

PXI and synthetic instrumentation



By Klaas Vogel, Acqiris

In instrumentation, as in most electronic technologies, ever-increasing application demands spur the development of improved technology, which in turn generates an increase in user expectations. One application where the PXI modular instrumentation standard is helping to raise the bar on both expectations and performance is in the evolution of synthetic instrumentation.

What is *synthetic instrumentation*? Think of it as a versatile hardware *black box* where software programs are used to interpret input signals and generate output signals according to a user-selected function. The logic behind synthetic instrumentation is to derive more functionality from a given hardware unit. You can define that functionality as more value from a single hardware investment, or as more utility within a limited footprint.

Because multiple software modules drive the functionality of the hardware to perform a variety of tasks, instead of using a series of purpose-specific electronic circuit designs, each providing one unique processing function, electronic component costs are reduced. Each software-driven function shares the I/O ports, buses, processing power, and memory of the base hardware configuration. With fewer components and fewer connections than several purpose-specific units, synthetic instrumentation can offer greater reliability and better mean-time-between-failure (MTBF), with easier troubleshooting and repair when necessary.

Multiple application-specific sensors are used to generate raw input signals for the synthetic instrumentation unit, where the appropriate software interprets those signals, generates the output, and records it. Users dictate which functions they want the unit to perform, based on the software programs they choose to run. In this way, one electronics hardware enclosure

can function as a variety of instruments, such as:

- An oscilloscope
- A spectrum analyzer
- A counter/timer
- A power meter
- Digital multimeters
- Up and down converters
- A number of other functions

The choice of PXI plays several important roles in the productivity of synthetic instrumentation. Fast data interfaces (up to 100 MBps sustained PCI bus data transfer), and the ability to accommodate higher volume I/O requirements, help to satisfy the ever-increasing demand for greater performance from smaller packages. And the compact size of the 3U PXI format is ideal for maximum space-saving efficiency, especially where portability is an important consideration. That makes it a perfect complement to the space-saving, value-enhancing goals of synthetic instrumentation.

In addition to physical size and performance advantages PXI offers for such applications, end users have also discovered logistical advantages to standardizing their instruments to the PXI form factor. One is the ready availability of high performance products in the newer PXI platform – with more than 1,000 PXI products currently available.

We are seeing this trend in military applications as defense customers and their system integrators favor PXI if forced to make a change from a platform such as VXI. Factors that combine to accelerate this trend include:

- The reliability of a PXI-based system
- The ability to conserve space in the end-use installation
- Versatility in terms of compatibility with PC, PCI, and CompactPCI equipment

- The increasing availability of high-performance products using the PXI form factor

The ability of the PXI platform to function in low-power configurations is particularly advantageous for battery-powered portable instrumentation. With batteries being such a considerable portion of a portable unit's weight, anything that can be done to reduce power consumption can help the instrument deliver comparable performance from a reduced battery size, or to allow longer performance time with the same-size battery.

Additional design strategies, such as developing highly integrated designs and using application-specific integrated circuit (ASIC) processors, can also increase processing capacity and reliability while streamlining package size and weight in synthetic instrumentation. An example of high-resolution, high sample rate digitizers using such technologies is the Acqiris DC122/152 Series (Figure 1), delivering 3 GHz bandwidth and 4 GSps sampling rates in compact 3U PXI modules.

The factors at play are similar across most market applications for instrumentation and synthetic instrumentation – defense, OEM manufacturing, laboratories, and



Figure 1

“ Whether your goals are to reduce space, reduce weight, or reduce costs in your ATE or manufacturing functions, it can pay to evaluate the potential savings available through synthetic instrumentation systems that are fully compatible with the PXI and PCI based systems you are already using. ”

research universities. One specific example of the economy of using synthetic instrumentation with a 3U PXI platform is a test bay for airframes. Formerly, that would require a whole series of dedicated instruments – oscilloscope, spectrum analyzer, timer/counter, power meter, switching network, etc. Today, all of the same performance characteristics can be monitored by a single synthetic instrument enclosure running multiple software programs to provide the same series of functions.

Whether your goals are to reduce space, reduce weight, or reduce costs in your ATE or manufacturing functions, it can pay to evaluate the potential savings available through synthetic instrumentation systems that are fully compatible with the PXI and PCI based systems you are already using.

Although synthetic instrumentation is still in the growth stage of development, interest from defense customers is acute and growing, both here and abroad. Whichever platform they use – PXI, VXI or LXI – test equipment manufacturers would do well to devote attention to this trend, as a substantial worldwide market could evolve over time. **PXI**

Acqiris is a designer and manufacturer of data conversion instruments. The company's capabilities include high-speed data acquisition and analysis products using PXI, PCI, and CompactPCI technologies. These include averagers, analyzers, and digitizers providing sampling rates up to 4 GSps performance for applications in research, ATE, and OEM markets.

For more information, visit the Acqiris website at: www.acqiris.com

EXECUTIVE SPEAKOUT