

FORCON INTERNATIONAL

MARK J. KEITH, P.E., CFEI, CQP

SUMMARY

Mr. Keith has over thirty years of engineering experience. His areas of expertise and services include electrical/electronic engineering investigations, including all aspects of the design, fabrication, production, and operation, patent infringement analysis, reverse engineering, product teardowns and failure analysis of electrical and electronic devices and products as well as computer systems, hardware and software. Other areas of expertise include fire origin and cause (O&C) investigations, lightning investigations, telecommunication/data network engineering, industrial automation and control products/applications and electrical product testing and compliance (UL, CE and FCC) in the design phase, and in post-design product failure analysis, including power and signal line surge analysis. He has also served as an expert witness and forensic engineer on many cases involving a wide variety of electrical and electronic devices and applications. Some projects have focused on fire hazards, and others dealt with shock and operator safety. He has also analyzed designs in reference to user abuse and unintended operation, which is often an overlooked aspect in most product safety reviews.

Because of his vast experience, Mark's areas of specialties also include, but are not limited to the following areas:

- Appraisal Umpire Services
- Energy Audits
- Failure Analysis & Reverse Engineering
- Fire Origin and Cause
- Forensic & Investigative Electrical Electronic Engineering
- Electronic Hardware Design
- Industrial Automation & Controls
- Lightning Investigations
- Patent Infringement Analysis
- Power Line and Signal Surge Analysis
- Power Quality
- Safety & EMC Compliance
- Telecommunication and Data Network Engineering
- Surety Investigations

EDUCATION

Master of Science in Electrical and Computer Engineering - North Carolina State University

Bachelor of Science in Electrical Engineering - Pennsylvania State University

REGISTRATIONS & CERTIFICATIONS

Registered Professional Engineer in the following States:

- Georgia # 038712
- North Carolina # 021552
- Pennsylvania #PE084878
- South Carolina # 30445
- Tennessee # 117314
- Virginia # 0402-051757
- West Virginia # 20720

Certified Fire and Explosion Investigator # 10672-10121 (CFEI)

Certified Power Quality Professional (CPQ)

US Security Clearance (Inactive)

PROFESSIONAL ASSOCIATIONS

Association of Energy Engineers
Institute of Electrical and Electronic Engineers (IEEE)
National Association of Fire Investigators (NAFI)
North Carolina Adjusters Association
Product Safety Engineering Society (PSES)

CONTINUING EDUCATION

Courses and Certifications completed in the following:

- SEL Power System Protection Seminar (7.5 PDUs) - Schweitzer Engineering Laboratories, 2019
- PEG 2019 Educational Seminar (20 PDUs) - ATIS Protection Engineers Group, 2019
- Asbestos Operations & Maintenance (16 Hour) for Class III Classification course, 2018
- NC/SC IAAI Training Conference – (five day course) - Myrtle Beach, SC 2017
- Power Quality Professional (CPQ) Certification - September 2013
- National Electric Code Training - 2013 (three day course), Keith Educational Seminars, Wilmington NC
- NAFI CFEI (Certified Fire and Explosion Investigator) - 2013
- Electromagnetic Compatibility Engineering - 2012 (three day course), Henry Ott Consultants
- NEBS Conference - 2010, Verizon and UL (Compliance for Wireless and Broadband Networks)
- North Carolina State University - Post Master's Degree
 - ASIC Design (ECE520), 2008
 - National Electrical Code Seminar, Oct. 2002
 - High Speed Networks (ECE570), 1997
 - Computer Communications (ECE571), 1996
 - Electromagnetic Fields and Systems (ECE540), 1995
- Fire Detection and Investigation - 2005, Durham Tech, Course # FIP 128, Durham NC.
- Product Liability: Understanding the design Process - 2004, The Warren Group
- Residential Home Inspector - April 2004 Wake Tech Community College, NC
- National Electrical Code Seminar- October 2002, North Carolina State University
- C Programming for Engineers -1994, University of Massachusetts
- Electromagnetic Interference and Compliance Seminar - 1993, Interference Control Technology Inc.
- Industrial Computers and Programmable Logic Controllers -1993, Square D Company
- Quality Engineering Theory, Practices and Principles - 1988, Stat-A-Matrix Institute

CAREER HISTORY

Engineering Services

FORCON International – Electrical Engineer

Providing forensic engineering and expert witness services in the field of electrical engineering.

EFI Global, Charlotte, NC – Forensic Electrical Engineering Consultant

Providing forensic engineering and expert witness services in the field of electrical engineering.

IEC & Associates, Raleigh NC - Principal Investigative Engineer

- Conducting Investigations on various electrical/fire matters and product liability cases.
- Investigations in the following areas:
 - Personal injury case involving a seat heater.
 - Lemon law motor vehicle case.
 - Lightning strikes.
 - Electronic failures in Industrial Automation Equipment.
 - Electrical failures and safety issues in a heating pad.
 - Electronic failures in computers.

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- Electrical & electronic safety issues in a forklift.
- Fluorescent lighting fixture fire.
- Utility surge and loss incident at a local golf course.
- Suspected Laptop Computer overheating incident which resulted in severe burns to the client.
- Electrical shock incident related to an extension cord.
- Electronic reliability issues in a computer monitor.
- Lightning strike incident at an asphalt plant.
- Lightning strike incident at an airport.
- Power utility surge event and fire damage to a home.
- Electronic failures and a fire in an electrical power conditioning device that resided in a medical facility.
- Fire Origin and Cause investigations in the following areas:
 - Residential, commercial, and Industrial wiring.
 - Appliances.
 - Motors.
 - Vehicles.
 - Battery chargers.
 - Telephone equipment
 - Electrical failures in a portable space heater
 - Convenience stores.

Forensic Analysis Corporation, Raleigh NC - Investigative Engineer

- Investigated water contamination loss in electronics at a data server center.
- Investigated suspected electronic failures on a Motorcycle accident case.
- Investigated a residential fire incident and suspected damage to high end video and audio home theater electronics. Responsibilities included fire investigation, research, and evidence review.
- Expert witness in a case regarding a malfunctioning medical implantable device.
- Responsibilities included investigation, research and evidence review.
- Investigation of suspected electronic failures in a residential HVAC system.
- Expert witness in lemon law motor vehicle case. Responsibilities included investigation, research, evidence review and deposition.
- Investigated a heavy equipment excavator fire. Responsibilities included fire investigation, research, and evidence review.
- Investigated a Power Utility Surge event involving a multi-million dollar residential structure. Responsibilities included electronic equipment failure analysis, Insurance fraud investigation.
- Responsibilities included evidence review and final report preparation/presentation to the client.
- Investigated and provided Lightning/Surge Analysis for multiple clients. Responsibilities included electronic equipment failure analysis, Insurance fraud investigation and final report to the client.

Intota (Infogroup/ORC) - Investigative Engineer

- Investigation of suspected electronic failures in a Microwave fire. Fire origin and cause case.
- Investigation of suspected electronic failures in a residential HVAC system. Fire origin and cause case.
- Expert witness regarding failure analysis in laundry appliance electronics.
- Electrical Engineering consultant regarding failure analysis of video electronics.

Marshall Miller Associates, Raleigh, NC - Investigative Engineer

- Co-investigator on an origin and cause investigation involving a Veterinary CBC machine.
- Co-investigator on an origin and cause investigation involving an apartment fire. Responsibilities included evidence review and final report presentation to the client.
- Conducted a fire origin and cause investigation involving a television set. Responsibilities included evidence review, electronic failure analysis, TV and electrical appliance fire research and final report preparation/presentation to the client.

Tasa Group, Blue Bell, PA - Investigative Engineer

Conducted an investigation of suspected electronic failures in a emergency backup electrical power system. Working as an expert witness in the legal case with respect to the electrical/electronic hardware design and failure analysis.

Consolidated Consultants, Chula Vista, CA - Investigative Engineer

Investigation of a Power Utility Surge event involving a residential structure and suspect electrical and electronic failures.

Institute for Products, Engineering & Construction, Scottsdale, AZ - Investigative Engineer

- Investigation of suspected electronic failures in a mobile phone.
- Investigation of suspected electronic failures in a laptop computer.
- Expert witness involving a laptop computer fire. Responsibilities included fire investigation research and evidence review.
- Expert witness involving computer software/systems, financial records and information.
- Electrical Engineering consultant for an electronic design dispute between a major appliance manufacturer and a sub-contract manufacturer. Responsibilities included evidence review, product design research, and final report preparation/presentation to the client.
- Conducted a origin and cause investigation of a cook top fire involving a solid surface range appliance. Responsibilities included evidence review, electronic failure analysis, electrical appliance fire research and final report preparation/presentation to the client.

National Forensic Consultants, Norristown, PA - Investigative Engineer

- Investigated and provided Lightning and Surge Analysis for multiple clients. Responsibilities included evidence review, electronic equipment failure analysis and final report preparation/presentation to the clients.
- Electrical Engineering consultant for a fire origin and cause investigation involving residential wiring. Responsibilities included evidence review and final report preparation/presentation to the client.
- Electrical Engineering consultant for a fire origin and cause investigation involving a cash register. Responsibilities included evidence review and research.
- Electrical Engineering consultant for a fire origin and cause investigation involving a large manufacturing facility. Responsibilities included evidence review and research.
- Expert witness in a legal case involving a defective electrical home appliance. Responsibilities included investigation, evidence review, electronic failure analysis, destructive testing and final report preparation/presentation to the client.

Technical Assistance Bureau, Inc., St Louis, MO - Investigative Engineer

Electrical Engineering consultant for a fire origin and cause investigation involving a floor model water cooler. Responsibilities included evidence review and final report preparation/presentation to the client

Moore Forensic Engineering, Apex, NC - Investigative Engineer

Electrical Engineering consultant for a fire origin and cause investigation involving a rear projection TV. Responsibilities included evidence review and final report preparation/presentation to the client.

Forensic Fire Consultants, Raleigh, NC - Investigative Engineer

- Electrical Engineering consultant for a fire origin and cause investigation involving a manufactured home. Responsibilities included evidence review and final report preparation/presentation to the client.
- Conducted two fire origin and cause investigations involving television sets. Responsibilities included evidence review, electronic failure analysis, TV and electrical appliance fire research and final report preparation/presentation to the client.

Kevin Kennedy & Associates, Inc., Indianapolis, IN - Investigative Engineer

Conducted a fire origin and cause investigation involving emergency backup electrical power equipment. Worked as an expert witness in the legal case with respect to the electrical/electronic hardware design and failure analysis.

Kemper Auto & Home, Charlotte, NC - Investigative Engineer

Conducted a power surge investigation on an industrial electrical generator. Responsibilities included evidence review, electronic failure analysis, and final report preparation/presentation to the client.

Intellectual Property and Patent Infringement Analysis

IEC & Associates, Raleigh, NC - Principal Investigative Engineer

- Currently working with an IP Attorney on a mobile phone and tablet computer patent portfolio. Responsibilities include monetizing and evaluating the patents, product teardowns, documentation research, product testing, claim chart generation, final report and presentation to the client. All the top tier mobile phone and tablet computers manufactures are represented in the infringement analysis.
- Patent and prior art search regarding microprocessor control and application in industrial motorized vehicles.

Otto Technologies, Raleigh, NC - Investigative Engineer

Patent infringement and review regarding multiple cases involving distributed computing systems for mobile devices. Responsibilities included prior art investigation, final report and presentation to the client.

Forensic Analysis Corporation, Raleigh, NC - Investigative Engineer

Patent infringement and review regarding an electronic pest and rodent pest control repeller. Responsibilities included claim review, prior art investigation, final report and presentation to the client.

Other Industry Related Experience Services

ESP SurgeX, Knightdale, NC - Compliance and Safety Engineer

- Project engineer for safety and agency compliance. Responsible for compliance and safety testing on all new and existing products, EMC/EMI/RFI requirements and standards, and design reviews.
- Currently preparing our in-house testing lab for self-certification via Intertek's SATELLITE Laboratory Scheme Data Acceptance Program.
- Also responsible for surge testing and analysis (UL 1449), failure analysis and internal forensic investigations. Currently working with the following compliance agencies: Intertek located in Cortland, NY, TUV Rheinland of North America located in Boxborough, MA and Youngsville, NC, TUV SUD located in Shenzhen City, 518052, P.R. China and Underwriters Laboratory located in RTP NC.

Overture Networks, Morrisville, NC - Senior Hardware Design Engineer

- Project engineer for UL and NEBS compliance. Also responsible for EMC/EMI/RFI design reviews, safety standards, compliance and testing on all new and existing products.
- Design Engineer for next generation Gigabit Ethernet and OC3/DS3 data aggregation products. Responsibilities include high-speed signal integrity analysis, Hardware Design, JTAG test generation and implementation, PCB debug, PCB test procedures and environmental testing. Corelis JTAG software tools were used in the projects.
- Environmental analysis and test verification of new and existing products.
- Interim hardware manager for 4 months (2010) while manager was on sick leave. Responsible for 5 engineers and new product introduction.
- Manufacturing and Test Engineering liaison for new product introduction.

Safenet Inc., Morrisville, NC - Senior Hardware Engineer

- Design Engineer for data encryption hardware projects for Safenet's next generation OC192, SONET and Gigabit Ethernet Encryption products. Responsibilities included Hardware Design, High Speed Signal Integrity Analysis, ROHS Compliance, JTAG test generation and implementation, PCB debug and PCB Test Procedures.
- Agency Compliance and Environmental testing and contract manufacturing liaison.
- Mentor Graphics and JTAG Technology JTAG software tools were used in these projects. Note: Additional information describing the job responsibilities is classified.

CipherOptics, Raleigh, NC - Senior Hardware Design Engineer

- Co-Project/Design Engineer for three projects for CipherOptics next generation Internet security product offering.
- Responsibilities include hardware design/debug, printed circuit board signal integrity analysis, and product verification and test. Cadence Concept 15.2 CAD or OrCad 10.0i was used for the designs.
- Additional responsibilities included:
 - JTAG test development and generation of manufacturing test sets using Corelis JTAG software tools.
 - Thermal analysis and test verification.

Inovia Telecom - Centennial Campus, Raleigh, NC - Principal Engineer

- Provided technical hardware solutions for Video over VDSL technology for new product line offering.
- Design and implemented universal high speed Gigabit ATM switch fabrics for Inovia's DSLAM product line. Responsibilities included hardware design/debug, printed circuit board design, and product verification.
- Motorola MPC8260 and MPC860 microprocessors were used in all hardware designs.
- Designed and implemented ATM test and interface boards for hardware verification.
- Lead hardware engineering interface for sister design team in Israel.
- Product support for current DSL access products in the field.
- Responsible for IEC 61000-4/IEC 801 EMC/EMI/RFI standards, compliance, and testing.
- Technical advisor/mentor to NC State Electrical Engineering Intern students.

IBM Corporation, RTP, NC - Staff Engineer

- Design Engineer for a PCMCIA 25 Mbit ATM adapter card. Responsibilities included hardware design of a XILINX FPGA PCMCIA/ISA arbitration controller. The design was VHDL based.
- Responsible for IEC 61000-4/IEC 801 EMC/EMI/RFI standards, compliance, and testing.

Connectware Inc., Morrisville, NC - Senior Design/Development Engineer

- Project/Design Engineer for an ATM-LAN (OC3, Ethernet and Token Ring) Bridge/Router device. The product was an Intel I960 33MHz microprocessor-based design. Responsibilities included hardware design/debug, PCB design, and product verification.
- Lead hardware engineering interface for a remote design team India.
- Responsible for IEC 61000-4/IEC 801 EMC/EMI/RFI standards, compliance, and testing.

Square D Company, Knightdale, NC - Senior Design/Development Engineer

- Industrial Computer-Programmable Logic Controllers Division
 - Designed and implemented a XILINX EPLD chip for a Programmable Logic Controller. Design provided backplane bus arbitration between an Intel 80C186 and a Motorola 68000 microprocessor, additional control functions and various I/O interfaces.
 - Designed an AC/DC (120 VAC/24V DC) 10 Watt switch mode (Buck converter) power supply.
 - Responsible for hardware design of an Intel 80C152 microprocessor based remote Programmable Logic Controller. Responsibilities included all phases of hardware design, test, and PCB design. This product received Control Engineering magazine's 1993 Editor's Choice Award for best distributed I/O product.
 - Responsible for IEC 1000-4/IEC 801 EMC/EMI/RFI standards, compliance, and testing on newly developed Industrial Programmable Logic Controller Products.
 - Team member of the Square D EMC/EMI/RFI Standards Committee.
 - Team member of the Square D Component/Supplier Qualification Committee.
- Photoelectric Sensors Division
 - Project/Design Engineer for analog/digital ASIC design and implementation for Industrial photoelectric proximity sensors. Designed and developed three high performance photoelectric ASICs. Responsibilities included all phases of design, test and final product manufacturing.
 - Team member of the Square D Corporate ASIC Strategic Implementation Group.

Avnet International Corporation, Smithfield, NC - Senior Microelectronic Design Engineer

Project/Design Engineer for digital system design for commercial satellite television receivers. Responsibilities included ASIC chip set re-design and verification.

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Exide Electronics Corporation, Raleigh, NC - Senior Product/Quality Engineer

- Provided Product/Quality Engineering for Uninterruptable Power Source Systems (UPS), Emergency Lighting Systems, and Motive Power Battery Charger Products.
- Responsibilities included system design modifications, PCB redesign and resolution of field failures and reliability issues.

GE Corporation, Research Triangle Park, NC - Senior Integrated Circuit Design Engineer

- Team member of the Microprocessor and ASIC Design and Development Group. Designed various Integrated circuits including an Arithmetic Logic Unit, Dual Port RAM ASIC, Medical Data Processing ASIC and a Control ASIC for a 120 Volt experimental light bulb. Responsibilities included all phases of Integrated Circuit design and fabrication.
- Provided technical support and design assistance for strategic customer accounts (domestic and foreign) and internal tactical application engineers.

DEPOSITION SUMMARY

Date	Case Name	Location
2019	Erie Insurance Exchange v. Harley Davidson of Greensboro. Inc	North Carolina General Court of Justice, Superior Court Division (Guilford County)
2017	North Carolina Farm Bureau v. One Source Water LLC and Waterlogic Commercial Products LLC	United States Distinct Court, Eastern District of North Carolina
2016	Delta v. Lightwave	Supreme Court, County of Los Angeles, California
2012	Baba V HP	United States District Court, Northern District of California, San Francisco Division
2012	Fermin v. Toyota Motor Corp.	United States Distinct Court, District of New Jersey
2011	Tracy L. Johnson vs. HP	26th Judicial District Court, Parish Of Bossier Louisiana
2008	Woodall v. Daimler Chrysler	Putnam County Circuit Court, West Virginia
2008	Calvert Sims v. Deltec	Superior Court of New Jersey, Hudson County