

# FLOORING/WORKSURFACE RESISTANCE AUDIT KIT

**Model 2003**



**Operating Manual**

## 1.0 INTRODUCTION

The Model 2003 Flooring/Worksurface Resistance Audit Kit, shown in Figure 1.0-1, contains a Megohmmeter, a pair of NFPA (ESDA STM4.) 5 lb (2.27kg), 2.5" (64mm) diameter probes, 3" (76mm) dia. Aluminum Plate/Ground plane, test leads, Wiring Verifier and a Humidity/Temperature/Dew Point indicator that is housed in a sturdy ABS carrying case. The kit enables the user to make a wide range of resistance measurements. Although it is designed primarily for making point-to-point and point-to-ground resistance measurements on installed flooring and work surfaces where either a 100 or 500 Volt test voltage is specified plus it may be used in any application where the 5 lb. (2.27kg) probe can be used. With the addition of appropriate (optional) probes or test fixtures, the kit can also measure surface and volume resistance/resistivity of material and product, plus wrist and heel ground strap resistance. This manual, along with the Model 6534 Megohmmeter manual, covers the many applications for this versatile test kit. The user is urged to read both manuals to become completely familiar with its many uses and applications.



Figure 1.0-1: Model 2003 Flooring/Worksurface Resistance Audit kit

## 2.0 DESCRIPTION

### 2.1 Model 6534 Megohmmeter (see 6534 Manual for more details)

Resistance Ranges:

Measurement Range	0 to 3999 $\Omega$	4.00 to 39.99k $\Omega$	40.0 to 399.9k $\Omega$	400 to 1000k $\Omega$
Resolution	1 $\Omega$	10 $\Omega$	100 $\Omega$	1k $\Omega$
Accuracy	$\pm$ (3% + 2 ct)			
Open voltage	approximately 4.5V			

Short circuit current:  $\leq 3\text{ma}$   
Voltage Ranges: 0 to 700 Volts AC or DC  
Audible Tone: Upper/lower alarm thresholds, switchable ON/OFF  
Batteries: Six (6)x1.5 Volt AA alkaline  
Battery Life: 3500 tests @ 5 seconds each

## 2.2 Model 850 Surface Resistance Probe

Weight: 5lbs.  $\pm 1$  oz. (2.27kg) each  
Electrode: Conductive elastomer rubber (carbon loaded)  
Hardness: 65 $\pm$ 10 shore A durometer  
Diameter: 2.5" $\pm$ .032" (64 $\pm$ 1mm)  
Resistivity: 10 Ohms-cm  
Minimum resistance: <100 Ohms

## 2.3 Model 5646A Humidity/Temperature/Dew Point Indicator

The Model 5646A Humidity/Temperature/Dew Point Indicator is a lightweight, portable electronic instrument that measures both temperature and relative humidity and calculates dew point on a single LCD readout. The capacitive thin film type humidity sensor has fast response and accurately measures over the range of 5-98  $\pm 3\%$  RH. The resistance type temperature sensor provides a temperature measurement range of +32 to +122  $\pm 1^\circ\text{F}$  (-20 to +70  $\pm 0.5^\circ\text{C}$ ).

## 2.4 Earth Ground AC Plug

The Earth Ground AC Plug is used to provide a standard banana jack connection to the 3<sup>rd</sup> wire ground.

## 3.0 APPLICABLE SPECIFICATIONS

ASTM F150: Electrical Resistance of Conductive Resilient Flooring

NFPA 99: Standard for Health Care Facilities

ESDA STM 4.1: Worksurfaces

ESDA STM 7.1: Floor Materials

ESDA STM 9.1: Footwear

ESDA STM 12.1: Seating

## 4.0 UNPACKING

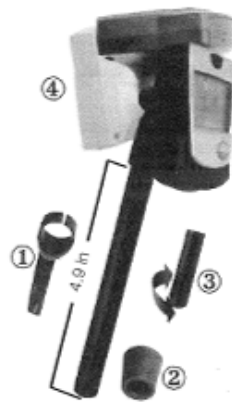
Before using your new Model 2003 Audit Kit, check the contents against the Kit Contents List in Table 4.1. Contact ETS immediately should any shortages be noted.

**TABLE 4.1  
2003 Kit Contents List**

<b>ITEM</b>	<b>QUANTITY</b>	<b>DESCRIPTION</b>
1	1	Case with key
2	1	Meter – Model 6534
3	1	Black Lead, 5' (1.5m)
4	1	Red Lead, 5' (1.5m)
5	1	AEMC Flash Drive
6	1 pair	Red & Black Clips
7	1	Green Lead, 25' (7.6m), Plug/Plug
8	1	Alligator Clip
9	2	5 lb. (2.27kg) Probe – Model 850
10	2	Red Lead, 5' (1.5m) for 850 Probes
11	1	Earth Grounding Plug
12	1	3" Aluminum Plate/Ground Plane
13	1	Humidity/Temp Indic. - Model 5646A
14	1	AEMC 6534 Document Bag

## **5.0 TEST PROCEDURES**

The testing of flooring material generally requires the measurement of point-to-point (Pt-Pt) and point-to-ground (RTG) resistance and the recording of humidity and temperature. Typical test voltages for these measurements are 100 or 500 Volts DC although measurements may be made at higher or lower voltages. The Model 5646A is used to measure the humidity and temperature at the time of measurement. The Operating Instructions are shown in Figure 5.0-1.



- ① Multi-purpose clip
- ② Holder for positioning stick in duct
- ③ Ø 12 mm  
The humidity sensor is protected by a quick twist of the bottom of the probe stem → the protective cap is closed. Should only be left open for the duration of the measurement.
- ④ Swivel head. The display can always be read.

**Technical data**

Type of application:	.....Short measurement
Measuring range:	.....5 to 95 %RH / 0 to +50 °C / -20 to +50 °C td +32 to +122 °F / -4 to +122 °F td
Resolution:	.....0.1 %RH / 0.1 °C / 0.1 °F
Accuracy:	.....(System accuracy at 25 °C / +77 °F) ±3 %RH / ±0.5 °C / ±0.9 °F
Parameters:	.....%RH, °C, °F
Ambient temperature:	.....0 to +50 °C / 32 to +122 °F
Storage temperature:	.....-20 to +70 °C / -4 to +160 °F
Battery type:	.....3 x AAA
Battery lifetime:	.....Approx. 1000 h
Probe stem:	.....Ø 0.5 in
Length:	.....4.9 in
Warranty:	.....2 years
CE guideline	.....2004/108/EEC

**Commissioning**

Remove the protective film on the display.

**Switching on**

ⓘ Press button:



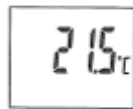
Segmenttest



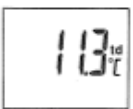
Current reading

**Changing the parameters**

ⓘ Press button repeatedly:



Temperature



Dew point



Humidity

**Switching off**

ⓘ Keep button pressed for 3 seconds.

**Selecting between °C/°F**

ⓘ When switching on keep button pressed until the segment test is finished, instrument switches to configuration menu. Press button again the instrument alternates between °C and °F. Wait 2 sec. before pressing the button again. The selected unit then applies.

**Please read before using instrument**

- Observe measurement ranges of sensor
- Do not exceed maximum storage and operating temperatures (e.g. protect measuring instrument from direct sunlight).
- Inexpert handling cancels your warranty.

**Changing the battery**



The battery has to be changed if the symbol appears in the display during the measurement.

✓ Instrument is switched off.

- 1 Open battery compartment cover.
- 2 Remove spent batteries and insert new batteries (3 x AAA) into the battery compartment. Observe polarity!
- 3 Close battery compartment cover.

**Auto Off function**

ⓘ If no button has been pressed in approx. 10 minutes, the instrument switches itself off automatically.

Figure 5.0-1: Model 5646A operating instructions

## 5.1 Point-to-Point Resistance Testing

The following 2003 kit items are required:

1. Model 6534 Megohmmeter
2. (2) 5' (1.5m) Red Test Cables for Model 850
3. (2) Model 850, 5lb. (2.27kg) Probes

Connect each Model 850 Probe to the Megohmmeter using the Red cables. Plug one to (+) and one to (-) Meter terminals as shown in Figure 5.1-1.



Figure 5.1-1: Pt-Pt resistance meter/probe hook-up

Place the Model 850 Probes on the surface to be measured at the spacing required by the test specification. A 3' (0.9m) spacing is typically required.

Select the desired voltage and resistance range using the Megohmmeter rotary selector switch.

Without touching either Probe, depress the large yellow test button on the Megohmmeter and record the resistance reading

**NOTE: Never touch the Probes while the Megohmmeter test button is depressed. High voltage is applied to the Probes when the button is down.** Once the button is released, the high voltage is removed, and the Probes may be handled.

Move the two Probes to the next test location and repeat the test procedure to obtain the next resistance reading.

## 5.2 Resistance-to-Ground Testing

The following kit items are required:

1. Model 6534 Megohmmeter
2. 5' (1.5m) Red Cable
3. 25' (7.6m) Plug to Plug Cable
4. Model 850, 5lb. (2.27kg) Probe
5. Black Alligator Clip (if required)
6. Earth Ground AC Plug (**Used with North American outlets**)

Referring to Figure 5.2-1, connect the Model 850 Probe to the Red Source terminal (+) using the 5' (1.5m) Red Cable. Connect the Megohmmeter to ground using the standard 25' (7.6m) Green Cable. Plug one end of this cable into the Black (-) terminal on the Meter and the other end into the ground of the earth ground plug (North American Outlets only). If a grounded metal object is used for the ground connection, then plug the supplied alligator clip onto the end of the 25' (7.6m) cable and clip it to the metal ground.

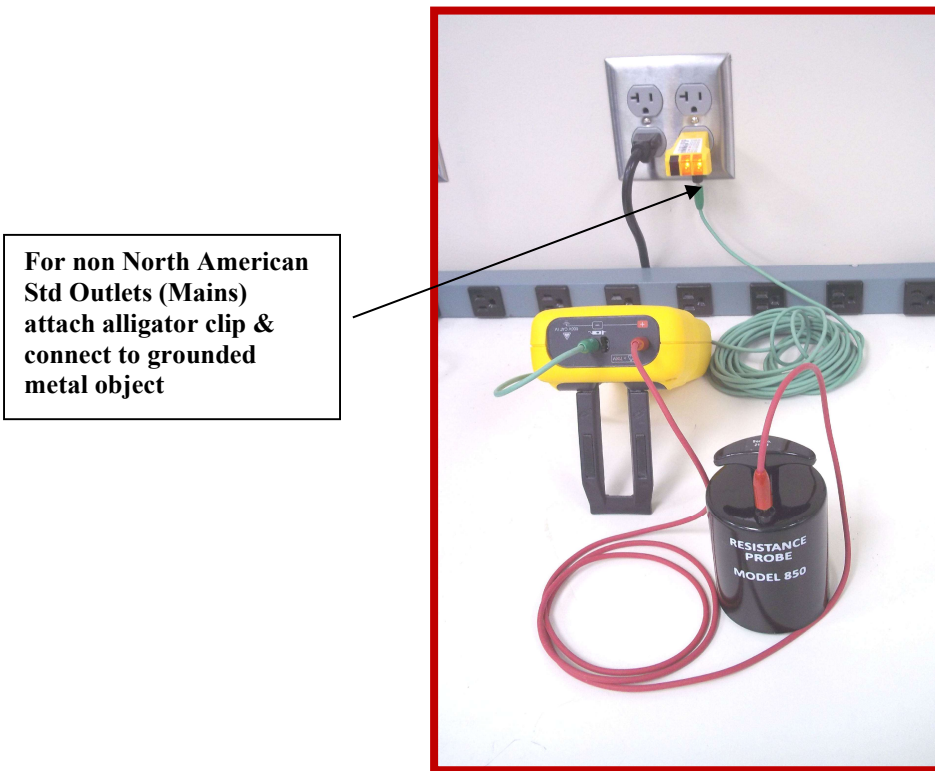


Figure 5.2-1: Typical RTG meter/probe hook-up

**NOTE:** If the ground point is less than 5' (1.52m) from the area being tested, the 5' (1.5m) Black Test Cable can be used instead of the 25' (7.6m) cable as shown in Figure 5.2-2.

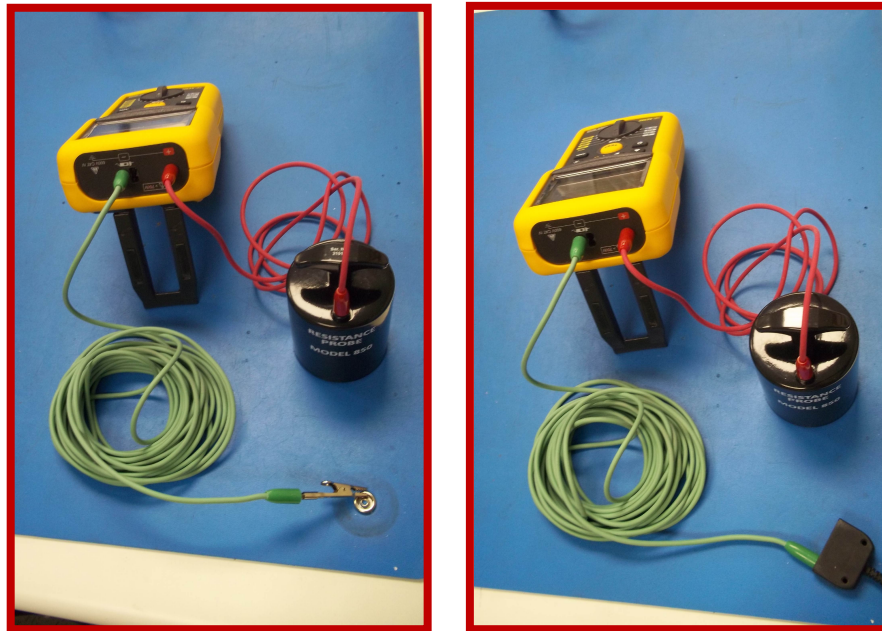


Figure 5.2-2: Alternate RTG meter/probe hook-up using 5' (1.5m) cable

Place the Probe at the desired test location and remove your hand from the Probe.

Select the desired test range and test voltage using the rotary switch on the Megohmmeter.

Without touching the Probe, depress the test button on the Meter and record the resistance reading.

After the test button is released, the Probe may be moved to the next test location and the next resistance reading taken.

**NOTE:** Some test methods may specify that the 2.5" (64mm) face of the test probe be covered with conductive foil (heavy duty aluminum foil or equivalent). The kit does not contain this material. The Model 850 uses a conductive rubber electrode with a maximum contact resistance of less than 100 Ohms. If the user desires to utilize foil, this may be accomplished by adding foil to each probe face and securing the foil to the probe using heavy-duty rubber bands or 3" (76mm) hose clamps.

## 6.0 WORK SURFACE TESTING

The Model 1035 with the Model 850 Probe may be used to measure point-to-point or point-to-ground resistance of static dissipative work surfaces. To make these measurements follow the same procedures and test set-up as for testing floors. Most work surfaces must be grounded and exhibit resistance on the order of  $10^5$  to  $10^{10}$  Ohms. Testing should be performed in accordance with applicable specifications for work surfaces. Applicable specifications include: ESDA STM 4.1, DOD-STD-1686A, DOD-HDBK-263 and FED STD 209C.

## 7.0 SEATING

To measure the resistance characteristics of seating follow the procedure specified in ESDA STM 12.1. It is similar to the RTG measurement. The meter/probe connections are shown in Figure 7.0-1.



Figure 7.0-1: Meter/Probe seating connections

## 8.0 Other Applications

### 8.1 Surface and Volume Resistance/Resistivity Measurements

#### 8.1.1 Volume Resistance/Resistivity

Volume resistance can also be measured with the standard Model 2003 Kit by connecting one 5lb. (2.27kg) Probe and the 3" (76mm) aluminum Plate to the Model 6534 as shown in Figure 8.1-1.



Figure 8.1-1: Volume resistance hook-up

Volume resistivity is calculated as follows:

$$\rho_v = 31.7 \text{ cm}^2 / t_{\text{cm}} \times R_m \text{ Ohms-cm}$$

Where t is the thickness of the sample in cm and R is the measured resistance in Ohms.

### 8.1.2 Optional ETS Model 803B Surface/Volume Resistance Probe

The Model 803B is designed in accordance with ANSI/ASTM D257 requirements for measuring surface and volume resistivity of planar material having a minimum diameter of 2.5" (64mm). It is specified in ESDA STM 11.11 and 11.12 for measuring the surface and volume resistance of planar material respectively. This 5 lb (2.27kg) Probe is compatible with the standard specimen size used in most electrostatic material evaluations. Refer to Figure 8.1-2a and b respectively for surface and volume resistance measurements.

When used with the Model 6534 surface and volume resistance measurements over the range of  $<1$  to  $2 \times 10^{10}$  Ohms can be made. When applicable, surface resistivity,  $\rho_s$  is calculated using  $10R_m$  and volume resistivity is calculated using  $7.1/t \times R_m$ .



a. Surface Resistance



b. Volume resistance

Figure 8.1-2: Meter/Model 803B connections

## 8.2 Alternate Pt-Pt and Volume Resistance Measurements

The Model 1035 Megohmmeter may be used to measure the end-to-end and volume resistance of objects including tubing, sample plaques, integrated circuit (IC) shipping tubes etc. using with the ETS Model 832 or Model 846 Clamp Electrodes. The Black and Red leads are used and are connected to the Electrodes as shown in Figures 8.2-1a and b. Refer to the Model 832 instruction manual for more detailed testing information.



a. End-end Resistance



b. Volume resistance

Figure 8.2-1: Meter/Clamp Electrode hook-up

### 8.3 Insulation Resistance Measurements

The test kit is capable of making high voltage, high resistance measurements of many types of components including cables, transformers, motors, generators, relays and other electrical items where the insulation resistance between two points is to be determined. Refer to the Model 6534 instruction manual, for details concerning Insulation Resistance Measurement.

### 8.4 Continuity Measurement

The Model 6534 Megohmmeter is equipped with a low resistance range that can be used to verify the integrity of low resistance (0 to 400 kOhm) circuits. Refer to the Model 6534 instruction manual for making continuity measurements.

### 8.5 Ground Strap Testing

Wrist straps and heel grounders may be tested for proper resistance using the Model 6534. The Green cable with alligator clip attached is plugged into the (-) input on the meter. The lead from the wrist strap can be plugged directly into the Red (+) jack on the meter, otherwise use the Red cable with alligator clip. This will be required for measuring heel grounders. The 50 Volt range is recommended since there is no advantage to testing at any higher voltage level. A standard wrist strap should measure between 0.75 and 1.25 megOhms.

### 8.6 Voltage Measurement

The meter may be used to measure AC or DC voltages up to 400 Volts. Refer to the Model 6534 instruction manual for details.

## 9.0 OPTIONAL ITEMS AVAILABLE

The Model 2003 Kit may incorporate additional instruments and accessories. Instruction manuals for these items are either contained within this manual as an Appendix or included separately.

Please contact ETS for information on any of these optional items.

## 10.0 WARRANTY

Electro-Tech Systems, Inc. warrants its equipment, accessories and parts of its manufacture to be and remain free from defects in material and workmanship for a period of one (1) year from date of invoice. The Seller, at his discretion, will either replace or repair without charge, F.O.B. Glenside, similar equipment or a similar part to replace any equipment or part of its manufacture which, within the above stated time, is proved to have been defective at the time it was sold. All equipment claimed defective must be returned properly identified to the Seller (or presented to one of its agents for inspection). This warranty only applies to equipment operated in accordance with Seller's operating instructions.

Seller's warranty with respect to those parts of the equipment that are purchased from other manufacturers shall be subject only to that manufacturer's warranty.

The Seller's liability hereunder is expressly limited to repairing or replacing any parts of the equipment manufactured by the manufacturer and found to have been defective. The Seller shall not be liable for damage resulting or claimed to result from any cause whatsoever.

This warranty becomes null and void should the equipment, or any part thereof, be abused or modified by the customer or if used in any application other than that for which it was intended. This warranty to replace or repair is the only warranty, either expressed or implied or provided by law, and is in lieu of all other warranties. The Seller denies any other promise, guarantee, or warranty with respect to the equipment or accessories and, in particular, as to its or their suitability for the purposes of the buyer or its or their performance, either quantitatively or qualitatively or as to the products which it may produce. The buyer is expected to expressly waive rights to any warranty other than that stated herein.

ETS must be notified before any equipment is returned for repair. ETS will issue an RMA (Return Material Authorization) number for return of equipment.

Equipment should be shipped prepaid and insured in the original packaging. If the original packaging is not available, the equipment must be packed in a sufficiently large box (or boxes if applicable) of double wall construction with substantial packing around all sides. The RMA number, description of the problem along with the contact name and telephone number must be included in formal paperwork and enclosed with the instrument. Round trip freight and related charges are the owner's responsibility.

**WOODEN CRATES MUST NOT BE USED. PACKAGING OF DELICATE INSTRUMENTS IN WOODEN CRATES SUBSTANTIALLY INCREASES THE CONTENT'S SUSCEPTIBILITY TO SHOCK DAMAGE. DO NOT PLACE INSTRUMENTS OR ACCESSORIES INSIDE OTHER INSTRUMENTS OR CHAMBERS. ELECTRO-TECH SYSTEMS, INC. WILL NOT ASSUME RESPONSIBILITY FOR ADDITIONAL COST OF REPAIR DUE TO DAMAGE INCURRED DURING SHIPMENT AS A RESULT OF POOR PACKAGING.**