Summer 2015 • Vol. 24, No. 2

The Pentek Pipeline

A quarterly publication for engineering system design and applications.

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"Offering many advantages over traditional copper connections, optical links will boost data rates, improve signal integrity and security, and greatly extend distance between system components."

Rodger Hosking, Pentek Vice President and Co-founder

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The Many Advantages of Optical Links

by Rodger Hosking, Pentek, Inc.

Advances in optical interface technology boost performance levels to help meet increasing data rates and signal bandwidths. New specifications define how to deploy these optical links within open industry standards, affording improved interoperability and supporting future upgrades. Offering many advantages over traditional copper connections, optical links will boost data rates, improve signal integrity and security, and greatly extend distance between system components.

Optical Links Offer Many Benefits

One major shortcoming of copper cable is signal loss, which becomes a serious limitation for higher frequency signals and longer cable lengths. Across a span of 100 meters, optical cables can sustain data rates up to 100 times higher than copper cable.

Because copper cables radiate electromagnetic energy, eavesdropping on network cables is a major security concern, not only for military and government customers, but also for corporations, banks, and financial institutions. Advanced signal sniffers in vehicles and briefcases are hard to detect and restrict. Optical cables are extremely difficult to "tap" without damaging the cable, resulting in immediate detection.

Signals flowing in copper cables are also susceptible to contamination from nearby sources of electromagnetic radiation, such as antennas, generators, and motors. This is critical for military and commercial aircraft and ships, as well as manned or unmanned vehicles, which are often packed with dozens of different electronic payloads. Optical cables are completely immune to EMI and even lightning discharges.

Physically, optical cables are much smaller and lighter than copper cables, especially important for weight-sensitive applications such as weapons, unmanned vehicles, and aircraft. Optical cables will operate just as well when submerged in seawater, and are completely immune to electrical shorting—especially important ➢

Property	Copper	Optical
Interface Transceiver Cost	Low ✓	High but dropping
PC Network Interface Cards	Integrated in PC or laptop ✓	Usually optional at $100-$200
Power over Ethernet	Supported at low cost ✓	Not possible
Data Rate	1 GHz	>10 GHz ✓
Cable Loss - 100 meters	94%	3% ✓
Max Transmission Distance	100 m (cat 6)	300 m (multi-mode) 10 km (single mode) ✓
EMI Susceptibility Risk	Moderate	Zero ✓
EMI Radiation Risk	Moderate	Zero ✓
Security / Eavesdropping Risk	High	Extremely Low ✓
Termination Costs	Low ✓	High
Cable Cost per Length	High	Low ✓
Cable Weight per 1000 m	60 to 600 kg	6 kg ✓
Fire Hazard	Supports current flow if shorted	Zero ✓
Tensile Strength	25 pounds	100-250 pounds ✓
Cleaning Requirements	No ✓	Yes

Table 1. *Advantages and disadvantages between copper and optical interfaces.*

The Many Advantages of Optical Links (continued)

where explosive vapors may be present. To ease installation through conduits and passages, optical cables have smaller diameters and can withstand up to ten times more pulling tension than copper cables.

Driven by huge commercial markets for data servers, storage networks, telecom systems, and home and office internet and entertainment systems, optical interfaces are replacing older copper connections for good reasons: cost and performance.

As the use of optical cables becomes more widespread, the cost per length can be much lower than copper cables that depend on commodity metal pricing. As is often the case, industrial, military and government embedded systems are now taking advantage of the many benefits of this rapidly advancing commercial technology.

Optical Cables

An optical cable is a waveguide for propagating light through an optical fibre. It consists of a central core clad with a dielectric material having a higher index of refraction than the core to ensure total internal reflection. Optical cables use either multi-mode or single-mode transmission.

Multi-mode cables accept light rays entering the core within a certain angle of the axis. They travel down the cable by repeatedly reflecting off the dielectric boundary between the core and the cladding. The core diameters are typically 50 or 62.5 microns, and the wavelength of light is typically 850 nm.

Single-mode cables propagate light as an electromagnetic wave operating in a single transverse mode straight down the fibre using typical wavelengths of 1310 and 1550 nm. The core diameter must be no greater than ten times the light wavelength, typically 8 to 10 microns. Although single-mode cables can carry signals over lengths 10 to 100 times longer than multi-mode, the transceivers are more expensive.

Hundreds of different types of optical cable connectors exist, each addressing specific applications and environments. The challenge is connecting the ends of two optical cables to retain the maximum fidelity of the light interface, in spite of human factors, tolerances, contamination, and environments. Special tools and kits for cleaning the ends of each optical fibre are essential for reliable operation.

Figure 1. *Pentek's Cobalt ® Model 52611 Quad Serial FPDP 3U VPX module supports four full-duplex LC optical cables for connections between chassis, each operating at over 400 MB/sec*

Optical Transceivers

Coupling electrical signals to light signals for transmission through optical cables requires optical transceivers. Most systems require full duplex operation for each optical link to support flow control and error correction. A pair of optical fibers, often bonded together in the same cable, supports transmit and receive data flowing in opposite directions.

Although several analog light modulation schemes (including AM and FM) have been used in the past, now almost all transceivers use digital modulation. Optical emitters simply translate the digital logic levels into on/off modulation of the laser light beam, while the detectors convert the modulated light back into digital signals. This physical layer interface for transporting 1's and 0's can support any protocol.

The Many Advantages of Optical Links (continued)

The latest transceivers use laser emitters to support data rates to 100 Gbits/sec and higher, and each generation steadily reduces the power, size and cost of devices. Different technologies are required for emitters and detectors, but both are often combined in a single product to provide full-duplex operation.

Optical transceivers thus provide a physical layer interface between optical cables and the vast array of electrical multi-gigabit serial ports found on processors, FPGAs, and network adapters. As a result, optical transceivers are transparent to the protocols they support, making them appropriate for a virtually any high-speed serial digital link.

Electrical signals of the optical transceivers connect to the end point device, which must then handle clock encoding and recovery, synchronization, and line balance at the physical layer. Data link layer circuitry establishes framing so that data words can be sent and received across the channel.

Choosing the Right Optical Protocol

Protocols define the rules and features supported by each type of system link, ranging from simple transmission of raw data to sophisticated multi-processor support for distributed networks, intelligent routing, and robust error correction. Of course, heavier protocols invariably mean less efficient data transfers and increased latency. Generally, it is best to use the simplest protocol that satisfies the given system requirement.

As an example of a lightweight protocol, Aurora for Xilinx FPGAs features onboard link-layer engines and high-speed serial transceivers. Aurora is intended primarily for point-to-point connectivity for sending data between two FPGAs. It includes 8b/10b or 64b/66b channel coding to balance the transmission channel, and supports single- or full-duplex operation. Aurora handles virtually any word length and allows multiple serial lanes to be bonded into a single logical channel, aggregating single lane bit rates for higher data throughput. Data rates for each serial lane can be 12.5 Gbits/sec or higher. Extremely simple and with minimal overhead, Aurora is very efficient in linking data streams between multiple FPGAs within a module, or between modules across a backplane.

Stepping up in complexity is the Serial FPDP protocol defined under VITA 17.1. It addresses several important needs of embedded systems, including flow control to avoid data overruns, and copy mode to allow one node to receive data and also forward it on to another node. The copy/loop mode supports a ring of multiple nodes eventually completing a closed loop. The nominal data rate on each lane is 2.5 Gb/s, but advances in device technology now support rates almost twice that speed.

Infiniband defines a flexible, low-latency, point-to-point interconnect fabric for data storage and servers with current rates of 14 Gbits/sec, moving up to 50 Gbits/sec in the next few years. Channel speeds can be boosted by forming logical channels by bonding 4 or 12 lanes.

The venerable Ethernet protocol still dominates computer networks, with 10 GbE now commonly supported by a vast range of computers, switches, and adapters. Even though Ethernet suffers from high overhead, making it somewhat cumbersome for high-data-rate, low latency applications, its ubiquitous presence virtually assures compatibility.

New Features for VITA 49.0: VITA Radio Transport (VRT)

Approved as an ANSI standard in 2007, VITA 49.0 defines standardized packets for connecting software radio systems for communications, radar, telemetry, direction finding, and other applications. The original specification addressed only receiver functions. Receive signal data packets deliver digitized payload data, a precise time stamp, and identifiers for each channel and signal. Context packets include operating parameters of the receiver including tuning frequency, bandwidth, sampling rate, gain, antenna orientation, speed, heading, etc. One notable shortcoming of the original specification was its inability to control the receiver.

VITA 49.2, a new extension to VRT now in balloting, adds control packets for delivering operational parameters to all aspects of the radio equipment, as well as support for transmitters. The new stimulus packets contain streaming digital samples of signals to be transmitted. Other new packets, called capabilities packets, inform the host control system of the available hardware in the radio along with the allowed range of parameters for control. Lastly, spectrum packets from the receiver deliver spectral information to help simplify spectral survey and energy detection operations required by the control system.

With this latest extension, VRT provides a standardized protocol for controlling and configuring all aspects of a ➢

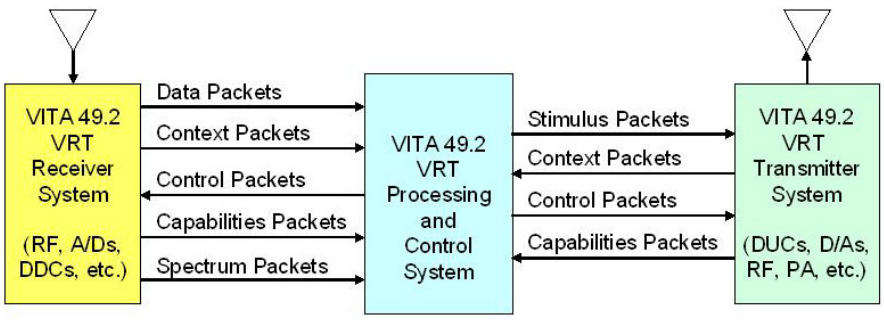


Figure 2. *New extensions to the VITA Radio Transport (VRT) protocol define standardized packets for control and status of radio receiver and transmitter equipment, as well as digitized receive and transmit signal payload packets for added flexibility.*

The Many Advantages of Optical Links (continued)

software radio transceiver. One major objective is enabling a common radio hardware platform to handle a wide range of applications simply by implementing new host software algorithms that exploit VRT protocols to achieve the required modes of operation.

New Optical Interfaces for VPX

Although optical interfaces using various connectors and cable types have been deployed in embedded systems for years, most of them use front panel connections. This can be a maintenance issue and is often not permitted in conduction-cooled systems.

The VITA 66 Fiber Optic Interconnect group has developed a set of standards that bridge optical connections directly through the VPX backplane connector. The first three are variants for 3U and 6U systems and are based on MT, ARINC 801 Termini, and Mini-Expanded Beam optical connector technology, respectively.

The metal housings are physically dimensioned to replace one or more of the standard MultiGig RT-2 VPX bladed copper connectors. The high-density MT variant defined in VITA 66.1 provides the highest density of the three, with up to 12 or 24 pairs of optical fibers, while VITA 66.2 and 66.3 each provide 2 pairs.

A fourth standard soon to be released, VITA 66.4, uses the MT ferrule but with a metal housing half the size of VITA 66.1, thus occupying only half of the 3U VPX P2 connector position. These housings are available from major vendors, including TE Connectivity and Molex.

To simplify implementation, Samtec offers its FireFly™ Micro Fly-Over system. It consists of a 12 pairs of optical fibres installed in an MT ferrule. One 12-lane optical flat cable connects to a small VCSEL laser emitter module and the other connects to a detector module.

Figure 3 shows the industry's first implementation of the emerging VITA 66.4 standard, the Pentek Flexor® Model 5973 3U VPX Virtex-7 FMC carrier. Here the electrical interfaces of the FireFly emitter and detector modules are connected directly to the GTX serial transceiver pins of the Virtex-7 FPGA. Today, FireFly transceivers are rated for 14 Gbits/sec with 28 Gbits/sec versions coming soon. With Pentek's Model 5973 operating at nominal data rates of 10 Gbits/sec through each optical fibre using the Aurora protocol, the backplane throughput is 12 GB/sec, simultaneously in both directions.

The first version of this product uses multi-mode transceivers and cable to support cable lengths of 100 meters or more. Single-mode transceivers will extend the distance to several kilometers. A wide range of MT optical cables and connector products allow board-to-board connections across the backplane, and backplane-to-chassis connections for external MTP cables to remotely located systems.

The 12 GB/sec VITA 66.4 optical interface complements the 8 GB/sec Gen 3 x8 copper PCIe interface on VPX P1, offering plenty of I/O for demanding applications. System engineers can now choose between optical and copper links to solve high data rate connectively requirements and take advantage of the benefits of each technology. ❒

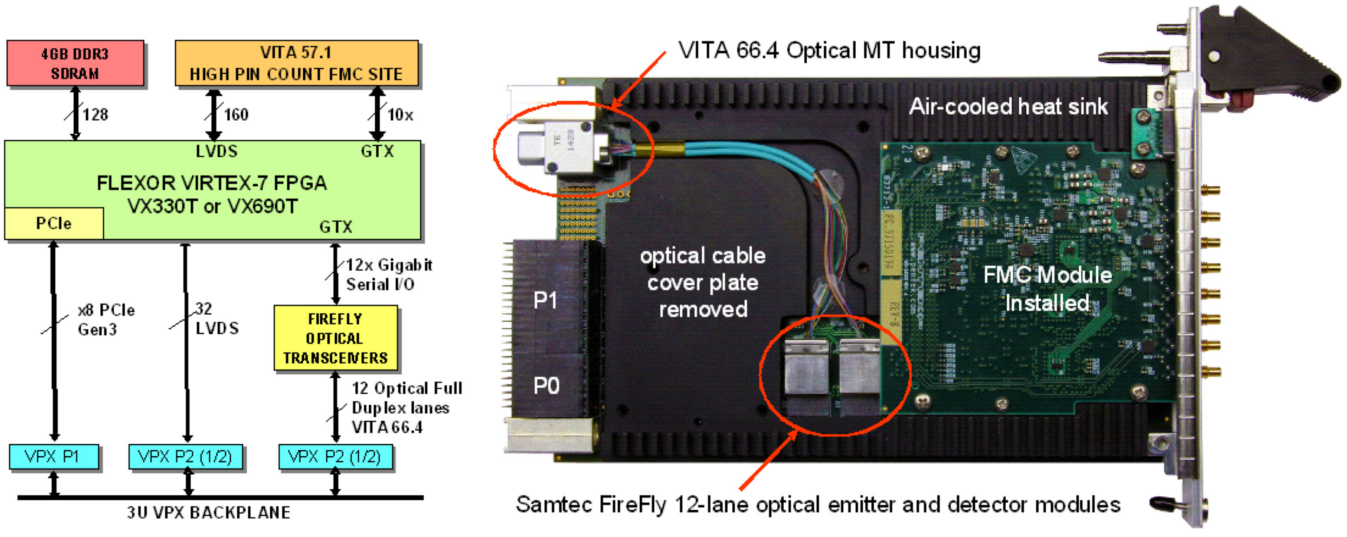


Figure 3. *Pentek's Flexor Model 5973 3U VPX Virtex-7 FMC carrier is the industry's first VITA 66.4 optical backplane product. Samtec FireFly optical transceivers deliver data rates up to 12 GB/sec full duplex to the backplane supporting a wide range of protocols implemented within the FPGA.*

Product Focus

Flexor 5973 & 7070

Pentek's Flexor Models 5973 and 7070 are FMC carriers that offer an optical interface. Model 5973 was introduced as industry's first FMC/VPX carrier with an optical backplane interface. Model 7070 is Pentek's FMC/PCIe carrier with an optical interface. Pentek uses Samtec's active optical Micro Fly-Over System, FireFly, as the optical backplane solution.

Model 5973 FMC/VPX Carrier

Pentek's Flexor Model 5973 features a high pin-count VITA 57.1 FMC site, 4 GB of DDR3 SDRAM, PCI Express (Gen. 1, 2 and 3) interface up to x8, optional user-configurable gigabit serial I/O, and optional LVDS connections to the FPGA for custom I/O.

Model 5973 delivers new levels of I/O performance by incorporating the emerging VITA 66.4 standard for half-size MT optical interconnect, providing 12 optical duplex lanes to the backplane. With the installation of a serial protocol, the VITA-66.4 interface enables gigabit backplane communications between boards independent of the PCIe interface.

"Pentek's innovative use of FireFly to create a flyover, optical backplane has also caused a ripple effect with other customer applications. As adoption increases in the HPC market, we expect to see it catching on with more customers in their servers and storage space. It's a truly robust solution for high data rate demands, and it's been exciting to see how some of our more cutting edge customers are designing it into their systems." - Adam Linderman, SI Product Manager for Samtec

Model 7070 FMC/PCIe Carrier

As a stand-alone signal processing board, Model 7070 provides an ideal development and deployment platform for demanding DSP applications. Combined with a Pentek FMC, it creates a complete radar and software radio solution.

Model 7070 features a high pin-count VITA 57.1 FMC site, 4 GB of DDR3 SDRAM, PCIe (Gen. 1, 2 and 3) interface up to x8, optional 12x user-configurable gigabit serial I/O, and optional LVDS connections to the FPGA for custom I/O.

Model 7070 delivers new levels of I/O performance through the built-in gigabit serial interface with optional optical transceivers, making 12 full duplex optical lanes available to an MTP connector. With the installation of a serial protocol in the FPGA, this interface enables a high bandwidth connection between 7070s mounted within the same chassis or over extended distances between chassis.

"Model 7070 has many useful capabilities," said Rodger Hosking, Vice President of Pentek. "The optical transceivers provide a direct pipeline to the FPGA for very high bandwidth links to remote sensors or systems. The powerful Virtex-7 handles the most challenging DSP tasks, and installing an FMC transforms the 7070 into a complete I/O subsystem."

Both of Pentek's Flexor FMC carriers work well with Pentek's FMC modules: Flexor Models 3312 and 3316. For more information on all these Flexor products, go to pentek.com/go/flexorinfo. ❐

Q&A with Pentek

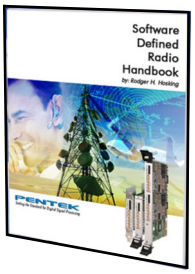
Q: How do I get help when I have a technical problem with a Pentek product?

A: Pentek offers FREE support to all our customers. The best way to contact support is to email support@pentek.com with some background information about your application and a description of the problem.

Q: I just received an email from YourPentek informing me that the software we are using has been upgraded. Do I need to upgrade? How do I get an upgrade?

A: There are many reasons we choose to upgrade the software. It could be to add functionality for a new board, to add support for an upgraded operating system, or to fix a bug in the software.

Typically, if you have a working application, it is probably not necessary to upgrade the software unless you need to accommodate a change in your system. If you are unsure, please contact our support staff at support@pentek.com and ask them to guide you.



Software Defined Radio Handbook

by Rodger H. Hosking

This handbook shows how DDCs and DUCs, the fundamental building blocks of SDR, can replace conventional analog receiver designs, offering significant benefits in performance, density and cost. Click here to download this FREE technical reference.

Product Focus

Talon RTR 2726A

Talon 200 MS/sec RF/IF Rugged Portable Recorder

Features

- Designed to operate under conditions of shock and vibration
- Portable system measures 16.0” W x 6.9” D x 13.0” H
- Lightweight, just less than 30 pounds
- Shock-and-vibration-resistant SSDs perform well in vehicles, ships, and aircraft
- 200 MHz 16-bit A/Ds
- 800 MHz 16-bit D/As
- 80 MHz record and playback signal bandwidths
- Records and plays back IF signals up to 700 MHz
- Up to 15.3 terabytes of SSD storage to NFTS RAID solid state disk array
- Real-time aggregate recording rates up to 3.2 GB/sec

TALON RTR RUGGED RECORDER

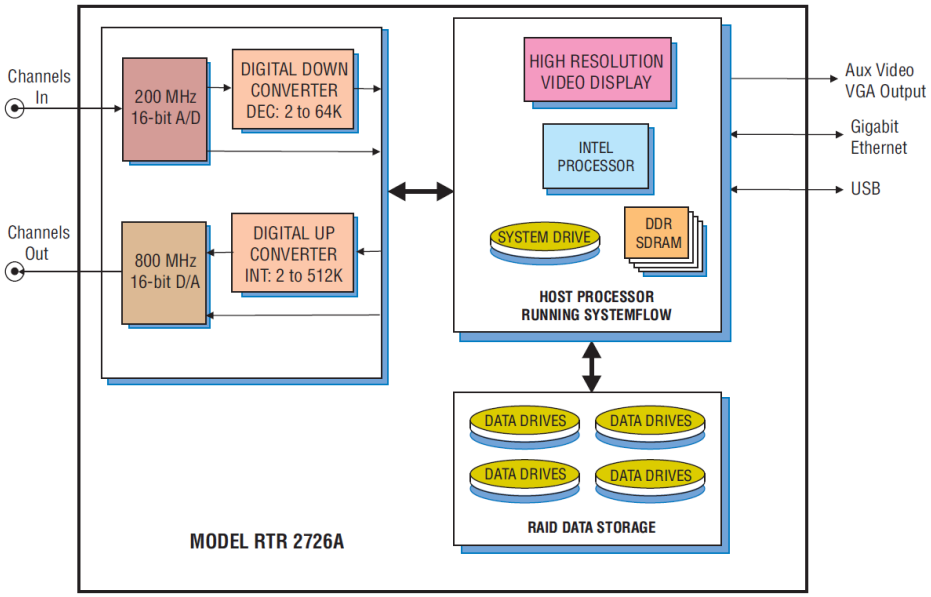
The new portable Talon® RTR 2726A implements a new packaging scheme that boasts a smaller, lighter chassis. Enhanced capability permits up to eight recording and playback channels configurable with the right combination for a specific mission or application. An optional DC power supply enables use in ground or airborne vehicles without inverters.

At the heart of the RTR 2726A are Pentek Cobalt® Series Virtex-6 software radio boards featuring A/D and D/A converters, DDCs (Digital Downconverters), DUCs (Digital Upconverters), and complementary FPGA IP cores. This architecture allows the system engineer to take full advantage of the latest technology in a turnkey system.

Application Examples

The RTR 2726A has many strategic uses in the intelligence and RF testing communities. The rugged packaging and small size makes it possible to quickly and easily deploy the recorder. The dynamic range of the recorder captures high-resolution signal details, making it an important signal analysis asset on any mission.

- Deployed in an aircraft, signals may be captured and analyzed during flight. Real-time analysis during active missions enables adjustments to be made to the mission plan to gather more appropriate intelligence.



- Adding the GPS time and position stamping option allows exact location information (longitude, latitude, and altitude) to be overlaid during mobile recording operations, permitting post-mission analysis to determine exactly where a signal was captured.

- Phase coherent multichannel acquisition and external date inputs are combined with sample-level time stamping to allow radar signals to be precisely recorded and perfectly reconstructed.

- Real world signals can be collected in harsh environments and then played back in lab environments for the test and development of new technology.

- Operating with the DC power option, recorders can be deployed in ground and air vehicles that may have only DC power, eliminating the weight and cost of power inverters.

For more information, go to:
pentek.com/go/pipe2726A ❐

Product Focus

Talon Value Series: RTV 2602 SFPDP System

In the last issue of Pipeline, we introduced a new rugged, portable Serial FPDP system. Now a Serial FPDP system is available in the Talon® Value Series of recorders: the Model RTV 2602 Serial FPDP recording and playback system. This new recorder extends the Talon Value Series of rackmount recorders that are optimized for laboratory operating environments.

The RTV 2602 supports up to four independently clocked Serial FPDP links using copper or optical cables with single-mode or multimode fibre with flexible baud rate selection to support virtually all popular Serial FPDP interfaces. It can both receive and transmit data over these links and supports real-time data storage to disk and playback from disk.

Up to four channels can be recorded or played back simultaneously, with an aggregate rate of up to 400 MB/ sec. Providing 4 TB of data storage, the six enterprise-class, hot-swappable front-panel drives can be easily replaced by empty drives when full.

"We offer the same high performance software package featured on all of our recorders," stated Chris Tojeira, Product Director of Recording Systems, "The RTV 2602 ships directly from stock, allowing us to satisfy customers with urgent requirements at a fraction of the cost of many alternative solutions."

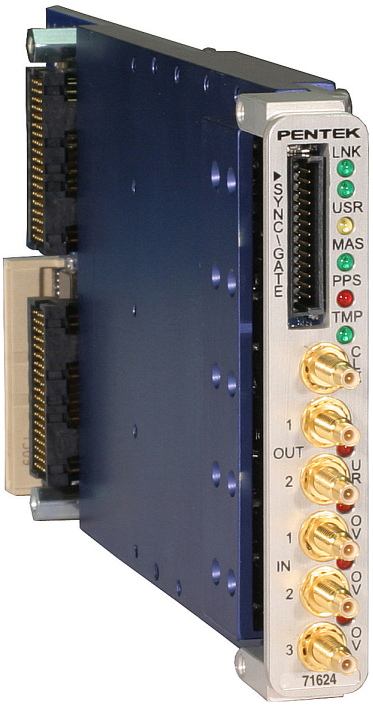
All Talon recorders are built on a Windows® 7 Professional workstation and include Pentek's SystemFlow® software, featuring a GUI (graphical user interface), signal viewer, and API (Application Programming Interface). The GUI provides intuitive controls for out-of-the-box turnkey operation using point-and-click configuration management.

Configurations are easily stored and recalled for single-click setup. User settings to configure data format for the signal viewer provide a virtual oscilloscope and spectrum analyzer to monitor signals before, during, and after data collection. The C-callable API allows users to integrate the recorder control into larger application systems.

For more information, go to: pentek.com/go/pipe2602 ❐

Free SystemFlow Demo

Pentek provides a **SystemFlow Simulator** for evaluating the SystemFlow software package. It demonstrates the configuration, record, playback, and status screens as well as the Signal Viewer.
Click here to download the Simulator.



Cobalt Model 71624: Dual Channel Adaptive IF Relay XMC

Pentek recently introduced the newest member of its Cobalt® line of XMCs (Switched Mezzanine Cards): the Model 71624 dual channel, 34 signal, adaptive IF (Intermediate Frequency) relay XMC with a Virtex-6 FPGA.

As an IF relay, Model 71624 accepts two IF analog input channels, modifies up to 34 signals, and then delivers them to two analog IF outputs. Any signal within each IF band can be independently enabled or disabled, and changed in both frequency and amplitude as it passes through the module.

Model 71624 supports many useful functions for both commercial and military communications systems including signal drop/add/replace, frequency shifting and hopping, amplitude equalization, and bandwidth consolidation. Targeted applications include signal monitoring, signal jamming, channel security, countermeasures, beamforming, and radar applications. ➢

Cobalt Model 71624: (continued)

Model 71624 features 34 digital down converters (DDCs), each independently tunable across a 100 MHz input IF range, handling signal bandwidths from 20 kHz up to 312 kHz. The DDCs deliver 34 baseband signals to the host computer, which determines how each signal is dropped, replaced, or changed in amplitude and frequency. The modified signals are then combined and delivered as an analog IF output.

"The flexibility of the Model 71624 allows each signal to be manipulated in its own way," said Rodger Hosking, Vice-President of Pentek. "Because the host computer is in the control loop, it supports adaptive applications such as signal scanning and tracking, as well as cognitive radio functions like jamming, denial of service, and other countermeasures," he added.

Adaptive Relay

Model 71624 comes preconfigured with a suite of time-tested Pentek IP functions for DDC, DUC, DMA transfers, and digital summation. Captured signals may be relayed with gain and frequency modifications directly through the module, or the host system may substitute a modified signal on any channel instead. Model 71624 features an on-board programmable sample clock synthesizer that is phase-lockable to an external frequency reference input. Multiple units can be synchronized for high channel count systems.

Form Factors

The Cobalt Model 71624 XMC is designed for commercial, rugged or conduction cooled operating environments. It is also available in several form factors, including 3U and 6U VPX (52624/53624 & 57624/58624), 3U and 6U cPCI (72624/73624/74624), AMC (56624) and PCIe (78624). For more information, go to: pentek.com/go/pipe71624 ❐

Product Focus

SPARK Model 8264

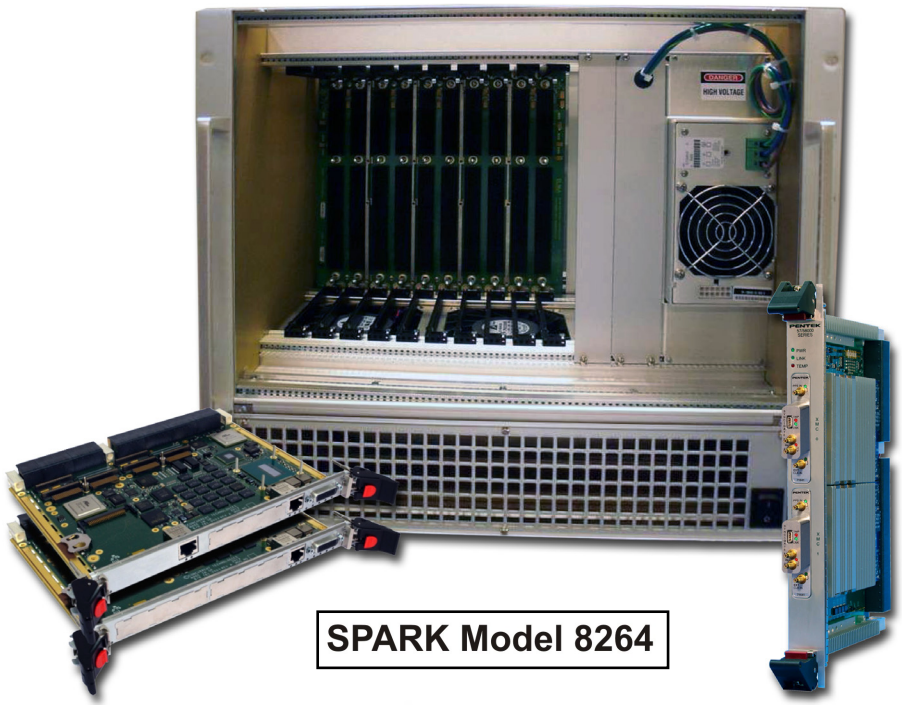
Features

- 9-slot, 6U 19-inch rackmount, 12-inch deep chassis that houses 6U VPX boards
- 64-bit Windows® 7 Professional or Linux® workstation
- 8 GB DDR3 SDRAM
- ReadyFlow® drivers and board support libraries installed
- Out-of-the-box, ready-to-run examples

The newest member of Pentek's SPARK™ development systems is now available: Model 8264. Model 8264 is a pre-configured 6U VPX system designed to speed application development for the expansive family of Pentek Cobalt® Virtex-6 and Onyx® Virtex-7 FPGA 6U VPX software radio and data acquisition I/O boards.

Model 8264 is delivered with customer selected Pentek hardware configured for either Windows 7 or Linux operating systems along with ReadyFlow BSP drivers and software examples, fully installed and tested. This pre-integrated system not only targets research and development in a lab environment, but also serves as a platform for deployed applications.

The Model 8264 extends the family of SPARK development systems that also includes the Model 8267 3U VPX and the Model 8266 PC development systems, giving customers a choice that meets their needs. In all configurations, the hardware is pre-installed in the appropriate slots and fully configured with proper cabling, power, and cooling strategies. The CPU board is configured with optimized BIOS and operating system settings.



SPARK Model 8264

SPARK Model 8264: (continued)

The customer can simply unpack the system, power up, and start developing or run example applications "right out of the box."

"The Model 8264 SPARK development platform slashes development time by weeks, because the development team can start coding immediately," stated Rodger Hosking, Vice President of Pentek. "The value of a pre-configured system with pre-compiled example code is priceless at the early development stage, where the learning curve can be quite steep."

Pentek works with customers to select from the extensive family of Cobalt and Onyx 6U VPX modules and then evaluates system requirements to configure the Model 8264 most appropriate for the final application. Engineering teams big and small alike can take advantage of Pentek expertise and SPARK to jumpstart a tight development schedule.

ReadyFlow Software

Pentek ReadyFlow drivers and board support libraries are pre-installed and tested. ReadyFlow includes example applications with full source code, a command line interface for immediate control over hardware without the need for compiling any code, and Pentek's Signal Analyzer, a full-featured analysis tool that continuously displays live signals in both time and frequency domains.

System Implementation

Built on a professional 6U rackmount workstation, the 8264 is equipped with the latest Intel® i7 processor, DDR3 SDRAM, and a high-performance single-board computer. These features accelerate application code development and provide unhindered access to the high-bandwidth data available with Cobalt and Onyx analog and digital interfaces. The 8264 can be configured with 64-bit Windows or Linux operating systems.

The 8264 uses a 19-inch 6U rackmount chassis that is 12 inches deep. Nine VPX slots provide ample space for an SBC, a switch card, and multiple Pentek boards. Enhanced forced-air ventilation assures adequate cooling for all boards and dual 500-W power supplies ensure more than adequate power for all installed boards.

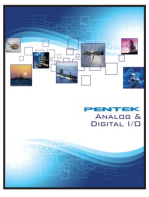
Front-panel access to USB, display, Ethernet and RS-232 ports simplifies development; an optional rear transition module supplements the front panel connections with SATA, audio, a second video interface, and additional USB ports.

Configuration

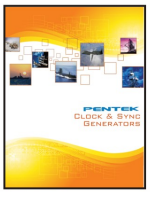
All 8264 systems come with software and hardware installed and tested. Up to seven Pentek boards in the 8264 can be supported. Please contact Pentek to configure a system that matches your specific requirements.

Available options include high-end multicore CPUs and extended memory support. For more information, go to: pentek.com/go/pipe8264 ❐

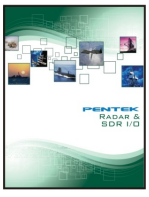
Downloadable Catalogs



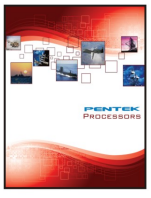
Analog & Digital I/O



Clock & Sync Generators

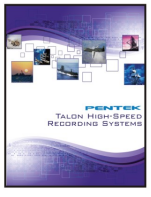


Radar & SDR I/O



Processors

Software & FPGA Tools



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