

### Overview

### Models

Hewlett Packard offers SCSI, Fibre Channel, Multi-Function Storage/LAN and RAID storage adapters for the HP 9000 and HP Integrity Servers.

The following table lists the HP mass storage adapters and supported servers.

#### Storage Adapter/Server Support

Product Number	Product Name	Integrity Servers						HP 9000 Servers					
		Super dome	rx 86x0	rx 76x0	rx 4640	rx 26x0	rx 16x0	Super dome	rp 8420	rp 7420	rp 4440	rp 34x0	rp 2400
<b>SCSI Adapters</b>													
A6829A	PCI Dual channel Ultra160 SCSI	H	H	H	H/V	H	H	H	H	H	H	H	H
A6828A	PCI Ultra160 SCSI	H	H	H	H	H	H	H	H	H	H	H	H
A5159B	PCI Dual-channel FWD SCSI	H							H	H			H
A7059A	Windows and Linux Ultra160 SCSI	W <sup>7</sup> L	W/L	W/L	W/L	W/L	L						
A7060A	Windows Linux 2 port Ultra160 SCSI	W <sup>7</sup> L	W/L	W/L	W/L	W/L	L						
A7173A	HP Dual Channel Ultra320 SCSI	H/W <sup>7</sup> /V/L	H/W/V/L	H/W/V/L	H/L/W/V	H/L/W/V	H/L/W <sup>5</sup> /V	H	H	H	H	H	H
<b>Fibre Channel Adapters</b>													
AB378A	HP PCI-X 2.0 1Port 4Gb Fibre Channel HBA	H/V <sup>12</sup>	H/V <sup>12</sup>	H/V <sup>12</sup>				H	H	H			
AB429A	HP PCI-X 1-port 4Gb Fibre Channel	W <sup>14</sup>	W <sup>14</sup>	W <sup>14</sup>									
AB379A	HP PCI-X 2.0 2-port 4-Gb Fibre Channel	H/L/W <sup>14</sup> v <sup>12</sup>	H/L/W <sup>14</sup> v <sup>12</sup>	H/L/W <sup>14</sup> v <sup>12</sup>				H/L	H/L	H/L			
A6826A	PCI-X Dual channel, 2 Gb Fibre Channel	H/L/V	H/L/V	H/L/V	H/L/V	H/L/V	H/L/V	H	H	H	H	H	H
A6795A	PCI 2-Gb Fibre Channel <sup>3</sup>	H	H	H	H	H		H	H	H	H	H	H
AB232A	2 Gb PCI-X FC for Windows, 64-bit	W	W	W	W	W							
A7298A	2 Gb Fibre Channel				W/L	W/L							
A7538A	PCI-X 1- port, 2 Gb FC (Linux only)		L	L	L	L	L						



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AB466A	PCI-X Dual Channel 2Gbps FC Adapter	W <sup>14</sup>	W	W	W	W	W <sup>8</sup>						
AB467A	PCI-X Single Channel 2Gbps FC Adapter	W <sup>14</sup>	W	W	W	W	W <sup>8</sup>						
AD167A	HP PCI-X 1-port 4Gb Fibre Channel	W <sup>14</sup>	W <sup>14</sup>	W <sup>14</sup>									
AD168A	HP PCI-X 2-port 4Gb Fibre Channel	W <sup>14</sup>	W <sup>14</sup>	W <sup>14</sup>									

Multi-Function Storage/LAN														
AB465A	PCI-X 2-port 2-Gb Fibre Channel / 2- port 1000Base-T	H/V <sup>11,13</sup>	H/V <sup>11,13</sup>	H/V <sup>11,13</sup>	H/V <sup>11</sup>	H/V <sup>11</sup>	H/V <sup>11</sup>	H	H	H	H	H		
AB290A	PCI-X 2-port 2 U320 SCSI / 2-port 1Gb Ethernet	H/V, <sup>13</sup>	H/V, <sup>13</sup>	H/V <sup>11,13</sup>	H/V <sup>11</sup>	H/V <sup>11</sup>	H/V <sup>11</sup>	H	H	H	H	H		
A9782A	PCI-X 2 Gb Fibre Channel/ 1000Base SX HBA	H/V <sup>11,13</sup>	H/V <sup>11,13</sup>	H/V <sup>11,13</sup>	H/V <sup>11</sup>	H/V <sup>11</sup>	V <sup>11</sup>	H	H	H	H	H		
A9784A	PCI-X 2-Gb Fibre Channel/1000Base- T HBA	H/V <sup>11,13</sup>	H/V <sup>11,13</sup>	H/V <sup>11,13</sup>	H/V <sup>11</sup>	H/V <sup>11</sup>	V <sup>11</sup>	H	H	H	H	H		
A5838A	PCI 2-port 100Base- T 2-Port Ultra2 SCSI	H <sup>1</sup>	H <sup>1</sup>	H <sup>1</sup>		H <sup>1</sup>		H	H	H	H	H	H	
RAID Controllers														
A7143A	PCI 4 channel RAID 160 SA SCSI										H	H	H	H
A9825A	Smart Array 5302 with 128 MB cache		W/L <sup>9</sup>			W/L								
A9826A	Smart Array 5304 with 256 MB cache		W/L <sup>9</sup>			W/L								
A9890A	PCI-X 2-channel SmartArray 6402 U320	W <sup>2</sup> /L	W <sup>2</sup> /L	H/W/L	H/W/V/L	W/H/V/L	H/L/ V/W			H <sup>3</sup>	H	H		
A9891A	PCI-X 4-channel SmartArray 6404 U320	W <sup>2</sup>	W <sup>27</sup>	H/W <sup>72</sup>		H/V	H/V/W						H	
337972- B21	PCI-X Smart Array P600 Serial Attached SCSI (SAS)	W <sup>2</sup>	W <sup>2</sup> /L	W <sup>2</sup> /L	W <sup>2</sup> /L	W <sup>2</sup> /L	W <sup>2</sup> /L							

Legend: H = HP UX / W = Windows Server 2003 (64 bit) / L = Linux (64 bit) / V = OpenVMS



### Overview

- <sup>1</sup> No Boot or Serviceguard support when used with Integrity Servers
- <sup>2</sup> For Windows environments, use with external storage only
- <sup>3</sup> A9890A not supported with rp7410 at this time
- <sup>4</sup> 3.3 volt slots only
- <sup>5</sup> For Windows, I/O Card is NOT supported on rx1600.
- <sup>6</sup> For Windows, I/O card is supported, but no longer orderable
- <sup>7</sup> For Windows, A9891A is NOT supported as a boot controller.
- <sup>8</sup> No boot support under Windows
- <sup>9</sup> For Windows, AB466A and AB467A are NOT supported on rx1600
- <sup>10</sup> For Windows environment boot support requires SP1 or later release
- <sup>11</sup> For OpenVMS, bootable over SCSI or Fibre Channel ports
- <sup>12</sup> Minimum OpenVMS version for support of the AB378A and AB379A is V8.3
- <sup>13</sup> Combo cards not supported on sx2000 systems at initial release of OpenVMS V8.3 (Superdome x2000, rx7640, rx864)
- <sup>14</sup> No boot support from factory, boot support capable in field; AB429A and AB379A not supported with sx1000 chipset.



### SCSI Adapters

		rp84x0: 16 cards rx8620: 16 cards HP9000 Superdome: 96 cards Integrity Superdome: 96 cards	HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v2	Yes Yes Yes Yes Yes
A6828A	PCI Ultra160 SCSI Adapter (EOL - and replaced with A7173A)	rp3440/rp3410: 4/2 cards rp4440: 6 cards rx26xx: 4 cards rx16xx: 1 card rx4640: 6 cards  rp7410/rp7420: 15 cards rx7620: 15 cards rp84x0: 16 cards rx8620: 16 cards HP9000 Superdome: 96 cards Integrity Superdome: 96 cards	HP-UX 11.0+ HP-UX 11.0+ HP UX 11i v1 HP UX 11i v1 HP-UX 11i v2 HP-UX 11i v2 HP-UX 11i v2 HP-UX 11.0+ HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v2	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
A5838A	PCI 2 port 100Base T/2 port Ultra2 LVD/SE SCSI Adapter (EOL - replaced with AB290A)	rp3440/rp3410: 3/1 cards rp4440: 6 cards rx26xx: 4 cards rx16xx: 1 card  rx7620: 15 cards rp84x0: 16 cards rx8620: 16 cards HP9000 Superdome: 96 cards Integrity Superdome: 96 cards	HP-UX 11.0+ HP-UX 11.0+ HP UX 11i v1 HP UX 11i v1 HP-UX 11i v2 HP-UX 11i v2 HP-UX 11.0+ HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v1 HP-UX 11i v2	Yes Yes Yes Yes No No Yes No Yes No Yes Yes No Yes No
A5159B	PCI Dual channel FWD SCSI Adapter (EOL - replaced with a 3rd Party Product (HPPHP program) from Rancho – Refer to the following website : <a href="http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,991,00.html">http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,991,00.html</a>	rp7400: 12 cards  rp84x0: 16 cards HP9000 Superdome: 96 cards	HP-UX 11.0+ HP-UX 11.0+ HP UX 11.0+ HP-UX 11.0+ HP-UX 11.0+ HP-UX 11i v1 HP-UX 11i v1	Yes Yes Yes Yes Yes Yes Yes
A7059A	Windows and Linux Ultra160 SCSI Adapter (EOL - and replaced with A7173A)	rx26xx(1 card) rx16xx rx26xx: 2 cards rx4640: 6 cards rx4640 : 2 cards	Linux Linux Windows Linux Windows	Yes Yes Yes Yes Yes

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		rx7620 (4 cards)	Windows/Linux	Yes
		rx8620 (8 cards)	Windows/Linux	Yes
		Integrity Superdome (16 cards)	Windows/Linux	Yes
A7060A	Windows Linux 2 port Ultra160 SCSI HBA (EOL - and replaced with A7173A)	rx26xx	Linux	Yes
		rx16xx	Linux	Yes
		rx26xx: 2 cards	Windows	Yes
		rx4640: 2 cards	Windows	Yes
		rx4640: 6 cards	Linux	Yes
		rx7620 (4 cards)	Windows/Linux	Yes
		rx8620 (8 cards)	Windows/Linux	Yes
		Integrity Superdome (16 cards)	Windows/Linux	Yes

### Comparing SCSI Interfaces

HP 9000 and Integrity server users may choose from a number of industry-standard SCSI I/O interfaces. The following table summarizes these interfaces.

**NOTE:** Although Fast/Wide/Differential SCSI and single-ended SCSI are both SCSI-2 compliant, SE devices may not be connected a to FWD SCSI bus.

### SCSI Capability Matrix

Characteristic	Single-Ended SCSI	Fast/Wide/Differential SCSI	Ultra2 LVD/SE SCSI	Ultra160 SCSI	Ultra320 SCSI
Other names bus is known by	<ul style="list-style-type: none"> <li>SE</li> <li>Standard SCSI</li> <li>SCSI</li> <li>SCSI 2</li> <li>SE SCSI</li> </ul>	<ul style="list-style-type: none"> <li>Differential Wide</li> <li>F/W SCSI</li> <li>Fast and Wide</li> <li>FWD - SCSI-2</li> <li>HVD</li> <li>High Voltage Differential SCSI</li> </ul>	<ul style="list-style-type: none"> <li>LVD</li> <li>Wide LVD</li> <li>Multi-mode LVD/SE</li> <li>Low Voltage Differential</li> </ul>	<ul style="list-style-type: none"> <li>Ultra3</li> <li>LVD</li> <li>Wide LVD</li> <li>Multi-mode LVD/SE</li> <li>Low Voltage Differential</li> </ul>	<ul style="list-style-type: none"> <li>Ultra4</li> <li>LVD</li> <li>Wide LVD</li> <li>Low Voltage Differential</li> </ul>
Compatibility with other SCSI bus types	No	No	Single Ended LVD	Ultra2, Ultra, LVD, Single Ended	Ultra160, Ultra2, Ultra, LVD
Maximum bus transfer rate	5 MB/s	20 MB/s	80 MB/s	160 MB/sec	320 MB/sec
Data bus width	8 bits	16 bits	16 bits	16 bits	16 bits
Number of connector pins	50	68	68	68	68
Maximum cable length	6 meters	25 meters	12 meters	12 meters	12 meters
Maximum connectivity	7 devices	15 devices	15 devices	15 devices	15 devices

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#### Fast/Wide/Differential SCSI-2 Interfaces

Hewlett Packard Fast/Wide/Differential (FWD) SCSI adapters feature 20 MB/s burst speed, and will support up to 15 FWD peripherals. For platform support see the SCSI Adapters, Maximum Cards, OS Support, Boot Support table on page 2.

#### Fast/Wide/Differential SCSI-2 Adapter Specifications

General Description	Product Number	General Specifications
PCI Dual port FWD SCSI 2 Adapter	A5159B (EOL - replaced with a 3rd Party Product (HPPH program) from Rancho – Refer to the following website : <a href="http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,991,00.html">http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,991,00.html</a> PCI Dual port FWD SCSI 2 Adapter	<ul style="list-style-type: none"> <li>• SCSI-2 compliant, 16 bit SCSI bus</li> <li>• 20 MB/s burst speed</li> <li>• Parity support</li> <li>• Maximum cable length is 25 meters</li> <li>• Connects up to 15 devices per adapter</li> </ul>

#### Restrictions and Limitations

1. Do not connect single ended SCSI-2 or Ultra2 LVD peripherals to FWD SCSI-2 interface cards. They are not compatible.
2. FWD SCSI 2 interface cards and single ended SCSI-2 cards may coexist in the same system.
3. FWD SCSI disks and FWD disk arrays may be mixed on the same card.

#### Fast/Wide/Differential SCSI-2 Description

The SCSI address of a device dictates the device's priority when arbitrating for the SCSI bus. SCSI address "7" is the address for the highest priority device (and is usually reserved for the host). Address '7' is followed in priority (from highest to lowest) by the subsequent addresses 6, 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8. Fast/Wide/Differential SCSI disk arrays and Fast/Wide/Differential SCSI disks can be mixed on the same card.

Under extreme I/O workload conditions, it is possible for lower-priority devices on a Fast/Wide/Differential bus to be "starved" for data throughput and time out. A retry will be automatic.

Similar to single ended (SE) SCSI, devices on the Fast/Wide/Differential SCSI bus are connected to each other in a "daisy chain." The first and last devices on the SCSI bus must provide proper termination on the bus. A terminator, which fits on a SCSI connector, is shipped with the adapter card and can be used to terminate the last device on the SCSI bus.

The Fast/Wide/Differential SCSI card is customer installable. The average installation time for the card is 15 minutes.

#### FWD SCSI Termination and Cabling

Both end points on a SCSI bus must be terminated. The adapter will supply termination to one end of the bus. The other end of the bus must be terminated as well. Use terminators to terminate the peripheral end of the SCSI bus. High-density FWD terminators are included with all the FWD adapters except the A5159B.

The A5159B is dual ported and has VHDCI connectors. Terminators are not included with the A515B since the final device in the SCSI chain may be HD or VHDCI. Thus the appropriate terminator should be ordered separately and utilized on the final device in

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the SCSI chain. Currently most FWD devices have HD connectors and in those cases a 68 pin HD HVD terminator should be ordered. That is C2905A: 68-pin HD High Voltage Differential Terminator.

The A5159B adapter has self-termination when no cable is attached to the connector. This means that when the card is installed, but no cable is attached, the card does self termination at the connector. Thus there is no need to add external terminators directly to the card connectors.

See the Service and User Guides with each card for information on how to disable the automatic self-termination for HA configurations utilizing V-cables and/or in-line terminated cables. On this subject, more information is forthcoming in this QuickSpec.

All other FWD cards do NOT have self-termination. When the card is installed in the system it needs to have terminators attached when not hooked to a properly terminated SCSI chain.

The Fast/Wide/Differential cards (A4800A, A5159B and A5159A) use high voltage differential transceivers that support cable distances up to 25 meters. When considering cable distances, however, all cable distances must be added, including cable from the host to the first storage device, cable consumed within the storage enclosure, and cable from storage device to storage device.

A Fast/Wide/Differential SCSI tower enclosure consumes 1.3 meters of Fast/Wide SCSI cable internally. A rackmount Fast/Wide/Differential SCSI storage enclosure consumes 1.75 meters. A Fast/Wide/Differential SCSI disk array consumes 0.7 meters of cable. Be sure to include these values in your calculations.

There are four types of Fast/Wide/Differential SCSI cables:

1. Standard male-male, 68-pin, high-density cable, which can be used to cable from the host adapter to the first peripheral and from peripheral to peripheral. These cables are available in 0.9-, 2.5-, 5-, and 10-meter lengths.
2. An extender cable that is also 68-pin high-density with one male and one female connector. This cable can be used to extend the cable from the adapter to a peripheral or to extend the peripheral to peripheral cable. Extender cable lengths available are 2, 5, and 10 meters.
3. V-cable, 68-pin, high-density, male/male/male.
4. V-cable, 68-pin, high-density, male male female. This cable is used with an extender to go host-to-host; use an external terminator on the last host.

The A5159B PCI Dual Port FWD SCSI Adapter uses Very High Density connectors (VHDCI). The cables needed for attaching to VHDCI on the adapter and high density (HD) on the peripheral are:

- C2361B-1.0-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable
- C2362B-2.5-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable
- C2365B-5.0-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable
- C2363B-10.0-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable
- C2375A-1.0-meter 68-pin VHDCI to 68-pin HD Multimode In-Line Termination SCSI Cable

The following table summarizes the high-density Fast/Wide/Differential SCSI cables that are available.

Fast/Wide/Differential SCSI Cables



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Product Number	Connectors	Purpose	Distance
Standard Cables			
C2911A	Male-male	Adapter to peripheral, peripheral to peripheral	0.9 meter
C2924A	Male-male	Adapter to peripheral, peripheral to peripheral	2.5 meter
C2925A	Male-male	Adapter to peripheral, peripheral to peripheral	10.0 meter
C2926A	Male-male	Adapter to peripheral, peripheral to peripheral	20.0 meter
Extender Cables			
5181-8690	Female-male	Extends standard or V-cable	2.0 meter
5181-8687	Female-male	Extends standard or V-cable	5.0 meter
5181-8685	Female-male	Extends standard or V-cable	10.0 meter

### Ultra320, Ultra160 and Ultra2/Wide/Low Voltage Differential SCSI-3 Interfaces

Hewlett Packard offers Ultra160 and Ultra2 Wide/Low Voltage Differential SCSI 3 adapters for PCI bus servers. These adapters feature 160 MB/s or 80 MB/s burst speed and will support up to 15 Ultra160, Ultra2 LVD or SE peripherals.

### Ultra2 Wide LVD/SE SCSI-3 Adapters and Specifications

	Product Number	General Description	Specification
Adapters	A7173A	HP Dual Channel Ultra320 SCSI Adapter	<ul style="list-style-type: none"> <li>• Standard PCI-X</li> <li>• 64-bit, 133 MHz</li> <li>• Compliant with PCI-X specification v1.0a</li> <li>• Compatible with 3.3V and 5V, 32-bit and 64-bit</li> </ul>
	A6829A (EOL, replaced with A7173A)	PCI Dual-channel Ultra160 SCSI Adapter	<ul style="list-style-type: none"> <li>• PCI universal adapter</li> <li>• SCSI 3 compliant</li> <li>• 16-bit SCSI bus</li> <li>• 160 MB/s synchronous</li> <li>• Parity support</li> </ul>
	A6828A (EOL, replaced with A7173A)	PCI Ultra160 SCSI Adapter	
	A5838A (EOL and replaced with AB290A)	PCI 2-port 100Base-T/2-port Ultra2 LVD/SE SCSI Combo Adapter	<ul style="list-style-type: none"> <li>• PCI universal adapter</li> <li>• SCSI-3 compliant</li> <li>• 16-bit SCSI bus</li> <li>• 80 MB/s synchronous</li> <li>• Parity support</li> </ul>

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Terminators	C2364A	High-density (HD) LVD/SE SCSI Terminator	Multimode HDTS68 LVD/SE
	C2370A	VHDCI LVD/SE SCSI Terminator	Multimode VHDCITS68 LVD/SE
Cables	C2361B	1.0-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable	LVD/SE
	C2362B	2.5-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable	LVD/SE
	C2365B	5.0-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable	LVD/SE
	C2363B	10.0-meter 68-pin VHDCI to 68-pin HD Multimode SCSI Cable	LVD only
	C2371A	1.0-meter VHDCI to VHDCI Multimode SCSI Cable	LVD/SE
	C2372A	2.0-meter VHDCI to VHDCI Multimode SCSI Cable	LVD/SE
	C2373A	10.0-meter VHDCI to VHDCI Multimode SCSI Cable	LVD only

#### Restrictions and Limitations:

1. Do not connect FWD SCSI-2 peripherals to Ultra2 interface cards. They are not compatible. However, Ultra2 interface cards and FWD SCSI-2 interface cards may coexist in the same system.
2. Maximum cable length is 12 meters. Connects up to 15 devices per adapter

The SCSI address of a device dictates the device's priority when arbitrating for the SCSI bus. SCSI address "7" is the address for the highest priority device (and is usually reserved for the host). Address '7' is followed in priority (from highest to lowest) by the subsequent addresses 6, 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9, and 8.

Under extreme I/O workload conditions, it is possible for lower priority devices on an Ultra2/Wide/Low Voltage Differential bus to be "starved" for data throughput and time out. A retry will be automatic.

Devices on the Ultra2 SCSI bus are connected to each other in a "daisy chain." The first and last devices on the SCSI bus must provide proper termination on the bus. A terminator, which fits on a SCSI connector, is shipped with the adapter card and can be used to terminate the last device on the SCSI bus.

#### Ultra2 LVD/SE SCSI Termination

The host adapter supplies termination power. Any or all of the devices on the bus may supply termination power. The first two devices that supply termination power should be located at each end of the SCSI bus. Other devices supplying termination power can be placed anywhere along the bus.

Both end points on a SCSI bus must be terminated. The adapter will supply termination to one end of the bus. The other end of the bus must be terminated as well. Use active terminators as described above to terminate the peripheral end of the SCSI bus. The terminators are not included with the adapter card and need to be purchased separately when needed. Sometimes terminators will come with the SCSI peripheral storage device.

All three of the Ultra2 LVD/SE SCSI adapters have self termination when no cable is attached to the connector. This means that when the card is installed, but no cable is attached, the card does self termination at the connector. Thus there is no need to add external terminators directly to the card connectors.

See the Service and User Guides with each card for information on how to disable the automatic self termination for HA configurations utilizing V-cables and/or in-line terminated cables. On this subject, more information is forthcoming in this guide.

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#### SCSI Usage Guidelines

- Power on all SCSI peripherals and make sure they have time to complete their self test before powering on the System Processor Unit (SPU).  
*NOTE: Some devices require termination power to pass the self test. These devices may fail self test if they are powered on before the host. If this occurs, the system will still boot up successfully and clear the error on the device.*
- Power on all SCSI peripherals that provide termination power first.
- Keep all devices powered on during and after system boot-up.
- Do not add or remove SCSI devices while the system or any SCSI peripheral providing term power is powered on.

#### Optimal Number of Disks per Interface Card

Disk I/O performance is governed by two factors:

1. The data throughput rate of the I/O channel and disks
2. The way the application(s) access data on the disks. The following information is meant to be used as guidelines rather than rules.

### Fibre Channel Products

Fibre Channel is an ANSI standard data transfer interface technology designed for high bandwidth, high performance interconnects between servers and storage devices, such as disk arrays and tape subsystems. Fibre Channel is becoming the choice for server to storage interconnect. FC is also becoming the technology of choice for SANs. Compared to SCSI, Fibre Channel offers much more flexibility in storage configurations. Fibre Channel gives you significantly greater distance between devices, greater number of total devices, and the ability to connect devices through hubs and switches. Hewlett Packard offers Fibre Channel Interface adapters and Fibre Channel to SCSI Multiplexer adapters for HP UNIX Enterprise servers and OpenVMS Integrity Servers.

FC hardware topologies include point-to-point, arbitrated loop (FC-AL) and switched (FC-SW). HP offers all three solutions for their servers. The three topologies involve very different levels of initial investment and deliver different combinations of availability, scalability, performance and manageability.

#### Fibre Channel Products Capabilities

Product Number	Product Name	Capabilities
AB378A	HP PCI-X 2.0 1-Port 4 Gb Fibre Channel HBA	PCI-X (64-bit, 266/133/66 MHz) with auto-negotiation for 4-Gb, 2-Gb or 1Gb transfer rates. Compatible with 3.3V slots
AB379A	HP PCI-X 2.0 2-port 4 Gb Fibre Channel HBA	PCI-X (64 bit, 266 /133 /66 MHz) with auto negotiation for 4 Gb, 2 Gb or 1 Gb transfer rates. Compatible with 3.3V slots
A6826A	PCI-X Dual Channel, 2 Gb Fibre Channel HBA	PCI-X (64 bit, 133 MHz) with auto-negotiation for 2 Gb or 1 Gb transfer rates. Offers full legacy support for 1 Gb Fibre Channel infrastructure and peripherals. Supports FC SW (Switched Fabric), FC AL (Arbitrated Loop), and direct connect in either 2 Gb or 1 Gb mode. For OpenVMS, supported in 8.2 and higher.
A6795A	PCI 2-Gb Fibre Channel Adapter	PCI 4x (64-bit, 66 MHz) with auto-negotiation for 2-Gb or 1-Gb transfer rates. Offers full legacy support for 1-Gb Fibre Channel infrastructure and peripherals. Supports FC-SW (Switched Fabric), FC-AL (Arbitrated Loop), and direct connect in either 2-Gb or 1-Gb mode.
A7538A	PCI-X 1-port, 2Gb FC (Linux only)	2 Gb Fibre Channel PCI-X for Linux with HP 64-bit server connectivity
A5158A (EOL)	PCI 2x Fibre Channel Adapter	PCI 2x adapter to connect peripherals employing FC-SW (Switched Fabric) FC-AL (Arbitrated Loop), and direct connect.
A6685A (EOL)	HSC Tachlite Fibre Channel Adapter	HSC adapter to connect peripherals employing FC-SW (Switched Fabric) FC-AL (Arbitrated Loop), and direct-connect for K-Class servers
A6684A (EOL)	HSC eff Tachlite Fibre Channel Adapter	HSC eff adapter to connect peripherals employing FC-SW (Switched Fabric) FC-AL (Arbitrated Loop), and direct connect for D- and R-Class servers.

### Fibre Channel Products

AB467A	PCI-X Single Channel 2Gbps Fibre Channel Adapter for Windows	HP StorageWorks 2Gb, Fibre Channel Host Bus Adapter is a single channel, 133 MHz, PCI-X to Fibre Channel Host Bus Adapter (HBA) with an embedded multi-mode optical interface for Integrity Server 64-bit connects.
AB466A	PCI-X Dual Channel 2Gbps Fibre Channel Adapter for Windows	HP StorageWorks 2Gb, Fibre Channel Host Bus Adapter is a dual channel, 133 MHz, PCI-X to Fibre Channel Host Bus Adapter (HBA) with an embedded multi-mode optical interface for Integrity Server 64-bit connects.

### Fibre Channel Connectors for Adapters and Cables

Product Number	Adapter Description	Adapter Connector Type
AB378A	HP PCI-X 2.0 1Port 4Gb Fibre Channel HBA	LC (SFF)
AB379A	HP PCI X 2.0 2 port 4 Gb Fibre Channel HBA	
A6826A	PCI-X Dual Channel, 2 Gb Fibre Channel HBA	Dual LC (SFF)
A6795A	PCI 2-Gb Fibre Channel Adapter	LC (SFF)
A5158A	PCI 2x Fibre Channel Adapter	SC (GBIC)
A6685A	HSC Tachlite Fibre Channel Adapter	SC (GBIC)
A6684A	HSC eff Tachlite Fibre Channel Adapter	SC (GBIC)
Product Number	Cable Description	Cable Connector Type
A3583A	FC Cable 2-meter SC Duplex 50/125 M/M Optical	SC/SC
A3531A	FC Cable 16-meter SC Duplex 50/125 M/M Optical	SC/SC
C7524A	FC Cable 2-meter LC Duplex 50/125 M/M Optical	LC/LC
C7525A	FC Cable 16-meter LC 50/125 LC/LC M/M Optical	LC/LC
C7526A	FC Cable 50-meter LC Duplex 50/125 M/M Optical	LC/LC
C7527A	FC Cable 200-meter LC Duplex 50/125 M/M Optical	LC/LC
C7529A	FC Cable 2-meter LC/SC Duplex 50/125 M/M Optical	LC/SC
C7530A	FC Cable 16-meter LC/SC Duplex 50/125 M/M Optical	LC/SC
C7534A	Fibre Channel SC F/F Extender Optical	LC/SC
C7540A	Fibre Channel Adapter Kit Optical (includes the C7529A and C7534A)	LC/SC

### Fibre Channel Products

#### Point-to-Point Connections Offer Simplicity and Flexibility

Simply connecting two nodes with a link automatically establishes a point-to-point connection. One of them will become port 1 and the other port 0 based on their relative Worldwide Names.

With Fibre Channel, even point-to-point topology, the simplest configuration, offers you significant advantages. For example, high availability can easily be achieved with a local server storage configuration cross-connected to a remote server storage configuration. Because of the extended distance support with Fibre Channel, the remote device could even be in another building.

#### Loops and Hubs for Connectivity

FC-AL (Fibre Channel Arbitrated Loop) is the low-cost FC alternative. FC-AL connects up to 127 nodes in a loop. Optional hubs are used to provide non disruptive pluggability by implementing a star configuration that acts as a logical loop. If the aggregate bandwidth requirement of the nodes on a loop is less than the bandwidth of the loop, then a loop-based connection scheme will likely satisfy performance needs as well as connectivity requirements.

High-availability server environments can use redundant hubs, host bus adapters (HBAs) and links to provide alternative paths for failover. For simple server and storage configurations, FC-AL will continue to offer the initial benefits of an FC host connection—flexible connectivity, distance, bandwidth and basic resource sharing—at an affordable cost. More advanced FC hub devices support FC loop connections while offering some of the benefits of switches. The arbitrated loop organizes up to 127 Fibre Channel ports on a ring, and distributes the routing functions among them. The arbitrated loop lets two ports communicate with one another in a full-bandwidth, full-duplex link (like the point-to-point example). However, unlike switches, hubs make all traffic in the configuration available to all devices.

The arbitrated loop is similar to a SCSI bus, but with several dramatic advantages, including many more nodes, much higher data rates, and a full-duplex link rather than a half-duplex connection. The arbitrated loop configuration is well-suited to a storage server and disk drives in JBODs (just a bunch of disks). It is significantly less expensive than a Fibre Channel switch, and from a system perspective, comparable to SCSI in cost.

While the primary advantage of the arbitrated loop is cost per port, it has several disadvantages when compared with switched topologies. These include limited connectivity and bandwidth, transit delay from serial links and the buffers in each repeater, time-consuming loop initialization (LIP) and arbitration protocols, and higher error rates because signals go through many more links. The hub also adds cost to a loop, but simplifies wiring and may enable the user to add management functions and deal more gracefully with failures and hot swap issues.

### Fibre Channel Products

#### Switches for Scalability, Performance and Availability

Fibre Channel Switched Fabric can interconnect up to 16 million nodes. Physical links can be 10 km or longer if they use single mode fiber, so a fabric may involve switches distributed over several buildings or over a metropolitan area. Switches are preferred when supporting large numbers of servers and storage connections. Switches provide scalability by enabling a Fibre Channel fabric to support hundreds or even thousands of server and storage nodes-well beyond the addressing capability of a single arbitrated loop or hub connection. Each storage node can attach directly to a switched fabric port; or multiple storage nodes can attach to a loop that also contains a fabric connection port. Fibre Channel switches provide higher performance-close to the full Fibre Channel data rate of 200 MB/sec-for each connection between input and output ports. A switch can improve performance by buffering the incoming data from each server, until the data can be passed on to the storage device. Finally, switches enhance availability. In a pure loop configuration, a host reset or device failure can cause a loop initialization that resets all the other devices on the loop; this interrupts the loop's availability to other servers and storage devices. A switch can prevent this kind of error propagation and can also enable rapid isolation and repair of hardware device failures.

### RAID Controller Cards

RAID (Redundant Array of Inexpensive Disks) provides high performance storage and full data redundancy in case of disk failure.

With the explosive growth of critical computing in both large and small businesses, there has been an ever increasing need to find better ways of storing and securing large amounts of data. Businesses demand a means of data storage and failure protection that ensures continuance in the event of a failure that would otherwise cripple their mission critical applications. The basic idea of RAID is to combine multiple small, inexpensive disks into an array that appears as a single logical storage unit or drive. The data is distributed across the disks in order to provide a method for data recovery or reconstruction in the event of a drive failure.

Please see the SCSI section in this QuickSpec for detailed information on understanding SCSI technologies including Ultra2 LVD/SE. The table below summarizes the specifications of current RAID controller cards.

Product Number	A7143A (EOL)	A9890A	A9891A
Description	PCI 4 channel RAID 160 SA SCSI Controller	PCI-X 2-channel Smart Array 6402	PCI-X 4-channel Smart Array 6404
PCI			
	<ul style="list-style-type: none"> <li>• PCI 2.2 compliant</li> <li>• PCI bus speed 64 bit, 66MHz</li> </ul>	<ul style="list-style-type: none"> <li>• PCI-X 1.0a compliant</li> <li>• PCI bus speed 64 bit, 66MHz</li> </ul>	<ul style="list-style-type: none"> <li>• PCI-X 1.0a compliant and 3.3V PCI compatible</li> <li>• PCI bus speed 64 bit, 66MHz</li> </ul>
Server Support			
HP-UX <ul style="list-style-type: none"> <li>• HP-UX 11i v1</li> <li>• HP-UX 11i v2</li> </ul>	<ul style="list-style-type: none"> <li>• rp7420-16 (v1)</li> <li>• rp7410-8 (v1)</li> <li>• rp7400 (v1)</li> <li>• rp4440-8 (v1)</li> <li>• rp3440-4 (v1)</li> <li>• rp3410-2 (v1)</li> <li>• rp5400 series (v1)</li> <li>• rp2400 series (v1)</li> </ul>	<ul style="list-style-type: none"> <li>• rp7420-16 (v1)</li> <li>• rp4440-8 (v1)</li> <li>• rp3440-4 (v1)</li> <li>• rp3410-2 (v1)</li> <li>• rx7620 (v2)</li> <li>• rx5670 (v2)</li> <li>• rx4640 (v2)*</li> <li>• rx2600 (v2)*</li> <li>• rx1600 (v2)*</li> </ul>	<ul style="list-style-type: none"> <li>• rp3440-4</li> <li>• rp3410-2</li> <li>• rx7620</li> <li>• rx5670</li> <li>• rx2600</li> <li>• rx1600</li> </ul>
Windows Server 2003 <ul style="list-style-type: none"> <li>• Datacenter Edition (DC)</li> <li>• Enterprise Edition (EE)</li> </ul>	Not Applicable	<ul style="list-style-type: none"> <li>• Superdome (DC)</li> <li>• rx8620 (DC/EE)2</li> <li>• rx7620 (DC/EE)4</li> <li>• rx4640(EE)4</li> <li>• rx2620 (EE)</li> <li>• rx1620(EE)</li> </ul>	<ul style="list-style-type: none"> <li>• rx8620(DC/EE)2,</li> <li>• rx7620(DC/EE)</li> <li>• rx2620(EE)</li> <li>• rx1620(EE)</li> </ul>
Linux <ul style="list-style-type: none"> <li>• Red Hat EL AS 2.1</li> <li>• Red Hat EL 3</li> <li>• SLES 8</li> <li>• SLES 9</li> </ul>	Not Applicable	<ul style="list-style-type: none"> <li>• rx1600*</li> <li>• rx1620 (1)</li> <li>• rx2600</li> <li>• rx2620(1)</li> <li>• rx4640 (3)</li> <li>• rx7620(1)</li> <li>• rx8620(1)(2)</li> <li>• Superdome(1)</li> </ul>	Not Applicable



### RAID Controller Cards

OpenVMS <ul style="list-style-type: none"> <li>OpenVMS V8.2 1 (or higher)</li> </ul>	Not Applicable	<ul style="list-style-type: none"> <li>rx1620 (max 1)</li> <li>rx2620 (max 2)</li> <li>rx4640 (max 2)</li> </ul>	<ul style="list-style-type: none"> <li>rx1620 (max 1)</li> <li>rx2620 (max 1)</li> </ul>
Integrity / HP 9000 Operating Systems Support			
	<ul style="list-style-type: none"> <li>HP-UX 11i v1</li> <li>PCI 4 channel RAID</li> <li>160 SA SCSI Controller</li> </ul>	<ul style="list-style-type: none"> <li>HP-UX 11i v1</li> <li>HP-UX 11i v2</li> <li>Windows Server 2003 Datacenter</li> <li>Windows Server 2003 Enterprise Edition</li> <li>Red Hat EL AS 2.1</li> <li>Red Hat EL 3</li> <li>SLES 8</li> <li>PCI X 2 channel</li> <li>Smart Array 6402</li> </ul>	<ul style="list-style-type: none"> <li>HP-UX 11i v2</li> <li>Windows Server 2003 Datacenter</li> <li>Windows Server 2003 Enterprise Edition</li> <li>PCI X 4 channel</li> <li>Smart Array 6404</li> </ul>
JBOD Support			
	<ul style="list-style-type: none"> <li>MSA30 DB (dual bus)</li> <li>MSA30 SB (single bus)</li> <li>Storage Works Enclosure 4300 Family</li> </ul>	<ul style="list-style-type: none"> <li>MSA30 DB (dual bus)</li> <li>MSA30 SB (single bus)</li> <li>Storage Works Enclosure 4300 Family</li> </ul>	<ul style="list-style-type: none"> <li>MSA30 DB (dual bus)</li> <li>MSA30 SB (single bus)</li> <li>Storage Works Enclosure 4300 Family</li> </ul>
SCSI Support			
Ultra 320	Yes	Yes	Yes
Ultra 160	Yes	Yes	Yes
Ultra 2	Yes	Yes	Yes
Ultra SCSI	Yes	Yes	Yes
Low Voltage Differential (LVD) Signaling	Yes	Yes	Yes
Single Ended (SE) Signalling	Yes	Not Supported	Not Supported
SCSI Channels	4 Ultra 160	2 Ultra 320	4 Ultra 320
External SCSI Ports	4 (VHDCI)	2 (VHDCI)	4 (VHDCI)
InternalSCSIPorts	2 (HD 68) (2)	2 ( HD 68)	2 ( HD 68)
Raid Levels			
		<ul style="list-style-type: none"> <li>ADG (Advanced Data Guarding)</li> <li>RAID 5</li> <li>RAID 1+0</li> <li>RAID 1</li> <li>RAID 0</li> </ul>	

### RAID Controller Cards

Maximum Capacity			
	<ul style="list-style-type: none"> <li>8.2 TB (56 drives x 146.8 GB)</li> </ul>	<ul style="list-style-type: none"> <li>4.1 TB (28 drives x 146.8 GB)</li> </ul>	<ul style="list-style-type: none"> <li>2 channel mode : 4 TB (28 drives x 146 GB)</li> <li>4 channel mode : 8 TB (56 drives x 146 GB)</li> </ul>
Cache Memory			
	<ul style="list-style-type: none"> <li>256 MB write cache memory</li> <li>ECC protection, battery-backed</li> </ul>	<ul style="list-style-type: none"> <li>128 MB write cache memory</li> <li>ECC protection, battery-backed</li> </ul>	<ul style="list-style-type: none"> <li>128 or 256 MB read / write cache memory</li> <li>ECC protection, battery-backed &amp; removable</li> </ul>
Drives Supported			
	<ul style="list-style-type: none"> <li>Up to 56 physical drives</li> <li>Up to 32 logical drives</li> <li>Up to 2 TB per logical drive</li> </ul>	<ul style="list-style-type: none"> <li>Up to 28 physical drives</li> <li>Up to 32 logical drives</li> <li>Up to 2 TB per logical drive</li> </ul>	<ul style="list-style-type: none"> <li>Up to 56 physical drives</li> <li>Up to 32 logical drives</li> <li>Up to 2 TB per logical drive</li> </ul>

\*NOTE: Includes RAID support to server's internal hard drives

Note 1 - RHEL 3 and SLES 9 only

Note 2 - connection to external storage only for rx8620

Note 3 - connection to external storage only for "original" rx4640

Note 4 -- For Windows, A9891A is NOT supported as a boot controller

### Online Addition and Replacement (OLAR) Support

Online Addition and Replacement of PCI HBAs is available on HP-UX 11i on HP Server rp5400 Series, HP Server rp7400 Series, HP Server rp8400, and Superdome platforms. This feature enables the addition and replacement of a failed HBA without having to reboot the system.

#### OLAR Support

Product Number	Product Name	OLR	OLA
SCSI			
A6829A	PCI Dual-channel Ultra160 SCSI Adapter	Yes	Yes
A6828A	PCI Ultra160 SCSI Adapter	Yes	Yes
A5149A-60001	Single-port Ultra2 SCSI HBA (PCI Bus)	Yes <sup>3</sup>	Yes <sup>2</sup>
A5149A-60101	Single-port Ultra2 SCSI HBA (PCI Bus)	Yes	Yes <sup>2</sup>
A5150A-60001	Dual-port Ultra2 SCSI (PCI Bus) Adapter	Yes	Yes <sup>2</sup>
A5150A-60101	Dual-port Ultra2 SCSI (PCI Bus) Adapter	Yes <sup>1</sup>	No
A5159A	Dual-port FWD SCSI (PCI Bus) Adapter	Yes	Yes <sup>2</sup>
Fibre Channel			
A6826A	PCI X Dual channel, 2 Gb Fibre Channel HBA	Yes	Yes
A6795A	PCI 2-Gb Fibre Channel Adapter	Yes	Yes
A5158A	PCI 2X Fibre Channel Adapter	Yes	Yes
Combination LAN/Storage			
A9782A	PCI X 2 Gb Fibre Channel/1000Base SX HBA	Yes	Yes
A5838A	PCI 2-port 100Base-T 2-port Ultra2 SCSI	Yes	Yes
RAID			
A7143A	PCI 4 channel RAID160 SA SCSI Controller	Yes	Yes
A5856A	RAID 4si, PCI 4-port Ultra2 SCSI RAID	Yes <sup>4</sup>	Yes <sup>4</sup>

<sup>1</sup> Only if the replaced HBA was running with auto-termination enabled.

<sup>2</sup> When PDC setting on the corresponding PCI slot has a usable initiator ID setting. The speed will be set to the current PDC value (if any) or be defaulted to the new HBA's value.

<sup>3</sup> Refer to the HBA documentation for details.

<sup>4</sup> Requires driver B.11.11.01 or later.

### I/O Considerations when Upgrading from PA-RISC to IPF HP-UX 11i v2

Product Number	Product Name	Notes
Supported-The following I/O adapters are supported on HP-UX 11i v2		
A3739B	FDDI Universal PCI Adapter	
A4926A	1000Base-SX PCI LAN Adapter	
A4929A	1000Base-T PCI Gigabit Ethernet LAN Adapter	
A5230A	PCI 10/100Base-T LAN Adapter	
A5506B	PCI 4-port 100Base TX LAN Adapter	
A5513A	PCI ATM 155 Mbps MMF Adapter	
A5783A	PCI Token Ring 4/16/100 Hardware Adapter	
A6386A	PCI HyperFabric2 fiber adapter	
A6748A	PCI 8-port serial MUX adapter	
A6749A	PCI 64-port serial MUX adapter	
A6795A	PCI 2-Gb Fibre Channel Adapter	
A6828A	PCI Ultra160 SCSI Adapter	
A6829A	PCI Dual-channel Ultra160 SCSI Adapter	
A6825A	PCI 1000Base-T Gigabit Ethernet Adapter	
A6847A	PCI 1000Base-SX Gigabit Ethernet Adapter	
J3525A	Dual-port PSI Adapter	Support on rx5670 requires adapter with EDC B-4306 or later
Z7340A	8-channel ACC for HP PCI Server Systems	

Limited Support-The following I/O adapters are supported on HP-UX 11i v2 with limited functionality		
A5149A	Single-port Ultra 2 SCSI HBA (PCI Bus)	No boot or Serviceguard support Product no longer orderable Product will not be supported with HP-UX 11i v3 Recommended replacement Product: A6828A
A5150A	Dual-port Ultra 2 SCSI (PCI Bus) Adapter	No boot or Serviceguard support No Superdome support Product no longer orderable Product will not be supported with HP-UX 11i v3 Recommended replacement Product: A6829A
A5158A	PCI 2X Fibre Channel Adapter	No boot support Product support scheduled for March '04 (no boot) Product no longer orderable Recommended replacement Product: A6795A
A5838A	PCI 2-port 100Base-T 2-port Ultra2 SCSI	No boot or Serviceguard support Product will not be supported with HP-UX 11i v3

### I/O Considerations when Upgrading from PA-RISC to IPF HP-UX 11i v2

Not Supported-The following I/O adapters are not supported on HP-UX 11i v2		
A3738A	10 100Base-T LAN Adapter	Replacement: A5230A
A3739A	PCI FDDI Dual LAN Adapter	Replacement: A3739B
A3740A	PCI Fibre Channel Adapter	Replacement: A6795A
A4800A	PCI FWD SCSI-2 Card for HP 9000 Servers	
A4919A	PCI HyperFabric 1X Adapter Card	Replacement: A6386A
A4930A	PCI Token Ring LAN Adapter	Replacement: A5783A
A5159A	Dual-port FWD SCSI (PCI Bus) Adapter	
A5159B	PCI Dual-channel FWD SCSI Adapter	
A5172A	PCI 100Base-FX LAN Adapter	
A5483A	PCI ATM 622 Mbps MMF Adapter	Replacement: A5513A
A5486A	HP SpeedCard (PCI)	
A5515A	PCI ATM 155 Mbps UTP5 Adapter	Replacement: A5513A
A5801A	HP PCI Serial HIPPI 800 Adapter	
A5856A	RAID 4Si PCI 4-port Ultra2 SCSI RAID	Replacement: A7143A-see A7143A requirements
A6092A	PCI HyperFabric 4X adapter card	Replacement: A6386A
A6150A	PCI 2D Graphics and 2-port USB Adapters	
A6150B	PCI 2D Graphics and 2-port USB Adapters	
A6792A	PCI 10/100Base-T LAN Adapter	Replacement: A5230A
J3526A	High-performance 4 port PCI Synchronous Adapter	Replacement: J3525A
J3557A	ATM 155 Mbps PCI Adapter for V-Class	
J3592A	8-port PCI Serial MUX card	Replacement: A6748A
J3593A	PCI 64-port Serial MUX system card	Replacement: A6749A

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