

ACL 390 Resistance Meter

OPERATION MANUAL



Meter is warranted for one year from the date of purchase on parts and labor.

Calibration is recommended every twelve months.

INTRODUCTION

The ACL 390 meter is a pocket-sized, lightweight, auto-ranging surface resistance tester. Its internal parallel electrodes comply with DIN EN 100 015/1 and ANSI/ESDA-S11.11. IEC electrodes can be externally connected for tests according to IEC 61340-4-1, ANSI/ESDA S4.1 & ANSI/ESDA S7.1. The measuring voltage is auto-ranging between 10v and 100v.

OPERATION USING INTERNAL PROBES

Prior to testing, make certain that surfaces to be tested are clean and free of contaminants. The value is indicated by twelve LEDs in different colors.

The measurement is taken between the tester’s two internal stainless steel probes. The measurement indicates what the resistance of the material is. The test voltage is auto-ranging between 10v and 100v. The meter will apply 10v to conductive surfaces and 100v for materials 10^6 or greater. When the (>) LED flashes during measurement, this indicates that the 9-volt battery is low and needs to be replaced. Calibration is recommended annually.



Caution:

Touching the electrodes with energized or highly-charged objects might damage the instrument.

Measuring Surface Resistivity

To measure electrical resistance on a flat homogeneous material, place the instrument onto the surface and press the “TEST” button.

Resistivity measurements are in ohms per square. LEDs indicate:

LED	Range	Definition
Green	$< 10^6$ ohms per square	Conductive
Yellow	$10^6 - 10^{11}$ ohms per square	Dissipative
Red	$10^{11} >$ ohms per square	Insulative

Measuring Resistance to Ground (RTG)

Plug the supplied grounding cord into one socket of the instrument. The associated internal electrode will be disconnected. Connect the opposite end of the grounding cord to “ground” or a “groundable point”. Place the instrument onto the surface and press the “TEST” button.

Resistance values are in ohms. LEDs indicate:

LED	Range	Definition
Green	$< 10^6$ ohms	Conductive
Yellow	$10^6 - 10^{11}$ ohms	Dissipative
Red	$10^{11} >$ ohms	Insulative

OPERATION USING EXTERNAL PROBES

The ACL 391 comes with two five-pound probes, test leads and carrying case. By connecting the probes to the ACL 390's sockets, it is possible to measure Point-to-Point (RTT) Resistance, Surface-to-Ground (RTG) Resistance, and Volume Resistance. Using these probes will allow compliancy with various standards including ANSI/ESDA S4.1 for Worksurface – Resistance Measurements, ANSI/ESDA S7.1 Resistive Characterization of Materials – Floor Materials. Please visit the ESD Association's website for more information on ESD test standards: www.esda.org.

Resistance Point-to-Point (RTT)

RTT measurements can be used for the evaluation of floors, chairs, carts, work surfaces and other ESD-controlled materials and products. Procedures vary regarding sample preparation, probe preparation and spacing of the five-pound probes. Select and read the correct test procedure or standard for the desired measurement.

- A. Connect one end of each of the banana test leads into the sockets of the meter. Connect the other end of the test coil cords into the five-pound probes.

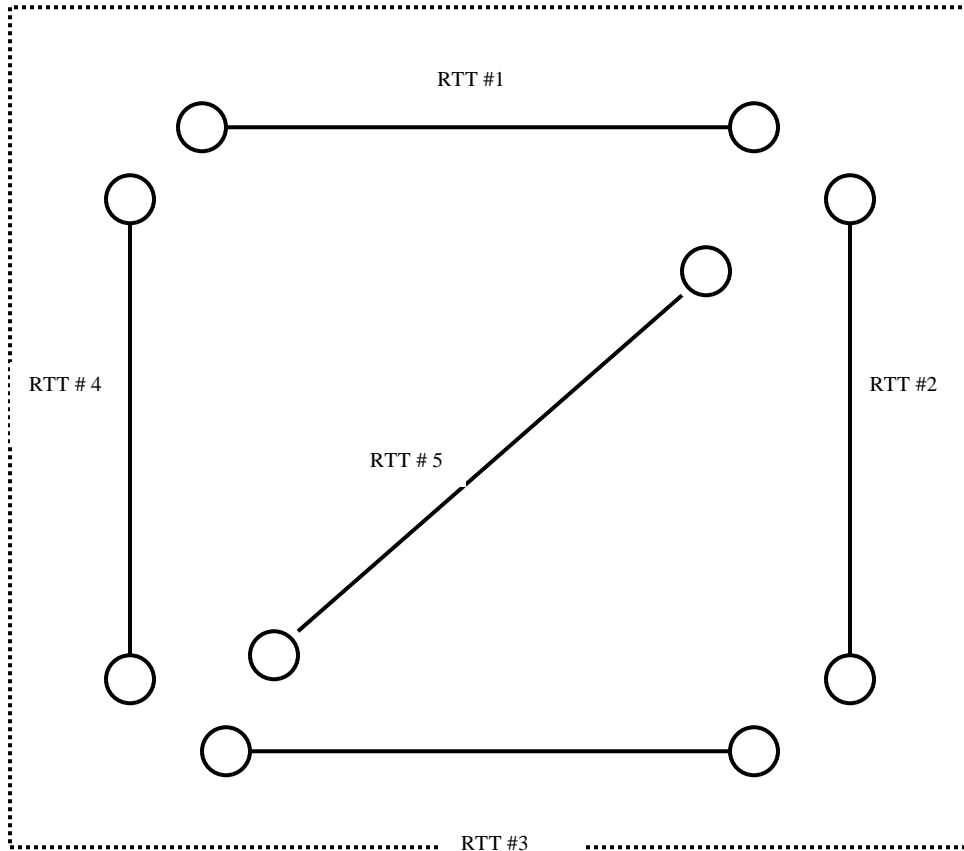


- B. Place both probes on the material according to test procedures or standard being used.
- C. Press the "TEST" button and the value will be displayed on the LED. The meter will apply the correct voltage (10v or 100v) according to the value of what is measured.

An example of measuring RTT on dissipative flooring:

Taking routine measurements of tiles with dissipative floor finish will support proper maintenance routines and will indicate any problems that may arise. Keeping a record of test results including temperature, humidity and electrical properties will provide a reference and will point toward a blueprint of traffic patterns on the floor.

To get an average measurement of a floor, map out a 4' x 4' section and conduct various tests (one at a time) within the square.



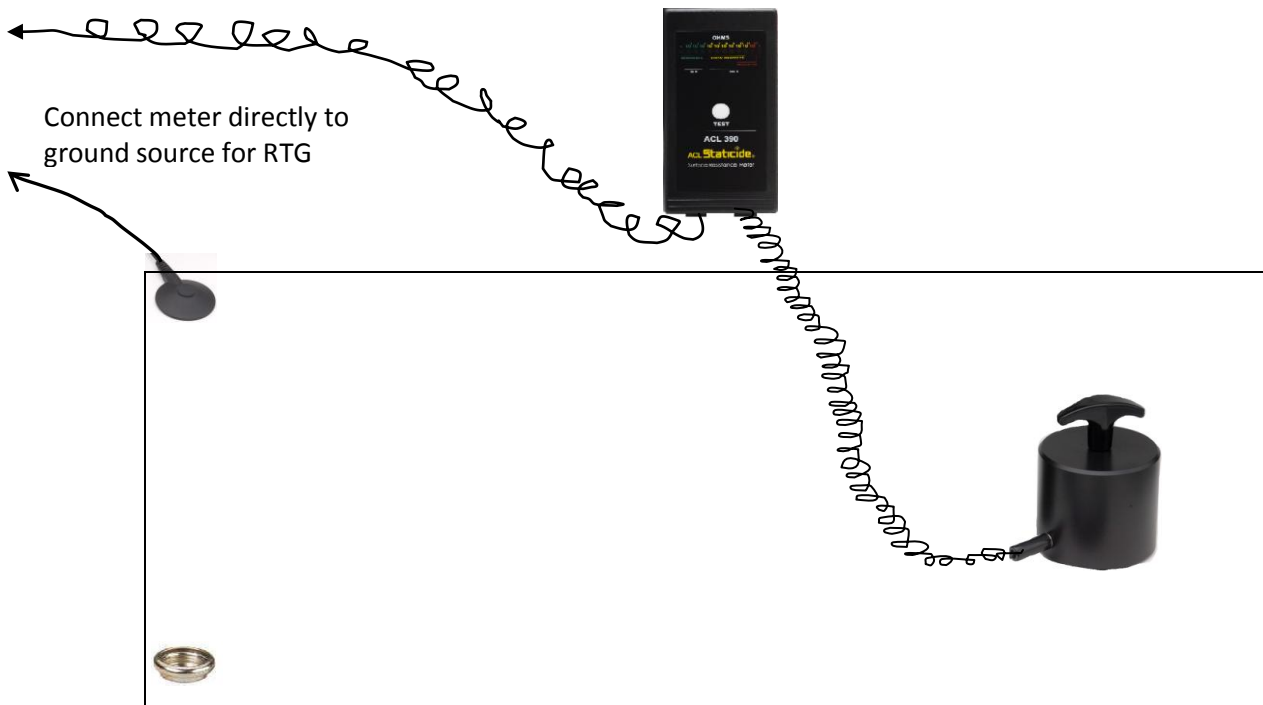
4' x 4' Section
(not to scale)

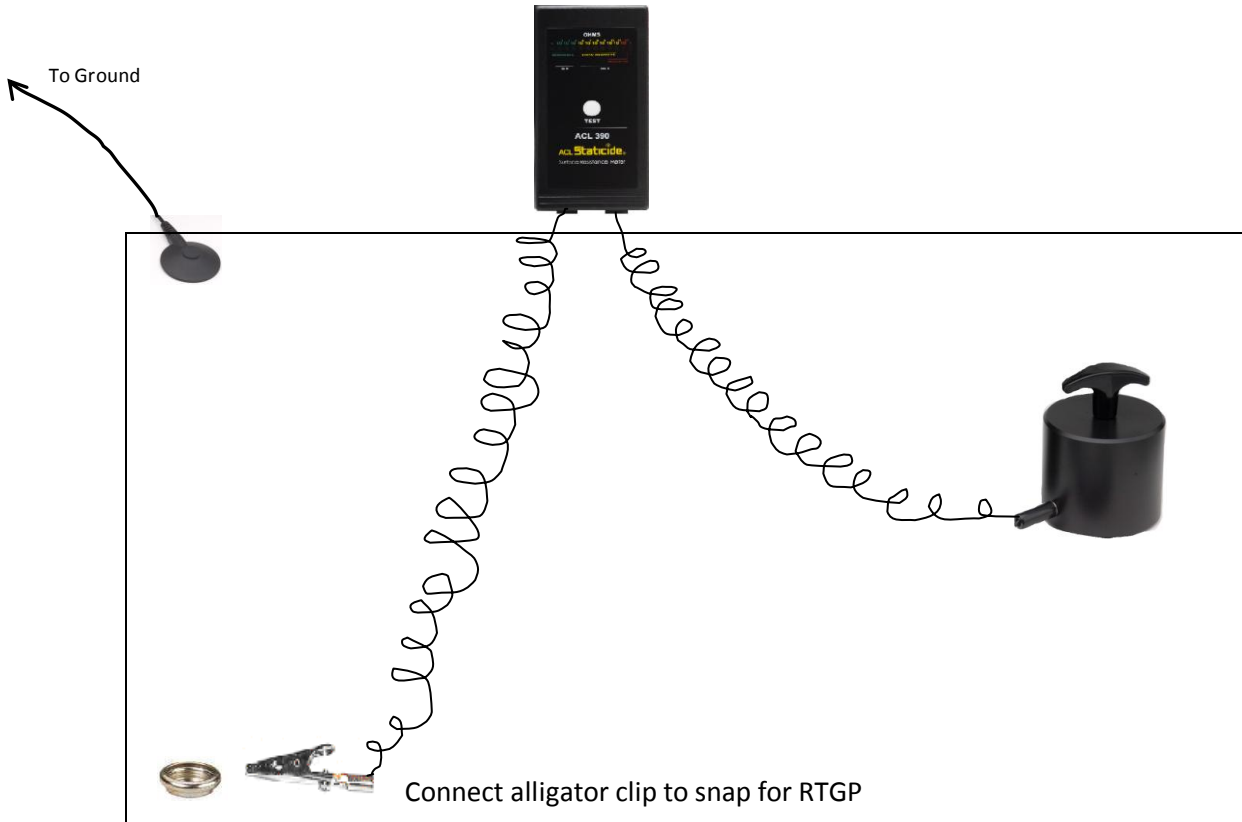
Each RTT test uses the five-pound probes placed three feet apart (36 inches). Connect the test leads to the meter. Attach a five-pound probe to the end of each lead and place three feet apart as indicated above. Press and hold the "TEST" button on the ACL 390 meter until a value is displayed.

Resistance Surface to Ground (RTG)

This procedure measures the surface resistance between a ground point and specific positions on the material being tested. RTG measurements can be used for the evaluation of floors, chairs, carts, work surfaces and other ESD-controlled materials and products. Keeping a record of test results for temperature, humidity and electrical properties will provide a reference.

- A. Plug the supplied grounding cord into one socket of the instrument. The associated internal electrode will be disconnected. Connect the opposite end of the grounding cord to ground (RTG) or a groundable point (RTGP).
- B. Plug one of the five-pound probes into the tester using the accordion cable with the banana plug. Position the probe on the surface to be tested in accordance with the desired test procedure.
- C. Press the "TEST" button and the value will be displayed on the LED. When performing test do not touch lead wires or probe. Avoid overlapping of lead wires. This will ensure accurate readings.
- D. Resistance values are in ohms. Record temperature, humidity and resistance.





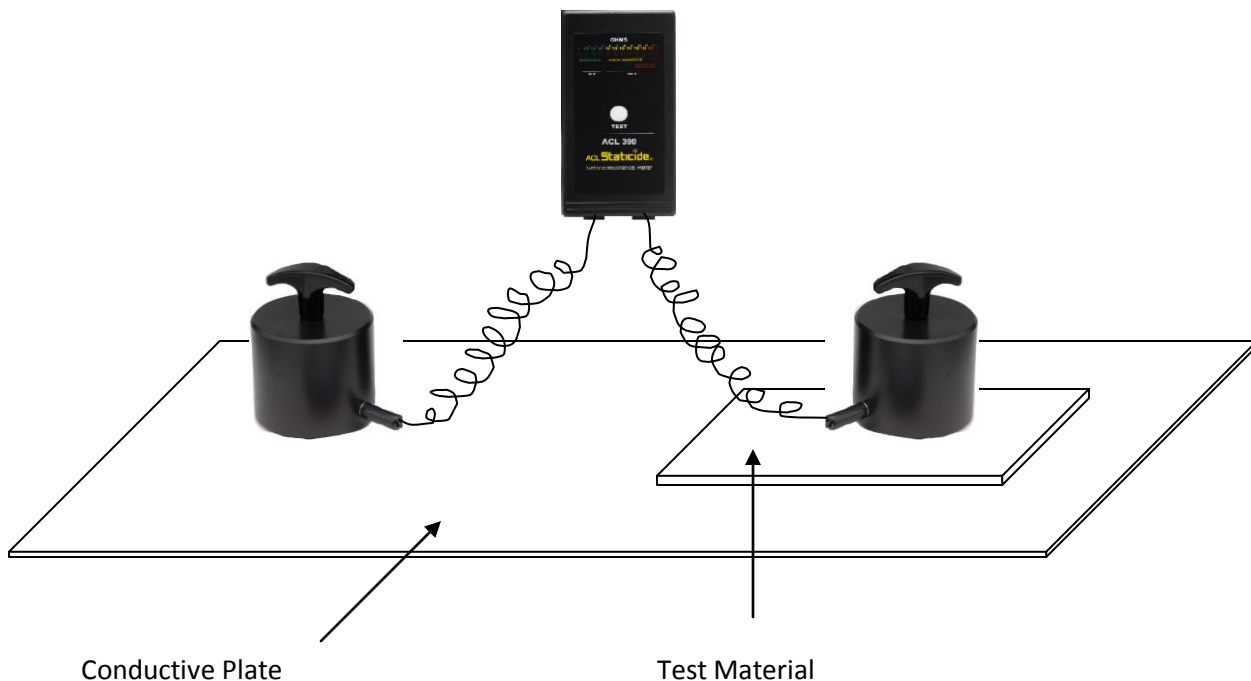
If you are testing RTGP on an ESD mat, you can attach the alligator clip to the lead and connect it to the ground snap or connect the banana plug to a common point ground plug:



Volume Resistance Measurement

Volume Resistance measures the electrical path through a material.

- A. Connect one end of each of the banana test leads into the sockets of the meter. Connect the other end of the test coil cords into the five-pound probes.
- B. Place sample material on a conductive metal plate (such as stainless steel). Place one of the five-pound probes on the material so that the material is sandwiched between the probe and metal plate. (See below.)
- C. Place the second five-pound probe on the conductive metal plate.
- D. Press the "TEST" button and the value will be displayed on the LED. Volume Resistance is in ohms-cm.



ACL MODEL #390 CALIBRATION INSTRUCTIONS

Equipment Needed

- Resistance decade box with 1% accuracy resistors – ACL uses a calibration box # 7100.SRM110.KA.T.
- Insulated screwdriver for adjustment
- Philips head screwdriver to open the case

Test Procedure

- Make sure calibration box is grounded.
- Place the ACL 390 meter onto the electrodes of the calibration box.
- Each resistance value must be selected and compared to the reading of the instrument while pressing the test button of the ACL 390.
- In case the values do not match, make the below adjustment.

Adjusting

1. Remove the back cover of the housing by unscrewing the four screws on the back.
2. Connect the ACL 390 to the calibration box.
3. Select decade $10^{11}\Omega$ with the rotary switch (3). Adjust the upper pot (P1) with the insulated screwdriver while keeping the test button pressed, until both values match.
4. Select span 3, $2 \times 10^6\Omega$ (1) (2). Adjust the lower pot (P2) until both values match.
5. When a change is made repeat steps to approximate the tolerances to zero.
6. After successful adjustment verify all values again.

LED Display	Selector	Right Rotary Switch	Resistor
$< 10^3$	Right	$< 10^3$	$< 1 \Omega$
10^3	Right	10^3	1 k Ω
10^4	Right	10^4	10k Ω
10^5	Right	10^5	100k Ω
10^6	Right	10^6	1M Ω
10^7	Right	10^7	10M Ω
10^8	Right	10^8	100M Ω
10^9	Right	10^9	1G Ω
10^{10}	Right	10^{10}	10G Ω
10^{11}	Right	10^{11}	100G Ω
10^{12}	Right	10^{12}	1T Ω
$> 10^{12}$	Right	∞	infinite
LED Display	Selector	Left Rotary Switch	Resistor
10^6	Left	$1,8 \times 10^6$	1,8 M Ω
10^6 and 10^7	Left	$3, 2 \times 10^6$	3, 2 M Ω
10^7	Left	$5, 6 \times 10^6$	5, 6 M Ω