

*The IEEE Instrumentation & Measurement Magazine*  
*August 2015 Issue*

---

*AUTOTEST 2014: A Forum of Innovations*

---

*President's Perspectives*

*Welcome to IEEE AUTOTESTCON 2015*

Reza Zoughi

IEEE Instrumentation and Measurement Society President

On behalf of the IEEE Instrumentation and Measurement Society (IMS), it gives me great pleasure to welcome you to IEEE AUTOTESTCON 2015. IEEE AUTOTESTCON is a unique event that brings together colleagues interested and involved in automated testing, product development and their users. This is also a wonderful venue for meeting new colleagues to learn about each other's products and initiate new collaborations. As in years past, we at the IEEE IMS are extremely happy to continue our support of IEEE AUTOTESTCON 2015 along with the IEEE Aerospace and Electronic Systems Society (AESS). These two societies share several common goals that make our mutual support of this event a must. National Harbor, Maryland, USA and its proximity to Washington, D.C. with all that is offered in our nations' capital, is sure to make this an exciting and rewarding experience, both technically and culturally. On behalf of the Society, I wish for you to have a wonderful experience at the IEEE AUTOTESTCON 2015.

Robert (Bob) J. Lyons, Jr.

Aerospace & Electronics Systems Society President

Representing the IEEE Aerospace & Electronics Systems Society, let me add my welcome to that of the IEEE Instrumentation and Measurement Society. As always, I extend my warmest welcome to our industry and government attendees, as well as to academicians and students of the art and science of testing, to this exciting event. IEEE AUTOTESTCON 2015's focus continues our change that started last year to a more technical interaction gathering, featuring detailed technical sessions and product displays and demonstrations, designed to inform our attendees of the latest developments in automated test equipment and systems to support military operating systems and weapons. This year's conference marks our return to the Washington, D.C. area for the first time in over thirty years, and I am sure you're going to find the Gaylord

Convention Center & Hotel at the National Harbor venue to be ideal for networking, reviewing displays of advanced test technology, and taking part in the technical sessions. IEEE AUTOTESTCON remains the premier event in the U.S., bringing together automated test systems developers and users who can participate in product demonstrations to keep vendors and customers informed about the latest technology and capability. This year's theme, "Increased Mission Effectiveness through Advanced Test & Support Technology," is also well-aligned with AUTOTESTCON's longstanding association with military systems. The increased sophistication and capability of our military systems demands the latest in automated test capability to keep them operating properly and at peak efficiency, so our warfighters can trust their systems to perform as designed, every single time. This keeps both them, and our country, safe and secure. For most of its history, the IEEE Aerospace & Electronics Systems Society has had a major focus on military systems and their support structure, and IEEE AUTOTESTCON is one of our most important conferences for all of those engaged in the myriad topics that form an integral part of the military equipment logistics and support environment. Please take full advantage of this exceptional opportunity to talk with old friends and meet new colleagues, share what you know with each other, and learn what is emerging in test systems, technology, and equipment. Enjoy IEEE AUTOTESTCON 2015!

---

## *Article Summaries*

---

### *A Testbed for Implementing Prognostic Methodologies on Cryogenic Propellant Loading Systems*

(Summary)

Chetan S. Kulkarni, George Gorospe, Matthew J. Daigle, and Kai Goebel

In previous work, the authors described the initial design of the prognostics testbed. Subsequent to this, construction of the testbed was completed, with the testbed being used to control the injection of fault modes on a solenoid valve, a current pressure transducer, a pneumatic valve that can be controlled only to open and closed positions, and a pneumatic valve that can be controlled to any discrete position. Additionally, battery health monitoring and predictive methods were implemented on the laboratory testbed. This paper presents the final testbed design, the faults injected in the system, discusses the integration with prognostics algorithms, and describes detailed experiments and results. The authors also discuss the prognostic results for batteries.

*This summary includes text from the introduction of the article.*

---

## *An AI-Estate Conformant Interface for Net-Centric Diagnostic and Prognostic Reasoning*

(Summary)

Houston King, Nathan Fortier, and John W. Sheppard

In this paper, the authors describe a net-centric architecture that abstracts the Reasoner Manipulation Services provided by AIESTATE to the network level. The client-server architecture is described in detail, as well as the XML-based messaging system that facilitates the communication between a reasoning client performing a diagnostic session and a reasoner server hosting the data-driven inference engine.

*This summary includes text from introduction of the article.*

---

## *Using Temporal Causal Models to Isolate Failures in Power System Protection Devices*

(Summary)

Nagabhushan Mahadevan, Abhishek Dubey, Ajay Chhokra,  
Huangcheng Guo and Gabor Karsai

Smart Electric Grids and their underlying generation, transmission and distribution systems are constantly exposed to dynamic environments resulting from varying power flows, both direction and magnitude, changing operational requirements and conditions, physical component degradation, and software failures. State of the art relies on a network of protection devices that include relays to detect anomalies and circuit breakers to isolate parts of the system that include the faulty components. The approach presented in the article is to use a discrete event model that captures the causal and temporal relationships between failure modes (causes) and discrepancies (effects) in a system, thereby modeling the failure cascades, while taking into account propagation constraints imposed by operating modes, protection elements, and timing delays. The key idea in our work is to consider the physical and logical connections of the subsystems and the time required for a fault to propagate from one component to another using temporal causal diagrams.

*This summary includes text from the introduction of the article.*

---

## *Linearized Adaptation of Non-Linear Post Conversion Correction for TIADCs: A Behavioral Model Study*

(Summary)

Charna R. Parkey and Dr. Wasfy B. Mikhael

Current and emerging applications need high speed and high resolution analog to digital converters (ADCs). Direct conversion for radar, communication, measurement systems as well as lower speed higher resolution applications such as medical imaging could benefit from the use of time interleaved analog to digital converters (TIADCs). This paper presents the implementation and results of the proposed adaptive linear combination of non-linear filters for post conversion correction of TIADCs applied to a behavioral TIADC model. Results show that the channelized correction scheme can suppress linear and nonlinear mismatch spurs by a significant amount, 30dB in the 2TIADC case, without the need for known system parameters.

*This summary includes text from the introduction of the article.*

---

## *Expanding Emulation from Test to Create Realistic Virtual Training Environments*

(Summary)

Daniel A. Tagliente, Charles Lyding, Joshua Zawislak, and Derek Marston

With some effort, almost any system can benefit from the implementation of product-representative emulators. The initial investment in hardware emulation, as discussed in the article, has not only provided a platform to support the development and testing of multiple systems, but it has also continued to provide ongoing dividends by enabling the creation of high-fidelity training environments, as well as lowering costs for the future sustainment of the system and the training of its end-users. The techniques discussed in this article can easily be adapted to a wide variety of commercial, industrial, aerospace, and military systems. Although the selection of emulation techniques and interfaces may vary, almost any research and development project can benefit from an early dedication to emulation, which may result in reduced overall costs and an accelerated development and test schedule.

*This summary includes text from the article.*

---

## *Columns*

---

### *Basic Metrology*

**What! The Ell?**

(Summary)

Bryan Kibble

In this issue's column, the author presents an entertaining review of formerly used measurement units, including the historical use of liquid measures based on obscure volumes and lengths such as the cubit and ell. He states how he "could carry on for a very long time exploring this muddled world of practical metrology, but my purpose is to contrast it with the minimalist approach of the SI which enables us to measure anything and everything unambiguously. We must stick to a common language and a common basis of measurement when safety and accuracy are paramount."

*This summary includes text from the article.*

---

## *CRUNCH*

### **Tridiagonal Systems, and the Evaluation of Polynomials Revisited**

(Summary)

Stephen A. Dyer

In the previous installment, the author looked at some general purpose linear solvers—some approaches to solving systems of simultaneous linear algebraic equations for cases in which there are no distinctive features offered by the coefficient matrix used in the description of the system. In this installment, the author looks at the solution of tridiagonal systems. A tridiagonal matrix is a band matrix of bandwidth  $[1, 1]$ ; i.e., only its diagonal, its subdiagonal, and its superdiagonal contain elements that are nonzero.

*This summary includes text from the article.*

---

## *Jack Dyer's Clinic*

### **Give Me Power (Supplies)**

(Summary)

Stephen A. Dyer

This issue's column allows the author to layout plans for a simple power supply as the first project, and writes, "Every piece of (active) instrumentation (and all but the simplest piece of electronic equipment) needs a power supply. Further, anyone designing or testing equipment needs power supplies on her test bench. One can never have too many power supplies! And simple is good, especially if we want to involve anyone with the aforementioned limited experience in the fun. (Again, my hope is that any project—whatever it might be—might be a

good enough reason for those having lesser experience and those having greater experience to become project partners.)”

*This summary includes text from the article.*

---

## *Legal Metrology*

### **More about the Verdict in the L’Aquila Earthquake Trial** (Summary)

Veronica Scotti

Last year, the author published a comment on the verdict of the trial about the missed warning for L’Aquila earthquake, which sentenced seven people (six scientists and a politician) for manslaughter. The verdict was based on the lack of a correct and deep evaluation and analysis of the seismic risk, especially considering the situation at that time, when a high number of earthquake shocks struck L’Aquila. The defendants appealed the sentence, and the second trial concluded in February 2015. Since its verdict has almost completely confuted that of the first trial, the author discusses it in this month’s issue, in hopes that *I&M Magazine* readers are still interested in the motivation of the legal proceedings that involve scientists whose only fault is that of expressing their opinion on the basis of the available scientific knowledge.

*This summary includes text from the article.*

---

## *Life after Graduation*

### **Success!** (Summary)

Max Cortner

In this issue’s column, the author describes how the business world attempts to evaluate and compensate employees, while continuously responding to change in the work environment. He discusses how, “Businesses need to react to changing market conditions, technical risks do not always work out, and the makeup of your group may change (even the boss).”

*This summary was written by K. Virostek,*

---

## *Future Trends in I&M*

### **The Importance of the Fundamentals** (Summary)

Kristen M. Donnell

The guest author for this issue's column is Kristen M. Donnell, a brilliant woman, who works hard with delight and passion. In the recent past, Kristen has received the Missouri University of Science and Technology 2014 Faculty Teaching Award and the IEEE Instrumentation and Measurement Society 2012 Outstanding Young Engineer Award. In her column, Kristen discusses, "The fundamentals are, in essence, the building blocks upon which all of our work is built, be it applied engineering, groundbreaking research, complex measurements, or even advanced coursework. To me, without a solid understanding of the fundamentals, it is nearly impossible to make substantial progress, making any future trend difficult to become a reality."

*This summary was written by K. Virostek,*

---

## *Departments*

---

## *New Products*

Robert Goldberg

Please send all "New Products" information to:

Robert M. Goldberg

1360 Clifton Ave.

PMB 336

Clifton, NJ 07012 USA

E-mail: [r.goldberg@ieee.org](mailto:r.goldberg@ieee.org)

### **Electromagnetic Safety Products**

With today's rapidly increasing presence of electronics and technology, more and more commercial and industrial products are emitting potentially harmful RF fields. As a result, various organizations and agencies are beginning to levy guidelines and allowable limits on human exposure to RF fields. For certain industries, it is now required that they measure the electromagnetic fields created by their products and ensure that those fields stay within established limits.

To make electromagnetic field (EMF) measurement easier and more accurate, AR RF/Microwave Instrumentation has introduced a family of products including meters and sensor

heads. Meter and sensor head combinations are available for both electric and magnetic fields ranging from DC to 40 GHz.

AR's Model SM400K and SM40G are state of the art solutions for the measurement and analysis of electromagnetic field safety applications. These portable and compact instruments operate over a wide range of frequencies while maintaining a small handheld footprint. They are user-friendly and provide very reliable measurements. In addition, they record the temperature of the surrounding environment as well as its GPS coordinates which can later be viewed through mapping software.

To go along with the SM400K and SM40G RF safety meters is a full line of electric and magnetic field sensor heads. Each sensor head is easily interchangeable through quick-change connectors and automatic sensor head detection in both meters. The SM40G broadband EM Field Meter provides measurement capability over a wide frequency (DC to 40 GHz) of electric, magnetic and electromagnetic fields when used with the appropriate sensor head. By selecting the appropriate sensor heads for the desired field types, a single meter with removable sensor heads can replace multiple fixed-head dedicated field measuring meters.

The SM40G allows the user to perform continuous monitoring activities, with more than 24 hours of recording time. AR's Model SM400K provides all of the measurement capability and features of the SM40G with the addition of being a high-performance hand-held analyzer from DC - 400 kHz, designed for measurement of electric and magnetic fields which are characterized by complex or impulse form factors.

For more information, visit <http://www.arworld.us>.

### **Boundary Scan Analyzer Will Support Intel® Microarchitecture Codenamed Skylake**

Keysight Technologies, Inc. has announced its Keysightx1149 boundary scan analyzer will expand its coverage capabilities to test the upcoming Intel® microarchitecture Codenamed Skylake.

The Keysight x1149 analyzer is designed to maximize structural test coverage for board designs that incorporate Intel processors. This additional test application for the Intel microarchitecture codenamed Skylake will help electronics designers and manufacturers use the x1149 to test boards with the new microprocessor architecture using boundary scan and Intel Silicon View

Technology (Intel SVT). Test engineers who need a powerful yet easy to use solution for developing their products based on the Intel microarchitecture codenamed Skylake will find the x1149 boundary scan analyzer a viable option to solve the test challenges of extremely limited test access of complex PCBAs with high-speed devices.

More information about the x1149 is available at <http://www.keysight.com/find/x1149>.

### **Random Incidence Microphone Covers More of the Human Audible Range**

The new 12.7 mm (0.5 in) Random Incidence Microphone, model 377C20 from PCB Piezotronics, is used in noise reduction testing. Random Incidence microphones, also known as Diffuse Field microphones, accurately measure multiple sounds that come from different directions or sounds in rooms with reflective surfaces. This microphone meets the IEC 61094-4 standard for test and measurement microphones with a frequency range up to 16 kHz (+/- 2 dB), the hearing range for most adults. It is ideal for general room acoustics measurements as well as testing in vehicles, such as aircraft cabins, automobile interiors and for calculating transmission loss with different materials.

Random Incidence microphones are commonly used for general omni-directional sound pressure level measurements. PCB carries a full complement of externally polarized and prepolarized condenser microphones and preamplifiers. Prepolarized microphones use standard coaxial cables and are ICP® compatible, allowing power supplies to be shared with other ICP® compatible products such as accelerometers. This compatibility provides a significant per-channel cost savings as well as reduces test set-up time. The 377C20 Random Incidence Microphone is A2LA and ILAC accredited.

For additional information, please contact Mark Valentino, Product Manager, at +1 (866) 816-8892 or via email to: [hmvalentino@pcb.com](mailto:hmvalentino@pcb.com).

### **PCI Fault Insertion Card**

Pickering Interfaces is expanding its range of PCI based switching solutions with the introduction of its first PCI Fault Insertion Card. This new PCI Fault Insertion Card (model 50-190) is available as either a one or two slot short PCI card with the following features:

- 75, 64 or 36 channels of fault insertion
- One or two fault insertion busses, each of which can select from three fault sources

- The ability to introduce open circuit paths, shorts between paths or shorts to fault connections such as battery or ground
- 2 Amp hot switch capacity for powers up to 60 W and voltages to 165 VDC/115 VAC
- High bandwidth suited for use on Can and FlexRay bus Systems

Pickering Interfaces promotes its test solutions in multiple platforms by offering fault insertion in different form factors (PXI and PCI) with the same options. This offering allows the user to choose the most appropriate platform for their test system. The 50-190 PCI Fault Insertion Card has the same functionality as their widely used 40-190 PXI Fault Insertion Module.

Find more information on their website at <http://www.pickeringtest.com>.

### **Piezo Stage Scanners with 10X Greater Positioning Area**

PI (Physik Instrumente) L.P., provides the PIHera family of compact X, XY and Z flexure-guided piezo Nanopositioning stages, offering travel ranges to 1.8 millimeters.

PI claims the PIHera flexure positioner series offers the largest variety of travel ranges and options of any high precision piezo Nanopositioning stage currently available.

PIHera stages come in single axis (horizontal and vertical), two-axis (XY), and XYZ combinations. Travel ranges start at 50  $\mu\text{m}$  and go all the way up to 1,800  $\mu\text{m}$  (1.8 mm). A total of 60 standard variations are available, including closed-loop, and UHV compatible versions. Driven by PI's proprietary PICMA® piezo ceramics (tested by NASA/JPL for 100 billion cycles and employed on the Mars Rover), PIHera piezo stages have unique properties especially important in long-term research and industrial applications.

PIHera closed-loop stages are equipped with direct-metrology capacitive sensors and provide resolution down to the sub-nanometer-level, in a compact, FEA optimized package for high stiffness and long lifetime. Direct metrology provides higher stability and linearity compared to inferred metrology feedback – usually based on piezo resistive strain gauges, a technique also available from PI for entry level piezo nanopositioners.

A choice of advanced digital servo algorithms optimized for piezo drives provide higher throughput, faster settling, and higher disturbance rejection than conventional PID-based controllers, resulting in better stability at the nanometer range and below.

## **Features & Advantages**

- No Wear & Tear: Flexures, Actuators, and Sensors are Maintenance-Free
- Longer Lifetime with Patented, Ceramic-Encapsulated Piezo Actuators
- Frictionless, Maintenance-Free, Precision Flexure Guiding System
- 50 to 1800  $\mu\text{m}$  Travel Ranges
- X, XY, Z, and XYZ Versions Available
- Closed-Loop Digital & Analog Control for up to 99.98% Position Accuracy
- Vacuum-Compatible Versions
- Stiff and Compact Design for Millisecond Responsiveness
- Resolution  $<1$  nm
- Capacitive Direct-Metrology Sensors for Faster Servo Response

Find more information, specifications and the product datasheets at: [http://www.pi-usa.us/news/news\\_PIHera\\_Piezo\\_Nanopositioning\\_Stages.php](http://www.pi-usa.us/news/news_PIHera_Piezo_Nanopositioning_Stages.php).

## **Ethernet Cabling System for All Device Connectivity Needs**

HARTING's newly released Ha-VIS preLink® is an ingenious, Ethernet cabling system for the full gamut of industrial applications. It is based on the simplicity of a termination block the user wires separately and then snaps securely into any one of seven mating profiles: RJ45, PushPull RJ45, M12 D-coded, M12 X-coded, RJ45 HARTING Industrial Form Factor, RJ45 Keystone and a preLink® extender for cable extensions and transitions, solid-stranded.

Cabling with Ha-VIS preLink® is extremely fast and simple, a single operation whatever the intended mating profile. Wires are inserted into the preLink® termination block according to their color codes. A special preLink® crimping tool ensures the wires are always assembled precisely and correctly. The cable is terminated and extra wire trimmed in one step. When the wired termination block is snapped into place in the connector, it becomes an integral part of that unit, not a separate interface.

HARTING's preLink® system is particularly well suited for installations in cramped spaces or junction boxes. Pre-assembled cable segments can be swapped out quickly during maintenance and upgrades. It also offers users a unique opportunity for future-proofing: An eight wire cable can be terminated even for use in a four-wire format. When the time comes to upgrade, like switching from fast to Gigabit Ethernet, there is no need to re-terminate: The wired termination block can be moved from a 4-pole D-coded M12 to an 8-pole X-coded M12 housing in seconds.

Until that day comes, the unused pairs are shielded to prevent cross-talk.

Find more information at: [info.harting-usa.com/ c0401gQJ0vtL00zA00eNd00](http://info.harting-usa.com/c0401gQJ0vtL00zA00eNd00).

### **Small Ultra HD 4K Video Camera**

Toshiba America Information Systems, Inc.'s Imaging Systems Division introduces a 32.5 x 38.4 x 40.9 mm (1.28 x 1.51 x 1.61 in), lightweight (approx. 2.5 oz.), 3-CMOS UltraHD video camera. Toshiba claims this camera to be the world's smallest.

The new IK-4K (3840 x 2160) UltraHD 4K camera delivers 59.94 Hz performance from the smallest package possible. It provides up to 1600 TV lines of resolution at real-time frame rates. Other features include five, user-programmable scene files, Toshiba's comprehensive settings menu with 12 color matrix adjustment for optimal color adjustment, 4x 3G-SDI, 59.94 Hz, UltraHD output, remote control via RS 232 and a standard C-mount lens mount.

The two-piece, remote-head, camera system design combines Toshiba Imaging's proprietary prism block technology and advanced image processing capabilities to deliver unmatched color accuracy and exceptional resolution with fine edge details.

The camera head can be located from 3 to 15 m (10 to 50 ft) from the camera control module, supporting a wide range of camera rigging options. The camera also features switchable formats from UltraHD 4K at 50/59.94 Hz, to 1080p and 1080i. When operating in HD1080p/i modes, the camera's unique capability eliminates the need for video distribution amplifiers (DAs). It can function as a built-in DA providing four simultaneous 1920 x 1080 50/59.94Hz video streams. This provides an enormous advantage in mobile broadcast studios and other vehicle-mounted camera applications where power is always at a premium. The camera needs only one 12 VDC power input to drive the four HD outputs to feed monitors, recorders, reference displays, or Wi-Fi transmitters.

For more information about Toshiba Imaging's IK-4K UltraHD 4K Camera, please visit [www.toshibacameras.com](http://www.toshibacameras.com).

### **New Automated Test and Alignment Capabilities for Motorola APX™ and MOTOTRBO™ Series Radios**

Cobham AvComm, formerly the Aeroflex AvComm business unit, has announced new automated test and alignment support for Motorola APX Series and Motorola MOTOTRBO

Series radios to its latest product; the 8800 Series Digital Radio Test Set. The application fully automates radio testing and alignment and ensures optimum radio performance in significantly less time; minimizing service and support costs for the end users and dealers.

According to Cobham, the 8800 provides an advanced method for repeatable and highly accurate test and alignment for Motorola radios that requires minimal technical interface. With the industry's largest color display, lightweight design, ruggedness, and now automated test and alignment capabilities, the 8800 is ready for any test environment; whether on the bench or in the field.

The Motorola APX Series Auto-test can be ordered as Option 103 and the Motorola MOTOTRBO Series Auto-test can be ordered as Option 104 for the 8800 Series. These software options are also field upgradeable.

For more information, contact your local Cobham AvComm sales office by calling Cobham AvComm Sales at +1 (800) 835-2352 or emailing to [info-test@aeroflex.com](mailto:info-test@aeroflex.com).

### **Intelligent Encoder Configurator with Instant Recall**

With its configurator for incremental and absolute rotary encoders, Wachendorff Automation is able to offer design engineers and developers genuine added value compared with conventional configurators of the same class.

The Wachendorff tool is intelligent, and most importantly, can recall previous data. The programming holds a complete store of the combination of all the technical features and is capable of combining them (over 1.5 million possibilities), using an intelligent logic to manage them. This intelligence and recall capability rules out any errors during the configuration process. Any devices that may be considered are identified after just a few entries. Several other configurators are also able to offer this feature; the highlight of the Wachendorff configurator lies in generating a data sheet that is individually tailored to a configured rotary encoder.

Clicking a product type transfers selection criteria chosen in advance during preselection to the 'product level' and therefore 'remembers' them. The product page is developed individually for the user based on this just-in-time data, offering them the possibility to continue configuring and/or generate their individual data sheet at any time. This function is unique and extremely helpful.

Explanatory fields also offer effective electrical and mechanical information, enabling Wachendorff to offer the user the ability to put together their specific rotary encoder based on their actual requests and requirements. The user benefits from the *unique* documentation, as for rotary encoders in particular there are very many interdependent factors in electrics and mechanics.

Exact rotary encoder types can be defined only with the help of expert knowledge. The data sheet *configured* by Wachendorff can be saved as a PDF document or printed out. One further interesting feature is that the particular status of the configuration can be documented in a PDF document at any time. This is helpful, for example, if the user wants advice about a definition from colleagues or technical support at Wachendorff Automation.

The configurator is available as a new feature on Wachendorff Automation's website and in four different languages (German, English, French and Spanish).

Find more information at [www.wachendorff-automation.com/](http://www.wachendorff-automation.com/).

### **High Accuracy Magnetostrictive Position Sensing Device**

MTS Sensors introduces a new robust, high performance magnetostrictive position sensor, using its innovative Temposonics® technology. The ET sensor is very well suited to deployment in applications with high temperature environments. It can deliver up to 0.005 mm resolution when used in combination with a suitable controller.

The new ET product offering significantly extends the supported temperature range of the MTS E-Series, with the ability to precisely determine exact positions even at 105 °C temperature levels. This small rod sensor can be integrated directly into a cylinder, with rod length options covering 50 mm to 3000 mm. It exhibits linearity deviation of less than 0.02% (full scale).

ET sensors have liquid ingress protection in accordance with IP68. Furthermore, ATEX certification for hazardous areas is available. These devices are equipped with a start/stop interface. They also have the capacity for sensor parameters to be automatically uploaded. A 316L stainless steel variant can be specified, if needed.

The proprietary Temposonics® magnetostrictive sensing technology developed by MTS Sensors presents customers with a non-contact method for accurately measuring position, which permits

its implementation into the most demanding of application environments. Sensors based on this technology are highly resilient to shock, vibrations and extreme temperatures.

Find more information at [www.mtssensors.com](http://www.mtssensors.com).

### **10-in-1 Multi-Function, Multi-Range, Industrial Timer/Counter**

Automatic Timing & Controls has introduced its new Model 385AR series. The Model 385AR series is an accurate, cost-effective, multi-function multi-range industrial timer/counter, offering the benefits of 10 unique operating modes within a single unit. It is designed to accept standard voltage inputs of 3 to 30 VDC, making it compatible with most industry proximity switches, solid state devices, as well as potential free contact encoders. Three unique input speeds, of 3 Hz, 30 Hz, and 5 kHz, respectively, are also standard.

The series further incorporates a built-in 12 VDC, 30 mA, sensor power supply with integral short circuit protection, as well as options for front panel or remote reset. The 385AR series will also reset on power interruption. The timer/counter mechanism of the Model 385AR is packaged within a highly compact 1/16 DIN (48 x 48 mm) housing with 2 SPST (NO) 5a @ 230 VAC contacts. Standard operating voltage range supply is 85 to 270 VAC/DC (50/60 Hz), with a maximum power consumption rating of 5VA.

In addition, series units feature a large, easy-to-read, four-digit, seven-segment LED display. They also incorporate dual setpoints, programmable input scaling, and batch counting, with a standard time setting accuracy of 0.05%, and onboard memory retention. A special onboard LED status indicator offers a unique and effective method for visual control indication.

Units are also both UL recognized and CE certified. They are easy and quick to both install and maintain. The unique versatility and accuracy of the Model 385AR series make it well-suited for cost-conscious manufacturing environments, in which the benefits of its multi-functionality and relatively low cost make it an invaluable component of any streamlined in-house maintenance strategy. Here, the Model 385AR can be an effective drop-in replacement for multiple industry 1/16 DIN industrial timer and counters, thereby reducing in-house inventory costs via the specification of a single and highly effective model to meet more universal application requirements.

For more information about the Model 385AR 10-in-1 multi-function multi-range industrial timer counter, visit [www.marshbellofram.com](http://www.marshbellofram.com).

### **Electromechanical Microwave Relay Switches**

Fairview Microwave Inc. introduces a completely new portfolio of electromechanical relay switches that cover ultra-broadband and millimeter-wave frequencies up to 40 GHz. These high-reliability RF switches are guaranteed to perform up to 2 to 10 million life cycles, which make them an ideal solution for demanding applications such as defense and commercial aviation, radar, wireless communications, satellite communications, test and measurement and many others.

The new coaxial relay switches from Fairview Microwave are available in multiple varieties from SPDT (Single Pole Double Throw) to SP12T (Single Pole 12 Throw) and are designed with either SMA, Type-N, or 2.92 mm, depending on the frequency range. Frequencies for these RF switches range from DC to 40 GHz depending on the model, power ratings range from 5 W to 700 W, operating voltage ranges from +12 V to +30 V and have high isolation up to 85 dB and low insertion loss of 0.15 dB at 1 GHz.

Fairview's new relay switches have a patented design of the actuator, and the transmission link has been optimized for magnetic efficiency and mechanical rigidity which is what guarantees operation up to 10 million life cycles. The MILSTD-202 qualified construction of each switch is designed to withstand exposure to sine and random vibration and mechanical shock. Offered in this release are 42 in-stock designs which include 38 connectorized models and 4 surface-mount devices which boast a small footprint and lower cost than traditional connectorized packages.

You can find more information by visiting [www.fairviewmicrowave.com/rf-products/electromechanicalrelay-switches.html](http://www.fairviewmicrowave.com/rf-products/electromechanicalrelay-switches.html).

---

### *In Memoriam*

Frank Reyes (1937–2015)

It is with great sadness and sorrow that we inform you of the passing of our dear friend and colleague, Mr. Frank Reyes. Frank was a long-time supporter of the Instrumentation and Measurement (I&M) Society and selflessly gave his time and expertise by being a wonderful and

effective volunteer serving in several capacities. In addition, Frank was also actively involved with the Aerospace and Electronic System (AES) Society, AUTOTESTCON and Systems Council.

#### Professional Contributions

IEEE I&M Society:

2006–2009 AdCom Member-at-Large

2007–2009 International Instrumentation and Measurement Technology Conference (I2 MTC)

Board Member

2007–2008 Vice President for Finance

2009–2015 Treasurer

2012 Recipient of the I&M Society Distinguished Service Award

2006–2011 AUTOTESTCON Board Member (I&M Society Representative)

IEEE AES Society:

2009 Vice President for Finance

2010–2012 Member of Board of Governors

2013–2014 Member of Board of Governors

2011–2013 Secretary

2012–2015 AUTOTESTCON Board Member (AES Society Representative)

IEEE Systems Council:

2014–2015 Systems Council Representative

2014–2015 Systems Council Treasurer

We will miss Frank terribly. Rest in peace my dear friend. —Reza Zoughi I&M Society  
President

#### **Family Remembrances**

Going over Frank's life is painful, his death was not expected and we still are not ready to let him go. Our hearts are broken and we can barely believe he is gone. But at the same time we truly want to celebrate the man he was and remember how much we all loved and cherished our time together with him. Frank became my step-father when I was 14, some 40 years later I consider him my dad.

Frank and Max were born in El Paso, Texas, on Feb. 10, 1937; they were identical twins. Frank had three brothers Max, Nacho, Robert, and two sisters, Emma and Carmen. He grew up and went to school in El Paso thru high school. Frank and Max attended Catholic school and were honor roll students. They both were active and very competitive in sports; baseball was their favorite, but they enjoyed all sports. Frank was also an altar boy, his life as a youth consisted of family, school, sports and the church. One thing Frank told me about being a twin was that he hated it when people didn't know who he was and would say "which one are you?" It was a sore spot for Frank in his youth. Although he loved his brother dearly and loved being a twin, he still wanted his own identity.

After Frank graduated from high school he followed his older sister Carmen to California where he attended UCLA:

1961 B.S.E.E. UCLA Major in Electronics

1962–1980 Post-Graduate courses in Engineering, UCLA and UC Irvine

1973 Completed Certificate in computer Science Program at UCI

1981–1987 Courses in Management, UCLA, UCI and Northrop In-house courses

1983 Completed Engineering Management Program at California Institute of Technology

In 1955, Frank joined the National Guard of California as a Reserve of the Army, and served from 1955 to 1964. His qualification was Marksmanship, Sharpshooter and Expert of the M1-17 Rifle. It seemed so unlike him, but he was a man of many talents. From 1961 to 1963 Frank worked for Northrop Electro-Mechanical Division, in Anaheim, CA. From 1963 to 1967, Frank worked at Hughes Aircraft, in Fullerton, CA. That's where he met my mother Opal Elizabeth. She told me he would walk by her desk everyday trying to get her attention; finally he got up the nerve to ask her to lunch. My mother was a beautiful woman with great legs (one of the things that attracted him to her), and she always wore high-heels. The problem was, in her high heels she was taller than Frank, so she started bringing flat shoes to work with her, to wear to lunch with Frank every day. And so their lives began, they married on August 18, 1967.

When Frank married Opal he acquired her five children, I was the youngest at the time and the only child still living at home. All of my siblings and their spouses adored Frank and he fit into our family perfectly. He became friends and golfing partners with my sister's husbands. There was not one person in our family who didn't love Frank, welcome him and embrace him into their lives. We shared all the holidays and family gatherings with games, joking and fun, those are memories we will cherish forever.

In 1968 Frank began working for Northrop Electro-Mechanical Division again. He was proud of his work on the Laser Target Designation System for the F-5, and the SEEHAWK Infrared System for the Coast Guard. From 1983 to 1993, he reached first, second and third level management. He was Responsible manager for development of Electro-Optic Test Console subsystem for the CASS program. Then in 1993, he retired at 56 years old. In July 1969, Opal and Frank welcomed a new baby into the family, Robert Allen Reyes was born and Frank was in his height of glory. He was always meant to be a dad and he was good at it. He took great joy in having a son and enjoyed going to all of his son's sporting events. I can't remember Frank ever missing one of Rob's games; he was always in the stands supporting his son. It was fun times and now looking back at pictures and remembering all the family times together, it seems to have gone too fast. We had a wonderful time together and family meant everything to Frank.

Frank was an incredible dog lover; there was never a time when he didn't have a dog. After he retired he was given a golden Labrador Retriever for his birthday and he loved that dog. He became active in an informal dog club; it was a group of people in the neighborhood who would meet at the park every day with their dogs. He gained a whole new group of friends, but that was Frank. He was very outgoing and friendly, and made friends where ever he went.

In 1993 when Frank retired, my mother decided she was also ready to retire and pretty much gave up cooking. Frank took over the job and truly embraced it. He told me he wanted to learn how to cook and so the cooking lessons began. He would find a recipe he wanted to try and I would come over and teach him how to follow the recipe and basically cook. It was great times full of good food and lots of laughter. One funny memory I have was he wanted to make a recipe that called for Italian sausage. What he bought was summer sausage that was wrapped in paper, but he didn't realize it was wrapped in paper because the paper was the same color as the sausage. He chopped up the sausage without taking the paper off and made the recipe with it. It turned out very good except we had to keep picking the paper out of our mouths. It was a great meal with lots of laughs, we giggled about it for years. I will truly miss his dinners, he was so proud of the cook that he became.

In his retirement, Frank was able to devote time to the Professional Organizations he was interested in. IEEE, I&M Society, Optical Society of America and AUTOTESTCON were the organizations he belonged to. He enjoyed his time with these groups, meeting new friends and

traveling made it even more enjoyable. His stories about the different countries and the people in these organizations were things he loved to talk about; it was great times for him.

In my mother's later years, she became a victim of the horrible disease of Alzheimer's. Frank was a loyal loving partner and cared for my mother. When she was finally moved into a care facility down the street from their home, he would go see her twice a day, every day. He was amazing, and I am so thankful to him for how he took care of my mom and I will always respect and honor him for that.

Last October 2014 my mother departed this world and entered her eternal life. At that time, we had no idea that 6 short months later Frank would be following her. It still seems so hard to comprehend and yet what choice do we have. We are thankful for the wonderful life we were able to share with Frank and are very thankful that we have such incredible memories of our lives together. It has been a blessing to our family to hear from so very many people, telling us what a wonderful man Frank was, believe me we know, but it's still so wonderful to hear and be reminded of. He will be missed terribly; he has left an empty spot in our lives that will never be filled. —*Brenna Arbello & Family*

### **Professional Colleague Remembrances**

I had the distinct privilege of working closely with Frank Reyes over the years on the I&M Society AdCom. He had already served as both the I&M Society Vice President for Finance and the Treasurer, when I was first elected as the new Vice President for Finance in 2011. He served as an invaluable mentor and friend to me as I attempted to understand the complexities of the IEEE budgeting process. I will never forget the very first IEEE Finance Workshop I attended with Frank. We met in the hotel lobby several hours before the program began on the evening of the first day of the workshop. Frank and I sat together with the budget open on each of our laptops, and he kindly and patiently began explaining the process to me by breaking it down into bits and pieces that made sense. When I walked into the actual workshop later that day, I knew I had been tutored by a master! Over the next three years, he was always available to answer my countless questions and provide both advice and encouragement. He taught me a lot about the Society's finances and budgeting, and I will always be indebted to him for sharing his vast knowledge with me. But, through working with each other, I also had the pleasure of enjoying meals together and visiting about our lives and families. Frank had the gifts of an inner calmness,

quick wit, and gentle smile. It was impossible not to feel good when in his presence. I truly was blessed to have Frank as a colleague and a friend, and I will deeply miss his wonderful spirit.

—*Ruth Dyer I&M Society Executive Vice President*

I can't remember when I first met Frank, for the simple reason that Frank was one of those persons that you think have always been there. To me Frank was not only a colleague, a member of the AdCom, the guru of the Society finances, as Vice President for Finances at first, and then as our Treasurer. He was a friend, and friends are always there, a discrete presence that reveals itself with a smile, a joke, or simply the words you need to hear, when you need them.

This was Frank. One of the gentlest persons I've ever met. In so many years of work together in the AdCom, I've never seen him losing his temper: an example to me I unsuccessfully tried to follow...

Despite his apparently frail look, Frank was also a strong person. Once again an example to all of us in the way he faced the terrible illness that took his beloved wife Opal away, and in the way he faced his own illness. Frank never gave up: this little, gentle man stood in front of life as a giant.

We all miss him. But I know that his discrete presence, his smiles, his gentle words will remain with me. Because a friend is always there, and forever.

—*Alessandro Ferrero Editor-in-Chief IEEE Transactions on Instrumentation & Measurement*

When you lose a friend it is always very difficult to express in words what you feel. Frank was a very good friend and I will never forget him. I remember the first time we met. It was in October 2005. Both of us had just been elected as new AdCom members and although our terms started in January 2006, we were invited to that meeting to start learning how the society was managed. Frank and I were sitting together and we could not believe what was going on during the meeting. Everything was difficult to understand and we thought that maybe we made a mistake in participating in the AdCom. Then, time showed us that Frank not only learned very quickly how to manage the society's finance but also that he became a reference to all of us because of his expertise. I also remember the time we spent together during the after-office hours when we went out to walk and enjoy those short moments in life. One of the funniest moments happened in Pompeii together with Reza, also a good friend. The three of us stepped into a place inside the ruins, which then we learned it should have been closed to tourists. Suddenly, a guardian who

was a hundred meters from us, started running and shouting in Italian, which we did not understand, but obviously he was angry. When he reached us, Reza had to apologize for our actions and both Frank and I were hiding behind Reza like two kids. We spent a lot of time with Frank where you could really get to know him as a very good and charming man. I will always miss you, my friend. You left a significant mark in my life.

—*Jorge Daher I&M Society Senior Past President*

Frank Reyes.....what can I say about Frank Reyes? Well, whatever I put on this page will never be enough.

For as long as I have been involved with IEEE, Frank has been there. He has served in so many capacities. Nearly every meeting I worked, Frank was there. The I&M AdCom....Frank was there. The AESS Board of Governors....Frank was there. Systems Council....Frank was there. The I2 MTC, AUTOTESTCON, year after year.... Frank was there!! Frank was one of my “travel buddies.” We flew together on occasion, always could sit down to dinner together, and would always take time to do a day of touring. My fondest memory was a day in Paris with Frank and Jim and Donna Howard. We walked so much our feet hurt! It was a spectacular day of seeing all the sites in Paris, finding our way together, navigating the metro, laughing so hard at the number of stairs we climbed, worshiping silently in glorious Sacre Coeur....it was truly a magical day. And one evening, he and I had a wonderful dinner with Marina Ruggieri. The three of us talked and laughed and enjoyed wonderful friendship together. There are dozens of stories exactly the same. Frank was always there. Frank was always kind. Frank was always comfortable and easy to be with. I just returned from meetings with the I&M Society and AESS. Frank’s absence was palpable. I miss him very, very much. Yes, of course, Frank will be missed for his contributions to IEEE and all that it entailed. He was an excellent, knowledgeable team member. But, for me.....I will miss Frank, my friend; a dear and wonderful friend.

—*Judy Scharmann I&M Society Executive Assistant*

*Director of Client Services, Conference Catalysts, LLC*

I first met Frank in 2011 when I was elected in the Society AdCom. He was a man of extreme kindness and humility, thoughtful and respectful to others, with fair and reserved attitude. I was strongly impressed when he opened his heart to us telling his unbearable sorrow for having loss of his beloved wife, Opal. I think that sharing his sorrow with us was a great gesture of friendship and consideration for us. I will be always grateful to him for that. A short time after his wife’s departure I had the honor to start working more closely with him. I learned so much

from Frank, not just on matters related to the finance of the society, but above all as a person. He was always very patient with me, answering exhaustively all my questions. I really appreciated this. Now, that he is no longer with us, I realize how much I'll miss him. Rest in peace my friend, I will hold your memory in my heart forever.

—*Dario Petri I&M Society Vice President for Finance*

I started on the AdCom as a graduate student, and Frank had always made me feel welcome. He felt a bit like an AdCom grandfather to me. My favorite memory of Frank takes place in Venice during my first trip to Europe traveling alone. I, along with Frank, Jorge Daher, and Reza Zoughi, had one free day before we all returned home from the Fall AdCom meeting. So, we decided to take the bus to Venice. I was amazed with the city when we got there, so much so that I kept getting sidetracked in all the shops. I would come out, and Frank would be standing there, waiting for me. This went on for a good part of the morning (truthfully, all three of my companions were pretty good sports about it.) Thinking back on that day, I can picture so clearly the three of them, Frank, Reza, and Jorge (who all happen to be fairly short men), standing along the streets of Venice, waiting for me to finish my never-ending shopping spree. It felt like I was visiting Venice with my own set of the Three Amigos. I have thought about this frequently over the last month, and it gives me a smile every time. Frank, thanks so much for all the smiles over the years. You are missed!!.

—*Kristen M. Donnell I&M Society AdCom Member*

I have known Frank Reyes for almost 30 years, and am the one responsible for getting him involved in IEEE activities, starting with IEEE AUTOTESTCON, and then I&M Society, AES Society, and the Systems Council. Frank worked for Northrop Grumman in Hawthorne, California, and a colleague and I convinced him to be the Registration Chair for IEEE AUTOTESTCON 1991. Frank retired from Northrop Grumman a few years after that and the post-work involvement with IEEE kept him active and busy and he thoroughly enjoyed it. Frank commented often that he met the nicest people in IEEE, but the reality is that we in IEEE found Frank to be about the nicest, most polite, pleasant, and hard-working individual WE had ever met. Frank was courteous, always complimentary, and became as good a loyal and trusted friend as you could want. Frank was devastated when his wife of over 50 years, Opal, passed away last year and his IEEE involvement kept him going and gave him purpose. Frank was compassionate and friendly and touched the heart and soul of everyone he met. We will miss his ready smile and encouraging ways and the joy he brought into the hearts of so many.

—*Robert Rassa IEEE Systems Council President*

It was our distinct pleasure to know Frank Reyes for an all too brief time of mutual service to the IEEE I&M Society AdCom. Fortunately, even for the unassuming Frank, it didn't take long to become fast friends. His soft spoken comments to AdCom meetings were always well thought out and timely. Frank was a man of service that inspired us all. His unselfish offering of time and talent was extended to us as if we were family. Just last February, Frank showed me a picture of his beloved late wife and I felt that he was including me in his family. Such a wonderful warm feeling from a wonderful warm man. Shirley spent time with Frank when I was busy with conference meetings and she connected quickly and closely as well. He often accompanied a small group on side tours and was comfortable in Uruguay or Italy. It was like having an older brother along to guide and guard the group. She enjoyed his quick wit and easy friendship. It was obvious to all the Frank enjoyed the company of many. We will certainly miss Frank dearly.

—*Max and Shirley Cortner*

*I&M Society Vice President for Education, I2MTC Board Chair*

I met Frank around 2005 at an AdCom meeting in Orlando. We really did not talk to each other at that time. Then, we met again in Sorrento, Italy where the 2006 I2 MTC and the follow-up I&M Society AdCom were being held. Interestingly enough, we both arrived in Naples about the same time and took the same bus to Sorrento, but still really did not know each other. After getting off the bus and while waiting for a taxi I walked up to him and re-introduced myself. We shared a taxi to a beautiful hotel where he and I were given two of the smallest and darkest rooms. We both called our room a “dungeon” and each other “dungeon-mates”! This is when Frank, Jorge and I went to Pompeii, as Jorge explained above. That was a fun day, which we laughed about for many years after.

Over the years Frank and I became closer friends and spent a lot of time together at the AdCom meetings. I always enjoyed his wit and his thoughtful comments. I learned a lot from Frank both about finances and also about interaction with others. We were in close contact during the last days of Opal's life. He was incredibly dedicated to her. At her funeral I saw how much pain her loss had brought to him. I also called him regularly during the time he was dealing with the awful cancer in him. Last year, Mary and I invited him to our house after Christmas. He did not want to be away from home at Christmas time since he wanted to spend time with his family and prepare Christmas dinner for them. So, afterwards he spent a short few days with us, to get his

mind off of his terrible disease for a while. One morning after breakfast we asked what he wished to do that day. He said: “It may sound corny, but I would like to visit the Anheuser Busch Brewery” (in St. Louis, Missouri where we live). He said this was on his “bucket list”! So, we spent a half-day there and enjoyed the brewery tour, a great lunch and a cold glass of beer. I am so glad we did that.

People constantly come into and leave one’s life. Frank came into our lives quietly, but made a wonderful and ever lasting impression. He was a dear friend who touched our souls, and will always be with us in our hearts. We miss his laughs, thoughtful interjections, his open-mind, kindness towards the weak and the needy, dedication to all he loved, patience, and love for what is good and right. We will miss him terribly.

—*Reza and Mary Zoughi I&M Society President*

*This print article includes a photograph.*

---

## *Chapter Report*

### **International Impedance Spectroscopy Workshop**

Organized by the IMS German Chapter at Technische Universität Chemnitz, Germany

24-26 September 2014

The annual International Workshop on Impedance Spectroscopy (IWIS) brings experts and young scientists together to discuss new research results in impedance spectroscopy. It has established itself as a platform for exchange of ideas beyond the classical border of specific application fields of impedance spectroscopy, such as electrochemistry, bioimpedance spectroscopy, corrosion research, energy storage and systems.

The 2014 workshop was taking place for the seventh time, and more than 70 scientists participated from 13 countries. Renowned speakers presented interesting keynote lectures on the fundamentals and applications of impedance spectroscopy, including Prof. Mark E. Orazem (University of Florida), Prof. Ørjan Grøttem Martinsen (University of Oslo), Prof. Mart Min (University of Tallinn), Prof. Sören Hohmann (Karlsruhe Institute of Technology), and Prof. Marco Carminati (Politecnico di Milano). Dedicated tutorials were presented on specific topics, helping new scientists to better understand, apply and introduce impedance spectroscopy to different fields. An exhibition in parallel with the conference showed interesting products of important manufacturers. The presented workshop contributions showed that the method of impedance spectroscopy has a tremendous potential in many fields of application. The Circle of

Experts in the IWIS met this year again and discussed possibilities to reinforce the scientific activities in this field. Judging from the success in laboratory applications and in the last decades in general, the methods have the potential to bring decisive innovation to measurement and sensor solutions. Selected workshop contributions are planned for the sixth edition of the annual book Lecture Notes on Impedance Spectroscopy published by Taylor & Francis (CRC Press).

The IMS Chapter held the third workshop on Medical Measurement Technologies at the Ruhr West University of Applied Sciences in spring 2015, and the next IWIS will take place from 23-25 September 2015 in Chemnitz, Germany. For more details, please visit the workshop website: <https://www.tu-chemnitz.de/iwis/>.

---