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1623-2

Earth/Ground Tester

Users Manual

January 2014

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Introduction

The 1623-2 Earth Ground Tester (Tester or Product) is a compact, field-rugged instrument that performs all four types of earth ground measurement. Specifically, the Tester is able to measure earth ground loop resistances using only clamps – called Stakeless testing. This method doesn't require the use of earth ground stakes or the disconnection of ground rods.

The 1623-2 features:

- One-button measurement concept
- 3-pole and 4-pole earth ground measurement
- 4-pole soil resistivity testing
- Selective testing, no disconnection of ground conductor (1 clamp)
- Stakeless testing, quick ground loop testing (2 clamps)
- Measuring frequency 128 Hz

How to Contact Fluke

To contact Fluke, use one of these telephone numbers:

- USA: 1-800-760-4523
- 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

Go to www.fluke.com to register your product, download manuals, and find more information.

To view, print, or download the latest manual supplement, visit

<http://us.fluke.com/usen/support/manuals>.

Safety Information

A **Warning** identifies hazardous 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.
- Use the Product only as specified, or the protection supplied by the Product can be compromised.
- Do not use the Product if it operates incorrectly.
- Do not use the Product if it is damaged.
- Do not use test leads if they are damaged. Examine the test leads for damaged insulation, exposed metal, or if the wear indicator shows. Check test lead continuity.
- Do not use the Product around explosive gas, vapor, or in damp or wet environments.
- Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.
- Use only current probes, test leads, and adapters supplied with the Product.
- Do not use a current measurement as an indication that a circuit is safe to touch. A voltage measurement is necessary to know if a circuit is hazardous.
- The battery door must be closed and locked before you operate the Product.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.
- Do not connect directly to mains.
- Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.

Table 1 is a list of symbols used on the Tester and in this manual.

Table 1. Symbols

Symbol	Description
	Risk of Danger. Important information. See Manual.
	Hazardous voltage. Risk of electrical shock.
	Battery Indicator
	Conforms to European Union directives.
	Conforms to relevant South Korean EMC Standards.
	Conforms to relevant Australian EMC requirements.
	This product complies with the WEEE Directive (2002/96/EC) 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. Go to Fluke's website for recycling information.

Storage

If the Tester is stored for an extended period of time or is not in use for a long time, you should remove the batteries.

Models and Accessories

These standard accessories were shipped with your Tester:

- 6 alkaline AA – type (LR6) batteries
- 2 measuring leads 1.5 m
- 1 connector cable (for RA 2-pole measurements)
- 2 alligator clips
- 1 Documentation CD with Users Manual
- Quick Reference Guide
- Safety Information

Table 2 lists the models and accessories.

Table 2. Models and Accessories

Description	Part Number
1623-2 Earth Ground Tester (Includes Users Manual, Safety Information, QRG, Geox Probe Cable, 2 clips, Lead set)	4325155
1623-2 Earth Ground Tester Kit (Includes Users Manual, Safety Information, QRG, Geox Probe Cable, 2 clips, Lead set, 4 Earth Stakes, 3 Cable Reels, C1620 Carrying Case, EI-162X & EI-162AC)	4325170
162x-7001 Service Replacement Kit (Includes Lead set & 2 clips)	2577167
Earth Stake	4325492
ES-162P3-2 Stake Set for 3 Pole Measurement (Includes 3 Earth Stakes, 1 Cable Reel 25M Blue, 1 Cable Reel 50M Red)	4359377
ES-162P4-2 Stake Set for 4 Pole Measurement (Includes 4 Earth Stakes, 1 Cable Reel 25M Blue, 1 Cable Reel 25M Green, 1 Cable Reel 50M Red)	4359389
EI-1623 Selective/Stakeless Clamp Set for 1623-2/1625-2 (Includes EI-162X, EI-162AC)	2577115
EI-162X Clip-on Current Transformer (sensing) with shielded cable set	2577132
EI-162AC Clip-on Current Transformer (inducing)	2577144
EI-162BN Split Core Transformer - for Pylon Testing (12.7 inch - 320 mm)	2577159
Shielded Cable (Used w/ EI-162X Clamp)	2630254
Cable Reel, 25M, Blue wire	4343731
Cable Reel, 25M, Green wire	4343746
Cable Reel, 50M, Red wire	4343754
C1620 Carrying Case	4359042

Additional Accessories

An **external current transformer** is available as an option, see Figure 1. The transformer has a transformation ratio between 80 and 1200:1 for the measurement of a single branch in mesh-operated earthing systems. This enables the user to measure on high voltage pylons without separating the overhead earth wires or earth strips at the bottom of the pylons. It is also used to measure lightning protection systems without separating the individual lightning protection wires.

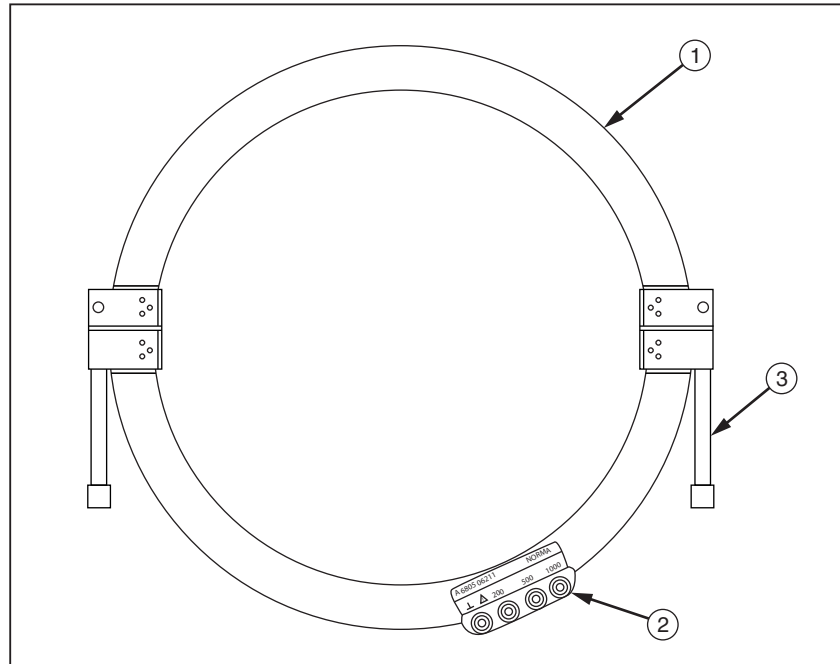


Figure 1. External Current Transformer EI-162BN

evx01.eps

- ① Transformer half (2)
Transformer end faces have bolts that pivot to aid in separating the Transformer halves. One Transformer end face has a slotted bolt hole that allows the bolt to pivot out of the end face.
- ② Transformation ratio connections: 1, 200, 500, and 1000
- ③ Fastener (2)

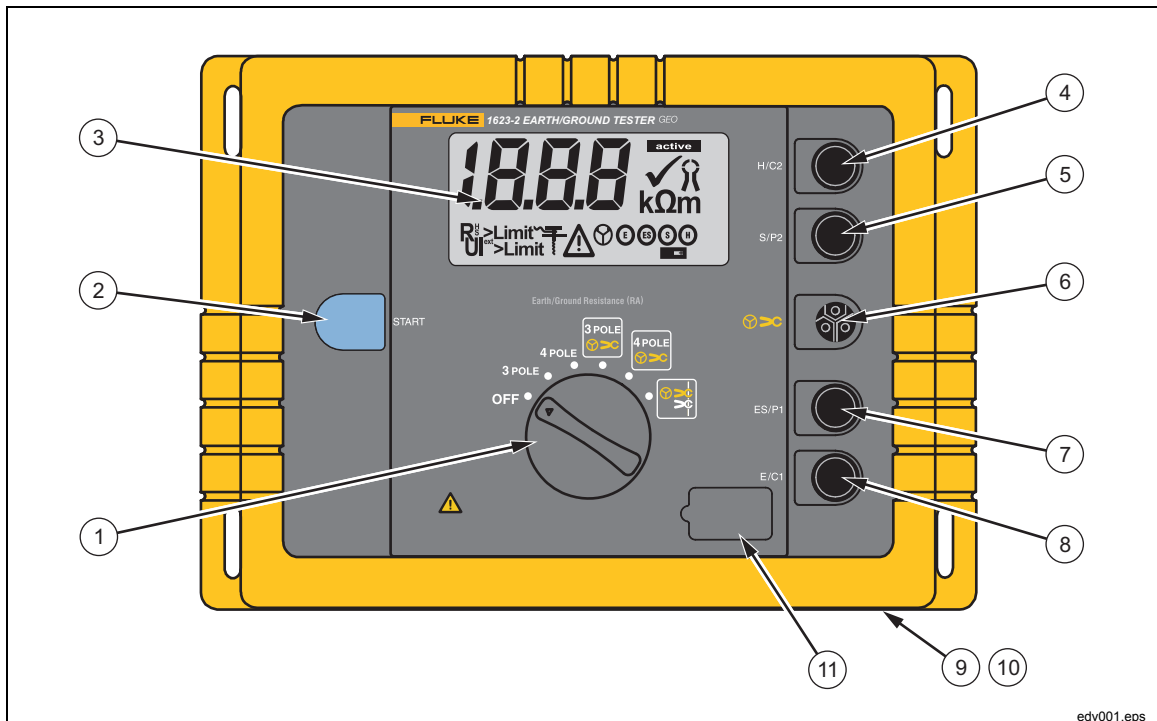
Features


Typical applications for the Tester include:

- Earth/ground resistance measurements in different installations, such as, high voltage pylons, buildings, electrical service grounding systems, mobile communication stations, and HF transmitters.
- Monitor and plan lightning protection systems
- Resistance measurements with earth electrodes; no separation

See Table 3 for a list of features and functions.

Table 3. Features and Functions

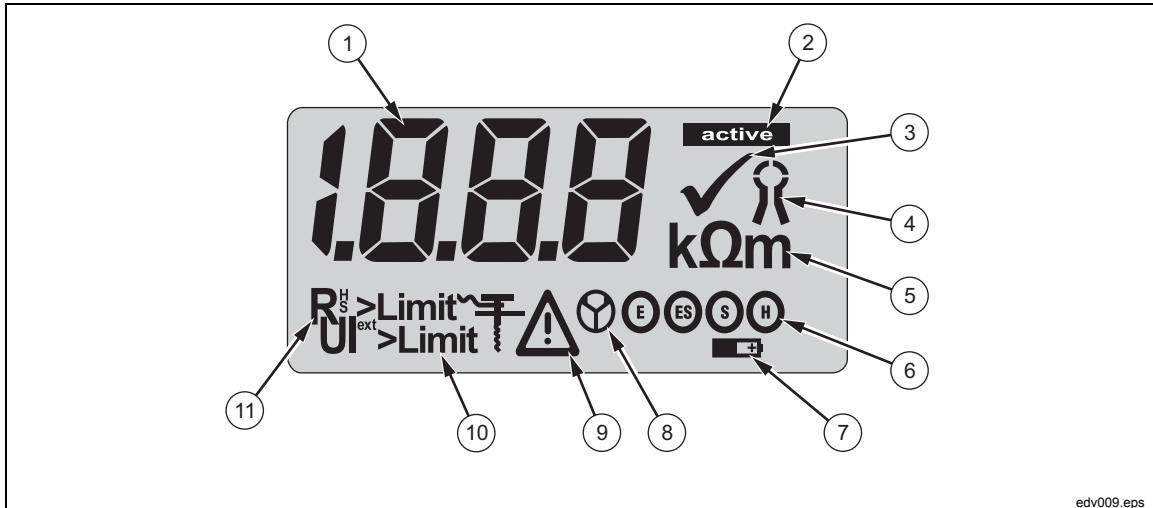


Item	Description
①	Rotary switch to select measurement function and ON/OFF
②	“START” button to start the selected measurement function
③	Liquid crystal display (LCD)
④	Connection “H/C2” for auxiliary earth (4 mm Ø)
⑤	Connection “S/P2” for probe (4 mm Ø)
⑥	Connection  for sense current test clamp
⑦	Connection “ES/P1” for earth electrode probe (4 mm Ø)
⑧	Connection “E/C1” for the earth/ground electrode to be measured (4 mm Ø)
⑨	Battery compartment for 6 alkaline batteries (type AA, LR6)
⑩	Screws to fasten the battery compartment
⑪	USB Type B Port

Display

The LCD is a 1999-digit display with special symbols and digit height of 25 mm. See Table 4 for location and description of each display element.

Table 4. Display



edv009.eps

Item	Description
①	Measurement value
②	Measurement in process
③	Measurement complete
④	Connection for current clamp
⑤	Measurement unit
⑥	Socket indicator
⑦	Battery voltage too low, replace batteries
⑧	Current clamp socket indicator
⑨	Error
⑩	External voltage too high/External current
⑪	RH>Limit: Auxiliary Earth electrode resistance too high
	RS>Limit: Probe resistance too high

Setup

Warning

Read the safety information before you power on the instrument. If you have problems, see *How to Troubleshoot*.

Batteries

Warning

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

- The battery door must be closed and locked before you operate the Product.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.
- Batteries contain hazardous chemicals that can cause burns or explode. If exposure to chemicals occurs, clean with water and get medical aid.

Warning

For safe operation and maintenance of the Product:

- Repair the Product before use if the battery leaks.
- Be sure that the battery polarity is correct to prevent battery leakage.

To insert the batteries:

1. Switch off instrument, see Figure 2.
2. Disconnect all test leads.
3. Open battery compartment.
4. Insert batteries. Always replace the complete set of batteries.
5. Close battery compartment.

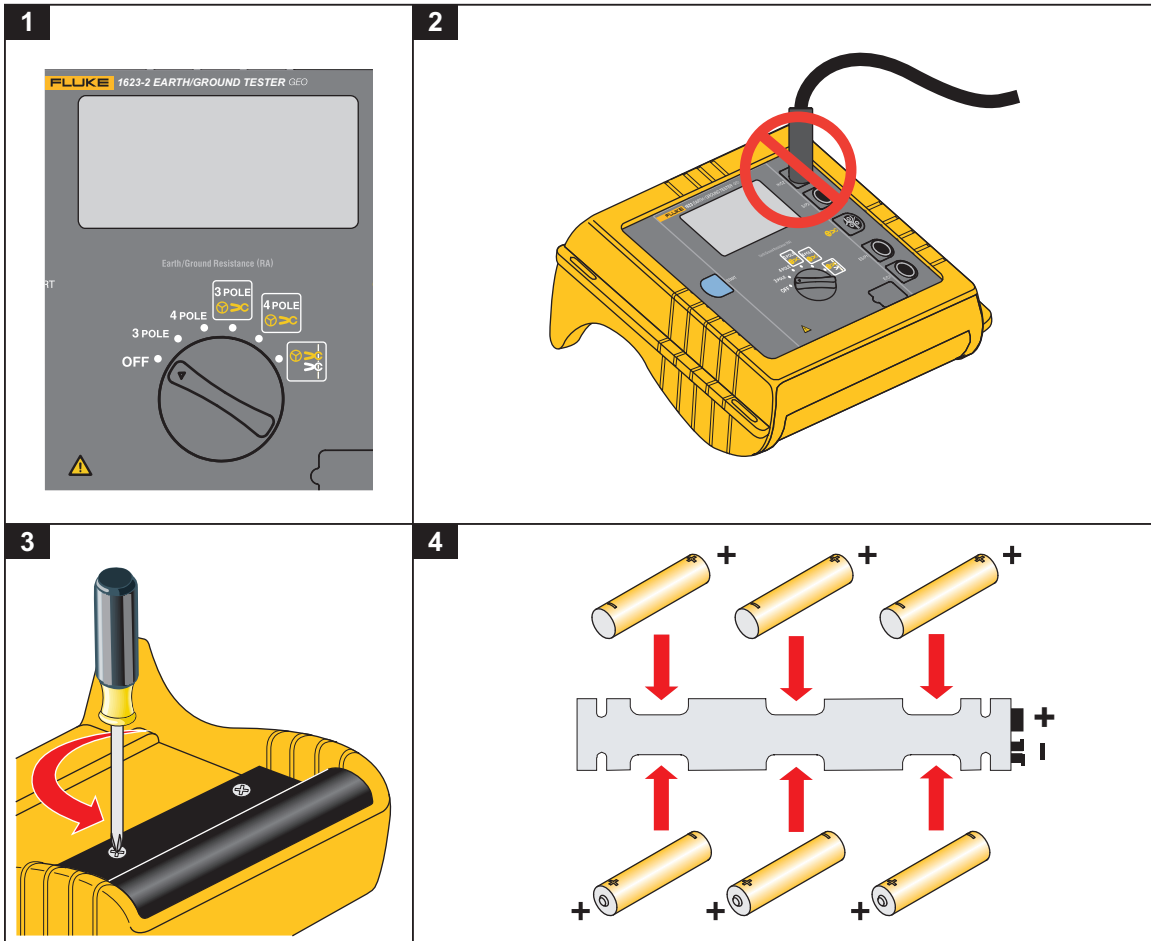


Figure 2. Battery Insertion

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Description of Functions

The functions are selected with the central rotary switch. Measurement values are shown on a liquid crystal display with correct decimal point and unit. Additional special characters indicate measurement mode, operating condition, and error messages.

The Tester includes these measurement functions:

- **Earthing Resistance (R_E)** The earthing resistance is determined by a 3-pole or 4-pole current and voltage measurement. The measuring voltage is a square pulse ac voltage with 48 / 20 V and a frequency of 94, 105, 111 or 128 Hz. The frequency can be selected manually or automatically (AFC).
- **Selective Measurement of Earthing (R_E \gg C)** Measurement of a single earth electrode in a mesh operated (parallel) earthing system. The current flowing through the single earth electrode is measured with an external current transformer.
- **Low Battery Indicator** Battery voltage is low, replace batteries.

Operation

The Tester is equipped with a 3-pole as well as a 4-pole resistance measurement that renders measurements of resistances of earthing systems and measurements of the soil resistivity of geological strata. The Tester also makes measurements with an external current transformer, with which a measurement of single resistance branches in interlinked networks (lightning protection and high voltage pylons with cabling) can be performed without separating parts of the system.

R_A 2-Pole, 3-Pole Measurements

To make 2-pole or dead-earth measurements, connect a jumper between terminals H/C2 and S/P2 with the supplied connector cable. Use only the earth electrode and the auxiliary earth electrode. Minimum distance between earth electrode (E/CD1) and auxiliary earth (H/C2) should be at least 20 m.

See Figures 3 and 4 and do steps 1 thru 4:

1. Select **3 POLE**.
2. Connect the test leads.

Connect terminal E/C1 to the earth/ground system to be measured with the supplied test lead and clip (1.5 m). Place two ground stakes in earth/dirt.

Note

Minimum distance between earth electrode (E/C1), probe (S/P2), and auxiliary earth (H/C2) should be at least 20 m.

Connect the stakes with the 25 m and 50 m cable reels to H/C2 and S/P2 as shown in Figures 3 and 4.

3. Push **START**.
active indicates that a measurement is in progress. For a continuous measurement, continue to push the START button.
4. ✓ indicates a completed measurement. The result is kept on the display until a new measurement is started or the main switch is turned.

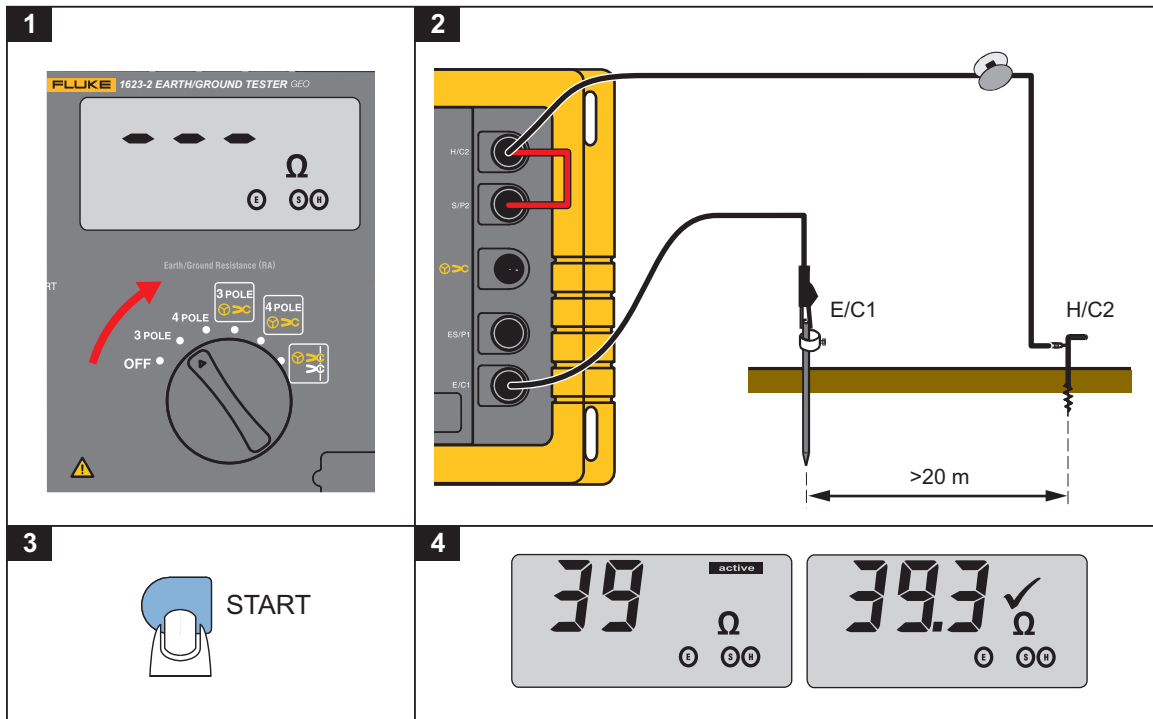


Figure 3. RA 2-Pole Measurement

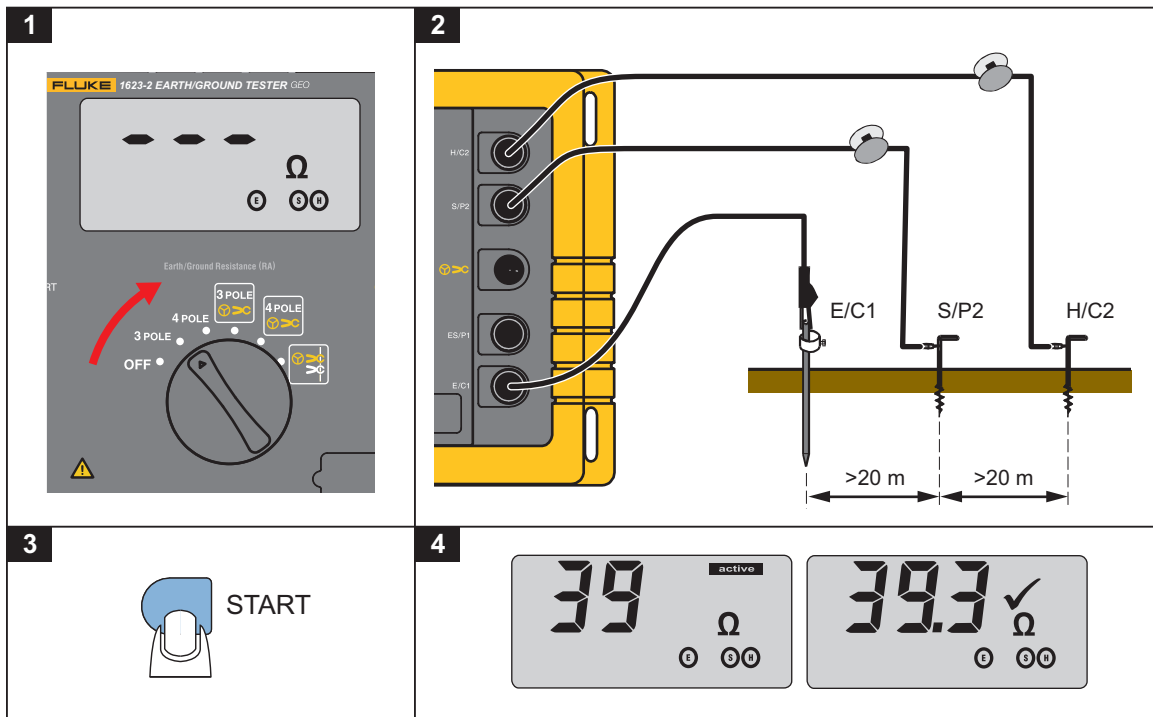


Figure 4. RA 3-Pole Measurement

R_A 4-Pole Measurements

To make 4-pole measurements:

1. Select **4 POLE** function. See Figure 5.

2. Connect test leads.

Connect terminals E/C1 and ES/P1 to the earth system to be measured with the two supplied test leads (1.5 m). Place two ground stakes in earth/dirt. Minimum distance between earth electrode (E/C1), probe (S/P2), and auxiliary earth (H/C2) should be at least 20 m. The ES test lead eliminates the influence of the test leads.

Connect the stakes with the 25 m and 50 m cable reels to H/C2 and S/P2 as shown below.

3. Push **START**.

active indicates that a measurement is in progress. For a continuous measurement, continue to push the START button.

4. ✓ indicates a completed measurement. The result is kept on the display until a new measurement is started or the rotary switch is turned.

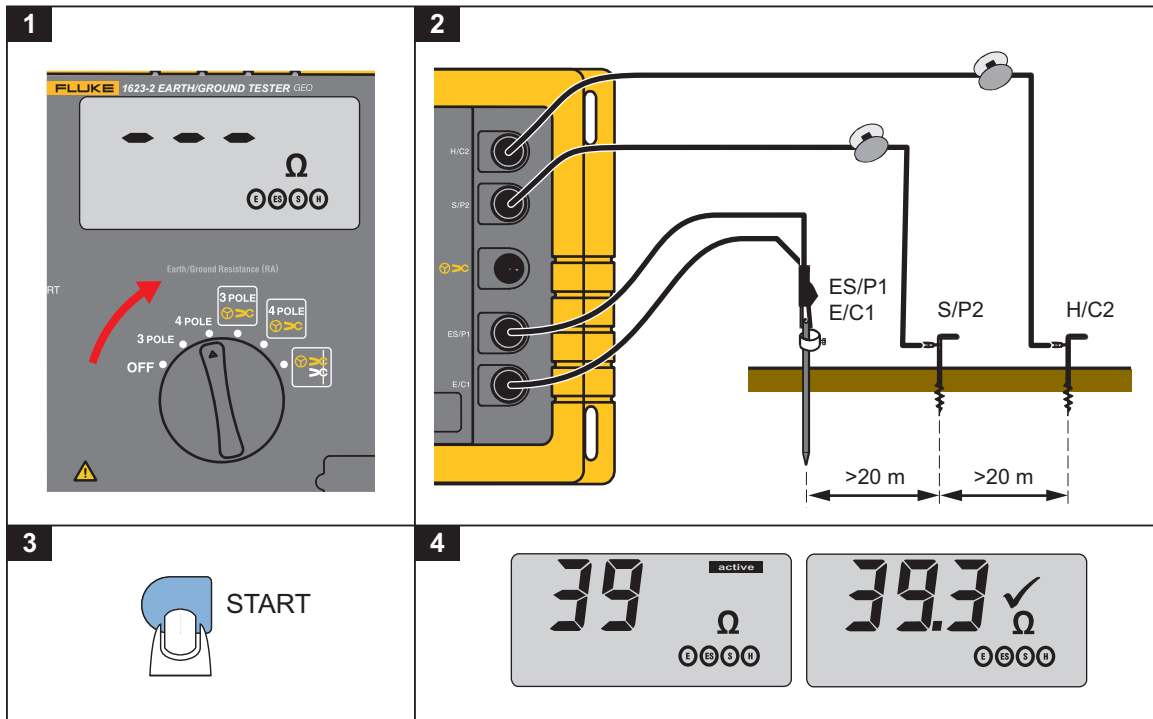


Figure 5. R_A 4-Pole Measurements

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R_A 3-Pole Selective Earth Resistance Measurement with Current Clamp

The R_A 3-pole Selective Earth Resistance Measurement with Current Clamp procedure is useful for the resistance measurement of different parallel sections of an earth/ground system.

1. Select **3 POLE** . See Figure 6.

2. Connect test leads.

Connect the supplied test lead (1.5 m) to terminal E/C1 and its other end to the ground system to be measured. Place two ground stakes in earth/dirt. Minimum distance between earth electrode (E/C1), probe (S/P2) and auxiliary earth (H/C2) should be at least 20 m.

Connect stakes with 25 m and 50 m wires to H/C2 and S/P2 as shown.

Connect current clamp with adapter cable as shown.

3. Push **START**.

active indicates that measurement is in progress. For continuous measurement, continue to push the START button.

4. ✓ indicates completed measurement. The result is kept on display until a new measurement is started or the rotary switch is turned.

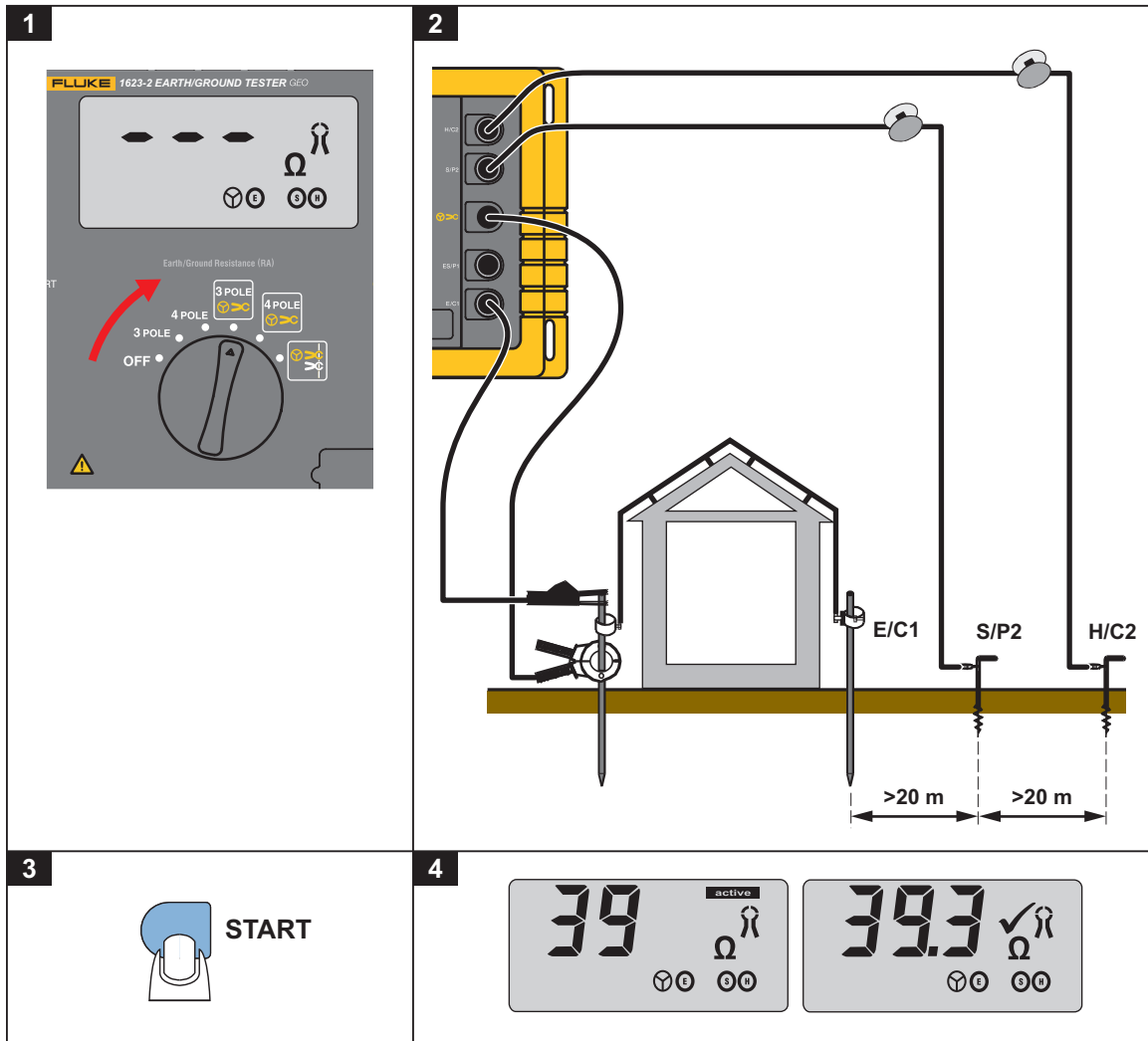


Figure 6. R_A 3-Pole Selective Earth Resistance Measurement with Current Clamp


edv005.eps

R_A 4-Pole Selective Earth Resistance Measurement with Current Clamp

The R_A 4-pole Selective Earth Resistance Measurement with Current Clamp procedure is useful for the resistance measurement of different parallel sections of an earth/ground system.

1. Select function **4 POLE**  **>C**. See Figure 7.

2. Connect test leads.


Connect terminals E/C1 and ES/P1 with the supplied safety test leads (1.5 m) to the earth electrode to be measured. Place two ground stakes in earth/dirt. Minimum distance between earth electrode (E/C1), probe (S/P2) and auxiliary earth (H/C2) should be a minimum 20 m. The  test lead eliminates the influence of the test leads.

Connect stakes with 25 m and 50 m wires to H/C2 and S/P2 as shown.

Connect current clamp with adapter cable as shown.

3. Push **START**.

active indicates that measurement is in progress. For continuous measurement, continue to push the START button.

4.  indicates completed measurement. The result is kept on display until a new measurement is started or the rotary switch is turned.