AE-780 Surface Resistance Meter

OPERATION MANUAL

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

Calibration is recommended every 12 months.

AE-780 Surface Resistance Meter

The AE-780 is a light weight, pocket-sized, auto ranging surface Surface Resistance Meter. It is designed to test conductive, anti-static, and static dissipative surfaces for electrical resistivity according to the ESDA's parallel resistivity probe method DIN EN 100 015/1 & ANSI/ESD-S11.11.

If meter is purchased with the accessory kit, it will comply to IEC 61340-4-1, ANSI/ESDA S4.1 & ANSI/ESDA S.7.1 when the five punch electrodes are used.

<u>AE-780 Surface Resistance Meter Includes:</u>

Tester

Two accordion cables (stereo to banana)

9 volt battery

Certificate of calibration

AE-780-1 Accessory kit

Two 5lb probes

Foam lined carrying case

Limits

Resistivity: 10^3-10^{12} ohms/sq.

Resistance: 10^3-10^{12} ohms

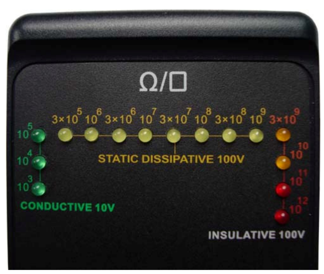
Measuring voltage: 10v and 100v

Introduction

The AE-780 Surface Resistance Meter is an easy to use tester for measuring surface resistivity. The AE-780 Surface Resistance Meter with the AE-780-1 accessory is a dependable audit kit for conductive and dissipative surfaces. This meter is designed to be used in all facets of material production including engineering, maintenance, quality control, incoming inspection, manufacturing, research, or sales departments for the testing of anti-static mats, floor finishes, paints, wrist straps, smocks, foot wear, bags and containers.

When using the built-in electrodes, the meter's test values for surface resistivity are in ohms per square (although they are displayed in ohms). When using the external five pound electrodes, the meter's test values for resistance are in ohms.

DECADE SCALE



10^3	=	1 kilohm
10^4	=	10 kilohms
10^5	=	100 kilohms
3×10^5	=	300 kilohms
10^6	=	1 meg ohm
3×10^6	=	3 meg ohm
10^7	=	10 meg ohms
3×10^7	=	30 meg ohms
10^8	=	100 meg ohms
3×10^8	=	300 meg ohms
10^9	=	1000 meg ohms
3×10^9	=	3000 meg ohms
10^{10}	=	10,000 meg ohms
10^{11}	=	100,000 meg ohms

10^{12} = 1,000,000 meg ohms

The tester value is indicated on the LED display. Half decades provide greater accuracy by giving a closer indication to the measurement value. A decade will brighten to the according test result. Colors signify the test value's function..

COLOR	INDICATING FUNCTION	ohm
Green	Conductive	10^3-10^5
Yellow	Dissipative: ideal test measurement	3 x 10^5 - 10^9
Orange	Dissipative but close to going out of space	3 x 10^9 – 10^{10}
Red	Near insulative to insulative	10^{11} - 10^{12}

TEST VOLTAGE

The test voltage ranges are 10v and 100v. According to ESDA standards S4.1, S7.1, and S11.11 10 volts should be applied for conductive surfaces less than 10^6 and 100v for materials 10^6 or greater. The AE-780 will automatically generate proper voltage according to test measurement.

As defined by the ESD Association, values indicate the following:

Voltage	Range	Definition
10 volt	< 10^6 ohms per square	Conductive
1oo volt	10^6 – 10^{11} ohms per square	Dissipative
100 volt	10^{12} > ohms per square	Insulative

A NOTE ABOUT VOLTAGE

In previous years, people desiring the measure resistivity or resistance followed the ASTM D264, ASTM 991, NFPA 56A or NFPA 99 test standards. These procedures required people to test at either 500 or 1000 volts. This cased concern regarding safety to the person doing the tests. The ESDA standardized the test procedures so that lower volts could be used at specific ranges.

The AE-780 meter used a 9 volt battery. Some meters with 9 volts batteries do not give the accuracy that you need to perform the tests especially at values higher than 10^7. The AE-780 is built with a transformer that converts the 9 volt charge from the battery to 10 volts or 100 volts. The meter applies a constant charge over the complete voltage range. Accuracy is depends on applied voltage, temperature, and humidity.

TEMPERATURE AND HUMIDITY

The humidity and temperature affect the electrical properties of the material being tested. The combination of low humidity and low temperature will give the highest electrical resistance results or slowest dissipation times. At high humidity a thin layer of water is condensed or absorbed on or in the material being tested. This is true of hydroscopic additives that are added to a material to increase the electrical conductivity. These additives will allow moisture to be absorbable in the materials they are added to.

At elevated temperatures the mobility of free electrons is increased thereby increasing the materials conductivity. This is especially true for carbon black, metallic oxides, metals, and other materials added to a material. When the material is at a lower temperature, built in stresses occur which might increase the resistance due to increased distance between the conductive additives. Thus, humidity and temperature must be known.

RECORDING DATA

ANSI/ESD Association and European CECC recognize the environmental effects to test measurements and specify in their standards that they measured and recorded. It is possible to test or manufacture a material at high humidity and pass all the test specifications, but when the customer receives the material and used it at a lower humidity or temperature the material fails to pass the specifications. This can cause rejects and loss of product.

Both ESD S4.1 ESD Protective Work surface sections 6.2.4 and ESD S7.1-1994 Resistive Characterization of Materials Floor Materials sections 5.2.3 require reporting of temperature and humidity at the time of testing. ANSI/EOS/ESD-S11.11-1993 Surface resistance measurement of Static Dissipative Planar Materials section 11.0 B states, “report the conditioning period, relative humidity, and temperature.”

CALIBRATION

Calibration is recommended annually. The AE-780 meter comes with a calibration certificate using equipment that is traceable to National Standards and CAD generated techniques. Meters can be sent back to ARMEKA ENGINEERING Ltd for calibration for a lab fee or it can be sent to a certified calibration lab (see page 12 for instructions). The meters also come with a CE mark approval.

MEASURING WITH INTERNAL ELECTRODES

The parallel resistivity probe method complies with EOS/ESD-S11.11. It is used to give fast electrical resistivity measurements on flat homogeneous materials. It may be used on multilayered materials, but this should be noted along with the temperature and humidity value on the data report.

When the measurement is taken between the tester's two mesh rails under the tester, the tester will indicate the surface resistivity of the material being tested.

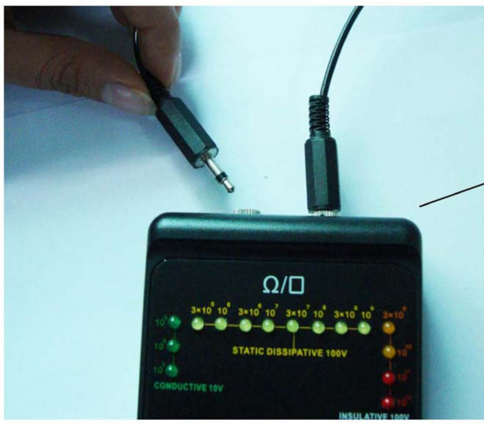
A. Prior testing, make certain that surfaces to be tested are clean and free of contaminants.
B. Allow the meter to equilibrate to the atmosphere the meter is to be used in. It may take a half hour for the meter to adjust to new environment conditions.
C. Place the meter on the desired surface to be tested.

D. Press and hold the red test button with approximately 5 pounds of applied force. The meter will display the surface resistivity in ohms per square.
E. When using the built-in electrodes, the meter's test values for surface resistivity are in ohms per square (although they are displayed in ohms).
F. The test value is indicated on the LED display. A decade will brighten to the according test value. Colors signify the test value's function (see page 3).

MEASURING WITH EXTERNAL ELECTRODES

When the measurement is taken using the 5lb external probes, the tester will indicate the resistance of the material in ohms.

It is used to give fast electrical resistivity measurements on flat homogeneous materials. It may be used on multilayered materials, but this should be noted along with the temperature and humidity value on the data report.



When the cables have been plugged in the appropriate socket, the parallel probes under the meter disengage.

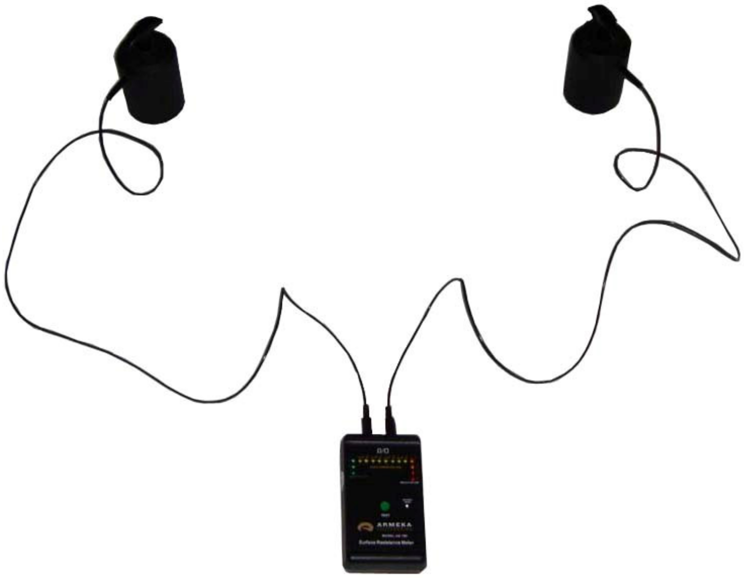
By utilizing these probes to the AE-780's sockets it is possible to measure Point to Point (RTT) Resistance, Surface to Ground (RTG), and Volume Resistance. Using these probes will allow compliancy with various standards including ANSI/ESDA S4.1 for Worksurface – Resistance Measurement, ANSI/ESDA S7.1 Resistive Characterization of Materials - Floor Materials.

When auditing is finished, unplug the cables and store probes in the protective case.

Resistance Between Two Points (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 5 pound probes. Select and read the correct test procedure or standard for the desired measurement. Test procedures can be purchased from www.esda.org.

A. Connect one end of each of the banana test leads into the sockets of the meter.
   Connect other end of the test coil cords into the 5 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 LCD. The meter will apply the correct voltage (10v or 100v) according to the value of what is measured.
D. When performing test do not touch lead wires or probes. Avoid overlappling of lead wires. This will ensure accurate readings.

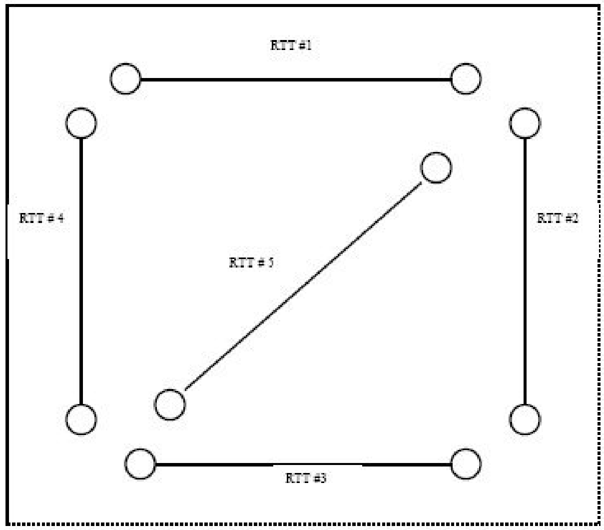
AN EXAMPLE OF MEASURING RTT IN DISSIPATIVE FLOORING:

Taking routine measurements of tiles with dissipative floor finish will insure proper maintenance habits and will indicate problems that may arise. Keeping a record of test results for temperature, humidity and electrical properties will provide a reference and will point toward a blueprint of traffic patterns on the floor. Good record keeping will insure success when developing and maintenance a maintenance program.

To get an average measurement of a floor, map out a 4” x 4” section and conduct five tests (one at a time) within the square. Conduct a test for each side of the square and a final test diagonally through the center as shown in the drawing below.

Each RTT test utilizes the 5 pound probes placed 3 feet apart (36 inches). Connect the test leads to the meter. Attach a 5 pound probe to the end of each lead and place 3 feet apart as indicated above. Press and hold the “TEST” button on the AE-780 meter until a value is displayed.

Armeka EngineeringOy Limited
Kilonkallio 5, FI-02610 Espoo, Finland.
Tel:+358 208 405 488 Fax: +358 9 5915 3535
www.armekaengineering.com



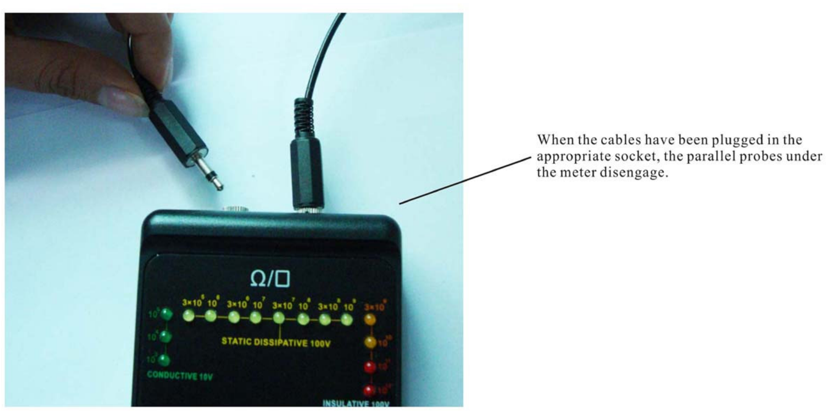
4' x 4' Section
(not to scale)

MEASURING RESISTANCE TOGROUND (RTG)

Resistance to ground 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.

AN EXAMPLE OF MEASURING RTG ON DISSIPATIVE FLOORING:

For Testing Resistance on Floors, S7.1 requires a minimum of 5 RTG tests per 5,000 SqFt. Connect the leads for the external electrodes to the meter.



Attach one lead to a 5lb probe and place probe on the floor that's being tested. Attach the other lead to an alligator clip and connect to a groundable point (RTGP). If using a ground adapter plug, plug the banana lead into the adaptor after the adapter is plugging into the receptacle.

Armeka EngineeringOy Limited
Kilonkallio 5, FI-02610 Espoo, Finland.
Tel:+358 208 405 488 Fax: +358 9 5915 3535
www.armekaengineering.com

AN EXALMPLE OF MEASURING TRG ON DISSIPATIVE TABLE MATS:

A. To test RTG for a workstation, connect the first lead to the meter and to a 5lb probe and put probe on work surface. Connect the 2nd lead to the meter and to a groundable point (RTGP).

B. To attach lead to RTGP, slip the alligator clip to the lead and connect it to the ground snap or connect the banana plug to a common point ground plug.

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. When recording test values, also notate the temperature and humidity as the environment can affect test results.

Volume Resistance Measurement MEASURING RESISTANCE TO GROUND (RTG)

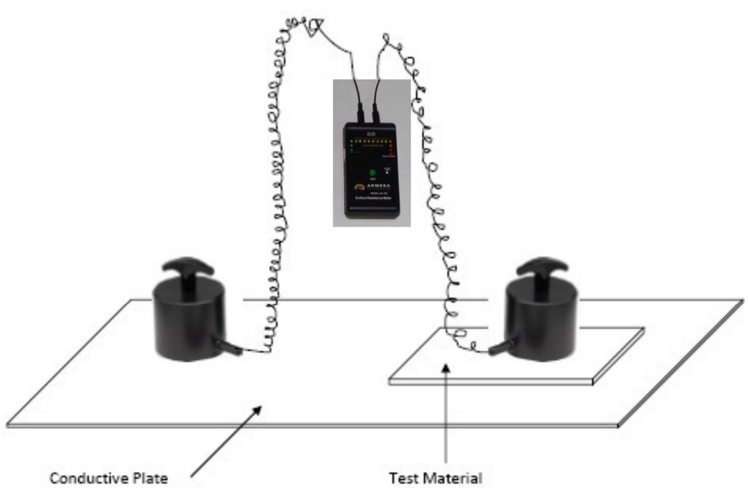
Volume Resistance measures the electrical path through a material.

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 5 pound probes.

B. Place sample material on a conductive metal plate (such as stainless steel). Place one of the 5 pound probes on the material so that the material is sandwiched between the probe and metal plate.(see below)

C. Place the second 5 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.



ARMEKA
ENGINEERING

AE-780 CALIBRATION INSTRUCTIONS

The checker should be calibrated on average every 12 months. A tester resistance can be applied across the parallel bars to verify if the checker is within specification, using a resistance decade box. Calibration can be obtained by contacting ARMEKA Incorporated.

SPECIFICATION

Dimension: -approx.	70mm x 130mm x 35mm
Weight: -approx.	103 grams
Power: -	Battery operated PP3 9 volt
Connections: -	2 x 3.5mm jack plug for each earth connection
Test Range: -	10^3 to 10^{12}
Dissipative Range: -	3 x 10^5 to 3 x 10^9 1/2 Decade between each decade on a logarithmic scale
Example:	1x 105 x 3.21 = 3 x 10^5 (1/2 Decade Measurement) x 3.21 = 1 x 10^6

Method of Measurement:

Surface Resistivity	(Ohms per square)
Point to Point Resistance	(Ohms)
Accuracy: -	+/- 0.5 Decade in Conductive Range
	+/- 0.25 Decade in Dissipative Range

TEST EQUIPMENT USED

Resistance Decade Box
Test Leads

The resistance decade box required will need a range of from >1 kilohm to 999 meg ohms or 10^9. Measurements greater than 10^9 are calculated using cad generated techniques, as high resistances greater than 10^9 are difficult to verify with a test voltage of 9 vlots.

Connect the test leads from the resistance decade box to the test probes of the checker, set the decade box to the desired resistance i.e. 10^3 = 1 K, then press and hold the checker's test button, then 10^3 LED should light, 10 K 10^4 LED should light and so on. To measure the changeover point between decades, increase the resistance o the decade box while pressing the checker's test button. Record the resistance when the next LED lights permanently (this is the changeover resistance).

Example: The first green LED is illuminated 10^3 = 1 kilohm.
At 3 or 4 kilohms 10^4 LED is illuminated, the changeover point is 3 or 4 kilohms. 10^4 = 10 kilohms so between 3 or 4 kilohms and 30 or 40 kilohms will be the changeover points from 10^4 to 10^5.

Please note that the checker has no internal parts to adjust, so verification of calibration can be achieved by using the above process. If verification cannot be achieved the unit should be returned to the supplier.