 Ω to 199.9 Ω		
2 kΩ	1 Ω	200 Ω to 1999 Ω		

\*Covers all deviations caused by influence quantities E<sub>1</sub>-E<sub>5</sub>

If the deviation E<sub>4</sub> caused by high probe or auxiliary probe resistance is higher than specified **Δ** flashes. Measured values are outside of the specified operating uncertainty.

Measuring time:            8 seconds (average from when **START** is pressed)

Limit input:                Tester retains set value even if instrument is turned off  
(assuming battery power supply is sufficient)

If Tester detects stray interference voltage ≥20 V, **Δ** is displayed and the measurement is not started.

Automatic changeover of resolution:

RH	Resolution
<7 k $\Omega$	0.01 $\Omega$
<50 k $\Omega$	0.1 $\Omega$
>50 k $\Omega$	1 $\Omega$

### Interference Voltage Display DC + AC

Vmax: 30 Veff

Common mode rejection: >80 dB at 50 Hz and 60 Hz

Ri: 680 k $\Omega$

Measuring uncertainty: <10 % for pure ac and dc signals

## Storage

If the Tester is not going to be used or is being stored for a long period, remove the battery and store separately from the Tester to avoid damage from battery leakage.

## Service

If you suspect that the Tester has failed, review this manual to ensure you are operating it correctly. If the Tester still fails to operate properly, pack securely using the original packing material (if available) and forward, postage paid, to the nearest Fluke Service Center. Include a brief description of the problem. Fluke assumes *no* responsibility for damage in transit.

To locate an authorized service center, call Fluke using the phone numbers listed below:

USA: 1-888-99-FLUKE (1-888-993-5853)

Canada: 1-800-36-FLUKE (1-800-363-5853)

Europe: +31 402 675 200

Japan: +81-3-6714-3114

Singapore: +65-6799-5566

Anywhere in the world: +1-425-446-5500

You may visit us on the World Wide Web at [www.fluke.com](http://www.fluke.com). To register your product, visit <http://register.fluke.com>.