



Conduant High Speed Recording Technology

Overview

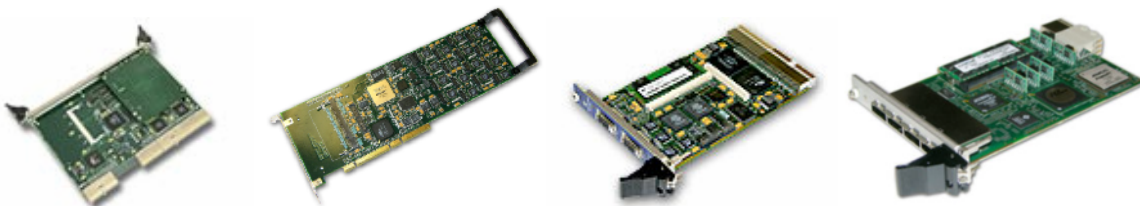
Introduction

This document is an introduction to the capabilities of Conduant Corporation's *StreamStor™* recording technology – the optimal high speed, high performance recording solution for imaging, simulation, radar, sonar or other critical data acquisition and playback applications. The purpose is to provide a framework to determine the suitability of this technology for your application.

StreamStor™ Technology

StreamStor™ is a storage controller architecture designed specifically to address real-time recording problems. It can utilize standard disk drives, notebook disk drives, rugged disk drives or various forms of solid state media to record real-time data streams to the storage media at high sustained data rates. The *StreamStor™* architecture is implemented as a completely independent system that does not rely on an outside computer or software for operation. An optimized hardware engine, on-board processor and real-time operating system eliminate any dependency on outside resources or interruptions that might cause data loss. The system can be embedded into an existing host computer, installed as a peripheral in a system or operate as a standalone device. This architecture provides reliable and sustained recording performance independent of host system workload.

StreamStor™ Products



Current *StreamStor™* products include PCI, CompactPCI and standalone recorder boards with data rates over 400 MB/s. All *StreamStor™* recorders can record directly from the PCI bus and several also have external data ports for direct data input.

The *StreamStor™* PXI-808 board is a versatile 3U CompactPCI or PXI product that has external cabling to the disk media. This product is capable of recording and playback at up to 200MB/s for over 4 hours. The compact design of this card can also be adapted to a PMC form factor for direct connection to single board computers in VME or other embedded environments.

The *StreamStor™* Amazon board is a full size PCI board that can record and playback to and from the PCI bus at 200 MB/s and can utilize daughter cards to implement external data ports with speeds over 400 MB/s. An sFPDP daughter card is currently available to provide a 64 bit, 66 MHz, DDR interface for data



recording or playback. Additional interfaces can be added to the base Amazon to provide serial, optical or other specialized interfaces.

The *StreamStor™ CPCI-816* is a 6U CompactPCI board with drive interfaces routed to the CompactPCI backplane. The drives can interface to the board through a rear IO board or can be integrated directly into the backplane. Conduant currently offers an 8U CompactPCI chassis with removable drives integrated directly to the backplane for this board. The CPCI-816 also has an optional daughter card with a Channel Link interface for data input/output at up to 200 MB/s. The Channel Link interface is an LVDS interface developed by National Semiconductor.

The *StreamStor™ PXIe-416* storage controller provides recording and playback capability for PXI Express and CompactPCI Express systems at 600MB/s. Quad eSATA 4X connectors allow connection to external storage such as the Conduant DM4 1U storage unit, external SATA drive chassis or up to 8 individual SATA disk drives. By providing an external connection for disk storage, the PXIe-416 allows high speed recording and playback applications to be designed around standard PXI Express chassis systems. Supporting capacities of up to 16TB (using 1TB disk drives), the PXIe-416 can provide hours of capacity for PXI Express recording or playback applications. The PXIe-416 is a 3U PXI Express (CompactPCI Express) card and can be installed in nearly any standard PXI Express or CompactPCI Express chassis (3U or 6U). The PXIe-416 supports advanced StreamStor functionality including circular recording (wrap mode) and direct recording from PCI Express sources.

Media Options

StreamStor™ products are designed around the ATA and SerialATA standards for interfacing to storage devices which provides some flexibility in choosing the storage media for different applications. These interfaces are widely used in the storage industry as the interface for magnetic disk drives in personal computers. In addition to the standard choice of a desktop style disk drive, these interfaces provide *StreamStor™* with the capability to interface with solid state and various rugged disk drives. Standard disk drives have limitations in altitude (air pressure), temperature, shock and vibration that preclude their use in many applications. In general the magnetic media options are much lower in cost than solid state alternatives, especially for the higher capacity options.

Magnetic Disk

Desktop Drives

Desktop disk drives (3.5") are generally available in capacities up to 750GB with ATA or SerialATA interfaces for compatibility with *StreamStor™* boards. The performance of these disk drives varies with model and the location but is generally from 30-65 MB/s. A few vendors utilize ramp load technology that removes the head from the disk in idle or power down situations. This provides some additional shock and vibration protection in non-operating conditions. These drives generally are designed to operate only in office environments and at altitudes below 10,000 feet.



Notebook Drives

Notebook disk drives (2.5") are designed for use in laptop computers and are therefore designed for slightly higher levels of shock and vibration than desktop disk drives. These drives are also designed to utilize a minimum amount of power and use only a single supply voltage. Capacities up to 160 GB are available with performance ranging from 15-40MB/s. These drives typically have the same temperature and altitude limitations of desktop disk drives.

Rugged Drives

Rugged disk drive products take a desktop or notebook drive and mount it in a special enclosure to provide high altitude, extended temperature and/or high shock and vibration capabilities. For high altitude applications (non-pressurized cabins) these drives are mounted in sealed enclosures so that the drive always operates in a higher pressure atmosphere. For temperature extreme conditions these enclosures can also include heaters to keep the environment at acceptable levels. Shock and vibration isolation can also be included using rubber or other type of isolators tuned to the particular environment.

Solid State

Solid state media utilizes non-volatile semiconductor based storage such as flash memory. Flash memory provides re-writable non-volatile storage but has a limited life span defined by the number of write cycles. Flash media also has performance limitations compared to magnetic disk drives. This type of media is generally best suited for extreme environmental conditions that cannot be accommodated with disk drives.

Compact Flash

Compact Flash is mass produced for consumer products such as digital cameras and portable music players. These cards have become very inexpensive and are available today in capacities up to 12GB per card. Compact flash has been tested with *StreamStor™* products since they utilize an older version of the ATA interface that is still backward compatible with *StreamStor™* products. Performance of over 8MB/s per card is attainable with these cards. Using 16 cards in parallel would provide over 100 MB/s recording and playback rate with a capacity of up to 192 GB.

SSD (Solid State Disk)

Various manufacturers produce Solid State Disk Drives for applications requiring faster speeds and higher capacities than that provided by Compact Flash products. In addition these products are also designed for more extreme environmental conditions. In general these devices utilize the same flash technology with a front-end controller that provides parallel reading/writing and write balancing to extend the life of the device. These drives are available as direct replacements for standard disk drives in capacities up to 128GB and performance approaching 50 MB/s. With appropriate selections these drives can utilize the full performance of the *StreamStor™* controllers.



Multi-drive modules



In order to provide higher bandwidth than a single storage drive can provide, *StreamStor™* utilizes multiple drive in parallel and spreads the data across all drives. In order to manage this collection of data the drives can be packaged into removable multi-disk modules for ease of movement between an airframe and a ground station. Conduant already provides removable modules to many customers in the TK200 chassis which provides 8 disk drives in a single removable module. Modules can be easily designed to an application specific requirement.

Recorder Configuration

There are several choices available for configuration of the recorder including Lab/Rack Mount configurations, a ruggedized CompactPCI version, a PMC version and a completely customized version of the recorder.

Lab/Rack Mount Configurations

Commercially available PCI Chassis' provide low cost solutions for high performance recording and playback. When paired with digital I/O boards, modular solutions can be delivered for a wide range of applications specifically tailored to record the signals appropriate for the application.



CompactPCI (PXI-808)

A CompactPCI version of the recorder allows the use of the hundreds of interface cards available for this bus. This provides an off-the-shelf capability to record data streams from nearly any interface on the mobile platform as required. The chassis of the recorder may require customization to achieve the desired physical footprint and to provide the level of ruggedness required.



PMC Variant

One possible configuration for the recorder is as a PMC (PCI Mezzanine Card) to allow direct installation onto an existing Single Board Computer (SBC). This allows direct integration into an existing VME or CompactPCI chassis. Depending on the media choice, the removable storage could be housed in an adjacent slot to the SBC or in a separate chassis with a removable media module.

Custom

The *StreamStor*[™] recording system is a complete standalone system with PowerPC processor and real-time OS. All of the data movement utilizes highly optimized hardware engines implemented in programmable logic devices. This architecture provides the flexibility to customize a *StreamStor*[™] recorder for specific application requirements. A complete custom system can be developed with a *StreamStor*[™] recording engine with all required external interfaces and removable media modules in the required space.



Integration

Multi-channel recording

Many recording applications require the aggregation of data streams from multiple sources. To address these applications, *StreamStor*[™] has multi-channel capability to provide the ability to record and manage multiple incoming data streams. Each data stream is independent of the others and can run at different data rates. Adding data streams does not impact the overall performance of the system as long as the aggregate rate does not exceed the rated performance of the recorder. Data can be retrieved from each data channel independently of the other streams.



Media Interchange

The availability of both solid state and rotating disk storage devices that are compatible with *StreamStor™* presents the opportunity to deliver a system with interchangeable media. Due to the tradeoffs in cost and performance it may be desirable to match the storage media used to the mission or experiment being performed. Solid state media should be considered for the most extreme environmental conditions and rotating disk for the less severe conditions.



Performance

StreamStor™ is optimized for sequential data recording. Real time data performance for various media options are shown below. Conduant continually qualifies media to maintain the broadest portfolio of media choices in the industry today.

Media Type	Write ID (MB/s)	Write OD (MB/s)	Read ID (MB/s)	Read OD (MB/s)	\$/GB (approx)	note
Compact Flash	13	13	13	13	\$ 52.00	(Pretec 4 GB)
Solid State Drives	38	38	47	47	\$ 300.00	(Adtron 12GB)
Notebook Hard Drive (2.5")	25	45	25	45	\$ 1.60	(Travelstar 80GB)
Desktop Hard Drive (3.5")	35	65	35	65	\$ 0.80	(WD 250 GB)

Multiple *StreamStor™* options are available. Each successive generation offers increase performance and value. Pricing for our latest Amazon product is less than \$30 per Megabyte Second.

