

*Noise in Measurements*

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*From the Editor's Bench*

Shlomo Engelberg

**I Call It Flexibility**

Recently my family celebrated a couple of life cycle events. In both cases, we cooked up massive dairy meals for our nearest and dearest. At the second party, one of our friends came to me with a smile and said, "I see that you caved in again. First, you got a dog, and now you are making dairy parties." She knows that I do not like most dairy foods and that if we make a dairy meal, it is probably not because I suggested it. I responded, "I don't think of it as caving in; I think of it as being flexible."

In working with people, the ability to be flexible can be crucial. If you don't care deeply about something, don't make an issue out of it. You and the people around you will all be happier. If you have little esthetic sense, there is no point in making an issue out of what color a room should be or what kind of furniture it should have. Let the folks who care about the issues make the decisions. If you do not care about exactly which bells and whistles are added to a project, let your coworkers who do care decide exactly what to add.

Flexibility has been coming to the world of instrumentation and measurement for years. Because of the ever shrinking transistor, it is possible to pack more and more computational power and memory into smaller and smaller packages. This has allowed us to make ever more flexible equipment. In recent years, we have seen the move towards software-defined and cognitive radio – two technologies that rely on flexibility. Software-defined radios and cognitive radios can both change how they behave based on the current situation. One can look at this as the radio "saying" that it is willing to be flexible about many things so long as it can perform its real job of transmitting and receiving signals.

Writing for the magazine is fascinating work, and it requires making a commitment to doing good work and finishing the work by a deadline. As a commitment to do work for the magazine is usually made in addition to other commitments, writing for the magazine often requires us to rely on our boss's or spouse's willingness to be flexible. Hopefully those around us will be willing to let us involve ourselves in work that we find interesting in exchange for having a happier spouse or worker.

Recently both Kim Fowler, the Instrumentation and Measurement Society's president, and I received a letter from a group of students. The students wanted answers to a couple of somewhat involved technical questions. Both Kim and I tried to help, and Kim sent out an email to the AdCom to see who else could help. Professor Serge Demidenko responded and suggested that

we start a column that provides short answers to – or pointers to sources that answer – questions asked by the magazine’s readers. When asked, Serge agreed to run the column. If you have a question or a problem whose answer is likely to be of interest to a sizeable fraction of the I&M community, please email it to Serge at [s.Demidenko@massey.ac.nz](mailto:s.Demidenko@massey.ac.nz).

In this month’s issue, we have articles and columns written by people who were willing to commit to helping us out and whose peers were willing to be a bit flexible. We have articles about noise in CMOS transistors, about how to analyze the performance and reliability of integrated circuits, about new measurement tools for nanoelectronic devices, and about automatic noninvasive measurement of blood pressure. Our regular columnists have, as always, provided us with additional food for thought. Enjoy!

*Shlomo*

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## *President’s Perspectives*

Kim Fowler

### **The Challenge of Measurement Science**

It seems to me that many people do not appreciate the challenge and necessity for measurement and instrumentation. Certainly the general public does not know what is important in completing and sustaining measurements or why it is important to do so. Even scientists and engineers seem to be hazy as to issues surrounding measurement and instrumentation. A recent white paper by Derek MacLachlan opens with this comment, “Accurate measurements are central to virtually every scientific and engineering discipline, but all too often measurement science gets little attention in the undergraduate curriculum [at least this is true in the United States]. Even those who received a thorough grounding in measurement fundamentals as undergraduates ... [have] forgotten some of the details.” (“Getting Back to the Basics of Electrical Measurements,” by Derek MacLachlan, Staff Applications Engineer, Keithley Instruments, Inc.).

Why do we not seem to understand the concerns and challenges of measurement and instrumentation? I think that several factors may play into our ignorance. The first is new technologies, such as the internet, gaming, and the smart grid. They can be more exciting than measurement science to the latest generation of students, academics, and practitioners. Second, the science of measurement has been thoroughly investigated over the past two hundred years which might breed complacency and potentially contempt. Third, no series of failures or catastrophes have occurred that can be attributed to issues within measurement science. These types of factors can reduce or eliminate the emphasis on measurement and instrumentation.

So what are we doing within the Instrumentation and Measurement Society to address these concerns? In the December 2010 issue of the magazine, I wrote briefly about some of the activities and ventures of the society. These activities: publishing, technical committees, and conferences, and ventures such as: the International Measurement University (IMU), tutorials, the Dis-tinguished Lecturer Program, website upgrades, and books on instrumentation fundamentals provide educational avenues and technical materials on measurement and instrumentation. We are also striving to develop new initiatives to further these educational

avenues and technical materials. I will provide more details of these new initiatives in future issues.

Another way to address the public awareness challenge for measurement and instrumentation is volunteer involvement in the society. The society has a dedicated group of volunteers leading the way. The newest members of the AdCom are Georg Brasseur, Dario Petri, and Mike Gard. Each has dived into the work of the AdCom and is contributing to one or more committees. Jorge Daher, the Executive Vice President, was re-elected and he continues his excellent effort for the society. You, too, can be involved. Here are the necessary qualifications to be an AdCom member: be an IEEE member in good standing and have demonstrated volunteer efforts in society activities. There are many different activities; investing yourself in any one of these activities will raise your visibility and demonstrate your effort. Some of these activities include chapter meetings, conference attendance and volunteer contribution, serving on ad hoc society committees, and serving on technical committees (I&M has 37 different technical committees) to promote a specific technical area and standards. The I&M Society's website at <http://www.ieee-ims.org/main/> is a good starting point for checking out the current activities and initiatives of the society and where you might contribute.

We are considering more possibilities, too. Your thoughts and suggestions are most welcome. We would love to have more people involved in these activities and future ones, too. Please consider volunteering and collaborating with us to provide even greater value to you and for our membership.

*Kim*

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## *Article Summaries*

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### *The Right Tools for the Right Measurement*

Jonathan L. Tucker  
(Summary)

Characterizing the unique properties of nanoscale materials and devices without damaging one-of-a-kind structures requires systems that provide tight control over sourcing to prevent device self-heating. With more devices shrinking in size, the demand increases for new kinds of test techniques that are based on scientifically robust interpretations of the data and that are supported by traceable measurements back to national measurement institutions. This article examines the measurement triad of DC I-V, CV, and the new Ultra-fast I-V pulsed systems.

*This summary includes text from the article.*

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### */f Noise in Advanced CMOS Transistors*

Yael Nemirovsky, Dan Corcos, Igor Brouk, Amikam Nemirovsky, and Samir  
(Summary)

This paper reviews  $1/f$  noise in state-of-the-art advanced MOSFETs, where the channel length has deep submicron or nano-scale dimensions. The origin of  $1/f$  noise, models of  $1/f$  noise, and ways of measuring  $1/f$  noise are briefly reviewed. Experimental results are reported for two different digital and mixed signal “low noise processes”: 0.18  $\mu\text{m}$  and 0.13  $\mu\text{m}$  of TowerJazz and 0.18  $\mu\text{m}$  CMOS-SOI of IBM. These technologies represent well-established advanced MOS (metal oxide semiconductor) technologies. The authors’ goal is to provide practicing engineers with a clear physical picture and useful tools for noise modeling, characterization, and reduction when designing circuits in advanced MOS technologies.

*This summary includes text from the article.*

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## *Quantitatively Analyzing the Performance of Integrated Circuits and Their Reliability*

Edward J. Wyrwas and Joseph B. Bernstein

(Summary)

Testing, instrumentation, and measurement electronics high reliability and high quality complex integrated circuits (ICs) to ensure the accuracy of the analytical data they process. Microprocessors and other complex ICs such as FPGAs are considered the most important components within instrumentation. They are susceptible to electrical, mechanical and thermal modes of failure, and stability of device parameters is key to guaranteeing that a system will function according to its design. This article discusses the importance of microprocessor and IC device reliability and how modifying the operational parameters of these devices through over- and under-clocking can either reduce or improve overall reliability, respectively, and directly affect the lifetime of the system in which these devices are installed.

*This summary includes text from the article.*

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## *Automatic Noninvasive Measurement of Arterial Blood Pressure*

Meir Nitzan

(Summary)

The non-invasive blood pressure measurement is probably the most common medical measurement, due to its clinical significance and simplicity. The manual version of the technique relies on a pressure-cuff, mercury manometer, and hearing of Korotkoff sounds. It is still preferred by most physicians over the available automatic devices for blood pressure measurement. In this paper, the author reviews the physical and physiological basis of the manual and the automatic techniques for the non-invasive measurement of blood pressure. The scientific background of the different techniques helps us to assess their ability to provide accurate evaluation of arterial blood pressure and reliable detection of hypertension.

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## *Columns*

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### *Instrumentation Notes*

Bruno Andò, Salvatore Baglio, and Angela Beninato

#### **Can Ferrohydrodynamic Instabilities Be Useful in Transducers?**

(Summary)

Magnetic fields applied to a ferrofluidic volume and the consequent magnetic force causes the alignment of the ferrofluidic particles in the direction of the field and modifies the viscosity and the control of the ferrofluid mass position. Interest in ferrofluids and magnetic particles exists because of the possibility of efficiently converting valuable elastic energy into mechanical energy in many applications. In this column, the authors describe some of the uses of ferrofluids and highlight ways to exploit its ferrohydrodynamic instabilities.

*This summary contains text from the column.*

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## *Departments*

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### *New Products*

Robert Goldberg

#### **New DMMs Offer Fast Measurement Speeds**

Agilent Technologies, Inc. introduces two digital multimeters (DMMs) to complement their family of PXI products. These new 6.5 digit PXI DMMs offer high measurement speeds along with excellent accuracy and stability. The M9182A 6.5 digit DMM and M9183A 6.5 digit enhanced-performance DMMs measure common parameters such as DCV, DCI, ACV, ACI, 2- and 4-wire resistance and temperature. Each offers 30 parts-per-million basic DCV and 300 parts-per-million basic ACV 1-year accuracies and inputs up to 300 volts. The DMMs deliver 4,500 readings-per-second and 20,000 readings-per-second, respectively. These fast reading speeds translate into higher test system throughput and lower cost of test.

The M9183A enhanced-performance DMM is capable of additional measurements, such as capacitance. This may reduce the need for additional instruments in a test rack, conserving rack space and budget. Both DMMs are compatible with PXI, PXI Hybrid, and compactPCI instrument main-frames, including Agilent's recently announced PXI mainframe products.

Each DMM ships with a full suite of software to enable easy system integration regardless of what software environment end-users have on their PCs. An intuitive software front panel enables DMM set-up, measurement and system troubleshooting without programming. The DMMs include IVI-COM, IVI-C, and LabVIEW G-drivers that are compatible with C++, Visual Basic, NI LabVIEW, and many other PC software environments.

For more information on Agilent's new PXI DMMs and their entire family of PXI products, go to [www.agilent.com/ find/PXI-DMM](http://www.agilent.com/find/PXI-DMM).

### **Miniature Linear Variable Displacement Transducer (LDVT)**

Meggitt Sensing Systems introduces the Sensorex model SX9W3, a rugged, high-accuracy miniature linear variable displacement transducer (LDVT), designed for high-precision displacement measurements within a variety of embedded and test bench applications.

With an overall length of just 26 mm (with body and core at null position) and a 9 mm diameter, the SX9W3 offers a maximum linearity error of less than  $\pm 0.25\%$  of full scale, with an option to further reduce to  $\pm 0.15\%$  of full scale. The transducers are designed to reliably operate over an operating temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$  to  $+257^{\circ}\text{F}$ ) and are environmentally sealed to IP65.

Meggitt's Sensorex LVDT's have no wearable parts for friction-free operation, while offering infinite resolution, long service life and high measurement repeatability. Units are highly resistant to shock and vibration, impervious to external magnetic fields and are designed to be compatible for use with all industry standard LVDT signal conditioners. The low mass of the Sensorex model SX9W3 core LVDT assembly makes the transducer ideal for use in applications where high-reliability displacement measurements are required, though where mass, weight and space constraints may be of concern.

Recommended accessories for the Sensorex model SX9W3 include the model SX3120 DIN rail signal conditioner for industrial applications as well as use of an MCHP conditioner for integration with electronic boards. In addition, a spare core assembly, mounting flange, and custom calibration and core assemblies are available upon request.

For detailed technical specifications, drawings or additional information about the Sensorex SX9W3 or other products available from Meggitt Sensing Systems, visit [www.meggittsensing.com](http://www.meggittsensing.com).

### **Ultrafast Fiber Laser**

TOPTICA presents a tunable "ultra compressed pulse" (UCP) model of their FemtoFiber pro series. The system provides a supercontinuum between 980 – 1400 nm and more than 30 mW output power. It features pulse durations even below 25 fs. TOPTICA claims this to be the shortest one can get on the market from a mode-locked fiber laser system.

After the introduction of the FemtoFiber pro IR (at 1560 nm), NIR (second harmonic at 780 nm) and SCIR (supercontinuum from 980 nm to 2200 nm) models in 2009, TOPTICA is now expanding the series with the FemtoFiber pro UCP model. As for all models, the commendation "pro" stands for excellent performance combined with ease of use, reliability and robustness.

The FemtoFiber pro UCP is based on reliable saturable absorber mirror (SAM) mode-locking technology and a subsequent core-pumped fiber amplifier. This master oscillator power amplifier

(MOPA) platform is all-fiber and based completely on polarization-maintaining fibers. The SAM technology ensures self-starting and a stable mode-locking under all laboratory conditions, and the all-fiber setup offers robustness against environmental changes.

The system includes two motorized prism compressors: the first optimizes the supercontinuum generated by a highly nonlinear fiber. The second motorized prism compressor is used to optimize the pulse duration. Thus pulse durations in the range down to 13 fs can be achieved. The standard repetition rate is 80 MHz, but 40 MHz is also available. Up to three fiber coupled seed ports turn every FemtoFiber pro model into a complex laser system for multi-beam experiments with optically synchronized laser pulses. Find more information at [www.toptica.com](http://www.toptica.com).

### **Integrated Alternating Relay and Duplex Controller**

The ATC Diversified Electronics division of Marsh Bellofram Corporation has announced the ARM Series, a family of rugged, high-reliability alternating relays and duplex controllers, designed to ensure equal runtime of multiple load installations in many industrial applications.

The Marsh Bellofram ARM Series incorporates a micro-processor-based controller which evenly distributes run-time by automatically alternating designated lead and lag loads between two device load sequences. The series also features an inrush delay, which prevents both loads from energizing simultaneously, thus significantly reducing line sag, while allowing for additional load capacity in the event of excess requirements. Units include five UL913 intrinsically safe low voltage/low current control switch inputs which are electrically isolated from the control voltage and load alarm contacts. Five LED indicators are included to confirm the functionality of the inputs. Incorporation of hand-off-automatic (H-O-A) switches allow for manual operation as needed.

Additional features include an integral alarm output, with alarm contacts that close when a control switch fails or system capacity is exceeded; control switch fault detection, which notifies the user of open and shorted control switch failures; and a test-and-clear switch, which verifies device function and resets the control switch fault detection algorithm as needed. The integral device logic of the ARM Series allows for outputs to continue their operation even if one input fails to open or close. Special controls are also available upon customer request. Available mounting configurations allow for back or front panel mounting, as required.

For more information about the ARM Series or other products available from Marsh Bellofram, visit [www.marshbellofram.com](http://www.marshbellofram.com).

### **USB Isolator Shields Connected Devices from Surges and Noise**

This compact, industrial-rated isolator from Acromag provides a high-voltage isolation barrier for USB 2.0 or 1.1 connections from computers to USB devices. It is useful to protect against over-voltage conditions caused by electrical surges and transient voltage spikes. Isolation also helps to eliminate ground loop errors and will minimize conducted noise from static discharge, magnetic fields, and radio frequency interference. Acromag's isolator offers high noise immunity with low radiated emissions for reliable data transfer in sensitive applications.

Industrial-grade features offer additional control for advanced users, and the unit is designed to meet UL/cUL and CE approval requirements. Typical applications involve process control devices, automation equipment, test and measurement systems, and medical instrumentation. The isolator is less than 1 x 2.5 x 2 inches and includes a USB host cable.

The isolator is inserted in-line with the USB connection and operates transparent to the devices with no software drivers required. It receives its power from USB and isolates that power to the connected device. A green power LED indicates that power is being received and will blink if the connected device is trying to draw more than 120mA. Default communication is USB Full Speed (12 Mbps) but can alternately be set for Low Speed (1.5 Mbps) via an internal jumper. The reset button enables re-initialization of a connected device without breaking the cable connection. High-retention USB A and USB B sockets increase connection integrity under shock and vibration.

Electrical isolation of up to 1500V AC / 2100V DC separates the USB host from the USB peripheral. Built-in surge/transient suppression up to 8kV protects all ports. Common mode filtering is also applied on all data lines. Output short circuit protection adds further safety and includes an auto-retry function.

For more information, please visit [www.acromag.com](http://www.acromag.com).

### **Miniature L Band Amplifier**

Mini-Circuits' new YSF-2151+ SATCOM L Band Amplifier is an Ultra flat design delivering outstanding gain-flatness ( $\pm 0.6$  dB) over the full 950 to 2150 MHz band. The YSF-2151+ amplifier utilizes Mini-Circuits System in Package (MSiPTM) technology and supports a unique combination of High Gain (20dB), High Dynamic Range (3dB NF and +35 dBm IP3) with excellent input and output return loss, making this an ideal gain block for both transmit and receive applications.

Find more information at [www.mini-circuits.com](http://www.mini-circuits.com).

### **Precision Power Analyzers Use New Architecture to Provide Faster Performance**

Newtons4th has introduced a new generation of Power Analyzers, featuring a new architecture that yields high accuracy and precision over a wide frequency range. The Newtons4th PPA5500 KinetiQ power analyzer series measures power, phase, harmonics, and impedance and provides a true RMS multimeter as well as real-time digital, tabular, graphic and oscilloscope displays.

Offered in single, two and three channel models, (up to six channels in a master/slave mode with an additional unit), the KinetiQ features high-speed sampling on all channels and optional LAN (Ether-net) and IEEE488 interfaces in addition to standard serial and USB PC interface ports. The unit provides the broadest range of internal and external current and voltage inputs available: 300mA<sub>pk</sub> to 300A<sub>pk</sub> (30Arms), 300mV<sub>pk</sub> to 3000V<sub>pk</sub> (1000V<sub>rms</sub>) in 9 ranges and DC as well as standard torque and speed inputs. Basic accuracy is 0.02% within the frequency range of 10mHz to 2MHz. Common mode rejection exceeds -130dB@100kHz. Phase accuracy exceeds 5 millidegrees.

The KinetiQ measures Watts ac, Watts dc, Volts ac, V<sub>pk</sub>, V<sub>rms</sub>, V<sub>dc</sub>, A<sub>ac</sub>, A<sub>pk</sub>, A<sub>surge</sub>, Arms, A<sub>dc</sub>, VA, VAr, PF, CF, frequency, phase, impedance, harmonics (to the 100th), THD, TIF, THF and TDD and more, and offers full real-time integration and data logging, with data storage to

1GB internal flash memory or a USB memory port. Standard 4mm safety leads (supplied) are used for voltage and internal current shunt connections. Simple BNC connections of N4L wideband shunts or third-party probes and transformers are offered for higher current applications. Data is displayed on a bright, full-color TFT, LED backlit display.

The PPA5500 is exceptionally useful to designers of electronic devices ranging from PWM motor drives and inverters to power supplies and lighting ballasts. It is ideal for standby power measurements due to its unique architecture, providing true no-gap measurements. The trend to design more efficient devices at ever higher conversion frequencies is driving the need for power measurement instruments with much greater high frequency accuracy, which is fulfilled by the all new PPA5500 series KinetiQ power analyzers.

For complete details, see the Newtons4th website: [http:// WWW.NEWTONS4TH.COM](http://WWW.NEWTONS4TH.COM).

### **New Control Catalog Covers Temperature, Pressure, Flow and More**

Omega announces their ControlCat28 catalog. It contains over 150 full color pages of state-of-the-art products separated into 7 sections: Automation, Sanitary, Temperature, Electric Heaters, Wireless/Data Acquisition, Pressure/Strain/ Force, and Flow/Level/Environmental.

A few featured products designed and manufactured by Omega are: the UV-1000 Universal Verbalizer, a handheld process-signal to speech device; the CTXL series of Circular Chart Recorders; the OMEGA-SCOPE® Wireless Hand-held Infrared Thermometer Series; and the FMA1000 series of General Purpose Industrial Air Velocity/ Temperature Transmitter/ Indicator.

A user-friendly index is available for easy product search and offers economical choices, popular models and accessories. Also featured are 105 classic Dilbert Cartoons, easy ordering options including online shopping, technical assistance, and fast delivery.

For more information, please visit [www.omega.com/literature/controlcat28/](http://www.omega.com/literature/controlcat28/).

### **Sensor System Ensures Optimal Heat Sink Efficiency**

The new Tactilus® heat-sink analysis system by Sensor Products, Inc. enables research and design engineers to quickly and precisely test and correct the surface contact and pressure distribution between the heat sink and semiconductor. Even a slight warping of the heat exchange structure or reduction in surface contact area can have a profound effect on cooling efficacy.

With Tactilus®, engineers can visualize actual contact forces and pressure distribution data on the circuit board components. As the mounting screws between the CPU and the heat sink are torqued, Tactilus® maps and measures the changing pressure distribution between the mating surfaces and displays it through its software. The heat sink interface can be tested, manipulated, and repositioned in real-time.

Unlike conventional transducers, the Tactilus® sensor is flexible and only 0.015-in. thick (0.38 mm), allowing it to be placed between the CPU and heat sink without affecting the assembly. The sensor pad has 625 resistive sensing points arrayed on a 25 × 25 grid. The total sensing area is 2 in × 2 in (5.1 × 5.1 cm). The scan speed is up to 1,000 Hertz, and the operating pressure range is 0 to 100 psi (0 to 7 kg/cm<sup>2</sup>).

Tactilus® collects and processes sensor data using powerful, easy-to-use, Windows®-based software that performs the following tasks:

Creates pressure vs. time graphs and histograms; Performs 2D, 3D and 360 degree image rendering and region of interest scaling; Displays maximum, minimum, and average pressures and does force integrations; and Prepares reports through export to Excel, ASCII, or Access formats.

The Tactilus® sensor system will endure hundreds of diagnostic uses on different heat sinks with consistent repeatability. It is highly resistant to electromagnetic noise, temperature, and humidity fluctuations. Accuracy is  $\pm 10\%$ ; repeatability is  $\pm 2\%$ ; hysteresis is  $\pm 5\%$ ; and non-linearity is  $\pm 1.5\%$ .

The Tactilus Sensor System is used to map and measure surface pressure distribution at the interface of tire tread footprints, door seals, heat seals, fuel cells, printed circuit boards, flat panel displays and wafer polishing, among its many uses.

For additional information, please visit [www.sensorprod.com/dynamic/heatsink](http://www.sensorprod.com/dynamic/heatsink).

### **Protocol Tester for Bluetooth**

AT4 wireless introduces the BITE T1212 Bluetooth Tester. The validated Bluetooth low energy option performs all the conformance test cases for Link Layer (LL) and Host Controller Interface (HCI) according to the current Bluetooth low energy requirements. Bluetooth low energy protocol Link Layer features like Device Discovery (Scanning and Advertising modes), Connection Handling for different roles (Advertiser, Initiator, Master and Slave), Timing in Active and Low Power modes, Radio Frame encoding, Frequency Hopping, Packets formats and Security, jointly with the characteristics of the Host Controller Interface (HCI), are now supported by the BITE Protocol Tester T1212. AT4 wireless claims that this becomes the only validated test equipment supporting these testing capabilities.

For more information, please visit [http://www.at4wireless.com/web\\_eng.html](http://www.at4wireless.com/web_eng.html).

### **New Test and Measurement Catalog**

The Pico Technology Test & Measurement Catalogue has been completely redesigned for 2010. It now contains more technical data on established and new products.

The PicoScope section adds the new PicoScope 2200 Ultra-Compact scopes and the PicoScope 3425 Differential scope. A PicoScope 2200 scope is also available in a new Education Kit designed for use in the classroom. The PicoScope 4000 Precision scopes, both with and without an arbitrary waveform generator, are now listed, as are the PicoScope 6000 High-Performance scopes with 350 MHz bandwidth and 5 GS/s real-time sampling rate. You will also find the PicoScope 9000 12 GHz Sampling scopes, which use sequential sampling to analyze repetitive signals with a time resolution of only 200 femtoseconds.

The Accessories section introduces a range of new scope probes, including differential high-voltage types for measuring several kilovolts and both active and passive types for bandwidths up to 1.5 GHz. In the PicoLog section, you will find the new PicoLog 1000 Series 12-channel and 16-channel voltage data loggers and the latest PT-104 4-channel platinum resistance data logger with USB and Ethernet ports.

The Pico Technology 2010 Test & Measurement Catalogue is available to download now, free of charge, from the Pico Technology website at [www.picotech.com](http://www.picotech.com). You can also request a printed copy by filling in the online form.

### **Dual Line Display Meter Allows Simultaneous Visualization of Two Separate Parameters**

Red Lion Controls, Inc. announces the PAX2A Dual Line Display Meter. The PAX2A can display input, total, minimum, maximum or setpoints on a 0.7 inch (1.8 cm) high six-digit main LCD display. This main display offers three programmable, easy-to-read colors: red, orange and green. Color change can be tied to the setpoints, providing the operator with a visual display of changing conditions in the application with updates up to 160 times per second. The panel meter also features a second display line with a 0.35 in (0.9 cm) high 9-digit green LCD display that can also be programmed for any of the above parameters and accommodates totalizing applications that easily exceed a normal 6-digit display. Plus, a 3-digit programmable custom unit indicator is also available.

The dual line display meter provides universal functionality, including universal input. The same meter accepts DC current, DC voltage, process signal, and thermocouple and RTD temperature sensor inputs. PAX2A also supports universal power input from 50 - 250 Vac or 21.6 to 250 Vdc. Built-in Mod-bus communications, in addition to field installable option cards: RS232, RS485, DeviceNet and Profibus, allow communications across a multitude of protocols.

Features that make the PAX2A effective and simple to operate include:

Universal process inputs: dc current, dc voltage, process signals, resistance, thermocouples or RTDs; Universal power supply: 50 to 250 Vac or 21.6 to 250 Vdc; Built-in USB port for simple connectivity; Meter update rate up to 160/second; Integrated Modbus communications; Setpoints: dual and quad relay; quad sinking and sourcing; Retransmitted analog output; and Communications: RS232, RS485, DeviceNet and Profibus.

For more information, please go to [www.redlion.net](http://www.redlion.net).

### **MEMS Inclinometers for Angular Tilt Detection**

TURCK has expanded its offering of inclinometers with the Q42, a new dual axis inclinometer sensor with a CANopen interface for angular tilt detection. This CANopen interface makes the Q42 inclinometer sensor ideal for use on mobile equipment and off-road vehicles. Q42 inclinometers have angle measurements of  $\pm 10$ , 45 and 60 degrees to suit a wide variety of industries and are designed for applications ranging from controlling tilt angle to leveling platforms.

The new TURCK Q42 inclinometer measures angular tilt in reference to gravity. At the heart of the TURCK Q42 inclinometer is a MEMS (micro-electro-mechanical system) device that incorporates a micro-electromechanical capacitive element into the sensor that utilizes two parallel plate electrodes, one stationary and one attached to a spring-mass system. Movement causes acceleration that produces deflection in the non-stationary electrode. This results in a measurable change in the capacitance between the two plates that is proportional to the angle of deflection. All measured values and parameters are accessible via the object directory. The micro board design in the MEMS technology allows for a compact, precise inclinometer in a very robust, industrialized package.

## *Membership Notes*

Mihalea Albu

### **Interview with Lorenzo Peretto, a Member of the Italian IMS Chapter**

At the end of 2010, our Society has 37 chapters. Local IEEE communities have helped organize activities that span engineering subjects, measurement science, and new technical views and, equally importantly, that help satisfy the curiosity that lives within each of us. While trying to better serve our members, we need to know more about how they see themselves shaped by the IEEE membership – beyond names, technical excellence, and volunteering – who are our colleagues?

One of the largest and extremely active IMS Chapters in Europe is the Italian Chapter. Many of its members contribute significantly to the Society. Here we present an interview with one member, Lorenzo Peretto. A short biography of his states:

Lorenzo Peretto received his MS and PhD degrees in Electronic Engineering and Electrotechnical Engineering from the University of Bologna in 1993 and 1997, respectively. He joined the EE Department as an Assistant Professor and then became an Associate Professor. He is a Senior Member of IEEE, participated in the IEEE working group for the revision of Standard 1459-2000 and has worked in the IEC TC 25, “on the new definition of the Ampere.” He is an IEC representative in the BIPM Joint Committee for Guides in Metrology. He is chair of the IMS TC 39. He has authored or co-authored more than 150 scientific papers and is a co-inventor of 21 Patents.

Intrigued by such prolific activity, I asked Lorenzo these questions:

*M.A.: Please tell us a about your engineering profile.*

L.P.: I own a company along with my business partner, Altea B.V., which sells voltage and current sensors for a variety of applications in medium voltage power systems. We also sell distributed measurement systems for fault detection and location in power networks. All of our products are designed to be suitable for Smart Grids architectures. They are small, compact, light, have low power consumption and mainly, they can be connected to communication devices for a remote control and measurements.

*M.A.: Did the Engineer in you ever come in conflict with the Educator?*

L.P.: Never! I find that the more I learn about the issues, mechanisms, and challenges in power networks and in actual electrical systems, the better and more clearly I can transfer that knowledge to students. A good teacher needs to be experienced in both theory and practice. So having the knowledge of practical issues and how to solve them makes the theory description provided to the students clearer. This has been demonstrated many times.

*M.A.: In short, what is your IEEE trajectory? What do you think is the "core" of IEEE membership?*

L.P.: I have been a member of IEEE since 1998 and a senior member (SM) since 2003. I joined the IEEE Instrumentation and Measurement Society (I&MS) at the beginning of my career. In my opinion, the core benefits of IEEE membership are represented by some important features. First of all one can share discussion, opinions, and principles with colleagues coming from around the world during International Conferences. Second, these are extraordinary opportunities to update your knowledge, to get to know new people, to learn the state of the art in research themes of your interest, and to face new challenges. IEEE offers a very large variety of conferences, so one can choose the ones better suited to his/her research topics. Third, the IEEE also gives us the very important opportunity to join Technical Committees whose main goals are to propose and provide Technical Standards related to both real-world applications and academic research.

M.A.: *What would you like to see the I&M Society doing in the future?*

L.P.: I would like to see I&M Society more involved in the applications world (in a technological perspective). During the years I have been going to conferences, I have gotten to know people who were expert in their fields who were attending both workshops and I&M Conferences. It would be very useful if we could exploit their vast knowledge of practical information from their fields. From my activity as an engineer, I have realized that many of these different fields of measurements also need new technical standards, definitions and guidelines written for industry. I have seen a need for guides: cookbooks on how to perform measurements, how to manage the uncertainty information, etc.

M.A.: *You are the chair of Technical Committee 39, Measurements in Power Systems. How does this TC's work keep up with the world's 24/7/on-line and fast evolving electrical engineering times?*

L.P. This area of power systems and their measurement is growing very fast worldwide and is gaining more and more attention by a large variety of people involved in this field. One goal of this TC is to provide fast responses to current issues and problems found nowadays in electrical power systems. I think that the first beneficiaries of this TC should be the electrical utilities and the industries of this sector. Many measurement problems can be collected from people in industry as well as in utilities and addressed by the TC members who are qualified to provide answers. Today, many people in industry are faced every day with people's inputs who are 'not experts' with often tragic consequences. That is why I consider it a must that researchers and experts in this field have a way to convey their knowledge freely.  
(This interview took place on August 13, 2010.)

### **The Graduate Fellowship Grant and the Faculty Course Development Grant** Kristen Donnell

The I&M Society is pleased to announce the Graduate Fellowship Grant, to support and encourage graduate-level research in the areas of Instrumentation and Measurement, and the Faculty Course Development Grant, to support and encourage faculty members to develop a new course or significantly revise an existing course with specific focus on Instrumentation and/or Measurement, taught in an engineering/physics/science curriculum. Details on the grants can be found in the Education area of the I&M website ([www.ieee-ms.org](http://www.ieee-ms.org)). For questions, please contact Kristen Donnell ([kmdgfd@mst.edu](mailto:kmdgfd@mst.edu)).