Instrumentation and Measurement in Space

Editorial

"Space, the Final Frontier"

Wendy Van Moer

I am sure that most of us know this sentence by heart, *Beam me up, Scotty*! It brings back a lot of memories from my childhood. Each Sunday morning, my father and I would watch an episode of the famous American science fiction TV series, "Star Trek.*"* I believe that show was the start of my fascination for everything that has to do with space.

The first step of Neil Armstrong on the moon was a tremendous piece of art from the field of instrumentation and measurement. State-of-the-art I&M techniques were definitely required to fulfill that mission. And it did not stop there. A lot of I&M techniques were developed for "space" and used "on earth" or vice versa. Every day, engineers in the field of I&M try to cross boundaries driven by their curiosity to know what lies beyond…

Navigation and communication are probably the two most important topics when talking about "space." In this issue of our magazine, you can read all about the importance of I&M in navigation and communication systems, from satellite testing to the Einstein Telescope.
Enjoy this issue on I&M in Space! … *to boldly go where no man has gone before.*

Groetjes,

Wendy

[The column title and the last line quote are from the voice-over introduction by William Shatner for each of the 79 episodes of *Star Trek: The Original Series*. The quote in the first line was repeated often in the series. Desilu Productions produced the series in 1966-67 and Paramount Television in 1966-69. It aired on NBC during those years.]

Article Summaries

The Einstein Telescope
(Summary)

Stefanie Kroker and Ronny Nawrodt

Albert Einstein postulated that gravitational waves (GWs) were waves in the curvature of space-time in his famous Theory of General Relativity. In this article, the authors present the operating principles of the modern GW interferometric detectors and the second generation of the detectors. Beyond the era of advanced detectors, the authors discuss novel instruments that could allow routine GW astronomy. Within a European-wide collaboration, a possible design of such a GW observatory—the Einstein Telescope—has been developed. It aims for a ten times increase in sensitivity compared to the second generation throughout the frequency range from a few hertz up to a few kilohertz.

This summary includes text from the introduction of the article.

5G Cellular: Key Enabling Technologies and Research Challenges
(Summary)

Ekram Hossain and Monowar Hasan

The evolving fifth generation (5G) cellular wireless networks are envisioned to provide higher data rates, enhance end-user quality-of-experience, reduce end-to-end latency, and lower energy consumption. This article presents several emerging technologies which could enable and define future 5G mobile communication standards and cellular networks. The authors highlight the key ideas for each technology and the major open research challenges related to measurement, testing and validating the performance of 5G system components. The fundamental research challenges for resource management in 5G systems are highlighted.

This summary includes text from introduction of the article.

Communication Satellite Antenna Testing
(Summary)

Robert B. Dybdal

Communication satellite systems necessarily require multi-disciplinary tests to assure and maintain effective system operation. This overview summarizes the overall testing for satellite communication systems and describes the subset of antenna and antenna-related testing in particular. Antenna test requirements address both RF and environmental specifications that include both launch and on-orbit extremes for space systems and wind and climate conditions for ground systems. In addition to characterizing antenna performance, other system test requirements have antenna-related measurements and test requirements.

High Frequency Waveform Engineering and its Applications: Tutorial 54
(Summary)

Mohammad S. Hashmi, Fadhel M. Ghannouchi, and Paul J. Tasker

This article has presented the fundamental concepts behind waveform engineering and its usefulness in modern RFPA design. It subsequently discussed a typical architecture of a high frequency waveform measurement system and then presented the required calibration approach. A section on the impedance tuning element dealt with the changes required in a typical waveform measurement system for carrying out waveform engineering. The article finally discussed three interesting applications of waveform engineering which have either brought or have the potential to bring a paradigm shift in RFPA design techniques.

This summary includes text from the article.

Columns

Basic Metrology

Everyday Instruments from Basic Metrology
(Summary)

Bryan Kibble

Usually the excuse given by metrologists for indulging in developing new ways to advance the already incredible reproducibility and coherence of the International System of Units is to quote the miniscule cost involved compared with the trillions of measurements it supports worldwide. However, another justification is that ways of making some simple measurements arose directly out of this research. The author presents a discussion of five commonly-used instruments such as GPS and the radio-controlled clock made possible by advances in basic metrology.

This summary includes text from the article.

CRUNCH

General-Purpose Linear Solvers!
(Summary)

Stephen A. Dyer

"CRUNCH" is a follow-on column that continues the number-crunching theme of its predecessor "By the Numbers." At present, its lifetime is imagined to be quite finite—perhaps a year or so worth of issues—that will present broadly useful algorithms and methods that are commonplace, in one sense or another, in introductory courses covering elementary numerical methods or signal processing concepts. This column presents the rules associated with solving two classes of linear equations and presents the algorithm and code associated with LU decomposition involved in the development of a general-purpose linear solver.

This summary was written by K. Virostek and includes text from the article.

Jack Dyer's Clinic

A Dream Come True!
(Summary)

Stephen A. Dyer

This inaugural introduction presents the history of and sets the stage for a regular column that will house an assortment of useful projects, tips and guidance in the broad area of instrumentation and measurement. Stay tuned for what the author promises to be "observant, practical and helpful."

This summary was written by K. Virostek.

Framing I&M Topics

I&M in Navigation Systems
(Summary)

Paolo Carbone, Dario Petri, and Antonio Tsourdos

Since the basis of navigation location, i.e., on positioning and orientation measurements, in recent years the *IEEE Transactions on Instrumentation and Measurement* has experienced a significant increase in the number of papers – both submitted and accepted – in this field. Unfortunately, many submitted papers have been rejected because they fall clearly outside the journal scope. This fact motivated the authors – as researchers in the field involved in the editorial Committee of the journal – to write this paper to specify what can be considered an I&M technical contribution in the field of navigation systems.

This summary includes text from the article.

Life after Graduation

Software in Measurement and Measurement in Software!
(Summary)

Lee Barford

This issue's column was written by Lee Barford who received the Ph.D. in computer science from Cornell University, Ithaca, NY. He is a Fellow at Keysight Laboratories, the research arm of Keysight Technologies. Lee is also Professor of Computer Science and Engineering (adjunct) at the Univ. of Nevada, Reno, Nevada, USA.

This summary was written by K. Virostek.

Future Trends in I&M

Change the Present for a Better Future
(Summary)

Irina Florea

This issue's column is contributed by Irina Florea, a young Romanian engineer who received the Bachelor of Science in "Instrumentation and Measurement" and the Master of Science in "Instrumentation and Advanced Measurement Systems" from the Polytechnic University of Bucharest. She is now working at Renault where she is bringing all her competences in I&M to industry.

This summary was written by K. Virostek.

Departments

Chapter Report

IMS Taipei Section Chapter Highlights 2013 – 2014
i-ONE International Instrument Technology Innovation Competition

Starting in 2009, the *i*-ONE International Instrument Technology Innovation Competition has been organized by the IEEE I&M Society's Taipei Section Chapter and the Instrument Technology Research Center (ITRC) of National Applied Research Laboratories (NAR Labs). The "*i*" in "*i*-ONE" stands for various layers of meaning, including *i*nstrument and instrumentation, *i*dea, *i*nnovation, *i*ntegration, *i*mplementation, and *i*nternationalization. The young participants from high school through graduate school from Taiwan and the broad Asian region are encouraged to be creative and innovative in the research and development of instrument technology from the beginning of their studies.

In November 2013, the 5th *i*-ONE International Instrument Technology Innovation Competition was held at ITRC in Hsinchu, Taiwan. It was an honor to invite Professor Pasquale Daponte, from the Administrative Committee of IEEE I&M Society as well as the President of IMEKO (International Measurement Confederation), to attend the ceremony and inspire all of the young scientists to take active roles in the innovation and design of instruments. Four groups in the high school level and four groups in the college and above level were awarded prizes. All of the students enjoyed the process of the competition and hoped they will continue researching in the field and connecting to the world. Every year, contestants may submit applications to *i*-ONE from May 1 to August 31. Please visit the official website (http://i-one.org.tw/index-e.jsp) for more detailed information.

Optical System Integration R&D Consortium

With the rapid advancement of technology, Taiwan's industry has migrated from the original equipment manufacturing (OEM) to the next generation of value added manufacturing. To bridge academia and industry, the *Optical System Integration R&D Consortium* was launched in November 2013 with the sponsorship of the IEEE I&M Society Taipei Section Chapter and the Instrument Technology Research Center (ITRC) of National Applied Research Laboratories (NAR Labs). The Optical System Integration R&D Consortium aims to assist academia by encouraging the development of original ideas or achievements into prototype models to be accepted by industries. Currently, there are over 70 members of the Consortium from academia and industry.

In 2014, the Optical System Integration R&D Consortium held two meetings to strengthen the interactions between members and to coordinate the university members' achievements with industry members' requests. The future goal of the Consortium is to reinforce these connections across the globe and seek international cooperation and collaborative opportunities. For detailed information, please refer to https//www.itrc.narl.org.tw/International/osic.php.

This print article includes photographs from the events discussed.

New Products

Robert Goldberg

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Graphical Sampling Digital Multimeter

Keithley Instruments introduces the DMM7510 7½-Digit Graphical Sampling Multimeter. The first of a new class of digital multimeters, it integrates a high accuracy digital multimeter, a digitizer for waveform capture, and a capacitive touchscreen user interface. The DMM7510 is designed to give users confidence in the accuracy of their results, the ability to explore measurements further, and intuitive touchscreen operation. Its user interface continues the company's "Touch, Test, Invent®" design philosophy that lets users learn faster, work smarter and invent easier.

The DMM7510 offers users a powerful combination of measurement capabilities:

- Precision multimeter offers the flexibility to select resolution levels from 3½ to 7½ digits
- Provides DC accuracies typically only found in metrology-grade instrumentation—but at about half the price of those solutions
- 14ppm basic 1-year DCV accuracy
- Expanded measurement ranges (100mV, 1Ω, and 10μA) enhance low level accuracy
- Auto-calibration feature minimizes temperature and time drift
- Low burden voltage improves low current measurement accuracy
- High accuracy signal sampling with a 1MS/sec, 18-bit digitizer.

The touchscreen allows you to view and analyze current and voltage waveforms and transients without the need for an additional instrument or a PC. The touchscreen interface/display supports setting up tests faster and more intuitively and viewing results both numerically and graphically.

Test results stored in any of the data buffers can be displayed in graph, histogram, or numerical/datasheet form. A built-in graphing utility supports displaying and comparing measurements or waveforms from up to four reading buffers at once. Test results and screen images can be stored quickly via the USB 2.0 memory port. Connections and controls simplify configuring multi-instrument test solutions, including input connectors, remote control interfaces (GPIB, USB 2.0 and LXI/Ethernet), a D-sub 9-pin digital I/O port (for internal/external trigger signals and handler control), and TSP‑Link® jacks for connecting to other Keithley instruments with an embedded Test Script Processor (TSP®).

More information on the DMM7510 is available on Keithley's website at www.keithley.com/dmm7510.

Vector Network Analyzer Advances Performance with Faster Test Times

Keysight Technologies, Inc. announces the E5080A ENA vector network analyzer (VNA), which offers a combination of RF measurement performance and speed, enabling a tenfold improvement in test time.

The new ENA uses the Keysight PNA- and PXI-Series software architecture, making it easier for engineers to take measurements across multiple Keysight VNAs. The ENA also offers a large color touchscreen display with fast access to basic measurements.

The E5080A offers comprehensive functionalities for measuring active and passive components such as amplifiers, mixers, antennas and cables, including balanced DUTs. Compared to the E5071C ENA, the E5080A offers performance advantages including more than 10 dB wider dynamic range (typically 147 dB) and up to 10 times faster measurement speed in real-world test scenarios. These enhancements improve precision and throughput in the testing of RF components such as filters with deep rejection bands.

Keysight claims to be the first VNA vendor to provide a software platform that spans benchtop and PXI-based VNAs. This universal platform uses the best attributes and capabilities of the ENA and PNA families and delivers familiar functionality across all Keysight VNAs. With the new touch-based GUI capabilities, including tabbed softkeys and drag-and-drop operations, the E5080A streamlines measurement flow and helps engineers get better results in less time. More information is available at www.keysight.com/find/E5080A.

Twelve Throw RF MEMS Ohmic Switch

DelfMEMS, is demonstrating what it believes to be the world's first, twelve throw, RF MEMS Ohmic contact switch. Until now, companies have tended towards the capacitive switch solution route. DelfMEMS has chosen the more difficult route of contact or Ohmic switching because of the superior performance. They have succeeded in creating the world's first, fully functional version. RF MEMS switches have been known for many years as outstanding potential solutions for mobile handset RF performance, but have so far failed to see any reasonable level of success either due to cost or reliability concerns. DelfMEMS has solved these issues with their FreeFlex™ MEMS technology.

The benefits of DelfMEMS RF-MEMS switching solution are being able to deliver the performances required for the next generation of handsets, LTE-A, and beyond, with ultra-low insertion loss, outstanding isolation and superior linearity to enable full uplink carrier aggregation.

The early samples of the SP12T switch have performance levels that are comparable to the current market leading solutions but for production devices the performance levels will be significantly higher, enabling the full potential of LTE-A and beyond data rates for both upload and download to finally be achieved.

Appointments to see the demonstration can be arranged by emailing sales@delfmems.com. More information can be found at www.delfmems.com.

Test Platform Advances Mission-Critical Aerospace Production Test
Marvin Test Solutions announces the TS-323 GENASYS Test Platform. GENASYS is a high-performance PXI-based system designed to meet the demands of mission-critical applications that require high performance functional testing. GENASYS features a high-density, multiplexed switching subsystem with any-pin-to-any-resource architecture and switch management software that provides automated, end-to-end signal routing. GENASYS also includes a high-performance digital subsystem that supports up to 512 I/O pins with multiple timing sets and per-pin PMU capability. The system will be deployed by Lockheed Martin Space Systems Company (LMSSC) for the functional testing of satellite systems and subsystems.

GENASYS supports future applications including: an open architecture, a functional test platform that is configurable, scalable, and the capability to support more than 4,000 I/O test points as well offering performance digital and analog test capabilities.

The GENASYS platform, with its high-performance digital subsystem and high-density switching subsystem, provides LMSSC the required functionality to support both their legacy and future test needs. For new, mission-critical test needs, the GENASYS platform offers test engineers advanced software tools with system and UUT simulation capabilities, and user-defined FPGA instrumentation for the support of custom control interfaces.

The high-performance PXI digital subsystem addresses a range of bus test requirements including 1553, 429, RS-232, and custom or parallel digital busses. In addition, the multiplexed pin architecture of the GENASYS platform supports more than 6,000 UUT pin connections. With hybrid pin capability, both analog and digital tests can be performed at the pin level.

To learn more about how the Marvin Test Solutions GENASYS functional test system can successfully address both current and future test needs that are currently supported by legacy functional test platforms, download the new white paper: "Solving Functional Test Obsolescence."

Visit www.marvintest.com for the download and additional information.

New Lock-in Amplifiers

Zurich Instruments releases the specifications for two new products simultaneously.

The MFLI Lock-in Amplifier is available in two variants, with a choice of two frequency ranges:

- MFLI 500 kHz Lock-in Amplifier: DC to 500 kHz and
- MFLI 5 MHz Lock-in Amplifier: DC to 5 MHz.

Covering the medium and low frequency part of the spectrum for dynamic signal measurements, the products are equipped with a wide array of features. Users will benefit from the superior performance paired with the LabOne toolset that existing Zurich Instruments customers know from their higher frequency instruments.

Zurich claims that this is the first time in the history of lock-in amplifiers that four instruments with different frequency ranges can be operated with the same software. The lock-in amplifiers from Zurich grow with the needs of the customers as they can add options to the instruments without sending them to the manufacturer, or purchase higher frequency instruments and keep working with the same user interface. Perhaps more significantly, the time invested in programming custom configurations can be reused as the LabOne programming interface is the same for all instruments.

The MFLI Lock-in Amplifier is also ideally suited for the integration business. It is one third the size of competitive instruments, opening up new footprint and packaging possibilities.

The instruments are now available for customer demonstrations and trials and will be showcased over the coming months at major international conferences and trade shows.

Find more information at www.zhinst.com.

Waterproof 3 Axis Acceleration And Tilt Sensor

JoyWarrior24F14 is a cost effective, waterproof, three axis acceleration and tilt sensor with USB interface from Code Mercenaries. The sensors measure with 14 bit resolution in ranges from ±1g to ±16g at 125 values per second. Angle resolution is better than 0.1°. The USB interface allows for ease of use with any computer.

Identifying as a joystick, the JW24F14 does not need any special drivers and access to the data is simplified. A configuration tool for setting the sensor parameters, a 3D tilt angle demo, a data recorder, and a calibration tool are part of the software support. The sensors are encapsulated to be waterproof and have mounting holes as well as an internal magnet for simple and fast mounting.

Sensor Features include:

- USB Low Speed interface (USB 1.1/2.0)
- X, Y, Z-axis at 14 bit resolution each
- 125 values per second
- Range ±1g, ±1.5g, ±2g, ±3g, ±4g, ±8g, ±16g software selectable
- Identifies as a joystick
- Size: 63 x 51 x 15 mm
- Mounting by screws or internal magnet
- Power supplied via USB.

Find more information at www.codemercs.com.

Laser Diode Upgrade

After the introduction of the DBR1 633 nm laser diode in early 2013, eagleyard now offers an additional housing option to its red product family. The GaAs2-based DBR laser diode with its new 14-pin butterfly package with window consists of an integrated thermistor, thermo-electric cooler (TEC) and a monitor diode. The device is capable of providing 10 mW @ 633 nm with a spectral linewidth of 750 kHz and below.

The small footprint of this laser diode is perfectly suited for demanding size requirements. Its integrated beam collimation and circular beam profile makes this laser diode very attractive for metrology applications. The compact design in conjunction with its narrow linewidth

performance opens new opportunities for users, as more bulky and power consuming HeNe lasers can now be replaced with a small laser diode.

The device is also available in the high reliable TO package as well as a 14-pin standard butterfly package with fiber pigtail and incorporates thermistor, thermo-electric cooler (TEC) and a monitor diode.

eagleyard's laser diodes are commonly used for various scientific and industrial applications involving metrology, biological research, spectral analysis, interferometry, sensing and a broad spectrum of other applications.

Please visit http://www.eagleyard.com/en/products/dfb-dbr-laser/ for more information.

Laser Distance Sensor

Banner Engineering announces the Q4X laser distance sensor. Featuring superior, versatile sensing performance, the Q4X reliably detects distance changes as small as 1 mm and covers a 25 to 300 mm range across multiple target colors, materials and surfaces. With the ability to detect presence/absence of a target or an object's orientation, the Q4X solves a variety of sensing applications.

The Q4X is optimal for difficult distance-based sensing applications as it easily detects objects regardless of target surface reflectivity, including black foam on black plastic, black rubber in front of metal, multicolor packaging and targets of all colors. Additionally, the sensor provides superior resistance to ambient light interference.

Offering a simplified user experience, the Q4X provides a clear distance readout from the highly visible, angled fourdigit display that is easily viewed from multiple vantage points. The Q4X also offers intuitive user setup utilizing three tactile buttons conveniently located below the display.

For more information on the Q4X laser sensor, watch the video: www.youtube.com/watch?v=W8ZIlBpR2PI or visit www.bannerengineering.com.

Signal Hound's "Spike" Software Boosts Performance

Signal Hound announces a significant software upgrade, called Spike, that will integrate all of its SAseries spectrum analyzers and TG-series tracking generator models, past and present, under the same open source Graphical User Interface (GUI) platform as the Signal Hound BB60C spectrum analyzer.

The Signal Hound USB-powered SA44B and SA124B are Software Defined Radios (SDR) optimized as spectrum analyzers. The SA44B operates from 1 Hz to 4.4 GHz and the SA124B operates from 100 kHz to 12.4 GHz. The Signal Hound TG44A and TG124A are tracking generators which work with the SA-series spectrum analyzers. Both the SA-series and TGseries instruments are compact, simple to use, and effective troubleshooting tools for field use, general lab use, engineering students, ham radio enthusiasts, and electronics hobbyists.

The new Spike software allows the SAs to function as realtime spectrum analyzers for sweeps of 250 kHz and less. That means every RF event will be captured when using spans that are equal to or less than 250 kHz. Another improvement is sweep speeds that are up to 8x faster for spans between 500 kHz and 2 MHz In addition, the SA graphics now include color persistence and a 2D waterfall display. The TG devices also benefit from Spike. Long-standing stability issues are resolved, to include making the high dynamic range user friendly and efficient. The tracking generators can now save 1000-point data files that are then loaded in the path loss table for normalizing precision measurements using RF cables and/or antennas. New to both the BB60C and the SA devices is a zero span pre-triggering function and calibrated I/Q data streaming.

Developers will be able to customize the Spike software by changing, adding, and deleting functions, layouts, and utilities in the SA and TG devices. A liberal software license allows developers to compile the modified spectrum analyzer code for redistribution. Even though the SAs are hardware limited when compared to the BB60C, they can now enjoy the flexibility and power of the BB60C software platform.

Please visit www.signalhound.com for more information.

RF Isolators and Circulators

Fairview Microwave has announced a new portfolio of ferrite passive devices up to 40 GHz. The products include new RF Circulators and Isolators, which are commonly used in radar systems, wireless communications, distributed antenna systems (DAS), test labs and amplifier systems where sensitive RF equipment would require protection from reflected signals.

Fairview Microwave's 2-port RF isolators are passive ferrite devices that aid in the protection of sensitive RF components from excessive power reflection. Fairview's RF isolators are designed with connectorized packages with SMA, Type-N, or 2.92 mm connectors and operate in select frequency bandwidths between 175 MHz and 40 GHz depending on the specific model. Several of the isolators exhibit high isolation levels of 20 dB min, insertion loss as low as 0.35 dB, and some have max power ratings up to 1,000 Watts.

Fairview's RF circulators are 3-port passive ferrite devices that circulate the flow of energy from each port to its clockwise adjacent port. Circulators are also unidirectional and control the signal direction and flow inside of an RF circuit. These new circulators from Fairview are designed with SMA or Type-N connectors and operate in select frequency bandwidths between 175 MHz and 26.5 GHz. Similar to the isolators, several circulator devices exhibit high isolation levels of 20 dB min, insertion loss down to of 0.35 dB, and some operate up to 1,000 Watts max power.

Please visit www.fairviewmicrowave.com/rf-products/rf-isolators-and-circulators.html for additional information.

High Accuracy Industrial Differential Pressure Transducer
The PX509HL Series industrial differential pressure transducers from Omega are rugged shock and vibration rated with high accuracy and are specifically designed to provide long life in demanding industrial areas. The compensated overload range minimizes errors induced by large line pressures. Features include welded stainless steel construction, user accessible potentiometers for zero and span, and demountable electrical terminations or a fixed conduit fitting without trim pots.

They are temperature compensated over a broad range providing excellent thermal properties and high long term stability. A precision micromachined silicon sensor is at the core and provides a very stable reading with exceptional high accuracy of 0.08% with a broad compensated range of -20 °C to +85 °C on most ranges.

Modular construction allows for fast delivery of most configurations. Customized models also can be developed.
For more information, please visit www.omega.com/pptst/PX509HL.html.

Flow Sensors for Visual Indication, Continuous Sensing and Accurate Switching

Gems Sensors & Controls announces its complete range of RotorFlow® sensors, now available as a standard catalog product. Gems RotorFlow is a family of electronic flow sensors, designed to provide reliable and continuous sensing, accurate switching, and clear visual indication within a variety of flow rate monitoring and metering applications.

With available measurement ranges from 0.1 GPM to 60.0 GPM (0.4 LPM to 227 LPM), the Gems RotorFlow line features a unique paddlewheel design which combines high-visibility composite rotors and durable solid-state electronics.

Gems RotorFlow RFO and RFA Type sensors offer flow rate measurement accuracy and integral visual indication. They are easily integrated into most digital logic units. RFO Types provide a 4.5 to 24 VDC pulsed DC voltage output that is directly proportional to measured flow rate, while RFA Types provide a continuous 0-10 VDC analog output. For customers needing simple visual indication, RFI Types offer effective, "at-a-glance" flow rate estimation and confirmation, with easy viewing of the run speed of the brightly orange colored, single-piece composite rotor. RFI Types are available with choice of either a DC pulsed or an adjustable 1 amp switched output.

For more information about RotorFlow sensors, or other flow sensing instrumentation offered by Gems Sensors & Controls,please visit www.GemsSensors.com.

Next Generation Sound Level Meter Utility Software

Larson Davis announces that new Sound Level Meter Software, SLM Utility G4, is now available as a free download on their website. Designed to be used with the Model 831 and LxT sound level meters, this utility provides a modern interface that will enhance the user experience when setting up the sound level meters or when analyzing data.

Also shipped with new products, this software enables users to work more efficiently with the Model 831 and LxT sound level meters by supporting simultaneous control of multiple meters. The G4 utility allows consultants and engineers to easily share setups, download and display data, and export to Excel® files through a USB or Internet connection. The standard software is 64-bit to support large data files and work efficiently on newer computers, although there is also a version available for 32-bit computers.

SLM Utility G4 is supported by Larson Davis when running on Windows® XP, Windows® 7 and Windows® 8 platforms. SLM Utility G4 has been designed to replace SLM Utility G3 and future new features will be made available only in SLM Utility G4.

For more information or to download SLM Utility G4, visit www.larsondavis.com/UtilityG4.