

**$E=mc^2$**

**“What led me more or less directly to the special theory of relativity was the conviction that the electromotive force acting on a body in motion in a magnetic field was nothing else but an electric field.”**

**—physicist Albert Einstein in a 1952 letter to the Michaelson Commemorative Meeting of the Cleveland Physics Society**

## PC/104 module unites GPS, cellular technologies

By Warren Webb

**T**HE NEW PCM-GPS from WinSystems combines GPS (global-positioning-system) and cell-modem support on a single PC/104 module for applications that require navigation, tracking, data logging, and communication functions. The GPS-receiver section delivers position, velocity, and time information, and the cell modem supports multiband GSM/GPRS (Global System for Mobile Communications/General Packet Radio Service) and CDMA (code-division-multiple-access) communications.

The board includes dual UARTs, the GPS receiver, an SMA-antenna connector, and a cellular-modem socket. WinSystems based the GPS receiver on Trimble's ([www.trimble.com](http://www.trimble.com)) Lassen SQ GPS module; it employs protocols



**With both GPS and cell-modem support, the PCM-GPS delivers navigation and communication functions for mobile applications.**

that are compatible with most commercial-navigation or map-software packages. The company based the cellular-modem section on Multitech Systems' ([www.multitech.com](http://www.multitech.com)) SocketModem wireless

modems. Targeting global use, they offer multiband GSM/GPRS Class 10 and CDMA-2000 1×RTT (Radio Transmission Technology) performance. Both units provide the controller, RF transceiver, and antenna interface in a single plug-in module. The SocketModem recognizes the AT command set, provides alarm management, and supports SMS (short-message services). WinSystems ships the PCM-GPS with an empty Multitech socket for user installation and activation at the customer's site.

The PCM-GPS consumes 60 mA at 5V within its -40 to +85°C operating range. Delivery is from stock to three weeks, and prices start at \$199.

► **WinSystems Inc.**, [www.winsystems.com](http://www.winsystems.com).

## Single-board computer claims “epic” speed record

TARGETING TRANSPORTATION, security, military, communications, distributed-control, and similar high-reliability applications, Octagon Systems' new XE-900 single-board computer comes in the EPIC (Embedded Platform for Industrial Computing) form factor. The XE-900 incorporates the low-power, 32-bit Via Eden CPU family in 400-MHz, 733-MHz, and 1-GHz versions. The module features two USB ports, six RS-232/422/485 serial ports, 24 lines of digital I/O, 10/100 BaseT Ethernet, CRT and flat-panel video, PC/104 and PC/104-Plus expansion, and a conductive-cooling system that eliminates the need for a fan even when the system is operating at 1 GHz. Targeting extreme environments, the XE-900 withstands high shock and vibration levels and operates in the -40 to +85°C temperature range.

Octagon Systems offers the XE-900 in Linux 2.6 and Windows XP embedded development kits that provide “instant-on” operation. The price is \$795, \$745, and \$695 (one) for the 1-GHz, 733-MHz, and 400-MHz versions, respectively; volume discounts are available.—by Warren Webb

► **Octagon Systems Corp.**, [www.octagonsystems.com](http://www.octagonsystems.com).



**With a 1-GHz processor option, the XE-900 lays claim to the fastest single-board computer in the EPIC format.**

# 15M-sample/sec, flexible-resolution digitizer heralds universal dynamic-measurement instrumentation

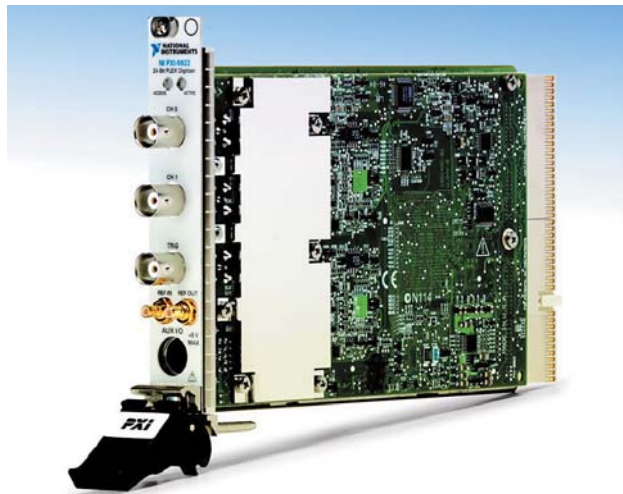
**D**ESIGN AND TEST engineers can now use one \$6495 modular instrument to make a range of dynamic measurements. As the manufacturer, National Instruments, puts it, the PXI-5922 flexible-resolution digitizer is a universal measurement tool for dynamic signals just as the digital multimeter is for dc and low-frequency ac signals. Engineers can combine the module with the LabView 7.1 graphical environment for system development to create numerous types of instruments, such as ac voltmeters, audio analyzers, frequency counters, spectrum analyzers, and I/Q-modulation analyzers that sometimes exceed the performance of high-end traditional instruments with similar functions.

“Virtual instrumentation redefined how test-and-measurement systems were built,” says James Truchard, PhD, NI president and chief executive officer. “By providing a device that spans many applications, the PXI-5922 flexible-resolution digitizer redefines how the hardware for virtual instrumentation is built. The

module takes us a long way toward our goal of a universal measurement-instrument platform.”

Unlike traditional measurement devices, whose resolution is independent of sampling rate, the PXI-5922 uses the NI FlexII ADC that can sample with resolution of 16 bits at 15M samples/sec to 24 bits at 500k samples/sec. The NI FlexII ADC incorporates patented methods for reducing the linearity- and temperature-drift errors inherent in multibit sigma-delta ADCs. With the module’s large dynamic range and low noise, design and test engineers can often directly digitize low-level signals without the need for external signal conditioners, such as filters and low-noise amplifiers. Reduced signal conditioning improves measurement accuracy and reliability and can also save test-system-development time.

The combination of measurement flexibility and high dynamic range suits the NI PXI-5922 for a range of applications. With performance exceeding that of most commercially available ADCs, for



The PXI-5922 digitizer allows you to trade off acquisition rate for resolution; resolution is 24 bits at 500k samples/sec and 16 bits at 15M samples/sec.

example, the module is useful for characterizing and testing the latest DACs. For precision audio applications, the digitizer’s ability to acquire signals with 24-bit resolution at rates as high as 500k samples/sec means that engineers can capture high-order harmonics with wide dynamic range. The module’s 18-bit resolution at 10M samples/sec makes it an excellent digitizer for acquiring baseband I/Q signals in digital-

communications systems.

For tight synchronization with other products, such as high-speed digitizers, arbitrary-waveform generators, and digital waveform generator/analyzers, NI built the module on the SMC (Synchronization and Memory Core) architecture. This architecture, which accommodates onboard memory as deep as 256 Mbytes per channel and allows high-speed data streaming, enables the module to synchronize with multiple instruments and to hold typical module-to-module skew to less than 1 nsec. Engineers can use the module to create mixed-signal stimulus/response measurements. By synchronizing multiple modules, acquisition can expand to 1632 channels.

—by Dan Strassberg

► **National Instruments**, 1-800-258-7022, [www.ni.com/modularinstruments](http://www.ni.com/modularinstruments).

## DILBERT *By Scott Adams*



► **Total media-networking connections in homes will grow from more than 50 million in 2005 to more than 200 million in 2009, a 29% compound-annual-growth rate, according to InStat/MDR.**

## Systems debug compressed-video streams in real time

**T**EKTRONIX HAS ANNOUNCED a series of compressed-video test systems that automatically monitor, analyze, and debug live and deferred-time video-transport streams, enabling fast problem

resolution on these streams. According to the company, the MTS400 series provides the market's highest performance analysis engine, as well as support for real-time video-over-IP (Internet protocol) monitoring, analysis, and recording in broadband-video and video-on-demand applications.

The growing sophistication of compressed-video standards and the transition to high-definition TV require the analysis of increasingly complex transport streams at higher bit rates. The instruments'

program-centric graphical user interface enables developers and evaluators of compressed-video equipment to quickly isolate and investigate protocol faults. The units provide a large collection of test and analysis packages offering monitoring and analysis of live and file-based compressed video, including MPEG-2 (Motion Picture Experts Group), MPEG-4, H.264, and VC-1 (video codec 1).

"The MTS400 series enables customers to achieve new levels of productivity by significantly reducing the

time required to analyze large and complex MPEG-transport-stream files," says Todd Biddle, vice president of Tektronix's video-product line. "With the new CaptureVu capabilities, equipment manufacturers and network operators for the first time can pinpoint and resolve compressed-video-transport-stream problems in real time."



**The compressed-video test systems in the MTS400 series automatically monitor, analyze, and debug live and deferred-time video-transport streams, enabling quick problem resolution.**

The MTS400 series comprises the MTS400 with prices starting at less than \$30,000 and the MTS430 with prices starting at less than \$56,000. Both models perform live CaptureVu analysis of video-transport streams received via ASI (Advanced Switching Interconnect), SMPTE (Society of Motion Picture and Television Engineers)-310M, or LVDS (low-voltage differential-signaling) physical interfaces. The MTS430 also provides as standard features—and the MTS400 provides as options—CaptureVu deferred-time analysis with support for MPEG-over-IP, PES (packetized-elementary-stream), buffer-analyzer, and multiplexer capabilities.

—by Dan Strassberg

► **Tektronix Inc**, 1-800-426-2200, [www.tektronix.com](http://www.tektronix.com).

## High-speed interfaces get PHY verification

EDA START-UP Knowlent Corp is offering a product to speed verification of the PHY (physical layer) of high-speed interfaces implemented in IC designs. The Opal simulation and debugging environment checks a design's PHY compliance with high-speed-interface standards, such as PCI Express, ATA, and DDR. Knowlent President and Chief Executive Officer Sandipan Bhanot says that numerous companies offer cores and verification suites for the functional layer of

high-speed-communication standards and a handful of players offers analog PHY cores for those standards. However, verification suites checking PHY-layer compliance with communications standards have been scarce.

Knowlent, which ex-Cadence ([www.cadence.com](http://www.cadence.com)) executives founded in 2001, has done most of the grunt

**Opal speeds verification of the physical layer of high-speed interfaces.**

work to create EVPs (electrical verification platforms), essentially testbenches for third-party Spice simulators that ensure that designs comply with PHY-level high-speed-interface specifications. "It is very different to run electrical

tests as opposed to digital because the IP [intellectual property] has to be changed for every type of test," says Bhanot. "For example, if you are running a transient simulation, you just attach a simple load model at the end. On the other hand, if you are running return-loss measurement, you need several types of models. We take all these variations and run them through Spice." Using Opal also means that users need not manually set up files for different types of tests.

Bhanot says that the EVPs will help with return-loss measurement and test for jitter, with one adapter testing for random jitter and another testing for deterministic jitter. The adapters also test whether a PHY conforms to eye-diagram specifications for a given standard. Initial EVP releases will target PCI Express and Serial ATA, with other high-speed-interface EVPs to follow in the coming months. The starting price is \$65,000 for an annual subscription.

The first customer for Opal is the PHY group of Artisan Components ([www.artisan.com](http://www.artisan.com)), which ARM Ltd ([www.arm.com](http://www.arm.com)) now owns. IP vendor and memory-modeling company Denali Software ([www.denali.com](http://www.denali.com)) is an investor, and its chief executive officer, Sanjay Srivastava, serves as a director on Knowlent's board of directors.

—by Michael Santarini

► **Knowlent**, 1-408-748-0600, [www.knowlent.com](http://www.knowlent.com).





## Sampling-scope bandwidth hits 100 GHz at 10M samples/sec

**W**ITH THE introduction of the WaveExpert 9000 and SDA 100G, LeCroy Corp joins Agilent (www.agilent.com) and Tektronix (www.tektronix.com) in offering scopes in a category that used to be called sequential equivalent-time sampling. LeCroy previously has offered only real-time-sampling digital scopes, some of which also incorporate RIS (random-interleaved sampling). With the scopes' 10M-sample/sec acquisition rate—at least 50 times as fast as that of other sequential-sampling scopes—and the addition of several sampling modes, including RIS, that are new to such scopes, the term “sequential equivalent-time sampling” no longer fits. LeCroy prefers to call the new units simply “sampling scopes,” even though that description can lead to confusion with real-time-sampling scopes.

The new instruments feature optional industry leading, 100-GHz bandwidth and a patent-applied-for CIS (coherent-interleaved-sampling) mode, which enables capturing and displaying of long serial-data waveforms with no need for an external pattern trigger. In addition, the scopes can produce TDR (time-domain-reflectometry) pulses that have 20-ps incident rise times, which LeCroy says are 50% faster than those of other instruments.

Traditional samplers produce an approximately gaussian sampling aperture. Unlike

those units, the monolithic sampling head, whose sampling-strobe-generation circuit employs a patented NLT (nonlinear-transmission line), creates a rectangular aperture. This approach enables the 100-GHz bandwidth. According to LeCroy Product Manager Mike Schneck, “Not only does the monolithic construction allow much higher sampling rates than do older discrete designs, but also the rectangular strobe reduces jitter, more accurately controls bandwidth, and provides nearly 100% efficiency.”

The CIS timebase derives the sampling gate by phase-locking to the clock signal, a technique that allows high sampling rates and precise tracking of the signal bit rate. The coherent nature of the sampling gate allows the system to lock to the data pattern simply by knowing its length. The scope can measure and process the resulting waveform in the same way that real-time scopes process traces. The RIS mode, which LeCroy calls a first in this type of instrument, allows the measurement of pulsed signals without the use of an external trigger signal.

LeCroy designed the WaveExpert 9000 and SDA 100G to meet the measurement needs of high-speed designs whose serial-data rates far exceed 3 Gbps and require high-bandwidth instruments that can measure fast-rise-time signals. The new instruments feature real-time waveform displays

and a jitter-measurement mode that measures total jitter as well as random- and deterministic-jitter components. The basic waveform memory in this mode is 4M samples per channel, which enables jitter-component breakdown and equalization on long serial-data patterns. Memory is expandable to 2G samples per channel, enabling the oscilloscopes to capture, display, and measure data patterns that are millions of bits long.

The \$21,500 WaveExpert 9000 aims at general-purpose signal-integrity applications, including TDR and eye-pattern analysis. LeCroy also offers a jitter- and eye-measurement package, with which, says Schneck, the WaveExpert 9000 can analyze jitter in accordance with many standards and can perform eye-pattern analysis faster than any competitive sampling scope. The \$41,500 SDA 100G targets serial-data applications and includes the CIS

timebase as well as the full jitter-measurement package.

In addition to the two mainframes, LeCroy has announced several plug-in modules for measuring electrical or optical signals. The electrical-input modules, which are priced from \$7000 to \$50,000, have bandwidths of 20, 30, 50, 70, and 100 GHz, whereas the optical modules, which cost \$25,000 and \$45,000, have bandwidths of 25 and 50 GHz. The \$7000, 20-GHz-bandwidth electrical module incorporates the TDR capability. Schneck predicts that the modular design will let users configure the WaveExpert 9000 and SDA 100G to meet testing needs without sacrificing the flexibility to extend capabilities as analysis requirements expand. For example, the initial electrical modules have single-ended inputs, but LeCroy expects to soon be able to announce differential-input modules.

The instruments include a full set of compliance masks as well as measurements for both RZ (return-to-zero) and NRZ (non-RZ) signaling formats. The CIS timebase enables a rapid mask-testing feature that compares as many as 3M samples/sec with a compliance mask—a 30-times speed improvement over other mask-testing approaches—and provides, says Schneck, the highest level of confidence in measurement accuracy.

—by Dan Strassberg

► LeCroy Corp, 1-800-453-2769, www.lecroy.com.



**The WaveExpert 9000 brings bandwidth as high as 100 GHz, dramatically faster waveform acquisition, and several new acquisition and analysis modes to a class of scopes that scope makers used to call sequential-equivalent-time-sampling scopes but now should perhaps call sampling scopes.**

► Global sales of music CDs and DVDs combined fell for the fifth year in a row last year, according to a report released by the International Federation of the Phonographic Industry. Worldwide music sales were \$33.6 billion, down 1.4% from 2003's total of \$34.1 billion. Unit sales fell 0.4%. Continuing declines in most of the rest of the world offset modest growth in the United States, the United Kingdom, and parts of Latin America.

# Scope introductions switch focus to general-purpose instruments

Much of the news in the oscilloscope market in the past few months has been made by instruments at the top end of the range, in both

performance and price. Real-time bandwidths have been extended to 13 GHz and over, with pricing in the \$100,000-region. However, the majority of tasks that scopes are required to perform do not need such exotic specifications. Real-time bandwidths under 1 GHz - well under, in most cases - are adequate, and this "volume" oscilloscope market has recently seen new introductions from two suppliers.

Yokogawa's DL9000 series ranges up to 1.5 GHz in band-



Yokogawa's DL9000 offers up to 1.5 GHz bandwidth in a general-purpose scope

width, with 10 Gsamples/sec sampling rates, and with memory up to 6.25 Mwords. The instruments' architecture is directed at maximising the number of sample points acquired per second, instead of only the waveforms per second. The DL9000s are structured around a custom chip, the advanced data stream engine, which combines signal processing and acquisition memory. With one such chip per channel (the instruments are four-channel units), there is no loss of speed for multi-channel operation. The scopes can acquire and display up to 450 million points per second. Frequency of event occurrence is shown by gradations of either colour or intensity on the screen. There are two models: 1.5 GHz or 1 GHz bandwidth. With ADCs shared across channels, the 1.5-GHz

version offers a maximum sampling rate of 10 Gsamples/sec with two channels in use, or 5 Gsamples/sec with four. The 1-GHz version has 50% of the corresponding sample rates. Record (memory) lengths can be ordered at 6.25 or 2.5 Mwords/channel. Acquired waveforms are written to memory in segmented and indexed records, which can be searched or superimposed after acquisition is stopped. Measuring 350×200×178 mm, the DL9000s use a 213-mm screen and run Windows CE. Pricing is from 11,000 to 18,000 €.

Agilent has taken a slightly different approach to the sub-1 GHz market with its 6000 series, a range of 12 scopes at 300, 500 and 1000 MHz bandwidth points. They use Agilent's MegaZoom display method, employing 256-level colour-intensity grading to show waveform details on an XGA screen. Memory depth is up to 8 Megapoints - 1 Mpoint is standard, with 2M and 8M upgrade levels. Maximum sample

rate is up to 4 Gsamples/sec, and display update rate is up to 100,000 waveforms/sec.

Customers can order the 6000 series units with an integrated 16-channel logic analyser module for mixed-signal operation, or add the logic analysis later in an upgrade; basic instruments are



Agilent's 6000 scopes aim to finally replace the last of the analogue scopes

2- or 4-channel. The mixed-signal capability is built-in: purchasers can opt to enable it later by buying a software key and a hardware interconnect cable. Pricing is from 4,800 to 14,600 €.—by Graham Prophet

► **Yokogawa Europe**, +31 33 464 1645, [www.yokogawa.com/eu](http://www.yokogawa.com/eu)  
► **Agilent**, +31 20 547 2000, [www.agilent.com](http://www.agilent.com)

## SoC hardware debug techniques extended to system-level

For system-on-chip designs that are based on an embedded processor platform, Novas Software is extending the reach of its debug tools to cover a complete project originated in a system-level design style. The company already has a strong presence in hardware (RTL-based) debug with its Verdi product; a new offering called nESL adds capabilities in the system and software areas. New features include transaction debug analysis, SystemC compiler, visualisation and tracing tools, and hardware-software debug interfaces. nESL is aimed at complex designs using embedded processor cores and bus-based communication. It provides a single environment with a common interface for debug at all levels - from a system model through simulation-based verification to emulation of the complete system. There is support for multiple languages, testbench and assertion code, mixed signal analysis, hardware/software analysis on certain commonly used processor cores and buses, and protocol analysis.

Transaction analysis is a way of viewing communication within a design; knowledge of a particular protocol, plus signal data, is combined in an abstraction that presents informa-

tion at the right level to gain an understanding of the system's bus-level behaviour. Complex device operation that cannot easily be understood from signal behaviour alone is made intelligible. Some of the protocol information is gained through a partnership with Spiritech ([www.spiritech.com](http://www.spiritech.com)). An open transaction interface assists with capture and storage of this data. Modeling of C, C++, and SystemC allows both hardware and software views of a system. nESL extracts hardware attributes from SystemC and presents the details in a separate window; software interactions are modelled in parallel, and users can study them in a familiar software debug style. Multiple software environments such as the ARM Realview debugger can be linked into a hardware/software co-debug environment. Novas says that this package provides coverage of all of the diverse methodologies that designers are using for debug in the emerging system-level design flow. Novas Software offers nESL as an option to the Verdi package; prices start at \$6000 for an annual licence. —by Graham Prophet

► **Novas Software**, [www.novas.com](http://www.novas.com)

## EDN/Texas Instruments Power Seminar Series

Reflecting our commitment to power technologies, EDN Europe is pleased to support Texas Instruments' 2005 Power Supply Design Seminars that will tour Europe over the coming two months. The tour starts on April 4th in Warsaw and ends in Barcelona on May 26th, meantime taking in key cities in Austria, the Czech Republic, Denmark, Finland, France, Germany, Italy, Ireland, the Netherlands, Norway, Poland, Russia, Spain, Sweden, Switzerland, and the United Kingdom. See the full list at [www.ti.com/europe/power/](http://www.ti.com/europe/power/), where you can also register. Space at each venue is limited, so register early to avoid missing out on one of the industry's key events.

Each seminar lasts a full day and spans eight topics that TI's presenters will cover using a mix of concepts, reviews of basic principles, and hands-on application examples. Presentation materials are included. The topics consist of:

Safety considerations in power supply design—an overview that provides an introduction to the issues and design solutions that safeguard power-supply users.

Sequencing power supplies in multiple voltage rail environments—supply-rail sequencing is now essential for logic and mixed-signal circuits that operate from different voltages.

A step-by-step approach to ac line-powered converters—uses an off-line, three-output, 150W forward converter to illustrate the design process for typical isolated converters.

Power supply layout considerations—how to keep parasitic components from degrading the operation of your designs.

Interleaving benefits for forward and flyback converters—a 200W forward converter example shows you how to use an interleaved topology to reduce the size and cost of filtering.

A practical introduction to digital power supply control—reviews the benefits, limitations, and performance of digital control for analogue power supply designers.

Compensating dc-dc converters with ceramic output capacitors—shows how to apply low-cost ceramic parts while retaining gain and phase margins in control loops.

New power supply components—ends the presentation.