

The IEEE Instrumentation & Measurement Magazine
December 2016 Issue

Back to Basics: Instrumentation

Editorial

Back to Basics

Wendy Van Moer

This is already our last issue of 2016! Time is flying so fast! And the world is evolving at a tremendous speed... So from time to time, it is a good idea to stand still and reflect back.

This year our *Magazine* covered some quite diverse subjects, from food to women in engineering to finding faults in military systems to medical applications of I&M. We also took the *Magazine* on a world trip and started that journey in Region 10. This last issue is a reflection issue: Back to Basics! And when I say back to basics, I immediately think about our column "Basic Metrology" initiated by Bryan Kibble. He left an inerasable mark on his column. But just before Bryan passed away, he asked his colleague and good friend Richard Davis (BIPM) to write a contribution for his column. After a while, I realized that Bryan made sure that we would find a perfect successor to take care of 'his' column. So I am very proud to announce that Richard Davis has accepted to handle the "Basic Metrology" column, starting in this December 2016 issue. Welcome on board, Richard!

Back to basics?! What is more basic for an instrumentation and measurement engineer than a slide rule? I am pretty sure that our young readers will raise their eyebrows and ask themselves: 'What is that?' Our more 'experienced' readers will sit back and think about the good old times when reading the article of Dennis Shea! Enjoy it!

What will the future bring us? We will investigate crimes in 2017, continue our world tour, and stop in Region 9. We will visit farms and fablabs. 2017 promises to be a very exciting year! I wish you all a nice ending of 2016 and a 2017 full of surprises and nice dreams!

Groetjes,
Wendy

President's Message

Remembering the Past – Acting Now- Planning for the Future

Ruth Dyer

During this past summer, my spouse and I had the distinct opportunity to spend time visiting both the Museo Galileo in Florence, Italy, and the Galileo's World Exhibits at the University of Oklahoma in the USA. Needless to say, we were able to view only a portion of the entire set of exhibits in each location, but in both cases we came away with a renewed appreciation of the genius, perseverance, and inventiveness of a very long line of scientists and engineers, many of whom were Italian, in the field of instrumentation and measurement (I&M). It was fascinating to view the craftsmanship and elegance of the huge number of instruments on display at the Museo Galileo from Giovanni Amici, Giuseppe Campani, Egnazio Danti, Felice Fontana, Galileo Galilei, Ferdinando II dé Medici, Edward Nairne, Leopoldo Nobili, Antonio Santucci, Evangelista Torricelli, Lorenzo della Volpaia, Alessandro Volta, and many others.

One of the most impressive aspects of the displays was the recognition of the impact of the many connections among art, astronomy, engineering, math, music, and science on the various versions of instruments that were developed, the measurements made with those instruments, and the interpretation of the measurements by the scientists and engineers who made them. The solid mathematical and engineering foundations developed by those in the Renaissance period have allowed subsequent generations of followers to continue to build upon them, and we owe much of the work being implemented today to those important foundations.

I think there is an important parallel between the work of scientists and engineers and the construction of the resplendent Cattedrale di Santa Maria del Fiore in Florence, Italy—or Il Duomo di Firenze (the Duomo of Florence), as it is ordinarily called. The Duomo was constructed over a 142-year period, and the large majority of those who helped build the cathedral never saw it finished. However, they faithfully and conscientiously contributed their individual parts—some evident, some hidden—to this majestic structure. Similarly, as scientists and engineers, we often provide contributions through our work to a particular specialty in science or engineering and are not always able to see the final result or impact of our work after it has been combined with the collective contributions of others over the years. I will not be so bold as to say we are building a cathedral together. However, I think it is important to recognize

that we are each contributing to the I&M field in ways that not only build upon the foundations and work of those who have gone before us, but also will provide the basis for contributions of those who will follow us.

One of the most important benefits the I&M Society provides to its members is the opportunity to easily learn more about the work of others through our publications of the *IEEE Transactions on Instrumentation and Measurement* and the *IEEE I&M Magazine*. In addition, you can participate in our conferences and workshops, be involved in one of our Technical Committees, or engage in a local I&M Society Chapter. Access to information about all of these opportunities is on the IMS website, at <http://iee-ims.org/>. We also have recently implemented a Video Tutorial project, and the first set of videos is now available on both our website, at <http://iee-ims.org/evts/tutorials>, and on the IMS Section of IEEE TV, at <https://ieeetv.ieee.org/channels/ims>. We hope you will consider submitting a proposal for your own video tutorial. Please visit the IMS website, actively engage with us, and share what you have learned.

Another great opportunity to share and learn about the most current advances in the I&M field is our upcoming 2017 International Instrumentation and Measurement Technology Conference (I2MTC), which will be held May 22–25, 2017 in Torino (Turin), Italy. Information about the conference is available at <http://2017.imtc.ieee-ims.org/>. I encourage you to consider submitting a paper and attending the conference, and it would be the perfect occasion to take a side trip to Florence and visit the Museo Galileo. I hope to see you in Torino this May!

Ruth A. Dyer

Article Summaries

Covariance Evaluation by Means of Uncertainty Assessment

(Summary)

Christophe Dubois, Laurent Leblond, Jean-Michel Pou, and Alessandro Ferrero

This article is aimed at showing that a careful analysis of the uncertainty budget of a measurement process allows us to obtain a reasonable estimate of – at least – the order of magnitude of the covariances, even when their experimental or strict theoretical evaluation is impractical. In this respect, it proposes a type B method for covariance estimation that extends previous research and considers an error decomposition model based on the error variation rate in the measurement process.

Pure and Applied Metrology

(Summary)

Harold Kirkham

The signal parameters measured by a device called a Phasor Measurement Unit are the amplitude, the frequency and the phase. Given a sample of the signal, these parameters can be measured simultaneously by regarding the measurement process as a mathematical fitting problem. The goodness of fit can also be calculated. In essence, goodness of fit is a measure of the definitional uncertainty. In pure metrology, the signal and the model used are made to match, that is, the definitional uncertainty is reduced as far as possible. That is not an option in applied metrology, but adding a goodness of fit metric to the statement of the result would be of benefit. The notions are broadly applicable, and have far-reaching implications.

This summary was written by the author.

Human Activity Monitoring Based on Hidden Markov Models Using a Smartphone

(Summary)

Rubén San-Segundo, Julián David Echeverry-Correa,
Christian Salamea and José Manuel Pardo

This paper presents an HS system based on Hidden Markov models (HMMs) for classifying physical activities: walking, walking-upstairs, walking-downstairs, sitting, standing and lying down. The system includes a feature extractor (developed by the authors and presented in a previous work), an HMMs training module and an HAR module. All experiments have been done using a publicly available dataset named UCI Human Activity Recognition Using Smartphones. The final results using HMMs obtain comparable results to other recognition methods. Some improvements have been obtained when considering a discriminative HMM training procedure.

This summary includes text from the article.

Photonics Enhanced Sensors for Food Monitoring: Part 1

(Summary)

Wendy Meulebroeck, Hugo Thienpont, and Heidi Ottevaere

This paper is the first part in a series of three where the authors show how photonics based food sensors can contribute to the quality control and safety of solid and liquid food products. In this first part, we describe the theoretical aspects of the various physical phenomena that can occur during food screening together with their related measurement setups. In addition, this document contains information regarding data processing and the concerned sensing platforms.

This summary includes text from introduction of the article.

Applied Instrumentation for Civil Engineering at the American University of Beirut

(Summary)

Imad H. Elhadj, Mihran Gurunian, and Nadeen Rishani

This article describes the development of a course on Applied Instrumentation for Civil Engineering students at the American University of Beirut. It is an elective course for civil and environmental engineering students and for electrical and computer engineering students. Discussions with faculty members in the Civil and Environmental Engineering (CEE) Department motivated the course and it was possible in part by support from the IEEE Instrumentation and Measurement Society's (IMS) Faculty Course Development Award.

This summary includes text from introduction of the article.

Columns

Back to Basics

(Summary)

Remembering the Slide Rule

Dennis Shea

The Slide Rule, once carried by many of us on our belt or prominently displayed on a pile of books to let the world know that we were “techies,” was the “calculator” for generations of designers. As with many technologies it became obsolete suddenly and in a matter of a few years was relegated to history, but more about that later. The objective of this column is not to provide an in depth analysis, history or instruction on the finer points of using the slide rule. My

objective is to perhaps inspire curiosity in those unfamiliar with the slide rule, to investigate and give it a try, or for those who have forgotten about its fun aspects, to take up the challenge, dust it off and see how much you remember. Perhaps even demonstrate and amaze a younger colleague.

This summary includes text from introduction of the article.

Basic Metrology

(Summary)

Mass Metrology – After 4000 Years, a Change is Coming

Richard Davis

The value of any calibrated mass standard is traceable to the mass of an object manufactured in the 1880s and still used. With a little imagination, we can see that such a system has ancient roots. In 2018, however, it is expected that the SI unit of mass, the kilogram, will be redefined by taking advantage of contemporary science. A key to making this change is a device once known as a “watt balance,” first conceived by Bryan Kibble in 1975. Bryan was a regular contributor to this magazine until his untimely death earlier this year. To honor his memory, the community now developing watt balances in laboratories throughout the world suggests that they be renamed Kibble balances. The article presents the basics of a Kibble balance.

This summary was written by the author.

Legal Metrology

(Summary)

A Very Short History of Measurement from a Social and Legal Perspective

Veronica Scotti

There is still a lot of work to do to persuade people that the adoption of a unique system of units, based on established scientific grounds, has so many benefits in all fields of our lives that it is worth abandoning old habits, even if rooted in centuries-old traditions. I hope that being aware of the long history of measurements, including the non-technical involvements, may help convince people that a unique measurement system is far better than many local systems. After all, the ancient Romans understood this 2000 years ago. Let’s not waste their lesson!

Future Trends in I&M

(Summary)

My Farewell to the “Future Trends in I&M” Column

Simona Salicone

If measurements have become so important and pervasive in our everyday life, the fundamental concepts in measurements should become part of everyone’s background, similar to the basic concepts of math and physics. And this is our task as metrologists to explain these basic concepts in a way as simply as possible. To do this we might need to give up, when speaking to non-metrologists, *uncertainty* and use other everyday terms that everybody can understand: measurement quality, measurement reliability, measurement confidence ...

This summary includes text from the article.

Society News

The IEEE Instrumentation and Measurement Society has Revamped Educational Video Tutorials

Salvatore Baglio

The Instrumentation & Measurement Channel on IEEE TV at <https://ieeetv.ieee.org/channels/ims> has been updated and better focused on the scope and field of interest of the IEEE Instrumentation and Measurement Society (IMS). Also, the Educational Video Tutorial section of the IMS website found at <http://ieee-ims.org/evts/tutorials> is now showing the new video tutorials.

Here you can find fifteen exciting videos, including eight new video tutorials recently recorded by top experts in the field. Five of them cover interesting hot topics in the field of sensors and sensor networks, one is focused on how sensors and measurement systems can be inspired by nature, and one presents a new hot topic in metrology: forensic metrology. Please visit these pages and enjoy the videos.

Video tutorials are separated in two main classes: Expert Series and Classroom Series. Expert Series video tutorials cover advanced topics in the area of instrumentation and measurements (I&M) and are given by very well know experts in the specific field. Classroom Series video tutorials are presented by students (with the supervision of the Professor) and focus on theoretical or experimental aspects of basic knowledge in the I&M field.

Invitation to Submit I&M Video Tutorials

If you wish to submit a proposal for a new Expert Series or Classroom Series video, please visit the related page on the IMS web page at <http://iee-ims.org/evts/tutorials>. Your proposal will be reviewed by the Editorial Board with the help of expert reviewers. If accepted, you may record your video with your own audio/video facilities or attend one of the video recording stages that will be organized at selected I&M conferences.

The print article contains photographs from at I2MTC 2016.

Departments

New Products

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New Sensor Hub Solution for Android™ Platform

Bosch Sensortec launches its next generation Android M Sensor Hub Solution, a ready-to-deploy solution for smartphones, tablets and other devices running the Android™ 6.0 Marshmallow operating system.

The new solution integrates an advanced feature software library to leverage Bosch Sensortec’s high performance sensor hubs, motion and environmental sensors. Compliant with Android 6.0

Marshmallow, this sensor hub solution supports full sensor data fusion with 3-, 6- or 9-axis sensors.

The solution can accommodate a variety of integrated solutions combining Bosch Sensortec sensor hubs with individual sensors, i.e., BMA4-series, BHA250, BMM150, BMG250, BMI160, BMX160 and BME680. The library complies with the Android M Compatibility Test Suite (CTS) 6.0.

In power-saving mode, with all of its low power sensors enabled, the solution significantly reduces power demand down to 0.1 mW. In full operating mode, with all of its 29 motion sensors, 7 environmental sensors, Android M specified virtual sensors, always-on, wakeup and non-wakeup features running, the power consumption still remains low at approximately 10 mW. Such power management capability is far superior to comparable solutions available today.

To reduce time-to-market cycle times and to support architectures with various power requirements, the solution's fully integrated software library provides all Android functions: significant motion, step counter, step detector, tilt detector, linear acceleration, gravity detection, geomagnetic rotation, game rotation vector, rotation vector, heading with magnetic calibration, batching, activity recognition, gestures, hi-fi and pedestrian dead reckoning.

The solution has been successfully benchmarked against the leading smartphones available in the market for key performance indicators such as static and dynamic accuracy, memory consumption, calibration and orientation stabilization time, and distortion detection.

For more information, go to www.bosch-sensortec.com.

Integrated Land Mobile Radio Testing Solution

Cobham and TRX Systems announce that the Cobham 3550R and the 8800 Series Radio Test Sets are now fully integrated with the TRX NEON® Signal Mapper application in an automated solution that simplifies and dramatically reduces the time required for indoor Land Mobile Radio (LMR) testing. NEON Signal Mapper automates the geo-referencing, cloud storage, and 3D visualization of LMR test data for technicians who use the 3550R and the 8800SX test sets to record and analyze two-way radio signals inside buildings.

The manufacturer claims the Cobham 3550R is the industry's first 1 GHz hand-held, rugged radio test system with a large color display and touch-screen operation. At just 8.3 pounds and packaged in a magnesium alloy case, the Cobham 3550R is a tough and portable radio test set. Combining many features of a benchtop radio test set with the added capabilities of VSWR and Distance to Fault analysis, the 3550R is perfect for testing radio transceivers, whether on the bench or in remote locations.

The Cobham 8800SX is designed for maximum test efficiency. With the large color touch-screen display, its unique "fast-stack" user interface, user-defined presets, customer frequency lists, and its ability to handle up to 125 W of direct power; test professionals can set up analog and digital meters and test functions.

Integrating NEON's capability to automatically collect geo-referenced test data with the 3550R and the 8800SX saves valuable time and money by:

- Automatically calculating indoor location and correlating with radio signal data, eliminating manual check-ins
- Removing data recording errors caused by incorrect location estimates in complex buildings through automatic indoor path determination
- Providing continuous logging of data with a high density of data points, including within typically difficult to map stairwells, elevators, and tunnels
- Supporting rapid analysis of signal coverage with 3D visualization and easy export of time-stamped data

For more information, visit the Cobham website at www.cobham.com or the TRX website at www.trxsystems.com.

App Turns iPhone/iPad into A Professional Measurement Device for Vibration Measurement

ACE Stoßdämpfer GmbH expands its range of useful apps for vibration measurement with the introduction of the VibroChecker PRO. It is the name of the latest software for the iOS operating system, which simply, quickly and professionally turns an iPhone or iPad into a device for measuring vibrations and impacts.

The innovation is further development on the very successful VibroChecker app, which has served thousands of users as a mobile vibration measurement device since its introduction in 2014.

Vibrations can be quickly and simply measured on machines and components within a frequency range of up to 50 Hz with the free VibroChecker, while the new VibroChecker PRO app expands the range up to 8000 Hz. This is made possible by simply connecting an external sensor with the iPhone or iPad via the lightning or USB interface and activating it with the app. This new combination provides users with very high-performance and cost-effective measurement equipment with a total weight of less than 1 kg.

In the range up to 50 Hz, both the VibroChecker and the VibroChecker PRO optionally use the acceleration sensors, gyroscopes and microphones integrated in the iPhone and iPad. In the ranges above this level, the external USB sensor Digiducer 333D01 (www.digiducer.com), not included in the nominal fee for the app, ensures even more professional measurements of up to 8000 Hz.

After completing the measurement, the results can be saved or simply sent to your own desktop, own specialist department or to the customer by e-mail. This new app is available now in the iTunes store.

For more information, visit www.acecontrols.com.

CM44P Analytical Transmitter for Monitoring Processes

Endress+Hauser introduces the Liquiline CM44P multichannel analyzer transmitter that accepts up to 16 parameters from analytical sensors and transmits them via 4-20mA HART, Profibus, Modbus or EtherNet/IP. The CM44P accepts inputs from up to two process photometers and four analytical sensors simultaneously. Mathematical functions allow the CM44P to calculate measured values on the basis of multiple input values.

The CM44P also performs diagnostics on all connected sensors and analyzers, and transmits error messages if an error occurs. All resulting diagnostic messages are reported. An optional web server allows operators to remotely access the transmitter. Using any web browser,

measurement values or diagnostic messages can be viewed or the device configuration can be changed.

The CM44P interfaces to all Memosens sensors from Endress+Hauser and other vendors. Memosens is an international standard, with all sensor-related data stored directly in the sensor head. The CM44P can access this data for analysis, mathematical calculations and diagnostic purposes, and transmit it via various interfaces. It can also store it in a tamper-proof database or SD card, export it to a CSV file for Microsoft Excel, and perform a data logger function with up to 150,000 entries in up to eight logbooks.

Mathematical functions can be used to calculate up to six “virtual” process values such as a pH calculation based on two conductivity values and others.

For more detailed information on CM44P, please visit the Endress+Hauser product page at www.us.endress.com/liquiline-cm44p.

Expanded Capabilities of Ultrafast-Scanning 9500 Atomic Force Microscope

Keysight Technologies, Inc. has announced the addition of several powerful new capabilities for the ultrafast-scanning 9500 atomic force microscope. These new capabilities include quantitative mapping of nanomechanical properties as well as electrochemistry applications and scanning electrochemical microscopy (SECM) techniques. The Keysight 9500 provides unrivaled scan rates up to 2sec/frame and comprehensive environmental control.

These new 9500 capabilities are enabled by Keysight NanoNavigator, a software package whose workflow-based graphical user interface (GUI) makes the system easy to operate for AFM users of all skill levels. The latest version of NanoNavigator enables Quick Sense, a new Keysight imaging mode that permits quantitative mapping of nanomechanical properties on a wide range of samples. Quick Sense lets users quickly and easily set modulation amplitudes and frequencies, acquire individual force-distance curves and measure adhesion and stiffness. All of the data is collected while the 9500 AFM simultaneously images the sample’s topography, resulting in precise and accurate characterization of local mechanical property variations at the nanoscale.

Furthermore, for electrochemistry applications, the new version of NanoNavigator provides control of potentials and cyclic voltammetry, affording researchers a useful complement to the

9500 system's comprehensive *in situ* imaging capabilities. In addition to electrochemistry applications, these environmental (gas, liquid, air) and temperature control capabilities facilitate advanced applications associated with materials science, life science, polymer science and electrical characterization.

More information about Keysight's ultrafast-scanning 9500 atomic force microscope is available at www.keysight.com/find/9500.

Expanded Semiconductor Test Capabilities

Marvin Test Solutions now offers its TS-960 Semiconductor Test Platform, the newest addition to the TS-900 Series.

The TS-960 platform features a 20-slot, 3U PXI chassis accommodating up to 512 125 MHz digital I/O channels with PMUs per pin, yet has a small footprint and modular structure, allowing users to address a range of test applications. Available as a bench top or with an integrated manipulator, the TS-960 platform takes full advantage of the PXI architecture to achieve a full-featured test solution for digital, mixed-signal or RF test applications.

The GX5296 delivers high-performance digital test capabilities and is ideal for addressing verification, focused production, and failure analysis test needs – or for replacing legacy test systems. The GX5296 builds on the successful GX5295 PXI digital subsystem, offering unrivaled timing, density, memory, and sub-nanosecond timing per pin capabilities. And with the addition of MTS' advanced software tools for program development / debug and comprehensive file conversion tools for WGL, VCD/eVCD, STIL, and ATP formats, the TS-960 provides no-compromise digital / mixed-signal test capabilities for component, SoC and SiP devices.

For more information regarding the TS-960 and GX5296, please visit <http://www.MarvinTest.com>.

New Power Supplies

IDEC Corporation announces the PS5R-V line of DIN-rail power supplies, completely replacing their existing PS5R and PS5R-S series with more efficient, compact and cost competitive models. These power supplies are specifically designed for use in demanding industrial applications and improve upon existing models in many areas.

The PS5R-V line of power supplies includes 7.5 W, 10 W, 15 W, 30 W, 60 W, 90 W, 120 W and 240 W versions. All models have a very compact form factor, with overall dimensions reduced by up to 25% from previous generations. Combined with DIN-rail mounting, the reduced form factors free up valuable control panel space and reduce installation costs.

Operating temperature ranges up to -25 to +75 degrees 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.

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.

Certifications and approvals include UL 508, UL 1310, SEMI F47 and RoHS. Meeting these stringent industry standards requires the use of very reliable components, leading to an MTBF exceeding one million hours in several of the models.

For complete specifications or additional information on the PS5R-V line of power supplies, please visit powersupply.idec.com/.

Signal Routing Software for Electronic Test

Pickering Interfaces announces their new signal routing software product, Switch Path Manager™. This software simplifies signal routing through switching systems and speeds up the development of switching system software. It can be used in labs as they develop test procedures as well as in automated test systems.

Originally known as Tecap Switching, Pickering is adding new features to the software and renaming it to better address the market requirements as well as clearly identifying the functionality. Switch Path Manager will be part of Pickering's super installer, which will provide customers access for up to 90 days at no cost.

Switch Path Manager signal routing software speeds up switch system development by automatically connecting system endpoints. The software supports Pickering's PXI, LXI, PCI and GPIB switching systems and the interconnection between them.

Switch Path Manager virtually describes any switching architecture and processes all stored project data for switching and routing at runtime. The user selects the modules from the library and defines the physical interconnections, as well as the endpoints. Endpoints are the boundary of the system where measurement and stimuli equipment and all the UUT access points are connected. By calling Point-to-Point or Point-to-Multipoint functions the routing is processed, and the required relays are controlled to establish a signal path between these endpoints. The router will never interfere with existing routes and will find an alternate bypass or will terminate with an error message if not successful. In addition, the router is intelligent enough to minimize the risk of unintended short circuits.

For more information, please visit www.pickeringtest.com.

Multi-function JTAG Board Tester fits into ECT (Xcerra) Fixtures

JTAG Technologies announces a new co-operation with Everett Charles Technologies (ECT). JTAG and ECT have just completed a successful integration of their JT 5705/FXT multi-function JTAG tester into the small linear series of cassette-based re-configurable fixtures.

The JT 5705/FXT is a compact (yet complete) single-board test system that supports analog measurement and stimulus, frequency measurements, digital I/O, boundary-scan testing (via two TAPs) and also in-system device programming. The latest JTAG software also includes multiple controller support that allows the linking of multiple units to create a homogeneous system of increased channel counts. Within the fixture the JT 5705/FXT cards mount on purpose built carriers featuring the ATE industry standard 208-pin 'Pylon' connectors.

Many new electronic designs feature some devices such as programmable logic and micro-controllers/SOCs that feature JTAG, however due to mixed signal nature of most of these designs it is useful to have mix of test signals to provide analog stimuli and measurement, digital I/O channels and so on. The JT 5705/FXT provides just these features.

In the ECT small linear series, access to the Unit Under Test (UUT) is provided through spring probes/nails that are part of a 'swappable' interface module often referred to as a cassette. The cassette links the resources within the fixture-tester (power, tester signals, auxiliary instruments, etc.) to the UUT. By swapping cassettes different board types can be tested on the same base

hardware – providing a cost effective solution especially for high-mix low series volume organizations.

As the boundary-scan market expands beyond the traditional high-density digital targets, so the test equipment must evolve to match. As well as supporting two JTAG (IEEE 1149.x) compatible TAPs with programmable thresholds, the JT 5705 unit has extensive I/O capability (64 channels), 8 of which can be defined as analog with a measure and stimulus range of $\pm 16V$ or 0-32V. Multiple JT 5705s can be 'linked and synched' to provide higher TAP and IO channel counts.

Find more information at <http://www.jtag.com>.

New Family of High-Speed Cameras

Vision Research has added further depth to its high-speed camera lineup with the debut of its new Phantom VEO® product family. Designed for a wide-range of applications including scientific analysis, material testing and defense research, Phantom VEO cameras offer the performance of the renowned Phantom V-Series in a small, rugged, five-inch cube packed full of new features.

Comprising eight individual models across four performance levels and two body styles, users will have incredible flexibility to identify a high-speed camera that meets their specific needs. All Phantom VEO cameras incorporate high-performance 12-bit, 35mm CMOS sensors (color or mono). At maximum resolution, the one megapixel (1280x800) Phantom VEO 710 and 410 can record at speeds up to 7,400 frames-per-second (fps) and 4,000 fps, respectively, while the four megapixel (2560x1600) Phantom VEO 640 and 340 can record at speeds of 1,400 fps and 800 fps, respectively.

Phantom VEO cameras are available with three onboard RAM memory configurations of 18 GB, 36 GB or 72 GB. Thanks to Multi-Cine, a function which partitions on-board RAM, Phantom VEO cameras can capture quick recordings back-to-back. With up to 72 GB of RAM, Phantom VEO cameras can capture more frames than most other comparable cameras on the market.

Record times at maximum fps and resolution for Phantom VEO cameras with the 72GB memory option are:

- Phantom VEO 340 (2560x1600 @ 800fps): 15 seconds

- Phantom VEO 640 (2560x1600 @ 1400fps): 8.5 seconds
- Phantom VEO 410 (1280x800 @ 4000fps): 12 seconds
- Phantom VEO 710 (1280x800 @ 7400fps): 6.5 seconds

To learn more about the Phantom VEO family of high-speed cameras, please visit <https://phantomhighspeed.com/Products/Phantom-VEO>.

Portable, Standalone High-Speed Camera System

Photron, Inc. introduces the PhotoCam SpeederV2. The portable, standalone high-speed camera system is specially designed for production fault-finding but has other fault finding applications. Intuitive and easy to use, the camera system allows workers to quickly view and identify production errors on the integrated 7-inch LCD remote touch screen, without the need for a computer or network infrastructure.

The SpeederV2 system is available with one or two miniature, remote camera heads that are tethered to a compact camera control unit. The new production line imaging system provides up to 2,000 frames per second (fps) at full pixel resolution (512 x 512) and higher frame rates at reduced resolutions. There are two video recording modes – Speed Priority Mode for high-frame-rate, full-resolution video capture to the onboard internal memory; and Time Priority Mode for extended duration video capture (i.e., very long recording times at reduced frame rates and/or resolutions) – which can be streamed to an integrated solid-state drive (SSD).

The PhotoCam SpeederV2 system operator can easily start or stop a recording manually using the touch screen or a simple thumb switch. Alternatively, the system can be automatically triggered with a TTL pulse or switch closure emitted in the event of equipment failure or production line disruption. Once the video is recorded, it can be played back in super slow motion, allowing factory personnel to view the production error and make necessary corrections immediately.

For more information about Photron's new PhotoCam SpeederV2 production fault-finding high-speed imaging system, please visit: <http://photron.com/product-category/cameras/remote-camera-heads/>.

Miniature Triaxial Family of Accelerometers

A new family of miniature triaxial ICP® accelerometers, Models 356A43, 356A44 and 356A45, has been introduced by PCB Piezotronics, Inc. They are small (0.4 x 0.4 x 0.75 in), lightweight (4.2 grams) and TEDS IEEE 1451.4 enabled. The TEDS feature self identifies the accelerometer and describes type, operation and attributes, making it extremely easy for an operator to track. Data contained in the TEDS programming include manufacturer, model number, serial number, calibration date, sensitivity, frequency response and measurement ID, all in compliance with IEEE 1451.4 standard.

Models are available with three sensitivities: 10 mV/g, 50 mV/g or 100 mV/g and are all packaged in a hermetically sealed titanium cube. The most common applications for this family of miniature triaxial ICP® accelerometers are modal and structural analysis, automotive NVH, and package testing.

Models 356A43, 356A44 and 356A45 are stock products and available for immediate shipment. For additional information please visit www.pcb.com.