PXI-based, advanced switching architecture for functional test

Virtually all ATE systems employ a switching subsystem in order to route test system resources to multiple test points on the UUT. The challenge for any switching subsystem is multi-dimensional and involves many considerations/trade-offs including footprint, performance, flexibility, maintainability, and reliability. Additionally, if the application needs to address legacy test needs, there can be the additional challenge to support not only current and future switching requirements, but also legacy test requirements.

Many of today’s functional test systems employ the PXI architecture which offers modularity and flexibility. However when combining switching and instrumentation, test engineers can be challenged to create a system that combines all of the switching and instrumentation capabilities in one compact platform.

To address these needs for a range of mixed-signal test applications, a new, advanced switching architecture, based on PXI can offer test engineers the required modularity and flexibility for a range of test applications requiring moderate to very high pin counts. Based on the 6U PXI standard, this new switching architecture leverages the flexibility of the 6U standard and features a compact footprint as well as the option to support both switching and instrumentation resources within a single, PXI chassis.

Key features include:
- A modular and expandable analogue matrix supporting an internal 16 wire bus for routing analogue instrumentation and triggers from an instrument source to the receiver interface.
- A matrix architecture that can support a large number (up to 64) of signal inputs, outputs, and triggers.
- An overall signal bandwidth of > 20 MHz (independent of switch card configuration) with dedicated switching cards offering a bandwidth of over 500 MHz.
- A multiplexed pin configuration that can support over 2200 I/O signals.
- An innovative analogue/digital hybrid pin switching architecture, offering a high bandwidth digital signal path and providing “any resource to any pin” functionality.
- Integration of a mass termination interface, providing a “cable-less” receiver interface and resulting in the elimination of thousands of wires.
- A comprehensive software environment for managing overall signal routing.

As shown in figure 1, the switching architecture includes a modular “resource matrix” subsystem, an internal 16 wire fabric switching bus, and integrated “matrix / mux” switch cards which support both matrix and multiplexing functions for analogue and digital resources.

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Note that the flexibility of the architecture offers more than the traditional “two port” input/output connections associated with individual switch cards, providing additional flexibility and tailored switching performance for specific applications.

An integrated PXI system solution
As previously noted, creating a test system that incorporates all of the required switching, instrumentation, and associated UUT interface as part of an integral, single chassis solution can be a challenge. However, by basing the test system core on the switching architecture described above, test engineers have the necessary infrastructure to create a functional test solution that combines all of the required switching and instrumentation capabilities into one compact, 20 slot, 6U PXI chassis. This 6U PXI chassis supports the integration of a high performance, PXI digital and switching subsystem and offers the following key features:

- Up to (8) high performance, PXI digital and switching subsystems can be realised. These systems can form modular, high performance switching subsystems can be realised. These systems can form
- 19 6U PXI peripheral slots supporting either 3U or 6U modules.
- Support for up (9) switching modules, offering over 2200 multiplexed, hybrid test connections.
- Support for up to (8) high performance, high voltage digital modules, supporting up to 256 digital channels which can be routed via the switch modules, providing hybrid capability.
- Note that the platform also supplies supplementary high voltage power for each digital module, eliminating the need for external power supplies.
- Integrated Scout, mass termination receiver providing a reliable, cable-less interface to the UUT.
- Integrated, high-level switching software, providing end to end signal routing.

The system can be configured with different switch modules, providing analogue/digital switching capability for both baseband and RF applications. These modules provide a combination of matrix and multiplexer capability, offering the flexibility to route signals to/from the backplane, UUT interface, and other external resources. To efficiently control and manage this switching system, a robust signal routing software environment is needed as well. This signal routing software, which is supplied with each system provides end to end signal routing and can be easily integrated with a variety of test executive environments including ATEasy as well as other Windows based environments. The software manages the task of routing signals through the system and also prevents erroneous or dangerous connections that could damage the system.

Summary
By leveraging the 6U PXI architecture and employing advanced signal routing topologies, modular, high performance switching subsystems can be realised. These systems can form the basis for creating compact, PXI-based ATE systems.

Figure 3 - PXI chassis with integrated receiver & switch card

Figure 4 - Chassis configuration

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