Analog Surface Resistance Megohmmeter Kit Operation and Maintenance

Made in the United States of America

Figure 1. SCS 701 Analog Surface Resistance Megohmmeter Kit

Description

The 701 Analog Surface Resistance Megohmmeter Kit includes a hand-held megohmmeter and accessories. The kit has been specifically designed for evaluating the resistive characteristics of static control surface materials and testing installed surfaces as specified in ESD Association Standards. The Megohmmeter has four test functions which allow the user to measure the resistance of a static control surface at either of two test voltages, verify proper Megohmmeter performance, and check the electrical continuity of the test set-up.

The Analog Surface Resistance Megohmmeter and its accessories are available in the following item numbers:

Item	Description
701	Analog Surface Resistance Megohmmeter Kit
770007	Concentric Ring Probe
770757	Two-Point Resistance Probe
770765	Handheld Electrode
770768	Glove Constant Area and Force Electrode (CAFE)
701-M	Replacement Analog Surface Resistance Meoghmmeter
701-W	Replacement 5 lbs. Electrode
701-L	Replacement Test Leads

Features and Components

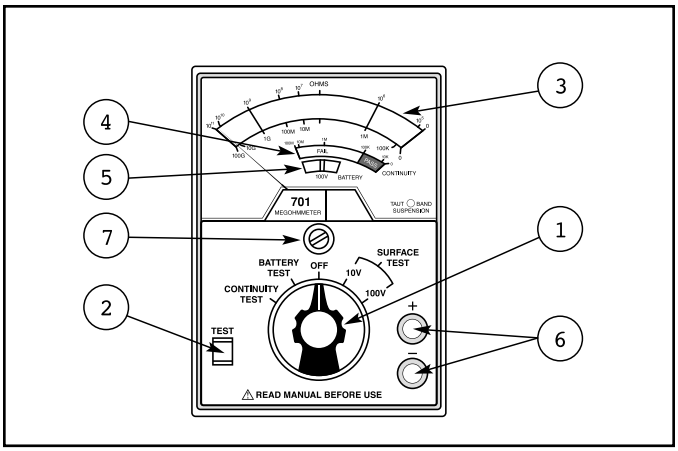

Figure 2. SCS 701 Analog Surface Resistance Megohmmeter features and components

1. Main Selector Switch: The main function selector switch allows the selection of desired test function.
2. TEST Button: This button engages the Megohmmeter and activates the test function selected.
3. OHMS Scale: This scale is used in conjunction with the SURFACE TEST functions to indicate the amount of resistance measured.
4. CONTINUITY Scale: This scale indicates the total resistance of the test setup (meter, leads, weights, and calibration plate) in the CONTINUITY TEST function.
5. BATTERY Scale: This scale indicates the charge level of the main battery of the Megohmmeter in the BATTERY TEST function by verifying the open circuit output test voltage.
6. Test Jacks: These jacks are used to connect the Megohmmeter to the test leads.
7. Mechanical Zero Adjust: This control is used to zero the pointer.

SCS - 926 JR Industrial Drive, Sanford, NC 27332
East: (919) 718-0000 | West: (909) 627-9634 • Website: StaticControl.com

Operation

- Turn off the Megohmmeter before connecting or disconnecting test leads, or before moving test weights.
- Turn off the Megohmmeter when not in use to save battery life.
- Do not use this Megohmmeter to measure live circuits.
- The following procedures should be followed each time the Megohmmeter is used.

Battery Test
Place the Megohmmeter on a table or other stable surface. With the function switch set to the OFF position, verify that the pointer is resting on the 10/100G mark on the left side of the display scale. If the pointer is not on the 10/100G mark, use the mechanical zero adjust on the face of the display.

Set the main selector switch to BATTERY TEST. Press TEST and hold for 15 seconds. The pointer should come to rest in the green area of the BATTERY scale. If the pointer is in the red area to the left of 100V, replace the battery and re-test. If the pointer is in the red area to the right of 100V, the megohmmeter may need recalibration.

Continuity Test
Place the Megohmmeter on a table top or other stable surface and attach the leads as shown in Figure 3. Place the test weights on the calibration plate or other bare metal surface and plug in the test leads. Set the main selector switch to CONTINUITY TEST. Press TEST. The pointer should come to rest in the green section of the CONTINUITY scale. If not, the test leads may be defective or the weights may require maintenance or cleaning.

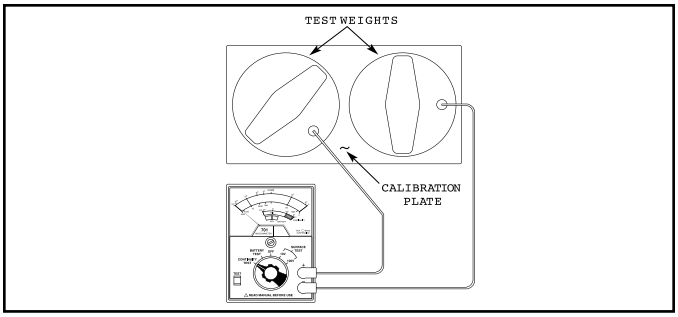

Figure 3. Performing a continuity test

Surface Test (Resistance Measurement)
Refer to the two following sections to determine which measurement(s) should be used for your application.

Place the Megohmmeter on a table top or other stable surface and attach the leads as shown in the appropriate sketch figures 5-1 through 5-5. Set the Main Selector Switch to the desired SURFACE TEST voltage. Place the test weight(s) on the surface to be tested and connect the test leads. Press TEST for 15 seconds and then read the resistance from the OHMS scale. After all readings have been completed, return the Main Selector Switch to the OFF position.

Resistance Measurement of Static Control Worksurfaces

This section provides a summary of the types of surface measurements specified and described by ESD-S4.1.

Measurements are performed for three reasons:
1. Periodic performance testing of installed static control work surfaces.
2. Qualification of installed static control work surfaces.
3. Evaluation of static control work surface materials.

Note: The following paragraphs are offered as a condensed summary of the test methods and procedures outlined in the EOS/ESD standard. For complete details, refer to the standard.

Test Description

1. Periodic Performance Testing Of Installed Static Control Surfaces: (Measurement of resistance from the top of an installed surface to ESD GROUND (RTS-ESDG) at ambient temperature and humidity).

Note: ESD GROUND is the point at which the ground cord or other grounding conductor from the static control surface is connected. The ground point may be an electrical ground, building ground, or other suitable ground. If you have questions concerning the correct ground, refer to ANSI/ESD STANDARD S6.1 and/or contact a qualified electrician.

This Resistance-to-Ground test verifies the surface is working correctly and will drain a static charge in a reasonable time. This test involves measurement of the total resistance from the static control surface through the conductor or ground cord to the ESD GROUND (ESDG), verifying the static control system is functioning correctly.

Note: ESD-S4.1 suggests that a static control surface that measures in the range of 1 x 10^6 ohms to 1 x 10^9 ohms.

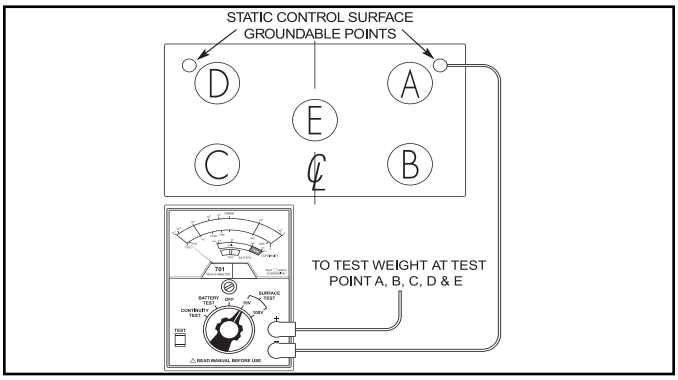

Figure 4. Periodic preformance tests of installed surfaces

SCS - 926 JR Industrial Drive, Sanford, NC 27332
East: (919) 718-0000 | West: (909) 627-9634 • Website: StaticControl.com

The following procedures should be followed when testing installed static control surfaces:

1. Complete BATTERY TEST and CONTINUITY TEST.
2. Set the SCS 701 Analog Surface Resistance Megohmmeter Kit on a table top or other stable surface and place a test weight at the desired test point as shown in Figure 5. Connect the test leads to the meter using the right angle banana plugs at the meter. Then connect one of the test leads to the test weight and the other to the ESD GROUND using one of the supplied clips.
3. Test the static control surface using the 100 volts SURFACE TEST. Press the TEST button for 15 seconds, allowing the pointer to stabilize; record the readings for each test point. If the reading is below 1 x 10^6 ohms, check the static control surface for an alternate path to ground; correct and retest. If some or all the readings are above 1x10^9 ohms, the static control surface may be dirty. Clean the surface using the manufacturer's recommended cleaning procedure. If the resistance reading is "infinite," there is an interruption (open) in the ground connection; repair and retest.

Qualification of Installed Static Control Surfaces
[Measurement of resistance of the top surface to the groundable point of the static control surface (RTS-GP)]. GROUNDABLE POINT is the point at which the grounding conductor is connected to the static control surface; the GROUNDABLE POINT is most commonly a snap (mats), a bolt (laminate), or a strip of conductive foil tape (flooring). This QUALIFICATION measurement is similar to those described in the test description section and is used to verify the correct installation of the GROUNDABLE POINT by the manufacturer or by the user. While the test procedure is the same, the test setup is slightly different; see Figure 5.

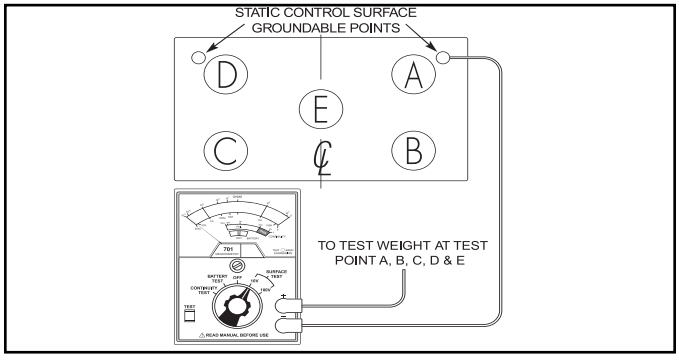

Figure 5. Qualification tests of installed surfaces

Evaluation of Static Control Materials
[Measurement of the resistance between two points on top of a static control surface (RTS-TS), and the resistance between a point on the surface and the groundable point (RTS-GP)] Material measurements are done to determine the intrinsic electrical properties of static control work surface materials.

Note: Values obtained by these tests may not reflect how a material will perform when installed as a static control surface.

Material evaluations are typically done at two humidities (12% RH and 50% RH) to determine whether the electrical properties of the material are humidity-dependent. If the low humidity test results are borderline or not within the expected ranges, caution should be exercised when using such materials in winter months or in dry conditions. To assure test accuracy, a minimum of six samples should be tested.

The test procedure is as follows:

A. Prepare a minimum of six samples of each material to be tested as shown in Figure 6.
B. Clean samples per manufacturers recommended cleaning procedures. Condition samples at 73°F (23° C) and 50% RH for 48-72 hours. Note: Samples must be maintained at the appropriate humidity level throughout the test procedures.
C. Complete BATTERY TEST and CONTINUITY TEST.
D. Surface-to-Groundable Point Test: Test samples per Figure 7, using both the 100 volts and 10 volts SURFACE TEST ranges at 50% RH and record the values as (RTS-GP).

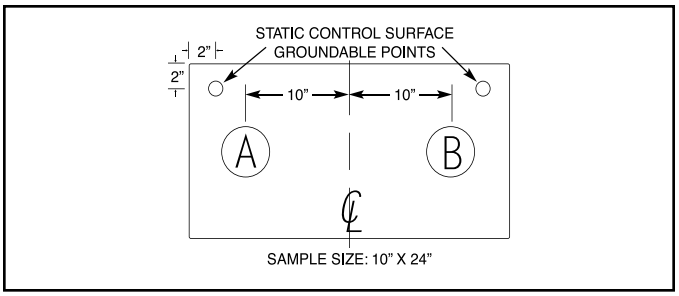

Figure 6. Material evaluation sample configuration

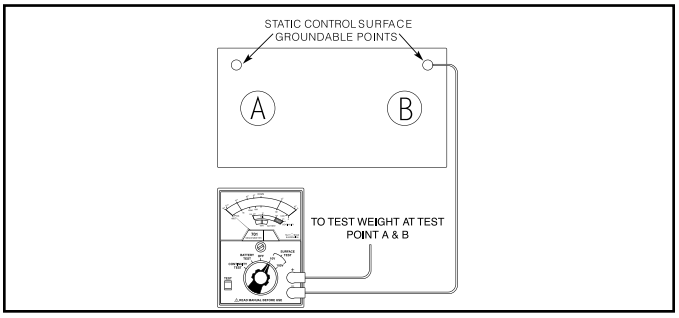

Figure 7. Material evaluation surface to groundable test point

SCS - 926 JR Industrial Drive, Sanford, NC 27332
East: (919) 718-0000 | West: (909) 627-9634 • Website: StaticControl.com

Procedure: Place the SCS 701 Analog Surface Resistance Megohmmeter Kit on a table top or other stable surface. Connect the test leads to the Megohmmeter by means of the right angle banana plugs. Connect the other end of one of the leads to one of the test weights and place the weight on the surface to be tested. Use one of the supplied clips to connect the other lead to the groundable point on the static control surface. Depress TEST button for 15 seconds and then record the reading.

E. Surface-to-surface Test: Test samples as shown in Figure 8 use both test weights and repeat the same test procedure used to determine (RTS-GP).

F. Repeat A through E after conditioning samples at 73°F (23°C) and 12% RH. Use the same test points and record the values.

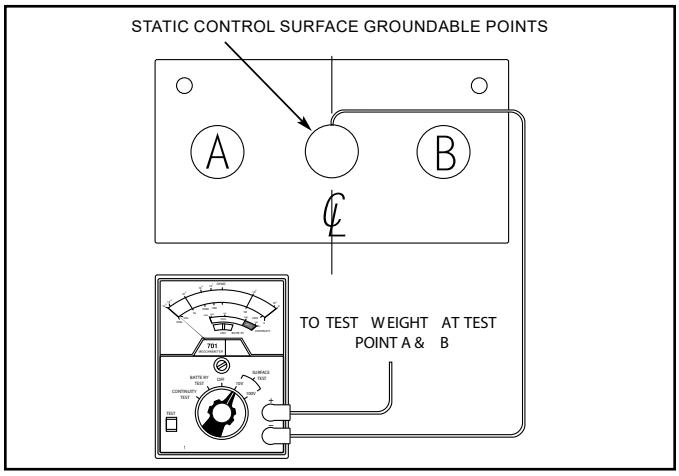

Figure 8. Material evaluation surface to surface test

Resistance Measurement of Static Control Flooring
This section provides a summary of installed or applied floor material measurements specified and described by ESD-S7.1. Note: The following paragraphs are offered as a co densed summary of the test methods and procedures outlined in the EOS/ESD standard. For complete details, refer to the standard.

PERIODIC PERFORMANCE TESTING OF INSTALLED OR APPLIED FLOORING MATERIALS
(Measurement of resistance from the surface of an installed floor to GROUNDABLE POINT at ambient temperature and humidity).

Note: GROUNDABLE POINT is a point on the floor material that is intended to accommodate an electrical connection from the floor material to an appropriate electrical ground. The ground point may be an electrical ground, building ground, or other suitable ground. If you have questions concerning the correct ground, refer to EOS/ESD Standard 6.0 and/or contact a qualified electrician.

The Resistance-to-Ground test verifies the surface is working correctly and will drain a static charge in a reasonable time. This test involves measurement of the total resistance from the static control surface through the conductor or ground cord to the ESD GROUND (ESDG), verifying the static control system is functioning correctly. Note: ESD 7.1 is designed to measure floor materials with resistances of 2.5×10^4 to 1.0×10^{11} ohms.

The following procedures should be followed when testing installed static control floor mats or flooring surfaces.

Test Procedure for Resistance to Ground
A. Complete BATTERY TEST and CONTINUITY TEST.
B. Before testing new floor mats or newly installed floors, clean mats/floors per manufacturer's recommendations. For testing of floor finishes or monitoring of existing floor materials, test in an as-is condition.
C. Perform tests at ambient humidity.
D. Place the SCS 701 Analog Surface Resistance Megohmmeter Kit and test weight at the desired test location.
E. Connect one lead of the meter to ground with supplied clip and the other lead to the test weight.
F. Set meter to 100V. Place test weight on the surface of the material being tested.
G. Push test button and record the resistance after the measurement has stabilized or after 15 seconds. Release test button.
H. Repeat the procedure placing the test weight on the surface at different locations.
I. Perform a minimum of five tests per contiguous floor surface material or a minimum of five tests per 5,000 square feet (464.5 m2) of floor material, whichever is greater. A minimum of three of the five tests should be conducted in those areas that are subject to wear or have chemical or water spillage or are visibly dirty.

Test Procedure for Resistance Point to Point

A. Complete BATTERY TEST and CONTINUITY TEST. If required clean electrodes as described in Test Weight Cleaning section below.
B. Before testing new floor mats or newly installed floors, clean mats/floors per manufacturer's recommendations. For testing of floor finishes or monitoring of existing floor materials, test in an as-is condition.
C. Perform tests at ambient humidity.
D. Place the Megohmmeter and test weight at the desired test location.
E. Connect test leads of the meter to the test weights.
F. Set meter to 100V. Place test weights three feet apart on the surface of the material being tested.
G. Push test button and record the resistance after the measurement has stabilized or after 15 seconds. Release test button.
H. Repeat the procedure placing the test weights three feet apart on the surface at different locations.
I. Perform a minimum of five tests per contiguous floor surface material or a minimum of five tests per 5,000 square feet (464.5 m2) of floor material, whichever is greater. A minimum of three of the five tests should be conducted in those areas that are subject to wear or have chemical or water spillage or are visibly dirty.

Maintenance

Battery Replacement

Before attempting to replace battery, place main selector switch in the OFF position.

The circuitry enclosed in the SCS 701 Analog Surface Resistance Megohmmeter Kit produces high voltages. Make sure that the main selector switch is in the OFF position before removing the back cover.

1. To open the back cover, remove the screw located in the center of the back cover.
2. The batteries are held in place by a metal bracket at the top of the Megohmmeter. To release this bracket, turn the screw located in the center of the bracket counter clockwise until the bracket swings free. The batteries will now slide out.
3. Install new batteries as shown in Figure 9. Note: Improper battery installation will damage the Megohmmeter.
4. Replace bracket and tighten bracket screw. Replace back cover and cover screw.

Batteries (2)	1.5 volt AA Cell, 3.6 volt AA Cell Lithium

Recommended Batteries: Model TL-5903 TADIRAN, ER6 Maxell, Saft LS 14500, Zeus ER14505

Figure 9. Replacing the batteries

Cleaning the 5 lbs. Electrodes

Caution: The test probes included in this kit are heavy. Exercise care in handling. After a period of use, the conductive rubber pads on the test weights may become soiled, causing the weight to fail the CONTINUITY TEST. To clean the surface of the conductive pad, use a 70% Isopropyl alcohol/water mixture on a clean low-linting cloth. Allow surface to "air dry" 15 minutes before use.

Zero Adjustment

On occasion, due to handling, vibration, or other causes, the pointer on the Megohmmeter may need adjustmen To zero the pointer, turn the main selector switch to the OFF position. Place the Megohmmeter on a level stable surface and turn the mechanical zero adjust screw until the pointer is over the left most mark on the OHMS scale.

Calibration

Frequency of recalibration should be based on the critical nature of those ESD sensitive items handled and the risk of failure for the ESD protective equipment and materials. In general, SCS recommends that calibration be performed annually.

In-house calibration can be performed by following the procedure below. Minimize crossing the test leads when possible. Contact SCS Customer Service should adjustments be necessary. Special equipment is required to adjust the meter.

Test Equipment

1 Digital Multimeter
1 High Voltage Probe
(40 kV rating, 1000:1 divider ratio)
1 Resistance Decade Box
(100 kΩ to 100 GΩ range, ±5% accuracy)

Setup

- **Test Area** - needs to be free of any high voltage transformers or power supplies and away from any type of fluorescent lighting or high power lighting.
- **Worksurface** - needs to be covered with a grounded conductive mat.
- **Technician** - needs to be connected to equipment ground.
- **Decade Box** - needs to be connected to equipment ground.

Verification Procedure

1. Use only the test leads that were supplied with the meter.
2. Use 99% isopropyl alcohol to clean the two test jacks located at the top of the meter. Oil from human fingers can affect the accuracy of the meter.
3. Set the meter's selector to Battery Test mode. Verify that the battery voltage is correct.
4. Connect the test leads to the meter. Connect the opposite end of the test leads the resistance decade box.
5. Set the resistance decade box to 100 kilohms. Set the meter's selector switch to Continuity Test. Verify that the meter displays ±5% or ±2º of arc accuracy. Short the two test leads, and verify that the meter has full scale deflection.
6. Verify that the meter displays ±5% or ±2º of arc accuracy when the resistance decade box is set to 1 megohm and 1 gigohm. Test at both 10 V and 100 V Surface Test voltages.
7. Disconnect the test leads from the resistance decade box. Use the high voltage probe and digital multimeter to verify that the output produces 92.7V to 106.7V when in the 100V Surface Test mode.

Specifications

Continuity Measurement Range	0 to 1 x 10^7 ohms
Resistance Measurement Ranges	1 x 10^5 to 1 x 10^{11} ohms @ 10 Volts, complies with ANSI/ESD S4.1 1 x 10^5 to 1 x 10^{11} ohms @ 100 Volts, complies with ANSI/ESD S4.1
Measurement Accuracy (@ 18 to 28 ºC, R.H. up to 90%)	±5%/ ±2º of arc
Continuity Circuit Internal Resistance	500 ohms
Resistance Circuit Internal Resistance	2 ohms
Power Supply	1 - 1.5 V AA cell 1 - 3.6 V AA cell lithium
Display	Analog
Operating Temperature	41ºF to 85ºF (5ºC to 30ºC)
Environmental Requirements	Indoor use only at altitudes less than 6500 ft. (2 km) Maximum relative humidity of 80% up to 85°F (30°C)
Dimensions (meter)	4.6" x 3.3" x 1.8" (117 x 84 x 46 mm)
Dimensions (electrode)	2.5" (64 mm) diameter x 4.7" (119 mm) height
Weight (meter with batteries)	12 oz (340 g)
Weight (electrode)	5 lbs (2.27 kg) each
Certifications	CE
Country of Origin	United States of America

Limited Warranty, Warranty Exclusions, Limit of Liability and RMA Request Instructions

See the SCS Warranty -
StaticControl.com/Limited-Warranty.aspx

SCS - 926 JR Industrial Drive, Sanford, NC 27332
East: (919) 718-0000 | West: (909) 627-9634 • Website: StaticControl.com