The Pentek Pipeline

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Pentek Offers Commercial, Conduction-cooled and Ruggedized Products

Throughout its 18-year history, Pentek has provided its customers with a stream of leading edge board-level solutions for demanding applications in data acquisition, digital signal processing and software radio.

Designed to best commercial practice, most of the early products were targeted for relatively benign laboratory environments. Nevertheless, many of them were successfully deployed in systems on various military land vehicles, manned and unmanned aircraft and maritime platforms including ships, buoys, submarines and even torpedoes.

Over the years, Pentek has worked closely with customers to develop a number of different strategies for deploying Pentek technology in this wide range of environmentally stressed systems. Pentek has now taken one more significant step in this direction by offering conduction-cooled technology for its latest product lines.

Ruggedized COTS

Environmental extremes in temperature, humidity, air pressure, mechanical shock and vibration are common in many military, space and industrial systems. In the past, boards designed to meet full military requirements incurred high costs and delayed deployment of new technology.

Now government agencies mandate the use of COTS (Commercial Off The Shelf) boards whenever possible with additional mission-specific environmental requirements imposed whenever necessary. This emergence of ruggedized COTS offers the benefits of shorter time to market, reduced costs, mature software development tools and improved life-cycle support.

Ruggedization Strategies

Some of the successful methods Pentek has developed for achieving ruggedization include:

- **Mechanical structures**: to reduce susceptibility to shock and vibration, mechanical structures can be attached to strategic locations on a board. These include ribs, stiffeners, hold-down clamps or brackets, spring retaining clips, adhesives, rubber pads and encapsulation materials.

Pentek first applied this technology to the Model 4285 Octal C40 DSP processor board for operation under conditions of shock and vibration in a military land vehicle. The aluminum frame secures the eight processor modules in their high-density sockets and serves as a board stiffener to resist vibration.

- **Conduction cooling**: many airborne applications require conduction-cooled hardware to ensure appropriate thermal management of a circuit board in the absence of air cooling. VMEbus products normally feature one or more heavy copper layers within the printed circuit board to conduct heat generated by devices to the edges of the board.

Additional structures may include an aluminum plate attached to the top (or bottom) surface of the assembly with milled recesses so it conforms to the top surfaces of the heat-generating components. Heat is transferred from the devices through the aluminum plate to the edges of the board where it is clamped to a channel in the cold wall plate at each side of the chassis. Pentek's new 68xx Series of high-speed A/D converter boards with Virtex-II Pro FPGAs are now available in conduction-cooled versions. ➤

Model 4285 Commercial (left) and Ruggedized Version

Model 6821 Commercial (left) and Conduction-cooled Version

Pentek Offers Commercial, Conduction-cooled and Ruggedized Products

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Conduction cooling technology can also be applied to PMCs/XMCs. A combination of thermal management copper layers within the printed circuit board and an aluminum frame, bar or plate, transfers heat from the module down to the carrier board, where it is drawn out to the cold wall. The new Pentek Model 7140 software radio transceiver PMC/XMC module is offered with this construction.

• **Ruggedized enclosures**: often the simplest and most effective method involves enclosing commercial COTS boards in a protective chassis. For shock and vibration, an inner card cage can be attached to an outer frame or chassis with springs and/or rubber isolators that absorb energy.

To handle low air pressure, extreme temperatures and/or contaminated environments a sealed, airtight chassis can transfer heat through forced-air cooling within the card cage to a heat exchanger.

Often the cost of such protective chassis is far less than developing the necessary modifications to the boards and has the cost, life cycle and logistical advantage of using standard, readily available COTS boards.

• **Component substitution:** in some cases, just a few critical components limit the temperature range of the board. By substituting industrial or military grade components, the board may tolerate required temperature extremes.

• **Conformal coating:** for protection against humidity and airborne contaminants, a protective sealant can be applied to the board and components.

• **Board modifications**: in some cases, the printed circuit board of a standard product can be modified to meet special environmental requirements. This may include substituting different extended-range components or adding clearance and mounting holes for thermal management heat sinks.

MIL STD 810

The U.S. Department of Defense publishes Military Standard 810 Test Methods for Environmental Engineering. This document defines how testing should be conducted for 24 different environmental factors to ensure uniformity in reporting performance across a wide range of testing facilities.

Specifiers of extended-environment systems should express their requirements in units of measurement and measurement methods consistent with MIL STD 810.

Some of the most commonly specified environmental factors are:

- Pressure (Altitude)
- Operating temperature
- Storage temperature
- Temperature shock
- Humidity
- Acceleration
- Mechanical shock and vibration
- Contaminants, e.g. salt, sand, etc.

Commercial off-the-shelf (COTS) System RTS 2501 Scalable Modular Data Acquisition and Processing System

Ruggedized System Enclosure Protects the Commercial System Boards Shown Above

Contact Us

Contact your Pentek representative to discuss your ruggedized requirements in detail. Our environmental engineering team will present the best strategy for a system solution that meets the needs of your application. ❑

Pentek Ruggedization Levels

Level	L0	L1	L2	L3	L4
Cooling	Forced Air	Forced Air	Forced Air	Conduction	Conduction
Operating Temp	0° to 50°C	0° to 50°C	-20° to 65°C	-40° to 70°C	-40° to 85°C
Storage Temp	-20° to 70°C	-40° to 100°C	-40° to 100°C	-50° to 100°C	-50° to 100°C
Sine Vibration	–	2g 20-500 Hz	2g 20-500 Hz	10g 20-2000 Hz	10g 20-2000 Hz
Random Vibration	–	0.01 g^2/Hz 20-2000 Hz	0.04 g^2/Hz 20-2000 Hz	0.1 g^2/Hz 20-2000 Hz	0.1 g^2/Hz 20-2000 Hz
Shock	–	10g, 11 ms	20g, 11 ms	30g, 11 ms	40g, 11 ms
Humidity, non-condensing					
No Conformal Coating	0% to 95%	0% to 95%	0% to 95%	0% to 95%	0% to 95%
With Conformal Coating	0% to 100%	0% to 100%	0% to 100%	0% to 100%	0% to 100%

Visit **www.pentek.com** for additional test specifications and the latest parameters.

215 MHz, 12-bit A/D VME Board with Virtex-II Pro FPGAs

[From page 4]

Virtex-II Pro FPGAs

The 6821 utilizes two Xilinx Virtex-II Pro Series FPGAs in various sizes. Each FPGA is optionally equipped with 128 MB of SDRAM and 16 MB of FLASH memory.

Each Xilinx Virtex-II Pro FPGA accepts 12-bit signals at the sampling frequency from the A/D converter. Several data packing modes are selectable across the multiple FPDP ports. The FPGAs also act as controllers for other board functions including gating and triggering.

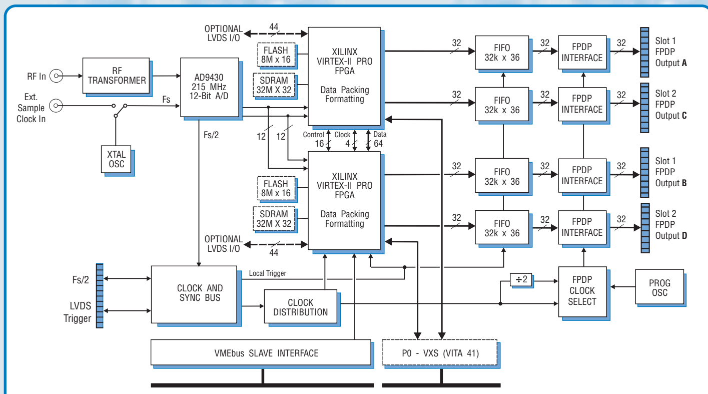
Optional LVDS I/O is available through either the VMEbus P2 connector or a second-slot front panel mezzanine.

Optional VXS Interface

The 6821 provides optional full duplex VITA-41 VXS links to the VME P0 connector for both FPGAs. These links support 4X Serial RapidIO, or other switched fabrics such as PCI Express and Aurora.

FIFOs and FPDP Outputs

Following each FPGA are two 32-bit wide FIFO buffers with a standard depth of 32k words. These FIFOs are useful as elastic memory to support hard disk latencies in recording applications.



Model 6821 Block Diagram

A total of four FPDP output ports are available, two per FPGA, to support data transfers of 320 MB/sec each or greater. One port per FPGA is attached to the 6821 front panel, with the second attached to an optional second-slot front panel.

A data demultiplexing mode splits the data stream between each pair of FPDP ports, reducing the output data rate by a factor of up to eight (depending on the data packing mode and number of FPDP ports) to support slower FPDP devices.

For more information on the Model 6821 commercial and conduction-cooled versions, visit: www.pentek.com/go/pipe6821cc. ❑

New! Switchless VXS System

In a recent joint press release, ELMA-Bustronic and Pentek announced a five-slot VXS system that significantly improves VMEbus system throughput and provides full fabric support for three payload cards without the need for a fabric switch card. This new switchless VXS system complies with the VITA 41.x specification and serves as an excellent platform for developing and testing VXS cards.

The five-slot system combines three payload slots with two conventional VME64x slots and allows design engineers to take full advantage of VXS technology. The Pentek Model 6821 (Product Focus, page 4) is the first in a family of Pentek VXS products supported by this new switchless VXS system.

"This switchless VXS mesh may prove to be a significant platform for VXS system development and could provide an important stimulus for additional VITA 41 solutions," stated Ray Alderman, executive director of VITA.

Go to www.pentek.com/go/pipeprVXS for more information. ❑

Online Webcast Nov. 10, 1 p.m. EST. Register Today!

New Technologies Drive Next Generation A/D Boards:

- **Speeds to 2 GHz**
- **VXS Switched Backplane Compatibility**
- **Virtex-II Pro FPGAs**
- **Convection- or Conduction-cooled**
- **Sync Bus for Multiboard Synchronization**

The seminar will cover the architecture of the A/D converters and will provide details on switched backplanes that improve VMEbus data throughput performance.

Design considerations on Pentek's very high-speed A/D boards will be presented, along with a discussion of the requirements of conduction cooling to meet the specifications encountered in environments such as military land vehicles, submarines and aircraft.

The Pentek implementation of a unique new sync bus for multiboard synchronization will also be discussed.

To demostrate the new technology advances, product details of Pentek's new high-performance A/Ds will be discussed.

- The Model 6821, a 215 MHz, 12-bit A/D Converter with Virtex-II Pro FPGAs highlighted here under Product Focus starting on page 4. Model 6821 is available now.
- The Model 6822, a dual-channel version of the Model 6821. Model 6822 will be available in Q1 of 2005
- The Model 6825, a 2 GHz, 10-bit A/D Converter with Virtex-II Pro FPGAs. Model 6825 will be available in Q2 of 2005.

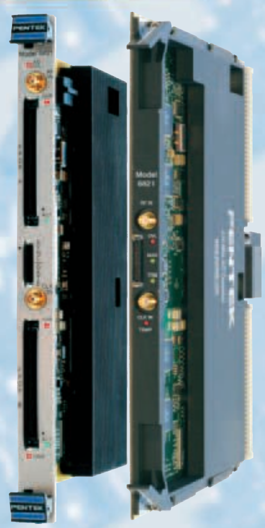
All three models feature dual Virtex-II Pro FPGAs and VXS switched backplane compatibility. They are all offered in conventional convection-cooled one-slot or two-slot versions and also in conduction-cooled configurations. The output data is available over FPDP ports. Optionally, additional FPDP ports are available on a second-slot front panel.

The webcast is scheduled for November 10, 1 p.m. EST. To register, visit: www.pentek.com/go/pipecc. ❑

Product Focus

Model 6821

215 MHz, 12-bit A/D VME Board with Virtex-II Pro FPGAs Available in Convection- and Conduction-cooled Versions



Model 6821 Commercial (left) and Conduction-cooled Version

GateFlow

Features

- AD9430 12-bit 215 MHz A/D
- Two Xilinx Virtex-II Pro FPGAs
- RF transformer supports input signals up to 700 MHz
- Four FPDP or FPDP II front panel ports
- FIFO data buffering
- Dual 4X VXS links for Serial RapidIO
- Compatible with Pentek GateFlow® IP Cores and FPGA Design Tools
- Multiboard synchronization

The Model 6821 is ideal as a high-speed data acquisition front end for real-time recording, digital receivers, and DSP systems. The 6821 is a complete high-frequency single channel A/D converter in a 6U VMEbus form factor. It accepts one front panel analog input and delivers digital output samples over two or four FPDP or FPDP II ports.

Input Stage and A/D Converter

The full scale input level is software selectable at +8 dBm or +2 dBm. The input transformer offers a low-distortion path to the differential inputs of the AD9430 A/D with a flat frequency response from 400 kHz to 700 MHz.

Clocking, Gating and Triggering

The A/D converter sample clock can be sourced from an internal 210 MHz (optionally 213.333 MHz) crystal oscillator or from an external sinusoidal clock at a maximum frequency of 215 MHz. This clock is accepted through a front panel SMA connector terminated in 50 ohms.

An external clock and sync bus supports synchronous data acquisition across multiple boards, ideal for applications such as multichannel radar systems. ➤