# Lead Length Effect on SPD Performance

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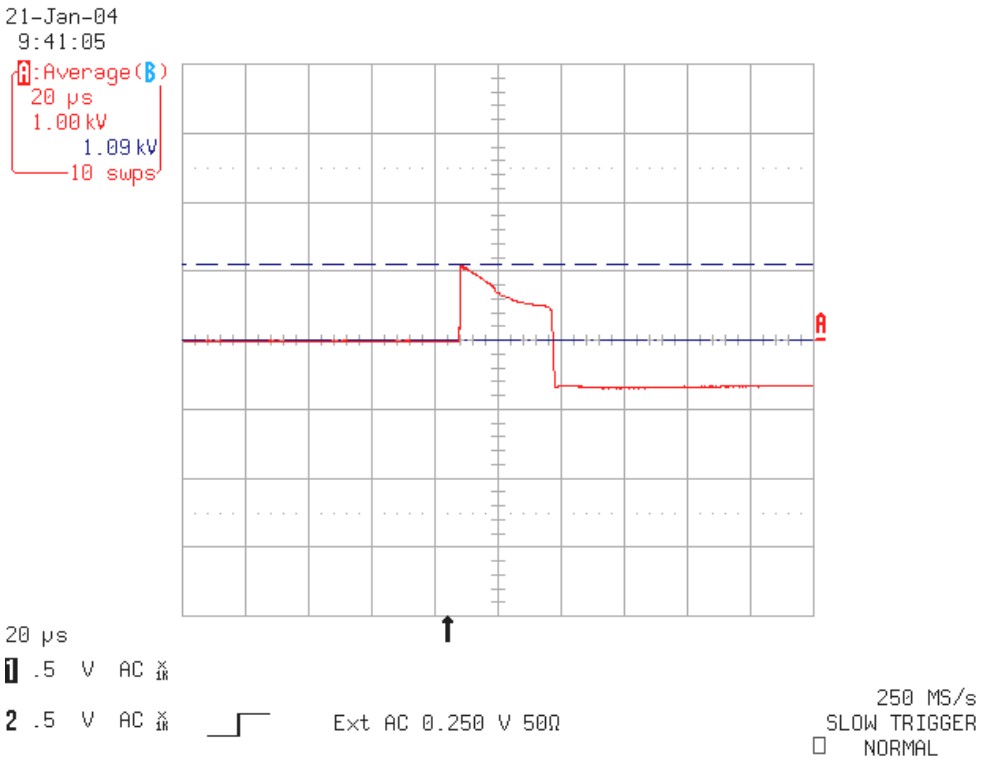
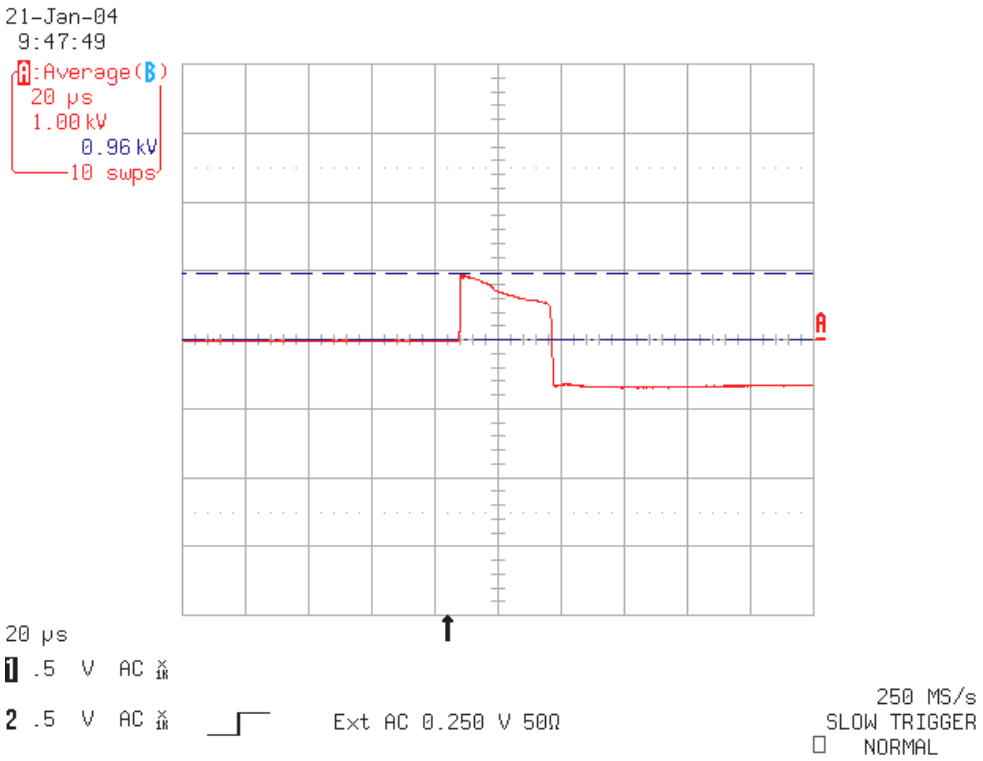
While conducting specification testing on a new surge suppression device I was required to cut the leads on the unit to 6" "outside the box" lead length for standardized testing. The unit arrived with 23.5 inches of lead from the board. I decided to test the idea that extended lead length has a detrimental effect on the operation of the SPD.

I utilized the EMC -Partner Modular Impulse Generator (MIG) Model MIG0603Inx surge generator incorporating: Combination wave 1.2/50; 8/20µs, Model MIG0603IN and Ring wave 100 kHz, Model MIG0603IN1 modules to produce the standard ANSI/IEEE C62.41-1991 Category B3/C1, 6kV, 1.2/50µs, 3kA, 8/20µs Combination Wave, at 0° phase angle insertion, positive polarity, static test. The LeCroy Model LT262, Dual Channel, 350 MHz, Digital Storage Oscilloscope with LeCroy Model PPE6KV, 1000X, 6000V peak probes were used to capture the event. The scope time base was set at 20µs with 250MS/s sampling rate.

I ran the test with the leads for Line 1 and Neutral at full length (23.5 inches from the board to the end). After application of the B3/C1 test wave, the let through voltage recorded for the unit was 1,090Vpk. The image from the scope is shown below:

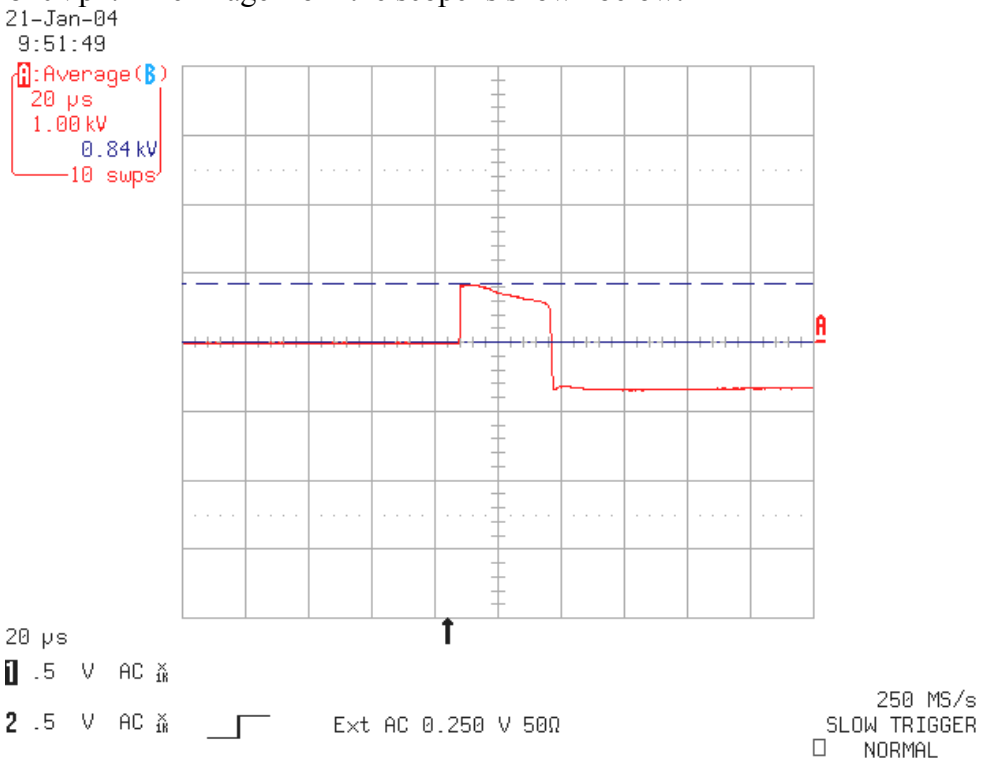



I then cut the leads to remove 5.5 inches from both the Line 1 and Neutral leads. This reduced the lead length from the board to the end of the lead to 18 inches. The let through voltage recorded for the unit after application of the B3/C1 test wave was 960Vpk. The image from the scope is shown below:




By reducing the lead length of 5.5 inches, the let through voltage had been reduced 130Vpk, or 23.636V per inch. This demonstrated a direct impact of excessive lead length on the let through voltage performance of the SPD.

The leads for Line 1 and Neutral were then cut another 6 inches to reduce them to a total of 12 inches from the board to the end of the leads. After application of the B3/C1 test wave, the let through voltage was 840Vpk. The image from the scope is shown below:



By reducing the leads another 6 inches the let through voltage had been reduced another 120Vpk, or 20V per inch. This reduction in the change per inch with the shorter lead length raises the possibility that the longer the lead length the more progressive the increase in let through, that it may not be a set volts per inch constant.

The total lead length reduction was 11.5 inches and the reduction in let through voltage total was 250Vpk. This is 21.739V per inch. While this was not meant to be an exhaustive study of the problem, it does validate the need for short, straight leads for every parallel connected SPD installation.