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# 2007

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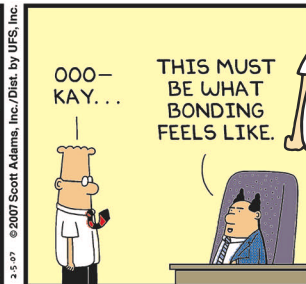
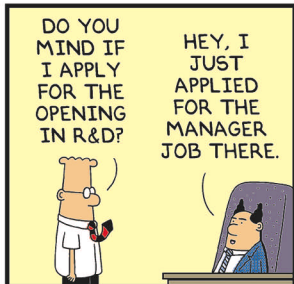
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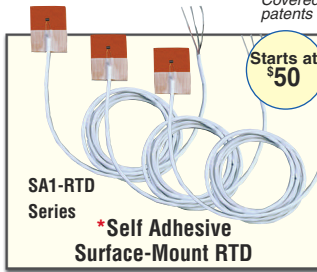
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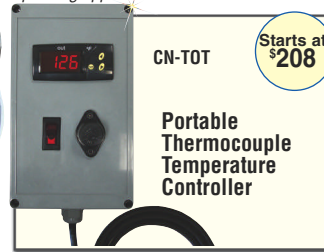
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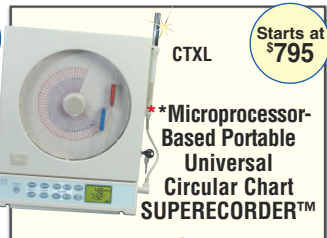
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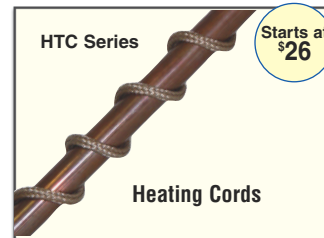
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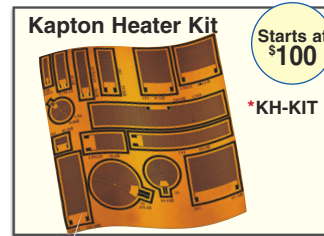
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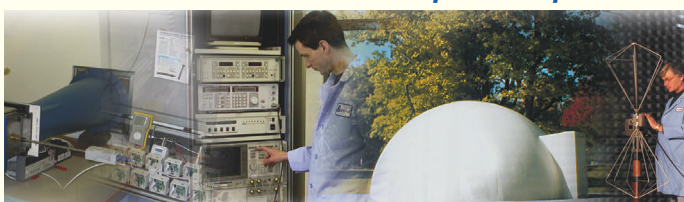
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By Lawrence D. Maloney,  
Contributing Editor

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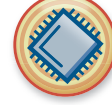
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## Guest commentary

### PCI Express boosts raw data transfers

PCI Express is an extension to the ubiquitous PCI bus that enables the increased performance required for raw data transfers and open data analysis in an Instrumentation 2.0 test system, reports Murali Ravindran, a product manager for PXI remote controllers at National Instruments. He elaborates on application areas opened up by PCI Express and the PXI Express instrument-focused implementation.

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## Blog commentaries and links

### Rowe's and Columns

Martin Rowe, Senior Technical Editor

- How to avoid (cable company) truck roll
- When ESD gets too close
- Maxwell's legacy

### Taking the Measure

Rick Nelson, Chief Editor

- An amazing cell phone
- Qualcomm asks White House help in patent dispute

### LXI: Instruments and Applications

Bob Stasonis, Chairman of the LXI Marketing Committee

- LXI general meeting attracts T&M professionals from across China

### Education and Careers

Amy Laskowski, Contributing Editor

- The No Child Left Behind Act leads way to a cash cow
- Senior capstone project helps disabled members of the community

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## From the archives

- **Sell machine vision to your boss**

You can follow six steps to help you present a machine-vision quality-improvement plan to your management, as contributing technical editor Jon Titus reported in our January 2003 issue.

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## Technology and values

**Technology is neutral; it's how we use it that's good or bad.**

That's been the view of various luminaries, including the physicist and engineer Simon Ramo and the management consultant Peter Drucker. Writing in the Winter 2006 edition of *IEEE Technology and Society*, Norman Balabanian collects several versions of the "technology is value-free" aphorism—and then demolishes them, asserting that "this litany of the happy technologist" constitutes an ideology of technology designed to mask the intentions of the political and economic forces behind technology development and deployment.



**RICK NELSON, CHIEF EDITOR**

The problem, writes Balabanian, is that the "we" to which technology-neutral proponents ascribe responsibility does not exist as a collective entity: "Surely it's some specific minds that shape technology, not an abstract 'mind'." Those minds, he suggests, reside in corporations seeking profit and market share. He cites as an example the refrigerator, whose arrival brought about the demise of neighborhood markets in favor of supermarkets to which people drive to buy a week's worth of perishable goods.

**We vote for technology whenever we decide to develop or purchase a product.**

He emphasizes that he is not passing judgment on refrigerators—he's only noting that the neighborhood market is no longer an option for most consumers, and he contends that consumers had no vote in the decision to entrench the supermarket/refrigerator society.

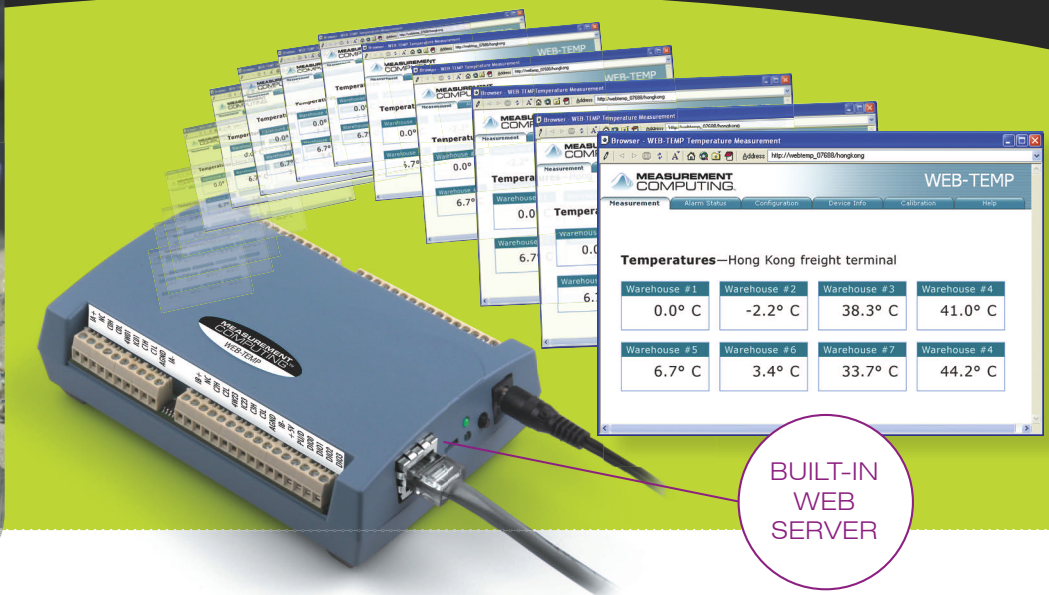
Balabanian advocates a "harmonious technology," which "would be responsive to direct social needs and would not require a hierarchical, exploitative, and alienating relationship among human beings."

What might such a harmonious technology look like? In the Summer 2007 *IEEE Technology and Society*, Jameson M. Wetmore presents a possible picture in "Amish Technology." Wetmore dispels the stereotype that the Amish eschew technology. They adopt it when they collectively decide it will help their community. For example, Amish dairy farmers use electrically cooled and stirred bulk milk tanks to comply with state regulations. Amish adults will not drive cars but will accept rides. In fact, the resistance to cars, Wetmore writes, stemmed in part from a 1907 ad that described them not as modes of transportation but as "the king of sports and the queen of amusements"—luxuries not in keeping with the Amish lifestyle.

Unlike Drucker and Ramo, the Amish ascribe values (usually negative ones) to technology and adopt it way too sparingly. Balabanian suggests the rest of us are forced to adopt it way too rapidly. Unfortunately, he doesn't explain how to achieve his "harmonious technology." Perhaps the best we can do is keep in mind that we are voting whenever we choose to develop, market, or purchase a technological product—and our votes shouldn't be value-free. T&MW

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## The EMC space

**D**avid Brumbaugh is a technical fellow at Boeing Phantom Works (Seattle, WA; [www.boeing.com/phantom](http://www.boeing.com/phantom)), the company's advanced research and development unit. Brumbaugh has specialized in electromagnetic compatibility (EMC) since joining Boeing in 1981, and he works on EMC design, analysis, and test. Martin Rowe recently interviewed Brumbaugh by telephone and by e-mail.

**Q: What is a technical fellow?**

**A:** Boeing has a technical career path for engineers who prefer to advance their careers as technical contributors rather than go into management.

**Q: What projects have you worked on?**

**A:** Since becoming an associate technical fellow and then a technical fellow, I've worked on EMC-related issues for several space-based and ground-based projects. I also consult on EMC issues to other groups within Boeing. I've spent most of my career in space-based systems that include the Sea Launch Company as well as Ground-based Midcourse Defense, part of the National Missile Defense System. I've worked on the International Space Station, and I also provide EMC support to the Navy's P-8A Poseidon, a maritime patrol aircraft currently under development at Boeing.

**Q: Please give an example of how you use your EMC knowledge.**

**A:** I've performed analysis of spacecraft power systems. To do that, I modeled the power system using conducted emissions test data taken on the spacecraft's individual systems. I then converted the simulated frequency response into the time domain. I could then calculate ripple on the power bus. Using the results, I can predict if there's enough margin for a new spacecraft component to work in the system. I can also use the model to predict if a new component's emissions will adversely affect other units on the power bus.

**Q: Have you worked on electrostatic-related issues?**

**A:** Yes. The environment in space is different from here on earth. A satellite in a geosynchronous orbit can become negatively charged, especially between the mid-night and dawn sector of its orbit. If a difference in charge occurs between parts of the satellite, a discharge



of current can occur. I often participate in the electrostatic design that mitigates the effects of discharges.

**Q: What is your involvement in EMC measurement?**

**A:** Boeing purchases subsystems and integrates them into spacecraft and aircraft systems. I'm responsible for making sure that a vehicle is safe to fly from an EMC perspective. I test whole systems for conditions such as lightning strikes on aircraft.

**Q: How do you perform such a test?**

**A:** We inject a low-level discharge into an aircraft and measure its transfer function in the frequency domain with a network analyzer. We want to see how the discharge transfers current throughout the vehicle. The measurements are converted into the time domain to determine the effects of a full-scale lightning event.

**Q: Are you involved in any technical committees?**

**A:** I'm secretary of the IEEE 1688 committee, which is working on an EMC-testing standard for line-replaceable electronic modules [Ref. 1]. I compile meeting notes and minutes and contribute at technical meetings. The committee's goal is to establish EMC test standards that reduce the risk of electromagnetic interference when a system requires a newly designed module. I'm also involved with the SAE AE4 (SAE Aerospace Electromagnetic Environmental Effects) committee on EMC and an AIAA standards committee, which is developing a new EMC standard for space systems. T&MW

### REFERENCE

1. Rowe, Martin, "IEEE to develop EMI standards for modular electronics," *Test & Measurement World* online, March 23, 2006. [www.tmworld.com/article/CA6318250.html](http://www.tmworld.com/article/CA6318250.html).

Every other month, we will publish an interview with an electronics engineer who has test, measurement, or inspection responsibilities. If you'd like to participate in a future column, contact Martin Rowe at [mrowe@tmworld.com](mailto:mrowe@tmworld.com).



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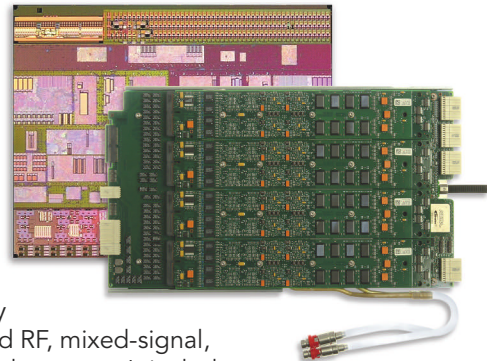
## Verigy targets consumer, RF, and nanoelectronic devices

Verigy has introduced instrumentation suites that can be accommodated within a V93000 compact test head to address three key application areas: consumer mixed-signal, RF, and nanoelectronics.

The Consumer Mixed Signal system includes an MB AV8 multi-band audio-video card that addresses professional audio, baseband IQ, and video devices. The system also includes a Pin Scale 400 card (pictured), which provides 100- to 400-Mbps data rates per pin at 224 Mvectors per pin. Also included are DC Scale VI32 and DC Scale DPS32 cards to provide precision voltages and support multiple power domains. Base price: \$600,000 for a 384-pin system.

Verigy's Port Scale RF system provides the RF measurement capability required to test emerging high-integration devices containing integrated RF, mixed-signal, digital, and power-management devices as well as embedded or stacked memory. It includes a 6-GHz RF source card, an RF front-end card that provides 12 RF ports, an RF interface, an MB AV8 card, and a 48-port RF calibration kit that can support up to 10 RF systems. Base price: \$320,000.

The company also introduced its V93000 Nanoelectronics Digital system for structural and functional test for wafer sort and final test of digital ICs fabricated in 65-nm and smaller geometries. The system includes a Pin Scale 400 digital pin card that scales from DC to 533 Mbps as well as a DC Scale DPS 32 card for supporting multiple sites and multiple power domains. Base price: \$499,000. [www.verigy.com](http://www.verigy.com).



## WiMAX Forum designates first certification lab in North America

The WiMAX Forum announced the first North America-based certification test lab on June 19 during the WiMAX Forum Member Conference in Madrid. Operated by AT4 wireless, the lab will be located in Virginia and will become one of five test labs for WiMAX Forum Certified products worldwide.

The lab will conduct WiMAX Forum certification testing and radiated performance testing (RPT), and AT4 wireless will develop certification test beds to match other test beds globally. WiMAX Forum members in the Americas may submit devices for certification at the Virginia facility beginning in October. [www.at4wireless.com](http://www.at4wireless.com); [www.wimaxforum.org](http://www.wimaxforum.org).

## Test summit scheduled for Semicon West

At the SEMI Test Summit & Reception at Semicon West in San Francisco, executives from five semiconductor ATE companies will join moderator Rick Nelson, chief editor of *Test and Measurement World*, and host Ashoke Seth, test operations director at Intel, in

a discussion focused on meeting the design, test, and yield requirements for advanced semiconductor manufacturing. Panelists will include R. Keith Lee, president and CEO, Advantest America; Lavi Lev, CEO and president, Crendence Systems; Tim Moriarty, presi-

dent, Nextest Systems; Mark Jagiela, president, Teradyne Semiconductor Test Division; and Keith L. Barnes, president and CEO, Verigy.

The summit will take place July 18, at 5:30 p.m. in the Moscone Center. [www.semiconwest.org](http://www.semiconwest.org).

## Network tester increases productivity

Spirent TestCenter 2.0, a system for testing voice, data, and video networks, increases productivity over version 1.0 by employing new software that helps users cut test-development time. TestCenter consists of a chassis with network-interface cards that generate and analyze traffic for access networks, core networks, switches, routers, and DSLAMS at protocol layers 2 through 7. You can use TestCenter for performance and conformance testing on network equipment in production or on service-provider networks.

The Inspire Architecture software lets you set up tests with a GUI and convert them to Tcl scripts. You can also convert prewritten scripts to GUIs for easy debug. A feature called HyperFilters lets you select data streams based on addresses, protocol tags, and protocol IDs and analyze them for errors.

TestCenter provides test scripts for protocols such as Ethernet at layer 2 and voice and video quality at layer 7. It also includes scripts for intermediate layers such as Internet Protocol (IP) and Multiprotocol Label Switching (MPLS).

Base price: \$30,000. *Spirent Communications*, [www.spirent.com/go/STC\\_2](http://www.spirent.com/go/STC_2).



Editors' CHOICE

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## NEWS BRIEFS

### Landrex touts AOI system sale

Landrex Technologies has announced the sale of its Optima II 7301 Express AOI system to Intelligent Manufacturing Solutions (IMS). Jeff Buxton, technical operations manager at IMS, cited the system's quick setup time as a key feature that would benefit IMS's high-mix environment. [www.landrex-us.com](http://www.landrex-us.com), [www.imscorp-us.com](http://www.imscorp-us.com).

### T&MW editors seek nominations for Test Engineer of the Year

Each year, *Test & Measurement World* names an outstanding engineer as the Test Engineer of the Year, and we are now accepting nominations for the 2008 award. From the nominations we receive, our editors will select six finalists, whom we will profile in our October issue. Readers will then have a chance to vote for the Test Engineer of the Year, and we'll announce the winner in early 2008.

The recipient of the award will designate an educational institution to receive a grant courtesy of award sponsors

## CALENDAR

**Autotestcon**, September 17–20, Anaheim, CA. Sponsored by IEEE. [www.autotestcon.com](http://www.autotestcon.com).

**International Test Conference (ITC)**, October 23–25, Santa Clara, CA. Sponsored by IEEE. [www.itctestweek.org](http://www.itctestweek.org).

**Vision**, November 6–8, Stuttgart, Germany. Produced by Messe Stuttgart. [www.vision-messe.de](http://www.vision-messe.de).

**Productronica**, November 13–16, Munich, Germany. Produced by Messe Munchen. [www.global-electronics.net/link/de/16407965](http://www.global-electronics.net/link/de/16407965).

To learn about other conferences, courses, and calls for papers, visit [www.tmworld.com/events](http://www.tmworld.com/events).

sors National Instruments and Keithley Instruments. The nomination deadline is August 1. [www.tmworld.com/awards](http://www.tmworld.com/awards).

## Mathematica gets an overhaul

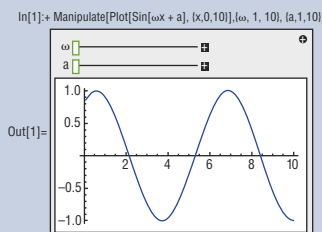
Mathematica 6 lets you import data from remote URLs without requiring you to download and save data files. It accepts data in Excel, OpenOffice, text, binary, and medical-file formats, and also lets you import audio and image files. You can then perform calculations on the data using more than 300 math functions.

You can use the bidirectional-calling feature to call code to and from many programming languages such as C, C++, C#, Java, Python, Visual Basic, and LabVIEW. These languages appear as objects, so you can manipulate data using prewritten code, or applications can use Mathematica for calculations.

With the software's interactive data-visualization tool, you can enter an argument and data parameters with specified ranges and then use sliders to change the data and see how changes affect the plot. The figure shows the syntax for a sine wave with adjustable amplitude and frequency.

The improved FindFit function lets you define a range of data that the function should use to create a curve-fitting equation. You can also edit and plot graphics in real time, as the software applies a stream of data to your equations. Mathematica 6 runs on Windows, Macintosh, Linux, Solaris, and HP-UX.

Base price: \$2495. Wolfram Research, [www.wolfram.com](http://www.wolfram.com).



Editors' CHOICE



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## RF tools run gamut from EDA to production test

>>> MTT-S International Microwave Symposium, June 3–8, 2007, Honolulu, HI, IEEE Microwave Theory and Techniques Society, [www.ims2007.org](http://www.ims2007.org).

**Rohde & Schwarz** demonstrated a true differential large-signal measurement technique for balanced active RF and microwave devices. The company also presented the ZVL combined vector network analyzer and spectrum analyzer; the FMU36 baseband spectrum and vector signal analyzer; the AMU200A, which combines signal generators and faders; the NRP-Z81 USB-enabled sensor; and for its 24-GHz ZVA24 and 40-GHz ZVA40 four-port vector network analyzers, the ZVA-Z110 option, which allows the instruments to make measurements between 75 and 110 GHz (W band).

**Anritsu** debuted its 6-GHz MS2690A and 13-GHz MS2691A signal analyzers. The company also introduced new portable Site Master analyzers for P25 and Tetra systems. **Giga-tronics** displayed its new 2520GTA signal generator. The 20-GHz instrument offers frequency and amplitude switching speeds of better than 350  $\mu$ s for any step size over its full frequency range.

**Temptronic** highlighted its new Mobile-Temp system, which supports the test of standard and high-frequency devices, assemblies, modules, PCBs, and multiple UUTs from  $-65^{\circ}$  to  $+200^{\circ}\text{C}$  in a compact mobile enclosure located at the tester site.

**Agilent Technologies** exhibited instruments such as its 10-MHz to 26.5-GHz PNA-X microwave network analyzer, the MXG signal generator and MXA signal analyzer, and a series of LXI (class A-certified) synthetic instruments. Agilent also announced that it is integrating its Electromagnetic Design System (EMDS) full-wave 3-D simulator into the company's Advanced Design System (ADS) EDA software platform.

**National Instruments** presented its PXI RF switch offerings and demonstrated PXI systems for RFID and other RF measurement applications. **Cascade Microtech** highlighted enhancements to its WinCal XE device-characterization tools. **Aeroflex** demonstrated its 3-Hz to 3-, 13.2-, and 26.5-GHz 3280 series spectrum analyzers, which now offer digital demodulation capabilities for 802.11a/b/g signals.

**Peregrine Semiconductor** announced that, through a collaborative effort with **Oki Semiconductor**, Oki is shipping in production volumes RFICs employing Peregrine's 0.5-micron UltraCMOS. Peregrine also introduced several flip-chip RF-switch ICs. T&MW



The 50-MHz to 18-GHz NRP-Z81 USB-enabled sensor combines an RF detector with analog- and digital-signal-processing capability to add full power-meter functionality to a PC.

Courtesy of Rohde & Schwarz.

## EDA firms tackle feature-dependent defects

>>> Design Automation Conference, June 4–8, 2007, San Diego, CA, IEEE, EDA Consortium, and SIGDA, [www.dac.com](http://www.dac.com).

**Cadence**, **Mentor Graphics**, and **Synopsys** all said they are pursuing design for test (DFT) along several fronts to accommodate a shift from random fabrication defects to feature-dependent defects. The three EDA companies are offering tools that allow test engineers to perform what some call "volume diagnostics" and others refer to as "defect diagnostics"—these tools gather data on errors found during the test of many devices, then make that data available for engineers to analyze.

The **MathWorks** introduced its Simulink Design Verifier, a software tool that generates tests and proves the design properties of model-based designs. Models can be implemented in Simulink or Stateflow using the Prover plug-in from **Prover Technology**. **National Instruments** highlighted the role of PXI in benchtop semiconductor test. A demonstration system at the NI booth showed how PXI could be used in the test of ICs, including digital and mixed-signal ICs.

**Breker Verification Systems** released Trek, a functional test synthesis tool that analyzes a verification plan for coverage and then generates test vectors. **ARM** announced the AMBA adaptive verification engine, which extracts and applies traffic profile information to predict how designs will perform. **Anchor Semiconductor** highlighted its NanoScope tool, which uses pattern matching to examine chip layouts.

**Knowlnt** previewed its analog Opal Test Bench Builder, currently in beta test, which leverages the company's Viper test language to capture design specifics and generate simulator-specific test code. **Synplicity** released its Confirma platform, a hardware-assisted verification platform for FPGA-based prototyping of ASIC and ASSP designs. T&MW

See the online version of this article at [www.tmworld.com/2007\\_07](http://www.tmworld.com/2007_07) for links to vendors and to our complete coverage of the International Microwave Symposium and the Design Automation Conference.

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## Fixed-mobile convergence imposes test challenges

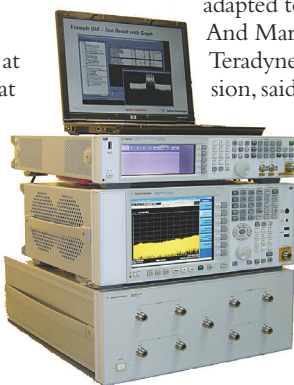
Fixed-mobile convergence is spurring on wireless applications, said keynote speaker Anil Kripalani on June 5 at the IEEE MTT-S International Microwave Symposium (IMS) in Honolulu, HI. Kripalani, senior VP for global technology affairs at Qualcomm, predicted that wireless handheld devices will let consumers make purchases, navigate, watch TV, access the Internet, interact with smart buildings, and monitor their health.

As RF applications proliferate, the chips, boards, and products that serve them will present numerous design challenges. Also at the IMS, Guy Sene, a VP and GM at Agilent Technologies, described two key technologies—3GPP Long Term Evolution (LTE) and WiMAX—and Agilent's strategies for addressing them, which include providing products ranging from ADS design-automation software to the MXZ-1000 manufacturing test system for WiMAX consumer premises equipment (CPE) and PC cards. The system supports fixed (IEEE 802.16-2004) and mobile (IEEE 802.16e-2005) systems using a point-to-point or point-to-multipoint architecture.

Along with Agilent, several other vendors at the IMS demonstrated instruments to speed the design and test of RF products. The instruments (see p. 15) ranged from the Rohde & Schwarz FMU36 baseband analyzer, which facilitates design characterization, to the Giga-tronics 2520GTA signal generator, which features switching speeds of better than 350  $\mu$ s to speed manufacturing test.

Of course, key to the success of consumer wireless products will be the ability to test the chips that go into them. In a phone interview, Keith Lee, president and CEO of Advantest America, said it's getting easy to drop RF circuitry onto a substrate but that testing

that circuitry is a complex task. Lavi Lev, CEO of Credence Systems, noted in an e-mail exchange that increasing RF integration will require test systems that are flexible and that can be easily adapted to customer requirements. And Mark Jagiela, president of the Teradyne Semiconductor Test Division, said in a phone interview that



**The MXZ-1000 WiMAX manufacturing test system combines the Agilent MXA signal analyzer, MXG signal generator, and an interface unit.**

Courtesy of Agilent Technologies.

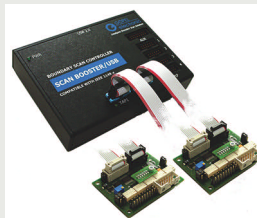
mixed digital and RF devices pose challenges in deciding whether to use an "uber tester" for single-insertion test or to distribute test among multiple test systems.

Lee, Lev, and Jagiela will participate in the SEMI Test Summit during Semicon West in San Francisco, and you can expect RF test to be one of the topics they discuss. Verigy president and CEO Keith Barnes will join them. He didn't comment specifically on RF test in an interview before the event, but Verigy's RF direction is suggested in its June 26 introduction of the Port Scale RF card for the V93000 SOC test platform (see p. 11). The instrument provides the RF measurement capability required to test devices containing integrated RF, mixed-signal, digital, and power-management circuitry as well as memory.

The SEMI Test Summit, which I will moderate, will be held at 5:30 p.m. on July 18 in the Moscone Center West Hall, Level 2. Nextest Systems president Tim Moriarty is also slated to participate. **T&MW**

### ScanBooster supports USB 2.0

Goepel electronic has introduced the ScanBooster/USB-FXT controller, which is based on a USB 2.0 interface. The new ScanBooster complements the already existing ScanBooster products, which provide critical TAP access for ATE fixtures and for HASS/HALT applications, supporting JTAG test and in-system programming. ScanBooster/USB-FXT features two separate TAPs and supports programmable TCK frequencies to 16 MHz. [www.goepel.com](http://www.goepel.com).



### LTX shifts manufacturing to Malaysia

LTX has announced plans to transition the manufacturing of its X-Series test systems to Jabil's Penang, Malaysia, facility from its current location in Billerica, MA. The move is designed to reduce LTX's cycle times and to augment its competitiveness in the global marketplace, according to a statement released by the company. The initiative, already underway, is targeted for completion by August 2008. [www.jabil.com](http://www.jabil.com); [www.ltx.com](http://www.ltx.com).

### Test Equipment Connection offers Huntron gear

Test Equipment Connection has entered into a US distribution sales agreement with Huntron to sell Huntron's Tracker 2700 and 2700S. These benchtop instruments use power-off signature analysis to identify component failures on printed-circuit boards (PCBs). The Tracker 2700S adds the ability to scan and compare up to 40 pins/channel using standard IC clips and cables. [www.testequipmentconnection.com](http://www.testequipmentconnection.com); [www.huntron.com](http://www.huntron.com).

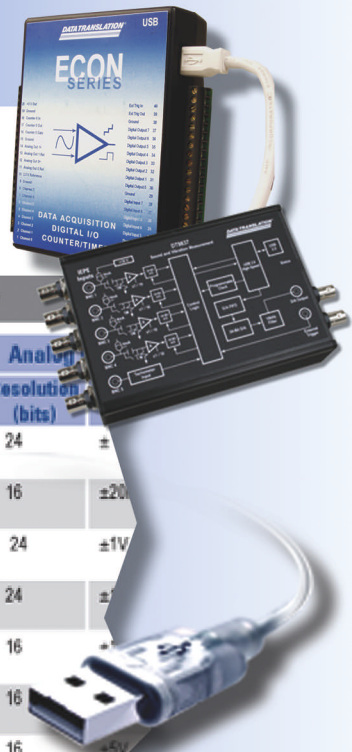


# USB. In detail.

## USB Data Acquisition

### Product Selection Chart

	USB Model	Summary	Analog		
			# of Channels	Throughput	Resolution (bits)
Temp	DT9871	48 thermocouple inputs, CJC per input, high accuracy, channel-to-channel isolation	48DI	10Hz per channel	24
	DT9805, DT9806	7 thermocouples, 1 CJC, temperature applications, 500V isolation	8DI/16SE	50kHz**	16
Sound & Vibration	DT9837	4 IEPE (ICP) sensor inputs, tachometer, simultaneous A/Ds	4 IEPE (SE) + 1 Tacho	52.734kHz* per channel	24
	DT9841-VIB	8 simultaneous	8 IEPE (SE)	100kHz* per channel	24
			2SE	2.0MHz* per channel	16
			4SE	1.25MHz* per channel	16
			6 or 12SE	225kHz* per channel	16
			16SE/8DI	500 kHz*	16



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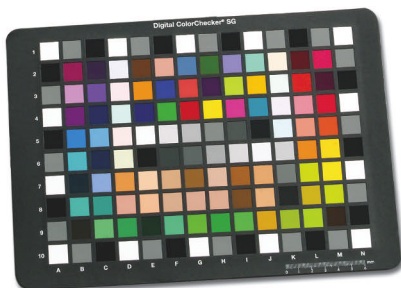
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## Calibrate camera coordinates and colors

**C**ameras used for metrology or color matching need calibration. Lenses can slightly distort images, and improperly mounting a camera can introduce measurement errors. Improper lighting or ambient light conditions can distort colors.

A machine-vision lens may exhibit barrel distortion, an effect that causes the sides of a square to bow out slightly in an image. This type of distortion can cause a 1–2% error be-



This Digital ColorChecker SG calibration chart provides 140 squares that represent a range of colors, gray scales, and skin tones. Although used primarily to calibrate photography cameras, the chart can calibrate color-vision equipment, too.

Courtesy of X-Rite and GretagMacbeth.

tween edges on an object and those in a camera's image. If your application cannot accept a measurement error within that range, choose machine-vision software that will compensate for barrel distortion or buy a higher-quality lens that can reduce barrel distortion to about 0.1%. (When you talk with lens companies about lens distortion, you may hear a "promille" specification, which means parts per thousand. Thus, 0.1% becomes 1 promille.)

A lens also can cause pincushion distortion that alters the sides of a square in an image so they appear to bow in slightly. This type of effect usually appears in inexpensive telephoto lenses. Again, software could correct for pincushion distortion, or you could move a camera closer to an object or buy a better lens.

A poorly mounted camera can produce perspective or trapezoidal distortion that makes distant objects in the camera's depth of field look closer together. In metrology applications, you must calibrate for this distortion or mount a camera perpendicular to the surface of the object you want to inspect.

To determine the extent of distortion, you can use a standard chart that provides accurately spaced and sized targets. This information also lets you relate an  $x$ -mm distance to the number of pixels that represent that distance in an image. An Accu-Place Dot-Distortion Target from Applied Image, for example, gives a camera dimensional targets that range from 2-mm-diameter circles on a 4-mm grid in an outer zone to 0.20-mm dots on a 0.40-mm grid in the center. Engineers can obtain other types of dimensional-calibration targets, too.

You may not need to calibrate your vision system's color measurements if you plan a simple comparison that distinguishes, say, white from red, because qualitative color information will suffice. But if your vision system must compare a color, perhaps on a keyboard or LCD, with a standard, you must calibrate the system's color measurements.

You can buy several types of standard color charts, but the ColorChecker charts from GretagMacbeth provide one of the better ranges of colors in a pattern of squares. The supplier offers a corresponding list of RGB values (daylight illumination) for each square, so you can relate standard colors to the RGB values your camera produces and the RGB values that your vision-system software processes and displays. T&MW

### FOR FURTHER READING

For more information on barrel and pincushion distortion, go to [www.vanwalree.com/optics/distortion.html](http://www.vanwalree.com/optics/distortion.html).

For more information about color calibration, go to [www.babelcolor.com/main\\_level/ColorChecker.htm](http://www.babelcolor.com/main_level/ColorChecker.htm).

### Banner debuts low-angle ring lights

A 150-mm low-angle ring light from Banner Engineering uses three tiers of LEDs for high-intensity, low-angle illumination. The light connects to Banner's PresencePLUS vision sensors or to an external power supply to provide optimal illumination of a part by enhancing the contrast of surface features. Models are available with infrared or visible red LEDs and offer continuous or strobed operation. [www.bannerengineering.com](http://www.bannerengineering.com).



### Camera employs GigE interface

The GC750 machine-vision camera from Prosilica connects to the Gigabit Ethernet port of a host computer and does not require a frame grabber. Built with a progressive-scan CMOS sensor and electronic shutter for capturing high-speed motion events, the GC750 runs at 60 fps with a resolution of 752x480 pixels. The camera comes in monochrome and color versions supporting both 8-bit and 10-bit formats. [www.prosilica.com](http://www.prosilica.com).

### System finds macro defects

Rudolph Technologies has begun shipping its NSX 100 automated macro-defect inspection systems that can inspect wafers in sizes of up to 200 mm at throughputs of up to 88 wafers per hour. Rudolph claims that the NSX 100 system is well-suited for processes such as gold-bump inspection, where higher resolution provides little or no benefit but higher throughput lowers cost of ownership. [www.rudolphtech.com](http://www.rudolphtech.com).



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# Laying the FOUNDATION for GROWTH

BY LAWRENCE D. MALONEY, CONTRIBUTING EDITOR

**W**ith solid performance almost across the board in 2006, the giant companies that set the pace for the test field finally put the last tech bust behind them. Leveraging new products, sharper market strategies, and fresh opportunities from new technology, half of the industry's top 10 public companies enjoyed double-digit growth last year. Even those with more modest performance saw a jump in orders that set the table for better times in 2007 and beyond.

"Electronic test is a mature field," noted analyst John Harmon of Needham & Company. "Over the long term, annual revenue growth of 6% to 7% is average, so it is significant if you get a year where you see 10% to 12% gains."

## Instrumentation in sharper focus

Industry leader Agilent Technologies, whose revenues in 2006 grew by a relatively modest 5% to just over \$3.4 billion in electronic measurement, is nonetheless viewed by analysts as a much tougher competitor, now that it has spun off its semiconductor test and semiconductor products divisions.

"If you analyze Agilent's past history, semiconductor ATE tended to be a negative, because of the cyclical nature of that business," observed senior research analyst S. Vidyasankar of Frost & Sullivan. "Now, the company can concentrate on such promising areas as communications test and instrumentation for life sciences."





In 2007, Agilent's focus is on "Phase II" of its transformation, said president and CEO Bill Sullivan. "We have strategically chosen key growth areas that include voice, video, and data network services, mobile Internet such as Mobile WiMAX and LTE, and the expanding electronics manufacturing market in Asia."

Harmon of Needham already sees signs of a leaner, meaner Agilent, which could pose a stiffer test for competitors. "Three years ago, Agilent was a year late in the product cycle for high-end oscilloscopes versus Tektronix," noted Harmon. "Now, it is a horse race again."

Three times the size of its nearest direct competitor—Tektronix—Agilent simply has a much wider product line to build on, pointed out Kiran Unni, research manager in Frost & Sullivan's Measurement and Instrumentation Group. "It also has a large mind share in the life sciences field." Agilent notched \$1.55 billion in sales from those bio-analytical measurement devices in 2006.

At just over \$1 billion, revenues at Tektronix were essentially flat in 2006, and Unni suggested that the company needs to put a greater focus on broadening its product line and market applications rather than pushing the performance envelope on such products as \$100,000 oscilloscopes.

But Tektronix CEO Rick Wills said that sales were only part of the story in 2006. "Yes, our sales were about flat, but our orders were up nearly 13%," Wills claimed that Tek is now delivering on "the most impressive flow of new products that I've seen in my 27 years with the company." He noted that in the oscilloscope line, the company has replaced every model from \$7000 up to \$150,000.

The Tektronix CEO also pointed to the company's progress in growing newer areas of the business, such as signal sources and spectrum analyzers, which have enjoyed a compound annual growth rate of more than 30% over the last four years. "The short answer is we plan to keep doing what we've been doing," Wills said.



**Agilent's Sullivan:**  
Focus on communications test.

Courtesy of Agilent Technologies.

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

COMPANY	2006 RANK	2005 RANK	2006 REVENUES (MILLIONS US\$)	2005 REVENUES (MILLIONS US\$)	PERCENT CHANGE
Agilent Technologies	1	1	3,419.0 <sup>1</sup>	3,265.0	5.0
Advantest	2	2	1,999.0	2,138.0	-7.4
Teradyne	3	3	1,376.8	1,075.2	28.0
Tektronix	4	4	1,039.9	1,034.7	flat
Fluke	5	5	1,011.0 <sup>2</sup>	945.0	7.0
Anritsu	6	6	842.0	766.0	9.0
Verigy	7	N/A	778.0 <sup>3</sup>	456.0	71.0
National Instruments	8	7	660.4	571.8	15.5
Aeroflex	9	8	551.8	463.4	19.0
Credence Systems	10	9	474.4	429.3	11.0

<sup>1</sup>Agilent Technologies revenues include only electronic measurement operations. Instrumentation for bio-analytical measurement totaled \$1.55 billion in 2006.

<sup>2</sup>Danaher does not report separate figures on its Fluke/Fluke Networks units. Our figures are an estimate, based on the reported 7% business increases in 2006 for its existing electronic test businesses.

<sup>3</sup>Verigy was spun off from Agilent Technologies in 2006.

Note: Rohde & Schwarz, a privately held company, reported annual sales of 1.3 billion euros in the fiscal year ending June 2006, an 18% increase over the previous year. This would make R&S the industry's third largest in this list, if privately held firms were included.

## Thrills and chills in ATE

If the semiconductor automated test equipment (ATE) business is a scary roller-coaster ride, industry youngster Verigy must be enjoying it. In the fiscal year ending October 31, 2006, Verigy's sales rose a whopping 71% to \$778 million. Verigy was spun off from Agilent Technologies during 2006. "Clearly, Agilent sold this business at a high point," noted Harmon of Needham.

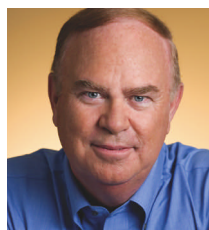
While sales were off slightly for Verigy in the first quarter of 2007 versus the same period in 2006, CEO Keith Barnes said that "Verigy's balanced product portfolio, focused in both SOC and memory device test, helped us continue to deliver solid results even during a cyclically soft period in the semiconductor test industry." Among the most promising growth drivers for Verigy: expansion of its flash memory, high-speed memory, and high-speed I/O areas.

Meanwhile, Japan's Advantest, the industry's semiconductor ATE kingpin, saw sales slip by 7.4% in the fiscal year

that ended in March of 2007, in part because of sluggish sales in nonmemory test systems. Still, the company is predicting overall sales growth of 8.5% this year. "We have a strategy for gaining share in flash memory and pursuing new customers in the DRAM market, in addition to our commitment to long-time memory customers," said R. Keith Lee, president and CEO of Advantest America.

In the second half of 2006, for example, Advantest announced its new T5383 test system for multipurpose memory devices, such as DRAM and SDRAM, as well as for flash memory and multichip packages. Lee claimed that this new system is also a "very cost-effective solution for communications device manufacturers, who face constant downward pricing pressure."

Advantest also is making progress in ramping up its system-on-chip (SOC) test business. The company now enjoys a market share of 30% in nonmemory test, according to Lee, up from just 10% in 2003. What's the biggest priority for Advantest in its new fiscal year? "We see both memory and nonmemory markets picking up in 2007 and 2008," said Lee, "but our biggest priority is continued investment in



**Barnes of Verigy:**  
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- Production logistics



R&D, which is the key to growth.” He cited development of new testers for the RF wireless market as an example.

Certainly, Advantest can’t afford to rest on its laurels. Teradyne, a key competitor in the SOC test area, saw its 2006 sales rise by 28% to \$1.38 billion. “Our flagship products, the FLEX [an SOC tester] and the J750 [a parallel tester], were the biggest reasons behind our strong 2006,” said CEO Michael Bradley. “By strategically repositioning the company on our test core in the last few years, we’ve been able to put our collective muscle behind these products.”

“Teradyne is very active and is competing well in Asia against Advantest,” said Vidyasankar of Frost & Sullivan. One sign of that progress: VLSI Research earlier this year named Teradyne on its 2006 list of “Best Customer-Rated Suppliers in China.”



**Teradyne's Bradley: Success from core products.**

Courtesy of Teradyne.

### **New products: lifeblood of growth**

Among other top 10 companies, National Instruments chalked up revenues of more than \$660 million in 2006. But that gain of 15.5% did not impress analyst Harmon of Needham, who pointed to past years where increases of 20% or more were commonplace at NI.

Dr. James Truchard, NI's president and CEO, countered that the company made the strategic decision during the downturn to invest in long-term performance by earmarking 16% of its revenue for R&D. “Today, we are seeing this strategy pay off with a record number of new products released in 2003, 2004, and 2005,” said Truchard. “This is the key



**Wills of Tektronix: Order backlog boosts 2007.**

Courtesy of Tektronix.

to achieving a 20% revenue growth.”

Frost & Sullivan's Unni also underscores the potential rewards from NI's concentration on new products and emerging applications. She is impressed, for example, with the latest version of LabView (8.2), which includes such features as an FPGA wizard and a Web services wizard.

In general, while the test market can be viewed as mature, analysts still see healthy opportunities, as companies create products to respond to such areas as nanotechnology, wireless communications test, and future generations of ICs.

Said Needham's Harmon: “At their most recent analyst meetings, both Agilent and Tektronix essentially said that we are in the middle of a 10-year economic growth cycle. I don't see anything that would derail the industry from solid growth.” T&MW

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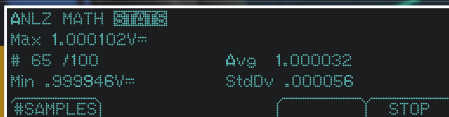
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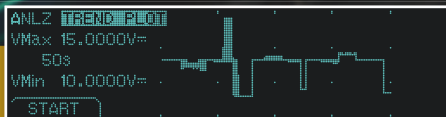
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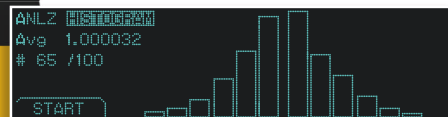
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- ▷ Services/Labs/Test Houses, p. 52

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## STAND-ALONE TEST INSTRUMENTS

### Analyzers, Logic and Bus

Agilent Technologies  
AIM USA  
Catalyst Enterprises  
FuturePlus Systems  
GE Fanuc  
GOEPEL Electronics  
Intellitech  
LeCroy  
Tektronix  
Thurlby-Thandar Instruments (TTi)  
VMETRO

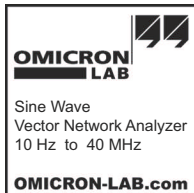
### Analyzers, Time Interval

EADS N.A. Defense Test & Services  
Fluke  
GuideTech  
Pendulum Instruments  
Photron  
Stanford Research Systems  
Wavecrest  
Yokogawa Corp. of America

### Analyzers, Waveform/Signal

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Anritsu  
Audio Precision  
Berkeley Nucleonics  
Boonton Electronics  
Brüel & Kjær, N.A.  
Data Physics  
Dewetron  
EADS N.A. Defense Test & Services  
Fluke  
GHI Systems  
GOEPEL Electronics  
Hioki USA  
Hi-Techniques  
JDSU

Krohn-Hite  
LDS Test and Measurement  
Leader Instruments  
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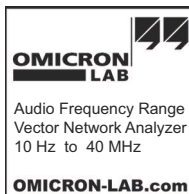
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Sencore  
Signal Recovery  
Stanford Research Systems  
SyntheSys Research  
Tektronix  
Vibration Research  
Wavecrest  
Yokogawa Corp. of America

### Attenuators, Electronic

JFW Industries

### Audio Test Sets

Agilent Technologies  
Audio Precision  
AudioControl Industrial  
Boonton Electronics  
Brüel & Kjær, N.A.  
Data Physics  
EADS N.A. Defense Test & Services  
Extex Instruments  
IET Labs  
LMS North America  
Monarch Instrument  
Opticom  
Prism Sound



Rohde & Schwarz  
Sencore  
Tecpel  
Tegam  
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### Calibration Standards

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Fluke  
Gigahertz-Optik  
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IET Labs  
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GMC-I Gossen  
Metrawatt  
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Omega Engineering  
Owens Design  
Rotek Instrument  
Tecpel  
Tegam  
Xitron Technologies  
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Everest Interscience  
Extech Instruments  
Fluke  
Hart Scientific

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Cryotronics  
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Pyrometer Instrument  
Sun Electronic Systems  
Tecpel  
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Agilent Technologies  
B&K Precision  
EADS N.A. Defense Test & Services  
Extech Instruments  
Fluke  
Instek America  
Monarch Instrument  
Pendulum Instruments  
Spectracom  
Stanford Research Systems  
Tabor Electronics

Tegam  
Thurlby-Thandar Instruments (TTI)  
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### Current Meters, Clamp-on

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Flex-Core  
Sperry Instruments  
Sypris Test & Measurement  
Tecpel

### Data-Acquisition Systems, Networked

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Advantech  
Astro-Med  
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Campbell Scientific  
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DAQ Systems  
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Tegam  
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Rigol Technologies  
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Tabor Electronics  
Tepcel  
Tegam  
Tektronix  
Thurlby-Thandar Instruments (TTI)  
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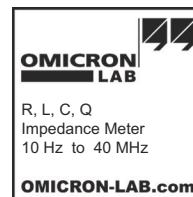
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B&K Precision  
Boonton Electronics  
Chroma ATE  
Clarke-Hess Communication Research  
Extch Instruments  
Fluke  
Hioki USA  
IET Labs  
Instek America  
Keithley Instruments



Protek Test and Measurement  
QuadTech  
Stanford Research Systems  
Tepcel  
Tegam

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Associated Research

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Fluke  
Instek America  
Leader Instruments  
Madell Technology  
Protek Test and Measurement  
Sencore  
Tepcel

### Oscilloscopes, Benchtop, Digital, 1 GHz and Above

Agilent Technologies  
B&K Precision  
LeCroy  
SyntheSys Research  
Tektronix  
Wavecrest  
Yokogawa Corp. of America

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Agilent Technologies  
Data Physics  
Fluke  
Hameg Instruments  
Hi-Techniques  
Instek America  
LDS Test and Measurement  
LeCroy  
Madell Technology  
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Model	Max. Output	BW
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AV-151J-B	±400V to 10 kΩ	50 kHz
AV-151B-C	±200V to 50 kΩ	100 kHz
AV-151G-B	±200V to 50 kΩ	350 kHz
AV-153AH-B	±200V to 1.2kΩ	300 kHz
AV-153B-B	±135V to 500 Ω	50 kHz
AV-151C-B	±100V to 10 kΩ	200 kHz
AV-153C-B	±90V to 100 Ω	30 kHz
AV-151H-B	±50V to 10 kΩ	1 MHz
AV-151D-B	±30V to 50 Ω	1 MHz
AV-151E-B	±25V to 20 Ω	20 kHz

The AV-151 and AV-153 series of function generators provide medium to high voltage outputs at frequencies as high as 1 MHz. Aside from generating sine, square, and triangle wave outputs from the internal oscillator, all models can also be used as variable-gain linear amplifiers for external inputs. This makes the AV-151 & AV-153 models useful as booster amplifiers for low-voltage arbitrary waveform generators. Many models are available with IEEE-488.2 GPIB and RS-232 ports. Ethernet connectivity is optional on these models.

For details about the 151 and 153 families, visit <http://www.avtechpulse.com/function>.

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own designs. Change in wireless technology is no longer

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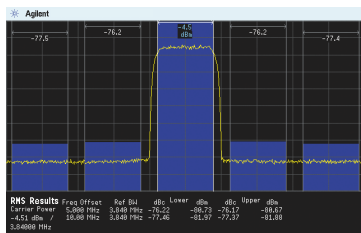
test technology keeping pace, it has to anticipate. Stay ahead,

find the edge, move it forward.

To see how the new Agilent MXG lets you measure at levels

never before possible, go to [www.agilent.com/find/possible1](http://www.agilent.com/find/possible1).

It's signal generation at the edge of possibility.



### Agilent MXG Signal Generator

ACLR (3GPP W-CDMA)	-71 dBc spec., -76 dBc meas. (1-carrier) -65 dBc spec., -70 dBc meas. (4-carrier)
Switching speed (SCPI)	1.2 ms
Simplified self-maintenance	Onsite calibration in less than 1 hour
Signal Studio software	W-CDMA, WiMAX, cdma2000/1xEV, GSM/EDGE, WLAN, TD-SCDMA



u.s. 1-800-829-4444, ext. 5461  
canada 1-877-894-4414, ext. 5461  
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The 4017B is the latest addition to B&K Precision's 4000 series of Function Generators. It is the first true Function Generator in its line to offer DDS (Direct Digital Synthesis) technology allowing the 4017B to generate very precise and accurate waveforms with little distortion.

- Multi-function LCD displays all output parameters:
  - o Frequency
  - o Level
  - o Offset
  - o Duty Cycle
- Up to 10MHz on Sine, Square & Ramp Waveforms
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- Variable DC offset

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Ph: 714.921.9095 Fax: 714.921.6422  
[www.bkprecision.com](http://www.bkprecision.com)



The water drop photo is courtesy of OMD photography





# Take a good look at your data acquisition provider



## ARE YOU SEEING ONLY PART OF THE PICTURE?

- ▶ **PRICE** Are they low priced? or just cheap?
- ▶ **HARDWARE** Do they have exactly what you want? or just what they want you to buy?
- ▶ **SOFTWARE** Do they have the right software for *your* application, budget, and skill set?
- ▶ **QUALITY** Do they back up their claims with lifetime warranties? Why not?
- ▶ **CONTINUITY** Will the application you wrote today work with their next-generation products?
- ▶ **SETUP TIME** Can you start taking measurements within minutes?
- ▶ **SUPPORT** Is your first phone contact an experienced engineer?

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Square Wave Generation  
Pulse Width Modulation  
Frequency Measurement  
Event Counter

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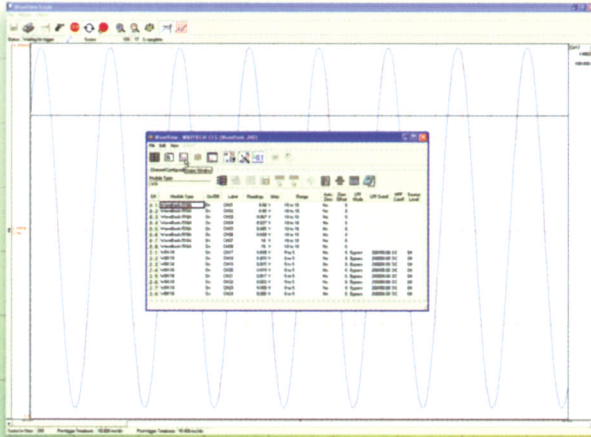
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- Optional eZ-Analyst™ for real-time spectrum analysis
- Support for Visual Studio® and Visual Studio® .NET, including examples for Visual C++, Visual C#, Visual Basic®, and Visual Basic® .NET
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## > STAND-ALONE TEST INSTRUMENTS *Continued*

### Oscilloscopes, Handheld

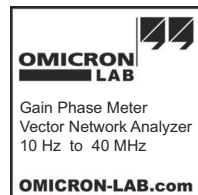
AEMC Instruments  
Agilent Technologies  
Data Physics  
Fluke  
Saelig

### Pattern Generators, Digital

Agilent Technologies  
Anritsu  
Berkeley Nucleonics  
Centellax  
Chroma ATE  
Klein Instruments  
Leader Instruments  
LeCroy  
Sencore  
SyntheSys Research  
Tabor Electronics  
Tektronix  
VMETRO

### Phase Meters/Phase Angle Voltmeters

Agilent Technologies  
Audio Precision  
Clarke-Hess Communication Research  
Colby Instruments  
Exttech Instruments  
Flex-Core  
Hioki USA  
Krohn-Hite  
North Atlantic Industries



Signal Recovery  
Sperry Instruments  
Tecpel  
Xitron Technologies  
Yokogawa Corp. of America

### Power Amplifiers

AR, RF/Microwave Instrumentation  
AudioControl  
Industrial  
California Instruments  
Chroma ATE

Clarke-Hess Communication Research  
Data Physics  
Krohn-Hite  
Ophir RF  
Tabor Electronics  
Trek

### Power Monitors/Analyzers

Advanced Power Designs  
AEMC Instruments  
Agilent Technologies  
Berkeley Varitronics Systems  
Bird Electronic  
Chroma ATE  
Clarke-Hess Communication Research  
Dewetron  
Exttech Instruments  
Flex-Core  
Fluke  
GMC-I Gossen Metrawatt  
Hioki USA  
IOtech  
Magtrol  
National Instruments  
Ross Engineering  
Sencore  
Spectrum Control  
Tektronix  
Xitron Technologies  
Yokogawa Corp. of America

### Power Sources & Conditioners

ABSOLUTE Electronics  
Advanced Power Designs  
Aeroflex  
Agilent Technologies  
AMREL  
Autotest  
B&K Precision  
Behlman Electronics  
C&D Technologies  
California Instruments  
Chroma ATE  
Clarke-Hess Communication Research  
Elgar Electronics  
Exttech Instruments  
Glassman High Voltage  
Hameg Instruments  
Hioki USA

Hipotronics  
Instek America  
Keithley Instruments  
Kepco  
Kikusui America  
Lake Shore  
Cryotronics  
Lambda Americas  
Ling Electronics

Pacific Power Source  
Pulizzi Engineering  
Sens-Tech  
Spectrum Control  
Spellman High Voltage Electronics  
Superior Electric  
Tamura Corp. of America

Tecpel  
Thurlby-Thandar Instruments (TTI)  
Tracewell Systems  
Vektrex Electronic Systems  
Vigor  
Xantrex Technology

### Serial Bus Testers/Debuggers

Catalyst Enterprises  
Connecticut Technology Products  
EXFO  
Finisar

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Reversible Output Polarity



### SERIES 230

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Digital Front Panel Metering  
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CHINA



## > STAND-ALONE TEST INSTRUMENTS *Continued*

FuturePlus Systems  
GOEPEL Electronics  
Ixia  
LeCroy  
Symtx  
SyntheSys Research  
Tektronix  
VMETRO  
Wavecrest

### Signal Conditioners

Advantech  
B & B Electronics  
Briel & Kjaer, N.A.  
C&D Technologies  
Data Physics  
Dataforth  
Dataq Instruments  
DL Instruments  
Endevco  
Flex-Core  
Futek Advanced Sensor Technology  
Hi-Techniques  
Keithley Instruments  
Kistler Instrument

Krohn-Hite  
LDS Test and Measurement  
Macro Sensors  
Measurement Computing  
Microstar Laboratories  
National Instruments  
Neff Instrument  
Newport Electronics  
Omega Engineering  
Pacific Instruments  
PCB Piezotronics  
Pico Technology  
Picosecond Pulse Labs  
Precision Filters  
R.C. Electronics  
Ross Engineering  
Signal Recovery  
Spectrum Control  
Stanford Research Systems  
Tabor Electronics  
Tegam  
Trek  
Yokogawa Corp. of America

### Sound/Audio Level Meters

AEMC Instruments  
Briel & Kjaer, N.A.  
Casella USA  
Exttech Instruments  
IET Labs  
Leader Instruments  
m + p international  
Monarch Instrument  
Protek Test and Measurement  
Sencore  
Tecpel  
Tektronix  
Yokogawa Corp. of America

### Spectrum Analyzers, Audio

Agilent Technologies  
Audio Precision  
AudioControl Industrial  
Briel & Kjaer, N.A.  
Casella USA  
Data Physics

Electronic Systems of Wisconsin  
LDS Test and Measurement  
LMS North America  
m + p international  
Opticom  
OROS  
Sencore  
Stanford Research Systems  
Tektronix

### Tachometers

AEMC Instruments  
Data Physics  
IET Labs  
LDS Test and Measurement  
Monarch Instrument  
Polytec  
Protek Test and Measurement  
Tecpel

### Temperature Meters, Bench

Fluke  
Keithley Instruments  
Lake Shore  
Cryotronics  
Monarch Instrument  
National Instruments  
Newport Electronics  
Omega Engineering  
Pyrometer Instrument

Stanford Research Systems  
Xitron Technologies

### Temperature Meters, Handheld

AEMC Instruments  
Amprobe  
Casella USA  
Computer Aided Solutions  
Everest Interscience  
Exttech Instruments  
Fluke  
Hart Scientific  
Hioki USA  
Linseis  
Monarch Instrument  
National Instruments  
Newport Electronics  
Omega Engineering  
Prostat  
Protek Test and Measurement  
Pyrometer Instrument  
Rotronic Instrument  
Saelig  
Sperry Instruments  
Tecpel  
Tegam  
Telatemp  
Testo  
Yokogawa Corp. of America

### Time/Frequency/Phase Standards

Agilent Technologies  
Berkeley Nucleonics  
Clarke-Hess Communication Research  
Colby Instruments  
Novatech Instruments  
Pendulum Instruments  
Spectracom  
Stanford Research Systems  
Symmetricom  
Tabor Electronics

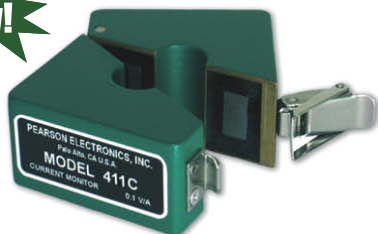
### Transformer Testers

Chroma ATE  
Clarke-Hess Communication Research  
Hipotronics  
QuadTech  
Xitron Technologies

### Wattmeters

Bird Electronic  
Boonton Electronics  
Chroma ATE  
Clarke-Hess Communication Research  
Flex-Core  
Tecpel  
Xitron Technologies

## Wide Band Clamp-on Current Monitor



Pearson Electronics is pleased to introduce a new line of Wide Band Clamp-on Current Monitors. The new design features a 1/2 inch or 1 inch aperture with a hinged type opening for easy operation. The new design incorporates Pearson's wide band frequency response in a demountable configuration for use on fixed conductors.

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Other models feature a 2.0 nanosecond rise time, or droop as low as 0.003% per microsecond.

**Contact Pearson Electronics for application information.**

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Telephone: (650) 494-6444 FAX (650) 494-6716  
www.pearsonelectronics.com



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ACCES I/O Products  
Adlink Technology  
Advanced Vehicle Technologies  
Advantech  
Agilent Technologies  
ASSET Intertech  
B & B Electronics  
Concurrent Computer  
Curtiss-Wright  
Elan Digital Systems  
ELMA Electronic  
FuturePlus Systems  
Geotest - Marvin Test Systems  
GOEPEL Electronics  
ICS Electronics  
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Intellitech  
IOtech  
JTAG Technologies

Keithley Instruments  
M3 Electronics  
Measurement Computing  
MEN Micro  
Moxa Technologies  
National Instruments  
Pickering Interfaces  
PLDA  
Saelig  
Scientific Solutions  
Sealevel Systems  
TAL Technologies  
VMETRO

### CompactPCI/PXI Analog I/O Cards

ACCES I/O Products  
Acromag  
Adlink Technology  
Advantech  
C&H Technologies  
Concurrent Computer  
DaqScribe Technology

Exacq Technologies  
GaGe  
Geotest - Marvin Test Systems  
GOEPEL Electronics  
Innovative Integration  
KineticSystems  
Measurement Computing  
MEN Micro  
National Instruments  
North Atlantic Industries  
Strategic Test  
Tabor Electronics  
Teradyne Assembly Test Div.  
United Electronic Industries

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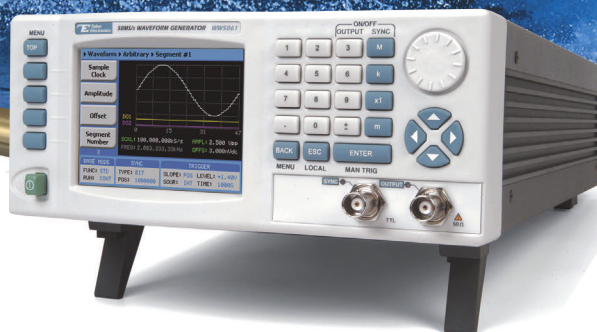
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- **Sine and Square waves generated to 25MHz,**  
For standard function generator use
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For standard function generator use
- **10Vp-p into 50Ω, 20Vp-p into open circuit,**  
To solve high voltage needs
- **Up to 1M waveform memory,**  
For single shot large waveforms
- **Comprehensive memory management,**  
To utilize memory consumption in complex waves
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For communication applications
- **3.8" LCD color user friendly display,**  
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WW1071/1072



100MS/s SINGLE/DUAL CHANNEL  
WAVEFORM GENERATORS

WW2571A/2572A



250MS/s SINGLE/DUAL CHANNEL  
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WW5064/1074/2074



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## > MODULAR INSTRUMENTS *Continued*

### CompactPCI/PXI Arbitrary Waveform Generators

Adlink Technology  
Advanced Power Designs  
Advantech  
Agilent Technologies  
C&H Technologies  
DaqScribe Technology  
Geotest - Marvin Test Systems  
GOEPEL Electronics  
National Instruments  
Pickering Interfaces  
Strategic Test  
Tabor Electronics  
United Electronic Industries  
ZTEC Instruments

**PCI, PXI, & VXI Waveform Generators**



ztecinstruments.com

### CompactPCI/PXI Counters/Timers

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Acromag  
Adlink Technology  
Advantech  
B & B Electronics  
Concurrent Computer Systems  
Geotest - Marvin Test Systems  
KineticSystems  
MEN Micro  
National Instruments  
Signametrics  
Spectracom  
United Electronic Industries

### CompactPCI/PXI Digital I/O Cards

ACCES I/O Products  
Acromag  
Adlink Technology  
Advantech  
C&H Technologies  
Conduant  
Exacq Technologies

GE Fanuc  
Geotest - Marvin Test Systems  
Giga-tronics  
GOEPEL Electronics  
Innovative Integration  
KineticSystems  
Measurement Computing  
MEN Micro  
National Instruments  
Navatek Engineering  
Pickering Interfaces  
Strategic Test  
Teradyne  
Assembly Test Div.  
United Electronic Industries

### CompactPCI/PXI Digitizers/Oscilloscopes

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Adlink Technology  
Advantech  
DaqScribe Technology  
GaGe

Geotest - Marvin Test Systems  
KineticSystems  
Measurement Computing  
National Instruments  
Pickering Interfaces  
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**PCI, PXI, & VXI Oscilloscopes**



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### CompactPCI/PXI DMMs

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MEN Micro  
National Instruments  
Pickering Interfaces  
Signametrics

### CompactPCI/PXI DSP Cards

DaqScribe Technology  
Exacq Technologies  
Innovative Integration  
MEN Micro  
VMETRO

### CompactPCI/PXI Logic Analyzers

Geotest - Marvin Test Systems  
National Instruments  
VMETRO

### CompactPCI/PXI Multifunction I/O Cards

ACCES I/O Products  
Acromag  
Adlink Technology  
Advantech  
Ballard Technology  
Concurrent Computer  
DaqScribe Technology  
GE Fanuc  
Geotest - Marvin Test Systems

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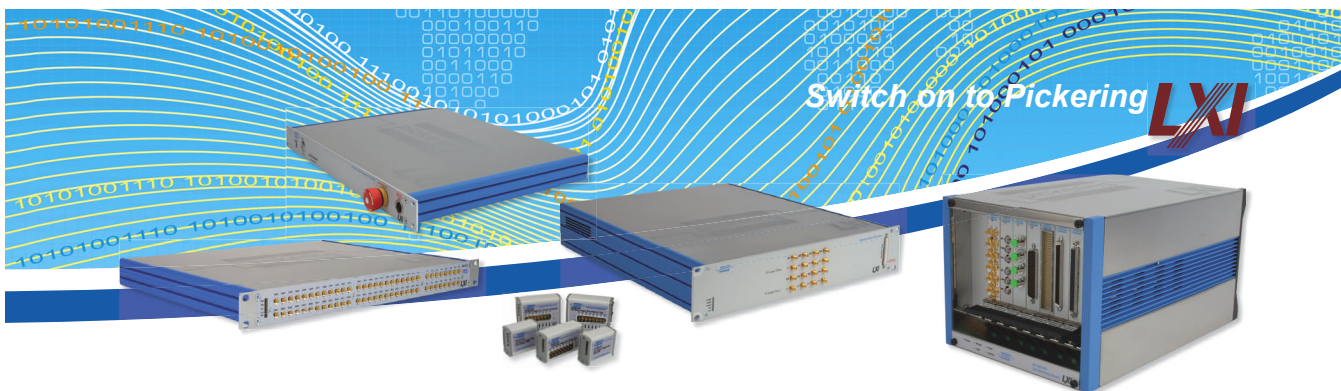
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Innovative Integration  
KineticSystems  
National Instruments  
Pickering Interfaces  
Sealevel Systems  
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Assembly Test Div.  
United Electronic Industries  
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### CompactPCI/PXI RF Measurement Cards

DaqScribe Technology  
Innovative Integration  
National Instruments  
Pickering Interfaces

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200/100/60MHz Digital Storage Oscilloscope

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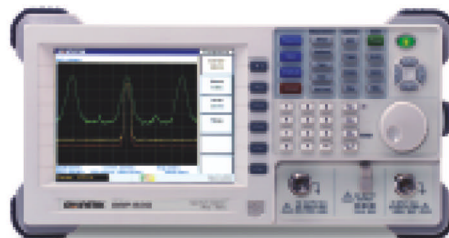


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- 2 or 4 Input Channels
- 1GSa/s Real-Time and 25GS/s Equivalent-Time Sampling
- 25k Points Record Length Maximum
- Large 5.6-in TFT Color Display
- 27 Automatic Measurements
- Three Math Functions Including "+", "-", and "FFT"
- Multi-Language Support
- USB Host : Flash Drive Storage and Color Printout with Grayscale
- USB Device : PC Remote Control
- Battery Power Operation (Optional)
- GPIB & RS-232C Interface

## Frequency Domain

3GHz Spectrum Analyzer

### GSP-830



- Low Noise Floor (-117dBm @1GHz, 3k RBW)
- Autoset Function
- Sequence Programming Functions
- ACPR, OCBW, Channel Power, N-dB Measurements
- Pass/Fail Test with Limit Line Editing
- 10 Markers with  $\Delta$  Marker, Peak Functions
- Split Windows Allowed Separate Settings
- AC/DC/Battery Multi-Mode Power Operation
- USB/RS232/GPIB(Optional) Interface
- Direct VGA Output
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- Light Weight of 5.8kg Without Options
- Optional Tracking Generator & Preamplifier

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### CompactPCI/PXI Signal Conditioners

Alligator Technologies  
DaqScribe Technology  
Frequency Devices  
Innovative Integration  
MEN Micro  
National Instruments  
Pickering Interfaces  
Teradyne  
Assembly Test Div.  
United Electronic Industries

### CompactPCI/PXI Spectrum Analyzers

National Instruments

### CompactPCI/PXI Switches/Multiplexers

Adlink Technology  
Advantech  
Chroma ATE  
Cytec  
Digalog Systems

Geotest - Marvin Test Systems  
Giga-tronics  
GOEPEL Electronics  
KineticSystems  
MEN Micro  
National Instruments  
Pickering Interfaces  
Signametrics  
Teradyne  
Assembly Test Div.

### CompactPCI/PXI Time and Frequency Measurement Cards

Geotest - Marvin Test Systems  
KineticSystems  
MEN Micro  
National Instruments  
Signametrics  
Spectracom  
Symmetricom  
United Electronic Industries

### Instrument Cards, Analog I/O

ACCES I/O Products  
Acromag  
Adlink Technology  
Advantech  
C&H Technologies  
Concurrent Computer  
Curtiss-Wright  
DaqScribe Technology  
Data Translation  
Dataq Instruments  
Diamond Systems  
EADS N.A. Defense Test & Services  
Elan Digital Systems  
Exacq Technologies  
Frequency Devices  
GaGe  
Geotest - Marvin Test Systems  
GOEPEL Electronics  
Highland Technology  
ICS Electronics  
Innovative Integration  
Intelligent Instrumentation

IOtech  
Keithley Instruments  
KineticSystems  
Lawson Labs  
LMS North America  
Measurement Computing  
MEN Micro  
Microstar Laboratories  
National Instruments  
Neff Instrument  
Pacific Instruments  
Pentek  
Pico Technology  
Scientific Solutions  
Sealevel Systems  
Strategic Test  
United Electronic Industries  
VMETRO  
VXI Technology

### Instrument Cards, Counter/Timer

ACCES I/O Products  
Acromag  
Adlink Technology

Advantech  
Bustec  
C&H Technologies  
Concurrent Computer  
EADS N.A. Defense Test & Services  
Geotest - Marvin Test Systems  
Intelligent Instrumentation  
KineticSystems  
Measurement Computing  
MEN Micro  
National Instruments  
Neff Instrument  
Signametrics  
Spectracom  
United Electronic Industries  
VXI Technology

### Instrument Cards, Digital I/O

ACCES I/O Products  
Acromag  
Adlink Technology  
Advantech

AIM USA  
Bustec  
C&H Technologies  
Concurrent Computer  
DaqScribe Technology  
Data Translation  
Diamond Systems  
EADS N.A. Defense Test & Services  
Elan Digital Systems  
Exacq Technologies  
Frequency Devices  
GaGe  
Geotest - Marvin Test Systems  
GOEPEL Electronics  
ICS Electronics  
Innovative Integration  
Intelligent Instrumentation  
IOtech  
Keithley Instruments  
KineticSystems  
Measurement Computing  
MEN Micro

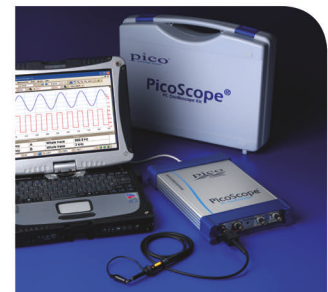
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# No Compromise Oscilloscope

Other oscilloscopes in this price range force you to compromise on one of the key specifications:  
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The PicoScope 5000 series is a no compromise PC oscilloscope at a price every engineer can afford.

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Technology



1GS/s sampling rate

250MHz bandwidth

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Measures:

- Power & Power Factor
- Active/Reactive Energy
- Demand kWh
- Load Changes (graph display)
- Transient voltage/Inrush current
- 4 MB memory



## **3196** **Power Quality Analyzer**

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- Detection and waveform display
- 4 current & 4 voltage channels
- 13 MB memory



## **3169** **Power Demand Meter**

Measures:

- Power & Power Factor
- Active/Reactive Energy
- Demand kWh
- Load Changes (graph display)
- 1 MB memory

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# INSTRUMENTATION

## > MODULAR INSTRUMENTS *Continued*

Microstar Laboratories  
National Instruments  
Navatek Engineering  
Neff Instrument  
Pacific Instruments  
Pentek  
Scientific Solutions  
Sealevel Systems  
Strategic Test  
United Electronic Industries  
Viewpoint Systems  
VMETRO  
VXI Technology

### Instrument Cards, Digitizers, Oscilloscopes

Acqiris USA  
Adlink Technology  
Bustec  
Chase Scientific  
Dewetron  
EADS N.A. Defense Test & Services  
Exacq Technologies  
GaGe  
Geotest - Marvin Test Systems  
Keithley Instruments  
KineticSystems  
Measurement Computing  
MEN Micro  
National Instruments  
Pacific Instruments  
Pickering Interfaces  
Pico Technology  
Saelig  
Strategic Test  
United Electronic Industries  
VXI Technology  
ZTEC Instruments

MEN Micro  
National Instruments  
Pickering Interfaces  
Signametrics  
VXI Technology

### Instrument Cards, DSP

Applied Signal Technology  
Concurrent Computer  
DaqScribe Technology  
Data Translation  
Exacq Technologies  
Innovative Integration  
Intelligent Instrumentation  
LMS North America  
MEN Micro  
Microstar Laboratories  
National Instruments  
Pentek

### Instrument Cards, Freq., Time, Synchro-Resolver

C&H Technologies  
Concurrent Computer  
EADS N.A. Defense Test & Services  
Geotest - Marvin Test Systems  
GuideTech  
Highland Technology  
Intelligent Instrumentation  
Keithley Instruments  
KineticSystems  
Measurement Computing  
MEN Micro  
North Atlantic Industries  
Pacific Instruments  
Signametrics  
Spectracom  
Symmetricom

### Instrument Cards, Logic Analyzers

Geotest - Marvin Test Systems  
National Instruments  
NCI Logic Analyzers

### Instrument Cards, MIL-STD-1553/ARINC

AIM USA  
Ballard Technology  
Bustec  
Curtiss-Wright  
GE Fanuc

Geotest - Marvin Test Systems  
KineticSystems  
Pickering Interfaces

### Instrument Cards, Prototype

C&H Technologies  
EADS N.A. Defense Test & Services  
Geotest - Marvin Test Systems  
Innovative Integration  
KineticSystems  
MEN Micro  
National Instruments  
Pacific Instruments  
Pickering Interfaces

### Instrument Cards, Signal Sources

Adlink Technology  
C&H Technologies  
Chase Scientific  
Data Physics  
Data Translation  
EADS N.A. Defense Test & Services  
Frequency Devices  
Geotest - Marvin Test Systems  
Highland Technology  
Keithley Instruments  
LMS North America  
Measurement Computing  
MEN Micro  
National Instruments  
Novatek Instruments  
Pacific Instruments  
Pentek  
Pickering Interfaces  
Signametrics  
Strategic Test  
United Electronic Industries  
VXI Technology  
ZTEC Instruments

### Instrument Cards, Spectrum Analyzers

Data Physics  
Dewetron  
National Instruments  
Pico Technology  
Saelig  
Tampa Microwave

### Instrument Cards, Switches, Multiplexers

Adlink Technology  
Advantech  
Bustec  
C&H Technologies  
Chroma ATE  
Colby Instruments  
Cytec  
EADS N.A. Defense Test & Services  
Geotest - Marvin Test Systems  
ICS Electronics  
Keithley Instruments  
KineticSystems  
National Instruments  
Neff Instrument  
Pacific Instruments  
Pickering Interfaces  
Signametrics  
Universal Switching  
VXI Technology

### Instrument Cards, Video Test

Acqiris USA  
EADS N.A. Defense Test & Services  
National Instruments  
ZTEC Instruments

### Instrument Controllers/Computers

Acromag  
Adlink Technology  
Agilent Technologies  
Bustec  
EADS N.A. Defense Test & Services  
Geotest - Marvin Test Systems  
ines  
Innovative Integration  
IOtech  
KineticSystems  
MEN Micro  
National Instruments  
Onset Computer  
PFU Systems  
United Electronic Industries  
VXI Technology

### Instrument Mainframes/Chassis

Acqiris USA  
Adlink Technology  
Agilent Technologies  
Dewetron

*Continued >*

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**CS328A-4 (4MS Buffer) \$1149**  
**CS328A-8 (8MS Buffer) \$1642**

### LCD Scopes



**Owon** - 25 or 60MHz 2-ch + trig. Standalone bench scope with USB connection and 7.8" color LCD.  
**PDS5022S (25MHz) \$349**  
**PDS6062T (60MHz) \$599**

### USB Bus Analyzers



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### I2C for PCs



**PCI93LV** - industry-standard I2C card for PCs. **\$499**  
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Optional **WINI2C** software **\$249**

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**Unimeter XQL (AC or DC) \$399**

### World's Fastest PC Scope



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**PS5203/PS5204 \$2230 / \$3343**

### Handheld Scopes



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**HDS1022M 20MHz \$529**  
**HDS2062M 60MHz \$799**

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easyRadio modules.....\$40  
USB-Serial adapters.....\$19  
USB-RS422 1/2/4ch.....\$48+  
Stepper Motor Controller.....\$89

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Geotest - Marvin Test Systems  
Giga-tronics  
Keithley Instruments



## > MODULAR INSTRUMENTS *Continued*

EADS N.A. Defense Test & Services  
ELMA Electronic  
Frequency Devices  
GaGe  
Geotest - Marvin Test Systems  
Hi-Techniques  
IMC DataWorks  
Keithley Instruments  
KineticSystems  
Neff Instrument  
Pacific Instruments  
Pickering Interfaces  
Precision Filters  
Tracewell Systems  
United Electronic Industries  
VXI Technology

### LXI Instruments

Agilent Technologies  
C&H Technologies  
Colby Instruments  
Pickering Interfaces  
VXI Technology  
ZTEC Instruments

### PC Card (PCMCIA) Modules

ACCES I/O Products  
B & B Electronics  
Ballard Technology  
Data Physics  
Data Translation  
FuturePlus Systems  
GE Fanuc  
GOEPEL Electronics  
ICS Electronics  
Innovative Integration  
Keithley Instruments  
Measurement Computing  
National Instruments  
Pickering Interfaces  
Sealevel Systems  
TAL Technologies

### PXI Embedded Controllers

ACCES I/O Products  
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Geotest - Marvin Test Systems

GOEPEL Electronics  
KineticSystems  
MEN Micro  
National Instruments  
United Electronic Industries

### PXI Mainframe Interconnects (Receivers)

Geotest - Marvin Test Systems  
MAC Panel  
National Instruments  
Virginia Panel

### PXI System Mainframes

Adlink Technology  
Chroma ATE  
Digalog Systems  
ELMA Electronic  
Geotest - Marvin Test Systems  
KineticSystems  
National Instruments  
Pickering Interfaces

Teradyne  
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### Signal-Conditioning Modules & Boards

ACCES I/O Products  
Acromag  
Advantech  
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Bustec  
DaqScribe Technology  
Data Translation  
Dataforth  
Dataq Instruments  
Dewetron  
DGH  
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Endevco  
Frequency Devices  
Highland Technology  
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Intelligent Instrumentation  
IOtech  
Keithley Instruments  
KineticSystems  
Krohn-Hite  
Lawson Labs  
Measurement Computing  
Microstar Laboratories  
National Instruments  
Neff Instrument  
North Atlantic Industries  
Pacific Instruments  
Pentek  
Pickering Interfaces  
Pico Technology  
Precision Filters  
R.C. Electronics  
Sealevel Systems  
Teradyne  
Assembly Test Div.  
United Electronic Industries  
VXI Technology

### VXI Instruments

Acqiris USA  
Advanced Power Designs  
Aeroflex  
Agilent Technologies  
AIM USA  
Boonton Electronics  
Bustec  
C&H Technologies  
Chroma ATE

Cytec  
Data Physics  
EADS N.A. Defense Test & Services  
ELMA Electronic  
GE Fanuc  
Giga-tronics  
Highland Technology  
ICS Electronics  
JTAG Technologies  
Kemo  
Keppco  
KineticSystems  
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IMV  
Instrumented Sensor Technology  
Kistler Instrument  
Omega Engineering  
PCB Piezotronics  
Polytec  
Robert A. Denton  
Summit Instruments

GMC-I Gossen  
Metrawatt  
Hioki USA  
Ion Physics  
Marsh Bellofram  
Pace Scientific  
Pearson Electronics  
Reinhardt System und Messelectronic  
Sypris Test & Measurement  
Tecpel  
Vektrex Electronic Systems

### Current Sensors

A.H. Systems  
AEMC Instruments  
Campbell Scientific  
ETS-Lindgren  
Flex-Core

*Continued >*

# What's your **PXI**Q?

**Geotest**

Marvin Test Systems, Inc.

[www.geotestinc.com](http://www.geotestinc.com)

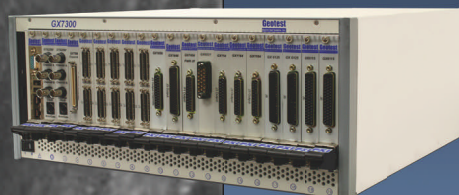
## SMART PXI CHASSIS

*Software controlled  
PXI trigger mapping*

*Built-in temperature and  
system power supply  
monitoring*

*ITA & rack mount  
configurations*

*Built-in peripherals with  
single slot controllers*



GX7300 - 20-slot, 3U PXI



GX7000A - 20-slot, 6U PXI



GX7100A - 14-slot, 3U / 6U PXI



GX7600 - 9-slot, 3U PXI Express

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Sensor Technology  
Honeywell Sensotec  
Kistler Instrument  
Newport Electronics  
Omega Engineering  
PCB Piezotronics

Robert A. Denton  
Sensor Products  
Tekscan

### Humidity Sensors

AEMC Instruments  
Omega Engineering  
Onset Computer  
Pace Scientific

Reinhardt System und  
Messelectronic  
Rotronic Instrument  
Saelig  
SensArray

### Magnetic Field Sensors

ETS-Lindgren  
Ion Physics  
Lake Shore  
Cryotronics  
Magnetic Shield  
Sypris Test &  
Measurement

### Position Sensors

BI Technologies  
Macro Sensors  
MTI Instruments  
North Atlantic  
Industries  
PerkinElmer  
Optoelectronics  
Polytec  
Robert A. Denton  
Sony Manufacturing  
Systems America  
Sypris Test &  
Measurement  
Ultrafast Sensors

### Sound Sensors

AEMC Instruments  
Brüel & Kjær, N.A.

### Temperature Sensors

AEMC Instruments  
BetaTHERM Sensors  
Everest Interscience  
Extch Instruments  
FLIR Systems  
Hioki USA  
Lake Shore  
Cryotronics  
Marsh Bellofram  
National Instruments  
Omega Engineering  
Onset Computer  
Pace Scientific  
PerkinElmer  
Optoelectronics  
Pico Technology  
Pyrometer Instrument  
Reinhardt System und  
Messelectronic  
Rotronic Instrument  
SensArray  
Sensor Products  
Tecpel  
Telatemp  
Thermo Electric

### Pressure Sensors

American Sensor  
Technologies  
Brüel & Kjær, N.A.  
Endevco  
Futek Advanced  
Sensor Technology  
Kistler Instrument  
Marsh Bellofram  
Omega Engineering  
Pace Scientific  
PCB Piezotronics  
Pressure Systems  
Sensor Products  
Sensortech  
Tekscan

## SOFTWARE

### Audio Test Software

CIMTEK  
Data Physics  
SigmaQuest

### C/C++ Libraries

Agilent Technologies  
CIMTEK  
Dalsa  
Data Translation  
EPIX  
Geotest - Marvin Test  
Systems  
GOEPEL Electronics  
ICS Electronics  
The Imaging Source  
Innovative Integration  
Intelligent  
Instrumentation  
JTAG Technologies  
Matrox Imaging  
Measurement  
Computing  
MVTec Software  
National Instruments  
Pacific Instruments  
Pentek

Rad-Icon Imaging  
Scientific Solutions  
Symtx  
TAL Technologies  
United Electronic  
Industries  
Vektrex Electronic  
Systems  
VI Technology

### Calibration Management Software

Advint  
AssetSmart  
Averna  
Beamex  
Blue Mountain Quality  
Resources  
Cascade Microtech  
CyberMetrics  
Data Physics  
Symtx



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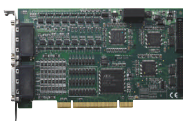




#### Data Acquisition and Motion Control in one DAQ Card

The PCI-9221 is the first ADLINK DAQ card to combine data acquisition and motion control functionalities. This card is a cost-effective 16-Bit high-resolution DAQ card with 2-CH encoder inputs featuring 16-CH single-ended or 8-CH differential input capabilities of up to a 250 kS/s sampling rate. The PCI-9221 provides a programmable function I/O supporting TTL digital I/O, general-purpose timer/counters, motor encoder inputs, and PWM (pulse width modulation) outputs for simple motion control.

For more info, go to:  
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#### High-Density 128-CH Isolated DIO Cards

This series of high-density DIO cards includes the PCI-7442, a 64-CH opto-isolated DIO card; the PCI-7443, a 128-CH opto-isolated DI card; and the PCI-7444, a 128-CH opto-isolated DO card. Each card is equipped with 1250 VRMS channel-to-system isolation protection and all input channels are identical. The PCI-7442/PCI-7443 each feature a Change-of-State (COS) interrupt to reduce CPU loading by only reading channels with changed logical state at each cycle. The PCI-7444 features a sink current of 250 mA for all channels at 100% duty cycle.

For more info, go to:  
[www.adlinktech.com/TM](http://www.adlinktech.com/TM)



#### High Sampling Rate PCI and PXI Data Acquisition Cards for Higher Throughput per Channel

Available in both PCI and PXI form factors, the DAQ-2016 and PXI-2016 feature a sample rate up to 800kS/s per channel. Designed for large-scale data collection and industrial automation, these four-channel cards offer a 16-bit resolution and a variety of analog and digital trigger sources and modes for efficient multi-channel simultaneous sampling. Both the DAQ-2016 and PXI-2016 cards can synchronize multiple external devices using a system synchronization interface or a PXI trigger bus.

For more info, go to:  
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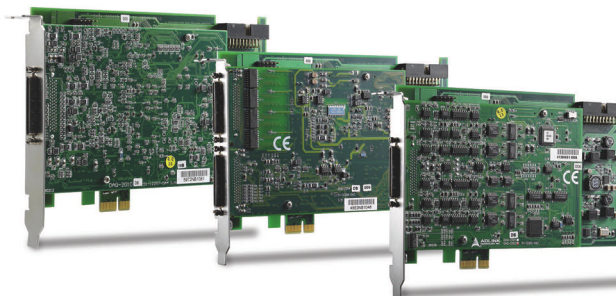


#### 8-Slot Portable PXI Chassis with Touch Panel LCD

The PXIS-2558 8-slot portable PXI chassis features a built-in 8.4" touch panel LCD and adopts innovative control functions including automatic fan speed control, status monitoring and exporting, and remote power control. Ideal for data acquisition and instrumentation applications, the PXIS-2558 weighs only 6.4kg/14lbs for convenient portability, has an extended operating temperature range of 0° to 55°C, and operates quietly at a rate of 41.6 dBA.

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## PCI Express A Full-Range Series of DAQ Cards



#### DAQe-2000 Series:

- ▶ 4-CH differential analog inputs
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- ▶ 16-bit A/D resolution, up to 800 kS/s simultaneous-sampling rate
- ▶ 2-CH 12-bit multiplying analog outputs with waveform generation

#### DAQe-2200 Series:

- ▶ 64-CH single-ended or 32-CH differential analog inputs
- ▶ 12-bit A/D resolution, 3 MS/s simultaneous-sampling rate
- ▶ 16-bit A/D resolution, up to 500 kS/s simultaneous-sampling rate
- ▶ 2-CH 12-bit multiplying analog outputs with waveform generation

#### DAQe-2500 Series:

- ▶ Up to 8-CH 400 kS/s 14-bit single-ended analog inputs
- ▶ 12-bit A/D resolution, 3 MS/s simultaneous-sampling rate
- ▶ Hardware-based arbitrary waveform generation
- ▶ Onboard 8/16 k-sample D/A FIFO and 2 k-sample A/D FIFO

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## > SOFTWARE *Continued*

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Data Physics  
Fluke  
Symtx

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eAutomation Group  
Aptech Systems (GAUSS)  
Averna  
CIMTEK  
Credence Systems  
Dalsa  
Data Physics  
Data Translation  
Dataq Instruments  
Dewetron  
DSP Development  
DYNAFLOW  
GaGe  
GE Fanuc

Geotest - Marvin Test Systems  
GHI Systems  
Givens Control Engineering  
GOEPEL Electronics  
Golden Software  
GraphPad Software  
Graphtec America  
Hi-Techniques  
IMC DataWorks  
Innovative Integration  
Integrated Sciences Group  
IOtech  
JMP  
Keithley Instruments  
LDS Test and Measurement  
LMS North America  
LogicVision  
m + p international  
M/RAD  
The MathWorks  
Measurement Computing  
MI Technologies

Microstar Laboratories  
Microsys Technologies  
National Instruments  
Network Instruments  
NorPix  
Northwest Analytical  
OriginLab  
Parametric Technology  
Pintail Technologies  
Red Rock Software  
SigmaQuest  
Signalysis  
StataCorp.  
Statit Software  
StatSoft  
Symtx  
Synergy Software  
TAL Technologies  
Tektronix  
Test Advantage  
TestEdge  
UGS PLM Software  
VI Technology  
Wavecrest  
ZTEC Instruments

### Instrument Control Software, Stand-Alone Executables

Advint  
Averna  
Dewetron  
EADS N.A. Defense Test & Services  
Geotest - Marvin Test Systems  
Giga-tronics  
ICS Electronics  
Intelligent Instrumentation  
IOtech  
Keithley Instruments  
KineticSystems  
Kuka Real-Time Products  
Measurement Computing  
MI Technologies  
Microstar Laboratories  
National Instruments  
Neff Instrument  
Northwest Analytical  
Pace Scientific

Pacific Instruments  
Quantum Change  
SigmaQuest  
Symtx  
TAL Technologies  
Tektronix  
United Electronic Industries  
Vektrex Electronic Systems  
VXI Technology  
Wavecrest  
ZTEC Instruments

### Statistical Process-Control Software

Aptech Systems (GAUSS)  
Averna  
CyberMetrics  
Integrated Sciences Group  
JMP  
The MathWorks  
Mitutoyo America  
National Instruments  
Northwest Analytical

Pintail Technologies  
SigmaQuest  
StataCorp.  
Statit Software  
StatSoft  
Symtx  
TAL Technologies  
Teradyne Assembly Test Div.  
Test Advantage  
VI Technology  
Viscom

### Test Software Add-ins

Adlink Technology  
Advint  
Agilent Technologies  
Aptech Systems (GAUSS)  
Averna  
Bloomy Controls  
Cascade Microtech  
CIMTEK  
Corelis  
Data Translation

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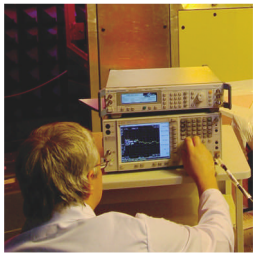
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## > SOFTWARE *Continued*

Dewetron	Measurement Computing
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Geotest - Marvin Test Systems	Pacific Instruments
GOEPEL Electronics	Scientific Solutions
ICS Electronics	SigmaQuest
IET Labs	Symtx
Integral Vision	TAL Technologies
Intelligent Instrumentation	United Electronic Industries
Keithley Instruments	Vektrex Electronic Systems
m + p international	VI Technology
Matrox Imaging	Wavecrest

## Web-Based Collaboration Software

A.T.E. Solutions
Advint
AssetSmart
Averna
EADS N.A. Defense Test & Services
Northwest Analytical
SigmaQuest
Statit Software
TestEdge
UGS PLM Software
VI Technology

## ACCESSORIES

### Connectors/Clips/Cables

Advanced Interconnections
Advint
Agilent Technologies
Amphenol
Aries Electronics
B & B Electronics
Bruel & Kjaer, N.A.
Cablescon
Cal Test Electronics
Components Corp.
Conec
Connect2it
Dynamic Signal
Emulation Technology
ETS-Lindgren
EXFO
E-Z-Hook
FCI
Fluke
Honeywell Sensotec
Huber + Suhner
Huntron
Hypertronics
ICS Electronics
ITT Electronic Components
Keithley Instruments
Lemo USA
MAC Panel
Magtrol
MegaPhase
Micro-Coax
Mill-Max Mfg.
National Instruments
ODU-USA
OptoTest
Pickering Interfaces
Plastronics
Pomona Electronics
Rika Denshi America

### Spectrum Control

Storm Products—Microwave
Superior Electric
Synergetix
Virginia Panel
W.L. Gore & Associates
Winchester Electronics
Xitron Technologies
Yamaichi Electronics USA
ZTEC Instruments

### Eyewear viewers

GOEPEL Electronics
Myvu

### Instrument Carts

Agilent Technologies
GOEPEL Electronics
Terra Universal
Tyrosys

### Instrument Enclosures/Containers

Agilent Technologies
ELMA Electronic
Fieldtex Products
Geotest - Marvin Test Systems
ICS Electronics
MAC Panel
Measurement Computing
Pacific Instruments
Schroff
Tracewell Systems
VI Technology

### Probes, Instrument

AEMC Instruments
Agilent Technologies
AR, RF/Microwave Instrumentation
B&K Precision
Boonton Electronics
Cal Test Electronics
DFT Microsystems
Emulation Technology
ETS-Lindgren
E-Z-Hook
FuturePlus Systems
GOEPEL Electronics
Hioki USA
Huntron
Instek America
Ion Physics
JDSU
Lake Shore Cryotronics
LeCroy
Micromanipulator
Multiprobe
National Instruments
Network Instruments
Omega Engineering
Owens Design
Pearson Electronics
Pomona Electronics
Probe Master
Ross Engineering
Sypris Test & Measurement
Tecpel
Tektronix
Terahertz Technologies
Tyrosys
Vektrex Electronic Systems
ZTEC Instruments

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Advint  
Avalon Equipment  
Denver Test Systems  
EADS N.A. Defense  
Test & Services  
KineticSystems  
m + p international  
TestEquity  
TestMart

### Distributors— Software

Acugen Software  
Advint  
DaqScribe Technology  
Intellitech  
Kuka Real-Time  
Products  
PTL Test Equipment

### Distributors— Test Instruments

Advint  
Avalon Equipment  
Bell Electronics NW  
Carltech International  
Circuit Specialists  
Continental Resources  
Digi-Key  
Direct Industry  
GMW Associates  
Huntron  
Knight Electronics

Macrotron Scientific  
Engineering  
Madell Technology  
MCM Electronics  
MetricTest  
Miller Industrial  
PTL Test Equipment  
S.R.S. Market  
Solutions  
Stanley  
Terra Universal  
TestEquity  
TestMart  
Transcat  
Tucker Electronics

### Manuals

Manuals Plus  
PTL Test Equipment  
Tektronix

### Online Auction Sites

Auktionshaus Dechow  
BidItUp.com  
DoveBid  
eBay  
LabX  
TestMart

### Rental/Lease— Test Instruments

Advanced Test  
Equipment Rentals  
Agilent Technologies  
Atlantic Coast  
Instruments  
Avalon Equipment  
Bell Electronics NW  
Continental Resources  
Electro Rent  
Industrial Resources  
Krohn-Hite  
Lake Shore  
Cryotronics  
MetricTest  
Microlease  
NoiseCom  
ORIX Rentec USA  
PTL Test Equipment  
QuadTech  
Spectratest  
TechRecovery  
Test Equipment  
Connection  
Test Equipment  
Solutions Today  
TestEdge  
TestEquity  
Trek  
Trek Equipment  
TRS-RenTelco  
Tucker Electronics

### Training— PC-Based Instruments

A.T.E. Solutions  
Bloomy Controls  
Data Physics  
Geotest - Marvin Test  
Systems  
JTAG Technologies  
MI Technologies

### Training— Software

A.T.E. Solutions  
ASSET Intertech  
Averna  
Bloomy Controls  
Corelis  
Geotest - Marvin Test  
Systems  
GOEPEL Electronics  
Integrated Sciences  
Group  
Intellitech  
LogicVision  
LTX  
Matrox Imaging  
MI Technologies  
OptEM Engineering  
QualityLogic  
Rohde & Schwarz  
Spirent  
Communications  
Statit Software  
Vektrex Electronic  
Systems  
VI Technology

### Used Equipment— Cards & Modules

Avalon Equipment  
Continental Resources  
Denver Test Systems  
m + p international  
NEA  
ORIX Rentec USA  
TestEquity  
TestMart  
TRS-RenTelco

### Used Equipment— Test Instruments

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Advanced Test  
Equipment Rentals  
Atlantic Coast  
Instruments  
Avalon Equipment  
Bell Electronics NW  
Bizi International  
CableTest Systems  
Continental Resources  
EXFO  
IET Labs  
Industrial Resources  
LabX  
Lake Shore  
Cryotronics  
MetricTest  
Microlease  
Micromanipulator  
Naptech Test  
Equipment

ORIX Rentec USA  
PTL Test Equipment  
Rohde & Schwarz  
Sencore  
Spectratest  
SurplusEq.com  
TechRecovery  
Tektronix  
Test & Measurement  
Global Exchange  
Test Equipment  
Connection  
Test Equipment  
Solutions Today  
TestEdge  
TestEquity  
TestMart  
Trek Equipment  
TRS-RenTelco  
Tucker Electronics  
Wavecrest  
Xitron Technologies

## SERVICES/LABS/TEST HOUSES

### Calibration/ Maintenance

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Advanced Test  
Equipment Rentals  
Advint  
Agilent Technologies  
Anritsu  
Boonton Electronics  
CIMTEK  
Cincinnati Sub-Zero  
Envirotronics  
ETS-Lindgren  
Extech Instruments  
Fluke  
Geller Microanalytical  
Lab  
GMW Associates

Instrumentation  
Engineering  
Keithley Instruments  
MetricTest  
Microlease  
Mindready Solutions  
Nevada Automotive  
Test Center  
NoiseCom  
OptoTest  
Pikes Peak Test Labs  
Robert A. Denton  
Ross Engineering  
Symtx  
Sypris Test &  
Measurement  
Tektronix  
Test Equipment  
Connection  
Test Site Services

Thunder Scientific  
Transcat  
Tucker Electronics  
VLSI Standards  
World Cal

### Repair Services

Agilent Technologies  
Cincinnati Sub-Zero  
Data Physics  
Dynamic Solutions  
Environment  
Associates  
Envirotronics  
ETS-Lindgren  
Fluke  
Invisar  
MegaPhase  
MI Technologies

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Pikes Peak Test Labs  
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Solutions  
Robert A. Denton  
Sypris Test &  
Measurement  
Tektronix  
Test Equipment  
Connection  
Transcat  
Tucker Electronics

### SPC/Quality Consultants

Agilent Technologies  
Averna  
National Quality  
Assurance—USA  
QualityLogic  
Real Controls  
Statit Software  
Sypris Test &  
Measurement  
TUV SUD America  
VI Technology

### Standards Documents

Agilent Technologies  
Averna  
Sypris Test &  
Measurement

### Web-Based Collaboration Subscription Services

A.T.E. Solutions  
Sypris Test &  
Measurement

### Web-Based Test Services (Fee)

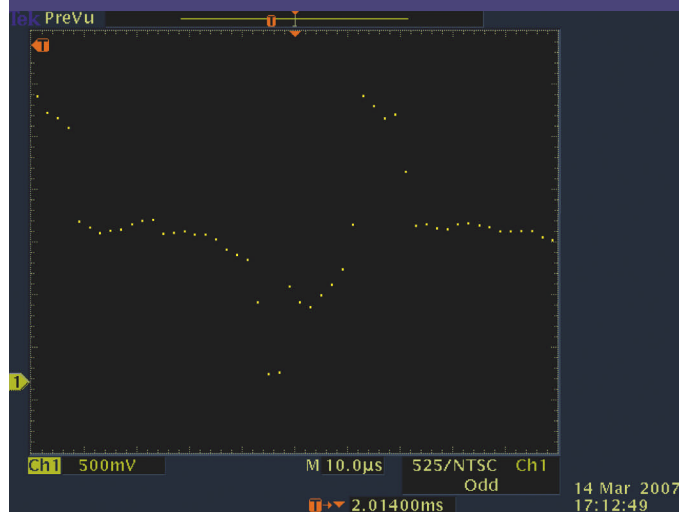
National Technical  
Systems  
TestEdge  
VI Technology

T&MW

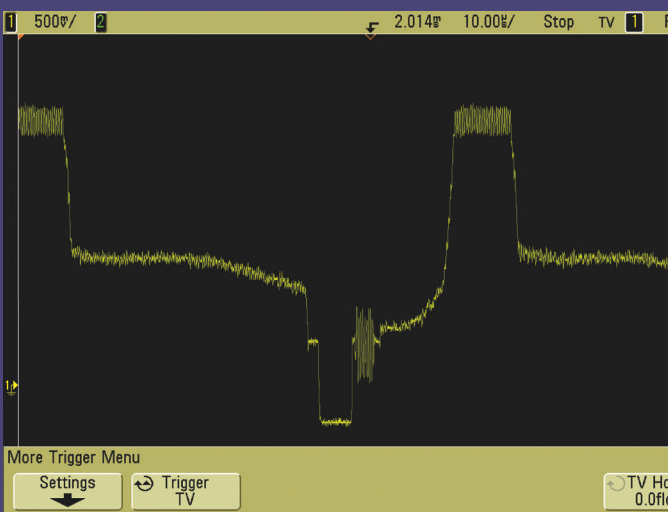


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Memory Depth	10 kpts, max	1 Mpts, max
Channels	2, 4	2, 4
Waveform Update Rate	3,600 wfms/s, max	100,000 wfms/s, max
Connectivity	Centronics, LAN (GPIB, VGA-out optional)	USB, LAN, GPIB, XGA-out (all standard)
Display	VGA resolution, <16 intensity levels	XGA resolution, 256 intensity levels

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\*Tektronix TDS3000B Series User Manual 071-0957-04, October 4, 2004.

\*\*Agilent 5000 Series Oscilloscope data sheet, Pub No 5989-6385EN, April 18, 2007.

Agilent and Tektronix oscilloscope acquisitions taken at identical settings: horizontal timebase = 2ms/div, vertical volts/div = 500 mV/div, connect the dots = on. 10:1 passive probes used for both measurements. Final screen images show both acquisitions zoomed in to 10 µs/div.



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## IN THIS SECTION

- ▷ ATE/Production Test/QA, below
- ▷ ATE/DFT/BIST Software, p. 58
- ▷ Accessories, p. 62
- ▷ Third-Party Suppliers, p. 64
- ▷ Services/Labs/Test Houses, p. 66

Vendor contact information begins on p. 99.

## ATE/PRODUCTION TEST/QA

### ATE, Parametric Testers

Agilent Technologies  
CIMTEK  
Keithley Instruments  
National Instruments  
ProductionLine Testers  
QualiTau  
Reinhardt System und Messelectronic  
Seica  
SPEA  
Symtx  
Telco Testing Solutions

### ATE, Printed Circuit Board

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Acculogic  
Advanced Testing Technologies  
Advint  
Aeroflex  
Agilent Technologies  
C&H Technologies  
Checksum  
CIMTEK  
Circuit Check  
Corelis  
DiagnoSYS Systems

Digalog Systems  
Digitaltest  
EADS N.A. Defense Test & Services  
GOEPEL Electronics  
Huntron  
Invisar  
JTAG Technologies  
Landrex Technologies  
Luther & Maelzer  
Micro Control  
National Instruments  
Navatek Engineering  
Owens Design

Qmax Test Equipments  
Reinhardt System und Messelectronic  
Seica  
SPEA  
Symtx  
Teradyne  
Assembly Test Div.  
Test Research  
Testronics  
Thermotron Industries  
VI Technology  
VXI Technology  
W.M. Hague

### ATE, Semiconductor

Advantest  
Agilent Technologies  
Boonton Electronics  
BPM Microsystems  
Chroma ATE  
Corelis  
Credence Systems  
DiagnoSYS Systems

EADS N.A Defense Test & Services  
Eagle Test Systems  
FocusTest  
GOEPEL Electronics  
Inovys  
Intellitech  
LTX  
Micro Control  
ProductionLine Testers  
Qmax Test Equipments  
SPEA  
Symtx  
Telco Testing Solutions  
Teradyne  
Semiconductor Test Div.  
UltraTest International  
Verigy  
VI Technology

### Bare Board Testers

Cablesan  
CableTest Systems

Caris Network Solutions  
Checksum  
Cirris Systems  
Digitaltest  
Everett Charles Technologies  
Luther & Maelzer  
ScanCAD International  
Seica  
W.M. Hague

### Boundary-Scan Test Tools

A.T.E. Solutions  
Acculogic  
Agilent Technologies  
ASSET Intertech  
Checksum  
CIMTEK  
Corelis  
DiagnoSYS Systems  
Digitaltest  
Flynn Systems

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> ATE/PRODUCTION TEST/QA *Continued*

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JTAG Technologies  
Navatek Engineering  
Riceations  
Seica  
Teradyne  
Assembly Test Div.

**Cable/Harness Testers**

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Cablesan  
CableTest Systems  
CAMI Research  
Checksum  
Cirris Systems  
CTC-Megatel

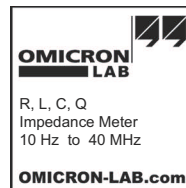
DIT-MCO  
International  
Dynalab Test Systems  
Hipotronics  
OptoTest  
QuadTech  
Reinhardt System und  
Messelectronic  
Slaughter  
Symtx  
Y.P. Unitesters

**Device Programmers**

ASSET Intertech  
BPM Microsystems  
Checksum  
Data I/O  
Digitaltest  
GOEPEL Electronics  
JTAG Technologies  
Navatek Engineering  
Reinhardt System und  
Messelectronic  
Stag Programming  
Solutions

**Discrete Component Testers**

Agilent Technologies  
CableTest Systems  
Corelis  
EADS N.A. Defense  
Test & Services  
Eagle Test Systems  
FETtest  
Integrated  
Technology Corp.  
Keithley Instruments  
National Instruments



ProductionLine  
Testers  
QuadTech  
QualiTau  
Scientific Test  
Semitek

Sencore  
Symtx  
Telco Testing  
Solutions

**Functional System Testers**

A.T.E. Solutions  
Advanced Testing  
Technologies  
Advint  
Averna  
CableTest Systems  
Checksum  
Chroma ATE  
CIMTEK  
DiagnoSYS Systems  
Digitaltest  
EADS N.A. Defense  
Test & Services  
Electronic Systems of  
Wisconsin  
GOEPEL Electronics  
Invisar  
Landrex Technologies  
National Instruments  
Navatek Engineering

Qmax Test  
Equipments  
Reinhardt System und  
Messelectronic  
Seica  
Symtx  
Teradyne  
Assembly Test Div.  
Thermotron Industries  
VI Technology

**Handlers/Sorters**

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Electroglas  
ic automation  
Micro Component  
Technology  
Multitest  
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**Memory Testers**

Advantest  
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**MEMS Testers**

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Autotest  
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Keithley Instruments  
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> ATE/PRODUCTION TEST/QA *Continued*

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Integrated Technology Corp.  
Interconnect Devices  
inTEST  
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Multiprobe  
QualiTau  
Reinhardt System und Messelectronic  
Suss MicroTec  
Temptronic  
Wentworth Labs

**Power Supply Testers**

ABSOPULSE Electronics  
Advanced Power Designs  
Autotest  
California Instruments  
Chroma ATE  
EADS N.A. Defense Test & Services  
Elgar Electronics  
Hipotronics  
Keithley Instruments  
National Instruments  
Pacific Power Source  
Reinhardt System und Messelectronic  
SPEA  
Symtx  
Vektrex Electronic Systems  
Xantrex Technology  
Xitron Technologies

**Switching Matrices, Stand-Alone**

Agilent Technologies  
C&H Technologies  
Colby Instruments  
Cytec  
EADS N.A. Defense Test & Services  
Giga-tronics  
JFW Industries  
Keithley Instruments  
National Instruments  
Pickering Interfaces  
Precision Filters  
Sun Electronic Systems  
Symtx  
Testforce  
Universal Switching  
VXI Technology

**Test System Components and Subassemblies**

Advint  
Aerotech  
Altera  
Analog Devices  
Averna  
CIMTEK  
Data Physics  
DFT Microsystems  
FocusTest  
Giga-tronics  
GOEPEL Electronics  
ic automation  
Interconnect Devices  
inTEST  
KineticSystems  
MAC Panel  
Micro Lambda  
Wireless  
Micromanipulator  
National Semiconductor  
Pickering Interfaces  
PLDA  
Reinhardt System und Messelectronic  
Semitek  
Sunstone Circuits  
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Aehr Test Systems  
Cascade Microtech  
Electroglas  
FormFactor

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ASSET Intertech  
Credence Systems  
JTAG Technologies  
LogicVision  
Mentor Graphics  
SynTest Technologies

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Acugen Software  
Agilent Technologies  
ASSET Intertech  
CIMTEK  
Corelis  
Flynn Systems  
GOEPEL Electronics  
see ad, next column  
Intellitech



JTAG Technologies  
LogicVision  
Mentor Graphics  
Rcreations  
Synopsys  
SynTest Technologies  
Teradyne  
Assembly Test Div.

**Design Verification Software**

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Atrenta

Averna  
Cadence  
Credence Systems  
GOEPEL Electronics  
Inovsys  
Intellitech  
Intusoft  
LPKF Laser and Electronics  
Mentor Graphics  
National Instruments  
Novas Software  
OptEM Engineering  
PDF Solutions  
SigmaQuest  
Synopsys  
Teradyne  
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UGS PLM Software  
VI Technology

*Continued >*





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GOEPEL Electronics  
Inovys  
LogicVision  
LPKF Laser and Electronics  
Mentor Graphics  
phoenix x-ray Systems + Services  
Rudolph Technologies  
SigmaQuest  
SynTest Technologies  
Test Advantage  
VI Technology

### DFM/DFY Software

Cadence  
Inovys  
LogicVision  
Synplicity  
VI Technology

### DFT Board Software

A.T.E. Solutions  
Accugic  
Acugen Software  
ASSET Intertech  
Corelis  
Credence Systems  
Flynn Systems  
GOEPEL Electronics



Intellitech  
JTAG Technologies  
LogicVision  
SPEA  
Teradyne  
Assembly Test Div.  
UGS PLM Software

### DFT Device Software

A.T.E. Solutions  
Acugen Software  
Cadence  
Credence Systems  
Flynn Systems  
GOEPEL Electronics  
Inovys  
LogicVision  
Mentor Graphics  
Synopsys  
SynTest Technologies  
Tesda

### Electronic Simulation Software, Board

Altium  
ANSOFT  
Geotest - Marvin Test Systems  
GOEPEL Electronics  
Intusoft  
LPKF Laser and Electronics  
Mentor Graphics

National Semiconductor  
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Paravirtual  
Texas Instruments

### Electronic Simulation Software, Device

Acugen Software  
ANSOFT  
Cadence  
Intusoft  
LPKF Laser and Electronics  
Mentor Graphics  
National Semiconductor  
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### Programming Languages

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Corelis  
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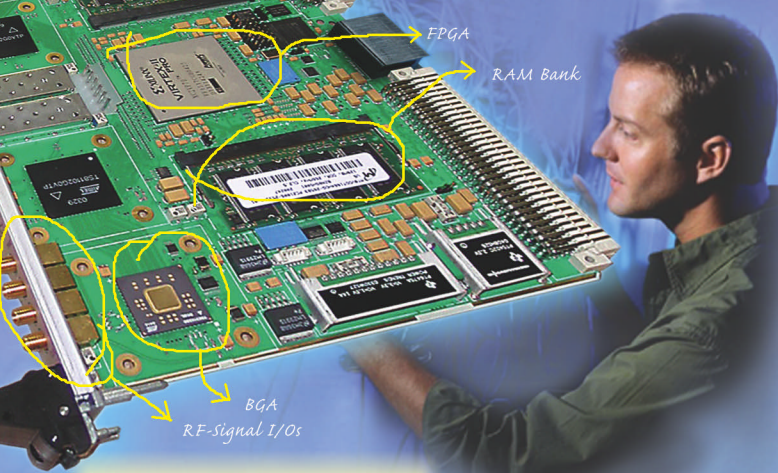


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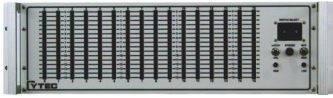


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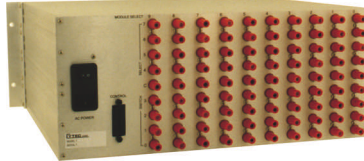
### General Purpose Test



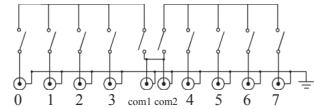
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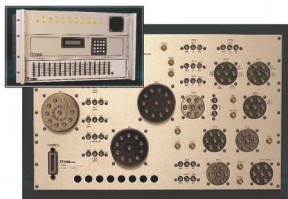
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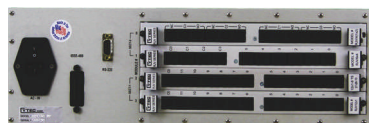
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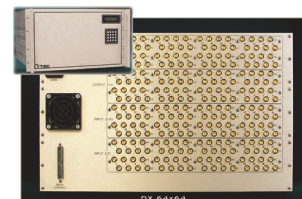
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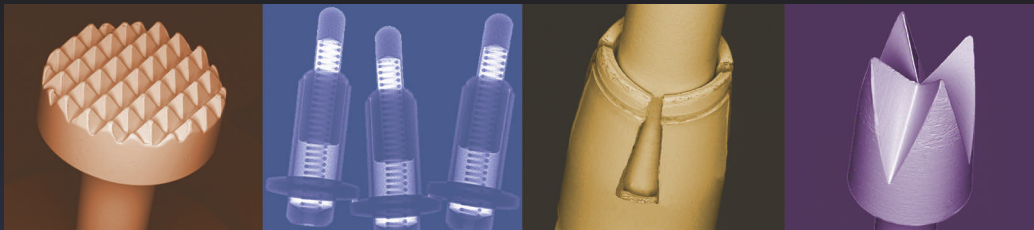
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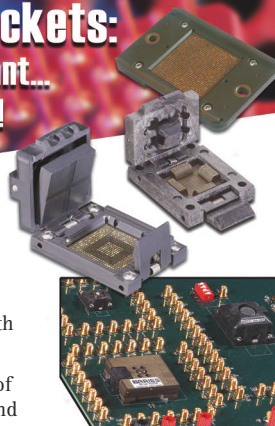
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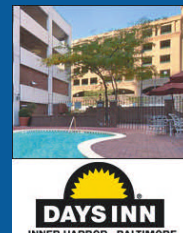
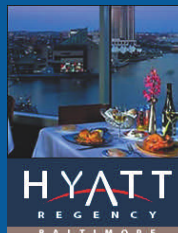
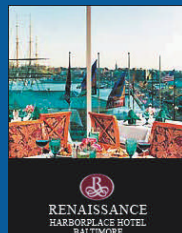


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## Agilent N9320A RF spectrum analyzer

- Frequency covers from 9 kHz to 3 GHz
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- Display average noise level -148 dBm
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- USB interface

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# COMMUNICATIONS TEST

## IN THIS SECTION

- ▷ RF/Microwave and Wireless Communications Test Equipment, see below
- ▷ Telecom/Datacom Test Equipment, p. 72
- ▷ Fiber-Optic/Electro-Optic Test Equipment, p. 76
- ▷ Third-Party Suppliers, p. 80
- ▷ Services/Labs/Test Houses, p. 80

Vendor contact information begins on p. 99.

## RF/MICROWAVE AND WIRELESS COMMUNICATIONS TEST EQUIPMENT

### Calibration Sets, Microwave

Boonton Electronics  
Cascade Microtech  
Colby Instruments  
Focus Microwaves  
Pendulum Instruments  
Rohde & Schwarz  
Storm Products—  
Microwave

### Calibrators, Antenna

A.H. Systems  
Colby Instruments

### Channel Simulators

Anite Group  
Azimuth Systems  
Leader Instruments

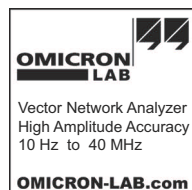
### Frequency Counters, RF/Microwave

Advantest  
Aeroflex  
Agilent Technologies  
Anritsu  
B&K Precision  
EADS N.A. Defense  
Test & Services  
Fluke  
Instek America  
National Instruments

Pendulum Instruments  
Pickering Interfaces  
Precision Test Systems  
Protek Test and  
Measurement  
Tabor Electronics

### Network Analyzers, RF/Microwave

Advantest  
Agilent Technologies  
Anritsu  
Cascade Microtech  
Giga-tronics  
JDSU  
National Instruments  
Omicron Electronics



Rohde & Schwarz

### Power Meters, RF/Microwave

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Agilent Technologies  
Anritsu  
AR, RF/Microwave  
Instrumentation  
Bird Electronic  
Boonton Electronics  
EADS N.A. Defense  
Test & Services  
ETS-Lindgren  
Focus Microwaves  
Giga-tronics  
National Instruments  
Ophir RF  
Pendulum Instruments  
Praxsym  
Precision Test Systems  
Protek Test and  
Measurement  
Rohde & Schwarz  
Schomandl  
Tektronix

### RF Field Strength Meters

AR, RF/Microwave  
Instrumentation  
Berkeley Varitronics  
Systems  
Bird Electronic  
ETS-Lindgren  
Lake Shore  
Cryotronics  
Leader Instruments  
Pendulum Instruments  
Precision Test Systems  
Schomandl  
Sencore  
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Willtek  
Communications

### Signal Analyzers, RF

Advantest  
Aeroflex  
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Anritsu

Continued >

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MI Technologies  
National Instruments  
Opticom  
Pendulum Instruments  
Pickering Interfaces  
Precision Test Systems  
Protek Test and Measurement  
Rohde & Schwarz  
Sencore  
Tektronix

Instek America  
L-3 Nova Engineering  
Leader Instruments  
MI Technologies  
Micro Lambda  
Wireless  
National Instruments  
NoiseCom  
Novatech Instruments  
Pendulum Instruments  
Pentek  
Picosecond Pulse Labs  
Praxsym  
Precision Test Systems  
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Schomandl  
Tabor Electronics  
Tektronix

**Spectrum Analyzers, RF/Microwave**  
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Aeroflex

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Berkeley Varitronics Systems  
Hameg Instruments  
Instek America  
JDSU  
National Instruments  
Pendulum Instruments  
Precision Test Systems  
Rohde & Schwarz  
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Sencore  
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Cytec  
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JFW Industries  
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Rohde & Schwarz  
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Anite Group  
Anritsu  
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MI Technologies  
National Instruments  
NoiseCom  
Pendulum Instruments  
Praxsym  
Precision Test Systems


RADCOM  
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Schomandl  
Spectracom  
Tabor Electronics  
Tektronix  
Willtek  
Communications  
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## TELECOM/DATACOM TEST


**Bit-Error-Rate Testers**  
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Catalyst Enterprises  
Centellax  
Connecticut Technology Products  
CTC-Megatel  
EXFO  
Finisar  
GL Communications

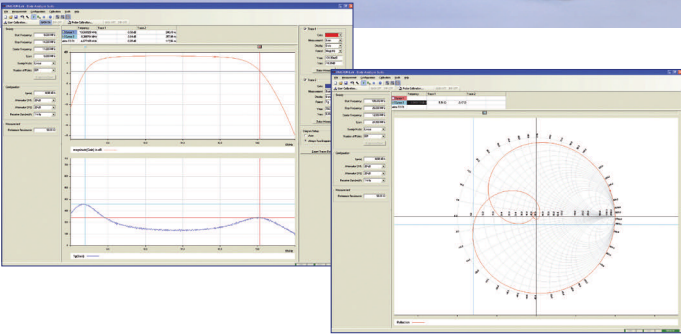
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International Data Sciences  
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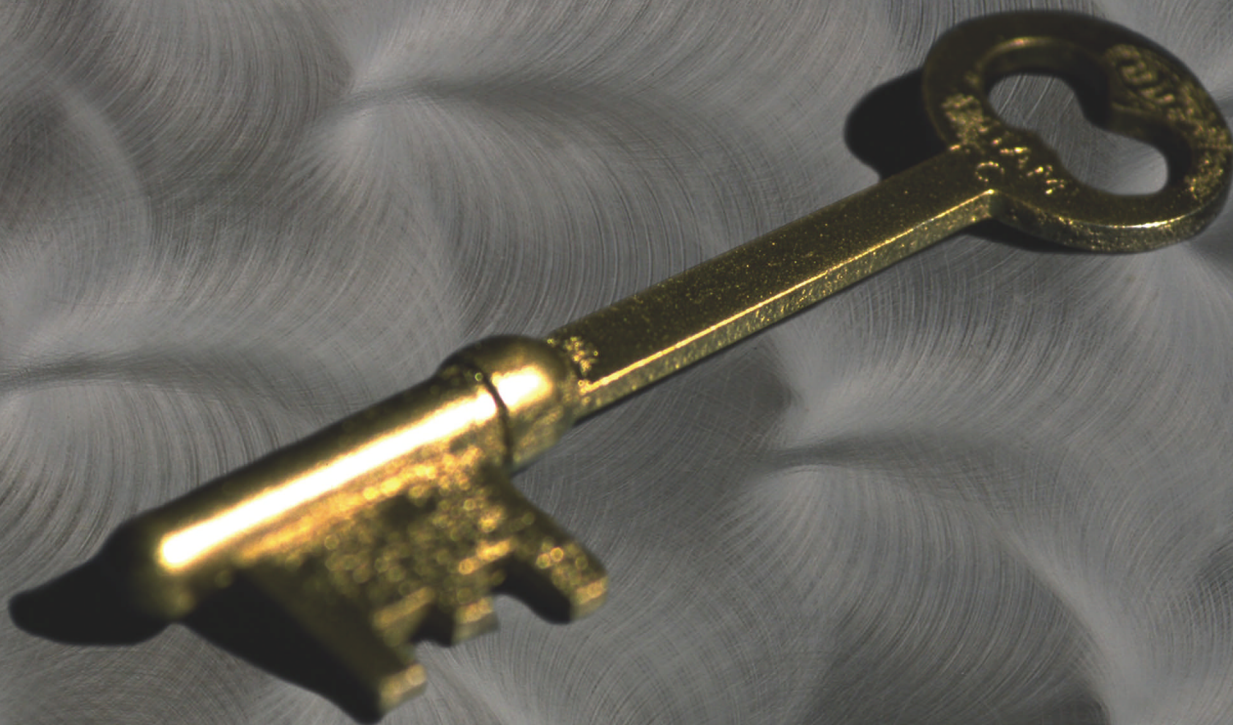
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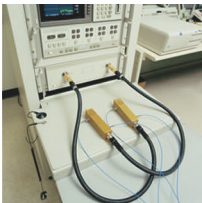
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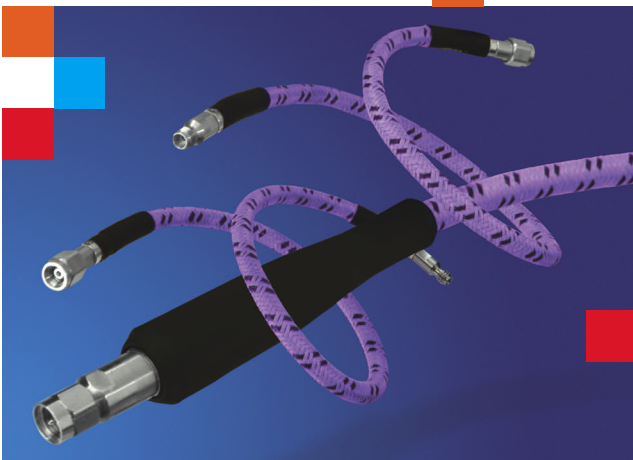
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Catalyst Enterprises  
CTC-Megatel  
EXFO  
Fluke Networks  
JDSU  
Leader Instruments  
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CTC-Megatel  
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Innocor  
International Data Sciences  
Ixia  
JDSU  
Network Instruments  
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RADCOM  
Spirent Communications  
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### Modem Testers, Cable/xDSL

Agilent Technologies  
Broadframe  
CTC-Megatel  
EXFO  
Genesys Test Engineering  
Ixia  
JDSU  
NoiseCom  
RADCOM  
Spirent Communications  
Sunrise Telecom  
Symtx  
Teradyne Assembly Test Div.  
Tracespan Communications

Agilent Technologies  
Broadframe  
CTC-Megatel  
EXFO  
Genesys Test Engineering  
Ixia  
JDSU  
Network Instruments  
QualityLogic  
RADCOM  
Spirent Communications  
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### Return-Loss Testers

Anritsu  
DiagnoSYS Systems  
EXFO  
Fluke Networks  
Genesys Test Engineering  
GL Communications  
JDSU  
Microtronix Systems  
Spirent Communications  
Sunrise Telecom  
Terahertz Technologies

### Network Test Software, Third-Party

EdenTree Technologies  
Seasolve Software

### SDH/PDH/SONET Testers

Agilent Technologies  
Anritsu  
EXFO  
GL Communications  
Innocor  
Ixia  
JDSU  
Pendulum Instruments  
RADCOM  
Spirent Communications  
Sunrise Telecom  
Teradyne Assembly Test Div.

### Packet Generators

Anritsu  
Catapult Communications  
GL Communications  
Innocor  
Ixia  
RADCOM  
Spirent Communications

### Protocol Analyzers, LAN and WAN

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Anritsu  
Benedict Computer

*Continued >*



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Communications  
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RADCOM  
Spirent  
Communications  
Symtx  
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### Telephone & DSL Line Simulators

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GL Communications  
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RADCOM  
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### Transmission Testers

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Applied Signal  
Technology  
B&K Precision  
Connecticut  
Technology Products  
CTC-Megatel  
DiagnoSYS Systems  
JDSU  
Microtronix Systems  
Pendulum Instruments  
Spirent  
Communications  
Sunrise Telecom

### VoIP & IPTV & MPEG Testers

Agilent Technologies  
Anritsu  
B&K Precision

Catapult  
Communications  
Chroma ATE  
EXFO  
Fluke Networks  
GL Communications  
Ixia  
JDSU  
Leader Instruments  
MicroImage Video  
Systems  
Microtronix Systems  
Network Instruments  
NoiseCom  
Opticom  
Photon  
Prism Sound  
QualityLogic  
Quantum Data  
RADCOM  
Rohde & Schwarz  
Sencore  
Spirent  
Communications  
Sunrise Telecom  
SyntheSys Research  
Tektronix

## FIBER-OPTIC/ELECTRO-OPTIC TEST EQUIPMENT

### Display/LED Testers

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Integral Vision  
Keithley Instruments  
Klein Instruments  
Microvision  
National Instruments  
Optomistic Products  
Radiant Imaging  
Sencore  
Test Coach

### Fault Locators

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Anritsu  
EXFO  
Fiber Instrument Sales  
JDSU  
Oz Optics  
Princetel  
Sunrise Telecom  
Symtx  
Terahertz  
Technologies

### Electro-Optics Testers

CIMTEK  
EADS N.A. Defense  
Test & Services  
EXFO  
Gigahertz-Optik  
JDSU  
Keithley Instruments  
National Instruments  
Newport  
Symtx  
Vektrex Electronic  
Systems

### Fiber-Optic Attenuators

Centellax  
EXFO  
Fiber Instrument Sales  
JDSU  
Oz Optics  
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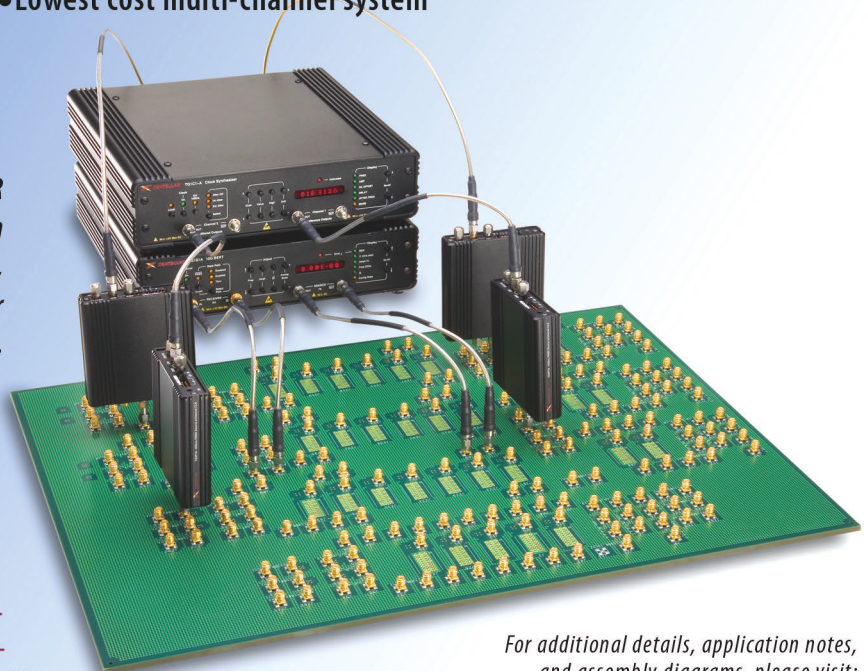


## Model No. SP10

### System Features:

- Operates from 150Mbps to 12.5Gbps
- Configurable with up to 12 generators or 6 BER testers
- Integrated jitter source for stressed eye generation
- Spread spectrum clocking for compliance testing
- PRBS patterns: 7, 10, 15, 23, 31
- Mark/space density (ratio of 0's to 1's): 1/2, 1/4, 1/8
- Generators are compact and easily placeable remotely
- Lowest cost multi-channel system

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## COMMUNICATIONS TEST

### > FIBER-OPTIC/ELECTRO-OPTIC TEST EQUIPMENT *Continued*

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EXFO  
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Fluke Networks  
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JDSU  
Newport  
OptoTest  
Oz Optics  
Princeton  
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Terahertz  
Technologies  
Ultrafast Sensors

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EXFO  
Fiber Instrument Sales  
Fluke Networks  
Gigahertz-Optik  
JDSU  
Newport  
OptoTest  
Oz Optics  
Sunrise Telecom  
Terahertz  
Technologies

#### Fiber-Optics Testers

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Telecommunications  
Agilent Technologies  
Anritsu  
CableTest Systems  
CTC-Megatel  
dBm Optics  
DIT-MCO  
International  
EXFO  
Fiber Instrument Sales  
Fluke Networks  
Ixia  
JDSU  
Luna Technologies  
National Instruments  
Newport  
OptoTest  
Photon  
Sunrise Telecom  
Symtx  
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Klein Instruments  
Newport  
Sencore

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Fiber Instrument Sales  
Fluke Networks  
Moritex USA  
OptoTest  
Oz Optics  
PerkinElmer  
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#### Loss Test Sets

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EXFO  
Fiber Instrument Sales  
Fluke Networks  
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Newport  
Oz Optics  
Photon  
Princeton  
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Edmund Optics  
EXFO  
Gigahertz-Optik  
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dBm Optics  
EXFO  
JDSU  
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#### Optical Power Meters

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Agilent Technologies  
Anritsu  
CTC-Megatel  
dBm Optics  
Edmund Optics  
EXFO  
Fiber Instrument Sales  
Fluke Networks  
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ILX Lightwave  
JDSU  
Newport  
OptoTest  
Oz Optics  
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dBm Optics  
EXFO  
Instrument Systems  
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#### Optical Switches

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EXFO  
Fiber Instrument Sales  
ILX Lightwave  
Ixia  
JDSU  
Keithley Instruments  
MRV Communications  
Newport  
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Piezosystem Jena  
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VXI Technology

#### Optical Time Domain Reflectometers

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Telecommunications  
Agilent Technologies  
Anritsu  
EXFO  
Fiber Instrument Sales  
JDSU  
Luna Technologies  
Sunrise Telecom

#### Photometers & Radiometers

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EXFO  
Gigahertz-Optik  
Instrument Systems  
International Light  
Klein Instruments  
Newport  
Photon  
Pyrometer Instrument  
Radiant Imaging  
Terahertz  
Technologies

#### Wavelength Meters

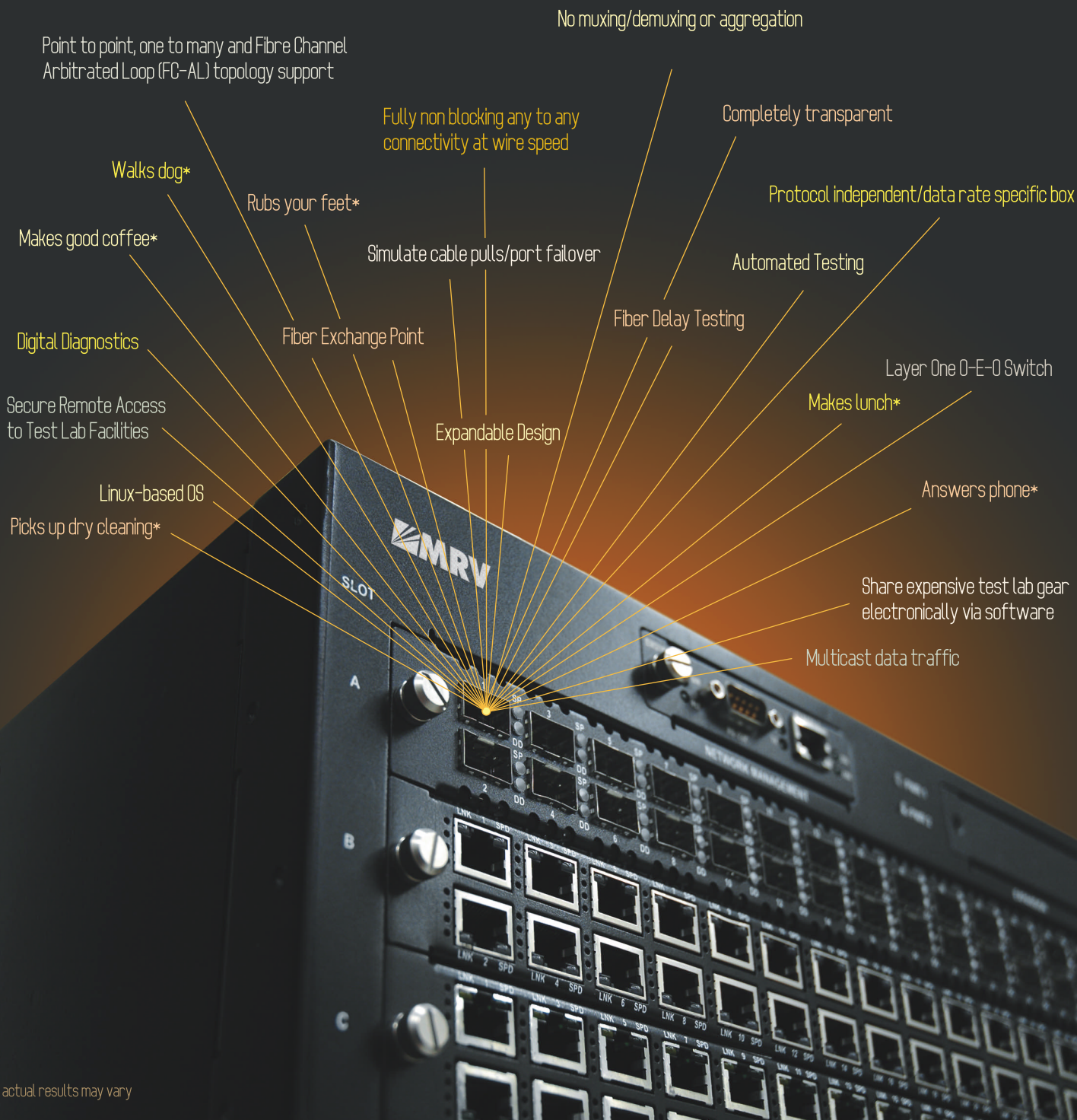
Agilent Technologies  
EXFO  
Newport

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# At times, nothing could be better than a free port

( Especially when that port can do so much )



\* actual results may vary

## Test Automation with a Physical Layer Switch

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Bell Electronics NW  
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PTL Test Equipment  
TechRecovery  
Test Equipment  
Connection  
Test Equipment  
Solutions Today  
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Avalon Equipment  
Bell Electronics NW  
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Fiber Instrument Sales

### Training— RF/Microwave/ Wireless Test

A.T.E. Solutions  
MI Technologies  
Rohde & Schwarz  
Test Site Services  
Willtek  
Communications

### Training— Telecom/ Datacom Test

A.T.E. Solutions  
EXFO  
Opticom  
QualityLogic  
Spirent  
Communications  
Test Site Services

### Used Equipment— FO/EO Test

Atlantic Coast  
Instruments  
Bizi International  
Creative Devices  
Electro Rent  
EXFO  
Fiber Instrument Sales  
Industrial Resources  
LabX

MetricTest  
Microlease  
Naptech Test  
Equipment  
ORIX Rentec USA  
PTL Test Equipment  
TechRecovery  
Test & Measurement  
Global Exchange  
Test Equipment  
Connection  
TestMart  
Trek Equipment  
TRS-RenTelco

### Used Equipment— RF/Microwave/ Wireless Test

Advanced Test  
Equipment Rentals  
Atlantic Coast  
Instruments  
Avalon Equipment  
Bell Electronics NW  
Bizi International  
Continental Resources  
Electro Rent  
Industrial Resources  
LabX  
MetricTest  
Microlease  
Naptech Test  
Equipment  
ORIX Rentec USA  
PTL Test Equipment  
Rohde & Schwarz  
Sencore  
TechRecovery  
Test & Measurement  
Global Exchange  
Test Equipment  
Connection  
Test Equipment  
Solutions Today  
TestEquity  
TestMart  
Trek Equipment  
TRS-RenTelco  
Tucker Electronics  
Tyrosys  
Willtek  
Communications

### Used Equipment— Telecom/ Datacom Test

Advanced Test  
Equipment Rentals  
AssetRelay  
Atlantic Coast  
Instruments  
Avalon Equipment  
Bell Electronics NW  
Continental Resources  
Electro Rent  
EXFO  
Industrial Resources  
LabX

MetricTest  
Microlease  
Naptech Test  
Equipment  
ORIX Rentec USA  
PTL Test Equipment  
TechRecovery  
Test Equipment  
Connection  
Test Equipment  
Solutions Today  
TestEquity  
TestMart  
Trek Equipment  
TRS-RenTelco  
Tucker Electronics

## SERVICES/LABS/TEST HOUSES

### Fiber-Optic Testing Services

Agilent Technologies  
Amkor Technology  
Averna  
Bloomy Controls  
Invisar  
Mindready Solutions  
National Technical  
Systems  
Symtx

### Telecom Testing Services

Agilent Technologies  
Amkor Technology  
Averna  
Bloomy Controls  
Communication  
Certification  
Laboratory  
D.L.S. Electronic  
Systems  
Elite Electronic  
Engineering  
Genesys Test  
Engineering  
GL Communications



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Mindready Solutions  
National Technical  
Systems  
Oneida Research  
Services  
QualityLogic

Symtx  
Sypris Test &  
Measurement  
Test Site Services  
TestEdge  
TUV Rheinland of  
North America  
TUV SUD America  
VI Technology

### Wireless Testing Services

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Amkor Technology  
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Laboratory  
D.L.S. Electronic  
Systems



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National Technical  
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QualityLogic  
Test Site Services  
TestEdge  
TUV SUD America  
VI Technology

T&MW



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**"IT'S MAGIC!"** . . . was one customer's reaction in response to the all-parameter measurement capabilities of our **Optical Vector Analyzer (OVA)**, the leading chromatic and polarization-mode dispersion (CD/PMD) tool on the market. The same could be said of our **Optical Backscatter Reflectometer (OBR)**, the industry-leading high resolution, high-sensitivity optical time domain reflectometer (OTDR); or our Distributed Sensing System (DSS), that allows high-resolution temperature and strain mapping using standard telecom grade fiber as the sensor, no specialty fiber, no Bragg gratings!

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Visit [www.lunatechnologies.com](http://www.lunatechnologies.com) to find out more about how to solve your difficult measurement challenges, learn about modern fiber system impairments like chromatic dispersion and PMD, or download one of our archived webinars.



**Optical Backscatter Reflectometer (OBR)**

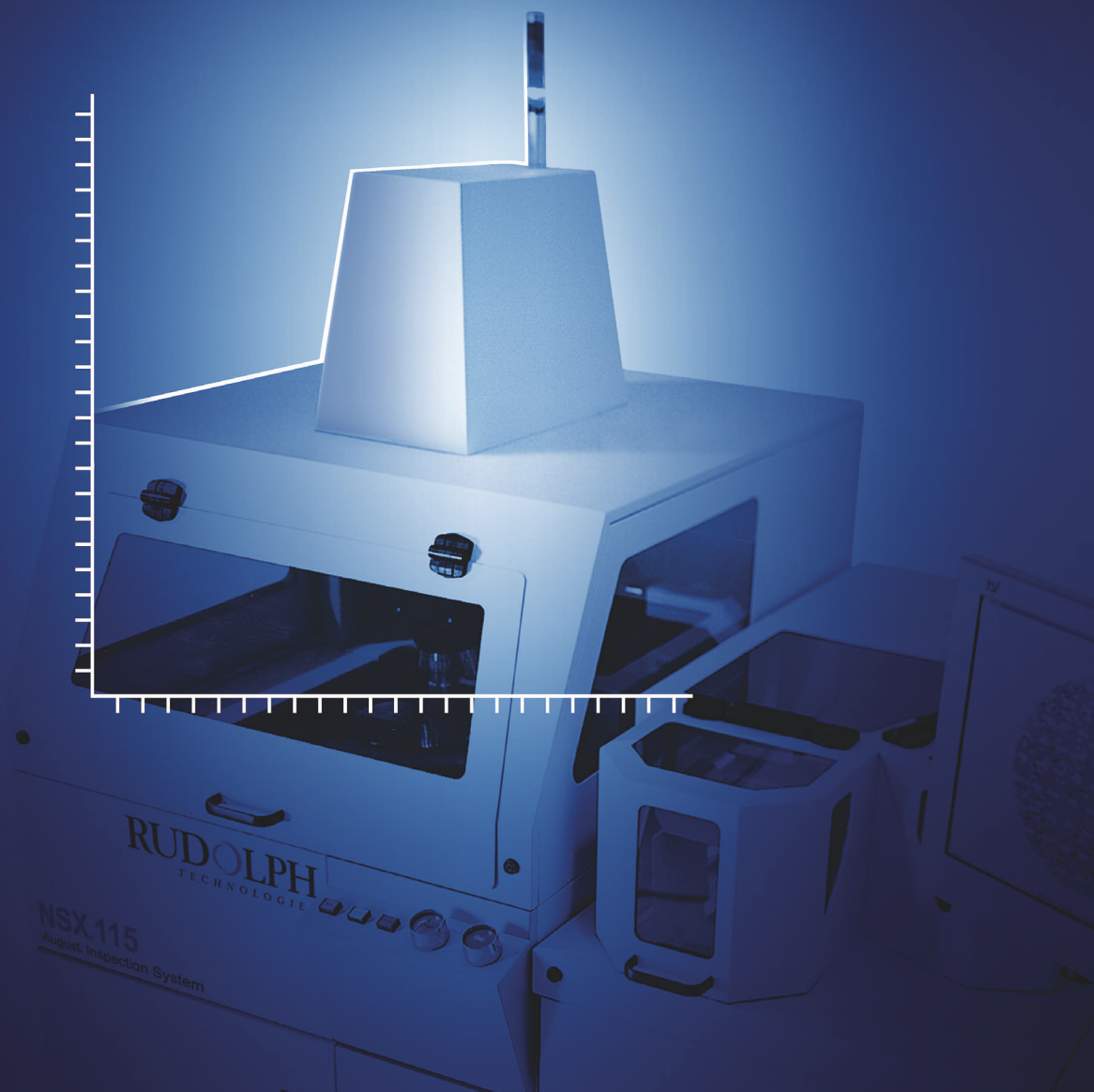
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## IN THIS SECTION

- ▷ Machine-Vision & Inspection Equipment, below
- ▷ Machine-Vision Software, p. 90
- ▷ Third-Party Suppliers, p. 91
- ▷ Services/Labs/Test Houses, p. 91

*Vendor contact information begins on p. 99.*

## MACHINE VISION & INSPECTION EQUIPMENT

### CAD Navigation Tools

Credence Systems  
Unisoft

### Camera Cables

Amphenol  
Basler Vision Technologies  
Cognex  
The Imaging Source  
Intercon 1  
MicroImage Video Systems  
National Instruments

### Cameras, Area Scan

Adimec  
Basler Vision Technologies  
Cognex  
Dalsa  
DRS Data & Imaging Systems  
EPIX  
Hamamatsu  
Illunis  
The Imaging Source  
Imperx  
JAI  
KAPPA opto-electronics  
Leutron Vision  
Lumenera  
MicroImage Video Systems  
NAC Image Technology  
National Instruments  
Panasonic Vision Systems  
Photron  
Pixelink  
Point Grey Research  
PPT Vision  
Rad-Icon Imaging  
Redlake  
Sentech America  
Silicon Imaging  
Sony Electronics

Thermo Fisher Scientific

Videology Imaging Solutions  
Vision Components  
Wintriss Engineering

### Cameras, Line Scan

Basler Vision Technologies  
Cognex  
Dalsa  
EPIX  
Hamamatsu  
JAI  
Lord Ingenierie  
PerkinElmer Optoelectronics  
Sentech America  
Vision Components  
Wintriss Engineering

### Cameras, Microscope

Basler Vision Technologies  
Carl Zeiss MicroImaging  
Chroma ATE  
Huntron  
The Imaging Source  
KAPPA opto-electronics  
Lumenera  
NAC Image Technology  
Nikon Instruments  
Olympus America  
Panasonic Vision Systems  
Photron  
QIOPTIQ Imaging Solutions  
Redlake  
Sentech America  
Silicon Imaging  
Sony Electronics  
Tamar Technology  
Vision Engineering  
WESCO

### Coordinate/Dimensional Measuring Equipment

Aerotech  
Immersion  
KAPPA opto-electronics  
MicroImage Video Systems  
Micro-Metric  
Micro-Vu  
Mitutoyo America  
Optical Gaging Products  
Polytec  
QIOPTIQ Imaging Solutions  
RAM Optical Instrumentation  
Rudolph Technologies  
Solarius Development  
Sony Manufacturing Systems America  
Tamar Technology  
Ultrafast Sensors  
View Engineering  
Vision Engineering  
WESCO

### Focused Ion Beam Systems

Credence Systems  
FEI  
JEOL USA

### Frame Grabbers

Active Silicon  
Adlink Technology  
Alacron  
BitFlow  
Carl Zeiss MicroImaging  
Cognex  
Dalsa  
Data Translation  
EPIX  
Euresys  
Foresight Imaging  
The Imaging Source

*Continued >*

## Versatile PCIe Acquisition Platform

Introducing X64 Xcelera—Next Generation Acquisition/Processing Technology



NEW X64 Xcelera

DALSA's **Xcelera Series** is defining next generation frame grabber capabilities with the ability to deliver bandwidth of 1GB/sec over multiple-lane PCI Express implementations with room to grow—from entry level frame grabbers, to high-performance image acquisition boards, to embedded vision processors.

### Xcelera Series frame grabbers feature:

- Transfer rates of up to 1GB/sec from image to host
- Uncompromising real-time FPGA acceleration
- Combines shading correction with output lookup tables
- Bayer decoding with gamma correction and white balance
- Windows XP, XP 64-bit, and Vista compatibility
- Trigger-to-Image-Reliability
- Integrated GIOs for real-time external events
- ROHS compliant

Download our Technology Primer:  
"PCI Express Advances Machine Vision"  
[www.dalsa.com/xcelera/217](http://www.dalsa.com/xcelera/217)

sensors | cameras | **frame grabbers**  
processors | software | vision solutions

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# AEROTECH AIR BEARING

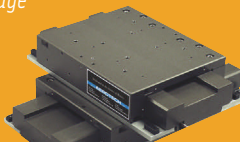
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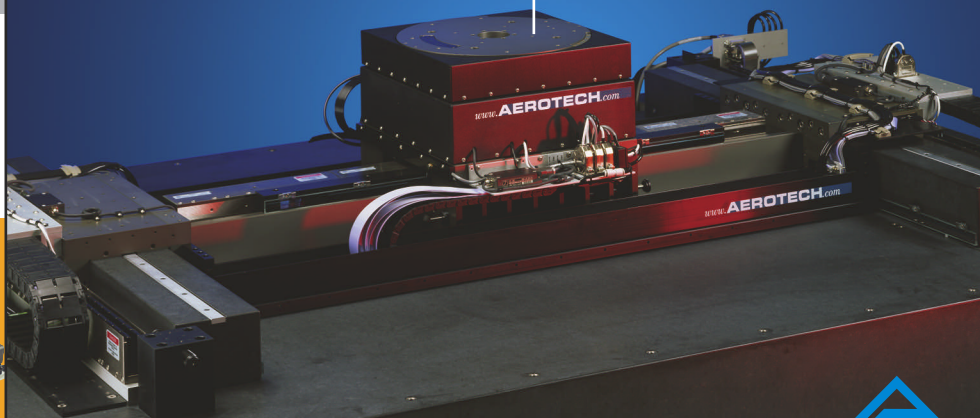


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Area Scan Cameras

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- Unique cooling system dissipates heat efficiently and keeps noise levels low during prolonged camera use
- AOI adjustments provide a linear speed increase for even faster imaging



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## > MACHINE VISION & INSPECTION EQUIPMENT *Continued*

Imperx  
KAPPA opto-electronics  
Leutron Vision  
Matrox Imaging  
MicroImage Video Systems  
National Instruments  
PerkinElmer Optoelectronics  
Pleora Technologies  
Siemens

### Inspection Systems for Packaged Devices

AccuSentry  
Checksum  
Comet North America  
Dage Precision Industries  
Dalsa  
DiagnoSYS Systems  
Edmund Optics  
Integral Vision  
Micromanipulator  
Micro-Vu  
OptoMetrix  
phoenix x-ray Systems + Services  
QIOPTIQ Imaging Solutions  
RVSI Inspection  
Smart Sonic  
View Engineering  
WESCO  
Wintriss Engineering  
X-TEK Group  
YesTech  
Zygo

### Inspection Systems for PCBs/Hybrids

AccuSentry  
Aerotech  
Agilent Technologies  
Chroma ATE  
Comet North America  
DiagnoSYS Systems  
Edmund Optics  
GOEPEL Electronics  
GSI Lumonics  
Landrex Technologies  
Machine Vision Products  
Metron Optics  
Micromanipulator  
Micro-Vu  
Omron Electronics  
Optical Gaging Products

Panasonic Factory Solutions Company of America  
phoenix x-ray Systems + Services  
QIOPTIQ Imaging Solutions  
RVSI Inspection  
ScanCAD International  
Seica  
Smart Sonic  
Sony Manufacturing Systems America  
Teradyne Assembly Test Div.  
Test Research  
Testronics  
View Engineering  
Viscom  
Vision Engineering  
WESCO  
X-TEK Group  
YesTech

### Inspection Systems for Wafers/Dies

AccuSentry  
Aerotech  
Ambios Technology  
Comet North America  
Dalsa  
Edmund Optics  
Hamamatsu  
Integral Vision  
JEOL USA  
Lake Shore Cryotronics  
Micromanipulator  
Micro-Vu  
Nikon Instruments  
Olympus America  
OptoMetrix  
Panasonic Factory Solutions Company of America  
phoenix x-ray Systems + Services  
Phoseon Technology  
QIOPTIQ Imaging Solutions  
Rudolph Technologies  
RVSI Inspection  
ScanCAD International  
Tamar Technology  
View Engineering  
Viscom  
Vision Engineering  
WESCO  
Zmation  
Zygo

### Inspection Systems, Thermal/Infrared

FLIR Systems  
Hamamatsu  
Ircon  
Monarch Instrument  
Phoseon Technology  
QIOPTIQ Imaging Solutions

### Inspection Systems, Video

AccuSentry  
Aerotech  
Agilent Technologies  
Carl Zeiss MicroImaging  
Dalsa  
Edmund Optics  
Huntron  
Image Labs International  
KAPPA opto-electronics  
Keyence  
Landrex Technologies  
Matrox Imaging  
Meiji Techno America  
MicroImage Video Systems  
Micro-Metric  
Micro-Vu  
Moritex USA  
NAC Image Technology  
Navitar  
Nikon Instruments  
Optical Gaging Products

Panasonic Vision Systems  
Photron  
QIOPTIQ Imaging Solutions  
RAM Optical Instrumentation  
Redlake  
Rudolph Technologies  
Silicon Imaging  
Tamar Technology  
Unitron  
View Engineering  
Vision Engineering  
Volpi USA  
WESCO  
Zmation

### Inspection Systems, X-Ray

Aerotech  
Agilent Technologies

*Continued >*

# Superior Imaging at High Frame Rates

NEW Falcon 4M60 SA



**DALSA's Falcon Series** cameras feature frame rates of up to 62 fps in 8 or 10 bit output to increase throughput and allow you to inspect more in less time. Combined with up to 4 megapixel resolution and true global (non-rolling) or electronic shutter, Falcon cameras deliver low noise and fast, smear-free image capture.

### Falcon Series cameras feature:

- 2 or 4 megapixel resolution
- Exposure control
- Flat Field Correction (FFC)
- 1000x anti-blooming
- Up to 62 fps
- Higher frame rates through vertical windowing
- Monochrome or color imaging

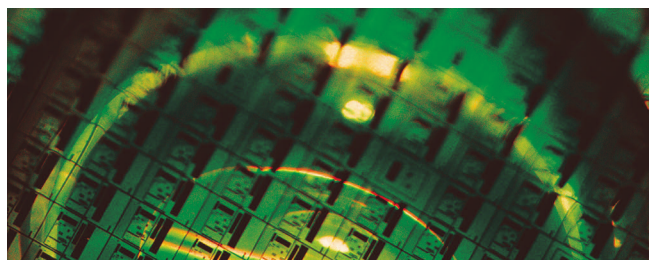
<b>Falcon 2M30 SA</b>	1600 x 1200 or 1920 x 1080	34 fps	Mono
<b>Falcon 4M15 SA</b>	2048 x 2048	16 fps	Mono or Color
<b>Falcon 4M30 SA</b>	2352 x 1728	34 fps	Mono
<b>Falcon 4M60 SA</b>	2352 x 1728	62 fps	Mono

Download our Technology Primer: "5 Critical Factors for Choosing Digital Image Capture Technology" [www.dalsa.com/falcon/2t7](http://www.dalsa.com/falcon/2t7)

sensors | cameras | frame grabbers  
processors | software | vision solutions



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### > MACHINE VISION & INSPECTION EQUIPMENT *Continued*

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 Glenbrook Technologies  
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 phoenix x-ray Systems + Services  
 Rad-ikon Imaging  
 Sens-Tech  
 Teradyne Assembly Test Div.  
 Viscom  
 X-TEK Group  
 YesTech

#### Inspection Targets/Grids

AccuSentry  
 Geller Microanalytical Lab  
 MicrolImage Video Systems  
 Redlake

#### Lenses, Camera

Carl Zeiss  
 Microlmaging  
 Cognex  
 CVI Melles Griot  
 The Imaging Source  
 LINOS Photonics  
 Navitar  
 Photron  
 QIOPTIQ Imaging Solutions  
 Rolyn Optics  
 Sentech America  
 Tamron USA  
 Volpi USA  
 WESCO

#### Lenses, Microscope

Anchor Optics  
 Carl Zeiss  
 Microlmaging  
 CVI Melles Griot  
 The Imaging Source  
 Infinity Photo-Optical  
 Meiji Techno America  
 Mitutoyo America  
 Navitar  
 Nikon Instruments  
 Olympus America  
 QIOPTIQ Imaging Solutions  
 Rolyn Optics  
 RVS Inspection  
 Unitron  
 WESCO

#### Lighting, Machine-Vision

AccuSentry  
 Advanced Illumination  
 Cognex  
 Fiberoptic Systems

*Continued >*

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Form Factor	PCI-X® or x1 PCIe™	PCI-X® or x4 or x1 PCIe™	PCI-X® or x4 PCIe™	x4 PCIe™
Acquisition Type	Camera Link® (Base)	Standard and non-standard analog	Camera Link® (Base, Medium, Full)	GigE Vision™
	Features an optional, customizable FPGA-based processing core to accelerate or off-load image processing tasks.			

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## MACHINE VISION & INSPECTION

### > MACHINE VISION & INSPECTION EQUIPMENT *Continued*

The Imaging Source  
Integral Vision  
Monarch Instrument  
PerkinElmer  
Optoelectronics  
Phlox  
QIOPTIQ Imaging  
Solutions  
Schott North America  
Siemens  
StockerYale  
Sunnex  
Tamar Technology  
Volpi USA  
WESCO  
Wintriss Engineering

Sunnex  
Tamar Technology  
Volpi USA  
WESCO

#### Magnifiers

GEI International  
QIOPTIQ Imaging  
Solutions  
Sunnex  
Vision Engineering

#### Microscopes, Accessories

Carl Zeiss  
MicroImaging  
Creative Devices  
Geller Microanalytical  
Lab  
Infinity Photo-Optical  
Meiji Techno America  
Micromanipulator  
Mitutoyo America  
Piezosystem Jena  
Prior Scientific  
QIOPTIQ Imaging  
Solutions

Rolyn Optics  
Tamar Technology  
Unitron  
Vision Engineering  
WESCO  
Zygo

#### Microscopes, Electron

FEI  
JEOL USA

#### Microscopes, Emission

Hamamatsu

#### HAMAMATSU

#### Failure Analysis Systems

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Micromanipulator  
QIOPTIQ Imaging  
Solutions

#### Microscopes, Optical

Anchor Optics  
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MicroImaging  
Chroma ATE  
Credence Systems  
Edmund Optics  
Fiber Instrument Sales  
GEI International  
Infinity Photo-Optical  
Klein Instruments  
Meiji Techno America  
Metron Optics  
Mitutoyo America  
Nikon Instruments  
Olympus America  
Optical Gaging  
Products  
Prior Scientific  
QIOPTIQ Imaging  
Solutions  
RAM Optical  
Instrumentation  
Rolyn Optics  
Rudolph Technologies

*Continued >*

## The CONNECTION has been made!

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**Gig E**

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# ANALYSIS FAILURE

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  - Highly sensitive observation of low voltage devices
- Full-featured optics • High resolution, custom InGaAs detector
  - True thermal InSb • Improved Hamamatsu laser system

[www.hps-systems.com](http://www.hps-systems.com)



*Tester Direct Docking Type*



*Backside Prober Type*

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## > MACHINE VISION & INSPECTION EQUIPMENT *Continued*

Sciencescope  
International  
Unitron  
Vision Engineering  
WESCO  
WITec Instruments  
Zygo

**Microscopes,  
Scanning Probe**  
Ambios Technology  
JEOL USA  
Multiprobe  
OptoMetrix  
QIOPTIQ Imaging  
Solutions

Ultrafast Sensors  
WITec Instruments  
  
**Optical  
Comparators**  
GEI International  
Metron Optics  
Micro-Vu  
Mitutoyo America

Nikon Instruments  
Optical Gaging  
Products  
QIOPTIQ Imaging  
Solutions  
Rudolph Technologies  
Sencore  
Smart Sonic  
Vision Engineering

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Stages and  
Tables**  
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CIMTEK  
Dynamic Solutions  
EXFO  
MI Technologies  
Micromanipulator  
Piezosystem Jena  
Prior Scientific  
Suss MicroTec  
Tamar Technology  
TDK RF Solutions  
Zmotion

JEOL USA  
Mitutoyo America  
Olympus America  
Optical Gaging  
Products  
QIOPTIQ Imaging  
Solutions  
Smart Sonic  
Solarius Development  
Tamar Technology  
Ultrafast Sensors  
Wintriss Engineering  
Zygo

**Vision Sensors**  
Cognex

**Sample  
Preparation  
Equipment**  
JEOL USA

**Surface-  
Analysis/Profiling  
Equipment**  
Ambios Technology  
Carl Zeiss  
MicroImaging  
Geller Microanalytical  
Lab

Dalsa  
Integral Vision  
Omron Electronics  
QIOPTIQ Imaging  
Solutions  
Sentech America  
Siemens  
Teledyne Scientific &  
Imaging  
Vision Components  
Wintriss Engineering  
Zmotion

## MACHINE-VISION SOFTWARE

### Image-Analysis Software

BitFlow  
Carl Zeiss  
MicroImaging  
Cognex  
Comet North America  
Dalsa  
Data Translation  
DRS Data & Imaging  
Systems  
DSP Development  
EPIX  
Euresys  
Golden Software  
Integral Vision  
Ircon  
KAPPA opto-  
electronics  
Landrex Technologies  
The MathWorks  
Matrox Imaging  
Micromanipulator  
Microsys Technologies  
MVTec Software  
National Instruments  
NorPix  
Olympus America  
Pixelink  
Sensor Products  
Test Advantage

### Machine-Vision Software

Adlink Technology  
Averna  
BitFlow  
CIMTEK  
Cognex  
Dalsa  
Data Translation  
EPIX  
Euresys  
GOEPEL Electronics  
The Imaging Source  
Ircon  
Landrex Technologies  
Matrox Imaging  
MVTec Software  
National Instruments  
NorPix  
Pixelink  
Pleora Technologies  
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International  
Stemmer Imaging  
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## THIRD-PARTY SUPPLIERS

### Distributors— Inspection Equipment

Aegis Electronic Group  
Creative Devices  
Firstsight Vision  
Image Labs International  
Infrared USA  
Macrotron Scientific Engineering  
Madell Technology  
Miller Industrial  
Mitutoyo America  
NET USA  
Silicon Imaging  
Stanley  
Stemmer Imaging  
Terra Universal

### Rental/Lease— Inspection Equipment

Advanced Test Equipment Rentals  
Agilent Technologies  
Industrial Resources  
Microlease  
ORIX Rentec USA  
TRS-RenTelco

### Training— Inspection

A.T.E. Solutions  
Matrox Imaging  
phoenix x-ray Systems + Services  
Sypris Test & Measurement

### Used Equipment— Inspection

Agilent Technologies  
Comet North America  
Creative Devices  
FLIR Systems  
Industrial Resources  
K & Us Equipment  
NEA  
Olympus America  
ORIX Rentec USA  
phoenix x-ray Systems + Services  
Teradyne  
Assembly Test Div.  
TRS-RenTelco

## SERVICES/LABS/TEST HOUSES

### Inspection Services

Agilent Technologies  
Amkor Technology  
Averna  
Comet North America  
Geller  
Microanalytical Lab  
Glenbrook Technologies  
GOEPEL Electronics  
Nevada Automotive Test Center  
Oneida Research Services  
phoenix x-ray Systems + Services

Pikes Peak Test Labs  
Premier Semiconductor Services  
Product Safety Consulting  
QIOPTIQ Imaging Solutions  
Southwest Research Institute  
Sypris Test & Measurement  
TUV SUD America  
V.J. Electronix  
Vision Systems International  
X-TEK Group  
Zygo

T&MW

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**Triggered Image Sequence Capture**  
**64-Bit Memory Addressing**  
**Camera Integration & Async Reset Control**  
**Video Sequence Capture** to Memory or Disk  
**XCAP-Lite** Software Included with PIXCI® EC1 Purchase  
**Windows & Linux** Compatible  
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Flow & Motion Analysis, Cine-loop  
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Stereo thru Eight-Camera Imaging  
Calibrated measurement  
Particle Analysis, Counting & Tracking  
**XCALIB C/C++ \$495** Royalty Free Programming Library provides multiple frame grabber control with FIFOs, sequence capture, dual buffer, triggered capture, and image display.

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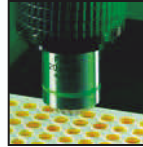
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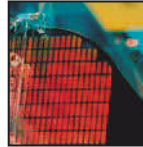
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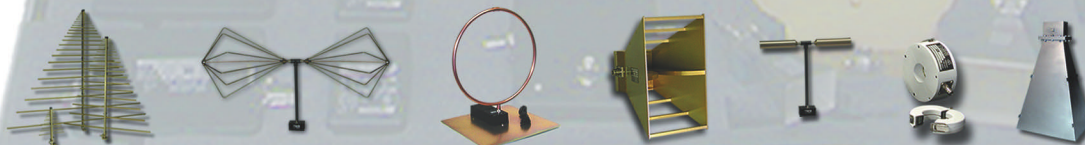
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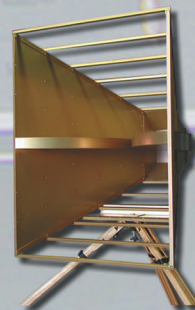
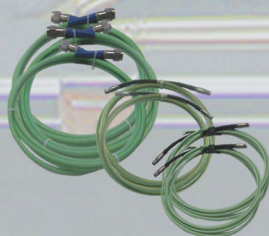


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# ELECTRICAL & PHYSICAL ENVIRONMENTAL TEST

## IN THIS SECTION

- ▷ Environmental Test Equipment, below
- ▷ EMC Test Equipment, p. 94
- ▷ ESD Control/Protection, p. 96
- ▷ Third-Party Suppliers, p. 96
- ▷ Services/Labs/Test Houses, p. 97

Vendor contact information begins on p. 99.

## ENVIRONMENTAL TEST EQUIPMENT

### Burn-In Trays/ Sockets

Aehr Test Systems

Antares Advanced  
Test Technologies

Aries Electronics

Armel Electronics

Emulation Technology

Ironwood Electronics

Micro Control

3M Electronics

Plastronics

RS Tech

Sharetree Systems  
Yamaichi Electronics

### Burn-In/ Screening Equipment

Advint

Aehr Test Systems

Associated  
Environmental  
Systems

Burnsco Technologies

C&H Technologies

Chart Industries

CIMTEK

Cincinnati Sub-Zero

Despatch Industries

Dynamic Solutions

EADS N.A. Defense  
Test & Services

Environment  
Associates

ESPEC

GOEPEL Electronics

HALT&HASS Systems

Integrated  
Technology Corp.

LR Environmental  
Equipment

m + p international  
M/RAD

Micro Control

Sharetree Systems

Sigma Systems

Sun Electronic  
Systems

Symtx

Temprotron

Thermal Product  
Solutions

Thermionics

Thermotron Industries

Vektrex Electronic  
Systems

VXI Technology

### Humidity Test Equipment

AEMC Instruments

Associated  
Environmental  
Systems

Carltext International

Cincinnati Sub-Zero

Computer Aided  
Solutions

Despatch Industries  
Environment  
Associates

Environmental  
Specialties

Envirotronics

ESPEC

Monarch Instrument

Q-Lab

Rotronic Instrument

Saelig

Sharetree Systems

Sigma Systems

Symtx

Telatemp

Terra Universal

Thermal Product  
Solutions

Thermotron Industries

### Pressure Test Equipment

Cincinnati Sub-Zero

Envirotronics

ESPEC

EST Testing Solutions

Monarch Instrument  
Neff Instrument  
Symtx  
Thermal Product  
Solutions  
Thermotron Industries

### Radiation Test Equipment

Berkeley Nucleonics  
Q-Lab

### Temperature Test Equipment

Aehr Test Systems

AEMC Instruments

Associated  
Environmental  
Systems

Burnsco Technologies

Campbell Scientific

Carltext International

Chart Industries

Cincinnati Sub-Zero

Computer Aided  
Solutions

Continued >

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# ELECTRICAL & PHYSICAL ENVIRONMENTAL TEST

## > ENVIRONMENTAL TEST EQUIPMENT *Continued*

Despatch Industries	FTS Systems	Monarch Instrument	Sharetree Systems
Dynamic Solutions	HALT&HASS Systems	Nanotran	Sigma Systems
Environment Associates	IOtech	Neff Instrument	Sovtest
Environmental Specialties	LR Environmental Equipment	Nevada Automotive Test Center	Sun Electronic Systems
Envirotronics	m + p international	Q-Lab	Symtx
ESPEC	Materials Development	QualiTau	Telatemp
EST Testing Solutions	Micromanipulator	Rotronic Instrument	Temptronic
		Saelig	Terra Universal

TestEquity	IMV
Thermal Product Solutions	Instron
Thermionics	Instrumented Sensor Technology
Thermotron Industries	IOtech
Trio-Tech International	L.A.B. Equipment
VXI Technology	LDS Test and Measurement
Xitron Technologies	Ling Electronics
	m + p international
	M/RAD
	Monarch Instrument
	MTI Instruments
	National Instruments
	Neff Instrument
	OROS
	Photron
	Polytec
	Sciometric Instruments
	Signalysis
	Sovtest
	Symtx
	TEAM
	Thermal Product Solutions
	Thermotron Industries
	Unholtz-Dickie
	Vibration Research
	VXI Technology

## Vibration Test Equipment

Agilent Technologies	Monarch Instrument
Associated Environmental Systems	MTI Instruments
B&W Engineering	National Instruments
Bruel & Kjaer, N.A.	Neff Instrument
CableTest Systems	OROS
Campbell Scientific	Photron
Chart Industries	Polytec
Data Physics	Sciometric Instruments
Despatch Industries	Signalysis
Dynamic Solutions	Sovtest
Electronic Systems of Wisconsin	Symtx
Environment Associates	TEAM
Envirotronics	Thermal Product Solutions
EST Testing Solutions	Thermotron Industries
GHI Systems	Unholtz-Dickie
HALT&HASS Systems	Vibration Research
	VXI Technology

## EMC TEST EQUIPMENT

### Anechoic Chambers/ GTEM/TEM Cells

AR, RF/Microwave Instrumentation
Cuming Lehman Chambers
ETS-Lindgren
TDK RF Solutions
Teseq

### Antennas/Masts

A.H. Systems
AR, RF/Microwave Instrumentation
Com-Power
Electro-Metrics
ETS-Lindgren
Rohde & Schwarz
TDK RF Solutions
Teseq

### Electrostatic Discharge Generators

AR, RF/Microwave Instrumentation
Electro-Tech Systems
HV Technologies
Kikusui America
Noise Laboratory
Ross Engineering
Teseq
Thermo Scientific

### EMC Test Software

AR, RF/Microwave Instrumentation
ETS-Lindgren
Mentor Graphics
Quantum Change
Rohde & Schwarz
TDK RF Solutions

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**America**

## > EMC TEST EQUIPMENT *Continued*

### EMI Receivers

Agilent Technologies  
AR, RF/Microwave  
Instrumentation  
ETS-Lindgren  
Rohde & Schwarz  
Teseq

### EMI Susceptibility Testers

AR, RF/Microwave  
Instrumentation  
Com-Power  
HV Technologies  
Noise Laboratory  
NoiseCom  
Quantum Change  
TDK RF Solutions  
Teseq  
Thermo Scientific

### Harmonics & Flicker Testers

AR, RF/Microwave  
Instrumentation  
California Instruments  
Elgar Electronics  
Hioki USA  
HV Technologies  
Kikusui America  
Xitron Technologies  
Yokogawa Corp. of  
America

### Precompliance Test Kits

A.H. Systems  
Com-Power  
Electro-Metrics  
ETS-Lindgren  
Hameg Instruments  
Noise Laboratory  
Quantum Change  
TDK RF Solutions

### Resistivity Testers

Electronic Systems of  
Wisconsin  
Electro-Tech Systems  
ESD Systems  
Hipotronics  
Keithley Instruments  
Lake Shore  
Cryotronics  
Monroe Electronics  
QualiTau  
Static Solutions  
Trek

### RF Field Intensity Meters (EMC)

Anritsu  
AR, RF/Microwave  
Instrumentation  
Bird Electronic  
Boonton Electronics  
ETS-Lindgren  
JDSU  
Teseq

### RF Power Amplifiers

AR, RF/Microwave  
Instrumentation  
Krohn-Hite  
Mini-Circuits  
Ophir RF  
Precision Test Systems

### Screen Rooms/ Shielding Materials

ETS-Lindgren  
Laird Technologies  
Magnetic Shield  
MuShield  
Saelig  
Swift Textile  
TDK RF Solutions  
W.L. Gore &  
Associates

### Shielded- Enclosure Leak Detectors

ETS-Lindgren

### Surge Testers

Electronic Systems of  
Wisconsin  
HV Technologies  
Noise Laboratory  
Teseq  
Thermo Scientific

## ESD CONTROL/PROTECTION

### Air Ionizers

DESCO  
ESD Systems  
MKS, Ion Systems  
3M Electronics  
Monroe Electronics  
Noise Laboratory  
Prostat  
Simco  
Terra Universal

### Bins/Boxes/ Protective Bags

Conductive  
Containers  
DESCO  
ESD Systems  
Lista International  
3M Electronics  
Terra Universal

### Electrostatic Measuring Equipment

ACL Staticide  
AR, RF/Microwave  
Instrumentation  
DESCO

Electro-Tech Systems  
ESD Systems  
MKS, Ion Systems  
3M Electronics  
Monroe Electronics  
Noise Laboratory  
Prostat  
Simco  
Static Solutions  
Stephen Halperin &  
Associates  
Trek

### ESD Control/ Monitoring Equipment

ACL Staticide  
DESCO  
Electro-Tech Systems  
ESD Systems  
MKS, Ion Systems  
3M Electronics  
Monroe Electronics  
Prostat

Simco  
Static Solutions  
Terra Universal  
Trek

### Flooring/Finishes

ACL Staticide  
DESCO  
ESD Systems  
Flexco  
3M Electronics  
Prostat  
Static Solutions  
StaticSmart

### Gloves and Finger Cots

DESCO  
ESD Systems  
QRP  
Terra Universal

### Protective Clothing and Wrist & Heel Straps

DESCO  
ESD Systems  
3M Electronics  
Prostat  
Static Solutions  
Terra Universal

### Work Surfaces/ Workstations

ACL Staticide  
BioFit Engineered  
Products  
DESCO  
ESD Systems  
Lista International  
3M Electronics  
Prostat  
Terra Universal

## THIRD-PARTY SUPPLIERS

### Distributors— EMC Test Equipment

Avalon Equipment  
Credence  
Technologies  
Macrotron Scientific  
Engineering  
MetricTest  
PTL Test Equipment  
TestMart  
Transcat

### Distributors— Environmental Test Equipment

Carltext International  
Data Physics  
Direct Industry  
Environment  
Associates  
m + p international  
Macrotron Scientific  
Engineering  
Terra Universal  
Transcat  
Tucker Electronics

### Distributors— ESD Protection & Control Products

Credence  
Technologies  
Miller Industrial  
S.R.S. Market  
Solutions  
Stanley  
Terra Universal  
TestMart

### Rental/Lease— EMC Test Equipment

A.H. Systems  
Advanced Test  
Equipment Rentals  
Atlantic Coast  
Instruments  
Bell Electronics NW  
Electro Rent  
Electro-Metrics  
Industrial Resources  
MetricTest  
Microlease  
ORIX Rentec USA  
TechRecovery  
Trek Equipment

TRS-RenTelco  
Tucker Electronics

### Rental/Lease— Environmental Test Equipment

Burnsco Technologies  
Cincinnati Sub-Zero  
Dynamic Solutions  
Electro Rent  
Environment  
Associates  
EST Testing Solutions  
HALT&HASS Systems  
Industrial Resources  
LR Environmental  
Equipment  
Microlease  
PTL Test Equipment  
Sharetree Systems  
Thermotron Industries  
TRS-RenTelco  
Tucker Electronics

### Training—EMC Test

A.T.E. Solutions  
D.L.S. Electronic  
Systems



Equipment Reliability  
Institute  
Garwood Laboratories  
OptEM Engineering  
Rohde & Schwarz  
Test Site Services  
TUV SUD America

### Training—ESD Protection & Control

D.L.S. Electronic  
Systems  
Electro-Tech Systems  
Equipment Reliability  
Institute  
Garwood Laboratories  
Prostat



> THIRD-PARTY SUPPLIERS *Continued*

Stephen Halperin & Associates  
Trek

**Training—  
Environmental  
Test**

A.T.E. Solutions  
Data Physics  
Environment Associates  
Equipment Reliability Institute  
HALT&HASS Systems  
Hobbs Engineering  
Nevada Automotive Test Center  
Technology Training

**Used  
Equipment—  
EMC Test**

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Advanced Test Equipment Rentals  
AR, RF/Microwave Instrumentation  
Atlantic Coast Instruments  
Avalon Equipment  
Bell Electronics NW  
Electro Rent  
Industrial Resources  
MetricTest  
ORIX Rentec USA  
Rohde & Schwarz  
TechRecovery  
Test Equipment Connection

TestMart  
Trek Equipment  
TRS-RenTelco  
Tucker Electronics

**Used  
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Environmental  
Test**

Advanced Test Equipment Rentals  
Burnsco Technologies  
Data Physics  
Dynamic Solutions  
Environment Associates  
Envirotronics  
EST Testing Solutions  
HALT&HASS Systems  
Industrial Resources  
K & Us Equipment  
LabX  
LR Environmental Equipment  
m + p international  
NEA  
ORIX Rentec USA  
PTL Test Equipment  
Sharetree Systems  
TestEquity  
Thermal Product Solutions  
Thermotron Industries  
Trek Equipment  
TRS-RenTelco  
Tucker Electronics  
Vibration Research

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Testing Services**

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Alion Science & Technology  
Associated Research  
BAE Systems  
Information and Electronic Systems  
CKC Laboratories  
Communication Certification Laboratory  
CSA International  
D.L.S. Conformity Assessment  
D.L.S. Electronic Systems



Elite Electronic Engineering  
Environment Associates  
EST Testing Solutions  
ETS-Lindgren  
Garwood Laboratories

Intertek  
Invisar  
MET Laboratories  
Motorola Product Testing Services  
National Technical Systems  
Nevada Automotive Test Center  
Noise Laboratory  
Northwest EMC  
PMG Technologies  
Product Safety Consulting  
Professional Testing  
Southwest Research Institute  
Sypris Test & Measurement  
TDK RF Solutions  
Teseq  
Test Site Services  
Tracewell Systems  
TUV Rheinland of North America  
TUV SUD America  
Underwriters Laboratories

**Environmental  
Testing Services**

Accolade Engineering Solutions  
Alion Science & Technology  
Amkor Technology  
Averna  
B&W Engineering  
BAE Systems  
Information and Electronic Systems  
Cincinnati Sub-Zero  
D.L.S. Electronic Systems  
Dynamic Solutions  
Elite Electronic Engineering  
Environment Associates  
Equipment Reliability Institute  
ESSC  
EST Testing Solutions  
Garwood Laboratories  
GOEPEL Electronics  
HALT&HASS Systems  
Intertek  
m + p international  
M/RAD  
MegaPhase

Micro Control  
Mindready Solutions  
Motorola Product Testing Services  
National Technical Systems  
Nevada Automotive Test Center  
Pikes Peak Test Labs  
PMG Technologies  
Premier Semiconductor Services  
Professional Testing  
Sharetree Systems  
Southwest Research Institute  
Sypris Test & Measurement  
Test Site Services  
Thermotron Industries  
Tracewell Systems  
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# VENDOR CONTACT INFORMATION

## A

**A.H. Systems**, Chatsworth, CA. 818-998-0223. [www.AHSystems.com](http://www.AHSystems.com).  
**A.T.E. Solutions**, Los Angeles, CA. 310-641-8400. [www.besttest.com](http://www.besttest.com).  
**ABSPULSE Electronics**, Ottawa, ON, Canada. 613-836-3511. [www.abspulse.com](http://www.abspulse.com).  
**ACCES I/O Products**, San Diego, CA. 858-550-9559. [www.accessio.com](http://www.accessio.com).  
**Accolade Engineering Solutions**, Irvine, CA. 949-597-8378. [www.accoladeeng.com](http://www.accoladeeng.com).  
**Acculogic**, Markham, ON, Canada. 909-475-5907. [www.acculogic.com](http://www.acculogic.com).  
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**Materials Development**, Chatsworth, CA. 818-700-8290. [www.mdc4cv.com](http://www.mdc4cv.com).  
**The MathWorks**, Natick, MA. 508-647-7000. [www.mathworks.com](http://www.mathworks.com).  
**Matrix Technologies**, Dachau, Germany. +49-8131-333588-0. [www.m-x.com](http://www.m-x.com).  
**Matrox Imaging**, Dorval, QC, Canada. 800-804-6243. [www.matrox.com/imaging](http://www.matrox.com/imaging).  
**MCM Electronics**, Centerville, OH. 800-543-4330. [www.mcmelectronics.com](http://www.mcmelectronics.com).  
**Measurement Computing**, Norton, MA. 508-946-5100. [www.mccdaq.com](http://www.mccdaq.com).  
**MegaPhase**, Stroudsburg, PA. 877-634-2742. [www.MegaPhase.com](http://www.MegaPhase.com).  
**Meiji Techno America**, Santa Clara, CA. 800-832-0060. [www.meijitechno.com](http://www.meijitechno.com).  
**MEN Micro**, Ambler, PA. 215-542-9575. [www.menmicro.com](http://www.menmicro.com).  
**Mentor Graphics**, Design-for-Test, Wilsonville, OR. 503-685-7000. [www.mentor.com/dft](http://www.mentor.com/dft).  
**MET Laboratories**, Baltimore, MD. 410-354-3300. [www.metlabs.com](http://www.metlabs.com).  
**MetricTest**, Hayward, CA. 510-264-0887. [www.metrictest.com](http://www.metrictest.com).  
**Metron Optics**, Solana Beach, CA. 858-755-4477. [www.metronusa.com](http://www.metronusa.com).  
**MI Technologies**, Suwanee, GA. 678-475-8300. [www.mi-technologies.com](http://www.mi-technologies.com).  
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**Micro Control**, Minneapolis, MN. 763-786-8750. [www.microcontrol.com](http://www.microcontrol.com).  
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**Microsys Technologies**, Mississauga, ON, Canada. 905-678-3288. [www.micro-sys.com](http://www.micro-sys.com).  
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**Microvision**, Auburn, CA. 530-888-8344. [www.microvsn.com](http://www.microvsn.com).  
**Micro-Vu**, Windsor, CA. 707-838-6272. [www.microvu.com](http://www.microvu.com).  
**Miller Industrial**, Tucker, GA. 770-270-0076.  
**Mill-Max Mfg.**, Oyster Bay, NY. 516-922-6000. [www.mill-max.com](http://www.mill-max.com).  
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**Mitutoyo America**, Aurora, IL. 630-820-9666. [www.mitutoyo.com](http://www.mitutoyo.com).  
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**3M Electronics**, Austin, TX. 800-328-1368. [www.3M.com/electronics](http://www.3M.com/electronics).  
**Monarch Instrument**, Amherst, NH. 800-999-3390. [www.monarchinstrument.com](http://www.monarchinstrument.com).  
**Monroe Electronics**, Lyndonville, NY. 585-765-2254. [www.monroe-electronics.com](http://www.monroe-electronics.com).  
**Moritex USA**, San Jose, CA. 408-363-2100. [www.moritex.com](http://www.moritex.com).  
**Motorola Product Testing Services**, Lawrenceville, GA. 770-338-3795. [www.motorola.com/producttesting](http://www.motorola.com/producttesting).  
**Moxa Technologies**, Brea, CA. 714-528-6777. [www.moxa.com/usa](http://www.moxa.com/usa).  
**MRV Communications**, Chatsworth, CA. 818-773-0900. [www.mrv.com](http://www.mrv.com).  
**MTI Instruments**, Albany, NY. 518-218-2550. [www.mtiinstruments.com](http://www.mtiinstruments.com).  
**Multiprobe**, Santa Barbara, CA. 805-560-0404. [www.multiprobe.com](http://www.multiprobe.com).  
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**MuShield**, Londonderry, NH. 603-666-4433. [www.mushield.com](http://www.mushield.com).  
**MVTec Software**, Munich, Bavaria, Germany. +49 89 4576950. [www.mvtec.com](http://www.mvtec.com).  
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**National Instruments**, Austin, TX. 512-683-0100. [www.ni.com](http://www.ni.com).  
**National Quality Assurance—USA**, Acton, MA. 800-649-5289. [www.nqa-usa.com](http://www.nqa-usa.com).  
**National Semiconductor**, Santa Clara, CA. 800-272-9959. [www.national.com](http://www.national.com).  
**National Technical Systems**, Calabasas, CA. 800-270-2516. [www.nts-corp.com](http://www.nts-corp.com).  
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**NCI Logic Analyzers**, Huntsville, AL. 256-837-6667. [www.nci-usa.com](http://www.nci-usa.com).  
**NEA**, Londonderry, NH. 603-669-6080. [www.nea-inc.com](http://www.nea-inc.com).  
**Neff Instrument**, Monrovia, CA. 800-423-7151. [www.neff.com](http://www.neff.com).  
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**Network Instruments**, Minnetonka, MN. 800-526-7919. [www.networkinstruments.com](http://www.networkinstruments.com).  
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**NoiseCom**, Parsippany, NJ. 973-386-9696. [www.noisecom.com](http://www.noisecom.com).  
**NorPix**, Montreal, QC, Canada. 514-846-0009. [www.norpix.com](http://www.norpix.com).  
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**OptoMetrix**, Renton, WA. 425-251-6363. [www.optomet.com](http://www.optomet.com).  
**Optomistic Products**, S. Freeport, ME. 207-865-9181. [www.optomisticproducts.com](http://www.optomisticproducts.com).  
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**OriginLab**, Northampton, MA. 413-586-2013. [www.originlab.com](http://www.originlab.com).  
**ORIX Rentec USA**, Los Angeles, CA. 877-849-6749. [www.orixonline.com](http://www.orixonline.com).  
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## P

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**Parametric Technology**, Needham, MA. 781-370-5000. [www.ptc.com](http://www.ptc.com).  
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**PFU Systems**, Plymouth, MN. 763-551-8261. [www.pfusystems.com](http://www.pfusystems.com).  
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**Princeton**, Pennington, NJ. 609-895-9890. [www.princeton.com](http://www.princeton.com).  
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**Prostat**, Bensenville, IL. 630-238-8883. [www.prostatcorp.com](http://www.prostatcorp.com).  
**Protek Test and Measurement**, Englewood, NJ. 201-227-1161. [www.protektest.com](http://www.protektest.com).  
**PTL Test Equipment**, Jupiter, FL. 561-747-3647. [www.ptltest.com](http://www.ptltest.com).  
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## Q

**QA Technology**, Hampton, NH. 603-926-1193. [www.gatech.com](http://www.gatech.com).  
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**RAM Optical Instrumentation**, Rochester, NY. 585-758-1300. [www.ramoptical.com](http://www.ramoptical.com).  
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## S

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**Audio Engineering Society (AES)**, [www.aes.org](http://www.aes.org). The AES is a professional society devoted exclusively to audio technology.

**Automated Imaging Association (AIA)**, [www.machinevisiononline.org](http://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](http://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](http://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.dslforum.org](http://www.dslforum.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](http://www.eia.org). EIA represents companies involved in the manufacture of electronic components, parts, systems, and equipment.

**ESD Association**, [www.esda.org](http://www.esda.org). The ESD Association is dedicated to advancing the theory and practice of electrostatic discharge avoidance.

**European Committee for Electrotechnical Standardization**, [www.cenelec.org](http://www.cenelec.org). CENELEC creates electrotechnical standards, many of them following the mandates of the European Commission.

**European Committee for Standardization (CEN)**, [www.cenorm.eu](http://www.cenorm.eu). CEN works to implement voluntary technical harmonization in Europe in conjunction with worldwide bodies and European partners.

**European Machine Vision Association (EMVA)**, [www.emva.org](http://www.emva.org). The EMVA works to strengthen the position of its members in worldwide markets, and it hosts the GenICam standard group.

**European Telecommunications Standards Institute (ETSI)**, [www.etsi.org](http://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](http://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](http://www.fibrechannel.org). The FCIA aims to develop the market for Fibre Channel products.

**Institute of Electrical and Electronics Engineers (IEEE)**, [www.ieee.org](http://www.ieee.org). The IEEE is a professional society that advances the theory and practice of electrical, electronics, and computer engineering as well as computer science.

**Institute of Environmental Sciences and Technology (IEST)**, [www.iest.org](http://www.iest.org). The IEST is concerned with the effects that natural, indoor, and extreme environments have on equipment and machinery.

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

**Institution of Engineering and Technology (IET)**, [www.theiet.org](http://www.theiet.org). The IET, a UK-based professional organization, aims to lead in the advancement of engineering and technology by facilitating the exchange of knowledge and ideas.

**International Committee for Information Technology Standards**, [www.incits.org](http://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](http://www.iec.ch). The IEC creates international consensus standards and conformity assessment schemes in the fields of electricity, electronics, and associated technologies.

**International Microelectronics and Packaging Society (IMAPS)**, [www.imaps.org](http://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](http://www.iso.org). The ISO promotes the development of international standards.

**International Society for Optical Engineering (SPIE)**, [www.spie.org](http://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](http://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](http://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](http://www.isa.org). ISA is a society of professionals involved in instrumentation, measurement, and control.

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

**LXI Consortium**, [www.lxistandard.org](http://www.lxistandard.org). The LXI Consortium is working to develop the LAN eXtensions for Instrumentation (LXI) standard.

**MFA Forum**, [www.mfaforum.org](http://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](http://www.meptec.org). MEPTEC is a trade association committed to enhancing the competitiveness of the back-end portion (assembly and testing) of the semiconductor business.

**National Cooperation for Laboratory Accreditation (NACLA)**, [www.nacla.net](http://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](http://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](http://www.nspe.org). The NSPE is an interdisciplinary professional engineering society.

**National Voluntary Laboratory Accreditation Program (NVLAP)**, [ts.nist.gov/Standards/214.cfm](http://ts.nist.gov/Standards/214.cfm). Administered by NIST, NVLAP provides third-party laboratory accreditation services.

**NCSL International**, [www.ncsli.org](http://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](http://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](http://www.pc104.org). The PC/104 Consortium disseminates information about PC/104 and serves as a liaison with standards organizations.

**PCI Special Interest Group (PCI-SIG)**, [www.pcisig.com](http://www.pcisig.com). The PCI SIG is committed to the development and enhancement of the PCI standard.

**PCMCIA**, [www.pcmcia.org](http://www.pcmcia.org). PCMCIA is an international standards body and trade association that promotes the interoperability of PC Cards in a variety of products.

**PXI Systems Alliance**, [www.pxisa.org](http://www.pxisa.org). The PXI Systems Alliance maintains the PXI specification, promotes PXI technology, and ensures multivendor interoperability.

**SAE International**, [www.sae.org](http://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](http://www.semi.org). SEMI is an international trade association for equipment and materials suppliers to the semiconductor, MEMS, and flat-panel display industries.

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

**Semiconductor Test Consortium (STC)**, [www.semitest.org](http://www.semitest.org). The STC oversees the Openstar (Open Semiconductor Test Architecture) platform.

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

**Surface Mount Technology Association (SMTA)**, [www.smta.org](http://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](http://www.tiaonline.org). The TIA is a trade association serving the communications and information technology industries.

**Test and Diagnostics Consortium (TDC)**, [www.test-diagnostics.org](http://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.

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

**VXibus Consortium**, [www.vxibus.org](http://www.vxibus.org). The VXibus Consortium develops and promotes the VXibus instrumentation standard.

**WiMAX Forum**, [www.wimaxforum.org](http://www.wimaxforum.org). The WiMAX Forum certifies and promotes the compatibility and interoperability of broadband wireless products based upon the harmonized IEEE 802.16/ETSI HiperMAN standard.

**ZigBee Alliance**, [www.zigbee.org](http://www.zigbee.org). The ZigBee Alliance works to enable low-power, wirelessly networked, monitoring and control products based on a global standard.

T&MW



# PRODUCT FOCUS

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

## Bowl-feed option for test handler

The Multitest MT9928 is an established tri-temp octal site gravity test handler. Multitest has recently expanded the load-

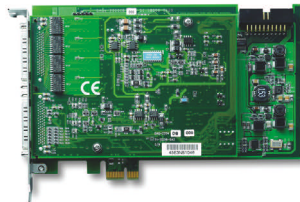


ing and unloading options by adding a bowl-feed option; according to the company, the MT9928 is the only octal-site gravity test handler on the market that offers a bowl-feeder module.

Multitest Electronic Systems  
[www.multitest.com](http://www.multitest.com)

## PCI Express DAQ card series

The Adlink DAQe-2200 series offers the high bandwidth of the PCI Express bus for data transfers up to 500 Mbytes/s. These 64-channel cards include a dif-



ferential mode for 32 analog input channels, analog/digital triggering, two-channel 12-bit analog outputs with waveform-generation capability, 24-channel programmable digital I/O lines, and a two-channel 16-bit general-purpose timer/counter.

Adlink Technology  
[www.adlinktech.com](http://www.adlinktech.com)

## Smart cameras for image processing

Vision Components offers programmable smart cameras for machine vision that can replace PC systems in a range of indus-



trial applications. Equipped with high-performance processors, they are suitable for use as stand-alone image-processing systems in measuring tasks and quality checks. Moreover, the compact devices offer new integration possibilities for machine and plant designers.

Vision Components  
[www.vision-components.com](http://www.vision-components.com)

## Thermocouple-to-wireless connector

Omega's Wireless Thermocouple Connector Series features stand-alone battery-powered thermocouple connectors that transmit linearized, cold-junc-



tion compensated measurements to a USB-powered receiver connected to a PC. Each unit can be programmed in the field to work as a type J, K, T, E, R, S, B, N, or C calibration connector. The connector can transmit data continuously at user-selectable time intervals.

Omega  
[www.omega.com](http://www.omega.com)

## Network analyzer family

The compact R&S ZVL from Rohde & Schwarz provides features that the company says are otherwise available only in larger and more expensive instruments, such as a wide frequency range from 9 kHz to 3 or



6 GHz, a dynamic range of 123 dB, and a bidirectional two-port measurement architecture. A software option for spectrum analysis is in the pipeline.

Rohde & Schwarz  
[www.rohde-schwarz.com](http://www.rohde-schwarz.com)

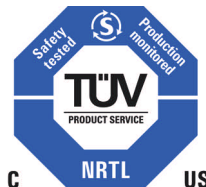
## NRTL information bank

As a Nationally Recognized Testing Laboratory (NRTL), TÜV SÜD America can determine whether your product meets necessary US work-

place requirements as well as other requirements.

At the company's NRTL information bank, called NRTL Spotlight, you can find information on OSHA, NRTLs, and standards, as well as FAQs, white papers, games, and more.

TÜV SÜD America  
[www.tuvamerica.com/nrtl](http://www.tuvamerica.com/nrtl)

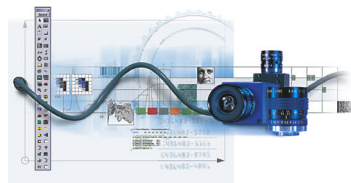


# PRODUCT FOCUS

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

## Libraries for imaging professionals

Common Vision Blox is a software platform for quick and reliable development and implementation of imaging applications. Based on an open ar-

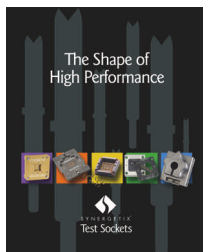


chitecture, it supports all common standards. In addition to an extensive set of standard tools, CVB offers various highly specialized tools and the possibility of integrating your own algorithms easily.

Stemmer Imaging  
[www.commonvisionblox.com](http://www.commonvisionblox.com).

## ICT test probes

ICT series test probes feature proprietary bifurcated beams that guarantee contact between the plunger and barrel, resulting in low and consistent resistance. The elimination of the clearance between the plunger and the barrel virtually seals the internal portion of the probes from contaminants. The probes are available in 0.050, 0.075, and 0.100 centers.



Interconnect Devices  
[www.idinet.com](http://www.idinet.com).

## Pulse generators offer flexibility

Keithley's Series 3400 pulse/pattern generators provide flexibility without the burden of a complicated front-panel interface. The high repetition rates, tight timing integration, and precision control over param-



ters such as rise/fall time, offset, amplitude, width, and period make these instruments appropriate for researchers working with new materials and nanotechnology, for semiconductor applications, and for RF design and development departments.

Keithley Instruments  
[www.keithley.com/products/pulsepatterngenerators](http://www.keithley.com/products/pulsepatterngenerators).

## LXI-compliant power supply

Kepco has introduced its first LXI (LAN eXtensions for Instrumentation) product, the KLP series of power supplies, which are compliant to LXI Class C specifications. Control is sup-

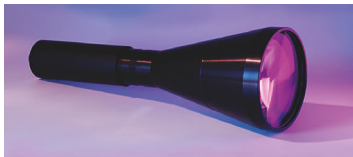


ported through the Ethernet in the KLP-1.2K model. The KLP series delivers 1200 W over an expanded operating range.

Kepco  
[www.kepcopower.com/klp.htm?tmw](http://www.kepcopower.com/klp.htm?tmw).

## Double-sided telecentric lenses

Navitar's double-sided telecentric lenses provide both image- and object-side telecentricity. Designed to work with CCD and



CMOS sensors with smaller pixel micro arrays, these lenses allow for telecentricity of less than 0.1% within the depth of field and distortion of less than 0.1% at the field corners.

Navitar  
[machinevision.navitar.com](http://machinevision.navitar.com).

## Fast PXI instrumentation amplifier

The Tegam Model 4040A is a fast PXI instrumentation amplifier designed to work with PXI digitizers and oscilloscopes. The Model 4040A offers 100-V differential inputs with 70 dB of CMRR. The bandwidth ranges from DC to 50 MHz with programmable gain, attenuation, offset, and filters.



Tegam  
[www.tegam.com](http://www.tegam.com).

## 10 new GigE cameras

The new Basler pioneer cameras are equipped with highly sensitive Kodak and Sony CCD sensors. Sensor sizes range from VGA to 5 Mpixels. With its extremely slim design and its foot-



print of 29x44 mm, the pioneer is the smallest camera in its class, according to Basler. All Basler pioneer models are compliant with the GigE Vision and GenICam standard.

*Basler Vision Technologies*  
[www.basler-vc.com](http://www.basler-vc.com).

## Amplifiers offer power upgrade

AR's "subampability" concept enables customers to upgrade some of their existing "S" series amplifiers to higher power with-



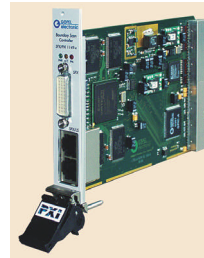
out purchasing new amplifiers. The Model 20S4G11A (20 W, 4 to 10.6 GHz) can expand to 40, 60, or 80 W, and the Model 35S4G8A (35 W, 4 to 8 GHz) can grow to 60, 90, or 120 W.

*AR Worldwide*  
[www.ar-worldwide.com](http://www.ar-worldwide.com).

## Extended JTAG/ boundary scan

Boundary-scan innovator Goepel recently introduced the VarioCore technology for its ScanFlex I/O modules. Unlike other modules used in automated test equipment for boards and systems, VarioCore-enabled I/O modules are reconfigurable at run-time to support a wide variety of I/O functionality.

*Goepel Electronics*  
[www.goepel.com](http://www.goepel.com).



## 3.0-GHz spectrum analyzer

Instek's new GSP-830 3.0-GHz spectrum analyzer offers many features such as autoset, a USB interface, and a brilliant TFT



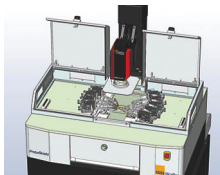
color display in one package at an affordable price. The battery pack option and low noise floor make this unit ideal for the lab or the field.

*Instek America*  
[www.instek.com](http://www.instek.com).

## Accurate device characterization

SUSS MicroTec has launched the next generation of ProbeShield Technology for highly accurate device characterization and reliability measurements on wafers up to 300 mm. The system introduces design features that enhance shielding effectiveness, ergonomics, and mechanics to provide a completely safe and accurate probing solution.

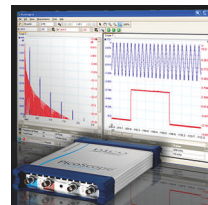
*Suss MicroTec*  
[www.suss.com/probeshield](http://www.suss.com/probeshield).



## USB 2.0 PC oscilloscope

The 250-MHz, PC-based PS5204 from Pico Technology offers a massive 128-Msample memory buffer for capturing long, complex waveforms and a real-time sampling rate of 1 Gsample/s. Other features include advanced triggering, a 250-MHz spectrum analyzer, and a 12-bit, 125-Msamples/s arbitrary waveform generator.

*Pico Technology*  
[www.picotech.com/pco393](http://www.picotech.com/pco393).



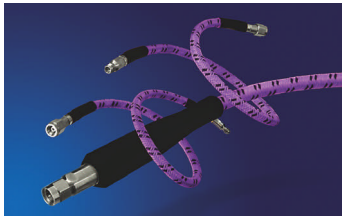


# PRODUCT FOCUS

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

## 110-GHz test assemblies

Gore PhaseFlex 110-GHz test assemblies with performance through 110 GHz offer torque and crush resistance, as well as stability with flexure and temperature, all while remaining



flexible. The Gore PhaseFlex 110-GHz test assemblies provide excellent phase and amplitude stability with flexure over a wide temperature range.

W.L. Gore & Associates  
[www.gore.com](http://www.gore.com)

## Imaging library features metrology

The Matrox Imaging Library (MIL) 8.0 with Processing Pack 3 features the new Metrology module for geometric dimensioning and tolerancing applica-

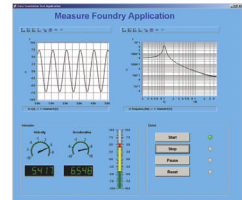


tions. The Metrology module determines the measurements of features such as arcs, circles, line segments, and points. Tolerances can be determined from dimensions, positions, and shape using features such as distances and length, coordinates, angularity, parallelism, and perpendicularity.

Matrox Imaging  
[www.matrox.com/imaging](http://www.matrox.com/imaging)

## Test and measurement software

Measure Foundry 5.0 is an open test and measurement software application builder. Measure Foundry offers complete support of all system standards including VISA and SCPI. Users can easily and quickly combine various test and measurement instruments to create powerful applications, without writing any code. Standard interfaces such as GPIB, USB, PCI, LXI, PXI/VXI, and RS-232 are supported.



Data Translation  
[www.measurefoundry.com](http://www.measurefoundry.com)

## DAQ logger and instrumentation software

Measurement Computing's new TracerDAQ Pro software package consists of four virtual instrument applications—a high-speed, 32-channel strip chart; a high-speed, four-channel oscilloscope; a 16-channel,



multi-waveform function generator; and a 20-channel rate generator—for graphically displaying, analyzing, and storing input data and for generating output signals. Price: \$199.

Measurement Computing  
[www.mccdaq.com](http://www.mccdaq.com)

## PRBS BER test systems

Centellax offers a 12.5-Gbit flexible frequency serial BERT system and a 40-Gbit BERT system, both perfect for accomplishing PRBS compliance testing for many popular interfaces: PCI Express, SATA, SAS, Fibre



Channel, HDMI, DVI, 10-Gig Ethernet, FBDIMM, Infiniband, DisplayPort, Unified Display Interface, SRIIO, Hypertransport, USB 2.0, and SPI 4.2.

Centellax  
[www.centellax.com](http://www.centellax.com)

## Motion-control and positioning systems

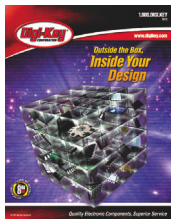
The "Automation Solutions for Electronic Manufacturing, Test and Inspection, and Data Storage" brochure presents Aerotech's motion-control and positioning systems for electronic assembly, pick and place,

PCB laser drilling and stencil cutting, wafer singulation, and automated optical inspection. Products include the Automation 3200 software-based controller, linear and rotary nanopositioners, servomotors and drives, robots, actuators, and industry-specific motion systems.

Aerotech  
[www.aerotech.com](http://www.aerotech.com)

## Thousands of products

Digi-Key's latest 2216-page catalog features more than 300,000 products from more



than 350 of the world's top manufacturers. This catalog includes thousands of new products from new and existing supplier

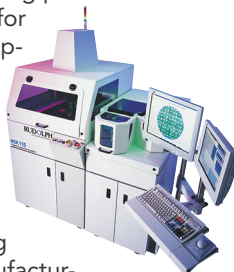
partners. The company's in-stock rate for items featured in the catalog is 90 to 95%. Additional products are available at the Digi-Key Web site.

Digi-Key  
[www.digikey.com](http://www.digikey.com).

## Macro defect inspection system

The NSX tool provides automated macro defect inspection with unmatched speed and flexibility throughout the device manufacturing process and is optimized for back-end applications.

Defects of 0.5 micron and larger can be created during wafer manufacturing, probing, bumping, dicing, and general handling and can have a major impact on yield.



Rudolph Technologies  
[www.rudolphtech.com](http://www.rudolphtech.com).

## 10-MHz DDS sweep/function generator

The B+K Precision Model 4017B DDS sweep/function generator combines several functions in a single unit that offers waveform



generation, pulse generation (through variable symmetry), frequency sweep, and a frequency counter. The heart of the instrument is a DDS-based system that produces precision timing for sine, square, or triangle wave generation with frequencies between 0.01 Hz and 10 MHz.

B+K Precision  
[www.bkprecision.com](http://www.bkprecision.com).

## Power quality analyzer

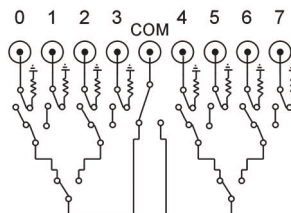
The PowerPad Jr. Model 8230 is an easy-to-use single-phase power-quality analyzer that is intended for electricians and engineers who need to measure and analyze single-phase and balanced three-phase power quality. Users can obtain instant waveforms of the electrical network's characteristics and also monitor their variation over time. All power quality parameters can be recorded.



AEMC Instruments  
[www.aemc.com](http://www.aemc.com).

## CATV/cable-modem switch

Cytec manufactures computer-controlled switches for cable TV or cable modems and switches



that are used in automated test, patch panels, or lab tests. New 1x8 or 1x16 modules with band-pass from DC to 1 GHz offer 75- $\Omega$  impedance, F connectors, terminated unused positions, and up to 24 dBm of power. Systems with up to 8000 switch points are available.

Cytec  
[www.cytec-ate.com](http://www.cytec-ate.com).

## Programmable electronic load

AMREL has released the Zero-Volt eLoad (ZVL) programmable electronic load, which operates at 0 V and draws 120 A in a 4U half- or 3/4-rack bench-top form factor. With voltage and current ratings of 10 to 150 V and 0 to 120 A within 100-, 200-, and 300-W power levels, the Zero-Volt eLoad offers the flexibility to fit your applications.



AMREL  
[www.amreleload.com](http://www.amreleload.com).

## PRODUCT FOCUS

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

### Antenna kit for high frequency

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 preamplifiers.

A.H. Systems  
[www.ahsystems.com](http://www.ahsystems.com)



### Fixed focal length lenses

Edmund Optics' TechSpec high-resolution fixed-focal-length lenses offer object-space resolution of better than two line-pairs

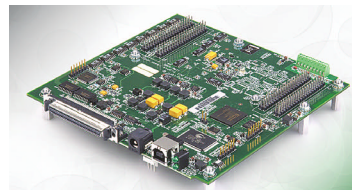


per millimeter and come in focal lengths of 8.5 and 12 mm. They support sensors as large as  $\frac{2}{3}$ -in. and provide superior performance in the visible spectrum. The lenses are designed for high-speed, high-resolution imaging, making them ideal for on-line inspection applications.

Edmund Optics  
[www.edmundoptics.com](http://www.edmundoptics.com)

### USB data-acquisition products

Measurement Computing's USB-2500 series boards provide true multifunction performance with up to 32 differential analog inputs, waveform-capable analog outputs, 24 high-speed digi-



tal I/O channels, four counter inputs, and two timer outputs. All boards feature synchronous analog, digital, and counter/timer I/O, guaranteeing deterministic I/O among all signal types. Base price: \$799.

Measurement Computing  
[www.mccdaq.com](http://www.mccdaq.com)

### Measure and analyze out of the box

IOtech's Ethernet-based DaqBook/2000 Series 16-bit, 200-kHz analog-to-digital converters are flexible, configurable, and expandable. Combined with the company's Out-of-the-Box software, the DaqBook/2000 becomes a powerful, easy-to-use



data-acquisition system that provides effortless datalogging and analysis. Over 40 I/O expansion options are available to customize the system for a particular application.

IOtech  
[www.iotech.com](http://www.iotech.com)

### Low-ripple high-voltage rack

Spellman's Bertan 205B Series high-voltage power supplies provide regulated outputs from 1 to 50 kV at 15 to 30 W. The low-noise, linear topology results in extremely low output



ripple specifications. The 205B Series units are reversible by design, providing either positive or negative output polarity, along with outstanding stability performance.

Spellman High Voltage Electronics  
[www.spellmanhv.com/bertan/tmw](http://www.spellmanhv.com/bertan/tmw)

# Say What?

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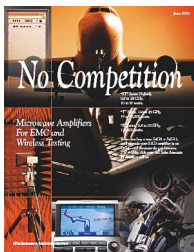


# CATALOGS & PRODUCTS

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

## Microwave amplifier brochure

AR's microwave amplifier brochure highlights the "S" series (1 to 800 W, 0.8 to 20 GHz) and the TWT amplifier series (1 to 16,000 W, 0.8 to 45 GHz). It includes photographs, descriptions, specifications, and performance graphs for each model. *AR Worldwide*, [www.ar-worldwide.com](http://www.ar-worldwide.com).



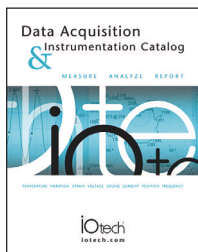
## Compact vision sensor

Vision Components' VisiCube camera, which measures only 65x45x45 mm and weighs 170 g, provides a compact image-processing solution for industrial environments. The smart cameras come with measuring lights and an integrated lens. *Vision Components*, [www.vision-components.com](http://www.vision-components.com).

## Environmental testing services

TÜV SÜD America offers complete environmental testing from its laboratories, including climatics (wind, temperature/altitude, humidity, etc.), dynamics (shock, vibration, etc.), package testing (compression, drop, etc.), and HALT/ HASS. *TÜV SÜD America*, [www.tuvamerica.com](http://www.tuvamerica.com).

## Data-acquisition catalog



Iotech's new full-color, 100-page "Data Acquisition & Instrumentation Catalog" is now available. The catalog describes solutions for vibration, temperature,

and more. The company's Out-of-the-Box software lets you acquire, save, analyze, and view data. *Iotech*, [www.iotech.com](http://www.iotech.com).

## Vector network analyzer

Bode 100 combines a PC-controlled vector network analyzer, a gain/phase meter, an impedance meter, and a sine-wave generator in a compact design. The frequency range of 10 Hz to 40 MHz is ideal for many RF and low-frequency applications. *Omicron Lab*, [www.omicron-lab.com](http://www.omicron-lab.com).

## USB data acquisition

SeaDAC modules connect to a computer's USB port and offer choices including reed and form C relays, optically isolated inputs, a TTL interface to industry-standard solid-state relay racks, and analog-to-digital and digital-to-analog functionality. *Sea-level Systems*, [www.sealevel.com](http://www.sealevel.com).

## Imaging software library

With its supreme flexibility, Common Vision Blox is the software library for image processing. Platform-independent and modular, it offers you the freedom to develop your application your way. *Stemmer Imaging*, [www.commonvisionblox.com](http://www.commonvisionblox.com).

## Electrical push-pull connectors

A catalog from LEMO describes the company's high-quality unipole-multipole connectors. The LEMO manufacturing program has been extended to 40 connector series with specific mating and environmental characteristics. *LEMO*, [www.lemo.com](http://www.lemo.com).



## Test and measurement catalog

The Rohde & Schwarz "Test & Measurement Products Catalog 2007/2008" is now available, presenting solutions for mobile radio, EMC, and broadcasting, as well as general-purpose and RF test equipment. You can order it from [customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com). *Rohde & Schwarz*, [www.rohde-schwarz.com](http://www.rohde-schwarz.com).

## GigE Vision and FireWire cameras

The 36 Basler scout camera models feature GigE Vision and FireWire-b interfaces and are equipped with a Sony CCD sensor ranging in size from VGA to 2 Mpixels. All scout models are GenICam compliant. *Basler Vision Technologies*, [www.basler-vc.com](http://www.basler-vc.com).

## RF power meter

The 1830A RF power meter achieves the lowest uncertainty RF power measurement available. It replaces the HP432A and is also compatible with

virtually all thermistor-based RF power sensors. *TEGAM*, [www.tegam.com](http://www.tegam.com).

## Double-sided lenses

Navitar's Double-Sided Telecentric Lenses provide image and object side telecentricity of less than 0.1% within the depth of field and distortion of less than 0.1% at the field corners. *Navitar*, [machinevision.navitar.com](http://machinevision.navitar.com).

## CD covers RF measurements

Keithley Instruments' free CD, *Making Quality RF Measurements*, is packed with information that can help you configure an RF measurement system. It includes an archived seminar, white papers, articles, application notes, data sheets, and technical notes. *Keithley Instruments*, [www.keithley.com/at/389](http://www.keithley.com/at/389).



## Test sockets

IDI's latest innovations in Synergetix high-performance test sockets include 10+ GHz on 0.4-mm pitch sockets, the only self-adjusting test sockets (XACT sockets), and 0.5-mm Kelvin sockets. *Interconnect Devices*, [www.synergetix.com](http://www.synergetix.com).

## Extended JTAG/boundary scan

Goepel electronic is a world-class vendor of JTAG/boundary-scan systems for electronic components. A catalog from the company covers the extended JTAG/boundary-scan ScanFlex and VarioCore hardware plus System Cascon software. *Goepel electronic*, [www.goepel.com](http://www.goepel.com).



## 300,000 products

Digi-Key's 2216-page catalog features more than 300,000 products from over 350 of the world's top manufacturers. New products include components from several new supplier partners. *Digi-Key*, [www.digikey.com](http://www.digikey.com).

(continued)

# CATALOGS & PRODUCTS

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## Intelligent power control

Available in 42-in. or 70-in. lengths with on/off control of up to 24 outlets, a configurable power-distribution unit from Pulizzi offers many features, making it ideal for data centers or remote site management. *Pulizzi Engineering*, [www.pulizzi.com](http://www.pulizzi.com).

## Programmable switching systems

Cytec's 80-page catalog of programmable switching systems for ATE and communications covers automated production and lab or environmental testing. It includes communication switches and programmable patch panels. Custom configurations are also available. *Cytec*, [www.cytec-ate.com](http://www.cytec-ate.com).



## 10-MHz sweep/function generator

The 4017B is the latest addition to B+K Precision's 4000 series of function generators. It is the first true function generator in its line to offer direct digital synthesis (DDS) technology, allowing the 4017B to generate very precise and accurate waveforms with little distortion. *B+K Precision*, [www.bkprecision.com](http://www.bkprecision.com).

## Web-based temperature measurements

Web-Temp, Measurement Computing's eight-channel temperature input device, supports thermocouples, RTDs, thermistors, and semiconductor sensors, and it has a built-in Web server. You can read temperatures on your browser from anywhere in the world. *Measurement Computing*, [www.mccdaq.com](http://www.mccdaq.com).

## High-voltage power supply

Spellman's Bertan 225 Series HVPS provides regulated outputs from 500 V to 50 kV at 15 W to 30 W. An IEEE 488 digital interface permits comprehensive power-supply control. Low noise and a linear topology result in extremely low output ripple. *Spellman High Voltage Electronics*, [www.spellmanhv.com/bertan/tmw](http://www.spellmanhv.com/bertan/tmw).

## Digital microscope

The new iVista digital imaging system is dedicated for semiconductor probing applications. The system is based on an ultra-high-resolution concept to provide sharp images and a unique multi-view function. *Suss MicroTec*, [www.suss.com/ivista](http://www.suss.com/ivista).

## 100-Gbytes/s modulator driver

The OA5MVM is a 100-Gbytes/s broadband amplifier for driving optical modulators. It makes an excellent modulator driver for developing 100G Ethernet products. *Centellax*, [www.centellax.com](http://www.centellax.com).

## Automation products

Omega is adding a new line of automation products to meet today's changing manufacturing landscape. Products include sensors, PLCs, HMI, enclosures, motion systems, power products, and more. *Omega Engineering*, [www.omega.com/omegamation](http://www.omega.com/omegamation).



## Macro inspection system

Over 500 NSX macro inspection systems have been installed in fabs around the world, providing high throughput and repeatable advanced macro defect inspection during wafer manufacturing, probing, bumping, and general handling. *Rudolph Technologies*, [www.rudolphtech.com](http://www.rudolphtech.com).

## Antennas and accessories

A.H. Systems offers EMC antennas, accessories, and calibration services for global testing. The company's catalog includes broadband antennas from 25 MHz to 40 GHz. *A.H. Systems*, [www.ahsystems.com](http://www.ahsystems.com).



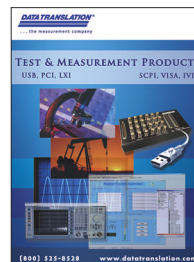
## PC-based oscilloscope

The PicoScope 5000 series of high-performance PC-based (USB 2.0) oscilloscopes feature 1-Gsample/s real-time sample rates, a 128-Msam-

ple record length, and a 12-bit, 128-Msample/s programmable arbitrary waveform generator. *Pico Technology*, [www.picotech.com/pco392](http://www.picotech.com/pco392).

## USB and PCI products

Data Translation's free 2007 product guide offers details on the company's USB and PCI data-acquisition test and measurement products. You can choose from a range of low-cost, simultaneous, and high-performance hardware and software products. *Data Translation*, [www.datx.com/productguide](http://www.datx.com/productguide).



## Power products

AMREL's eLoad line of air- and water-cooled programmable electronic loads range from 60 W to greater than 100 kW, and the ePower line of linear and switching programmable power supplies range from 20 W to more than 900 kW. Customizations are available. *AMREL*, [www.amrel.com](http://www.amrel.com).

## Test and measurement instruments

Instek'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. *Instek America*, [www.instek.com](http://www.instek.com).

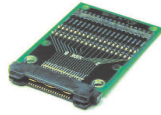
## Stereo zoom microscopes

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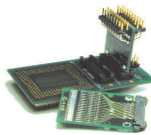
## New LED test

Ultra FINN, an innovation in LED color and intensity testing, features improved accuracy, increased speed, and greater reliability in a miniaturized package. It comes with a customized sleeve for easy installation and testing of closely spaced LEDs. *Test Coach*, [www.testcoach.com](http://www.testcoach.com).

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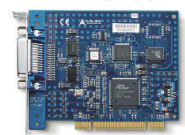
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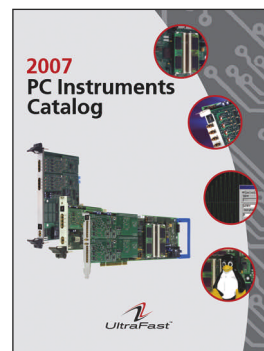
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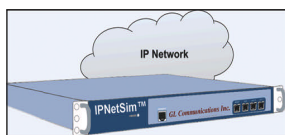
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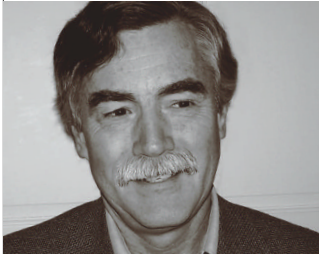
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[An exclusive interview with a technical leader]



**MICHAEL J. SULLIVAN**

VP and CTO  
Astro-Med  
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Michael J. Sullivan joined Astro-Med in 1983 and assumed responsibilities as CTO in August 2000. Prior to his service with Astro-Med, he held engineering positions with the Naval Underwater Systems Center and Rhode Island Hospital, where his biomedical research was included in government and academic publications. Sullivan holds several patents pertaining to thermal printing and data-acquisition recording. He is a graduate of the University of Rhode Island with a BSEE and an MSEE.

Contributing editor Larry Maloney spoke with Sullivan about data-acquisition trends in a recent telephone interview.

## Data acquisition hits the road

**Q: Astro-Med is involved in data acquisition, neurological instruments, and label printing. What ties these technologies together?**

**A:** The neurological business, which includes EEG systems for monitoring patients with sleep disorders, is really a specialized form of data acquisition, relying on such technologies as analog-to-digital converters, isolation techniques, sampled data streams, and digital filters. Our label printer connection began when our T&M products focused on chart recording with thermal technologies. The label printer and T&M product groups have become much more diverse, but they still share key technical elements, such as hybrid design [mixing analog and digital], use of microprocessor firmware to embed functionality, and complex graphic presentations of data.

**Q: What distinguishes your data-acquisition products?**

**A:** Streaming large amounts of sampled data directly to a disk drive is something we introduced and continue to perfect. This approach avoids the limits that Windows places on typical data-acquisition products. The field recorder, a strong niche for us, gives a user everything he or she needs for data acquisition and review in a compact, rugged package that can be used almost anywhere. Our user interface combines large LCDs with touch panels and icons that create a distinctive look and make our products easy to use. We also believe that we are the best people to go to when you need a real-time chart recorder, which we typically sell as a peripheral to our data-acquisition products.

**Q: Can you cite some other technical advances that Astro-Med has pioneered?**

**A:** We added data acquisition to our products well before the PC was introduced. At that time, we used small amounts of static memory to augment our chart recorders. We introduced high-speed streaming of sampled waveforms direct to disk drive and

continue to increase the bandwidth of this approach. Before that innovation, you had to decide between high sample rates and long captures. Now, you can have both. In addition, we were one of the first to use DSPs to provide real-time filters and other functions as part of a data-acquisition product. Our Dash2 and Dash4 products were among the first data recorders designed for field use, including operation from battery.

**Q: What application areas are responsible for your biggest customer volume?**

**A:** We are very strong in aerospace, where our data-acquisition products test new aircraft on the ground and via telemetry. Similarly, engineers rely on our equipment for test and evaluation of automotive components. Other key applications include field service for monitoring processes in steel, aluminum, and paper mills, as well as the monitoring of power-generating equipment.

**Q: What are the most important features that test engineers want to see in data-acquisition systems?**

**A:** The ability to “grab and go” and have multiple functions in one package. They also want simplicity of operation. An engineer may not use the product every day and cannot afford a long learning curve before collecting data. Connectivity and multimedia are becoming more important as well. Engineers need to get acquired data “out of the box” so they can edit it, combine it with other data, and produce reports. We provide the interfaces and software to help with this. Finally, the demand always exists for more channels, higher sample rates, and smaller size. T&MW



Michael Sullivan comments on the importance of telemetry and networking in data acquisition, as well as trends affecting product development, in the online version of this interview: [www.tmworld.com/2007\\_07](http://www.tmworld.com/2007_07).



## HIGH-SPEED TEST

# (Loop)back to the future

## New test methods tackle $\geq 6.4$ Gbps data rates



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*Manufacturers of microprocessors and high-end graphics chipsets are now employing high-speed serial buses like PCI Express and HyperTransport to deliver data and I/O rates up to 6.4Gbps. By 2010, 10Gbps and above may be the norm.\**

Test, as always, will play a critical role in delivering these exponentially higher speeds at not-much-higher cost. However, faster serial buses introduce tough challenges, where traditional functional test and simple design-for-test (DFT) methodologies fall short. Older “functional” test flows on high-end ATE platforms offer the most thorough fault coverage, but these time-tested methods prove increasingly prohibitive in terms of cost, complexity and cycle times. Moreover, cost per pin rises with bus speed in high-speed data applications, making functional testing even less viable.

Manufacturers have thus turned to loopback techniques (i.e., using the device to source the test data and receive it back into the device for recognition) that enable cost optimized testing of today’s high-speed buses. Loopback testing can be very effective, but the manner in which it is implemented is especially critical, considering the typical loss budget for high-speed signals. This loss budget, which determines the magnitude of acceptable signal degradation, typically has three components—contributed by the transmitter, receiver, and interconnect—all of which could degrade the signal “eye” over the loopback path and thus impact coverage.

To date, alternative DFT techniques like “near-end loopback” have already introduced cost efficiencies (via ease of programming and reduced capital investment in ATE) in testing devices for high-end consumer and computing applications. Near-end loopback techniques can be self-contained within the DUT with pathways created between the I/O pins. However, the inherent cost savings and simplicity carry stiff tradeoffs in terms of coverage. There are no parametric measurements, a lack of signal control, and lower likelihood of catching faults related to signal integrity or bit errors. For example, a simple internal, or load board loopback, would allow a marginal receiver to “hide” in the shadow of a robust

transmitter and pass the loopback test screen. While these uncertainties can be worked around at lower speeds, compromising coverage at  $\geq 6.4$ Gbps is way too risky.

### Far-end Loopback: Less Jittery, Lower Cost

Between the two extremes, innovative techniques such as far-end loopback combine the flexibility of DFT with the more in-depth diagnostics of functional testing. Lengthening the feedback path by placing the DUT in communication with an intelligent but still cost-effective tester makes production-level testing of high-speed buses viable for the first time. Even more compelling, far end loopback with programmable signal degradation can be employed to cut costs and speed time-to-market while introducing unprecedented coverage.

This type of loopback offers significant advantages:

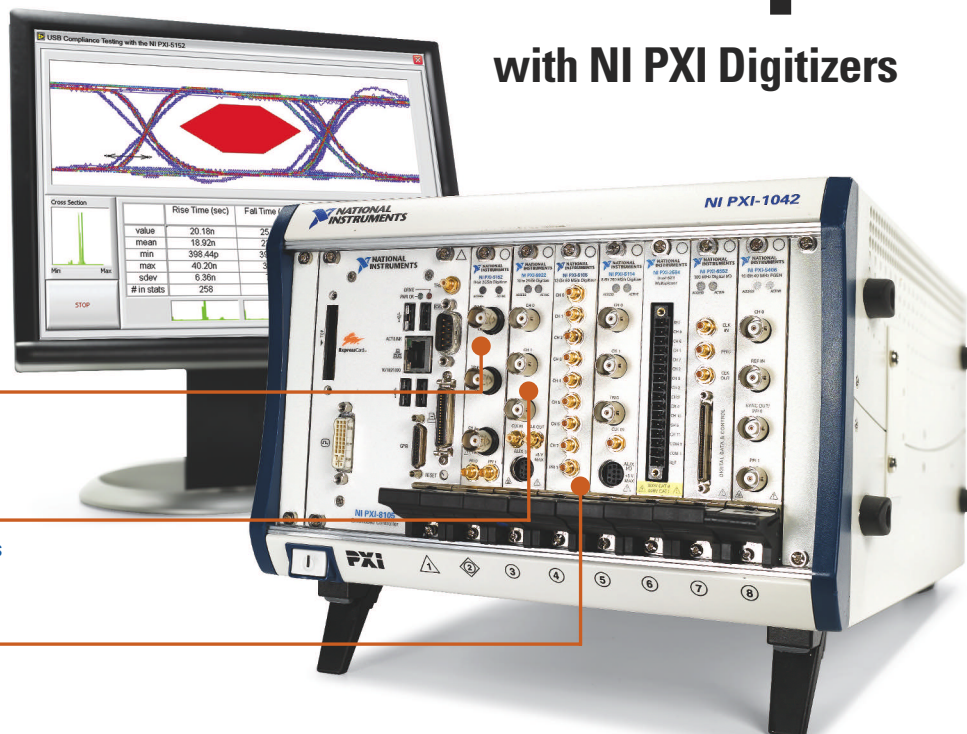
- Provides signal control to stress the eye
- Increased coverage in detecting sensitivity to signal integrity issues and bit errors
- Addition of circuitry enabling jitter to be injected and measured
- Covers all three parts of the loss budget
- $R_x$  and  $T_x$  channels can be used to deliver test vectors to the core logic and protocol stack
- Access to device pins for full DC parametric testing

Clearly, exponentially faster bus speeds are driving fundamental shifts across the board, from design through production. Test companies can play an important leadership role in this fast-paced environment, by delivering innovative products and solutions that enable customers to optimize and accelerate their latest test methodologies at lower cost, while minimizing risk.

*To see how our latest products and innovative test techniques can solve your high speed challenges, visit [www.credence.com/loopback](http://www.credence.com/loopback)*

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RF	Up to 6.6 GHz, 20 MHz RTB
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Multifunction I/O	Analog I/O, digital I/O, counters