

*The IEEE Instrumentation & Measurement Magazine*  
*April 2016 Issue*

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*Instrumentation and Measurements is Worldwide:  
Highlighting Region 10*

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*Editorial*

**IM Around the World**

Wendy Van Moer

Instruments and measurements, we use them all day long, in our professional as well as our daily life, everywhere around the world. From now on, each April issue of *Instrumentation and Measurement Magazine* will be dedicated to a specific IEEE region. It will allow the different regions to show to the rest of the world their work in the field of I&M. What kind of I&M research is going on in that particular region? What are the difficulties? Where do they put the focus?

This April issue is dedicated to IEEE Region 10. Our guest editor is Prof. Ruqiang Yan, from the School of Instrument Science and Engineering, Southeast University, China. He is also a member of the Administrative Committee of the IEEE IM Society. It was a great pleasure to work with him on this issue, and I would like to take the opportunity to thank him for his dedication and valuable time.

Welcome to Region 10!

Groetjes,  
Wendy

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*Guest Editorial*

**Instrumentation and Measurement around the World: Region 10**

Ruqiang Yan

Instrumentation and measurement have made significant contributions to various science and engineering domains. With the rapid advancement of electronics, communication, and computer technology, we are also witnessing new development of instrumentation design and measurement methods around the world. As a young faculty member working in the field, it is a great honor for me to organize this special issue with the goal of introducing research activities related to instrumentation and measurement in the IEEE Region 10, which is also referred as Asia Pacific Region and covers a geographical area stretching from South Korea in the north-east to New Zealand in the south to Pakistan in the west. In this special issue, five papers from researchers in Region 10 were invited to present various aspects of the instrumentation and measurement.

The paper written by Professor Aiguo Song (China) introduces the curriculum of higher education of measurement control and instrumentation specialty in China. He uses the Southeast University as an example to illustrate the education of instrumentation and measurement for undergraduate students. The paper written by Professor Xuefeng Chen (China) provides an overview of wind turbine monitoring and diagnosis activities in China, where the hardware structure and software implementation of the monitoring and diagnosis systems are discussed. The paper written by Professor Subhas Mukhopadhyay (New Zealand) talks about some of the research and development activities on instrumentation and measurement happening in New Zealand, especially the research activities of the Smart Sensing and Intelligent Systems Group of Massey University. The paper written by Professor Amitava Chatterjee (India) elaborates, with extensive examples, the development of a novel real-time biometric identification system utilizing Near-Infrared (NIR) imaging of Palm Dorsa Subcutaneous Vein Pattern (PDSVP) as a physiological biometric feature. The paper written by Professor Sergey Kharkovsky (Australia) describes the design of a 3-axis multifunctional imaging system with microwave and laser sensing techniques and demonstrates its applicability to non-contact detection of metal and dielectric targets embedded in layered structures and to cracks on the surface of tilted and cylindrical specimens.

I hope the readers will find this Special Issue interesting and informative. I would like to express my sincere appreciation to the Editor-in-Chief, Professor Wendy Van Moer, for her support and

valuable advice. You may contact Dr. Yan at Ruqiang@seu.edu.cn. His bio is available at <http://iee.ims.org/contacts/ruqiang-yan>.

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## *Article Summaries*

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### *Non-contact Inspection of Construction Materials Using 3-axis Multifunctional Imaging System with Microwave and Laser Sensing Techniques*

(Summary)

Sergey Kharkovsky, Paritosh Giri, and Bijan Samali

In this paper, the design of a 3-axis multifunctional imaging system with microwave and laser sensing techniques is described, and the results of its application to non-contact testing of construction materials are presented. This system can provide automated control of the movement of sensing units including a microwave antenna and a laser displacement sensor for contour following, optimization of standoff distance, and two imaging capabilities. The applicability of the system to non-contact detection of metal and dielectric targets embedded in layered structures and flaws such as cracks on the surface of tilted and cylindrical specimens has been demonstrated.

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

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### *Real-Time NIR Imaging of Palm Dorsa Subcutaneous Vein Pattern Based Biometrics: An SRC Based Approach*

(Summary)

Sandip Joardar, Amitava Chatterjee, and Anjan Rakshit

With the advancement in biometric recognition techniques, Palm Dorsa Subcutaneous Vein Pattern (PDSVP) has emerged as a reliable and promising physiological biometric feature. However, the procedure of automatic data acquisition and PDSVP extraction is quite challenging. This article shows how this problem can be addressed in practice where a real life biometric identification system has been developed utilising near infrared (NIR) imaging of

PDSVP of humans, where no fixed setup is employed for data acquisition. The paper highlights three key ideas: automatic data acquisition, PDSVP extraction and, subsequently, biometric person identification using sparse representation based classification.

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

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## ***Wind Turbine Condition Monitoring and Fault Diagnosis in China***

(Summary)

Xuefeng Chen, Ruqiang Yan, and Yanmeng Liu

In this article, the authors introduced some of the research activities regarding the development of wind turbine condition monitoring and fault diagnosis systems at a collaborative innovation center of high-end manufacturing equipment in China. In particular, a key technique based on sparsity theory has been developed to monitor and diagnose wind turbines running in variable speed conditions.

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

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## ***Research Activities on Sensing, Instrumentation, and Measurement: New Zealand Perspective***

(Summary)

Subhas Mukhopadhyay

The research activities on sensors, instrumentation, and measurement in New Zealand are vibrant and dynamic. This report provides a glimpse of some of the research and development activities happening recently. The report's basis is the papers presented at workshops of the IEEE IMS New Zealand chapter over the last few years, along with special emphasis on the activities of the Smart Sensing and Intelligent Systems Group (S2IS) of Massey University, New Zealand.

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

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## ***Higher Education of Measurement Control and Instrumentation Specialty in China***

(Summary)

Aiguo Song and Lihui Wang

In China, attention to the education of measurement control and instrumentation has increased since 1997, when the Measurement Control and Instrumentation Specialty was redefined and approved by the Ministry of Education of China. The Measurement Control and Instrumentation Specialty is a broad-range discipline involved with optics, mechanics, electronics and computer technology. In this paper, the authors introduce the specialty-training goal and curriculum for undergraduate students. They selected the Southeast University in China as an example to illustrate the education of measurement and instrumentation for undergraduate students.

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

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## *Spectrum Sensing Challenges: Blind Sensing and Sensing Optimization* (Summary)

Mohamed Hamid, Slimane Ben Slimane,  
Wendy Van Moer, and Niclas Björsell

By any measure, wireless communications is one of the most evolving fields in engineering. In this regard, cognitive radio (CR) based on dynamic spectrum access (DSA) has been attracting huge attention as a promising solution for more efficient utilization of the available radio spectrum. DSA is based on finding and opportunistically accessing the free-of-use portions of spectrum. To facilitate DSA, spectrum sensing can be used. However, spectrum sensing faces many challenges in different aspects. Such aspects include blind sensing and sensing optimization, which are both to a great extent measurement challenges. The authors discuss different contributions in addressing these two challenges in this article.

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## *Columns*

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### *Basic Metrology*

**Is the Universe Shaking?**

Bryan Kibble

This month's column includes a discussion of gravitational waves, at which time the author indicated they had not been directly observed. Circumstantial evidence, he suggests, no matter how strong, is not totally convincing for the human mind. There is always the possibility that we are the victims of a coincidence in that the energy loss could have some other cause, which just happens to be the right amount. It is therefore gratifying that several efforts are under way to detect directly the effect of a gravitational wave on separated test masses as it passes through our solar system. But these efforts involve pushing the limits of present observational technology to an incredible extent."

*This summary includes text from the article.*

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## *Future Trends in I&M*

### **Future Measurement Technology is Not Always about New Technology**

Jenny Wirandi

Dear readers,

My guest author for this issue is Jenny Wirandi, from Sweden. I am happy that her contribution comes immediately after Mohammed Khalil's one (February 2016 issue), when he highlighted, with his own experience, the gap between research and industry. In fact, Jenny is showing us an example where this gap has been filled, providing also enthusiastic economical results.

Curious readers, I immediately leave you to her experience!

Until the next issue,

*Simona*

*This text introduces the column and was written by Simona Salicone.*

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## *Life After Graduation*

### **Who's the Boss?**

Max Cortner

Although the focus of most managers is directing work and rating their employees, the best managers seek long term results by addressing the real needs of their engineers. The best bosses

get to know their engineers interests as well as their talents. For any given project, the assignments of all team members can't be optimized. But with an understanding of your interest, it is more likely that the boss will assign you to the task you want. In a matrix organization, your boss can guide you to projects that match your interest. These opportunities will allow you to shape your own career as well as setting you up for performance success and a promotion. It's up to you to be the boss of your career!

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## *Departments*

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### *New Products*

Robert Goldberg

Please send all "New Products" information to:

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### **PXI Solid State Multiplexer**

Pickering Interfaces announces the launch of a new 5 Amp PXI Solid State Multiplexer. This new Solid State Multiplexer (model 40-652) was originally designed for a large defense contractor looking for a multiplexer that could handle large inrush currents. The 40-652 MUX series offers a range of configurations suitable for hot or cold switching signals up to  $\pm 100$  V at 5 Amps. The use of solid-state relays allows the hot switching of signals without any life degradation, including DC signals that EMR (Electro-Mechanical Relay) designs can only handle with much-reduced service life and power handling. The design is capable of switching inductive loads up to a stored energy of 20 mJ and is capable of withstanding 30 Amp inrush currents for 300  $\mu$ s when switching capacitive loads. The multiplexer module is available in single pole 48:1, two pole 24:1, single pole dual 24:1 or single pole 24:1 configurations.

The use of solid-state relays also ensures a fast, typical operating time of 85  $\mu$ s, making it ideal for use in applications where the speed of test is critical. This range is also supported by Pickering Interfaces eBIRST switching system test tools. These tools provide an easy to use solution to quickly identify faulty switching systems.

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

### **Functional Tester Supports M2M/IoT Integration**

Machine-to-machine communications (M2M) and the Internet of Things (IoT) are leading the way into an increasingly networked world. The R&S CMW290 functional radio communication tester from Rohde & Schwarz is for users who want to integrate wireless modules into their platforms and test them.

Wireless technologies such as LTE, Bluetooth®, and WLAN make it possible to connect devices with the Internet or with each other anywhere and everywhere. Manufacturers who integrate wireless modules into devices must ensure the correct functioning of the target platform and the applications. Rohde & Schwarz has specifically designed its economical R&S CMW290 functional radio communication tester to meet the requirements of integrators with mostly cost-sensitive applications.

Users from the M2M/IoT sector typically require only simple functional tests for hardware and applications. The R&S CMW290 therefore offers all essential measurements for RF or hardware testing. For end-to-end testing of applications, the R&S CMW290 can simulate a cellular network and set up a connection between the application on the device or system and the server. This enables users to check the correct functioning of platforms with integrated wireless module in a defined network. The R&S CMW290 supports all cellular and noncellular standards.

Find more information about Rohde & Schwarz at [www.rohde-schwarz.com](http://www.rohde-schwarz.com).

### **Mixed Domain Oscilloscope**

Tektronix, Inc. introduces the MDO4000C Series of Mixed Domain Oscilloscopes that can be configured with up to six instruments in a single unit including a full spectrum analyzer. Starting with the highest-performance oscilloscope of any 6-in-1 instrument from Tektronix, engineers can upgrade their MDO4000C instruments over time to meet their most demanding challenges and add functionality as needs change or budgets allow.

As with previous generations in the MDO4000 series, the MDO4000C provides a synchronized view of analog and digital waveforms along with RF spectrum traces, making it the ideal debug tool for Internet of Things (IoT) and many other embedded engineering applications. Like the 6-in-1 MDO3000 introduced last year, the MDO4000C expands on its core oscilloscope functionality with options to add a spectrum analyzer, arbitrary/function generator, logic analyzer and protocol analyzer. A digital voltmeter (DVM) is available for free with product registration.

As an oscilloscope, the MDO4000C features long record length, fast sample rate and fast waveform capture rate to help uncover elusive problems.

Compared to standalone instruments, the MDO4000C saves time lost from having to look for and configure instruments and delivers outstanding value without compromising on performance. It also enhances usability through integration. For instance, the built-in arbitrary waveform generator makes it easy to capture signals on the scope, modify them, and then replay them through the generator, enabling margin testing by making it easy for users to add noise to any signal.

For more information, go to [www.tektronix.com/mdo4000](http://www.tektronix.com/mdo4000).

### **Advanced Electronic Warfare Simulation**

Giga-tronics Incorporated and D-TA Systems Corporation have announced the joint development of an advanced Electronic Warfare signal simulation system.

The ability to accurately model the electromagnetic threat environment and key emitter characteristics is the key to testing and evaluating state-of-the-art electronic warfare equipment. In partnership with D-TA Systems, Giga-tronics offers a broadband, wide instantaneous bandwidth solution through a powerful combination of the GT-ASGM18A Advanced Signal Generator and D-TA's System-95 IF processing system. System-95 features the DTA-9500 ultra-wideband digital IF transceiver and the DTA-5000 RAID Server.

The D-TA and Giga-tronics partnership has created a paradigm shift in EW threat simulation. A real-life RF threat environment can be readily created by playing out pre-recorded and/or simulated data.

For more information, please visit [www.gigatronics.com](http://www.gigatronics.com) and [www.d-tacorp.com](http://www.d-tacorp.com).

### **Next Generation Human Vibration Meter**

Larson Davis, a division of PCB Piezotronics, Inc., announces the release of the new HVM200 Human Vibration Meter that implements the latest measurement technology for industrial hygiene and product testing applications.

The HVM200 is used to measure human exposure to vibration in order to prevent injury and better understand workplace hazards and product performance. The HVM200 includes the functionality needed to measure the hand-arm vibration and whole body vibration requirements in support of the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and directive 2002/44/EC of European Parliament.

This meter provides options available for 1/1 and 1/3 octave filters (0.5 Hz to 2000 Hz and 0.4 Hz to 2500 Hz respectively) and raw vibration data recording. Data can then be archived or transferred using USB, Wi-Fi or a removable micro SD memory card.

Industrial hygienists and product test engineers can now leverage the power of their phones or tablets by acquiring the free app available on Google Play™ and the Apple App Store. This app

can be used in conjunction with the HVM200 to setup a test, make the measurements, and view the results.

Vibration data taken with the HVM200 can also be viewed and analyzed on a personal computer using the HVM option for the Larson Davis G4 software. With the G4 HVM software option you can download data and view it in graphical or tabular format. You can also perform “what-if” analyses by graphically modifying the data and recalculating results. Then a report can be generated and the data can be exported for archival or further processing.

For more information about HVM200 visit [www.larsondavis.com/HVM200](http://www.larsondavis.com/HVM200).

### **Multichannel Streaming and Recording on a Wideband Digital Receiver**

Keysight Technologies, Inc. introduces multi-module synchronization for its M9703B AXIe (AdvancedTCA Extensions for Instrumentation and Test) high-speed digitizer/wideband digital receiver – increasing the total number of streaming and recording channels available with the M9703B. The new bundles options (-CB1/-CB2) enable multichannel phase coherent digital down conversion (DDC) which has applications in 5G, Radar and Satellite Communications, and Aerospace & Defense.

With up to 320 MHz instantaneous bandwidth (IBW) with tunable intermediate frequency, this high-speed digitizer meets the needs for new technology development in 5G wireless mobile broadband. Used with the recommended host computer configuration, the new options allow guaranteed recording time, storing all I/Q samples for later analysis. A command line software application is included in the bundle for an easy launch and control of the streaming and recording.

As a component of the Keysight solution, the M9703B AXIe high-speed digitizer/wideband digital receiver (bundles -CB1/-CB2) allows customers to quickly characterize the channel behavior in these frequency bands and enables researchers to develop the necessary channel models for designing and validating air-interface alternatives.

For other applications where gapless streaming and recording is not required but there is a need to simultaneously read while acquiring, the new signal processing firmware (-TSR option) enables simultaneous capture and transfer of triggered acquisition data to the host computer.

Highlights Include:

- New bundle options allow multichannel digital down conversion streaming and recording capability on a wideband digital receiver
- Ideal for applications in 5G, Radar and Satellite Communications, and Aerospace & Defense, and
- Guaranteed recording time, storing all I/Q samples up to full-storage capability of host computer for long-duration frequency post-analysis.

Information about product configuration is available at [www.keysight.com/find/M9703B](http://www.keysight.com/find/M9703B).

### **Bluetooth-Enabled Data Logger**

Lascar Electronics introduces the latest addition to its EasyLog family of data loggers - the EL-BT-2, its first Bluetooth-enabled temperature and humidity sensor providing users with wireless monitoring via their Android phone or tablet. Available from the Google Play store, the App allows Android users to wirelessly configure the data logger for use, retrieve and view graphed and tabulated data from the device, view alarms as well as email saved data to third parties. This remote monitoring solution is vital in applications where loggers need to be left in situ at all times, and extremely useful for any other users who would rather not physically handle their data logger during set-up or data download.

The easy-to-use app provides an animated walkthrough, enabling users to set the sample rate, temperature scale, temperature and humidity alarms, Bluetooth power-save settings, LCD settings, and variable start times. Data can then be downloaded from the sensor wirelessly at any time, for viewing on any Android device. Data stored on the Android device's memory card and app allows users to send readings to another device or Windows PC for further analysis, via email or another cloud service.

The compact EL-BT-2 data logger can store up to 500,000 temperature and humidity readings, with a measurement range of -20 to +60 °C (-4 to +104 °F) and 0-100% RH. The unit's LCD screen details current, minimum and maximum readings alongside a status indicator for a direct indication of the environment it has been exposed to without using the App. A rechargeable lithium ion battery with a battery life of up to one year powers the device or the unit can be plugged into an AC power source permanently.

Accurate monitoring and logging of environmental data is absolutely crucial to the role of the modern Facilities Manager and others, whether monitoring a large-scale cold supply chain, or just simply checking on the general work environment for employees. The EL-BT-2's wireless function makes environmental monitoring significantly easier, especially for smaller FM teams. Please visit [www.easylogbt.com](http://www.easylogbt.com) for further information.

### **Digital Oscilloscopes**

Siglent Technologies introduces a new line of digital oscilloscopes with Super Phosphor (SPO) technology. This new SDS2000X Series is available in bandwidths of 70 MHz, 100 MHz, 200 MHz and 300 MHz, with real time sampling rates up to 2 GSa/s. Most common functions can be accessed with a single-button control.

The advanced technology features of these new scopes include waveform capture rates up to 500,000 wfms/s, record length up to 140 Mpts, and 256-level color and intensity grading display. An innovative trigger mode includes: Edge, Slope, Pulse, Window, Runt, Interval, Dropout, Pattern and HDTV Video. Low background noise supports 1 mV/div to 10 V/div voltage scales.

The family of SDS2000X Super Phosphor Oscilloscopes includes an array of measurement and math capabilities, with options for a built-in 25 MHz arbitrary waveform generator, 16 digital channels (MSO), and serial decoding. All scopes include Siglent's 8-inch TFT-LCD display with 800 x 480 resolution, and supports auto detection of 10X probe with read-out port. I/O interfaces include USB Host, USB Device, LAN, Pass/Fail, Trigger Out and GPIB (optional). The History function can record up to 80,000 frames of waveforms, easily accessible from the control panel.

A full range of current and voltage probes are available.

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

### **Scientific Camera with High Frame Rates and Megapixel Resolution**

Princeton Infrared Technologies, Inc. introduces the 1280SCICAM shortwave infrared (SWIR) camera that delivers long integration times and the high frame rates at megapixel resolution. Princeton claims the 1280SCICAM provides the longest integration times and the highest frame rates available on the market today. The lattice-matched indium gallium arsenide (InGaAs) sensor features 1280 x 1024 resolution at frame rates greater than 95 frames per second (fps) at full-frame size and operates in the visible to shortwave infrared spectrum from 0.4  $\mu\text{m}$  to 1.7  $\mu\text{m}$ . The camera's small 12-micron pitch, coupled with the low read noise (75% from 1.0 to 1.6 microns) of the imaging array, make the new camera ideal for scientific imaging tasks in the SWIR and visible wavelengths. Other applications include high-speed machine vision and long-range surveillance operations where the small pitch is especially important.

A 3-stage thermoelectric cooler (TEC) is integrated into a vacuum package to provide the 1280SCICAM with three temperature setpoints for different conditions, 25 °C (no cooling), 0 °C (fan-cooled), and -50 °C (water-cooled).

The on-board array has 14-bit digital output, snapshot exposure with no image lag and features an unprecedented low read noise of  $<30\text{e}^-$ , which is lower than any other cooled SWIR scientific camera currently available. Princeton IR Tech's advanced SWIR-InGaAs camera has a medium-base Camera Link® to support fast fullframe-rate imaging. The camera's high dynamic range ratio is greater than 3000:1, with integration times ranging from 50 microseconds to more than 3 minutes. The new 1280SCICAM is available with F- and C-mount lenses.

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

### **New Line of High Efficiency Power Supplies**

IDEC Corporation announces the PS5R-V line of DIN-rail power supplies, offering high-efficiency in a compact form factor. These power supplies suit a wide range of needs and carry all of the required certifications necessary for use in demanding applications. This next generation of the industry standard PS5R power supply family has updated features and specifications to meet current and future needs.

The PS5R-V line of power supplies includes 10 W, 15 W, 30 W, 60 W and 120 W versions, with additional versions coming soon. These power supplies have a very compact form factor with overall dimensions reduced by up to 25% from previous generations. The reduced form factors combine with DIN-rail mounting to free up valuable control panel space and reduce installation costs.

Operating temperature ranges from -25 °C to +75 °C offer more versatility. These extended operating temperature ranges often allow these power supplies to be used in control panels without the need for air conditioning or other cooling devices. In addition, operating efficiencies have been significantly improved, up to 16% from previous generations.

The PS5R-V line of power supplies is approved for installation in Class I Division 2 environments in standard control cabinets, making them ideal for use in hazardous location applications such as oil and gas processing and petrochemical facilities. These power supplies add to IDEC's current line of products approved for installation in hazardous areas.

Certifications and approvals include UL 508, UL 1310, SEMI F47 and RoHS. Meeting these stringent industry standards requires the use of very reliable components, resulting in an MTBF of up to 900,000 hours for this line of power supplies.

For complete specifications or additional information on the PS5R-V line of power supplies, please visit [http:// powersupply.idec.com/](http://powersupply.idec.com/).

**PC-Based Waveform Acquisition Operates up to the GHz Range**

For applications requiring extended electronic waveform acquisition and generation, Spectrum has announced a new storage system that works with its PC-based digitizer and generator cards to dramatically increase possible recording and replay times. The new system can be used with any of Spectrum's M2i, M3i or M4i series of PCIe digitizer or waveform generator cards and delivers data storage sizes from 1 to 32 TB with full support for continuous data streaming at rates up to 3 GB/s. The combination makes it possible to capture high frequency signals up to the GHz range and continuously store them for hours on end or lower frequency signals for even longer periods of time.

Each Tera-store system can house up to six digitizer cards, making it possible to configure instruments with 1 to 96 fully synchronous acquisition channels. If more channels are required then a 16 slot April 2016 IEEE Instrumentation & Measurement Magazine 57 docking station can be added to expand the system up to 256 channels.

At the heart of the platform is a carefully selected, base PC system. This powerful computer includes a Supermicro 4U/ Tower with 8 drive bays and 6 free PCIe slots for digitizer or generator cards.

The Tera-store streaming solutions are complete turn-key systems and come factory configured with Spectrum's Sbench 6 Professional software for digitizer control, data capture, display and analysis.

The systems are available with a choice of streaming rates, from 400 MB/s up to 3 GB/s, and storage capacities, from 1 TB to 32 TB. The various options consist of a high performance RAID controller and a number of solid-state or hard-disk drives (SSD/HDDs) that are configured to support the required transfer rates and storage times.

Tera-store systems are suited to applications where continuous data acquisition or replay is required or large volumes of data need to be collected, stored and analyzed.

For more information, visit [www.spectrum-instrumentation.com](http://www.spectrum-instrumentation.com).

## **New Motion Controllers for Ultrasonic Piezo Positioners**

PI (Physik Instrumente) L.P. now offers a new line of controllers for ultrasonic direct-drive motors and positioning stages. The new controllers offer greater flexibility and responsiveness to user requirements ranging from precision positioning to handling.

Positioning systems based on ultrasonic ceramic directdrive motors (PIline®) provide very high dynamics and resolution in a compact, low-profile package. PI now offers a new line of motion controllers for these positioning systems to address the requirements for OEMs and research customers.

The new C-877.1U11 single axis controller is as small as a deck of cards and priced significantly below the standard single axis controller offered in the past. In addition, a new low-cost 2-axis controller is also available.

The digital servo circuit of the new controllers (automatic switchover between static and dynamic PID parameters) takes into account the properties of ultrasonic motors to achieve maximum dynamic performance with settling times as low as a few 10 milliseconds without sacrificing resolution and smooth operation.

All ultrasonic motors provide fast acceleration and velocities of 100s of millimeters/second. At the top of the spectrum, the new C-867.262 multi-phase controller allows for extremely smooth motion with velocities as small as 1µm/sec and below.

Positioning stages are equipped with an ID chip in the connector, and during start-up the ultrasonic drives identify themselves to the controller, loading the matching operating parameters automatically. The controllers are delivered with extensive software packages, including drivers for LabVIEW as well as dynamic libraries for Windows and Linux.

For more information, please visit [www.pi-usa.us](http://www.pi-usa.us).