



Instruction Sheet

703 Static Meter

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. 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

Operating Procedure (continued)

Calibration

Each meter is accurately calibrated prior to shipment. There should be no need to adjust the calibration screws located under the protected 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
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); Ever-ready 216, Burgess 2U6, Ray-o-Vac 1604, NEDA 1604.
3. To change batteries, remove cap on the bottom of the handle. There are two retaining screws. Pry off the snap-on battery clips from both batteries.
4. Replace clips and insert new batteries, being careful that snaps on the battery match those on the clip.

NRC Regulations

You automatically become a GENERAL LICENSEE when you receive the 3M Model 703 Static Meter. Applicable N.R.C. Regulations may be found on the back of this sheet. The use of this device in an Agreement State is regulated under requirements substantially the same as these. In general the regulations state:

- (1) All labels **must** be maintained on the device and you **must** comply with the instructions provided with the device.
- (2) You cannot transfer the device(s) to another general licensee.
- (3) In case a static meter has been subjected to fire or other catastrophe or has been lost or stolen, **NOTIFY THE STATIC CONTROL SYSTEMS DEPARTMENT, 3M, IMMEDIATELY BY TELEPHONE. THE NUMBER TO CALL (collect) IS 612/733-9420.** Ask for the Regulatory Affairs Manager. You will be advised relative to reporting the incident to the proper authorities if required.
- (4) Do not touch the foil or the grid of the Tritium Holder. Federal regulations do not require a leakage test on this static meter.
- (5) If the device needs repairs, a new source, or its use is to be discontinued, return the entire unit to 3M (see address in item #1,) "When the Instrument will not Zero". Do not discard as scrap.
- (6) **MODIFICATION OF 3M STATIC METERS BY OPERATIONS SUCH AS CUTTING, DRILLING, WELDING, BRAZING OR OTHER DESTRUCTIVE AND/OR ALTERING OPERATIONS IS IN VIOLATION OF FEDERAL LAW AND NOT ALLOWED UNDER ANY CIRCUMSTANCES.**
- (7) Under USNRC and State regulations your operations using 703 static meters may be inspected for compliance with these regulations. State regulations may require registration of your devices.

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.