The IEEE Instrumentation & Measurement Magazine
June 2013 Issue

Signal Processing
I&M Systems in Nuclear, Battery and Underground Environments

From the Editor's Bench

Mike Gard

Industrial Content and the Signal Processing Issue

These pages frequently express a determination to increase industrial content. The Magazine's readers will find this issue has a very pronounced industrial orientation.

Three articles are extended papers from the October 2012 Future of Instrumentation in Industry Conference. "Advanced Instrumentation for Extreme Environments," by Alexander Melin, Roger Kisner, and David Fugate examines the difficulties of designing instrumentation and systems for nuclear reactors illustrated by a high-temperature fluoride salt coolant pump loop. "Thermoacoustic Thermometry for Nuclear Reactor Monitoring," by Randall Ali, Steven Garrett, James Smith, and Dale Kotter describes a novel thermoacoustic sensor package deriving its operating power from the high temperature differential in nuclear reactor fuel rods, giving us a new appreciation for energy harvesting in a difficult environment. Jamie Coble, Pradeep Ramuhalli, Ryan Meyer, and Hash Hashemian in "Online Sensor Calibration Assessment in Nuclear Power Systems," explore instrument issues in an operating nuclear plant where calibration, repair, and replacement problems are greatly complicated by the hostile environment, severe operating constraints, and long intervals without access to the instruments (other examples include submarines, and spacecraft). This latter article includes material of interest to anyone who must deal with instruments experiencing gradual degradation over time.

The other June articles are contributed by authors in a variety of different industries. Scott Cole's "Minimizing Radiated Noise in Magnetically Sensitive Applications" presents an excellent practical discussion of engineering trade-offs and techniques to identify, localize, and mitigate noise problems affecting a very sensitive low-frequency magnetic field instrument for pipe and cable locating. Max Cortner, Efren Dizon, and Jorge Rodriguez-Alvarez discuss the unusually complex issues encountered when testing primary batteries for implantable medical devices in "Testing Lifetime Performance of Primary Batteries." Laszlo Kovacs, Denes Fodor, Otto Klug, and Krisztian Enisz in "Measurement Automation System for Aluminum Electrolytic

Capacitor Development," take us behind the scenes of electrolytic capacitor development, giving the reader a new appreciation for the little aluminum cylinders of microfarads that appear everywhere in modern electronics.

Finally, three veteran columnists have made their usual excellent contributions. Bruno Ando has provided "Inkjet Printing: A Real Opportunity for the Next Generation of Low-Cost Sensors." James Schooley in "Egad! It's a Mole!" takes us though one of the fundamental developments during the early years when chemistry began to shake off the mantle of alchemy to become the science we know today. No issue would be complete without Bob Goldberg's "New Products" column; the June issue is up to standard.

This issue was identified in the 2013 editorial calendar as a salute to signal processing since manuscripts submitted to the Magazine typically contain a high proportion of signal processing topics. As luck and Murphy would have it, we have excellent industrial material and no signal processing. The EIC, who bears sole responsibility for this situation, promises to take steps to insure that our editorial calendar topics reflect the article content. And to those readers whose work involves a good deal of signal processing: I owe you an issue.

We appreciate and encourage reader feedback. The EIC wishes to thank those readers who took the time to write in response to the article "The Theory of Evidence: A New Promising Approach to the Evaluation and Expression of Measurement Uncertainty," which appeared in the February 2013 issue. The responses were uniformly positive, and we are now working with the author, Simona Salicone, to define additional articles for future issues.

Other exciting articles and tutorials are in preparation. In addition to Veronica Scotti's article to explain the L'Aquila decision (see the April 2013 issue of this column), Dr. Ian Mills and Dr. Terry Quinn have agreed to prepare an article explaining soon-to-be implemented changes in the SI mass standard. They have been in the vanguard of activity supporting redefinition of one of the most fundamental of units; this should be a memorable article. In addition, Dario Petri has offered to prepare at least one tutorial on "Fundamentals of Measurement," which will allow us all to revisit and reinforce the essential elements of our chosen specialty.

The 2013 Instrumentation and Measurement Society's Officers and Editors Meeting was held 21-22 February in Atlanta, Georgia. The sole objectives of this meeting were to scrutinize missions and plans of the I&M Society's standing committees and publications and to do some serious brainstorming to insure the Society's committees and publications meet their obligations to the Society and the Society's membership. The discussions were helpful and to the point. The Magazine's emphasis remains the same, but behind-the-scenes changes to improve quality and increase the variety of industrial, academic, and metrological content were identified and are

now being implemented. The Society is serious about supporting and informing its members and welcomes your suggestions.

As always, the *I&M Magazine* encourages manuscripts from industrial authors. Instrumentation and measurement activity accompanies almost any serious effort in applied science and engineering, so we welcome submissions from authors working in almost any measurement field. The Magazine currently has particular interest in manuscripts dealing with energy applications (especially oil and gas) for the December 2013 issue. There still is time – the manuscript submission deadline for the December issue is 18 July 2013. Please share what you know; we'd really like to hear from you. More later,

Mike

Please contact Mike at IandMMagazineEIC@ ieee.org. His bio is available at http://www. ieee-ims.org/publications/im-magazine.

Article Summaries

Advanced Instrumentation for Extreme Environments

(Summary)

Alexander Melin, Roger Kisner, and David Fugate

Oak Ridge National Laboratory (ORNL) is investigating embedded instrumentation and controls technology for next generation nuclear power generation applications. Embedded systems encompass a wide range of configurations and technologies; the authors define embedding in this instance as the integration of the sensors and the control system design into the component design using a systems engineering process. In this paper, they focus discussion on the challenges of sensor design in extreme environments and specifically the sensor design for a high-temperature fluoride salt pump. The high temperature pump is used to demonstrate the performance improvements that embedded instrumentation and controls can bring to nuclear power plant components and as a test-bed to assist in the development and validation of techniques for extreme environments.

This summary includes text from the article.

Minimizing Radiated Noise in Magnetically Sensitive Applications

(Summary)

Scott Cole

Magnetically sensitive systems must be designed with special attention to any components that can radiate magnetic energy. Most often, the problematic section is the power supply, since there can be high frequency switching, inductors (antennas), and broadband signals. This article illustrated the design process for magnetically sensitive designs using an example taken from the pipe and cable locating industry. In this example, a small battery-operated instrumentation package must accurately sense unusually small magnetic fields while maximizing battery life. Battery life considerations required the system to utilize a switching power regulator, which required multiple redesigns to minimize noise to a point where the system could perform satisfactorily.

This summary includes text from the article.

Thermoacoustic Thermometry for Nuclear Reactor Monitoring

(Summary)

Randall A. Ali, Steven L. Garrett, James A. Smith, and Dale K. Kotter

The interior of a nuclear reactor presents a particularly harsh and challenging environment for both sensors and telemetry due to high temperatures and high fluxes of energetic and ionizing particles among the radioactive decay products. The authors describe an approach that exploits the high temperatures and uses materials immune from the effects of ionizing radiation to create a self-powered temperature sensor providing reactor performance information even when external electrical power is unavailable. This solution represents one of simplicity and synergy with the harsh operating conditions within the nuclear reactor. There are no physical moving parts required for these TAC devices, no heat exchangers are required for operation, and the sensor is self-powered, as it uses heat from nuclear fuel as its energy source. The information needed from these TAC sensors are emitted as frequency-coded acoustic signals and are therefore easy to measure and to multiplex for systems containing multiple sensors. Integrating such sensor systems, along with the existing nuclear reactor instrumentation, may prove to provide major benefit for the nuclear industry.

This summary includes text from the article.

Testing Lifetime Performance of Primary Batteries

(Summary)

J. Max Cortner, Efren Dizon, and Jorge Rodriguez-Alvarez

In present technology, pacemaker and implantable defibrillator batteries are primary batteries, rather than rechargeable batteries. This creates an additional requirement: using

minimal battery capacity during production tests and performance measurements. It is vital to use high impedance voltmeters and carefully design the interconnected equipment. Two distinct testing regimens are necessary for successful batteries: *battery life testing* to predict the long term performance of a particular design, and *production process tests* to monitor manufacturing parameters and assure a high level of quality control. This article details these regimens of testing. The multiple simultaneous protocol life testing scheme described in this article has been employed for several batteries in both high output defibrillator and low output pacemaker designs for the past ten years.

This summary includes text from the article.

Online Sensor Calibration Assessment in Nuclear Power Systems

(Summary)

Jamie Coble, Pradeep Ramuhalli, Ryan Meyer, and Hash Hashemian

Online monitoring (OLM) for sensor calibration interval extension was proposed to the US Nuclear Regulatory Commission (NRC) in 1998 by the Electric Power Research Institute, and the generic concept of OLM for calibration interval extension was accepted by the NRC in 2000. Similar modeling and anomaly detection techniques can be applied for online signal validation tasks. A recent review of the state of the art of OLM for calibration assessment and signal validation identified several open questions that should be addressed to complete the scientific basis for OLM in nuclear power systems [2]. This article summarizes the results of the recent assessment. Sensor technology in the nuclear power industry and the current approach to periodic calibration assessment are outlined in the following section. Then, the alternative OLM-based approach is described. In addition, the remaining scientific questions in OLM-based calibration assessment and signal validation are summarized.

This summary includes text from the article.

Measurement Automation System for Aluminum Electrolytic Capacitor Development

(Summary)

Laszlo Kovacs, Denes Fodor, Otto Klug, and Krisztian Enisz

At Electronic Parts and Components Ltd. in Hungary, a complex Measurement Automation System has been implemented to automate measurements during electrolyte development, register the experimental capacitors created with experimental electrolytes, support different kinds of capacitor tests, and accelerate evaluation of measured data. This paper briefly

presents the basic structure of capacitors and the manufacturing process, introduces the structure of the system and two significant measurements: one on the electrolyte and the other on the capacitor, and then discusses the evaluation process which helps research and development engineers to accelerate innovation.

This summary includes text from the article.

Columns

Instrumentation Notes

Inkjet Printing: A Real Opportunity for the Next-Generation of Low-Cost Sensors
(Summary)

Bruno Ando

This column follows up on an earlier introductory article and addresses a benchmark among printing technologies, focusing on "direct printing" solutions as the most suitable approach for the rapid prototyping of low-cost sensors. Low-cost printed, flexible sensors are of great interest for the scientific community, including research laboratories and academies, and can be conveniently used in many application contexts. The author compares screen printing, inkjet printing and hybrid processes with the goal of determining criteria useful in selecting the most appropriate technology, a task that often depends on the development context and application area. In addition, technologies being developed at the University of Catania, DIEEI Laboratory and new developments in this field are introduced.

This summary includes text from the article.

History of Physical Standards

Egads! It's a Mole!
(Summary)

James F. Schooley, Sr.

In another version of his series in the history of measurement standards, the author provides a survey of the fundamental developments when "chemistry began to shake off the mantle of alchemy to become the science we know today." The concepts of historical figures such as Robert Boyle and Antoine Lavoisier and Amedeo Avogadro are covered and how their theories crystalized into standards that describe the relationship of molecular mass, moles, molecules and volume. Future modifications of the mole will improve its accuracy.

This summary includes text from the article and a summary by M.Gard.

Departments

New Products

Robert Goldberg

New 5½-Digit Digital Multimeter

The Model 2110 5½-Digit Dual-Display Digital Multimeter from Keithley provides a comprehensive set of capabilities, superior measurement accuracy, and high speed for a broad range of applications. It features fifteen measurement functions, seven math functions, and has dual-line display capability allowing it to display two different measurements concurrently. The Model 2110 provides a wide variety of measurements for portable, bench, and system applications.

The Model 2110 provides precision and a rich set of capabilities at a value price. It has 0.012% one-year basic dc voltage accuracy and 0.020% one-year basic resistance accuracy up to the 100 kO range. It provides a wide number of measurement ranges and functions:

- dc voltage: 0.1V, 1V, 10V, 100V, and 1000V,
- ac voltage: 0.1V, 1 V, 10V, 100V, and 750V,
- dc current: 10 mA, 100 mA, 1A, 3A, and 10A,
- ac current: 1A, 3A, and 10A,
- Two- and four-wire resistance: 100O, 1kO , 10 kO , 100 kO, 1MO, 10 MO, and 100 MO,
- Frequency: From 10 Hz to 300 kHz,
- Capacitance measurement: 1 nF, 10 nF, 100 nF, 1 µF, 10 µF, 100 µF,
- Thermocouple measurement: J-, R-, S-, T-, E-, N-, B-, C-, and K-type thermocouples,
- Temperature (RTD and NTC Thermistor) measurements,
- Diode measurement,
- Continuity test, and
- Programmable A-D converter and filter settings for signal to noise optimization.

  Additionally, these mathematical operations can be performed on measurement readings: percentage, average, min/max, NULL, limits, mX+b, dB, and dBm testing.

On the 5½-digit setting, the Model 2110 delivers up to 200 readings per second via the USB remote interface. On the fast 4½-digit setting, it reads up to 50,000 readings per second and up to 30,000 readings per second into the buffer, making it ideal for production and monitoring applications in which speed is critical.

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

High Efficiency Solar Cell

Heliatek claims a new world record for organic solar technology with a cell efficiency of 12% for its organic solar cells. This world record, established in cooperation with the University of Ulm and TU Dresden, was measured by the accredited testing facility SGS. The measurement campaign at SGS also validated the superior low light and high temperature performances of organic photovoltaics (OPV) compared to traditional solar technologies.

The 12.0% record cell with a standard size of 1.1 cm^2, combines two patented absorber materials which convert light of different wavelengths. Using two different absorber materials creates a stronger absorption of photons and improves energy utilization through a higher photovoltage.

Thanks to OPV's unique behavior at high temperatures and low light conditions, this 12% efficiency is comparable to about 14% to 15% efficiency for traditional solar technologies like crystalline silicon and thin film PV. Whereas those technologies significantly lose cell efficiency with rising temperatures and decreasing solar irradiation, organic cells increase their efficiency in these conditions, leading to much higher energy harvesting in real life environments.

The new efficiency for OPV improves the prior record of 10.7% which was also set by Heliatek. Heliatek's OPV technology based on small molecules (oligomers) is currently being transferred to commercial production. The commercialization of first partner energy harvesting applications with integrated Heliatek Solar Films components is expected in late 2013.

The key to Heliatek's success is the family of small organic molecules, oligomers, developed and synthesized at its own laboratory in Ulm, Germany. Heliatek deposits small organic molecules in a low temperature, roll-to-roll vacuum process. Its organic solar cells are made of nanometer-thin layers of high purity and uniformity. This enables the company to literally engineer the cell architecture to systematically improve efficiency and lifespan. This technology is very similar to the well-established OLED technology (organic LEDs) except that it operates in reverse, taking in light to create electricity.

Find out more about smart solar technology at www. heliatek.com/.

Customizable Switching and PXI Control Card

Geotest-Marvin has introduced the GX6196, a 6U PXI switch and control board that can be used to create custom switching, signal conditioning, or custom control interfaces.

All switching and control resources are available via (5) inter-board connectors which interface to the user-defined daughter / mezzanine board. The mezzanine board provides all connections to the unit under test (UUT) via two 78 pin D-sub connectors. By providing access

and control to all 96 relays, users have the option to create custom relay configurations, custom switched load board configurations or even custom interface circuitry controlled by the module's software function calls.

The GX6196 is supplied with a software package which includes a virtual instrument panel and Windows 32/64-bit driver libraries for ATEasy, LabView, LabView/Real-Time, C/C++, Microsoft Visual Basic®, Linux 32/64, Delphi, and Pascal.

For more information, please visit www.geotestinc.com/ Product.aspx?model=GX6196.

Bit Error Ratio Tester

Agilent Technologies announces a 32-Gb/s bit error ratio tester with fast rise time and higher output amplitude.

A new era of data center infrastructure enabling cloud computing, big data, and analytics are driving the development of new high-speed data transfer standards such as 100-Gb Ethernet and 32-Gb Fiber Channel. These higher speeds create new testing challenges for optical and electrical component designers. More stringent requirements for component characterization necessitate faster rise/ fall times. Optical transceivers and transmitter optical subassemblies (TOSAs) require high drive voltages that standard pattern-generator outputs cannot supply.

To address the issue, Agilent has created remotely mountable pattern-generator heads for use with its N4960A BERTs (bit error ratio testers). The new pattern-generator heads feature improved rise and fall times of 12 ps to give ASIC designers the headroom necessary for signal fidelity at the test pin.

In addition, these new options integrate higher voltage output drivers into the pattern generator. This feature allows designers of optical transceivers to directly drive VCSELs (vertical-cavity surface-emitting lasers), TOSAs and laser modulators for higher-data-rate applications such as 100-Gb Ethernet without the need for external driver amplifiers, associated interconnecting cables, and power supplies.

As part of the N4960A BERT family, the new pattern generators are configured as remote heads connected to the BERT controller with a cable. This configuration allows the pattern generator to be located close to the device under test, minimizing the length of the signal cable, which helps minimize signal degradation.

Additional information about Agilent's new N4960A BERT is available at www.agilent.com/find/N4960A.

Wideband Power Input Limiter Protects Devices

The new CLM-83-2W+ limiter from Mini-Circuits covers an extremely wide bandwidth (30 MHz to 8.2 GHz) with a footprint only 0.12 x 0.12 x 0.045 in (3.048 mm x 3.048 mm x 1.143 m)

high. High-power inputs (up to +32 dBm) are reduced to +12 dBm or less, with only 0.5 dB of small-signal insertion loss—at operating temperatures up to 105 °C. Like the rest of the Mini-Circuits limiter lineup, it offers excellent protection against ESD spikes, power surges and RF transceiver leakage in hostile environments where unwanted signals prevail.

Applications include:

- Military, Hi-Reliability applications,
- Stabilizing generator outputs,
- Reducing amplitude variations, and
- Protecting low noise amplifiers and other devices from ESD or input power damage.

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

Miniature Length Sensor Measures Speed, Position, or Distances

Omega introduces its new series of miniature length-measurement sensors that are compact in size and easy to use. The ZMD series features a built-in spring- loaded torsion arm that provides a simple-to-adjust torsion load, allowing the unit to be mounted in almost any orientation, including upside-down. Using a 6 in circumference wheel, the ZMD can be used on almost any surface, while operating at speeds up to 3000 feet per minute (914.4 meters per minute). The housing is a durable, conductive composite material that will eliminate static build up which makes this product ideal for light- to medium-duty sensing applications. Whether you need to measure speed, position, or distances, the CE compliant ZMD series sensor is the ideal solution.

The complete spec sheet is available at www.omega.com/ pptst/ZMD.html.

Next-Generation Temp/RH Data Loggers

Onset announces the HOBO UX100 Series, the company's next-generation family of data loggers for tracking temperature and relative humidity in indoor environments. Onset claims the HOBO UX100 Series loggers offer a dramatic price/performance advantage over competitive products by delivering higher accuracy, larger measurement capacity, and more LCD display features to make environmental data collection faster and easier than ever.

Facility managers, energy auditors, and others will use the matchbox-sized UX100 Series data loggers to quickly and easily collect indoor environmental data in a broad range of applications.

HOBO UX100 data loggers streamline indoor environmental monitoring applications and make deployment faster than ever. The loggers feature an easy-to-view LCD display that visually confirms logger operation and battery status, eliminating the need to connect the logger to a PC to see the information.

UX100 loggers also feature start and stop pushbuttons and rare earth magnet, strap, and command-strip mounting options to enable faster deployment and greater mounting flexibility and reliability.

Once data have been recorded with HOBO UX100 data loggers, they can be easily viewed in graph form and analyzed using Onset's HOBOware® Pro software. Time-saving tools allow users to batch-configure and readout hundreds of loggers in a fraction of the time it would take with previous generations.

Please visit www.onsetcomp.com for complete details and technical specifications.

Mini Data Logger Features Multiple Sensors

The new possibility of selecting up to five sensors of the same measurand affords the user a multitude of new areas of application for the MSR145 mini data logger. Developed by the Swiss technology company MSR Electronics GmbH, the MSR145 can be equipped with fluid pressure sensors for the first time, and temperature measurements are now possible for an extended measuring range from -250 °C to +1200 °C.

Four years ago, the developers of MSR Electronics GmbH presented the world's first miniature MSR145 quality data logger. The key features of the universal logger were and still are its small housing, exceptionally large memory and high modularity.

You can now select whether you wish to equip the MSR145 data logger with more than one sensor of the same measurand. As options, you can now connect up to five temperature, humidity or pressure sensors to the MSR145, or you can combine various sensors with one another. In addition to temperature, humidity or pressure, you can further select an acceleration sensor or you can decide on two or four additional analog inputs, depending on the number of channels you have already assigned. To measure the pressure of fluids such as water or oil, the MSR145 mini data logger can now be equipped with an external pressure sensor for an absolute measuring range of either 0 to 3000 mbar or 0 to 30 bar. Technical specifications and international distributors may be found at www.msr.ch.

International Power Source

The Interpower International Power Source (IPS) provides a low-cost, convenient source of ac power at various operating voltages and frequencies found around the world (typically 110-240 Vac/50-60 Hz) which is important for testing any products that are exported.

Output power is delivered through one of two ranges: Low range (NEMA5-20) and High range (six standard international sockets), so that products can be conveniently powered during development or just prior to shipment.

The Interpower International Power Source carries the following approvals: ETL Certified, SEMKO Certified, CB Certificate, and RoHS Compliant.

Technical Specifications are:

- P/N: 85522211. Input: 100 – 240 VAC/50-60 Hz, supplied through 20 A NEMA 5-20 plug. Output: 2200 VA maximum, Low Range variable 10-138 VAC @ 16 Arms max and High Range variable 10-276 VAC @ 8Arms max, 47-450Hz, with 1 RS232 and 1 USB port.
- P/N: 85522201. Input: 100 – 240 VAC/50-60 Hz, supplied through 20 A NEMA 5-20 plug. Output: 2200 VA maximum, Low Range variable 10-138 VAC @ 16Arms max and High Range variable 10-276 VAC @ 8Arms max, 47-450 Hz. No communications port option.
- P/N: 85521711. Input: 100 – 240 VAC/50-60 Hz, supplied through 15 A NEMA 5-15 plug. Output: 1725 VA maximum, Low Range variable 10-138 VAC @ 12.5Arms max and High Range variable 10-276 VAC @ 6.25Arms max, 47-450 Hz, with 1 RS232 and 1 USB port.
- P/N: 85521701. Input: 100 – 240 VAC/50-60 Hz, supplied through 15A NEMA 5-15 plug. Output: 1725 VA maximum, Low Range variable 10-138 VAC @ 12.5Arms max and High Range variable 10-276 VAC @ 6.25Arms max, 47-450 Hz. No communication port option.

LabVIEW drivers are available for part numbers 85521711 and 85522211. They can be downloaded from National Instruments' website. Login to: http://search.ni.com/nisearch/app/main/p/bot/no/ap/tech/lang/en/pg/1/sn/ssnav:idr/q/interpower/.

Find more information at www.interpower.com.

Synchronous Serial Interface with Four Individually Configurable Ports

Sealevel's 5402e is a PCI Express synchronous serial interface that provides four ports individually configurable for RS-232, RS-422, RS-485, RS-530, RS-530A or V.35. Designed using the first 4-port PCIe sync board to support the popular Zilog Z85230 Enhanced Serial Communication Controller (ESCC), the synchronous serial adapter is an ideal solution for military, satellite, radar and other applications that require robust synchronous communications.

In RS-232 mode, all common modem control signals are implemented for compatibility with a wide range of peripherals. For maximum compatibility with a variety of synchronous protocols, a digital phase lock loop (DPLL) is included on each port, and the board supports data rates up to 128K bps in burst mode. For easy implementation, a fan-out cable is included that terminates the on-board 100-pin SCSI-style connector to four DB-25M connectors. Terminal blocks, adapter cables and other helpful accessories are available to simplify installation.

Software support, critical for successful synchronous communication development, is provided through Sealevel's SeaMAC V5 synchronous serial driver. HDLC/SDLC protocols are supported as well as certain configurations of Monosync, Bi-sync and Raw modes.

For more information, visit www.sealevel.com.

USB 3.0 Oscilloscopes Launched

The first PC oscilloscopes with a USB 3.0 interface have been released by Pico Technology. With the new USB 3.0 PicoScopes, large data captures and streaming of large data sets are now much faster.

The PicoScope 3207A is a 2 channel USB oscilloscope with 250 MHz bandwidth, 1 GS/s sampling rate, 256 MS buffer memory and a built-in function generator. Basic timebase accuracy is ±2 ppm. Other features include digital triggering for accurate, stable waveform display and equivalent-time sampling which boosts the effective sampling rate to 10 GS/s for repetitive signals. The PicoScope 3207B has 512 MS buffer memory and an additional 32k-sample arbitrary waveform generator with 100 MS/s update rate. As the scope obtains its power from the USB port, there is no need for an external power adaptor.

The oscilloscopes are supplied with the PicoScope software for Windows which turns your computer into a powerful oscilloscope and spectrum analyzer. The software includes many advanced features such as: automatic measurements; serial decoding of RS-232/UART, SPI, I2C, CAN, LIN and FlexRay data; and mask limit testing that are only available as expensive add-ons for most competing scopes. Software updates are free of charge.

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

Multi-Axis Motion System

Complex motion control applications often require the design of custom systems. This process is usually expensive and time consuming for the project developers. The new Technosoft multi-axis motion system, iPOS360x SX, makes this phase faster and easier, giving the designer an extremely compact (100 x 98 x 37 mm) ready-to-run solution based on the new family of Technosoft iPOS drives.

The iPOS360x SX allows you to plug in up to four iPOS3602 VX or iPOS3604 VX intelligent drives and provides all necessary connectors (motor, encoder feedback and I/O signal) for each drive. The drives are connected through a CAN-bus link. Two CAN-bus connectors plus an optionally connectable terminal resistor ensure a rapid connection to any CAN-bus network configuration. An RS-232 link offers easy access to all drives for setup and testing using a standard PC. Future developments of the iPOS360x SX will include an Ethernet port and an Ethernet-to-CAN adapter.

Using iPOS drives, the iPOS360x SX multi-axis motion system offers a cost-effective solution for controlling up to four DC brushed, (rotary or linear) brushless, or step motors (4 x 144 W, 4 x 36 V). Each iPOS360x drive has a built-in motion controller and provides PLC features. Each can operate as a standard CiA402 CAN open slave drive or can be programmed to execute complex motion programs directly at drive level using the high level Technosoft Motion Language (TML). The TML language programming allows each drive to execute complex motion sequences including setting of various motion modes, I/O signals handling, arithmetic and logic operations, conditional jumps and calls or data transfers between axes.

The iPOS360x SX will enable you to implement a multi-axis system by configuring any drive as master: the application master drive will call each axis to execute and confirm complex TML functions. The slave drives may also be programmed to periodically send information messages to the master drive, so the latter can monitor each task's progress. If the master is at PC or PLC level, the iPOS360x drives operate as intelligent slaves in a similar manner as above, while executing their TML program stored in the local non-volatile memory.

Product specifications can be found at: www.technosoftmotion.com/products/OEM_PROD_ iPOS-Multi-Axis.htm.

Measure Fluid Characteristics

Anton Paar claims the MCR 702 to be the first rheometer with fully integrated TwinDriveTM technology. A rheometer is a laboratory device used to measure the way in which a liquid, suspension or slurry flows in response to applied forces. It can be operated in several test modes and covers all rheological applications – past, present and future.

In the 2EC mode, TwinDriveTM technology combines two powerful synchronous EC (Electrically Commutated) motor units in a modular setup: the upper EC motor in the rheometer is permanent; and the lower EC motor can be extracted and integrated at will. Doubled EC motors extend the scope of testing options, e.g. with optional counter-rotation for enhanced rheo-microscopy. MCR 702 TwinDrive can be operated with both motors' maximum shear rate combined and is optionally employed for extensional rheology applications or tests with parallel rotation at different speeds.

In the EC mode, the lower motor unit is easily removed in accordance with individual application needs. After extraction of the lower motor, the instrument can be operated as a single-drive rheometer, making the most of the single EC motor's TruStrainTM capability and enabling "classic" stress-controlled tests. The EC mode opens MCR 702 up to the wide variety of custom-tailored temperature devices and application-specific accessories.