

The IEEE Instrumentation & Measurement Magazine

February 2018 Issue

FabLabs around the World

Editorial

2018?? Already??

Wendy Van Moer

Yes, it is already 2018! Time is flying... but let's look at the bright side of it. We have 365 new days to live, love and enjoy life. And, on top of that, 365 new days to read and enjoy our magazine!

A lot of new topics, new articles and new discussions are coming your way in 2018!

This February issue is dedicated to the Fabrication Laboratories all around the world!

A couple of years ago FabLabs were new and rare. Now you can find them almost everywhere.

But what is a FabLab?

This is what the official definition says: FabLab– digital fabrication laboratories– were set up to inspire people and entrepreneurs to turn their ideas into new products and prototypes by giving them access to a range of advanced digital manufacturing technology (<http://www.fablabni.com/what-fablab.html>).

The idea was conceived by renowned inventor and scientist Professor Neil Gershenfeld at the prestigious Massachusetts Institute of Technology (MIT). His idea was a simple one: to provide the environment, skills, advanced materials and technology to make things inexpensively and quickly anywhere in the world, and to make this available on a local basis to entrepreneurs, students, artists, small businesses and in fact, anyone who wants to create something new or bespoke.

To me, a FabLab is a place where everyone can enjoy instrumentation and measurement... a place where everyone can bring their creative ideas to life, without even realizing that they are fully overwhelmed by instrumentation and measurement! A perfect place to introduce children into instrumentation and measurements...

Enjoy this first issue of the year, because before you know 2019 will be knocking on your door...

Groetjes,
Wendy

President's Message

New Year, Continuing the Journey

J. Max Cortner

Greetings and best wishes for a happy and prosperous new year from the Instrumentation and Measurement Society!

As engineers we often are faced with problems, and our first step is to assess the resources available to help us solve them. The IEEE Instrumentation and Measurement Society (IMS) faces many of the same pressures and problems of the IEEE as a whole. As the new President of the IMS, I am greatly encouraged by the resources we have to solve them. It amazes me that people of such high caliber are dedicated enough to their profession to volunteer significant amounts of their valuable time. As members of the IMS, you have elected some wonderful people to provide leadership on the Administrative Committee (AdCom). I am truly honored to be serving as President of your society in 2018, and I believe I am well equipped through the talent on the AdCom to address our needs as a profession.

Many of the members of the AdCom continue from last year, and we had a great year in 2017! I owe a great debt of gratitude to Past President Ruth Dyer for her leadership. During 2017 we underwent examination as a society during our five-year Publications Review in February and again in our five-year Society Review in June. Both of these independent committees gave us

high compliments and recognized many best practices that we have developed over the years. The foundation of these is our deliberate IMS strategy to address all aspects of our organization and the actions that flow from it. Please feel free to contact any of the officers listed at the end of the article.

Early in the year, I have the pleasure of reviewing and refining that strategy (which can be found on our website: iee-ims.org) with the 2018 slate of AdCom Officers and Editors-in- Chief. We will set goals for each committee and review the mission of the IMS to:

- Provide the most comprehensive and high-quality services to our members and related professionals
- Serve as the professional incubator for the growth of all (particularly younger) members and
- Be in the forefront of future I&M technological advances.

We will review the metrics accumulated in 2017 and grade ourselves on our effectiveness at serving you, our members. In 2018, look for expanded conferences in number and content, enhanced publications (*Transactions on Instrumentation and Measurement* and the *I&M Magazine*), great Distinguished Lecturers, and Video Tutorials. Watch the website and read the newsletter, because we will have additional offerings as the year goes on. This is a dynamic time for the IMS and we have great things in store. Watch us! Better yet, get involved and join us in improving our great organization.

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Max

Article Summaries

IAMM Sensor City—A Global Innovation Hub for Sensor Technology

(Summary)

Roberto Ferrero, Elizabeth Beattie, and Joanne Phoenix

The fourth industrial revolution technologies, including Big Data, autonomous systems, systems integration and cloud computing, are transforming modern manufacturing by enabling the generation and analysis of digital data that supports the development of smarter products, processes and supply chains. Innovation in this sector is also happening at a very fast pace. Strengthening the link between academia and industry is therefore essential to guarantee that academic research in instrumentation and measurement gets rapidly to the market, and at the same time, innovative ideas from industry get the necessary academic support. This is where Sensor City can help.

This text is from introduction of the article.

Academic FabLabs for Industry 4.0: Experience at University of Naples Federico II

(Summary)

Leopoldo Angrisani, Pasquale Arpaia, Francesco
Bonavolonta, and Rosario Schiano Lo Moriello

The birth and the first steps of the HT FabLab founded at the University of Naples Federico II aim to valorize an innovative teaching experience inspired by business, the makers movement. In particular, students continue to take advantage of the skills acquired to engage in a series of

multidisciplinary projects, suggested by the teachers, with applied research features and achievable by the innovative techniques of digital craft-work in IoT, Industry 4.0, biomedicine, and so on. Hence, the need to team up, and to acquire spaces/workshops and materials for extracurricular activities to usefully complement theoretical teaching, was realized by HT FabLab. The initiative met the favor of DIETI, the PBS School, and the University. These institutions see HT FabLab as an opportunity to transform potential spin-off ideas and projects, attract local industry partners in need of profound transformation, and seek innovate technology during the economic crisis, and above all, provide enrichment of the training offered to engineering students.

This text is from the conclusion of the article.

Instrumentation and Measurement Testing in the Real-Time Lab for Automation of Complex Power Systems

(Summary)

Ferdinanda Ponci, Abhinav Sadu, Robert Uhl, Markus Mirz,
Andrea Angioni, and Antonello Monti

This paper presents an overview of the portion of the real-time simulation laboratory of the Institute for Automation of Complex Power Systems at RWTH Aachen University, dedicated to the testing of instrumentation, measurement and monitoring applications. Its key feature is the ability to test monitoring systems and complex monitoring methods as integrated systems as well as a set of individual components. This is made possible by testing platforms that accommodate a mix of interoperable real and real-time simulated components and include communications, databases, and protocols that are representative of the field deployment of the monitoring system.

This text is from the introduction of the article.

A 3D-Printable Instrument to Improve Force Vector Measurement in CPR Training

(Summary)

Gries F. M. Silva-Calpa, Carina C. Teixeira, Felipe C. Marx,
Jauvane C. de Oliveira, and Shervin Shirmohammadi

In this paper, the authors present a practical, portable and low-cost CPR system to measure force vector and frequency of CPR compressions. They built a 3D component to methodically attach a standard Little Anne CPR training manikin to a Nintendo Wii Balance Board. CPR compressions performed on the manikin are plotted by our software (Windows or Android version). This system shows, in real time, the performance of the user related to the force, angle and frequency of the CPR compressions, allowing self-evaluation for the improvement of CPR practice. The authors highlight that, unlike other CPR training systems, this system measures the angle at which the compressions are performed, which is an essential measure in a real CPR situation. Moreover, this system shows the user's objectively measured performance and removes the possible subjectivity of the human trainer.

This text is from the conclusion of the article.

Internet of Things for Smart Ports: Technologies and Challenges

(Summary)

Yongsheng Yang, Meisu Zhong, Haiqing Yao, Fang Yu,
Xiuwen Fu, and Octavian Postolache

Nowadays, the Internet of Things can be considered an important technological revolution related to smart cities, smart homes, smart factories and smart ports implementations. As the presence of smart sensing systems in ports becomes a reality, different operation areas are working today in automatic mode. This paper highlights the main requirements and the key ideas for each ports' sensing solution and also the challenges related to the calibration and testing of distributed sensing systems associated with the main equipment that compose the world largest ports such as quayside cranes, automated guided vehicles for container handling and yard cranes. Details of the architecture and operations and sensing systems for smart ports are described. Communication standards for smart ports are discussed, and smart ports implementation examples regarding structural health monitoring are considered.

This text is from the introduction of the article.

Length Measurements in Ancient Greece: Human Standards in the Golden Age of the Olympic Games

(Summary)

Luca Parvis

Standards are quickly moving towards quantum metrology and provide extremely low uncertainties, which let people perform highly accurate measurements. Yet in the golden age of the early Olympic Games, most standards were based on human elements and were limited by their poor reproducibility. This paper discusses the old standards of length, their differences between cultures and places, their large uncertainty and, notwithstanding this, their great importance in the natural evolution of humanity.

This text is from the introduction of the article.

Making Sleep Study Instrumentation More Unobtrusive

(Summary)

Jaspal Singh and R. K. Sharma

Insights into the complex behavior of physiological systems, applications of advanced computational techniques, shrinking electronics and advanced wireless technologies are being applied to sleep study instrumentation. After a short review of standard polysomnography, this article takes a look at the research directions that promise a new era of patient-friendly sleep study instrumentation.

This text is from introduction of the article.

Estimating the Specific Heat Capacity and Heating of Electronic Sensors and Devices

(Summary)

Ilkka Korhonen and Jero Ahola

This article studies the specific heat of electronics by reference to theory and empirical tests. An experimental value for the specific heat capacity of standard electronic components is

determined. The value can be used for estimation of heating of electronics in a closed case. The second part of the paper focuses on modeling, simulation and empirical tests of heating of electronics in a closed, insulated enclosure.

This text is from introduction of the article.

Columns

Basic Metrology

(Summary)

Zeroth Laws – Hiding in Plain Sight

Richard Davis

The most famous and widely accepted “zeroth law” is the zeroth law of thermodynamics. The first and second laws were already in place, but a preliminary law was seen to be missing, perhaps because it was too “obvious.” The missing piece postulates the existence of temperature and provides the rationale behind instruments (thermometers) that can measure temperature. It is this metrological oversight that makes this zeroth law and others like it a fit subject for a column on basic metrology.

This text is from the introduction of the column.

Life After Graduation

(Summary)

Succession to a Maker

Erik Timpson

This month’s column introduces the new columnist for Life After Graduation, Erik Timpson. In his first installment, the author introduces the concept of a FabLab. Using a local space as an example, he enthusiastically discusses the important role in being “maker spaces” for innovators. He encourages readers to “(1) find a fab lab by you, (2) make a cool instrument or measurement, and (3) write about it ... to be included in the next issue.”

Future Trends in I&M

(Summary)

I&M in Energy Efficiency

Santiago Barcón

Besides a gradual shift to renewables, the main opportunity lies in Energy Efficiency: do the same with less energy. Advances have been made but a long road is still ahead, and reductions of up to 25% are possible in existing buildings and homes. In some cases even more can be achieved. The advances in electronics allow us to measure in an economical way even the smallest loads, to integrate them, analyze and decide— with the adequate algorithms— the actions to be taken.

This text is from the body of the column.

Society News

TC-42 Photonic Technology in Instrumentation and Measurement

George Xiao

Photonics plays a critical role in everyday life. Telecommunications, sensor technology, medicine and spectroscopy, to name a few, all rely on this 20th-century discovery. Photonic technology is increasingly used in instrumentation and measurement for applications in the oil and gas industry, electric power systems, aerospace missions, transport, civil structure, military, defense, ocean exploration, biomedical detection, environmental monitoring and other areas. The field is related to many of the fastest evolving engineering professions in a challenging time but with increasing opportunities.

This committee aims to bring together experts in the field and maintain associations with other technical committees in the Instrumentation and Measurement Society (IMS) and other societies in the related areas, develop standards in the field as appropriate, as well as to organize special sessions in IMS-sponsored conferences and organize special issues for IEEE journals.

The goals of this committee are to:

- Promote and disseminate technical information related to the fields listed below via workshops, lectures, and technical papers:
 - Photonic technology in the sensors and instrumentation of industrial and clinical areas that include:
 - chemical, medical and biological applications
 - indoor/outdoor environmental monitoring and
 - structural health monitoring
 - Photonic instrumentation for optical fiber communication applications
 - Novel photonic concepts and techniques for the measurement of physical, chemical and biological parameters
 - Micro- and nano-scale photonic sensors
 - Multiplexed and distributed photonic sensor networks
 - High speed photonic instrumentation and measurement systems
 - Photonic sensor fusion and big data
 - Photonic technology for chemical, environmental, biological and medical measurement
 - Interferometric and polarimetric photonic sensors
 - Micro- and nano-structured fiber and waveguide sensors
 - Photonic multiplexing and sensing networking
 - Distributed photonic sensing
 - Smart photonic devices, structures and systems
 - Photonic sensing applications, field tests and standardization
 - New concepts for photonic sensing
- Maintain connections with other groups, societies and organizations working in the related areas
- Develop standards in the field as appropriate
- Organize special sessions during the I2MTC and special issues in IMS sponsored IEEE/OSA *Journal of Lightwave Technology*

Chairs:

- Dr. Gaozhi (George) Xiao, National Research Council (Canada), FIEEE, IMS Representative for *Journal of Lightwave Technology*, IMS Representative for IEEE Council on RFID, Associate Editor of *IEEE TIM*, Chair of IEEE IMS TC-42. Email: George.Xiao@nrc-cnrc.gc.ca
- Prof. Tuan Guo, Jinan University (China), Guest Editor of *Sensors*, Associate Editor of *IEEE Sensors Journal*. Co-chair of IEEE IMS TC-42. Email: tuanguo@jnu.edu.cn

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Activities

- Organizing special issues for *IEEE/OSA Journal of Lightwave Technology*
- Organizing special sessions for I2MTC

TC-42 is currently calling for participation in the committee. If you are interested, please contact either Dr. George Xiao or Prof. Tuan Guo.

Departments

New Products

Robert Goldberg

Please send all “New Products” information to:

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5G RF Design Verification Test Toolset

Keysight Technologies, Inc. has announced the 5G RF DVT Toolset, claiming an industry-first network emulation solution for 5G radio design verification test. The new toolset cost-effectively scales from sub-6 GHz to mm Wave, and from pre-5G standards to new radio (NR).

The 5G RF DVT Toolset is the latest solution in Keysight's 5G network emulation solution (NES) portfolio. The 5G RF DVT Toolset is based on Keysight's UXM 5G wireless test platform and is the first-to-market 5G Protocol R&D Toolset. The toolset is engineered to ensure measurement traceability—from early prototyping to acceptance and manufacturing.

The 5G RF DVT Toolset uses Keysight's test automation platform (TAP), allowing the design engineer to easily create and customize RF and radio resource management (RRM) test cases with the highest degree of parametrization.

Highlights of the Toolset:

- Verify 5G devices with a rich RF measurement suite for conducted and over-the-air (OTA) test
- Validate 5G beamforming and beam management in new 5G devices with antenna arrays on-chip
- Verify 5G waveforms and numerology with flexible test case development, fast execution of test campaigns, and in-depth results analysis

More information about the 5G protocol R&D toolset is available at www.keysight.com/find/5G-Protocol.

New PXI and LXI Switching Solutions

Pickering Interfaces announces their latest high-density PXI and Ethernet LXI Switching and Simulation Solutions. These products include a 4-slot USB/LXI Modular Chassis (model 60-105) and the BRIC™ Ultra-High-Density PXI Matrix Modules (model 40-559).

The 4-slot USB/LXI Modular Chassis (model 60-105) complements Pickering's recently released 2-slot USB/LXI Modular Chassis in that they both offer a small, lightweight form factor ideal for portable, benchtop and space restrictive applications. These chassis are designed for desk or rack mounting and feature remote control via USB or LXI Ethernet. Remote control over a network enables the switching function of a test system to be located as close as possible to the target equipment. This new 4-slot chassis supports between one and four Pickering 3U PXI modules. Possible systems include switching matrices up to 2208 crosspoints or up to 72 channels of programmable resistor/sensor simulation.

Both the 2-slot and this new 4-slot chassis are USB 3.0 compatible and have a fully compliant LXI interface. These communications standards enable the chassis to be controlled directly through standard interfaces found on most personal computers and tablets that support HTML5, allowing for a very practical route into a variety of applications in the modular test and measurement market.

The BRIC™ Ultra-High-Density PXI Matrix Modules (model 40-559) are robust 1 Amp/20W switching modules, with up to 4,096 crosspoints. Constructed with Pickering Electronics' new miniature 4 mm x 4 mm Reed Relays, these new 1 Amp matrices have similar switch densities compared to 0.25 Amp, 0.3 Amp or 0.5 Amp high-density matrix solutions, providing far more robust and reliable switching in the same footprint. The matrices are available in 2, 4, or 8-slot PXI sizes and are designed for high performance matrix requirements. With their high level of switching density, these PXI matrices allow a complete Functional ATE system to be housed in a single 3U PXI or PXIe Hybrid chassis.

The 40-559 is available with Y-bus widths of x4, x6, x8, x12 and x16, the three smaller versions having the added versatility of a dual analog bus which allows each BRIC module to be programmatically configured as two totally separate matrices.

The range comes with Pickering's Built-in Relay Self-Test (BIRST) and is also supported by their eBIRST Switching System Test Tools. These tools provide a quick and simple way of finding relay failures within the modules.

For more information, visit www.pickeringtest.com.

Spectrum Analyzer Offer 5 GHz Signal Analysis Bandwidth

The Rohde & Schwarz FSW85 signal and spectrum analyzer now provides 5 GHz analysis bandwidth, which is required for analyzing wideband signals such as automotive radar FMCW chirp signals, IEEE 802.11ay signals and 5G waveform candidates.

Rohde & Schwarz is addressing the fast-growing demands for characterizing wideband components and systems by introducing the new R&S FSW-B5000 option. In combination with the R&S RTO2064 digital oscilloscope as an external digitizer, the R&S FSW85 signal and spectrum analyzer equipped with the new hardware option provides equalized 5 GHz signal analysis bandwidth.

The amplitude and phase response of the R&S FSW85, together with the R&S FSW-B5000 are fully characterized at the factory across the entire frequency range. The amplitude and phase measurement accuracy are guaranteed throughout the measurement bandwidth. The R&S FSW-B5000 supports center frequencies between 9.5 GHz and 90 GHz. For frequencies above 85 GHz, the R&S FSW85 needs to be equipped with the R&S FSW-B90G option, which extends the frequency range up to 90 GHz.

The transient and pulse measurement applications for the R&S FSW allow in-depth, wideband analysis of FMCW chirp signals and hopped and pulsed radar signals required for automotive radar applications. The R&S FSW-B5000 option also makes it possible to capture IEEE 802.11ay wideband signals for postprocessing and to perform measurements on waveform candidates for the future 5G standard.

For more information on the product, visit www.rohde-schwarz.com/ad/press/fsw.

Multi-Channel Arbitrary-Waveform Generator

Zurich Instruments announces the HDAWG, an arbitrary waveform generator with high channel density and short trigger latency (<50 ns). The HDAWG comes in either a 4 or 8 channel configuration, both offering a 16-bit output and signal cache of 500 MSamples per channel. The maximum sample rate is 2.4 GSa/s at a signal bandwidth of 750 MHz, and each signal output has both a TTL marker-output and a TTL trigger input. Furthermore, there is a 32-bit digital IO which can produce and read complex bit-patterns.

For applications where a large number of channels is required, multiple instruments can be synchronized and centrally controlled. The HDAWG is controlled via the browser-based LabOne user interface and through MATLAB, LabView, Python, .NET or C. Sequences can be easily written, edited and compiled using the embedded scripting language and compiler. The resulting sequences are lean and can be swiftly transferred to the instrument over 1 GbE or USB 3.0. This saves time and increases workflow efficiency, and allows the user to maintain an overview of complex signal patterns.

The HDAWG has been developed to meet the highest requirements of R&D. For example, in Quantum Computing Applications to produce pulsed signal sequences with minimal noise. Further applications include NMR, electronic component testing, spectroscopy and Radar/Lidar.

Find more information at www.zhinst.com.

Compact, All-In-One Resilient Positioning, Navigation and Timing System (PNT)

The VersaPNT from Spectracom combines a Global Navigation Satellite System (GNSS) receiver, inertial measurement technology and high-performance timing oscillators to provide Assured PNT in GNSS-degraded and denied environments. This rugged and highly customizable device serves as a navigation system, master clock and network time server for mobile applications in harsh environmental conditions.

Spectracom claims the VersaPNT is the first all-in-one, always-accurate positioning, navigation and timing solution that delivers accurate, software-configurable position, navigation, altitude, time, and frequency signals under all circumstances.

VersaPNT minimizes size, weight and power (SWaP) by combining PNT functions normally achieved through multiple independent subsystems, allowing for efficient integration into a wide variety of ground, air and maritime platforms.

VersaPNT Features:

- GNSS-aided inertial navigation and timing
- High performance internal time base and inertial sensor to manage potential GNSS loss
- GNSS time and frequency source with NP/PTP time server
- Ability to integrate future PNT signal sources such as STL, CAN Bus, etc.
- High versatility with software-configurable inputs/outputs
- Network sync, set up and management
- Easy integration, with small footprint and low power consumption
- Compatible with external IMUs
- Measurement data is logged internally and streamed through a serial or LAN interface
- Ruggedized (MIL-STD-810G) low size, weight and power
- Conduction-cooled
- Standby power mode

Applications include Blue Force Tracking, Vehicle navigation, Mobile radios and C4ISR and Robotics.

Find more information at spectracom.com.

Bi-Directional 15 Kw 500 V DC Power Supply

Delta Elektronika has introduced its first 15 kW standard power supply offering a bi-directional output and advanced new features at the price of a standard version. Operation is easy, with no need to study bulky manuals.

The SM500-CP-90 features a flexible constant power output characteristic: the lower the voltage, the higher the current: 500 V, -30 to +30 A, 250 V, -60 to +60 A and 166 V, -90 to +90 A.

Voltage, positive current and negative current can all be adjusted from zero to maximum.

In sink mode, Delta's Power Regeneration Technology returns energy back to the grid with an efficiency of 95%. Because of this high efficiency, cabinet height is restricted to just 3 U without any compromise on product lifespan.

Dynamic response to load changes is excellent allowing very fast load variations between -90 and +90 A while all-digital control makes it possible to adapt regulation to match load type. The input range of a standard unit encompasses 380 up to 480 V AC rated voltages, covering 86% of the world's electricity grids.

The constant output power covers the output range of five separate power supplies with a traditional rectangular VI-curve. Choosing the best output range is much easier now and offers users far better value for money.

Bi-directional power means the same constant power characteristic in the second quadrant for the full 15 kW. It also operates like an electronic load. Previously Delta's power supplies would be equipped with an optional power sink capable of absorbing up to 10% of the total energy which was dissipated via internal heat sinks. Now, the power sink is standard and can sink up to 100% of the power without the need for dissipating lots of energy.

With new Power Regeneration Technology Delta returns full power back into the grid and the efficiency of 95% avoids the need for expensive water cooling. Compared to traditional electronic loads— where dissipation is 100%— there is a power loss of just 5%.

Fast response to load changes has been a challenge for a long time, especially when it comes to changing from positive to negative current and vice-versa. The full integration of source and sink in one device is a neater and more efficient solution. Output voltage of the SM500-CP-90 recovers in 200 μ s after a load change from +90 to -90 A and -90 to +90 A.

For more information, visit www.delta-eletronika.nl.

Flying Probe for Test

Seica S.p.A. is showcasing the new Pilot V8 next > series flying prober, featuring a renovated and stylish look thanks to the premium materials of the chassis, and innovative electrical worth discovering performances, undoubtedly the most complete flying probing test platform on the market.

In its most complete configuration, the Pilot V8 next > series tester will provide up to 20 mobile test resources for an electronic board, ranging from probes which can supply today up to 2 A current each, high-resolution cameras for automatic optical inspection, barcode reading and datamatrix, LASER, capacitive probes, pyrometers, optical fiber sensors for LEDs, mini-fixtures for boundary scan and On-Board Programming, up to high-frequency probes for measures over 1.5 GHz.

To confirm its nature, highly oriented to medium/high volume production, the Pilot V8 next > series will be available in a fully-automated version, making its vertical architecture perfectly suitable to be combined with board loading/unloading modules, capable of hosting from 1 to 12 board racks (even of different types) or with handling and “tilting” modules, to make it perfectly compatible with any standard assembly line with horizontal architecture. All of the automation modules are available in the catalog of Seica Automation. The HR version of the Pilot V8 next > series projects the system towards minimized size of objects, around 30 μ m, while the XL version extends the work area from the standard 610 x 540 mm to 800 x 650 mm, providing unique solutions for testing “extra-large” boards.

Find more information at www.seica.com.

New Manufacturing Execution Software (MES)

Aegis Software has announced their newest FactoryLogix software solution. If Industry 4.0 seems to be a utopian view of the future of manufacturing affordable by only the top tiers of manufacturing, Aegis is showcasing an alternative way forward, one that is practical, non-disruptive and introduces real practical steps. Aegis Software Brings “The Smarter Perspective” on Industry 4.0 MES Technology towards an Industry 4.0 that works in the intended business sense, as well as from the technology perspective.

The software and hardware technologies showcase a modern approach, specifically designed for Smart factories. The product supports the new industry standard, CFX, and some revolutionary, affordable hardware in the form of Raspberry Pi based production stations. It is no longer necessary to accept compromised solutions from providers that require armies of developers to create customized software, expensive bespoke hardware or have a proliferation of PCs on the shop-floor. Aegis Software, the leader of key modern software technologies, presents FactoryLogix, the singular software platform approach to Industry 4.0 solutions.

To learn more about FactoryLogix[®] and Aegis Software’s approach to Industry 4.0, please visit www.aiscorp.com/.

Miniature, Lightweight Hybrid Sensors for Force, Displacement, Pressure, Strain and Acceleration Measurements

The Micro-Measurements[®] brand of Vishay Precision Group, Inc., has introduced a new range of miniature, lightweight hybrid sensors, offering cost-effective force, displacement, pressure, strain and acceleration measurements within high-volume OEM and test applications.

Design of the new Micro-Measurements hybrid sensor range incorporates the brand's own precision foil strain gauges, adhesively bonded to flat substrates, constructed of either metal, composite, or polymer. Hybrid sensors are manufactured by VPG using the same high-volume production equipment as those used to create its precision strain gauges. The result is a cost-effective family of strain-gauge based hybrid sensors with consistent batch-to-batch performance characteristics. Users may further incorporate an optional miniature signal amplifier, as either a stand-alone component or attached to the sensor. Hybrid sensors may be attached via mounting holes with choice of screws, spot welding, or clamping, thereby eliminating adhesive bonding requirements. The hybrid sensors are further optionally available with pre-attached lead wires and connectors, for simplified customer handling without soldering requirements.

New hybrid sensors can effectively support a variety of high-volume OEM consumer product, process control, automotive testing, non-critical medical device, educational research, and industrial requirements. Process control applications include liquid-level sensing, motor control, and vibration monitoring. Automotive testing applications include passenger weighing, foot-pedal pressure, seatbelt tension, emergency braking, suspension control, and engine monitoring. Medical applications include pumps, respirators, and other non-critical devices.

For more information regarding hybrid sensors, visit www.micro-measurements.com.

Pressure Transmitter with Low-Power Voltage Output

Endress+Hauser added a 1-5 VDC Low Power output option to the PMP71 pressure transmitter that draws only 17 milliwatts of power at 9 V, making the PMP71 consume less power during operation than any other voltage-output pressure transmitter. This low-power draw makes the PMP71 ideally suited for battery and solar-powered applications where low power consumption is critical.

The PMP71 measures the absolute and gauge pressure of gas, steam or liquid and has built-in algorithms to calculate level, volume and mass of liquids. Measuring spans are available in

ranges from -6 to +6 psi up to -15 to 10,500 psi. For safe operation at process temperatures up to 752 °F, it has a piezoresistive measuring cell and metallic welded process isolating diaphragm.

The PMP71 has ATEX, FM, CSA, NEPSI, IECEx approvals and is suitable for use in up to SIL3 hazardous applications. The voltage output version is available with the CSA C/US XP approval in North America.

For more detailed information on the PMP71 pressure transmitter, please visit www.us.endress.com/PMP71.

Micro ICP® Pressure Sensor for Sensing Shock Waves and High-Speed Dynamic Pressure

PCB's new micro ICP® Pressure Sensor, Model 132B38, is suited for wind tunnel applications that require very small test sensors and very high frequency response. This improved design features a centered sensing element which improves accuracy of time of arrival, targeting, sniper/projectile detection systems, and aerodynamic testing in high speed wind tunnels. Model 132B38 measures high frequency pressure phenomena and can resolve short wave length, dynamic pressure pulses.

This pressure sensor measures shock waves above 11 kHz and up to 1 MHz. With a measurement range of 50 psi and a resolution of 0.001 psi, it is sensitive enough to measure standing waves associated with boundary-layer transitions and the bow and stern of shock waves created by projectiles. The sensor features a stainless-steel housing and a 10-foot integral cable that terminates in a 10-32 coaxial jack.

For additional information, visit www.pcb.com/Aerospace/windtunnelsensorspressure.

Precision Linear Motor Stage

PI further expands its PIMag® series of high dynamics linear motor stages with a family of 18, the V-508-- a new series of compact linear positioning stages with high force 3-phase linear

motors and crossed roller guides. PI's ultra-precise linear motor stages are well-suited for industry and research. Applications include metrology, testing, positioning, scanning, precision automation, micro-assembly, biotechnology, delay-lines, laser beam control, optics, lens testing, and photonics alignment.

The V-508 family of linear motor stages is offered with 80 mm, 170 mm, and 250 mm travel range. Two motor options are available: ironless for highest resolution and smoothest motion, and iron-core for highest force, acceleration, and velocity up to 1 m/sec.

Mechanically, the V-508 series features high load precision crossed roller bearings with anti-creep cage assist, preventing roller creep— ideal prerequisites for long lifetime in high duty cycle industrial applications, together with the zero-wear, non-contact linear motor.

A variety of incremental and absolute measuring linear encoders are available, from 0.2 nanometer resolution to 78 nanometers resolution. Absolute encoders provide the stage position to the controller immediately after power up. No referencing is required, and there is no possibility to lose encoder counts in electrically noisy environments.

Linear motors provide very smooth motion and a high dynamic velocity range along with rapid acceleration because they provide motion directly without the need of additional mechanical components, such as drive screws and gearboxes that add friction, vibration, and noise. They are ideal for scanning applications or automation tasks where repetitive fast start/stop motion with high precision is required and where reliability and maximum uptime are crucial. In addition to electromagnetic 3-phase and voice-coil linear motors, PI also provides several types of electro-ceramic linear motors.

Several types of controllers, along with software tools, drivers and example programs are available from PI and ACS motion control.

For more information, visit www.pi-usa.us/products/precision_positioning_pi-micos/Linear_Precision_Positioning_Stages_Mc.php#V508.