

PXI - An ideal platform for a variety of industrial applications

Overview

This white paper explains in detail the PXI architecture and discusses the benefits PXI systems present in a variety of industrial applications.

Introduction

PXI (PCI eXtensions for Instrumentation) is a rugged modular test platform specifically designed to allow for flexible, fast multiple instrument synchronised measurements in a reduced footprint compared to the more usual rack & stack instruments.

PXI combines standard PC technology from the CompactPCI specification with integrated timing, synchronisation and triggering delivering a rugged platform with a far superior performance compared to any other test and measurement architecture. PXI has become an increasingly important industry standard for test, measurement and automation applications.

PXI is governed by the PXI Systems Alliance (PXISA), an industry consortium with over 70 companies, including Amplicon, to promote and maintain the PXI Standard, ensure standards compliance and system interoperability. For more information on the PXISA, including the PXI specification, visit www.pxisa.org

Hardware Architecture

PXI systems comprise of three key components: PXI chassis, PXI system controller and PXI peripheral modules.



Figure 1. Eight slot PXI chassis containing an embedded system controller and eight peripheral modules.

PXI Chassis

The PXI chassis is the fundamental component of the PXI system. The chassis contains a high-performance PXI backplane, which features the PCI bus, timing and triggering buses. By utilising these timing and triggering buses, users can design/build systems for industrial applications that require precise synchronisation.

PXI chassis are available in both 3U and 6U form factors, from six-slot portable unit to a twenty-slot rackmount platform with special features including DC power supplies, LCD displays and touch panels.

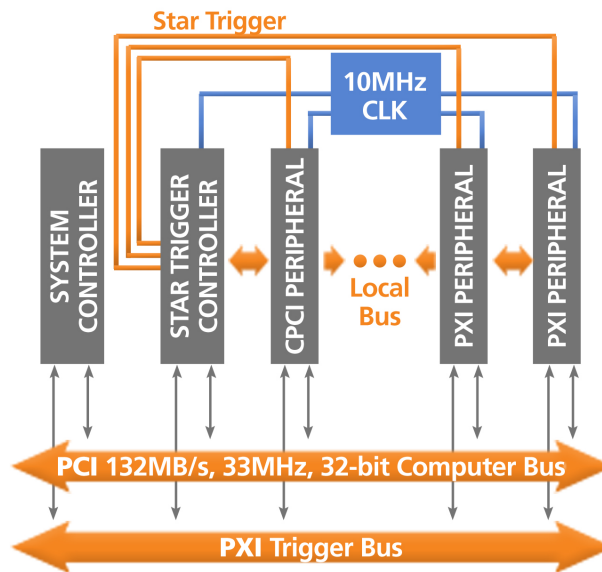


Figure 2. PXI timing and triggering busses.

PXI controllers

A PXI chassis is equipped with a system controller slot in the first left slot of the chassis, as defined by the PXI hardware specification. Available both in 3U and 6U form factors with a choice of processor from Celeron to Core i7, users can choose from different controller options including remote controllers from an industrial computer or laptop PC (via bus extension kits) and high performance PXI embedded controllers with a Windows operating system. PXI controllers are also available with built-in memory and storage capacity to suit a variety of industrial applications.

There are two types of PXI remote controllers: laptop control and industrial PC control.

Laptop control of PXI systems

Using the ExpressCard-to-PXI extension kit (including EC-8560, PXI-8565 and 3m high speed cable), users can control PXI systems from a laptop via the ExpressCard slot. The ExpressCard technology leverages the features of the PCI Express bus but in a small form factor for laptop computer usage. With comprehensive hardware and software transparency, the extension kit enables fast and convenient detection of any installed PXI cards in the PXI chassis, without the requirement of additional drivers or software installation.



Figure 3. The ExpressCard-to-PXI extension kit.

The ExpressCard-to-PXI extension kit offers laptop users great portability and convenience for remote control and measurement applications. For more information, please contact one of the Amplicon PXI specialists.

Industrial PC control of PXI systems

Using the PCI Express-to-PXI extension kit (including PCIe-8560, PXI-8565 and 3m high speed cable), users can control PXI systems from an industrial PC via the high-bandwidth PCI Express technology. With comprehensive hardware and software transparency, the extension kit enables fast and convenient detection of any installed PXI cards in the extension system without additional drivers or software.



Figure 4. The PCI Express-to-PXI extension kit.

Suitable for remote industrial control or automation applications, the PCI Express-to-PXI extension kit is designed to withstand rugged environments and harsh operating conditions.

The link between the host PC and the external chassis is a PCI Express x1 link which represents a dual-simplex communications channel consisting of two low-voltage differentially driven signal pairs. The signalling rate can reach up to 2.5 Giga bits per second in each direction. The maximum extension distance can be enhanced up to 7 meters without decreasing signal rate by utilising a shielded twisted cable.

With PXI remote controllers, users can maximise processor performance with reduced cost by utilising an industrial PC or laptop to remotely control a PXI system. In addition, the PXI remote controllers can be used to build multi-chassis PXI systems for high channel count applications.

PXI embedded Controllers

PXI embedded controllers provide a complete system housed within a PXI chassis eliminating the requirement for an external PC. The embedded controllers are equipped with standard PC features including integrated CPU, hard-drive, RAM, USB, Gigabit Ethernet ports, VGA, serial and other peripherals, as well as the Windows operating system. With the Windows OS capability, PXI embedded controllers use similar application software typically found in a PC platform.



Figure 5. The ADLINK PXI-3950 Intel Core2 Duo T7500 2.2GHz PXI embedded controller.

PXI embedded controllers are suitable for industrial applications that require a “one box” solution..

PXI Peripheral Modules

Amplicon offers a wide range of PXI modules for instrumentation, data acquisition, switching, motion control, and communication interfaces. There are over 1200 products available from the 70+ members of the PXI Systems Alliance (PXISA).

PXI is an open industry standard defined by the PXISA, users can mix and choose PXI Chassis, PXI controllers and PXI peripheral modules from multiple vendors.

Software Architecture

PXI architecture is based on standard PC technologies, such as PCI bus, CPUs, hard-drives and peripherals. The software development and operation of PXI systems is similar to a standard Windows-based PC. For example, the software tools used on PXI-2005 multifunctional data acquisition card in a PXI system is identical to the PCI-2005 version; hence existing application software and example code does not need to be rewritten when moving from PCI to PXI platform.

PXI products from Amplicon include software drivers that support the most common programming environments such as Visual Studio, C, C++, Visual Basic, MATLAB and LabVIEW.

Why Choose PXI platform

When designing a test system, users need to take into consideration two key factors; the technical requirements and the financial constraints. The technical requirements include meeting the products test needs which translates into measurement performance or functionality, test throughput, and the flexibility to adapt the test system to a variety of future devices under test (DUT). PXI can provide this flexibility at an affordable cost compared to other test and measurement platforms.

The PXI platform can offer benefits to your industrial application including higher throughput, advanced timing and synchronisation, system reliability and longevity, reduced space and system cost.

Higher Throughput

Every industrial application varies and has specific requirements. In most industrial applications, latency and bandwidth are the two vital elements when choosing a test system platform. Bandwidth measures the rate at which data is sent across the bus, typically in Megabytes per second, while latency measures the inherent delay in data transmission across the bus.

Most users recognise the importance of bandwidth since it affects whether data can be sent as fast as it is acquired and how much on-board memory their instruments will require. Latency has a direct impact on applications such as digital multimeter (DMM) measurements, switching, and instrument configuration, since it affects how quickly a command sent from one node on the bus (PC controller) arrives at the other node (instrument).

PXI provides high speed for a wide range of industrial applications with both high bandwidth and low latency via the PCI/PCI Express bus.

Advanced Timing and Synchronisation

PXI offers advanced timing and synchronisation capability via the trigger bus. Through shared timing and synchronisation, users can vastly improve the accuracy of measurements or synchronise multiple devices to act as one for high-channel-count applications.

A variety of measurement and automation applications require advanced timing and synchronisation capabilities that can not be implemented across PC standard I/O buses such as PCI/PCI Express, LAN, and USB.

System Reliability and Longevity

PXI is a test, measurement and control platform designed for demanding applications that require maximum uptime and a high level of reliability. With the rugged Eurocard form factor, forced-air cooling and wide operating temperature range, PXI has proven to be a powerful and robust standard that is suitable for vast range of industrial applications. The modularity of the PXI platform makes it easy to configure and repair PXI systems, resulting in very low mean time to repair (MTTR). PXI also

offers the flexibility to upgrade individual PXI peripheral modules or controllers without replacing the entire system.

Reduced Space

Conventional instruments such as oscilloscopes and waveform generators traditionally use GPIB, USB or LAN as their interfaces to automated test systems. When fitted in a 19" rack cabinet, this makes the whole system very cumbersome. With a PXI platform, users can replace a basic instrument like an oscilloscope with a single slot PXI oscilloscope card that sits inside the PXI chassis, along with a PXI signal generator and PXI data acquisition cards, thereby significantly reducing space.

Low System Cost

PXI delivers high-precision instruments, synchronisation, and timing features at an affordable price compared to conventional benchtop instruments. With PXI, users can utilise the same operating system and application software similar to a standard PC. The familiarity of the software reduces installation costs and the need to re-train test engineers every time a new system is implemented. Because PXI is based on a PC technology, users can benefit from low component costs, familiar software, and system reuse.

PXI permits test system development against specific customer needs and eliminates the costs associated with general purpose instrument features that are not required. In addition PXI provides a lower cost route to expand the test system capabilities against future requirements.

Summary

Conventional Automated Test Equipment (ATE) systems usually occupy large equipment racks; and anything that can be done to reduce the space needed is always welcomed by the factory floor. Using PXI modular instrumentation technology enables users to downsize ATE systems and also reduce overall test costs. Downsizing the ATE with a PXI alternative doesn't only offer a more cost effective smaller footprint, but it also amounts to lower maintenance costs, faster test times, faster development times, and better test coverage.

The modular architecture of a PXI system means that maintenance and serviceability are far simpler. In the event of a failure, a PXI module can be quickly and easily replaced.

The software applications and operating system that run on a PXI system are familiar to users because they are already used on common industrial computers. So by migrating your ATE rack system to PXI platform will allow for faster integration, a more reliable performance and simplified maintenance, thereby lowering the total cost of ownership.

For more information, please contact one of the Amplicon PXI Specialists on 01273570220 or via sales@amplicon.com