

## THE DIFFERENCE BETWEEN ELECTROSTATIC VOLTMETERS, FIELDMETERS, STATIC METERS AND STATIC LOCATORS

There are several different names associated with instruments used to measure electrostatic charge, voltage and fields. The term *electrostatic* (or static charge) is commonly used to refer to the voltage measured on the surface of an object. In actuality, *charge* is the parameter associated with the voltage on the surface of an object and its capacitance where  $Q$  (Charge) =  $C$  (capacitance) times  $V$  (voltage) or ( $Q=CV$ ) Charge is expressed in Coulombs and can be measured directly using a Coulomb Meter (or Nanocoulombmeter) and Faraday cup.

There are two basic types of measurements used to measure the voltage or field potential on the surface of an object. When using a static meter (static locator, fieldmeter), it is the voltage that is actually being measured.

**ELECTROSTATIC VOLTMETERS** measure the actual potential (voltage) at the surface of the object under test. These instruments use non-contacting sensors with a high voltage amplifier to drive the sensing probe to the same potential as that of the surface being measured. By measuring the output of the high voltage amplifier an accurate indication of the unknown potential can be determined. Measurement accuracy is typically 0.1% regardless of probe-to-surface spacing (spacing is usually in the range of 0.1") with a target resolution 0.1" (2.5mm) or smaller. Electrostatic voltmeters typically can measure over the range from millivolts to several thousand volts.

**ELECTROSTATIC FIELDMETERS** measure the electrostatic field produced by a charged surface located some distance away (voltage per unit distance) from a high input impedance or chopper stabilized sensor that is referenced to ground. (**These meters are also called static meters or static locators**). The sensor-to-surface distance must be known in order to obtain an accurate measurement. The size of the surface being measured in relation to the field of view of the sensor, the relation of the charged surface to ground and the presence of other objects in proximity to the surface all can have a significant impact on the measurement.

These meters are generally calibrated and their accuracy specified when a grounded meter is placed a fixed distance from a large flat plate in free space that is charged to a specific voltage. For example, a 12" x 12" plate in free space is charged to 1kV and the static meter sensor is set exactly 1.0" from the center of the plate. The meter is then calibrated to read 1kV. The Meter is now calibrated to measure field strength of 1kV/inch. The voltage on the surface of an unknown large flat object in free space that is exactly 1.0" from the face of the sensor can be determined with an accuracy of better than 5%.

If the surface being measured has voltage gradients (different voltages at different locations) the meter will indicate the average voltage on the surface. Therefore, these meters are not the best choice when making high-resolution measurements on a given surface.

For near-field measurements, the relationship between voltage and distance is linear. At a spacing of 2.0" the meter will read 500V etc. Fieldmeters are capable of measuring

very large voltages at sufficiently large distances. However, if the sensor, and test surface are calibrated as a total system by placing a known voltage on the surface or onto foil placed on the surface, a fairly accurate measurement can be obtained since all the variables such as distance, size, interference etc. would be compensated for in the calibration. With a calibrated test set-up accuracies better than 2% can be obtained.

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