

3M BRAND STATIC METER

MODEL 703

INSTRUCTION SHEET

DESCRIPTION

The 703 is an electronic instrument that will indicate the quantity and polarity of the voltage due to a static charge without contacting the surface. It is completely self-contained and uses standard 9V transistor batteries as a power source.

THEORY OF OPERATION

General

The Model 703 is a field strength meter, i.e., it measures the strength of the electric field generated by a static charge. The electric field induces into a grid, located in the tip of the meter, a charge that is proportional to the charge being measured.

Induction is the process where a static charge appears on the surface of an uncharged object due to the close proximity of another charged object. This is what happens when a hard rubber comb carrying a negative static charge approaches human hair — a positive charge will appear on the hair. This induced charge is generated without contact, and will remain only as long as the hair and the comb are in close proximity.

Measuring Element

There are three sections to the measuring element — a grid, ionizing source, and high impedance amplifier.

The function of the grid is to receive the induced charge from the electric field. This may be positive or negative depending on the polarity of the charged surface.

The ionizing source is a Tritium foil (H_3) which causes the air space between the grid and the amplifier to become electrically conductive. The ionized air allows a small current to flow from the grid to the amplifier. This signal is translated by the amplifier into the magnitude and polarity of the voltage due to the charge on the object being measured and is displayed on the meter face.

Distance

Since the strength of an electric field decreases with distance, the output of the meter should be in volts per inch or volts per centimeter. This is a difficult parameter to visualize; therefore, three specific distances were chosen and the meter dial was calibrated in volts at these distances. A further discussion of these distances will be given in the section on meter adjustments.

OPERATING PROCEDURE

The operator holds the 703 in the manner of a gun and depresses the trigger to activate the meter. The trigger must be depressed during measurement and the meter should be adjusted for zero as outlined below. With the trigger still depressed the meter is aimed at the surface being measured, taking care not to over-range (peg) the meter by moving too close to a highly charged surface. The spacing between the object and the tip of the instrument determines the full scale sensitivity. The reading of the meter indicates both the voltage level and the polarity (+ or -) of the charged surface.

PRINCIPLE OF OPERATION: The charge on the surface being measured is induced onto an internal element of the meter. This is detected by using a nuclear source and a high resistance voltage measuring element. The signal is displayed on a tri-scale meter. The voltage read on the 703 is the potential difference between the object under test and ground, provided the operator is grounded.

METER ADJUSTMENTS: Since the 703 will read both positive and negative voltages, the zero point is the center of the meter face. Before making a measurement the zero should be checked by turning the meter on and adjusting the black knurled knob above the meter face. During this adjustment the opening in the tip of the meter should be aimed at an open space away from any charged surface. **ZERO ADJ.**

The scale that is read while making a measurement depends on the distance between the charged surface and the tip of the meter. The top scale is used at a distance of 2", the middle scale at 6", and the lower scale at 12" from the object being measured. To change the range of the meter, increase or decrease the size of the opening by adjusting the aperture. The full scale readings are as follows:

	Aperture Setting		
	10X	1X	1/10X
Top Scale	50KV	5KV	0.5KV
Middle Scale	100KV	10KV	1 KV
Lower Scale	200KV	20KV	2 KV

DISTANCE
2"
6"
12"

Calibration

Each meter is accurately calibrated prior to shipment. There should be no need to adjust the calibration screws located under the protective caps on each side of the housing. Due to the sensitivity and difficulty of precise calibration it is recommended that the meter be returned to the factory if calibration is ever needed. Any tampering with these calibration adjustment screws by the user voids the warranty on the device. To determine if calibration is necessary, measure the voltage on a piece of Scotch Brand #810 magic mending tape. Pull 8"-10" of tape from the roll and hold in the air so the strip of tape hangs down from the hand. The reading should be at least 5000 volts positive at a distance of two inches.

WHEN THE INSTRUMENT WILL NOT ZERO:

1. Batteries need replacement (see below). If the new batteries do not correct the problem, return the instrument for repair and/or calibration to:

3M COMPANY
STATIC CONTROL SYSTEMS
Gate 4, Bldg. 590
TCAAP
New Brighton, Minnesota 55112
ATTN: SCSQC

There is a minimum charge of \$40.00 for this service. Charges in excess of \$40.00 require customer approval prior to repair.

2. If the charge on the surface measured is very high the element in the meter can be saturated. If this occurs ground the tip of the meter until a zero can be obtained. Do not use the meter in the immediate vicinity of High Electrical Discharge Machinery, such as corona discharge equipment for the surface treatment of plastic film.

TO CHANGE BATTERIES

1. The normal operating life of fresh batteries is approximately 50 hours continuous use at 15°F or higher.
2. The Model 703 Static Meter uses two (2) 9V batteries (same type as used in transistor radios); Eveready 216, Burgess 2U6, Ray-o-Vac 1604, NEDA 1604.
3. To change batteries, remove cap on the bottom of the handle. There are four retaining screws. Pry off the snap-on battery clips from both batteries before removing them from the handle.
4. Insert new batteries and replace clips, being careful that snaps on the battery match those on the clip.

NRC REGULATIONS

The 3M Model 703 Static Meter is manufactured, tested, and labelled in accordance with requirements set forth in a valid license issued to 3M Company by the Nuclear Regulatory Commission. These devices contain tritiated titanium foil (Tritium). Tritium is a weak beta emitter.

Do not touch the foil or the grid of the Tritium Holder. Federal regulations do not require a leakage test on this static meter.

If the device needs repairs, a new source, or its use is to be discontinued, return the entire unit to 3M Company (see address in item #1, "When the Instrument will not Zero". Do not discard as scrap.

You automatically become a GENERAL LICENSEE when you receive a 3M Model 703 Static Meter. NRC REGULATIONS are included with these instructions. The use of the device in an Agreement State is regulated under requirements substantially the same as these.

NOTICE TO REGISTER

Many states require registration of any equipment utilizing radioactive material. It is your responsibility as purchaser to register with your State Board of Health, Radiological Division, if so required.

IMPORTANT NOTICE TO PURCHASER:

This is a Sensitive Electrical Instrument and with reasonable care should give many years of useful service. Each device is inspected before shipment and is in good working order. The Meter is warranted against defects in material and workmanship for ninety (90) days from the date of purchase.

The Seller's and Manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct or consequential, arising out of the use, or the inability to use the product.

**NUCLEAR REGULATORY COMMISSION
GENERAL LICENSE PROVISIONS
EXCERPTS FROM 10CFR20, 10CFR30, & 10 CFR31
APPLICABLE TO GENERAL LICENSING**

§ 31.5 Certain measuring gauging or controlling devices. 2,3

(a) A general license is hereby issued to commercial and industrial firms and research, educational and medical institutions, individuals in the conduct of their business, and Federal, State or local government agencies to acquire, receive, possess, use or transfer, in accordance with the provisions of paragraph (b), (c) and (d) of this section, byproduct material contained in devices designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.

(b) The general license in paragraph (a) of this section applies only to byproduct material contained in devices which have been manufactured or imported and labeled in accordance with the specifications contained in a specific license issued by the Commission pursuant to § 32.51 of this chapter or in accordance with the specifications contained in a specific license issued by an Agreement State which authorizes distribution of the devices to persons generally licensed by the Agreement State.

(c) Any person who acquires, receives, possesses, uses or transfers byproduct material in a device pursuant to the general license in paragraph (a) of this section;

(1) Shall assure that all labels affixed to the device at the time of receipt and bearing a statement that removal of the label is prohibited are maintained thereon and shall comply with all instructions and precautions provided by such labels;

(2) Shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as are specified in the label; however;

(i) devices containing only krypton need not be tested for leakage of radioactive material, and (ii) devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or 10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose;

(3) Shall assure that the tests required by paragraph (c) (2) of this section and other testing installation, servicing and removal from installation involving the radioactive materials its shielding or containment, are performed;

(i) in accordance with the instructions provided by the labels; or (ii) by a person holding a specific license from the Commission or an Agreement State to perform such activities;

(4) Shall maintain records showing compliance with the requirements of paragraph (c) (2) and (c) (3) of this section. The records shall show the results of tests. The records also shall show the dates of performance of, and the names of persons performing, testing, installation, servicing, and removal from installation concerning the radioactive material, its shielding or containment;

(5) Upon the occurrence of a failure of or damage to, or any indication of a possible failure of or damage to the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of 0.005 microcurie or more removable radioactive material shall immediately suspend operation of the device until it has been repaired by the manufacturer or other person holding a specific license from the Commission or an Agreement State to repair such devices, or disposed of by transfer to a person authorized by a specific license to receive the byproduct material contained in the device and within 30 days, furnish to the Director of the appropriate Nuclear Regulatory Commission Regional Operations Regional Office listed in Appendix D of Part 20 of this chapter a report containing a brief description of the event and the remedial action taken;

(6) Shall not abandon the device containing byproduct material;

(7) Shall not export the device containing byproduct material without a specific license from the Commission authorizing such export;

(8) Except as provided in paragraph (c) (9) of this section shall transfer or dispose of the device containing byproduct material only by transfer to a specific licensee of the Commission or of an Agreement State whose specific license authorizes him to receive the device and within 30 days after transfer of a device to a specific licensee shall furnish to the Director of Licensing, U.S. Nuclear Regulatory Commission, Washington D.C. 20545 a report containing identification of the device by manufacturer's name and model number and the name and address of the person receiving the device. No report is required if the device is transferred to the specific licensee in order to obtain a replacement device;

(9) Shall transfer the device to another general licensee only;

(i) Where the device remains in use at a particular location. In such case the transferor shall give the transferee a copy of this section and any safety documents identified in the label of the device and within 30 days of the transfer, report to the Director of Licensing U.S. Nuclear Regulatory Commission, Washington D.C. 20545, the manufacturer's name and model number of device transferred, the name and address of the transferee, and the name and/or position of an individual who may constitute a point of contact between the Commission and the transferee; or

(ii) Where the device is held in storage in the original shipping container at its intended location of use prior to initial use by a general licensee.

(10) Shall comply with the provisions of §§ 20.402 and 20.403 of this chapter for reporting radiation incidents, theft or loss of licensed material, but shall be exempt from the other requirements of Parts 19 and 20 of this chapter.

(d) The general license in paragraph (a) of this section does not authorize the manufacture or import of devices containing byproduct material.

FOOTNOTES:
1. Persons possessing byproduct material in devices under the general license in § 31.5 before Jan. 15, 1975 may continue to possess use or transfer that material in accordance with the requirements of § 31.5 in effect on Jan. 14, 1975.

2. The recordkeeping and reporting requirements for § 31.5 have been cleared by GAO under B180225 (ROGS). This clearance expires on November 30, 1977.

§ 30.34 Terms and conditions of licenses.
(a) Each license issued pursuant to the regulations in this part and the regulations in Parts 31-36 shall be subject to all the provisions of the Act, now or hereafter in effect, and to all valid rules, regulations and orders of the Commission.

(b) No license issued or granted pursuant to the regulations in this part and Parts 31-36, nor any right under a license shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Commission shall, after securing full information, find that the transfer is in accordance with the provisions of the Act and shall give its consent in writing.

(c) Each person licensed by the Commission pursuant to the regulations in this part and Parts 31-36 shall confine his possession and use of the byproduct material to the locations and purposes authorized in the license. Except as otherwise provided in the license, a license issued pursuant to the regulations in this part and Parts 31-36 of this chapter shall carry with it the right to receive, acquire, own, possess, and import byproduct material. Preparation for shipment and transport of byproduct material shall be in accordance with the provisions of Part 71 of this chapter.

(d) Each license issued pursuant to the regulations in this part and Part 31-36 shall be deemed to contain provisions set forth in section 183b-d., inclusive, of the Act, whether or not these provisions are expressly set forth in the license.

(e) The Commission may incorporate, in any license issued pursuant to the regulations in this part and Parts 31-36, at the time of issuance, or thereafter by appropriate rule, regulation or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use and transfer of byproduct material as it deems appropriate or necessary in order to:

- (1) Promote the common defense and security;
- (2) Protect health or to minimize danger to life or property;
- (3) Protect restricted data;
- (4) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

RECORDS, INSPECTIONS AND TESTS

§ 30.51 Records.

Each person who receives byproduct material pursuant to a license issued pursuant to the regulations in this part and Parts 31-36 shall keep records showing the receipt, transfer, export and disposal of such byproduct material.

§ 30.52 Inspections.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect byproduct material and the premises and facilities wherein byproduct material is used or stored.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by him pursuant to the regulations in this chapter.

§ 30.53 Tests.

Each licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part and Parts 31-36, including tests of:

- (a) Byproduct material;
- (b) Facilities wherein byproduct material is utilized or stored;
- (c) Radiation detection and monitoring instruments, and
- (d) Other equipment and devices used in connection with the utilization or storage of byproduct material

ENFORCEMENT

§ 30.61 Modification and revocation of licenses.

(a) The terms and conditions of each license, issued pursuant to the regulations in this part and Parts 31-36 shall be subject to amendment, revision or modification by reason of amendments to the Act, or by reason of rules, regulations and orders issued in accordance with the terms of the Act.

(b) Any license may be revoked, suspended or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act, or because of conditions revealed by such application or statement of fact or any report, record or inspection or other means which would warrant the Commission to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and provisions of the Act or of any rule, regulation or order of the Commission.

(c) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended or revoked unless prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

§ 30.62 Rights to withhold or recall byproduct material.

The Commission may withhold, recall or order the withholding or recall of byproduct material from any licensee who is not equipped to observe or fails to observe such safety standards to protect health as may be established by the Commission, or who uses such materials in violation of law or regulation of the Commission, or in a manner other than as disclosed in the application therefor or approved by the Commission.

§ 30.63 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Act or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 62, 63, 81, 82, 101, 103, 104, 107 or 109 of the Act of any rule, regulation or order issued thereunder, or any term, condition, or limitation of any license issued thereunder, or for any violation for which a license may be revoked under section 186 of the Act. Any person who willfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and upon conviction, may be punished by fine or imprisonment or both, as provided by law.

§ 20.402 Reports of theft or loss of licensed material.

Each licensee shall report by telephone and telegraph to the Director of the appropriate Nuclear Regulatory Commission Regional Operations Regional Office listed in Appendix D, immediately after its occurrence becomes known to the licensee, any loss or theft of licensed material in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas.

§ 20.403 Notifications of incidents.

(a) **Immediate notification.** Each licensee shall immediately notify the Director of the appropriate Nuclear Regulatory Commission Regional Operations Regional Office shown in Appendix D by telephone and telegraph of any incident involving byproduct, source or special nuclear material possessed by him and which may have caused or threatens to cause:

- (1) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual of 150 rems or more of radiation; or exposure of the feet, ankles, hands or forearms of any individual to 375 rems or more of radiation; or
- (2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II; or
- (3) A loss of one working week or more of the operation of any facilities affected; or
- (4) Damage to property in excess of \$100,000.

(b) **Twenty-four hour notification.** Each licensee shall within 24 hours notify the Director of the appropriate Nuclear Regulatory Commission Regional Operations Regional Office listed in Appendix D by telephone and telegraph of any incident involving licensed material possessed by him and which may have caused or threatens to cause:

- (1) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or
- (2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in Appendix B, Table II; or
- (3) A loss of one day or more of the operation of any facilities affected; or
- (4) Damage to property in excess of \$1,000.

(c) Any report filed with the Commission pursuant to this section shall be prepared so that names of individuals who have received exposure to radiation will be stated in a separate part of this report.

APPENDIX D

**UNITED STATES NUCLEAR REGULATORY COMMISSION
REGULATORY OPERATIONS OFFICES**

REGION	ADDRESS	TELEPHONE	
		DAYTIME	NIGHTS & HOLIDAYS
I	Region I, Directorate of Regulatory Operations, USAEC 631 Park Avenue King of Prussia, Pennsylvania 19406	215-337-1150	215-337-1150
II	Region II, Directorate of Regulatory Operations, USAEC Suite 818, 230 Peachtree St., NW. Atlanta, Georgia 30303	404-526-4503	405-526-4503
III	Region III, Directorate of Regulatory Operations, USAEC 799 Roosevelt Road Glen Ellyn, Illinois 60137	312-858-2660	312-739-7711
IV	Region IV, Directorate of Regulatory Operations, USAEC 10395 West Colfax Avenue Denver, Colorado 80215	303-837-4211	302-237-5095
V	Region V, Directorate of Regulatory Operations, USAEC P.O. Box 1515 Berkeley, California 94704	415-486-3141	415-273-4237