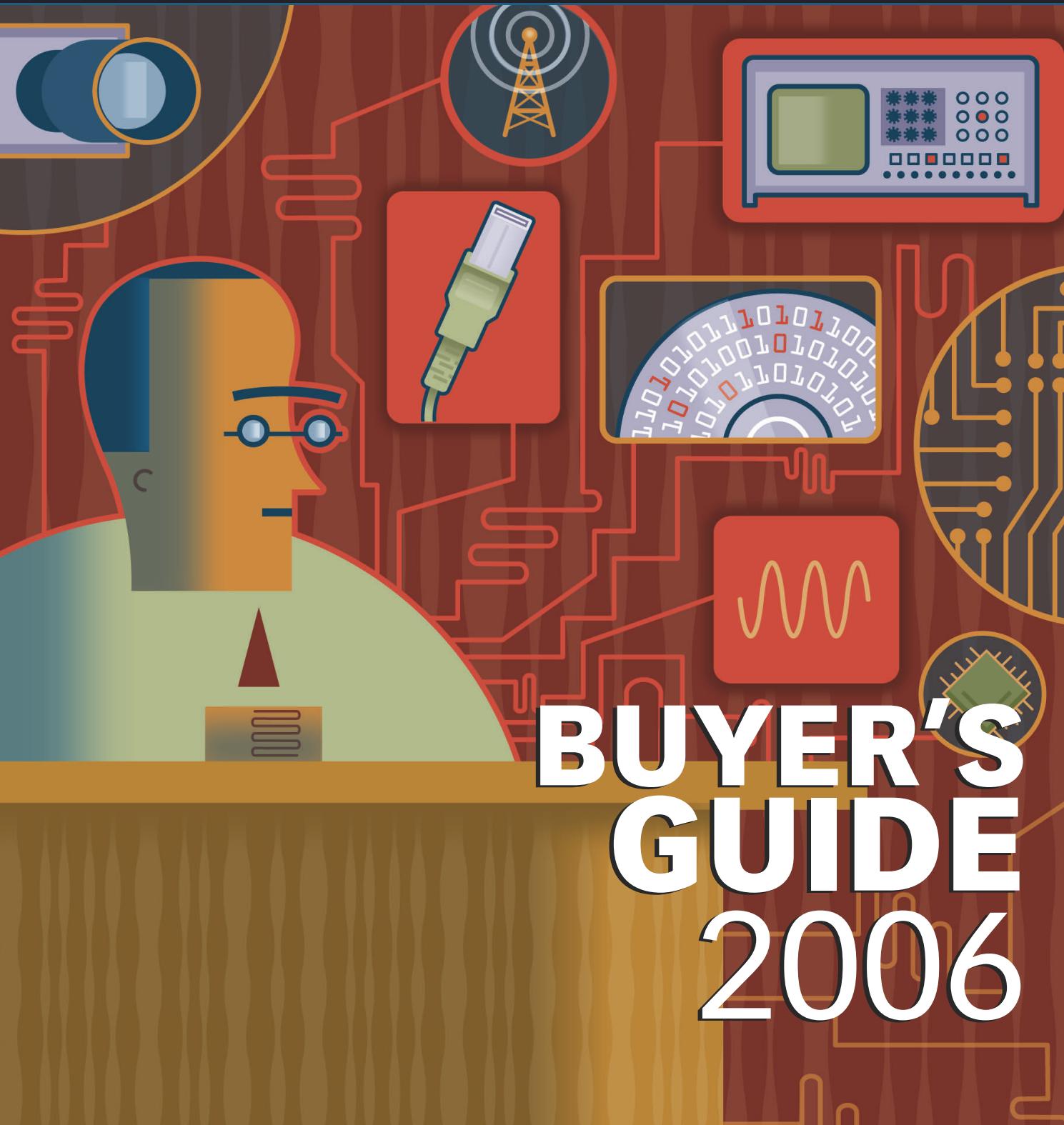


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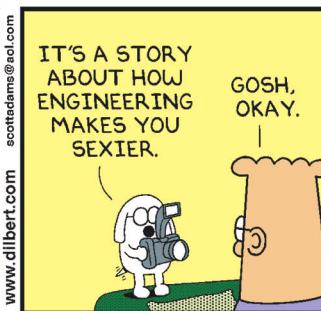
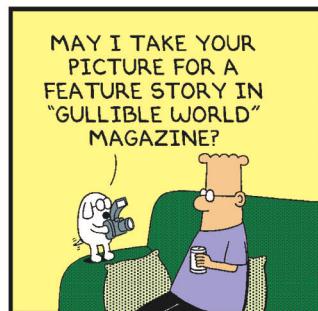
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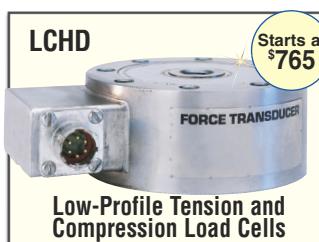
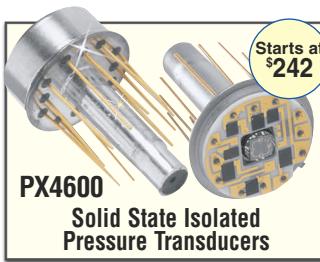
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Gains and Pains

Some companies clean up at the expense of others.

Alan R. Earls,
Contributing Editor

Test & MEASUREMENT WORLD®

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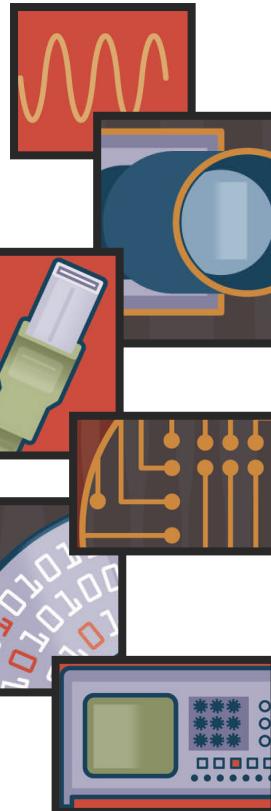
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Test Engineer of the Year: Final call for nominations

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If you know an outstanding engineer, be sure to nominate him or her for our 4th annual "Test Engineer of the Year" award. Test engineers or design engineers with some test-and-measurement responsibilities are eligible for this award. Please submit your nominations by July 15.

We will announce the finalists in our September issue and ask readers to vote for their favorite candidate. The winner, who will be announced in our March 2007 issue, may designate an engineering education program to receive a \$30,000 grant, courtesy of program sponsors Agilent Technologies, Keithley Instruments, and National Instruments.

www.tmworld.com/awards

Online glossary

Confused about acronyms and definitions? Consult *Test & Measurement World's* online glossary, which has been recently updated to reflect changes in communications and test terminology.

www.tmworld.com/glossary

> BLOG COMMENTARIES AND LINKS

"Rowe's and Columns"

In his new blog, Senior Technical Editor Martin Rowe talks about general-purpose instrumentation, EMC, communications test, and any other topics that come along. Check out his recent posts—and add your comments:

- **Where has VB gone?**

Is anyone using Visual Basic in test applications anymore, or did VB fade away when Microsoft introduced the .NET version?

- **New or recycled?**

Like many engineers, Rowe likes to find ways to keep old products running like new—including his six-year-old cell phone and his Windows 98 computer. What about you?

"Taking the Measure"

by Rick Nelson, Chief Editor

- The Fermi problem: Solve it and win a book
- Feature creep: The latest in shoe phones
- A modest proposal for CEOs: Offshore them
- A bogus attack on net neutrality
- Design for manufacturability: What, exactly, is it?

"Education and Careers"

by Amy Laskowski, Editorial Intern

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Buying back the future

The role of stock markets is to encourage investment in publicly held companies that can raise sufficient funds to undertake research, development, and manufacturing efforts beyond the financial means of typical private companies or individuals.

Unfortunately, this process is breaking down. *USA Today*, in "Some tech companies cut R&D budgets" (June 14, p. 1B), reports that R&D spending among high-tech firms listed on American,



Nasdaq, and New York stock exchanges has fallen from 12.7% of revenue in 2001 to 10.4% in 2005. Compa-

RICK NELSON, CHIEF EDITOR

nies making R&D cuts include Sun Microsystems, Hewlett-Packard, and Microsoft. In addition, Bell Labs is facing cuts even beyond the ones I commented on in my July 2003 "Editor's Note" (www.tmworld.com/2003_07) due to the merger of its parent Lucent Technologies with Alcatel. The US government is not stepping in to fill the gap left by corporate cuts.

What are companies doing with the funds they might otherwise invest in R&D? In many cases, they are repurchasing their own stock, as the *Wall Street Journal* reports in "Big companies put record sums into buybacks" (June 12, p. A1).

Such buybacks can benefit shareholders in that they increase earnings per share outstanding, at least in the short term, and not coincidentally, they boost the earnings of CEOs whose compensation is tied to stock performance—although some CEOs do quite well despite poor stock performance, as columnists writing in the *New York Times* report in "The Corner Office in Bangalore" (June 9, p. 27).

Whatever their positive short-term effects, buybacks can presage a long slump. The *Journal* article notes that Intel's stock has fallen 60% since a \$4.6 billion buyback in 1999, although the company continues to pursue the strategy and repurchased \$10 billion worth of shares in 2005—that at least represents a better bargain than the 1999 purchase.

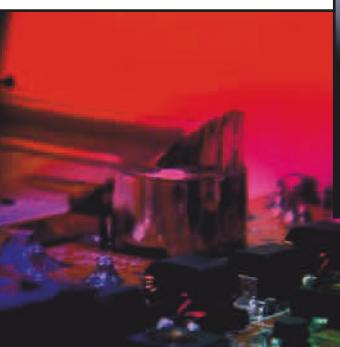
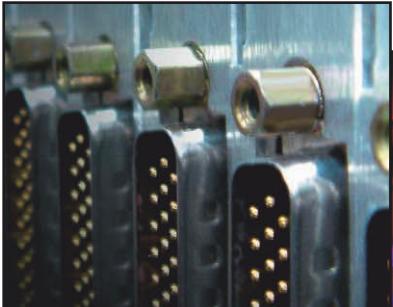
Stock buyback programs can be effective in addressing share prices that don't adequately reflect company worth. But too often, such a program is a declaration by a company that it is out of ideas, that it no longer knows how to innovate. Commenting on cuts in US R&D in the *USA Today* article, Kei Koizumi, a director of the American Association for the Advancement of Science, says, "It's not a good sign for the future innovation capacity of the US economy."

Who will make up that capacity? Sibling publication *R&D Magazine* ("The state of global R&D," September 2005), in conjunction with Battelle, reports that while R&D spending will grow 6% in the US from 2004 to 2006, over the same period it will grow 28% in China. T&MW

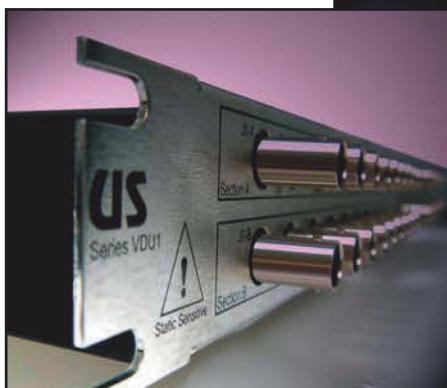
Too often, a stock buyback program is a company's declaration that it is out of ideas.

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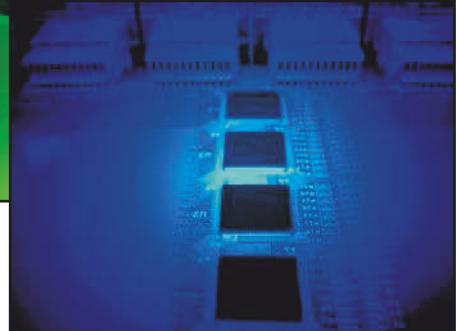
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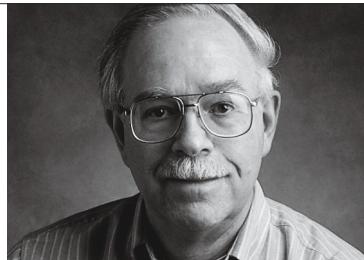
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Our crumbling infrastructure, Part CXVII

Living on a gravel road and near the end of our utility company's power line, we've grown resigned, but not accustomed, to interruptions of our electricity supply. Aside from the occasional gray squirrel that attempts to bridge an insulator, most failures occur when a tree or limb falls across a power line. From casual observation, I'd estimate that our utility does not spend enough time and money trimming trees that abut its lines.



Whether you call it deferred maintenance or neglected infrastructure, chances are you'll encounter examples every day—crumbling highway pavement, faded lane marker lines, broken test probes...test probes? Ever watch a technician use a test lead—sans its probe—to check a power-supply

voltage? I have, and while the tech is still around, the company isn't.

You decide whether failure to maintain test leads and equipment can cause a company's demise, or merely hint at parsimonious management. While you're at it, walk through your work area and look for these telltale signs of infrastructure decay:

- damaged or broken test leads, probes, and connectors;
- power cables with frayed insulation and missing third-wire grounds;
- test equipment shelved due to malfunctions or missing parts;
- fingertip grunge deposits on instruments and keyboards;
- data-acquisition systems in need of operating-system backup;
- absent or out-of-date antivirus software for lab PCs;
- antistatic benchtops and floors that need recertification;
- broken chairs and workbench stools;
- empty or unlabeled bins in supply cabinets; and
- uncalibrated or out-of-calibration instruments.

You can alter or expand the list to suit your work environment, but the last point deserves amplification. Writing in *Test & Measurement World*'s May 2006 issue, Martin Rowe reported that the next version of the NCSLI's Recommended Practice document would include a discussion of data-retention requirements. Corporate lawyers are advocating the destruction of calibration data and other proof-of-quality information that might have significance in product liability trials.

Those of us who work in quality assurance and measurement devote our efforts toward finding truth. According to the lawyers, defending truth costs money, and the risk of losing money trumps both truth and the value of a robust infrastructure to society. So, the next time your AC power fails, go ahead and take out your frustration over our crumbling infrastructure by swinging an axe at a tree—but not at a lawyer. And never ask a lawyer to measure high voltage with a broken test lead. **T&MW**

FOR FURTHER READING

Check out Martin Rowe's article, "Here come the lawyers," to learn why calibration data makes the legal profession nervous: www.reed-electronics.com/tmworld/article/CA6328027.html.

An official survey of power poles conducted by the Florida Public Safety Commission in May 2005 returned favorable results: www.floridapsc.com/general/publications/powerpoleintegrity05-05.pdf.

Yet, one Florida utility customer recorded his experience with rotted power poles, excessive line voltage, and flawed ground returns here: fpl-fraud.com.

Cathodic-protection systems prevent corrosion from attacking pipelines that carry hazardous liquids, but operators rely on long test leads to ensure that the system is functioning as intended. Here's why Conoco received a \$20,000 fine, in part for neglecting test leads on Hoo Hoo Road: ops.dot.gov/regions/southwest/CONOCO_INC_420015005.htm.

To view a series of tutorials on power quality, see: www.reed-electronics.com/tmworld/article/CA378936.

For tips on surviving your next AC-power measurement session, read: www.marcspages.co.uk/pq/4010.htm.

Learn safety tips and troubleshooting techniques that may help you safely repair smaller components of your household's crumbling infrastructure: repairfaq.ece.drexel.edu/REPAIR/F_appfaq2.html.

If you're plagued by power-line interference, this slowly loading site offers an explanation of equipment and methods you can use to track down possible sources: www.qsl.net/n8dmt/powerline.html.

A FOLLOW-UP

I received an inquiry requesting the name of the manufacturer of the microprocessor-based semiconductor analyzer kit that I mentioned in my "Here, kit, kit" column (www.reed-electronics.com/tmworld/article/CA6292123). For details, visit: www.m3electronix.com.

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RF enables "mobile living room"

At a press event held June 12 in conjunction with the IEEE MTT-S International Microwave Symposium, participants touted RF products that will point the way to the "mobile living room." Vendors of test and test-related products included Cascade Microtech, which highlighted its M150 DC-to-220-GHz measurement platform, and W.L. Gore, which exhibited its Phasellex 110-GHz test assemblies (pictured).

Speaker Jim Cable, Peregrine CEO, used the "mobile living room" phrase in his address concluding the event. The mobile living room, Cable said, is enabled by portable devices that enable you to carry with you all the comforts of home: your phone, camera, television, and games, for example. Enabling such mobile devices, he contended, will be products such as his firm's CMOS SOCs. Peregrine used the event to debut RoHS-compliant RF switches.

Another speaker, Jim Norling, marketing director at Freescale, described how his firm will use high-voltage RF power technology combined with low-cost over-molded plastic packaging to expand into industrial, scientific, and medical (ISM) applications. Norling noted that the expansion was spawned by the development of Freescale's 50-V VHV6 RF LDMOS technology (very high-voltage sixth-generation RF laterally diffused metal oxide semiconductor), a 50-V enhancement to Freescale's 28-V LDMOS technology.



ATI employs Mentor's Modular TestKompress

Mentor Graphics has announced that ATI Technologies has implemented Mentor's TestKompress embedded deterministic test (EDT) tool. ATI used Modular TestKompress, a new block-level implementation of Mentor's EDT methodology that improves compression performance and routing on large, complex devices.

"Working closely with Mentor Graphics, we were able to use the TestKompress product to thoroughly test our new chip at no additional test cost," said Michael Do, design for test (DFT) architect at ATI Technologies.

The Modular TestKompress tool implements an embedded compression scheme at the block level that reduces the size of the test sets required for complex designs, enabling comprehensive test coverage without sacrificing test throughput. Modular TestKompress provides designers with a block-based flow whereby each block, along with associated compression logic, can be implemented and verified independently. The tool simplifies the design flow for large block-based designs and reduces the routing area needed to connect the compression hardware.

The TestKompress tool fits easily into most scan-based design flows and

offers the same at-speed test capabilities as Mentor Graphics' FastScan automatic test pattern generation (ATPG) tool. The TestKompress tool's patented compression capabilities reduce the

amount of test data required for the detection of the speed-related defects that are more prevalent at nanometer process technologies. www.mentor.com/products/dft.

Optical tester shrinks

JDSU's T-BERD 6000 performs the same optical measurements as larger units but in a more portable size. The T-BERD 6000 can perform the measurements needed to test optical access networks, metro networks, and core transport networks.

The T-BERD 6000 has built-in measurement functions that include a fault locator, power meter, and optical loss test set. You can add functions from a set of more than 40 measurement modules, including a spectrum analyzer, a polarization-mode dispersion analyzer, a chromatic-dispersion meter, and a very-long-range (VLR) optical time-domain reflectometer (OTDR). An ultra-long-haul module has a 50-

dB dynamic range at 1550 nm. It can store up to 128,000 measurements with an 0.1-s sweep. An optional optical-talkset function lets you communicate along a fiber. And an automatic bidirectional analysis function cuts test time by 50% for OTDR, insertion loss (IL), and optical return loss (ORL) measurements, which otherwise use single-directional testing.

The instrument shows results on an 8.4-in. display (touch screen optional). The main unit can store test results and transfer them to a PC over USB and Ethernet links. PC software lets you analyze and store data offline. The T-BERD is powered by a lithium-ion battery.

Base price: \$2990. [JDSU](http://www.jdsu.com), www.jdsu.com.

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NIST works to reduce cell-phone noise

Researchers at the National Institute of Standards and Technology (NIST) along with RF Micro Devices and IBM Semiconductor R&D Center have developed a new method for measuring very faint thermal noise in electronic circuits. The researchers say the technique may help improve the signal range, data rate, and battery life of cell phones and other wireless communications devices.

The researchers have been focusing on inexpensive CMOS transistors, which are used in ICs for wireless devices. The noise levels for CMOS transistors have typically been too low to measure accurately in much of their signal frequency range (1–10 GHz). The technique measures the noise in CMOS devices before they are cut from silicon wafers and packaged. NIST says this may be the first method for on-wafer noise measurements directly linked to national standards for thermal noise power.

The team has also made use of “reverse” noise measurements—focusing on noise emitted from the input of the transistor when incoming signals are re-

CALENDAR

EMC Symposium, August 14–18, Portland, OR. Sponsored by IEEE, EMC Society. www.emc2006.org.

EOS/ESD Symposium, September 10–15, Tucson, AZ. Sponsored by ESD Association. www.esda.org/symposia.html.

Autotestcon, September 18–21, Anaheim, CA. Sponsored by IEEE. www.autotestcon.com.

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flected and scattered—as a tool for checking noise parameters. They say this method can improve precision, particularly of the optimal impedance properties needed in transistors to minimize noise, and that reverse noise measurements also may help improve modeling of CMOS transistors. www.nist.gov.

RF tools get design links

The Advanced Design System (ADS) 2006A high-frequency EDA software features design links from Agilent's Genesys software, which the company acquired with its purchase of Eagleware, to speed the generation of complex, high-frequency system and circuit designs. ADS 2006A also includes system-simulation enhancements that allow wireless designers to move seamlessly among RFIC/package/board design, system design, and test equipment.

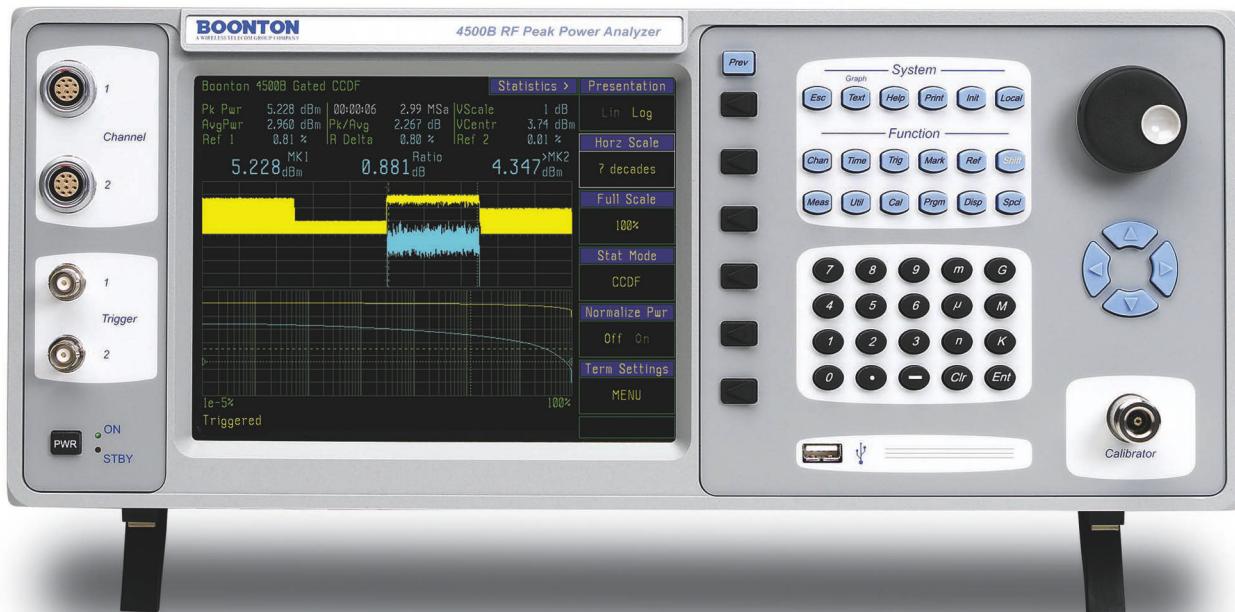
The new capabilities in ADS 2006A include WhatIF, an intermediate frequency (IF) planning tool for RF system architects; Spectrasys, a continuous-spectrum RF system simulator with root-cause analysis; and Synthesis, eight design assistants that implement manufacturable circuit-level designs, such as precise image-reject filters for RF boards.

ADS 2006A also includes several enhancements, including accelerated layout connectivity and performance on large monolithic millimeter-wave integrated circuits (MMICs) and reticles, and faster circuit and EM simulators that support 64-bit computer architectures to solve design problems that were too large to compute with 32-bit architectures five years ago.

Base price: \$8400. Available in October. Agilent Technologies, www.agilent.com.

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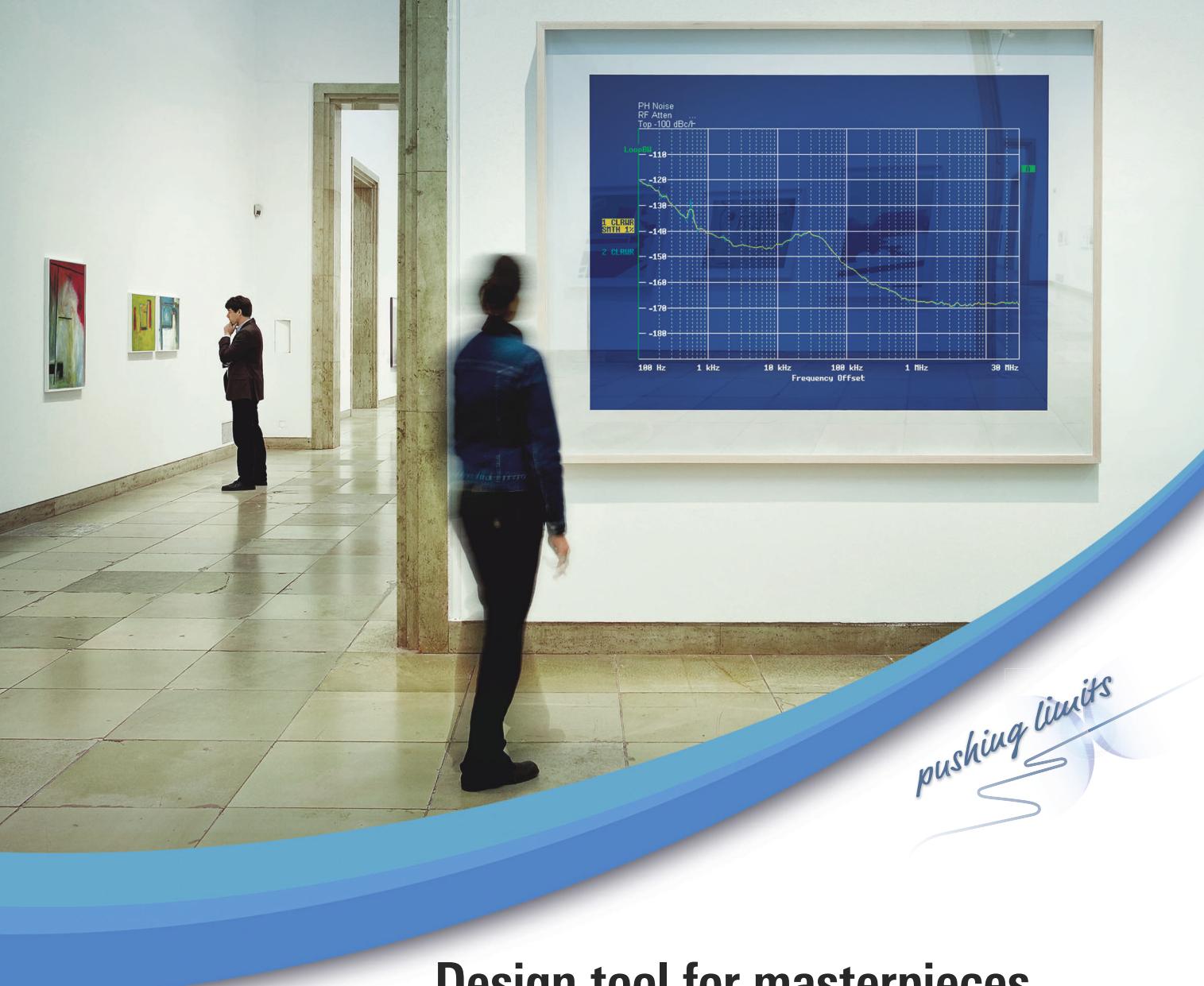


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All bets are on TV

>>> Globalcomm (formerly Supercomm), June 6–8, Chicago, IL, Telecommunications Industry Association (TIA), www.globalcomm2006.com.

IPTV was everywhere at Globalcomm, as network-equipment makers vied to fill network service providers' demand for switches, routers, and other network elements. IPTV, as well as voice and data services, needs test equipment. The telecom test industry was well represented with new products.

Anritsu (www.us.anritsu.com) added optical return loss and automatic bidirectional measurement options to its CMA50 line of loss test sets. RL features include measurement to -55 dB, pass/fail thresholds, and real-time readings for fast verification of results. Auto bidirectional features include up to four wavelengths out of a single port (1310/1490/1550/1625 nm) and dynamic range of 50 dB for testing of fibers as long as 200 km. **Ixia** (www.ixiacom.com) introduced Aptixia IxLoad 3.10 software, which can assess all aspects of IPTV service infrastructure for quality of experience (QoE). The software works with the company's hardware test platforms. **Spirent Communications** (www.spirentcom.com) demonstrated its line of test equipment, which includes broadband test systems, call generators, DSL line simulators, and data generators.

Agilent Technologies (www.agilent.com) made three announcements, two of which add IPTV to existing test products. The N2X multi-service tester, which emulates and measures

thousands of subscribers and video clips, measures delay factor and loss using the Media Delivery Index. The company also added IPTV test capabilities to its FrameScope Pro handheld Ethernet performance tester, which can measure performance of video, voice, and data over Ethernet-based networks. Agilent's third announcement was a Distributed Network Analyzer.

JDSU (www.jdsu.com) announced that its HST-3000 handheld triple-play services tester adds testing for VDSL2 at data rates up to 30 Mbps over copper wires. VDSL2 is a physical-layer technology for delivering IPTV to subscriber premises. The company also introduced the MTS/T-BERD 6000 fiber-optic network tester. The instrument measures insertion loss, return loss, and optical power, and it functions as an optical time-domain reflectometer.

Sparnex (www.sparnex.com) demonstrated its own VDSL2 tester. The LSX 2030 can test transmissions on lines up to 26,000 ft of 26 AWG wire. **Yokogawa** (www.yokogawa.com/us) demonstrated its AQ6370 optical spectrum analyzer. **University of New Hampshire Interoperability Lab** (www.iol.unh.edu), the subject of *T&MW*'s April cover story, "Today's testing, tomorrow's engineers" (www.tmworld.com/2006_04), gave presentations on its testing capabilities for Ethernet, DSL, IP, and VoIP. **T&MW**



The FrameScope Pro measures performance on voice, video, and data transfers over Ethernet.

Courtesy of Agilent.

ZigBee flies higher

>>> Sensors Expo, June 7–8, Rosemont, IL, Questex Media Group, www.sensorexpo.com.

ZigBee, the 250-kbps wireless communications link for sensors, switches, and other devices, was a hot topic at this year's Sensors Expo, where ZigBee Alliance president Bob Heile presented a session on the topic and where companies showing equipment unrelated to sensor measurements appeared in the exhibit hall. For example, **AR Worldwide** (www.ar-worldwide.com) exhibited its EMI test equipment, including amplifiers and receivers. Engineers designing ZigBee into their products must test receivers for susceptibility to interference and must test transmitters for unintentional harmonics. **Frontline Test Equipment** (www.fte.com) demonstrated a ZigBee protocol analyzer.

Traditional sensors and measurement equipment were, though, still quite visible. Accelerometer makers **PCB**

Piezotronics (www.pcb.com) and **Kistler** (www.kistler.com) exhibited their accelerometers and signal conditioners. **D&R Technology** (www.d-r-t.com) exhibited a line of automotive sensors used in seats for triggering air bags. **Flexpoint** (www.flexpoint.com) demonstrated bend sensors that change resistance when bent.

Data-acquisition equipment was also still prevalent at Sensors Expo, although with fewer exhibitors than in years past. **LDS Test and Measurement** (www.lds-group.com) exhibited oscilloscopes and data recorders. **Measurement Computing** (www.mccdaq.com) demonstrated its line of USB and PCI data-acquisition products. **National Instruments** (www.ni.com) showed data-acquisition products for PXI and USB, as well as for the proprietary CompactRIO. **T&MW**



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Audio: Not what it used to be

ONCE UPON a time, the word “audio” conjured up thoughts of high-quality sound delivered by dedicated home-stereo systems. “Portable audio” referred to a transistor radio or a Sony Walkman. Today, it seems like every pocket-sized consumer product has audio, with iPods and MP3 players leading the way. In many homes, the living room stereo is now an iPod placed into a speaker/amplifier system.

The change in consumer audio from analog to digital and from home-based systems to portable units has brought profound changes in the testing of consumer audio products. Cost is now the driving force in audio testing.

“Testing of consumer audio product varies from zero to 100%,” said Bruce Hofer, chairman of Audio Precision. That is, some contract manufacturers of MP3 players may perform numerous tests on production players, while others may not test audio quality at all.

Graham Boswell, sales and marketing director at Prism Sound, echoed Hofer’s sentiments. “There’s enormous price pressure today,” he said. “I’ve seen large companies try to perform audio tests with PC sound cards.” Boswell pointed out that sound cards lack calibration, have limited performance, and have higher noise floors than audio testers. “Noise floors in sound cards can run into tens of millivolts, which is as much as four orders of magnitude higher than on audio testers.”

Audio products such as MP3 players, USB audio devices, and TV set-top boxes rely heavily on digital signal processing. No longer does audio travel as analog signals, but rather as digital data streams. The result: Engineers have less knowledge about analog circuits than they used to.

“Analog isn’t taught the way it once was,” noted Hofer. “People know how to use a scope and a DMM but don’t

appreciate the power of the frequency domain.” Boswell has observed the same trend, but reports some success at getting engineers to look at the frequency domain.

Part of the reason that the FFT is making a comeback is because audio tester software is easier to use than it once was. PCs are now powerful



The APx585 audio tester is designed for ease of use. Courtesy of Audio Precision.

enough to perform frequency analysis in real time, making spectral plots easily attainable. Hofer noted that software helps people set up tests correctly and makes information available to engineers and test operators.

High-quality audio isn’t dead—far from it. “The audio CD raised our expectations for sound quality,” said Hofer. Thus, makers and users of professional audio products and high-end home equipment still perform rigorous audio-quality testing (Ref. 1). The same applies to automotive sound systems (Ref. 2). New cars now have eight or more speakers, each with unique equalization based on model and interior options of a vehicle.

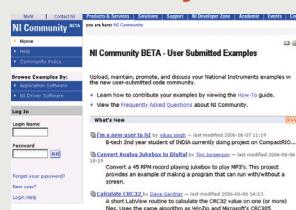
Hofer notes that as people get used to Dolby 5.1 surround sound in home theaters, they may want it in their cars, too. He would not be surprised if some SUV’s began offering movie sound system options in the future. **T&M**

Paper covers fax over IP verification

QualityLogic has released a free white paper on verification of V.34 (color) fax systems. The five-page paper discusses the need for interoperability testing of V.34 faxes transmitted in Internet Protocol (IP) packets over Ethernet. www.qualitylogic.com/forms/pub_download.html.

National Instruments adds online user community

National Instruments has added a user community to its Web site where users can post code examples to share with others. Users who post code get to keep control of their code and post updates. The community site is still in beta, and National Instruments welcomes feedback. community.ni.com.



NIST doubles quantum code speed

NIST has developed a quantum key distribution (QKD) system that uses single photons in different orientations to produce a continuous binary code, or “key,” for encrypting information. The system can detect if someone other than the intended recipient tries to intercept the transmission. Researchers produced this key at a rate of more than 4 Mbps over 1 km of optical fiber.

www.nist.gov/public_affairs/releases/quantumfiber.htm.

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1. Nelson, Rick, “Sound science,” *Test & Measurement World*, November 2004, p. 24. www.tmworld.com/2004_11.
2. Rowe, Martin, “Music to your ears,” *Test & Measurement World*, February 2004, p. 22. www.tmworld.com/2004_02.

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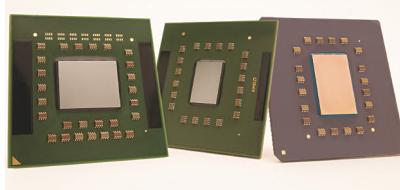
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Testing diversification

ON MAY 16, microprocessor manufacturer Advanced Micro Devices (AMD) announced the end of "boring PCs" (Ref. 1). The company has developed a new line of processors, some of which will include all of the features that can squeeze onto the silicon, while others economize on power consumption and other performance parameters, as well as



The photo shows a lidless dual-core AMD processor (right), a 90-nm single-core version (center), and one manufactured at 130 nm. Courtesy of AMD.

cost. The resulting plethora of microprocessors will spawn an even wider range of new PC products.

For PC OEMs, the benefits are evident. OEMs will select microprocessor features and price points for computer configurations that address specific user priorities. In addition to smaller machines, the new processors will support "thin clients"—PCs without hard drives that rely entirely on networks for software delivery and data storage. These less-than-general-purpose systems will permit simpler designs, less-complex surrounding circuitry, and lower cost. Intel appears ready to move in a similar direction.

For the test community, an explosion of this magnitude will add to the programming burden and complicate the process of tracking program flavors and versions. Also, the Balkanization of the PC means that manufacturers will sell fewer of each model, so amortization of nonrecurring engineering costs such as test programs and fixtures will become more difficult.

Today, contract manufacturers who make PCs for several OEMs can re-use major pieces of their test programs to

reduce the startup effort of taking on new customers or releasing new products. Reforming the "boring PC" will mean that less of a test program designed for one PC will be applicable to a PC aimed at a different application. Emulation test techniques would present a particular challenge, since emulator programs (and hardware, if the device pinouts are not the same from model to model) depend greatly on the internal function of the processor itself.

Nevertheless, industry experts remain optimistic. Agilent engineer/scientist Ken Parker remarked, "I see little effect at in-circuit test because most microprocessors that we see are socketed and are not present during test. There will be layout differences, but since the other parts of the boards will be substantially different anyway, each board will still need a different fixture. On the other hand, if the processor re-

sides onboard during ICT, the test will have to exploit any available testability, which could be different for each device type. Including IEEE 1149.1 on all the boards would alleviate much of the problem and eliminate a lot of work."

Jim Benson, Agilent AXI product engineer added, "It won't be much of an issue for inspection unless the chips use a new type of solder connection. In most cases, we would simply have to add a new package to the device library."

Right now we know only what AMD and others intend to do. Much of its impact will depend on the extent of the fragmentation and over what period of time. We need to watch how this plays out. **T&MW**

REFERENCE

John Spooner, "AMD Aims to Reform Boring PCs," *eWeek*, May 16, 2006. www.eweeek.com.

Generators deliver up to 40 GHz

Giga-tronics' Panther 2500 signal generators provide outputs ranging from 100 kHz to 8 GHz, 20 GHz, 26.5 GHz, and 40 GHz with frequency resolution of 0.0001 Hz. Key specs include phase noise of -111 dBc at 10-kHz and 100-kHz offsets on a 10-GHz carrier frequency. Switching times are less than 500 μ s. The instruments come with Automation Xpress, a PC-based software package designed to enhance ATE programming productivity. www.gigatronics.com.



RoHS loophole stays open

The European Commission's attempts to plug the so-called "control system loophole" in the RoHS directive are not likely to come into effect before 2008 and could be delayed until 2010, reports sibling publication *Electronics Weekly*. This potential loophole has caused confusion among some companies that are still unclear whether it puts their products outside of the legislation. www.electronicsweekly.com.

Boundary-scan I/O modules

JTAG Technologies' JT 2127 series of digital I/O scan modules extend test coverage by connecting to edge connectors, dual-inline memory module (DIMM) sockets, or non-boundary-scan logic. The scan modules exercise a board's connections or test points in synchronism with boundary-scan enabled devices. For boards not fitted with DIMM sockets, a separate module carrier splits the scan module's I/O into 32-channel blocks. www.jtag.com.

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As you look at the revenues generated by test equipment makers over the course of 2005, one thing becomes clear: Members of the "A team"—made up of Agilent and Advantest—were having things their way. Meanwhile, others who were among the top 10 revenue generators in 2004—notably Teradyne and LTX—saw their fortunes slip. But Agilent started on top and stayed on top and is still big compared to almost anyone else, and Advantest squeezed into a very solid second place. And with Advantest's year-to-year growth rate of almost 103% in 2004 and of nearly 36% in 2005, Agilent is doubtless casting nervous glances over its shoulder these days.

For now, though, the company says things look pretty rosy. About two-thirds of Agilent's revenue was generated from outside of the US in fiscal 2005. And with 20,000 employees, the company has managed to give itself a global presence. Of the company's total net revenue of \$5.1 billion, \$3.3 billion was generated by the Electronic Measurement Group, \$500 million came from the Semiconductor Group (which was sold early this year, and is now called Avago Technologies), and another \$1.4 billion came from the Bioanalytical Measurement Group.

"Agilent is definitely the number one in T&M, but Advantest has come up fast, especially in the past two or three years," said Kiran Unni, a program manager at Frost & Sullivan, a research and management firm.

Unni said the key for Advantest has been moving away from just memory test, where it has traditionally been very strong—with something like 60% of the market—and into SOC and semiconductor testing. "The margins are small but [the company has] managed to pass Teradyne in market share and revenue," she noted.

"Advantest has long been the industry leader in memory test," said R. Keith Lee,



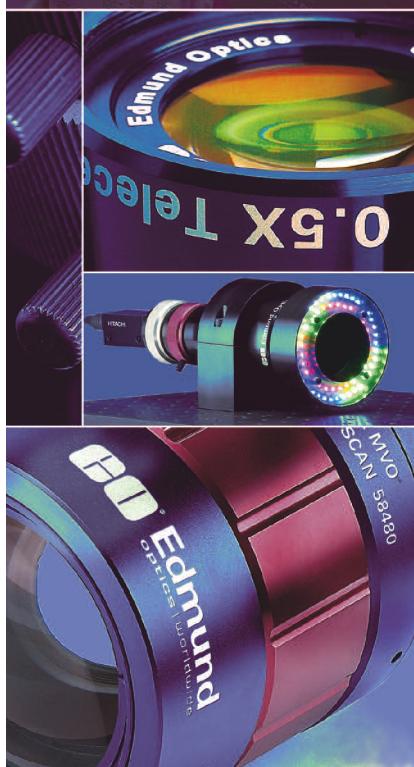
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TOPS IN TEST

president and CEO of the company's Advantest America division. "Now, through the success of the T2000 open-architecture SOC test platform, we are also recognized as a leader in the SOC test market."

Indeed, Lee said cost-effective test and lowering the overall cost of system ownership is important to customers and is "the driver of Advantest's commitment to providing innovative test and handling solutions." In particular, Lee



Looking at the future of the test-and-measurement industry, Lee said, "We are at the cusp of a mammoth business model change, caught between contemporary IC demands that can be summarized as 'more, faster, cheaper, better' and a traditional ATE business model that is no longer viable." In other words, said Lee, "the traditional ATE model fails in today's consumer-driven SOC device environment." Lee said the key for the industry, therefore, is to adopt

Top 10 test-and-measurement companies in revenue (publicly traded companies)

COMPANY	2005 RANK	2004 RANK	2005 REVENUES (MILLIONS US\$)	2004 REVENUES (MILLIONS US\$)	PERCENT CHANGE
Agilent Technologies	1	1	3,800.0 ^a	3,800.0	0.0
Advantest	2	3	2,230.0	1,640.0	36.0 ^b
Teradyne	3 ^c	2	1,088.0	1,800.0	-39.6
Tektronix	4	4	1,000.0	920.6	8.6
Fluke	5	5	945.5	800.0	18.2
Anritsu	6	6	783.0	741.8	5.6 ^b
National Instruments	7	7	571.8	514.0	11.2
Aeroflex	8	9	463.4	414.1	11.9
Credence Systems	9	8	429.3	439.8	-2.4
LTX	10	10	135.0	255.8	-47.2

^a Agilent Technologies' revenues shown here include only electronic measurement and automated test operations. Total test-and-measurement revenue is \$7.2 billion.

^b Because of currency fluctuations, percent increases in yen for Advantest and Anritsu were slightly higher.

^c Privately held Rohde & Schwarz reported annual sales of 1.1 billion euros (about \$1,540 million) in November 2005, representing 20% sales growth, and would place third on a list that included private and public test companies.

cited the success of the T2000, which is an ATE platform based on the OpenStar specifications introduced in 2004 by the Semiconductor Test Consortium (STC). Lee said the future of the T2000 looks very positive. "We have good momentum and good interest from potential customers."

Lee also cited another aspect of Advantest that he said has contributed to the company's growth. "Advantest differs from most ATE companies because we view manufacturing as a strategic core competency and so we keep our manufacturing in-house," he said. In turn, he added, "Our manufacturing capabilities allow us to deliver high-quality systems that lead the industry in accuracy and reliability."

an open-architecture approach. "Advantest believes that a single platform, open architecture is the future, and that shapes our perspective on the industry," he said.

Unni at Frost & Sullivan said beyond the huge success of Agilent and Advantest, 2005 also saw continued strength for Tektronix, in third place among publicly traded test-and-measurement companies, though the company's ability to make a real impact beyond its traditional strength in oscilloscopes remains elusive. Beyond that, Unni said, everyone should watch for bio/pharm instrumentation to emerge as a continued source of growth. "Perkin-Elmer, Thermo Electron, and Waters all made strong moves toward pharma and life sciences last year," she added. **T&MW**

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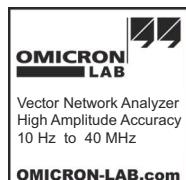
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Colby Instruments

Aeroflex

Agilent Technologies

Anritsu

Boonton Electronics

ICS Sensor Processing

Keithley Instruments

MI Technologies

National Instruments

Opticom

Precision Test Systems

Protek Test and Measurement

Rohde & Schwarz

Sencore

Tektronix

Aeroflex

Agilent Technologies

Anritsu

Chase Scientific

Giga-tronics

ICS Sensor Processing

Instek America

MI Technologies

Micro Lambda Wireless

Micronetics

National Instruments

Noise Com

Nova Engineering

Novatech Instruments

Pentek

Picosecond Pulse Labs

Praxsym

Tektronix

Precision Test Systems

Racal Instruments

Ramsey Electronics

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ASCOR

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VXI Technology

Wireless Communications Testers

Aeroflex

Agilent Technologies

Anite Group

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Azimuth Systems

CIMTEK

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TELECOM/DATACOM TEST EQUIPMENT

Bit-Error-Rate Testers

Telinc

Wavecrest

Aeroflex

Agilent Technologies

Anritsu

Catalyst Enterprises

Connecticut

Technology Products

CTC Union

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EXFO

Finisar

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Modem Testers, Cable/xDSL

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Assembly Test Div.

Tracespan

Communications

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Fluke Networks

Genesys IBS

RADCOM

continued >

COMMUNICATIONS TEST

> TELECOM/DATACOM TEST EQUIPMENT *continued*

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Packet Generators

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Telinc

Warwick Control Technologies

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Anritsu

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Fluke Networks

Genesys IBS

GL Communications

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Microtronix Systems

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Ixia

JDSU

CommTest

JDSU

Test & Measurement

Pendulum Instruments

RADCOM

Spirent Communications

Tektronix

Teradyne Assembly Test Div.

Spirent Communications

Syntex

Tektronix

Teltone

Telephone Line Simulators

Advent Instruments

Catapult Communications

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Micro Seven

Microtronix Systems

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Telinc

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Prism Sound
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FIBER-OPTIC/ELECTRO-OPTIC TEST EQUIPMENT

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Instrument Systems
Integral Vision

Keithley Instruments
Klein Instruments
Microvision
National Instruments
Optomistic Products
Radiant Imaging

Electro-Optics Testers

CIMTEK
EXFO
Gigahertz-Optik
Instrumentation Engineering
JDSU
Test & Measurement
Keithley Instruments
National Instruments
Newport
Racial Instruments
Symtx
Vektrex Electronic Systems

JDSU
Test & Measurement
Newport
Noyes Fiber Products
OptoTest
Oz Optics
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Terahertz Technologies
Ultrafast Sensors

Fault Locators

AEMC Instruments
Anritsu
EXFO
Fiber Instrument Sales
JDSU
Test & Measurement
Oz Optics
Princetel
Symtx

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CTC Union Technologies
EXFO
Fiber Instrument Sales
Fluke Networks
Gigahertz-Optik
JDSU
CommTest

Fiber-Optic Attenuators

EXFO
Fiber Instrument Sales

continued >

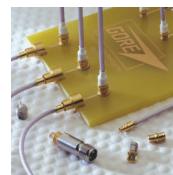
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Terahertz Technologies	Syntx Wavecrest	Technologies	Princetel PXIT	Pickering Interfaces
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Agilent Technologies	EXFO	Anritsu EXFO	Syntx	Racial Instruments
Anritsu	Gigahertz-Optik	Fiber Instrument Sales	VXI Technology	Syntx
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dBm Optics	Newport	JDSU Test & Measurement		Assembly Test Div.
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Keithley Instruments	Luna Technologies
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International Light Klein Instruments
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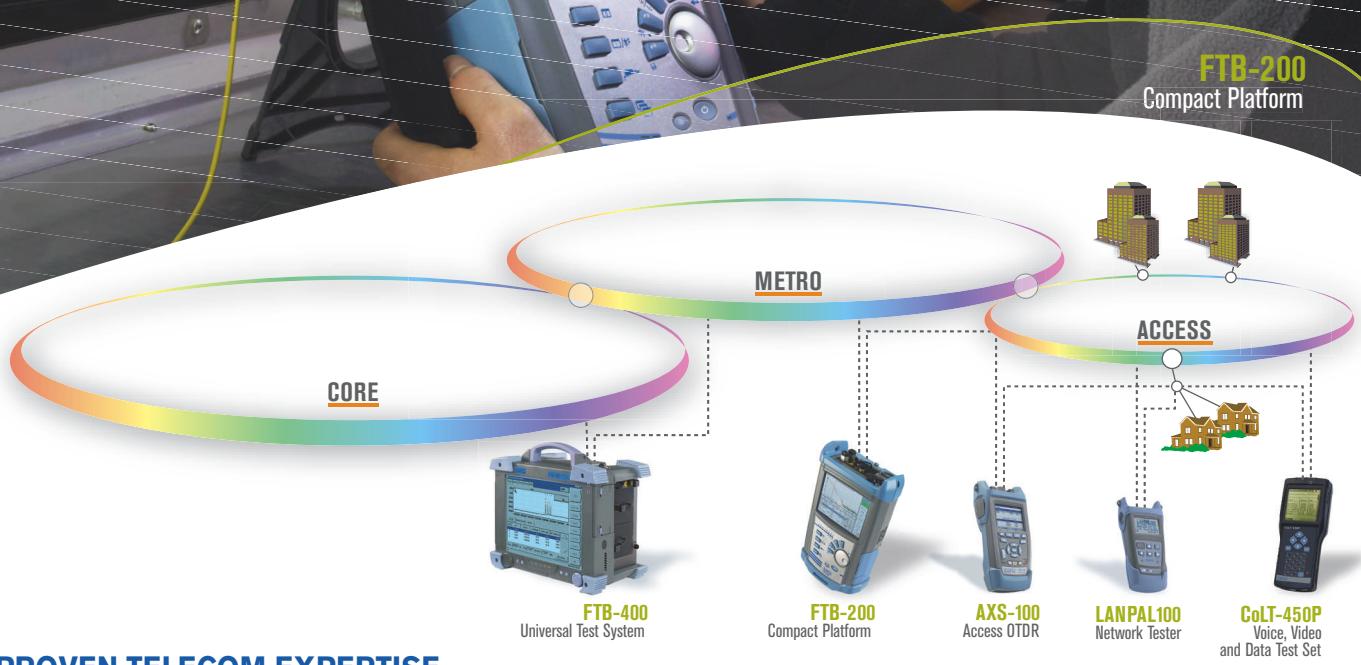
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Tucker Electronics
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Wavecrest

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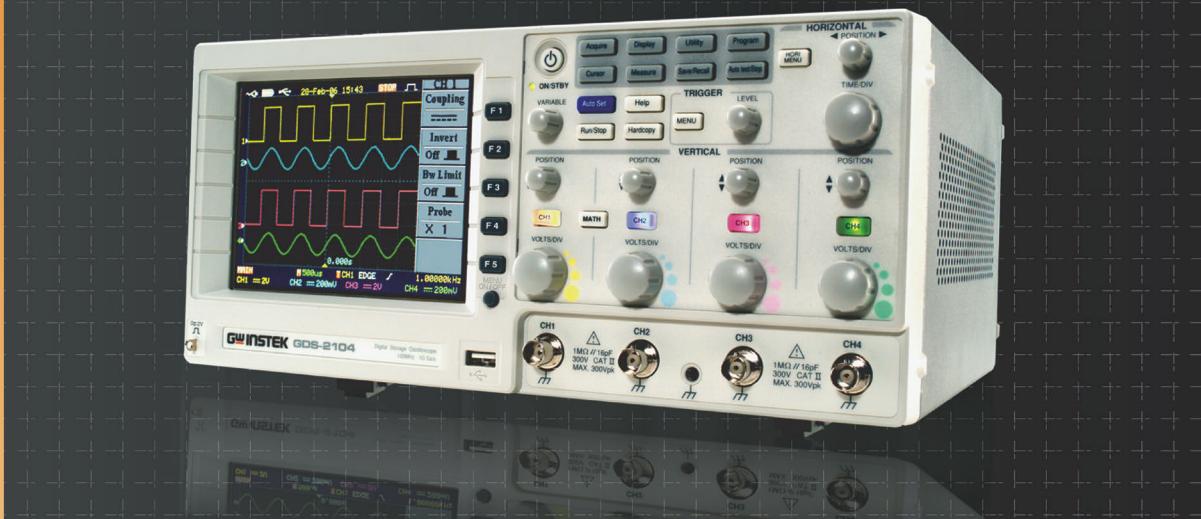


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- ▷ Stand-Alone Test Instruments, below
- ▷ Modular Instruments, p. 46
- ▷ Sensors, p. 56
- ▷ Software, p. 57
- ▷ Accessories, p. 59
- ▷ Third-Party Suppliers, p. 60
- ▷ Services/Labs/Test Houses, p. 61

STAND-ALONE TEST INSTRUMENTS

Analyzers, Logic and Bus

Agilent Technologies
AIM USA
Catalyst Enterprises
Condor Engineering
FuturePlus Systems
Global Specialties
GOEPEL Electronics
Interface Technology
LeCroy
MCC
Tektronix
Thurlby-Thanadar Instruments (TTi)
VMETRO
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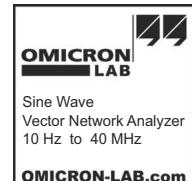
Analyzers, Time Interval

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Wavecrest
Yokogawa Corp. of America

Analyzers, Waveform/Signal

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Analogic
Anritsu
Audio Precision
Berkeley Nucleonics
Boonton Electronics
Brüel & Kjaer, North America

Clarke-Hess Communication Research
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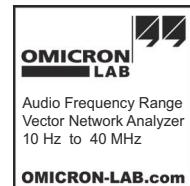
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Data Physics
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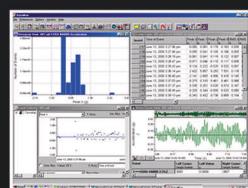
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Data Translation

Dataq Instruments

dataTaker

Daytronic

Dewetron

DGH

Fluke

GHI Systems

GOEPEL Electronics

Graphtec America

Hioki USA

Hi-Techniques

ICS Sensor Processing

IMC DataWorks

Innovative Integration

Instrumented Sensor Technology

Intelligent Instrumentation

IOtech

Lawson Labs

LDS Test and Measurement

LMS Instruments

Macro Sensors

Microstar Laboratories

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Onset Computer

Pace Scientific

Pacific Instruments

Pico Technology

R.C. Electronics

Sony Precision Technology America

Summit Instruments

Tecpel

Yokogawa Corp. of America

Dataloggers and Event Recorders

ACR Systems

Advantech

AEMC Instruments

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B & B Technologies

Burke E. Porter Machinery

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MODEL	TABOR WW2571/2	Agilent 33250a
Channels	1 / 2	1
Type	True Arb Implementing DDS	DDS Based AFG
WaveformType	All Standard, Arbitrary and Real-life waveform	Standard and only limited Arbitrary
Sample Clock Rate	1.5S/s to 250MS/s	200MS/s
Memory Size	1 Meg (2 Meg optional)	64k
Memory Management (Sequences/ Steps)	10 / 16.000	N/A
Vertical Resolution	16 bits	12 bits
Modulation	AM, FM, FSK, ASK, (n)PSK, Frequency Hops, sweep and more	AM, FM, PM, PWM, FSK and sweep
Max Frequency (Sine/Square/others)	100MHz/100MHz/ 32MHz	80MHz/80MHz/ 1MHz
Max Amplitude	16Vp-p	10Vp-p
Digital Outputs	16 Bit LVDS parallel	N/A
Connectivity	LAN, USB and GPIB	GPIB, RS232
Warranty	5	1
Price Starts at	\$4,495 *	\$4,553



35 Years
Celebration

Leading the Way
In Waveform Generation

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Specification compiled from Tabor 2571/2 data sheet and Agilent 33250a data
sheet 5968-8807EN, March 14, 2005. Prices are taken from the vendors websites.
Exclude VAT.



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INSTRUMENTATION

> STAND-ALONE TEST INSTRUMENTS *continued*

Fluke	Mitutoyo America
Givens Control Engineering	Monarch Instrument
GMC Instruments	National Instruments
GOEPEL Electronics	Newport Electronics
Graphtec America	Nomadics
Heim Data Systems	Omega Engineering
Hioki USA	Onset Computer
Hi-Techniques	OptoTest
IMC DataWorks	Pace Scientific
Innovative Integration	Pacific Instruments
Instrumented Sensor Technology	Photron
Intelligent Instrumentation	Pico Technology
IOtech	Rotronic Instrument
Keithley Instruments	Saelig
Kipp & Zonen	SOLTEC
LDS Test and Measurement	Sony Precision Technology America
Linseis	TEAC America
M/RAD	Tecpel <i>see ad, next column</i>
Measurement Computing	Telatemp
	Total Temperature Instrumentation
	VMETRO



VXI Technology
Yokogawa Corp. of America

DMMs, Benchtop/ System

Agilent Technologies
B&K Precision
Fluke
GMC Instruments
Hioki USA
Instek America
Keithley Instruments
Meterman Test Tools
Protek Test and Measurement

Signal Recovery
Tegam
Thurlby-Thandar Instruments (TTI)
Yokogawa Corp. of America

DMMs, Handheld

A.W. Sperry Instruments
AEMC Instruments
AMREL
B&K Precision
Extech Instruments
Fluke
GMC Instruments
Hioki USA
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Linseis
Meterman Test Tools
Newport Electronics
Omega Engineering
Protek Test and Measurement



Tegam

Electronic Filters

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DL Instruments
Frequency Devices
Interpower
JDSU CommTest
Kemo
Krohn-Hite
Micro Lambda Wireless
Pacific Instruments
Picosecond Pulse Labs

Precision Filters
Signal Recovery
Stanford Research Systems

Electronic Loads

Advanced Power Designs
AMREL
Autotest
C&D Technologies
California Instruments
Chroma ATE
Instek America
Keithley Instruments
TDI-Dynaload

Generators, Pulse, Function, Arbitrary

Agilent Technologies
AMREL
Analogic

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~~\$13,885~~

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MODEL	TABOR WW1281	Tektronix AWG520
Channels	Differential, Channel 1 Normal and Channel 2 Inverse	2
Type	True Arb Implementing DDS	True Arb
WaveformType	All Standard, Arbitrary and Real- life waveform	All Standard, Arbitrary and Real- life waveform
Sample Clock Rate	50S/ s to 1.2MS/ s	50kS/ s to 1GS/ s
Memory Size	8 Meg (16 Meg optional)	4 Meg
Memory Management (Sequences/ Steps)	1 / 4,096	1 / 8,000
Vertical Resolution	12 bits	10 bits
Modulation	FM, FSK, PSK, sweep and more	N/A
Max Frequency (Sine/Square/others)	125MHz/ 125MHz/ 125MHz	100MHz/ 100MHz/ 100MHz
Max Amplitude	2Vp- p	2Vp- p
Connectivity	LAN, USB and GPIB	LAN and GPIB
Warranty	5	1
Price Starts at	\$12,495 *	\$32,400



35 Years
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Leading the Way
In Waveform Generation

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Specification compiled from Tabor 1281 data sheet and Tektronix AWG520 data sheet 76W_11846, August 26, 2004. Prices are taken from the vendors websites. Exclude VAT.

T
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INSTRUMENTATION

> STAND-ALONE TEST INSTRUMENTS *continued*

Anritsu
Applied Signal Technology
Avtech Electrosystems
B&K Precision
Beamex
Berkeley Nucleonics
Chase Scientific
Data Physics
Directed Energy
Fluke
Frequency Devices
Geotest - Marvin Test Systems
Global Specialties
Highland Technology
Hioki USA
Instek America
Keithley Instruments
Krohn-Hite
Madell Technology
Meterman Test Tools
Micronetics
Noise Com

Picosecond Pulse Labs

Signal Recovery

Stanford Research Systems

Tabor Electronics

Tecpel

Tegam



Tektronix

Thurlby-Thandar Instruments (TTi)

Wavecrest

Yokogawa Corp. of America

Hipot/Insulation Breakdown Testers

AEMC Instruments

Associated Research

B&K Precision

Cablescan

CableTest Systems

Chroma ATE

Cirris Systems

Clare Instruments
Compliance West USA

DIT-MCO

International

Electronic Systems of Wisconsin

Glassman High Voltage

GMC Instruments

Hioki USA

Hipotronics

Instek America

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Sefelec

Slaughter

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Instrumentation Amplifiers

Alligator Technologies

Avtech Electrosystems

C&D Technologies
Power Electronics Division

Data Physics

Dataq Instruments

Dewetron

DL Instruments

Frequency Devices

Keithley Instruments

Kemo

Kistler Instrument

Microstar Laboratories

MSI Sensors

Pacific Instruments

PCB Piezotronics

Picosecond Pulse

Labs

Precision Filters

R.C. Electronics

Ross Engineering

Signal Recovery

Stanford Research Systems

Tabor Electronics

Tegam

Trek

Intermittent Fault Testers/Analyzers

CableTest Systems

Photron

Sovtest

LCR Meters/Bridges

Agilent Technologies

AMREL

B&K Precision

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Meterman Test Tools



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- * AV-156A-B, 5 Amps, 15V compliance (25V opt.), 10 us - 10 ms, 4 us rise time
- * AV-156G-B, 10 Amps, 15V compliance (25V opt.), 10 us - 10 ms, 4 us rise time
- * AV-156H-B, 30 Amps, 30V compliance, 0.3 - 30 ms, 50 us rise time
- * AV-156J-B, 30 Amps, 30V compliance, 0.3 - 30 ms, 50 us rise time, floating

Dual-channel models are also available - ideal for airbag squib testing and other tests requiring two current pulses with variable time delay:

- * AV-156E-B, Dual-channel 5A, 25V, 1-100 ms, 10 us rise time, 0-1000 ms delay
- * AV-156F-B, Dual-channel 10A, 25V, 1-100 ms, 4 us rise time, 0-1000 ms delay

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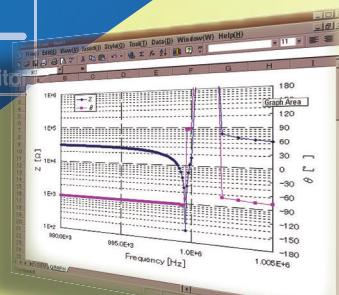
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<http://www.avtechpulse.com>

Germany / Aust / Switz: Schulz-Electronic
France: K.M.P. Elec. Japan: Meisho Corp.
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LCR Meters

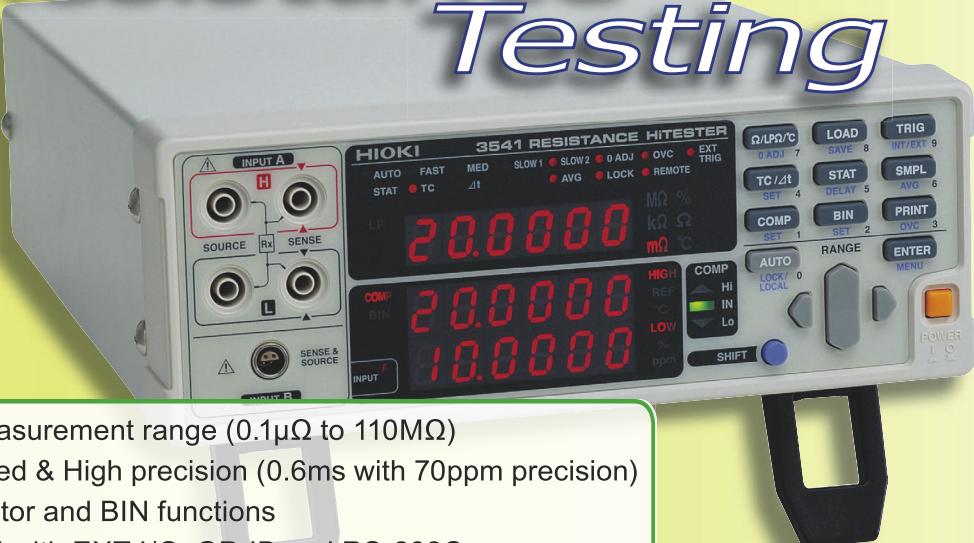


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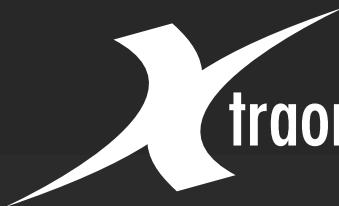
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DL1700



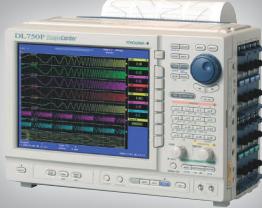
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DL1600



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> STAND-ALONE TEST INSTRUMENTS *continued*

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Applied Physics Systems

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Magnetic Shield

Sypris Test & Measurement

Tecpel

Microprocessor/ IC Trouble-shooting Tools

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Fluke

Huntron

Navatek Engineering

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Agilent Technologies

B&K Precision

Fluke

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Insteck America

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Madell Technology

Protek Test and Measurement

Tecpel

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B&K Precision

LeCroy

SyntheSys Research

Tektronix

Wavecrest

Yokogawa Corp. of America

Oscilloscopes, Benchtop, Digital, Below 1 GHz

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Data Physics

Fluke

Hameg Instruments

Hi-Techniques

Insteck America

LDS Test and Measurement

LeCroy

Madell Technology

Tektronix

Yokogawa Corp. of America

Oscilloscopes, Handheld

AEMC Instruments

Data Physics

Fluke

Saelig

Tektronix

Pattern Generators, Digital

Agilent Technologies

Anritsu

Chroma ATE

Interface Technology

Klein Instruments

Microlmage Video Systems

SyntheSys Research

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Tektronix

VMETRO

Phase Meters/ Phase Angle Voltmeters

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Marsh Bellofram

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Xitron Technologies

Yokogawa Corp. of America

Power Sources & Conditioners

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> STAND-ALONE TEST INSTRUMENTS *continued*

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Serial Bus Testers/ Debuggers
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Catalyst Enterprises
Connecticut Technology Products
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Measurement Computing
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Newport Electronics
Omega Engineering
Pacific Instruments
PCB Piezotronics
Pico Technology
Precision Filters
R.C. Electronics
Spectrum Control
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Sound/Audio Level Meters

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Temperature Meters, Handheld

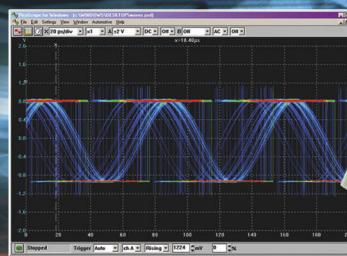
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The PicoScope 3000 series oscilloscopes are the latest offerings from the market leader in PC oscilloscopes combining high bandwidths with large buffer memories. Using the latest advances in electronics, the oscilloscopes connect to the USB port of any modern PC, making full use of the PCs' processing capabilities, large screens and familiar graphical user interfaces.

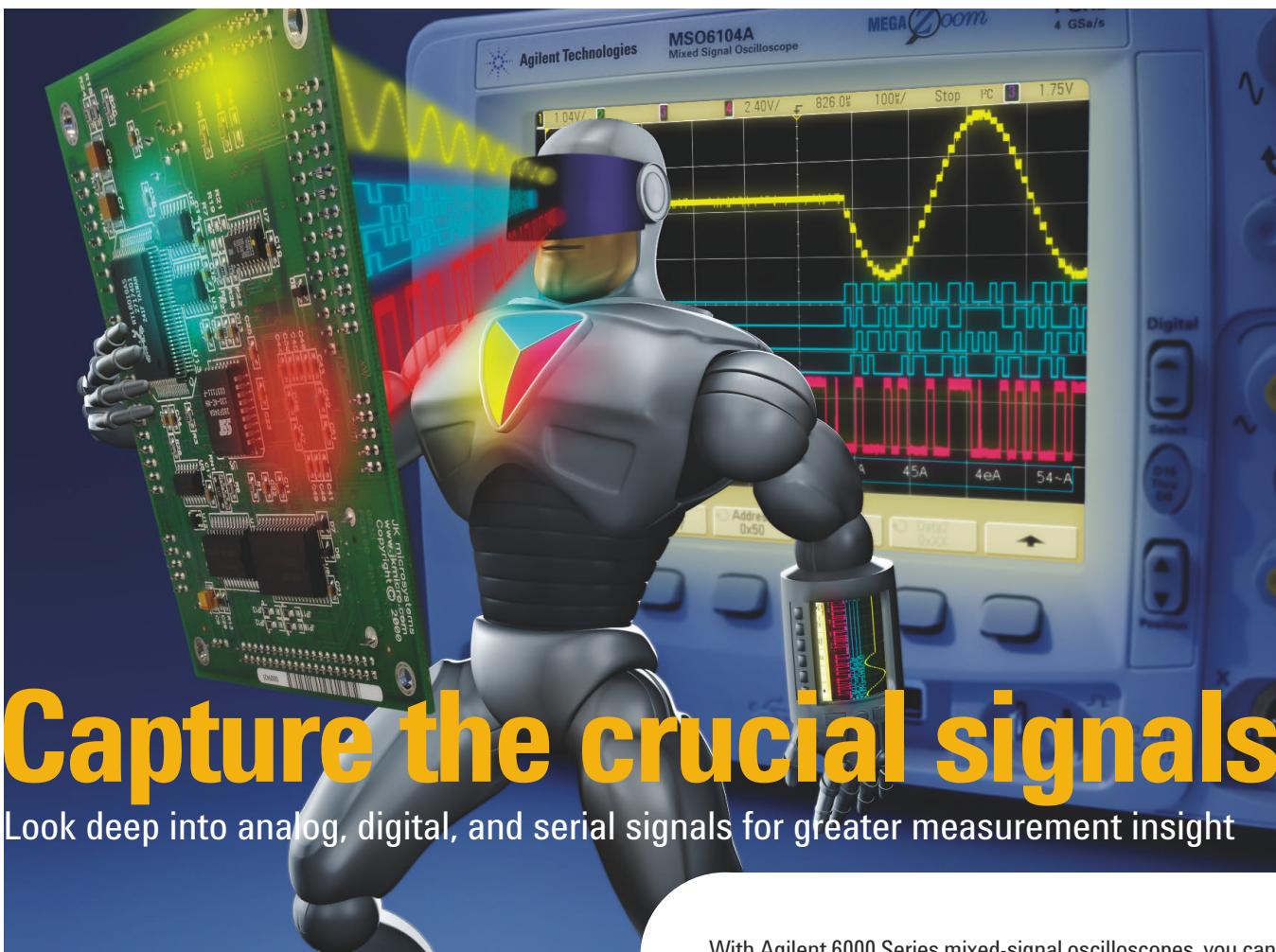
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- 1MB buffer memory
- High speed USB 2.0 interface
- Advanced display & trigger modes
- Compact & portable
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Sampling rate (single shot)	50MS/s	100MS/s	200MS/s
Channels	2+Ext trigger	2+Ext trigger/Sig gen	2+Ext trigger/Sig gen
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Timebase accuracy	50ppm	50ppm	50ppm
Spectrum ranges	0 to 25MHz	0 to 50MHz	0 to 100MHz
Buffer memory size	256KB	512KB	1MB
Resolution / accuracy	8 bits / 3%		
Ranges	±100mV to ±20V		
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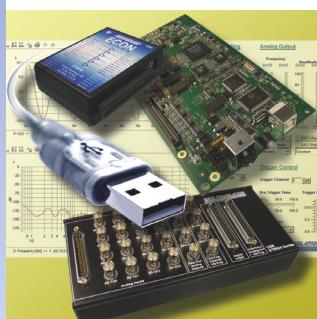
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Adlink Technology
Advantech
Analogic
C&H Technologies
Computer Aided Solutions
Condor Engineering
Conduant
Exacq Technologies
Frequency Devices
Geotest - Marvin Test Systems
GOEPEL Electronics



Innovative Integration
JTAG Technologies
KineticSystems
Measurement Computing
MEN Micro
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Pickering Interfaces
PLD Applications
Strategic Test
Teradyne Assembly Test
United Electronic Industries

CompactPCI/PXI Logic Analyzers

Exacq Technologies
Geotest - Marvin Test Systems
National Instruments
VMETRO

CompactPCI/PXI Multifunction I/O Cards

ACCES I/O Products
Acromag
Adlink Technology
Advantech
Analogic
Ballard Technology
Concurrent Computer
Condor Engineering
DaqScribe Technology
Exacq Technologies
Geotest - Marvin Test Systems
GOEPEL Electronics
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CompactPCI/PXI Digitizers/ Oscilloscopes

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DaqScribe Technology
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Ztec

CompactPCI/PXI RF Measurement Cards

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National Instruments
Pickering Interfaces
Ztec

CompactPCI/PXI Signal Conditioners

Alligator Technologies
Analogic
DaqScribe Technology
Frequency Devices
Innovative Integration
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Pickering Interfaces
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CompactPCI/PXI Spectrum Analyzers

Exacq Technologies
ICS Sensor Processing
National Instruments

CompactPCI/PXI Switches/ Multiplexers

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Chroma ATE
Cytel
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Exacq Technologies
Geotest - Marvin Test Systems
GOEPEL Electronics
KineticSystems
MEN Micro
National Instruments

Pickering Interfaces
Signametrics
Teradyne Assembly Test

CompactPCI/PXI Time and Frequency Measurement Cards

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Instrument Cards, Analog I/O

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Measurement Computing	Data Translation	National Instruments	Strategic Test	Exacq Technologies	Pickering Interfaces
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Microstar Laboratories	Elan Digital Systems	Pickering Interfaces	United Electronic Industries	Signametrics	
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Pacific Instruments	GaGe				
Pentek	Geotest - Marvin Test Systems				
Pico Technology	GOEPEL Electronics				
Racal Instruments	ICS Electronics				
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DaqScribe Technology
Data Translation
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ICS Sensor Processing
Innovative Integration
LMS Instruments
MEN Micro
Microstar Laboratories
National Instruments
Pentek
Ztec

Instrument Cards, Freq., Time, Synchro-Resolver

C&H Technologies
Concurrent Computer
Exacq Technologies
Geotest - Marvin Test Systems
GuideTech
Highland Technology
Keithley Instruments
KineticSystems
Measurement Computing
MEN Micro
North Atlantic Industries
Pacific Instruments
Racal Instruments
Signametrics
Spectracom
Symmetricom

Instrument Cards, Logic Analyzers

Exacq Technologies
Geotest - Marvin Test Systems
National Instruments
NCI Logic Analyzers

Instrument Cards, MIL-STD-1553/ARINC

AIM USA
Ballard Technology
Bustec
Condor Engineering

Curtiss-Wright Controls

Geotest - Marvin Test Systems
KineticSystems
Pickering Interfaces

Instrument Cards, Prototype

C&H Technologies
Geotest - Marvin Test Systems
Innovative Integration
Interface Technology
KineticSystems
MEN Micro
National Instruments
Pacific Instruments
Pickering Interfaces
Racal Instruments

Instrument Cards, Signal Sources

Adlink Technology
Analogic
C&H Technologies
Chase Scientific
Data Physics
Data Translation
Exacq Technologies
Frequency Devices
Geotest - Marvin Test Systems
Highland Technology
Keithley Instruments
LMS Instruments
Measurement Computing
MEN Micro
National Instruments
Novatech Instruments
Pacific Instruments
Pentek

Pickering Interfaces

Racal Instruments
Signametrics
Universal Switching

VXI Technology

National Instruments
Neff Instrument
Pacific Instruments
Pickering Interfaces
Precision Filters
Racal Instruments
Tektronix
Tracewell Systems

United Electronic Industries

National Instruments

Pico Technology
Saelig

Instrument Cards, Switches, Multiplexers

Adlink Technology

Advantech

Analogic

Bustec

C&H Technologies

Chroma ATE

Cytec

Exacq Technologies

Geotest - Marvin Test Systems

ICS Electronics

Keithley Instruments

KineticSystems

Manufacturing Technology

National Instruments

Neff Instrument

Pacific Instruments

Pickering Interfaces

Racal Instruments

Signametrics

Universal Switching

VXI Technology

Instrument Cards, Video Test

Acqiris USA
Exacq Technologies
National Instruments
Racal Instruments
Videology Imaging Solutions

Instrument Controllers/Computers

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Adlink Technology
Agilent Technologies
Bustec
Geotest - Marvin Test Systems
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IOtech

KineticSystems

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Newport Electronics

Onset Computer

PFU Systems

Racal Instruments
Tektronix
United Electronic Industries

Instrument Mainframes/Chassis

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Agilent Technologies
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Frequency Devices
GaGe
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Hi-Techniques
IMC DataWorks
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Manufacturing Technology
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Racal Instruments
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LXI Instruments

Agilent Technologies
Elgar Electronics
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TAL Technologies	Endevco	Racal Instruments	Racal Instruments
	Frequency Devices	Summit Instruments	Teradyne
	Highland Technology	VXI Technology	Assembly Test
	ICS Electronics		VXI Technology
	ICS Sensor Processing		Ztec
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Conduant	Innovative Integration	Agilent Technologies	Agilent Technologies
Geotest - Marvin Test Systems	Intelligent Instrumentation	Data Physics	ASCOR
GOEPEL Electronics	IOtech	Morrow Technologies	Bustec
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MEN Micro	KineticSystems	VMETRO	Highland Technology
National Instruments	Krohn-Hite		Interface Technology
United Electronic Industries	Lawson Labs		KineticSystems
	Measurement Computing		Racal Instruments
	Microstar Laboratories		Signametrics
Geotest - Marvin Test Systems	National Instruments		Spectracom
MAC Panel	Neff Instrument		Symmetricom
National Instruments	Newport Electronics		VXI Technology
Virginia Panel	North Atlantic Industries		Ztec
	Pacific Instruments		VXIbus Mainframes/Chassis
	Pentek		Agilent Technologies
	Pickering Interfaces		ASCOR
Adlink Technology	Pico Technology		B & B Technologies
Chroma ATE	Precision Filters		Chroma ATE
Digalog Systems	R.C. Electronics		ELMA Electronic
ELMA Electronic	Racal Instruments		ICS Electronics
Geotest - Marvin Test Systems	Sealevel Systems		KineticSystems
KineticSystems	Teradyne Assembly Test		MAC Panel
National Instruments	United Electronic Industries		National Instruments
Pickering Interfaces	VXI Technology		Racal Instruments
Teradyne Assembly Test	VXIbus Amplifiers, Attenuators		Teradyne Assembly Test
Tracewell Systems	Agilent Technologies		Tracewell Systems
United Electronic Industries	Alligator Technologies		Virginia Panel
	Frequency Devices		VXI Technology
ACCES I/O Products	Kemo		VXIbus Power Meters and Power Supplies
Acromag	KineticSystems		Advanced Power Designs
Advantech	North Atlantic Industries		Agilent Technologies
Alligator Technologies	Racal Instruments		Boonton Electronics
Analogic	VXI Technology		Chroma ATE
Bustec			Giga-tronics
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JTAG Technologies
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Pacific Instruments
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Pleora Technologies
Rad-icon Imaging
Scientific Solutions
Symtx

TAL Technologies
United Electronic Industries
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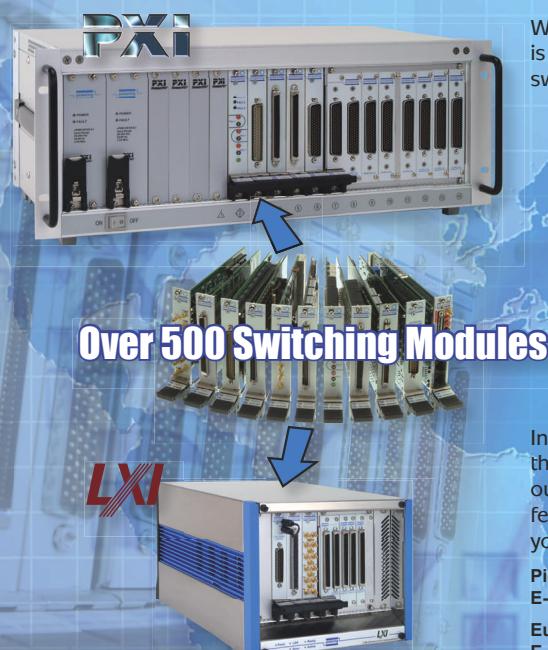
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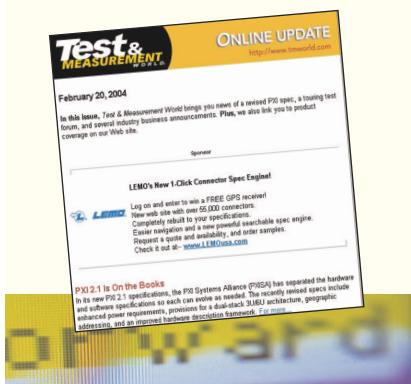
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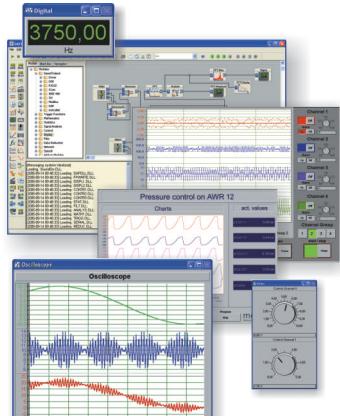


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- ▷ ATE/DFT/BIST Software, p. 66
- ▷ Accessories, p. 68
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- ▷ Services/Labs/Test Houses, p. 74

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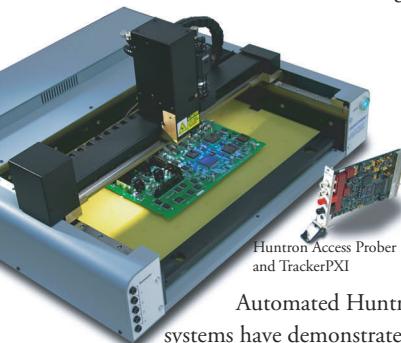
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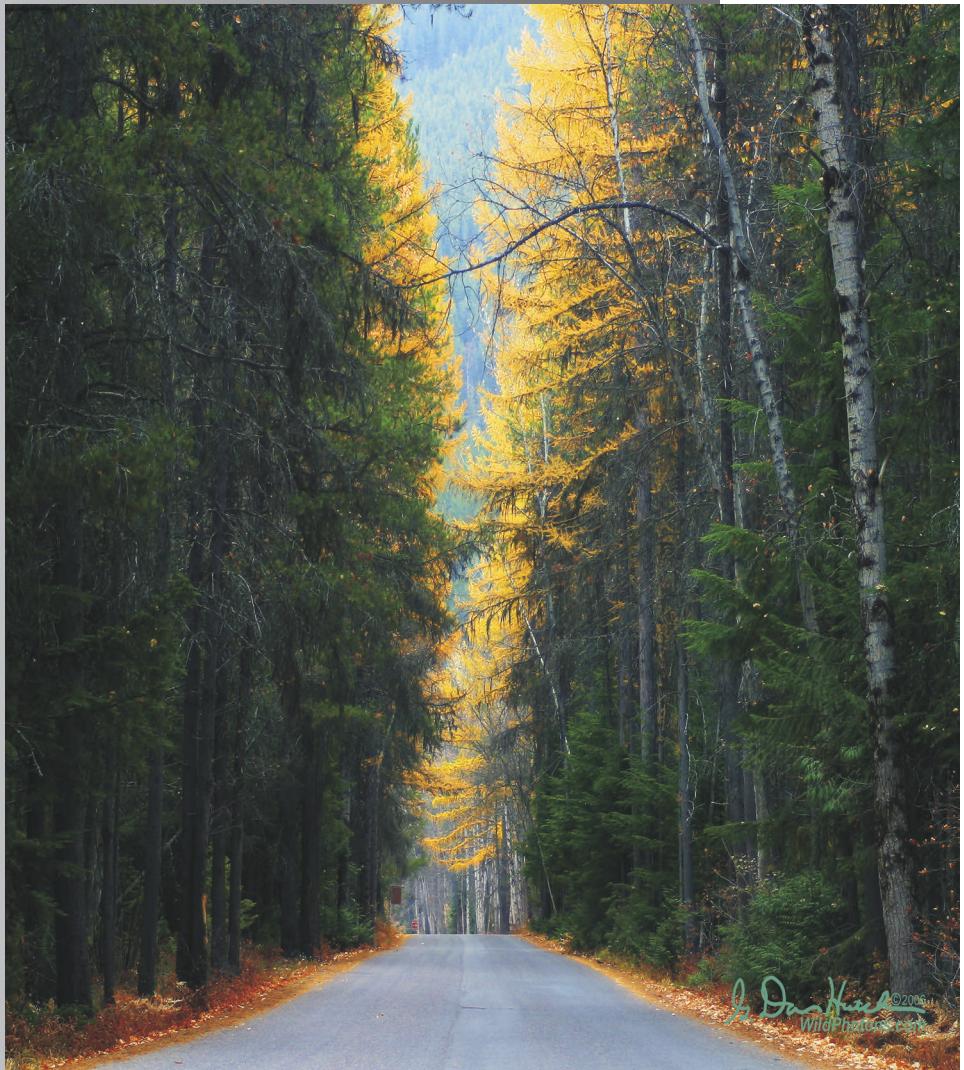
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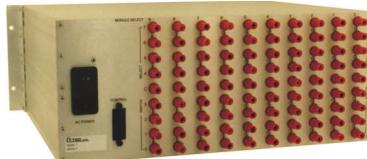
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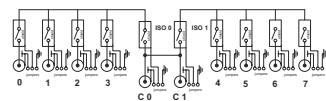
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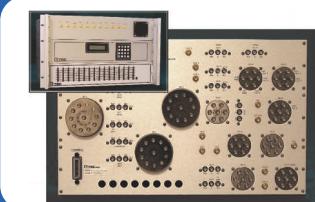
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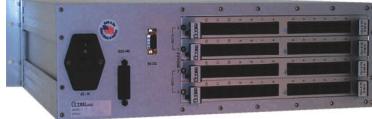
Microwave, RF, Video



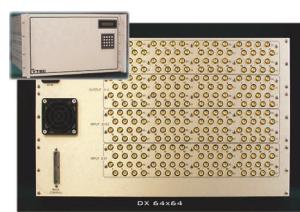
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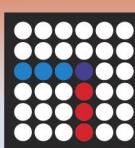
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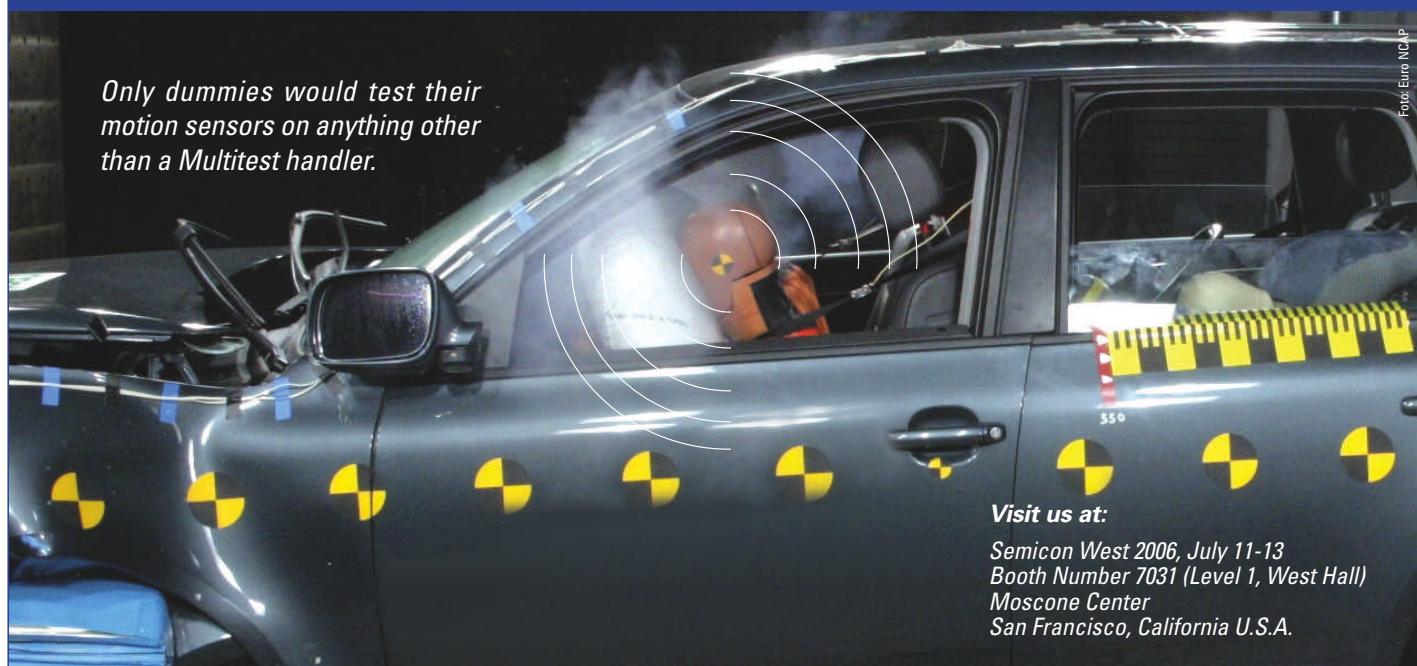
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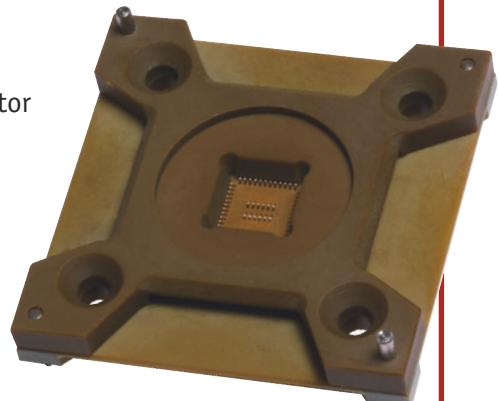


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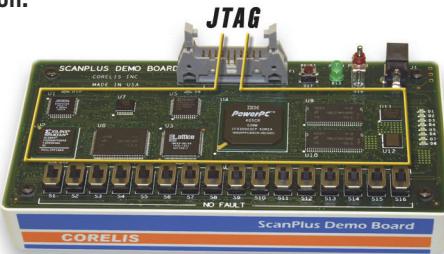
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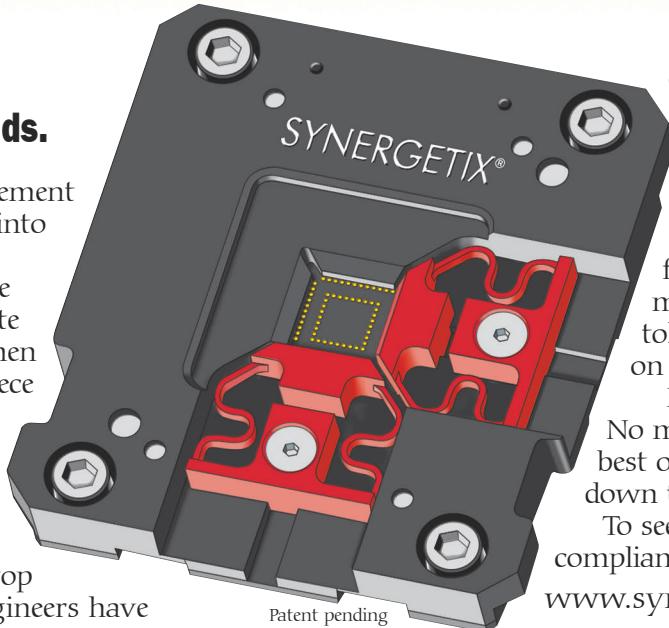


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- ▷ Machine-vision & Inspection Equipment, below
- ▷ Machine-Vision Software, p. 84
- ▷ Third-Party Suppliers, p. 85
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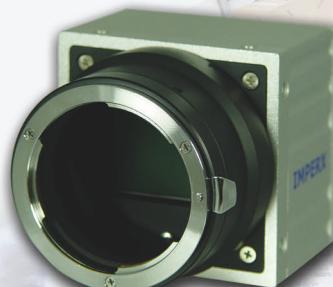
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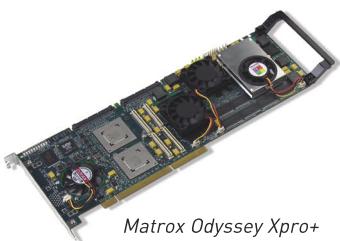
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IN THIS SECTION:

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- ▷ Environmental Test Equipment, at right
- ▷ ESD Control/Protection, p. 88
- ▷ Third-Party Suppliers, p. 90
- ▷ Services/Labs/Test Houses, p. 91

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ELECTRICAL & PHYSICAL ENVIRONMENTAL TEST

> ENVIRONMENTAL TEST EQUIPMENT *continued*

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	Trek
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Custom Systems Integration, Endicott, NY. 607-757-0200. <http://www.customsi.com>.
CyberMetrics, Scottsdale, AZ. 480-922-7300. <http://www.cybermetrics.com>.
Cytec, Penfield, NY. 585-381-4740. <http://www.cytec-ate.com>.

D

D.L.S. Electronic Systems, Wheeling, IL. 847-537-6400. <http://www.dlsemc.com>.
Dage Precision Industries, Fremont, CA. 510-683-3930. <http://www.dageinc.com>.
Dalsa, Waterloo, ON, Canada. 519-886-6000. <http://www.dalsa.com>.
Dalsa Coreco, St. Laurent, QC, Canada. 514-333-1301. <http://www.imaging.com>.
DAQ Systems, Bozeman, MT. 406-586-8028. <http://www.daqsystems.com>.
DaqScribe Technology, Centennial, CO. 303-220-7457. <http://www.daqscribe.com>.
Data I/O, Redmond, WA. 800-426-1045. <http://www.dataio.com>.
Data Physics, San Jose, CA. 408-437-0100. <http://www.dataphysics.com>.
Data Translation, Marlborough, MA. 800-525-8528. <http://www.datx.com>.
Dataforth, Tucson, AZ. 520-741-1404. <http://www.dataforth.com>.
Dataq Instruments, Akron, OH. 330-668-1444. <http://www.dataq.com>.
DataTaker, Chesterland, OH. 800-956-4437. <http://www.computeraidedsolutions.com>.
Daytronic, Dayton, OH. 937-293-2566. <http://www.daytronic.com>.
dBm Engineering, Boulder, CO. 720-406-1200. <http://www.dbmengineering.com>.
dBm Optics, Lafayette, CO. 303-464-1919. <http://www.dbmoptics.com>.
DCC, Pennsauken, NJ. 856-662-7272. <http://www.DCCorporation.com>.
Denver Test Systems, Phoenix, AZ. 888-641-8637. <http://www.denvertest.com>.
DESCO, Chino, CA. 909-627-8178. <http://www.desco.com>.
Despatch Industries, Minneapolis, MN. 952-469-5424. <http://www.despatch.com>.
Dewetron, Charlestown, RI. 877-431-5166. <http://www.dewamerica.com>.
DFT Microsystems, Burlington, MA. 514-878-8271. <http://www.dftmicrosystems.com>.
DGH, Manchester, NH. 603-622-0452. <http://www.dghcorp.com>.
DiagnoSYS Systems, Kissimmee, FL. 800-788-6219. <http://www.diagnosys.com>.
Diamond Systems, Mt. View, CA. 650-810-2500. <http://www.diamondsystems.com>.
Digalog Systems, New Berlin, WI. 262-797-8000. <http://www.digalogsystems.com>.
Digi-Key, Thief River Falls, MN. 800-344-4539. <http://www.digikey.com/>.
Digitaltest, Concord, CA. 925-603-8650. <http://www.digitaltest.com>.
Direct Industry, Marseille, France. +33-4-9103-8090. <http://www.directindustry.com>.
Directed Energy, Ft. Collins, CO. 970-493-1901. <http://www.directedenergy.com>.
DIT-MCO International, Kansas City, MO. 816-444-9700. <http://www.ditmco.com>.
Diversified Technical Systems, Seal Beach, CA. 562-493-0158. <http://www.dtsweb.com>.
DL Instruments, Ithaca, NY. 607-277-8498. <http://www.dlinstruments.com>.
DoveBid Test & Measurement Group, Roseville, CA. 800-442-5835. <http://www.dovebidtmg.com>.
DRS Technologies, Data & Imaging Systems, Oakland, NJ. 760-918-0526. <http://www.drsdigitalimaging.com>.
DSP Development, Newton, MA. 617-969-0185. <http://www.dadisp.com>.
Ducommun, Carson, CA. 310-513-7280. <http://www.ducommun.com>.
DYNAFLOW, Jessup, MD. 301-604-3688. <http://www.dynaflow-inc.com>.
Dynalab Test Systems, Reynoldsburg, OH. 614-729-6550. <http://www.dynalabtesters.com>.
Dynamic Solutions, Northridge, CA. 818-831-0832. <http://www.dynsolUSA.com>.

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VENDOR CONTACT INFORMATION

E

Eagle Test Systems, Buffalo Grove, IL. 847-367-8282. <http://www.eagletest.com>.
eBay, San Jose, CA. <http://www.ebay.com>.
EdenTree Technologies, Newbury Park, CA. 805-499-4555. <http://www.edentretech.com>.
Edmund Industrial Optics, Barrington, NJ. 800-363-1992. <http://www.edmundoptics.com>.
Elan Digital Systems, Fareham, Hampshire, UK. +44 (0)1489-579799. <http://www.elandigitalsystems.com>.
Electro Rent, Van Nuys, CA. 818-787-2100. <http://www.electrorent.com>.
Electroglas, San Jose, CA. 408-528-3000. <http://www.electroglas.com>.
Electro-Metrics, Johnstown, NY. 518-762-2600. <http://www.electro-metrics.com>.
Electron Tubes, Rockaway, NJ. 973 586 9594. <http://www.electrontubes.com>.
Electronic Development Labs, Danville, VA. 434-799-0807. <http://www.edl-inc.com>.
Electronic Systems of Wisconsin, Racine, WI. 262-554-1211. <http://www.eswtesters.com>.
Electro-Tech Systems, Glenside, PA. 215-887-2196. <http://www.electrotechsystems.com>.
Elgar Electronics, San Diego, CA. 858-450-0085. <http://www.elgar.com>.
Elite Electronic Engineering, Downers Grove, IL. 630-495-9770. <http://www.elitetest.com>.
ELMA Electronic, Fremont, CA. 510-656-3400. <http://www.elma.com>.
Emulation Technology, Santa Clara, CA. 408-982-0660. <http://www.emulation.com>.
Endevco, San Juan Capistrano, CA. 949-493-8181. <http://www.endevco.com>.
Environment Associates, Chatsworth, CA. 818-709-0568. <http://www.eatest.com>.
Environmental Specialties, a Luwa Group Company, Raleigh, NC. 800-688-5859. <http://www.LuwaES.com>.
Envirotronics, Grand Rapids, MI. 616-554-5020. <http://www.envirotronics.com>.
EPIX, Buffalo Grove, IL. 847-465-1818. <http://www.epixinc.com>.
Equipment Reliability Institute, Santa Barbara, CA. 805-564-1260. <http://www.equipment-reliability.com>.
ESD Systems, Marlboro, MA. 508-485-7390. <http://www.esdsystems.com>.
ESPEC, Hudsonville, MI. 616-896-6100. <http://www.espec.com>.
ESSC, Cincinnati, OH. 513-793-7774. <http://www.esscinc.com>.
EST Testing Solutions, Holland, MI. 800-611-7859. <http://www.est-usa.com>.
ETEC, W. Peabody, MA. 978-535-7683. <http://www.etec-inc.com>.
ETS-Lindgren, Cedar Park, TX. 512-531-6400. <http://www.ets-lindgren.com>.
Euresys, Itasca, IL. 630-250-2300. <http://www.euresys.com>.
Everest Interscience, Tucson, AZ. 520-792-4545. <http://www.everestinterscience.com>.
Everett Charles Technologies, Pomona, CA. 909-625-5551. <http://www.ectinfo.com>.
Exacq Technologies, Indianapolis, IN. 317-845-5710. <http://www.exacq.com>.
EXFO, Vanier, QC, Canada. 418-683-0211. <http://www.exfo.com>.
Extech Instruments, Waltham, MA. 781-890-7440. <http://www.extech.com>.
E-Z-Hook, Arcadia, CA. 626-446-6175. <http://www.e-z-hook.com>.

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Faxitron X-Ray, Wheeling, IL. 847-465-9729. <http://www.faxitron.com>.
FEI, Hillsboro, OR. 503-726-7500. <http://www.feic.com>.
FETtest, Morgan Hill, CA. 408-778-0234. <http://www.fettest.com>.
Fiber Instrument Sales, Oriskany, NY. 315-736-2206. <http://www.fiberinstrumentsales.com>.
Fiberbyte, San Francisco, CA. 415-543-6859. <http://www.fiberbyte.com>.
Fiberoptic Systems, Simi Valley, CA. 805-583-2088. <http://www.fiberopticsystems.com>.
Fieldtex Products, Rochester, NY. 585-427-2940. <http://www.fieldtex.com>.
Finisar, Eden Prairie, MN. 952-941-5905. <http://www.finisar.com>.
Firstsight Vision, Tongham, Surrey, UK. +44(0)-1252-780000. <http://www.firstsightvision.co.uk>.
Flexco, Tuscumbia, AL. 800-633-3151. <http://www.flexcofloors.com>.
Flex-Core, Columbus, OH. 614-889-6152. <http://www.flex-core.com>.
Flextronics Test, Oakland, NJ. 201-651-1111. <http://www.flextronics.com>.
FLIR Systems, N. Billerica, MA. 800-464-6372. <http://www.flirthermography.com>.
Fluke, Everett, WA. 425-347-6100. <http://www.fluke.com>.
Fluke Networks, Everett, WA. 425-446-4519. <http://www.flukenetworks.com>.

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Flynn Systems, Nashua, NH. 603-598-4444. <http://www.flynn.com>.
Focus Microwaves, Dollard-des-Ormeaux, QC, Canada. 514-684-4554. <http://www.focus-microwaves.com>.

Foresight Imaging, Lowell, MA. 978-458-4624. <http://www.fi-llc.com>.

FormFactor, Livermore, CA. 925-290-4169. <http://www.formfactor.com>.

Frequency Devices, Haverhill, MA. 978-374-0761. <http://www.freqdev.com>.

Frontline Test Equipment, Charlottesville, VA. 800-359-8570. <http://www.fte.com>.

FTS Systems, Stone Ridge, NY. 800-824-0400. <http://www.ftssystems.com>.

Futek Advanced Sensor Technology, Irvine, CA. 949-465-0900. <http://www.futek.com>.

FuturePlus Systems, Colorado Springs, CO. 719-278-3540. <http://www.futureplus.com>.

G

GaGe, Lockport, IL. 514-633-7447. <http://www.gage-applied.com>.

Garwood Laboratories, Pico Rivera, CA. 562-949-2727. <http://www.garwoodtestlabs.com>.

GEI International, E. Syracuse, NY. 315-463-9261. <http://www.geionline.com>.

Geller Microanalytical Lab, Topsfield, MA. 978-887-7000. <http://www.gellermicro.com>.

Genesys IBS, Blaenavon, UK. +44 (0)195-793260. <http://www.genesysibs.com>.

Geotest - Marvin Test Systems, Irvine, CA. 888-837-8297. <http://www.geotestinc.com>.

GHI Systems, San Pedro, CA. 310-548-6544. <http://www.ghisys.com>.

Gigahertz-Optik, Newburyport, MA. 978-462-1818. <http://www.gigahertz-optik.com>.

Giga-tronics, San Ramon, CA. 925-328-4650. <http://www.gigatronics.com>.

Givens Control Engineering, Burlington, ON, Canada. 905-631-8293. <http://www.givenscontrol.com>.

GL Communications, Gaithersburg, MD. 301-670-4784. <http://www.gl.com>.

Glassman High Voltage, High Bridge, NJ. 908-638-3800. <http://www.glassmanhv.com>.

Glenbrook Technologies, Randolph, NJ. 973-361-8866. <http://www.glenbrooktech.com>.

Global Specialties, Cheshire, CT. 800-572-1028. <http://www.globalspecialties.com>.

GMC Instruments, Nuernberg, Bavaria, Germany. +49-0911-86020. <http://gmc-instruments.com>.

GMW Associates, San Carlos, CA. 650-802-8292. <http://www.gmw.com>.

GOEPEL Electronics, Austin, TX. 512-502-3010. <http://www.goepel.com>.

Golden Software, Golden, CO. 303-279-1021. <http://www.goldensoftware.com>.

Gordon Kapes, Skokie, IL. 847-676-1750. <http://www.gkinc.com>.

GraphPad Software, San Diego, CA. 858-259-5770. <http://www.graphpad.com>.

Graphtec America, Santa Ana, CA. 949-770-6010. <http://www.westerngraphtec.com>.

GSI Lumonics, Wilmington, MA. 978-661-4300. <http://www.gsilumonics.com>.

GuideTech, Sunnyvale, CA. 408-733-6555. <http://www.guidetech.com>.

Guideline Instruments, Smiths Falls, ON, Canada. 613-283-3000. <http://www.Guideline.ca>.

H

H+W Test Products, Seekonk, MA. 508-336-3200. <http://www.hwtestproducts.com>.

HALT&HASS Systems, Westminster, CO. 303-465-5988. <http://www.haltandhass.com>.

Hamamatsu Photonic Systems, Bridgewater, NJ. 908-231-1116. <http://hps-systems.com>.

Hameg Instruments, Mainhausen, Germany. +49 (0) 6182 800 0. <http://www.hameg.com>.

Hart Scientific, a Division of Fluke, American Fork, UT. 801-763-1600. <http://www.hartscientific.com>.

Hartman Associates, Woodland Hills, CA. 818-887-4266. <http://hartmanassoc.com>.

Heim Data Systems, Belmar, NJ. 732-556-2318. <http://www.HeimData.com>.

Highland Technology, San Francisco, CA. 415-551-1700. <http://www.highlandtechnology.com>.

Hioki USA, Cranbury, NJ. 609-409-9109. <http://www.hiokiusa.com>.

Hipotronics, Brewster, NY. 845-279-8091. <http://www.hipotronics.com>.

Hi-Techniques, Madison, WI. 608-221-7500. <http://www.hi-techniques.com>.

Hobbs Engineering, Westminster, CO. 303-465-5988. <http://www.hobbsengr.com>.

Honeywell Sensotec, Columbus, OH. 614-850-5000. <http://www.sensotec.com>.
HUBER+SUHNER, Essex, VT. 630-250-0100. <http://www.hubersuhnerinc.com>.
Huntron, Mill Creek, WA. 800-426-9265. <http://www.huntron.com>.
HV Technologies, Manassas, VA. 703-365-2330. <http://www.hvtechnologies.com>.
Hypertronics, Hudson, MA. 978-568-0451. <http://www.hypertronics.com>.

ic automation, Mainz, Germany. +49-(0)6131-62718-0. <http://www.ic-automation.de>.
ICS Electronics, Pleasanton, CA. 925-416-1000. <http://www.icselect.com>.
ICS Sensor Processing, Part of Radstone Embedded Computing, Ottawa, ON, Canada. 613-749-9241. <http://www.ics-ltd.com>.
IET Labs, Westbury, NY. 516-334-5959. <http://www.ietlabs.com>.
Illunis, Minnetonka, MN. 952-975-9203. <http://www.illunis.com>.
ILX Lightwave, Bozeman, MT. 800-459-9459. <http://www.ilxlightwave.com>.
Image Labs International, Bozeman, MT. 406-585-7225. <http://www.imagelabs.com>.
The Imaging Source, Charlotte, NC. 704-370-0110. <http://www.theimagingsource.com>.
IMC DataWorks, Madison, WI. 608-231-6123. <http://www.imcdataworks.com>.
Imperx, Boca Raton, FL. 866-849-1662. <http://www.imperx.com>.
IMV, Chiyoda-ku, Tokyo, Japan. 03-3262-6335. <http://www.imv.co.jp>.
Industrial Resources, Orange, CA. 800-654-7368. <http://www.industrialresources.com>.
ines, Hannover, Bad Nenndorf, Germany. +49-5723-9162-50. <http://www.inesinc.com>.
Infinity Photo-Optical, Boulder, CO. 303-440-4544. <http://www.infinity-usa.com>.
Infrared USA, A Division of TTI Instruments, Williston, VT. 802-863-0085. <http://www.infrared-usa.com>.
Innoco, Kanata, ON, Canada. 613-599-4069. <http://www.innoco.com>.
Innovative Integration, Simi Valley, CA. 805-578-4260. <http://www.innovative-dsp.com>.
Innovative Technologies, Dublin, CA. 925-803-2880. <http://www.virtualrack.com>.
Inovys, Pleasanton, CA. 925-660-1700. <http://www.inovys.com>.
Instek America, Chino, CA. 909-591-8358. <http://www.instek.com>.
Instron Structural Testing Systems, Novi, MI. 248-553-4630. <http://www.instron.com/ist>.
Instrument Systems, Ottawa, ON, Canada. 613-729-0614. <http://www.instrumentsystems.com>.
Instrumentation Engineering, Oakland, NJ. 201-651-1111. <http://www.ietest.com>.
Instrumented Sensor Technology, Okemos, MI. 517-349-8487. <http://www.isthq.com>.
Integral Vision, Wixom, MI. 248-668-9230. <http://www.iv-usa.com>.
Integrated Sciences Group, Bakersfield, CA. 661-872-1683. <http://www.isgmax.com>.
Integrated Technology, Tempe, AZ. 480-968-3459. <http://www.inttechcorp.com>.
Intelligent Instrumentation, Tucson, AZ. 520-573-0887. <http://www.instrument.com>.
Intellitech, Durham, NH. 603-868-7116. <http://www.intellitech.com>.
Intercon 1, Div. of Nortech Systems, Baxter, MN. 800-237-9576. <http://www.nortechsys.com/intercon>.
Interconnect Devices, Kansas City, KS. 913-342-5544. <http://www.idinet.com>.
Interface Technology, Walnut, CA. 909-595-6030. <http://www.interfacetech.com>.
International Data Sciences, Warwick, RI. 401-737-9900. <http://www.idsdata.com>.
International Light, Peabody, MA. 978-818-6180. <http://www.intl-light.com>.
Interpower, Oskaloosa, IA. 800-662-2290. <http://www.interpower.com>.
Intertek ETL Entela, Kentwood, MI. 800-888-3787. <http://www.intertek-ettentela.com>.
inTEST, Cherry Hill, NJ. 856-424-6886. <http://www.intest.com>.
Intrinsic Quality, Elk Grove Village, IL. 847-363-2585. <http://www.intrinsicquality.com>.
Intusoft, Gardena, CA. 310-329-3295. <http://www.intusoft.com>.
Invisar, Chapel Hill, NC. 919-969-9812. <http://www.invisar.com>.
Ion Physics, Fremont, NH. 603-895-5100. <http://www.ionphysics.com>.
IOtech, Cleveland, OH. 440-439-4091. <http://www.iotech.com>.
Ircon, Niles, IL. 847-967-5151. <http://www.ircon.com>.
Ironwood Electronics, Burnsville, MN. 952-229-8200. <http://www.ironwoodelectronics.com>.
Ixia, Calabasas, CA. 818-871-1800. <http://www.ixiacom.com>.

J

JAI Pulnix, San Jose, CA. 408-383-0300. <http://www.jaipulnix.com>.
JDSU, CommTest, Milpitas, CA. 408-546-5000. <http://www.jdsu.com>.
JDSU, Test & Measurement, Germantown, MD. 866-228-3762. http://www.jdsu.com/test_and_measurement.
JEOL USA, Peabody, MA. 978-535-5900. <http://www.jeol.com>.
JFW Industries, Indianapolis, IN. 317-887-1340. <http://www.jfwindustries.com>.
JMC, Newfield, NJ. 856-697-4400. <http://www.jmcserv.com>.
JMP, Cary, NC. 877-594-6567. <http://wwwjmp.com>.
Johnstech International, Minneapolis, MN. 612-378-2020. <http://www.johnstech.com>.
JTAG Technologies, Stevensville, MD. 877-367-5824. <http://www.jtag.com>.

K

K & Us Equipment, Boulder Creek, CA. 831-338-7246. <http://www.KandUs.com>.
K.J. Marketing Services, Toronto, ON, Canada. 416-252-1061. <http://www.kjmarketing.com>.
KAPPA opto-electronics, Monrovia, CA. 626-256-4343. <http://www.kappa-vision.com>.
Keithley Instruments, Cleveland, OH. 440-248-0400. <http://www.keithley.com>.
Kemo, Jacksonville, FL. 904-223-0662. <http://www.kemocom.com>.
Kepco, Flushing, NY. 718-461-7000. <http://www.kepcopower.com>.
Keyence, Woodcliff Lake, NJ. 201-930-0100. <http://www.keyence.com>.
KineticSystems, Lockport, IL. 815-838-0005. <http://www.kscorp.com>.
Kipp & Zonen, Bohemia, NY. 631-589-2065. <http://www.kippzonen.com>.
Kistler Instrument, Amherst, NY. 716-691-5100. <http://www.kistler.com>.
Klein Instruments, Portland, OR. 503-245-1012. <http://www.kleinstruments.com>.
Krohn-Hite, Brockton, MA. 508-580-1660. <http://www.krohn-hite.com>.
Kuka Real Time Products, Tustin, CA. 714-505-1485. <http://www.kuka-controls.com>.
Kurz Instruments, Monterey, CA. 831-646-5911. <http://www.kurz-instruments.com>.

L

L.A.B. Equipment, Franklin Park, IL. 630-595-0144. <http://www.labequipment.com>.
L-3 Titan Group, San Diego, CA. 858-527-6100. <http://www.titan.com>.
LabX, Midland, ON, Canada. 888-781-0328. <http://www.labx.com>.
Laird Technologies, Earth City, MO. 314-344-9300. <http://www.lairdtech.com>.
Lake Shore Cryotronics, Westerville, OH. 614-891-2244. <http://www.lakeshore.com>.
Lambda Americas, San Diego, CA. 619-575-4400. <http://www.lambdapower.com>.
Landrex Technologies, Santa Clara, CA. 408-567-9801. <http://www.landrex-us.com>.
Lawson Labs, Malvern, PA. 610-725-8800. <http://www.lawsonlabs.com>.
LDS Test and Measurement, Middleton, WI. 608-821-6600. <http://www.lds-group.com>.
Leader Instruments, Cypress, CA. 714-527-9300. <http://www.leaderusa.com>.
LeCroy, Chestnut Ridge, NY. 800-553-2769. <http://www.lecroy.com>.
Lemo USA, Rohnert Park, CA. 707-578-8811. <http://www.lemousa.com>.
Leutron Vision, Burlington, MA. 781-238-0213. <http://www.leutron.com/us>.
Ling Electronics, W. Haven, CT. 203-933-8000. http://www.qualmark.com/ling_index.html.
LINOS Photonics, Milford, MA. 800-334-5678. <http://www.linos.com>.
Linseis, Princeton Junction, NJ. 609-799-6282. <http://www.Linseis.net>.
LMS Instruments, Troy, MI. 248-952-5664. <http://www.lmsintl.com>.
LogicVision, San Jose, CA. 408-453-0146. <http://www.logicvision.com>.
LPKF Laser and Electronics, Wilsonville, OR. 503-454-4200. <http://www.lpkfusa.com>.
LR Environmental Equipment, Los Angeles, CA. 323-770-0634. <http://www.lre.com>.
LTX, Westwood, MA. 781-461-1000. <http://www.ltx.com>.
Lumenera, Ottawa, ON, Canada. 613-736-4077. <http://www.lumenera.com>.
Luna Technologies, Blacksburg, VA. 540-961-5190. <http://www.lunatechnologies.com>.
Luther & Maelzer, Pepperell, MA. 978-433-3680. <http://www.WMHague.com>.

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M

m + p international, Verona, NJ. 973-239-3005. <http://www.mpihome.com>.

M/RAD, Woburn, MA. 781-935-5940. <http://www.mradcorp.com>.

M3 Electronics, Apex, NC. 919-924-3525. <http://www.m3electronics.biz>.

MAC Panel, High Point, NC. 336-861-3100. <http://www.macpanel.com>.

Machine Vision Products, Carlsbad, CA. 760-438-1138. <http://www.machinevisionproducts.com>.

Macro Sensors, Pennsauken, NJ. 856-662-8000. <http://www.macrosensors.com>.

Macrotron Scientific Engineering, Unterhaching / Munich, Bavaria, Germany. +49-89-45 111-0. <http://www.macotron.org>.

Madell Technology, Buena Park, CA. 714-670-9023. <http://www.madelltech.com>.

Magnetic Shield, Bensenville, IL. 630-766-7800. <http://www.magnetic-shield.com>.

Magtrol, Buffalo, NY. 716-668-5555. <http://www.magtrol.com>.

Manuals Plus, N. Salt Lake, UT. 801-936-7000. <http://www.manualsplus.com>.

Manufacturing Technology, Ft. Walton Beach, FL. 850-664-6070. <http://www.mtifwb.com>.

Marsh Bellofram, ATC, Newell, WV. 800-727-5646. <http://www.automatictiming.com>.

Materials Development, Chatsworth, CA. 818-700-8290. <http://www.mdc4cv.com>.

Mathsoft Engineering & Education, Cambridge, MA. 617-444-8000. <http://www.mathsoft.com>.

The MathWorks, Natick, MA. 508-647-7000. <http://www.mathworks.com>.

Matrix Systems, Calabasas, CA. 818-222-2301. <http://www.matrixsystems.com>.

Matrox Imaging, Dorval, QC, Canada. 800-804-6243. <http://www.matrox.com/imaging>.

MCC, Hopewell, NJ. 609-466-1751. <http://www.mcc-us.com>.

MCM, an InOne company, Centerville, OH. 800-543-4330. <http://www.mcm-inone.com>.

Measurement Computing, Norton, MA. 508-946-5100. <http://www.mccdaq.com>.

MegaPhase, Stroudsburg, PA. 877-634-2742. <http://www.MegaPhase.com>.

Meiji Techno America, Santa Clara, CA. 800-832-0060. <http://www.meijitechno.com>.

Melles Griot Optics Group, Rochester, NY. 585-244-7220. <http://www.mellesgriot.com>.

MEN Micro, Lago Vista, TX. 512-267-8883. <http://www.menmicro.com>.

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Micro Lambda Wireless, Fremont, CA. 510-770-9221. <http://www.microlambdawireless.com>.

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Micro-Coax, Pottstown, PA. 610-495-0110. <http://www.micro-coax.com>.

MicroImage Video Systems, Boyertown, PA. 610-754-6800. <http://www.mivs.com>.

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Micro-Vu, Windsor, CA. 707-838-6272. <http://www.microvu.com>.

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Moritex, Cambridge, UK. +44(0) 1223-301-148. <http://www.moritex.com>.

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Motorola Product Testing Services, Lawrenceville, GA. 770-338-3795. <http://www.motorola.com/producttesting>.

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Multiprobe, Santa Barbara, CA. 805-560-0404. <http://www.multiprobe.com>.

Multitest Elektronische Systeme, Rosenheim, Germany. +49-(0)8031-406 0. <http://www.multitest.com>.

MuShield, Goffstown, NH. 603-666-4433. <http://www.mushield.com>.

MVTec Software, Munich, Bavaria, Germany. +49 89 4576950. <http://www.mvtac.com>.

N

NAC Image Technology, Simi Valley, CA. 800-969-2711. <http://www.nacinc.com>.

Naptech Test Equipment, Lower Lake, CA. 707-995-7145. <http://www.naptech.com>.

National Instruments, Austin, TX. 512-683-0100. <http://www.ni.com>.

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National Semiconductor, Santa Clara, CA. 800-272-9959. <http://www.national.com>.

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Navatek Engineering, Rancho Santa Margarita, CA. 949-888-2222. <http://www.navatek.com>.

Navitar, Rochester, NY. 585-359-4000. <http://navitar.com>.

NCI Logic Analyzers, Huntsville, AL. 256-837-6667. <http://www.nci-usa.com>.

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Noise Com, Parsippany, NJ. 973-386-9696. <http://www.noisecom.com>.

Noise Laboratory, Sagamihara, Kanagawa, Japan. +81-42-712-2051. <http://www.noisenek.co.jp>.

Nomadics, Stillwater, OK. 405-372-9535. <http://www.aigproducts.com>.

NorPix, Montreal, QC, Canada. 514 907 1588. <http://www.norpix.com>.

North Atlantic Industries, Bohemia, NY. 631-567-1100. <http://www.naii.com>.

Northwest Analytical, Portland, OR. 503-224-7727. <http://www.nwasoft.com>.

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Omega Engineering, Stamford, CT. 800-848-4286. <http://www.omega.com>.
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Optical Gaging Products, Rochester, NY. 585-544-0400. <http://www.ogpnet.com>.
Opticom, Erlangen, Germany. +49 9131-530 200. <http://www.opticom.de>.
OptoMetrix, Renton, WA. 425-251-6363. <http://www.optomet.com>.
Optomistic Products, South Freemont, ME. 207-865-9181. <http://www.optomisticproducts.com>.
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OriginLab, Northampton, MA. 413-586-2013. <http://www.originlab.com>.
ORIX USA, Los Angeles, CA. 877-849-6749. <http://www.orixonline.com>.
OROS, Noise & Vibration Solutions, Dulles, VA. 888-200-6767. <http://www.OROS.com>.
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Oz Optics, Carp, ON, Canada. 613-831-0981. <http://www.ozoptics.com>.

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Pacific Instruments, Concord, CA. 925-827-9010. <http://www.pacificinstruments.com>.
Pacific Power Source, Irvine, CA. 949-251-1800. <http://www.pacificpower.com>.
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Panasonic Factory Solutions Company of America, Buffalo Grove, IL. 847-495-6100. <http://www.panasonicfa.com>.
PCB Piezotronics, Depew, NY. 716-684-0001. <http://www.pcb.com>.
PDF Solutions, San Jose, CA. 408-280-7900. <http://www.pdf.com>.
Pearson Electronics, Palo Alto, CA. 650-494-6444. <http://www.pearsonelectronics.com>.
Pendulum Instruments, Bromma, Sweden, Sweden. +46-8-598-51000. <http://www.pendulum-instruments.com>.
Pentek, Upper Saddle River, NJ. 201-818-5900. <http://www.pentek.com>.
PerkinElmer Optoelectronics, Fremont, CA. 510-979-6500. <http://optoelectronics.perkinelmer.com>.
PFU Systems, Plymouth, MN. 763-551-8261. <http://www.pfusystems.com>.
Phlox, Aix les Milles, Cedex, France. +33-4-42-90-76-20. <http://www.phlox-gc.com>.
phoenix x-ray Systems + Services, Camarillo, CA. 805-389-0911. <http://www.phoenix-xray.com>.
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Pico Technology, St Neots, Cambridgeshire, UK. +44 (0)1480-396395. <http://www.picotech.com>.
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Pleora Technologies, Kanata, ON, Canada. 613-270-0625. <http://www.pleora.com>.
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Point Grey Research, Vancouver, BC, Canada. 604-730-9937. <http://www.ptgrey.com>.
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Precision Filters, Ithaca, NY. 607-277-3550. <http://pfinc.com>.

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Racal Instruments, Irvine, CA. 949-859-8999. <http://www.eads-nadefense.com>.

RADCOM, Paramus, NJ. 201-518-0033. <http://www.radcom.com>.

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Redlake, Tucson, AZ. 520-547-2772. <http://www.redlake.com>.

Reinhardt System und Messelectronic, Diessen, Bavaria, Germany. +49-8196-934100. <http://www.reinhardt-testsystem.de>.

Reliability Analysis Laboratory, Raytheon, Tewksbury, MA. 800-725-4787. <http://www.reliabilityanalysislab.com>.

ReMaTek, St. Laurent, QC, Canada. 514-333-0101. <http://www.rematek.com>.

Ricreations, Universal Scan, Gainesville, GA. 678-455-7255. <http://www.universalscan.com>.

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<http://www.rockwellscientific.com>.

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<http://www.rmte.net>.

Rohde & Schwarz, Columbia, Maryland. 410-910-7800.
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<http://www.rossengineeringcorp.com>.

Rotek Instrument, Waltham, MA. 781-899-4611. <http://www.rotetek.com>.

Rotronic Instrument, Huntington, NY. 631-427-3898. <http://www.rotronic-usa.com>.

Router Solutions, Newport Beach, CA. 949-737-4567. <http://www.rsi-inc.com>.

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RVSI Acuity CiMatrix, Nashua, NH. 800-468-9503. <http://www.acuitycimatrix.com>.

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S

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<http://www.metersuperstore.com>.

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ScanCAD International, Morrison, CO. 303-697-8888. <http://www.scancad.com>.

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Sefelec, Yucaipa, CA. 909-797-0484. <http://www.sefelec.com>.

Seica, Strambino, Italy, Italy. +39-0125-636811. <http://www.seica.com>.

Semitek, Richardson, TX. 972-783-8100. <http://www.semitek.com>.

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Sensortechnics, Walpole, MA. 508-660-8823. <http://www.sensortechnics.com>.

Sentech America, Carrollton, TX. 972-481-9223. <http://www.sentechamerica.com>.

Sharetree Systems, Gloucestershire, Stroud, UK. +44(0)-145-382-8642.
<http://www.sharetree.com>.

Sigma Systems, El Cajon, CA. 619-258-3700. <http://www.sigmasystems.com>.

SigmaQuest, Santa Clara, CA. 408-654-9401. <http://www.sigmaquest.com>.

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Stanford Research Systems, Sunnyvale, CA. 408-744-9040. <http://www.thinkrs.com>.

Stanley Supply & Services, N. Andover, MA. 800-225-5370.
<http://www.stanleyworks.com>.

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Suss MicroTec, Sacka bei Dresden, Saxony, Germany. +49-35240-73-0.
<http://www.suss.com>.

SV Probe, Santa Clara, CA. 408-727-6341. <http://www.svprobe.com>.

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TEAC America, Montebello, CA. 323-726-0303. <http://www.teac.com>.

TEAM A.T.E., Denver, CO. 303-628-7722. <http://www.team-ate.com>.

TEAM, Burlington, WA. 360-757-8601. <http://www.teamcorporation.com>.

Technology Training, Santa Barbara, CA. 866-884-4338. <http://www.TTiedu.com>.

TechRecovery, Mendon, MA. 877-837-8872. <http://www.techrecovery.com>.

Tecpel, Sin Yi District, Taipei, Taiwan. +886-2-2737-5866. <http://www.tecpel.com>.

Tegam, Geneva, OH. 404-466-6100. <http://www.tegam.com>.

Tekscan, South Boston, MA. 617-464-4500. <http://www.tekscan.com>.

Tektronix, Portland, OR. 800-426-2200. <http://www.tektronix.com>.

Telatemp, Fullerton, CA. 714-879-2901. <http://www.telatemp.com>.

Telco Testing Solutions, Tempe, AZ. 480-603-1828. <http://www.telcotesting.com>.

Telinc, Mount Laurel, NJ. 800-257-5110. <http://www.telinc.com>.

Teltone, Bothell, WA. 800-426-3926. <http://www.teltone.com>.

Temptronic, an inTest company, Sharon, MA. 781-688-2300.
<http://www.temptronic.com>.

Teradyne, Assembly Test Div., North Reading, MA. 800-837-2396.
<http://www.teradyne.com/atd>.

Teradyne, Semiconductor Test Division, Boston, MA. 617-482-2700.
<http://www.teradyne.com>.

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Terahertz Technologies, Oriskany, NY. 315-736-3642.
<http://www.terahertztechnologies.com>.

Terra Universal, Fullerton, CA. 714-578-6000. <http://www.terrauniversal.com>.
Test & Measurement Global Exchange (Tame), Lexington, MA. 617-820-8630.
<http://www.tame.com>.

Test Advantage, Tempe, AZ. 480-337-3377. <http://www.testadvantage.com>.
Test Coach, Hoffman Estates, IL. 847-885-4880. <http://www.testcoachcorp.com>.

The Test Connection, Reistertown, MD. 410-526-2800. <http://www.ttc.com>.
Test Equipment Connection, Lake Mary, FL. 800-615-8378.
<http://www.testequipmentconnection.com>.

Test Equipment Solutions Today, Foster City, CA. 888-889-8378.
<http://www.testsolu.com>.

Test Research, Taipei, Taiwan. +886-2-28328918. <http://www.tri.com.tw>.

Test Site Services, Milford, MA. 508-634-3444. <http://www.testsiteservices.com>.

TestEdge, San Diego, CA. 858-451-1012. <http://www.testedgeinc.com>.

TestEquity, Thousand Oaks, CA. 800-950-3457. <http://www.testequity.com>.

TestMart, San Bruno, CA. 650-624-0525. <http://www.testmart.com>.

Testo, Flanders, NJ. 973-252-1720. <http://www.testo.com>.

Testronics, McKinney, TX. 972-542-3111. <http://www.testronics.com>.

Texas Instruments, Dallas, TX. 800-336-5236. <http://www.ti.com>.

ThermaCal, Solon, OH. 440-498-1005. <http://www.thermacal.com>.

Thermal Product Solutions, A unit of SPX, Williamsport, PA. 570-326-1770.
<http://www.thermalproductsolutions.com>.

Therma Electric, Saddle Brook, NJ. 201-843-5800.
<http://www.thermo-electric-direct.com>.

Thermo Electron, Thermo KeyTek, Lowell, MA. 978-275-0800.
<http://www.thermo.com/ess>.

Thermonics, Santa Clara, CA. 408-496-6838. <http://www.thermonics.com>.

Thermotron Industries, Holland, MI. 616-393-4580. <http://www.thermotron.com>.

Thunder Scientific, Albuquerque, NM. 505-265-8701.
<http://www.ThunderScientific.com>.

Thurlby-Thandar Instruments (TTi), Huntingdon, Cambs, UK. +44-1480-412451.
<http://www.tti-test.com>.

TiePie engineering, Sneek, Friesland, Netherlands. +31 515 415 416.
<http://www.tiepie.nl>.

Total Temperature Instrumentation, Williston, VT. 802-863-0085.
<http://www.tti-global.com>.

Tracespan Communications, Ann Arbor, MI. 734-846-0549. <http://www.tracespan.com>.

Tracewell Systems, Westerville, OH. 800-848-4524. <http://www.tracewellsystems.com>.

Transcat, Rochester, NY. 800-828-1470. <http://www.transcat.com>.

TransEra, Orem, UT. 800-666-3216. <http://www.HTBasic.com>.

Trek, Medina, NY. 585-798-3140. <http://www.trekinc.com>.

Trek Equipment, Sausalito, CA. 415-332-1555. <http://www.trekequip.com>.

Trio-Tech International, Van Nuys, CA. 818-787-7000. <http://www.triotech.com>.

TRS-RenTelco, DFW Airport, TX. 800-874-7123. <http://www.trs-rentelco.com>.

Tucker Electronics, Garland, TX. 800-527-4642. <http://www.tucker.com>.

TUV America, Danvers, MA. 800-888-0123. <http://www.TUVamerica.com>.

TUV Rheinland of North America, Newtown, CT. 888-975-3943. <http://www.tuv.com>.

Tyrosys, Plano, TX. 877-897-6797. <http://www.tyrosys.com>.

TYX, Reston, VA. 703-264-1080. <http://www.tyx.com>.

U

UGS, Plano, TX. 800-498-5351. <http://www.ugs.com>.

Ultrafast Sensors, Thousand Oaks, CA. 866-205-0592.
<http://www.ultrafastsensors.com>.

UltraTest International, San Jose, CA. 408-433-2244. <http://www.ultratest.com>.
UMD Advanced Test Technologies, Vancouver, WA. 360-433-6230.
<http://www.udmtech.com>.

Underwriters Laboratories, Northbrook, IL. 847-272-8800. <http://www.ul.com>.

Unholtz-Dickie, Wallingford, CT. 203-265-3929. <http://www.udco.com>.

Unisoft, Milford, CT. 888-486-4246. <http://www.unisoft-cim.com>.

United Electronic Industries, Canton, MA. 781-821-2890. <http://www.ueidaq.com>.

Unitron, Bohemia, NY. 631-589-6666. <http://www.unitronusa.com>.

Universal Switching, Van Nuys, CA. 818-785-0200. <http://www.uswi.com>.

V

V.J. Electronix, Bohemia, NY. 800-858-9729. <http://www.vjelectronix.com>.

Vektrex Electronic Systems, San Diego, CA. 858-558-8282. <http://www.vektrex.com>.

Verigy, Santa Clara, CA. 800-283-8378. <http://www.verigy.com>.

VI Technology, Austin, TX. 512-327-3348. <http://www.vi-tech.com>.

Vibration Research, Jenison, MI. 616-669-3028. <http://www.vibrationresearch.com>.

Victor, Andover, MA. 978-470-2900. <http://www.vicorpowers.com>.

Videology Imaging Solutions, Greenville, RI. 401-949-5332.
<http://www.videologyinc.com>.

View Engineering, Simi Valley, CA. 805-578-5000. <http://www.vieweng.com>.

Viewpoint Systems, Rochester, NY. 585-475-9555. <http://www.viewpointusa.com>.

Virginia Panel, Waynesboro, VA. 540-932-3300. <http://www.vpc.com>.

Viscom, Norcross, GA. 678-966-9835. <http://www.viscomusa.com>.

Vision Components, Hudson, NH. 603-598-2588. <http://www.vision-components.com>.

Vision Engineering, New Milford, CT. 860-355-3776. <http://www.visioneng.com>.

Vision Systems International, Yardley, PA. 215-736-0994. <http://www.vision1.com/vsi>.

VLSI Standards, San Jose, CA. 408-428-1800. <http://www.vlsistandards.com>.

VMETRO, Houston, TX. 281-584-0728. <http://www.vmetro.com>.

Volpi USA, Auburn, NY. 315-255-1737. <http://www.volpiusa.com>.

VXI Technology, Irvine, CA. 949-955-1894. <http://www.vxitech.com>.

W

W.J. Ford Surplus Enterprises, Smith's Falls, ON, Canada. 613-283-5195.
<http://www.testequipmentcanada.com>.

W.L. Gore & Associates, Elkton, MD. 800-311-3060. <http://www.gore.com>.

W.M. Hague, Pepperell, MA. 978-433-3777. <http://www.WMHague.com>.

Warwick Control Technologies, Fen End, Warwickshire, UK. +44(0)1676 536010.
<http://www.warwickcontrol.com>.

Wavecrest, Eden Prairie, MN. 952-831-0030. <http://www.wavecrest.com>.

Wentworth Laboratories, Brookfield, CT. 203-775-0449.
<http://www.wentworthlabs.com>.

WESCO, Western Scientific, San Francisco, CA. 415-826-5732.
<http://www.wescomicroscopes.com>.

Willtek Communications, Indianapolis, IN. 317-595-2021. <http://www.willtek.com>.

Wintriss Engineering, San Diego, CA. 800-550-7300. <http://www.weco.com>.

WiTec Instruments, Savoy, IL. 217 351 9705. <http://www.witec-instruments.com>.

X

Xantrex Technology, Burnaby, BC, Canada. 604-422-8595. <http://www.xantrex.com>.

Xitron Technologies, San Diego, CA. 858-530-8099. <http://www.xitrontech.com>.

X-TEK Group, Tyngsboro, MA. 978-649-6333. <http://www.xtekxray.com>.

Y

Yamaichi Electronics USA, San Jose, CA. 408-456-0797. <http://www.yamaichi.us>.

YesTech, San Clemente, CA. 949-361-2714. <http://www.yestechinc.com>.

Yokogawa Corp. of America, Newnan, GA. 770-254-0400. <http://www.yokogawa.com/us>.

Y-tek, Raleigh, NC. 919-676-4741. <http://www.Y-tek.com>.

Z

Zmation, Portland, OR. 503-253-8871. <http://www.zmation.com>.

Ztec, Albuquerque, NM. 505-342-0132. <http://www.ztec-inc.com>.

Zygo, Middlefield, CT. 860-347-8506. <http://www.zygo.com>.

T&MW

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PROFESSIONAL SOCIETIES & TRADE ASSOCIATIONS

Accellera, www.accellera.org. Formed by the merger of VHDL International and Open Verilog International, Accellera drives the development of standards that enhance a language-based design automation process.

AeA, www.aeanet.org. Formerly the American Electronics Association, AeA is a trade association representing all segments of the technology industry.

American Association for Laboratory Accreditation (A2LA), www.a2la.org. The A2LA is dedicated to accreditation of competent testing and calibration laboratories, proficiency testing providers, and reference materials producers.

American Council of Independent Laboratories (ACIL), www.acil.org. ACIL is a trade association representing independent, commercial scientific, and engineering firms.

American National Standards Institute (ANSI), www.ansi.org. ANSI is a private, nonprofit administrator and coordinator of the US voluntary standardization system.

American Society for Nondestructive Testing (ASNT), www.asnt.org. ASNT promotes the discipline of nondestructive testing (NDT) as a profession and facilitates NDT research.

American Society for Quality (ASQ), www.asq.org. The American Society for Quality advances learning, quality improvement, and knowledge exchange to improve business results.

American Society of Test Engineers (ASTE), www.astest.org. The ASTE, a nonprofit corporation, is dedicated to promoting test engineering as a profession.

ASTM International, www.astm.org. ASTM develops and distributes voluntary technical standards and related information.

Audio Engineering Society (AES), www.aes.org. The AES is a professional society devoted exclusively to audio technology.

Automated Imaging Association (AIA), www.machinevisiononline.org. The AIA is a trade association for machine-vision imaging suppliers and users. AIA also maintains the Camera Link and GigE Vision standards.

British Standards Institution (BSI), www.bsi-global.com. British Standards is the National Standards Body of the UK, responsible for facilitating, drafting, publishing, and marketing British Standards and other guidelines.

Canadian Standards Association (CSA), www.csa.ca. CSA is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace.

DSL Forum, www.dsforum.org. DSL Forum is a consortium of telecommunications, equipment, computing, networking, and service-provider companies that promotes the use of DSL technology.

Electronic Industries Alliance (EIA), www.eia.org. EIA represents companies involved in the manufacture of electronic components, parts, systems, and equipment.

ESD Association, www.esda.org. ESD Association is dedicated to advancing the theory and practice of electrostatic discharge avoidance.

European Committee for Electrotechnical Standardization (CENELEC), www.cenelec.org. CENELEC creates electrotechnical standards, many of them following the mandates of the European Commission.

European Committee for Standardization (CEN), www.cenorm.be. CEN works to implement voluntary technical harmonization in Europe in conjunction with worldwide bodies and European partners.

European Telecommunications Standards Institute (ETSI), www.etsi.org. ETSI's mission is to produce the telecom standards that will be used throughout Europe.

Federal Communications Commission (FCC), www.fcc.gov. The FCC is charged with regulating interstate and international communications by radio, television, wire, satellite, and cable.

Fibre Channel Industry Association (FCIA), www.fibrechannel.org. The FCIA aims to develop the market for Fibre Channel products.

IEEE, www.ieee.org. The IEEE is a technical professional society that advances the theory and practice of electrical, electronics, and computer engineering as well as computer science.

Institute for National Measurement Standards (INMS), inms-iennm.nrc-cnrc.gc.ca/. The INMS, Canada's national metrology institute (NMI), carries out a range of research and service activities.

Institute of Environmental Sciences and Technology (IEST), www.iest.org. The IEST is concerned with the effects on equipment and machinery of natural, indoor, and extreme environments, which may occur under aerospace, naval, and climatic conditions.

Institution of Engineering and Technology (IET), www.theiet.org/. The IET, a UK-based organization, was formed by the merger of the Institution of Electrical Engineers (IEE) and the Institution of Incorporated Engineers (IIE). It aims to advance engineering and technology by facilitating the exchange of knowledge and ideas.

InterNational Committee for Information Technology Standards (INCITS), www.incits.org. The INCITS works to produce voluntary consensus standards for storage media, databases, programming languages, multimedia, and communication among computing devices and information systems.

International Electrotechnical Commission (IEC), www.iec.ch. The IEC creates international consensus standards and conformity assessment schemes in the fields of electricity, electronics, and associated technologies.

International Microelectronics & Packaging Society (IMAPS), www.imaps.org. IMAPS is a professional society dedicated to educating engineers in all phases of electronics packaging.

International Organization for Standardization (ISO), www.iso.org. ISO promotes the development of international standards.

International Society for Optical Engineering (SPIE), www.spie.org. The SPIE is a technical society dedicated to advancing engineering, scientific, and commercial applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

International Telecommunication Union (ITU), www.itu.int. Through the ITU, governments and industries establish and coordinate policies, standards, regulations, and treaties covering global telecommunication networks.

IPC-Association Connecting Electronics Industries, www.ipc.org. IPC is a global trade association that represents all facets of the electronic interconnection industry, including design, printed wiring board manufacturing, and electronics assembly.

ISA, The Instrumentation, Systems, and Automation Society, www.isa.org. ISA is a society of more than 39,000 professionals involved in instrumentation, measurement, and control.

Japan Electric Measuring Instruments Manufacturer's Association (JEMIMA), www.jemima.or.jp/english/index.htm. JEMIMA promotes research and standards to help develop Japan's electric measuring instrument industry.

LXI Consortium, www.lxistandard.org. The LXI Consortium is working to develop the LAN eXtensions for Instrumentation (LXI) standard.

MFA Forum, www.mfaforum.org. The MFA Forum is an association of telecom, networking, and other companies focused on advancing the deployment of multi-vendor, multi-service packet-based networks.

Microelectronics Packaging and Test Engineering Council (MEPTEC), www.meptec.org. MEPTEC is a trade association committed to enhancing the competitiveness of the assembly and testing of semiconductors.

National Cooperation for Laboratory Accreditation (NACLA), www.nacla.net. NACLA's primary mission is to evaluate US laboratory accreditation bodies (ABs).

National Institute of Standards and Technology (NIST), www.nist.gov. NIST promotes US economic growth by working with industry to develop and apply technology, measurements, and standards.

National Society of Professional Engineers (NSPE), www.nspe.org. The NSPE is an interdisciplinary professional engineering society.

National Voluntary Laboratory Accreditation Program (NVLAP), www.nist.gov/nvlap. Administered by NIST, NVLAP provides third-party laboratory accreditation services.

NCSL International, www.ncsli.org. The National Conference of Standards Laboratories, NCSL International, is an association of metrology organizations with a focus on education.

Optical Society of America (OSA), www.osa.org. The OSA is a nonprofit professional society of engineers and scientists in the optics and photonics community.

PC/104 Consortium, www.pc104.org. The PC/104 Consortium disseminates information about PC/104 and serves as a liaison between the PC/104 community and standards organizations.

PCI Special Interest Group (PCI-SIG), www.pcisig.com. The PCI SIG is committed to the development and enhancement of the PCI standard.

PCMCIA, www.pcmcia.org. PCMCIA is a standards body and trade association that promotes the interoperability of PC Cards in a variety of products.

PXI Systems Alliance, www.pxisa.org. The PXI Systems Alliance maintains the PXI specification, promotes PXI technology, and ensures multivendor interoperability.

SAE International, www.sae.org. SAE International works to advance the engineering of mobility systems, whether for use on land or sea or in air or space.

Semiconductor Equipment and Materials International (SEMI), www.semi.org. SEMI is a trade association for equipment and materials suppliers to the semiconductor, MEMS, and flat-panel display industries.

Semiconductor Industry Association (SIA), www.sia-online.org. The SIA is a trade organization that represents US-based semiconductor manufacturers.

Semiconductor Test Consortium (STC), www.semitest.org. The STC oversees the OPENSTAR (Open Semiconductor Test Architecture) platform.

Society for Information Display (SID), www.sid.org. The SID is devoted to the advancement of electronic display technology, manufacturing, and applications.

Standards Council of Canada, www.scc.ca. The Standards Council of Canada oversees Canada's National Standards System.

Surface Mount Technology Association (SMTA), www.smta.org. The SMTA seeks to advance the industry through education, training, and networking in regards to electronics assembly technologies and related business operations.

Telecommunications Industry Association (TIA), www.tiaonline.org. The TIA is a trade association serving the communications and information technology industries. TIA represents the communications sector of the Electronic Industries Alliance (EIA).

Test and Diagnostics Consortium (TDC), www.test-diagnostics.org. The TDC brings together users and suppliers from industries such as medical, automotive, satellite, railroad, trucking, and defense to optimize the test and diagnostic environment.

Underwriters Laboratories (UL), www.ul.com. The UL is an independent, nonprofit certification organization that evaluates products in the interest of public safety.

VMEbus International Trade Association (VITA), www.vita.com. VITA is a nonprofit trade association that promotes the use of open system architectures.

VXIbus Consortium, www.vxibus.org. The VXIbus Consortium develops and promotes the VXIbus instrumentation standard.

ZigBee Alliance, www.zigbee.org. The ZigBee Alliance works to enable low-power, wirelessly networked, monitoring and control products based on a global standard.

PRODUCT FOCUS

The following write-ups were supplied by advertisers in this issue.

USB-based thermocouple module

The USB-4718 is Advantech's first dedicated USB-based thermocouple module. The USB-



4718 supports seven different types of thermocouples (J,

K, T, E, R, S, B), six voltage input ranges, 0–20-mA or 4–20-mA current input (to support a variety of sensors), and 16 isolated digital I/O channels. The USB-4718 supports either USB 2.0 or USB 1.1 buses.

*Advantech, Cincinnati, OH.
800-205-7940;
www.eautomationpro.com.*

Pulsed laser diode drivers

The Avtech AVO-9 Series offers a range of easy-to-use, ultra-high-speed pulsed laser diode drivers. Each AVO-9 output module has a specially designed



high-speed socket for the user's laser diode. This arrangement provides a user-friendly plug-and-play setup without degrading performance.

*Avtech Electrosystems, Ogdensburg, NY. 888-670-8729;
www.avtechpulse.com.*

Breakthrough in automated programming

The new FLX500 from Data I/O is a self-contained, automated device programmer that fits on a desktop. Eliminating the



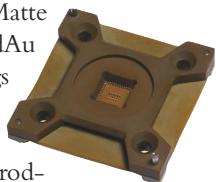
need for special facility requirements, the FLX500 offers plug-and-program

capability. Supporting virtually all devices, the system is modular, expandable, offers extremely low changeover times, and requires virtually no operator training.

Data I/O, Redmond, WA. 425-881-6444; www.dataio.com.

Test sockets for lead-free test

The Pad ROL200 Series test socket is designed for testing QFN, DFN, and other pad-style applications in lead-free production test. The Pad ROL200 Series can test Matte Tin and NiPdAu device platings while preserving load boards. This product maintains the excellent mechanical and electrical performance Johnstech has come to be known for.



*Johnstech International, Minneapolis, MN. 612-378-2020;
www.johnstech.com.*

100-W hot switch

JFW's latest solid-state switch allows you to hot switch up to 100 W. The 50S-1268, a 1P2T RF switch, has a frequency range



of 100–500 MHz and a maximum insertion loss of 0.5 dB. Isolation is 55 dB mini-

mum, and the switch is available with a choice of SMA, N, BNC, or TNC connectors.

*JFW Industries, Indianapolis, IN. 317-887-1340;
www.jfwindustries.com.*

Microwave connectors

GORE 100 Series connectors are a super high-density blindmate, high-performance mi-



crowave interconnect system offering performance through 100 GHz. GORE 100 connectors were developed as a response to the industry's demand for increased packaging density, low mass, and increased performance. The blindmate interfaces are robust, durable, and lightweight.

*W. L. Gore & Associates, Newark, DE. 410-506 7787;
www.gore.com.*

PRODUCT FOCUS

The following write-ups were supplied by advertisers in this issue.

EMI test receiver

The R&S ESU from Rohde & Schwarz is a new family of CISPR 16-1-1-compliant EMI test receivers that meet civil and



military standards for electromagnetic interference measurements. The instrument features a complete set of parallel detectors and is available in three models with the frequency ranges 20 Hz to 8 GHz, 26.5 GHz, and 40 GHz.

Rhode & Schwarz, Munich, Germany. +49 89 4129-0; www.rohde-schwarz.com.

High-performance smart camera

The VC4466 with 1-GHz DSP power is one of the world's fastest smart cameras with computational power of 8000 MIPS



rivaling a 7.2-GHz Pentium. It has 64

Mbytes of DRAM and 4 Mbytes of Flash EPROM for program and data storage (expanded by the 512-Mbyte SD card inside). It can acquire full frames (1024x768 pixels) at 30 frames/s.

Vision Components, Hudson, NH. 603-598-2588; www.vision-components.com.

Probe increases first-pass yields

You can increase first-pass yields with IDI's ICT. This revolutionary probe design features bifurcated beams at the top of the barrel.

The result is lower and more consistent resistance and near-perfect pointing accuracy. The compliant fit between the plunger and barrel virtually seals the internal portion of the probe from contaminants.

Interconnect Devices, Kansas City, KS. 913-342-5544; www.idinet.com.



Optical manufacturing test platform

Designed to house a scalable amount of test modules, the IQS-500 Intelligent Test System

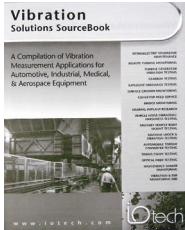
offers multi-mode and single-mode functionalities. This powerful platform tests active/passive CWDM, DWDM, and FTTH components and systems—at both the R&D and manufacturing levels. The IQS-500 also provides a flexible solution for performing transmission equipment qualification.

EXFO, Vanier, QC, Canada. 800-663-3936; www.exfo.com.



Vibration solutions sourcebook

IOtech offers a compilation of vibration-measurement applications for automotive, industrial,



medical, and aerospace equipment. The Wave-Book and ZonicBook series of measurement

products are featured in these applications. For a free copy of the sourcebook, contact the company at 888-890-1322 or sales@iotech.com, or visit www.iotech.com/literature.

IOtech, Cleveland, OH. 888-714-3272; www.iotech.com.

3.0-GHz spectrum analyzer

Insteek's new GSP-830 3.0-GHz spectrum analyzer offers many features like autoset, a USB interface, and a brilliant TFT color



display in one package at an affordable price. The battery-pack option and low noise floor make this unit ideal for the lab or the field.

Insteek America, Chino, CA. 909-591-8358; www.insteek.com.

Development environment & test executive

Combining a test-development environment and test executive into one integrated, complete



package, ATEasy's open architecture offers all the tools necessary to develop and maintain software components—from instrument drivers to complex test programs. Offering value and versatility, ATEasy contains all the tools you need in one integrated package.

Geotest—Marvin Test Systems, Irvine, CA. 888-837-8297; www.geotestinc.com.

GigE Vision and MIL

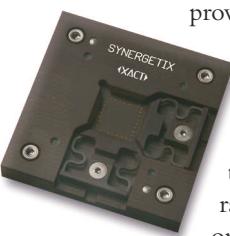
Matrox Imaging supports GigE Vision with a driver for use with the Matrox Imaging Library (MIL) development kit. The driver requires very little host CPU intervention for processing incoming GigE Vision traffic, and it is compatible with any network interface card (NIC). The MIL GigE Vision driver is available as a driver update to MIL/MIL-Lite 8.0.

Matrox Imaging, Dorval, QC, Canada. 514-822-6000; www.matrox.com.

Test socket solves device variance

Synergetix introduces the first self-adjusting test socket with compliant walls to increase first-pass yields. Named XACT, it provides an exact fit for each device, no matter how wide the tolerance ranges found on your device prints. A patent is pending. To see how these compliant walls work, visit the company's Web site.

Synergetix, Kansas City, KS. 913-342-0404; www.synergetix.com/XACT.



Antenna kit for high frequencies

A.H. Systems' Model AK-571-4 antenna kit provides a convenient solution for increased frequency requirements from 700 MHz to 40 GHz. Specifications that require higher test frequencies also require an accurate antenna solution. This kit includes one SAS-571 horn antenna, one SAS-574 horn antenna, low-loss cables, and adapters in an antenna storage case with several extra cutouts for optional pre-amplifiers.

A.H. Systems, Chatsworth, CA. 818-998-0223; www.ahsystems.com.



Capture analog, digital, and serial signals

Now it's possible—with a single acquisition—to capture analog, digital, and serial signals in real



time. Agilent 6000 Series scopes let you view time-aligned analog waveforms, logic patterns, and serial data streams on a single display. You can correlate their interplay. And with MegaZoom memory, you won't miss a detail in your design.

Agilent Technologies, Palo Alto, CA. 800-829-4444; www.agilent.com/find/scope.

Optical positioning for test handlers

The Multitest vision alignment, supporting the full tri-temp range (-55°C to 155°C), is avail-

able as an add-on for all MT9510 and MT9510XP systems. The testing company may switch between regular and vision-alignment according to its needs. Each device is scanned and positioned individually without substantial influence on throughput, and all devices being contacted simultaneously (up to four devices) are aligned individually.

Multitest, Rosenheim, Germany. +49-8031-60-60; www.multitest.com/eng.



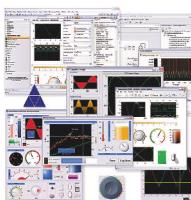
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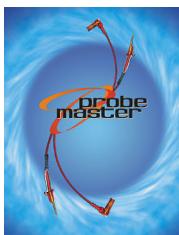
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Dalsa Coreco, St. Laurent, QC, Canada. 514-333-1301; www.imaging.com.

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Pulizzi Engineering, Santa Ana, CA. 714-540-4229; www.pulizzi.com.



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A.H. Systems provides EMC antennas, accessories, and calibration services for your global testing. The company's new catalog includes new broadband antennas from 25 MHz to 40 GHz. A.H. Systems, Chatsworth, CA. 818-998-0223; www.ahsystems.com.



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TÜV America has announced a new environmental testing laboratory offering climatics (wind, temperature/altitude, humidity, etc.), dynamics (shock, vibration, etc.), package testing (compression, drop, etc.), HALT testing, HASS services, and more. TÜV America, Danvers, MA. 800-888-0123; www.tuvamerica.com.

11-Mpixel GigE camera

The IPX-11M5 offers 4000x2672 at 5 frames/s. It features built-in LUT, defective pixel correction, and flat-field correction, and it is fully programmable, field upgradeable, and RoHS compliant. The IPX-11M5 works with all image-processing packages. Imperx, Boca Raton, FL. 866-849-1662; www.imperx.com.

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Data Translation's 2006 USB product guide offers details on the company's broad range of USB data-acquisition products. You can choose from low-cost, simultaneous, high-performance, and DSP products. For a free copy, call the company or visit its Web site. Data Translation, Marlboro, MA. 800-525-8528; www.datatranslation.com/productguide.

PC-based oscilloscope

The PicoScope 3000 range of high-performance PC-based oscilloscopes are lightweight and portable and feature high bandwidths and sampling rates previously not available in PC-based units. Pico Technology, Cheshire, UK. +44(0)1480-396395; www.picotech.com/scopetm.

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Test and measurement products

Insteek's new test and measurement catalog is a valuable source of technical information and displays the company's entire line card. Users can compare instruments and determine the right spec for their application. Insteek America, Chino, CA. 909-591-8358; www.insteek.com.

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The AVT-418 vehicle network interface connects a host computer to a module or vehicle. It supports all the current popular automotive protocols and uses an Ethernet connection to the host computer. Advanced Vehicle Technologies, Davidsonville, MD. 410-798-4038; www.avt-hq.com.



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Power analyzer

Xitron Technologies has unveiled the 2801 advanced single-channel power analyzer, designed for use on engineering and R&D benchtops as well as in critical manufacturing and production testing environments. Xitron Technologies, San Diego, CA. 858-530-8099; www.xitrontech.com.

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Data-acquisition resource

Bluecat New Horizons in Data Acquisition Systems features 120 Dilbert cartoons. The catalog contains more than 130 pages of information about USB data-acquisition products, Ethernet data-acquisition products, signal conditioners, portable dataloggers, wireless devices, and plug-in boards. Omega Engineering, Stamford, CT. 800-848-4286; www.omega.com.

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It includes conversion tables, selector guides, and RF switching applications. You can request a free copy at the company's Web site. Keithley Instruments, Cleveland, OH. 440-248-0400; www.keithley.com/at/263.

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Hamamatsu provides emission, laser stimulation, and substrate thickness monitoring systems for the failure-analysis field. Hamamatsu Phemos and μ Amos tools are renowned for their reliability and sensitivity. Hamamatsu, Bridgewater, NJ. 908-231-0960; www.hps-systems.com. (continued)

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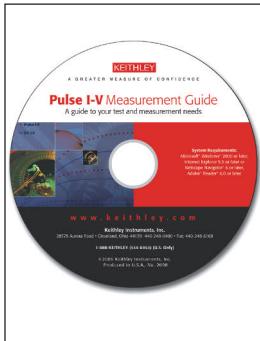
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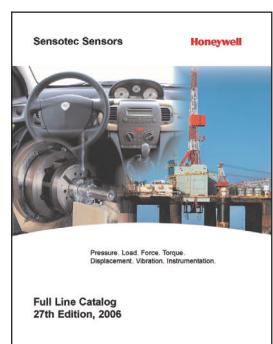
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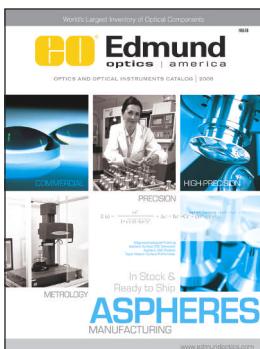
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CORENTIN THIERCELIN

Founder & CEO
DirectIndustry.com
Marseille, France

In 2001, Corentin Thiercelin founded DirectIndustry.com, a "virtual exhibition" Web site that helps engineers find information on industrial equipment and components. Previously, Thiercelin founded AllAccess and Access Technology—a free quarterly journal distributed to the automation sector. He served as the head of research and development for quality-control machines in commercial agriculture for MAF, and he has also worked at ELM Leblanc in France on the development of industrial gas heaters. Thiercelin earned a degree in design and engineering at the National School of Advanced Design and Engineering (ENSA) in Paris.

Chief editor Rick Nelson recently exchanged e-mails with Thiercelin about the role of the Web in purchasing decisions.

Connecting engineers and manufacturers

Q: Could you briefly describe the history of your company?

A: I was a research and development engineer in California from 1995 to 1997. My fellow engineers and I spent a lot of time chasing information from one source to another. I realized that there was a real need to centralize and rationalize it all. Burgeoning globalization meant this need would only get more urgent. The Internet seemed the perfect tool. I returned to France and teamed up with two other engineers to put my ideas into practice.

Q: How many exhibitors are represented on your site?

A: There are currently 5600 exhibitors online showing over 40,000 individual products—26% from American companies.

Q: Out of the 24 industrial sectors represented on the site, how important is test and measurement?

A: Very important, representing over 15% of all exhibitors. Four months ago, we had to split the category "Sensing and Measurement," which had been the first category on our home page in 2001, into "Sensors" and "Measuring Instruments," because it was getting too big. We knew that the basic idea of DirectIndustry would live or die with test and measurement, because it's a sector with constant innovation and thus a greater need to organize information.

Q: How many people visit your site, and how many are focused on test and measurement?

A: We've just passed 2.1 million unique visitors per month—16% from test and measurement. 30% of all visitors return at least once a month.

Q: Why do engineers need specialized industrial search engines—why not use search engines such as Google?

A: Google is an amazing tool, and anyone who says otherwise can't be taken seriously. But the Internet isn't standing still. Like all media before, it's evolving from general

usage to usage that is more specialized. Google is so exhaustive that it can sometimes lack the order and logic necessary for professionals to compare products and brands effectively. As a search engine specialized for industry, DirectIndustry returns this order to the search, saving professionals time and headaches. The fact that 700,000 visitors access us directly at least once a month is ample proof of this need.

Q: Do you have any immediate plans for introducing new features?

A: Soon we will launch a virtual technical library containing 3000-plus PDF catalogs from manufacturers across the world.

Q: What makes your PDF feature different from such services on other sites?

A: It's true that lots of sites include PDF catalogs—nothing ground-breaking here. However, this is a good example of how we do things differently. Engineers aren't really looking for a whole catalog, or even a section of a catalog, but for a kernel of information buried somewhere within. On DirectIndustry you won't have to download anything. You can search a 400-page catalog by key word and find the right page in seconds. A tool bar allows you to print out the page, browse the surrounding pages, or send an e-mail request to the manufacturer. This demonstrates our principle of organizing information intuitively to engineers, for fast and effective research.

Q: Why do you think your site is more helpful for engineers than other specialized search engines?

A: It's made by engineers for engineers. This means we never stray from certain guiding principles—keep it fast, keep it intuitive, and above all, keep it focused on the products. T&MW

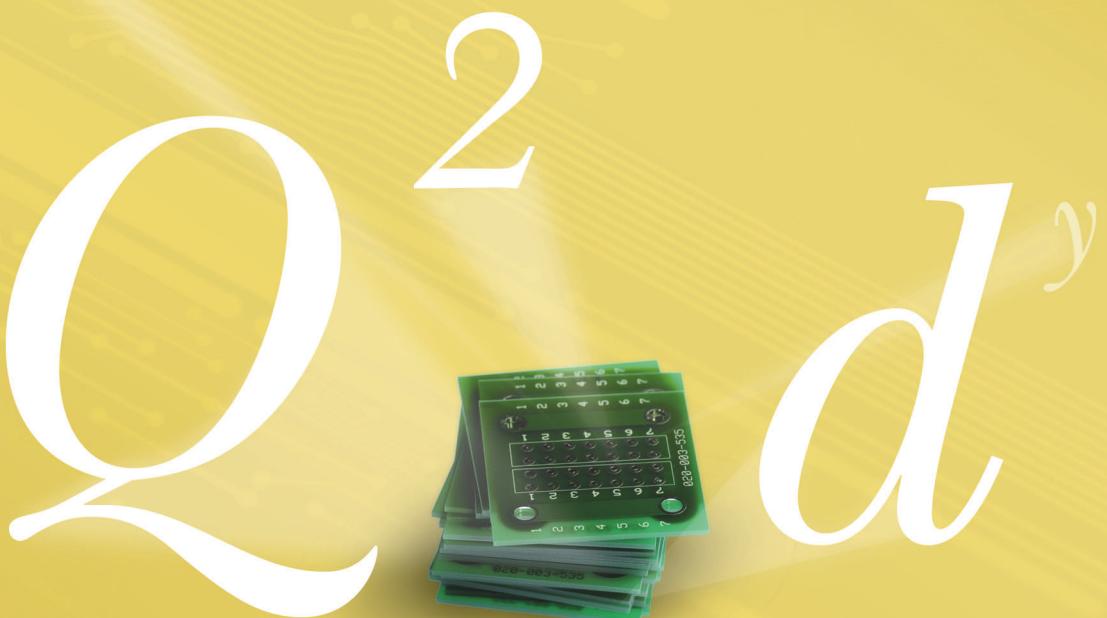


Corentin Thiercelin comments on long-term plans for DirectIndustry.com in the online continuation of this interview: www.tmworld.com/2006_07.

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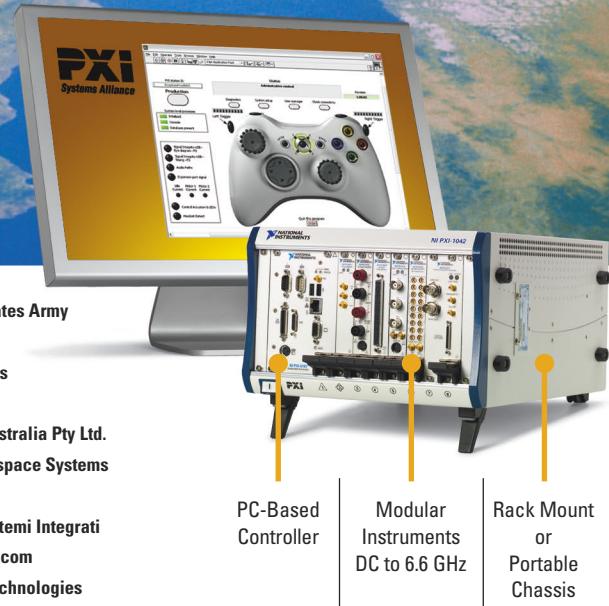
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