



StorFacts™ Report

SCSI Adapter Analysis

This StorFacts™ Report analyzes current IBM SCSI adapters. Features discussed include the following:

1. FC1912 / FC1974
2. FC5710 / FC5712 / FC5736



For more information – <http://www.gstinc.com/store/SCSI-C615.aspx>



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SCSI Overview

Introduction

SCSI celebrates its 20th anniversary with a bang by moving to the seventh generation of the bus that introduces a maximum data transfer at a staggering 320 MB/sec. Over the course of the past two decades the protocol has evolved from an 8-bit, single-ended interface transferring data at 5 MB/sec to a 16-bit, differential interface transferring data at 160 MB/sec. For the first time SCSI protocol has been revised to reduce the time spent on processing overhead, resulting in increased performance.

Up to 5 MB/Sec	Up to 10 MB/Sec	Up to 20 MB/Sec	Up to 40 MB/Sec	Up to 80 MB/Sec	Up to 160 MB/Sec	Up to 320 MB/Sec
				Ultra2 SCSI	Ultra3 or Ultra160 SCSI	Ultra320 SCSI
				Fast-40 SPI-2 LVD SCSI	Fast-80 SPI-3 LVD SCSI	Fast-160 SPI-4 LVD SCSI
SCSI-1	SCSI-2 SE	SCSI-3 SPI Fast & Wide SE	Fast-20 Ultra SCSI SE			
	SCSI-2 Fast Differential HVD SCSI	SCSI-3 SPI Fast & Wide Differential HVD SCSI	Fast-20 Ultra SCSI Differential HVD SCSI			
Narrow (8 bit data) bus only			Wide (16 bit data) and narrow (8 bit data) bus		Wide (16 bit data) bus only	



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SCSI

SCSI's commitment to backward compatibility and legacy support are the primary reasons for its durability as an I/O interface. Throughout SCSI's 20-year history, each successive generation of the standard has been backward compatible with each and every previous generation of SCSI. As a result SCSI is the industry standard for disk drive connection in virtually all high-performance servers.

New Features Speed Ultra320 SCSI

Ultra320 SCSI is the next step in the SCSI evolution. With the introduction of Ultra160 SCSI, three key technologies were introduced: Dual Edge Clocking, Domain Validation, and Cyclic Redundancy Check (CRC). Now Ultra320 SCSI introduces additional technologies that include for the first time, protocol changes that will reduce overhead and improve performance. These changes will allow data to transfer safely and reliably at 320 MB/sec.

Ultra320 SCSI includes the following key features:

- **Double Transfer Speed:** This doubles the transfer rate across the SCSI bus to a burst rate of 320 MB/sec allowing higher transfer rates across the SCSI bus and increasing the disk drive saturation point. This results in increased performance, especially in environments that use extended transfer lengths or have many devices on a single bus.
- **Packetized SCSI:** This includes support for packet protocol. Packetized devices decrease command overhead by transferring commands, data, and status using DT (dual transition) data phases instead of slower asynchronous phases. This improves performance by maximizing bus utilization and minimizing command overhead. Furthermore, packet protocol also enables multiple commands to be transferred in a single connection. In Ultra160 SCSI, data is transferred in synchronous phase at 160 MB/sec, while the command and status phases are still transferring at slower asynchronous phases and limited to a single transfer per connection.
- **Quick Arbitration and Selection (QAS):** This reduces the overhead of control release on the SCSI bus from one device to another. This improvement reduces command overhead and maximizes bus utilization.
- **Read and Write Data Streaming:** This minimizes the overhead of data transfer by allowing the target to send one data stream LUN Q-TAG (LQ) packet followed by multiple data packets. In a non-streaming transfer, there is one data LQ packet for each data packet. Write data streaming performance is also increased because the bus turn-around delay (from DT data in to DT data out) is not incurred between each LQ and data packet.
- **Flow Control:** This allows the initiator to optimize its pre-fetching of data during writes and flushing of data FIFOs during reads. The target will indicate when the last packet of a data stream will be transferred which will allow the initiator to terminate the data pre-fetch or begin flushing data FIFOs sooner than was previously possible.



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Ultra320 SCSI lines up with PCI-X

Faster I/O performance will saturate the PCI bus, therefore most host implementations are tied to PCI-X. Disk drive media rates continue to increase. Later this year the drive data rates are expected to exceed 40MB/sec. SCSI will need to jump past Ultra160 SCSI in order to support sustained throughput from the average number of drives in a server (four).

Under standard PCI the host bus has a maximum speed of 66 MHz. This allows for a maximum transfer rate of 533 MB/sec across a 64-bit PCI bus. With Ultra160 SCSI, two SCSI channels on a single device achieve a maximum transfer rate of 320 MB/sec leaving plenty of overhead before saturating the PCI bus. However, at 320 MB/sec, two SCSI channels can now achieve 640 MB/sec, which will saturate a 64-bit / 66MHz PCI bus. In addition to PCI-X doubling the performance of the host bus from 533 MB/sec to a maximum of 1066 MB/sec, there are protocol improvements so that efficiency of the bus is improved over PCI. Together PCI-X and Ultra320 SCSI provide the bandwidth necessary for today's applications.

Applications for Ultra320 SCSI

With the acceleration of microprocessor performance, bottlenecks in the I/O channel continue to be a cause for concern. SCSI continues as the workhorse technology that addresses this problem. With a transfer rate of 320 MB/sec, Ultra320 SCSI is the next step in the evolution. With PCI-X delivering bus rates up to 1066 MB/sec, high-performance SCSI I/O allows for greater speeds across the entire PC bus.

As computer systems increase in capability, new applications evolve to take advantage of the available power and features. For example, desktop publishing, scientific visualization, video and audio editing, digital broadcasting and other data-hungry applications continue to push the I/O bandwidth and require a more advanced interface to handle increased data transfer.

In addition to the increased speed of 320 MB/sec, the new technology that reduces overhead will benefit real transaction process applications such as data-mining, material requirements planning (MRP), and other database programs. Random access applications such as these can involve searching for data on many different disk drives on the server. Technology such as QAS will benefit these applications by reducing the overhead of control release from one device to another on the SCSI bus.

To keep up with the multiple data streams that today's processors can accept and generate, high-performance RAID arrays are required. These large disk farms with RAID configurations can also benefit from Ultra320 SCSI's high bandwidth. For example, high-end workstations have applications where they must merge several video and audio clips from different channels and disk drives. A high-performance RAID array can have between eight and fifteen disk drives attached to a single channel. Include a dual channel controller and the total array can be up to 30 disk drives, which makes SCSI a natural choice. Finally, Ultra320 SCSI's transfer rate of 640 MB/sec across both channels will insure that there is adequate bandwidth to provide maximum performance.



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Applications for Ultra320 SCSI

New streaming video and audio editing applications have taken advantage of the accelerated performance of I/O. Ultra320 SCSI will provide the bandwidth to manage tomorrow's increasingly rich collection of dynamic media. Media creators require performance that allows them to work faster and more efficiently. Ultra320 SCSI provides the speed, capacity, scalability and reliability that these I/O hungry applications require.

As demand for external storage in the SAN environments continues to grow, Ultra320 SCSI insures that the technology is there to allow integrators to take full advantage of their existing installed base and not effect the performance of Ultra320 SCSI. With SAN, customers have an extensive fabric connecting to several SCSI drive boxes throughout their company. Ultra320 SCSI maintains compatibility with existing low voltage differential (LVD) SCSI technology and allows customers to mix new and old technologies without interruption.

SCSI Continues to Protect your Investment

Companies continue to face the challenges of managing ever growing amounts of data and are turning to new emerging technologies that can boost performance while easily integrating into their existing computing infrastructure. SCSI technology continues to evolve to address these greater needs and allows customers to build on their existing infrastructure and protect their existing investment.

SCSI has always been designed to provide an upgrade path with low switching cost and Ultra320 SCSI continues that legacy. Ultra320 SCSI maintains the backward compatibility with previous versions of SCSI even with its new added features. For example, packetized SCSI is compatible with non-packetized parallel SCSI. As a result, packetized SCSI devices can reside on the same bus as non-packetized SCSI devices.

SCSI scalability has always been an advantage and Ultra320 SCSI is no exception. Ultra320 SCSI offers the scalability and performance that entry, mid- and high-range servers require. It allows up to 15 SCSI devices on a single channel with up to 30 across dual channels. As companies' needs expand SCSI enables them to add additional storage as needed. And because Ultra320 SCSI maintains compatibility with existing Ultra160 SCSI, Ultra2 SCSI, and Ultra Wide SCSI devices, companies can easily and inexpensively expand their infrastructure.



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Conclusions

SCSI enters its 20-year anniversary by ushering in a new technology. Ultra320 SCSI is sure to add to the existing legacy of past SCSI technologies. SCSI has come a long way from its original 5MB/sec transfer rate. At 320 MB/sec, Ultra320 SCSI is only the latest in SCSI evolution. As technology continues to move into the 21st century, the industry can continue to look forward to new and faster SCSI technology. Ultra640 is already in development.

With new technologies such as packetized SCSI, QAS, training and pre-comp, SCSI will continue to deliver performance safely and reliably for generations to come. As performance continues to grow, so will the applications that can take full advantage of greater I/O performance. PCI-X accelerates performance across the host bus to 1066 MB/sec and Ultra320 SCSI is there to take full advantage of this available bandwidth.

And as always, SCSI maintains its backward compatibility allowing customers to protect their investment while concurrently giving them the ability to grow as their needs increase. No other I/O technology can provide these advantages. SCSI continues to increase its performance, features, enhancements and market share. Ultra320 SCSI is the newest example of SCSI's continued commitment to providing the industry with the I/O bandwidth necessary for an increasing number of performance hungry applications. SCSI will continue to evolve and with Ultra640 SCSI already on the roadmap, it will be impossible to replace.





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1912

Dual Channel Ultra320 SCSI Adapter, 320MB/s

The PCI-X DDR Dual Channel Ultra320 SCSI Adapter (#1912) is a 64-bit 3.3 volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (max.top). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MB per second on systems that have internal backplanes that are capable of supporting Ultra320 speeds.

In order to achieve an Ultra320 SCSI bus data rate of up to 320 MB per second and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To fully utilize this 320 MB per second performance, all attaching devices should also be Ultra320 LVD devices. But, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device.

Two VHDCI 68-pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68-pin, (#2118) can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X DDR Dual Channel Ultra320 SCSI Adapter.

Two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales/web pages for verification of connectivity support with this adapter.

The PCI-X Dual Channel Ultra320 SCSI Adapter (#1912) is a native boot adapter with AIX 5.2L or later software in a supported pSeries or RS/6000 systems. The adapter also supports target mode.

Limitations:

- The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105.
- Even though the Dual Channel Ultra320 SCSI nonRAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBytes/s), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane.
- Attributes required: One available 3.3 volt PCI or PCI-X slot or PCI-X 2.0 DDR slot



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1974

Dual Channel Ultra320 SCSI Adapter, 320MB/s

The PCI-X Dual Channel Ultra320 SCSI Adapter (#1974) is a 64-bit 3.3 volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (max.), up to twice the maximum data transfer rate of the previous Dual Channel Ultra3 SCSI adapter (160 MBps). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MB per second on systems that have internal backplanes that are capable of supporting Ultra320 speeds.

In order to achieve an Ultra320 SCSI bus data rate of up to 320 MB per second and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To fully utilize this 320 MB per second performance, all attaching devices should also be Ultra320 LVD devices. But, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device.

Two industry standard VHDCI 68-pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68-pin, (#2118) can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X Dual Channel Ultra320 SCSI Adapter.

The two external ports provide connectivity to an IBM 2104-DS4 Expandable Storage Plus Drawer or 2104-TS4 Expandable Storage Plus Tower at up to 320 MB/s SCSI bus data rate. The two external ports also provide connectivity to an IBM 2104-DU3 Expandable Storage Plus Drawer or 2104-TU3 Expandable Storage Plus Tower at up to 160 MB/s SCSI bus data rate and to an IBM 2104-DL1 Expandable Storage Plus Drawer or 2104-TL1 Expandable Storage Plus Tower at up to 80 MB/s SCSI bus data rate. Also the two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales/web pages for verification of connectivity support with this adapter.

The PCI-X Dual Channel Ultra320 SCSI Adapter (#1974) is a native boot adapter with AIX 5.1 or AIX 5.2 software in a supported pSeries or RS/6000 system. The adapter also supports target mode.

FC1974, Continued

Limitations:

- The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105.
- Even though the Dual Channel Ultra320 SCSI RAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBytes/s), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane.
- Disk drives internal to the pSeries system shipped prior to September 1, 2003 require a disk drive microcode update to run at Ultra320 speed.

To obtain the appropriate microcode update, go to the following web page:

<http://techsupport.services.ibm.com/server/mdownload/>

- Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices
- Attributes required: One available 3.3 volt PCI or PCI-X slot





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5710

Dual Channel Ultra320 SCSI Adapter, 320MB/s

The PCI-X Dual Channel Ultra320 SCSI Blind Swap Adapter (#5710) is a 64-bit 3.3 volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Blind Swap Adapter provides two SCSI channels (busses), each capable of running 320 MBps (max.), up to twice the maximum data transfer rate of the previous Dual Channel Ultra3 SCSI adapter (160 MBps). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MB per second on systems that have internal backplanes that are capable of supporting Ultra320 speeds.

In order to achieve an Ultra320 SCSI bus data rate of up to 320 MB per second and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To fully utilize this 320 MB per second performance, all attaching devices should also be Ultra320 LVD devices. But, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device.

Two industry standard VHDCI 68-pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68-pin, (#2118) can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X Dual Channel Ultra320 SCSI Blind Swap Adapter.

The two external ports provide connectivity to an IBM 2104-DS4 Expandable Storage Plus Drawer or 2104-TS4 Expandable Storage Plus Tower at up to 320 MB/s SCSI bus data rate. The two external ports also provide connectivity to an IBM 2104-DU3 Expandable Storage Plus Drawer or 2104-TU3 Expandable Storage Plus Tower at up to 160 MB/s SCSI bus data rate and to an IBM 2104-DL1 Expandable Storage Plus Drawer or 2104-TL1 Expandable Storage Plus Tower at up to 80 MB/s SCSI bus data rate. Also the two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales/web pages for verification of connectivity support with this adapter.

The PCI-X Dual Channel Ultra320 SCSI Blind Swap Adapter (#5710) is a native boot adapter with AIX 5.1 or AIX 5.2 software in a supported pSeries or RS/6000 system. The adapter also supports target mode.



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FC5710, Continued

Limitations:

- The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105.
- Even though the Dual Channel Ultra320 SCSI RAID Blind Swap Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBytes/s), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane.
- Disk drives internal to the pSeries system shipped prior to September 1, 2003 require a disk drive microcode update to run at Ultra320 speed. To obtain the appropriate microcode update, go to the following web page URL:

<http://techsupport.services.ibm.com/server/mdownload/>

- Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices
- Attributes required: One available 3.3 volt PCI or PCI-X slot





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5712

Dual Channel Ultra320 SCSI Adapter, 320MB/s

The PCI-X Dual Channel Ultra320 SCSI Adapter (#5712) is a 64-bit 3.3 volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (max.), up to twice the maximum data transfer rate of the previous Dual Channel Ultra3 SCSI adapter (160 MBps). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MB per second on systems that have internal backplanes that are capable of supporting Ultra320 speeds.

In order to achieve an Ultra320 SCSI bus data rate of up to 320 MB per second and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To fully utilize this 320 MB per second performance, all attaching devices should also be Ultra320 LVD devices. But, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device.

Two industry standard VHDCI 68-pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68-pin, (#2118) can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X Dual Channel Ultra320 SCSI Adapter.

The two external ports provide connectivity to an IBM 2104-DS4 Expandable Storage Plus Drawer or 2104-TS4 Expandable Storage Plus Tower at up to 320 MB/s SCSI bus data rate. The two external ports also provide connectivity to an IBM 2104-DU3 Expandable Storage Plus Drawer or 2104-TU3 Expandable Storage Plus Tower at up to 160 MB/s SCSI bus data rate and to an IBM 2104-DL1 Expandable Storage Plus Drawer or 2104-TL1 Expandable Storage Plus Tower at up to 80 MB/s SCSI bus data rate. Also the two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales/web pages for verification of connectivity support with this adapter.

The PCI-X Dual Channel Ultra320 SCSI Adapter (#5712) is a native boot adapter with AIX 5.1 or AIX 5.2 software in a supported pSeries or RS/6000 system. The adapter also supports target mode.

FC5712, Continued

Limitations:

- The two external ports do not support the connection to the IBM 7131-105 IBM Multi-Storage Tower Model 105.
- Even though the Dual Channel Ultra320 SCSI RAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBytes/s), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane.
- Disk drives internal to the pSeries system shipped prior to September 1, 2003 require a disk drive microcode update to run at Ultra320 speed.

To obtain the appropriate microcode update, go to the following web page:

<http://techsupport.services.ibm.com/server/mdownload/>

- Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices
- Attributes required: One available 3.3 volt PCI or PCI-X slot





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5736

Dual Channel Ultra320 SCSI Adapter, 320MB/s

The PCI-X Dual Channel Ultra320 SCSI Adapter (#5736) is a 64-bit 3.3 volt adapter and is an excellent solution for high-performance SCSI applications. The PCI-X DDR Dual Channel Ultra320 SCSI Adapter provides two SCSI channels (busses), each capable of running 320 MBps (max.). Each SCSI bus can either be internal (on systems that support internal SCSI device or backplane attachments) or external. Internally attached Ultra320 devices are designed to run at a data rate of up to 320 MB per second on systems that have internal backplanes that are capable of supporting Ultra320 speeds.

In order to achieve an Ultra320 SCSI bus data rate of up to 320 MB per second and also maintain a reasonable drive distance, the adapter utilizes Low Voltage Differential (LVD) drivers and receivers. To fully utilize this 320 MB per second performance, all attaching devices should also be Ultra320 LVD devices. But, if Ultra2, Ultra3, or Ultra320 devices coexist on the same bus, each device will operate at its rated speed. For lower speed single-ended (SE) devices, the SCSI bus will switch to single-ended (SE) performance and interface to all devices on that SCSI bus at the lower SE bus data rate of the device.

Two VHDCI 68-pin connectors are mounted on the adapter's end bracket allowing attachment of various LVD and SE external subsystems. A .3 meter converter cable, VHDCI to P, Mini-68 pin to 68-pin, (#2118) can be used with older external SE devices or subsystems to allow connection to the VHDCI connector on the PCI-X DDR Dual Channel Ultra320 SCSI Adapter.

The two external ports provide connectivity to numerous other SCSI external subsystems. Check the external subsystem sales/web pages for verification of connectivity support with this adapter.

The PCI-X DDR Dual Channel Ultra320 SCSI Adapter (#5736) is a native boot adapter with AIX 5.3L or AIX 5.3D software in a supported pSeries or RS/6000 system. The adapter also supports target mode.

Limitations:

- Even though the Dual Channel Ultra320 SCSI nonRAID Adapter has ports that run at ultra320 SCSI speeds (up to 320 MBytes/s), the internally attached disk drives will run at a maximum SCSI bus data rate specified by that supporting system disk backplane.

FC5736, Continued

To obtain microcode updates go to the following Web page:

<http://techsupport.services.ibm.com/server/mdownload/>

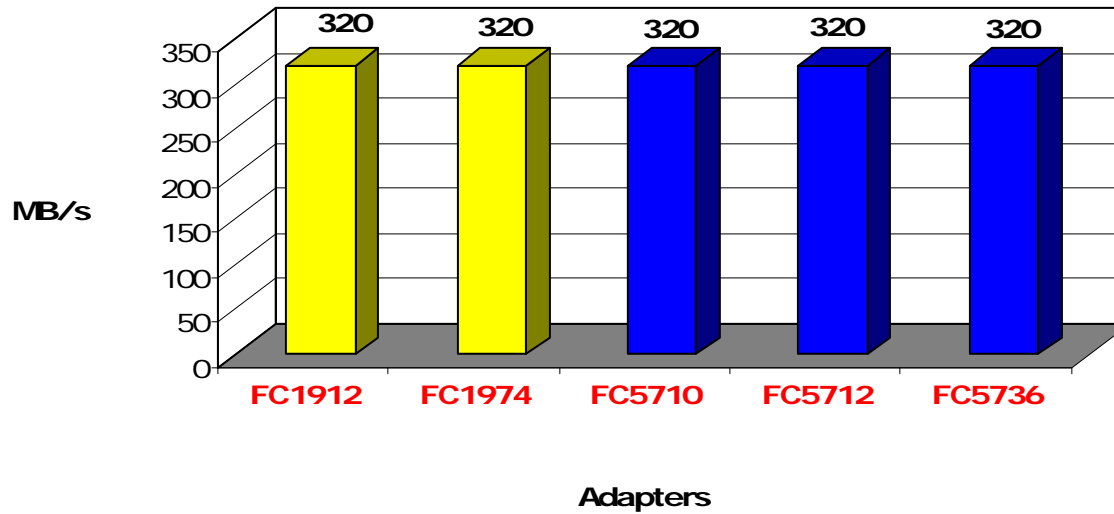
- Attributes provided: Attachment of internal SCSI devices (on systems that support an internal SCSI device or backplane attachment with this adapter) and external SCSI devices
- Attributes required: One available 3.3 volt PCI or PCI-X slot or PCI-X 2.0 DDR slot.





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SCSI Performance



Ultra320 SCSI is the next step in the evolution of the parallel SCSI protocol designed to address the continuing growth in the demand placed on storage connectivity bandwidth. It doubles the bandwidth of its predecessor - Ultra160 SCSI at 160 MByte/sec - to 320 MByte/sec by doubling the clock frequency from 40 MHz to 80 MHz while transferring data over a 16-bit bus on both the rising and falling edges of the clock. Furthermore, Ultra320 SCSI enhances the efficiency of information flow by incorporating the "Packetized SCSI" protocol. This reduces data transfer overhead by permitting multiple commands, status and associated data to be merged and transferred between an initiator and a target device in two bursts - one with commands and data for write operations from the initiator to the target, and the other in the reverse direction containing statuses and data derived from read operations.



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Maximum Disk > p5 Servers

p5 Servers	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
7037-A50	3	0.90	-	-	3	0.90
9115-505	2	0.60	-	-	2	0.60
9110-510	4	1.20	-	-	4	1.20
9110-51A	4	1.20	-	-	4	1.20
9111-520	8	2.40	48	14.40	56	16.80
9131-52A	8	2.40	48	14.40	56	16.80
9113-550	8	2.40	96	28.80	104	31.20
9133-55A	8	2.40	96	28.80	104	31.20
9116-561	12	3.60	-	-	12	3.60
9117-570	24	7.20	240	72.00	264	79.20
9118-575	2	0.60	16	4.80	18	5.40
9119-590	-	-	128	38.40	128	38.40
9119-595	-	-	192	57.60	192	57.60



StorFacts™ Report

Maximum Disk > pSeries Servers

pSeries	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
7026-B80 (640)	5	1.50	-	-	5	1.50
7028-6C1 (610)	6	1.80	-	-	6	1.80
7028-6C4 (630)	4	1.20	24	7.20	28	8.40
7028-6E1 (610)	6	1.80	-	-	6	1.80
7028-6E4 (630)	4	1.20	-	-	4	1.20
7029-6C3 (615)	8	2.40	-	-	8	2.40
7029-6E3 (615)	8	2.40	-	-	8	2.40
7038-6M2 (650)	4	1.20	96	28.80	100	30.00
7039-651 (655)	2	0.60	16	4.80	18	5.40
7040-671 (670)	-	-	48	14.40	48	14.40
7040-681 (690)	-	-	128	38.40	128	38.40



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Maximum Disk

OpenPower	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
9123-710	4	1.20	-	-	4	1.20
9124-720	8	2.40	96	28.80	104	31.20

IntelliStation	Max Disk > Base System		Max Disk > I/O Drawers		Max Disk > Combined	
	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's	Disk Bays	Capacity > TB's
7047-185	3	0.90	-	-	3	0.90
9111-285	4	1.20	-	-	4	1.20
9112-265	10	3.00	-	-	10	3.00
9114-275	4	1.20	-	-	4	1.20

I/O Drawer	Max Disk > I/O Drawers	
	Disk Bays	Capacity > TB's
2104-DS4	14	4.20
7031-D24	24	7.20
7040-61D	16	4.80
7311-D20	12	3.60
9119-5791	16	4.80
9119-5794	8	2.40