

3M™ Test Kit for Static Control Surfaces 701

User's Guide



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Safety Information

This User's Guide contains cautions and warnings alerting the user to hazardous operating and servicing conditions. This information is flagged by CAUTION or WARNING headings throughout this publication, where applicable, and is defined in this manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel, and to retain the operating integrity of this Tester, these instructions must be adhered to.



WARNING

- Turn off the Tester before connecting or disconnecting test leads, or before moving test weights.
- Do not use this Tester with any accessories not specifically designed to be used with this product.
- Do not use this Tester to measure live circuits.
- The circuitry enclosed in the 3M™ Test Kit for Static Control Surfaces 701 produces high voltages. Make sure that the main selector switch is in the OFF position before removing the back cover.



CAUTION

- The test weights included in this kit are heavy. Exercise care in handling.
- Improper battery installation will damage this Tester.



CAUTION

- Tester to be used indoors only.



CAUTION

To reduce the risks associated with environmental contamination from the device along with the Lithium and Alkaline battery:

- At the end of service life, dispose of the charge analyzer and batteries in accordance with federal, state and local requirements.

1.0 Intended Use

The 3M™ Test Kit for Static Control Surfaces 701 is designed to measure the resistance of static control work surfaces and flooring. This is to be done in a manner as described in this User's Guide. Measurements described in this guide refer to the ESD Association Standards S4.1 (Worksurfaces-Resistance Measurements) and S7.1 (Floor Materials-Resistive Characterization of Materials). These standards are available from the ESD Association, www.ESDA.org. Refer to the User's Guide for complete use of this test kit. Use of other components may cause improper performance and/or an unsafe condition.

2.0 Safety Symbols



This marking adjacent to another marking or terminal or operating device indicates the operator must refer to an explanation in the User Guide to avoid damage to the equipment and/or personal injury.



WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It also may be used to alert against unsafe practices that may cause property damage.

3.0 Introduction Description

The Test Kit for Static Control Surfaces 701 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 Tester 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 Tester performance, and check the electrical continuity of the test set-up.

Accessories

All accessories required for operating the Tester are included in the test kit. Available replacement parts are listed on page 7.

Unpacking And Inspection

Examine the shipping carton for obvious signs of damage. If damage is suspected, open the carton and inspect the Tester for possible damage. If damage is noted, notify the carrier and supplier immediately. If the Tester appears to be in good condition, read this User's Guide in its entirety. Check that all accessories are included with the kit, then run a series of familiarity tests as instructed in this User's Guide.

4.0 Controls, Connectors, & Indicators General

Before attempting any operation of the Tester, become familiar with each control. A thorough understanding of how the Tester operates will help avoid mistakes and prolong its useful life.

1. **Main Selector Switch:** The main function selector switch allows the selection of desired test function.

2. **TEST Button:** This button engages the Tester 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 Tester in the BATTERY TEST function by verifying the open circuit output test voltage.

6. **Test Jacks:** These jacks are used to connect the Tester to the test leads.

7. **Mechanical Zero Adjust:** This control is used to zero the pointer.

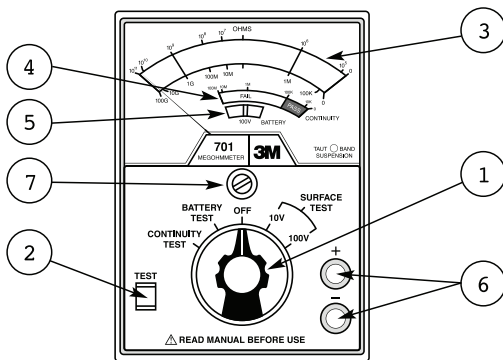


Figure 3-1. Controls, Connectors and Indicators

5.0 Operating Instructions



WARNING

- Turn off the Tester before connecting or disconnecting test leads, or before moving test weights.
- Do not use this Tester with any accessories not specifically designed to be used with this product.
- Do not use this Tester to measure live circuits.



CAUTION

- The test weights included in this kit are heavy. Exercise care in handling.

NOTE: The following procedures should be followed each time the Tester is used.

Battery Test

Place the Tester on a table top or other stable surface. 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 retest. If the pointer is in the red area to the right of 100V, the Tester may need recalibration.

Continuity Test

Place the Tester on a table top or other stable surface and attach the leads as shown in Figure 4-1. 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.

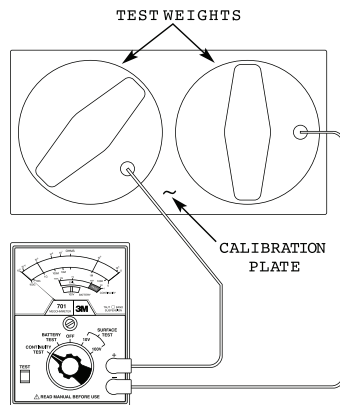


Figure 4-1: Continuity Test

Surface Test (Resistance Measurement)

Refer to the two following sections to determine which measurement(s) should be used for your application. Place the Tester 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.

6.0 Resistance Measurement of Static Control Work Surfaces

General

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 groundpoint may be an electrical ground, building ground, or othersuitable ground. If you have questions concerning the correct ground, refer to ANSI/ESD STANDARD S6.1 and/or contact aqualified electrician.

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

NOTE: ESD-S4. 1 suggests that a static control surface that measures in the range of 1x106 ohms to 1x109 ohms.

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

A. Complete **BATTERY TEST** and **CONTINUITY TEST**.

B. Set the 3M™ Test Kit for Static Control Surfaces 701 on a table top or other stable surface and place a test weight at the desired test point as shown in Figure 5-1. 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.

C. 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 1×10^6 ohms, check the static control surface for an alternate path to ground; correct and retest. If some or all the readings are above 1×10^9 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.

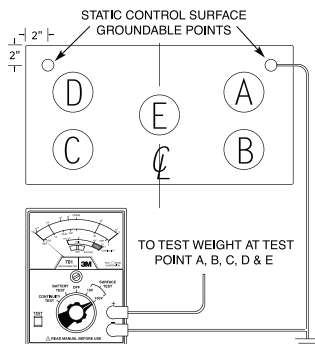


Figure 5-1: Periodic Performance Tests of Installed Surfaces

2. 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 5-2.

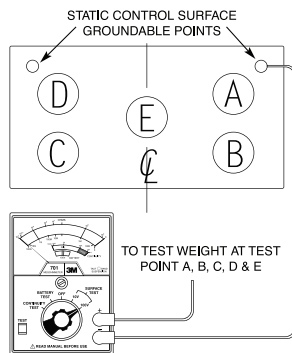


Figure 5-2: Qualification Tests of Installed Surfaces

3. 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 5-3.
- 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 5-4, using both the 100 volts and 10 volts SURFACE TEST ranges at 50% RH and record the values as (RTS-GP).

Procedure: Place the 3M™ Test Kit for Static Control Surfaces 701 on a table top or other stable surface. Connect the test leads to the Tester 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.

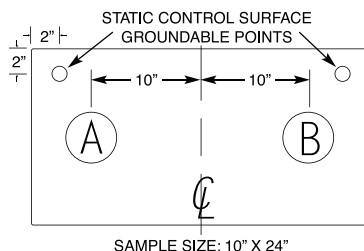


Figure 5-3: Material Evaluation Sample Configuration

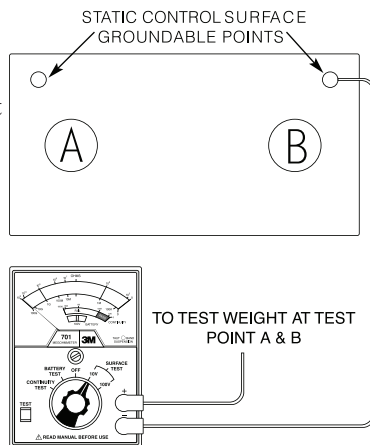


Figure 5-4: Material Evaluation Surface to Groundable Point Test

- E. Surface-to-surface Test: Test samples as shown in Figure 5-5; 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.

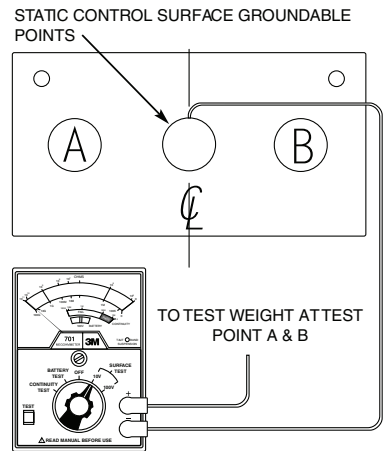


Figure 5-5: Material Evaluation Surface to Surface Test

7.0 Resistance Measurement of Static Control Flooring

General

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 condensed summary of the test methods and procedures outlined in the EOS/ESD standard. For complete details, refer to the standard.

Test Description

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**. If required clean, electrodes as described in Test Weight Cleaning section page 6.
- 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 3M™ Test Kit for Static Control Surfaces 701 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 Tester 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.

8.0 Maintenance

General

This section details the maintenance which may be performed by the user. Performance by the user of any maintenance not specified here will void the Tester warranty. If it is determined that maintenance beyond the scope of this section is required, contact your local 3M sales representative or call 3M Technical Service (Electronics Materials Solutions Division) at 866-722-3736.



Figure 6-1: Battery Replacement



CAUTION

Batteries are intended for use in applications subject to replacement only by a trained service technician. Use only non-rechargeable batteries.

Battery Replacement

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



WARNING

The circuitry enclosed in the 3M™ Test Kit for Static Control Surfaces 701 produces high voltages. Make sure that the main selector switch is in the OFF position before removing the back cover.

- A. To open the back cover, remove the screw located in the center of the back cover.
- B. The batteries are held in place by a metal bracket at the top of the Tester. 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.
- C. Install new batteries as shown in Figure 6-1.



CAUTION

Improper battery installation will damage this Tester.

- D. Replace bracket and tighten bracket screw. Replace back cover and cover screw.

Test Weight Cleaning



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 Tester may need adjustment. To zero the pointer, turn the main selector switch to the **OFF** position. Place the Tester on a level stable surface and turn the mechanical zero adjust screw until the pointer is over the leftmost mark on the OHMS scale.

9.0 Replacement Parts

The following parts are user-replaceable parts:

Description	Part Number
3M™ Megohmmeter 701	701-M, 98-0798-2290-8
3M™ Test Weight (each)	701-W, 98-0798-2291-6
3M™ Test Leads (pair)	701-L, 98-0798-2292-4
3M™ Insulated “Bulldog” Clip	3037, 98-0798-0838-6
3M™ Non-insulated Alligator Clip	3038, 98-0798-0399-9
User's Guide	78-9101-8695-2
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

Technical Data

The following electrical specifications are valid for operating temperatures of 65°F (18°C) to 82°F (28°C), at relative humidity up to 90% for altitudes up to 2000 m, unless otherwise noted. Pollution degree 2, class 3.

Test Function	Measurement Range*	Open Circuit Voltage**	Internal Resistance
Continuity	0 to 10 MΩ	10V ± .7V	500Ω
10V	10 ⁵ Ω to 10 ¹¹ Ω	10V ± .7V	2Ω
100V	10 ⁵ Ω to 10 ¹¹ Ω	100V ± 7V	2Ω

*Measurement Accuracy: ±5% ±2° of arc.

**Measured internally at voltage source.

Battery Test

1–1.5V AA Cell

Batteries

1–1.5V AA Cell

1–3.6V AA Lithium*

*See replacement parts above for batteries.

Physical Data

Tester	Test Weights(2)
4.6"(H) x 3.3"(W) x 1.7"(D)	Weight: 5 lbs. (2.27 Kg) each
(11.7 x 8.4 x 4.3 cm)	Diameter: 2.7" (6.8 cm)
Weight: 11 oz (5.9 kg)	Height: 5.1" (13.0 cm) (w/handle and pad)

Handling and Safety Precautions

Read all Health Hazard, Precautionary, and First Aid statements found in Material Safety Data Sheet (MSDS) and/or product label of chemicals prior to handling or use.

Regulatory Information

WEEE Statement

The following information is only for EU-members States: The mark shown to the right is in compliance with Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE). The mark indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems according to local law.

Intertek Statement

Intertek Listed to US and Canada Safety Standards
Mark of Conformity to European Directives (Conformité Européene).
Certified by Intertek Testing Services and meets US and Canada safety requirements.

CE Statement

Meets CE (European Conformity) requirements.

FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

NOTE: Modifications to this device shall not be made without the written consent of 3M. Unauthorized modifications may void the authority granted under Federal Communication Rules and Industry Canada Rules permitting the operation of this device.

NOTE: Per the European Battery Directive, Alkaline Batteries are not provided with the equipment and must be locally sourced.

ICES Statement

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la NMB-003 du Canada.

3M is a trademark of 3M Company.

Important Notice

All statements, technical information, and recommendations related to 3M's products are based on information believed to be reliable, but the accuracy or completeness is not guaranteed. Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use. Any statements related to the product which are not contained in 3M's current publications, or any contrary statements contained on your purchase order shall have no force or effect unless expressly agreed upon, in writing, by an authorized officer of 3M.

Warranty; Limited Remedy; Limited Liability.

This product will be free from defects in material and manufacture for one year from the time of purchase. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** If this product is defective within the warranty period stated above, your exclusive remedy shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product. **Except where prohibited by law, 3M will not be liable for any indirect, special, incidental or consequential loss or damage arising from this 3M product, regardless of the legal theory asserted.**



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