Subchapter 4.7—Disk Arrays

4.7.1—HP Surestore Disk Array 12H
(Previously named HP Disk Array with AutoRAID Model 12H.)

Description

The Disk Array 12H is an AutoRAID technology storage solution. It is the same product as the previously named HP Disk Array with AutoRAID Model 12H. It is a high-performance, self-configuring fault-tolerant storage solution. The Surestore Disk Array 12H with FC MUX is highly scalable (>20TB), offers excellent OLTP performance (>10K IOPs), and offers high flexibility (modularity and >10.0 km campus-wide support).

The array eliminates the requirement for the system administrator to understand RAID levels. It dynamically adapts to the system's workload, optimizing performance and cost. Users will find configuration significantly easier than other array products, since no RAID levels need to be selected. Fibre Channel connectivity to the host is now available on the Surestore Disk Array 12H via support of the FC-SCSI Multiplexer (A3308A, A3511A/AZ). This new functionality allows superior scalability of both performance and capacity to AutoRAID arrays.

Note: The Surestore Disk Array 12H with FC MUX designation in this section is a reference to the supported configuration of FC-SCSI Multiplexer and the Disk Array 12H (with AutoRAID technology). It is not a reference to a bundled product on the CPL.

To get more information on the Surestore Disk Array 12H with FC MUX, refer to the Design Guide at http://eps.rose.hp.com. (Site not available to channel partners.) Full factory integration (including racking and cabling) is available only for configurations described in the Design Guide. You MUST order A5147A - Enterprise Storage Integration Product for full factory integration of configurations in the Design Guide.

Figure 4.7.1.1 HP Surestore Disk Array 12H (A3700A, A3700AD and A3700AZ)

Includes:	Maximum Configuration	Features
• Rackmount package (deskside optional) • Single or Dual Controller • Two power supplies • Three blowers (provides redundant cooling)	• 12 disk drives • Raw capacity: 436.8 GB with 36.4-GB-disks; 218.4 GB with 18.2-GB-disks • Protected disk storage: 365.6 GB with 36.4-GB disks; 182.8 GB with 18.2-GB disks • Dual controllers • 192 MB cache, 96 MB per controller • Three power supplies • Three blowers (provides redundant cooling)	• Dynamic data migration between RAID 1/0 and RAID 5 - eliminates need to understand different RAID levels • Auto configuration • Active Hot Spare • Fully mirrored cache • Hot-swap capability for disks, power supplies, blowers and controllers • Redundant cooling standard • Redundant controllers standard • Optional redundant power • Fast Wide Differential SCSI connection to server • FC connection to server via FC-SCSI Multiplexer. • Deskside easily upgradable to rackmount configuration • Rackmount convertible to deskside • Upgrade to FC connectivity with FC-SCSI MUX on OS 10.20 and above.

The following figures show the rear of the array. There are four SCSI connectors, two for each controller. The SCSI connectors provide the option to daisy chain the two controllers on the same SCSI bus or to have each controller on a different SCSI bus. The Surestore Disk Array 12H (with AutoRAID technology) requires one power cord for each installed power supply. The Surestore Disk Array 12H requires up to three power cords.

Figure 4.7.1.2 HP Surestore Disk Array 12H
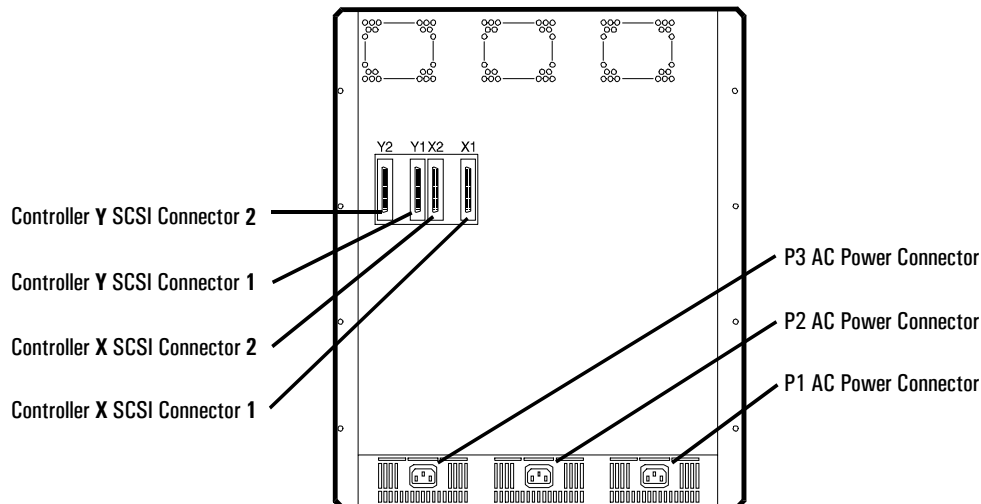
Features

High Availability Functionality

The HP Surestore Disk Array 12H offers state of the art high availability features, such as: hot-swappable modules, redundant load-sharing power supplies, redundant cooling, active hot-swap disk drives, dual active controllers, mirrored cache, battery-backed NVRAM and support by HP high availability software.

- **Hot Swappable:**
  The power supplies, fan modules, array controllers and disk drives are all hot swappable. Consult the user manual or service manual for instructions on hot-swapping the disks and controllers. In non-redundant power supply configurations (two supplies in the 12H), the removal of a power supply will cause the array to halt.
- **Redundant Power Supplies:**
  A redundant power supply can be ordered for the array. When the redundant power supply is installed, the power supplies share the workload. If one of the power supplies fails, the remaining power supplies will take over the load for the entire enclosure. Each power supply has its own independent power cord. It is not necessary, but recommended, to have the redundant power supply installed in the enclosure.
- **Redundant Fans:**
  The Surestore Disk Array 12H enclosure comes standard with three fan modules. Although two operational fans can maintain cooling, it is strongly recommended that the defective blower be replaced as soon as possible to maintain the reliability of the array. It is important that all three fan modules remain installed, even if one of the fans has failed. Keeping all the fans installed is important to maintain proper air flow within the array and hence proper cooling of the array components. Disk mechanism slots and power supply slots may be empty without affecting the air flow and cooling characteristics. Up to eight empty disk slots and one empty power supply slot are supported configurations.

Powerfail Protection

An Uninterruptible Power System (UPS) is **required** for powerfail protection for the Surestore Disk Array 12H.

Active Hot Spare Disk Drive

The default configuration of the HP Surestore Disk Array 12H is with a global hot spare disk. The array distributes one disk's worth of space across all disks as a global hot spare rather than reserving an entire single disk. This has two user benefits. First, all disks are being used. Therefore, the array (and the customer) is certain that the "hot spare" is working. Second, utilizing the active hot spare disk for user data provides a performance increase. If the active hot spare is turned off, the usable capacity of the array will increase by the usable capacity of one disk module. Turning active spare off will force the customer to delay a rebuild of a failed disk until the failed disk is replaced with a new disk. HP **strongly** recommends the use of active hot spare to help ensure data protection.

Supported RAID Modes

The HP Surestore Disk Array 12H eliminates the need to discuss (and understand) the different RAID levels. Internally, the arrays support both RAID 1/0 and RAID 5 and migrate data between these RAID levels based on the application workload. The user only specifies logical units (LUNs), but does not (and can not) specify the RAID mode for the LUN. Data within each LUN may be (and most likely is) divided between RAID 1/0 and RAID 5. The user benefit of this functionality is improved ease of use (simplified configuration and management) and performance. Refer to "Surestore Disk Array 12H with AutoRAID Technology--The Role of Self-managed Storage Systems", Keyword IDCAUTORAID on ESP.

The user can implicitly control how much data is in RAID 1/0 or RAID 5. When the user configures 50% or less of the available capacity as LUNs, all of the user data will be in RAID 1/0. On the other extreme, a minimum amount of RAID 1/0 space (10%) will be allocated when the user configures all the available capacity as LUNs. At no time can the user control which data is in RAID 1/0 or RAID 5. This is determined by access patterns.

Dual Controllers and Cache

The HP Surestore Disk Array 12H can be ordered with one or two controllers. In a dual controller solution the controllers are dual active, concurrent access controllers. This means both controllers have access to all the data. Controllers come with 96 MB cache. The controller memory is used for data maps, read cache, and write cache. The design of the enclosure maintains RFI integrity even with one controller removed.

Table 4.7.1.1 Usable Capacity With Active Hot Spare Off (1 GB = 1,000,000,000 bytes)

Number of Disks	HP Surestore Disk Array 12H		
	Maximum Usable Capacity with 9.1-GB disks	Maximum Usable Capacity with 18.2-GB disks	Maximum Usable Capacity with 36.4-GB disks
12	90.4 GB	182.8 GB	365.6 GB
11	82.3 GB	166.4 GB	332.8 GB
10	74.2 GB	150.0 GB	300.0 GB
9	66.0 GB	133.6 GB	267.2 GB
8	57.9 GB	117.2 GB	234.4 GB
7	49.8 GB	100.8 GB	201.6 GB
6	41.7 GB	84.3 GB	168.6 GB
5	33.6 GB	67.9 GB	135.8 GB
4	25.4 GB	51.4 GB	102.8 GB

Four disk modules are the minimum supported configuration for the Surestore Disk Array 12H. The 12H supports 18.2-GB and 36.4-GB 10K single-ended disk drives in 54-mm modules. HP AutoRAID technology's auto configuration capability allows different disk capacities and speeds to be mixed within a single enclosure. This can easily be done at the customer's site. However, because of factory considerations, only homogeneous drive sizes are integrated at the factory. The above tables review the maximum usable capacity for the given number of disks assuming that all of the available capacity is configured for user data (minimum RAID 1/0 space). When sizing AutoRAID arrays, it is generally best to order slightly more usable capacity than is required by the customer's application. The extra space, which is not configured as user data, will be used by the array to improve performance. Also, when possible, it is beneficial to order the array with some empty slots. This allows for future expansion if either more user capacity is required or additional RAID 1/0 space is needed to improve performance.

Configuration

Table 4.7.1.2 HP Surestore Disk Array 12H

Product Number	Option Number	Description
A3700A		HP Rackmount Surestore Disk Array 12H – Rackmount Array Enclosure – Two Empty Controller Slots – Three Fan Modules – Two Power Supplies – Twelve Empty Disk Slots – 0.5-meter Ultra-flexible SCSI cable – Fast Wide Differential SCSI Terminator – Not Factory Integrated (Disks, power supplies, controllers and the enclosure ship in separate containers for integration in the field)
		Redundant power supply is optional
	002	Third Power Supply
		Disks (Must select one option)
	184	4×18.2GB 10K rpm disk drive
	185	5×18.2GB 10K rpm disk drive
	188	8×18.2GB 10K rpm disk drive
	192	12×18.2GB 10K rpm disk drive
	504	4×36.4GB 10K rpm disk drive
	505	5×36.4GB 10K rpm disk drive
	508	8×36.4GB 10K rpm disk drive
	512	12×36.4GB 10K rpm disk drive
		Controllers (Must select one of either Option 200 or Option 203)
	200	One 96-MB HP Disk Array AutoRAID Controller

Product Number	Option Number	Description
	203	Two 96-MB HP Disk Array AutoRAID Controllers
		Cables
	801	.9-meter 68-pin HD Male to 68-pin HD Male Cable
	802	2.5-meter 68-pin HD Male to 68-pin HD Male Cable
	803	5.0-meter 68-pin HD Male to 68-pin HD Male Cable
	804	10.0-meter 68-pin HD Male to 68-pin HD Male Cable
	806	CA 1-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	807	CA 2.5-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	808	CA 5-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	809	CA 10-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	811	1-meter VHDCI to 68-pin high-density low-profile
	812	2.5-meter VHDCI to 68-pin high-density low-profile
	813	5-meter VHDCI to 68-pin high-density low-profile
	814	10-meter VHDCI to 68-pin high-density low-profile
	840	2.0-meter V-cable – 68-pin high-density male
	841	2.0-meter V-cable – VHDCI / VHDCI / 68-pin high-density male
	842	2.0-meter V-cable – VHDCI / VHDCI I / L Terminator / 68-pin high-density male
	843	2.0-meter V-cable – 68-pin HD / VHDCI / 68-pin high-density male
	844	2.0-meter V-cable – 68-pin HD / VHDCI I / L Terminator / 68-pin high-density male
	851	10.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
	871	2/5-meter V in-line terminator cable – 68-pin HD male for V-Class
	873	2/3-meter V in-line terminator cable – 68-pin HD male for V-Class
	875	5.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
C7519A		0.5-meter SCSI cable VHDTS68/HDTS68 HVD ILT M/F
		Configuration Tools
	ASJ	NT Support Kit (This software is required for the array to work with NT systems.)
	003	MPE Tracking (This option should be ordered with all arrays that will be connected to MPE systems. This is a configuration tracking solution only.)
B6191AA		**Supporting Software (CD-ROM)**
		Supporting Software This software is required for the array to work with HP-UX. The customer is not required to order more than one per installation site. If the array is ordered as part of an integrated system order, B6191AA need not be ordered because the necessary supporting software will automatically be included with the HP-UX order.
A3700AD		HP Deskside Surestore Disk Array 12H – Deskside Array Enclosure – Two Empty Controller Slots – Three Fan Modules – Two Power Supplies – Twelve Empty Disk Slots – 0.5-meter Ultra-flexible SCSI cable – Fast Wide Differential SCSI Terminator – Factory Integrated into Deskside Cabinet
		Redundant power supply is optional
	002	Third Power Supply
		Disks (Must select one option)
	184	4 × 18.2GB 10K rpm disk drive
	185	5 × 18.2GB 10K rpm disk drive
	188	8 × 18.2GB 10K rpm disk drive
	192	12 × 18.2GB 10K rpm disk drive
	504	4 × 36.4GB 10K rpm disk drive
	505	5 × 36.4GB 10K rpm disk drive
	508	8 × 36.4GB 10K rpm disk drive
	512	12 × 36.4GB 10K rpm disk drive
		Controllers (Must order one of either Option 200 or Option 203)
	200	One 96-MB HP Disk Array AutoRAID Controller
	203	Two 96-MB HP Disk Array AutoRAID Controllers
		Cables
	801	.9-meter 68-pin HD Male to 68-pin HD Male Cable
	802	2.5-meter 68-pin HD Male to 68-pin HD Male Cable
	803	5.0-meter 68-pin HD Male to 68-pin HD Male Cable
	804	10.0-meter 68-pin HD Male to 68-pin HD Male Cable

Product Number	Option Number	Description
	806	CA 1-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	807	CA 2.5-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	808	CA 5-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	809	CA 10-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	811	1-meter VHDCI to 68-pin high-density low-profile
	812	2.5-meter VHDCI to 68-pin high-density low-profile
	813	5-meter VHDCI to 68-pin high-density low-profile
	814	10-meter VHDCI to 68-pin high-density low-profile
	840	2.0-meter V-cable – 68-pin high-density male
	841	2.0-meter V-cable – VHDCI / VHDCI / 68-pin high-density male
	842	2.0-meter V-cable – VHDCI / VHDCI I / L Terminator / 68-pin high-density male
	843	2.0-meter V-cable – 68-pin HD / VHDCI / 68-pin high-density male
	844	2.0-meter V-cable – 68-pin HD / VHDCI I / L Terminator / 68-pin high-density male
	851	10.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
	871	2/5-meter V in-line terminator cable – 68-pin HD male for V-Class
	851	10.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
	871	2/5-meter V in-line terminator cable – 68-pin HD male for V-Class
	873	2/3-meter V in-line terminator cable – 68-pin HD male for V-Class
	875	5.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
C7519A		0.5-meter SCSI cable VHDTS68/HDTS68 HVD ILT M/F
		Configuration Tools
	ASJ	NT Support Kit (This software is required for the array to work with NT systems.)
	003	MPE Tracking (This option should be ordered with all arrays that will be connected to MPE systems. This is a configuration tracking solution only.)
B6191AA		**Supporting Software (CD-ROMs)**
		Supporting Software This software is required for the array to work with HP-UX. The customer is not required to order more than one per installation site. If the array is ordered as part of an integrated system order, B6191AA need not be ordered because the necessary supporting software will automatically be included with the HP-UX order.
A3700AZ		HP Factory-Racked Surestore Disk Array 12H – Factory-Racked Array Enclosure – Two Empty Controller Slots – Three Fan Modules – Two Power Supplies – Twelve Empty Disk Slots – 0.5-meter Ultra-flexible SCSI cable – Fast Wide Differential SCSI Terminator – Factory Integrated into Specified Rack
		Redundant power supply is optional
	002	Third Power Supply
		Disks (Must select one option)
	184	4 × 18.2GB 10k rpm disk drive
	185	5 × 18.2GB 10k rpm disk drive
	188	8 × 18.2GB 10k rpm disk drive
	192	12 × 18.2GB 10k rpm disk drive
	504	4 × 36.4GB 10K rpm disk drive
	505	5 × 36.4GB 10K rpm disk drive
	508	8 × 36.4GB 10K rpm disk drive
	512	12 × 36.4GB 10K rpm disk drive
		Controllers (Must order one of either Option 200 or Option 203)
	200	One 96-MB HP Disk Array AutoRAID Controller
	203	Two 96-MB HP Disk Array AutoRAID Controllers
		Cables (At least one is required for factory-racked units)
	801	.9-meter 68-pin HD Male to 68-pin HD Male Cable
	802	2.5-meter 68-pin HD Male to 68-pin HD Male Cable
	803	5.0-meter 68-pin HD Male to 68-pin HD Male Cable
	804	10.0-meter 68-pin HD Male to 68-pin HD Male Cable
	806	CA 1-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	807	CA 2.5-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	808	CA 5-meter 68-pin high-density low-profile to 68-pin high-density low-profile
	809	CA 10-meter 68-pin high-density low-profile to 68-pin high-density low-profile

Product Number	Option Number	Description
	811	1-meter VHDCI to 68-pin high-density low-profile
	812	2.5-meter VHDCI to 68-pin high-density low-profile
	813	5-meter VHDCI to 68-pin high-density low-profile
	814	10-meter VHDCI to 68-pin high-density low-profile
	840	2.0-meter V-cable – 68-pin high-density male
	841	2.0-meter V-cable – VHDCI / VHDCI / 68-pin high-density male
	842	2.0-meter V-cable – VHDCI / VHDCI I / L Terminator / 68-pin high-density male
	843	2.0-meter V-cable – 68-pin HD / VHDCI / 68-pin high-density male
	844	2.0-meter V-cable – 68-pin HD / VHDCI I / L Terminator / 68-pin high-density male
	851	10.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
	871	2/5-meter V in-line terminator cable – 68-pin HD male for V-Class
	851	10.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
	871	2/5-meter V in-line terminator cable – 68-pin HD male for V-Class
	873	2/3-meter V in-line terminator cable – 68-pin HD male for V-Class
	875	5.0-meter 68-pin HD male to 68-pin HD male in-line terminator cable for V-Class
C7519A		0.5-meter SCSI cable VHDTS68/HDTS68 HVD ILT M/F
		Configuration Tools
	ASJ	NT Support Kit (This software is required for the array to work with NT systems.)
	003	MPE Tracking (This option should be ordered with all arrays that will be connected to MPE systems. This is a configuration tracking solution only.)
B6191AA		**Supporting Software (CD-ROMs)**
		Supporting Software This software is required for the array to work with HP-UX. The customer is not required to order more than one per installation site. If the array is ordered as part of an integrated system order, B6191AA need not be ordered because the necessary supporting software will automatically be included with the HP-UX order.

Table 4.7.1.3 Add-on/Upgrade Products

Upgrade	HP Surestore Disk Array 12H
18.2-GB Disk Drive 10K RPM S/E	A3714A (54 mm disk module)
36.4-GB Disk Drive 10K RPM S/E (Replaces A5292A)	A6518A (54 mm disk module)
Power Supply	A3708A (1 power supply with no power cable)
Power Cable Option for Racked Configurations	004
Power Cable Option for Wall Outlets (localized according to country of origin of the order)	006
Surestore Disk Array 12H Controller	A3706A (96-MB controller)
Fan Module	A3709B
Fast Wide Differential SCSI Terminator	C2905A
0.5-meter Ultra-flexible SCSI Cable	C2981A
SCSI Cable .5-meter VHDTS68/HDTS68 HVD ILT M/F	C7519A
Empty Deskside Cabinet (allows conversion of rack-mounted unit to deskside unit)	A3701A
CD-ROM software for FW upgrade	A5284B (For single controller solutions)
12H Power Upgrade Kit (Also supported on 12H w/FC MUX per Design Guide at http://eps.rose.hp.com (site not available to channel partners)	A4915A
Front Door for 12H – Quartz Grey	A5429A
PCI Differential UW SCSI HBA for NT	A5252B
Software Integration Kit (Required for the 12H to work with NT systems.)	A5253A

Cables and Terminators

SCSI cables must be explicitly ordered for the HP Surestore Disk Array 12H. Each array comes with a 0.5-meter SCSI cable to daisy chain the two controllers. If the controllers are to be placed on a separate bus, then two SCSI cables must be ordered. Otherwise, a single cable may be ordered. For factory-racked configurations, the cables must be ordered with the original order. Failure to do so may result in delayed shipment due to the inability of the factory to construct and test the ordered configuration.

When connecting SCSI cables to the array remember that Fast Wide Differential SCSI has a 25 meter limit. When computing the SCSI cable lengths, use 0.5 meters for each controller. For example, in a daisy chained controller configuration using the supplied 0.5-meter cable, the total cable length for the array is 1.5 meters; 0.5 meter for controller X, 0.5 meter for the SCSI cable, and 0.5 meter for controller Y. Then add to this the cable length to the server. The total must be less than 25 meters.

In-line terminated cables are used in ServiceGuard and High Availability MC certified systems. The enables the host bus adapter to be serviced without interrupting the accessibility of the SCSI bus by other hosts. If the host bus adapter card has auto termination, it needs to be defeated by adjusting jumper shunts per the host bus adapter user guide instructions. In-line terminated cables allow servers and host bus adapter cards to be serviced without inhibiting the remainder of the SCSI bus by removing termination dependency from the host bus adapter.

When the HP Surestore Disk Array 12H is to be used in a ServiceGuard environment, in conjunction with an A4800A host bus adapter, a C2980A should be ordered. When the HP Surestore Disk Array 12H is to be used in a ServiceGuard environment, in conjunction with an A5149A host bus adapter, a C7519A should be ordered.

Note: If a 2.0-meter V-cable is required, remember to use 4 meters when computing total cable length, since there are two 2.0 meter segments to this cable.

The Surestore Disk Array 12H includes the SCSI terminator with the array.

Fibre Channel SCSI Multiplexer and Fibre Channel Adapters.

For ordering information about Fibre Channel adapters and FC-SCSI Multiplexer, refer to the *HP UNIX Servers Ordering Guide.*

Racking Specifications

The following table reviews racking specifications for the HP Surestore Disk Array 12H.

Table 4.7.1.4 Factory-Racking Specifications

Product Number	Description	EIA Units	Required Mounting Hardware	Current Consumption		VA Rating for UPS	Number of AC Plugs
				120V AC (100-127 V)	230V AC (208-240 V)		
A3700A	HP Rackmount 12H	13	Included	7.3A	3.8A	870 VA	2 (3 Opt.)
A3700AZ	HP Factory-Racked 12H	13	Included	7.3A	3.8A	870 VA	2 (3 Opt.)

Note: When sizing circuit breakers, inrush currents must be considered. The inrush current specifications the 12H are:
110V @ 60 Hz: 27A for 17 ms
110V @ 50 Hz: 27A for 20 ms
220V @ 60 Hz: 55A for 17 ms
220V @ 50 Hz: 55A for 20 ms

Racking Considerations

When racking the HP Surestore Disk Array 12H into a 1.1-meter, 1.6-meter or 2.0-meter cabinet, consider the following points when constructing the order.

- Only the 1.1-meter and 1.6-meter cabinets are available in standard factory-racked configurations.
- For special EPS 2.0-meter racking configurations, see the Design Guide at http://eps.rose.hp.com. (Site not available to channel partners.)
- The Surestore Disk Array 12H is 13 EIA units high.
- The FC-SCSI Multiplexer is 4 EIA units high.
- If the desire is to have the array racked into a cabinet at the factory, order product number ending in AZ. To order an array to be field-racked, select product number A3700A for Surestore Disk Array 12H.

- The maximum number of arrays that can be racked into a cabinet is shown in the following table. If maximum storage capacity is required, consider the Back-to-Back Rack Upgrade. The Back-to-Back Rack Upgrade is not available as a factory integrated option.
- In some cases, a second power distribution unit in the cabinet may be desired or required. However, the second PDU cannot be installed at the factory. It must be installed at the customer site.
- 1.0-meter factory configured racks are shipped into North America with 120V PDUs. 1.6-meter factory configured racks are supping into North America with 230V PDUs. 1.1-meter and 1.6-meter factory configured racks shipped outside of North America are equipped with 200-240V PDUs.

Table 4.7.1.5 HP Surestore Disk Array 12H

Type of Rack	Max. Arrays Supported	Max. Usable Capacity	PDU Power Outlets Required	120V AC		230V AC	
				Current Required (Amps)	16A PDUs Required[1]	Current Required (Amps)	16A PDUs Required
1.25-meter (25 EIA)	1	182.8 GB	3	8.7A[2]	1	4.4A[3]	1
1.6-meter (33 EIA)	2	365.6 GB	6	17.4A	2	8.9A	1
1.6-meter with Back-to-Back Rack Upgrade (no side access available)	3	548.4 GB	9	N/A	N/A	13.2A	1 (10 outlets per PDU)
1.6-meter with Back-to-Back Rack Upgrade (with side access available)	4	731.2 GB	12	N/A	N/A	17.6A	2 (10 outlets per PDU)
2.0-meter rack (41 EIA)	3	548.4 GB	9	26.1A	2	13.2A	1
2.0-meter with Back-to-Back Rack Upgrade (no side access available)	5	914 GB	15	N/A	N/A	22.0A	2
2.0-meter with Back-to-Back Rack Upgrade (with side access available)	6	1096.8 GB	18	N/A	N/A	26.4A	2

[1]Refer to the Power Redundancy section for power redundancy of Surestore Disk Array 12H racked solutions
[2]Nominal current at 120 VAC is 7.3A, maximum current at minimum voltage of 100 VAC is 8.7A
[3]Nominal current at 230 VAC is 3.8A; maximum current at minimum voltage of 200 VAC is 4.4A

Surestore Disk Array 12H Back-to-Back Racking

Customers who can provide front and rear access to their data storage racks may obtain maximum disk storage capacity with a minimum use of floor space by completely filling their rack cabinets with AutoRAID arrays mounted both in the front and the rear of the cabinet. This field upgrade solution is known as back-to-back racking, and allows up to four Surestore Disk Array 12H arrays to be mounted in a 1.6-meter cabinet, or up to six Surestore Disk Array 12H arrays in a 2.0-meter cabinet. The upgrade solution provides power features, plus the necessary hardware to reposition PDUs and rear door hinges.

This solution is available as either:
- a field upgrade to existing cabinets (whether originally sold as bundled or unbundled cabinets) or
- additional/replacement components for new standalone (unbundled) cabinets.

Precaution*: Cable access in the Back-to-Back Rack configuration must be considered. Easy access to one side of the cabinet is required in order to permit fully loading a back-to-back rack. From the side, cables are easily accessed for installation, or reconfiguration. If side access is not easily acquired, then it is important that the rack not be fully loaded. Leaving openings in the back of the rack permits access to the cables.*

Note*: Back-to-back rack configurations must use 200-240V PDUs. 120V PDUs are not supported. Back-to-back rack configurations are available as factory integrated in limited configurations. When considering back-to-back rack, contact your HP service organization.*

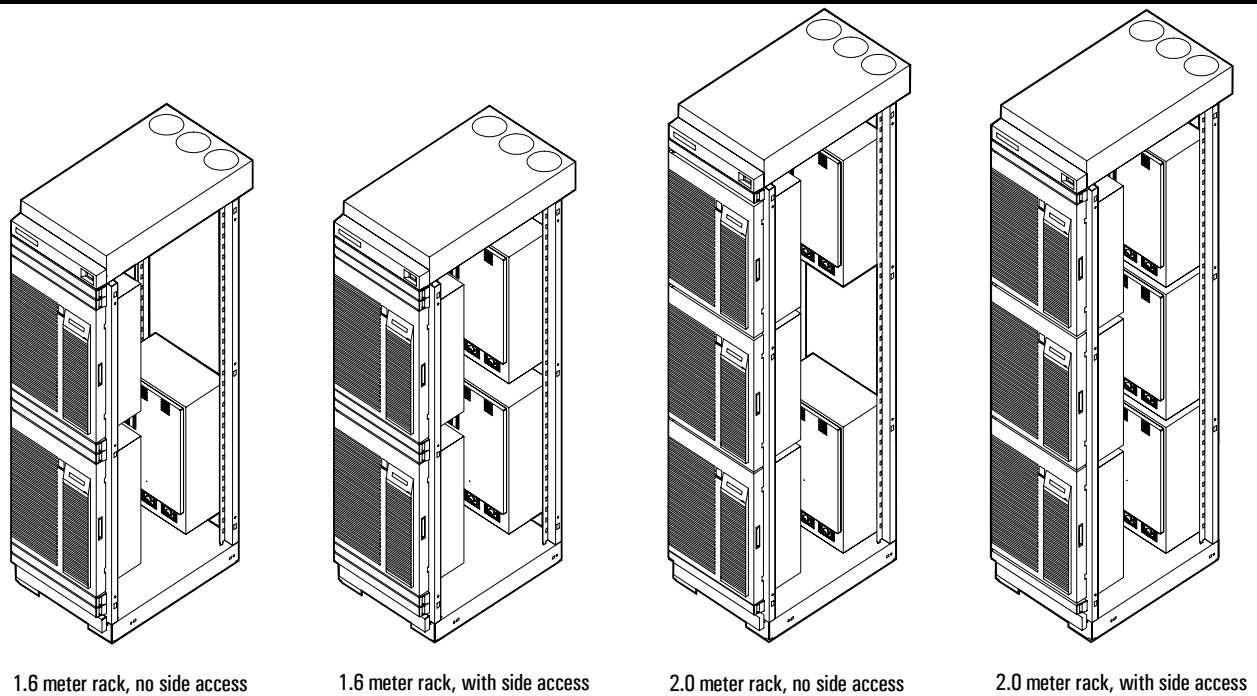**Figure 4.7.1.3 Surestore Disk Array 12H Back-to-Back Rack Configurations**

1.6 meter rack, no side access   1.6 meter rack, with side access   2.0 meter rack, no side access   2.0 meter rack, with side access

Table 4.7.1.6 Additional/Replacement Cabinet Components Required to Upgrade to Back-to-Back Racking Solution

Product Number	Description	Quantity Required	EIA Units
C2981A	0.5-meter ultra-flexible SCSI cable	varies [1]	
C2980A	SCSI Cable 0.5-meter HDTS68 HVD ILT M/F	varies	
C7519A	SCSI Cable 0.5-meter VHDTS68/HDTS68 HVD ILT M/F	varies	
C2788A	Computer rail kits	0 to 4 [2]	
E4456A	200-240V PDU North American with L6-20P power plug and 10 IEC-320 receptacles	0 to 2 [3]	
E4457A	200-240V PDU International, unterminated, with 10 IEC-320 receptacles	0 to 2 [3]	
E5931A	200-240V PDU North American with L6-30P power plug (for use with UPS [4]) and 10 IEC-320 receptacles	0 to 2 [3]	
E5932A	200-240V PDU International, unterminated (for use with UPS [4]) and 10 IEC-320 receptacles	0 to 2 [3]	

[1] Ultra-flexible SCSI cables should be used to interconnect all Surestore Disk Array 12Hs (with AutoRAID technology) on the same SCSI bus.

[2] Two Surestore Disk Array 12Hs (with AutoRAID technology) are supported per single rail kit. If customer's rack is completely filled with front-racked disk storage enclosures, then no additional rail kits are required.

[3] Upgraded rack must contain two 10-receptacle 240V PDUs

[4] PDUs for use with Uninterruptible Power Supplies (UPS) do NOT have any wiring for an on-off switch

Power Redundancy

Because the Surestore Disk Array 12H (with AutoRAID technology) has 3 power supplies, power redundancy in racked configurations requires the use of an AutoRAID 12H Power Upgrade Kit (A4915A). This upgrade kit contains three PDUs (one for each power cord from the array) and an installation guide for high availability configurations.

The mounting hardware kit (E7693A) includes new rear door hinges, and a rear door latch. The mounting kit repositions the PDUs out of the way from the rear-mounted units.

The ultra-flexible 0.5-meter SCSI cable (C2981A) is strongly recommended as a replacement for any existing standard SCSI cables to make installation and maintenance easier.

How to Configure and Order the HP Surestore Disk Array 12H

These disk arrays can be configured for ordering by answering the following simple questions:
- How much usable capacity is required for the customer's application?
- Does the customer require smaller capacity disk drives for improved performance?
- Which operating system must be supported?
- Is the array to be a deskside unit, racked into a cabinet in the field, or racked into a cabinet in the factory?
- Is a redundant power supply required? (Answering YES is strongly recommended)
- Will controllers be on the same SCSI bus?
- What type of SCSI cable, and how long does it need to be?
- Does the customer require Fibre Channel Host connect?
- Is the customer adding or upgrading to 10K disk drives in a current solution and need upgraded fans?

How to Configure a Surestore Disk Array 12H with FC MUX

Following are samples of the Surestore Disk Array 12H with FC MUX configurations. FC-SCSI Multiplexer is available with up to two FC host connections and up to four SCSI ports for storage subsystem connection. Follow current SCSI guidelines when configuring 12H behind the MUXs SCSI ports. Two FC-SCSI Multiplexers are required for full redundancy. For additional information on these configurations, see the Design Guide Website at http://eps.rose.hp.com. (Site not available to channel partners.)
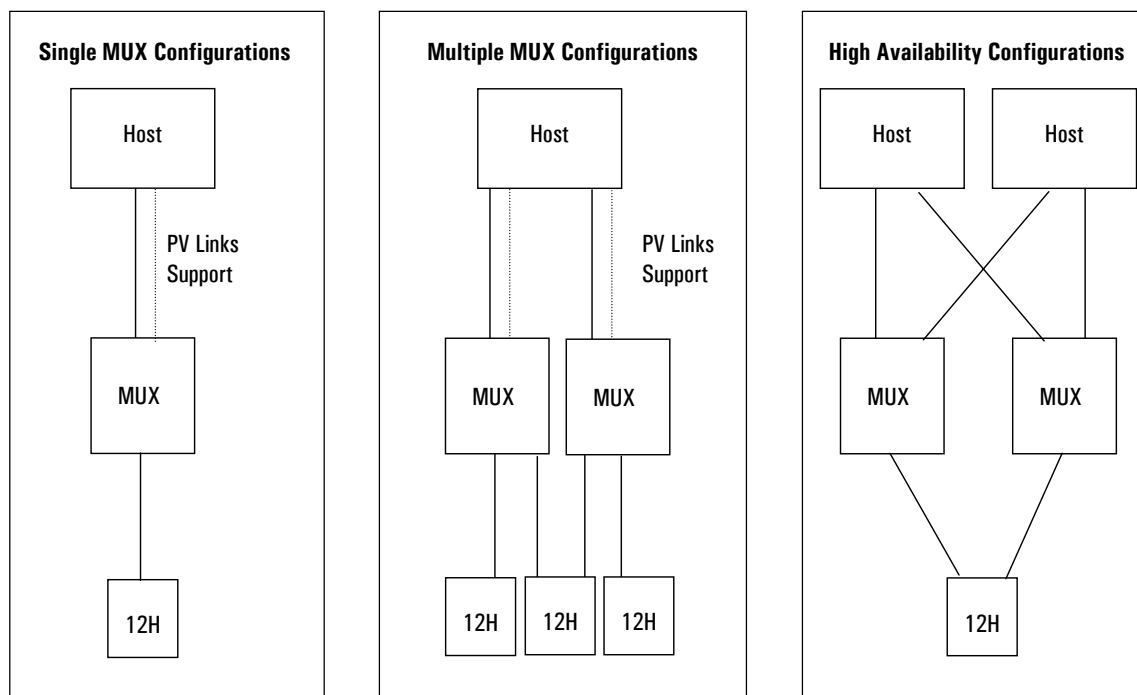
Figure 4.7.1.4

Figure 4.7.1.5

Up to 8 SPUs are supported in a
non-HA environment

| SPU |
| FC Adapter | FC Adapter |

| SPU |
| FC Adapter | FC Adapter |

Up to 500m

Up to 500m

Long Wave
Hub
(A4839A/AZ)

Building 1

Building 2   Up to 2km

This is a non-HA distance systems
with cascade hubs..

Long Wave
Hub
(A4839A/AZ)

Up to 500m

12H with FC MUX

FC-to-SCSI MUX

12H | 12H | 12H | 12H

Up to 9 mass
storage subsystems
(Model 12Hs with
FC MUX) could be
connected to each
hub

Figure 4.7.1.6

Up to 4 SPUs are supported in
MC/ServiceGuard cluster
configurations

| SPU |
| FC Adapter | FC Adapter |

| SPU |
| FC Adapter | FC Adapter |

Up to 500m   Up to 500m   Up to 500m   Up to 500m

Hub
(A3724A/AZ)

Hub
(A3724A/AZ)

Up to 500m   Up to 500m   Note that these are two separate FC-AL loops.

12H with FC MUX

FC-to-SCSI MUX   12H

12H

FC-to-SCSI MUX   12H

12H

Up to 6 mass
storage subsystems
(Model 12Hs with 2
FC Muxes) could be
connected to each
hub

This is a high availability configuration,
with no single point of failure, and 500
meter cables between hubs. Since each
Hub can support up to 10 connections,
maximum number of SPUs and mass
storage subsystems must not exceed 10.

Figure 4.7.1.7

SPU

FC Adapter | FC Adapter

SPU

FC Adapter | FC Adapter

Up to 4 SPUs are supported in MC/ServiceGuard cluster configurations

Up to 500m | Up to 500m | Up to 500m | Up to 500m

Long Wave Hub (A4839A/AZ)

Long Wave Hub (A4839A/AZ)

Building 1

Building 2

Up to 2km | Up to 2km

This is a high availability and distance configuration, with no single point of failure.

Long Wave Hub (A4839A/AZ)

Long Wave Hub (A4839A/AZ)

Note that these are two separate FC-AL loops.

Up to 500m | Up to 500m

12H with FC MUX

FC-to-SCSI MUX

12H
12H
12H
12H

FC-to-SCSI MUX

Up to 9 mass storage subsystems (Model 12Hs and 2 FC MUXs) could be connected to each hub

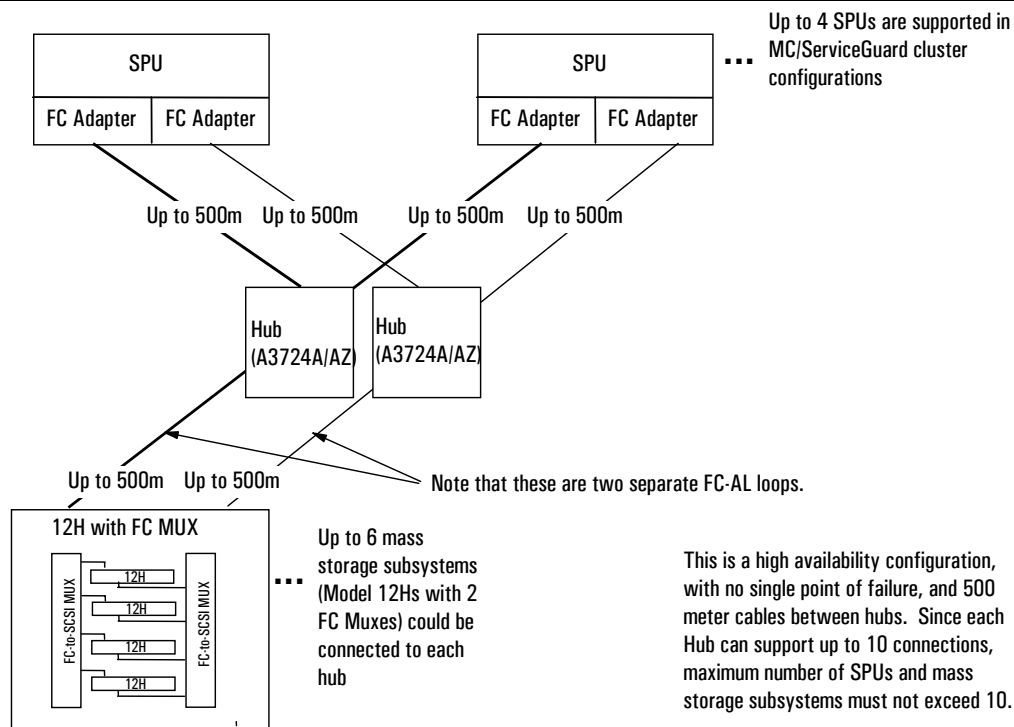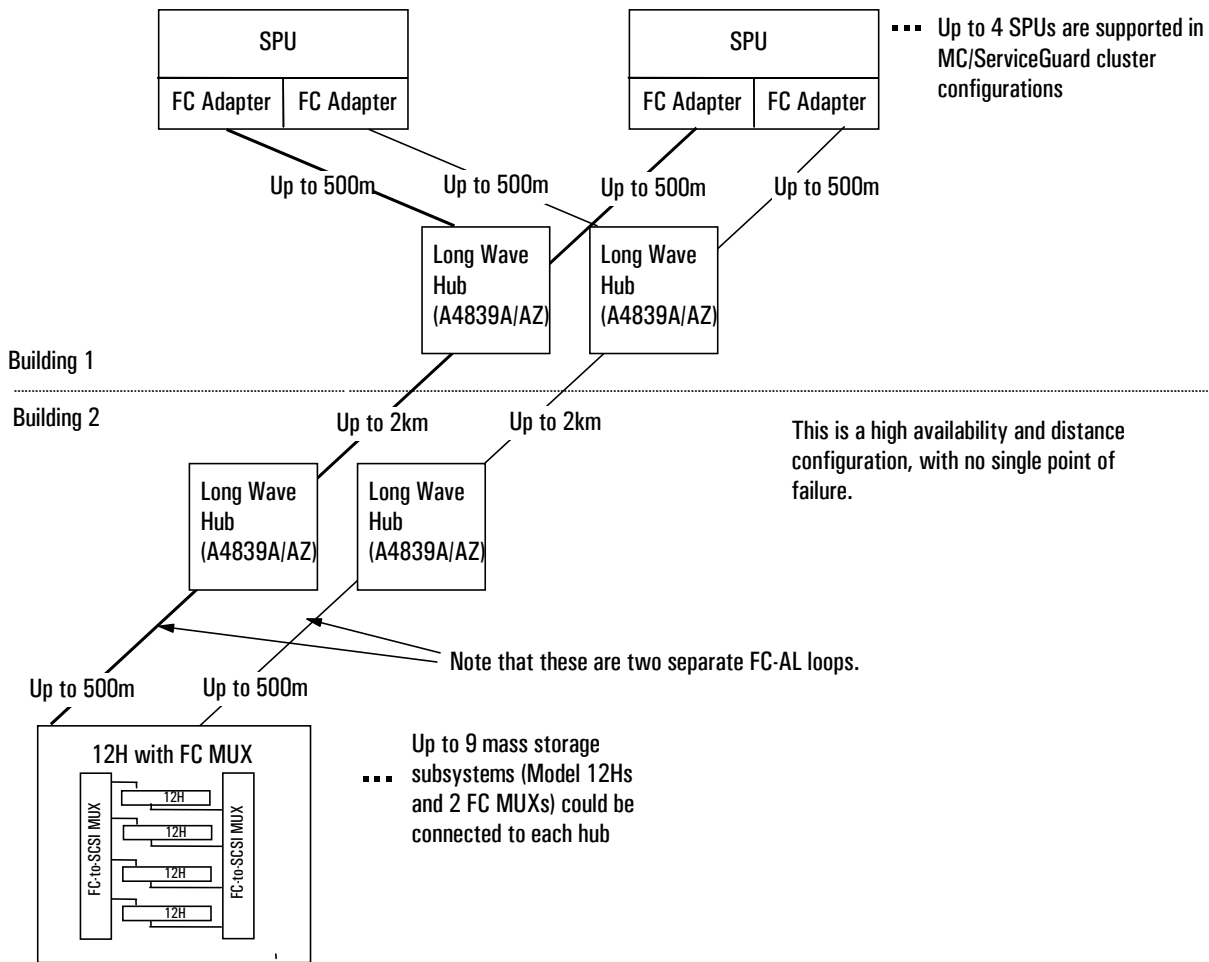***Question 1: Usable Capacity?***

If the customer requires a quantity of disk drives not offered as an option, order the option that is closest to, but not exceeding, the customer's requirement, and then order additional add-on disks. However, note that the A3700AD and AZ products provide factory installation of only the disks ordered under an option. Any additional add-on disks will be shipped in separate boxes. The additional add-on disks can be field installed in seconds, and require no additional configuration.

Table 4.7.1.7 Usable Capacity vs. Option for HP Surestore Disk Array 12H

	Customer's Required Capacity	Option Number
Usable Capacity with 18.2-GB Disks	117.2 GB to 182.8 GB	152 or 192 (12 disks)
	67.9 GB to 117.2 GB	148 or 188 (8 disks)
	51.4 GB to 67.9 GB	145 or 185 (5 disks)
	Less than 51.4 GB	144 or 184 (4 disks)
Usable Capacity with 36.4-GB Disks	234.4 GB to 365.6 GB	312 (12 disks)
	168.6 GB to 234.4 GB	308 (8 disks)
	135.8 GB to 168.6 GB	305 (5 disks)
	102.8 GB to 135.8 GB	304 (4 disks)

Note: When sizing AutoRAID arrays, it is generally best to order slightly more usable capacity than is required by the customer's application. The extra space that is not configured as user data will be used by the array to improve performance. Also, when possible, it is beneficial to order the array with some empty slots. This allows for future expansion if either more user capacity is required or additional RAID 1/0 space is needed to improve performance.

Note: HP has provided a Capacity Planning Tool, available on the web at www.hp.com/go/AutoRAID_tool.

Question 2: High performance or low cost?
Generally, smaller disks will outperform fewer large disks. Choose lower capacity disks for performance sensitive customers or choose higher capacity disks for price sensitive customers. Other factors may need to be considered, such as the availability of SCSI buses.

Question 3: Operating System?
The Surestore Disk Array 12H (with AutoRAID technology) requires software to work properly with current HP-UX operating systems. Because newer HP servers have discontinued using DDS tape as a software delivery vehicle, Surestore Disk Array 12H (with AutoRAID technology) only provides CD-ROMs as a software delivery vehicle. The required software for most supported HP-UX operating systems is provided by the B6191AA CD-ROM set. The customer **must** be sure to order the B6191AA product to receive the software.

The Surestore Disk Array 12H is supported on HP-UX 10.01, 10.10, 10.20 and 11.0. In addition, the 12H is now supported on Windows NT Server v4.0 SP3 and Windows NT Server Enterprise Edition v4.0 SP3. For more information, refer to the Enterprise Storage for NT Ordering and Configuration Guide. The 12H with FC MUX configurations are supported on HP-UX 10.20 and 11.0.

Table 4.7.1.8 Operating System Support

Operating System	HP Surestore Disk Array 12H	HP Surestore Disk Array 12H with FC MUX
HP-UX Release		
10.01	Yes	No
10.10	Yes	No
10.20	Yes	Yes
11.00	Yes	Yes
NT Release		
Windows NT Server v4.0 SP3	Yes	No
Windows NT Server Enterprise Edition v4.0 SP3	Yes	No
HP 3000 Release		
MPE/iX 5.5 (Requires 5.5 Express 7 or later) (Requires B3821AA Opt 001–Order # DCE/3000)	Yes	No
MPE/iX 6.0 (Requires Express 6.0 Express 1 or later) (Requires B3821AA Opt 001–Order # DCE/3000)	Yes	No

Question 4: Deskside or rackmount?

Table 4.7.1.9 Product Number to Order

Type of Array	HP Surestore Disk Array 12H
Deskside Unit	A3700AD
Field Racked Array	A3700A
Factory Racked Array	A3700AZ

Question 5: Redundant power supply?
It is recommended that all orders include option #002, the redundant power supply.

Question 6: Daisy Chain Controllers?
If the two controllers are to be daisy chained, then only one cable must be ordered. Otherwise, two cables should be ordered.

Controllers on Same SCSI Bus
- Cable 1: From host bus adapter or previous device to controller X.
- Cable 2: From controller X to controller Y. (Included with each array.)
- Terminator or Cable 3: From controller Y to next device. Normally cable 3 will be ordered with the next device.

Controllers on Different SCSI Buses
- Cable 1 and 2: From host bus adapters or previous devices to controllers X and Y.
- Terminators or Cable 3 and 4: From controllers X and Y to next devices. Normally cables 3 and 4 will be ordered with next device.

Question 7: Cables?
If a V-cable is required, order option #840. Otherwise refer the following table.

Table 4.7.1.10 Cable Length versus Option

Cable Length	Option Number	Product Number
.9 meter	801	C2911A
2.5 meters	802	C2924A
5.0 meters	803	C6510A
10.0 meters	804	C2925A

The following cable options are specific to V-Class Servers.

Table 4.7.1.11 V-Class Cable Options

Cable Length	Option Number
10.0 meters	851
2/5 meters	871
2/3 meters	873
5.0 meters	875

When the HP Surestore Disk Array 12H is to be used in an MC/ServiceGuard environment in conjunction with an A4800A host bus adapter, a C2980A should be ordered. When the HP Surestore Disk Array 12H is to be used in an MC/ServiceGuard environment in conjunction with an A5149A host bus adapter, a C7519A should be ordered.

Support

Supported Servers

The Surestore Disk Array 12H is supported on all the currently shipping HP 9000 Commercial Servers:
- 8x7
- 890
- A-Class
- D-Class
- E-, F-, G-, H-, I-Class
- N-Class
- K-Class
- T-Class
- V-Class

The Surestore Disk Array 12H is supported on both the HP-PB and HP-HSC buses.

Fibre Channel Support (Surestore Disk Array 12H with FC MUX only)
- D-Class
- K-Class
- N-Class
- T-600
- V-Class

NetServers Support
- LH Pro
- LXe Pro
- LX Pro
- LXr Pro
- LXr Pro8, LXr 8000
- LH2
- LH3
- LH4

Note: Order HBA for NT connections A5252B.

HP 3000 Support
- 9x8
- 9x9KS
- 99x

Table 4.7.1.12 Supported Functionality

Functionality	HP Surestore Disk Array 12H (with AutoRAID technology)	HP Surestore Disk Array 12H (with AutoRAID technology) with FC MUX
HP-UX 9.04	No	No
HP-UX 10.0	No	No
HP-UX 10.01	Yes	No
HP-UX 10.10	Yes	No
HP-UX 10.20	Yes	Yes
HP-UX 11.00	Yes	Yes
Windows NT Server v4.0 SP3	Yes	No
Windows NT Server Enterprise Edition v4.0 SP3	Yes	No
Windows NT Server v4.0 SP4	Yes	No
Windows NT Server Enterprise Edition v4.0 SP4	Yes	No
MPE 9x8, 9x9KS, 99x with MPE/iX 6.0	Yes	No
Boot - Single-host	Yes	No
Boot - Multi-host	No	No
Root	Yes	Yes
Swap	Yes	Yes
Install	Yes	Yes
LVM	Yes	Yes
SwitchOver/UX	No	No
MirrorDisk/UX	Yes	Yes
MC/ServiceGuard	Yes	Yes
Hard Partitioning Required	No	No
Ordered Writes	No	No
Hot Swap	Yes	Yes

High Availability Software

Both MC/ServiceGuard and MirrorDisk/UX are supported with the AutoRAID arrays. The array can not be used as a boot device in MC/ServiceGuard environments.

When the AutoRAID array is to be used in an MC/ServiceGuard environment in conjunction with an A4800A host bus adapter, a C2980A should be ordered. When the AutoRAID array is to be used in an MC/ServiceGuard environment in conjunction with an A5149A host bus adapter, a C7519A should be ordered.

Requirements

10K rpm Disk Drives

Customers upgrading to or adding 10K rpm disk drives to arrays shipped before 01 November 1998 may need to upgrade the fan modules. All three fan modules must be upgraded to #A3709B. The original fan modules displayed a label that is flat. The new #A3709B version displays a 3D bubble label design—easily identifiable visually and by touch. Current array enclosures are shipped with module #A3709B.

36.4-GB Disk Drives

36.4-GB disk drives are supported in A3700AD and A3700AZ configurations through options only. The disks in these configurations must be ordered through option selections. The firmware (HP54) that supports these disks is preloaded on controllers at the factory—thus insuring the proper use and supportability of this disk. This disk is supported with HP54 firmware ONLY. HP54 firmware is currently not available as a field upgrade except through factory Technical Support. When the HP54 field upgrade is generally available, the 36-GB disk as an add-on disk and the A3700A (Field-rackable solution) will be available for customers who wish to do field enclosure upgrades or fill empty slots to increase capacity in already owned enclosures. Support notes will ship with each disk detailing the risks of installing the 36-GB disk with any firmware other than HP54.

Customers should be advised that rebuild times for 36-GB disks will be twice as long as that of 18-GB disks. This is consistent with previous disk capacity changes. As the capacity doubles, so does the rebuild time in the event of a failure.

Customers should be advised that the Surestore Disk Array 12H LUN capacity is 8. With 432 GB of raw disk space there are 360 GB usable space—which divided into 8 equal LUNs is 45 GB per LUN. If the customer prefers to have a single volume set on a single tape the solution with the current DLT-7000 tape is to turn on hardware compression. Now they will get 70 GB per DLT tape.

Powerfail Protection

HP **strongly** recommends that a UPS be used with the Surestore Disk Array 12H disk array for protection of data and applications in the event of a powerfail. In addition, HP **strongly** recommends the use of the HP PowerTrust UPSs with the arrays.

Required Software

The required HP-UX system software for the Disk Array 12H is provided by the IPR releases on part number B6191AA.

Note: This software will already be installed for Instant Ignition customers.

Recommended Firmware Roll and Patches

Check with your Hewlett-Packard service representative to ensure that you have the required firmware and patches.

Miscellaneous

Interchanging Components with the High Availability Storage System

As can be quickly seen, the industrial design of the AutoRAID array is very similar to the HP High Availability Storage System. Care must be taken before interchanging components between these families of enclosures.

The disks in the array are single-ended SCSI disks, while in the Storage System they can be differential SCSI or single-ended SCSI. If the customer is using singled-ended disks within the HP High Availability Storage System, they can only be interchanged with the arrays if they are product number: A3517A or A3646A. Disks with product number A3317A are incompatible with, and should not be used in, the arrays. The HP High Availability Storage System uses 37-mm and 74-mm disk modules, while the Surestore Disk Array 12H (with AutoRAID technology) uses 54-mm disk modules.

Table 4.7.1.13 Disk Module Feature Compatibility Matrix

Module Features	HP High Availability Storage System	HP Surestore Disk Array 12H
Fast Wide Differential SCSI	Yes	No
Single-ended SCSI	Yes	Yes
37-mm Disk Modules	Yes	Yes (leaves 17 mm opening between modules). Consult User's Manual or Service Manual for details.
54-mm Disk Modules	No	Yes
74-mm Disk Modules	Yes	No

The original power supplies shipped with the HP High Availability Storage System, A3325A, should also not be used in the arrays. These power supplies have difficulty with the higher power consumption of an array compared to the storage enclosure.

Table 4.7.1.14 Module Compatibility Matrix

Module	HP HA Storage System	HP Surestore Disk Array 12H
A3325A Power Supply	Yes (Obsolete)	No
A3538A Power Supply	Yes	No
A3708A Power Supply	No	Yes
A3326A Fan Module	Yes	No
A3709A Fan Module	No	Yes
A3709B Fan Module	No	Yes
A5286A 18.2-GB FWD Disk, 37-mm module	Yes	No
A3710A 18.2-GB S/E Disk, 54-mm module	No	Yes
A5292A 36.4-GB S/E Disk 54-mm module	No	Yes
A3706A 96-MB Controller	N/A	Yes

Table 4.7.1.15 Customer Maintainability/Installability (HP Surestore Disk Array 12H)

	CE Call Required	Support as Customer Maintainable/ Installable	Hot-swap supported for this feature	Scheduled Downtime Required for this Activity
Initial Array Installation (Racked products)	Yes (CE installation included in price of product)	No	No	Yes
Initial Array Installation (Deskside product)	No	Yes	No	Yes
Addition of incremental disk drives after initial configuration	No	Yes	Yes	No
Addition of redundant power supply	No	Yes	Yes	No
Replacement of failed controller	No	Yes	Yes	No
Replacement of failed disk module	No	Yes	Yes	No
Replacement of failed power supply (when redundant power supply exists)	No	Yes	Yes	No
Replacement of failed fan module	No	Yes	Yes	No

Note: For customer maintainability/installability of FC-SCSI Multiplexer, refer to **Chapter 3**.