

Test systems evolve with PXI

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PXI certainly has its place in the test and measurement world. For those users looking to increase productivity with a faster system or who seek to reduce the size of their test equipment, PXI should always be high on the list of potential options.



Figure 1. Portable 8-slot chassis with integrated 15" colour LCD and separate keyboard

■ In recent years, we have seen an increased interest in PXI (PCI extensions for instrumentation) following its launch in 1998. As members of the PXI System Alliance (PXISA), Amplicon has followed and supported the developments PXI has taken over the past years, the latest being PXI Express which follows the adoption of PCI Express as a standard. This architectural development enables measurement data to be transferred to the PC more quickly than the existing PCI bus bandwidth restrictions would allow – achieved by using each of the existing bus connections as a stand-alone serial channel with the provision for channel multiplexing where higher data throughput is required.

PXI is based on the Compact PCI (cPCI) standard with its front-loading PC controller and eurocard-style interface cards. This physical architecture provides a stable, time-tested rugged platform that is useful for test applications and is easy to use, program and maintain. If a card needs to be replaced, users can hot-swap cards quickly providing a very low mean time to repair (MTTR), which in turn aids diagnosis in complex systems.

The PXI standard adds control features, such as triggering (as found in oscilloscopes) to the PCI functionality, in turn providing synchronisation between the PXI instruments contained within a single or multiple chassis. There is also a reference 10 MHz clock source in each PXI chassis for timing control. Alternatively, the Star trigger bus, with equidistant control lines to

each PXI module, can be used to negate propagation delays. Separate chassis can be synchronised by using the time portion of the GPS signal data which is connected to the Star trigger lines of the individual chassis, providing precise timing control over distance without the delays inherent in a wired system. This technique has been used successfully within manufacturing environments where multiple PXI systems are used to test a product on a production line where the individual chassis may be separated by a considerable distance, and a timing signal would arrive at each at slightly different times. Using this GPS signal method, the chassis can be accurately synchronised with each other to produce one continuous test sequence.

PXI utilises the same technology as PCI and runs on the same hardware and software platforms, such as the latest Pentium 4 or M processor. This enables users to develop and run their test applications as they would do on a standard PC with Windows or real-time operating systems. The application software then depends on the preference for either a visual programming language like Visual Basic and C++, or a graphical programming package such as National Instruments LabVIEW.

Depending upon on the application, customers can use either the embedded controller or a desktop/industrial PC to run their PXI application. Use of an embedded controller eliminates the need for a separate PC, which in turn reduces the size and eases the use of the test sys-

tem and would be a suitable solution for a field application. Choosing an embedded controller does not cause any restrictions as they typically come with serial, Ethernet and USB interfaces as standard. For those users who want a PXI system, but who prefer to use a desktop or an industrial PC to accommodate an essential PCI or ISA card that is not available in a PXI version, a PCI to PXI bridge, available from Amplicon, can be used. This provides a PCI bridge between the PC and PXI system, so the PXI system operates as though it were inside the PC.

With PXI becoming more accepted in industry, and with growth in this technology sector continuing through downturns in the overall manufacturing sector, there have been an increasing number of suppliers to the market that now boasts over 1100 products, giving customers a greater choice to choose from when building a test system. Amplicon, for example, represents a number of PXI manufacturers in the UK and has seen new products being introduced at a fast pace.

An example of this is the recently introduced Signametrics range which provides a 7fi digit digital multimeter (DMM) that offers similar, if not better, accuracy to a rack-mount alternative, while using the 32-bit PCI bus to transfer measurements at a much greater speed, thereby increasing productivity for the end user. The range of oscilloscopes now varies from 8-bit resolution, sampling at 2.5 GS/s to high accuracy 16-bit cards from Ztec Instruments. A recent introduction to the range is the portable 8-



Figure 2. Signametrics provides a 7 1/2 digit digital multimeter

slot chassis with integrated 15" colour LCD and separate keyboard, which is useful for mobile solutions. Not all traditional instruments are available in the PXI form factor at present, so Amplicon can provide a GPIB interface card that allows integration of a whole solution.

The market largely adopting the PXI standard is the manufacturing industry. A recent application saw a manufacturer of electronic consumables use a PXI system to test and ID the manufactured item. With the PXI system in place, product failures in the field could be traced back to the source for investigation. PXI

was chosen in this application because of its high reliability, fast data acquisition, ease of replacement and flexibility. Amplicon has also seen enquiries from the avionics and military industry. The interest from this market lies with the fact that PXI offers a fast, rugged and portable test solution. An application recently adopting PXI was a military avionics company which required a test system to perform pre-flight checks. The company required that the test system be deployed and assembled ready for action at a moment's notice. Historically, this application could have only been done using a PC with rack-mount instrumentation that would typically tower above most operators heads. It always had the uncertainty of whether it would survive transportation in the field, which was not ideal since the equipment plays such a vital role in keeping aircraft operational.

PXI is increasingly the preferred solution for field instrumentation with all the test equipment and controller contained in a portable case with built-in keyboard and screen. Previously, customers were faced with the prospect of carrying a PC under one arm, GPIB instruments under the other and cables "between their teeth", which is never the best entrance to make when visiting prospective clients. ■

From PXI to PXI Express

Following the natural progression made from PCI to PCI Express, PXI is also under development to provide the greater than 45-fold increase in data throughput from 132 MB/s to 6 GB/s using the same data transmission protocol used within the physical layer as PCI Express. This will provide not only the additional control and signals which prompted the migration from PCI to PXI, but will open up the PXI standard to a vista of applications within production, test and measurement and ATE where the data throughput had not previously been sufficient.

This will pave the way for high frequency resolution data monitoring within a number of traditional markets, and open up those which traditionally would have used expensive bespoke solutions with the associated hardware and software integration and development problems. Backward compatibility will be maintained with existing PXI modules for both hardware and software, with the new protocol for data transfer being transparent to the software and hardware developers.

The PXI Express specification was ratified in September 2005, and we can expect to see the first chassis, controllers, and modules featuring peripheral slots become available from Amplicon later this year. With these new high-performance PXI Express products added to the wide selection of PXI-based instruments already available, engineers can benefit from solutions for many new applications such as high-speed digital interfaces and imaging, guaranteeing the growth in use of PXI-based test and measurement systems for manufacturing and test applications into the future.

Not all applications currently designed with PXI connectivity and protocols will be migrated to PXI, since some of the applications such as DMMs, switching for relay and industrial I/O will not require the high bandwidth provided by the new PXI Express architecture. The PXI Express modules and cards will be able to co-exist with PXI systems by the ability of the system to route PCI and PCI Express signalling to new slots. Amplicon's continuous product update policy, and their involvement with the PXISA, will aid in the drive to develop and provide PXI-based industrial data acquisition products and technical services.