ESD association technical report

ESD TR3.0-01-02
(Formerly TR13-02)

ALTERNATE TECHNIQUES FOR MEASURING IONIZER OFFSET VOLTAGE AND DISCHARGE TIME

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Foreword:
Static charge control has become essential to maximizing production yields and product throughput in the manufacturing of semiconductors, disk drives, flat panel displays and many other products. Most electronic devices are not sensitive to ESD events that occur below 100 volts (HBM). However, many sectors of the electronics industry have recently been producing devices that are reported to be very sensitive. For instance, the disk drive industry is manufacturing assemblies with devices that have reported sensitivities down to 20 volts (HBM), and 5 volts (MM & CDM). Because of these sensitivities, many disk drive manufacturers are specifying ionizer offset values of ±5 volts or less, and discharge times from 1000 to 10 or less volts. In order to measure ionizers with this type of specification, charged plate monitors with greater sensitivities, better accuracies and lower voltage thresholds should be used.

ESD STM 3.1 (formerly ANSI/EOS/ESD-S3.1)[1] has been used in the industry for a number of years to characterize ionization systems for use in the electronics industry. This standard requires the use of a 15 cm x 15 cm (6" x 6") plate separated from a ground plane that causes the instrument to have a 20-picofarad capacitance. The voltage on the plate is typically monitored with a non-contact electrostatic voltmeter or fieldmeter as the charged plate monitor (CPM) performs the offset voltage and discharge time measurements.

The current standard calls out offset voltage measurements, from an initially uncharged plate and the discharge time measurements call out measurements of discharge times from 1000V to 100V. When the standard was written and the CPM was specified, there were few sensitive components requiring ionizer balance better than 50 volts. The issue of 20 volts and better ionizer balance did not arise until MR heads began being produced in quantity in the early 1990's. One of the most important issues to remember in making offset voltage measurements is that the voltage measured by the CPM is not the same as the voltage on an MR head or IC. While the plate of the CPM might be similar in size to a semiconductor wafer, it bears little relationship to other electronic components. It would be desirable to have an alternate measuring technique that more closely represents the electrostatic conditions on small parts.

Since most CPM measurements according to STM 3.1 take less than 5 minutes, there was no concern in the design of the CPM for making long term offset voltage measurements. Similarly, the CPM was not intended to make measurements of rapidly varying ionizer outputs due to the plate time constant and frequency limitations of the plate voltage sensor.

In addition to the need for greater measurement sensitivity and accuracy, many of these measurements must be performed in small, confined spaces, requiring a sensing plate much smaller than the 15 cm x 15 cm (6" x 6") plate called out in ESD STM 3.1.

When non-standard measurement techniques are used to monitor ionization systems, many sources may produce inaccuracy, correlation errors and distortion of the measurement. Some of these sources are:

- Capacitance of the monitor plate.
- Indirect airflow onto the monitor plate.
- Capacitive loading of monitor plate due to its proximity to grounded equipment parts.
- Accuracy of the plate voltage sensor.
- Inaccuracies of the timing hardware/firmware/software.
- Temperature and humidity conditions being different than under actual operating conditions.
- Charged plate self discharge times

The best methods to use for these non-standard measurements are ones that represent the actual product being neutralized. Matching of the capacitance, geometry and materials of the device would provide the best opportunity for understanding the impact of the ionization system on the product.

These are alternate test methods for measuring ionizer offset voltage and discharge time. Issues related to