

# EOS/ESD ASSOCIATION REGIONAL TUTORIALS

## May 15-17, 2018

Teradyne Conference Center 600 Riverpark Drive, North Reading, MA 01864 USA  
Lunch and refreshments provided

### May 15, 2018

#### FC201:ESD- A Surprisingly Frequent Root Cause of Device Failure

**9:00 a.m. - 12:00 p.m.**

Instructor: Ted Dangelmayer, Dangelmayer Associates, LLC.



While most companies are acutely aware of the hazards of ESD, few are aware of just how pervasive ESD failures actually are. Likewise, many ESD Program Managers have difficulty securing adequate management support. This tutorial will shed light on multiple sources of ESD damage and the circumstances where ESD failures dominate. Recent studies into the misdiagnosis of EOS failures suggest that ESD damage may, in fact, occur much more often than previously realized – especially at the circuit board level. This fact is a compelling justification for strong management support. The student will also learn which are the most frequent ESD failure mechanisms among CDM, HBM and MM and why. The student will also learn about the best practices for prevention for these recently recognized sources of ESD damage.

### May 15, 2018

#### FC360:EOS in Manufacturing & Test

**1:00 p.m. - 4:00 p.m.**

Instructor: Terry Welsher, Dangelmayer Associates, LLC.



Electrical overstress (EOS) is a major cause of device failure in manufacturing and in the field. Despite this, there is relatively little information on the sources of EOS and on prevention practices, particularly for the factory. In this tutorial, the fundamentals of device overstress are reviewed. Relationships among device EOS stressing models, such as the Wunsch-Bell curve, are discussed. The causes of EOS and EOS-like events in manufacturing are described and categorized by source and by stress-type. The difficulties in distinguishing between power-induced EOS and high current ESD events such as charged-board events (CBE) and cable discharge events (CDE) are discussed. Case histories, including failure analysis and root cause determination, are presented and the few relevant industry specifications are reviewed.

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### May 16, 2018

#### FC361: Preparing for Ultra-sensitive devices

**9:00 a.m. - 12:00 p.m.**

Instructor: Terry Welsher, Dangelmayer Associates, LLC.



Advanced ESD Controls and Auditing Measurements for CDM & Class 0 (ultra-sensitive) devices and Circuit Boards are not well known and there are many technical and strategic pitfalls that must be avoided. Industry definitions (threshold levels) for Class 0 will be described and the history of their use will be reviewed. The Class 0 category is broken down into sub-categories of increasing risk. Students will learn how to make valid measurements, avoid common pitfalls, and how to use this data to successfully handle Class 0 sensitivities. Advanced measurements will be described including event detection and high speed current measurements. Students will learn when each measurement type is useful. Compelling case studies will illustrate these techniques and the success they produce.

ESD Control procedures for Class 0 manufacturing require customization, attention to detail and a full understanding of the technology. Thus, each company will need to develop a Class 0 ESD subject matter expert (SME) to ensure the correct and cost effective counter measures are taken. SOPs (Special Operating Procedures) developed by SMEs will be discussed that have proven to virtually eliminate Class 0 failures.

This tutorial will be highly interactive with live demonstrations, in-plant photographs, and video clips. Students will be encouraged to ask questions and actively participate in the discussions. References to technical literature on ultra-sensitive devices will be included.

### May 16, 2018

#### DD155/FC155: ESD Control Workstations: Set-up, Practical Considerations and Measurements

**1:00 p.m. - 4:00 p.m.**

Instructor: Ted Dangelmayer, Dangelmayer Associates, LLC.



The complexity of properly installing workstations is often underestimated, On the 'surface' it appears to be a simple installation of an ESD static dissipative mat or ESD hard laminate. However, there are important issues learned from years of experience that impact cost, durability, ESD performance, maintenance and complain verification. A good ESD control workstation is the cornerstone of ESD Program Management (EPM). Workstations used in processing ESD susceptible items are intended to maintain a near zero potential by providing ground paths for basic components of the workstation and a connection point for personnel grounding apparatus. The workstation should provide protection from CDM (Charged Device Model) ESD as well as HBM (Human Body Model). This practical tutorial will teach you how to set-up an effective ESD controlled workstation that accomplishes these goals. It will cover selection and qualification of the required materials and how to install them correctly. Other workstation issues will be discussed including: application of ionization, garment grounding, ESD chairs, handling containers, tools and compliance verification consistent with ESD TR53.

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### May 17, 2018

FC150: Hands-on ESD Measurements &  
Instruments-Uses and Pitfalls

**9:00 a.m. - 12:00 p.m.**

Instructor: Ted Dangelmeyer, Dangelmeyer Associates, LLC.



Accurate data is the foundation of effective ESD program management. This hands-on tutorial will explain and demonstrate the proper use of ESD test equipment such as static locators, resistance meters, charge plate monitors, and event detectors. We will examine pitfalls of using these common instruments that can result in an incorrect representation of the ESD risk. For example, static locators can give misleading readings if the effects of voltage suppression are not taken into account. We will also discuss the effective use of ionization since ionizers that are not measured, maintained, and located correctly may contribute ESD hazards to the work area. Each student will participate in class exercises to perform these tests. The hands-on experience is the best way to understand the seriousness of the pitfalls and the benefits to taking the proper precautions. What you learn will help you avoid frequent auditing problems and improve your compliance verification program.

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### About the Instructors:



Ted Dangelmayer is the president of Dangelmayer Associates, LLC and has assembled an ESD consulting team consisting of the foremost authorities in virtually all ESD areas of both product design and manufacturing. He received the "Outstanding Contribution" award and the EOS/ESD Association "Founders" award. He was president of the EOS/ESD Association, chairman of the ESDA standards committee, and general chairman of the EOS/ESD Symposium. He has published two editions of his book, ESD Program Management, numerous magazine articles, and technical papers. Ted holds three patents and is iNARTE certified. He is currently president of the Northeast local chapter of the ESD Association and a member of the education committee.



Dr. Terry L. Welscher retired from Lucent Technologies-Bell Laboratories Engineering Research Center in 2001, as the director of the quality, test, & reliability department. He began his career in Bell Labs in 1978; where he worked on electrical conduction mechanisms in insulating polymers and electrolytic corrosion failure mechanisms in electrical interconnection materials. In 1984, he was appointed distinguished member of technical staff for his work in these fields. In 1986, he was promoted to technical manager to re-constitute the Bell Laboratories core expertise in electrostatic discharge (ESD). The newly formed group proceeded to produce a string of ground-breaking contributions to the field and played a key role in advancing industry standards. In 1994, he broadened his group's activities to all aspects of hardware reliability for Lucent Technologies with special emphasis in environmental stress testing (EST) and product reliability prediction and planning. In 1997, he was promoted to director of the quality, test & reliability center of excellence where he directed the development and deployment of product quality, test and reliability assurance practices for

Lucent Technologies business units. This work included design for testability of integrated circuits, board and system level test and diagnosis and special techniques for testing of RF and optoelectronic systems and components. After leaving Lucent, he became reliability director for LaserSharp Corporation, an optical fiber laser amplifier company, where he was responsible for product quality, reliability, and compliance. Since 2004, he has been senior vice president of Dangelmayer Associates, LLC, an EOS/ESD consulting firm. Dr. Welscher was chairman of the ESD Association standards committee 1988-1989. He was technical program chair in 1991, vice general chair in 1992, and general chair in 1993 of the EOS/ESD Symposium. He served as member of the Symposium board of directors 1993-1995. He has also been active in quality standards and road mapping activities with Sematech, the EOS/ESD Association, and the JEDEC 14 quality and reliability committee. He served on the board of directors of JEDEC 1999-2001. He is currently co-chair of the joint JEDEC/ESDA HBM and CDM ESD working groups, and member of the Board of Directors and Past President of the EOS/ESD Association. Recently, he has led the effort to harmonize and merge JEDEC and ESDA device testing standards. He holds a BS in chemistry from Florida State University and a PhD in chemical physics from the University of Texas at Austin. He is author or co-author of fifty papers in solid state physics, applied mathematics, organic chemistry, electronics reliability, and electrostatic discharge. For his contributions to the ESD Association, Terry was presented with the Outstanding Contribution award in September 2016.

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Register Online at [www.esda.org/events/calendar/](http://www.esda.org/events/calendar/)

First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_

Company Name: \_\_\_\_\_

Street: \_\_\_\_\_ City: \_\_\_\_\_

State/Province: \_\_\_\_\_ Country \_\_\_\_\_ Zip/Postal Code: \_\_\_\_\_

Address is (please circle the one that applies) Home or Company

Phone: \_\_\_\_\_ E-mail: \_\_\_\_\_

- May 15, 2018 – \$510 / non-members \$610  
FC201: ESD – A Surprisingly Frequent Root Cause of Device Failure  
FC360: EOS in Manufacturing & Test
- May 16 & 17, 2018 – \$820 / non-members \$920  
FC361: Preparing for Ultra-Sensitive Devices  
DD155/FC155: ESD Control Workstations: Set-up, Practical Considerations and Measurements  
FC150: Hands-on ESD Measurements & Instruments-Uses and Pitfalls
- May 15-17, 2018 (all three days) – \$1,330 / non-members \$1,430

Cancellation & refund requests will be honored only if received in writing no later than April, 2nd 2018, and are subject to a \$50 fee. Any other approved dispositions will also be assessed a \$50 fee.

### Payment Information:

Register Online at <http://www.cvent.com/d/jtqr99>

Other forms of payment Contact:

**EOS/ESD Association, Inc.**

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### Accommodations

Residence Inn by Marriott Woburn  
300 Presidential Way, Woburn, MA 01801  
(781) 376-4000

Courtyard Boston Woburn  
240 Mishawum Road, Woburn, MA 01801  
(781) 932-3200

Co-sponsored by the Northeast Chapter ESD Association <http://www.nechapter-esda.org>

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