Modular and box instruments find synergy

By Richard A. Quinnell, Contributing Technical Editor

Agilent Technologies made a major push into modular instrumentation with its September 2010 introduction of nearly 50 PXI and AXIe products. I met with Von Campbell, Agilent’s planning manager, Modular Product Operation, to learn more about the company’s modular initiative.

Q: What is driving Agilent’s thrust into modular instrumentation?
A: Agilent is answering developers’ demands for the size, speed, flexibility, and scalability that modular instruments offer. Customers are asking for instruments that can do what they want without being limited by what an instrument designer decided the customer wanted. For instance, communications test needs instrumentation that provides from 1 to N channels for testing such things as MIMO radio communications. Modular instruments are the most cost-effective way of providing exactly what such applications need. So, Agilent is now giving its customers a choice across all formats and sizes of instrumentation.

Q: What kinds of modular instruments will Agilent be offering?
A: The initial mass introduction concentrated on PXI and AXIe instruments, system hardware, and software, but Agilent will be supporting all the instrument connectivity options. This includes LXI with GPIB as a legacy port on box instruments, USB for low-end and portable instruments, and VXI legacy instruments, along with PXI, PXIe, and AXIe, of course.

Q: Does this modular drive imply a change in the box-instrument market?
A: Not at all. Box instruments will always provide more optimized measurements because instrument makers control the design’s environment. The modular environment cannot guarantee the instrument designer tight control of factors such as cooling and electronic noise, so the modular instrument must typically sacrifice some precision to achieve the needed tolerance.

Also, box instruments have a built-in user interface with fixed-function knobs and buttons. For well-established measurements, this fixed interface makes the box instrument easier and quicker to set up and use. Each approach—modular and box—has its niche, and the synergy between them is something Agilent can leverage.

Q: What sort of synergy do you mean?
A: Modular instruments provide an avenue for breakthrough technologies to become available in the market more quickly than with box instruments. In return, engineers using box instruments gain the benefit of the modular field experience with the new technologies to help ensure more robust and optimized designs for key measurement applications. Meanwhile, the measurement science developed while optimizing the box instrument becomes available to the modular instrument users. This synergy benefits test engineers throughout the entire technology-adoption curve.

Q: How do you see test instrumentation evolving in the future?
A: Test engineers will have a full choice of platforms to address a variety of needs—LAN-based testing, low-cost and portable instruments, modular instruments in a range of capacities, and optimized stand-alone instruments. And we are working on making test-system software agnostic. Regardless of form factor and operating system, the same software intellectual property will be available on any type of instrument capable of performing a task. This software will be fairly fine grained, with individual measurement functions and device drivers available to mix and match to the instrument and application.
“PXI Test Report” goes modular
By Richard A Quinnell
Contributing Technical Editor

Over the last decade, PXI has grown from a start-up into a major player in test instrumentation. The technology has continually expanded in range and scope, repeatedly proving the benefits of modular design for test. Thanks in large part to PXI, modular has become a well-established approach to test-instrument design, and this success has prompted the development of other modular standards, including LXI for box instruments and now AXIe for large-format boards. Agilent Technologies has recently underscored the importance of modular design by announcing a strategic push to integrate modular formats with its traditional box-instrument offerings (p. 43).

Because of the growth of modular instrumentation, Test & Measurement World has expanded the range and scope of the “PXI Test Report.” Starting with this issue, the report has been renamed the “Modular Instrumentation Test Report” and will cover all the modular instrument standards, including PXI, USB, LXI, VXI, AXIe, and their extensions. This broadened range of topics will allow us to cover both individual technologies and the interplays among them, and to guide you toward finding the right modular format for your test needs.

Let us know what you think. What topics in modular test do you want us to address? Send me your suggestions. ☐

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RTD signal conditioner offers USB configuration
The initial offering in Acromag’s ST130 series of low-cost temperature transmitters is an ASIC-driven RTD signal conditioner that combines the simplicity of a digital USB setup and calibration interface with the performance advantages of analog signal conditioning. Selling for $89, including free Windows configuration software, the Model ST131 DIN Form B head-mount instrument converts the input signal from any 100-Ω platinum RTD sensor to a proportional loop-powered 4- to 20-mA output.

The Model ST131 operates over a range of –40°C to +80°C and offers functions such as sensor excitation, signal linearization, lead-wire compensation, and sensor fault detection. www.acromag.com.

LeCroy launches DDR3 protocol analyzer
LeCroy’s Kibra 380 is a stand-alone protocol analyzer for DDR3 that enables users to monitor two slots of quad-rank DDR3 DIMMS concurrently. The instrument is controlled over a USB interface with a Windows-based PC; LeCroy says this lowers the cost of testing by eliminating the need for costly logic analyzers, while simplifying setup and shortening validation cycles.

Combining waveform views and decoded state listings with dedicated trigger logic, the Kibra 380 improves visualization of DDR3 state transitions and protocol violations. Specialized trigger logic can identify more than 65 JEDEC timing and command violations across all ranks and banks simultaneously.

Using nonintrusive slot interposer probes, the Kibra 380 provides lossless capture of address, command, and control signals. Along with built-in CrossSync ports for performing multiprotocol analysis, the Kibra 380 features a dedicated, low-latency SMA trigger-output signal to a scope for read/write operations. www.lecroy.com.
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AXIe products reach the market

By Richard A. Quinnell, Contributing Technical Editor

Following an exceptionally fast track for a new modular standard, AXIe products have now started showing up in the test market. Two of the standard’s three founding companies are actively building a base of chassis and system modules and expect to release more in 2011. All three are pushing to increase AXIe’s versatility in test applications, although they are using slightly different approaches.

AXIe (ATCA Extensions for Instrumentation) began when Aeroflex, Agilent Technologies, and Test Evolution founded the AXIe Consortium in November 2009. Within seven months, the organization had released its initial hardware specifications, and products began appearing at the end of the third quarter of 2010. “This is the fastest-growing standard I have come across,” said David Poole, CTO of Aeroflex Test Solutions.

This rapid development stems in part from the consortium’s adoption of the ATCA (Advanced Telecommunications Computing Architecture) standard as its base. “ATCA has been widely adopted, offers modularity through the use of mezzanine cards, has the advantage of large board size, offers a mesh computing architecture, and can use PCIe as the data bus,” said Poole. The use of PCIe on the ATCA backplane gives AXIe a high degree of compatibility with PXI Express hardware and software, which will allow AXIe modules mounted on a carrier card to be used in PXI systems and provide an immediate base of test functions for AXIe systems.

The AXIe standard has also evolved quickly because it meets a need for larger-format modules than PXI can provide—a need that companies had already begun to address. “The size, power, and form factor of PXI are not sufficient for some applications,” said Von Campbell, Agilent’s planning manager, Modular Product Operation. “We were designing an internal standard for large-format modules when we were approached by the others [in the consortium] regarding AXIe. There was a lot of similarity and synergy between the efforts.”

“The whole target of AXIe was to provide much more real estate than PXI could offer for designs where you want everything to fit onto one module,” said Aeroflex’s Poole.

One such design is digital pin testers for ATE (automated test equipment), according to David Oka, VP of engineering at ATE developer Test Evolution. “PXI is good for RF and AC testing, but it’s missing from PXI is lots of DC channels and lots of digital pins. There is not enough space when trying to build a 1000-channel tester.”

Taking different tacks in AXIe development

Beyond the large-module format, AXIe offers other advantages over PXI, although the consortium founders are exploiting these advantages in different ways.

The higher power limits of AXIe modules are especially interesting to Agilent with its goal of bringing its measurement expertise to a full range of modular form factors. PXI limits modules to 30 W of power, while AXIe allows 200 W per module—a better match for porting box-like instrumentation.

“A lot of high-end ICs and ASICs draw 30 W already,” said Steve Narciso, R&D manager for Agilent’s Modular Product Operation. “So, we need the extra power of AXIe.”

Test Evolution likes the connectivity that AXIe offers from the backplane. Unlike PXI, the AXIe specification includes a backplane area called Zone 3 that users can define. This area allows AXIe instruments to use rear transition modules rather than front-panel connections to link with a test fixture.

“PXI needs costly cabling to connect to a test fixture,” said Oka, “which also makes it difficult to change fixtures.” Oka explained that attaching the fixture to the rear transition modules not only simplifies connection but also provides more repeatable timing at the DUT (device under test) socket.

“Production ATE timing is adjusted to be correct at the socket,” he said, “which is hard to do with uncontrolled cabling to fixtures.”

Aeroflex’s goal for AXIe is more strategic than immediate. “We were interested in AXIe from a theoretical viewpoint for future efforts,” said Poole. “Any such standard is attractive. You never know what you’re going to need.”

Fig. 1. The five-slot M9505A AXIe chassis with a system module from Agilent Technologies occupies the same 19-in. rack space as a PXI chassis, but it provides much more circuit and power-handling capacity. Courtesy of Agilent Technologies.
Poole also noted that Aeroflex’s participation in developing the standard was an investment toward reducing future design efforts. “If participating ensures that if you have a future need, it is easier to get your stuff ported [to the standard].”

**AXIe product offerings**

These differing areas of interest are reflected in the products each of the companies is offering. Aeroflex, for instance, is not yet producing any AXIe products. According to Poole, PXI currently provides the level of modularity the company needs, although he expressed interest in the multiprocessing potential of AXIe’s mesh network structure and in the consortium’s plans to eventually develop a small form factor.

Agilent has focused its initial AXIe efforts on creating a base for future instrumentation. In September 2010, the company released a two-slot (M9502A) and a five-slot (M9505A) AXIe chassis, each with a built-in controller module (Figure 1). The company also released the first AXIe instrument—the U4301A PCIe Gen 3 analyzer.

The M9505A makes clear some of the advantages AXIe brings to test design, according to Agilent’s Campbell. The chassis offers designers much more capacity.

The five AXIe modules together provide a total of 4500 cm² in board space and can handle 1000 W of power. The 17 instrument cards in the PXIe chassis total 2720 cm² in board space and support only 510 W. Thus, according to Campbell, the AXIe chassis offers the equivalent of at least 25 PXIe slots in the space of 18.

Test Evolution’s first AXIe offerings target its primary business of having established a leading position in wireless device manufacturing test. Aeroflex recognizes the need to provide outstanding value, performance and speed.

The facts speak for themselves. Today, the Aeroflex PXI 3000 Series RF modular test platform is deployed across the globe, testing a quarter of all mobile phones produced.

Aeroflex’s proven reliability means customers enjoy uptimes approaching 100% and they benefit from continual software updates free of charge, which expand test coverage and speed, thus increasing the value of their investment.

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ATE equipment development. The Ev500 test system uses a five-slot AXIe 3.1 chassis and provides single-site characterization for a DUT. The Ev2800 uses a dual 14-slot AXIe 3.1 chassis and a 20-slot PXI chassis to provide multisite DUT support and a production test head with more than 1000 channels.

To create these systems, Test Evolution developed its own AXIe modules and chassis, which are also available as stand-alone products. The DD48 dynamic digital pin card offers 48 channels, each with 64 Mbits of capture-and-send memory.

The DPS12 device power supply module provides 12 output channels—which can be ganged—with multiple voltage and current ranges. The module can provide a forced-voltage test and then measure current with 16-bit accuracy, and it offers programmable pulse generation. The company also offers a chassis interface system module for AXIe that functions as both a slot-1 controller and a PXIe hub.

**Starter kits available**

Oka said that Test Evolution sees AXIe as an open-standard alternative to proprietary designs for semiconductor ATE that also promises significant cost savings. To help fulfill that promise, Test Evolution is offering AXIe products that support custom designs.

One is an AXIe starter module that implements all the system interfaces and leaves a large open area on which developers can attach a rider card containing their own designs (Figure 2). The starter module has an open schematic design and open-source software driver, simplifying the conversion of a developer’s rider-card design into a full AXIe module.

Test Evolution also offers a 14-slot chassis with an open framework to support prototype development. The open cage exposes the cards in a way that eases access for probing and debug, a feature Test Evolution found valuable in its own debug efforts. “It was hard to work with cards in a closed chassis,” said Oka.

While commercially available AXIe products are still scant, the ones that are available provide test engineers with a basic framework from which they can begin creating their own modules. In that effort, Agilent’s Campbell offered some advice. “If you can do things in CompactPCI and PCIe, you’re a long way toward being able to use AXIe,” he said.

He added, “Also, AXIe software is essentially identical to PXI, so use the same software architectures. Take ad-
vantage of what you know in PXI; don’t try to be different.”

Campbell also advised developers to think about a layout with regard to airflow across the AXIe board. An AXIe board can contain several copies of the circuit from a PXI module, and Campbell pointed out that designers often simply line up functions when replicating them on a larger board. That tends to cause heat sinks to line up and block one another’s airflow. “Make sure things don’t line up,” he said.

If developing your own AXIe board is not an option, you may only need to wait a little longer for more modules to become available. Agilent’s Campbell promised, “We’ll see a whole lot more product coming out in the next calendar year.” He added that “the test community should be looking at what they want in the AXIe format” to help define future offerings.

Meanwhile, the standard continues to evolve. According to Aeroflex’s Poole, the AXIe Consortium is defining a standard implementation for a PXI carrier card and has a MicroTCA version of AXIe on its roadmap.

“There is still quite a bit of work to do,” Poole said. But the potential is clear. AXIe has launched and is building momentum, promising to substantially raise the bar for modular test instrumentation. “AXIe is for companies looking to push the envelope,” said Poole.

FOR FURTHER INFORMATION


