Part Number: MP4004C

9500
Shared Virtual Array

Physical Planning

StorageTek
June, 2000

Information contained in this publication is subject to change. In the event of changes, the publication will be revised. Comments concerning its contents should be directed to the address shown below.

StorageTek
One StorageTek Drive
Louisville, Colorado
80028-2201

Contents

Preface

Notices

United States FCC Compliance Statement

The following is the compliance statement from the Federal Communications Commission:

Note: This equipment has been tested and found to comply to the limits for Class A digital devices pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

Some of the cables used to connect peripherals must be shielded and grounded as described in the installation manual. Operation of this equipment with the required cables that are not shielded and correctly grounded may result in interference to radio and TV reception.

Changes or modifications not expressly approved by StorageTek could void the user's authority to operate the equipment.

Industry Canada Compliance Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numerique német pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Reglément sur le brouillage radioélectrique édicté par le ministére des Communications du Canada.

Japanese Compliance Statement

The following is the compliance statement from Japan:

この装置は、クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 VCCI-A

Note: This equipment is in the Class A category information technology equipment based on the rules of Voluntary Control Council For Interference by Information Technology Equipment (VCCI). When used in a residential area, radio

interference may be caused. In this case, user may be required to take appropriate corrective actions.

Consequently, when used in residential area or in an adjacent area thereto, radio interference may be caused to radios and TV receivers, etc. Read the instructions for correct handling.

Taiwan Warning Label Statement

The following is the warning label statement from Taiwan, R.O.C.:

About This Book

This book provides detailed physical specifications, cable information, environmental specifications, and power requirements for the 9500 Shared Virtual Array. Two checklists are also included within this book: the wiring comments checklist and the physical planning checklist.

Who Should Read This Book

The information in this book is for the use of the customer, StorageTek marketing representatives, CSEs, and independent consultants involved with installation planning.

Do You Have the Complete Book?

This book consists of page 1 through page 54.

Note: The last two pages are the reader comment form and its mailer. These pages may not be there if someone sent the comment form to StorageTek.

Trademarks

StorageTek is a registered trademark of Storage Technology Corporation. All other trademarks and features mentioned in this document are either trademarks of Storage Technology Corporation or of other corporations.

Related Documents

The documents listed below comprise the complete SVA 9500 set. See “Viewing and Ordering Documents” (below) to obtain documents through available distribution channels.

Shared Virtual Array (SVA) Subsystem

Documents below are available online, on CD-ROM, and as bound books.

- *9500 Shared Virtual Array Introduction (MP4001B).*
- *9500 Shared Virtual Array Operation and Recovery (MP4002B)*
- *9500 Shared Virtual Array Planning, Implementation and Usage (MP4003B)*
- *9500 Shared Virtual Array Physical Planning (MP4004B)*
- *9500 Shared Virtual Array Reference (MP4005B)*
- *9500 Shared Virtual Array System Assurance (MP4006B)*
- *Peer to Peer Remote Copy Configuration Guide (MP4007A)*

Shared Virtual Array Administrator (SVAA) for OS/390

Documents below are available online and on CD-ROM.

- *SVAA for OS/390 Configuration and Administration (PN 3112905xx)*
- *SVAA for OS/390 Reporting (PN 3112906xx)*
- *SVAA for OS/390 Messages and Codes (PN 3112907xx)*
- *SVAA for OS/390 Installation, Customization, and Maintenance (PN 3112908xx)*

SnapShot for OS/390

Documents below are available online and on CD-ROM.

- *SnapShot for OS/390 User's Guide (PN 3112912xx)*
- *SnapShot for OS/390 Installation, Customization, and Maintenance (PN 3112913xx)*

Shared Virtual Array Administrator (SVAA) for Solaris

Documents below are available online and on CD-ROM.

- *SVAA for Solaris User's Guide (PN 3112909xx)*
- *SVAA for Solaris Messages (PN 3112910xx)*
- *SVAA for Solaris Installation (PN 3112911xx)*
- *SVAA for Solaris Quick Start Guide (PN 3112971xx)*

SnapShot for Solaris

Documents below are available online and on CD-ROM.

- *SnapShot for Solaris User's Guide (PN 3112914xx)*
- *SnapShot for Solaris Quick Start Guide (PN 3112915xx)*

Shared Virtual Array Console (SVAC) for Windows NT

The document below is available online and on CD-ROM.

- *SVAC for Windows NT Quick Start Guide (PN 3112993xx)*

Viewing and Ordering Documents

Viewing the Documents Online

SVA 9500 documents can be viewed (and printed on your printer - these are PDF files) at the Customer Resource Center website at:

`http://www.support.storagetek.com/wwcss/SilverStream/Pages/pgCRCHome.html`

Click on 'Disk Subsystems', then 'Docs' under the 9500 section.

Note: A password is required. You may obtain the password from a StorageTek marketing representative.

Ordering Documents

SVA 9500 documents are available on CD-ROM, and bound book. Consult a StorageTek marketing representative to order the various manuals relating to the 9500.

CD-ROM

- Customer hardware documents: a CD-ROM of SVA 9500 customer documents is available by requesting the *9500 Customer Documentation, PN MP-9500x*.
- Software documents: a CD-ROM of SVA 9500 software documents is available by requesting *SVA Software Publications, PN 311295301-xx*.

Bound Books

Individual bound books of SVA 9500 documents are available through Software Manufacturing Distribution (SMD); request by document title and/or part number.

Other Documents

The following IBM documents may also assist you in using SVA 9500:

- *Planning For IBM Remote Copy SG24-2595-xx*
- *Remote Copy Administrator's Guide and Reference SC35-0169-xx*

History of Changes

Rev A - Initial release. November 1999.

Rev B - First reissue. December 1999.

- Changed the page numbering scheme to match that used by the PDF files.
- Updated BTU figures

Rev C - Second reissue. June 2000.

- Added Chapter 8 for fibre channel attachment information.
- Minor changes and updates.

Chapter 1 Installation Planning Requirements

Introduction

This guide was developed to help the customer, the StorageTek marketing representative and the StorageTek CSE plan the installation of the StorageTek Shared Virtual Array subsystem.

As a function of the planning process, you must verify and acknowledge that the site meets the minimum physical requirements detailed in this guide. Use the planning guidelines and specifications to ensure that the installation site for the Shared Virtual Array subsystem is physically prepared to receive the subsystem. This guide also provides a suggested installation-planning schedule and the physical dimensions, environmental conditions, site power specifications, electrical distribution requirements, and additional requirements for installing an Shared Virtual Array subsystem. ”Appendix B Physical Planning Checklist” on page 49 provides a worksheet and checklist for use in pre-installation planning activities.

Installation Planning Schedule

StorageTek assigns an installation team to plan and coordinate each subsystem installation in order to promote error-free installations. StorageTek marketing and CSEs work with the customer to assist in planning any installation.

The following suggested schedule provides sufficient lead time for the major events that must occur prior to installation. This schedule provides a general guideline; actual lead times may vary.

1. Three months before delivery, the installation team:
   - Plans the physical layout of the equipment using the physical planning templates and 1/4-inch grid paper.
   - The templates are scaled 1/4-inch = 1 foot. (Physical planning templates are provided in Figure 1-1 on page 13).
   - Reviews floor loading requirements. (Refer to “Floor Loading” on page 21.)
   - Ensures that equipment power requirements and the specified electrical outlets will be available.
   - Determines if I/O cables must be routed outside the computer room. If so, special cables with an improved nonflammability rating must be used. (Refer to “System Cables” on page 15 for the proper cables to order.)
2. Two months before delivery, the installation team:
   - Orders the Shared Virtual Array Administrator (SVAA) software.
   - Ensures that adequately trained personnel will be available at

delivery.

3. Four weeks before delivery, the installation team:
   - Reviews the planned physical layout and power requirements.
   - Submits the order for subsystem cables.
   - Surveys the installation site and identifies the equipment necessary to move the subsystem from the delivery platform to the installation area.
   - Identifies any special shipping requirements.
   - Confirms the scheduled delivery date.
   - Orders and schedules the installation of the phone line(s).
4. Two weeks before delivery, the installation team:
   - Confirms the scheduled delivery date.
   - Establishes an installation time schedule and includes sufficient system time to test subsystem operations.
   - Ensures that all parts and bills of material are on hand to accomplish hardware and software conversions to presently-installed equipment.
   - Ensures that the required power outlets have been installed.

Subsystem Layout

Floor space and layout requirements differ for each subsystem depend upon the intended applications as well as the physical area available. In general, consider the following points:

- Priority assignments, cable lengths, and service clearance requirements are some of the limiting factors when installing a subsystem.
- Subsystem layout is determined by a combination of factors. Some factors include:

  -- equipment components

  -- plans for future expansion

  -- procedures for using auxiliary I/O equipment

  -- operator convenience

  -- visibility from the console

  -- other physical requirements.
- Storage space may be required within the computer room for temporary storage of media, circuit cards, printouts, and other data processing materials. All materials must be stored in properly-designed and protected storage areas.
- If ServiceTek is to be installed (or is included in future plans), additional space is required for the associated modems and/or Extended Routing Switch (XRS). Additional phone lines are required, as well.

- Space may be required for office equipment, storage cabinets, files, tables, desks, and voice telephone equipment.
- Work-flow between the computer room and other areas must be carefully considered when planning aisles and intermediate storage areas.

Priority

Priority is the sequence in which I/O devices are attached to the channels. The assignment of priorities is application and program-sensitive and affects the capabilities of the channels. When planning the Shared Virtual Array subsystem channel attachment keep the following information in mind:

- It is *recommended* that the Shared Virtual Array subsystem be the *only* device on the channel.
- Shared Virtual Array subsystems are *always* high-priority on parallel channels.
- Ensure that any devices that precede the Shared Virtual Array subsystem in the sequence on any given channel are plugged low.
- Shared Virtual Array subsystem must always be *last on the channel*, on parallel channels.

Physical Characteristics

Because each customer has different requirements, make an accurate drawing of any proposed layout. The physical planning template, scaled at 1/4 inch to the foot, is provided in Figure 1-1 on page 13.

This template shows the clearances required for operator and engineer servicing and test equipment, the swing radii of access panels, and the cable hole locations. Use this template to simplify the design of the subsystem layout.

The Shared Virtual Array subsystem addresses the user's floor space constraints. The physical characteristics of the Shared Virtual Array, including floor space requirements, are listed in Table 1-1 on page 12.

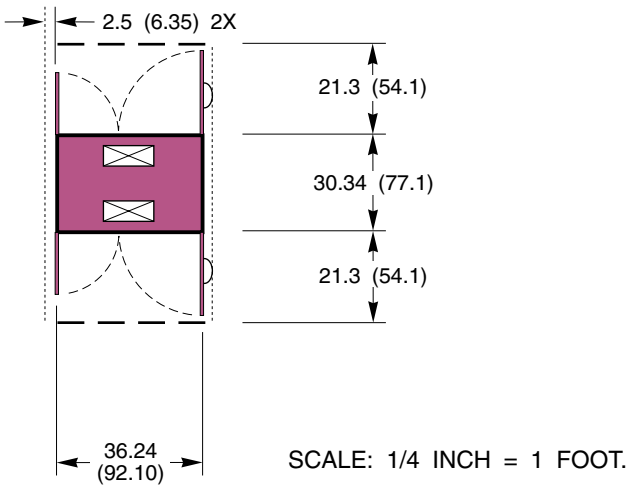
Service personnel require access to both the front and rear of the equipment. Therefore, there must be adequate space (or the ability to make space) for panel openings, test equipment, and for a CSE to work. In addition, there must be outlets available in the room for test equipment and tools.

Table 1-1 Subsystem Physical Characteristics

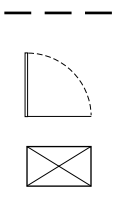
Physical Attribute	Dimensions
Height	154.94 cm (61.0 inches)
Width (with two side covers)	92.1 cm (36.24 inches)
Depth	77.1 cm (30.34 inches)
Service Clearance (front and rear)	54.1 cm (21.3 inches)
Side Clearance (left and right)	6.4 cm (2.5 inches)
Weight	445 kg (982 pounds)

NOTES:

1. DIMENSIONS ARE IN INCHES (CENTIMETERS).
2. OPERATOR PANEL IS ON FRONT OF UNIT.
3. HINGED COVERS ARE SHOWN IN OPEN POSITION (SEE LEGEND).
4. NO SIDE ACCESS REQUIRED. THIS CLEARANCE IS CUSTOMER OPTIONAL FOR PERSONNEL ACCESS.



LEGEND:



C95009

Figure 1-1 9500 Shared Virtual Array Physical Planning Template

This page intentionally left blank

Chapter 2 System Cables

Consider the following general issues when laying out the system and preparing the cable order:

- The location and number of control units assigned to each channel
- The number of channel interfaces that will be connected to each control unit
- The routing of the I/O cables (i.e. outside/inside the computer room)

Locate subsystem components so the maximum cable lengths given in the equipment specifications are not exceeded. See your StorageTek installation planning representative for valid StorageTek cable part numbers.

Planning the cable order:

- Refer to “Measuring Cable Lengths” on page 15 for the right cable length
- Refer to “I/O Cables” on page 15 for channel connection information
- Refer to “Electrical Power” on page 25 for power connection cable information

Measuring Cable Lengths

To measure cable lengths, measure the center-to-center distance between cable entry holes (along the cable route) *plus* the length of cable required to reach above the raised floor to the connector located on the device.

I/O Cables

When planning for the ordering and installation of I/O cables, consider the options for standard connection lengths and the recommendations for type and labeling of cables presented in the following paragraphs. See your StorageTek installation planning representative for valid StorageTek cable part numbers.

Note: Channel cables can be ordered in 10 foot increments, up to 400 feet.

Fiber-Optic Control Interface Cables

Review this general fiber-optics handling information before starting any 9500 system procedure involving fiber-optic components. To prevent damage to fiber-optic components, follow these general rules:

- Do not exceed the maximum bend radius of a fiber-optic cable, as this can break the glass strands and prevent light transmission.
- Fiber-optic cables ***cannot*** be repaired in the field. If a cable is damaged, order a replacement.
- If a fiber-optic strand breaks, clean up the glass fragments to avoid injury.

- Avoid touching the core of a fiber-optic cable, as this can contaminate the glass strand and prevent light transmission. If a core becomes contaminated, clean it with a fiber-optic cleaning kit.
- Do not reinstall original protective plugs on fiber-optic card jacks. The plugs are assumed to be contaminated and can damage the fiber-optic coupler if reinstalled. If fiber-optic cables will remain disconnected from jacks (subject to contamination), install new plugs.

Table 2-1 Fiber-Optic Control Interface Cable Specifications

Optical Performance	**Specification**
Attenuation	1.0 db/km @ 1300 nm
Bandwidth	500 MHz/km @ ≤ 2 km
Handling Characteristics	**Specification**
Pulling Strength	27.2 kg (60 pounds))
Crush Resistance	650 Newtons/cm (371 foot-pounds/inch^2)
Minimum Bend Radius	96 mm (3.74 inches); or 20× cable outside diameter (OD)
Cable Weight	59.7 kg/100 meters(401 pounds/1000 feet)
Bending Cycles	100 at minimum bend radius
Physical Environment	-16°C to +32°C (3.2°F to 89.6°F)

ESCON Cables Lengths and Part Numbers

Table 2-2 Subsystem Controller-to-Host ESCON Cables

Plenum Rated PN	Description
10800043	2 meters (5 feet)
10800044	3 meters (10 feet)
10800045	4 meters (12 feet)
10800046	7 meters (20 feet)
10800047	13 meters (40 feet)
10800048	22 meters (70 feet)
10800049	31 meters (100 feet)
10800050	46 meters (150 feet)
10800051	61 meters (200 feet)
10800052	77 meters (250 feet)
10800053	92 meters (300 feet)
10800054	107 meters (350 feet)
10800055	122 meters (400 feet)
1080XXXX	Variable 4.1 to 500 meters (12 to 1640 feet)

Note: Non-standard lengths, available through StorageTek Marketing group

This page intentionally left blank

Chapter 3 Site Requirements

Prior to subsystem arrival, the following site specifications must be addressed:

1. Environmental specifications
2. Floor loading
3. Electrical power
4. Grounding
5. Power distribution system
6. Power specifications
7. Operating temperature
8. Storage areas
9. Fire precautions

These specifications must be considered prior to initial installation of the computer system; however, any time components are added to a system, the site requirements must be reviewed to ensure proper installation.

Environmental Specifications

The environmental specifications for shipping, storing, and operating the Shared Virtual Array subsystem are shown in Table 3-1. The parameters to be maintained are temperature, thermal change, humidity, and altitude.

Table 3-1 Storage Environmental Requirements

Environmental Factors	Shipping Environment[2]	Storage Environment[3]	Operating Environment
Temperature	-40° to +140° F (-40° to + 60° C)	50° to 104° F (10° to 40° C)	59° to 90° F (15° to 32° C)
Thermal Change (max. rate/hr)	27° F (15° C)	27° F (15° C)	9° F (5° C)
Humidity %	10 to 80 percent	10 to 80 percent	20 to 80 percent
Altitude	0 to 50,000 feet (0 to 15,240 meters)	0 to 10,000 feet (0 to 3,050 meters)	0 to 8000 feet (0 to 2439 meters)

Note:

1. Shipping environment must not exceed storage environment limits for longer than 10 days.
2. Storage environment must not exceed operating environmental limits for longer than 60 days.
3. Humidity specifications exclude conditions that may cause condensation on disk drives.

Floor Loading

Strict compliance with ratings and weight distribution clearance is critical. The floor loading information provided must be reviewed carefully.

DANGER
Failure to comply with the floor load rating and service clearance requirements can result in compromised structural integrity or raised floor structure collapse causing injury and/or property damage.

The rating and condition of all raised floor panels and pedestals must be evaluated.

Table 1-1 on page 12 provides weight measurements for all units. Table 3-2 on page 22 provides the floor loading for weight measurements for all units.

As additional clearance is provided around each unit or subsystem, the average floor load decreases. This is shown in Table 3-2 on page 22. Examples of floor loadings are listed in Table 3-4 on page 24. Figure 3-2 on page 23 shows locations and loads for each load point. Equipment loading from adjacent floor area must be considered in the evaluation of the overall floor loading. Consult a structural engineer for a specific loading analysis and determination of floor capacity.

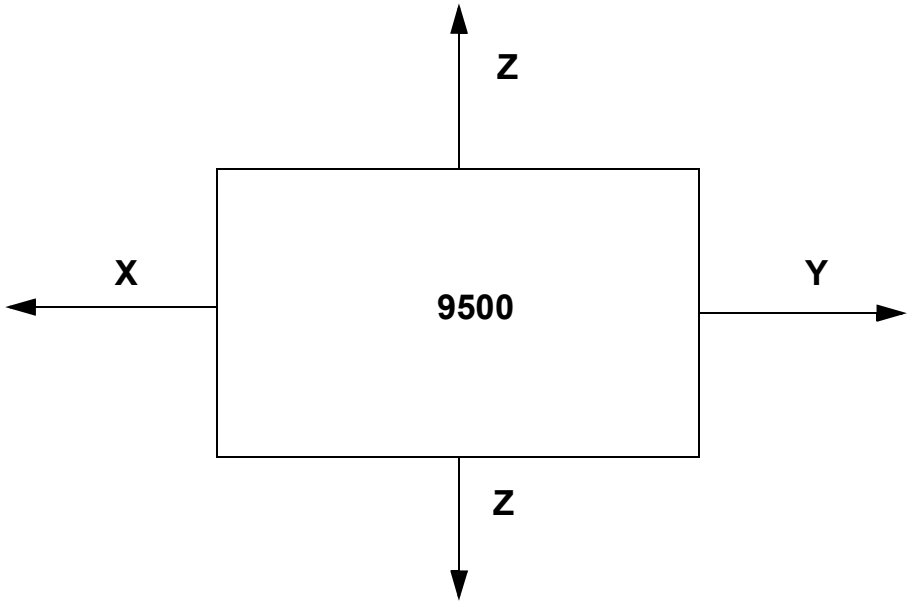


Figure 3-1 9500 Axis Reference

Table 3-2 Superimposed Floor Load

Service Clearance (Z) Inches (cm)	Average End Clearance (X+Y) / 2, Inches (CM)				
	3 (7.6)	24 (61.0)	36 (91.4)	48 (121.9)	60 (152.4)
22 (55.9)	91 lb/sq ft^2 (443 kg/m^2)	70 lb/sq ft^2 (340 kg/m^2)	63 lb/sq ft^2 (308 kg/m^2)	58 lb/sq ft^2 (285 kg/m^2)	55 lb/sq ft^2 (268 kg/m^2)
38 (96.5)	77 lb/sq ft^2 (374 kg/m^2)	60 lb/sq ft^2 (295 kg/m^2)	55 lb/sq ft^2 (270 kg/m^2)	52 lb/sq ft^2 (252 kg/m^2)	49 lb/sq ft^2 (239 kg/m^2)
46 (116.8)	72 lb/sq ft^2 (350 kg/m^2)	57 lb/sq ft^2 (279 kg/m^2)	53 lb/sq ft^2 (257 kg/m^2)	49 lb/sq ft^2 (241 kg/m^2)	47 lb/sq ft^2 (229 kg/m^2)
54 (137.2)	68 lb/sq ft^2 (331 kg/m^2)	55 lb/sq ft^2 (267 kg/m^2)	51 lb/sq ft^2 (247 kg/m^2)	48 lb/sq ft^2 (232 kg/m^2)	45 lb/sq ft^2 (222 kg/m^2)
62 (157.5)	64 lb/sq ft^2 (315 kg/m^2)	52 lb/sq ft^2 (256 kg/m^2)	49 lb/sq ft^2 (238 kg/m^2)	46 lb/sq ft^2 (225 kg/m^2)	44 lb/sq ft^2 (215 kg/m^2)

Notes:

1. Average end clearance calculation formula: (X+Y) / 2.
2. Refer to Figure 3-2 on page 23. for location and load of each support point.
3. Values in this table assume 15 lb/ft^2 (73 kg/m^2) superimposed dead load over entire area for raised floor, cables, etc., and 15 lb/ft^2 (73 kg/m^2) live load for personnel and equipment in clearance areas between subsystems.
4. Loading of adjacent floor area must be considered in evaluation of overall floor capacity.
5. Other floor loading configurations are possible. Consult a structural engineer for specific loading analysis/evaluation of floor capacity.

Table 3-3 Shared Virtual Array Loading Specifications

Produce Model #	Basic Load[1]	Superimposed Floor Load[2]
9500	149 lb/sq ft (730 kg/sqm)	99 lb/sq ft (485 kg/sqm)

Notes:

1. The floor load over the machine footprint alone.
2. Same conditions as in Table 3-2 on page 22 with 30 inch ‘Z’ service clearance and 0 inches in ‘X’ and ‘Y.’

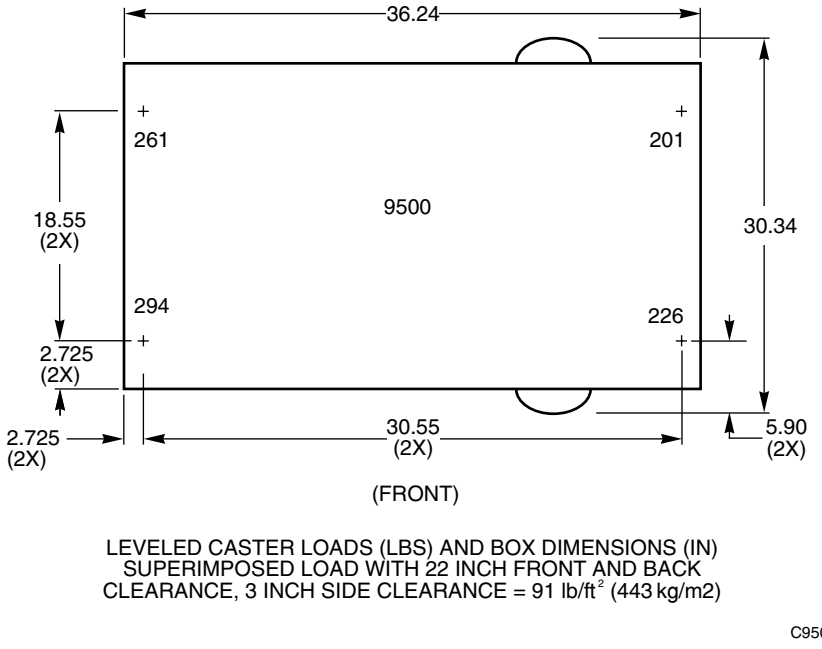


Figure 3-2 Shared Virtual Array Weight Distribution and Leveler Locations

Raised Floors

Reactions and locations of all loads at support points of the Shared Virtual Array are shown with physical specifications in Figure 3-2 on page 23. A representative of the customer's raised floor manufacturer or a structural engineer should be consulted to assure that installations on existing floors meet the following criteria. New floors should be designed and built to this criteria.

The raised floor panels must be capable of resisting a concentrated load of 1000 pounds (454 kilograms) anywhere on the panel with a maximum deflection of 0.08 inches (2 millimeters). In addition, a rolling load of 400 pounds (181 kilograms) anywhere over the panel must be accommodated. Protective floor covering should be used over access floor panels when moving the Shared Virtual Array units to prevent floor surface damage. Where floor tiles are cut to provide service access, additional pedestals may be required to maintain panel capacity. Perforated panels are not required for the Shared Virtual Array units, but if they are used, they must be verified for load rating.

The raised floor pedestals must be able to resist a 5000 pound (2268 kilogram) axial load. Lateral stability of raised floors in areas of high earthquake activity must be considered. The raised floor system shall be capable of resisting the lateral forces shown in Table 3-4 on page 24. These forces are applied at the top of the pedestal, and are based on the seismic zone in which the installation occurs.

Table 3-4 Horizontal Force Chart

Seismic Risk Zone1	**V (Horizontal Force Applied at Top of Pedestal)**	
	Pounds	Kilograms
1	27.6	12.6
2A	41.4	18.8
2B	55.2	25.1
3	82.8	37.7
4	110.4	50.2

Note: Horizontal forces based on 1991 Uniform Building Code (UBC) Sections 2336 and 2337 assuming minimum operating clearance of multiple 9500 Shared Virtual Array units. Installations in areas not covered by the UBC should be engineered to meet seismic code provisions of local jurisdiction.

Chapter 4 Power

Electrical Power

StorageTek equipment operates best with a reliable power source that is free from interference or disturbance. Power supplied by local power companies is generally of sufficient quality.

To take full advantage of the Shared Virtual Array's subsystem ac power redundancy, the two ac inlet/line filter assemblies should receive power from two independent sources that are not likely to fail simultaneously.

The StorageTek equipment yields reliable operation when supplied by a properly installed power system. Qualified personnel must ensure that the voltage measured at the power receptacle is within the specified tolerance for the machine. In addition to power for StorageTek products, a separate power feeder is required for such items as lighting, air conditioning and other electrical systems.

Electrical power for the building is normally derived from a 3-phase power distribution system. Single-phase power outlets (receptacles) are normally provided in general office areas. Data processing rooms are normally provided with 3-phase power. The SVA 9500 operates on single phase power.

AC power configurations are described in Table 4-1 on page 26 and should be used as a guideline for any site where StorageTek equipment is to be installed. Specific Shared Virtual Array subsystem power requirements and heat figures are listed in Table 4-2 on page 27 (with no power component failures) and in Table 4-3 on page 28 (with one power component failure).

Electrical Connectors

The part number of the subsystem power connectors for 60 Hz applications (supplied with the units) is a Russell Stoll 3750DP

The compatible mating connectors (which are not provided) are:

- Russell Stoll 9R33V0W (rigid/bulkhead mount)
- Russell Stoll 9C33V0 (flexible mount)

Note: There is no Hubbell compatible connector.

Because of the varied connection requirements of 50 Hz power systems, power connectors for 50 Hz applications are not provided.

Power Source Specifications

The Shared Virtual Array subsystem is designed to operate at the voltages listed in Table 4-1 on page 26 for the indicated frequencies.

The following paragraphs provide additional specifications for Shared Virtual Array subsystem power.

Table 4-1 9500 Subsystem AC Source Power

AC Power Source	Voltage Range	Frequency Range
Single Phase, 3 wire	170-240	47-63

Frequency Limits

The Shared Virtual Array subsystem is frequency tolerant from 47 to 63 Hz.

Circuit Breakers, Connectors and Degree of Power Redundancy

Caution: To avoid injury and prevent subsystem damage, always label AC line filter cables to indicate:

- the side of the subsystem where the cable supplies power (0 or 1)
- the customer AC source name
- the wall panel number
- the breaker numbers (for all three phases)

Power Considerations

The following considerations should be addressed when site power is configured to accept the Shared Virtual Array subsystem:

1. This subsystem inherently prevents loss of data.
2. The various degrees of available redundancy in the possible configurations vary in cost as the complexity of the configuration changes.
3. Host power configuration should be considered when configuring power for the Shared Virtual Array subsystem.

Redundancy

The following are examples of different levels of possible ac redundancy (from low to high):

1. No redundancy. Both ac cords from the same unit connected to different panels and breakers which receive power from the same local utility source.
2. Secondary Selective System. The site is redundantly powered from two sources and is equipped with a transfer mechanism; essentially, a building with “two line cords.”
3. One side of the Shared Virtual Array subsystem powered from the utility; the other side connected to the same utility *with* an uninterruptable power source (UPS) backup.
4. Both sides of the subsystem powered from the same utility; both sides backed up from individual UPS systems.

5. Separate utility sources available at the site; each side of each subsystem unit powered from a different utility.
6. Separate utility sources available at the site; each side of each subsystem powered from a different utility, and with a UPS backup on one source.
7. Separate utility sources available at the site; each side of each subsystem unit powered from a different utility, and with a UPS backup on both utility sources.

Line-to-Line Voltage Imbalance

The value of any of the three phase-to-phase equipment voltages in a 3-phase system shall not differ by more than 2.5% from the arithmetic average of the three voltages.

Harmonic Content

When the equipment is operating, the maximum total harmonic content of the power system voltage waveforms on the equipment feeder must not exceed 5% with the equipment operating.

Power Measurements

All Arrays have 16 drives.

Table 4-2 1N Data

No. of 16-Drive Arrays	AC Voltage in	AC Current in	VA	Watts	Power Factor	BTU/Hr
4	264	8.674	2290	2179	0.95	7437
4	208	10.811	2248	2205	0.98	7526
4	180	12.557	2261	2237	0.989	7635
3	264	7.448	1967	1871	0.95	6386
3	208	9.188	1912	1874	0.98	6396
3	180	10.516	1893	1872	0.99	6389
2	264	6.424	1696	1617	0.95	5519
2	208	7.986	1661	1630	0.98	5563
2	180	9.18	1655	1638	0.99	5590
1	264	5.528	1460	1398	0.96	4771
1	208	6.885	1432	1408	0.98	4806
1	180	7.905	1424	1411	0.99	4816

Table 4-3 2N Data

No. of 16-Drive Arrays	AC Voltage in	AC Current in	VA	Watts	Power Factor	BTU/Hr
4	264	9.771	2579	2275	0.881	7765
4	208	11.236	2339	2204	0.942	7522
4	180	12.729	2291	2213	0.965	7553
3	208	11.23	2021	1956	0.967	6676
3	180	11.335	2043	1977	0.967	6748
2	208	8.678	1807	1716	0.949	5857
2	180	9.785	1761	1708	0.97	5829
1	208	7.377	1534	1464	0.95	4997
1	180	8.389	1512	1472	0.97	5024

The current is the total current measured into both line cords.

1N refers to no power supplies failing. 2N refers to one power supply failing.

Grounding

For personnel safety, as well as electrostatic discharge (ESD) protection, a machine must be properly grounded. An insulated green or green/yellow wire ground, at least the same size as the phase wire, is required between the branch circuit panel and the receptacle. This is not a neutral.

Note: Local codes and standards may establish more stringent requirements. Always comply with local codes.

For personnel safety, the ground must have sufficient low impedance to limit the voltage to ground and to facilitate the operation of circuit protective devices. For example, the ground path shall not exceed one ohm for 120 volt, 20 ampere branch circuit devices. This yields a maximum machine voltage of 20 volts in the event of internal shorts.

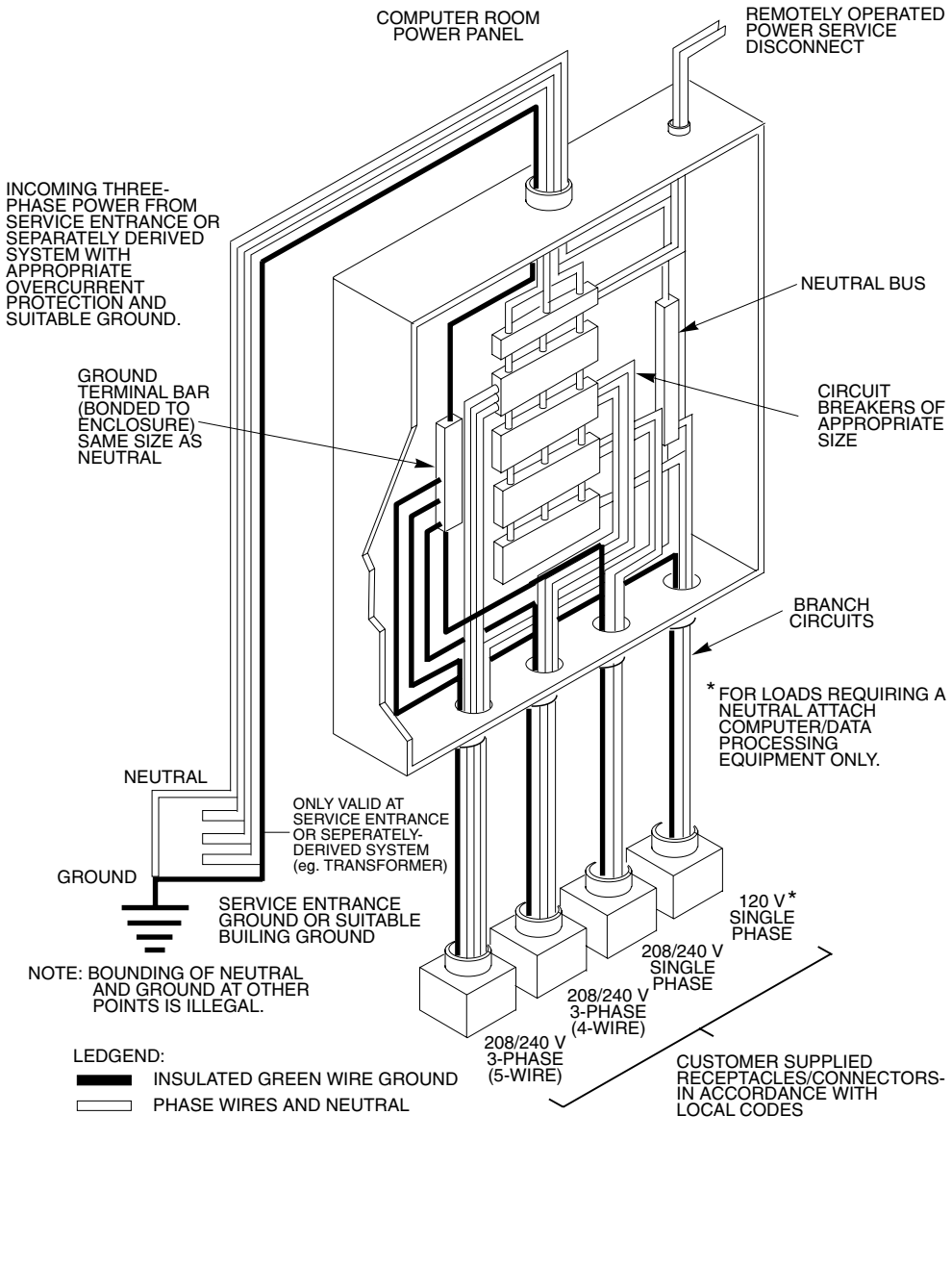


Figure 4-1 Electrical Power and Grounding

Good bonding techniques such as bared metal and inside/outside star washers are recommended. It is not sufficient to provide ground paths through anodized material or hinges. Sheet metal screws must never be used as a means of attaching a ground.

A low impedance grounding and lightning protection must be considered when planning and installing an electrical system. The electrical contractor must meet local and national code requirements.

StorageTek equipment power cords contain an insulated equipment grounding wire (green or green with a yellow stripe) that connects the machine frame to the ground terminal at the power outlet.

The power outlets for StorageTek equipment must be connected by an equipment grounding conductor to the grounding bus bar in the branch circuit distribution panel. The grounding bus bar must be connected by an equipment grounding wire back to the service entrance or separately derived power source (transformer).

Static Electricity

Static electricity can be caused by the movement of people, furniture, and equipment. In addition to causing discomfort to personnel, an electrostatic discharge (ESD) can cause a machine malfunction. It is possible for electrostatic discharge (ESD) to destroy discrete components on logic cards, change information on magnetic media, or cause other problems.

Special attention must be given to floor paneling and floor covering. Panels must be made with nonconducting cores for high resistance. Anti static floor coverings are required.

Other sources of static electricity include furniture, casters, vacuum cleaners, and plastic access panels. The resistance between furniture and the floor must be at least 10 *u*ohms.

Every possible precaution must be taken to minimize static discharge. This can be accomplished by providing a conductive path from raised floors to ground and maintaining the computer room humidity within the recommended control parameters.

Ensure you follow the proper ESD precautions as prescribed in the maintenance manuals.

Power Distribution System

The following defines the electrical power distribution system required for proper operation of your StorageTek equipment.

Power Load

By calculating the power load of all the equipment, you may determine the number of amps required for your power service. Large inrush conditions, such as motor start times, need to be considered. When multiple

subsystems/units are to be installed, your electrician should rotate the phases when connecting power (to prevent overloading any single phase).

Power Panel Feeders

Ensure that the feeder wires to the branch-circuit distribution panel (Figure 4-1) have adequate current handling capacity for the StorageTek equipment power load.

Branch Circuits

The computer branch circuit panel must be in an unobstructed, well-lighted area in the computer room.

Note: Electricians are to review and adhere to local codes and regulations at all times when planning and installing branch circuits.

The individual branch circuits on the panel must be protected by suitable circuit breakers properly rated according to manufacturer specifications and applicable codes. The branch circuit breaker must not exceed the local code requirements to protect branch circuit conductors. Breakers must have delays for motor start inrush. Each circuit breaker must be labeled to indicate which branch circuit it is protecting.

Branch circuits installed under a raised floor must be within 10 feet (three meters) of the machines they supply. If the branch circuits are required to run in a metal conduit, either rigid or non-rigid, the conduit system must be continuous and uninterrupted from the machine power cord connection to the building or transformer ground.

This page intentionally left blank

Chapter 5 Precautions

Safety Precautions

Review this general safety information before starting any 9500 system procedure. Also review specific safety information (i.e., DANGER and CAUTION notices) within a particular procedure each time before starting that procedure.

DANGER
Hazardous voltages are ALWAYS present when power is applied to a system unit. If a system uses batteries as part of its backup power system, a hazardous energy potential exists even when customer AC source power is disabled. Use EXTREME CAUTION when working around power connections, line filters, AC inlets, power distribution units, and DC power supplies.

- ALWAYS complete steps in the order listed. Performing steps out of order can expose you to potentially dangerous or lethal shock hazards.
- NEVER work alone when power is present in any part of a system, or under hazardous conditions. Ensure that another person familiar with the system power-off controls is in the immediate area while you are working.
- Remove metal objects (rings, watches, badge chains, etc.) and place those in your pocket or away from the unit you are working on.
- Use only approved tools and test equipment, as supplied in the service representative tool kit.
- Prompty replace worn or broken tools and defective test equipment.
- Ground power tools and test equipment before beginning procedures.
- Restrict loose clothing and hair to avoid entanglement in moving parts.
- Use caution when working near open floor tiles.
- Wear safety glasses when using power tools, chemicals, or soldering.
- Replace covers and doors as quickly as possible to maintain proper unit airflow and to prevent FRU overheating which could cause thermal EPO.
- Use good housekeeping practices to prevent fire hazards and accidents.
- Before returning a system unit to a customer, complete these steps.
  - Reinstall all fasteners that were removed.
  - Reconnect all cables; NEVER leave a 'live' cable end exposed.
  - Reinstall all internal covers and ensure those are properly seated.
  - Reinstall all external doors and ensure those are locked.

Operating Temperature

The Shared Virtual Array subsystem is designed to operate within a temperature range of 59 degrees to 90 degrees F (15 degrees to 32 degrees C). Other equipment that is installed in the same room may have more or less restrictive conditions or may have special cooling requirements. A complete list of Shared Virtual Array environmental requirements is provided in Table 3-1 on page 20.

You can size your cooling system's requirements by referring to Table 4-2 on page 27 and Table 4-3 on page 28 for the KBTUs per hour generated by the Shared Virtual Array.

The life of your StorageTek equipment can be increased by keeping its environment as cool as possible. Avoid locating it near hot air exhausts, heat exchangers or other heat generating devices.

The Shared Virtual Array subsystem is protected against overheating by internal thermal sensors that will shut down the equipment in the event of high temperature conditions. For maximum reliability, it is recommended that room temperature be maintained at 70 degrees F (21.1 degrees C) plus or minus 5 degrees.

Storage Areas

All storage areas for Shared Virtual Array accessories must comply with National Fire Protection Association standards. Magnetic media are to be stored in fire resistant cabinets away from magnetic fields. Magnetic fields greater than 50 oersteds intensity can cause loss of information or the introduction of noise on both tapes and disks.

Areas to be used for the storage of magnetic media should have environmental controls to maintain temperature of 60 degrees F to 90 degrees F (16 degrees C to 32 degrees C) and humidity of 8% to 80%.

The room must be constructed of fire-resistant material with a minimum two-hour fire-resistance rating. The fire prevention equipment recommended for the room is a chemical-flooding system or a sprinkler system.

Fire Prevention

Note: Always review and adhere to local codes and regulations for fire prevention.

Fire prevention can be classified into two categories:

- Passive
- Active

Passive fire prevention (the first line of defense) is the integrity of the computer room and its ability to withstand fire and water damage. For optimum protection, observe the following:

- Locate the computer room away from the storage of gases and other potential explosives.
- Fireproof and waterproof your walls, floors and ceilings.
- Install shatterproof windows that are sealed in masonry.
- All main electrical circuits must have emergency power off switches located where they can be quickly activated during an emergency evacuation.

Active fire prevention is the fire control system and is implemented through the installation of fire prevention equipment.

- Install smoke alarms or other early warning equipment in the computer room.
- Place all combustible waste in flame-suppressant trash containers.
- Install carbon dioxide fire extinguishers for electrical fires and pressurized water extinguishers for ordinary combustible materials.

This page intentionally left blank

Chapter 6 Primary Problem Areas and Issues

Most electrical utility companies provide power to satisfactorily operate StorageTek equipment. However, possible equipment errors can be caused by outside (radiated or conducted) transient electrical noise signals being superimposed on the power provided to the equipment. Figure 6-1 shows a typical transient grounding plate, which is not to be confused with the code approved grounding electrode.

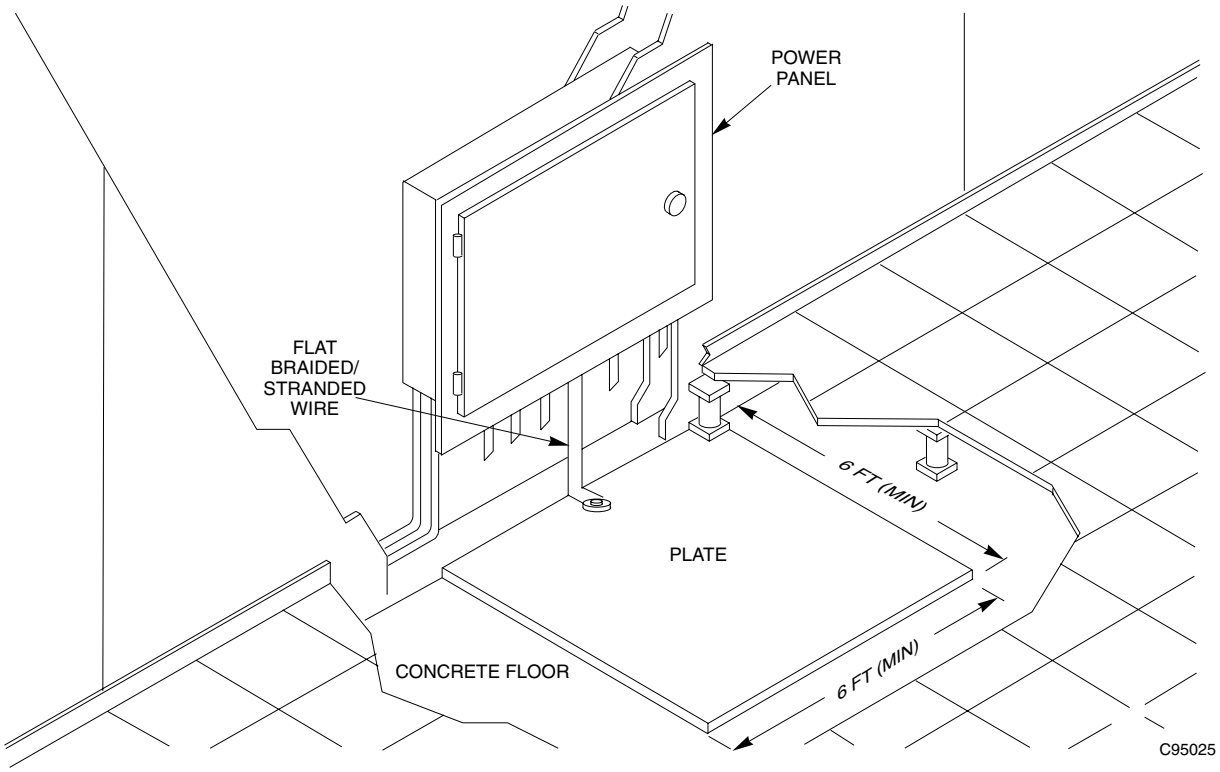


Figure 6-1 Transient Grounding Plate

Proper lightning protection must be installed on the computer power source.

A means for disconnecting power from all equipment in the computer room must be provided. This means of disconnecting must be in locations readily accessible to the operator at the principle exit doors. Consult local and national codes to determine the requirements for this disconnect.

StorageTek equipment is designed to operate within most common power line disturbances. The quality of incoming power, however, can make a substantial difference in the performance of the equipment. Power disturbances or transients can cause equipment power failures or errors. Transients can come into the site on the power company lines, but (with

the exception of lightning) are more often caused by electrical equipment installed within the building. For example, transients can be caused by welders, cranes, motors, induction heaters, elevators, copy machines and other office equipment.

Failures caused by the power source are basically of three types:

1. Power outages include short duration dips in voltage as well as prolonged outages (brownouts). To take advantage of the Shared Virtual Array subsystem redundant ac power distribution function, one subsystem input should be connected to a UPS (uninterruptable power source) system.
2. Transient electrical noise superimposed on power lines may be caused by a variety of industrial, medical, communication or other equipment:
   - Within or adjacent to the computing facility
   - Near the power company's distribution lines.
3. Switching large electrical loads can cause problems, even though the source is on a different branch circuit. If such a condition is suspected, a separate dedicated feeder or transformer for your StorageTek equipment directly from your power source is recommended.

   Motor-operated devices on the same power source as StorageTek equipment can, under certain conditions, cause intermittent electrical disturbances. To minimize the effects of high frequency noises, the branch circuit power panel servicing the equipment must be mounted in contact with bare building steel or connected to it by a short length of cable.

   If this is not possible, a metal area (power panel plus conduit, plus plate) of at least 10 square feet (approximately 1 square meter) in contact with masonry may be used. The plate must be connected to the green wire common. (Refer to Figure 4-1 on page 29.) The connection must not be more than 5 feet (1.5 meters) long and must consist of No. 12 AWG (0.0051 square inches or 3.3 square millimeters) or larger wire.

   If transient-producing devices have been removed from the power bus and the computer room power panel and power line disturbances still exist, it may be necessary to install power line isolation equipment. This equipment includes:
   - Transformers
   - Motor generators
   - Uninterruptable power sources (UPS)
   - Other power conditioning equipment

Chapter 7 SCSI Open System Attachment

Selecting A Site

The SVA Attach Feature is designed to operate in a typical commercial environment, and should be located near a grounded, three-pronged power outlet in an area that is clean and dust-free, well ventilated, and isolated from strong electromagnetic fields produced by electrical devices such as air conditioners, large fans, large electric motors, radio and TV transmitters, and high-frequency security devices. The SVA Attach Feature needs to be placed close enough to the host processor so that the SCSI cable length requirements can be met without having the SCSI cables exposed in a hazardous manner. For a discussion of the actual length of the SCSI cable, see “SCSI Cable Lengths” below.

SCSI Cable Type

The SVA Attach Feature is primarily used in high performance, high availability installations. It is imperative that high quality cable and terminators be used. Many installation problems can be traced to faulty cable or terminators. If you are unsure of your cabling system, contact StorageTek technical support.

SCSI Connector Types

The SVA Attach Feature uses 68 pin high density female P-type connectors. There are two connectors at the rear of the SVA Attach Feature, one for each SCSI bus.

SCSI Terminators

The SVA Attach Feature is supplied with a feed-through terminator attached to the SCSI ports. The terminator should meet the minimum recommendations of the SCSI specification. These feed-through terminators are shown installed on items 5 and 6 of Figure 7-2 on page 33 of the S*hared Virtual Array Extended SCSI Attach Feature Information Guide*, 95837. Figure 3-5 on page 16 of the S*hared Virtual Array Extended SCSI Attach Feature Information Guide*shows a feed-through terminator.

SCSI Cable Lengths

SVA Attach Feature units should be located such that all of the SCSI devices to be connected to it are within the cable length limitations (25 meters). This SCSI cable length applies individually to each SVA Attach Feature box. The length of the “cable” includes not only the external cable that runs from one device or host to another, but the part of the cable that is internal to the device or host up to the SCSI bus receiver/drivers on the interface card within that device or host.

SCSI Cables Available From StorageTek

Table 7-1 Cable Lengths and Part Numbers

Cable Length (meters)	StorageTek Part Number
3	10083313
6	10083314
15	10083315
20	10083316

Optical Data Link (ODL) Options

The SVA Attach Feature currently provides LED-based ODL w/ Duplex "SC" connector.

All of the current ODL options use a 1300nm wavelength. For this type of installation, StorageTek recommends 62.5/125 micron multimode fiber.

Note: IBM Corporation produces a highly informative booklet, *'Planning for Fiber Optic Channel Links"* (publication number GA23-0367-03) which contains a great deal of useful information concerning fiber optic cabling systems. This publication can be ordered from an IBM representative or branch office.

Table 7-2 StorageTek ESCON Cable lengths

Length	StorageTek Part Number
2 meters (5 feet)	1080043
3 meters (10 feet)	1080044
4 meters (12 feet)	1080045
7 meters (20 feet)	1080046
13 meters (40 feet)	1080047
22 meters (70 feet)	1080048
31 meters (100 feet)	1080049
46 meters (150 feet)	1080050
61 meters (200 feet)	1080051
77 meters (250 feet)	1080052
92 meters (300 feet)	1080053
107 meters (350 feet)	1080054
122 meters (400 feet)	1080055
Variable from 4.1 meters to 500 meters (12 feet to 1640 feet)	1080XXXX

Specifications

Table 0-1 SVA Attach Feature and SVA Attach Feature Cable Specifications

Controls/Displays:	
Front panel	Configuration switches and status LEDs
SCSI Interface:	
Connector	68-pin high-density
Terminator	External (removable)
Maximum number of LUNs	120 per bus
Number of busses	2
Max instantaneous data rate	40 MB/Sec. (Ultra and Wide)
Data transfer modes	Asynchronous or synchronous to 20 MHz narrow or wide
Maximum total SCSI Cable Length (Twisted Pair):	
Differential	25 meters
SCSI Cable characteristics:	
Type Round Twisted Pair	28 AWG shielded twisted pair
SVA Attach Feature Mechanical:	
Size	4.5” X 17.2” X 16.8”
Weight	20 pounds
Power supply	90-264 VAC, 50-60 Hz, 160 VA
SVA Attach Feature Environmental:	
Temperature (operating)	10 to 35^{o} C (50 to 95^{o} F)
Humidity	Maximum 80% non-condensing

This page intentionally left blank

Chapter 8 Fibre Open System Attachment

Fibre Cable Type

The 9500 SVA supports both single mode and multi mode fibre channel attach. If you are unsure of your cabling system, contact StorageTek technical support.

Fibre Channel Cables Available From StorageTek

Table 8-1 Fibre Cable Part Numbers

Single Mode	
10800171	3 meters p
10800172	3 meters r
10800173	22 meters p
10800174	22 meters r
10800175	46 meters p
10800176	46 meters r
10800177	500 meters p
Multi Mode	
10800121	1 meter p
10800122	2 meters r
10800123	5 meters p
10800124	10 meters p
10800125	20 meters p
10800126	30 meters p
10800127	50 meters p
10800128	100 meters p
10800129	250 meters p
10800130	500 meters p
10800131	1 meter r
10800132	2 meters r
10800133	5 meters r
10800134	10 meters r
Note: P = Plenum, R = Riser	

Table 8-1 Fibre Cable Part Numbers (Continued)

10800135	20 meters r
10800136	30 meters r
10800137	50 meters r
10800138	100 meters r
10800139	250 meters r
10800140	500 meters r
Note: P = Plenum, R = Riser	

Appendix A Wiring Comments

It is recommended that the customer request the installing electrician to complete the checklists found in Appendix B and Appendix C and use them as a simple site survey. You may wish to obtain quotes on any 'No' item checked.

Table A-1 Transformer-to-Panel Site Survey (for Site Electrician)

Yes	No	Objective
☐	☐	Neutral properly connected to the distribution transformer and distribution transformer properly grounded to the service entrance ground via a full-sized insulated conductor (not just the small strap furnished with the transformer).
☐	☐	Neutral and ground wiring insulated and full-sized, as above (same or larger size as phase conductors).
☐	☐	Verify that all connections are tight by checking tightness and visually inspecting for discoloration.
☐	☐	With an ohmmeter, check and verify that all isolated ground terminals are terminated to the same point. Remove the incoming ground connection (with power off) and verify that the outlets are not grounded with the incoming ground removed. Remove the incoming neutral. Verify that there are no neutral-to-ground shorts or bonding on the load side and that there are no neutral-to-ground reversals.
☐	☐	All portions of mainframe, related peripherals, and nearby terminals (including CRTs, consoles, printers, modems, etc.) powered via protected power. All voltages at proper levels, as required. Adjust distribution transformers if voltages are out of tolerance.
☐	☐	All phase wiring at least the minimum size required by the NEC and preferably one size larger per 30.5 meters (100 feet) of run. **Note:** Always review and adhere to local codes and regulations.
☐	☐	Each circuit has a full-size neutral and full-size ground conductor not shared with any other circuit.
☐	☐	Ground NOT shared or common with neutral except at service entrance or main ground point; neutral NOT bonded at panel.
☐	☐	Consistent grounding (preferably single-point reference) used on all of the above. (Not random conduit.)
☐	☐	System ground not bonded at circuit breaker panel.
☐	☐	Install all isolated ground (orange) outlets.

Table A-1 Transformer-to-Panel Site Survey (for Site Electrician) (Continued)

Yes	No	Objective
☐	☐	Above wiring loaded to less than or equal to 80% as shown by ammeter while system is operating with maximum activity (steady state load only). Distribution transformers not overloaded.
☐	☐	All phases at panel are properly balanced (voltage and current) while system is operating at normal activity.
☐	☐	Verify all connections are tight and not discolored.

This page intentionally left blank

Appendix B Physical Planning Checklist

The following is provided as a checklist for use during pre-installation planning.

StorageTek CSEs will oversee the installation of the Shared Virtual Array subsystem and verify that the prerequisite conditions for subsystem installation are met. Table B-1 provides a worksheet that will aid in planning and installing the subsystem, and will help to ensure that all minimum requirements for installation are met.

Table B-1 Physical Planning Checklist

		Is adequate space available for all units? Refer to "Subsystem Layout" on page 10.	_____ _____
		Have all required cables been identified by type and length? Refer to "System Cables" on page 15.	_____ _____
		Are site environmental conditions for subsystem storage and operation within tolerance. Refer to "Environmental Specifications" on page 20.	_____ _____
		Are all floors at the installation site, and along the path to that site, of adequate structural integrity to support the subsystem? Refer to "Floor Loading" on page 21.	_____ _____
		Are site electrical power and grounding of sufficient quality to provide the Virtual Tape Storage Subsystem (SVA) with reliable power that is free from interference or disturbance? Refer to "Static Electricity" on page 30	_____ _____
		Is site power within specification for voltage and frequency? Refer to "Power Source Specifications" on page 25	_____ _____
		Is the site properly equipped to meet the subsystem heat dissipation requirements? Refer to "Power Measurements" on page 27	_____ _____
		Is the site properly equipped to meet the subsystem current requirements? Refer to "Power Measurements" on page 27	_____ _____
		Is the site power distribution system capable of handling the additional load provided by the SVA? "Power Distribution System" on page 30	_____ _____

Table B-1 Physical Planning Checklist

		Are the proper connectors available to connect site power to the SVA?	_____ _____
		Is there a procedure in place to ensure correct labeling of SVA source power cables? Refer to "Circuit Breakers, Connectors and Degree of Power Redundancy" on page 26	_____ _____
		Have all issues of redundant power sources been addressed and resolved? Refer to "Circuit Breakers, Connectors and Degree of Power Redundancy" on page 26	_____ _____
		Are the feeder wires to the branch circuit distribution panels large enough to handle the load of the equipment? Refer to "Power Panel Feeders" on page 31	_____ _____
		Do branch circuit panels meet the minimum requirements for breaker rating and code conformance? Refer to "Branch Circuits" on page 31	_____ _____
		Is each circuit breaker labeled to indicate which circuit it is protecting? Refer to "Branch Circuits" on page 31	_____ _____
		Is branch circuit grounding properly connected? Refer to "Grounding" on page 28	_____ _____
		Is lightning protection properly installed on the site power source? Refer to "Primary Problem Areas and Issues" on page 37	_____ _____
		Has the customer electrician completed the two checklists provided in "Storage Areas" on page 34	_____ _____
		Is a storage area being provided? Refer to "Storage Areas" on page 34	_____ _____

Table B-1 Physical Planning Checklist

		Have all codes and regulations for safety and fire-prevention been reviewed as they apply to this system installation? Refer to "Fire Prevention" on page 34	_____ _____

READER'S COMMENT FORM

Manual Name: _____ Manual PN: _____

Please check or fill in the items; adding explanations/comments in the space provided.

Which of the following terms best describes your job?

☐ Field Engineer	☐ Manager	☐ Programmer	☐ Systems Analyst
☐ Engineer	☐ Mathematician	☐ Sales Representative	☐ Systems Engineer
☐ Instructor	☐ Operator	☐ Student/Trainee	☐ Other (explain below)

How did you use this publication?

☐ Introductory text ☐ Reference manual ☐ Student/Trainee ☐ Instructor text

☐ Other (explain) _____

Did you find the material easy to read and understand? ☐ Yes ☐ No (explain below)

Did you find the material organized for convenient use? ☐ Yes ☐ No (explain below)

Specific criticisms (explain below):

Clarifications on pages _____

Additions on pages _____

Deletions of pages _____

Errors on pages _____

Explanations and other comments:

Note: *Staples can cause problems with automated mail sorting equipment. Please use pressure sensitive or other gummed tape to seal this form. If you would like a reply, please supply your name and address on the reverse side of this form.*

Thank you for your cooperation. No postage stamp necessary if mailed in the U.S.A.

TO COMPLY WITH POSTAL REGULATIONS, FOLD EXACTLY ON DOTTED LINES AND TAPE (DO NOT STAPLE)

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 2 LOUISVILLE, CO U.S.A.

POSTAGE WILL BE PAID BY ADDRESSEE

STORAGE TECHNOLOGY CORPORATION
ENTERPRISE DISK INFORMATION DEVELOPMENT
ONE STORAGETEK DRIVE
LOUISVILLE CO 80028-2201

FOLD HERE AND TAPE DO NOT STAPLE FOLD HERE AND TAPE

If you would like a reply, please print:

Your Name: _____

Company Name: _____ Department: _____

Street Address: _____

_____

Cut or Fold
Along Line