Reed Business Information. (RBI.)
October 2009
www.tmworld.com

Test & MEASUREMENT WORLD®

THE MAGAZINE FOR QUALITY IN ELECTRONICS

Christian Steele, product development section manager at Peregrine Semiconductor.

TESTING THE TESTER COMPONENTS

Engineers at Peregrine Semiconductor have developed unique measurement approaches to test the firm's line of RF switches.

Page 28

Noisecom's cutting edge technology will lead you down the road to success with our innovative and high-speed solutions.

As a global provider of noise generators, modules, diodes and specialized test solutions we are ready to meet your present needs, as well as address your future applications.

For more information visit: www.noisecom.com or call +1 973-386-9696.

- RF & Microwave AWGN
- Digital Noise Generation
- Satellite Communications (BER, Eb/No)
- Wireless (WiMAX & LTE)
- >60 GHz Noise Figure
- Serial Data Compliance (Jitter, Rj)
- Wireless HD Testing
- Receiver & Antenna Calibration




Wireless Telecom Group
Boonton Microlab Noisecom Willtek

Noisecom

Where Do I Go for Test and Measurement Products?

omega.com, of Course!

Your single source for process measurement and control products!

Portable Fiber Optic Thermometers

Starts at $2650

HHTFO-101 Starts at $2695

FOH201 $2650

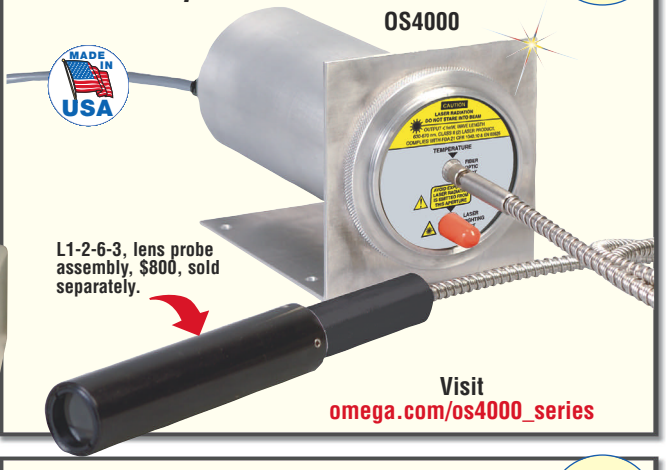
FOB100 Starts at $2995

Visit omega.com/hhtfo-101
Visit omega.com/foh201
Visit omega.com/fob100

Fastest Industrial Fiber Optic Infrared Temperature Transmitter with Smallest Spot Size

Starts at $395

OS4000



L1-2-6-3, lens probe assembly, $800, sold separately.

Visit omega.com/os4000_series

Process Signal to Speech Converters

Starts at $239

OMEGASAYS®

*Handheld Universal Verbalizer UV1000 $239

*Programmable Universal Verbalizer 1/8 DIN Panel Meter UV1000-PM $285

*PATENTED

Visit omega.com/uv1000-pm
Visit omega.com/uv1000

Not intended for Medical Related use

Electromagnetic Testers

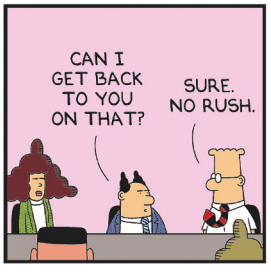
Starts at $149

HHG1394 $399

HHG1392 $199

HHG191 $149

Visit omega.com/hhg191
Visit omega.com/hhg1394
Visit omega.com/hhg1392



Find thousands of temperature measurement and control products in one place! Visit omega.com to order your FREE copy of The Temperature Handbook™ and Encyclopedia 6th Edition

FREE! Hardbound Handbook and Encyclopedia

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

For Sales and Service, Call TOLL FREE

1-888-82-66342®
1-888-TC-OMEGA

Cover Art: An Allen Welkis Adaptation Based on an Original Norman Rockwell Illustration

Shop Online:
omega.com/909TM3

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

Shop Online at
omega.com®
OMEGA®

"We Started With A Dream, And It's Grown Into A Reality."

Donald "Shep" Shepherd
Chairman

We've come a long way from that first amplifier built in my basement almost 40 years ago.
Today we're recognized as the ultimate source for testing and communications solutions in the worlds of EMC, military, wireless, and beyond. And our products are everywhere. They're boosting the power of military radios for our troops in battle; driving the most sophisticated industrial/medical/scientific equipment; testing the emissions and susceptibility of electronic equipment; and helping new electronic products get to market faster.

We've become the industry leader by continually setting the bar a little higher. By raising quality. And increasing cost-efficiency. With innovations like "subampability" – the ability to add power to existing amps; and test systems that can be upgraded from the Internet to adapt to changing specs.

With the combined resources of all the AR companies, AR is your source for everything from RF power amplifiers, antennas, complete test systems, probes, monitors, software and receivers to military booster amps, and RF amplifier modules that can be customized to meet the toughest specs. We take great pride in the support & service we deliver to our customers anywhere in the world, whenever they need it.

"AR is truly the source for infinite solutions, combining the innovations of all AR companies worldwide with the products & services to manage today's needs, meet tomorrow's challenges, and turn their dream into realities."

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

40 years ar
And Still Going Strong

rf/microwave instrumentation • modular rf • receiver systems • ar europe

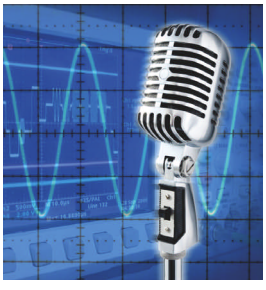
USA 215-723-8181. For an applications engineer, call 800-933-8181.
In Europe, call ar United Kingdom 441-908-282766 • ar France 33-1-47-91-75-30 • emv GmbH 89-614-1710 • ar Benelux 31-172-423-000

COVER BY: SANDY HUFFAKER/ GETTY IMAGES

OCTOBER 2009
VOL. 29 NO. 9

Test & MEASUREMENT WORLD®

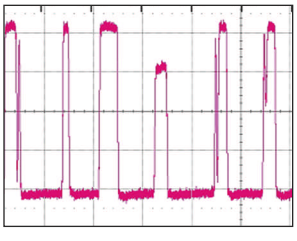
CONTENTS



Test Voices / Page 11

DEPARTMENTS

FEATURES



TECH TRENDS

MARKET TRENDS

TEST DIGEST

TEST REPORT SUPPLEMENT

www.tmworld.com

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

3-D chips, outreach to designers planned for 2009 ITC

Boundary-scan, testing of 3-D chips, yield vs. quality, and outreach to the design community will be among items on the agenda at the 40th International Test Conference, scheduled for November 3–5 in Austin, TX. Read our exclusive interview with program chair Bill Eklow of Cisco Systems to learn more about this year's program, including the new "workshop in a session" and a new career track.

www.tmworld.com/itc2009_preview

Join us on LinkedIn

Stay in touch with the people and happenings in your industry—become a member of the *Test & Measurement World* group on LinkedIn.com. Join discussions on test, measurement, and inspection topics; network with your peers; stay tuned to the latest industry news; and create new business opportunities.

www.linkedin.com/e/gis/2196932

Don't let the economy compromise quality

In the current economic climate, some customers want to unadvisedly extend calibration intervals, says Christopher Grachanen, operations manager at Hewlett-Packard's Houston Metrology Group.

www.tmworld.com/2009_grachanen

Does your salary measure up?

Check out the results of our 2009 Career & Salary Survey to learn how your salary and benefits compare to those of your peers.

www.tmworld.com/salary_2009

Take a T&M Challenge

Answer our latest challenge question, and you could win a prize courtesy of the challenge sponsor.

www.tmworld.com/challenge

"How can I tell if a power supply is reliable?"

There's an indicator on the front.

It says "Agilent." With a typical MTBF of 40,000 hours, over half-a-century of experience, and with more than 250 models to choose from, Agilent's power supplies are the ones you can count on. In fact the array of our power supplies is so extensive, it wouldn't fit on this page. For clean, low-noise, programmable power to countless DUTs, there's an Agilent power supply with your name on it. Actually, it's our name on it, but you know what we mean.

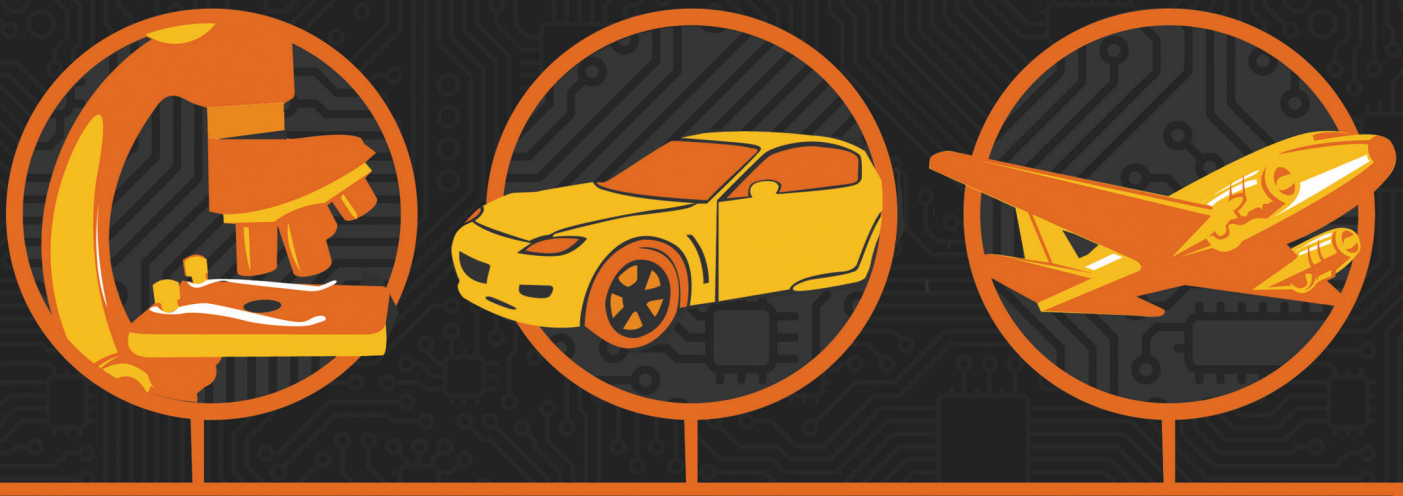
Take a brief quiz and save up to 10%.
And enter to win an iPod touch.
www.agilent.com/find/poweronquiz

Agilent Authorized Distributor

CR RENT • BUY • LEASE
CONTINENTAL RESOURCES, INC.
866-925-7633 www.conres.com/test-equipment

Limited time offer. See Web site for full promotion details.
Discount offer applies to 144 power supplies.

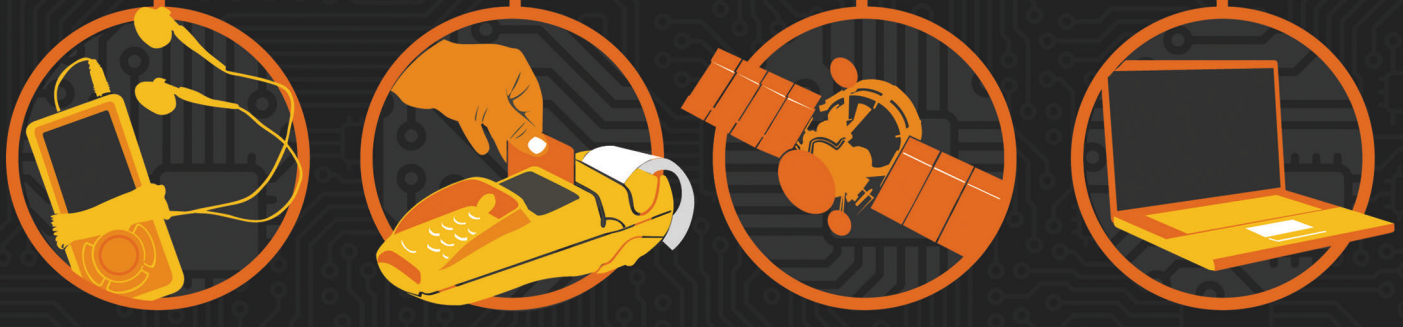
Agilent Technologies



NO MATTER WHAT THE IDEA

YOUR PCB PROTOTYPES SHOULD BE THE EASY PART

QUOTE & ORDER PCBS ONLINE AT **WWW.SUNSTONE.COM** OR CALL **1-800-228-8198**



SUNSTONE CIRCUITS

THE EASIEST PCB COMPANY TO DO BUSINESS WITH

ValueProto™

PCBexpress®

Full Feature

Sunstone Circuits® pioneered the online ordering of printed circuit boards and is the leading PCB solutions provider with more than 35 years of experience in delivering quality prototypes and engineering software. With this knowledge and experience, Sunstone is dedicated to improving the PCB prototyping process from quote to delivery (Q2D®).

Did You Know? Sunstone Offers:

- Controlled impedance testing
- Fine lines and spacing [.003]
- RoHS compliant finishes
- Free 25-point design review
- Free shipping & no NRE's
- Flex / Rigid Flex Boards
- Online Quote & Order
- PCB123® design software
- RF / Exotic Materials
- Over 99% on-time or early delivery
- Best PCBs in the industry
- Live customer support 24/7/365

RICK NELSON
EDITOR IN CHIEF

How many CE devices are enough?

Consumer electronic devices are making significant inroads in surprising places. *The Boston Globe* (Ref. 1) reported last month that the New England prep school Cushing Academy is trading in its library books on a $500,000 electronic learning center, complete with flat-panel TVs, laptop-friendly study carrels, and a $12,000 cappuccino machine, all supplemented with electronic readers.

I think Cushing Academy might be premature in substituting a digital learning center supplemented by electronic readers for its library. As the *Globe* put it, "…the long-term shape of the Internet-era news and publishing industries has yet to be settled, and the precise route that progress takes is hard to predict." One risk is that e-book providers might repossess content they've sold, as Amazon.com did with copies of George Orwell's *1984* and *Animal Farm*.

Is there really a need for so many multifunction, Web-enabled devices, such as e-books, smartphones, and netbooks?

Nevertheless, the move to e-books seems inevitable. Last month, market-research firm In-Stat weighed in with research showing a strong trend toward adoption of the devices. The firm reports that the market is heating up as Amazon updates its Kindle line-up and as Sony debuts models costing as little as $199 as well as a $399 version offering 3G connectivity through AT&T.

"Until Sony announced its wireless e-reader, the company remained at a distinct disadvantage to Amazon," says Stephanie Ethier, In-Stat analyst. "But now Sony can not only compete with Amazon more directly, but can also address a wider range of consumers than Amazon since it offers more affordable e-reader models to consumers who may not want wireless connectivity."

Worldwide, In-Stat forecasts, e-reader shipments will reach 28.6 million units in 2013, up from 924,000 in 2008. Market drivers, the firm reports, include new entrants to market, international expansion of e-book availability, price declines, and the electronic distribution of newspapers.

Also last month, In-Stat announced it's offering a $1495 report titled "Electronic Book Survey: US Consumers' Attitudes and Behaviors Towards the Burgeoning E-Book Market," which says the e-book market has plenty of room for growth that will be bolstered by features such as e-mail and Web connectivity. "According to In-Stat's most recent consumer survey, current e-book owners desire e-mail capability in the next e-book they purchase," says Ethier. "Longer battery life and Internet connectivity are the top two desired features among respondents who don't currently own an e-book but plan to buy one in the next year."

Can a built-in camera be far behind?

Is there really a need for so many multifunction, Web-enabled devices, such as e-books, smartphones, and netbooks (each with a dedicated power supply, of course)? Can you afford to leave your laptop behind when you travel? Have you ever left behind your dedicated camera in favor of your cellphone's camera (like professional photographer Shawn Rocco, who writes the Cellular Obscura blog)? Just how many devices are enough? T&MW

REFERENCE

1. "Overeager futurism at Cushing," *The Boston Globe*, September 7, 2009. www.boston.com/bostonglobe/editorial_opinion/editorials/articles/2009/09/07/overeager_futurism_at_cushing.

> > > POST YOUR COMMENTS AT WWW.TMWORLD.COM/BLOG.

Test & MEASUREMENT WORLD

EDITORIAL STAFF

Editor in Chief: 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:

Bradley J. Thompson, brad@tmworld.com

Steve Scheiber, sscheiber@aol.com

Richard A. Quinnell, richquinnell@att.net

Ann R. Thryft, ann@tmworld.com

Editorial Intern: Jennifer Kempe

Publisher: Russell E. Pratt

Senior Art Director: Judy Hunchard

Senior Art Director/Illustrator: Dan Guidera

Director of Creative Services: Norman Graf

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

CEO: John Poulin

President, Business Media: Jeffrey G. DeBalko

VP of Finance: Jane Volland

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

CIRCULATION:
Jeff Rovner
303-265-6266
jrovner@reedbusiness.com

LIST RENTAL:
Hector Gonzalez
630-288-8368
hector.gonzalez@reedbusiness.com

GENERAL AD SALES AND MARKETING:
800-438-6597

REPRINTS:
The YGS Group
800-290-5460, ext. 149;
tandmw@theygsgroup.com

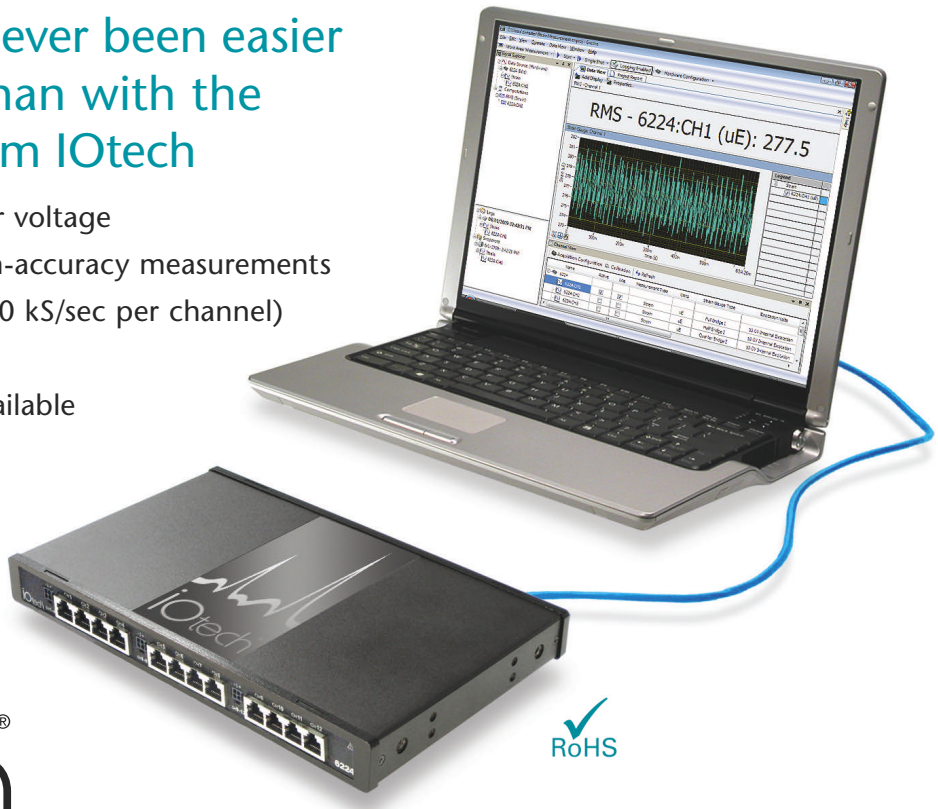
Subscribe to *T&MW* online:
www.getfreemag.com/tmw

Reed Business Information. (RBI.)

EASY. ACCURATE. FLEXIBLE.

Data acquisition has never been easier and more powerful than with the ***NEW* 6000 Series** from IOtech

- Measure strain, temperature, or voltage
- Up to 24-bit resolution for high-accuracy measurements
- High-speed sampling (up to 100 kS/sec per channel)
- Synchronize multiple units
- 250 Vrms ch-to-ch isolation available
- Includes easy-to-use **Encore** logging & analysis software
- Start taking data in minutes with no programming



iOtech®

RoHS

iotech.com/6000 (888) 890-1322 sales@iotech.com

See a live software demo at **www.iotech.com/6000**

PRECISION MATTERS

24-bit solutions from Measurement Computing

SIMULTANEOUS SAMPLING!

USB-2404-10

USB-bus powered ±10 V, 24-bit analog input device

- Four 24-bit analog inputs
- 50 kS/s per channel sample rate
- 250 Vrms channel-to-channel and channel-to-ground isolation

$999

ALSO AVAILABLE

USB-2404-60
±60 V analog input range..... **$1099**

USB-2404-UI
Four channel, 24-bit universal analog input; measure voltage, current, temperature, and resistance **$999**

System solution

Provides up to 64 voltage or 32 thermocouple channels

USB-2416

USB-based 24-bit, isolated, high-channel-count multifunction DAQ module

- 32 single-ended/16 differential analog inputs
- Configurable for voltage or thermocouples
- 500 VDC minimum isolation between field wiring and USB interface
- Also available: USB-2416-4AO adds four analog output channels ($1299)

$1099

AI-EXP32

Expansion module for USB-2416 or USB-2416-4AO

- Adds 32SE/16DI analog inputs and 16 digital I/O lines to USB-2416 or USB-2416-4AO
- Any input can be a voltage or thermocouple
- Connects directly to USB-2416 module via 37-pin D connector

$649

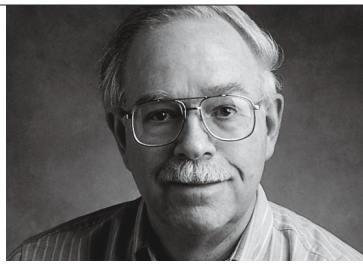
VISIT MCCDAQ.COM OR CALL US TODAY AT 1-800-234-4232

MEASUREMENT COMPUTING
LEADER IN DATA ACQUISITION & CONTROL

OEM SOLUTIONS
LEVERAGE OUR ENGINEERING AND DESIGN EXPERTISE

MCCDAQ.COM
info@mccdaq.com

BRAD THOMPSON
CONTRIBUTING TECHNICAL EDITOR
brad@tmworld.com



Hewlett and the Packards

For years, I've awaited a chance to use that title. Pretriggers included my colleague Martin Rowe's performance with the Crazy Kings blues band at the 2009 IEEE EMC Symposium (www.tmworld.com/video) and the names of 1950s' rock groups featured on Joel Najman's "My Place," an ongoing broadcast history of rock-and-roll on Vermont Public Radio.

But actually, my latest instrument acquisition, a Hewlett-Packard 3577A network analyzer and its companion 35677A S-parameter test set, inspired the title. HP's products now outnumber those of Tektronix in my geriatric-instrument collection.

As described in HP's 1990 catalog, the HP 3577A comprises a synthesized signal source spanning 5 Hz to 200 MHz and a three-channel receiver capable of extracting magnitude and phase information from its inputs. In typical applications, the instrument compares the source's output with a DUT's (device under test's) input and output, extracts magnitude and phase information, and presents the results on a CRT display. The S-parameter test set extracts scattering parameters from a DUT. The HP 3577A's HP-IB (IEEE 488) interface allows remote control and data acquisition via a suitably equipped PC and software.

Older used instruments (and especially those from HP) offer advantages: First, they're much less expensive than their new (but better-performing) counterparts. Second, they're relatively easy to repair. Schematics and service information are still available, and components have generic equivalents or else are retrievable from a salvaged instrument. Third, rescuing and restoring older equipment offers educational benefits, and the capabilities of restored instruments can expand one's horizons. For example, one of my HP 3577's first tasks will involve measurement of a matched set of 455-kHz crystal filters for a receiver project I have in mind.

Drawbacks include space (older equipment occupies a lot of volume), time (you trade off repairs for experiments), and economics (but contrast test instruments' prices with, say, vintage motorcycles). And sampling oscilloscopes won't leave oil stains on rugs.

Hewlett and the Packards may have never made a hit record, but they produced an amazing band…of instruments. T&MW

To read past "Test Voices" columns, go to www.tmworld.com/testvoices.

THE ROTARY CURSOR KNOB BLUES

An unfortunate design decision affects some HP3577As and other instruments of 1980s' vintage that feature a front-panel rotary cursor control. Inside, a grain-of-wheat incandescent lamp shines through a radially slotted interrupter wheel and illuminates photosensors, producing phase-offset pulses as the front-panel knob rotates.

At the time, HP's innovative electro-optical products included LEDs, which begs the question: Why, oh why, did the instrument division opt for failure-prone incandescent lamps? Repairing the encoder involves partial removal of the instrument's front panel, a nontrivial task. Paul Grohe has prepared a slide show and a detailed description that illustrate the replacement procedure:
www.edn.com/article/CA6514038.html

Also, *EDN*'s Paul Rako offers a few thoughts on inaccessible lamps:
www.edn.com/blog/1700000170/post/1110020511.html

To learn much more about the HP 3577A's inner workings, go here:
www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1984-11.pdf

THE DISPLAY MODULE CRT REJUVENATION SHUFFLE

Several HP instruments incorporated a display module (e.g., the HP 1349A and HP 85662A) whose CRT loses intensity and focus over time. It's sometimes possible to restore or improve the display by temporarily increasing the tube's heater voltage and grid current. This Website discusses the process and its risks and benefits:
www.thegleam.com/ke5fx/crt.html

TEST-RELATED ROCK-AND-ROLL BANDS

"Cali and the Brators" probably isn't taken yet, but read the book *Rock Formations* by Dave Wilson to be certain.

Genesis
HIGH SPEED

Proven HBM accuracy
...now available in the megahertz range

...with Genesis HighSpeed

Up to
100 MS/s
sample rate
per channel

Ultra
High-speed
DAQ

best of
sensors
expo 2009

See Genesis HighSpeed
on our new website:
www.hbm.com/highspeed

HBM, Inc.
19 Bartlett Street
Marlborough, MA 01752, USA
Tel: +1 800-578-4260 · Email: info@usa.hbm.com

HBM

Aeroflex wins Marine Corps contract for radio test systems

Aeroflex at Autotestcon 2009 (September 14–17, Anaheim, CA) announced that the US Department of Defense has awarded the company a five-year, $40.5 million contract to supply GRMATS (ground radio maintenance automatic test systems) equipment to the US Marine Corps. Aeroflex will supply the Marine Corps with its new 7200 CATS (configurable automated test set), a commercial off-the-shelf platform for testing software-defined radios and other high-technology devices.

"With its modular, standards-based design, the 7200 CATS makes radio testing future-proof," said Jeff Gillum, VP and GM, Aeroflex Wichita. "We can test any radio standard today, and within the same benchtop box, change test capabilities for any radio or module technology planned for future deployment."

The 7200 combines industry-standard hardware modules and multigigabit-per-second data buses with a plug-and-play software architecture. The test set is based on the Aeroflex Common Platform, which was designed to be compatible with the software communications architecture used by the JTRS (Joint Tactical Radio System). The 7200 supports the testing of existing and planned JTRS radio families. Its baseline configuration includes a 90-MHz instantaneous digitization and signal-generation bandwidth, better than –108-dBc/Hz phase-noise capability, 2.6-GHz frequency coverage, and packaging that meets MIL-PRF-28800F Class 3.

Per the contract with the Marine Corps, the test platform will be adopted for testing new digital and legacy radio systems. In addition to testing software-defined radios and modules such as JTRS, the 7200 CATS can test radar, avionics, and other devices. www.aeroflex.com.

IEEE ratifies 802.11n

In September, the IEEE announced that its Standards Board ratified the IEEE 802.11n-2009 amendment, which provides for improved data rates and ranges for WLANs. The amendment should help the data communications industry address the demands placed on WLANs by large file transfers and by next-generation multimedia applications.

The IEEE says that 802.11n, which has been in development for seven years, will permit the rollout of scalable WLANs that deliver tenfold-greater data rates than previous networks while ensuring co-existence with legacy systems. Publication of the 560-page amendment is scheduled for mid-October.

"This was an extraordinarily wide-ranging technical challenge that required the sustained effort and concentration of a terrific variety of participants. When we started in 2002, many of the technologies addressed in 802.11n were university research topics and had not been implemented," said Bruce Kraemer, chair of the IEEE Wireless LAN Working Group. "The performance improvements achieved via IEEE 802.11n stand to transform the WLAN user experience, and ratification of the amendment sets the stage for a new wave of application innovation and creation of new market opportunities." www.ieee.org.

NIST updates guide to radio-controlled clocks

NIST (National Institute of Standards and Technology) has updated its guide to radio-controlled clocks, which the

Broadband amplifier powers EMI tests

Editors' CHOICE

Rohde & Schwarz has entered the broadband amplifier market through a joint engineering effort of its instrumentation and broadcast divisions. The new BBA100 broadband amplifier, when combined with an antenna, lets engineers at EMC test labs perform immunity tests. Its modular design lets you add amplifier modules when you need to increase power or widen bandwidth; you can remove or replace modules by taking off the amplifier's front panel.

The BBA100 amplifier modules have frequency ranges that cover 9 kHz to 250 MHz and 80 MHz to 400 MHz with modules of 125 W, 250 W, and 500 W. Modules for the 250-MHz to 1-GHz range provide 70 W, 125 W, and 250 W. Power ratings are based on the 1-dB compression point rather than the 3-dB point. The instrument has a built-in Web server that emulates the screen and buttons of the instrument's front panel, letting you operate it over a copper or optical Ethernet network. It also has a GPIB port for automated control in a lab or test rack. You can use the BBA100 with the company's EMC-32 EMC test software.

Base price: $23,139. *Rohde & Schwarz, www.rohde-schwarz.com.*

organization says is among its most-requested publications, as it is downloaded about 100,000 times each year from the NIST site. In the US, the signals received by radio-controlled clocks originate from NIST radio station WWVB, located near Fort Collins, CO.

The updated guide—"WWVB Radio Controlled Clocks: Recommended Practices for Manufacturers and Consumers (2009 Edition)"—is intended to help manufacturers develop reliable radio-controlled clocks and to help consumers learn how products work and troubleshoot reception problems. The updated version contains revised rules for Daylight Saving Time, corrections in time zone tables, and several new recommendations for manufacturers.

The guide also lists the latest WWVB specifications, several of which have been changed to make radio-controlled clocks work better (for one example, the station's broadcast power has been boosted). tf.nist.gov/general/pdf/2422.pdf.

CALENDAR

International Test Conference, November 1–6, Austin, TX. *IEEE, www.itctestweek.org.*

Vision 2009, November 3–5, Stuttgart, Germany. *Messe Stuttgart, www.messe-stuttgart.de/vision.*

Productronica, November 10–13, Munich, Germany. *Messe München, productronica.com.*

To learn about other conferences, courses, and calls for papers, visit www.tmworld.com/events.

Anritsu debuts E Platform handheld analyzers for wireless test

Editors' CHOICE

The recently launched E Platform family of handheld analyzers from Anritsu replaces the company's D series of Site Master and Cell Master analyzers, extending functionality and enhancing performance over the earlier models. The new Site Master offers a cable and antenna analyzer frequency range of 2 MHz to 4 or 6 GHz, compared with 25 MHz to 4 or 6 GHz for the older model. The new version also offers a spectrum analyzer frequency range of 100 kHz to 4 or 6 GHz, up from 100 kHz to 3 GHz.

The new Cell Masters offer cable and antenna analyzer frequency ranges of 2 MHz to 4 GHz, vs. 25 MHz to 4 GHz for older versions, and offer a spectrum analyzer frequency range of 100 kHz to 4 GHz, compared to the previous 100 kHz to 3 GHz.

The E Platform add phase-measurement capability, dual measurement displays, and USB ports. The instruments include a 2000-trace internal memory (vs. 300 for older models) and support 4- to 18-GHz USB power sensors. And the 8.4-in. 800x600 touch screens improve upon the earlier 6.4-in. 640x480-pixel nontouch design.

Other enhancements include new marker, limit-line, and channel-scanning capabilities and support for WCDMA/HSDPA and fixed and mobile WiMAX. The instruments also offer improved sweep speeds (1 ms per data point, down from 2.5), DANL (–152 dBm, down from –135 dBm), dynamic range (better than 95 dB, vs. 65 dB), and phase noise (–105 dBc/Hz at a 100-kHz offset, vs. –75 dBc/Hz at a 30-kHz offset).

Base prices: Site Master—$7160; Cell Master—$14,950. *Anritsu, www.us.anritsu.com.*

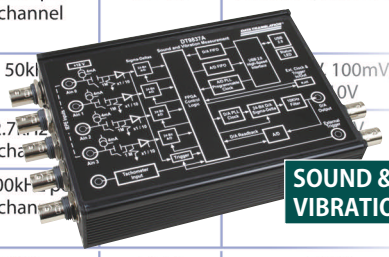
USB Data Acquisition.

Plug and Play Measurement.
Every feature. Compare. Learn. Use.
Always, 5-Day Delivery.

Product Selection Chart

	Model	Summary	Analog Input Features: # of Channels	Throughput	Resolution	Input Range
Low Cost	DT9810	Lowest cost, 10-bit, non-isolated	8SE	25kHz	10-bit	0 to 2.44V
	DT9812-2.5V	Low cost, 8 analog inputs, 12-bit, 2.5V range, non-isolated	8SE	50kHz	12-bit	0 to 0.1525V, 0.305V, 0.61V, 1.22V, 2.44V
	DT9812-10V DT9813-10V DT9814-10V	Low cost, up to 24 analog inputs, 12-bit, 10V range, non-isolated	8/16/24SE	50kHz		±1.25V, 2.5V, 5V, 10V
	DT9816 DT9816-A	Low cost, simultaneous, 6 A/Ds @ up to 150kHz, 16-bit, non-isolated	6SE	50kHz/150kHz per channel		
	DT9853 DT9854	Low cost, up to 8 analog outputs, 16-bit, 16 digital I/O, 1 C/T, 300V isolation	–	–		–
Temp.	TEMPpoint	Thermocouple, voltage, or RTD inputs, A/D and CJC per input, high accuracy	8-48	10Hz per channel	24-bit	±1.250V (0.15mV LSB)
	DT9805 DT9806	7 thermocouples, 1 CJC, temperature applications, 500V isolation	8DI/16SE	50k		100mV, 0V
Sound & Vibration	DT9837 DT9837A	4 IEPE (ICP) sensor inputs, tachometer, simultaneous A/Ds	4 IEPE (SE) + 1 Tacho	52.7		
	DT9841-VIB	8 IEPE (ICP) sensor inputs, simultaneous A/Ds with DSP, 500V isolation	8 IEPE (SE)	100k		
Simultaneous High Speed	DT9832A	Simultaneous, 2 A/Ds @ 2.0MHz each, 500V isolation	2SE	2.0MHz per channel	16-bit	±10V
	DT9832	Simultaneous, 4 A/Ds @ 1.25MHz each, 500V isolation	4SE	1.25MHz per channel	16-bit	10V
	DT9836	Simultaneous, up to 12 A/Ds @ 225kHz each, 500V isolation	6 or 12SE			
High Speed	DT9834	High-speed, up to 16 analog inputs, 500kHz, 16-bit, 500V isolation	16SE/8DI			
	DT9834-32	High-speed, up to 32 analog inputs,	32SE/16DI	50		

LOW COST



SOUND & VIBRATION

SIMULTANEOUS HIGH SPEED

We can help!
Call or visit us online.

800-525-8528
www.datatranslation.com

DATA TRANSLATION®

Inventors of ISO-Channel™ Protection Technology.

Agilent

Tektronix

LeCroy

Rohde & Schwarz

National Instruments

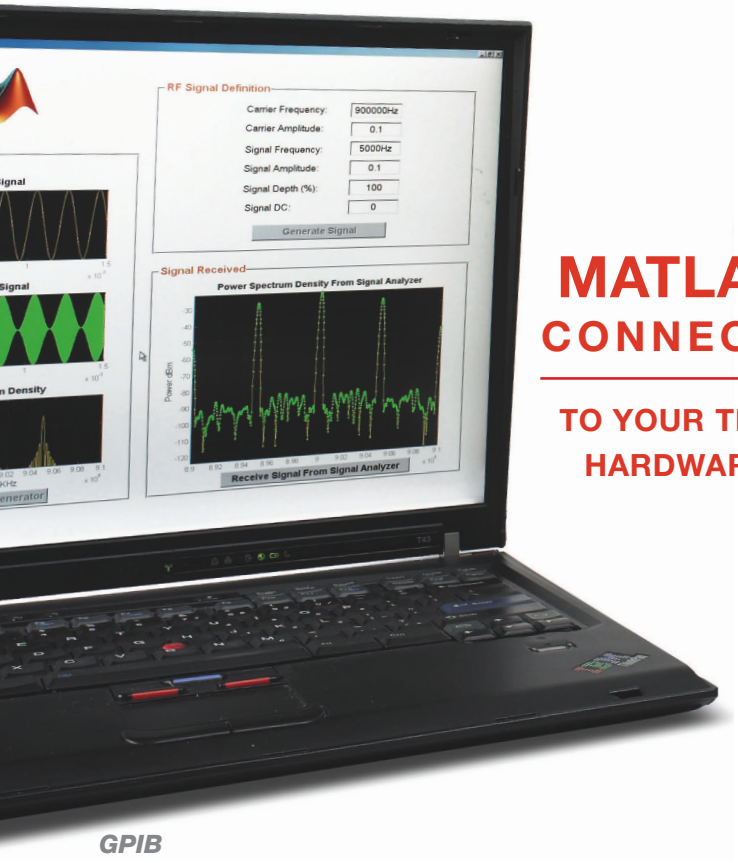
Anritsu

Keithley

Yokogawa

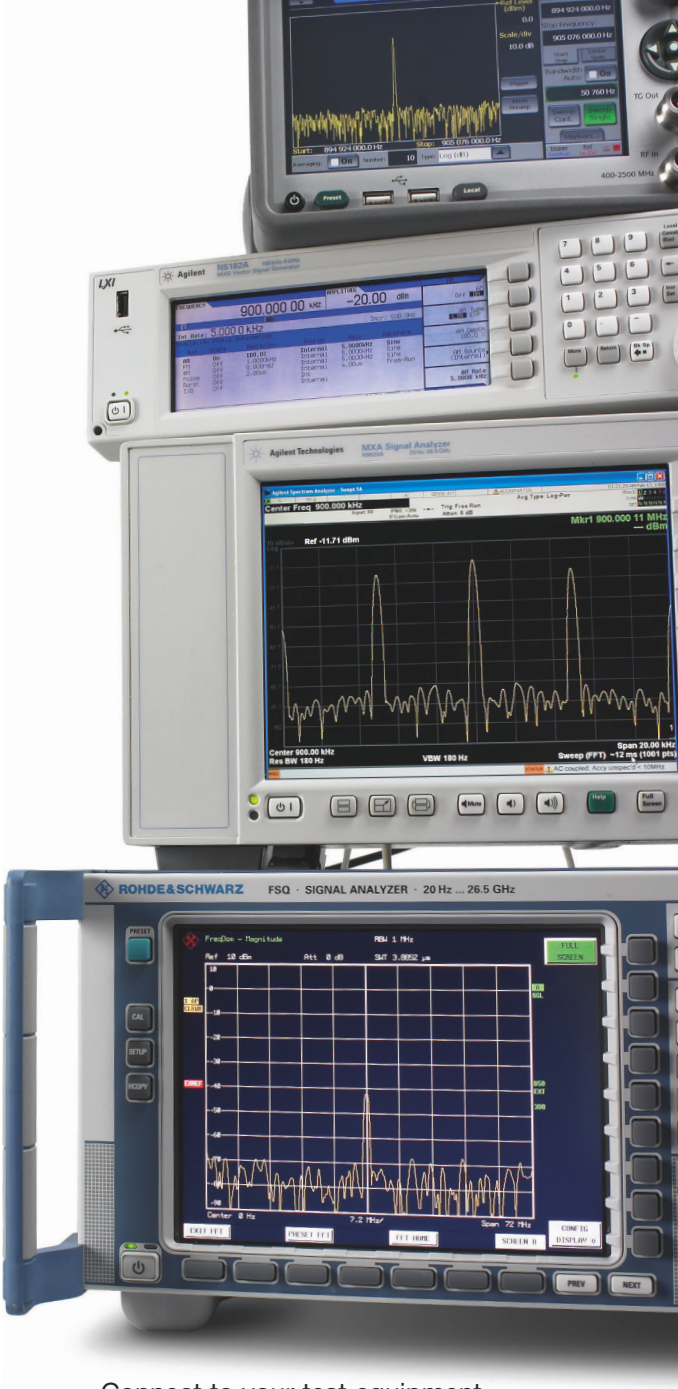
Tabor

Pickering



MATLAB CONNECTS

TO YOUR TEST HARDWARE



Connect to your test equipment directly from MATLAB® using standard communication protocols and hundreds of available instrument drivers.

Analyze and visualize your test results using the full numerical and graphical power of MATLAB.

For more information on supported hardware, visit www.mathworks.com/connect

GPIB

LXI

IVI

TCP/IP

VISA

USB

UDP

RS-232

The MathWorks™

Good technology, good products, good gig

> > > IEEE Symposium on EMC, August 17–20, Austin, TX, IEEE EMC Society, www.emc2009.org.

At the 2009 IEEE EMC Symposium, attendees enjoyed a variety of technical sessions, product exhibits, and music.

In a technical session titled "A Flexible EMI Measurement Sheet to Measure Electric and Magnetic Fields Separately with Distributed Antennas and LSIs," graduate student N. Masunaga from the University of Tokyo explained the problem of devices such as cellphones having intrasystem emissions problems. Masunaga described a solution to the problem of locating an emission that uses a flexible EMI receiving antenna sheet that wraps around the equipment under test. The sheet consists of a matrix of 4x4 PCBs (printed-circuit boards) with a stretchable interconnect between them. Each PCB consists of four antennas, making for 64 antennas.

Steve Ferguson of Washington Labs gave a demonstration on test setups for MIL-STD-461F Method CS116, which covers conducted susceptibility on cables and power leads. "There's no such thing as a shielded power cable," he noted, "because when you get to the AC mains, there's no shielding."

A panel discussion featured engineers from Intertek, Cisco, and Silent Solutions. Topics included "Can design software guarantee EMC compliance?" The panelists agreed that software can help, but it's not perfect because software is written based on assumptions that may not match an application. The panelists also discussed standards and how they reflect new technologies. Silent's Lee Hill noted that "Standards are imperfect and sometimes it's hard to know which standard applies to a product."

ON THE EXHIBIT FLOOR

ETS-Lindgren announced the Model 3183 omnidirectional biconical antenna, which is designed for EMI chamber field-uniformity measurements as required for CISPR 16 immunity tests. The antenna works over a frequency range of 1 GHz to 18 GHz.

Teseq introduced several new products in time for this year's Symposium. The PMM 9010 digital EMI receiver uses digital signal processing that functions as a digital IF downconverter and resolution bandwidth filter. The IOB 4000 input/output box lets you monitor and control equipment that's in a chamber during an EMC test. A fiber-optic communications port lets you control the unit from a PC that's outside the test chamber using USB or RS-232. Teseq also introduced the PMM EP-600 and PMM EP-601 active broadband probes for measuring electric field strength inside an EMI test chamber or TEM/GTEM cell.

Steve Ferguson of Washington Labs demonstrates how to comply with MIL-STD-461F.

Rohde & Schwarz introduced the BBA-100 modular broadband amplifier that lets you add amplifier modules when you need to increase power or widen bandwidth (see p. 13).

AR introduced the ATR26M Arrow Series of broadband log-periodic antennas. The antennas have frequency spans from 150 MHz-1 GHz to 26 MHz-6 GHz with maximum power levels from 300 W to 6 kW. **Fischer Custom Communications** exhibited a susceptibility tester for 1000BaseT Ethernet lines. It can inject transient signals for IEC 1000-4-5 surge-generation requirements. **Pearson Electronics** displayed current probes for emissions and susceptibility testing.

ON STAGE

On August 18 and 19, the exhibition hall featured a stage where attendees could show off their musical talent in a variety of genres, including rock, blues, jazz, and country. Austin-based Chadd Thomas and the Crazy Kings opened and closed the sessions and backed up several engineer musicians. The online version of this article (www.tmworld.com/2009_10) contains a link to "EMC engineers pull off a good gig," which features photos and a video of *Test & Measurement World*'s Martin Rowe playing "The Measurement Blues." T&MW

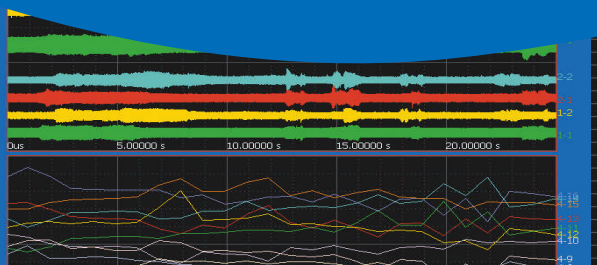
The EMC Engineers band (l-r): Jeff Silberberg (guitar), Mike Caruso (bass), Louis Feudi (vocals), Ken Wyatt (drums), and Leo Smale (guitar).

Now More Than Ever, You Need Products That Are...

Hioki's 8860-50 Hybrid Recorder

- Runs Windows CE
- Advanced Trigger & Search Functions
- LAN Port
- Built-in web browser
- Advanced Math Functions
- Dual Compact Flash card
- 16 Logic Inputs

CAT IV 600V
CAT III 1000V



400us	-2.000mV	1.150mV	-1.625mV	1.438mV	4.0094mV
450us	-2.100mV	1.250mV	-1.063mV	1.125mV	3.8906mV
500us	0.150mV	0.450mV	0.875mV	-0.125mV	3.6812mV
550us	2.000mV	-1.000mV	1.750mV	-0.875mV	4.1938mV
600us	2.000mV	-1.400mV	1.688mV	-0.937mV	3.8438mV
650us	1.900mV	-1.050mV	1.688mV	-0.937mV	3.4375mV
700us	1.950mV	-1.250mV	1.812mV	-0.937mV	3.0563mV
750us	1.900mV	-1.050mV	1.750mV	-0.937mV	1.4344mV
800us	2.400mV	-1.100mV	1.750mV	-0.937mV	-1.9437mV
850us	2.300mV	-0.950mV	1.875mV	-0.937mV	-3.3969mV
900us	2.450mV	-1.600mV	1.625mV	-1.125mV	-3.3875mV
950us	2.300mV	-1.050mV	1.187mV	-0.562mV	-3.8000mV
1.00ms	0.350mV	-0.250mV	-0.687mV	0.750mV	-3.6469mV
1.05ms	-1.700mV	0.850mV	-1.688mV	1.250mV	-3.4844mV
1.10ms	-2.150mV	1.300mV	-1.500mV	1.375mV	-3.8563mV
1.15ms	-1.800mV	0.900mV	-1.688mV	1.312mV	-3.5625mV
1.20ms	-1.650mV	1.350mV	-1.750mV	1.312mV	-2.6438mV
1.25ms	-1.600mV	1.200mV	-1.750mV	1.312mV	-1.2969mV
1.30ms	-1.850mV	1.250mV	-1.563mV	1.438mV	1.6594mV
1.35ms	-1.800mV	1.350mV	-2.000mV	1.250mV	3.7937mV
1.40ms	-1.800mV	0.950mV	-1.625mV	1.500mV	3.8688mV
1.45ms	-1.750mV	1.000mV	-0.687mV	1.312mV	3.7313mV
1.50ms	0.150mV	0.250mV	0.500mV	-0.750mV	3.8938mV
1.55ms	1.850mV	-0.750mV	1.563mV	-0.813mV	3.8250mV

...Technologically Advanced, Built To Last.

Producing High Quality Products For 75 Years

HIOKI

6 CORPORATE DRIVE • CRANBURY, NJ
PHONE: 609.409-9109
FAX: 609.409-9108
www.hiokiusa.com

ISO 14001
FOR A CLEAN ENVIRONMENT
"we're doing our part"

MARTIN ROWE
SENIOR TECHNICAL EDITOR
mrowe@tmworld.com

The technical divide

There seems to be a gap between senior engineers (over age 45) and junior engineers (28 and under) that is wider than just the difference in age. With the current economy, the ratio of junior to senior engineers is growing because of early retirements and layoffs. The senior engineers who remain often have less time to train the next generation.

"Management doesn't always get it," said Wayne Moorhead, a former ATE applications manager. "They let go senior engineers simply because they make more money than recent graduates. Unfortunately, senior engineers are often more productive than their younger peers."

"Mentorship is a must today and time has to be made for it," he added. "Bringing new engineers up to speed quickly provides a good return on investment. But at the same time, new engineers must understand that they own their careers and they should aggressively find learning opportunities and mentors."

Richard McDonell, product manager for automated test at National Instruments added, "On-the-job training

for automated test is becoming increasingly difficult for many companies." "Experienced test engineers are finding themselves mentoring a larger number of new engineers, and [they] face a growing challenge of keeping up with their own job responsibilities."

Chris Grachanen, metrologist at Hewlett-Packard, has experienced this firsthand. He's found that he can no longer take the time to train the basics of measurements, particularly RF. The lack of time to train puts Grachanen in a quandary. Because he needs to accomplish something right away, he may not have time to teach others so they can relieve him of some of his workload. "Today, everyone needs to understand RF, so I assign technical reading to get junior engineers started, then I make time to answer questions," he said. He also asks recent graduates to read about math and physics to get them started.

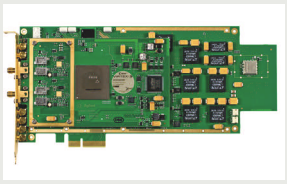
The lack of time for mentoring can add to a cycle that is difficult to break. ATE consultant Louis Unger noted that "test engineers are put into roles that resemble assembly work more than engineering because production can't be slowed while someone learns how to address problems."

Ken Wyatt, former EMC engineer at Agilent Technologies and now a consultant, saw the problem coming prior to his retirement and decided to do something about it. He developed training courses in EMC for Agilent engineers in North America, Europe, and Asia. His seminars typically drew 20 to 25 engineers, with his last seminar in Malaysia drawing 45. He then trained two other senior engineers to continue training others in EMC.

McDonell has found that companies are looking to their suppliers to assist them by providing self-paced training for their new test engineers to come up to speed more quickly. In response to that, his company has developed a free technical guide on test-engineering (Ref. 1). Other companies such as Agilent Technologies also provide application notes on test basics (Ref. 2).

What have you found? If you know of other materials on test-engineering fundamentals, tell your peers. Leave a comment in the online version of this article at www.tmworld.com/2009_10. T&MW

PCIe digitizer moves on four lanes



The U1084A PCI Express two-channel digitizer samples at 4 Gsamples/s with 1.5-GHz bandwidth. Its four PCIe lanes can move data across the bus at up to 650 Mbytes/s. An onboard DSP provides filtering and peak detection. www.agilent.com.

Switch cards enhance mainframe

VTI Instruments has added three switch cards to its EX1200 series of instrument mainframes. The EX1200-3164 is a 1x4, two-wire multiplexer that supports temperature sensors. The EX1200-4128 is a 4x128 one-wire multiplexer with 0.5-A relays that switch up to 150 V. The EX1200-6216 is a dual (1x16) RF multiplexer with 1-GHz bandwidth. www.vtiinstruments.com.

USB module acquires data on six channels

The DT9816-S USB data-acquisition module samples at 800 ksamples/s on each of its six 16-bit analog channels. It includes eight digital inputs, eight digital outputs, and one counter/timer. www.datatranslation.com.

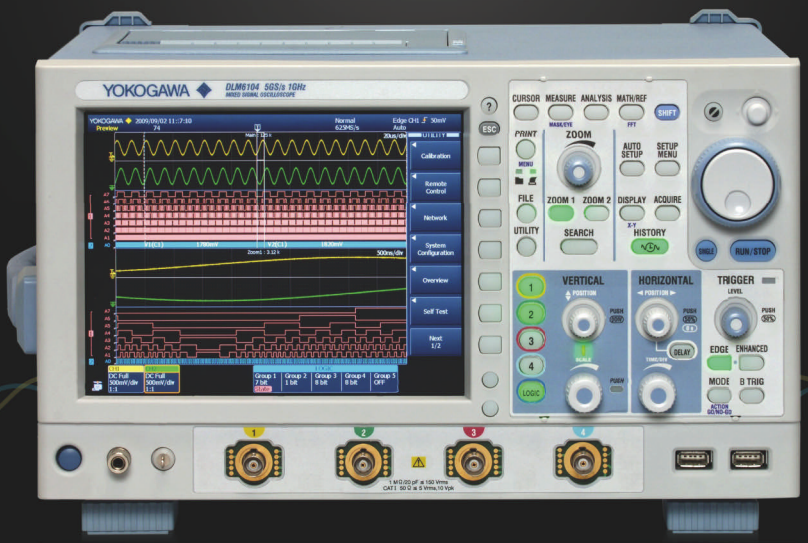
REFERENCES

1. *Designing Automated Test Systems - A Practical Guide to Software-Defined Test Engineering,* National Instruments. zone.ni.com/devzone/cda/tut/p/id/10058.

2. *Test-System Development Guide: Choosing Your Test-System Hardware Architecture and Instrumentation,* Application Note 1465-5, Agilent Technologies. cp.literature.agilent.com/litweb/pdf/5988-9820EN.pdf.

Read past Tech Trends columns at www.tmworld.com/techtrends.

Not just making *HISTORY*, we invented it.



With the DLM6000 Oscilloscopes, *we bring you the future.*

In 1924, Yokogawa created the N-3 mechanical oscilloscope, which could observe AC waveforms before the invention of the CRT. In 1988, Yokogawa pioneered long memory and introduced ***History Memory*** in digital oscilloscopes, allowing users to review and isolate past waveforms.

Since then, we've continued to innovate through twelve generations of digital and mixed signal oscilloscopes. The DLM6000 series represents the culmination of this research and innovation. To Yokogawa, foresight means a lifetime partnership in test and measurement solutions.

- 500MHz / 1GHz / 1.5GHz DSO and MSO models
- New layout optimized for Ease-of-use
- Detect anomalies with industry-leading 2.5 million wfms/sec and 2000 ***History Memory*** segments
- Characterize waveforms with most cursor types, parameters, statistics, and math
- Enhance signals with most DSP and Bandwidth filters
- Analyze serial bus signals with hardware accelerated decoding
- Ideal for Benchtop or ATE applications

YOKOGAWA

QUALITY ■ INNOVATION ■ FORESIGHT

http://tmi.yokogawa.com

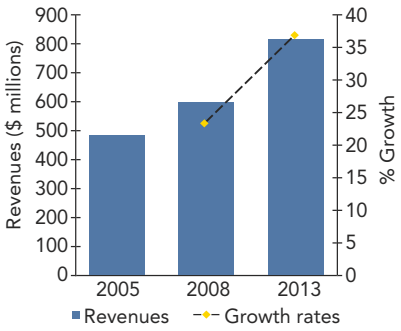
ADA 902

SRIHARI PADMANABHAN
RESEARCH ANALYST
FROST & SULLIVAN
www.frost.com

Market for network-monitoring systems grows

The demand for passive network-monitoring systems is increasing as network operators prefer to use monitoring systems over traditional protocol analyzers. In 2008, the total wireless protocol analyzer and network-monitoring systems market generated revenues of $595.5 million, which is an increase of 13.0% over 2007. The markets for traditional troubleshooting and monitoring protocol analyzers and for load stress generators and functional testers suffered a decline of 9.5% and 7.0% respectively over 2007. This trend toward the use of passive systems is expected to continue, and that market is forecast to reach $814.16 million in 2013 by growing at a CAGR (compound annual growth rate) of 6.5% (see **chart**).

Some of the test-equipment manufacturers in the passive-system space, such as Accanto Systems and RADCOM, have already shifted their focus from protocol analyzers to emerging markets like network-monitoring systems and CEM (customer experience management) systems. As network operators have expanded their networks, subscribers have been given a greater choice of providers, which in turn has increased competition in the market.



Total market revenue for the wireless protocol analyzer and network monitoring market from 2005 to 2013.

To tackle this situation, network operators are spending more money on measuring the QoS (quality of service) and QoE (quality of experience) at the subscriber's end. Because CEM systems can provide network operators with these parameters and reduce customer churn, demand for such systems increased significantly in 2008. Tektronix, the market share leader in this space, recently acquired Arantech, a Dublin-based provider of CEM systems, to address this trend.

The convergence of voice, video, and data is also a major factor that is driving the need for network-monitoring systems. With increasing demand for mobile broadband and IP-based networks, numerous services are being introduced that will increase the adoption rate of new technologies such as LTE in future. As carriers converge multiple network types, there is a greater need to monitor the network for end-to-end performance, resulting in greater demand for network-monitoring systems.

Some of the other factors that are driving the wireless network-monitoring systems market include:

- development of new technologies like LTE and mobile WiMAX;
- demand for GSM and CDMA technologies in emerging countries like India, China, and Nigeria; and
- complexity of the 3G networks, which forces service providers to buy network-monitoring systems capable of monitoring services across different technologies.

As service providers have provided more services to their subscribers in the recent past, their focus on service quality and subscriber experience has greatly increased. This trend is expected to continue in the future, as the demand for high-bandwidth services and mobile applications will continue to increase. T&MW

Analysts raise PC expectations

Financial analysts at FBR Capital Markets (www.fbr.com) are positive on both Intel and AMD, noting that recent checks into Q3 PC builds with the top five notebook ODMs (original design manufacturers) and top four desktop motherboard makers are once again better than the firm's month-ago checks. "Overall, we forecast Q3 PC builds will grow 22% QOQ [quarter over quarter] (up from 18% QOQ one month ago)," wrote Craig Berger and Robert Pikover, semiconductor market analysts at FBR. "Our contacts now expect notebook units to grow 25% QOQ (up from 21% QOQ one month ago)." For more, see www.edn.com/article/CA6697544.html.

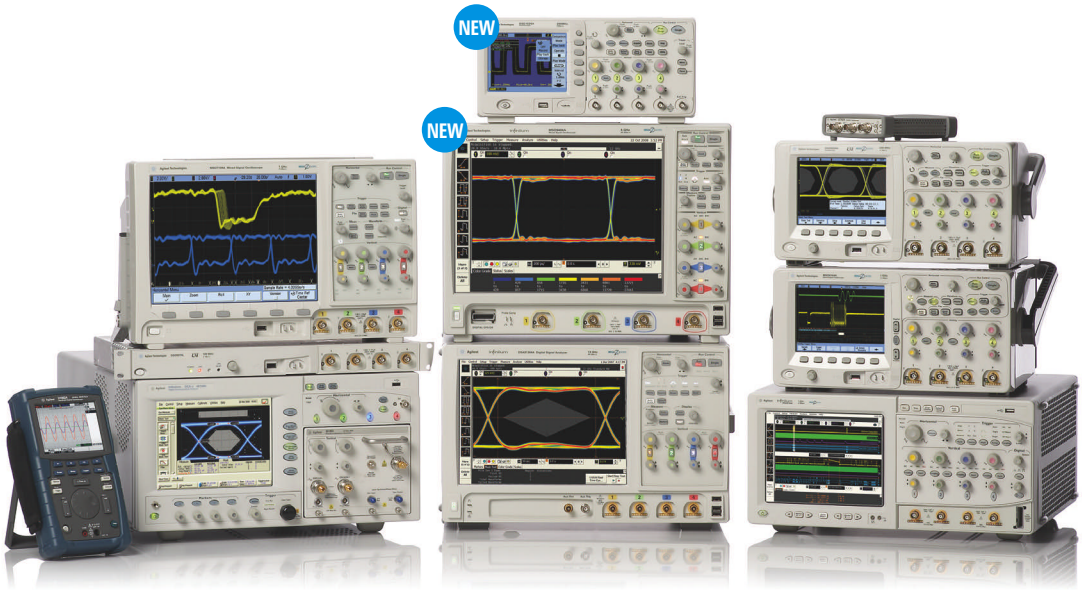
Gold in green technology?

At a recent panel sponsored by Monte Jade, the question was posed, is there really an opportunity for microelectronics vendors in the Green Tech movement? Jim Diller, a angel-level fund leader at venture capital group VentureTech Alliance, pointed out that today about half of the world is underserved in terms of lighting. Given the huge advantage of LEDs in efficiency and life, he said, a huge market for LEDs is a question of when, not if. He said that other markets, such as solar energy, would also need microelectronics for measuring and monitoring functions. For more, see www.edn.com/article/CA6697713.html.

E-book adoption strong

In-Stat has reported on research showing a strong trend toward adoption of e-books. The firm reports that the market is heating up as Amazon updates its Kindle lineup and as Sony debuts models costing as little as $199. Worldwide, In-Stat forecasts, e-reader shipments will reach 28.6 million units in 2013, up from 924,000 in 2008. See the online version of this column for links to more information (www.tmworld.com/markettrends).

Why is Agilent the fastest growing oscilloscope manufacturer?



Because we listen to you.

To build our scopes, Agilent carefully examines the challenges you face. Then we deliver products that solve your problems in imaginative ways. Like the multi-chip module that enables Infiniium's industry-leading signal integrity. And the ASIC that underlies InfiniiVision's patented Mega*Zoom* deep memory giving you the industry's best signal visibility. You'll find innovations like these in each of our scopes — that's why more and more engineers are choosing Agilent over other scope brands.*

Agilent 20 MHz to >90 GHz real-time and sampling scopes

- Handhelds, portables, rack-mounts and benchtops
- 50+ application-specific software packages for exceptional insight
- Innovations that satisfy your toughest demands

See why more and more engineers choose Agilent.
Download our catalog
www.agilent.com/find/scopecatalog

EDN INNOVATION Honoring Excellence in Electronics WINNER 2008
Elektra 08 European Electronics Industry Awards WINNER
2008 design news GOLDEN MOUSETRAP Finalist
BEST of TEST 2009 TEST & MEASUREMENT WORLD Finalist

 *Prime Data August 2008 CAGR T&M Report

u.s. 1-800-829-4444 canada 1-877-894-4414

Agilent Technologies

SEMICONDUCTOR TEST

Characterizing noise in voltage-reference ICs

Voltage-reference stability and noise frequently define the measurement limits of instrumentation systems. In particular, reference noise often sets stable resolution limits.

Reference voltages have decreased with the continuing drop in system power-supply voltages, making reference noise increasingly important. The compressed signal-processing voltage range mandates a commensurate reduction in reference noise to maintain resolution. Noise ultimately translates into quantization uncertainty in ADCs, introducing jitter in applications such as scales, inertial navigation systems, infrared thermography, digital voltmeters, and medical-imaging apparatus.

A new voltage reference, the LTC6655, has the accuracy and temperature coefficient typical of high-grade, low-voltage references. No other low-voltage electronic reference, however, can equal the new device's extremely low 0.1- to 10-Hz noise. You must use special techniques to verify the part's noise performance.

A straightforward approach appears simple. **Figure 1** illustrates a 0.1- to 10-Hz noise-testing scheme that includes a low-noise preamplifier, filters, and a peak-to-peak noise detector. But the practical implementation represents a measurement with a high order of difficulty. The preamplifier's 160-nV noise floor requires special design and layout techniques. For example, you'll need to strip out the reference-under-test's DC potential with a capacitor/resistor combination, and you'll need to choose a highly specialized tantalum capacitor optimized for leakage, and you should note that the capacitor's dielectric absorption requires a 24-hr charge time to ensure meaningful measurement results.

My article (Ref. 1) in sibling publication *EDN* provides complete details on measuring the capacitance leakage and constructing the measurement circuit, which has a forward gain of 1 million to allow conventional instruments to provide a readout of noise values. The article also provides a table of high-sensitivity, low-noise amplifiers that you can use to implement the circuit.

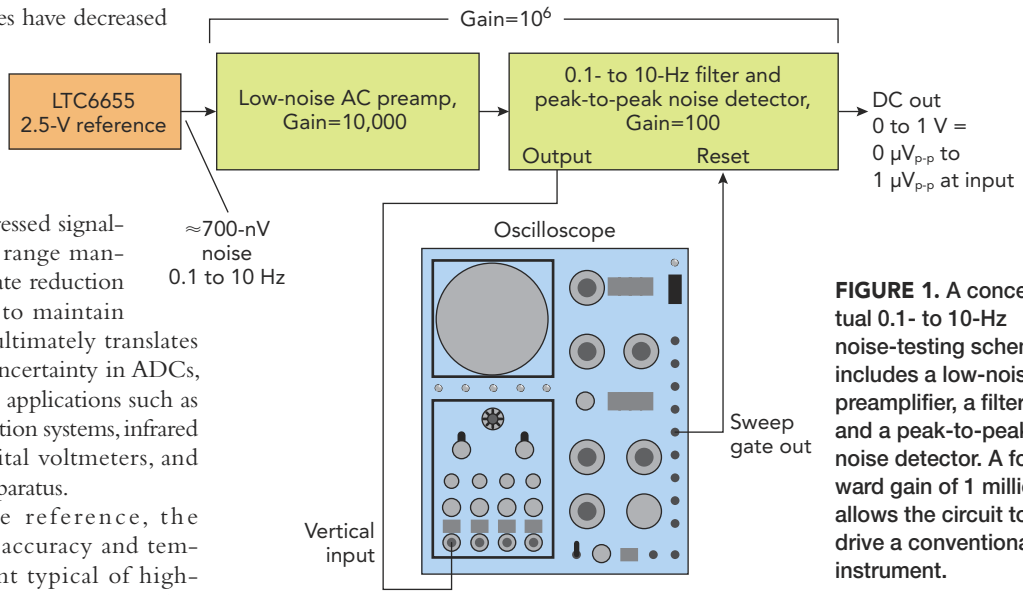


FIGURE 1. A conceptual 0.1- to 10-Hz noise-testing scheme includes a low-noise preamplifier, a filter, and a peak-to-peak noise detector. A forward gain of 1 million allows the circuit to drive a conventional instrument.

Jim Williams, EDN *consulting editor and Linear Technology staff scientist*

REFERENCE

1. Williams, Jim, "Characterizing noise in high-performance voltage-reference ICs," *EDN,* September 3, 2009. p. 35. www.edn.com/article/CA6685970.html.

PRODUCT TRYOUT

Handy instrument needs cleaner install

Circuitgear CGR-101 USB oscilloscope, Syscomp Electronic Design, www.syscompdesign.com. Price: $179.

The Circuitgear CGR-101 is a combination 20-Msamples/s oscilloscope, function generator, pulse-width modulation signal generator, and digital I/O module that has the potential to be a handy troubleshooting tool on the bench, in the field, or even at home. While the instrument does what it is supposed to do, getting it to work is more tedious than it should be.

The software and driver installation process, not usually an issue, gets in the way. The process has too many steps, and if you don't follow the on-screen instructions exactly, you may never get the instrument to communicate with your Windows, Mac, or Linux PC. That's what happened to me. I needed a clean copy of Windows before the installation would work. You may not need that if you follow the instructions precisely. *(continued)*

The New LeCroy Oscilloscopes

60 MHz - 30 GHz

Insight With Confidence

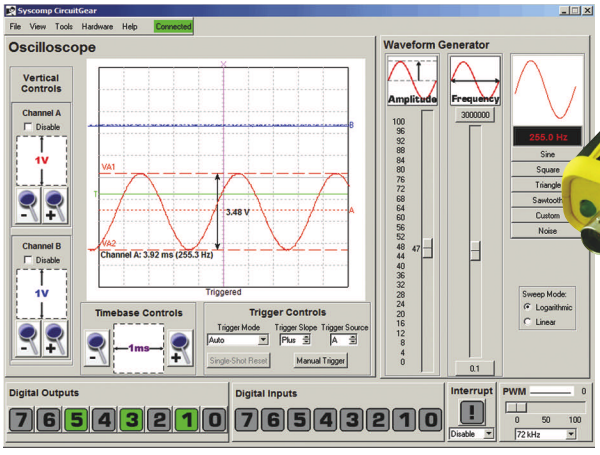
LeCroy's oscilloscope line is broader than ever, and each product benefits from LeCroy's rich, 45-year heritage of providing deep insight into complex signals. Whether you need to measure, characterize and analyze the highest speed signals using the world's fastest (30 GHz) real-time oscilloscope; require a lower cost, portable oscilloscope; or something in-between, LeCroy has the bandwidth you want and the performance you need.

LeCroy

To learn more, visit www.lecroy.com or call 1-800-5-LeCroy

Handy instrument needs cleaner install *(continued)*

Once I had the oscilloscope working, I found it to be a good educational tool. Syscomp provided a simple test circuit—a transformer—that let me evaluate the instrument. The software is easy to use (once you get through the installation), and I was able to characterize the transformer's frequency response. The instrument's vector network analyzer mode is a nice feature, letting you quickly generate Bode plots for gain and phase.



The CGR-101 oscilloscope is a versatile instrument for its $179 price tag.

The oscilloscope software needs more triggers than just the level trigger that it provides. Pulse-width triggering, for example, would add value. Furthermore, you have no way to trigger the oscilloscope on a digital pattern unless you write your own application using the instrument's programming commands. That's unlike the Link Instruments MSO-19, which has that ability although it has only one oscilloscope channel (Ref. 1). At just $179, though, the CGR-101 is a versatile instrument—if you follow the install directions.

To read my complete review of the Circuitgear CGR-101, see the online version of this article at www.tmworld.com/2009_10.

Martin Rowe, Senior Technical Editor

REFERENCE

1. Rowe, Martin, "Product tryout: USB mixed-signal oscilloscope," *Test & Measurement World*. www.tmworld.com/martin_USB.

Spread the Word...

Tabor's Home in The USA

EADS NORTH AMERICA

MODULAR

IF/Baseband

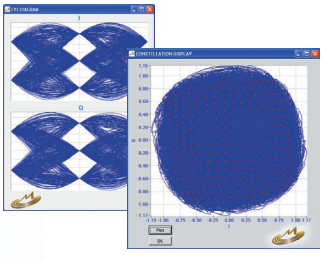
A New Era in **Communication Design.**

Models 2571A & 2572A

TABOR'S NEW WONDER WAVE SERIES

Wireless design is clearly oriented towards DSP based architectures. SDR (Software Defined Radio) based designs are the preferred solutions to today's wireless communication requirements. Although the final products operate at RF frequencies, signal processing takes place at either baseband (IQ) and/or IF at both ends of the transmission chain: transmitter and receiver. With EVM lower than 0.5%, Tabor's 2571A and 2572A are the ideal generators to test digital front-ends and up-converters. The 2572A provides the accuracy and channel matching required to test quadrature modulators at the transmitter side and decoders at the receiver side, whereas the 2571A provides an ideal, cost-effective platform for IF generation that requires only one channel. For designs requiring modulated signals in digital bus format, their LVDS outputs provide a simple, single box solution.

For more information or to schedule a demo, call **EADS North America Test and Services** at 800-722-2528 or visit our website **www.taborelec.com/us**



EVM

Frequency	Symbol Rate		
	0.1 MS/s	1 MS/s	5 MS/s
10 MHz	0.15% (1)	0.30% (1)	1.40% (1)
80 MHz	0.25% (2)	0.50% (2)	1.20% (2)
100 MHz	0.25% (3)	0.50% (3)	1.20% (3)

EVM Test conditions:
Sample Clock Frequency = as specified;
Modulation = QPSK;
Baseband Filter = Raised Cosine;
Alfa = 0.35

ACLR

Frequency	Symbol Rate		
	0.1 MS/s	1 MS/s	5 MS/s
10 MHz	73 dB (1)	73 dB (1)	65 dB (1)
80 MHz	64 dB (2)	64 dB (2)	60 dB (2)
100 MHz	64 dB (3)	64 dB (3)	60 dB (3)

ACLR Test conditions:
BW = Symbol Rate;
Offset = 1.35 x Symbol Rate

(1) Sample Clock Frequency = 100 MS/s
(2) Sample Clock Frequency = 200 MS/s
(3) Sample Clock Frequency = 250 MS/s

Leading The Way In Waveform Generation

TABOR ELECTRONICS Ltd.
Since 1971

DMM handles logic nanosecond-pulse-width waveforms

Use a flip-flop to square a narrow-pulse waveform.

By Marián Štofka, Slovak University of Technology, Bratislava, Slovakia

When testing sequential-logic circuits, you may find that, although the repetition rate of a logic signal is within the range of your DMM (digital multimeter), you can't measure it. The displayed frequency value is either dubious or chaotically changing in time. The DMM may also behave as if there were no signal.

Any of these undesired states might appear when the duty cycle of the measured waveform is either close to 0 or is approaching 1. This problem occurs because you can't expect a DMM with an upper frequency limit of perhaps 200 kHz to measure 100-ns-wide pulses, even if the repetition rate of these pulses is well below the upper limit of the DMM's frequency range and is perhaps just 5 kHz. For a rough estimation of bandwidth for measuring a pulse width of 100 ns, consider this pulse to be a half-period of a square-wave signal. Use the following equation to calculate the required bandwidth:

$$B \approx \frac{1}{2T_w} = \frac{1}{2 \times 10^{-7}\ s} = 5\ \text{MHz}$$

This frequency is well beyond the bandwidth of most DMMs.

The second cause of failing to measure the repetition rate of logic waveforms with duty cycles that are too low or too high lies in the internal AC coupling of the DMM during frequency measurement. Thus, the decision threshold of an internal comparator, which you derive from the mean value of the measured waveform, is close to either the low level or the high level of the waveform. In the case of narrow pulses, the operation of the internal comparator becomes ambiguous, as any noise in the measured waveform or any noise that the comparator itself generates may cause an error.

You can address the problem by placing a binary divider between the source of a logic signal and the DMM. The binary divider comprises IC_1, a positive-edge triggered, D-type flip-flop (**Figure 1**). The supply pin of IC_1 connects to the supply terminal of the tested logic circuit. Therefore, you can run the logic at any industry-standard supply voltage of 1.2 V, 1.5 V, 1.8 V, or 2.5 V. If you use 3.3-V logic, use an external 2.5-V source to supply IC_1. The internal protective diodes at pin 1 of IC_1, along with resistor R_1, reduce the voltage swing at pin 1 to an acceptable level in such a case.

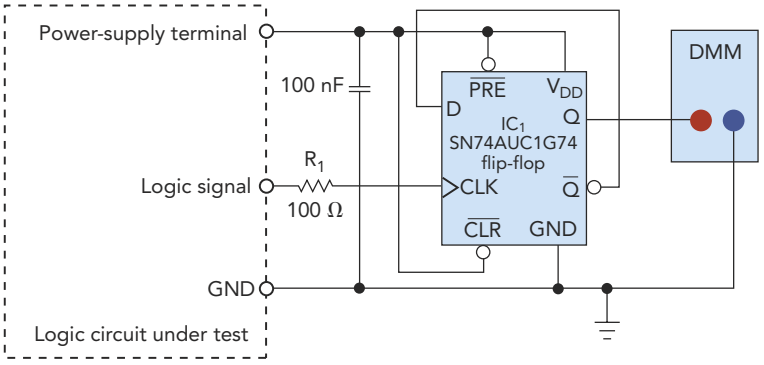


Figure 1 A binary divider turns low- or high-duty-cycle waveforms into square waves so you can measure their frequencies.

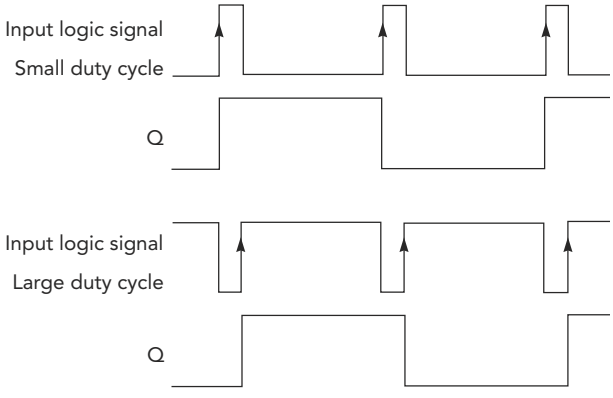


Figure 2 The flip-flop output, Q, produces a signal with a 50% duty cycle.

A square-wave signal is at the output of the binary divider (**Figure 2**). The DMM no longer sees nanosecond pulses at its measuring terminal. You then must multiply the displayed frequency value by two to obtain the correct frequency. Due to relatively low values of R_1 and of the flip-flop's input capacitance (C_{IN}, approximately 2.5 pF) at the device's clock input, you need not worry about frequency compensation. The time constant of $R_1 \times C_{IN}$ is just 0.25 ns. The width of pulses at the input of the circuit can be as low as 1 ns. T&MW

This article first appeared in the August 20 issue of EDN.

Do you have a test idea you'd like to share?

Publish it here, and receive $150.

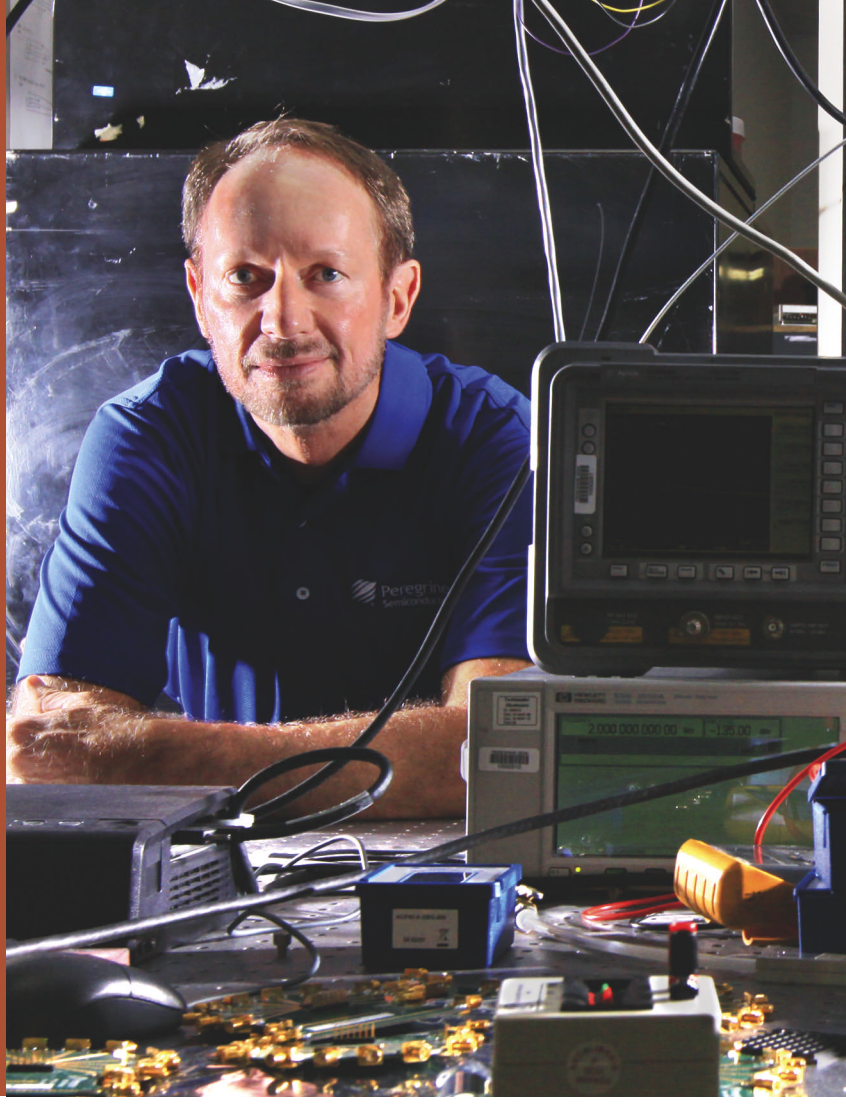
Send your ideas to: tmwtestideas@reedbusiness.com

Read other Test Ideas at: www.tmworld.com/testideas

SEMICONDUCTOR TEST

Engineers at Peregrine Semiconductor have developed unique measurement approaches to test the firm's line of RF switches, whose performance might surpass that of the test equipment in which they might ultimately find use.

BY RICK NELSON, EDITOR IN CHIEF



SANDY HUFFAKER/GETTY IMAGES

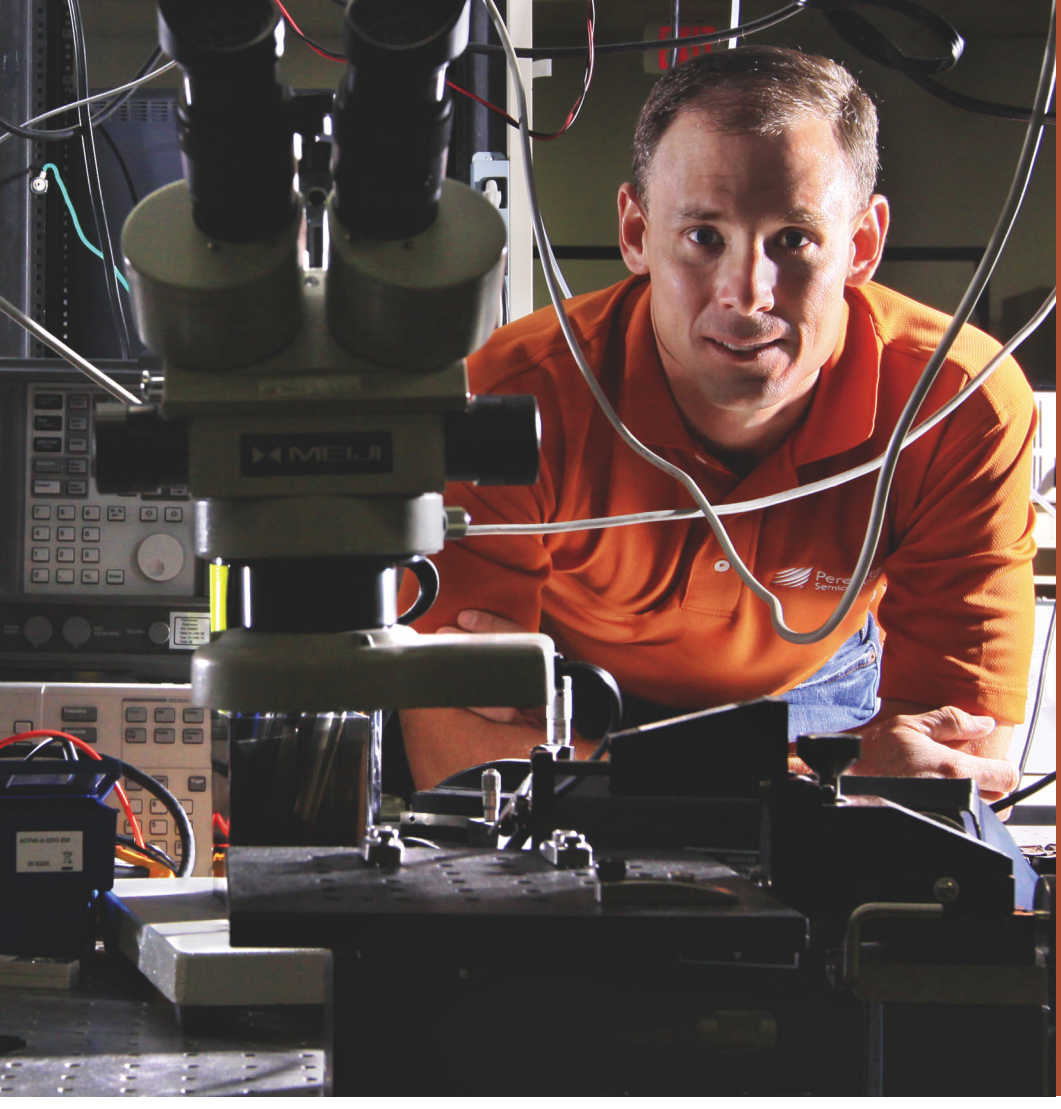
TESTING THE TESTER COMPONENTS

SAN DIEGO, CA—Peregrine Semiconductor builds a range of RF switches and other devices based on its UltraCMOS solid-state SOS (silicon-on-sapphire) process, which integrates ultra-thin silicon CMOS circuitry on a dielectric sapphire substrate. The company's SOS devices operate beyond 10 GHz and at power levels greater than 40 dBm. They target applications ranging from high-volume consumer electronics to high-reliability test-equipment and military and aerospace systems.

For consumer electronics, Peregrine's devices find use in digital-TV, cable and satellite set-top-box, game-console, and cellular-handset applications. For these applications, Peregrine complements its switches with PLLs, prescalers, and mixers, thereby allowing Peregrine parts to make up a significant portion of an RF transceiver signal chain, for example (**Figure 1**). Rodd Novak, VP of sales, marketing, and business development at Peregrine, said the handset market offers significant high-volume opportunities, with the company's nine-throw switches going into pentaband phones. He added that the company ships 2 million of the devices per week.

In addition to making parts for consumer electronics, Peregrine offers a high-reliability lineup that meets the needs of test equipment, telecom infrastructure, and military and aerospace systems. The company also provides foundry services, offering process design kits as well as standard-cell libraries and IP.

The test-equipment market is a key one for Peregrine. And because the company's switches can be used in test equipment, the switches must deliver levels of performance that exceed that which can be economically and accurately measured by commercially available test systems. To overcome this limitation, Peregrine's engineers have developed unique approaches to perform device characterization and high-volume production test.



Bill Jasper, senior test engineer (left), applies his previous experience at a contract test operation to help meet his production test responsibilities at Peregrine Semiconductor. He is joined here in the engineering laboratory by Christian Steele, product development section manager at Peregrine, who is responsible for the characterization of Peregrine's UltraCMOS SOS switches and other RF components.

Christian Steele, product development section manager at Peregrine, said the company's parts can appear to be deceptively simple ones that would be seemingly easy to test. The parts tend to be low-pin-count, 6- to 20-lead devices, but he pointed out that when it come to measuring specs like linearity, the challenges immediately become apparent. "When we try to measure harmonics or IP3 [third-order intercept point] or the 1-dB compression point," Steele said, "it's very challenging and can't easily be done using traditional test techniques." Similarly, he said, insertion loss might be guaranteed within a 0.1-dB or 0.2-dB range from part to part. "If a typical max variation is 0.1-dB wide, the test equipment we are using to collect a distribution of data has to be very repeatable. That challenges our test capabilities and makes us rethink how we perform functions like de-embedding."

Mark Schrepferman, director of communications and industrial products at Peregrine, explained that the test challenges that Steele's team faces help Peregrine develop parts for the test-equipment market. Those parts include the PE42552 absorptive SPDT (single pole, double throw) switch, which operates to 7.5 GHz with a 1-dB compression point of 34.5 dBm and exhibits an insertion loss of 0.65 dB at 3 GHz (**Figure 2a**). Also for test-equipment applications, the company complements the PE42552 switch with the PE43703 7-bit digital step attenuator (**Figure 2b**).

Working with test vendors

Schrepferman said Peregrine gets valuable input on the evolving needs of the test market by working closely with ATE (automated test equipment) vendors as well as by sounding out

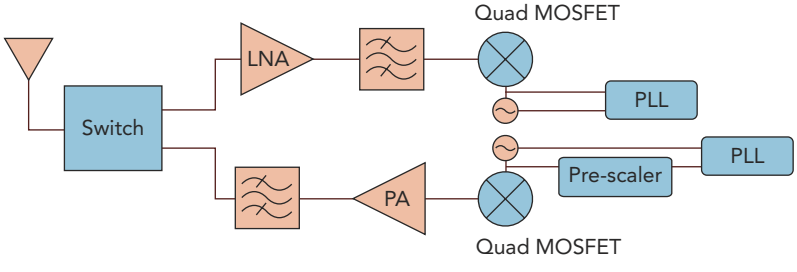


FIGURE 1. Peregrine Semiconductor complements its switch products with prescalers, PLLs, and a MOSFET quad array for mixer applications. The combination can make up a substantial portion of an RF transceiver front end.

Peregrine's test engineers. "Basically, with the current devices out there," Schrepferman said, "whether GaAs or standard bulk CMOS or mechanical switches or even MEMS [Ref. 1], there are a lot of limitations, and the more we interact with the test-and-measurement folks, the better we understand the limitations they've been up against for many years."

There are a lot of topnotch engineers in test companies trying to deliver a set of resources that can source and measure RF test signals (perhaps with a DC offset), and that requires a lot of switching and multiplexing, Schrepferman said, adding that the test-vendor engineers are able to design workarounds to compensate for the limitations they face, perhaps stripping out the DC component of a signal and then adding it back in. He explained that those engineers are very forthcoming in what their needs are, and this enables Peregrine to evolve its roadmap and develop the parts that can make such workarounds unnecessary. Peregrine, he said, works with its test customers on issues such as ground-placement layouts that can facilitate load-board design. Added Steele, "We see [engineers at test-equipment vendors] as strategic allies who put our devices through their paces."

Mark Schrepferman works closely with engineering teams at test-equipment vendors and finds that "Basically, they are all saying the same thing: They want higher-linearity, lower-loss parts that are repeatable and reliable and that settle quickly."

SANDY HUFFAKER/GETTY IMAGES

As for what these engineers want, Schrepferman said, "Basically they are all saying the same thing: They want higher-linearity, lower-loss parts that are repeatable and reliable and that settle quickly." That last point shouldn't be minimized. Test engineers, Schrepferman said, resort to hot-switching to avoid settling-time delays. "We found that with our technology, two of the things we do very well are high linearity, which is great because you don't want the components in your lineup tainting the signal you're trying to measure, and our settling time is much faster than GaAs."

When testing its own products, Peregrine faces different test challenges in characterization and production test. Steele focuses on characterization, and he noted that many people perform characterization with a big-box ATE system, a relatively quick approach that can simplify the development of production test programs. But, Steele said, "A big-box tester is not going to offer anywhere near the performance and repeatability we need to measure our parts. So, what we have had to do is design individual automated test systems that will measure one or two parameters in a very accurate, repeatable manner. Each part that gets characterized may go through four different stations as we measure harmonics, S-parameters, switching time, IP3, 1-dB compression point, and so on, with each station giving us the highest performance we can possibly get for one or two specific parameters, without being limited by ATE."

The multiple-station, multi-insertion approach to characterization is not practical for high-volume production test, but Steele said, "My group of characterization engineers works extremely closely with the production test group, because we have to understand what parameters to directly test in production and which ones we have solid characterization data on so we can guarantee them statistically."

Switching and production test

Steele said that when Peregrine started testing its products in production volumes, it needed to test parts with four to six outputs. But the expensive commercial big-box test systems that were available would have one or two sources and one or two receivers and would use electromechanical switches to route signals between the limited number of instruments and the many ports of the DUT (device under test).

"A lot of those mechanical switches have a reliability of very few switching events," Steele said, "often less than 2 million, and at the volumes we are shipping our handset switches we would be replacing very expensive mechanical switches every month, and that is a very expensive proposition." He cited a related problem: "Before a switch breaks, you also see a degradation in its performance with respect to its return loss and

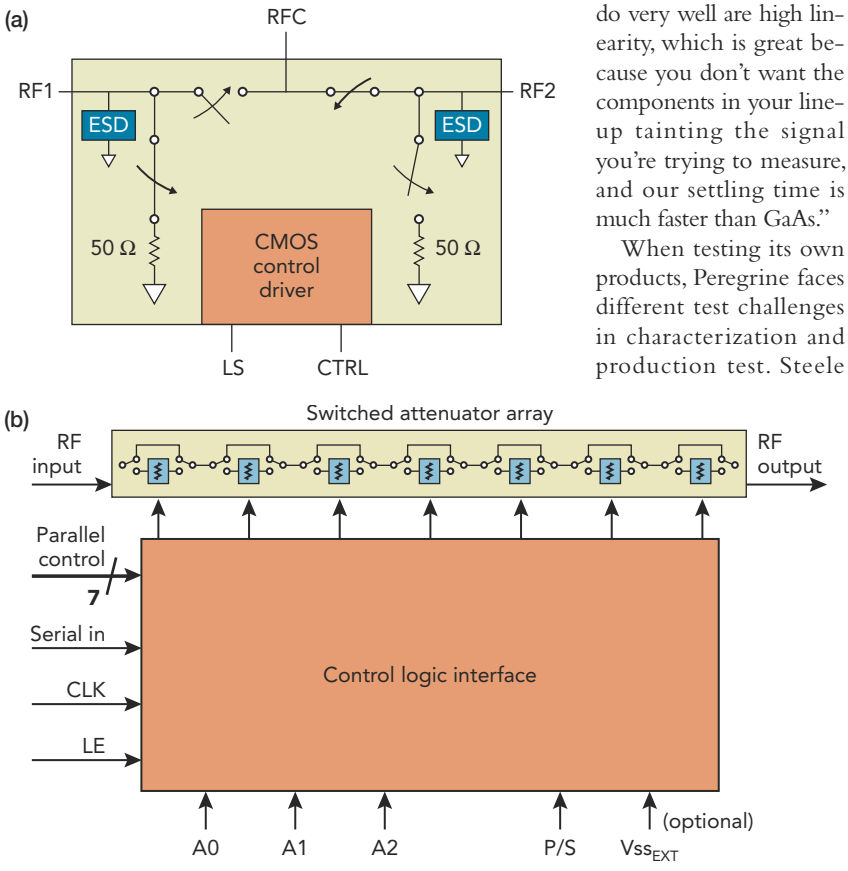


FIGURE 2. (a) For test-equipment applications, Peregrine offers the PE42552 absorptive SPDT switch, which operates to 7.5 GHz with an insertion loss of 0.65 dB at 3 GHz. (b) Peregrine complements the PE42552 with the PE43703 7-bit digital step attenuator.

SANDY HUFFAKER/GETTY IMAGES

insertion loss. And that's bad for us because we are trying to measure low insertion loss in a very repeatable and consistent manner, and we don't want a test system to color our data."

Bill Jasper, senior test engineer, worked for a contract test operation before taking on production test responsibilities at Peregrine, and he has a thorough understanding of the switching issues involved in implementing a production test system. "In a typical RF test problem," he said, "You have a component like an LNA [low-noise amplifier] or mixer, and you've got a suite of tests to perform on it. But those tests often have contradictory requirements. For a noise test, for example, you don't want filters in the signal path, but IP3 or intermodulation tests require filters in the signal path. So you face this dilemma, and when you start building an interface to the DUT, you are invariably stuck with relays because of linearity issues. But relays are slow and unreliable, and I was always keeping an eye out for an alternative. And I eventually came across Peregrine. It made switches and step attenuators with linearity specs better than the parts I was testing, so I could easily mix those components in and switch in different filters and attenuation settings and get a very fast, reliable test out of it."

Rodd Novak says test requirements are becoming more challenging. "Four years ago," he said, "we guaranteed 0.2-dB insertion-loss performance variations across devices. Our next-generation technology is pushing 0.05-dB variation."

The next-generation fixture

Steele said that while a few mature products are tested on big-box ATE, the majority of Peregrine's products run on the company's custom solution. He explained, "Today, with our SP9T [single pole, nine throw] device, we have 10 RF ports on the product. If we want to do a dual-site test, we have 20 RF ports. What we have had to do is look at test solutions from a custom standpoint, and we decided to customize our own solution and build it for the testing we need to do, eliminating any mechanical devices and implementing a completely solid-state solution that lets us do a fair amount of parallel testing."

Steele described the production test system, which serves for both package test and wafer probe to deliver known-good devices, as essentially a rack-and-stack configuration that includes an assortment of DC supplies, current meters, power amplifiers, signal analyzers, and signal generators. But at the heart of the test system, he emphasized, is a Peregrine-designed test fixture (**Figure 3a**) that routes signals between test-system instruments and DUT ports. He noted that the company has developed various fixtures through the years.

Building on Jasper's experience at his previous job, Peregrine has just designed its next-generation test fixture, which, Steele said, uses upwards of 50 Peregrine parts (**Figure 3b**). He emphasized that the Peregrine products are easy to use, requiring very few supporting components, unlike, for instance, GaAs devices, which require blocking capacitors, or PIN diodes, which require DC bias circuitry. The new fixture, Steele said, "will enable us to leverage faster test equipment, because our solid-state parts minimize settling time and switching time."

The test fixture delivers amplified power to the DUT and provides return channels from the DUT back to the measurement instruments. "If you are measuring a nine-throw switch," Steele said, "you don't want any switching events to interfere with your measurements—you want all dedicated measurement paths. But we also want to save the expense of power meters and spectrum analyzers, so we did a lot of custom design work inside that fixture to enable parallel measurement without switching events."

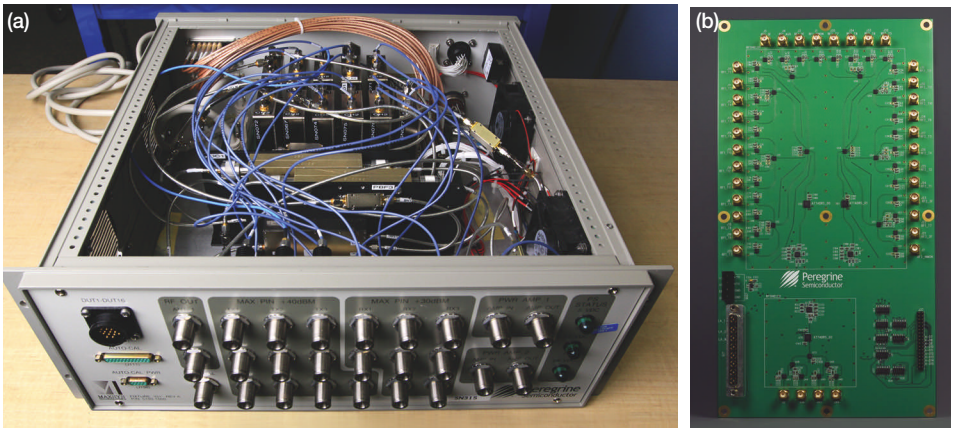


FIGURE 3. A Peregrine-designed test fixture is at the heart of Peregrine's test solution. (a) A hand-wired fixture will be replaced in the company's next-generation test system by (b) a board that uses upwards of 50 Peregrine components. Peregrine's engineers received the first new board in August and are integrating it into the next-generation test systems.

"We make switches"

In fact, Jasper said that when he arrived at Peregrine, the company was using a test fixture that employed a "very clever method of testing parts that required no switches." The problem with this approach, he added, was that it didn't scale well as the company moved on to introduce nine-throw switches and 7-bit attenuators.

Steele elaborated, "When you've got 18 output ports to measure, it gets pricey to use 18 spectrum analyzers or power meters or downconverters, so we have to get creative." Added Jasper, "The only way out of that was to use switches, and fortunately we make switches that offer the necessary performance."

Test challenges are only increasing as frequencies increase and modulation schemes become more complex, Steele said. Novak added that test requirements are getting tougher as the technologies advance. For example, he said, "Four years ago, we guaranteed 0.2-dB insertion-loss performance variations across

devices. Our next-generation technology is pushing 0.05-dB variation."

Furthermore, the tests have to take place at high power levels. Said Steele, "A lot of our products operate at high power—our mobile products are operating up around 35 dBm, and some of the commercial switches are going up to 40, with the 0.1-dB compression point around 45 dBm. So when we go to test those, we need to be able to hit them with their data-sheet power, and in a lot of cases in the lab, we need to go up beyond that data-sheet power. So, it gets challenging on how do you route these high-power signals to your DUT and make sure the test system won't inject harmonics that interfere with the measurement. How can we build a system that's got very pure signals going in and out of the DUT?"

To ensure accurate, correlated measurement capability throughout its test-equipment line-up, Peregrine has implemented six-sigma methodologies and performed extensive gauge R&R (repeatability and reproducibility) studies (Ref. 2). Those studies, Steele said, help to establish calibration procedures and ensure correlation among test systems and fixtures at Peregrine's headquarters and the many systems deployed at its Asian contractor. And the results of those studies, he said, have contributed to the development of the next-generation fixture and test system.

Steele said that to ensure R&R, the Peregrine engineers minimize test-system interconnects, keep load-board designs simple, carefully choose their instruments, and pay close attention to instrument programming to get accurate results fast. "Depending on how you set the equipment up, you'll get different answers," he said, "so we have to spend a great deal of time understanding the best settings for the measurement we are making, and then we will code that up" for use in the production test program. He added that they typically avoid using an instrument's preset measurement functions, saying, "A lot of times we don't let the machine use its own brain. I once had a mentor who taught me never to use preset. It will get you the answer, but it's not necessarily the answer you want. To understand how your equipment really works, you have to set it up yourself."

Steele said that Peregrine's engineers have developed fast, efficient test-execution techniques that have driven average test times down to under 1 s, adding that it's not uncommon to run off 50 or 60 different DC and RF tests in that time period. Jasper said the next-generation test system will reduce that time further, especially for the RF tests. And because test time is money, the pressure will be on, he said, to reduce DC test times as well. T&MW

REFERENCES

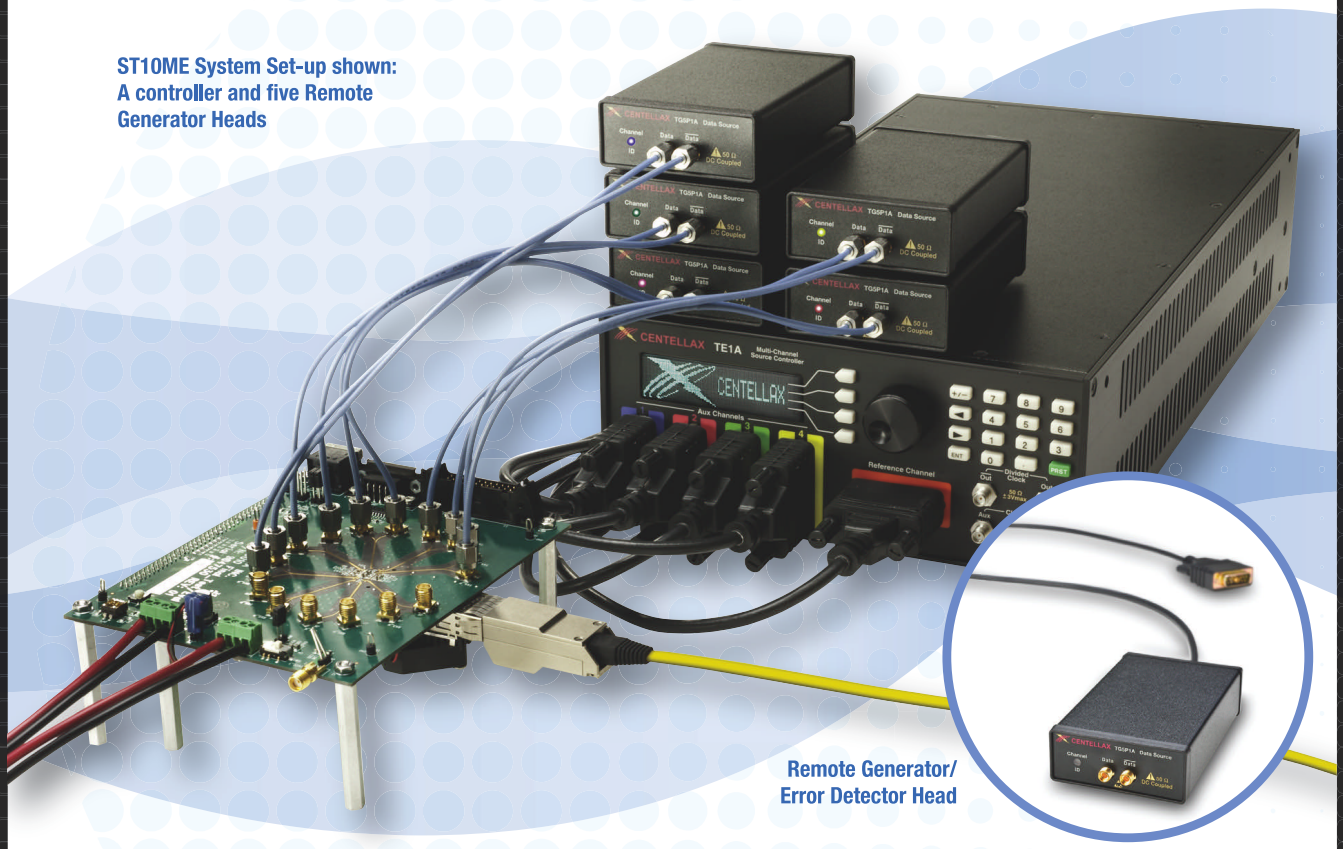
1. Nelson, Rick, "RF switching options," *EDN*, September 17, 2009. p. 30.

2. *NIST/Sematech e-Handbook of Statistical Methods,* Section 2.4, "Gauge R & R studies," 2003–2006. www.itl.nist.gov/div898/handbook.

Centellax Offers Test System

For Multi-rate 4x10G Optical Active Cable Transceiver Testing

ST10ME System Set-up shown:
A controller and five Remote Generator Heads



Remote Generator/
Error Detector Head

SYSTEM FEATURES:

- Lowest Cost per Channel Test Solution
- Differential or single-ended output
- PRBS generator with de-emphasis
- PRBS patterns:
  - 2^7, 2^10, 2^15, 2^23, 2^31
  - Inverted / Non-Inverted
  - Fixed Patterns: 1010, 1100
- Adjustable output amplitude (0V to 2V)
- DC offset (-2V to 2V)
- 2 Tap de-emphasis (0 to 20db)

OTHER APPLICATIONS:

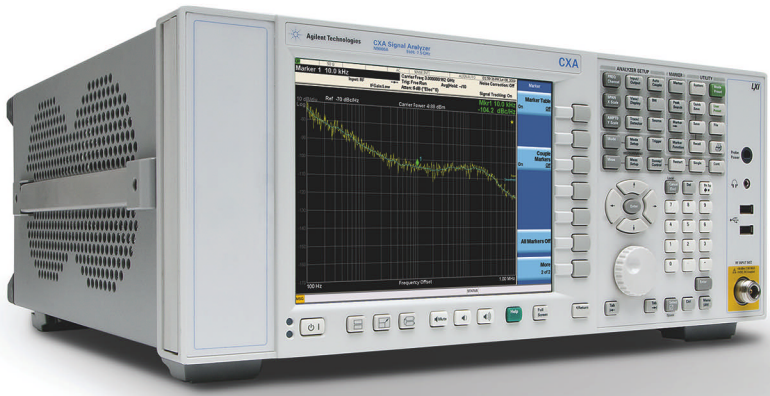
- BER or eye-mask testing of multi-lane high-speed data channels
- Multi-aggressor crosstalk analysis and verification for backplane, serdes and fpga testing
- Parallel stimulus/response testing for higher manufacturing throughput
- Multi-channel BER testing

For additional details, application notes and assembly diagrams, please visit our website: www.centellax.com

CENTELLAX

3843 Brickway Blvd. • Suite 100 • Santa Rosa • CA 95403 • USA
Ph 707.568.5900 | **Fax** 707.568.7647 | sales@centellax.com
Toll Free 866.522.6888 | www.centellax.com

“I need to achieve profit goals and control costs.”



Fast, lean and ready to adapt.

Pressure to control costs is increasing. But so is pressure to deliver faster. Agilent’s new CXA signal analyzer helps you do both, whether for product development or manufacturing testing. It’s the quickest analyzer in its price class. One-button channel power, ACP, OBW and SEM* measurements speed design and test results for greater yield. And it’s one of the new future-ready test tools in the Agilent X-Series spanning instruments, measurements and software. That’s flexibility to run lean today and upgrade as needed. Spec Agilent, and expect more.

The *NEW* Agilent CXA signal analyzer (N9000A)
-157 dBm DANL for fast spur search
70 standard-specific formats with 89600 VSA software
Simultaneous detectors, trace math and up to 12 markers
EMC, analog demod, phase noise, noise figure applications
Unlock additional capabilities with an easy license key upgrade

X POWERED

The Power to Get to Market Faster

Download the demo video and EMC application note at www.agilent.com/find/fastCXA

* Adjacent Channel Power, Occupied Bandwidth and Spectrum Emission Mask

u.s. 1-800-829-4444 canada: 1-877-894-4414

Agilent Technologies

Divide and conquer SIGNAL ANOMALIES

An oscilloscope's segmented acquisition memory lets you isolate signal anomalies and increase screen update rate.

BY ART PINI, LECROY

Real-time oscilloscopes digitize signals and store them in memory before processing and displaying waveforms. Knowing how to most effectively allocate that memory can help you get to the root cause of signal problems more quickly.

Under normal operation, an oscilloscope treats its entire acquisition memory as a single block, and it alternates between acquiring and displaying data. With segmented memory, the oscilloscope divides its acquisition memory into equal portions. Segmented memory reduces dead time between acquisitions because the oscilloscope does not update the screen until the entire acquisition memory is full. Depending on the oscilloscope model, dead time between acquisitions can be as little as 800 ns as opposed to tens of milliseconds in normal mode.

Segmented memory also lets you acquire only a waveform's parts of interest. In waveforms that have significant idle time, you can trigger an acquisition to coincide with a characteristic of interest. Thus, the memory won't fill with unwanted samples. Because the oscilloscope creates shorter records than when it uses normal memory, the effective acquisition sample rate increases, resulting in improved time resolution in the measurement.

Another advantage of segmented memory is that it time stamps each trigger event, showing the time of trigger, time between triggers, and time since the first trigger. If you trigger on an anomaly such as a runt pulse in a waveform, the trigger times will tell you the approximate rate at which the anomaly occurs—a potent diagnostic tool.

How segmented memory works

Figure 1 shows how an oscilloscope divides its acquisition memory into segments, each storing a unique acquisition. You can set up a trigger on a characteristic such as pulse width, and each time the trigger conditions are satisfied, the oscilloscope will capture and store data into a new segment. In this example, the oscilloscope acquired 10 segments from a waveform.

Figure 2 shows an application of how segmented memory can help you analyze an

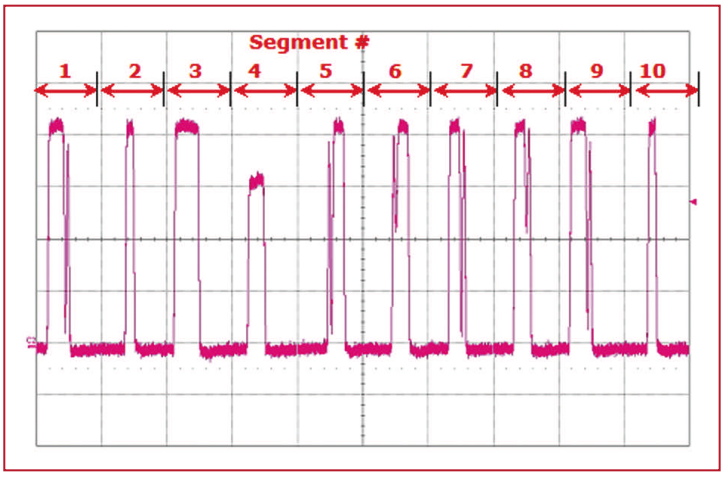


FIGURE 1. This segmented-memory acquisition consists of 10 segments, displayed sequentially in adjacent mode.

anomaly. The waveform, captured using normal memory mode, consists of multiple pulses about 200 ns wide separated in time by about 1.5 µs. The waveform contains intermittent low-level pulses that you need to isolate and analyze. Because the pulses are about 200 ns wide, you can use a timebase setting of 100 ns/div when using segmented memory. That provides 1 µs across 10 divisions, which is enough to let you see the wanted and unwanted pulses.

The number of samples per segment depends on the oscilloscope's memory capacity and the number of segments you specify. For a given size of acquisition memory, the greater the number of segments, the fewer samples in each segment.

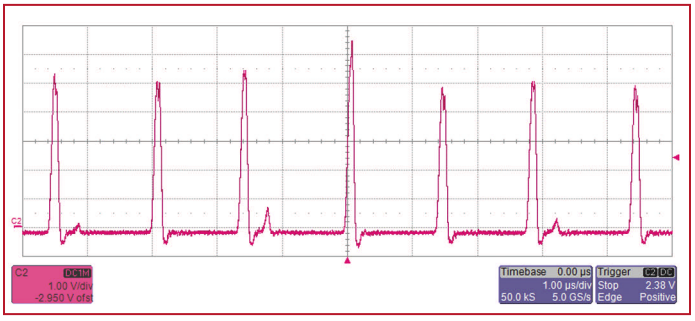


FIGURE 2. The runt pulses in this waveform require further investigation.

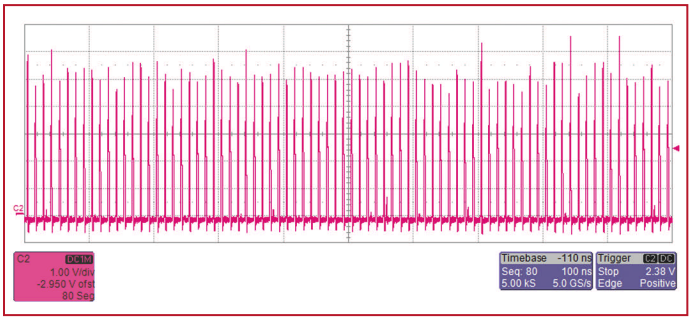


FIGURE 3. A segmented-memory acquisition of 80 segments of 5 ksamples fills the oscilloscope's 400 ksamples of acquisition memory.

Figure 3 shows a setup for capturing the anomalies in the waveform from Figure 1. In this example, I selected time/division and the number of segments. The oscilloscope automatically allocated acquisition memory. This particular oscilloscope can store 400 ksamples of waveform data. Because I selected 100 ns/division and 80 segments, the oscilloscope will allocate 5 ksamples/segment (400 ksamples/80 segments). At a sample rate of 5 Gsamples/s, 5 ksamples spans 1 µs. That lets you see the wanted and unwanted pulses.

Figure 4 shows the time stamps for acquisitions triggered by the presence of a runt pulse after the main pulse. Note that the time stamps, which include the absolute trigger times as well as time since the first trigger and time between triggers, indicate that these pulses occur over a period of 20 µs.

The 20-µs period provides insight into the nature of the condition, namely that these anomalous pulses occur at a 50-kHz rate. That rate could be the power-supply switching frequency or the display update rate of the unit under test. Knowing the rate of occurrence of the anomaly lets you link it to other system operations.

You can also zoom in on a memory segment to view a waveform anomaly in greater detail. Turning on a zoom display automatically zooms to a single segment. In Figure 4, the zoom trace Z2 shows the 49th segment as an isolated trace, as shown by the number 49 in the zoom trace (Z2) annotation box. By using the horizontal zoom control, you can scroll through the entire sequence acquisition one segment at a time.

If you turn on display persistence, the oscilloscope automatically overlays all the segments on the display. That lets you see a waveform history using either intensity or color-mapped persistence.

Using persistence is but one way to view data in segmented memory. In addition to the adjacent display mode shown in Figures 2, 3, and 4, there are other display types: overlay, waterfall, perspective, and mosaic. **Figure 5** shows these.

The overlay display overlaps all the segments and allows the user to compare them. Waterfall displaces each segment trace by a small vertical offset, while the perspective display shifts them with both a vertical and horizontal offset. These two views let you see changes

FIGURE 4. Time-stamp information can help you diagnose the frequency of occurrence of an anomalous waveform characteristic.

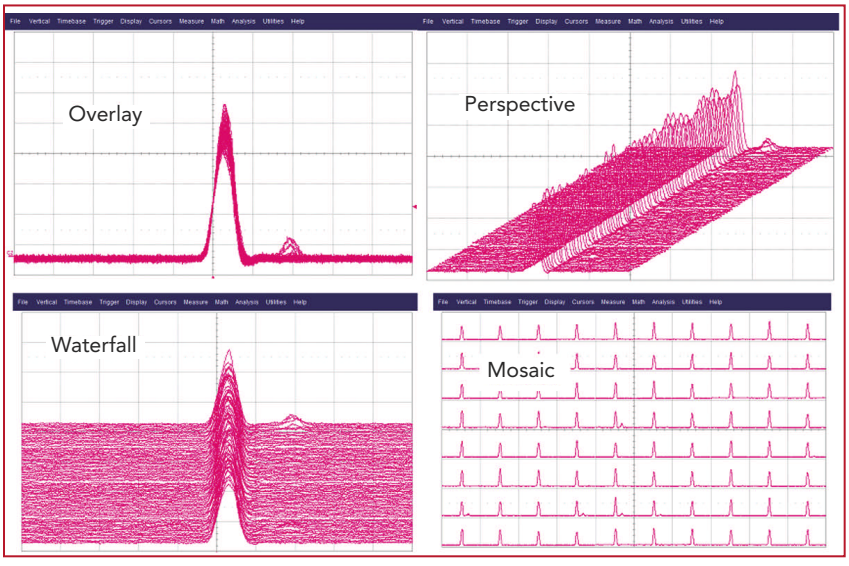


FIGURE 5. You can view the contents of segmented memory as overlays, waterfalls, perspectives, or mosaics.

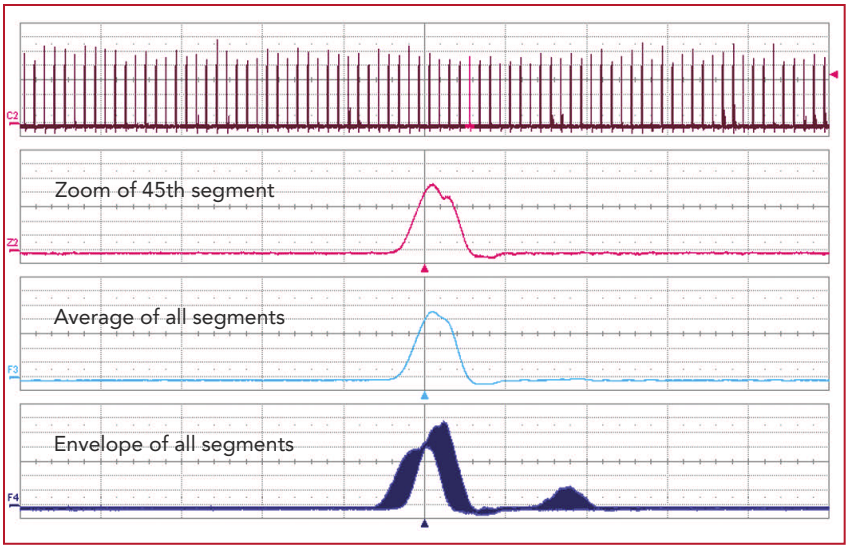


FIGURE 6. With a zoom into a single segment, an average of all 80 segments, or an envelope of all 80 segments, you can apply mathematical processing to your signal data.

in the data over time. The final display mode is mosaic. Here, up to 80 traces are displayed individually. This, like a slide sorter, lets you search for particular segment features.

You can also apply mathematical processing to data in segmented memory. **Figure 6** shows the source sequence mode trace (top trace), the zoom of the 45th segment, the average of all 80 segments, and the envelope (minimum and maximum values) of all the segments. The oscilloscope is intelligent enough to automatically handle data as a series of waveforms. If you choose average or envelope, the oscilloscope will add all the segments before computing those parameters. T&MW

Art Pini *is the applications engineering manager for LeCroy, Chestnut Ridge, NY. He holds a BSEE from the City College of New York and an MSEE from the City University of New York. He has over 45 years experience in supporting measuring instruments. Arthur.Pini@lecroy.com.*

visit us online
ap.com

CHOOSE WISELY.

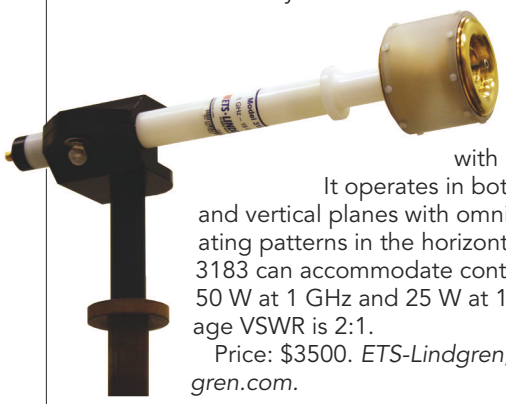
When decisions worth millions of dollars are being based on your recommendations, your data must be beyond question. Our analyzers are on R&D benches and production lines across the world because engineers want the assurance of instruments that are best in class: best for performance, best for supporting the newest audio formats and digital interfaces, best for speed, data sharing, and ease-of-use.

Audio Precision: best in class and the recognized standard in audio test.

APX585 MULTICHANNEL AUDIO ANALYZER WITH HDMI AND DIGITAL SERIAL I/O.

Small antenna covers wide range

The Model 3183 omnidirectional biconical antenna from ETS-Lindgren has a frequency range from 1 GHz to 18 GHz, which covers common frequencies of EMC immunity and emissions measurements. Because of its small size and wide bandwidth, the antenna is suited for characterizing fields in EMI chambers as required for CISPR 16 immunity measurements. You can also use the antenna to make harmonic measurements on amplifiers in accordance with IEC 61000-4-3.



It operates in both the horizontal and vertical planes with omnidirectional radiating patterns in the horizontal plane. The 3183 can accommodate continuous power of 50 W at 1 GHz and 25 W at 18 GHz. Its average VSWR is 2:1.

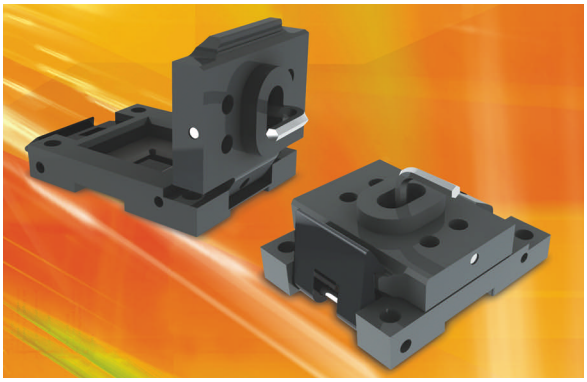
Price: $3500. *ETS-Lindgren, www.ets-lindgren.com.*

Aries adds new CSP test socket

With the introduction of a socket that accommodates devices 13 mm^2 or smaller with a pitch of 0.30 mm or higher, Aries Electronics has expanded its line of CSP (chip-scale package) and MicroBGA (ball-grid array) test and burn-in sockets that have an optional adjustable pressure pad. The Aries CSP/MicroBGA test and burn-in socket family accommodates a variety of CSP, MicroBGA, DSP, LGA, SRAM, DRAM, and flash devices by using machined (for small quantities) or custom molded (for large quantities) pressure pads and interposers.

The new CSP socket incorporates a simplified pressure-pad compression design for a greater range of movement without overcompressing fragile devices. Users can adjust the pressure pad on the new socket with the lid open or closed simply by using the included hex key; the socket can adapt to device thickness variations up to 1 mm. Greater ranges can be custom-designed per application. The ability to adjust the compression force on the device enables the operator to fine-tune the pressure pad force, which is helpful when trying to overcome coplanarity issues with the device or test board.

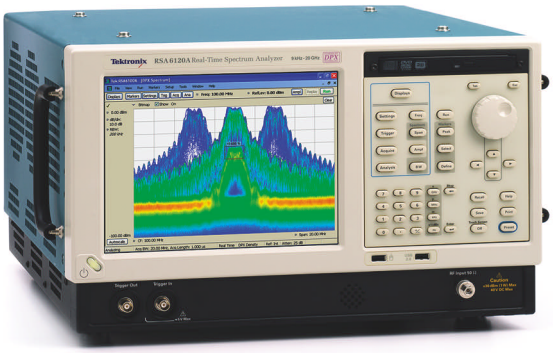
With a signal path of 0.077 in. (1.96 mm), the new socket provides minimal signal loss for higher bandwidth capability. The socket is easily mounted to and removed from the burn-in board. Contact forces are 15 g per contact on a 0.30-mm to 0.35-mm pitch, 16 g per contact on a 0.40-mm to 0.45-mm pitch, and 25 g per contact on pitches of 0.50 mm or larger. Operating temperature is –55°C to +150°C, and estimated contact life is a minimum of 500,000 cycles.



Base price: $200 for a typical BGA device with 64 leads on 0.8-mm pitch. *Aries Electronics, www.arieselec.com.*

Tektronix spectrum analyzers reach 20 GHz

Tektronix has expanded its RSA6000 series of spectrum analyzers to include the RSA6120A, which extends top bandwidth from 14 GHz to 20 GHz, making the instrument suitable for applications throughout the Ku band. The analyzer offers a spurious-free dynamic range of 75 dB and a TOI (third-order intercept) of +19 dB above 6 GHz, which the company says is 3 dB to 8 dB better



TOI performance than competing instruments at X (8 to 12 GHz) and Ku (12 to 18 GHz) bands. The RSA6120A also offers a 110-MHz real-time capture bandwidth.

The RSA6120A incorporates a switched-filter preselector to optimize channel flatness operation for all measurements. Flatness across 100 MHz, for instance, is specified at ±0.7-dB RMS and ±1.5° RMS. In addition, the RSA6120A provides radar designers with signal-analysis tools, statistical measurement, and waveform replay with acquisition history.

Base price: $96,400. *Tektronix, www.tektronix.com.*

Stand-alone logger reads temperature and RH

The OM-EL-USB-2-LCD from Omega Engineering is a stand-alone datalogger that measures and stores up to 16,379 temperature readings (over a range of –35°C to +80°C) and up to 16,379 relative humidity readings (over a range of 0 to 100% RH). It also provides dew-point indication using the supplied Windows control software.

A high-contrast 2½-digit LCD offers a variety of temperature and humidity information. At the touch of a button, you can cycle between the current temperature and humidity,

as well as the maximum and minimum stored values for each.

You can set up the OM-EL-USB-2-LCD and download logged data by plugging the unit into a PC's USB port. The Windows-based software lets you set up such parameters as datalogger name; °C or °F temperature units; a logging rate of 10 s, 1 min, 5 min, 30 min, 1 hr, 6 hr, or 12 hr; and high and low alarms. A data-rollover function allows unlimited logging periods by overwriting the oldest data when the memory is full. Downloaded temperature, humidity, and dew-point data saved in text format can be graphed, printed, and exported to other applications for further analysis.

Price: $97. *Omega Engineering, www.omega.com.*

Get optical signals in shape

Filters and signal processors change the amplitude and phase of electrical signals, but optical signals also need shaping. The S-Series of programmable optical processors from Finisar allows you to develop your own filters for processing optical signals. You can use either the single-output WS1000S or the quad-output WS4000S to filter and shape optical signals. These instruments let you simulate the amplitude and phase distortions that occur in optical networks for testing fiber-optic components and systems.

The S-Series instruments use a technology borrowed from projection TV: LCoS (liquid crystal on silicon). LCoS devices work by reflecting incoming light based on an image in the silicon that changes according to the amount of voltage applied to it. They produce a 256-level gray-scale image with 10-mm resolution, which affects the reflectivity of the silicon. The image characteristics can change the amplitude and phase of the reflected optical signal. Reflectivity is also wavelength dependent, so you can get wavelength-sensitive reflection images. You can thus create programmable filters, modulate light

carriers, re-time pulses, split pulses, and control dispersion.

The four-channel WS4000S lets you take a single input and switch it among four outputs. Each output channel can have a different reflective image.

The S-Series instruments come with Windows-based software that lets you develop images and upload them to the instrument through its USB port. For automated applications, you can develop software in LabView with drivers shipped with the instrument. Finisar reports that Linux drivers will be available by the end of 2009.

Prices: WS1000S—$24,000; WS4000S—$42,000. *Finisar, www.finisar.com.*

Signal analyzer permits CPU upgrade

The CXA signal analyzer from Agilent Technologies is the company's lowest-cost model in the X series. Two models that range in frequency from 9 kHz to 3 GHz or 7.5 GHz perform RF power measurements such as adjacent channel power and spurious emissions. Optional applications include modulation analysis, noise-figure measurements, phase-noise measurements, and EMC precompliance measurements. The CXA has a removable CPU module to permit upgrades as PC technology improves.

Base prices: 3 GHz—$12,657; 7.5 GHz—$16,360. *Agilent Technologies, www.agilent.com.*

PCB unveils Series 4115K rotary torque transducers

PCB Aerospace & Defense has introduced the Series 4115K rotary torque transducers for use in torque studies on aircraft turbine engine air starters and cantilevered aerospace hydraulic motors as well as in automotive applications such as dynamometers, drive shafts, transmissions, fans, and electric motors. The new transducers use noncontact, rotary transformers to send excitation voltage to, and receive measurement signals from, the strain-gage instrumented rotating sensor element.

In addition to the torque output signal, an optional pickup provides an output proportional to speed and an optional K-type thermal couple to monitor internal bearing temperature. PCB says these units feature high torsional stiffness and low rotating inertia. Models are available with several measurement ranges and speeds up to 27,000 rpm.

PCB Aerospace & Defense, www.pcb.com .

Spirent adds 40G/100G test capabilities

Spirent Communications has added a 40/100-Gbps module to its TestCenter chassis-based network tester. The HyperMetrix 40/100 Gigabit Ethernet module uses two TestCenter slots, and it accepts a CFP optical transceiver module as its network interface.

Like other HyperMetrix modules, the 40G/100G module provides protocol testing for layers 2 through 7, and this module also adds testing for layer 1, the physical layer. At layer 1, the module provides lane-skew measurements between the lanes of the optical interface (a 40-Gbps link contains ten 10-Gbps lanes and a 100-Gbps link contains ten 10-Gbps lanes).

You can test a network element with the HyperMetrix module by adding skew to the lanes to find where a link is lost. The module can generate PRBS test patterns for testing bit-error rate on an optical link.

Above the physical layer, the HyperMetrix can generate and analyze layer 2 Ethernet traffic and layer 3 (Internet Protocol) traffic. At the upper layers, it can test HTTP and FTP traffic as well as streaming audio and video with QoE video metrics.

You can run tests through a Windows-based application, and you also can automate your tests through a Tcl scripting interface.

Spirent Communications, www.spirent.com.

FREE WEBCAST

HOW TO TEST MIMO DEVICES VIA CHANNEL SOUNDING?

Presenter

• **MARK BUFFO**

Business Development/Marketing Director for RF products at Keithley Instruments.

In this webinar, we will introduce the basic concepts of the wireless communication channel, MIMO channel sounding, and channel emulation. We will then introduce a flexible and cost-effective test system that can be used for performing channel sounding, channel emulation, and functional testing of MIMO wireless devices.

October 27th, 2009 • 2PM Eastern / 11AM Pacific

Never before has an understanding of the wireless channel been such an important and integral part of the design and development of wireless systems. Traditional single-carrier systems have had to deal with multipath fading and inter-symbol interference, while multi-carrier and MIMO systems have introduced techniques to minimize, or even benefit from, these effects. The standards bodies have introduced a variety of channel models intended to represent real-world wireless channels, and test equipment vendors have come up with a variety of solutions to simulate these channel models for the purposes of testing wireless devices. However, these channel models only cover a small subset of all possible wireless channels. To increase this coverage, and provide for more confidence that a particular design will work when deployed, channel sounding can be employed to characterize a real-world MIMO wireless channel, that can then be used for testing a device using channel emulation.

>>> REGISTER TODAY

TMWorld.com/Webcasts

Sponsored by:

KEITHLEY

www.keithley.com

Produced by:

Test & MEASUREMENT WORLD

Stand-alone vision systems get simpler

By Ann R. Thryft, Contributing Technical Editor

Small, stand-alone machine-vision systems are becoming popular in semiconductor and solar-cell inspection. Joshua Jelonek, technical product manager for vision and marking technology for Keyence Corp. of America, commented on the challenges facing designers of these systems and how the systems are changing to meet users' needs.

Q: What are the challenges in building stand-alone turnkey vision systems for semiconductor and solar-cell inspection?

A: Vision applications are all about isolating the defects from the background. Improvements in image-enhancement tools let us isolate defects more effectively than before. These improvements have become necessary because of the reflective nature of wafers and semiconductor components. Stray light from standard illumination sources can create hot spots, which must be removed to produce an even background so defects stand out clearly.

Most stand-alone turnkey vision systems include standard filters, but these alone cannot tackle some of the more challenging applications. It's necessary to use a combination of filters to remove texture and shading variations from difficult targets such as crystal oscillators and cylindrical battery housings. Recently, we combined a few of these filters into a single tool to remove some of the guesswork for novice users and let them keep existing, inexpensive, standard lighting configurations. This reduces costs by shaving integration time and eliminating the need for expensive, high-end lighting.

Q: What new technologies and trends are affecting stand-alone vision systems?

A: One big trend is the switch to the EtherNet/IP [Ethernet Industrial Protocol] industrial communications protocol for process control and automation applications. This protocol makes it possible to effortlessly connect production-line sensors to industrial PLCs for easier integration and high-speed decision making. Another trend is the fact that, due to advances in processors, new CCD 5-Mpixel color cameras can quickly process 24-bit data to distinguish even the most minute variations in color, such as cracks in a solar wafer or slight discolorations on small components.

Q: What's changing in customer demand for stand-alone vision systems?

A: More customers want the ability to connect multiple cameras with a central control unit to inspect several sides of a component, or to inspect a larger area with more detail. For example, you can connect four 5-Mpixel color cameras to our CV-5000 system to take a 20-Mpixel image of a solar cell with a single snapshot.

Customers are also realizing that it is more cost-effective to use systems that don't need engineering time to program and that can be up and running with minimal hassle. In response to customer demands, a major goal of many vision companies is to combine powerful tools with an easier-to-use interface.

One way to do this is to simplify the number of components a customer needs to buy, including software tools. A stand-alone system is somewhat like an ASIC-based smart camera-plus: It has all of the communications capacity onboard. Everything you need for programming and production-line communications is embedded into the controller. A stand-alone system is not PC-based, so users can take it out to the production line and configure settings on the spot without a laptop, but it can be programmed via a PC if needed. □

Joshua Jelonek
Technical Product Manager
for Vision and Marking
Technology
Keyence Corp. of America

INSIDE THIS REPORT

EDITOR'S NOTE

Keeping it lean, mean, and simple

By Ann R. Thryft
Contributing Technical Editor

Buyers of machine-vision components and systems are feeling the budget pinch. As a result of the continuing economic crunch, they have a lot less time or money than just a year or two ago.

People in the industry are coping by keeping things simple. One way to do that is to use older technology and squeeze as much benefit out of it as possible. Analog cameras, for example, have been around for decades in semiconductor and electronics inspection, and the transition from analog to digital technology has accelerated in the last few years (p. 46). Yet, analog is still the camera technology of choice in many areas where digital cameras aren't really needed, and for many application engineers, analog cameras are easier and simpler to install.

Another way to keep things simple is to design only the inspection system your production line, and your customers, need. Cognex's customer Schneider Electric did exactly that for its Osiswitch Compact line of limit switches (p. 48). In the process, Schneider Electric solved some complex inspection problems and reduced its customer return rate to zero parts per million, a figure often associated with much more complex and expensive systems than this two-camera, five-light-source, one-laser configuration. □

Contact Ann R. Thryft at ann@tmworld.com.

HIGHLIGHTS

StockerYale improves line-scan illuminator

Ten times brighter than StockerYale's standard line-scan illuminator, the Cobra Slim comes with white LED illuminators and offers line-scan illumination in excess of 4 million lux. The illuminator covers wavelengths from 360 nm to 1550 nm and ensures a high level of uniformity thanks to its chip-on-board LED module fabrication, which yields an essentially unbroken line of semiconductor light. Intensity control and temperature monitoring are available through an optional Ethernet interface. www.stockeryale.com.

AOI system inspects larger boards

You can now use the OptiCon SmartLine, a desktop AOI system from Goepel, for inspecting printed-circuit boards up to 400x390 mm in size. Intended for small-volume manufacturing, the Opticon SmartLine, which includes an integrated PC, serves as an offline test station or repair station.

At the core of the system is a camera-based imaging unit that employs a custom telecentric lens, along with an illumination system that consists of three basic modules that deliver multicolored and multidirectional illumination.

The company's Extended Color Technology enables both high-contrast gray-scale and high-resolution color imaging. Since the PC is completely integrated into the main chassis, only a monitor and keyboard are needed to begin inspection work. www.goepel.com.

Smart cameras offer right-angle housing

Joining the Impact family of smart cameras from PPT Vision is the right-angle T-Series, which offers both in-line and remote-head housings to permit greater flexibility in camera positioning. Teamed with the company's Impact software, the T-Series can be used for applications such as automated inspection and optical character recognition.

With its high-speed 1600-MIPS processor, the T-Series right-angle camera performs inspections at a rate of up to 6000 ppm. Six right-angle models are available, including color, gray-scale, and 1600x1200-pixel resolution options. www.pptvision.com.

MEMS inspection system works alone or in-line

Vi Technology has introduced the Reveal MEMS AOI equipment for semiconductor applications. The company says the Reveal is able to detect various sizes of foreign materials or scratches, and the system can also measure die positioning, rotation, tilt, and other parameters when required.

The new system features high-accuracy axes and an optical acquisition system with a submicron pixel size. It detects foreign materials, such as silicon, alumina, or human-related particles, in sizes larger than 3 µm. At the same time, the equipment inspects the structure integrity of the MEMS die by checking missing or damaged beams or wires as well as the position of the die (x, y, and rotation) within the package.

The Reveal MEMS can be used as a stand-alone system for small production batches, or it can be integrated with customized handling equipment for use as an in-line system. Vi Technology says it can be adapted to any product type and size as well as to any carrier, such as wafers, boats, trays, or strips. www.vitechnology.com.

Test & MEASUREMENT WORLD

TMWorld.com

- Industry News
- Blogs
- Contests
- Video
- White Papers & Design Guides
- Webcasts
- e-Newsletters

Compelling, Current, Original Content.

Analog cameras still play a role

By Ann R. Thryft, Contributing Technical Editor

Although analog cameras are falling out of favor for new designs, engineers continue to use small analog cameras, like JAI's CV-A55IR, largely as replacement cameras in legacy equipment. Courtesy of JAI.

Many engineers designing machine-vision systems for semiconductor inspection applications continue to specify analog cameras because they are widely available and cost less than digital cameras. Although digital cameras continue to make inroads in machine vision, the use of analog cameras is not declining as quickly as some predicted when digital technology first became available.

"Designers of machine-vision systems have continued to use analog TV cameras wherever they could because of their low cost and high availability," said Steve Kinney, director of technical pre-sales and support for JAI. "These have been the highest performing cameras for the lowest dollar cost for a long time, because of their standard formats. Eight to 10 years ago, three quarters of the cameras used in machine vision, by unit volumes, were analog cameras."

The analog cameras used in electronics inspection output signals in either NTSC or PAL TV formats for color, and either the RS-170 or the CCIR 601 standard for monochrome, said Kinney. Most cameras used in machine vision are progressive scan, rather than interlaced, since the progressive-scan image-transfer method doesn't suffer from the problems interlaced cameras have with creating sharp images of moving objects, he said.

Analog cameras can be more cost-effective than digital cameras if all that's needed is a live view, said Joe Cook, VP of sales for Toshiba Teli's eastern territory. "Due to the economy, people may choose to install analog cameras for cost-savings reasons, even in a new system," he said. "But if you need to connect analog cameras to a PC, by the time you add a frame grabber and software, the cost can be more than that of a digital camera. Competitive digital technology is bringing down the price of digital cameras, as more vendors have moved into this market."

The move to digital cameras occurred for several reasons, including higher-bandwidth standards, greater connectivity, and easier interfacing to a PC, said Kinney. "In the early days of digital cameras, as the decline of TV-standard cameras started, most machine-vision cameras were still analog even if they weren't TV-format analog," he said. "The proportion of machine-vision camera unit shipments represented by analog cameras is declining rapidly; today it is 35 to 40%."

Applications for analog

In electronics inspection, Toshiba Teli sees analog cameras still being deployed in areas such as pattern recognition and pass/fail inspection for quality control, said Hisa Ishigami, the company's VP of engineering. Typically, engineers use them at both the beginning and the final stages of semiconductor manufacturing. "At the beginning of the line, [analog cameras] may detect surface defects," he said. "At the end, they may be used to check whether the chip package is labeled correctly and in the right location and whether wires are bonded properly from the chip to the package."

"We see analog cameras being used in legacy applications in electronics inspection, such as older wire-bonding, pick-and-place, and AOI [automated optical inspection] equipment as well as legacy slice-and-dice and wafer-inspection equipment," said Andrew Buttress, Sony's product manager for visual imaging products. "Most new capital equipment designs are using strictly digital interfaces. But in the current economic downturn, a lot of the electronic and semiconductor tool OEMs have put other refinements into their tools to increase productivity without necessarily changing the camera, so analog cameras are still being used in upgrades to existing designs."

Another reason for analog's popularity in the semiconductor and electronics inspection space has been the distance its signals can travel on coax cables, said Kinney. "Before the GigE Vision standard, if you wanted to run cameras 300 to 400 feet without connecting them to a PC, only analog could go that distance, although with some tradeoffs such as signal degradation and loss of amplitude," he said.

Analog limitations

Lower performance, in terms of both resolution and frame rate, have been two of the drivers in the conversion from analog to digital technology. "The main disadvantage of analog today is the lower resolution compared to what is being offered in digital," said Cook. "Compared to analog cameras, digital cameras are available in higher resolutions, so you can process more data in less time with more detail."

In general, progressive-scan analog cameras have higher resolutions than typical analog cameras, such as interlaced cameras, said Buttress. "But you don't see the much higher megapixel-level resolutions in analog technology." The highest end of analog resolution for machine vision is 1280x960 pixels,

and the maximum speed likely in older analog cameras was 30 fps. "With the newer progressive-scan analog cameras, you can get up to 200 fps using partial scan—that is, without using the full resolution. In other words, you have to reduce the field of view," he said.

Buttress also commented on the costs associated with analog cameras. He acknowledged that compared to digital cameras, most older analog technology is relatively inexpensive, but he added, "With analog, however, the image data is represented as a voltage level, and that data has to be digitized to make an image. So, you have to add a frame grabber for digitizing the image data, and that adds cost."

Another major problem with analog is noise. Coax cable carries a small signal, so a 10-mV or 20-mV noise spike shows up in the signal, Kinney explained. "In general, a digital signal is immune to noise until it reaches a very high threshold," he said. "A little noise doesn't matter to digital cameras, but it has very visible effects in analog camera images."

Among the most popular analog cameras are those with a small form factor, such as the CS9001 remote-head camera. Courtesy of Toshiba Teli.

The need to improve productivity is pushing customers to migrate away from analog cameras, said Buttress. Customers must now inspect more parts per minute, which means they must take more images per second, so not only is resolution increasing, but also frame rate. Depending on the application, however, these two don't always increase at the same rates. "For example, when inspecting a populated circuit board with an AOI system that moves cameras around the viewing area, you may want a 1- to 2-megapixel camera and need to run it at 60 or 90 fps, perhaps using Camera Link to get that speed," he said. "But in wafer inspection, you may need to view feature sizes as small as 2 microns and will require 16 megapixels to do so, but the speed may be only 3 fps."

The move from analog to digital technology in machine vision, however, is neither easy nor simple: There's a lot to learn, said Ishigami. "With digital cameras, you have the camera; the camera interface, such as Camera Link, FireWire or GigE, and an input device such as a frame grabber, FireWire card, or GigE port supporting jumbo frames; the software; and the computer," he said. "The first time you work with FireWire or hook up GigE or Camera Link, you're using different cables, and you are also using digital files, so there's a huge learning curve involved over analog." To install digital cameras on a production line, engineers need specialized computer-related knowledge, such as how to connect IEEE 1394 FireWire and a familiarity with Windows. "There's a lot of industry knowledge about how to use analog cameras, and it's easy to hook up analog cameras to existing equipment in a wide variety of applications," Ishigami said.

Today, analog cameras are used mostly in situations with legacy equipment, staff that are used to analog, or both, said Kinney. "Since analog cameras use mature technology, with limited performance that requires fewer parts than newer digital models, manufacturers have been able to create some very small, lightweight models tailored to the needs of specific applications," he said. "These may be certain types of pick-and-place equipment and other equipment with repetitive, high-G motion, where the small size and weight of analog cameras is an advantage, as is the ability to connect them via flexible coax cables." Although the reasons for using analog cameras are diminishing, they may remain in some of these applications for quite a while. □

Vision system enables zero defects

By Ann R. Thryft, Contributing Technical Editor

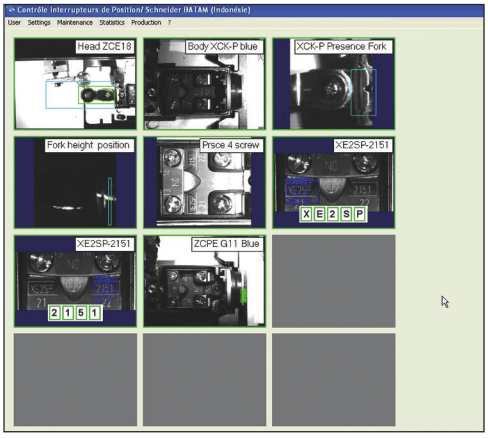
Schneider Electric's Osiswitch Compact line of limit switches are used in industrial automation and control equipment. From only 100 different components, the production line can create up to 2000 different product types, or "references," each identified by an industrial reference code. Each product is composed of around 20 parts selected from those 100 components, which include mechanical parts and circuit breakers.

Although switches that are made from several different product types can look identical on the outside, inside there are many different sets of components and many different configurations of those components. The Osiswitch Compact limit switches are only 30x70 mm, and their subassemblies must be checked before they are enclosed within a body.

"We have to check many small parts on a product," said Nicolas Charollais, marketing director for Schneider Electric. This is why, until recently, the company assembled these products by hand. It is also why the company used a simple control system—naked eye inspection—for ensuring that a customer got the right product assembled with the right parts list, he said.

"Although from a customer's standpoint the main benefit of these products is the fact that they are configurable, from a manufacturing perspective that configurability was also the main problem," said Charollais. Products can have the same body, but the same external design can be associated with many different references, depending on which kind of contact is inside, along with other components and their configuration.

"At Schneider Electric, we focus on product quality at all levels of production," said Charollais. According to customer feedback, the biggest problem with this product line was not quality or performance, he explained, but the fact that customers occasionally received a product that was slightly different inside from what the outside label stated. "In those cases, the product reference a customer ordered was not the one delivered, although it looked the same," he said. Because of this, the Osiswitch Compact product line's customer return rate was around 100 parts per million.



Schneider Electric's vision system eliminates defects by identifying subassemblies of several different product types that can look identical on the outside. It uses functions such as shape control, color control, part position control, and optical character recognition along with the multi-image display function of Cognex's VisionPro software. Courtesy of Schneider Electric.

When the company started a new product family in the Osiswitch Compact line, it also decided to implement a new control bench for that entire line that would reduce the customer return rate to zero parts per million, said Charollais. "But since the product itself isn't very expensive, we

didn't want to make expensive investments in a new assembly line, so the system had to be cost-effective."

Because the parts inside each product are so small and close together, and also because they look so similar to each other, inspection cannot be done by fiber-optic detectors. Fiber optics can only detect different mechanical shapes, and, in this case, those mechanical component shapes are too similar. Schneider Electric therefore decided that vision was the only inspection solution.

Cognex and its partner integrator Esox did a feasibility study for Schneider Electric and proposed a solution that allows complete assembly inspection of each component of the different products by analyzing the product's nomenclature. The nomenclature is the list of components or parts making up the product, which have to be recognized to ensure that they are the right ones for that product and that they are present in the assembly. The analysis is performed by the multi-image display function of Cognex's VisionPro software. This function makes it possible to recognize a part either from its shape or from the industrial reference code written on it via letters and numbers recognition.

The vision station is made up of two cameras and five LED light sources, plus a laser beam. The first camera, a high-resolution model (1600x1200 pixels), inspects the internal parts of the product and checks the industrial reference code inscribed on the contacts. The second, lower-resolution camera inspects the overall view of the product. Images are recorded in the inspection database and used to improve upstream manufacturing and prevent defects.

The lighting system also represented a serious challenge. Esox designed an optical system with a software tool programmed to operate according to exposure times. This system allows the lighting to be adapted according to each product reference, so several lighting variations can be called up in sequence, depending on which product family in the Osiswitch Compact line is being inspected, said Charollais.

Depending on the complexity of each product inspection, the system displays one or more images, up to 12, one per frame, on a single screen. The software processes each image, and the inspection results appear on each of these frames, labelled red (wrong part or part position) or green (correct part or part position), allowing the operator to rapidly visualize any problems.

Schneider Electric completed the system's fine-tuning at its facility in France and installed the first system at one of its production sites in Spain. After two weeks of further tuning and industrial tests for recognizing different product configurations, the production line was transferred to the company's manufacturing site in Batam, Indonesia.

This vision system allows fully automatic control of the manufacturing of Schneider Electric's Osiswitch Compact products. Because the system archives all statistics, all nonconforming defects can be monitored. This kind of control also means that inspected products are completely traceable.

"This system has helped us reach zero defects for this new product family," said Charollais. "We now also have more flexibility." If the company wants to implement a new product reference made up of existing parts the system knows, it takes only a few minutes. There are currently 600 product references for this new product family, with a potential of up to 1000.

"When we create a new reference, we might change only one part inside the product because a customer has asked for that particular configuration," he said. Since the system can learn a new reference quickly and easily, Schneider Electric doesn't have to spend time creating new documents or training people for its inspection. "This lets us speed up the manufacturing portion of creating a new product," said Charollais. □

Test & MEASUREMENT WORLD

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

BUSINESS STAFF

Publisher: Russell E. Pratt, rpratt@reedbusiness.com

Associate Publisher: Judy Hayes, judy.hayes@reedbusiness.com

Director, Custom Programs and Solutions: Karen Norris-Roberts, knorris@reedbusiness.com

VP Interactive Media & Sales Management: Karthik Krishnan

Online Account and Marketing Manager: Melanie Turpin, melanie.turpin@reedbusiness.com

Assistant to the Publisher: Darlene Fisher

Online Client Services Manager: Jennifer Caruso

Market Research Director: Rhonda McGee

Group Production Director: Dorothy Buchholz

Production Manager: Joshua Levin-Epstein

Customer Contracts Coordinator: Donyetta Jenkins

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

Internet Sales Director: Laura Lang-Dacus, 408-984-4871 laura.lang-dacus@reedbusiness.com

France, Spain, UK, Ireland, Benelux, Scandinavia: John Waddell, London, England. 44-20-8312-4696

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

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

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

Japan: Shintaro Koyama, Tokyo, Japan. 81-3-3402-0028

Taiwan: Laura Chen, Taiwan, ROC. 886-2-2314-7206

Singapore, Malaysia, Hong Kong: Wai Chun Chen, Singapore. 65-6544-1151

VOL. 29, NO. 9

HOW DOES YOUR SALARY STACK UP?

Check out the results of Test & Measurement World's 2009 Career & Salary Survey at TMWorld.com and learn how your compensation compares with your peers'.

TEST & MEASUREMENT WORLD
SALARY SURVEY
2009

www.tmworld.com/salary_2009

Test & MEASUREMENT WORLD
TMWorld.com

ADVERTISER INDEX

VIEWPOINT

[An exclusive interview with a technical leader]

R. KEITH LEE
President & CEO
Advantest America
Santa Clara, CA

President and CEO of Advantest America, R. Keith Lee is a technology industry veteran of more than 25 years. Since he joined Advantest America in 1984, Lee has held senior management positions in design and development, sales and marketing, and applications and systems engineering. Before Advantest, he worked for Megatest, Mitel, and AT&T in senior marketing management and engineering positions. He holds a bachelor's degree in electrical engineering from Auburn University.

Contributing editor Larry Maloney interviewed Lee by phone on new technologies for semiconductor test and emerging applications that will boost the industry.

Rebound ahead for semiconductor test

Q: What evidence do you see of a turnaround in semiconductor test?
A: It's difficult to predict the future, but we see some early signs of recovery. The large economic stimulus program from the Chinese government, for example, is driving a resurgence in consumer electronics, which increases demand for ICs. We're also seeing industry consolidation, both in the semiconductor industry and in test equipment, especially memory test. That, too, is a healthy sign and an important step toward recovery. Recent inventory adjustments are spurring a rebound in chip prices, which bodes well for the future, and there's continuing progress in the early adoption of next-generation microprocessors and DDR3-SDRAM.

Q: What sectors of the semiconductor market will lead the recovery?
A: What we are hearing from our customers in the SOC (system-on-chip) market is that consumer electronics will lead the way, particularly netbooks and smartphones. The increasing complexity of these products will stimulate the market for test equipment.

Another positive development is the launch of the Windows 7 operating system this fall, which should trigger an increase in corporate PC purchases in the first half of 2010. Longer term, the test industry will benefit from the growth of RFICs and the increasing semiconductor content in automotive applications. Also in automotive, we expect to see more applications for power-management ICs for hybrid cars and other green sectors.

Q: Which of the Advantest platforms are in the best position to benefit as the industry rebounds from recession?
A: There are two key platforms I'd like to cite. One is our flagship T2000 line for SOC testing, a product that has done very well since its launch in the digital logic space for microprocessors and graphics processors. At the end of 2008, we released a new portfolio of RF test modules for the T2000 platform, and we're now seeing some early adopters for those products. In addition, we will announce in 2010 a series of mixed-signal modules for the T2000.

A second very significant platform, announced in July, is the T5385 test system for memory wafer test, with the capability to test up to 768 die in parallel for DRAM. This platform is particularly well-suited for testing the new high-speed DDR3 memory.

Q: Overall, what are the key properties that Advantest wants to build into its ATE (automated test equipment) products?
A: A common theme throughout our platforms is parallel test, which we pioneered over two decades ago for memory and analog/digital applications. Now, we are migrating that same capability to SOC test. Earlier this year, Advantest unveiled a module for the T2000 that can test four RF devices in parallel. Customers are responding very well to this parallel test strategy.

Q: Is there much synergy between Advantest's test solutions and its mechatronics systems?
A: Absolutely. Our mechatronics systems operation provides development and delivery of robotics handling equipment for electronics package test. In the memory test area, we developed many years ago what we call the test cell, which includes the tester, handling equipment, and interconnect technology. We've had a very positive response from customers to this turnkey approach, which can be optimized for very high performance and throughput. We're now pushing this same test cell concept into the SOC area and seeing some very good results. T&MW

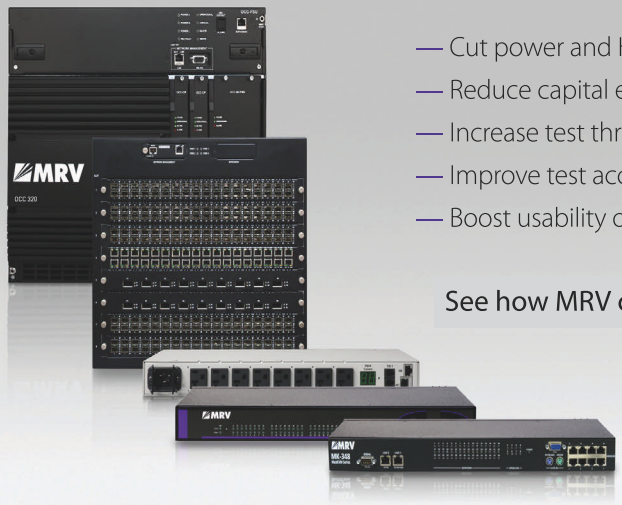
R. Keith Lee answers more questions on ATE systems and the semiconductor market in the online version of this interview: www.tmworld.com/2009_10.

To read past Viewpoint columns, go to www.tmworld.com/viewpoint.

Does your Test Lab Budget fall short of your needs?

Put MRV's powerful arsenal of Test Lab Management Products to work for you!

MRV's solutions help you cut costs and eliminate time-wasting, labor-intensive practices.



- Cut power and HVAC consumption to reduce costs and conserve energy
- Reduce capital expense by sharing equipment among several users or groups
- Increase test throughput without increased headcount
- Improve test accuracy by eliminating human error
- Boost usability of equipment through secure remote access

See how MRV can save money and improve the operation of your Test Lab!

Visit www.mrv.com/bestpractices to download your guide to MRV's Best Practices in the Test Lab.

MRV
Connectivity Unlimited™

Green Engineering

MEASURE IT – FIX IT

La Selva Biological Station developed a wireless sensor system to monitor the rain forest ecosystem.

Nucor Steel optimized its steel melting process to drastically reduce electricity consumption.

CEMS Engineering built a control system to reduce energy use of industrial air chillers by 30 percent.

Vehicle Projects created a complex control system for a zero-emission, fuel-cell-powered locomotive.

MEASURE IT

Acquire	Analyze	Present
Acquire and measure data from any sensor or signal	Analyze and extract information with signal processing	Present data with HMIs, Web interfaces, and reports

FIX IT

Design	Prototype	Deploy
Design optimized control algorithms and systems	Prototype designs on ready-to-run hardware	Deploy to the hardware platform you choose

Engineers and scientists around the world are solving some of today's most pressing environmental issues using the NI graphical system design platform to design, develop, and deploy more efficient and environmentally friendly products, technologies, and processes. Using modular hardware and flexible software, they are not only testing and measuring existing systems but also creating innovative ways to fix the problems they find.

>> Download green engineering resources at **ni.com/measureitfixit** **888 293 3091**

NATIONAL INSTRUMENTS