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TECHNOLOGY SOLUTIONS

Getting the Full Picture from Your Charge Plate Monitor

AC ionizers have proven useful for eliminating electrostatic discharge in the most budget conscious of applications, such as those in the disk drive industry. When that industry moved to manufacturing ultra-sen- sitive MR heads, AC ionizers proved to be more damaging to heads than helpful, owing to their unrecognized Maximum Offset Voltage. The Maximum Offset Voltage went unnoticed because ionizer performance is measured with a Charge Plate Monitor (CPM), which cannot respond quickly enough to show the 50-60 Hz time variation of an AC ionizer.

The flat panel display (FPD) industry also uses AC ionizers and in addition employs advanced variable frequency (VF) ionizers in many applications. These ionizers are effec- tive at eliminating static charge but if they are calibrated using only a conventional CPM, they may perform with unexpected negative results.

Hidden Voltages

The maximum offset voltage of an ionizer is defined by EOS/ESD 3.3-2000 and 3.2-1995 as the largest voltage excursion, either positive or negative. A CPM digitizes the analog plate voltage and calculates this parameter. Unfortunately, the design of all CPMs to date features bandwidth limited to a maximum response of only several hertz. This allows CPMs to achieve their perform- ance economically.

If an AC or VF ionizer is used with a frequency of >8 Hz, the CPM reports very little Maximum Offset Voltage and virtually no Maximum Offset Voltage for >30 Hz. This is extremely misleading and potentially dangerous to the product the ionizer is intended to pro- tect.

Owing to the bandwidth limitation, it is not reasonable for a CPM alone to be used with an ionizer operating at >20 Hz, as it reports a Maximum Offset Voltage less than one tenth of what it actually is. A response curve measured for the Ion Systems Model 280 CPM is shown in Figure 1. As shown, an ionizer being operated at 10 Hz or above cannot be safely adjusted with a CPM alone.

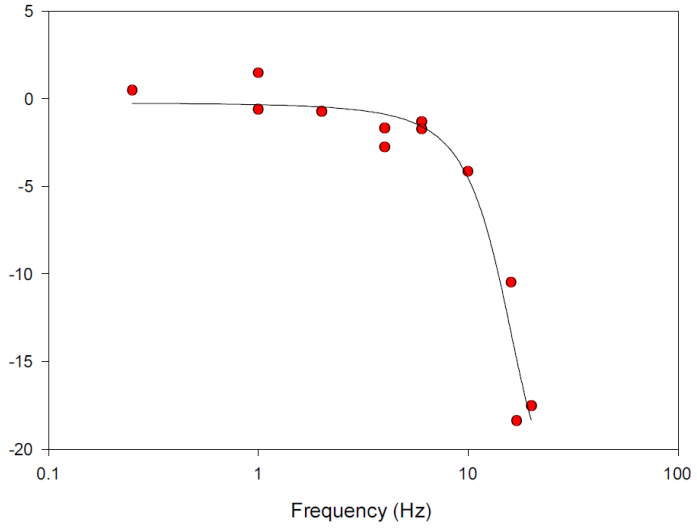

Figure 1. Frequency Response of an Ion Systems Model 280 CPM

Getting the Full Picture

The solution to this hidden Maximum Offset Voltage dilemma is to use a digital sampling oscilloscope (DSO) in conjunction with the CPM. Virtually any brand of DSO provides a bandwidth of >1 MHz. Since the *analog* out- put of a CPM typically has a bandwidth of >100 Hz, recording the CPM's output with the oscilloscope provides a bandwidth in excess of what is

required to accurately meas- ure the Maximum Offset Voltage of an AC or VF type ionizer.

If the Maximum Offset Voltage is measured in this way, it produces a result that is representative of the actual Maximum Offset Voltage that delicate components on a flat panel display plate will experience. Having this information allows the user to adjust the Maximum Offset Voltage of the ionizer to safe voltage levels.

In a recent preventative maintenance (PM) operation, a VF ionizer was operated at a frequency of 16 Hz. The ionizer was measured with a Trek 156A CPM and a Tektronix TDS340 (100 MHz) DSO. Measurements were taken with the CPM plate placed 60 cm from the ionizer. (See Figure 2.) The CPM indicated offset readings from 0 to 14, representing a maximum offset voltage of 14 volts, while the oscilloscope indicated 87 volts. This variance can mean the difference between protecting and dam- aging the product.

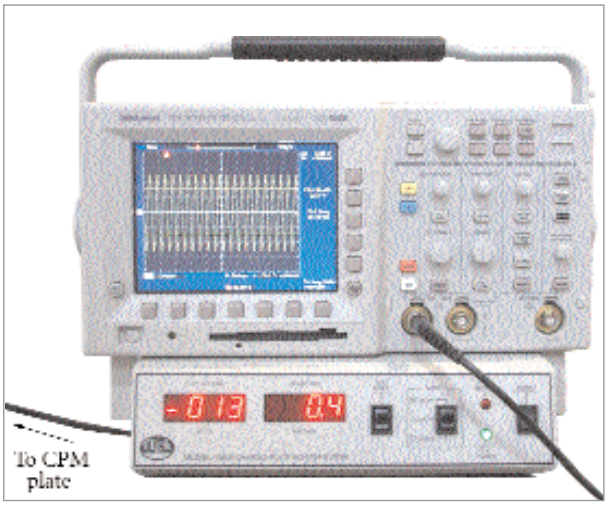

Figure 2. Using A Charge Plate Monitor Along With A DSO

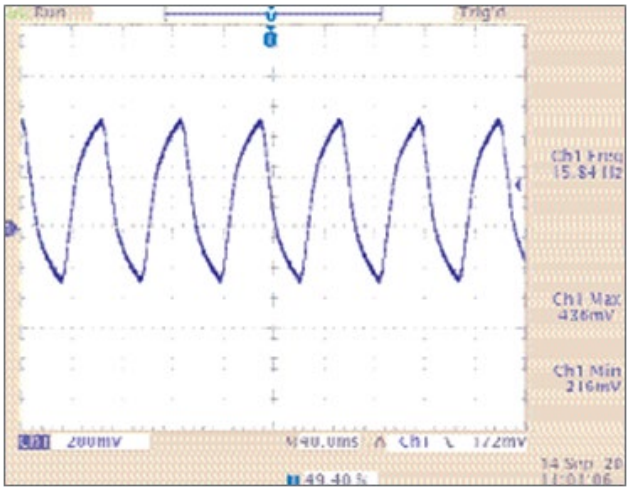

Figure 3. Measuring The Maximum Offset Voltage Of A VF Ionizer With A CPM/DSO
Note pulse parameters on the right

How to Use a DSO with a CPM

Maximum Offset Voltage

All CPMs available on the market today feature an analog output. The output is typically accessible via a BNC connector mounted on the rear panel.

To connect the DSO to the CPM, connect the oscilloscope input (set to high impedance) to the CPM output. The scaling factor for the CPM plate voltage is indicated by the output connector. It may read in the form of 200:1 or 200 V/V. In either case, it tells how to scale the reading on the oscillo- scope to translate to plate voltage. For example, a Maximum Offset Voltage of 500 volts might read

2.5 volts on the oscilloscope owing to a CPM out- put scaling factor of 200:1.

Most DSOs offer a feature called Pulse Parameters. This feature allows the user to program a calculation based on the details of the waveform. When using a DSO/CPM combination, it is a good idea to select the parameters **Max**, **Min**, and **Freq**. (The Maximum Offset Voltage is simply the larger of the two values multiplied by the scaling factor printed on the back of the CPM.) Some DSOs allow the user to enter this scale factor and read the Maximum Offset Voltage directly.

Discharge Time

Since advanced ionizers have been designed to provide an extremely high density of air ions, the discharge time of the ionizer is quite fast and may not be within the operation capability of the CPM. In addition, the CPM typically measures the time from the start of the measurement (±1000V) to the first crossing of the threshold (±100V). The effect of the Maximum Offset Voltage makes this an overly optimistic estimate of the discharge time (see EOS/ESD 3.3-2000 for details). For those reasons, it is appropriate to use a DSO to measure the discharge time.

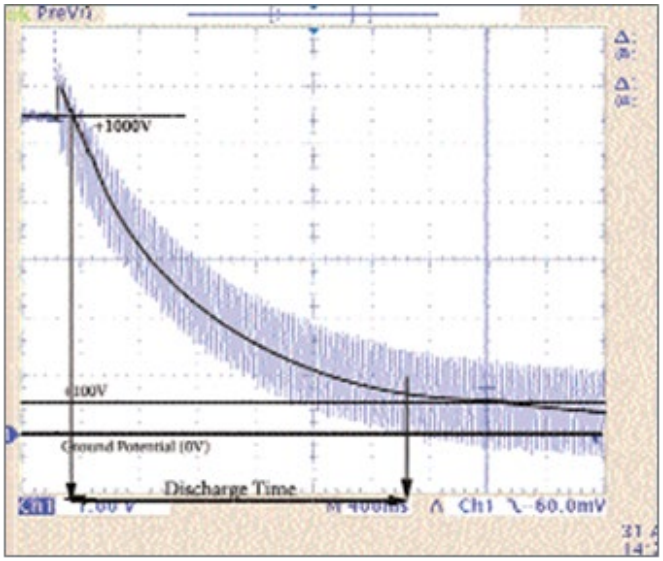

Figure 4. Measuring Discharge Time As Defined By EOS/ESD 3.3-2000 With A CPM/DSO Combination

Application Summary

Necessary Changes

Although the technology of Charge Plate Monitors was appropriate and cost-effective in the 1990s, the extensive use of AC and VF ionizer technology makes it essential to use wider bandwidth tools to obtain an accurate reading of the maximum offset voltage. Using a CPM with an oscilloscope will show the full picture of an ionizer's Maximum Offset Voltage.

Appropriate Adjustments

For AC ionizers with no output amplitude adjustment, taking the hidden Maximum Offset Voltage into account means adjusting the distance between the ionizer and the target so that the Maximum Offset Voltage voltage does not interfere with the sensitive target.

For variable frequency pulsed bar ionizers, adjusting the output levels and ontime will allow the user to set the Maximum Offset Voltage.

In all cases, an ionizer is an excellent way to eliminate static charge, but for a complete picture of ionization in your application, it is important to understand the limitations of using the CPM to measure Maximum Offset Voltage alone.

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