Charge Analyzer 711

Operating Instructions

August 2005
78-8136-3182-3

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Safety Information

Read, understand, and follow all safety information contained in these instructions prior to use of the 3M™ Charge Analyzer 711. Retain these instructions for future reference.

Intended Use:
The 3M Charge Analyzer 711 is intended for use in testing the performance of static control products.

This device is designed for use as specified in the operating instructions. It is intended for use in an indoor environment and has not been evaluated for other uses or locations.

EXPLANATION OF SIGNAL WORD CONSEQUENCES	
⚠ **DANGER**:	Indicates a potentially hazardous situation, which, if not avoided, will result in death or serious injury and/or property damage.
⚠ **WARNING**:	Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury and/or property damage.
⚠ **CAUTION**:	Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury and/or property damage.
CAUTION:	Indicates a potentially hazardous situation, which, if not avoided, may result in property damage.

EXPLANATION OF PRODUCT SAFETY LABEL SYMBOLS	
	**Attention: Read accompanying documentation**
	**Warning: Risk of Electric Shock**
	**Ground Symbol: Ground device according to instructions.**

⚠WARNING

To reduce the risks associated with hazardous voltage, which if not avoided, could result in death or serious injury:

- Connect the attached ground wire on the rear panel to an electrical ground before operating.
- Refer to 3M™ Charge Analyzer 711 Operating Instructions manual.

⚠WARNING

To reduce the risks associated with hazardous voltage:

- Connect the attached ground wire on rear panel to an electrical ground before operating the analyzer;
- Do not use if the 3M™ Charge Analyzer 711 housing or power supply are damaged;
- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

To reduce the risks associated with fire or explosion:

- Do not operate the analyzer in an explosive environment. The analyzer is not designed to be intrinsically safe.

⚠CAUTION

To reduce the risks associated with use of alcohol for cleaning:

- When cleaning the analyzer per the operating instructions, follow the MSDS procedures for safe use of the required cleaning solution.

To reduce the risks associated with environmental contamination from the NiMH battery pack and circuit boards containing lead-bearing solder:

- The charge analyzer contains a NiMH battery pack and circuitry that contains lead in the solder. At the end of service life, dispose of the charge analyzer in accordance with federal, state and local requirements.

CAUTION

To reduce the risks associated with property damage due to improper repair or modification:

- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

To reduce the risks associated with property damage from improper maintenance:

- Unit must be cleaned and checked periodically for correct operation.

Important Notes

- Avoid extreme discharge of the rechargeable batteries. If the batteries require charging, do not allow the unit to sit idle for a period of time without first fully charging the batteries.
- Do not use the charge analyzer 711 or Remote Field Sensor Probe in areas where high AC or DC field strengths are present.
- Do not discharge to the sensor element of the charge analyzer 711 or 3M™ Remote Field Sensor Probe.
- Do not allow any object to contact the sensor elements. Permanent damage to the sensor elements may occur. When not in use, keep sensor heads protected with supplied covers.
- AC fields with frequencies >1Hz cannot be measured.

1. General Function and Description

Note: ***To obtain the maximum understanding and use of this instrument it is recommended that the instruction manual be thoroughly reviewed. Follow Setup & Use procedures, observing all safety messages and important notes listed in each of the operating functions.***

The 3M™ Charge Analyzer 711 is an electronic test instrument designed for ease of use. The lightweight and compact construction offers great versatility in the workplace. It can be used as a laboratory analytical tool, evaluating the performance of ionizing equipment, static-protective packaging, worksurfaces, and personnel grounding systems. It is also very effective for use as a demonstration tool in employee static awareness training programs.

All parameter settings are controlled via a built-in EEPROM. When the Charge Analyzer is switched off, all last set parameters are stored in an EEPROM. These parameters are defaulted to when the analyzer is switched on again. In case of a malfunction, the unit will display a corresponding message and then automatically switch off.

The analyzer operation works according to the fieldmill-principle. The fieldmeter is a parametric amplifier. An electrostatic field induces a charge on the sensor electrode, generating an AC current that is proportional to the field strength. An amplifier measures this current without reducing the energy of the electrostatic field in average time.

The analyzer is powered by built-in rechargeable NiMH-batteries or an AC wall plug-in adaptor. When the unit is powered from the rechargeable batteries, the LCD-display will not be back illuminated to extend battery life. This power saving feature will initiate within 60 seconds after the last measurement or button depression. Also during battery operation, the continuous LED-bar indication changes to a single (momentary) action. In case of a low battery power condition, the analyzer automatically switches off, first displaying **LOW BATTERY** then **SWITCHING OFF UNIT**. If this occurs, continued operation of the analyzer can be maintained through the AC adaptor. Recharge time is approximately 14 hours with unit off, when batteries are fully discharged.

Important Note

- Avoid extreme discharge of the rechargeable batteries. If the batteries require charging, do not allow the unit to sit idle for a period of time without first fully charging the batteries.

Two vertical LED bars indicating 0 – 100% charge level and polarity are located on the left and right sides of the front panel. The alphanumeric LCD-display is the information center of the analyzer and allows the user to observe the principles of static protection. The unit's high accuracy makes it well suited for product performance analysis.

All interfacing connections are made at the rear of the unit. The following outputs are available: The charge analyzer 711 can be connected to a y (t)-recorder via the +/- 2 volts analog output.
Connection to a PC for data recording purposes is available through a RS232 data port.

A Remote Field Sensor probe is connected through a 4-Pin circular socket located on the rear of the unit. The sensor operates on the same measurement principle as described above. This feature allows to the user to make measurements by means of a hand-held or fixed position probe in remote locations, where it may be impossible to position the analyzer. Measurement distances with the probe are 1, 2, 5, 10, & 20 centimeters. The built-in microprocessor automatically converts the measured field strength via the chosen distance into a charge of an equivalent potential in volts. The display automatically switches from volts to kilovolts.

The following operating functions will be automatically activated, when the appropriate electrode or sensor is connected to the base unit.

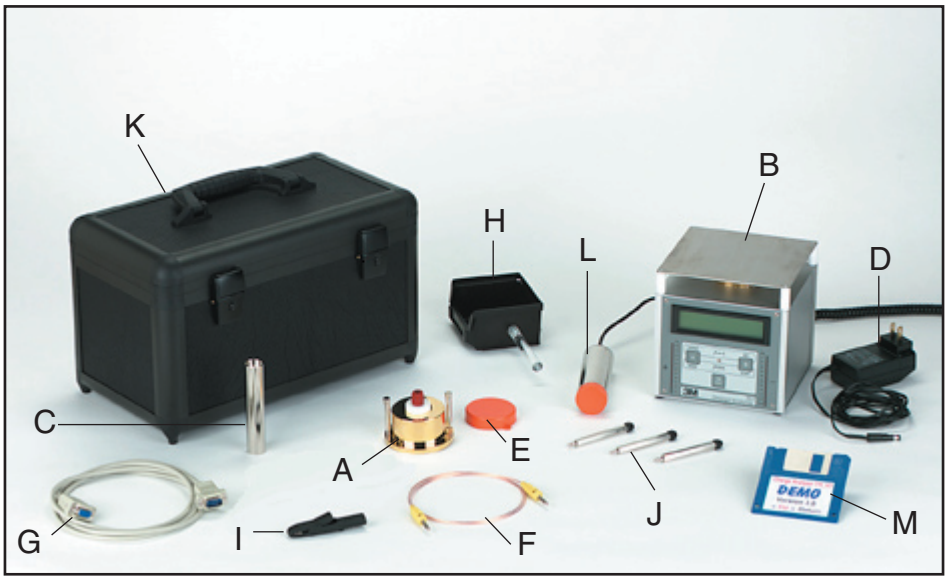
The charge analyzer 711 comprises of four types of independent operating functions:

- Static fieldmeter sensor – Measuring electrostatic fields
- Voltmeter - Measuring the potential on charged objects
- Static decay time – Measuring charge-decay and balance of ionizing equipment by charge plate monitor (CPM) method.
- Remote field sensor probe – Measuring the potential on charged objects in confined areas.

Change between these operating functions will be verified on the display as **CHANGE MODE OF OPERATION.**

2.0 Accessories

The 3M™ Charge Analyzer 711 is shipped in a durable black case with foam interior containing the following accessories:



A. Cup electrode

B. Plate electrode

C. Cylinder electrode

D. AC/DC adaptor, DC 12 V / 500 mA

E. Sensor red cover

F. PTFE measuring lead, 1m

G. RS 232 interface cable

H. 50 mm (2 inches) high conductive container with insulating handle

I. Insulated bulldog clip

J. Metal-spacers (3) with thread, 76 mm (3 in.) length

K. Transport case

L. Remote Field Sensor Probe, 711 RS for measuring electrostatic fields, with 2-meter cable & red cover.

M. Software for Data Acquisition

Operating instructions (Not Shown)

Certificate of Conformity (Not shown)

3. Specifications

Dimensions:
Base unit: (152 x 152 x 152) mm
(6 x 6 x 6) inches

Weight:
1,6 kg (3.53 lbs.)

High voltage cascade:
> 1100 V positive or negative (current limiting resistor: 10 MΩ)

Power supplies:
Built-in NiMH-rechargeable batteries, 1400 mAh - Recharge time approximately 14 hours (unit off) when batteries are fully discharged

AC adaptor: secondary side, DC 12 V/500 mA

Operating time (rechargeable batteries):
2 hours (approx.) with full charge.
1.5 hours (approx.) when using Remote Field Sensor

Storage memory capacity:
128 k EEPROM (e.g. sufficient for approximately 100 CPM-measurements)

Response time:
0 to 100 % _ 100 ms

Impedance:
10^{15} Ω (PTFE-separators cleaned)

Accuracy:
± 2.5 % of range end value (digitized)
Analog Output
± 10% 25, 100, 500, & 5,000 VDC
± 5 % 1,000 VDC

Operating functions:
CPM (positive/negative/automatic), Voltmeter, and Fieldmeter

Interfaces:
Analog output ± 2v (± 1 V, in 500v range for voltmeter).
Input to output ratio in Voltmeter Mode: 25vdc = 12.5 to 1, 100vdc = 50 to 1, 500vdc = 500 to 1, 1,000vdc = 500 to 1, 5,000vdc = 2500 to 1.

Serial PC-COM RS232

Remote Field Sensor Probe, Model 711 RS:
34mm diameter - 190 gms (6.7 oz.)

Measurement Ranges:
Distance/Voltage/Resolution
1 cm (0 to 10kv) 1V
2,5 cm (0 to 20kv) 2V
5 cm (0 to 50kv) 10V
10 cm (0 to 100kv) 10V
20 cm (0 to 200kv) 20V

Displays:
Two, 11-segment positive & negative LED-bar charge indicators
16-digit alphanumeric dual row LCD

Settings: CPM - operating function:
Starting voltage: 600 V - 1200 V in 1 V-steps
Stop voltage: 1 V - 500 V in 1 V-steps
(in decimal mode)

Static decay time:
0.1 seconds - 99.9 seconds

Offset-voltage time:
0 seconds (Indefinite time, CPM in floating mode)
1 - 10 seconds (1 second steps)
10 - 60 seconds (10 second steps)

Voltmeter operating function:
Ranges: 25 V, 100 V, 500 V, 1.0 kV,
5.0 kV and auto range

Fieldmeter operating function:
Ranges: Manual 1.25 kV/m, 5 kV/m, 25 kV/m,
50 kV/m, 250 kV/m, and automatic

Plate electrode:
VA-steel (152 x 152) mm/(6 x 6) inches, removable, capacitance (20 ± 2) pF

Cup electrode:
Gold-plated electrode with 4mm-banana socket, for voltage measurements

Selection of operating function:
Pre-setting is “FIELDMETER”, additional automatic settings by applying the plate or cup electrode
Operating temperature:
0 to 45°C (32º F to 113º F)

Humidity:
Maximum 60 %
Note: At high relative humidity, charge leakage may occur affecting the decay time measurement.

Storage temperature:
-30˚ C to 60° C (-22˚ F to 140˚ F)

Declaration of conformity

EN 60204-1/85
EN 60204-1/91
EN 61010 (SAFETY)
EN 50082-1
EN 50082-2

4. Fieldmeter Operation

Kilovolts/Meter Measurement Ranges:
Manual/Auto; 1.25 kV/m, 5.0 kV/m, 25 kV/m, 50 kV/m, & 250 kV/m

Meter display symbols in Fieldmeter mode

F = 3M™ Charge Analyzer 711 in Fieldmeter mode (upper left corner).
R = Kilovolts/Meter measurement range (kV/m) selected.
AR = Auto voltage measurement range selected (arrow ← symbol will briefly flash in lower left corner before symbol appears. Arrow → symbol will briefly flash during overflow condition when in the auto range).
E = Electrical field strength (V/meter) as measured. If range selected is too low **OVERFLOW** will appear.

Setup

⚠WARNING

To reduce the risks associated with hazardous voltage:

- Connect the attached ground wire on rear panel to an electrical ground before operating the analyzer;
- Do not use if the analyzer housing or power supply are damaged;
- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

To reduce the risks associated with fire or explosion:

- Do not operate the analyzer in an explosive environment. The analyzer is not designed to be intrinsically safe.

The following procedure zeros each voltage range in the Fieldmeter measurement mode.

1. Ground the charge analyzer 711 by attaching the ground wire with alligator clip on the rear panel of the unit to an earth/electrical ground.
2. Remove the plate electrode (b) from the analyzer if attached.

*Note: **If the unit is ON at this time, the display will briefly indicate CHANGE MODE OF OPERATION then FIELDMETER IS ENABLED.***

3. Depress the on/off button to activate the analyzer.
4. Cover the measurement electrode on the top of the unit with the red sensor cover (e).
5. Select each range by depressing the “A” button **RANGE** momentarily. Be sure to allow a brief moment between each range selection to perform the zeroing. This completes the zeroing of all ranges.

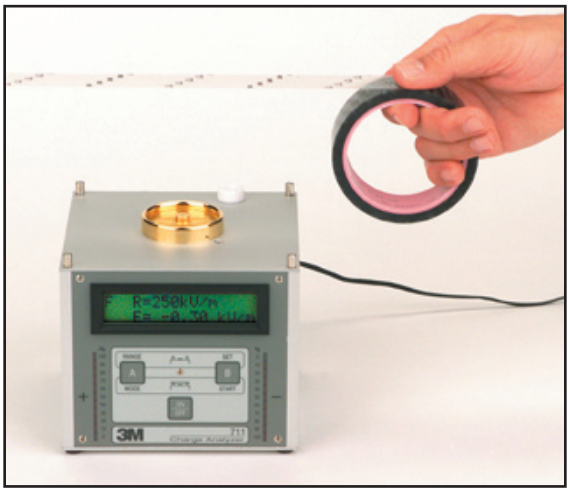
Use

1. Remove the red sensor cover (e) from the measurement electrode.
2. Select the desired voltage range by depressing the “A” button.

Note: If OVERFLOW appears during the measurement select a higher range.

The 3M™ Charge Analyzer 711 is now ready to measure electrostatic fields on objects such as tapes, films, plastic objects, etc., indicating in kilovolts per meter.

Demonstration #1 Testing of Low Tribocharging Tapes



With the charge analyzer 711 in the FIELDMETER operating mode, pull the tape off the roll and hold it above the sensor. The digital display reads the field strength in kV/m. To convert readings of kV/m into volts use the following formulas:

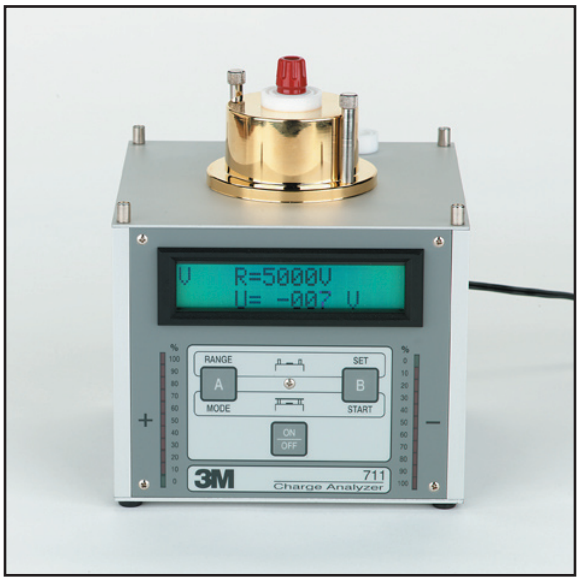
R/100 x D (cm) or R/39.37 x D (in.) where:
R = Reading indicated on the display and D = Distance between tape and sensor electrode, measured in centimeters or inches.

Example 1: If reading on the display of the analyzer is 200 KV/m and the distance to the sensor electrode is 5 cm, the voltage on the tape is calculated by: 200/100 x 5 = 10 Kilovolts

Example 2: If reading on the display of the analyzer is 50 KV/m and the distance to the sensor electrode is 3 inches, the voltage on the tape is calculated by: 50/39.37 x 3 = 3.8 Kilovolts

Note: Properly performing ESD control tapes must minimize charging when unwound from the carrier roll.

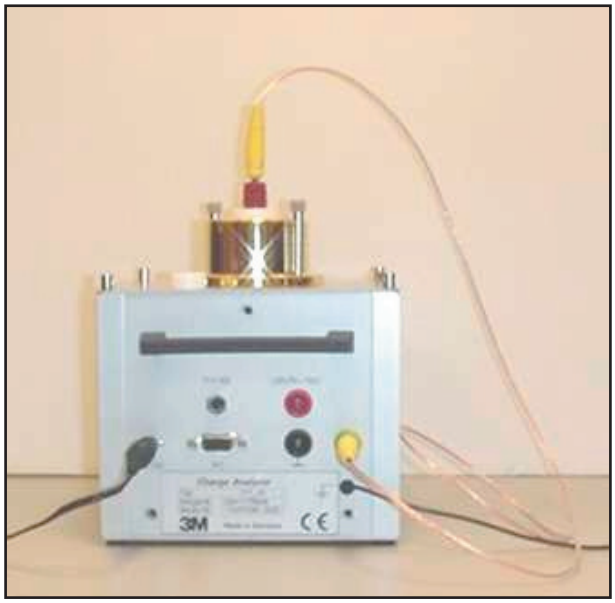
5. Voltmeter Operation



Voltage Measurement Ranges:
Manual/Auto; 25V, 100V, 500V, 1000V, & 5000V

Meter display symbols in Voltmeter mode

V = 3M™ Charge Analyzer 711 in Voltmeter mode (upper left corner).
R = Voltage measurement range selected. If range selected is too low OVERFLOW will appear.
AR = Auto voltage measurement range selected (arrow ← symbol will briefly flash in lower left corner before symbol appears. Arrow → symbol will briefly flash during overflow condition when in the auto range.
U = Voltage level on cup electrode.



Setup

⚠WARNING

To reduce the risks associated with hazardous voltage:

- Connect the attached ground wire on rear panel to an electrical ground before operating the 3M™ Charge Analyzer 711;
- Do not use if the analyzer housing or power supply are damaged;
- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

To reduce the risks associated with fire or explosion:

- Do not operate the analyzer in an explosive environment. The analyzer is not designed to be intrinsically safe.

The following procedure zeros each voltage range in the Voltmeter measurement mode.

1. Remove the plate electrode and red sensor cover from the 3M™ Charge Analyzer 711, if attached.
2. Mount the gold cup electrode (a) to the top of the analyzer and secure with the attached long-knurled screws.
3. Insert the banana plug on one end of the PTFE lead wire (f) into the ground jack on the back of the analyzer.
4. Insert the other banana plug end of the PTFE lead wire (f) into the gold cup electrode (a).
5. Ground the unit by attaching the ground wire with alligator clip on the rear panel of the unit to an earth/ electrical ground.
6. Depress the on/off button to activate the analyzer. The display will briefly indicate **CHANGE MODE OF OPERATION** then **VOLTMETER IS ENABLED** (if cup has not been previously attached).
7. Depress the "B" button (SET) to display **OFFSET A**.
8. Select **OFFSET A** by depressing the "A" button to display **UPDATE OFFSET** menu.

*Note: **If you should depress the "B" button (SETUP), you will have to switch off the analyzer to get back into the Voltmeter mode.***

9. Select **YES** by depressing the "A" button. **GROUND CUP, READY >B** will appear on the display for verification that the cup electrode is indeed grounded.
10. Select the "B" button to activate the automatic zeroing feature in the Voltmeter mode. Display will indicate **READ ALL OFFSET, UPDATING**, zeroing all ranges.

This completes the zeroing procedure. The display returns to the measurement mode.

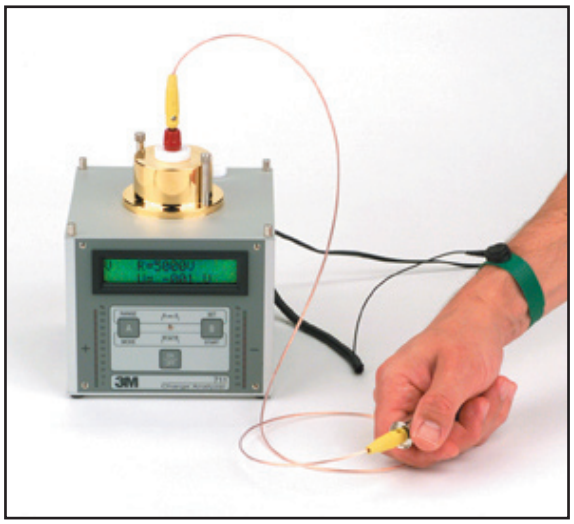
Use

1. Unplug the PTFE lead (f) from the ground jack at the rear of the analyzer.
2. Plug the PTFE lead (f) into the cylinder electrode (c).
3. Select the desired voltage range by momentarily depressing the "A" button.

*Note: **If OVERFLOW occurs during the measurement select a higher range.***

The charge analyzer 711 is now ready to monitor the effectiveness of static control products, measuring electrical charge on people and conductive objects, indicating in volts.

Demonstration #2 Performance of a Wrist Strap



1. Hold the cylinder electrode in one hand and perform normal body movements (e.g., sitting down, standing up, walking back and forth, etc.), experienced in the work environment. Observe voltage variations on the 3M™ Charge Analyzer 711.
2. Now attach a static control wrist strap to the arm and connect to an earth/electrical ground as recommended by the manufacturer. Perform the same body movements and observe the reduced or eliminated voltage variations on the charge analyzer.

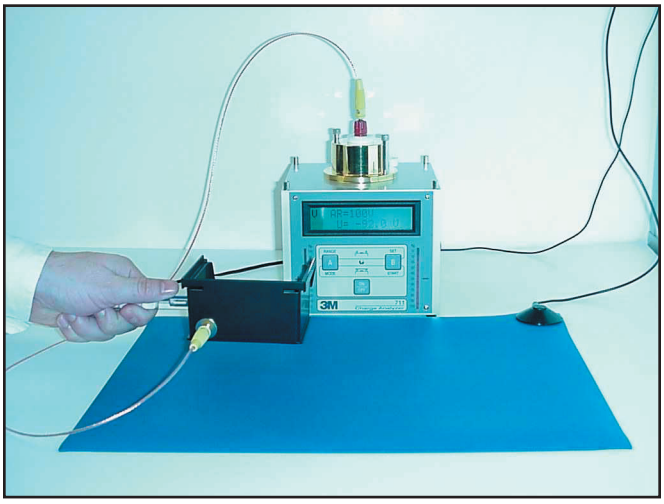
Note: Properly performing ESD control wrist straps must be able to eliminate static charging on a person.

Demonstration #3 Performance of an ESD Control Flooring

1. Stand on a non-static control flooring (e.g., mat, tile, epoxy, etc.).
2. Hold the cylinder electrode in one hand and perform normal body movements (e.g., sitting down, standing up, walking back and forth, etc.), experienced in the work environment. Observe voltage variations on the analyzer.
3. Now stand on a static control flooring (e.g., mat, tile, epoxy, etc.) using ESD control footwear/straps.
4. Hold the cylinder electrode in one hand and perform some body movements and observe reduced or eliminated voltage variations on the analyzer.

Note: Properly performing ESD control flooring in conjunction with ESD control footwear/straps must be able to minimize and quickly drain electrical charges developed by a person.

Demonstration #4 Performance of a Static Control Worksurface



1. Plug the PTFE lead (f) into the banana jack on the conductive container (h).
2. Hold the container by insulating handle being careful not to contact the sides of the container.
3. Charge yourself up by rubbing your feet on a non-static flooring material and touch the container with other hand to charge it. Notice the level of charge on the 3M™ Charge Analyzer 711.
4. Contact an ESD control worksurface with the container and observe the voltage reduction and removal.

Note: ***Properly performing conductive containers must be able to quickly drain a charge from their surface when placed upon an ESD control surface.***

Demonstration #5 Discharge Performance of a Static Control Packaging Material

1. Place a packaging material on top of a grounded static control worksurface.
2. Charge up the conductive container as described above in Demonstration #4 and contact the top of the packaging material with the charged container. Observe the amount of charge draining through the packaging material on the charge analyzer.

Note: ***Properly performing packaging materials must be able to quickly drain a charge from their surface when placed on an ESD control surface.***

6. Static Decay Time & Balance Operation

Voltage Decay Ranges:
Start: 600 to 1100 volts
Stop: 1 to 500 volts

Meter display symbols in Static Decay mode

TIMER = Mode
000V-000V = Start & stop voltage range
U = Voltage level on plate
OFFS-TIME = Offset time in seconds

Setup

⚠WARNING

To reduce the risks associated with hazardous voltage:

- Connect the attached ground wire on rear panel to an electrical ground before operating the analyzer;
- Do not use if the 3M™ Charge Analyzer 711 housing or power supply are damaged;
- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

To reduce the risks associated with fire or explosion:

- Do not operate the analyzer in an explosive environment. The analyzer is not designed to be intrinsically safe.

The following procedure zeros each voltage range, adjusts the start and stop voltage, and adjusts the offset time in the Static Decay Time measurement mode.

*Note: **You must remove the charge plate to change to FIELDMETER mode to perform the following procedure.***

Voltage range zero procedure:

Perform zeroing on first power up.

1. Ground the 3M™ Charge Analyzer 711 by attaching the ground wire with alligator clip on the rear panel of the unit to an earth/electrical ground.
2. Remove the plate electrode (b) from the Charge Analyzer.
3. Depress the on/off button to activate the analyzer. The display will briefly indicate **CHANGE MODE OF OPERATION** then **FIELDMETER IS ENABLED.**
4. Cover the measurement electrode on the top of the unit with the red sensor cover (e).
5. Select each range by depressing the "A" button **RANGE** momentarily. Be sure to allow a brief moment between each range selection to perform the zeroing. This completes the zeroing of all ranges.

Setting the START & STOP voltage:

*Note: **The Start voltage can only be adjusted from 600 to 1100 volts. The Stop voltage can only be adjusted from 1 to 500 volts. The maximum period of time that the 711 allows for the measurement of the start to stop voltage is 99.9 seconds.***

1. Depress the "B" button (SET) to display **SETUP B**.
2. Depress the "B" button to display the **START 600-1100** voltage range menu.
3. Notice the blinking cursor under the thousandths position of the four-digit voltage value located on the second line of the display. Change the value of this digit by depressing the "A" button momentarily. Continue to momentarily depress the "A" button until the desired value (0-9) is obtained.
4. Depress the "B" button once to move the cursor to the next digit and adjust the value (0-9) with the "A" button.
5. Continue adjusting the value of the remaining digits to the desired level. If you make a mistake continue to depress the "A" & "B" buttons consecutively to obtain the desired value.
6. When the desired voltage value is obtained, continue to depress the "B" button until the display reads **A<YES** & **NO>B.**
7. Depress the "A" **YES** button to verify and store the start voltage value. Depressing the "B" **NO** button repeats the voltage value setting menu again.
8. The **STOP 1-500** voltage range menu is now displayed. Adjust the stop voltage using the "A" & "B" buttons as described in the **Start** voltage procedure above.
9. Depress the "A" button **YES** to verify and store the stop voltage value. Depressing the "B" **NO** button repeats the voltage value setting menu again.

Note: ***If you should select a start or stop voltage outside of the ranges listed above, the 3M™ Charge Analyzer 711 will not store that value. If the charge plate does not reach the set stop voltage within 99.9 seconds the counter stops and the display flashes*** *TIME EXCEEDED.* ***This message will appear in Positive, Negative, and Auto decay modes.***

Setting the Offset Time

When the start and stop voltage procedure is completed the **OFFSET** menu will be displayed. The offset time can be adjusted from 0 (Indefinite time), 1 to 10 seconds (1-second steps), and 10 to 60 seconds (10-second steps). To change the offset time perform the following steps:

1. Depress "A" **CHANGE** button repeatedly to move through time settings.
2. When the desired time is set, depress the "B" **OK** button to store. The start and stop voltage values with the offset time value will then be displayed momentarily.
3. Next the display will indicate **TIMER+OFFSET OK**. If values are correct, depress the "A" **YES** button. If not, depress the "B" **NO** button which will restart the start voltage menu.
4. The display will then indicate **CLEAR MEMORY** if changes were made. Depress the "A" **YES** button to store the revised settings. **PARAMETER CHANGED** will momentarily appear. If no changes were made, display will indicate **PARAMETER NOT CHANGED**.

Note: ***To measure offset balance for time periods longer than 60 seconds, set offset time to zero seconds "0 s". This puts the Charge Analyzer CPM in a floating mode for an indefinite time period. The unit will not have an active timer in this mode. Elapsed time must be recorded by the operator using a stop watch or other time recording device. Connection to the analog output using a chart recorder e.g. allows for monitoring of the offset voltage during long time periods. Depressing the "B" button twice during the indefinite offset time mode returns the display to the DECAY TIME/START mode.***

This completes the voltage range zeroing, start/stop voltage, and offset time setup.

Use

1. Remove the red sensor cover from the measurement electrode.
2. Mount the plate electrode (b) to the analyzer. Be sure that the red sensor cover (e) is removed from the sensor electrode. Display will indicate **DECAY TIME**, voltage polarity ("Either" **POS, NEG,** or **AUTO**) and **PRESS START.**
3. Depress the "A" MODE button to select Positive, Negative, or Auto (Positive & Negative) decay.

Note: ***In AUTO mode there will be an approximate 5 seconds delay between positive & negative decay tests.***

4. The display will now indicate **DECAY TIME: POS, NEG,** or **AUTO** on the first line and **PRESS START** on the second line.
5. Depressing the "A" **YES** button again after **AUTO** decay is displayed will select the **READ OFFSET CPM** menu. Depressing the "A" **YES** button will initiate the system verification and the display will respond with **UPDATING**.

Note: ***System verification (Zero point adjustment) is only recommended before the first measurement, when parameters are first set with the attachment of the plate electrode. If the "B" button (NO) is depressed you will return to the start of the DECAY TIME menu.***

The charge analyzer 711 is now ready to measure static charge neutralization effectiveness and the offset balance of ionizers.

Demonstration #6 Charge Plate Monitor and Static Decay Time Measurements – Air Gun Ionizer

Static neutralization (the ability to reduce or eliminate a charge on a surface) is an important quality for ionizers. Static decay time is defined as the time interval needed to reduce a defined voltage potential on an object to a defined lower potential by means of applied ionized air. Another important aspect for ionizers is the ability to produce a balanced stream of positive and negative ions. The 3M™ Charge Analyzer 711 can be used to accurately measure both of these parameters.

Note: ***For more detailed information on measuring the performance of ionizers refer to the ESD standard ANSI/EOS/ESD-S3.1 for Protection of Electrostatic Discharge Susceptible Items-Ionization.***

1. Depress the "B" (START) button to charge the plate and begin the measurement menu.
2. On the first line the selected start and stop voltages are indicated. On the second line, the plate default charge-voltage is indicated (approximately 1200 volts).

Note: ***If the charge plate does not retain the applied voltage it may be due to a high level of room humidity or contamination on one or more of the four PTFE spacers. PTFE spacers should be cleaned with laboratory grade alcohol. Use clean cotton or latex gloves when directly handling these spacers.***

3. Position the ionizing air gun above the charge plate and activate the air gun blowing ionized air at the plate. The timer in the analyzer will begin counting (in 1/10's of seconds) when the set start voltage is reached on the plate. At this time the display will indicate **TIMER** (present timer count in seconds) and **U** (present voltage level on the charge plate).
4. When the stop voltage is reached, the unit will begin the offset time (ionizer balance) mode. The display will indicate **OFFS-TIME** (starting timer at set time) and **U** (current charge plate voltage).
5. When the offset time is complete, the display will indicate the following: **OFF** (Maximum voltage offset observed during offset time period), **T** (Set offset time), and **NEG.** or **POS. DECAY** (Time to reach the stop voltage). In the **Auto** mode both positive and negative decay time will alternately be displayed.

Note: ***If the charge plate does not reach the set stop voltage within 99.9 seconds the counter stops and the display flashes TIME EXCEEDED.***

6. Shortly after the measurement is completed, the display will alternately indicate the decay time test results and **A<CONTINUE**. Depressing the "A" (Continue) button will display the **SAVE VALUES** menu. Selecting "A" (YES) button will allow saving of the static decay time measurement test data into a file location numbered 01 - 99. Depress the "B" (OK) button to store the data in the displayed file number location.

To store data in a previously used file location number, depress the “A” (Change) button. File locations can be changed in steps of ten using the “A” button or in steps of one within an indicated decade, by using the “B” button. Once you have selected the previously used file location depress the “B” (OK) button to store the data. The display will then indicate that the file selected is about to be overwritten by **OVERWRITE NO**. Select button “A” YES to proceed. The display will then briefly indicate **Please Wait Saving** and then return to the **DECAY TIME/START** menu.

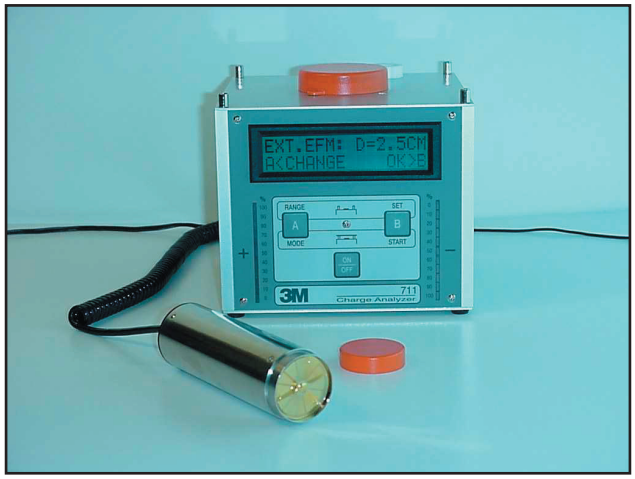
If after performing a static decay time measurement and storing of the test data is not required, depress the “B” button. The display will briefly indicate **BREAK** and then return to the **DECAY TIME/START** menu.

Demonstration #7 Charge Plate Monitor and Static Decay Time Measurements – 3M™ Ionized Air Blower

1. Attach the three metal-spacers (j) by screwing into the three locations at the rear of the 3M™ Charge Analyzer 711.
2. Position the charge analyzer 711 in front of the ionizer blower with the display facing upward.
3. Measure the static decay rate and offset balance by following the procedure outlined in Demonstration #6 above.

Note: ***For more detailed information on measuring the performance of ionizers refer to the ESD standard ANSI/EOS/ESD-S3.1 for Protection of Electrostatic Discharge Susceptible Items-Ionization.***

7. Remote Field Sensor Probe Operation



Measurement Ranges:
Distance/Voltage/Resolution
1 CM (0 to 10kv) 1V
2,5 CM (0 to 20kv) 2V
5 CM (0 to 50kv) 10V
10 CM (0 to 100kv) 10V
20 CM (0 to 200kv) 20V

Display automatically converts from volts to kilovolts

Meter display symbols in 3M™ Remote Field Sensor Mode

"EFM" = 3M™ Charge Analyzer 711 in External Field mode (upper left corner).
"D" = Distance between probe and surface to be measured.
"U" = Voltage level on charged surface or object.

Setup

⚠WARNING

To reduce the risks associated with hazardous voltage:

- Connect the attached ground wire on rear panel to an electrical ground before operating the analyzer;
- Do not use if the analyzer housing or power supply are damaged;
- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

To reduce the risks associated with fire or explosion:

- Do not operate the analyzer in an explosive environment. The analyzer is not designed to be intrinsically safe.

The following procedure activates the charge analyzer for use with the remote field sensor probe 711 RS.

1. Turn off the charge analyzer.

*Note: **If the plate electrode is not attached to the analyzer, place the red cover over the measurement electrode to prevent accidental damage.***

2. Insert the 4 Pin plug (observing keyed position at bottom of socket) of the remote field sensor probe cable into the 711 RS socket on the rear of the analyzer. Tighten the outer shell onto the socket (clockwise motion), until secured.
3. Ground the unit by attaching the ground wire with alligator clip on the rear panel of the unit to an earth/ electrical ground.

4. Depress the on/off button to activate the 3M™ Charge Analyzer 711. The display will briefly indicate **RECEIVED DATA WAIT**.
5. The display will next indicate **EXTERN EFM, A<OFF & ON>B**. Depress the "B" button (ON) to activate the 3M™ Remote Field Sensor Probe. Selecting the "A" button (OFF) will deactivate the sensor and return the Charge Analyzer to an internal measurement mode.
6. When ON is selected the display will indicate **EXT. EFM, D = CM, A<CHANGE, & OK>B**. Select the desired measurement distance by depressing the "A" button (CHANGE) momentarily until desired distance is displayed.

Note: This value represents the distance in centimeters between a charged surface and the sensor head.

7. Depress the "B" button (OK) to select. The display will briefly indicate **PARAMETER CHANGED** when distance value is changed.
8. The display now indicates external field mode, distance, and measured voltage. To change the distance setting again while in the external field mode, depress the "B" button momentarily and repeat steps 5-7.
9. With red cover on probe, zero the remote field sensor by inserting a small probe or tool into the hole located at the rear of the sensor. At the bottom of the hole there is a membrane switch. Momentarily apply light pressure to activate the zeroing feature. The analyzer display will briefly indicate **ZERO ADJUSTMENT**.

Note: When changing to a lower distance setting, re-zeroing is recommended. For higher distances it is not necessary to re-zero.

This completes the remote field sensor probe setup & zeroing.

Use

1. Remove the red cover from the remote field sensor probe.
2. Position the sensor in front of the charged surface or object to be measured.

Important Note

- When measuring an unknown voltage on a surface, position the probe at a far distance away and approach the surface slowly to prevent accidental discharges to the sensor element. If there is a suspected high charge or if the surface of the object is uneven, the measuring distance should be increased.

3. Observe the measured voltage (U = Volts or Kilovolts) on the analyzer display.

Note: The remote field sensor probe measures the electrical field in V/m. The electrical field is measured automatically based on the set measurement distance and is then internally calculated and indicated as volts in the displayed U = V.

Example 1: If the distance between the object and sensor equals 2.5 cm and the "U" value indicates 500 volts, then the strength of the electric field is in this case 500V/inch (Since 1 inch = 2.5 cm approximately).

To change the measurement into V/m, multiply the indicated U = V value displayed by the appropriate factor to obtain 100 cm, (1 m) length.

Example 2: If the distance between the object and the sensor equals 10 cm and the "U" value indicates 500 volts, using chart below, then the V/m is in this case 5000 volts.

Distance (cm)	Factor
1	100
2,5	40
5	20
10	10
20	5

To convert readings into volts/inch or volts/cm use the following two formulas:
R/100 x D (cm) or R/39.4 x D (in.) where:
R = Reading indicated on the analyzer display. D = Distance between object and sensor electrode, measured in inches or centimeters.

The charge analyzer 711 is now ready to perform measurements through the remote field sensor probe.

Demonstration #8 Measuring a Charge on an Object Using the 3M™ Remote Field Sensor Probe

Hold the conductive container (h) in one hand and rub the handle against the sleeve of your shirt or pants to accumulate a charge on the handle. Hold the remote field sensor probe in front of the handle at the distance selected on the 3M™ Charge Analyzer 711 and observe the voltage.

8. Data Recording & Analog Outputs

The charge analyzer 711 has two outputs (analog for a y(t) recorder & digital for a serial PC-COM interface) located at the rear of the unit.
Recorder requirements: Internal resistance (R_{in}) greater than 1000 ohms.
Connect recorder to the red and black banana jacks at the rear of the analyzer using banana plug style wires.

PC Requirements for Data Recording of Static Decay Measurements:

486-Processor, VGA-Monitor, 3.5" Floppy Disk Drive, System Software DOS 5.0 or Windows™ 3.1 minimum, RS 232-Bus (COM 1 - 4).

Connect the output socket by means of the enclosed interface cable to the RS 232-Bus of the PC. Activate the enclosed software in the floppy disk drive by using the command "a:\>" (for example). Then type "711" to start the software in the appropriate language and follow the program instructions. See help files (Text Documents help1.txt, help2.txt, and help3.txt) located in folder 711_v3e for measurement information.

9. Verification Procedure

The following procedure can be used to determine if the 3M™ Charge Analyzer 711 is operating within the stated specifications:

Equipment required

- DC ± 5,000V (≤ ± 1% tolerance) adjustable high voltage power supply
- Four lead wires (banana plug style)
- Digital Multimeter (Voltmeter scale), ≤ ± 0.1% tolerance

Charge Analyzer 711 Internal Sensor

1. Mount the cup electrode (a) to the top of the analyzer and perform the zeroing function described in Section 5. Voltmeter Operation / Setup.

Important Note

- Do not discharge to the sensor element.

2. Connect a lead wire between the ground jack of the unit and the low/return side of the DC high voltage power supply.
3. Connect a lead wire between the DC power supply output connection and the banana jack of the cup electrode (a).
4. Connect remaining two wires between the digital voltmeter (± voltage inputs) and the red/black banana jacks (analog output) at the rear of the analyzer. (Select meter scale ± 2vdc)
5. Select the proper range on the unit, apply DC high voltage power supply to each full range, **(25 VDC, 100VDC, 500VDC, 1,000VDC, and 5,000VDC).** Verify that the display indicates within ± 2.5% of full range. See verification check list form on next page.

Note: ***Also verify during step 5 that the analog output is within tolerance. Input to output ratio for each voltage range is as follows:***

711 Voltage Range Setting	Ratio Input to Analog Output Multiply analog output voltage by the appropriate value below to obtain 711 input value.	Decimal Value Multiply input voltage to the 711 by the appropriate factor below to obtain analog output value.
25Vdc	12.5 to 1	0.08
100Vdc	50 to 1	0.02
500Vdc	500 to 1	0.002
1,000Vdc	500 to 1	0.002
5,000Vdc	2500 to 1	0.0004

6. Repeat Step 5 for Negative voltages.

3M™ Charge Analyzer 711
Verification Check List

Serial Number_____

Date_____Inspector_____

Range Setting	P.S. Voltage & Display Voltage	√ (+) Pass (-)		√ (+) Fail (-)		Analog Output	√ (+) Pass (-)		√ (+) Fail (-)	
25 VDC	±25Vdc **Full Range** ±2.5% **24.4 - 25.6**					**Full Range** 2.0Vdc ±10%				
100VDC	±100Vdc **Full Range** ±2.5% **97.5 - 102.5**					**Full Range** 2.0Vdc ±10%				
500VDC	±500Vdc Full Range ±2.5% **487.5 – 512.5**					**Full Range** 2.0Vdc ±10%				
1,000VDC	±1,00Vdc Full Range ±2.5% **975 – 1025**					**Full Range** 2.0Vdc ±5%				
5,000VDC	±5,000Vdc Full Range ±2.5% **4875 – 5125**					**Full Range** 2.0Vdc ±10%				

10. Maintenance/Calibration/Repair of 3M™ Charge Analyzer 711 & 3M™ Remote Field Sensor Probe

Maintenance - If the charge plate does not retain the applied voltage, it may be due to high level of room humidity or contamination on one or more of the four PTFE spacers. PTFE spacers should be cleaned with laboratory grade alcohol. Use clean cotton or latex gloves when directly handling these spacers.

⚠CAUTION

To reduce the risks associated with use of alcohol for cleaning:

- When cleaning the analyzer per the operating instructions, follow the MSDS procedures for safe use and handling of laboratory grade isopropyl alcohol.

To reduce the risks associated with environmental contamination from the NiMH battery pack and circuit boards containing lead-bearing solder:

- The charge analyzer contains a NiMH battery pack and circuitry that contains lead in the solder. At the end of service life, dispose of the charge analyzer in accordance with federal, state and local requirements.

When not in use, the field sensors should be covered at all times with the supplied red covers. Extreme care should be taken to prevent contact to the sensor elements. They should be kept free of insulating coatings caused by dust, paint, or varnish vapors, and condensed water. To clean the sensor element, use a laboratory grade alcohol applied to a lint-free cloth. Lint free cotton swabs may also be used. Care must be taken not to cause damage to the impeller or sensor surface at all times.

CAUTION

To reduce the risks associated with property damage due to improper repair or modification:

- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair

To reduce the risks associated with property damage from improper maintenance:

- Unit must be cleaned and checked periodically for correct operation

Calibration/Repair – 3M Electronic Solutions Division provides a calibration and repair service for the charge analyzer 711. If this type of service is required, contact our Customer Service Department, at 1-800-328-1368 for more details.

⚠ WARNING

To reduce the risks associated with hazardous voltage:

- Do not attempt to modify or repair — no user serviceable parts inside — contact 3M Service for repair.

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