Reed Electronics Group
November 2007
www.tmworld.com

Test & MEASUREMENT WORLD®

THE MAGAZINE FOR QUALITY IN ELECTRONICS

Mark Marden, antenna engineering manager at Tyco Electronics' M/A-COM business unit.

Engineers at Tyco Electronics' M/A-COM business unit test antennas, cables, components, and subsystems for aerospace and defense applications.

RF TESTING SPINS THROUGH TRANSMISSION PATHS

Page 28

Switching?

We don't make just "pretty" boxes.....

Series G2
Rack Mountable Switching Systems

Controlled with
TCP/IP

We know what you're thinking, but we are very excited for engineers to know about our Series G2 product line! Except to our existing clients, this "box" doesn't look that pretty to the naked eye. But, if you review all the features included in our programmable switching products, you'll see the hidden beauty! The best part is that you get all these features at a competitive price. **See if you can find all the features included, then give us a call.**

- 1000's of plug-in modules available
- Built-in Ethernet, GPIB and Serial ports
- Hotswap redundant power supplies
- Field upgradable firmware
- Rugged aluminum construction
- Built-in rack and chassis slide mounting
- Solid-state, relay, digital or fibre optic switching
- Built-in forced air cooling with monitoring
- Field proven performance and reliability
- BITE for superior performance
- International wide-range AC power capacity
- Intelligent front panel illuminated control keypad
- Long life high contrast VFD display
- Hinged front panel access to power supplies
- Free LabView VISA drivers
- Excellent product support and quality

Download our latest control software called **RouteWarePRO** and take it for a **FREE 30-Day** test drive today!

Audio - Video - Digital - RF - IF - ATE - Telemetry - Cellular - Microwave

Universal Switching Corporation

State-of-the-Art Switching Solutions

7671 North San Fernando Road
Burbank, CA 91505 USA

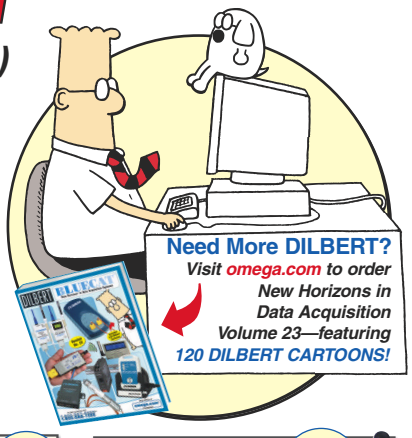
ISO 9001:2000 Certified

Call to get your FREE catalog today.

Phn +1 818-381-5111
Fax +1 818-252-4868
Email sales@uswi.com
Web uswi.com

Need More Data Acquisition Options?
Shop online at omega.com®

100,000 process control and measurement products (and counting)



Go to: www.omega.com/dilbert for your daily dose of DILBERT!

Starts at $495

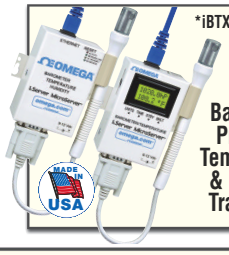
*iSE-TH

Temperature and Humidity Environmental Monitor

Starts at $210

DRF Series

DIN Rail Mount Signal Conditioners



*iBTX-D

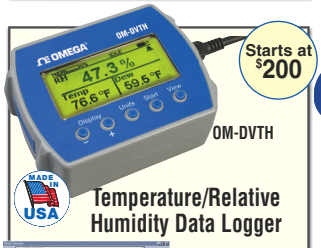
Starts at $295

Barometric Pressure, Temperature, & Humidity Transmitter

Z Series

Starts at $95

Wireless Sensor System



Starts at $200

OM-DVTH

Temperature/Relative Humidity Data Logger

&analab® Professional Solutions for ALL Your Compliance Requirements

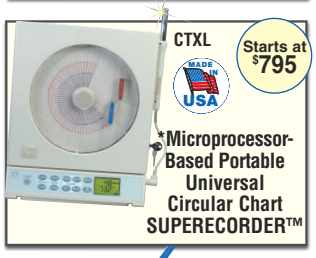
analab, LLC
630 Heron Drive
Bridgeport, NJ 08014
Phone: 1-856-467-4200
Fax: 1-856-467-4406
Email: info@analab1.com

analab1.com® **1-800-262522-9®** **1-800-analab-x**

Starts at $240

iDR

Temperature, Process and Strain Controllers & Signal Conditioners



CTXL

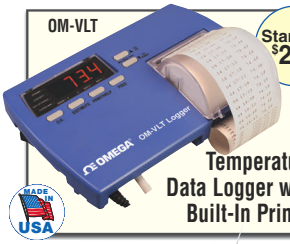
Starts at $795

*Microprocessor-Based Portable Universal Circular Chart SUPERECORDER™

Starts at $550

OS533E

*OMEGASCOPE® Handheld Infrared Thermometers



OM-VLT

Starts at $255

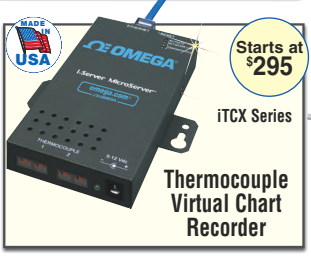
Temperature Data Logger with Built-In Printer

UWTC Series

Starts at $125

Exclusive and Patented

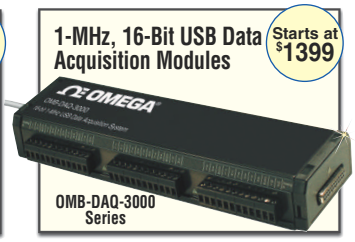
*Wireless Thermocouple Connector/Converter The Smart Connector™



Starts at $295

iTCX Series

Thermocouple Virtual Chart Recorder



1-MHz, 16-Bit USB Data Acquisition Modules

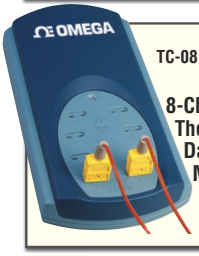
Starts at $1399

OMB-DAQ-3000 Series

Starts at $845

OMA-VM520 Series

OMEGAPHONE Temperature Alarm Dialer



TC-08

Starts at $490

8-Channel USB Thermocouple Data Acquisition Module

For Sales and Service, Call TOLL FREE

1-888-82-66342®
1-888-TC-OMEGA

Shop Online:
etestandmeasurement.com

PATENTED
Covered by U.S. and International patents and pending applications

Shop Online at
omega.com®
OMEGA®

Spend up to 19% less

And our 34401A is now even better looking

Agilent's 34401A DMM, the long-held industry standard, now sports a new look along with a 9% price cut. And the high performance 34410A is 19% less than it was before.




Specification	34405A	34401A	34410A	34411A
Resolution	5½ digits	6½ digits	6½ digits dual display	6½ digits dual display
Basic DC Accuracy	250 ppm	35 ppm	30 ppm	30 ppm
Max Readings/s (continuous to PC)	19	1,000	10,000	50,000
Connectivity	USB	GPIB RS-232	GPIB, USB, LAN LXI Class C	GPIB, USB, LAN LXI Class C
Price	$745*	~~$1,172*~~ $1,070*	~~$1,595*~~ $1,295*	$1,995*

STANLEY
Supply & Services 800-225-5370 www.stanleysupplyservices.com/DMM

Take advantage of these new prices today; go to
www.agilent.com/find/dmmcompare

* Prices in USD and subject to change

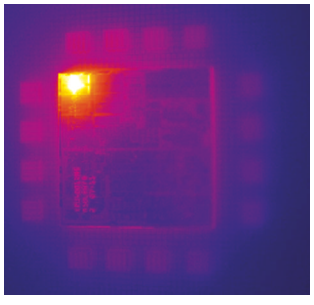
Agilent Technologies

COVER BY: MARK WILSON

Test & MEASUREMENT WORLD®

NOVEMBER 2007
VOL. 27 NO. 10

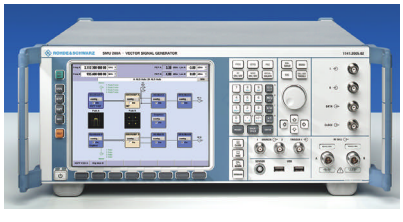
CONTENTS



Machine vision / Page 41

DEPARTMENTS

FEATURES



TECH TRENDS

TEST DIGEST

TEST REPORT SUPPLEMENT

www.tmworld.com

> Check out these exclusive features on the *Test & Measurement World* Web site:

Guest commentary

A test transformation

The cost of test has been an issue ever since the IC was developed. Who better to understand this than William Mann, who not only founded the IEEE Semiconductor Wafer Test Workshop but also served 16 years as its general chair? In part 1 of a three-part series, Mann covers the period from an Intel executive's call to cut test costs at the 1999 International Test Conference through the emergence of open-architecture, DFT-focused ATE. In part 2, he discusses the savings that result from testing devices in parallel. And in the final installment, he investigates complementary temperature tests between wafers and packages.

www.tmworld.com/guests

Remember when 50-MHz clock signals were state-of-the-art?

Music man Martin Rowe is back. With his latest offering, "Below a Gigahertz," Rowe reflects on problems with high-speed signals and how they make yesterday's signal-integrity problems seem trivial.

www.tmworld.com/gigahertzsong

Vote for the Test Engineer of the Year

Read about the six finalists, whom we profiled in our October issue, and then use our online ballot to vote for the 2008 Test Engineer of the Year. The winner will designate a $20,000 donation to an engineering school, courtesy of National Instruments and Keithley Instruments. Voting deadline is December 5.

www.tmworld.com/teoty

Blog commentaries and links

Taking the Measure

Rick Nelson, Chief Editor

- Tektronix buyout—consolidation, or spin-offs?
- Crime pays! Cybercrooks net $105B!

Engineering Students at Work

Jessica MacNeil, Contributing Editor

- Students fulfill dreams at NASA
- Internships around the world

www.tmworld.com/blogs

Take a T&M Challenge

Respondents who answer our Oscilloscope Challenge question correctly will be entered into a drawing for an Apple iPod, courtesy of Yokogawa. Those who answer our RF Challenge correctly will be entered into a drawing for a TomTom ONE navigation system, courtesy of Keithley Instruments. New questions every month!

www.tmworld.com/challenge

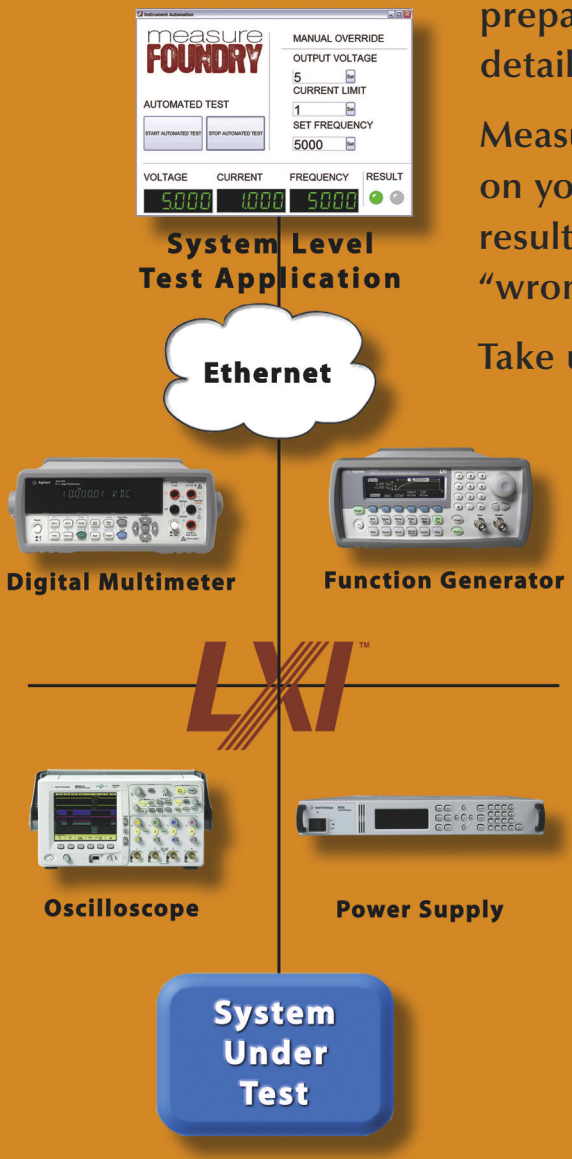
Eliminate Programming ...

Focus on Test & Measurement Functionality

EVERYONE WOULD LIKE TO GO DIRECTLY TO THEIR TEST RESULTS. There is precious little time to painstakingly prepare and set up the programming details of an application.

Measure Foundry allows you to focus on your desired results. You get to your test results much faster and can never connect the "wrong way".

Take us up on our best offer. You can download Measure Foundry 5.0 and use it for 14 days with no obligation. We bet that you'll find you can set up measurement data without ever writing a line of code.



Take a good look at it:
www.MeasureFoundry.com.

After all, making measurements productive is why we are here.

DATA TRANSLATION®

measure FOUNDRY™

1-800-525-8528
www.measurefoundry.com

Now with CV Measurement Capability

ONE TOOLBOX ALL THE TOOLS

Solution
izes test file
st sequencing
Looping control
Windows®-based
Creates, edits, compiles subroutines
Data management
Sub-femtoamp noise
User test modules
Pulse I-V control softwa
Reliability testing
Interactive test modules
User libraries
External instrument driver
Standardizes test methods
Automation capabilities
Prober control support
10/100 Base-T network
Pulse generation (dual
Digital oscilloscope (du
LCR meter support
Stress/measure capabilities
Semiconductor modeling support
Switch
Device modeling simulation support
Printing
Spreadsheets
Mass storage
4-probe Van Der Pauw resistivity measurements
Hall measurements
Subroutine libraries
Factory supplied libraries
System diagnostics
System security

The industry's leading parametric analyzer *now has lab-grade PULSE CAPABILITY*

Keithley's easy-to-use **Model 4200-SCS provides a total solution** for DC and pulse characterization and reliability testing.

Request a FREE *Semiconductor Interactive Test Environment Simulator* at www.keithley.com/at/303.

KEITHLEY

A GREATER MEASURE OF CONFIDENCE

publisher@keithley.com ■ 1-800-588-9238 ■ Fax 440-248-6168

Test & MEASUREMENT WORLD

EDITORIAL STAFF

Chief Editor: Rick Nelson
rnelson@tmworld.com
ATE & EDA, Inspection, Failure Analysis, Wireless Test, Software, Environmental Test

Managing Editor: Deborah M. Sargent
dsargent@tmworld.com

Senior Technical Editor: Martin Rowe
mrowe@tmworld.com
Instruments, Telecom Test, Fiber-Optics, EMC Test, Data-Analysis Software

Assistant Managing Editor: Naomi Eigner Price
neprice@tmworld.com

Contributing Technical Editors:

Jon Titus, jontitus@comcast.net

Bradley J. Thompson, brad@tmworld.com

Steve Scheiber, sscheiber@aol.com

Greg Reed, tmw@reedbusiness.com

Richard A. Quinnell, richquinnell@att.net

Editorial Intern:

Jessica MacNeil

Publisher: Russell E. Pratt

Senior Art Director: Judy Hunchard

Senior Art Director/Illustrator: Dan Guidera

Director of Creative Services: Norman Graf

Prepress Manager: Adam Odoardi

Audience Marketing Manager:
Angelique L. Vinther
303-470-4296;
angelique.vinther@reedbusiness.com

Reprints: Reprint Management Services (RMS),
800-290-5460, ext. 149;
tandmw@reprintbuyer.com

List Rental: Julie Cronin, jcronin@dm2lists.com

Reed Business Information-US,
A Division of Reed Elsevier Inc.

CEO: Tad Smith

CFO: John Poulin

HOW TO CONTACT T&MW

EDITORIAL:

225 Wyman St.
Waltham, MA 02451

Phone: 781-734-8423
Fax: 781-734-8070
E-mail: tmw@reedbusiness.com
Web: www.tmworld.com

SUBSCRIPTIONS:

For address changes, cancellations, or questions about your subscription, please contact:

Customer Service
Reed Business Information
8878 S. Barrons Blvd.
Highlands Ranch, CO 80129

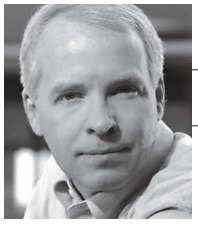
Phone: 800-446-6551
Fax: 303-470-4280
E-mail: subsmail@reedbusiness.com
Web: www.getfreemag.com/tmw

Subscribe to *T&MW* online:
www.getfreemag.com/tmw

Reed Electronics Group

Test cocktail reaching its limit?

Traditional test approaches are failing to keep pace with the requirements of dense, complex devices, according to comments from participants in the 9th European Manufacturing Test Conference (EMTC), held October 9 in Stuttgart, Germany, in conjunction with Semicon Europa. Conference chair Rene Segers of NXP Semiconductors kicked off the day-long event by noting that the traditional digital test cocktail, consisting of ATPG plus delay and I_{DDQ} tests, is running out of steam. Further, he said, analog test remains an art that resists structural-test approaches.



RICK NELSON, CHIEF EDITOR

During the conference, engineers representing both test vendors and semiconductor makers described efforts to extend test to meet today's needs. Software will have a key role to play, according to keynote speaker Dan Glotter, CEO of OptimalTest. He proposed that enterprise test-management software can improve yield by 1 to 4% (by reclaiming false fails) and reduce DPPM levels by 20 to 50%. But software alone won't solve all the challenges, and additional presenters described other approaches for improving test processes:

- Stephane Mougin, a product engineering manager at STMicroelectronics, described the application of a Credence Sapphire test system in a multiple-time-domain approach to improving test quality while reducing test cost.
- Enrique De Guzman, a test engineer at AMI Semiconductor Philippines, discussed the impact of test-handler temperature characteristics when testing temperature-sensitive devices. He concluded that the optimization of handler soak time can improve both yield and test capacity.

STDF effort supports volume diagnostics.

- Peter Hotz, a field product specialist for RF test at Teradyne, described the use of field solvers and evaluation PCBs for developing best practices for RF device-interface-board layout.
- Joachim Moerbt, department manager responsible for mechatronics activities at Advantest Europe, described a flexible high-parallel device interface for testing DRAM modules at 400 MHz.
- Jerry Broz, senior applications engineer at International Test Solutions, described off-line methodologies for assessing online wafer-probe contact-resistance performance to optimize cleaning protocols.

Finally, Ajay Khoche, lead consultant for advanced test methodologies at Verigy—recognizing that faults will never completely go away—described efforts toward using the Standard Test Data Format (STDF) to streamline test-failure dataflow to enhance volume diagnostics.

The ultimate lesson of the workshop seems to be that no one solution will suffice to contend with all DUT fault mechanisms. Test vendors and their customers will need to collaborate to enhance existing test cocktails while developing new test techniques. T&MW

Post your comments at www.tmworld.com/blog.

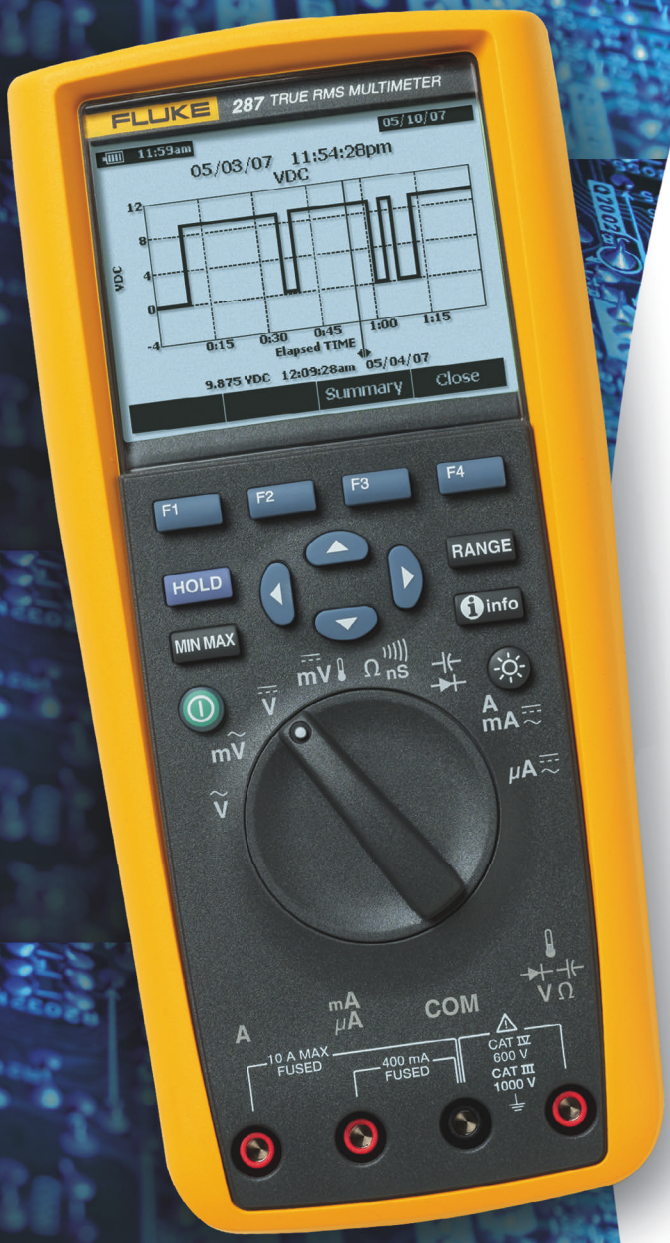
FLUKE®

April 30
12:25 hours

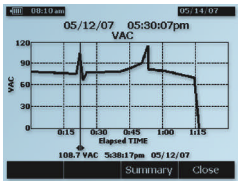
May 1
13:35 hours

May 2
12:05 hours

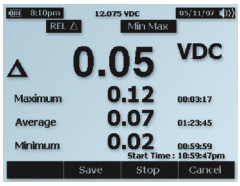
May 3
13:15 hours



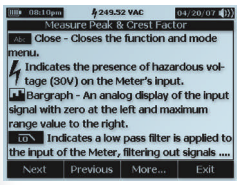
This DMM is so advanced, it shows you the trends.
For Electronics professionals who demand the best in performance, accuracy and capabilities. The Fluke 287 Electronic True-rms logging multimeter with TrendCapture is the best.



Precise performance
Quickly characterize and document design performance, watching events and glitches right on the DMM.



Easy to use
For instant help, press the New "i" button. Scroll buttons and soft keys offer easy navigation and custom displays.



Fluke. *Keeping your world up and running.*®

Run the new Fluke 287 through its paces. Demos online at **www.fluke.com/287**

Trendsetter.

[An exclusive interview with a test engineer]

Concentrated oxygen

DANIEL GUIDERA

David Boyd is a senior test engineer at Respironics (www.respironics.com) in Kennesaw, GA, a company that manufactures medical equipment including oxygen concentrators. A 10-year Respironics veteran, Boyd works with electrical and mechanical engineers to ensure that the company's products are designed to accommodate test. He also works with manufacturing to support automated test and data analysis. Martin Rowe recently interviewed Boyd by telephone.

Q: What is an oxygen concentrator?
A: An oxygen concentrator removes nitrogen from air and produces an output that is typically 93% to 95% oxygen. Physicians prescribe oxygen concentrators for patients who need more oxygen than the air can provide. The units weigh about 30 lbs and are used in many homes.

Q: Describe a typical test.
A: Each of our test stations consists of a two-bay rack. One bay contains valves, tubing, and mass-flow controllers that control the test-flow rate of oxygen from the concentrators. The stations also route each unit's output to a pressure sensor, and they multiplex each unit's output to an oxygen analyzer. We use a data-acquisition card to monitor the pressure transducers' 4–20-mA outputs and to control the valves. The stations also communicate serially with the concentrators.

Q: How do you support manufacturing?
A: I developed automated test stations for our latest line of concentrators. I specify the test equipment and write the software. I also visit production every day to get ideas for how to improve the tests or make them easier for the operators. I keep the test data in databases and use the data to monitor our production process.

Q: What have you done to improve test for the operators?
A: The test area is large, and concentrators may be some distance from the test station's monitor. I made it easier for the operators to control the test station by giving them a wireless interface. An operator uses a Bluetooth bar-code scanner to scan the unit's ID and test position, which tells the station that the unit has been added to or removed from the floor. The station responds with text-to-speech outputs to the test operator through a radio transmitter and also alerts the operator when units complete test.

I also installed a temperature/humidity monitor on the factory floor that is connected to the test stations over a LAN. The stations poll the monitor once a minute. By using a network, we need only one monitor, and all test stations work from the same data.

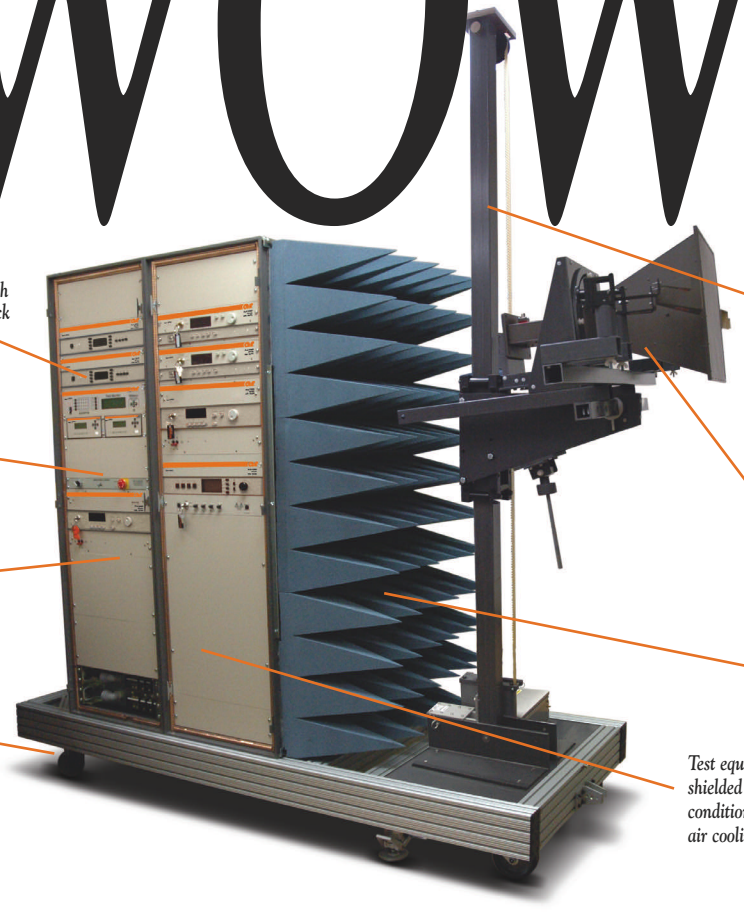
Q: What do you do with the test data?
A: I store test results in a SQL Server database. We add several thousand data points a day because we produce in high volumes and take multiple oxygen purity, pressure, and other measurements from each concentrator. Our QA engineers use the data to track our manufacturing process, looking for signs that the oxygen-purity measurements are drifting.

Q: How do you work with design engineers?
A: I work with electrical and mechanical engineers by suggesting features that ease testing. For example, I asked for a serial diagnostic port so that the automated testers can monitor concentrators during a test. We also use the ports to download firmware updates and operating parameters to the units and to calibrate them.

Q: Must Respironics' products comply with specifications from regulatory agencies?
A: Yes. We document our test stations, validate them against a protocol that demonstrates they reject out-of-spec units, and verify calibration regularly, in compliance with FDA and ISO agencies. T&MW

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.

WOW!



Imagine how we can solve your EMC or RF Systems needs!

AR people don't do anything half-way. Whether it's our legendary mismatch capability, the quality components we use, or the way we check and recheck every single detail, we always take the extra step. That's what makes an AR system so completely reliable.

It isn't just that we can put a system together to solve any EMC or RF test scenario – it's the parts that go into that system!

We have complete test systems "on the shelf" that perform entire tests with just the press of a few buttons. The AS40000 Radiated Immunity Test System (800 MHz – 40 GHz), for example, allows you to coordinate five amplifiers, a field monitor, two power meters, two system controllers, a signal generator, and a 20-foot antenna mast with five antennas.

AR can also put together a customized system to solve your test problems, with the power and frequency you need – from 10 kHz – 45 GHz. You can start with just a few essential components and then build a system around them.

Every product in your AR test system is backed by the most comprehensive warranty in the business; and a global support network that's second to none. When you have a question about any part of the system, you know exactly who to call.

We've been here for over 35 years and we'll continue to be here, serving your needs and engineering the products that meet tomorrow's challenges.

To learn more, visit www.ar-worldwide.com or call us at 215-723-8181.

ISO 9001:2000 Certified

rf/microwave instrumentation

Other ar divisions: modular rf • receiver systems • ar europe

USA 215-723-8181. For an applications engineer, call 800-933-8181.

In Europe, call ar emv United Kingdom 441-908-282766 • ar emv France 33 -1-47-91-75-30 • emv Germany 89-614-1710 • emv Netherlands 31-172-423-000

Multitest debuts pick-and-place handler at Semicon Europa

Multitest launched its MT2168 pick-and-place platform at Semicon Europa (October 9–11, Stuttgart, Germany) with the goal of offering manufacturing flexibility and optimum tester utilization. The MT2168 base unit handler is scalable from an engineering configuration to a high-end production configuration. It supports various contact-site and pitch configurations to enable continued use of existing load boards.

In addition, the system minimizes the number of parts in conversion kits for different package types; conversion times for a single operator are less than 10 min. Conversion kits are available for package types including QFP, BGA, PLCC, TSSOP, CSP, QFN, PGA, and LGA. The MT2168 covers the range of ambient-hot applications (+155°C standard, +175°C optional) for devices measuring from 3x3 mm to 70x70 mm with a thickness ranging from 10 mm down to 0.3 mm. Contact sockets are available in standard, high-frequency, and Kelvin versions.

The MT2168 optimizes the tester utilization by providing throughput up to 20,000 units/hr with up to 16 contact sites while providing a soak capacity of three to five JEDEC trays as well as an index time of 0.38 s (single mode). The company reports that the MT2168 is designed to minimize the number of pick-or-place transitions—from the eight to 10 typical of traditional handlers down to five. Self-teaching processes replace manual adjustments, resulting in a system that is stable and less sensitive to adjustments. www.multitest.com.

7 layers offers WiMAX conformance testing in North America

7 layers has selected Rohde & Schwarz to assist in the establishment of a WiMAX radio conformance test lab in Irvine, CA. The lab targets equipment for commercial WiMAX services, based on IEEE 802.16e, expected to be deployed in 2008.

7 layers offers development, testing, and qualification services for GSM, GPRS, 3G, Bluetooth, and other wireless communication technologies. The company has sites in Germany, China, Korea, Taiwan, and the US.

"We have known 7 layers as an expert partner for wireless communications testing for many years, and we are certain that the test and support services they can offer their clients will help manufacturers to market their new WiMAX products efficiently," said Jack Cowper, VP of North American sales and marketing at Rohde & Schwarz.

He continued, "Due to a WiMAX Forum policy, customers should be aware that in addition to the radio conformance test services 7 layers offers, final certification tests must be conducted at a WiMAX Forum Designated Certification Lab (WFDCL)." Cowper explained that 7 layers' test services should reduce bottlenecks at the one WFDCL in the US. The lab, which is located in Virginia, was scheduled to open in October. www.7layers.com; www.rohde-schwarz.com.

Tektronix to be sold to Danaher

Danaher reports that it has reached an agreement to purchase test-equipment maker Tektronix for approximately $2.8 billion in a transaction that is

Measure 48 temperatures, all at once

Editors' CHOICE

Data Translation's TEMPoint, Model 9871 accepts 48 thermocouple or voltage inputs and provides a dedicated 24-bit analog-to-digital converter (ADC) and dedicated cold-junction compensation (CJC) for each. Housed in a 2U, half-rack box, the TEMPoint provides 1000-V channel-to-channel isolation. A rear-panel, 37-pin connector provides eight digital inputs and eight digital outputs. The unit requires a 5-V power supply and consumes just 4 W.

The TEMPoint comes with either a USB or an LXI Ethernet port for control from a PC. The LXI version includes a Web server for instrument control from a browser.

The system's application software lets you configure any channel as a voltage or thermocouple input. It supports type B, E, J, K, N, R, S, and T thermocouples. Each channel is individually programmable so you can mix thermocouple types. Maximum throughput is 15 samples/s on all channels. Software support includes the company's Measure Foundry and QuickDAQ, Visual Basic.NET, DT-Open Layers, and Matlab. A software development kit adds support for other languages such as C/C++. The LXI version adds an IVI-COM instrument driver.

Price: $6995. *Data Translation, www.datatranslation.com.*

expected to be completed by the end of the year. When the sale is completed, Tektronix, which has annual revenues of approximately $1.1 billion, will become part of Danaher's Electronic Test platform, where it will join the Fluke and Fluke Networks subsidiaries and nearly double the division's revenues. www.danaher.com; www.tektronix.com.

Intertek acquires software testing lab

London-based Intertek has acquired National Software Testing Labs (NSTL), a lab that performs functionality, usability, quality assurance, and compliance testing for mobile applications used in entertainment, gaming, and banking. Headquartered in suburban Philadelphia, PA, NSTL has additional offices and labs in the US, Canada, Brazil, India, and Taiwan.

The NSTL acquisition followed closely on Intertek's August acquisition of Product Quality Partners, a provider of test services to wireless/mobile application providers, network carriers, and handset and accessory manufacturers who need to evaluate application interoperability and carrier network compatibility. www.intertek.com.

CALENDAR

Optical Fiber Communication Conference and the National Fiber Optic Engineers Conference (OFC/NFOEC), February 24–28, 2008. San Diego, CA. Managed by the Optical Society of America, www.ofcnfoec.org.

Measurement Science Conference, March 10–14, 2008, Anaheim, CA. Sponsored by the Measurement Science Conference, www.msc-conf.com.

APEX and IPC Printed Circuits Expo, March 29–April 3, 2008, Las Vegas, NV. Sponsored by IPC, www.goipcshows.org.

See our complete calendar at www.tmworld.com/events.

Editors' CHOICE

Keithley debuts LXI system-switch/multimeter

The Series 3700 LXI Class B-compliant system switch can control up to 576 multiplexer channels in a six-slot, 2U form factor and has an optional integrated 7½-digit digital multimeter (DMM). Together with plug-in switch and control cards, the Series 3700 can serve in a functional test system or in data-acquisition and measurement applications. It can perform multichannel I-V testing and accelerated stress tests.

The Model 3706 mainframe contains multiple processors to maximize measurement speed and system throughput. It features a single-channel reading rate that ranges from greater than 10,000 DCV/two-wire ohms readings/s at 3½-digit resolution to 60 readings/s at 7½-digit, 26-bit resolution. The Series 3700 is available with four mainframe options: with or without the DMM and with or without a front-panel display and keypad. The DMM option eliminates the need to manually coordinate an external DMM with a switch topology, freeing up development time. A USB 2.0 port allows users to save measurements to nonvolatile memory.

The Series 3700 also incorporates Keithley's Test Script Processor for creating test scripts that are embedded in and executed within the instrument, enabling it to perform autonomously.

Base prices: mainframe—$1790; plug-in cards—$925. *Keithley Instruments, www.keithley.com.*

Maximizing the impact of test engineering

New off-the-shelf software tools help engineers increase their productivity, while encouraging collaboration with remote partners and suppliers

A recent Test & Measurement World careers survey says it all: Design and test engineers are being stretched to the limit. Respondents report that they lack sufficient time, support and training to tackle all their day-to-day challenges.

Working for highly competitive electronics and communications companies, these time-limited engineers must assure the success of new product launches with ever tighter deadlines, while supporting off-shore electronics manufacturing services (EMS) providers.

In the end, most test engineers eventually face the same glaring issue: How to successfully achieve shorter product development cycles while ensuring product performance and quality?

Real World Pressures

Typically, engineers spend significant effort on programming, above and beyond what is required for test automation. They struggle to maintain deployed test systems in synch with new product releases, and they must aggregate and interpret test data scattered across Excel spreadsheets. Often, they must wait several days to see if product and process changes are being deployed properly in production by EMS staff in distant locations.

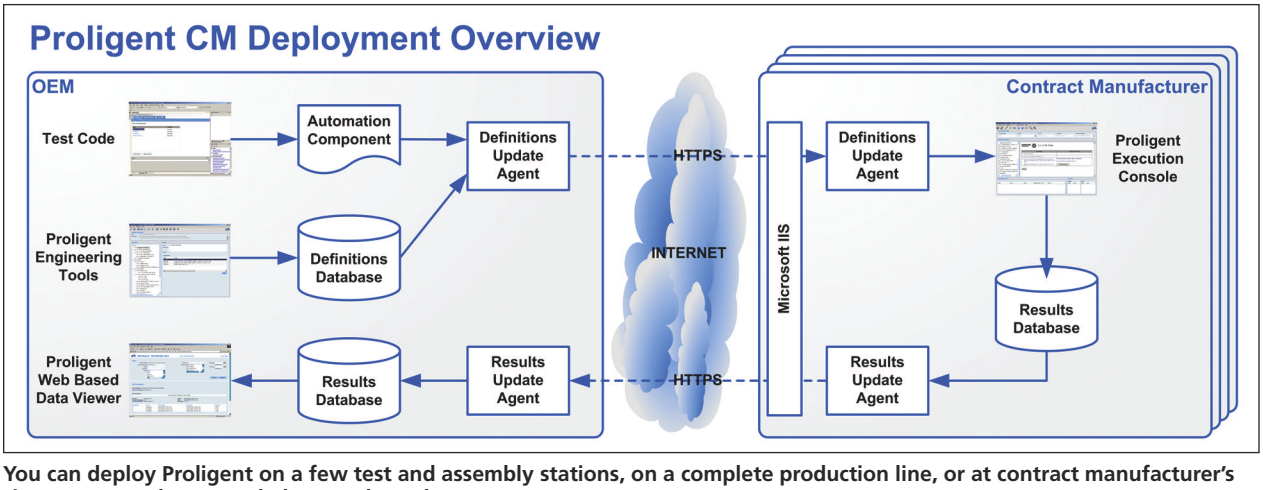
Before standardized software platforms became available, companies like Nortel, Alcatel and Harris realized the need to streamline their test processes. Yves Lacroix, Test Director at ONI Systems in the late 1990s, recalls the challenge of having new and complex products and software features coming along at an ever-increasing rate. "We badly needed a way to systematically introduce new products to the market, while making sure that they met the most stringent quality requirements for multiple product releases."

Working at Nortel in the 1990s, Jean-Yves Allard, now VP of R&D at Averna, decided to develop a platform internally that would do just that. A major challenge: How to sustain test developments at partners' sites all over the world. There was no consistency in how tests were being performed, nor was their any visibility over production results. Furthermore, Allard recalls, maintaining software on computing platforms that changed every other year became almost impossible.

Finally, an answer to these problems arrived in the form of Proligent™ by Averna. This ready-to-use solution eases the implementation of test strategies, while accelerating and standardizing test system development. As result, more OEMs are coming to depend on Enterprise Test Software (ETS) platforms like Proligent to provide an infrastructure for defining how test processes are created, deployed, monitored and analyzed. Additionally, they can integrate and synchronize test systems with other enterprise functions, ranging from R&D to manufacturing to supply chain.

Reengineering the Way You Work

Proligent delivers value to test engineers across a number of dimensions. For example, the platform can help engineers build test systems faster and more intuitively by avoiding programming issues not directly related to measurement automation.



You can deploy Proligent on a few test and assembly stations, on a complete production line, or at contract manufacturer's site. Usage can be expanded as needs evolve.

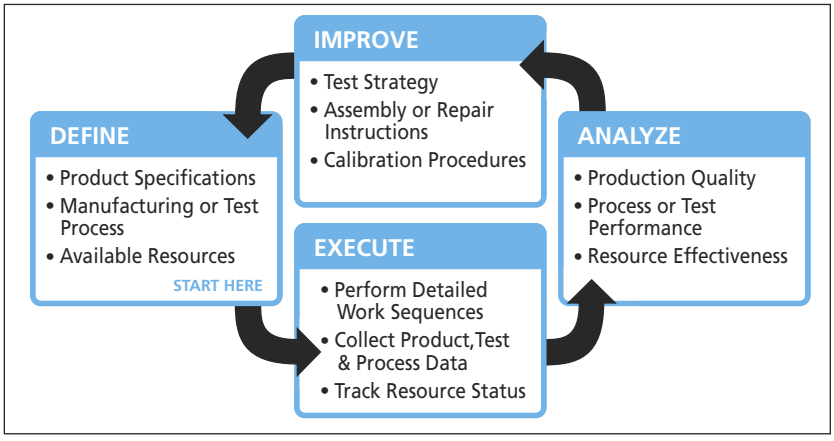
Proligent comes with an easy-to-use configuration interface for creating entire test sequences. You can easily create a product test plan without writing thousands of lines of code or dealing with troublesome spreadsheets.

The platform also makes it easy to define test plans in terms of product characteristics, measurement tolerances and test processes. Once your test plans are defined, they can be automatically deployed to all stations. Introducing new products is significantly simplified, since test sequences can be built without assuming a particular product configuration. Proligent's run-time arbitration capability helps you select the right tolerances and binaries to be used according to the unit under test product specification.

When it comes to Product Data Management, Proligent lets you collect, store, distribute and share product and test data in a central database. This eliminates having to manually sift through log files and Excel spreadsheets. Test data is also 100% traceable.

Process control issues can be addressed, too, since Proligent manages the flow of activities between test, repair and assembly stations. Proligent comes with standardized reports, including defects Pareto, cycle time, yield, and measurement analyses. Since test data is exportable to XML or CSV format, you can easily build customized reports.

Facilitating how your organization deals with multi-site collaboration, Proligent can eliminate problems caused by time zones and error-prone updates of new product and test software releases. When product tolerances, or test procedures are adjusted, Proligent can synchronize test systems with these engineering changes, even when the systems are located at another facility such as an EMS provider. All reporting is done via the web, so information is quickly communicated anywhere in the world.



Proligent has been designed to help test engineers design test systems faster and more efficiently, and maximize the impact of test from the early stages of conception to execution and analysis.

Customers Speak: Lower Costs, Fewer Defects

Harris Corporation, a giant electronics company, has used the Proligent test platform alongside NI TestStand to develop its test stations.

"Proligent is a key part of the Harris strategy for implementing test management best practices and establishing critical links to the rest of the production flow," explains Denis Gagnon, manager, Test Engineering, Harris MCD. "It allows us to significantly lower the cost of developing test software in order to automate defect detection and the characterization of units in production. Without adding overhead to test development, Proligent allows us to supervise, control and trace our products anywhere our test stations are located."

Harris is now considering retrofitting its legacy microwave test systems to standardize on Proligent, thereby reducing maintenance costs and better managing the collaboration with remote production facilities.

But Proligent isn't just a way to alleviate headaches at large companies. Proligent helped SigmaPoint, a contract electronics manufacturer, push its operations to improved performance levels. "Using this ready-to-use tool that incorporates best practices, we were able to develop a test station in as quickly as three weeks," says Steve Blouin, Test Engineering Director, SigmaPoint.

A Powerful Partnership

As a National Instruments Select Alliance Partner, Averna developed Proligent in collaboration with National Instruments to provide additional capabilities to NI TestStand.

"In addition to the leading test management features provided by NI TestStand, test developers are interested in tools to extend their existing systems," says Craig Anderson, Marketing Group Manager for NI TestStand. "They want to easily store and analyze their test data, as well as manage multiple test stations. Proligent and NI TestStand together deliver the development efficiency, data visibility and streamlined deployment required in today's complex and competitive manufacturing industry."

And those advantages are present, whether your company is a small start-up or an established OEM or EMS, or whether you manufacture your products in-house or overseas. Whatever the situation, Proligent is making a big difference in how test engineers do their jobs and contribute toward their company's success.

FOR MORE INFORMATION

Engineers can learn more about the Proligent test engineering platform by visiting www.proligent.com, emailing info@proligent.com or calling 1-877-842-7577.

Want to save time and money on INDUSTRIAL EQUIPMENT?

Let BuyerZone do the heavy lifting so you don't have to.

Save time and money on industrial equipment purchases. Get free advice and pricing articles on everything from forklifts, to pallet racks to floor cleaning equipment and more. BuyerZone is here to do the heavy lifting of finding all the suppliers. You just need to make the final decision. At BuyerZone, you're in control. We're just here to make your work easier.

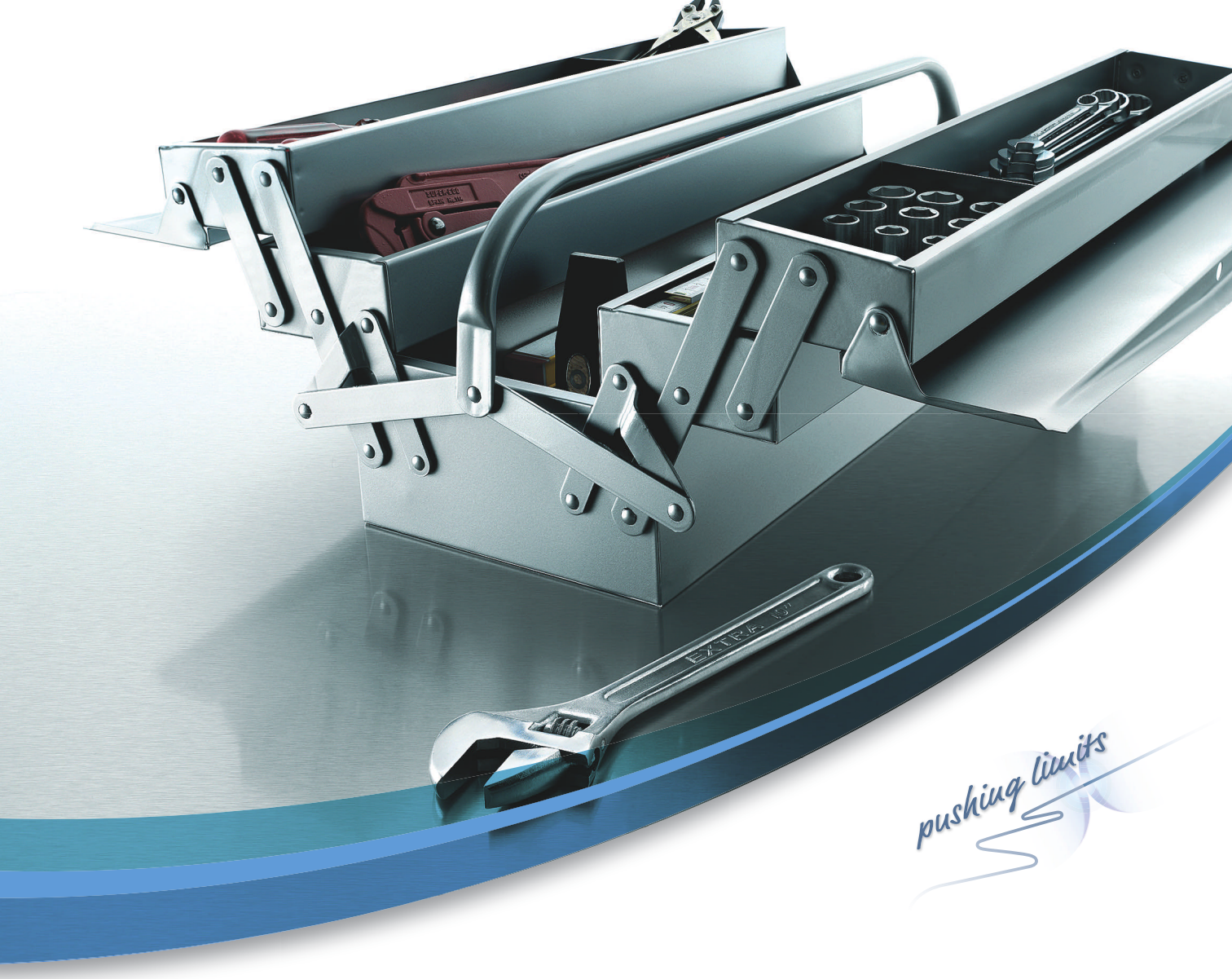
Join the millions who've already saved time and money on many of their Industrial Equipment purchases by taking advantage of BuyerZone's FREE, no obligation services like:

- Quotes from multiple suppliers
- Pricing articles
- Buyer's guides
- Supplier ratings
- Supplier comparisons

REQUEST FREE QUOTES NOW!
Call (866) 623-5565 or visit BuyerZoneIndustrial.com

BuyerZone
Where Smart Businesses Buy and Sell

A division of
Reed Business Information.



Tool for every trade

The new R&S®SMB100A analog signal generator – setting standards in the mid-range

In production, in the lab, or in service – the new R&S®SMB100A signal generator is the perfect toolbox for everyday use. Not only its broadband and SSB phase noise, its harmonics, but especially its high output level are unique in this class of instruments. No doubt, the new R&S®SMB100A is the ideal do-it-all solution. Just contact us to see for yourself.

Best signal quality in the mid-range

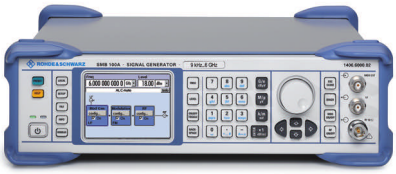
- Wideband noise typ. -152 dBc (>10 MHz offset)
- SSB phase noise typ. -128 dBc (20 kHz offset, f=1 GHz)
- Nonharmonics typ. < -85 dBc (>10 kHz offset, f=1,5 GHz)

Highest output power in its class

- typ. +25 dBm

On-site servicing as a convenient alternative

- For low cost of ownership and maximum instrument availability



ROHDE&SCHWARZ

www.rohde-schwarz.com/ad/smb

MIL/aero venue showcases general-purpose instruments

> > > Autotestcon, September 17–20, 2007, Baltimore, MD, www.autotestcon.com.

Autotestcon 2007 provided test and measurement companies a chance to highlight their instrument offerings for commercial as well as military applications. **ZTEC Instruments** debuted its ZT4610VXI digital oscilloscope, which targets high-density aerospace and defense ATE applications. **Aeroflex** announced that its Synthetic Multifunction Adaptable Reconfigurable Test Environment (SMART^E), which includes hardware, software, test practices, and support, is based on the company's fifth-generation synthetic technology for providing synthetic test systems for testing radar, satellite payloads, and T/R (transmit/receive) modules and subsystems for phased-array radar antennas (see p. 66). The company also announced a modular PXI RF test platform for wireless applications up to 6 GHz. With this platform, the company is targeting not only military/aerospace test applications but commercial cellular ones as well (see p. 65).

Agilent Technologies released the latest version of the Agilent Virtual Rack platform, which provides an interactive way for aerospace/defense companies to create flexible system frameworks with minimal effort in the integration, automation, maintenance, and evolution of test systems. **Metrikos**, in conjunction with **Huntron**, demonstrated its patent-pending near-field signature-analysis technology, which supports close proximity sensing of EM fields emanating from active or passive circuitry; its noncontact measurement capability could make it particularly useful for troubleshooting conformally coated boards in military applications.

SenarioTek highlighted its new technology for correcting RF test-system calibration errors due to the changes in environment, including temperature changes as well as changes related to repeatability issues in switches, cables, and connectors. **Geotest—Marvin Test Systems** debuted a slew of PXI products, including a standards module, a differential digitizer, 3U and 6U chassis, a signal generator, a digital I/O instrument, and controllers. **National Instruments** announced its NI PXIe-5672, an RF vector signal generator that delivers signal generation from 250 kHz to 2.7 GHz, 20 MHz of instantaneous bandwidth, and real-time data streaming at up to 25 Msample/s (see p. 64).

Keithley Instruments announced two additions to its Series 2600 SourceMeter instruments for semiconductor parametric analysis and testing. The Models 2635 and 2636 provide resolutions as fine as 1 fA to support test of semiconductor, optoelectronic, and nanotechnology devices. The company also highlighted its new Series 3700 system-switch/multimeter and plug-in card family (see p. 12). **JTAG Technologies** introduced its ProDFT service for testability analysis and report generation. A ProDFT report equips the user to optimize a board or system design for testability as well as to rapidly prepare the tests using JTAG Technologies' ProVision development suite.

Data Translation highlighted its new TEMPpoint series of temperature-measurement instruments (see p. 11). **Pickering Interfaces** showcased its new high-performance, high-density RF switching systems, which are usable to 3.5 GHz. **GaGe Applied Technologies** exhibited the new Cobra CompuScope family of 8-bit, 1- or 2-Gsamples/s digitizers. The company also highlighted its LapScope PCI expansion chassis, which enable laptop computers to accommodate GaGe's CompuScope and CompuGen cards.

Amrel introduced its eController with Ethernet, which controls the company's eLoad electronic loads and ePower power supplies while consolidating an arbitrary waveform generator, a waveform digitizer, and a waveform editor within a single GUI. **Intepro Systems** displayed its first LXI-based power-supply test system, the I-9500LXI, which targets the test of power converters under 1000 W.

Diagnosys displayed its PinPoint II, PinPoint UDA, and S500 functional test systems. **Teradyne** exhibited its Spectrum CTS commercial avionics test system as well as the Spectrum-9100 functional test platform for factory and depot environments. T&MW

The ZT4610 VXI digital oscilloscope targets high-density aerospace and defense ATE applications. The C-size instrument provides 1-GHz analog bandwidth and a maximum 4-Gsamples/s sampling rate.
Courtesy of ZTEC Instruments

See the online version of this article at www.tmworld.com/2007_11 for links to vendors and to our full product write-ups.

HIGH-SPEED TEST

Living In Multiple Time Domains

Raising the Value of Test using MTDs

Eric Thacker, Marketing Director
Credence Systems Corporation
eric_thacker@credence.com

New semiconductor devices have several buses operating at various frequencies. Programming methods for many ATE systems do not account for data rate differences between buses, which complicates device debug and places huge demand on pattern memory. You can now successfully optimize test pattern size, debug time, and tester costs using a Multiple Time Domain (MTD) approach, i.e., separating each bus into its own time domain and by programming the test rates for each domain independently.

In spite of scan DFT-based compression algorithms, scan vectors continue to proliferate, especially as new "two vector" fault models are added for better fault coverage. Also, functional test vectors are still required on many devices to elevate quality and yield levels. You can compress ATPG scan patterns, but functional patterns cannot be similarly compressed. This becomes critical since ATE pattern memory depth is limited, often forcing expensive memory upgrades.

Functional patterns from simulation need to be processed before loading in the tester. Signals have to be cyclized, timing aligned, and strobes need to be added – a highly iterative process – and the resultant pattern is then compiled in a tester format. Functional patterns consist of device information for high speed (HS) data and clock buses, low speed (LS) command buses and DC pins. The traditional way for test patterns to be cyclized is to use the smallest period consistent with the event rate of the fastest bus (e.g., a 5ns period) on all pins. This is acceptable for HS pins but not for LS and DC pins. Moreover, the 5ns period is still applied even when the HS bus is not toggling.

The more optimal MTD approach processes each bus at its natural frequency, by separating each into its own time domain. If the HS pin is not toggling at maximum frequency during the entire pattern, you can have two different test periods for one timing domain and then switch between periods on-the-fly. This greatly simplifies test program development, specifically in the set-up of timing and creation of test vectors.

Debug using traditional methods is trickier since you are limited in the adjustment of the strobe and drive edges. The MTD approach offers key advantages:

- *The debug time is reduced, since the pattern doesn't need to be re-generated to move strobes or drive edges.*
- *The waveforms displayed at the tester are easier to understand since the data transfers of each bus are displayed in their own native data rate.*

To be able to fully exploit MTD benefits, the tester must fulfill certain key requirements that enable inter-instrument synchronization, including (1) Coherent, repeatable, test start (2) Per-domain vector sequencing, and (3) Per-domain test period and timing.

Modern ATE architectures share the same pattern memory for both functional and scan-based vectors, requiring that the demand for total vector storage between functional and scan-based vectors be balanced, to avoid purchasing memory upgrades for the tester channels. Platforms such as Credence Systems' Sapphire tester with XTOS software allow engineering teams to easily adopt MTD processing for functional patterns, which:

- *Enables faster debug cycles and better test floor efficiency*
- *Eliminates unnecessary capital expenditures for additional tester memory*

The flexible XTOS software offers further benefits. The XTOS STIL pattern compiler allows each time domain to be a separate STIL vector file. The XTOS Waveform display tool joins these disparate, asynchronous time domains into an integrated display, showing the user-selectable tester channel waveforms in a time-coherent fashion with different period time scales used by each domain.

To read a paper about how a leading IC manufacturer is effectively using a successful MTD approach today, visit *www.credence.com/sapphire*

RICK NELSON
CHIEF EDITOR
rnelson@tmworld.com

Tools take aim at memory yield

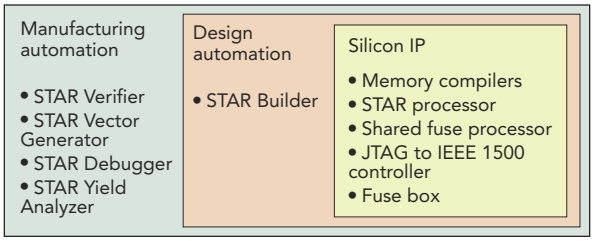
Yield ramping is becoming a critical aspect of chip design and production as geometries shrink to 65 nm and below. The topic garnered widespread coverage at last month's International Test Conference (October 21–26, Santa Clara, CA).

As Janusz Rajski, ITC program chair and Mentor Graphics chief scientist and director of DFT engineering, put it in an interview before the show, "We have noticed that a lot of the challenges we saw in the past are compounding when we go to 65 nm and below. Issues related to power and to the staggering complexity and small feature sizes of 65-nm devices add new types of defects—including systematic defects—that can impact yield."

Many presentations and product highlights focused on yield enhancement for system-on-chip (SOC) devices. But of course, yield has long been an issue for memory chips as well. As Dr. Yervant Zorian, Virage Logic's VP and chief scientist, puts it, "Memories are defect magnets," attracting random, systematic, and parametric defects.

To help deal with such defects, Virage at ITC introduced a new version of its Self Test and Repair (STAR) memory system. Originally introduced in 2001 and, according to Zorian, now employed by more than 100 companies, STAR has gained a dashboard of user-selectable options that let users make tradeoffs between test time, die area, and diagnostic resolution.

But the key feature addressing yield, said Zorian, is the STAR Yield Accelerator, part of a manufacturing-automation component of the system that, in the new release, complements the technology's design-automation and silicon-IP components (**figure**). The Yield Accelerator incorporates STAR Verifier, Vector Generator, Debugger, and Yield Analyzer components.



The STAR system from Virage Logic includes manufacturing-automation components, which complement the technology's design-automation and silicon-IP features.

The goals, said Zorian, are to localize a defect to a specific cell, to determine whether the cause is design- or process-related, and to learn from current chips to improve future ones. Project-based pricing for STAR with Yield Accelerator begins at $50,000.

Virage Logic also announced that it has opened the STAR memory system architecture to enable the integration of commercially and internally developed memories. Brani Buric, VP of product marketing and strategic foundry relationships, said the intention is to unlock the technology's value for customers whether or not they use Virage Logic memories.

In addition, Virage announced the availability of a new family of 65-nm products: SiWare Memory compilers and SiWare Logic libraries. SiWare Memory includes a portfolio of silicon-aware, power-optimized, 65-nm memory compilers along with a dashboard capability for managing design tradeoffs; SiWare Logic includes yield-optimized standard cells, multiple-threshold process variants, engineering change-order kits, and ultralow power kits.

The new offerings broaden the company's Silicon Aware IP portfolio to enable customers to design faster, lower-power, and more area-efficient SOCs while achieving higher yields. Project pricing starts at $70,000. T&MW

10-GHz ZIF socket handles BGAs

Ironwood Electronics' CG-BGA-500 ZIF socket for 0.5-mm pitch ball-grid arrays (BGAs) operates to 10 GHz with less than 1-dB of insertion loss. The socket can dissipate several watts without extra heat sinking and can handle up to 100 W with a custom heat sink. The contact resistance is typically 23 mΩ per pin. The socket accommodates 6-mm BGA body-size IC packages having 121 balls in an 11x11 array. Base price: $616. www.ironwoodelectronics.com.

Fabless services firm picks Verigy

Verigy has announced that Alchip Technologies has selected the Verigy V93000 SOC Series Pin Scale system as its next-generation test platform. Alchip, a provider of silicon design and manufacturing services, will use the V93000's multisite and parallel test capabilities to support Alchip's requirements for testing its customers' high-pin-count SOC and system-in-package (SIP) devices. www.alchip.com; www.verigy.com.

Carsem selects microFLEX for automotive device test

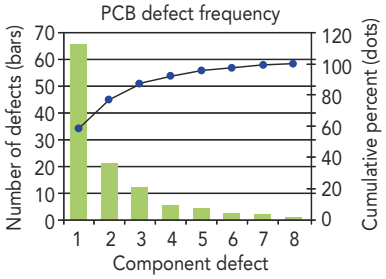
Teradyne reports that Carsem, a provider of packaging and test services to the semiconductor industry, has purchased a Teradyne microFLEX test system to test battery-management devices used in automotive applications. Equipped with DC90 V/I high-current and high-voltage instrumentation, the microFLEX test system will be installed in Carsem's Ipoh, Malaysia, facility. www.teradyne.com; www.carsem.com.

JON TITUS
CONTRIBUTING TECHNICAL EDITOR
jontitus@comcast.net

Send vision data to SPC software

You expect a vision system to indicate a pass or fail condition after each inspection. But your system also might identify the *types* of failures, such as missing ICs, damaged capacitors, or nonfunctional displays. Using statistical process-control (SPC) software to collect and process information about the types of defects you encounter can give you better control over their causes and help you improve production yields.

You may already use home-grown statistical tools and even Excel spreadsheets to compute moving averages,



A Pareto chart shows the defects that cause the most problems. Eliminating defects related to component #1 raises the ratio of products that pass inspection to about 77%. Test engineers can next eliminate defects related to component #2 and raise the ratio to better than 87%.

standard deviations, range limits, and so on. A commercial SPC package formalizes the tools and techniques and provides information in standard charts that other engineers can understand. And commercial SPC packages use standard algorithms to help you keep processes under control and within specifications.

SPC software produces graphic information such as the Pareto chart, named after Italian economist Vilfredo Pareto (1884–1923), which in SPC applications plots defects from highest to lowest number. The Pareto chart shown in the **figure** illustrates the cumulative increase in the quality of products as engineers and equipment operators eliminate each defect. Elimination starts with the defect that causes the most problems.

SPC techniques also produce charts that plot how manufacturing variables change in production lots. A typical chart plots a variable, perhaps a critical dimension, from each lot of products against the expected average value. This type of graph also includes upper-control and lower-control limits. If a production lot's average dimension exceeds these limits, part of the production process related to the dimension has gone out of control. Engineers don't simply pull limits out of thin air or use those demanded by a marketing department; they use process statistics to determine limits based on normal distributions of defects.

You will find many other types of quality-measurement charts in commercial SPC software. But no matter how you look at SPC, the goal is not to simply plot data, but to identify the root causes of defects and eliminate them.

If you want to link inspection data from a vision system to SPC software, you must ensure the vision system can produce results in a format SPC software can accept. Many software packages provide tools that simplify this data-transfer step.

The QuickBuild tool within Cognex's Vision Pro software, for example, lets engineers use comma-separated-value or tab-separated-value formats to transfer ASCII-encoded information to other applications. Likewise, data from National Instruments' Vision Builder and LabView programs let engineers choose from many formats and use ActiveX controls to exchange data between applications. Software from both companies uses the TCP/IP protocol to transfer data to networked computers and servers. T&MW

FOR FURTHER READING

For an introduction to SPC, step through Wayworld's tutorial at www.wayworld.com.

Software supplier MoreSteam provides more details about SPC at www.moresteam.com/toolbox/t402.cfm.

S/TEM microscope includes monochromator

FEI's Titan3 80-300 scanning/transmission electron microscope (S/TEM) extends the capabilities of FEI's Titan, introduced in 2005 to provide aberration-free, sub-Ångström vision so researchers could study how atoms combine to form materials, how materials grow, and how they respond to external factors. An included monochromator provides information about bonding states of atoms and about electronic properties on the nanoscale. www.fei.com.

Camera aids production-line fault finding

Designed for machine-vision and process-control applications, the Fastcam MC1 remote-head camera from Photron delivers 2000 fps at full resolution and up to 10,000 fps at reduced resolution. Two memory options provide for either 2 s (1 Gbyte) or 4 s (2 Gbytes) of record time at 2000 fps and 8 s (1 Gbyte) or 16 s (2 Gbytes) at 500 fps. www.photron.com.

Cognex expands wafer reader offerings

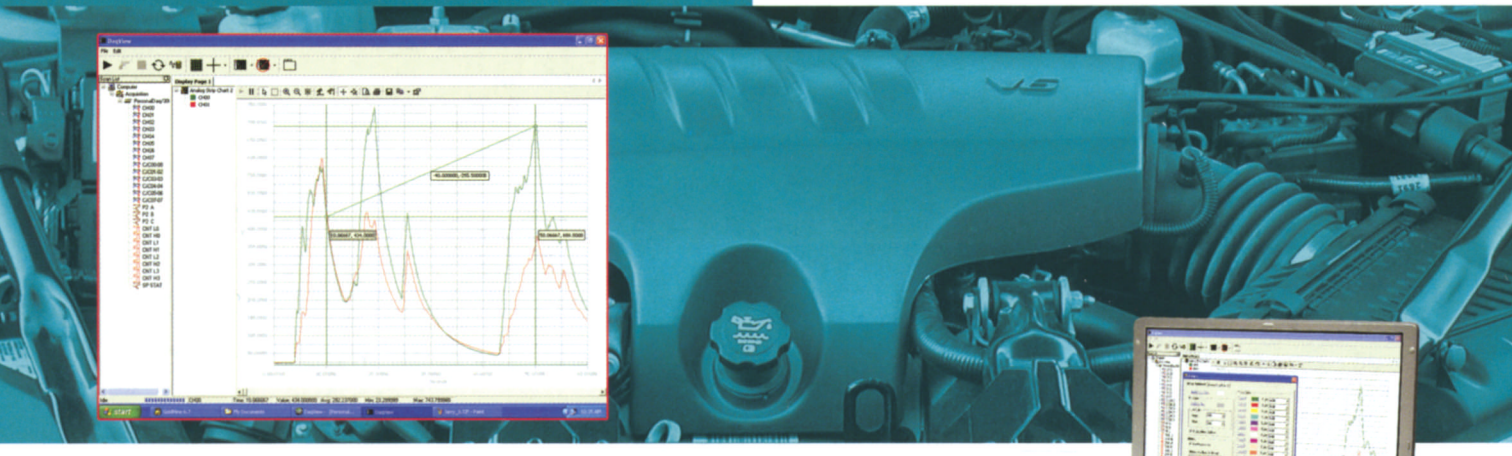
With the addition of the In-Sight 1720, Cognex now offers three high-performance wafer readers. The In-Sight 1720 features OCR and bar-code reading with a 752x480-pixel CMOS sensor. The In-Sight 1721 incorporates a high-resolution 1024x768-pixel CCD for 300-mm wafers with T7 Data Matrix codes, while the In-Sight 1722 includes infrared lighting for ultra-thin oxide, nitride, and polyimide wafer coatings. www.cognex.com.

THE LEADER IN DATA ACQUISITION SOLUTIONS

Out-of-the-Box
DATA ACQUISITION

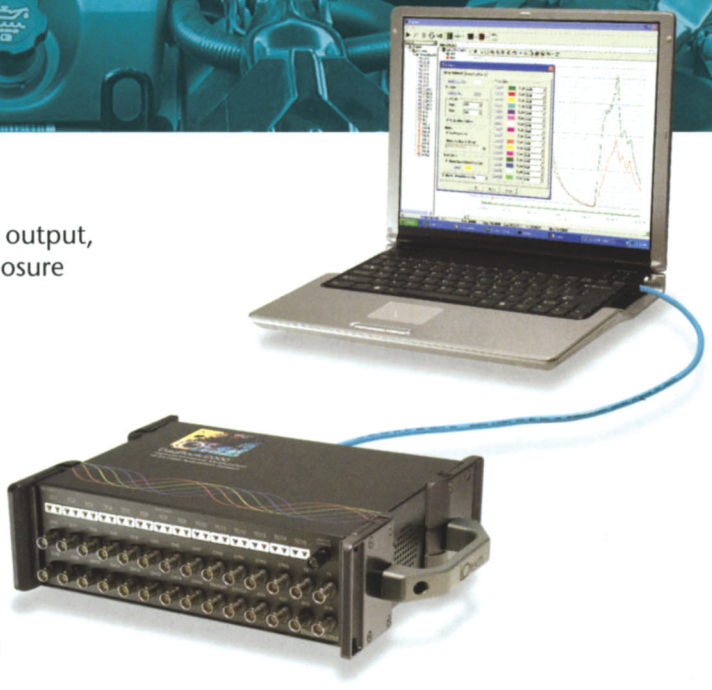
IOtech's **DaqBook** with ***Out-of-the-Box* DaqView** software offer the widest selection of portable data acquisition for thermocouples, strain gages, accelerometers, and many more.

> *Contact IOtech for an on-site demo*



DaqBook features include:

- Analog input, analog output, frequency input, timer output, and digital I/O; all in one compact and portable enclosure
- 16-bit, 200-kHz A/D converter
- Included DaqView *Out-of-the-Box* software for effortless data logging and analysis
- Comprehensive drivers for DASYLab®, MATLAB®, LabVIEW®, Visual C++®, Visual C#®, Visual Basic®, and Visual Basic® .NET
- Operates -30˚ to +70˚C
- DaqBooks attach to over 40 DBK signal conditioning options to assemble a low-cost system, customized to your particular application



Visit *iotech.com/daqbook* for complete specs, pricing, and accessory information, or call (888) 890-3011

IOtech®

iotech.com/daqbook
call us (888) 890-3011
email us sales@iotech.com

MEASUREMENT COMPUTING

HIGH PERFORMANCE MULTIFUNCTION DATA ACQUISITION

USB-1608HS $1199

Simultaneous 8-channel, 16-bit, USB-based multifunction module

Features

- Eight differential or single-ended analog inputs
- True simultaneous sampling (1 A/D converter per input)
- 250 kS/s per channel (2 MS/s aggregate)
- 32-bit event counter
- Analog/digital trigger inputs
- 16 digital I/O bits—LED status indicators

ALSO AVAILABLE
USB-1608HS-2AO $1399
Adds two analog outputs

USB-1616HS $1399

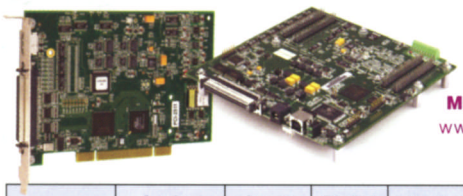
1-MHz, 16-channel, 16-bit, USB-based multifunction module

Features

- 16 single-ended or 8 differential analog inputs
- 7 programmable input ranges
- Analog inputs can measure voltage or thermocouples
- 4 counter inputs capable of measuring frequency, period, pulse width, or quadrature encoders up to 20 MHz
- Synchronous I/O—analog, digital, and counter/timer
- Optional expansion module quadruples analog inputs

ALSO AVAILABLE
USB-1616HS-2 $1499
Adds two analog outputs
USB-1616HS-4 $1599
Adds four analog outputs

PCI-2500 AND USB-2500 SERIES 1-MHz, 16-BIT MULTIFUNCTION DATA ACQUISITION BOARDS

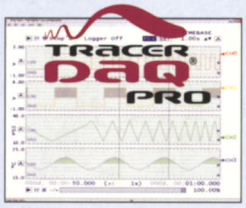


STARTING AT $549

MORE INFORMATION
www.mccdaq.com/2500

Product	Analog Inputs	Input Ranges	Digital I/O	Analog Outputs	Counters (32-bit)	Timers (16-bit)
PCI-2511	16SE	1	24	-	4	2
PCI-2513	16SE/8DI	7	24	-	4	2
PCI-2515	16SE/8DI	7	24	2	4	3
PCI-2517	16SE/8DI	7	24	4	4	2
USB-2523	16SE/8DI	7	24	-	4	2
USB-2527	16SE/8DI	7	24	4	4	2
USB-2533	64SE/32DI	7	24	-	4	2
USB-2537	64SE/32DI	7	24	4	4	2

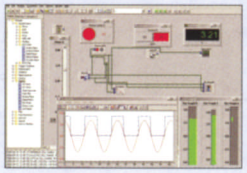
A COMPLETE RANGE OF SOFTWARE FOR EVERY SKILL SET, INCLUDING:



TracerDAQ® Pro $199
Data Acquisition Logger and Instrument Software Suite
4 virtual instruments: Strip Chart, Function Generator, Oscilloscope, and Rate Generator

DASYLab
Data Acquisition System Laboratory

AVAILABLE IN FOUR SPECIALIZED VERSIONS
www.mccdaq.com/dasylab



DASYLab Starting at $499
Intuitive graphical DAQ development environment
Over 90 data acquisition, control, processing, and display functions in the following categories/modules (availability differs by version): Inputs/outputs • Signal analysis • Trigger • Control • Display • Files • Data reduction • Mathematics • Statistics • Network

Call us today at (508) 946-5100

A complete selection of low-cost DAQ hardware—and software for every skill set

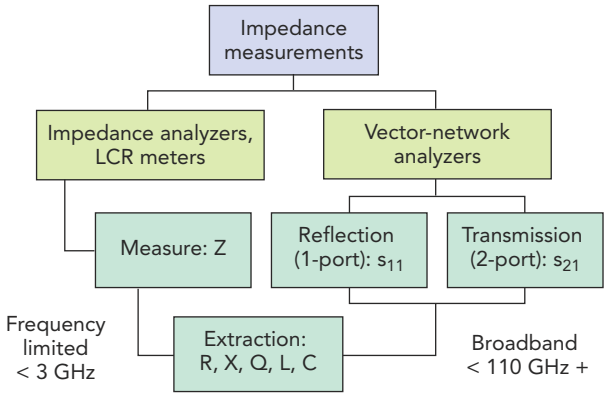
MEASUREMENT COMPUTING **www.mccdaq.com**

SEMICONDUCTOR TEST

Evolving IC technology influences impedance measurements

In semiconductor device and process characterization and model verification, wafer-level impedance measurements are a necessity, especially in a world of high-k, ultra-thin, and low-k dielectrics. In the Webcast "The A B C-V's of Accurate Impedance Measurements on Wafer," Andrej Rumiantsev, applications group manager at Suss MicroTec Test Systems, begins by summing up technology trends as described in the International Technology Roadmap for Semiconductors (ITRS): Integration levels are getting higher, devices are getting smaller, gate oxides are getting thinner, gate leakage is getting higher, and frequencies are getting higher. He then explains how those trends affect impedance measurements and how engineers can best ensure accurate, repeatable measurements.

Rumiantsev describes the LCR meters and vector-network analyzers that can be used to make impedance measurements, and he describes in detail several methods for measuring impedance that differ based on the measurement frequency, the setup, and the equipment used (**figure**). He notes that LCR meters can be effective at relatively low frequencies (less than 3 GHz), while S-parameter extraction using a vector-network analyzer provides good repeatability and reliability to 110 GHz and beyond. He comments on the importance of environment control in any on-wafer impedance measurement, because DUTs are sensitive to temperature changes, electromagnetic interference (EMI), and light. To optimize measurement accuracy, he says, instruments should be integrated into a probe system to minimize cable lengths and eliminate feed-throughs.



On-wafer impedance measurement methods differ depending on the frequency of interest as well as on the type of instrumentation used.

The Webcast, sponsored by Suss and produced by *Test & Measurement World* and *Semiconductor International*, provides details on auto-balancing bridge (ABB), RF I-V, and S-parameter impedance-measurement methods. It also covers probe and probe-pad considerations as well as calibration and calibration-verification methods. You can view the archived Webcast at www.tmworld.com/webcasts.

Rick Nelson, Chief Editor

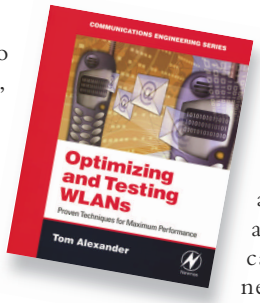
BOOK REVIEW

The tools and tricks of WLAN test

Optimizing and Testing WLANs, by Tom Alexander, Newnes (www.newnespress.com), 2007. 253 pages. $59.95.

The rapid development of IEEE 802.11 WLAN technology has resulted in a dearth of literature on how to test WLANs, contends author Tom Alexander, who sets out to fill the gap. He largely succeeds with this book, which serves as a readable introduction to WLAN test without getting bogged down in the details of the IEEE specs.

Alexander begins with a WLAN introductory chapter before moving on to test and measurement. He begins chapter 2 with the basics, employing a target-practice analogy to define uncertainty, precision, and resolution. He divides instrumentation into physical-layer, protocol, and installation categories, with the last category consisting mostly of ad hoc "walk test" systems that combine spectrum analyzers, sniffers, traffic sources, GPS receivers, and meters. Subsequent chapters provide details on each of these areas.



Alexander provides a good overview chapter on WLAN test environments, including open air, screened room, chambered, and conducted (in which antennas are replaced with cables), and he describes near- and far-field regions within an anechoic chamber.

In consecutive chapters on physical-layer and protocol tests, he takes readers through the gamut of test types, rang-

The tools and tricks of WLAN test *(continued)*

ing from functional tests that occur during development to compliance tests that determine whether a product meets IEEE specs as well as government-mandated emissions requirements. In the physical-layer chapter, he provide such details as how a constellation diagram represents error-vector magnitude; the protocol-test chapter covers transport-layer, network-layer, and data-link-layer test.

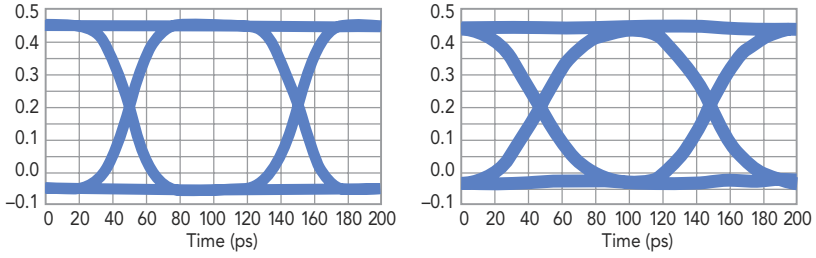
Additional chapters cover topics including application-level measurements (including voice over WLAN, or VoWLAN, test), manufacturing test, and multiple-input multiple-output (MIMO) test. An appendix provides a helpful list of relevant standards and organizations. (Note: The publisher is owned by *Test & Measurement World*'s parent company.)

Rick Nelson, Chief Editor

INSTRUMENTS

Simulations and measurements show consistency

Engineers often use both eye diagrams and S-parameters to characterize passive components such as connectors, printed-circuit board (PCB) backplanes, and relays. When engineers Minh Tran and An Trinh of Teledyne Relays wanted to characterize a new design, they worked with customers to verify that both methods could produce the same results. They also showed that different instruments could produce similar results.



The eye diagram on the left was made from s_{21} measurements on a VNA. The eye on the right was measured with a sampling oscilloscope. Courtesy of Teledyne Relays.

Tran and Trinh measured s_{21} on relays in their lab with an Agilent Technologies vector-network analyzer (VNA). They sent their test results to a customer, whose engineers produced a simulated eye diagram from a simulated 2^9–1 pseudorandom bit sequence (PRBS) signal at 10 Gbps. The customer's engineers repeated the s_{21} measurements on an Anritsu VNA and ran the results through the same algorithm, which produced nearly identical results.

The customer's engineers then set out to prove the validity of the simulated eye diagrams by making the measurements directly with an Agilent sampling oscilloscope. The results proved that the s_{21}-based simulations were valid.

Not content to stop there, Tran and Trinh approached another customer to measure s_{21}. This customer used an Agilent VNA and also produced a simulated eye diagram. The measurements proved consistent with those produced by the first customer.

In addition to proving the validity of the s_{21} measurements, Tran and Trinh measured the effects that a test board and cables had on the eye diagrams. They also measured insertion loss of the relays at frequencies up to 21 GHz with the Agilent VNA. The test setup used impedance-matched transmission lines between the relays and the VNA. Test results shows a nearly flat response at frequencies up to 19.5 GHz.

For more details about the tests that Teledyne Relays conducted, see the online version of this article at www.tmworld.com/2007_11.

Martin Rowe, Senior Technical Editor

NOISE COM
RISING ABOVE THE NOISE.

Sure, other companies talk about diodes, generators and components, but why work with an imitator when you can work with Noise Com? With 25+ years' experience and knowledge, only Noise Com can deliver total noise solutions. From custom components to complex instrumentation, you'll find the reliability and control you need, and the results you expect.

COUNT ON THE NOISE LEADER. COUNT ON NOISE COM FOR:

- Custom designs
- Complete line of noise solutions
- Analog and digital noise
- Passion for innovation
- Proven expertise

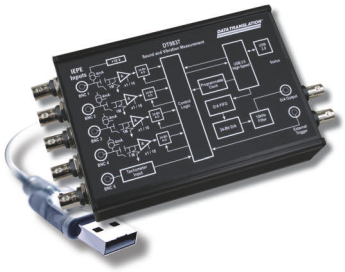
NOISE/COM

A WIRELESS TELECOM GROUP COMPANY

25 Eastmans Road, Parsippany, NJ 07054 • P: 973.386.9696 F: 973.386.9191 • www.noisecom.com

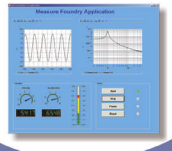
Measurement Application? We Have Answers

Sound & Vibration
DT9837
Portable USB Module



Temperature Measurement
TEMPpoint
Ultra-Accurate 48-Channel Instrument

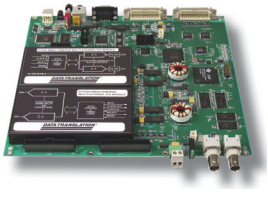
measure FOUNDRY™
Powerful. Open. Application Builder.



Simultaneous Acquisition
DT9832 Series
2MHz per Channel

Low Cost USB Modules
ECONseries
Starting at $149

Real-Time DSP
DT9841
Data Acquisition System



We make measurements easy.
We cover a range of 129 different USB data acquisition modules, each supported by our patented Measure Foundry application software.
We are here to help.

www.datatranslation.com
800-525-8528

DATA TRANSLATION®

COMMUNICATIONS TEST

Keeping the videoconference moving

DEVICE UNDER TEST

Videoconferencing systems that let people hold conferences over the Internet or over private networks. Systems include multipoint control units (MCUs) and middleware that connects clients to conferences. MCUs connect to audio and video equipment such as phones and Webcams. Servers can install conferencing software on client computers when an attendee registers for a meeting.

THE CHALLENGE

Verify interoperability of the videoconferencing software with audio/visual equipment manufactured by numerous companies. Analyze call-setup negotiations. Interject stresses on the network and evaluate audio and video quality.

THE TOOLS

- Apache Jakarta Project: open-source network-traffic testing software. jakarta.apache.org/jmeter.
- Empirix: VoIP network traffic simulation and monitoring system. www.empirix.com.
- Radvision: testing software for H.323 and SIP networks. www.radvision.com.
- Shunra: network emulator. www.shunra.com.
- Wireshark: open-source network protocol analyzer. www.wireshark.org.

PROJECT DESCRIPTION

Radvision (Fair Lawn, NJ, www.radvision.com) manufactures videoconferencing systems. Testing of videoconferencing systems starts with connectivity. The system must work with Microsoft Windows PCs and connect to conferencing equipment such as phones and room systems. Radvision desktop CTO David Bundy explained that engineers test the company's products with audio and video endpoints. Thus, the lab is equipped with a wide range of audio and video sources and displays. "Even though there are industry standards," he explained, "companies interpret them differently. Testing lets us find those differences."

To test connectivity and interoperability, Radvision engineers start by connecting audio/video equipment to PCs running its videoconferencing server and client software. An MCU provides clients and servers with access to a conference (see **figure**). Testing starts with a "clean" network where engineers can verify that the system can add calls to a conference. They use the company's testing software to verify proper call setups and teardowns using H.323 and session-initiation protocol (SIP) protocols.

The H.323 and SIP protocols handle voice and video, but other protocols handle network connections and transport. Engineers use open-source software, running on the server PC, to measure Ethernet packet jitter, latency, and loss. Using the software, engineers capture the data streams from hundreds of calls and play them back to get repeatable tests. An open-source network protocol analyzer lets the engineers monitor and troubleshoot network connections.

After verifying connectivity, the engineers add impairments to stress their videoconferencing hardware and software. Network simulators add packet jitter and latency to the test network. The engineers use bandwidth limitation to verify that their systems will drop the bandwidth of connections as needed. For example, a 256-kbps connection might drop to 64 kbps as network bandwidth drops.

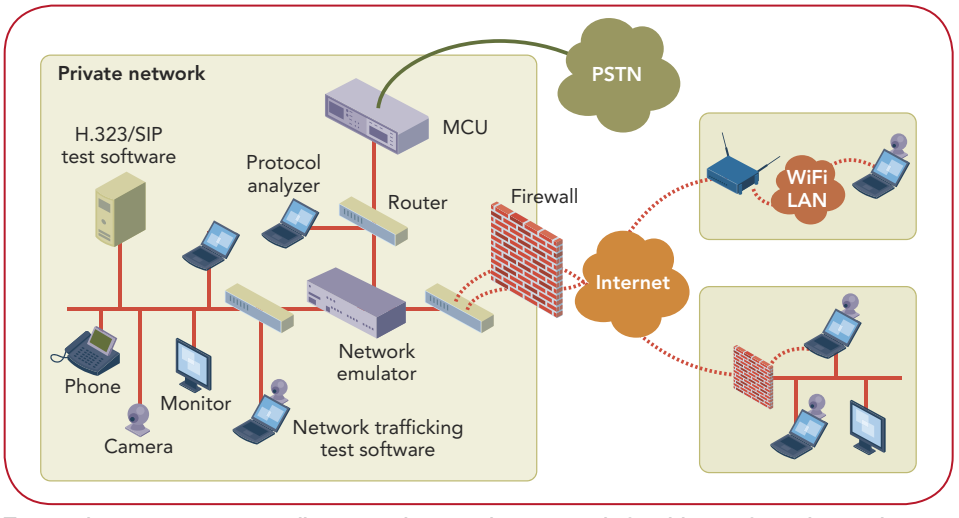
Radvision engineers must verify that conferencing software can traverse firewalls. To do that, they verify that the software runs like a Web-based application using HTTP.

The final test measures audio and video quality, which engineers measure with live participants. While Radvision will use voice-quality testers, the company mostly relies on live participants.

LESSONS LEARNED

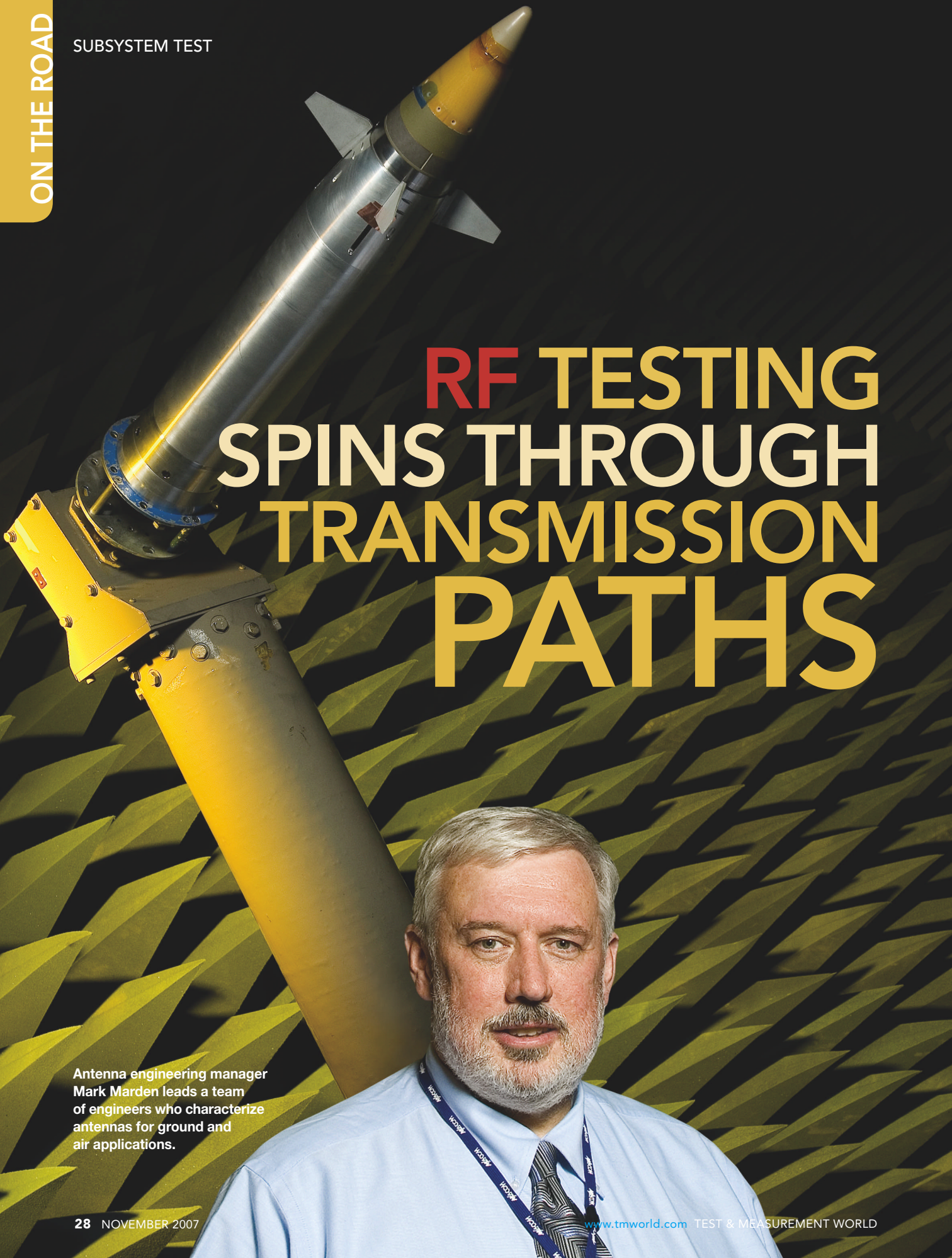
"Even with standards and emulation tools," said Bundy, "you need to test with the actual third-party endpoints for audio and video conferencing. Network stress tools and analysis tools are a must to emulate and evaluate performance in real networks, but you must also capture real network conditions and emulate them with your tools."

Martin Rowe, Senior Technical Editor



Test equipment connects to a live network to monitor protocols for videoconferencing equipment.

RF TESTING SPINS THROUGH TRANSMISSION PATHS



Antenna engineering manager Mark Marden leads a team of engineers who characterize antennas for ground and air applications.

Engineers at Tyco Electronics' M/A-COM business unit test antennas, cables, components, and subsystems for aerospace and defense applications.

BY MARTIN ROWE
SENIOR TECHNICAL EDITOR

LOWELL, MA—A northeastern manufacturing city once known for its textiles is now the headquarters of Tyco Electronics, a maker of RF components and subsystems used in defense and aerospace applications. No longer part of Tyco International, Tyco Electronics M/A-COM manufactures products with brand names such as Adams-Russell, Phoenix Microwave, and Anzac—the names of companies it has acquired over the years.

At the Lowell headquarters, engineers design antennas in many shapes and sizes that run at frequencies up to 60 GHz. Most of these antennas fit into aircraft, missiles, and munitions. The company also manufactures cable assemblies, designing and manufacturing its own cable from raw materials and making connectors in its machine shop.

The company's RF components include frequency converters, amplifiers, doublers, mixers, and switches. Many of these components work in subsystems such as line-replaceable units (LRUs) and electronics warfare (EW) systems. Tyco Electronics also manufactures a device that jams radio signals from improvisational explosive devices (IEDs) and helps save lives in Iraq.

When testing RF components and systems used in aerospace and defense applications, the Tyco Electronics engineers need to use a variety of techniques. Their tests must not only verify the accuracy of high-frequency signals but must also take into account the harsh conditions of the anticipated operating environment. Tyco Electronics designs products for aerospace and defense, which is not a high-volume business. For these products, a few thousand pieces is considered high volume. Testing ranges from 100% characterization for every unit, where each tests takes hours, to simple pass/fail tests that take just a few seconds.

Antenna gain

Tyco Electronics' antennas are used in communications, EW, and navigation systems. They also transmit telemetry or receive GPS signals. The antennas require full characterization for new designs, and engineers led by antenna engineering manager Mark Marden measure antenna pattern, gain, and voltage standing wave ratio (VSWR). **Figure 1** shows two spiral antennas that mount on a launch vehicle. The diameter of an antenna determines its frequency range. Other antenna shapes include flat panels and cones, but shapes and sizes vary widely. Antenna engineers characterize antennas using any of six in-house anechoic chambers that range in size from 12 ft^3 to 60x24x24 ft. Aircraft, spacecraft,

MARK WILSON

FIGURE 1. Spiral antennas fit onto a launch vehicle for monitoring payload operation. Courtesy of Tyco Electronics.

missile, and munitions-based antennas require full-spherical testing, while land-based antennas require hemispherical testing only.

The engineers have devised a mechanism that lets them measure 360° radiating patterns of antennas in the chambers. They move the antenna under test 360° relative to a fixed antenna. **Figure 2** shows the equipment layout for an anechoic chamber that engineers use to articulate the antenna under test's azimuth angle and elevation angle. Typically, the positioner moves the antenna under test in 0.5° and smaller increments. Engineers can adjust the fixed antenna's height because it resides on a movable mast, although its position remains fixed during a test. "The antenna under test becomes the center of the universe" said Marden.

Figure 3 shows a cone-shaped antenna under test in a chamber. A laser-sighting tool system aligns the antenna under test to the fixed antenna, and it maintains the antenna under test's center of rotation during a test. **Figure 4** shows the fixed horn antenna inside the chamber.

Using an Agilent Technologies network analyzer, the engineers measure field amplitude and phase (not all customers require phase measurements), making some 30,000 measurements per frequency. Each test uses eight to 10 frequencies that cover the antenna's frequency range. A test takes between 30 min and two hours to run. Engineers need about four hours to set up and calibrate for a test.

MARK WILSON

Test engineering manager Bill Kane leads a team of engineers who develop automated testers used for production and design verification.

Before installing the antenna under test in the chamber, the engineers calibrate the setup using an antenna with a known gain as a standard. That provides a reference set of measurements to which the engineers can compare the response of an antenna under test.

Antenna environments

Antennas used in aerospace and defense applications must operate over a wide range of temperatures, and they must withstand shock, vibration, and pressure. Prior to placing environmental stresses on an antenna, the engineers make base-

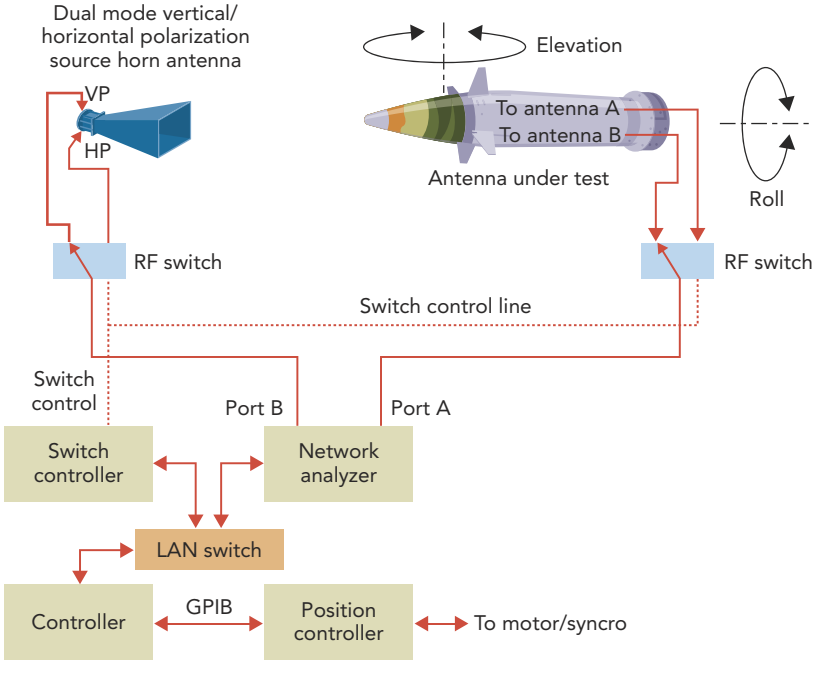


FIGURE 2. Equipment in an anechoic chamber aligns the positions of a transmitting antenna and an antenna under test and articulates the antenna under test for data acquisition.

FIGURE 3. A mechanical arm rotates an antenna under test around a pivot point.
Courtesy of Tyco Electronics.

Advanced semiconductor test technology and solutions

we collaborate

SCALABLE PLATFORM ARCHITECTURE | LOWERS LIFETIME COST-OF-OWNERSHIP | SPEEDS TIME TO MARKET | IMPROVES YIELD | SUPPORTED GLOBALLY

It takes a community of dedicated experts to design, manufacture, and deliver semiconductors in today's market — collaboration among many partners in the supply chain. We work with our customers on innovative approaches to solve complex test challenges. Whether it's characterizing the latest devices, improving yield or reducing cost in high-volume manufacturing, our goal is to be a valued extension of our customers' research and development, manufacturing and supply chain teams. Collaborate for brilliant results. See **www.verigy.com/go/collaborate**.

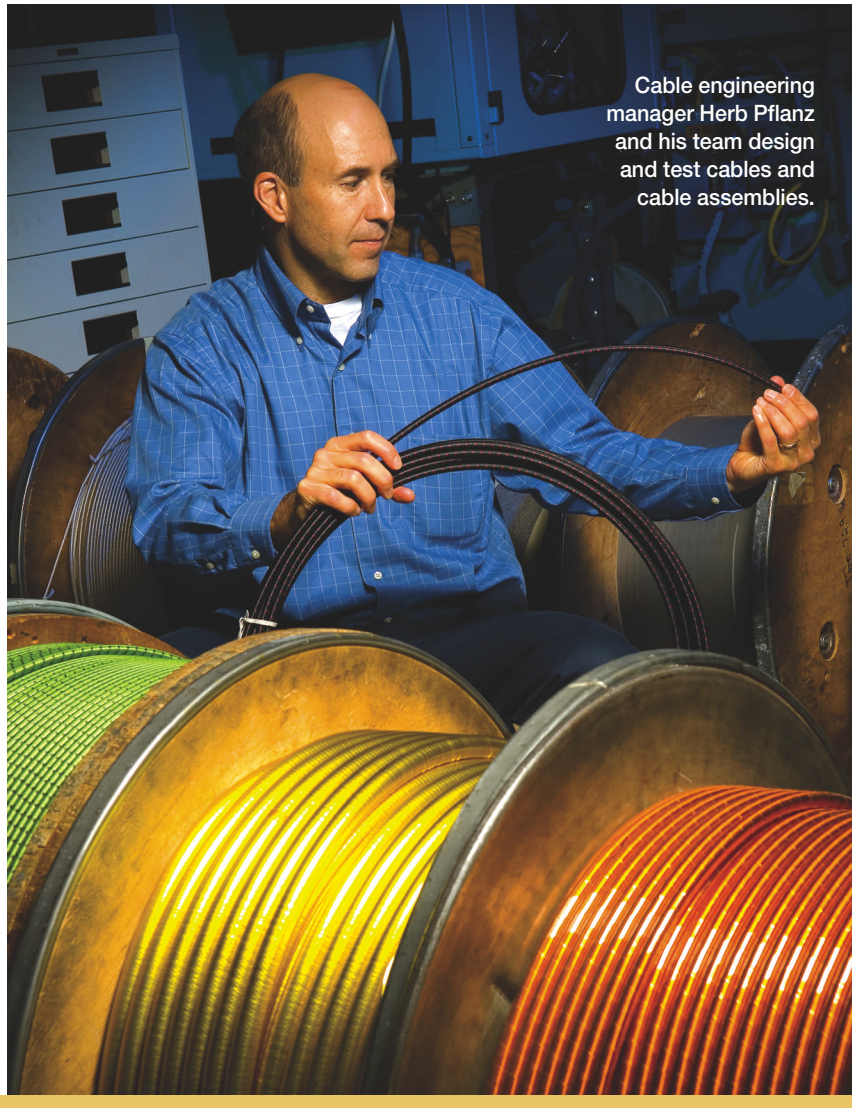
VERIGY
the brilliance of innovation

line measurements, called "acceptance tests," where they prove to the customer that an antenna meets specifications. After subjecting an antenna to environmental stresses, the engineers repeat the performance measurements, this time called "qualification testing."

Qualification testing includes temperature, vibration, and pressure tests as well as highly accelerated life testing (HALT). Engineers may subject an antenna to more than one environmental stress at a time. In the environmental lab, a thermal chamber that contains heaters and LN2 (for cooling) subjects an antenna to temperatures of ±300°F. The chamber can reside on a vibration table, which lets engineers subject the antenna to temperature and vibration simultaneously.

The environmental lab also contains several Thermotron temperature chambers, including a thermal-shock chamber. An elevator moves parts through hot and cold chambers to produce thermal stress. A temperature/altitude chamber stresses parts over wide temperature ranges and over altitudes to 100,000 ft. Humidity chambers simulate dry and humid climates.

Engineers in Marden's group also support production testing. "The percentage of units tested for production per customer requirements varies widely," he noted. "Mission-critical antennas such as those used in launch vehicles will get 100% pattern and gain tested on every



Cable engineering manager Herb Pflanz and his team design and test cables and cable assemblies.

MARK WILSON

Spinning lives on in Lowell

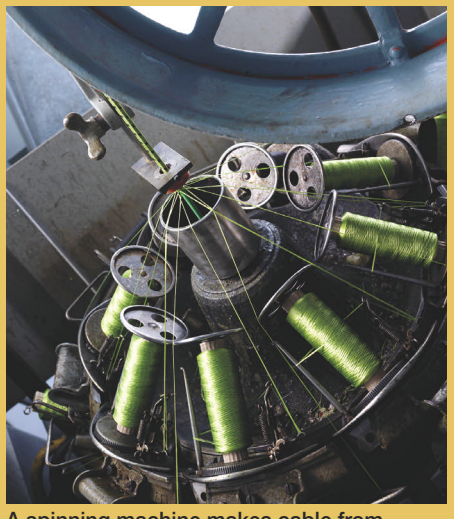
In the 19th century, Lowell and other cities along the Merrimack River gained notoriety for their textile mills. Today, all that remains of the textile industry are the old buildings and a museum. Although some of the spinning machines in the museum still work, they don't produce any textiles for sale.

But that's not to say that all spinning has left Lowell. At Tyco Electronics, located a few miles up river from the old mills, machines keep spinning wire into cable.

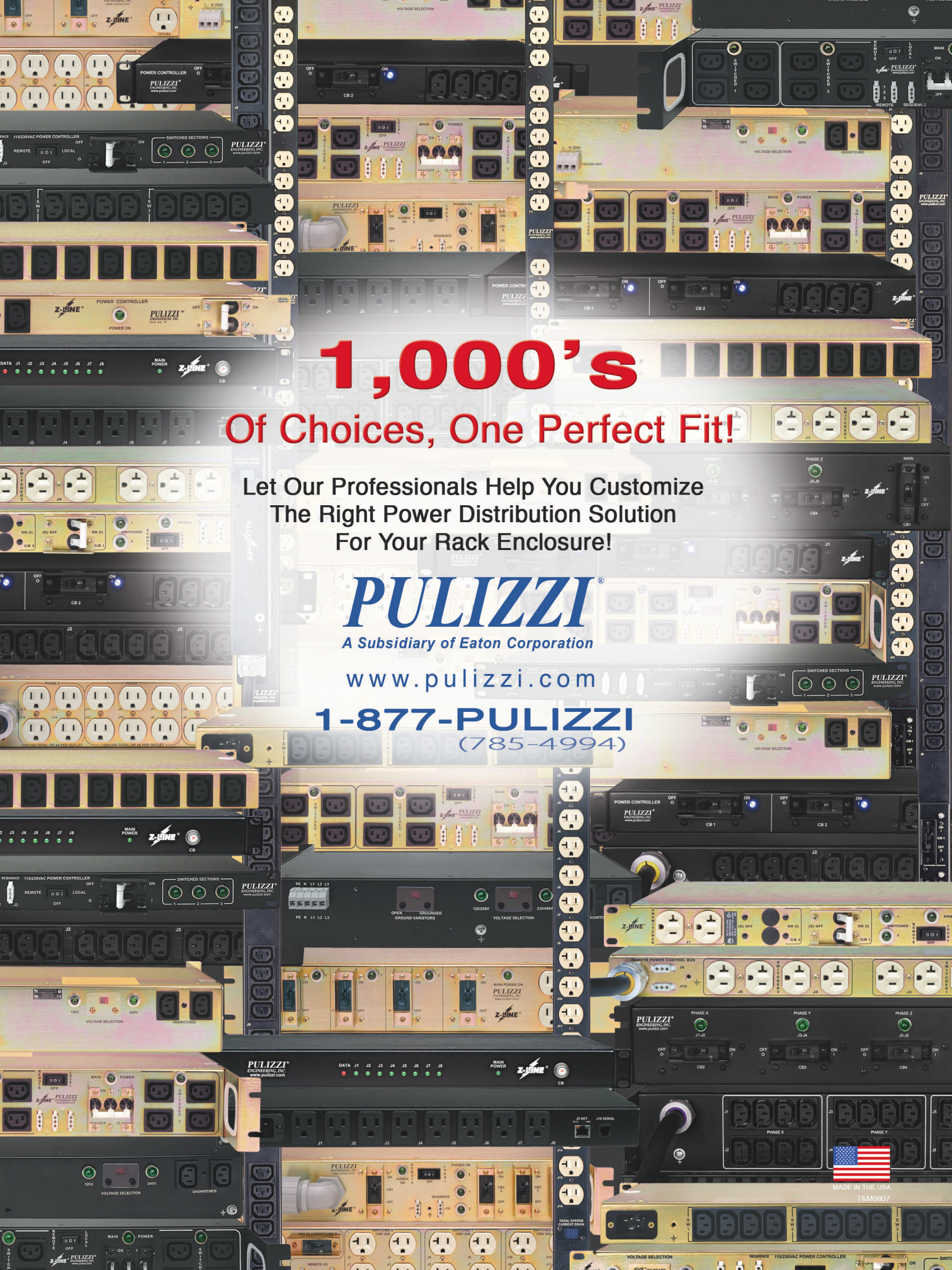
Machines like the one in the **photo** hold rolls of wire or insulating material that is used to form cables. As the machine extracts materials from the rolls, the rolls spin on their axes. They also spin as a group, an action that braids the material into a woven pattern. The machine can spin wire for a cable's center conductors or can spin insulating material into braided shields.

The online version of this article contains a short video of a spinning machine in action (www.tmworld.com/2007_11).

Martin Rowe



A spinning machine makes cable from spools of wire and thread.


1,000's
Of Choices, One Perfect Fit!
Let Our Professionals Help You Customize
The Right Power Distribution Solution
For Your Rack Enclosure!
PULIZZI®
A Subsidiary of Eaton Corporation
www.pulizzi.com
1-877-PULIZZI
(785-4994)
MADE IN THE USA
T&M0807

unit in addition to VSWR measurements."

Many of the company's military antennas are US Government classified. To make sure that test data remains secure, engineers often store measurements in computers with removable hard drives that are stored in a safe.

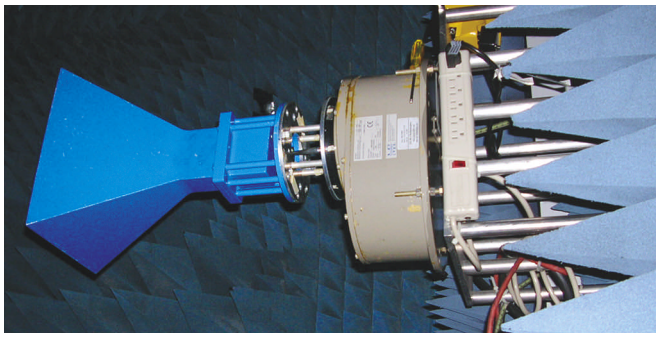


FIGURE 4. Engineers can adjust the height of a transmitting horn antenna to accommodate different sizes of transmitting antennas.

Cables matter

Antennas transmit and receive RF signals, but they need cable and connectors to route those signals to electronic equipment. Because of the specialized uses for Tyco Electronics' products, the company manufactures its own cables and connectors, then assembles them into cable assemblies.

"We manufacture over 300 types of cables in Lowell," said cable engineering manager Herb Pflanz. "We use raw wire, Teflon, Kapton, and Nomex to make cables for military and commercial aircraft." ("Spinning lives in Lowell," p. 32, explains how Tyco Electronics manufactures cables.)

Cables range in length from 6 in. to hundreds of feet. Most operate from DC to 18 GHz, but some work in the range of 26.5 to 50 GHz.

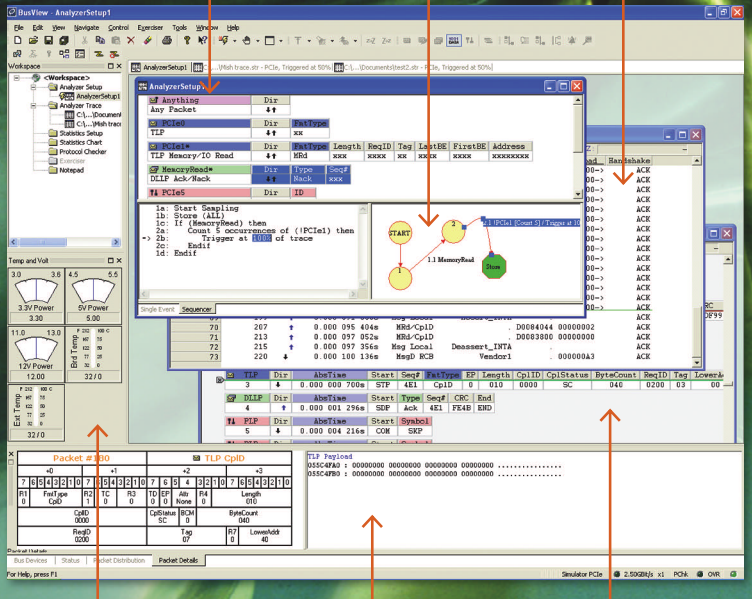
The engineers test cables by measuring transmitted power, reflected power, VSWR, and insertion loss. Customers may specify insertion-loss measurements in dB/m or dB/100 ft. "Cables have a frequency-versus-loss tradeoff. The larger a cable's diameter, the lower its insertion loss but the lower its frequency range," said Pflanz. "Customers will specify loss, length, and frequency range, which dictate a cable's diameter."

Sometimes, a customer specifies sets of cables matched for time delay, insertion loss, or phase. Customers often specify phase matching to within ±10°. To meet that specification, Tyco Electronics engineers design cables with the highest possible velocity of propagation. According to Pflanz, a cable's velocity of propagation typically ranges from 76% to 82%, with 100% being the speed of light.

The velocity of propagation affects a cable's electrical length. "A 12-in. piece of cable can have the same electrical length as a 14-in. cable, depending on velocity of

PCI Express made easy

with the Vanguard Express Analyzer



Powerful

- Supports x1 to x8 PCI Express
- Analyzer, Performance Monitor and Protocol Checker
- Search or Filter for an event or pattern quickly

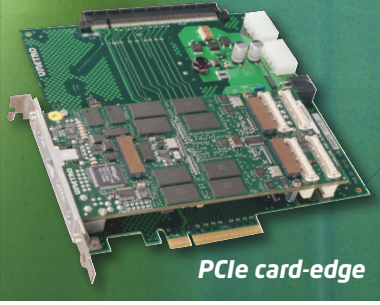
Flexible

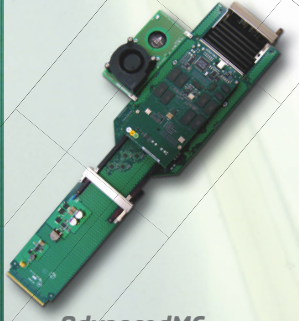
- Ethernet or USB host connection
- All functions can operate concurrently and independently

Easy to Use

- Arrange trace data in Packet, Link, Split Transaction, Data or Lane Views with the click of a mouse
- Same GUI as the Vanguard PCI & VME analyzers
- Set up trigger events and sequences using drop down menus
- Extensive on-line help


XMC


PCIe card-edge


AdvancedMC

20 BEST IN TEST 07
TEST & MEASUREMENT WORLD HONORABLE MENTION

2007 FINALIST ACE AWARDS EETIMES

Processing and FPGA - Input/Output - Data Recording - Bus Analyzers

For more information, please visit
http://analyzer.vmetro.com or call
(281) 584-0728

VMETRO
innovation deployed

propagation," Pflanz noted. **Figure 5** highlights how two cables with identical lengths can pass signals at different speeds, thus producing a phase difference between signals that entered the cables in phase. To produce in-phase outputs, the cables may need different physical lengths.

Tyco Electronics keeps a database of cable characteristics that engineers use to specify matched cables. Cables produced in the same lot will have nearly identical electrical lengths for a given physical length, but cables from different lots, even when manufactured using the same materials and processes, will have different velocities of propagation and thus different electrical lengths. The company will ship electrically matched cable of different lengths as long as those lengths meet customer requirements.

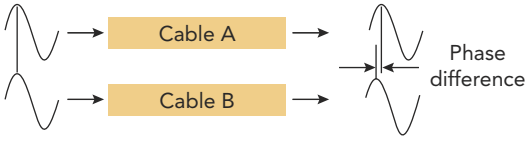


FIGURE 5. Cables with the same physical length but with different propagation velocities will produce outputs with a difference in phase.

Customers may also specify amplitude-balanced cables. These cables are often matched for ±5% insertion loss, but may be tighter. A customer might, for example, specify an insertion loss of 20 dB ±1 dB.

Connecting it all

Engineers at Tyco Electronics also design RF connectors with both standard and custom interfaces that the company manufactures in Lowell. Some connectors have complex designs that incorporate keying rings and self-locking mechanisms that prevent users from using the connectors incorrectly. Some are straight, while other are bent from 45° to 90°. Some connectors have field-replaceable ends.

Critical electrical measurements for connectors include peak-power handling, average power, and insertion loss. Average power ratings vary with frequency, and most range from 50 W to 500 W, although some connectors can handle several thousand watts. Engineers use power meters and network analyzers to make these measurements.

Connectors and cables carry signals to and from electronic devices, and Tyco Electronics manufactures amplifiers, filters, LRUs, and other devices that process signals. LRUs contain analog components such as amplifiers and frequency converters controlled by microprocessors.

Many RF assemblies have analog inputs that adjust parameters such as gain and frequency response. The microprocessor-based digital-control boards in LRUs have digital-to-analog converters that generate those voltages. Engineers use data-acquisition systems to measure and calibrate control voltages. Senior principal engineer Ravi Hans leads a group of eight engineers who develop digital control boards and test systems that test and calibrate RF assemblies.

Engineers in Hans' group test control boards with oscilloscopes, logic analyzers, power supplies, and data-acquisition systems from Agilent Technologies. The engineers developed test boards that perform both digital and RF testing. Using field-programmable gate arrays (FPGAs), engineers can configure a test board for each digital controller. "We have unique interfaces to our boards and need a reconfigurable test board," said Hans. The boards have RS-232 and USB computer interfaces for automated control and configuration.

To automate digital testing, the engineers have developed a reconfigurable test executive written with National Instruments' LabWindows/CVI. "We can reuse code written for engineering evaluations, transferring them to production," Hans added.

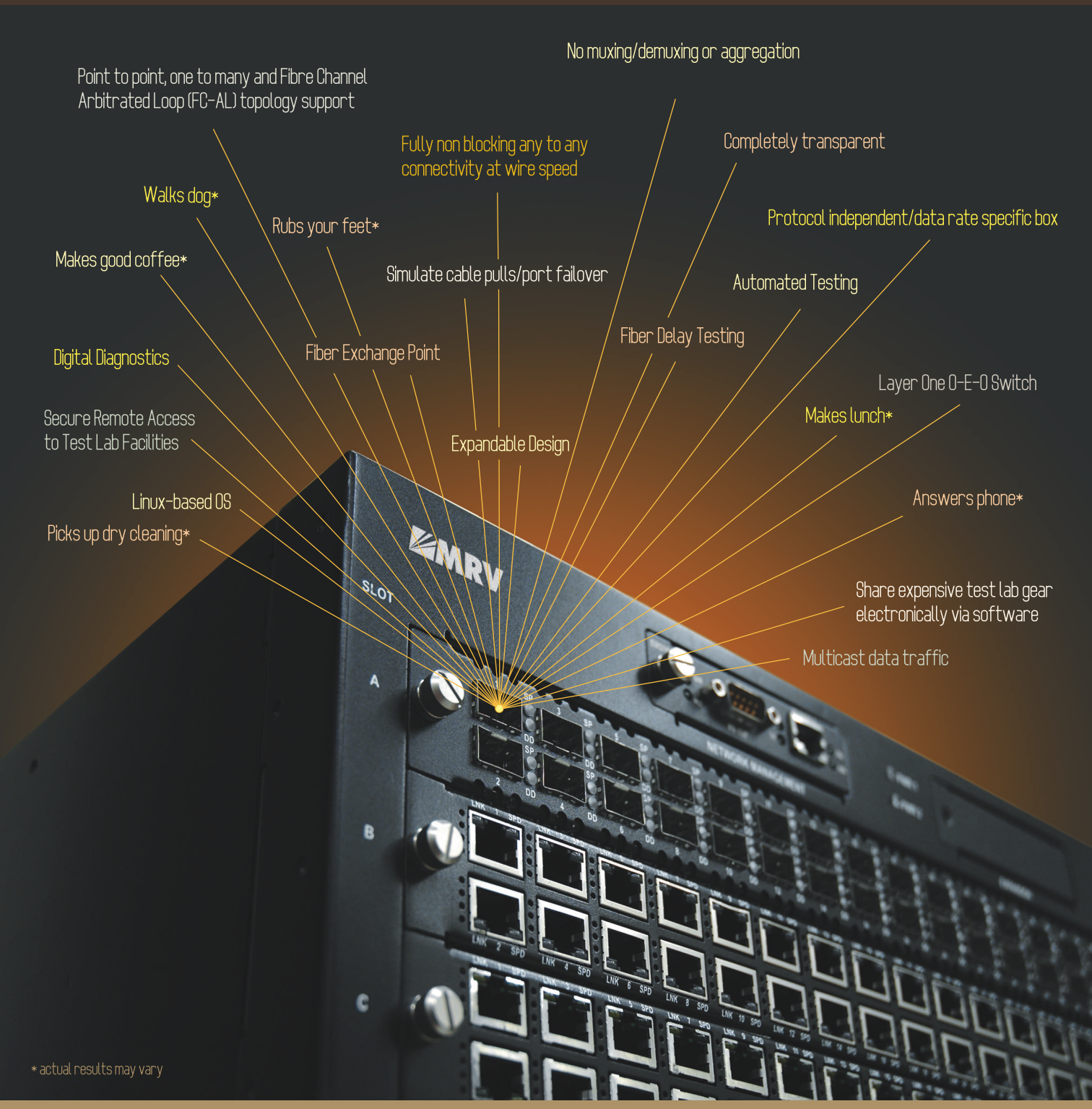
Engineers in Hans' group worked with antenna engineers to develop a device that jams signals aimed at detonating IEDs. Engineers designed the software and firmware that soldiers use to program the jamming device. They also developed tests for RF signal power, frequency, spectrum performance, and DC power consumption.

On to production

RF components and systems, ranging in quantities from hundreds to thousands, must go through production testing. Test engineering manager Bill Kane oversees

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

Media Cross Connect switches are ideal for the Lab Manager and Test Engineer who are trying to create a "light's out" and "wire once" environment. The Media Cross Connect can automate cable reconfigurations in storage systems, servers, peripherals and operating systems. In test labs, the Media Cross Connect offers superior test efficiency and productivity as well as cost performance by allowing test engineers to centralize, share and truly distribute redundant pieces of expensive test gear such as protocol analyzers, traffic/data generators, devices under test (DUT's), servers and storage systems.

Managed by our secure Linux Network Management Card, the Media Cross Connect allows remote access so test engineers can truly share lab resources and minimize downtime.

MRV

Service Aware Networking Technologies™

mediacrossconnect.com

test development for RF component production facilities in Lowell and in San Jose, CA.

The production test teams maintain more than 100 test systems between the combined facilities. These systems can range in complexity from automating a few instruments on a bench to automating one, two, or three racks of test equipment. The test systems have been designed to test passive components as well as multifunction assemblies (MFAs) from DC to 50 GHz.

The automated test systems typically provide savings of over 90% to unit cycle time. For example, one of the complex EW systems that used to require more than 40 hrs of manual test time can now be tested in 3 hrs over three temperatures. In addition, the test systems provide true "fire and forget" capability, which allows one operator to operate several stands at once; testing can also be conducted overnight with no operator necessary.

At Tyco Electronics, test engineers develop both government-funded and company-funded test systems. Government-funded systems are dedicated to testing a specific range of products, while company-funded systems may test a wide range of products. Test engineers often reconfigure company-funded systems to meet production needs on new programs using the latest equipment and software.

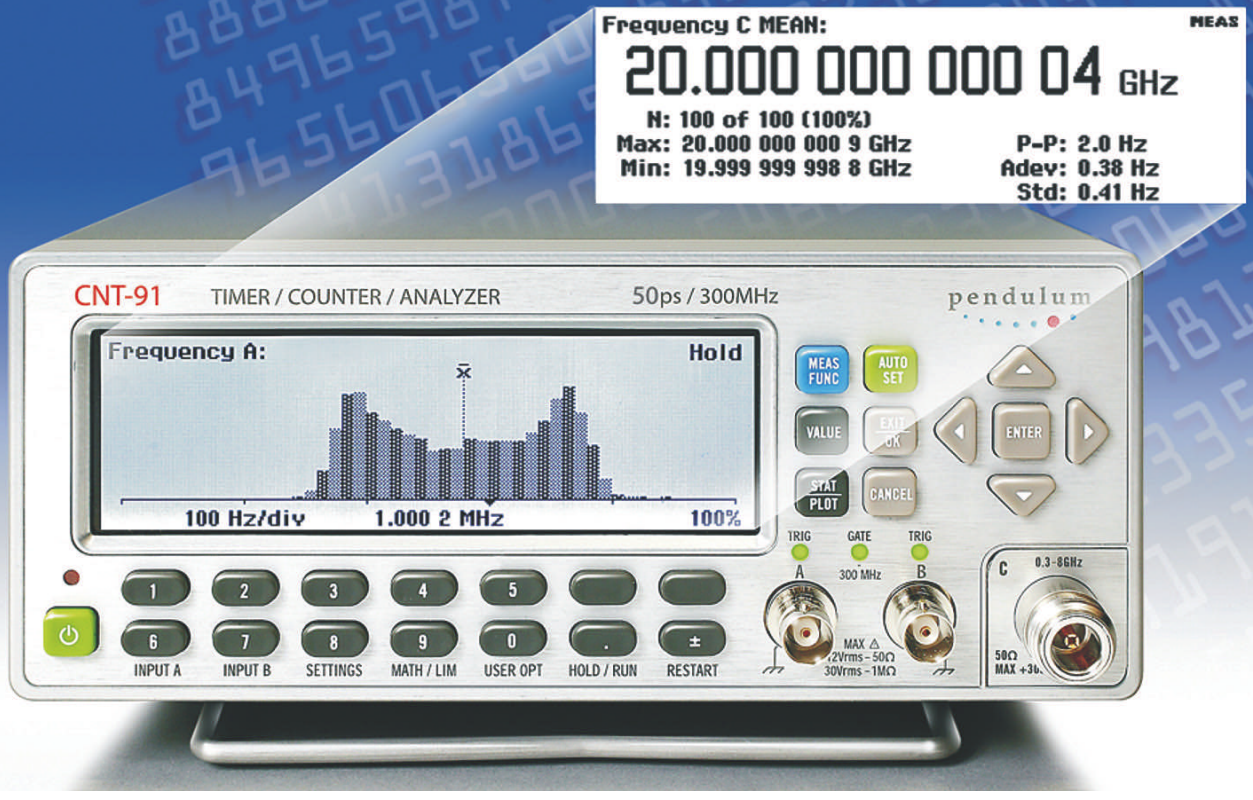
Four of the single-rack test stations test three types of high-power amplifiers. Bed-of-nails fixtures connect the tester's power supplies to printed-circuit boards (PCBs). Network analyzers, spectrum analyzers, and digital multimeters (DMMs) measure most test parameters.

"Design engineers perform bench testing while we develop the automated test stations," said Kane. "They use the automated testers during product development. We also run tests for design engineering, and we often write automation code that they use. We later reuse the code for production."

Software engineers in Kane's group have developed a library of test functions using Agilent Vee that they often reuse to test new products. Test software stores measurement results in a database, generating as many as 90 sheets of data per part, depending on the length of a test. Unclassified test data resides on an Oracle database; engineers can analyze the data, looking for trends that may take days of testing to appear, to improve manufacturing processes.

Engineers at Tyco Electronics extensively test antennas, components, and systems used for military and aerospace applications. "The ability to produce automated test systems in-house, alongside the project development team, provides a tremendous advantage in development cycle time and cost," said John McGuire, manager of quality and operational excellence for the group. T&MW

Continuous
Time & Frequency Measurements
with Zero Dead-Time



NEW CNT-91 Timer/Counter/Analyzer
Ultimate Speed, Resolution & Analysis

Save Test Time
Continuous data streaming during, not after, measurements
Up to 20 GHz range, burst measurements down to 20 ns
250,000 meas/sec to internal 3,5M total result memory
Up to 15,000 meas/sec over GPIB and USB

Perform Ultra High Resolution Measurements
50 ps single-shot time interval resolution
12 digits/sec frequency resolution

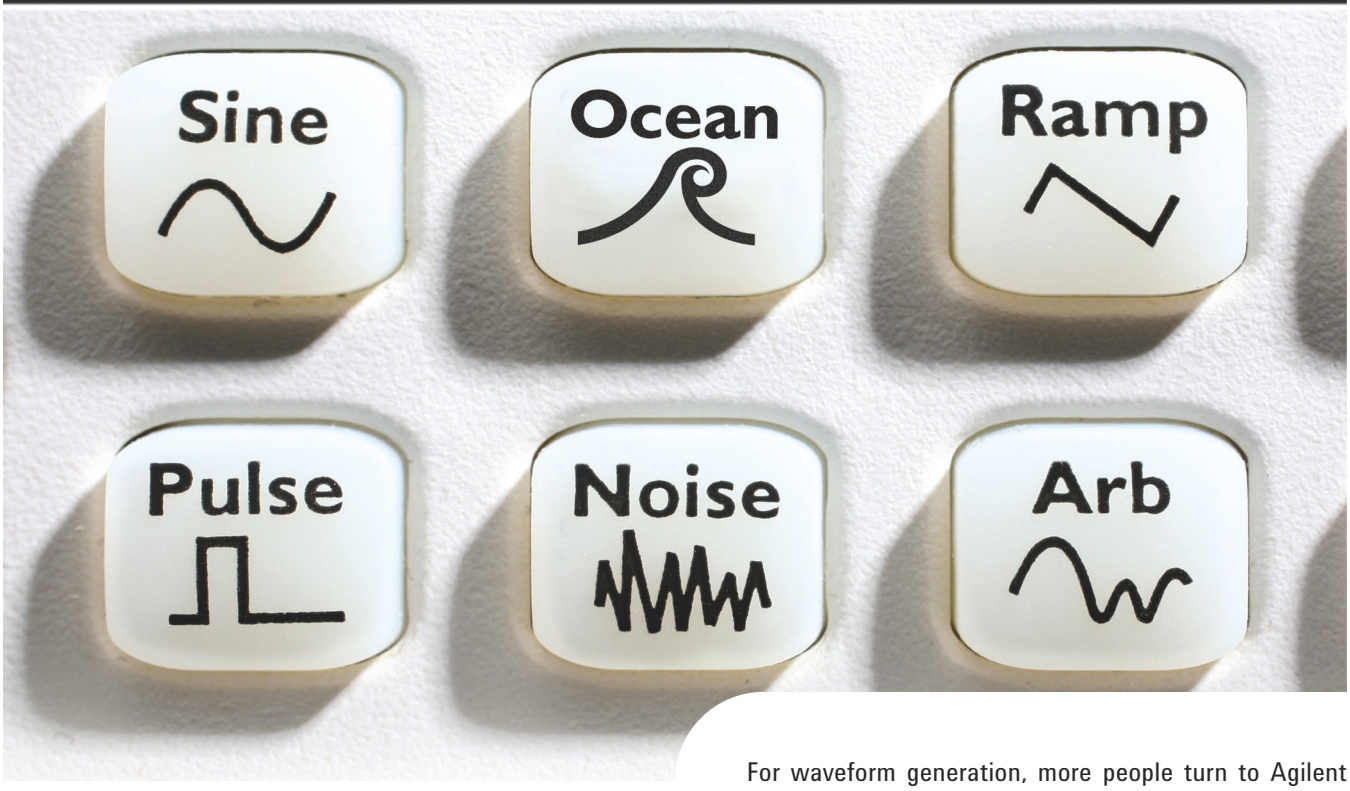
View Advanced Graphic Analysis in Real-Time
Graphic display of jitter, histograms, trend and modulation
Modulation domain analysis to 20 GHz with TimeView SW

Pendulum Instruments
- Experts in Time & Frequency Calibration, Measurement and Analysis
Phone: 510-428-9488 (USA/Canada) +46 8 598 510 57 (Worldwide)
www.pendulum-instruments.com

pendulum
Incorporating XL Microwave

Create any kind of waveform

With the industry's best-selling function generators.



Agilent 33220A Function Generator

	33220A *20 MHz Sine & Square*	***33250A*** *80 MHz Sine & Square*
Basic Waveforms	*11 Built-in Low Distortion*	
Pulse	*Variable Edge 5 MHz*	*Variable Edge 50 MHz*
Arbitrary Waveforms	*14-bits, 64K points*	*12-bits, 64K points*
Modulation *(Internal / External)*	*AM, FM, PM, FSK & PWM*	*AM, FM & FSK*
Open Connectivity	*USB, GPIB & LAN*	*GPIB & RS232*
Price *(USD, Subject to change)*	*$1,853.00*	*$4,553.00*

TUCKER ELECTRONICS

800-527-4642
www.tucker.com/agilent

u.s. 1-800-829-4444

canada 1-877-894-4414

www.agilent.com/find/functiongens2

For waveform generation, more people turn to Agilent than anyone else.

The Agilent 33220A and 33250A produce almost any kind of waveform you can imagine. You'll have built-in modulation, sweep, and burst capabilities. You'll be able to generate pulses and create arbitrary waveforms using up to 64K points of memory. With this much functionality, the possibilities are endless.

Agilent function generators come with free IntuiLink software and industry standard I/O connectivity for your PC. Built for both R&D and manufacturing use, the 33220A and 33250A add value to every stage of the design cycle.

To learn more, go to www.agilent.com/find/functiongens2

Agilent Technologies

Images from infrared cameras can identify problems visual inspections and electrical tests overlook.

ENGINEERS WARM UP *to* IR VISION

BY JON TITUS, CONTRIBUTING TECHNICAL EDITOR

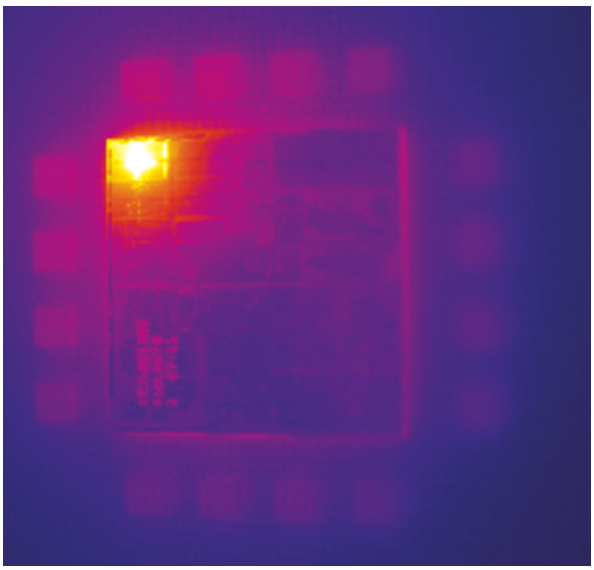
Although a thermal, or infrared, vision system can easily inspect printed-circuit boards (PCBs) and their components, many people in the electronics business don't fully understand what thermal imaging can do for them. In essence, an infrared (IR) camera provides a visual thermal profile that will immediately indicate problems.

Andy Beck, national sales manager at Mikron Infrared, recently found himself the lone exhibitor of IR-imaging equipment at a trade show. "Engineers would ask, 'What does infrared have to do with vision?' I explained thermal imaging and some typical applications. After a few minutes, the engineers could envision many applications in their companies. But prior to their booth visit, they hadn't thought of IR imaging as an inspection tool."

Even when engineers know about IR vision, they can discount its value. "We used an IR camera to show a skeptical researcher that a small IC ran at 80°C," said Rich Barton, technical director at OptoTherm. "But he used a thermocouple to measure the IC's temperature as 40°C. On small packages, a sensor acts like a heat sink, so it cannot accurately measure the IC's normal operating temperature." After the customer used a smaller sensor, thermal grease, and insulation, sensor measurements climbed close to 80°C. "This fellow then realized all his previous measurements were incorrect."

A typical IR-vision project starts with a conversation that lets equipment suppliers determine whether an IR-based inspection system can meet key inspection requirements. "We send the inquirer a form with about 30 questions to answer," said Beck. Based on the answers, a price quotation may follow to quickly separate buyers with a budget from "tire kickers."

"Mikron manufactures IR cameras and provides a turnkey IR-imaging system, so we can easily add capabilities and answer questions about any problem," explained Beck. Suppose, though, engineers buy cameras from vendor A, software from vendor B, and computers from vendor C. When their home-built system has problems, who takes responsibility and sorts everything out? "Engineers should find a reputable company and buy a complete inspection system from it for no other reason than the vendor will take full responsibility for the entire system," said Beck.



The thermal image of a biased computer chip quickly reveals a defect that visible-light imaging would not see. Courtesy of FLIR Systems.

Choose your detector technology

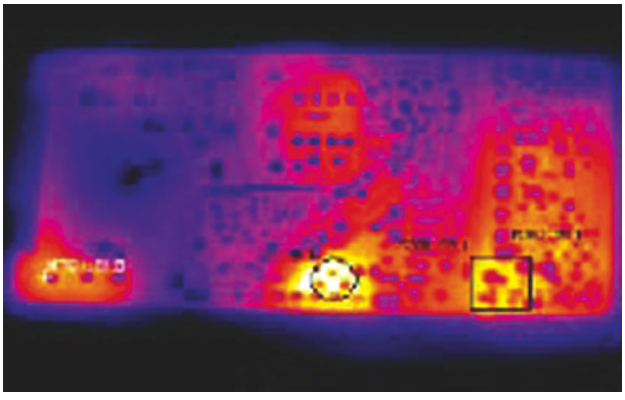
IR sensors can employ what seems like gee-whiz technology. FLIR Systems manufactures two types of IR detectors, a heat detector and a photon counter. The heat detector, called a microbolometer, uses small sensors that change resistance as they receive more or less IR energy. The photon-counter detectors, based on indium antimonide (InSb), absorb photons and convert them into electrons that sensors store temporarily as charge.

"Microbolometers usually require a longer integration time than do InSb detectors," said David Bursell, national director for the science segment at FLIR. "But they cost less and might need only a thermoelectric, or Peltier, cooling device, if any." Cameras in the company's ThermaCam A Series used in process and monitoring applications all employ an uncooled microbolometer sensor.

"The InSb detectors cost more and may require liquid-nitrogen cooling at –195°C [78 K]," continued Bursell. "They detect small energy differences and produce a crisper thermal image, though." People often use InSb-detector cameras in R&D labs when they need high thermal sensitivity. Software provides the key to useful inspection results. "As you apply power to a known-good PCB, you can take a series of images as components warm up," explained Ross Overstreet, science-segment engineer at FLIR. "Then, you do the same thing for a PCB under test and subtract the known-good and test images to observe any out-of-limits changes that could indicate a problem. The system looks for temperature differences rather than actual temperatures."

"People might not realize IR-imaging software does not have to deal with the effects of lights and shadows in an image, for example," said Chris Bainter, FLIR's senior science segment engineer. "So, that simplifies system requirements, and algorithms can run faster. Thus, software can do more with an image in a given time."

Some engineers may have overly high expectations about what an IR camera can do. Unlike the IR cameras used in science-fiction movies, real IR cameras cannot see through most objects, so you cannot "see" an overheated chip inside an enclosure. Even with that limitation, though, IR cameras can detect internal problems.



Hewlett-Package uses IR cameras in its product-safety lab to identify potential hazards. Preliminary IR images help identify components that require further tests. Courtesy of FLIR Systems.

"If you look at electrical panels and one appears hotter than the others, you could infer an overheated device behind the hot door," noted Beck of Mikron Infrared. "After you open the door, the camera can measure temperatures of individual components."

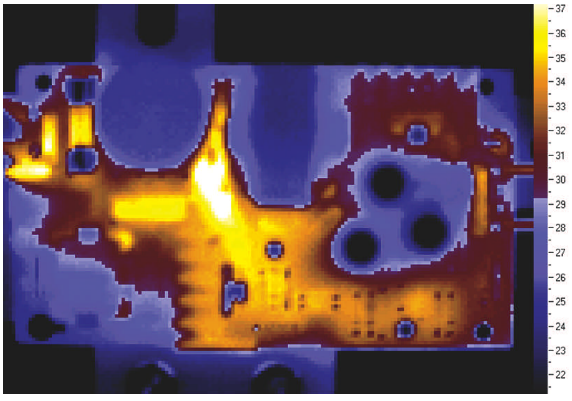
Keep an eye on emissivity

A basic IR camera measures radiation, not temperature. Either camera firmware or software on a PC converts radiation measurements to temperatures based on ambient conditions and material characteristics. Camera manufacturers provide calibration information for each camera and sensor type, based on lab measurements. Users adjust emissivity values based on the types of materials they plan to work with.

Many engineers may not appreciate how emissivity relates to IR measurements. Emissivity values range from 0 to 1 and describe how well a surface emits IR radiation compared to radiation from a blackbody at the same temperature. A blackbody has an emissivity of 1, and a polished aluminum surface, for example, has an emissivity of about 0.3.

OptoTherm's Barton cautioned that if you want to measure a surface temperature accurately, you should have a material with an emissivity of 0.5 or greater. For emissivities below 0.5, software compensation may produce inaccurate results. "At a low emissivity, reflected energy from light bulbs, peoples' heads, HVAC equipment, and other sources interferes with measurements," said Barton.

Uncoated metals have a low emissivity, so component legs, exposed PCB traces, solder, stainless-steel tops on ball-grid arrays (BGAs), and similar components can cause measurement problems. Other materials, such as glossy paint and some plastics and ceramics may have low emissivity at high measurement angles. Barton explained that if you position an IR camera within 20° of the axis perpendicular to a component's surface, you get a relatively high emissivity. But if you move more than 45° away from that axis, reflections can become a problem.



During power-up, this PCB produces a range of temperatures at its components. Courtesy of OptoTherm.

"When a surface has an emissivity below 0.5 and people must measure temperatures below 100°C, they can run into difficulties," he said.

A few tricks can help engineers overcome low emissivity. A thin layer of Kapton polyimide tape or a piece of masking tape has a uniform emissivity of about

Dirt? Rain? Sun?
Ready for the access world.

Meet the SharpTESTER Access Line, the new authority in access network testing.

Built to withstand the rigors of real-life field testing, the AXS-200 SharpTESTER goes beyond traditional performance assessment and fault characterization: it provides accurate pinpointing for every part of your network—a ready-made solution for delivering flawless broadband services.

Integrated test platform
Ethernet
Copper/DSL/triple-play
Optical-link characterization

EXFO ruggedness for the access network
Weather-proof
Outside-plant-certified

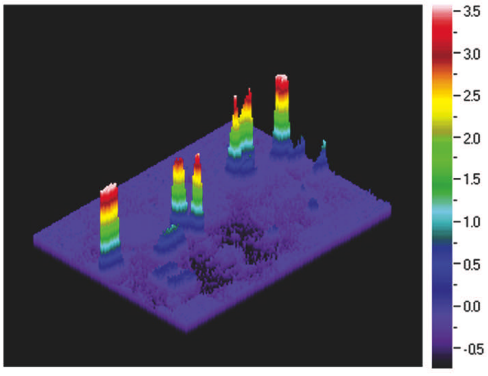
Intuitive interface
One-touch test functions
Clear pass/fail assessment: ✓ or ✗
Color transflective screen

Discover it at **EXFO.com/sharp.**

EXFO
EXPERTISE REACHING OUT
www.EXFO.com

0.95. Just apply the material to the component's surface, and measure the temperature of the taped area. A bit of flat-finish paint or white correction fluid also works well. A small piece of tape or a dab of paint should not affect the thermal properties of the surface.

Some IR-inspection equipment, such as OptoTherm's Micro thermal imager for semiconductors and its EL system for PCB inspections, operate offline. But Barton claimed that because component densities often preclude the use of inline in-circuit testers and because flying-probe testers take too much time, the electronics industry may start to use more IR-inspection systems on production lines.



When compared with thermal data from a known-good board, the image of a failed board shows specific defects that have higher-than expected temperatures. Courtesy of OptoTherm.

Keep the heat inside

Often, engineers want to measure component temperatures inside an enclosure that blocks IR radiation. They might need to heat a PCB to, say, 50°C to measure how much heat its components produce under that condition.

"Our cameras operate from 7 to 14 µm, where most materials appear opaque," explained Barton. "Engineers can cut a hole in an enclosure and cover it with an exotic material such as germanium or an amorphous material transmitting IR [AMTIR], which comes in several formulations. Then, they can measure surface temperatures through the IR-transparent material without disturbing ambient conditions."

If engineers need a large viewing port, they can cover holes with a thin plastic, but they must adjust their IR camera's emissivity setting to account for a small radiation attenuation through the film. "Films with a thickness of about 3 mils generally have about a 90% transmittance for long-wave IR radiation. Polyimide is one of the best plastics, and it has a transmittance of about 93 or 94%," said Barton.

Go far in the near IR

Cameras that use an indium gallium arsenide (InGaAs) sensor extend spectral coverage into near-infrared (NIR) and short-wave IR (SWIR) wavelengths where the sensitivity of standard silicon CMOS- and CCD-sensor cameras tapers off. And unlike thermal IR cameras that may require cryogenic cooling, InGaAs cameras operate at room temperature.

SWIR inspections let engineers look below the surface of silicon wafers to spot defects. When viewed in the short-wave IR spectrum, a silicon disk in a flashlight with light output at 1.55 µm appears transparent (left). When viewed in visible light, the silicon appears opaque (right). Courtesy of Sensors Unlimited.

SAVE THE DATE!
December 5, 2007

> NEW UPCOMING WEBCAST

MAXIMIZING THE IMPACT OF TEST ENGINEERING

SPEAKER:
Jean-Yves Allard
VP of Research and Development, Averna

MODERATOR
Rick Nelson
Editor-in-Chief, Test & Measurement World

With product launch cycles accelerating, and with electronics complexity increasing every year, test engineering is now more critical than ever to new product success. Test systems have to be developed and deployed quickly—locally and at EMS sites worldwide—so that product launches are on time.

In this webcast, design and test engineers facing these pressures will learn about Enterprise Test Software (ETS), an innovation designed to integrate and synchronize test systems with other enterprise functions such as R&D, manufacturing and supply chain.

Attendees will learn how to:

1. Accelerate test system development
2. Effectively manage product and test data
3. Define test procedures and direct how they are followed
4. Facilitate multi-site collaboration
5. Achieve real-time asset management and test visibility

REGISTER NOW!

TMWorld.com/Webcasts

Produced by: Test & Measurement World TMWorld.com

Sponsored by: PROLIGENT

NIR wavelengths cover from about 0.75 to 1.4 μm, and SWIR wavelengths cover from 1.4 to 3.0 μm.

"In this wavelength range, the InGaAs cameras detect *reflected* IR radiation with a temperature sensitivity between about 150 to 900°C," explained Bob Struthers, director of sales and marketing at Sensors Unlimited, a supplier of NIR/SWIR sensors and cameras. "So, even though we talk about IR radiation, engineers don't have to deal with room-temperature background radiation and emissivity as they must with true thermal-imaging equipment." Except for differences in pixel size and the number of pixels per image, NIR/SWIR cameras behave much like silicon-sensor cameras.

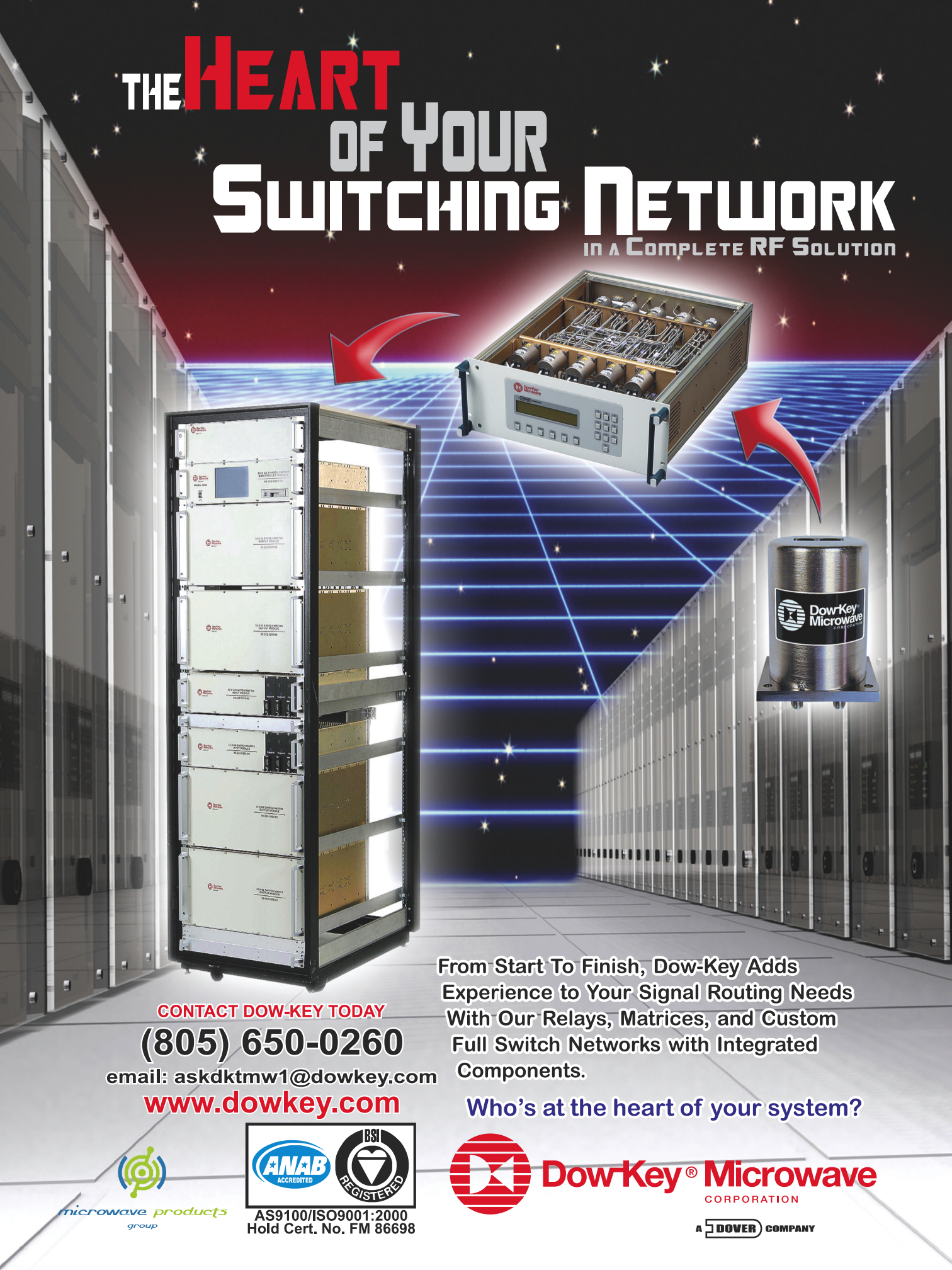
"Silicon becomes transparent at about 1.1 μm, so you can use an InGaAs camera to inspect features and detect flaws below a wafer's surface," said Struthers. "You also can verify that production processes have properly laid out a circuit's sublayers." This type of inspection can use standard halogen or incandescent lamps that radiate well into the NIR/SWIR band.

Test engineers can bias circuits on a die or wafer and use an emission microscope, which combines an NIR/SWIR camera and an optical microscope, to detect the small numbers of photons emitted by defects. "Those emissions occur at about 1.3 μm, which falls right at the 'sweet spot' for an InGaAs camera," said Struthers. "The glass in microscopes transmits radiation down to about 2.5 μm, so it easily passes photons at 1.3 μm. When you select glass lenses for SWIR cameras, though, ensure they do not include IR-blocking filter or coatings."

Cameras based on InGaAs sensors also play a role in fiber-optic tests and quality control. "The wavelengths used in fiber-optic communications occur between about 1.3 and 1.6 μm, which coincides with the peak sensitivity for InGaAs sensors," noted Struthers. "Quality-control people can use an SWIR camera to ensure light goes through fiber-optic components properly. And they can inspect laser sources to make sure you don't have mode hopping and that they produce the expected light pattern and intensity." T&MW

THE HEART OF YOUR SWITCHING NETWORK

IN A COMPLETE RF SOLUTION



From Start To Finish, Dow-Key Adds Experience to Your Signal Routing Needs With Our Relays, Matrices, and Custom Full Switch Networks with Integrated Components.

CONTACT DOW-KEY TODAY

(805) 650-0260

email: askdktmw1@dowkey.com

www.dowkey.com

Who's at the heart of your system?

microwave products group

ANAB ACCREDITED BSI REGISTERED

AS9100/ISO9001:2000
Hold Cert. No. FM 86698

Dow-Key® Microwave CORPORATION

A DOVER COMPANY

LXI Class C instruments are making inroads into RF and microwave test applications, and Class A and B instruments are beginning to emerge as well.

LXI speeds gigahertz MEASUREMENTS

BY RICK NELSON, CHIEF EDITOR

Ethernet isn't generally considered a conduit for RF and microwave signals, but the appearance of the LXI version of Ethernet on a variety of instruments is simplifying and speeding RF and microwave measurement tasks.

When considering LXI for RF applications, said Chris Van Woerkom, senior marketing engineer in the Electronic Measurements Group of Agilent Technologies, "You first look at the alternative. GPIB is bandwidth-limited, and while being able to send a lot of data down the pipe is not always important for RF and microwave applications, there are certainly cases where you want to dump a fair amount of data, and extra bandwidth is useful."

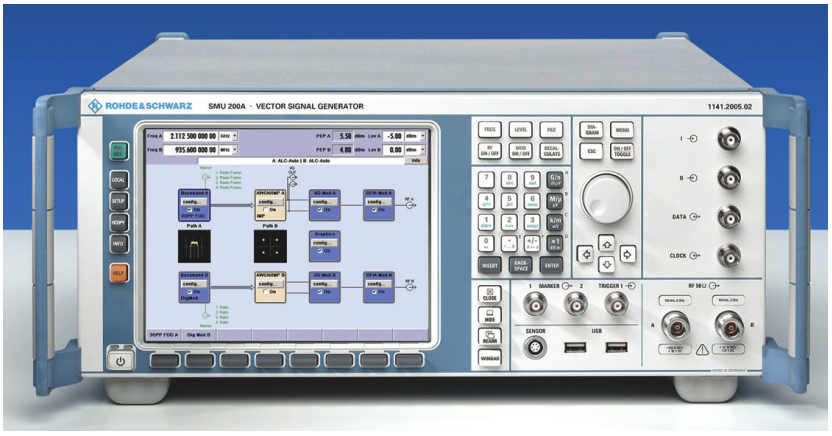


FIGURE 1. The LXI-compliant SMU 200A allows users to internally configure up to two I/Q sources, simulate up to four fading channels, add noise, and output two RF signals for demanding applications such as 2x2 MIMO receiver testing.
Courtesy of Rohde & Schwarz.

LXI's cost and trigger advantages

But even if you don't need the bandwidth, said Mark Elo, marketing director of RF products at Keithley Instruments, "GPIB is old and slow and expensive. It adds a lot of cost to an instrument." As for LXI vs. plain Ethernet, which has been a standard feature in instruments for years, Elo said, "LXI provides better remote-control standards and requires that each instrument have a Web server, which enables engineers in different countries to share measurement information fairly easily. In addition, LXI's triggering capability emulates the GPIB triggering capability."

Commented Bob Rennard, president of the LXI Consortium and a program manager at Agilent Technologies, "LXI Class C is basically GPIB over Cat-5 LAN cables with a few extra cool features thrown in." (To learn how the three classes of LXI instruments differ, see "LXI triggering," www.tmworld.com/2006_09.)

Justin Stallings, senior product manager at Rohde & Schwarz elaborated: "LXI offers trigger capabilities that go far beyond what GPIB can do." With LXI, he added, "Instruments like signal generators and spectrum analyzers can synchronize to each other without a controller being involved," by means of Class A instruments' wired trigger bus, by LAN peer-to-peer messages, or, for Class B instruments, by absolute-time events synchronized via IEEE 1588.

Stallings added that his firm now offers for its FSL spectrum analyzers an extension card that implements the LXI wired trigger bus and that can be configured via the FSL's Web interface. Currently, he said, the company is working on IEEE 1588 Class B instruments: "Using the clock synchronization provided by 1588 allows triggering on absolute time," and

he added that it permits instruments to make measurements automatically—that is, without a controller.

Such capability, he said, would be useful in a distributed setup in which, for example, a signal generator and spectrum analyzer might be located at different ends of a large airplane. "There's no easy way to connect both instruments with a hardware trigger signal," but IEEE 1588 time stamping enables sequences of measurements to occur based on absolute time.

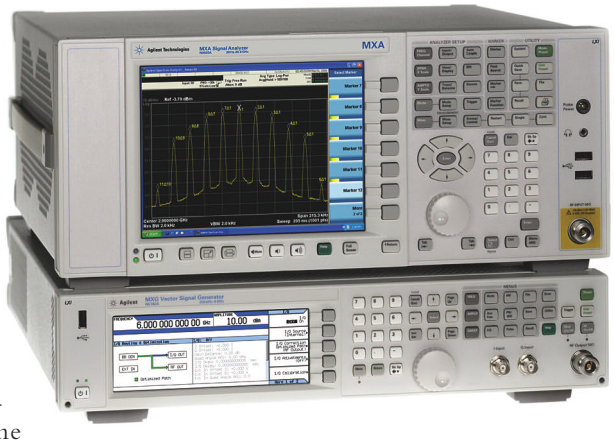


FIGURE 2. The MXA signal analyzer and MXG signal generator bring LXI connectivity to RF source-measurement tasks. Courtesy of Agilent Technologies.

Reducing overhead and latency

The LXI Consortium's Rennard said he has seen several applications where LXI brings significant benefits to RF and microwave measurement applications. "The first that comes to mind are stimulus-response measurements, where you've got a source and analyzer that are tied together and using some network features of peer-to-peer communication. With LXI connecting the source and analyzer, we've seen a significant decrease—two orders of magnitude—in communication overhead, since you don't have to go back and forth to a controller."

He continued, "Further, a controller will likely be a PC environment with a Microsoft operating system, which may be off clearing a cache somewhere. You've got no idea exactly when things will execute. When you go peer to peer, traffic between an instrument and a controller gets reduced to almost nothing. At the same time, determinism improves significantly. In demos we've done, we've seen measurement times shrink from a couple hundred microseconds down to one microsecond or less—it's a huge improvement."

And if you use Class B instruments with IEEE 1588, he said, "Latency goes down to zero, because you can start scheduling things and basically overlap some of your stimulus and response."

Throughput is key

For high-throughput applications, the instruments themselves have to be fast, said Keithley's Elo, adding that his firm addresses measurement speed by incorporating a digital signal processor (DSP) into its instruments, avoiding constraints related to a microprocessor executing instrument firmware. But instrument speed is only part of the solution.

Jim Curran, signal-analysis division manager for the Wireless Business Unit of Agilent's Electronic Measurements Group, elaborated. LXI, he said, enables smart instruments like Agilent's MXA signal analyzer and MXG signal generator to communicate with each other to quickly test products like an iPhone, which combine multiple cellular bands along with WiFi capability. Using LXI-based peer-to-peer communications, added Agilent's Woerkom, makes it unnecessary to employ inefficient programming techniques such as the insertion of wait states.

Curran also explained that while measurement throughput is ultimately key for commercial applications, compatibility is a key factor in military and aerospace. Test systems can span decades, he said, and LXI is emerging as the standard that will mesh easily with multiple generations of interconnect technology.

But intergenerational compatibility is only one issue. Another is compatibility between lab and deployed systems. Agilent addresses this issue, Curran said, by ensuring program compatibility among the LXI Class C instruments common in lab environments and the Class A and B instruments that are likely to make up large systems deployed outside the lab.

Application examples

Consortium president Rennard cited a number of RF/microwave application areas in which he's seen LXI provide benefits: "One we've seen over and over again in military and communications applications is what I'll call cross-domain analysis. Think of a mixed-signal oscilloscope [MSO] with logic and oscilloscope functions—analog and digital—on the same product. The reason they are so popular is there is a lot of utility, a lot of value in that. Now, if you take that paradigm of an MSO and—instead of just a scope and a logic analyzer with a common time base—if you extrapolate that into any instrument pair, it becomes super powerful."

Rennard cited a specific example applicable to radar and commercial communications test: "Suppose you are generating a complex waveform digitally, as in a software-defined radio, and then you are looking at the spectrum in a modulation analyzer or spectrum analyzer. What you want to do is step through the baseband code while monitoring the spectrum analyzer to see where the constellation blows up. And when the constellation blows up, you

ON TMWorld.com

LXI INSTRUMENTS

The online version of this article lists LXI-compliant RF/microwave instruments, including spectrum analyzers, vector signal analyzers, signal sources, switching systems, upconverters, downconverters, and network analyzers.

www.tmworld.com/2007_11

CLASSES A, B, AND C

To read more about the three functional LXI classes, which differ primarily in their triggering capabilities, read "LXI triggering" by Bob Rennard in the September 2006 issue of *Test & Measurement World*.

www.tmworld.com/2006_09

Creating **Camera Envy!**

NEW! ThermoVision SC8000 Science-Grade Infrared Camera
1024 x 1024 MWIR: MEGA Pixels, MEGA Performance!

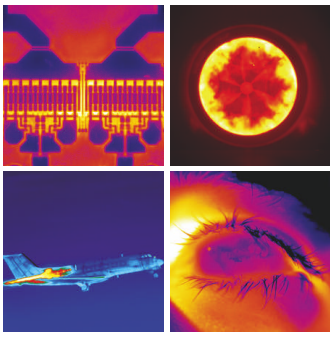
1024 x 1024 MEGA Pixel Infrared Camera!

ThermoVision® SC8000
MWIR Science-Grade
Infrared Camera!

Brought to you by FLIR Systems

Check Out These Great Features:

- 1024 x 1024, 16-channel InSb FPA
- Gigabit Ethernet, Camera Link Full, and USB Interfaces
- Preset Sequencing & Superframing Modes
- Integrated IRIG-B Timing
- Multiple Integration and Triggering Modes
- Flexible FPA Windowing
- Powerful RTools Software
- Optional Software Development Kit (SDK) Available



FLIR SYSTEMS
The Global Leader in Infrared Cameras

1 800 464 6372
Canada 1 800 613 0507
www.infraredresearchcameras.com

Schedule an Onsite Demonstration!

Call to speak to one of our Scientific Segment Engineers:
1 800 464 6372
Or visit: **www.infraredresearchcameras.com**

want to see exactly what frame or what code in the baseband caused it to blow up.

"Until now, it's been almost impossible to make that measurement—it's been difficult to get adequate correlation between the baseband and the RF. But LXI with Class B gives you a common time frame, or a common reference, and that makes the measurement trivial."

Similarly, he said, consider another application, "on a radar range where you have a source and receiver that are separated by tens of meters, hundreds of meters, or kilometers." Making good measurements "has been just impractical over such long distances," he said, "whereas using LAN makes them trivial."

FIGURE 3. The LXI Class C-compliant 60-100 chassis allows 3U PXI RF and other switching modules to be supported in an LXI environment. The chassis comes with a generic IVI driver to control the PXI modules in accordance with the LXI specification. Courtesy of Pickering Interfaces.

Finally, Rennard cited applications where integrators are trying to control a system shutdown. Consider, he said, an aircraft radar system where you have power regulators, an RF front end, and a number of different sensitive components on a DUT, and the DUT's pretty expensive—$50,000 to $100,000. "The DUT comes off an airplane, and you know it doesn't work—otherwise it would still be on the airplane. You are trying to find what's wrong with it, you are running it through a routine, you find a fault—say, an overcurrent situation—and you want to shut down in a hurry before you blow up sensitive components and make a problem even worse."

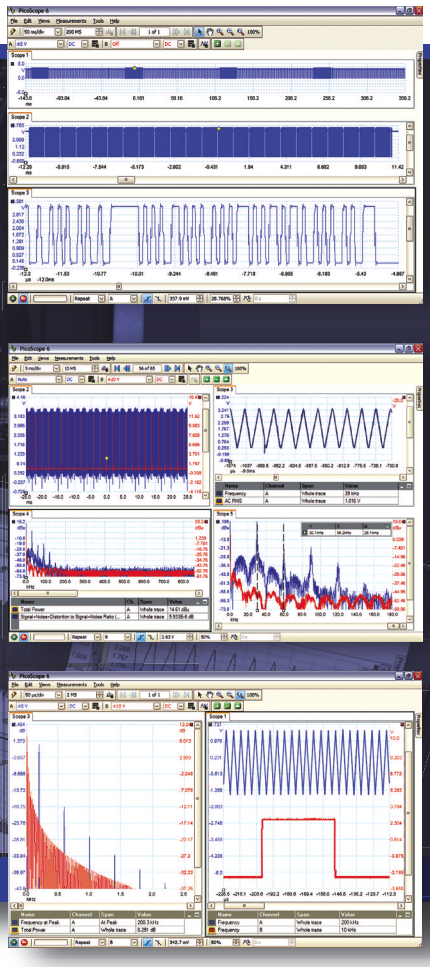
He explained that with "garden-variety" LXI or with Class B LXI, you can employ peer-to-peer communications to, for example, respond to an overcurrent situation sensed by a power supply. The power supply, he explained, can fire a trigger that shuts down the power supply itself as well as initiating a cascading sequence that shuts off, for instance, RF receivers and generators as well as other power supplies in a way that doesn't further damage the DUT in the process. "This used to take hundreds of milliseconds or even seconds to complete. It can now be done in a very orderly fashion with timing standard deviations down in the microsecond range."

Low-frequency LXI assistance

Companies like Agilent, Rohde & Schwartz, Keithley, and Pickering Interfaces make LXI-compliant RF/microwave in-

From the market leaders in pc oscilloscopes...

USB Connected **High Speed PC Oscilloscopes** and Spectrum Analyzer



5000 SERIES

PicoScope 5000 Series

The No Compromise PC Oscilloscopes

250 MHz bandwidth
1 GS/s real-time sample rate
128 Megasample record length

With class-leading bandwidth, sampling rate, memory depth and an array of advanced high end features, the PicoScope 5000 PC Oscilloscopes give you the features and performance you need without any compromise.

3000 SERIES

The 3000 Series of oscilloscopes from Pico Technology include general purpose and high resolution models: With 12 bit resolution and 1% accuracy, the 10MHz PicoScope 3424 is able to detect changes as small as 0.024% (244ppm) – making it the ideal 4-channel oscilloscope for analog design and analysis. The higher speed 8 bit models in the PicoScope 3000 series feature sampling rates up to 200MS/s and up to 1 MS/s record lengths for general purpose and portable applications.

2000 SERIES

The PicoScope 2000 series oscilloscopes offer single and dual channel units that offer highly portable/low cost solutions to general purpose testing. The award winning 25MHz handheld 2105 fits comfortably into the palm of your hand yet still includes the powerful features found in larger oscilloscopes.

Advanced Triggers

In addition to the standard triggers the PicoScope 5000 series comes standard with pulse width, window, dropout, delay, and logic level triggering.

250MHz Spectrum Analyzer

High speed USB 2.0 Connection

Automatic Measurements

Arbitrary Waveform Generator

Define your own waveforms or select from 8 predefined signals with the 12 bit, 125MS/s arbitrary waveform generator.

Waveform Playback Tool

PicoScope software now allows you to go back, review, and analyze up to 127 captures within its waveform playback tool.

pico® Technology

VISIT **www.picotech.com/pco403**

to check out our full line of pc based instruments or call **1.800.591.2796** for information and a product catalog

struments, but, as Rennard's aircraft radar example illustrates, other, low-frequency instruments and power supplies can also form part of an RF/microwave test system. The ability of RF and microwave as well as other instruments to work together was amply demonstrated at the Autotestcon show in September, when products from companies including Agilent, C&H

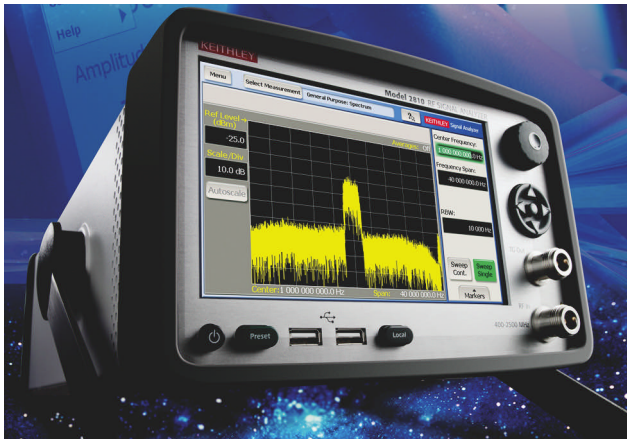


FIGURE 4. The 2800 and 2900 family of 2.5- and 6-GHz LXI-compliant generators and analyzers include onboard DSPs to enable, for example, a complete suite of GSM tests in 16 ms.
Courtesy of Keithley Instruments.

Technologies, Keithley, Kepco, The MathWorks, Rohde & Schwarz, VXI Technology, and Xantrex all worked together over a wireless network.

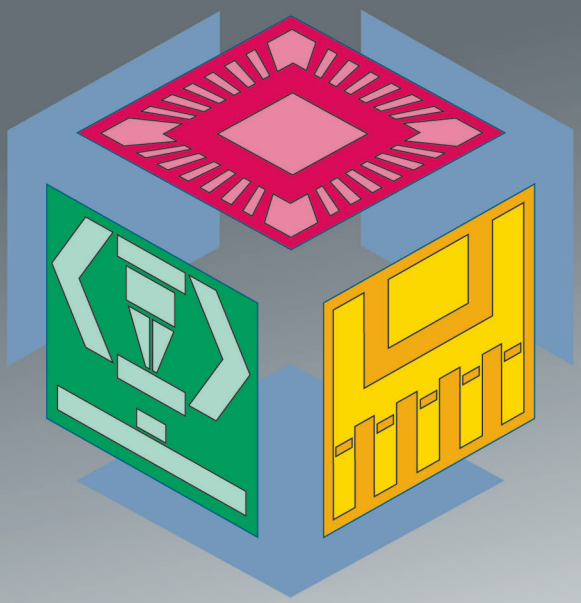
The multivendor demo, said Rennard, served "to help the consortium sort out a real-world integration challenge. It's not enough for single company to do this, because there may be interpretations or differences that get common-moded out, whereas working with teams from different companies more closely replicates the real world."

Of course, LXI systems can include instruments featuring connection schemes other than LXI. Bob Stasonis, North American sales and marketing manager for Pickering Interfaces, a firm that makes PXI and LXI products, noted that his firm's LXI Class C-compliant 60-100 chassis allows Pickering's 3U PXI RF and other switching modules to be supported in an LXI environment. The chassis comes with a generic IVI driver to control the PXI modules in accordance with the LXI specification, he added.

It seems likely that PXI and LXI will coexist, each serving specific applications areas while complementing each other in many cases. But it seems equally likely that, although GPIB won't disappear overnight, LXI will gradually supplant it, much as in the PC world where USB, for instance, has supplanted RS-232 and the parallel printer port.

Concluded Elo of Keithley, "Most of the leading companies developing wireless products have a roadmap to utilize LXI. Now, we are in the transition period. There is a lot of legacy equipment around and legacy test stands and test executives that depend on GPIB. But GPIB is old and slow and expensive. LXI will be the dominant connectivity standard for instrumentation as we pass though this century." T&MW

smt-exhibition.com



SMT HYBRID PACKAGING

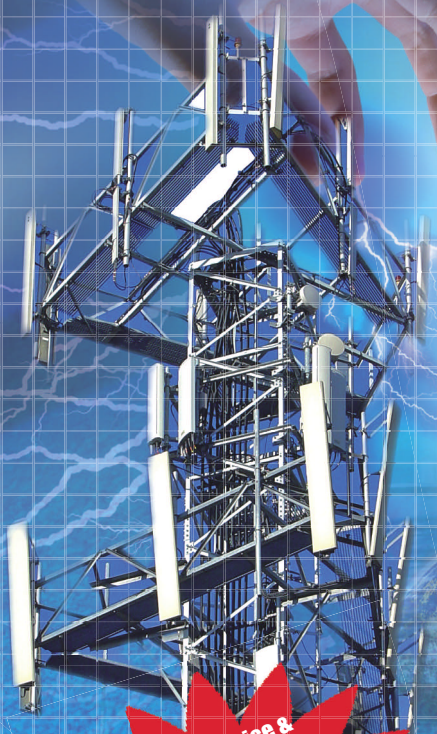
System Integration in Micro Electronics

Exhibition & Conference
Nuremberg 3–5 June 2008

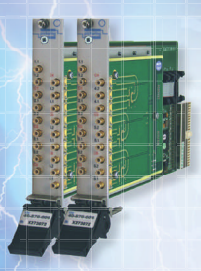
the place to be

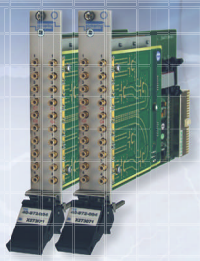
Organizer: Mesago Messe Frankfurt GmbH, Rotebuehlstrasse 83–85, 70178 Stuttgart,
phone +49 711 61946-79, fax +49 711 61946-93, smt@mesago.messefrankfurt.com

Switch On to Pickering

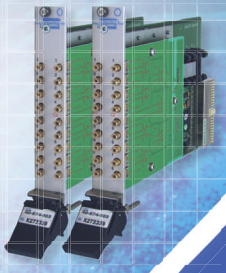


40-870 Hex SPDT, 3 GHz 50 Ω
40-830 Hex SPDT, 2.5 GHz 75 Ω



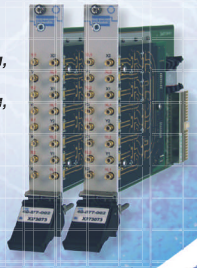


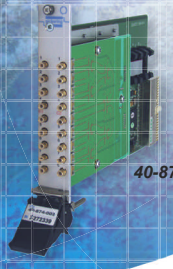
40-874 Dual 8-1 MUX, 3 GHz 50 Ω
40-834 Dual 8-1 MUX, 2.5 GHz 75 Ω



40-872 Quad 4-1 MUX, 3 GHz 50 Ω
40-832 Quad 4-1 MUX, 2.5 GHz 75 Ω

40-877 2x2 Matrix Dual Loop Thru, 3 GHz 50 Ω
40-837 2x2 Matrix Dual Loop Thru, 2.5 GHz 75 Ω

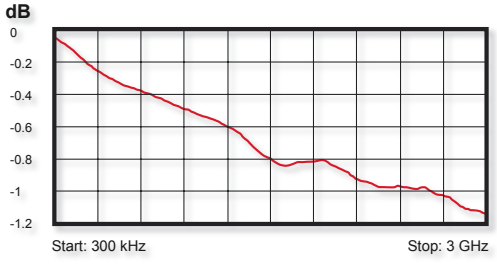




40-875 Single 16-1 MUX, 3 GHz 50 Ω

Detailed Price & Technical Information On-Line www.pickeringtest.com

New Generation: PXI 3 GHz RF Switching Modules



Typical Insertion Loss Plot

For the very best in RF switching look no further than Pickering Interfaces.

Our new range of 3 GHz RF PXI switching modules offer the highest density, and performance, 50 Ohm and 75 Ohm switching solutions in PXI. With an expanding range of cost effective building blocks to switch 3 GHz signals, Pickering have the perfect modules to create compact solutions with typical VSWR of 1.2 and insertion loss below 1 dB. With a range including Triple/Hex SPDT, Single/Dual/Quad 4:1 MUX's, Single/Dual 8 to 1 MUX's, a 16 channel MUX and Single/Dual 2x2 matrices in just a single 3U PXI module look no further than Pickering Interfaces for your next RF switching application.

Challenge us to meet your next RF switch requirement!

See these products at www.pickeringtest.com/radio

LXI

LXI Chassis, 60-100

All Pickering PXI Switch modules can be used in our LXI (Ethernet) controlled chassis, 60-100.

www.pickeringtest.com

Pickering Interfaces Inc., Grants Pass, OR. Tel: +1 541 471 0700 E-mail: ussales@pickeringtest.com
(East Coast Regional Office) Woburn, MA. Tel: +1 781 897 1710 E-mail: useastsales@pickeringtest.com

Direct Sales Offices in USA, UK, Sweden, Germany, Czech Republic, France and China

pickering

Taking PXI to the next level

By Richard A. Quinnell, Contributing Technical Editor

At the recent Autotestcon show (September 17–20, Baltimore, MD), Geotest—Marvin Test Systems introduced several new PXI instruments, including a PXI Express 100-MHz digital test instrument and a digital instrument that can support an I/O signal range of 25 V_{p-p}. The company also unveiled a unique offering: a PXI standards module that provides NIST-traceable voltage, resistance, and frequency standards for in-system calibration and certification of test systems (see p. 64).

I recently spoke by phone with Geotest's senior product marketing manager Michael Dewey about the company's major push into PXI.

Q: What prompted Geotest to create so many new products?

A: We've been in PXI almost since its inception and our customers are now beyond the early adoption stage and into the second wave. They are looking for that next iteration in technology to address increasingly sophisticated applications, and we try to bring extra features and value for customers who need something a little more special. PXI is now 10 years old. It's time to move beyond commodity items.

Q: So, these new product introductions are customer driven?

A: Well over 50% of our new products are the direct result of conversations with customers with a special request. The standards module, for instance, started with a specific conversation. We do validate new ideas with market research and by talking with other customers, of course, but we pride ourselves on being responsive to our customers both in product features as well as service.

Q: How is PXI Express affecting product development?

A: We were right in at the front end of PXI Express. It's the logical evolution of PXI, and we made sure we were up to date with its development.

We started working on products more than a year ago. At first, it was hard to find CPUs with PXIe interfaces, although it's not a problem anymore. We're using it in our new digital instruments, because our designs have deep memory so there is a lot of data to load and unload. PXIe makes a significant difference in the time needed to set up a tester and read results.

Q: Do you see manufacturing test as the next big market for PXI?

A: PXI started out in R&D dealing with limited prototypes and is now moving to the manufacturing space. It's part of the natural evolution for a test and measurement product. Also, we are seeing the VXI platform getting "long in the tooth," with very little new coming out in VXI. As a result, people in manufacturing have to move away from the VXI space to another platform. They are comfortable with card-based modular architectures, however, so PXI is a natural step for them.

Michael Dewey
Senior Product Marketing Manager, Geotest
Courtesy of Geotest—Marvin Test Systems

Q: What challenges does PXI still face?

A: One general issue is: Can I rely on my IC suppliers to keep providing the parts I need? Test systems have to stay around 5 to 10 years—a long time compared to the life cycle of a typical IC. It's a constant challenge for everyone to ensure that we can keep producing and supporting our products. □

To read more about the use of PXI instruments in manufacturing test, see "PXI aids manufacturing test," in the September 2007 issue of the "PXI Test Report," www.tmworld.com/2007_09.

INSIDE THIS REPORT

EDITOR'S NOTE

What will drive PXI?

Richard A. Quinnell, Technical Editor

When I was first introduced to PXI, I saw it as a response to the high cost of laboratory test instrumentation. The ability to create any of several useful instruments from a handful of building blocks held appeal as a lower-cost way of handling occasional, but urgent, equipment requirements. It was difficult to financially justify purchasing an instrument that would see only infrequent use. It was easier to justify purchasing a card that could turn what I had into what I needed.

The needs of R&D engineers seem to have driven much of the product development in PXI's first decade, but that's changing. As PXI matured, it became increasingly interesting to those involved in manufacturing test. Now, manufacturing test is becoming a major market for PXI, and the application's needs are affecting new PXI product development, as the stories in this issue attest.

What will drive PXI product development going forward? Will manufacturing test grow to become the dominant market, causing new PXI product development to focus on refinements that improve manufacturing efficiency rather than on stretching technology to widen R&D possibilities? Or will R&D needs continue to drive technological innovation in PXI, and then migrate to manufacturing test in support of the products that R&D develops?

Or both? □

Contact Richard A. Quinnell at richquinnell@att.net

HIGHLIGHTS

ZTEC updates function-generator software

Responding to requests from customers, ZTEC Instruments has improved the ZWave control software and drivers for its ZT530 C-class of function/arbitrary waveform generators. The company says its new ZWave soft front-panel (SFP) application is easier to use and that it also looks and operates like a traditional bench signal generator.

Boyd Shaw, ZTEC Instruments' director of marketing, explained, "Over the years, we received a lot of feedback on our original ZWave function generator software. Customers were telling us that the hardware was great, but that the accompanying software was not as easy to use as they would like. Customers wanted ZWave to look and operate like a benchtop function generator."

The new ZWave controls any ZT530 instrument. The drivers that are part of the ZWave installer also provide class-level support, which enables users to change instrument platforms without needing to rewrite any software. For example, code written for a ZT530 PCI instrument can be used for a ZT530 PXI instrument.

The new drivers also provide hooks into C, LabView, LabWindows/CVI, COM, and Visual Studio. In addition, the new ZWave runs on Windows Vista and Linux 2.6.x; the original ZWave ran only on Windows 2000 and XP. The new ZWave and instrument drivers are available for free. www.ztecinstruments.com/download-software.

Keithley upgrades membership status

The PXI Systems Alliance (PXISA) reports that Keithley Instruments has increased its membership status to the Executive Member level. Prior to the upgrade, Keithley had been an Associate Member. The higher level of membership gives Keithley a voice in the development and approval of the PXISA's technical specifications. www.pxisa.org; www.keithley.com.

Metrikos, Huntron offer near-field signature analysis

Metrikos, in conjunction with Huntron, demonstrated at Autotestcon its patent-pending near-field signature-analysis technology, which supports close proximity sensing of electromagnetic fields emanating from active or passive circuitry.

The technology is based on the observation that identical printed-circuit boards will emanate nearly identical fields as a function of an RF sensing probe's position relative to each board. The Metrikos approach makes use of robotic RF probe positioning to determine a board's near-field signature as a function of x, y, and z coordinates.

Metrikos calls each probe position a Virtual Test Point, whose value can be stored for subsequent recall and comparison. Anomalies—such as an open trace, short, or bad component—alter Virtual Test Point values, and a comparison of a board under test's signature with that of a known good board isolates faults—even on conformally coated boards.

A near-field test system includes PXI instrumentation and a Huntron Access Prober platform, which positions a Metrikos NFSA sensor at programmable x, y, and z locations over a circuit under test. Huntron distributes the systems. www.huntron.com.

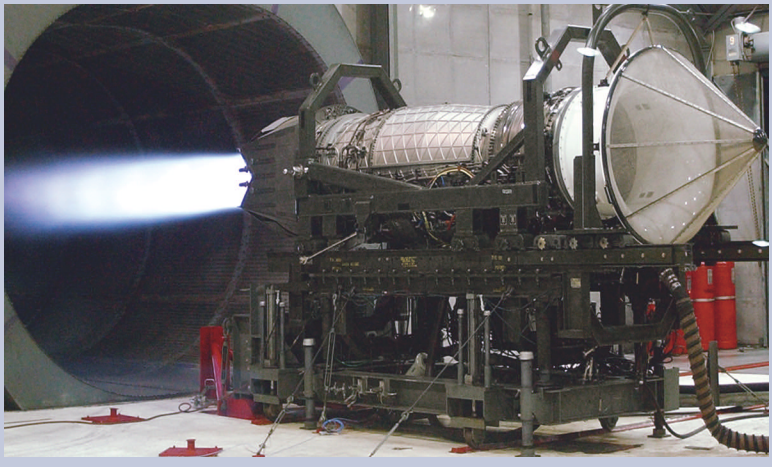
GUEST COMMENTARY

PXI enables high-channel-count, single-chassis data acquisition

Nicole Faubert, Marketing Manager, GaGe/KineticSystems

The PXI Systems Alliance (PXISA) has demonstrated a data-acquisition system that packs a groundbreaking 864 channels in a single PXI/CompactPCI chassis. The live, multivendor demonstration was one of three that the PXISA presented at Autotestcon (September 17–20, Baltimore, MD) to mark the 10th anniversary of the PXI standard.

The demonstration system, which acquired data from a jet-engine simulation, included hardware and software from six PXISA members: KineticSystems, GaGe, Geotest, Keithley Instruments, ADLINK, and



A demonstration at Autotestcon showed that a single-chassis PXI/cPCI system could serve in real-world jet-engine tests. Courtesy of the US Air Force.

National Instruments. KineticSystems integrated 10 different PXI/cPCI modules into a 3U/6U combo chassis from Geotest. With previous standards, it would have been difficult if not impossible to implement such a high-channel-count data-acquisition system within a single chassis.

The PXI/cPCI system collected temperature, pressure, flow, RPM, and ARINC-429 measurements from the jet-engine simulation. It included digital I/O, analog-to-digital and digital-to-analog converters, signal conditioning, digitizers, frequency counters, and multifunction data acquisition. Both 3U and 6U PXI/cPCI modules were used in the system.

"The extra real estate gained by the use of 6U PXI/cPCI is an important design factor in high-channel-density instruments," said Steve Krebs, director of engineering for KineticSystems. "The combination 3U/6U chassis from Geotest also proved very valuable in the overall integration of all manufacturers' instruments. LabWindows/CVI was an efficient development environment to create a user-friendly interface for this high-channel-count data-acquisition system."

The online version of this article shows the system's instrument configuration, and it comments on two other PXISA Autotestcon demonstrations: www.tmworld.com/2007_11. □

PXI Digital Test

Geotest
Marvin Test Systems, Inc.
www.geotestinc.com

The industry's highest performance and widest selection

- Vector rates to 200 MHz with up to 512 MB of memory
- High voltage (-10v to +15v), with per pin programmability
- PXI and PXI Express, 3U and 6U formats
- Support for multiple logic families including LVDS
- Data formatting and algorithmic sequencing
- Up to 244 I/O channels per card

With more than 20 different PXI digital cards in our product line, Geotest has the right solution for today's digital test needs and tomorrow's technologies.

CELEBRATING 10 YEARS · One Industry Standard PXI Systems Alliance

PXI makes inroads into RF test

By Richard A. Quinnell, Contributing Technical Editor

Several recent product introductions indicate that PXI is pushing ahead in the RF test arena. The frequency, bandwidth, and operating speed of PXI RF modules are all improving rapidly, while the size and power demands of modules are dropping. In addition, RF test is beginning to exploit the potential for portability inherent in PXI, allowing engineers to capture field data for playback in the laboratory.

At least two major vendors—Aeroflex and National Instruments—introduced RF test products for the PXI architecture at this year's Autotestcon show (September 17–20, Baltimore, MD). Aeroflex announced a configurable RF test platform that included new hardware modules and instrumentation software as well as a chassis to tie them all together. The company also introduced SMART^E, a synthetic test environment for RF testing that supports PXI as well as LXI, cPCI, and GPIB instruments. National Instruments introduced an RF vector signal generator for PXI Express that can stream data from hard disk or PC memory to the generator at the instrument's full data rate.

Both companies' introductions demonstrate the ever-increasing performance that PXI instrumentation is achieving in RF applications. Tim Carey, Aeroflex product manager, explained that the Aeroflex 3030C 3-GHz and 3035C 6-GHz RF digitizers have extended their frequency range down from 330 kHz in previous generations to 250 kHz. At the same time, the new models offer a signal bandwidth to 90 MHz, up from 33 MHz. The new Aeroflex 3025C RF signal generator also offers a bandwidth extended to 90 MHz and has stretched its power output to a range from –120 dBm to +7 dBm.

The National Instruments PXIe-5672 RF vector signal generator (see p. 64) brings to the table the ability to stream hours of data at 25 Msamples/s through its PXI Express interface. The ability to accept streaming data allows the generator to work from external data storage, which frees users from the limitations of onboard memory. The unit can generate signals from 250 kHz to 2.7 GHz with a 20-MHz instantaneous bandwidth.

The PXI Express bus allows instruments such as this vector signal generator to stream data off a disk array and provide hours of test stimulation. Courtesy of National Instruments.

RF modules are shrinking

Along with the performance improvements, the new generation of PXI RF products brings with it a reduced form factor. According to National Instruments' senior product manager Joseph Kovacs, this reduction is a by-product of technology improvements in the cellular and wireless markets.

"As that industry continues to grow and push its limits," said Kovacs, "RF components get smaller, and we are able to use them to shrink the number of slots our products need. Our 5660 downconverter, for instance, occupied three slots when it was introduced. Two years later, technology had progressed and we got it down to two. We also gain real estate, which lets us fit more into the chassis."

The presence of a built-in controller and touch-screen color display turns the Model 3000A PXI chassis into a full stand-alone instrument. Courtesy of Aeroflex.

Kovacs also noted that these same technology trends are resulting in lower-power RF products. "Power is not an issue for a benchtop instrument, but for PXI, with its 25-W per slot power limits, it can be," said Kovacs. "The cellular industry's push for low power is thus benefiting PXI."

Such reductions in power and size make it easier for system developers to create complete RF test and data-recording instruments small enough to be portable. As Kovacs explained, portable instruments allow test engineers to go out into the field and capture the real RF environment and then bring it back to the lab for use as a test stimulus instead of having to simulate complex scenarios such as multi-satellite GPS signals.

One of Aeroflex's introductions directly targets such portable operation. The Model 3000A chassis (see p. 65) is a ruggedized aluminum enclosure with built-in system controller, seven peripheral card slots, a 350-W power supply, and an 8.4-in. touch-screen color display. The presence of the touch-screen display and system controller, noted Carey, transforms the chassis into a self-contained, stand-alone instrument for either bench or portable operation. The chassis and

PXI and RF test • from page 61

components offer an extended operating temperature range of 0°C to 55°C, making the system applicable to field use, as well.

Portability is not the only benefit of shrinking RF components. Compact PXI RF components are also of interest in the military and aerospace markets, where size and weight are important considerations. The constraints of unmanned aircraft used in reconnaissance, NI's Kovacs noted, make the small size of PXI an important benefit.

PXI targets manufacturing test

Small size and reduced power also benefit a major emerging market for PXI: manufacturing test. "We're seeing that size is a big concern in manufacturing," said Kovacs. "Space is a big deal. They [manufacturers] want a small footprint." Kovacs pointed out that, for manufacturing, the ability to fit more test capability into a smaller area translates into more revenue per square foot.

The use of PXI in manufacturing test is an important market for both companies. Each promotes PXI as offering seamless migration from R&D to manufacturing, noting that the exact same instrument module that the designers use to develop a product can be incorporated into manufacturing test. This equipment commonality helps eliminate the need for test setups and procedures created at the bench to be re-created for testers on the production floor.

While both companies acknowledge this market duality, they are taking slightly different approaches to addressing it. Aeroflex has incorporated a number of features and options in its latest product offerings that target the key needs of manufacturing test: easy configuration and rapid test throughput. One way the company speeds test configuration is through complete, preconfigured systems that eliminate integration and compatibility concerns.

Aeroflex also offers software to speed testing. For its PXI Studio application software, the company has introduced plug-ins designed for the analysis of WiMAX signals, simplifying the setup and execution of compliance tests. The increased power range for the 3025C comes along with a 10X improvement in its ability to switch frequencies, with both features supporting the rapid test of RF components. Carey also noted that the increased bandwidth of the latest modules allows them to support virtually any wireless market, including cellular, wireless data, and RFIC test.

National Instruments prefers to keep its instrumentation more general in scope, according to Kovacs, and the company concentrates on the higher accuracy needs of the laboratory rather than the test speed needs of manufacturing. Kovacs also noted that NI keeps its products more general because it provides only the building blocks.

"Our partners are the ones that create systems," said Kovacs. "Some are working with GSM and GPRS while others are working with RFID. Our approach is to produce products that will provide solutions all across the spectrum and avoid being pigeonholed in a single market segment."

Whether aimed more at manufacturing or at the laboratory, the new generation of RF products shows that PXI is continuing to push the envelope for RF test. Shrinking footprints and power demands of modules are extending PXI's applicability in both production floor and field environments; higher bandwidths are extending the range of signals that can be generated or analyzed; and faster bus transfers are making greater memory depths possible for generating more thorough and realistic testing. And the trends indicate that such gains will continue at least over the next few years. □

Test and measure this.

TMWsuppliersearch finds your next great supplier in three clicks or less. Talk about an elegantly engineered solution. Log on now at tmwsuppliersearch.com.

Test& MEASUREMENT WORLD supplier SEARCH

Kellysearch.com
Everything you need, nothing you don't

Reed Business Information

United States Postal Service

Statement of Ownership, Management, and Circulation (Requester Publications Only)

1. Publication Title: Test & Measurement World **2.** Publication Number: USPS 660-730 **3.** Filing Date: October 1, 2007 **4.** Issue Frequency: Monthly except January **5.** No. of issues Published Annually: 11 **6.** Annual Subscription Price: US $103, CAN $152; MEX $150, FOR $215 **7.** Complete Mailing Address of Known Office of Publication: Reed Business Information, 8878 Barrons Blvd., Highlands Ranch, CO 80129 **8.** Complete Mailing Address of Headquarters or General Business Office of Publisher: Reed Business Information, Division of Reed Elsevier, Inc., 360 Park Avenue South, New York, NY 10010 **9.** Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor: Publisher: Russell E. Pratt, Editor: Rick Nelson, Managing Editor: Deborah M. Sargent, Reed Business Information, 225 Wyman St., Waltham, MA 02451 **10.** Owner: Reed Business Information, Division of Reed Elsevier, Inc., 360 Park Avenue South, New York, NY 10010 **11.** Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities: None **12.** (Must be completed if the publication title shown in item 1 is a publication published and owned by a non-profit organization). The purpose, function and nonprofit status of this organization and the exempt status for federal income tax purposes: Has Not Changed During Preceding 12 Months **13.** Publication: Test & Measurement World **14.** Issue Date for Circulation Data: September 1, 2007

15. Extent and Nature of Circulation:	Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest Filing Date
a. Total Number Copies *(Net Press Run)*	58,131	57,276
b. Legitimate Paid and/or Requested Distribution (by Mail or Outside the Mail)		
1. Individual Paid/Requested Subscriptions Stated on PS Form 3541. (Include direct written request from the recipient, telemarketing and internet request from recipient, paid subscriptions including nominal rate subscriptions, advertiser's proof copies and exchange copies)	55,006	54,432
2. Copies requested by Employers for Distribution to Employees by Name or Position Stated on PS Form 3541	0	0
3. Sales Through Dealers and Carriers, Street vendors, Counter Sales and Other Paid or Requested Distribution Outside USPS	823	924
4. Requested Copies Distributed by Other Mail Classes Through the USPS (eg First-Class Mail)	0	0
c. Total Paid and/or Requested Circulation (Sum of 15b (1), (2), (3) and (4))	55,829	55,356
d. Nonrequested Distribution (By Mail and Outside the Mail) Free		
1. Nonrequested Copies Stated on PS Form 3541 (include Sample copies, Requests over 3 years old, Requests induced by a Premium, Bulk Sales and Requests including Association requests, Names obtained from Business Directories, Lists and other sources)	950	932
2. Nonrequested Copies Distributed Through the USPS by Other Classes of Mail (eg First-Class Mail, Nonrequestor copies mailed in excess of 10% Limit mailed at Standard Mail or Package Service Rates)	0	0
3. Nonrequested Copies Distributed Outside the Mail (include Pickup Stands, Trade Shows, Showrooms and Other Source)	420	200
e. Total Nonrequested Distribution (Sum of 15d (1), (2) and (3))	1,370	1,132
f. Total Distribution *(Sum of 15c and e)*	57,199	56,488
g. Copies Not Distributed (see Instructions to Publishers #4 (page 3))	932	788
h. Total *(Sum of 15f and g)*	58,131	57,276
i. Percent Paid and/or Requested Circulation (15c divided by f times 100)	97.60%	98.00%

16. Publication of Statement of Ownership for a requester Publication is required and will be printed in the November 2007 issue of this publication.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner: Simon Young, Group Audience Marketing Director, September 24, 2007
I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

Reed Business Information Statement of Digital Circulation

1. Publication Title: Test & Measurement World

	12 Month Average	September
Printed Circulation as reported on PS Form 3526, Line 15a	58,131	57,276
Digital Circulation	9,368	9,822
Total Circulation	67,499	67,098

Simon Young, Group Audience Marketing Director, September 24, 2007

PRODUCTS

Pickering introduces 2-A PXI switch matrix

Expanding its range of PXI switch matrix products, Pickering Interfaces now offers a 2-A, two-pole switch matrix based on its BRIC architecture. The 40-566 PXI BRIC module is available in a variety of two-pole matrix configurations, ranging from 55x4 to 385x4. Each version supports 2-A hot switching and voltages up to 250 VAC.

The BRIC4 form factor occupies four slots of a PXI chassis and supports up to a 165x4 two-pole matrix, while the BRIC8 form factor occupies eight slots in a PXI chassis and supports up to a 385x4 two-pole matrix. All versions use high-density DIN41612 connectors.

The integrated backplane arrangement maximizes the matrix bandwidth and ensures users have a fully configured product with no need for terminal blocks and time-consuming wiring. The 40-566 comes with VISA and IVI drivers and operates in any PXI chassis. BRIC4 modules can operate in LXI environments using Pickering's 60-100 chassis.

Pickering Interfaces, www.pickeringtest.com.

Geotest releases PXI standards module

The new GX1034 standards module enables PXI system designers to develop a system-recertification strategy that employs only internal system resources. By incorporating the GX1034 in a system, engineers can set up a system-accuracy verification strategy that recertifies a system's source and measurement baseband instrumentation. The module features NIST-traceable voltage, resistance, and frequency standards.

Geotest–Marvin Test Systems, www.geotestinc.com.

National Instruments debuts PXI RF vector signal generator

The NI PXIe-5672 RF vector signal generator delivers signal generation from 250 kHz to 2.7 GHz, 20 MHz of instantaneous bandwidth, and real-time data streaming at up to 25 Msamples/s. The NI PXIe-5672 also features a PXI Express interface that makes it possible to stream data from hard disk or PC memory at the full output rate of the instrument. The module is compatible with all NI PXI and PXI Express instruments and with NI LabView modulation algorithms.

National Instruments reports that while on traditional instruments waveform generation and acquisition sizes are generally limited to several hundred megabytes because of bus-bandwidth and onboard-memory limitations, the PXIe-

5672's PXI Express technology enables engineers to use a redundant array of independent disks (RAID) to continuously stream waveforms that are up to 3 Tbytes in size.

By combining the NI PXIe-5672 with the NI PXI-5661 vector signal analyzer and the NI HDD-8264 RAID array, engineers can stream up to 20 MHz of RF bandwidth for more than 5 hrs. This technique lets engineers record RF signals from many types of physical locations and under a variety of environmental conditions, making it possible to capture signals that exhibit traditional wireless challenges including multipath fading, interference, and fluctuations in signal strength.

Engineers also can use the NI PXIe-5672 to regenerate recorded waveforms in a laboratory environment. This technique for waveform generation improves the efficiency and accuracy of wireless receiver validation and verification by allowing for more repeatable channel emulation testing.

Base price: $17,499. *National Instruments, www.ni.com.*

Aeroflex PXI RF platform operates to 6 GHz

The PXI 3000 Series RF test platform from Aeroflex is designed for wireless applications up to 6 GHz. The scalable platform supports research as well as manufacturing and can integrate into cellular, wireless data, RFIC test, and military/aerospace test applications. New PXI modules extend frequency range coverage to include HF, VHF, and UHF—from 250 kHz to 6 GHz for signal analysis and from 1 MHz to 6 GHz for signal generation. New modules include the 3025C, a 1-MHz to 6-GHz digital signal generator; the 3030C, a 250-kHz to 3-GHz wideband RF digitizer; and the 3035C, a 250-kHz to 6-GHz wideband RF digitizer.

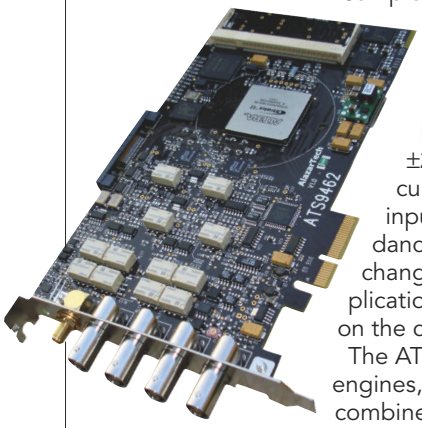
A new PXI chassis and system controller hosts both the Aeroflex modular instruments and PXI Studio application software. The PXI chassis includes one system controller slot and seven peripheral PCI or PXI slots to support multiple configurations of Aeroflex PXI modules. The chassis is available in two models: The 3000 is suitable for use with embedded or external controllers. The 3000A is equipped with an integrated 8.4-in. touch-screen color display with an 800x600-pixel resolution and the 3001A PM 1.8-GHz embedded system controller module. The 3000A can be used as a self-contained, stand-alone instrument.

Base prices: 3-GHz system with signal generation and signal analysis—$40,000; 6-GHz configurations—$50,000. *Aeroflex, www.aeroflex.com.*

Digitizer card streams in four lanes

The ATS9462 PCI Express (PCIe) digitizer card has no onboard memory because it doesn't need any. Using four PCIe lanes, the card can stream data to a PC's memory at a sustained rate of 720 Mbytes/s. That's fast enough to keep pace with the card's two 180-Msample/s analog-input channels.

As with other four-lane PCIe cards, you can plug the ATS9462 into any available 4-, 8-, or 16-lane PCIe slot.



Sample rates range from 1 ksample/s to 180 Msamples/s. Digitizer inputs have 16-bit resolution and 65-MHz bandwidth. Input voltage range is ±200 mV to ±16 V. DC accuracy is ±2% of range for all input ranges. Input impedance is 1 MΩ, but you can change that to 50 Ω for RF applications by using a DIP switch on the card.

The ATS9462 uses two trigger engines, called X and Y. You can combine the two engines using logical OR, AND, or XOR operands and then specify the number of records to capture in an acquisition, the length of each record, and the amount of pretrigger data.

The card includes software that lets you operate the card, acquire data, and store data. Optional software development kits are available for C/C++, Visual Basic, LabView, and Linux.

Price: $4995. *AlazarTech, www.alazartech.com.*

USB modules offer 80 analog inputs

National Instruments has released two 16-bit, 80-analog-channel USB data-acquisition modules. The USB-6225 samples at 250 ksamples/s, and the USB-6255 samples at 1.25 Msamples/s. The USB-6255's stated sample rate is for a single channel, with the aggregate sampling rate of 750 ksamples/s; the USB-6225 maintains its maximum sample rate when running multiple channels.

Both models feature two 16-bit analog outputs (833 ksamples/s for the USB-6225 and 2.8 Msamples/s for the USB-6255) and 24 digital I/O channels, eight of which are clocked. Each module can store up to 4055 samples in first-in/first-out memory, and each also includes two 32-bit counter/timers.

You can connect sensors, signal conditioners, and other signal sources to the modules through their screw-terminal connectors. The modules are compliant with IEEE 1541.4 transducer electronics data sheet (TEDS) sensors. Software support includes LabView, LabWindows/CVI; LabView SignalExpress, Visual Studio .NET, C/C++/C#, and Visual Basic.

Prices: USB-6225—$1599; USB-6255—$2599. *National Instruments, www.ni.com.*

Aeroflex introduces synthetic instrument system

The Synthetic Multifunction Adaptable Reconfigurable Test Environment (SMART^E) is based on Aeroflex's proprietary technology for providing synthetic test systems to meet the requirements for testing radar, satellite payloads, and T/R (transmit/receive) modules and subsystems for phased-array radar antennas. In this fifth generation of the technology, the chassis has evolved to accommodate commercial off-the-shelf (COTS) LXI modules; it now supports multiple vendors and multiple industry-standard platforms (including LXI, PXI, cPCI, and GPIB).

The SMART^E 5000 can be configured for testing electronic warfare (EW) and military systems; radar; communication, navigation, and identification (CNI) systems; and general-purpose microwave products. SMART^E also features system declassification of embedded facilities now mandated for most military systems. Aeroflex reports that the SMART^E has demonstrated a throughput that is 10X greater than that of comparable rack-and-stack systems.

The system works with Windows, C/C++/C#, and National Instruments' TestStand, and a standard test library enables users to customize the built-in tests.

Prices start at $500,000 for an 8-GHz capable system and can range up to more than $1 million for more complex test environments (up to 40 GHz). *Aeroflex, www.aeroflex.com.*

Agilent announces TD-SCDMA calibration application

Agilent Technologies has introduced its E6835A TD-SCDMA calibration application for TD-SCDMA (time division-synchronous code-division multiple access) mobile-phone manufacturing. Designed for use with the company's E6601A wireless communication test set, the Agilent E6835A enables the E6601A to support multiformat handset calibration,

which includes TD-SCDMA, GSM/GPRS/EDGE, W-CDMA/HSDPA, and cdma2000/1xEV-DO.

The E6835A application supports all requirements for TD-SCDMA chipset calibration. It also provides many of the additional RF performance tests as required by the 34.122 TD-SCDMA test standard. These tests include mean power and RRC-filtered mean power, adjacent-channel leakage ratio, spectrum emission mask, error vector magnitude, frequency error and peak code domain error, occupied bandwidth, and transmit on/off power mask measurements.

Base prices: E6835A TD-SCDMA calibration application—$11,900; E6601A wireless communications test set—$24,000. *Agilent Technologies, www.agilent.com.*

Mentor debuts TestKompress Xpress

TestKompress Xpress technology allows IC manufacturers to meet their quality objectives for process nodes at 65 nm and beyond. This latest version of the TestKompress product (which debuted in 2001) increases the achievable level of compression by providing a more efficient way to handle so-called "X-states"—the unknown states that can arise during manufacturing test. X-states can result in a loss of test coverage if not handled properly and tend to increase the test-pattern size required to test a device thoroughly.

Mentor Graphics' patented Xpress compactor technology pro-

vides an efficient way to deal with X-states by combining embedded test-data selection circuitry with a software control algorithm. Using Xpress technology requires no change to the functional design and is transparent to the TestKompress user.

Mentor Graphics, www.mentor.com.

Signal generator features fast frequency changes

Anritsu's MG37020A microwave signal generator uses a voltage-controlled oscillator to cut switching speed over the company's earlier models. Capable of generating carrier signals from 10 MHz to 20 GHz, the MG37020A changes output frequency at speeds from 50 µs to 100 µs. That's faster then the millisecond switching time of Yttrium Iron Garnet (YIG) oscillators used in the company's other signal generators.

In ATE applications, frequency switching from the time the instrument receives a command to the time it executes a command is critical, so the MG37020A uses a dedicated processor to control its hardware while it uses a Windows-based processor to handle its user interface. Because the MG37020A is Windows-based, it also adds USB and LAN ports to the traditional IEEE 488 and RS-232 ports.

Applications for the MG37020A include data-intensive testing such as for antennas where you typically perform a frequency sweep over many antenna positions. You can also use it to test RFICs and other components such as microwave amplifiers, splitters, and couplers as well as radar systems. The instrument has a phase-tracking option that lets you connect up to four MG37020As together and change their output frequencies while maintaining their phase relationships. That's useful for testing I/Q modulators where you need to test them over a specified frequency range.

Base price: $24,250. *Anritsu, www.us.anritsu.com.*

A team approach to network testing

With Fanfare iTeam 3.0 software, you can automate testing of communications networks, network elements (such as switches and routers), and test equipment. iTest 3.0 acts like a test executive for Tcl scripts, letting you develop multithreaded tests—an otherwise difficult task with Tcl alone. You can use iTest 3.0 to store test sequences and reuse them each time you need to perform regression tests on new software or firmware.

Many network elements and test equipment can be controlled

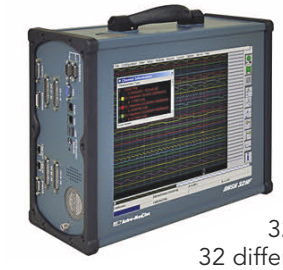
through a command-line interface (CLI) or a Web browser. iTest 3.0 provides both interfaces, plus it provides access to the Windows CLI (once known as a DOS prompt). You can capture commands sent through the CLI and export them to Tcl, which lets you develop your own automated tests. The CLI includes a Tcl shell, which provides you with access to Tcl-based programming tools.

When you develop a sequence of Tcl scripts, you can right-click on any script in the sequence list to add custom test limits. Through the script list, you can run scripts manually or automatically, stopping at the end of each script. In addition, you can also use loops and nests to further automate your tests. After you use scripts, a CLI, or a browser to run tests and collect data, you can analyze your results and produce test reports. iTeam 3.0 runs on Windows, Linux, and Solaris operating systems.

Price: $6500. *The Fanfare Group, www.fanfaregroup.com.*

Astro-Med's portable recorder logs 32 channels

The Dash 32HF, a high-frequency data-acquisition recorder from Astro-Med, records up to 32 channels to an internal hard drive at sample rates of up to 500 kHz and a bandwidth of 100 kHz/channel.



Equipped with a 15-in. monitor that allows touch-screen control and real-time data viewing and analysis, the Dash 32HF provides 32 differential inputs that accept up to ±50 VDC (35 V rms). The system's digital signal processing offers a variety of filtering capabilities, including low-pass, high-pass, band-pass, and notch filtering. The unit also includes frequency counter inputs.

The Dash 32HF comes with a dedicated 250-Gbyte internal hard drive for capturing data, a DVD burner for archiving data, and Windows-based software that allows data to be imported to a PC for analysis and review. Other features include a 10/100/1000BaseT Ethernet interface for data uploading and a USB 2.0 port for archiving data to external drives.

Intended for applications ranging from transient capture to remote troubleshooting, the Dash 32HF is portable and rugged enough to withstand harsh environments. It is built into a compact case that is 16x12.125x6.628 in. and weighs less than 22 lbs. An optional high-security version is available for defense and aerospace applications.

Base price: $23,995. *Astro-Med, www.astromed.com.*

(continued)

ADVERTISER INDEX

B&K Precision releases DC supply for test and service

The Model 9130 programmable triple-output DC power supply from B&K Precision offers stability and accuracy for electronic test, production, and service applications where multiple independent DC supplies are required. It provides 0 to 30 V, 0 to 3 A on two outputs and provides 0 to 5 V, 0 to 3 A on the third output. Each output is floating, and outputs can be adjusted independently or connected in series or parallel to produce higher voltages or currents.

Microprocessor control circuitry provides temperature stability and

load regulation of 0.01% +3 mV. The unit can power up to the same state it was in when it was powered off. This allows the supply to go back to work as soon as power is restored, whether the power-off condition was intentional or caused by a power outage. Nonvolatile memory stores up to 50 power supply settings to allow quick and easy testing when multiple voltage and current values are required.

The Model 9130 uses 4-mm sheathed banana jacks, and front-panel indicators and controls include an on/off power switch, a high-resolution LCD, closed-case calibration, and an encoder knob for quick analog-like control. Communication is via a USB or optional RS-232 interface.

Dimensions of the compact benchtop supply are 3.45x3.8x13.9 in. (214.5x88.2x354.6 mm), suitable for 2Ux½U rack-mount applications.

Price: $895. *B&K Precision, www.bkprecision.com.*

Strategic Test releases 100-Msamples/s PCI Express oscilloscope card

The UF2e-2031 oscilloscope PCI Express card from Strategic Test has four 100-Msamples/s 8-bit analog-to-digital converters that can also operate in an interpolated mode to acquire data on two channels at 200 Msamples/s. The card offers 64 Msamples of memory (which can be expanded to 4 Gsamples), continuous streaming to a host PC at greater than 120 Msamples/s, and a signal-to-noise ratio of greater than 44.5 dB.

The oscilloscope card comes with the SBench 5.3 oscilloscope program as well as with drivers for Microsoft Windows Vista, XP64, XP and Linux. Triggering options include level, window, pulse-width, re-arm, double triggers, and an external TTL trigger input. Trigger conditions can be set on multiple cards or systems combined with AND/OR logic.

Base price: $6990. *Strategic Test, www.strategic-test.com.*

COMSOL 3.4 adds parallel processing and SPICE models

The COMSOL Multiphysics 3.4 modeling tool adds support for multicore processors and will use as many processor cores as are available in a computer to cut the speed of running a model. COMSOL Multiphysics is a software package that uses Finite-Element Analysis to model designs in a myriad of engineering disciplines that include RF and EMI.

COMSOL 3.4 has several modeling modules that you can use separately or together. For example, you can model the heating of an electronic component based on its power dissipation. The RF module lets you model RF systems. New models include lumped-port boundary conditions and specific absorption rate (SAR) of the human head when subjected to electromagnetic radiation from an antenna.

The AC/DC module now lets you build circuit models in COMSOL Multiphysics and run them in SPICE-based circuit simulators. You can also use the AC/DC module to model electric motors. Version 3.4 also adds processing tools that let you compute geometric properties such as area, volume, center of gravity, and moment of inertia.

Base price: $7995. *COMSOL, www.comsol.com.*

CATALOGS & PRODUCTS

These write-ups were supplied by advertisers in this issue.

RF power amplifier brochure

The "RF Power Amplifier Brochure" from AR RF/Microwave Instrumentation features a range of RF power and tube amplifiers. The brochure highlights the 'A,' 'L,' and 'W' series amplifiers that cover 1–10,000 W and DC–1 GHz. Specifications and performance graphs are included. *AR RF/Microwave Instrumentation, www.ar-worldwide.com.*

Megapixel infrared camera

FLIR's megapixel SC8000 infrared camera for test applications offers high resolution, high speed, and high performance with its 1024x1024 focal-plane array. The SC8000 features preset sequencing and superframing modes. *FLIR Systems, www.goinfrared.com.*

True simultaneous sampling

MCC's new USB-1608HS offers true simultaneous sampling of eight channels of 16-bit single-ended or differential analog input at 250 kHz per channel. The USB-1608HS-2AO includes two 16-bit analog output channels. *Measurement Computing, www.mccdaq.com.*

Automation special supplement

Omega's full-color supplement showcases a selection of automation products including programmable logic controllers, pushbuttons, intelligent relays, wireless devices, stack lights, proximity sensors, and more. The supplement includes economical choices, popular models, and accessories. *Omega Engineering, www.omegamation.com.*

High-voltage power supply

Spellman's Bertan 205B Series HVPS provides regulated outputs from 1 to 50 kV at 15 to 30 W. The low-noise, linear topology results in extremely low output ripple. The 205B Series are reversible, providing either negative or positive polarity, along with stable performance. *Spellman High Voltage Electronics, www.spellmanhv.com/bertan/tmw.*

Ultra-accurate by design

TEMPpoint is a series of easy-to-use, highly accurate temperature-measurement instruments. Each box is a standalone instrument offering 48 separate 24-bit inputs for connection to a PC via USB or Ethernet (LXI). *Data Translation, www.datatranslation.com.*

In-circuit test system

CheckSum's new Agilent 3070-compatible ICT test system includes the hardware and software to reuse existing 3070 test fixtures, even with TestJet, at a much lower cost. *CheckSum, www.checksum.com.*

(continued)

CATALOGS & PRODUCTS

These write-ups were supplied by advertisers in this issue.

USB digital multimeter

The new Model 2100 6½-digit USB digital multimeter from Keithley Instruments simplifies critical measurements, making it ideal for R&D engineers, test engineers, scientists, and students making basic precision measurements. *Keithley Instruments, www.keithley.com/at/495.*

Test and measurement software

Measure Foundry is an open application builder for test and measurement systems. Users can combine instruments from a multitude of vendors and make sophisticated measurements without any programming. You can download a free evaluation copy at www.measurefoundry.com/eval. *Data Translation, www.datatranslation.com.*

New LED test

Ultra FINN, the latest innovation in LED color and intensity testing from Test Coach, features improved accuracy, increased speed, and greater reliability. The Ultra FINN comes with a customized sleeve for easy installation and testing of closely spaced LEDs. *Test Coach, www.testcoach.com.*

Test & MEASUREMENT WORLD

225 Wyman St., Waltham, MA 02451
781-734-8423 Fax: 781-734-8070
Sales e-mail: tmwsales@reedbusiness.com
Editorial e-mail: tmw@reedbusiness.com
Web: www.tmworld.com

BUSINESS STAFF

Publisher: Russell E. Pratt
rpratt@reedbusiness.com
Marketing Manager: Laura Koulet
Assistant to the Publisher: Darlene Fisher
Online Client Services Manager: Lyndsay A. Richmond

Market Research Director: Rhonda McGee

Group Production Director: Dorothy Buchholz
Production Manager: Joshua Levin-Epstein
Customer Contracts Coordinator: Kristin Chalifour

ADVERTISING SALES

CT, NJ, New York City, Long Island:
Mike Moore, Chatham, NJ. 973-701-9340
1.mikemoore@gmail.com

Midwest, Southeast, NY (except NYC & LI), PA, MD, DE, and Canada:
James Leahey, Kenosha, WI. 262-656-1064
james.leahey@reedbusiness.com

CA, CO, TX, and Northwest:
Mary Lu Buse, Calabassas, CA. 818-880-4024
marylu.buse@reedbusiness.com

New England, South Central; Classified, Test Marts, TestLits, and Account Development Nationwide:
Kathy McNamara, Waltham, MA. 781-734-8421
kathy.mcnamara@reedbusiness.com

Benelux, United Kingdom, Ireland, Scandinavia:
John Waddell, London, England. 44-20-8312-4696

Germany, Austria, Switzerland: Adela Ploner, Dachau, Germany. 49-8131-366992-0

Italy: Roberto Laureri,-Milano, Italy. 39-02-236-2500

France, Spain, Portugal: Alain Faure, Issy-les-Moulineaux, France. 33-1-55-95-95-11

Israel: Asa Talbar, Tel Aviv, Israel. Fax: 972-3-562-9565

Asia:

Hong Kong: Simon Lee, 852-2965-1526

Japan: Ken Mikami, Tokyo, Japan. 81-3-3402-0028

Korea: M.S. Kim, Seoul, South Korea. 82-02-752-4392

Taiwan: Grace Wu, Singapore. 886-22311-7609

Singapore, Malaysia: Wai Chun Chen, Singapore. 65-654411151

VOL. 27, NO. 10

VIEWPOINT

[An exclusive interview with a technical leader]

LAVAL TREMBLAY
VP of Engineering
Matrox Imaging
Dorval, QC, Canada

Laval Tremblay received his EE degree in 1980 from École Polytechnique in Montreal, and he joined Matrox in 1983 after working at Mitel Semiconductors and Northern Telecom. By 1986, Tremblay had been promoted to project leader, working on the company's first PC-based image processor add-on hardware. By the time he was named director of engineering in 1994, Tremblay had already begun to set Matrox on a course to redefine the industry standards in image processing. He was named VP of engineering in 2004.

Contributing editor Larry Maloney conducted an e-mail interview with Laval Tremblay on trends in machine-vision applications.

Breaking down barriers to machine vision

Q: How would you assess the progress in getting companies to adopt machine-vision solutions?
A: Frankly, this is difficult for us to answer. Our customers are the ones convincing end users to adopt machine-vision. If you take a look at the financial results of the major component players, you'll see that sales are not growing by leaps and bounds. But sales are progressing slowly, and volumes are up. In addition, there is no shortage of new opportunities. The semiconductor-inspection market is still lucrative, while other markets like robotics are coming on strong.

Q: What's behind the growth in robotics applications?
A: The increased interest in vision-guided robots can be attributed to "flexible manufacturing," where an assembly line must be able to make different products. A robot with vision can "react" to a given situation and instantly accommodate the needs of a particular product run. Smart cameras nicely complement robotics applications because the camera can control the robot itself, very much like a remote PC.

Q: What are the chief barriers that slow the adoption of machine vision?
A: Price still plays a significant role, but that is changing as the cost of technology decreases. Historically though, there are users who have experienced significant difficulties at the deployment phase, and that led to a lot of poor-quality systems, which in turn damaged the overall perception of vision systems. What that means for machine-vision vendors is that there are some users who need to be convinced that machine-vision solutions can be set up and maintained easily.

Of course, the industry has matured in leaps and bounds, so the technology has improved. Vision libraries, such as the Matrox Imaging Library, are also including more higher-level tools to remove some of the complexity of implementing machine-vision systems.

Q: How can vision companies make systems more attractive to customers?
A: Vision products must be robust and easy to use, and it's the software that's the key. You can't take advantage of the latest computer chipsets or frame grabbers or the highest data-rate 2-D and 3-D cameras without appropriate software support.

That said, software tools are evolving, too. Early applications relied on low-level processing primitives such as filters and transforms to extract the required information out of an image. Today, those primitives have been built into high-level functions. We now have ready-made tools that help developers build more robust applications in far less time and at a lower cost.

Q: How is Matrox addressing ease-of-use concerns?
A: We've addressed the ease-of-use issues largely with our Matrox Design Assistant interface, which is designed for use with the Matrox Iris E-Series smart-camera family. Design Assistant is an intuitive flow-chart-based development environment that helps developers configure and deploy machine-vision applications without programming. Its development environment provides access to a comprehensive set of highly efficient and field-proven image-analysis and measurement tools.

Q: How are you helping your customers adapt to the variety of machine-vision protocols?
A: The Matrox Imaging Library has been platform-independent since its first release in 1993. One of our very earliest goals was to support different interface standards, whether through our hardware or via third-party products for both the GigE Vision and 1394 interfaces. T&MW

Laval Tremblay provides more observations on machine-vision protocols, use of color, and other trends in the online version of this interview: www.tmworld.com/2007_11.

The Power of Four!

Tabor's New Home in The USA

EADS
North America Defense
Test & Services

Tabor's New Four-Channel Waveform Generators leading features:

- **50, 100 and 200MS/s Four-channel versions,**
  To Solve wide range of applications
- **16 Bit Vertical Resolution,**
  For more precise high frequency waveforms
- **Sine and Square waves generated up to 80MHz,**
  For standard function generator use
- **Four separate SYNC outputs**
  For independent channel synchronization
- **10Vp-p into 50Ω, 20Vp-p into open circuit,**
  To solve high voltage needs
- **Up to 4M waveform memory,**
  For single shot large waveforms
- **Comprehensive memory management,**
  To utilize memory consumption in complex waves
- **Small case size,**
  To save space and cost without compromising signal integrity
- **3.8" LCD color user friendly display,**
  For easy and intuitive use
- **Ethernet 10/100, USB 2.0 and GPIB interfaces,**
  For more connectivity options
- **ArbConnection and full IVI and MATLab Drivers,**
  For easy control, waveform and modulation creation

WARRANTY 5 YEARS

WW2074

200MS/s FOUR CHANNEL
WAVEFORM GENERATOR

WW1074

100MS/s FOUR CHANNEL
WAVEFORM GENERATOR

WW5064

50MS/s FOUR CHANNEL
WAVEFORM GENERATOR

For more information or to schedule a demo, call today 800-722-2528
or visit our website **www.taborelec.com/us**

TABOR'S NEW WW WONDER WAVE SERIES

Leading the Way In Waveform Generation

TABOR ELECTRONICS Inc.
Since 1971

The Choice for Test Management

> *"At Mindready, we used NI TestStand, LabVIEW, and PXI, to create an RF testing solution including AM/FM, RDS, SIRIUS, XM, DAB, and IBOC, reducing total system costs by more than 50 percent."* – *Phil Williams, Senior VP of Business Development, Mindready*

NI TestStand, the Industry Standard in Test Management Software

Chosen by the top 10 global manufacturing companies, NI TestStand is a ready-to-run environment for developing, managing, and automating test sequences. NI TestStand works with any programming language and facilitates smoother integration with enterprise systems, getting you to first test faster.

NI TestStand

- *Ready-to-run environment increases efficiencies and test throughput*
- *Easy sequence flow, reporting, database logging, and connectivity to enterprise systems*
- *Built-in parallel and batch execution and synchronization*

>> View demos and download FREE software at **ni.com/teststand** **800 891 8841**

NATIONAL INSTRUMENTS