The Pentek Pipeline
A quarterly publication for engineering system design and applications.

Fall 2012 • Vol. 21, No. 2

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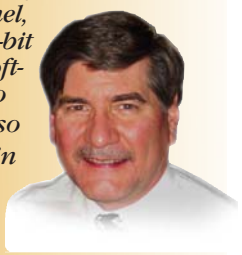
Choosing the Right Mezzanine for COTS Systems

In This Issue

- Technical pros and cons when designing with popular mezzanine standards.

More in the feature article.

"The Pentek Onyx™ Model 71760 Four-Channel, 200 MHz, 16-bit A/D XMC software radio board is also available in PCIe, CompactPCI, and OpenVPX form factors."



Rodger Hosking, Pentek Vice President and Co-founder

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Free Technical Resources

- **Videos**
  Model 78640 Model 78621
  Model 78670 Model 53662
- Setup a YourPentek account for custom news alerts
- Sign up for Virtex-7 Onyx product updates
- ***New!*** *High-Speed Real-Time Recording Systems Handbook*
- ***Updated*** edition of the *High-Speed Switched Serial Fabrics Handbook*
- ***Updated*** edition of the *SDR Handbook*
- ***Updated*** edition of the *FPGAs for Software Radio Systems Handbook*
- ***Updated*** edition of the *High-Speed A/Ds Handbook*

Because they are effective in handling the extreme breadth of I/O functions required, open architecture embedded systems for military or aerospace applications have always relied on mezzanine, or daughter cards, to provide flexibility and modularity. Thanks to the widespread adoption of industry standards defining these mezzanine products, carrier boards can accept mezzanine boards from a wide range of vendors that specialize in niche technologies and interfaces.

Today, three popular mezzanine standards dominate the embedded market: PMC (PCI Mezzanine Card), XMC (Switched Mezzanine Card), and FMC (FPGA Mezzanine Card). These mezzanines support all popular industry architectures including VME, VXS, OpenVPX, CompactPCI, and CompactPCI Serial for both 3U and 6U form factors and across a range of cooling techniques and ruggedization levels. Each of these three mezzanine standards presents a unique set of advantages and shortcomings that we will discuss in this article.

PMC Module Standards

Defined under the IEEE 1386.1 standard over 15 years ago, PMC uses the mechanical dimensions of the CMC (Common Mezzanine Card) from IEEE 1386 with the addition of up to four 64-pin connectors to implement a 32- or 64-bit PCI bus as well as user I/O.

As shown in Figure 1, two connectors, P11 and P12, handle a 32-bit PCI bus, which is expandable to 64 bits with the addition of the P13 connector. Operating at PCI bus clock speeds of 33 or 66 MHz, the 32-bit interface delivers a peak transfer rate of 132 or 264 MB/sec respectively, and twice that for a 64-bit interface. A later extension called PCI-X boosts the clock rate to 100 or 133 MHz for a peak transfer rate of 800 or 1000 MB/sec for 64-bit implementations. The optional P14 connector supports 64 bits of user-defined I/O.

As interconnect technology for mass-market PCs began shifting away from parallel PCI buses towards the faster PCIe (PCI Express) gigabit serial links, the need for a similar migration for mezzanine modules became apparent.

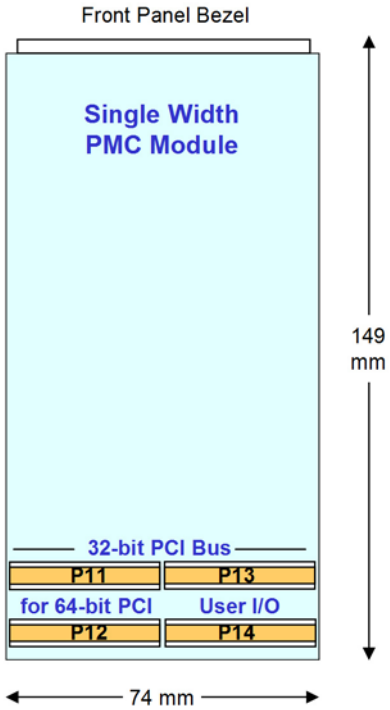

Figure 1. PMC Module Outline Dimensions and Connectors

XMC Module Standards

XMC modules are defined under VITA 42 as the switched fabric extension of the PMC module. It requires either one or two multipin connectors called the primary (P15) and secondary (P16) XMC connectors shown in Figure 2. Each connector can handle eight bidirectional serial lanes, using a differential pair of pins for each direction. The VITA 42.3 sub-specification defines pin assignments for PCIe, while VITA 42.2 covers SRIO (SerialRapidIO).

Typically, each XMC connector is used as a single x8 logical link or as two x4 links, although other configurations are also defined. Data transfer rates for XMC modules depend on the gigabit serial protocol and number of lanes per logical link. ➤

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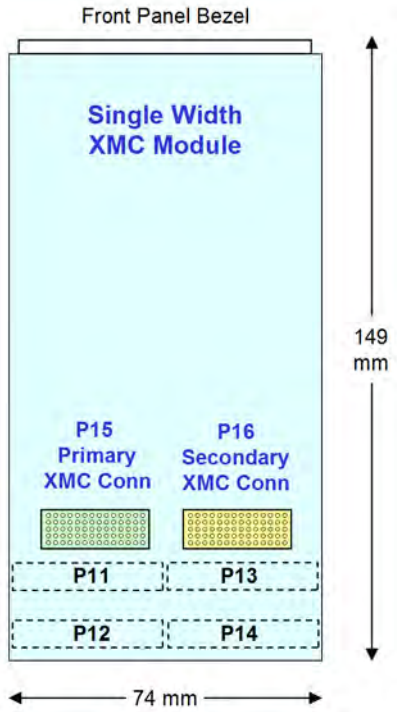

Figure 2. XMC Module Outline Dimensions and Connectors

FMC Module Standards

Defined in the VITA 57 specification, FMC modules are intended as I/O modules for FPGAs. They depart from the CMC form factor, with less than half the real estate, as shown to scale in Figure 3. Two different connectors are supported: a low-density connector with 160 contacts and a high-density connector with 400 contacts. Connector pins are generically defined for power, data, control and status with specific implementation depending on the design.

FMC modules rely upon the carrier board FPGA to provide the necessary interfaces to the FMC components. These can be single-ended or differential parallel data buses, gigabit serial links, clocks and control signals for initialization, timing, triggering, gating and synchronization. For data, the high-density FMC connector provides 80 differential pairs or 160 single-ended lines. It also features ten high-speed gigabit serial lanes, with differential pairs for each direction.

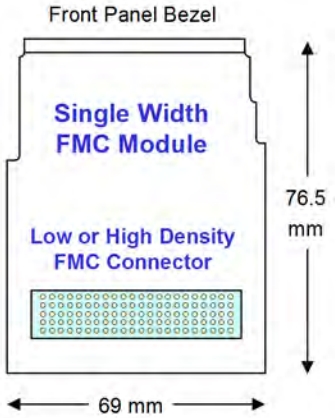

Figure 3. FMC Module Outline Dimensions and Connectors

Transfer Rate Comparison

Regarding the data transfer rates, PMC and XMC modules are well determined by the interface standard installed. Nevertheless, these rates are often affected by the carrier board in several ways. A shared PCI bus supporting other traffic will effectively block all transfers to a PMC until it is granted use of the bus.

For example, this problem occurs on dual PMC SBCs (single board computers) where the two PMCs often share the same local PCI bus. Also, when PMCs are installed on simple 3U CompactPCI carriers, the common PCI backplane must be shared across all boards installed in the card cage. Lastly, a carrier card or adapter that presents a lower speed PCI bus to the PMC module will force the module to operate its interface at that lower speed.

XMCs have an inherent data rate advantage over PMCs because they use fast gigabit serial links. Even the slowest x4 PCIe 1.0 interface still matches the fastest PCI-X 64-bit bus at 133 MHz. However, a major system-level implication for the gigabit serial interfaces is that they are dedicated point-to-point links and are not subject to the sharing penalty of parallel buses. Figure 4 shows the peak data transfer rates for PCIe and SRIO for different width gigabit serial links.

Ultimately, any system will have CPU and memory bandwidth limitations, but new multicore processors and chip sets feature more than 40 PCIe Gen3 lanes, each handling 1 GB/sec, and four DDR3 memory banks, each delivering transfer rates of 12.8 GB/sec. In these systems, a dedicated x8 PCIe link between the XMC and the system supports a respectable transfer rate of 8 GB/sec.

Unlike PMCs and XMCs, FMCs do not use industry standard interfaces like PCI or PCIe. Instead, each FMC has a unique set of control lines and data paths, each one differing in signal levels, quantity, bit widths and speed. At a 1 GHz data clock rate, the 80 differential data lines can deliver 10 GB/sec. At a 5 GHz serial clock rate, the ten gigabit serial lanes can deliver 5 GB/sec. In fact, specification design goals for FMCs are actually twice these rates.

Real Estate and Power Dissipation

FMC modules are less than half the size of PMCs and XMCs, and less real estate means less freedom to strategically place components for shielding, isolation and heat dissipation. For example, A/D converters are extremely sensitive to spurious signal pickup from power supplies, voltage planes, and adjacent copper traces. Often, the required power supply lines must be re-regulated and filtered locally on the same board as the A/D converters for best results. Arranging this circuitry on a small FMC module can be ➤

	Total Lanes	Duplex Mode	PCIe 1.0	SRIO 1.0	SRIO 2.0 PCIe 2.0	SRIO 2.0	PCIe 3.0
Clock (GHz)			2.5	3.125	5.0	6.25	8.0
Peak Data Transfer Rates (GB/sec)	x4	Half	1.0	1.25	2.0	2.5	4.0
		Full	2.0	2.5	4.0	5.0	8.0
	x8	Half	2.0	2.5	4.0	5.0	8.0
		Full	4.0	5.0	8.0	10.0	16.0
	x16	Half	4.0	5.0	8.0	10.0	16.0
		Full	8.0	10.0	16.0	20.0	32.0

Figure 4. Peak Data Transfer Rates for Various XMC Serial Link Configurations and Protocols

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challenging. Even though XMC modules have more components, they can often be rearranged more easily because of the larger board size.

FMCs require the FPGA to reside on the carrier board, while FPGA-based XMC modules include the FPGA on the mezzanine board. Schematically, the overall circuitry between the front end and the system bus may be nearly identical, but the physical partitioning occurs at two different points.

To illustrate this, Figure 5 shows two different implementations of a four-channel A/D converter software radio module for 3U OpenVPX. Notice that both block diagrams feature the same A/D converters and FPGAs, and provide the same x8 PCIe interface to the OpenVPX backplane. The XMC implementation on top uses the XMC connector between the FPGA and the backplane, while the FMC implementation below uses the FMC connector between the A/Ds and the FPGA.

Because most of the power is consumed by the FPGA, comparing power dissipation between FMC and XMC modules will strongly favor the FMC. However, since the same resources are used in both block diagrams, the overall 3U module power dissipation is nearly identical.

In a comparison between PMC and XMC or FMC modules, there is one additional factor to consider: Gigabit serial interfaces implemented in FPGAs typically consume more power than parallel bus interfaces. So when considering PMC products versus XMC/FMC products for a four-channel A/D converter module, the PCI bus of the PMC module will draw less power than a PCIe link. Of course, the extra power required for PCIe delivers tremendous benefits in both speed and connectivity.

Software/FPGA Development Issues

Each FMC presents a unique electrical interface that must be connected to an FPGA configured precisely to handle that specific device. This may be a reasonable solution if the FMC module and the FMC carrier are both supplied by the same vendor, and the FPGA on the carrier is pre-configured by the vendor for the specific FMC module installed.

For 6U carriers with two or three FMC sites, the FPGAs must be configured to match the specific combination of each of the FMC modules installed at each site. This FMC-to-FPGA dependency creates a potentially large number of combinations resulting in configuration management and customer support issues.

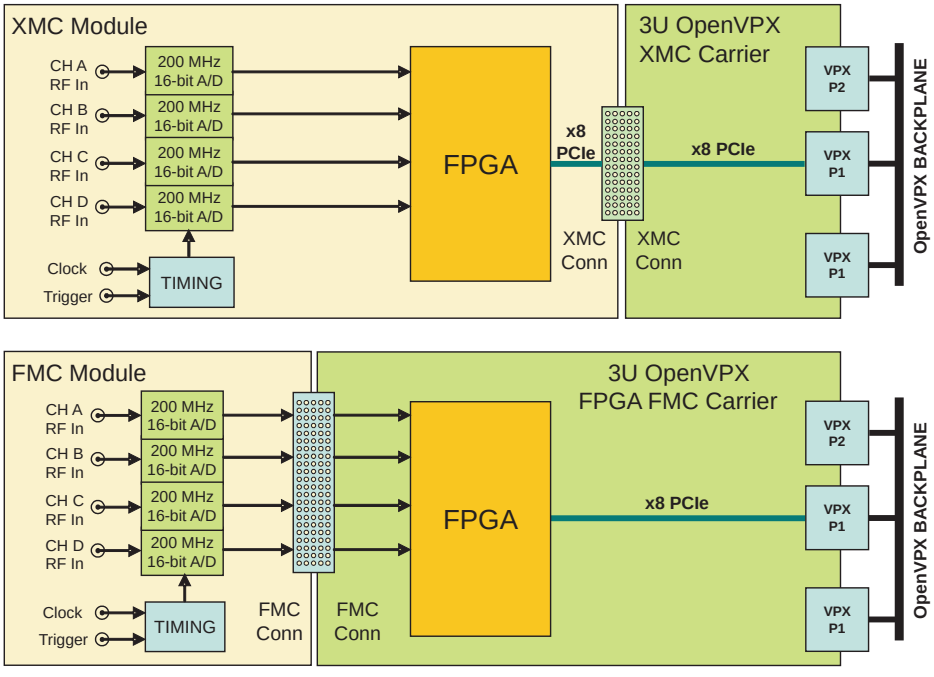

Figure 5. Simplified Block Diagrams Comparing XMC and FMC Four-Channel Software Radio 3U OpenVPX Modules

When a customer purchases an FMC module from one vendor and an FMC carrier from a different vendor, additional challenges arise. Someone must develop custom FPGA configuration code for the carrier to support the FMC module. Perhaps the FMC vendor will agree to develop code for a third-party carrier. Perhaps the carrier vendor will develop code for a third party FMC module.

Failing either of these strategies, the user must configure the FPGA. In this case, both the FMC module and the FMC carrier are third party products with two different technical support resources. If something doesn't work, it can be difficult to resolve problems in an efficient and effective way. And, if either the FMC module vendor or the FMC carrier vendor should revise his product, it may affect the interoperability of the two boards.

Perhaps the most challenging aspect of FMCs is the development of software drivers and board support libraries covering the myriad combinations of modules and carriers. Unless these are supplied from a single vendor who also supplies the FMC module and carrier, the same support and development issues discussed above for FPGA development may arise.

In contrast, PMCs and XMCs use industry standard system interfaces, typically PCI and PCIe, with a strong trending towards PCIe. Nearly all recent embedded systems take advantage of the widely-adopted PCIe standard for interconnecting system elements. This includes VXS, OpenVPX, and CompactPCI, as well as high-performance PC platforms using PCIe cards installed in motherboard expansion slots. These factors reduce dependency on the XMC vendor and problems resolving multi-vendor responsibility.

XMC Example

Figure 6 shows an XMC module featuring the latest Virtex-7 FPGA technology in a four-channel 200 MHz 16-bit A/D software radio module. It is equipped with dual XMC connectors, each capable of supporting eight lanes of gigabit serial links. The standard product features an x8 PCIe Gen 2.0 interface, and it's optionally available with Gen 3.0 to boost system transfer rates to eight GB/sec.

Notice the cutouts along the sides of the product to accommodate surrounding metal structures for conduction cooling, ➤

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making the product ideal for both lab and deployed military systems such as unmanned vehicles.

The product is also available in PCIe, CompactPCI, and OpenVPX form factors through carrier board adapters, and is supported with the Pentek ReadyFlow Board Support Libraries for Windows, Linux and VxWorks. Customers wishing to add custom IP for signal processing or special algorithms can choose the Pentek GateFlow FPGA Design Kit containing full VHDL source code and the complete FPGA project. However, many customers take advantage of the rich collection of factory-installed FPGA functions which address communications and radar applications, thereby saving the need for custom FPGA development.

Figure 6. Pentek Onyx Model 71760 Four-Channel A/D XMC Module

Summary

Figure 7 summarizes the points discussed in this article comparing PMC, XMC and FMC modules. Military and aerospace system integrators must weigh the pros and cons of each, remembering that all three are available in rugged versions suitable for deployment in severe environments.

If lowest power is the driving factor, PMCs may still be the right choice, especially if interface speed is not critical. With hundreds of vendors and thousands of products, PMCs offer the most of specialized I/O solutions.

FMC modules can be quite effective as long as the same vendor supplies both the mezzanine module and the carrier with tested and installed FPGA configuration code. Otherwise, XMC modules offer excellent solutions for embedded systems due to the proliferation of links, carriers, backplanes, and adaptors all based on PCIe. This eliminates the need for a custom FPGA development effort, minimizes product support issues, and speeds development cycles. ❑

Feature	PMC	XMC	FMC
Max Data I/O Rate	1 GB/sec	32 GB/sec	30 GB/sec
Full Duplex I/O	No	16 lanes	10 lanes
Interface	Shared Bus	Dedicated Point-to-Point	By Design
System Interface Standards	PCI PCI-X	PCIe SRIO	None Custom IP
Board Size	110 cm^2	110 cm^2	53 cm^2
Relative Power Dissipation	Medium	High	Low
Software Drivers	Yes	Yes	Maybe
Multi-vendor carrier/module Interoperability	Excellent	Excellent	Poor
Vendor Dependency	Low	Low	High
Requires Custom FPGA Design	No	No	Yes
System Integration Time	Normal	Normal	High

Figure 7. Feature Comparison of PMC, XMC, and FMC Mezzanine Modules

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Talon High-Speed Recorders

Product Catalog

Product Focus

Model 71651

Two-Channel 500 MHz A/D with DDC, DUC with Two-Channel 800 MHz D/A, and a Virtex-6 FPGA - XMC

General Information

Model 71651 is a member of the Cobalt® family of high-performance XMC modules based on the Xilinx Virtex-6 FPGA. A multi-channel, high-speed data converter with a programmable DDC, it is suitable for connection to HF or IF ports of a communications or radar system.

It includes two A/Ds, two D/As and four banks of memory. In addition to supporting PCI Express Gen. 2 as a native interface, the Model 71651 includes a general-purpose connector for application-specific I/O.

A/D Acquisition IP Modules

The 71651 features two A/D Acquisition IP Modules for easily capturing and moving data. Each module can receive data from either of the two A/Ds, a test signal generator or from the D/A Waveform Playback IP Module in loopback mode.

Each IP module has an associated memory bank for buffering data in FIFO mode or for storing data in transient capture mode. All memory banks are supported with DMA engines for easily moving A/D data through the PCIe interface.

Model 71651 is also available in OpenVPX, PCI Express and CompactPCI formats.

Features

- Supports Xilinx Virtex-6 LXT and SXT FPGAs
- Two 500 MHz 12-bit A/Ds
- Two multiband DDCs (digital downconverters)
- One DUC (digital upconverter)
- Two 800 MHz 16-bit D/As
- Multiboard programmable beamformer
- Sample clock synchronization to an external system reference
- LVPECL clock/sync bus for multimodule synchronization
- PCI Express (Gen. 1 and 2) interface, up to x8

DDC IP Cores

Within each A/D Acquisition IP Module is a powerful DDC IP core. Each DDC has an independent 32-bit tuning frequency setting that ranges from DC to f_s, where f_s is the A/D sampling frequency. Each DDC can have its own unique decimation setting, supporting as many as two different output bandwidths for the board. Decimations can be programmed from 2 to 131,072 providing a wide range to satisfy most applications.

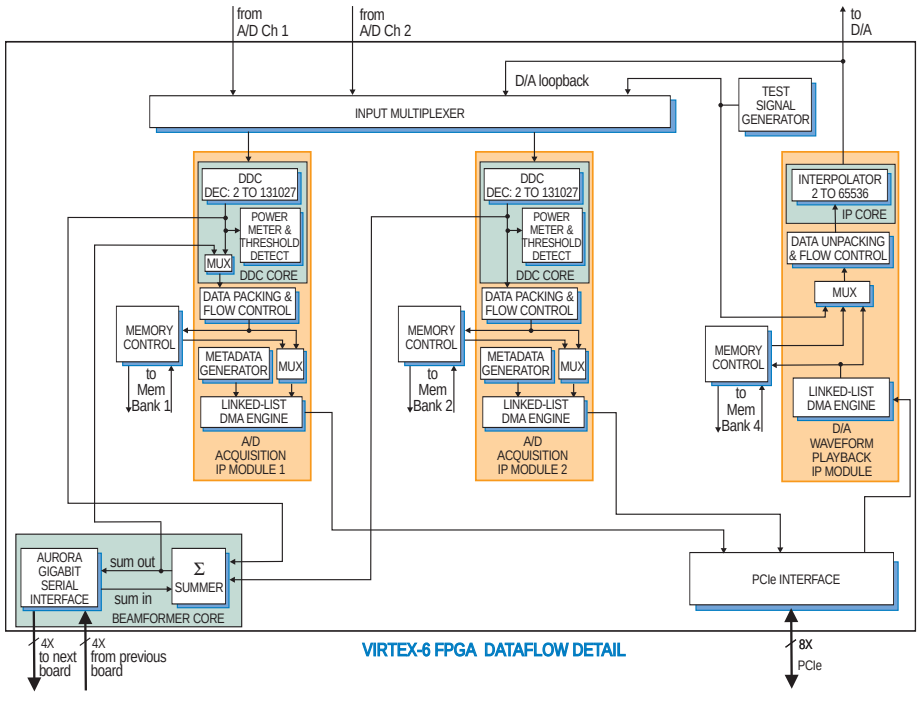
The decimating filter for each DDC accepts a unique set of user-supplied 16-bit coefficients. Each DDC delivers a complex output stream consisting of 24-bit I + 24-bit Q or 16-bit I + 16-bit Q samples at a rate of f_s/N.

Beamformer IP Core

In addition to the DDCs, the 71651 features a beamforming subsystem. Each DDC core contains programmable I & Q phase and gain adjustments followed by a power meter that continuously measures the individual average power output.

In addition, each DDC core includes a threshold detector to automatically send an interrupt to the processor if the average power level of any DDC core falls below or exceeds a programmable threshold.

A programmable summation block provides summing of any of the two DDC core outputs. An additional programmable gain stage compensates for summation change bit growth. A power meter and threshold detect block is provided for the summed output.



D/A Waveform Playback IP Module

The Model 71651 factory-installed functions include a sophisticated D/A Waveform Playback IP module.

For more information and a price quotation on the Model 71651, go to:

pentek.com/go/pipe71651 ❑

Product Focus

Model 78671

Four-Channel 1.25 GHz D/A with DUC, Extended Interpolation and Virtex-6 FPGA - x8 PCIe

General Information

Model 78671 is a member of the Cobalt family of high-performance PCIe boards based on the Xilinx Virtex-6 FPGA. This four-channel, high-speed data converter is suitable for connection to transmit HF or IF ports of a communications or radar system.

It includes four D/As with a wide range of programmable interpolation factors, four digital upconverters and four banks of memory. In addition to supporting PCI Express Gen. 2 as a native interface, the Model 78671 includes optional general-purpose and gigabit serial connectors for application-specific I/O.

Features

- Four 1.25 GHz 16-bit D/As
- Four digital upconverters
- Extended interpolation range from 2x to 1,048,576x
- Programmable output levels
- 250 MHz max. output bandwidth
- 2 GB of DDR3 SDRAM
- Supports Xilinx Virtex-6 LXT and SXT FPGAs
- Dual-µSync clock/sync bus for multiboard synchronization
- PCI Express (Gen. 1 & 2) up to x8

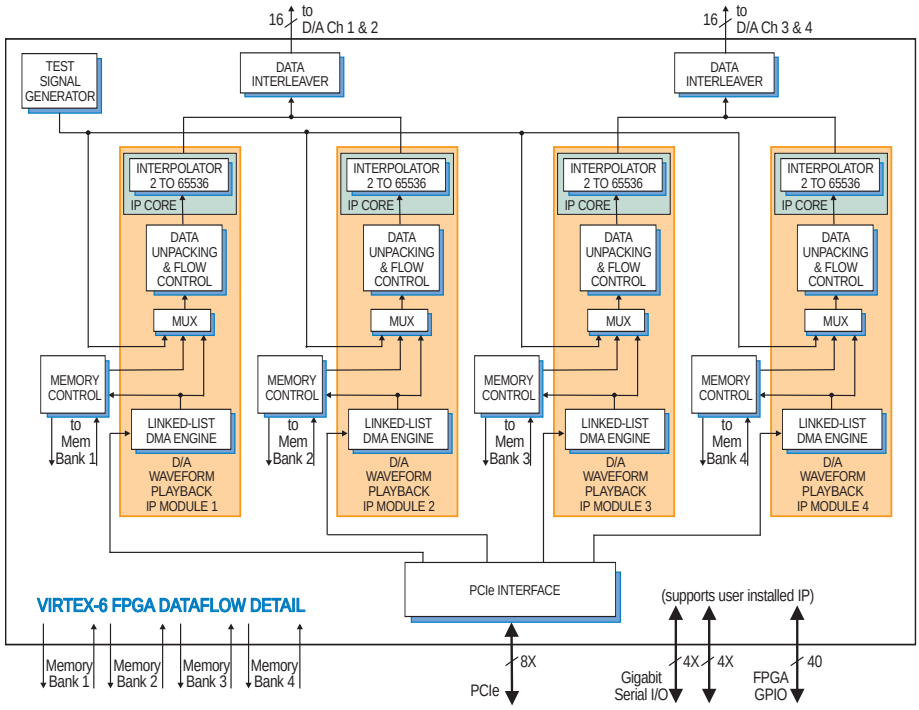
Cobalt
ReadyFlow Board Support Libraries
GateFlow

Model 78671 is also available in XMC, OpenVPX and CompactPCI formats.

The Cobalt Architecture

The Pentek Cobalt Architecture features a Virtex-6 FPGA. All of the board's data and control paths are accessible by the FPGA, enabling factory-installed functions including data multiplexing, channel selection, data packing, gating, triggering and memory control. The Cobalt Architecture organizes the FPGA as a container for data processing applications where each function exists as an intellectual property (IP) module.

Each member of the Cobalt family is delivered with factory-installed applications ideally matched to the board's analog interfaces. The 78671 factory-installed functions include four D/A waveform playback IP modules, to support waveform generation through the D/A converters. IP modules for DDR3 SDRAM memories, a controller for all data clocking and synchronization functions, a test signal generator, and a PCIe interface complete the factory-installed functions.



Digital Upconverter and D/A Stage

Two TI DAC3484s provide four DUC and D/A channels. Each channel accepts a baseband real or complex data stream from the FPGA and provides that input to the upconvert, interpolate and D/A stage.

When operating as a DUC, it interpolates and translates real or complex baseband input signals to a user-selectable IF center frequency. It delivers real or quadrature (I+Q) analog outputs to the 16-bit D/A converter.

If translation is disabled, each D/A acts as an interpolating 16-bit D/A with output sampling rates up to 1.25 GHz. In both modes, the D/A provides interpolation factors of 2x, 4x, 8x and 16x. In addition to the DAC3484, the 78671 features an FPGA-based interpolation engine which adds two additional interpolation stages programmable from 2x to 256x. The combined interpolation results in a range from 2x to 1,048,576x for each D/A channel and is ideal for matching the digital downconversion and data reduction used on the receiving channels of many communications systems.

PCI Express Interface

The Model 78671 includes an industry-standard interface fully compliant with PCI Express Gen. 1 and 2 bus specifications.

For more information and a price quotation on the Model 78671, go to:

pentek.com/go/pipe78671 ❑

Product Focus

Model RTS 2716

Eight-Channel Serial FPDP Rackmount Recorder

General Information

The Talon® RTS 2716 is a complete turnkey recording system capable of recording and playing multiple serial FPDP data streams. It is ideal for capturing any type of streaming sources including live transfers from sensors or data from other computers and is fully compatible with the VITA 17.1 specification. Using highly-optimized disk storage technology, the system achieves aggregate recording rates up to 2 GB/sec.

The RTS 2716 can be populated with up to eight SFP connectors supporting serial FPDP over copper, single-mode, or multi-mode fiber, to accommodate all popular serial FPDP interfaces. It is capable of both receiving and transmitting data over these links and supports real-time data storage to disk.

Programmable modes include flow control in both receive and transmit directions, CRC support, and copy/loop modes. The system is capable of handling 1.0625, 2.125 and 2.5 GBaud link rates supporting data transfer rates of up to 247 MBytes/sec per serial FPDP link.

SystemFlow Software

The RTS 2716 includes the SystemFlow® Recording Software. SystemFlow features a Windows-based GUI that provides a simple and intuitive means to configure and control the system. Custom configurations can be stored as profiles and later loaded as needed, allowing the user to select preconfigured settings with a single click.

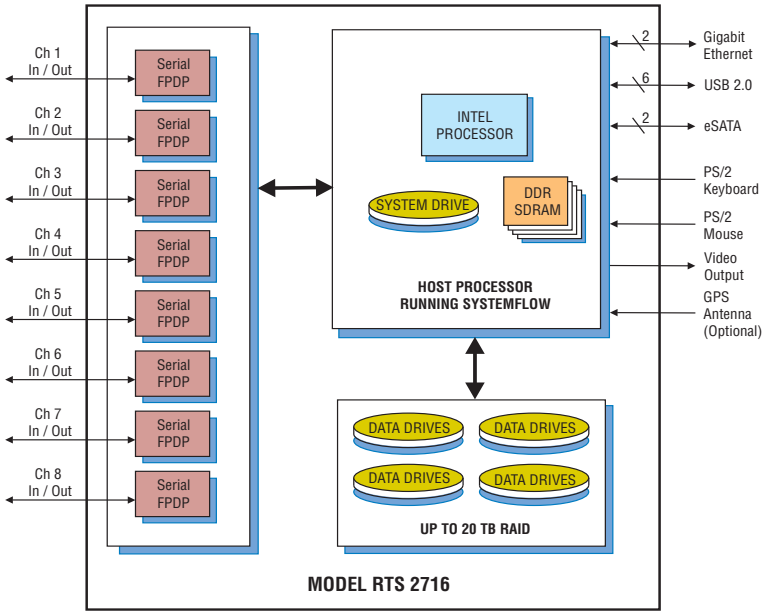
Built on a server-class Windows 7 Professional workstation, the RTS 2716 allows the user to install post-processing and analysis tools to operate on the recorded data.

Features

- Up to eight I/O channels in a single 4U or 5U 19-inch industrial rackmount PC server chassis
- Supports Flow Control, CRC, and Copy/Loop Mode as a receiver and transmitter
- Supports 1.0625, 2.125 and 2.5 GBaud link rates
- Copper, single-mode and multi-mode fiber interfaces available
- Real-time sustained recording rates of up to 2 GB/sec in 8-channel configuration
- Up to 20 TB of storage to NTFS RAID disk array
- RAID levels of 0 ,1, 5 , 6, 10 and 50
- SystemFlow GUI virtual instrumentation panel for fast, intuitive operation
- C-callable API for integration of recorder into application
- File headers include time stamping and recording parameters
- Optional GPS time and position stamping
- Windows® 7 Professional workstation with high-performance Intel® Core™ i7 processor

TALON RTS COMMERCIAL RECORDER

SystemFlow



The RTS 2716 records data to the native NTFS file system, providing immediate access to the recorded data.

Data can be off-loaded via two gigabit Ethernet ports or six USB 2.0 ports. Additionally, data can be copied to optical disk, using the 8X double layer DVD±R/RW drive.

Flexible Architecture

The RTS 2716 is configured in a 4U or 5U 19" rack-mountable chassis, with hot-swap data drives, front panel USB ports and I/O connectors on the rear panel.

Systems are scalable to accommodate multiple chassis to increase channel counts and aggregate data rates.

All recorder chassis are connected via Ethernet and can be controlled from a single GUI either locally or from a remote PC.

Multiple RAID levels, including 0, 1, 5, 6, 10 and 50, provide a choice for the required level of redundancy. Up to 24 hot-swappable SATA drives are optionally available, allowing up to 20 terabytes of real-time data storage space in a single chassis.

For more information and a price quotation on the Model RTS 2716, go to:
pentek.com/go/pipe2716 ❑

Product Focus

Model RTR 2736

Eight-Channel Serial FPDP Rugged Portable Recorder

General Information

The Talon RTR 2736 is a turnkey, recording system capable of recording and playing multiple serial FPDP data streams in a rugged, lightweight portable package. It is ideal for capturing any type of streaming sources including live transfers from sensors or data from other computers and is fully compatible with the VITA 17.1 specification. Using highly-optimized disk storage technology, the system achieves aggregate recording rates up to 1.6 GB/sec.

The RTR 2736 can be populated with up to eight SFP connectors supporting serial FPDP over copper, single-mode, or multi-mode fiber, to accommodate all popular serial FPDP interfaces. It is capable of both receiving and transmitting data over these links and supports real-time data storage to disk.

Programmable modes include flow control in both receive and transmit directions, CRC support, and copy/loop modes. The system is capable of handling 1.0625, 2.125 and 2.5 GBaud link rates supporting data transfer rates of up to 247 MBytes/sec per Serial FPDP link.

Optional GPS time and position stamping allows the user to mark the beginning of a recording in the recording file's header.

Features

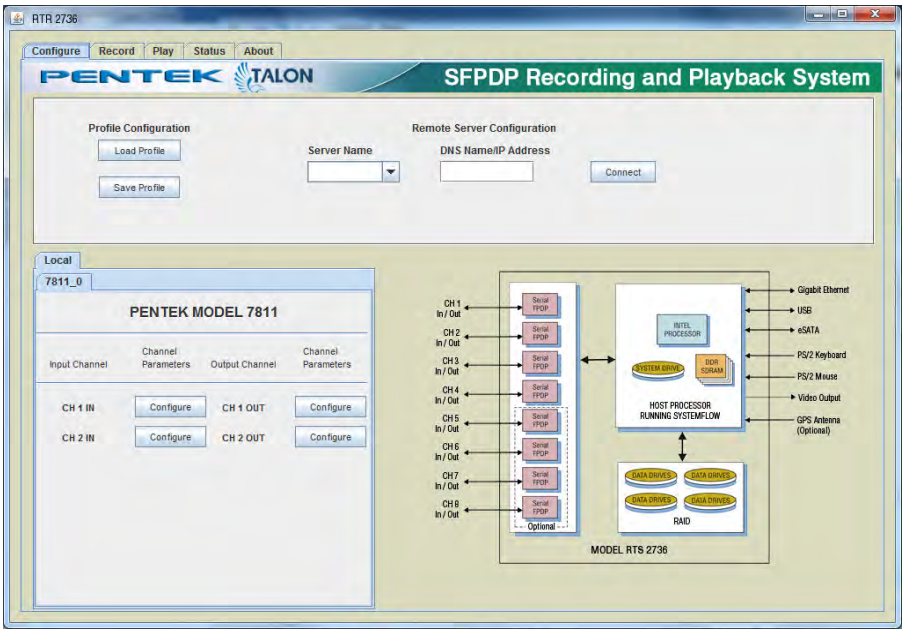
- Designed to operate under conditions of shock and vibration
- Portable system measures 16.9" W x 9.5" D x 13.4" H
- Rugged aluminum alloy chassis
- Lightweight, approximately 30 pounds
- Shock- and vibration-resistant SSDs perform well in vehicles, ships and aircraft
- Up to eight I/O channels
- Supports Flow Control, CRC, and Copy/Loop Mode as a receiver and transmitter
- Supports 1.0625, 2.125 and 2.5 GBaud link rates
- Copper, single-mode and multi-mode fiber interfaces available
- Real-time sustained recording rates of up to 1.6 GB/sec
- Up to 3.8 terabytes of storage to NTFS RAID disk array
- SystemFlow GUI virtual instrumentation panel for fast, intuitive operation
- Windows 7 Professional workstation with Intel Core i7 processor
- Optional GPS time and position stamping

TALON RTR RUGGED RECORDER

SystemFlow

SystemFlow Software

The RTS 2736 includes the SystemFlow Recording Software. SystemFlow features a Windows-based GUI that provides a simple and intuitive means to configure and control the system. Custom configurations can be stored as profiles and later loaded as needed, allowing the user to select preconfigured settings with a single click.



Built on a server-class Windows 7 Professional workstation, the RTR 2736 allows the user to install post-processing and analysis tools to operate on the recorded data.

The RTR 2736 records data to the native NTFS file system, providing immediate access to the recorded data.

Data can be off-loaded via a gigabit Ethernet port, eight USB 2.0 ports, two USB 3.0 ports or two eSATA 3 Ports. Additionally, data can be copied to optical disk, using the 8X double layer DVD±R/RW drive.

Rugged Architecture

The RTR 2736 is configured in a portable, lightweight chassis with eight hot-swap SSDs, front panel USB ports and I/O connections on the side panel. It is built on an extremely rugged, 100% aluminum alloy unit, reinforced with shock absorbing rubber corners and an impact-resistant protective glass. Using vibration- and shock-resistant SSDs, the RTR 2736 is designed to reliably operate as a portable field instrument.

Drives can be easily removed or exchanged during or after a mission to retrieve recorded data.

For more information and a price quotation on the Model RTR 2736, go to:

pentek.com/go/pipe2736 ❑

Product Focus

Model RTR 2749

Ultra Wideband One- or Two-Channel RF/IF, 3.2 GS/sec Rugged Rackmount Recorder

General Information

The Talon RTR 2749 is a turnkey system, used for recording high-bandwidth signals. The RTR 2749 uses 12-bit, 3.6 GHz A/D converters and can provide sustained recording rates up to 3.2 GB/sec. It can be configured as a one- or two-channel system and can record sampled data packed as 8-bit-wide consecutive samples, or as 16-bit-wide consecutive samples (12-bit digitized samples residing in the 12 MSBs of the 16-bit word.)

The RTR 2749 uses Pentek's high-powered Virtex-6-based Cobalt boards that provide the data streaming engine for the high-speed A/D converters. Channel and packing modes as well as gate and trigger settings are among the GUI-selectable system parameters, providing complete control over this ultra wideband recording system.

Features

- Designed to operate under conditions of shock and vibration
- Sample rates up to 3.2 GHz in single-channel mode
- Sample rates up to 1.6 GHz in dual-channel mode
- Capable of recording RF/IF frequencies to 1.75 GHz in single-channel mode
- Capable of recording RF/IF frequencies to 2.8 GHz in dual-channel mode
- 12-bit A/D, with 12- and 8-bit packing modes
- Real-time sustained recording rates of up to 3.2 GB/sec
- 4U 19 inch rugged rackmount PC server chassis
- Windows 7 Professional workstation with Intel Core i7 processor
- Up to 20 terabytes of SSD storage to NTFS RAID solid-state disk array
- RAID levels of 0 ,1, 5 , 6, 10 and 50
- SystemFlow GUI with signal viewer analysis tool
- C-callable API for integration of recorder into application
- Optional GPS time and position stamping

TALON RTR RUGGED RECORDER

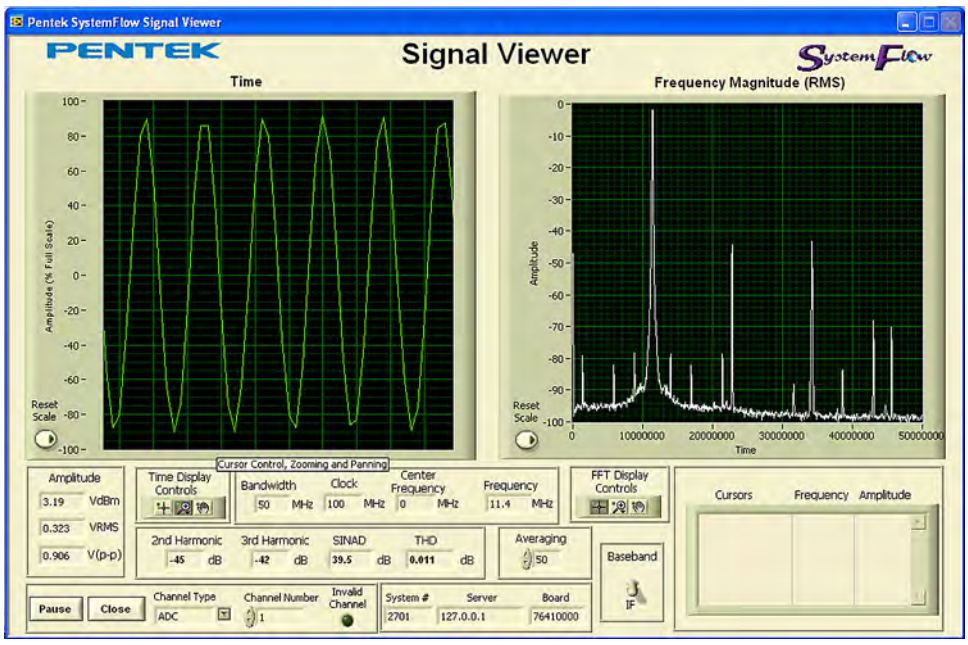
SystemFlow

SystemFlow Software

The RTR 2749 includes the SystemFlow Recording Software. SystemFlow features a Windows-based GUI that provides a simple means to configure and control the system. Custom configurations can be stored as profiles and later loaded when needed, allowing the user to select preconfigured settings with a single click.

SystemFlow also includes signal viewing and analysis tools, that allow the user to monitor the signal prior to, during, and after a recording session. These tools include a virtual oscilloscope and a virtual spectrum analyzer.

Built on a Windows 7 Professional workstation, the RTR 2749 allows the user to install post processing and analysis tools to operate on the recorded data. The RTR 2749 records data to the native NTFS file system, providing immediate access to the recorded data.



Rugged and Flexible Architecture

Because SSDs operate reliably under conditions of shock and vibration, the RTR 2749 performs well in ground, shipborne and airborne environments. The 40 hot-swappable SSDs provide storage capacity of up to 20 TB. The drives can be easily removed or exchanged during or after a mission to retrieve recorded data.

The RTR 2749 is configured in a 4U 19" rugged rackmount chassis, with hot-swappable data drives, front panel USB ports and I/O connectors on the rear panel.

Systems are scalable to accommodate multiple chassis to increase channel counts and aggregate data rates. All recorder chassis are connected via Ethernet and can be controlled from a single GUI either locally or from a remote PC. Multiple RAID levels, including 0, 1, 5, 6, 10 and 50 provide a choice for the required level of redundancy.

For more information and a price quotation on the Model RTR 2749, go to:

pentek.com/go/pipe2749 ❑

Product Focus

Model RTR 2756

Eight-Channel Serial FPDP Rugged Rackmount Recorder

General Information

The Talon RTR 2756 is a complete turnkey recording system capable of recording and playing multiple serial FPDP data streams. It is ideal for capturing any type of streaming sources including live transfers from sensors or data from other computers and is fully compatible with the VITA 17.1 specification. Using highly-optimized disk storage technology, the system achieves aggregate recording rates up to 2 GB/sec.

The RTR 2756 can be populated with up to eight SFP connectors supporting serial FPDP over copper, single-mode, or multi-mode fiber, to accommodate all popular serial FPDP interfaces. It is capable of both receiving and transmitting data over these links and supports real-time data storage to disk.

Programmable modes include flow control in both receive and transmit directions, CRC support, and copy/loop modes. The system is capable of handling 1.0625, 2.125 and 2.5 GBaud link rates supporting data transfer rates of up to 247 MBytes/sec per serial FPDP link.

Optional GPS time and position stamping accurately identifies each record.

Features

- Designed to operate under conditions of shock and vibration
- Complete serial FPDP record and playback system
- Up to eight I/O channels in a single 4U 19 inch rugged rackmount PC server chassis
- Removable SSDs
- Up to 20 terabytes of storage to NTFS RAID disk array
- Copper, single-mode and multi-mode fiber interfaces available
- Real-time sustained recording rates of up to 2 GB/sec in eight-channel configuration
- Supports Flow Control, CRC, and Copy/Loop Mode as a receiver and transmitter
- Supports 1.0625, 2.125 and 2.5 GBaud link rates
- RAID levels of 0 ,1, 5 , 6, 10 and 50
- SystemFlow GUI virtual instrumentation panel for fast, intuitive operation
- C-callable API for integration of recorder into application
- Windows 7 Professional workstation with high performance Intel Core i7 processor
- Optional GPS time and position stamping

TALON RTR RUGGED RECORDER

SystemFlow

SystemFlow Software

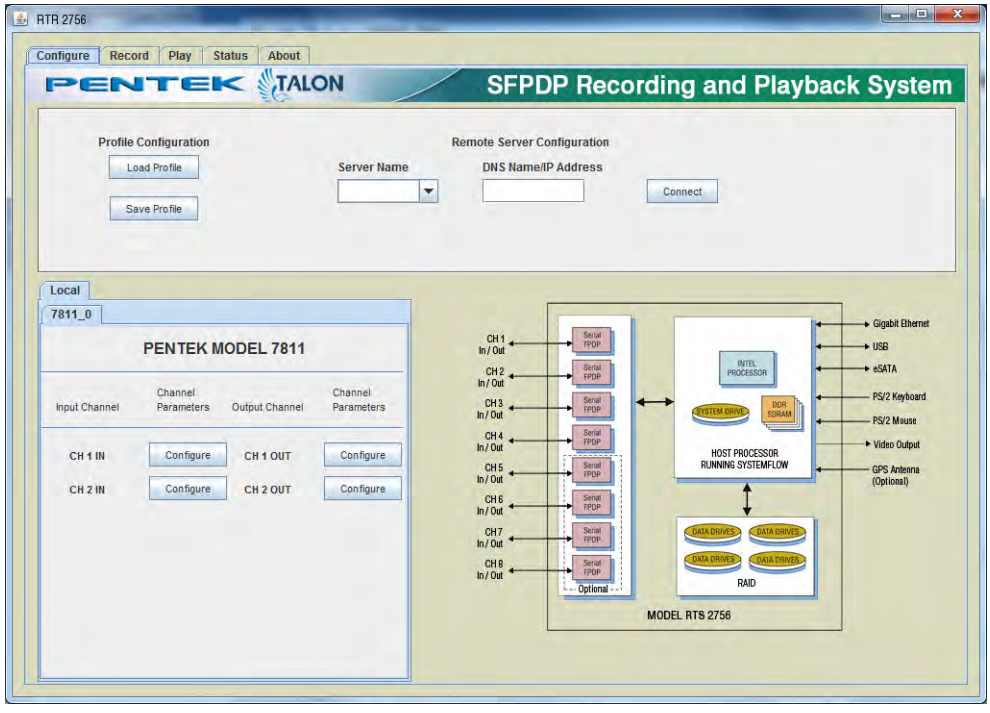
The RTR 2756 includes the SystemFlow Recording Software. SystemFlow features a Windows-based GUI that provides a simple and intuitive means to configure and control the system.

Custom configurations can be stored as profiles and later loaded as needed, allowing the user to select preconfigured settings with a single click.

Built on a server-class Windows 7 Professional workstation, the RTR 2756 allows the user to install post-processing and analysis tools to operate on the recorded data.

The RTR 2756 records data to the native NTFS file system, providing immediate access to the recorded data.

Data can be off-loaded via two gigabit Ethernet ports or six USB 2.0 ports. Additionally, data can be copied to optical disk, using the 8X double layer DVD±R/RW drive.



Rugged and Flexible Architecture

Because SSDs operate reliably under conditions of shock and vibration, the RTR 2756 performs well in ground, ship and airborne environments. Configurable with as many as 40 hot-swappable SSDs, the RTR 2756 can provide storage capacities of up to 20 TB in a rugged 4U chassis. Drives can be easily removed or exchanged during or after a mission to retrieve recorded data.

Systems are scalable to accommodate multiple chassis to increase channel counts and aggregate data rates.

For more information and a price quotation on the Model RTR 2756, go to:

pentek.com/go/pipe2756 ❑