

1621

Earth Ground Tester

Users Manual

PN 2842206

June 2007

© 2007 Fluke Corporation, All rights reserved. Printed in the Netherlands.
All product names are trademarks of their respective companies.

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is two years and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized 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 Fluke. Warranty support is available only if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

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

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE 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 countries or states 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 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.

Fluke Corporation
P.O. Box 9090
Everett, WA 98206-9090
U.S.A.

Fluke Europe B.V.
P.O. Box 1186
5602 BD Eindhoven
The Netherlands

Table of Contents

Title	Page
Introduction	1
Unpacking.....	1
Packing	1
Safety Regulations	2
Symbols	3
Accessories	4
Features.....	5
Software.....	7
LCD Display	7
Interference Detection.....	8
Auto Shut-Off	8
Resistance Limit Mode	9
Battery Installation.....	10
Operating Instructions.....	11
3-Pole Measurement	11
AC Resistance Measurement	13
Troubleshooting.....	14
Specifications.....	15
Storage	18
Service	18

List of Tables

Table	Title	Page
1.	Optional Accessories	4
2.	Features and Functions	6
3.	Display	8
4.	Troubleshooting	14

List of Figures

Figure	Title	Page
1.	Features and Functions	5
2.	Display	7
3.	Battery Installation.....	10
4.	Three-Pole Measurement Setup.....	12
5.	AC Resistance Measurement	13

1621 Earth Ground Tester

Introduction

The Fluke 1621 Earth Ground Tester (referred throughout as the “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/EN 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.

This instrument is manufactured in compliance with quality assurance system EN ISO 9001. Compliance with current applicable EMC regulations is documented by the attached **CE** sign.

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 Regulations

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.

In this manual, a **⚠ Warning** identifies hazardous conditions and actions that could cause bodily harm or death. A **⚠ Caution** identifies conditions and actions that could damage to the Tester, the equipment under test, cause permanent loss of data, or impair Tester performance. Disregarding warning and caution notices can lead to serious physical injury and material damage.

⚠⚠ Warning






To avoid electrical shock or damage to the Tester:

- **If the Tester is used in a manner not specified in this manual, the protection provided by the Tester may be impaired.**
- **Operating electrical devices implies that parts of the device carry dangerous voltages.**
- **Assume that safe operation of the Tester is *not* possible if the device shows visible damage.**
- **Assume that safe operation of the Tester 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 Tester 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 Tester 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

The following symbols are found on the Tester or in this manual.

	Hazardous voltage. Voltage >30 V dc or ac peak might be present.
	Risk of danger. Important information. See Users Manual.
	Double insulation
	Battery
CE	Conforms to relevant European Union directives
	Do not dispose of this product as unsorted municipal waste. Contact Fluke or a qualified recycler for disposal.
CAT II	<p>The enclosure is designed for 600V CATII pollution degree 2 to cover unintended connection to hazardous fault voltages at the earthing system.</p> <p>CAT II equipment is designed to protect against transients from energy-consuming equipment supplied from the fixed installation, such as TVs, PCs, portable tools, and other household appliances.</p>

Accessories

The following accessories are shipped with your 1621 Earth Ground Tester:

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

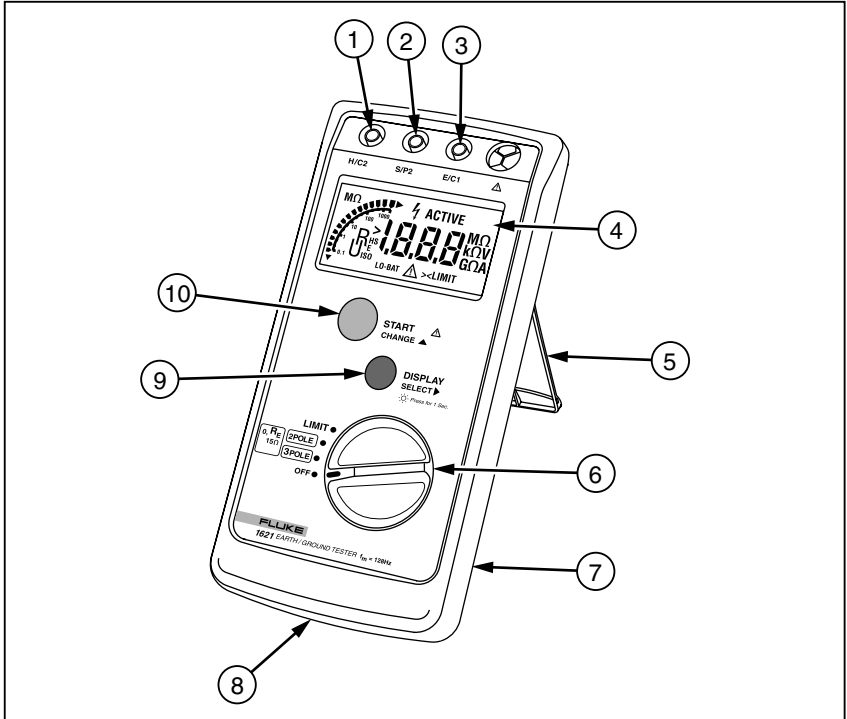
For a list of optional accessories, see Table 1. To order an accessory, see “Service.”

Table 1. Optional Accessories

Description	Item/Part No.
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

No.	Description
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	DISPLAY button for selecting measurement results and other functions
⑩	START 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**).

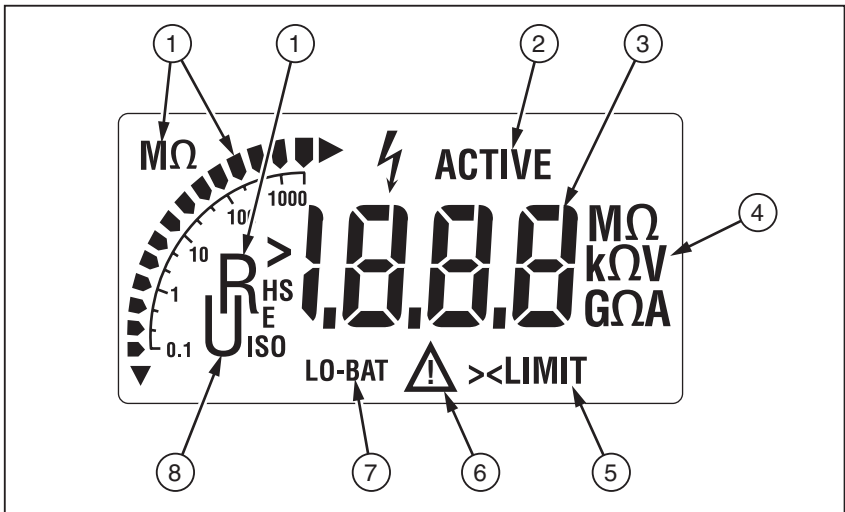


Figure 2. Display

evp02.eps

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	ACTIVE icon indicates a measurement is in progress
③	Digits display measurement results and messages
④	kΩ icon indicates reading value is in kilohms (x1000)
⑤	>LIMIT icon indicates measurement value exceeds the set limit or that auxiliary electrode resistance or probe resistance value exceeds 199 kΩ
⑥	⚠ icon flashes if measurement value exceeds set limit or leakage voltage exceeds 20 V
⑦	LO-BAT icon indicates battery voltage is low
⑧	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 ⚠ 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 and 1999 Ω .

To set the maximum resistance:

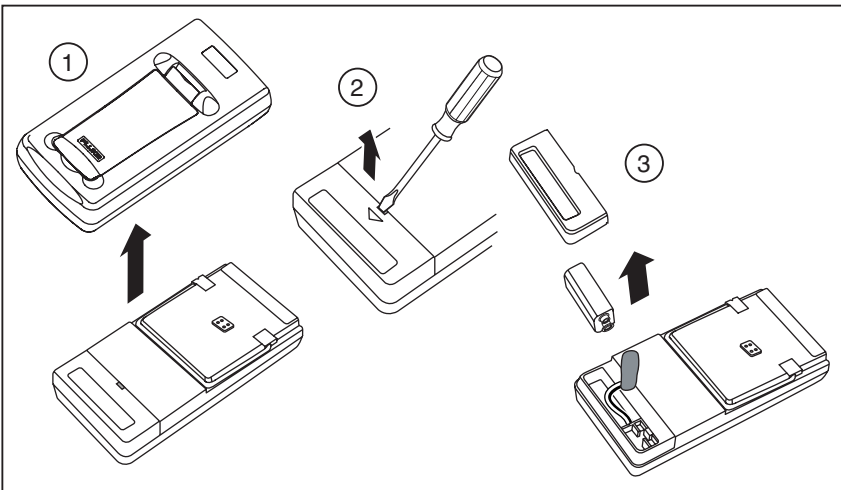
1. Set the rotary switch to **LIMIT**. If the limit mode is on, the Tester displays the stored limit setting. If the limit mode is off, the Tester displays OFF.
2. If the limit mode is off, press **START**. The Tester displays the stored limit setting.
3. Press **DISPLAY** to step through the digits 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.



evp006.eps

Figure 3. Battery Installation

Operating Instructions

⚠️⚠️ Warning

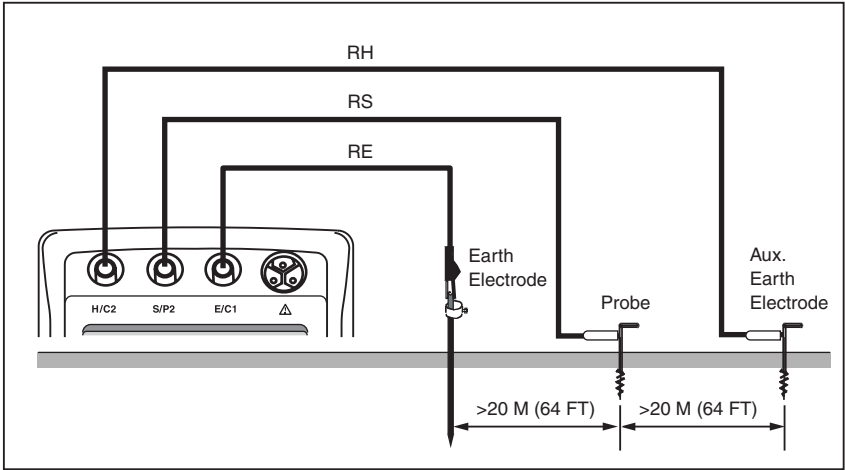
To avoid possible electric shock or personal injury, before powering up and operating the device, carefully read and follow all safety regulations described in “Safety Regulations.”

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 (RE) automatically displays. To display the auxiliary electrode resistance (RH), press **DISPLAY**. To display the probe resistance (RS), press **DISPLAY** again.



evp03.eps

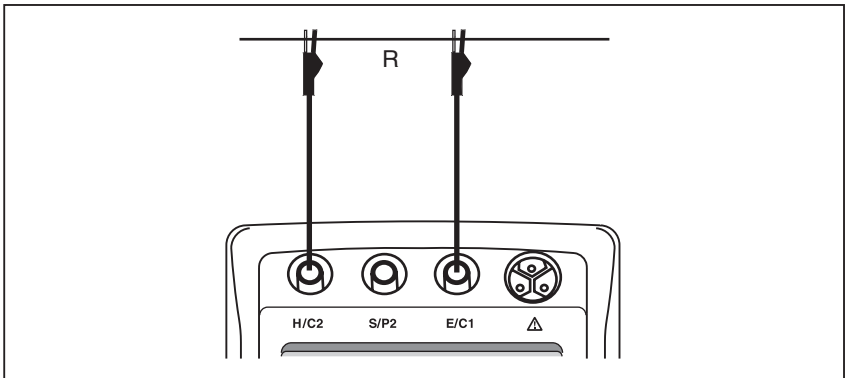
Figure 4. Three-Pole Measurement Setup

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

Troubleshooting

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

Table 4. Troubleshooting

Step	Description
1	<p>Auxiliary electrode resistance (R_H) too high</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 >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>Probe resistance (R_s) too high</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 >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>Is your resistance measurement performed with the specified operating uncertainty?</p> <p>If the probe resistance (R_s) or auxiliary electrode resistance (R_H) is too high to perform a measurement with the specified operating uncertainty, the flashing Δ 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>Is your resistance measurement result reliable?</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>Weak battery</p> <p>If the battery is weak (<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 _{eff} maximum (effective voltage)
Between jacks S/P2 and E/C1:	250 V _{eff} maximum
Climatic class:	VDE/VDI 3540 RZ (conforming to KWG as per DIN 40040, 4/87)
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 (+68 °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/EN 61010-1, 600VCATII, pollution degree 2

Maximum Deviations:

Parameter	Influence Factor	Deviation influence
E_1	Position	0 %
E_2	Supply Voltage	0 %
E_3	Temperature E_3	2.3 %
E_4	Serial Interference Voltage (20 V)	0.6 %
E_5	Probe- and Auxiliary probe Resistance	10 %

Test voltage: 3.7 kV

Protection type: IP 40; IEC/EN 60529

Electromagnetic compatibility: Emission: IEC/EN 61326 Class B
Immunity: IEC/EN 61326 Annex C

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 cm³**RE 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/EN 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_{eff}

Earth Ground Tester
Specifications

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

*Covers all deviations caused by influence quantities E_1 - E_5

If the deviation E_4 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 Ω	0.01 Ω
<50 k Ω	0.1 Ω
>50 k Ω	1 Ω

Interference Voltage Display DC + AC

Vmax:	30 Veff
Common mode rejection:	>80 dB at 50 Hz and 60 Hz
Ri:	680 k Ω
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: +81-3-3434-0181
 Singapore: +65-738-5655
 Anywhere in the world: +1-425-446-5500

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