Magstar 3494 Tape Library

Introduction and Planning Guide

GA32-0279-11

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GA32-0279-11

Note!
Before using this information and the product it supports, be sure to read the general information under “Notices” on page 133.

Twelfth Edition (September 1999)

This edition, GA32-0279-11, is a revision of GA32-0279-10, which is now obsolete. Significant changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

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Preface

This publication contains installation, planning, and migration information for the Magstar 3494 Tape Library.

Related Information

3494 Tape Library

For related information about the Magstar 3494 Tape Library, see:

- *Magstar 3494 Tape Library Operator Guide*, GA32-0280
- *Magstar 3494 Tape Library Physical Planning Template*, GX35-5049
- *Magstar 3494 Tape Library Operator's Quick Guide*, GX35-5051
- *Magstar 3494 Tape Library Maintenance Information*, SA37-0407
- *Online Library Omnibus Edition Hardware Collection*, SK2T-5483

3490E Tape Subsystem

For information about the 3490E tape subsystem, see:

- *Care and Handling of the IBM Magnetic Tape Cartridge*, GA32-0047
- *Tape and Cartridge Requirements for the IBM Magnetic Tape Cartridge Drives*, GA32-0048
- *Tape and Cartridge Requirements for the IBM Enhanced Capacity Magnetic Tape Cartridge Drives*, GA32-0216
- *IBM 3490 Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C1A, C22, and C2A Introduction*, GA32-0217
- *IBM 3490 Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C1A, C22, and C2A Operator's Guide*, GA32-0218
- *IBM 3490 Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C1A, C22, and C2A Hardware Reference*, GA32-0219
- *IBM 3490E Tape Subsystem Models F00, F01, F1A, and F11 Installation, Planning, and Operator's Guide*, GA32-0378
- *IBM 3490 Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C1A, C22, and C2A Planning and Migration Guide*, GC35-0219

3590 Tape Subsystem

For information about the 3590 tape subsystem, see:

- *Magstar 3590 Tape Subsystem Introduction and Planning Guide*, GA32-0329
- *Magstar 3590 Tape Subsystem User's Guide*, GA32-0330
- *Magstar 3590 Tape Subsystem Hardware Reference*, GA32-0331
- *IBM 3590 Tape Subsystem Guide*, SG24-2506
- *IBM Magstar 3590 Tape Subsystem: Multiplatform Implementation*, SG24-2549

AIX

For information about AIX systems and software, see:

- *AIX Parallel and ESCON Channel Tape Attachment/6000 Installation and User's Guide*, GA32-0311
- *AIX Version 4.2 for RISC System/6000 General Concepts and Procedures*, GC23-2202
- *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers: Installation and User's Guide*, GC35-0154
- *AIX Version 4.2 for RISC System/6000 Installation Guide*, SC23-2341

AS/400

For information about AS/400 systems and software, see:

- *AS/400 Physical Planning Reference*, SA41-3109
- *AS/400 Automated Tape Library Planning and Management*, SC41-3309
- *AS/400 Physical Planning Reference*, SC41-5109
- *AS/400 Basic System Operation, Administration, and Problem Handling*, SC41-5206
- *OS/400 Backup and Recovery*, SC41-5304
- *AS/400 Advanced Series Backup Recovery and Media Services for OS/400*, SC41-5309
- *OS/400 CL Reference*, SC41-5722
- *AS/400 System API Reference*, SC41-5801
- *A Practical Approach to Managing Backup Recovery and Media Services for OS/400*, SG24-4840

RS/6000

For information about RS/6000 systems and software, see:

- *RISC System/6000 Getting Started: Using RISC System/6000*, GC23-2377
- *RISC System/6000 Getting Started: Managing RISC System/6000*, GC23-2378
- *RISC System/6000 Planning for System Installation*, SA38-0508
- *RISC System/6000 Problem Solving Guide*, SC23-2204

MVS

For information about MVS systems and software, see:

- *DFSMS/MVS Version 1 Release 1: General Information Library Guide*, GC26-4900
- *DFSMS/MVS Version 1 Release 1: Guide and Master Index*, GC26-4904
- *MVS/ESA Planning: Installation and Migration for MVS/ESA System Product Version 4*, GC28-1077
- *MVS/ESA Library Guide for System Product*, GC28-1601
- *MVS/ESA Conversion Notebook for MVS/ESA System Product Version 4*, GC28-1608
- *MVS/ESA System Management Facilities (SMF) Data Set Definition*, GC28-1628
- *MVS/ESA Operations System Commands*, GC28-1826

- *JES3 Command Reference*, SC23-0063
- *DFSMS/MVS Version 1 Release 1: Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*, SC26-3051
- *DFSMS/MVS Version 1 Release 1: Object Access Method Application Programmer's Reference*, SC26-4917
- *DFSMS/MVS Version 1 Release 1: Planning for Installation*, SC26-4919
- *Basic Tape Library Support User's Guide and Reference*, SC26-7016
- *DFSMS/MVS Version 1 Release 1: Implementing and Customizing DFSMShsm*, SH21-1078

VM/ESA

For information about VM/ESA systems and software, see:

- *VM/ESA: Library Guide and Master Index for System/370*, GC24-5436
- *VM/ESA: Library Guide and Master Index*, GC24-5518
- *VM/ESA: General Information*, GC24-5550
- *VM/ESA: DFSMS/VM FL221 Installation and Customization*, SC26-4704
- *VM/ESA: DFSMS/VM FL221 Messages and Codes*, SC26-4707
- *VM/ESA: DFSMS/VM FL221 Removable Media Services User's Guide and Reference*, SC35-0141

VSE/ESA

For information about VSE/ESA systems and software, see:

- *Magstar 3494 Tape Library User's Guide: Library Control Device Driver for VSE/ESA*, GC35-0176

Additional Information

For additional information about the Magstar 3494 Tape Library, see:

- *IBM Fiber-Optic Channel Link Planning and Installation*, GA23-0367
- *9309 Rack Enclosure General Information and Site Preparation*, GA24-4103
- *IBM Token-Ring Network Introduction and Planning Guide*, GA27-3677
- *IBM System/360, System/370, 4300, 9370, and ES/9000 Processors: Input/Output Equipment Installation Manual–Physical Planning*, GC22-7064
- *IBM General Information Manual: Installation Manual–Physical Planning*, GC22-7072
- *Resource Access Control Facility (RACF) General Information*, GC28-0722
- *System/370 Channel Emulator/A User's Guide and Service Information*, SA23-2696
- *IBM Magstar Virtual Tape Server: Implementation Guide*, SG24-2229
- *Guide to Sharing and Partitioning IBM ATL*, SG24-4409
- *IBM Automated Tape Library: A Practical Guide*, SG24-4632
- *IBM Virtual Tape Server and Enhancements to Magstar*, SG24-4917

Organization

The information in this book is presented as follows:

- "Chapter 1. Introduction" on page 1 provides an overview of the Magstar 3494 Tape Library and its functional units, configurations, and features.
- "Chapter 2. Specify and Special Features" on page 37 describes the language group features, safety labels, cartridge features, and model and feature conversions.
- "Chapter 3. Programming Support" on page 63 describes the operating system support for the 3494 tape library.
- "Chapter 4. Site Planning and Preparation" on page 77 describes the physical characteristics and installation requirements for the 3494 tape library.
- "Chapter 5. Migration to the 3494 Environment" on page 85 describes the planning procedures for hardware and software migration for the 3494 tape library.
- "Chapter 6. Physical Planning and Specifications" on page 97 describes the cooling and power requirements, acoustic and environmental specifications, and cabling information for the 3494 tape library.
- "Appendix A. Cartridge System Tape and Cartridge Labels" on page 117 describes the tape cartridge requirements for the 3494 tape library.
- "Appendix B. Physical Planning Template" on page 123 describes the space requirements for the 3494 tape library.
- "Appendix C. Planning for the 3494 and Task Allocation" on page 125 discusses the task assignments recommended for the 3494 tape library.
- "Glossary" on page 137 includes descriptions or terms used in this publication.
- "Index" on page 141 includes keywords and terms to help retrieve information in this publication.

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Summary of Changes

This summary of changes includes specific release updates to this book.

Twelfth Edition

This release includes the following new information:

- 3590 Model A60 Controller feature code enhancements
- Description of Single-Cell Output Facility

This release also includes changes to correct errors or omissions in the previous edition.

Eleventh Edition

This release includes the following new information:

- Addition of 3494 Model B18 Enhancements
- Addition of 3590 Model E1A Tape Drive
- Addition of 3590 Model A60 Controller

Tenth Edition

This release includes the following new information:

- Addition of VTS Import/Export functions
- Addition of SCSI attachment capability to VTS subsystems

Chapter 1. Introduction

This chapter provides an overview of the Magstar® 3494 Tape Library and its functional units, configurations, and features.

Magstar 3494 Tape Library

The Magstar 3494 Tape Library, Figure 1, is designed to meet the storage capacity requirements of 160 to 6240 cartridges. The 3494 supports an intermix of tape drive and 12.7-mm (0.5-in.) cartridge technologies. It can be configured for a specific number of tape drives and control units.

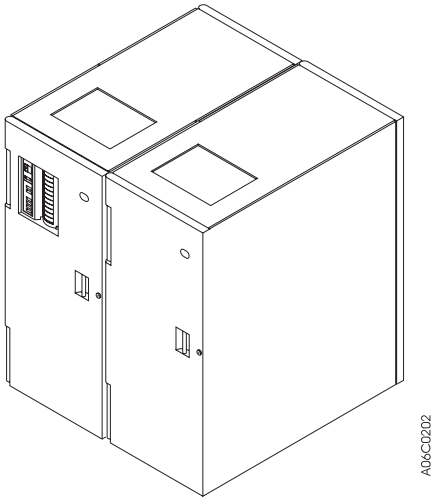


Figure 1. Magstar 3494 Tape Library

The Magstar 3494 Tape Library is available with the models shown in Table 1.

Table 1. Magstar 3494 Tape Library Models

Name	Description
Model L10, L12, L14	Magstar 3494 Tape Library Control Unit
Model D10, D12, D14	Magstar 3494 Tape Library Drive Unit
Model B16, B18	Magstar 3494 Virtual Tape Server
Model S10	Magstar 3494 Tape Library Storage Unit
Model HA1	Magstar 3494 Tape Library High Availability Unit
Note: Additional storage can be added to a 3494 tape library with a Model D10, D12, or D14, with or without tape drives.	

Subsystem Description

The 3494 tape library, with the models and features available, offers:

- Read capability for 3490E tape technology
- Read and write capability for 3490E and 3590 tape technology
- Support for one to 62 tape transports
- Model L1x Control Unit Frame attachment to Model D10, D12, D14, B16, S10, and HA1 frames (see “3494 Tape Library Configurations” on page 14)
- Support for 3490E Model C1A, C2A, and F1A tape drives and 3590 Model B1A and E1A tape drives
- Cartridge storage capacity of 160 to 6240 tape cartridges
- Data storage capacity up to 62.4 TB of uncompressed data and 187.2 TB of data with 3:1 compression
- Data paths via SCSI-2, Ultra SCSI, ESCON®, and parallel (3490E only)
- Library Manager command paths via RS-232, LAN, ESCON, and parallel
- Control unit frame upgrades from Model L10 to Model L12 or L14
- Upgrades of drive unit frames from Model D10 to Model D12 or D14
- Upgrades of drive unit frames from FC 5300 to 5302 or from FC 5300 to 5304
- Automatic utilization of the full capacity of tape cartridges by stacking logical volumes end-to-end on the cartridge with the 3494 Model B16 and B18 Virtual Tape Servers (VTS)
- Hot standby dual Library Manager control units, two service bays, and a second accessor
- Dual active accessors

Table 9 on page 20 shows the cartridge capacity for various 3494 configurations.

3494 options include a Convenience Input/Output Station feature, RS-232 or LAN host attachment capability, a High-Capacity Input/Output Facility, a Dual Gripper feature, a Remote Library Manager Console feature, a second disk drive for the Library Manager, and a wide range of attachment capabilities.

The 3494, depending on the tape subsystems used, permits either SCSI-2, ESCON, or parallel attachment to a host processor. The 3590 tape subsystem uses SCSI-2 or ESCON attachment for the data interface. The 3494 can be shared by up to 16 data channels and up to eight RS-232 control paths or four RS-232 control paths and LAN attachment.

The 3494 Model B16 or B18 VTS delivers an increased level of storage capability to the traditional storage product hierarchy. To host software, a VTS subsystem looks like a 3490E Enhanced Capability Tape Subsystem with associated Cartridge System Tape or Enhanced Capacity Cartridge System Tape. This virtualization of both the tape drive and the storage media to the host allows transparent utilization of the 3590 tape technology capabilities.

The Model HA1 (High Availability) consists of two Service Bay Frames for storage of an inactive or non-functioning accessor and a second Library Manager. The configuration requires a left service bay and a right service bay. The second Library Manager and second accessor are located in the right service bay when viewing the library from the front (Input/Output Station side). With an optional feature (FC 5050), the Model HA1 allows both accessors to be active at the same time.

The 3494 library provides an automated tape solution for a variety of system environments. The wide range of configurations and options provides customers with the flexibility to most effectively address their unique requirements.

The 3494 automates the retrieval, storage, and control of Cartridge System Tape, Enhanced Capacity Cartridge System Tape, and High Performance Cartridge Tape. When used with supporting software and appropriate tape subsystems, the 3494 allows cartridges to be mounted and demounted on tape drives without operator involvement.

The 3494 has the following key attributes:

- Automates cartridge tape libraries
- Provides expandable cartridge storage
- Allows additional tape drives to be added
- Selects requested cartridges and accesses tape volumes quickly
- Allows the intermix of Cartridge System Tape, Enhanced Capacity Cartridge System Tape, and High Performance Cartridge Tape in any frame
- Supports the 3490E Model C1A, C2A, and F1A tape subsystems
- Supports the 3490E Model F1A tape subsystem and the Model F1A Feature Code 3000 Controller
- Supports the 3590 Model B1A and E1A tape subsystems and the 3590 Model A00, A50, and A60 Controllers
- Supports the Magstar 3494 Model B16 and B18 Virtual Tape Servers
- Supports Virtual Tape Server SCSI Host Attachment
- Supports Virtual Tape Server Import and Export operations
- Cleans tape drives automatically
- Incorporates enhanced tape drive error recovery
- Allows installation on solid or raised floors
- Provides high reliability and availability
- Enables enhanced remote service capability
- Provides unattended operation
- Allows the emulation of an automatic cartridge loader
- Supports stand-alone applications and unlabeled cartridges
- Supports dual Library Manager controllers for greater availability and reduced service intervention
- Supports dual accessors for greater availability and reduced service intervention
- Supports dual active accessors for higher performance

Functional Characteristics

The 3494 is a self-contained, fully enclosed product (with optional, stand-alone Model B18 Virtual Tape Server **4** in Figure 2) that can be installed on a solid or a raised floor. Figure 2 also shows a typical configuration of a Magstar 3494 Tape Library with a control unit frame containing the 10-cartridge Convenience Input/Output Station feature **1**, an optional drive unit frame **2**, and an optional storage unit frame **3**.

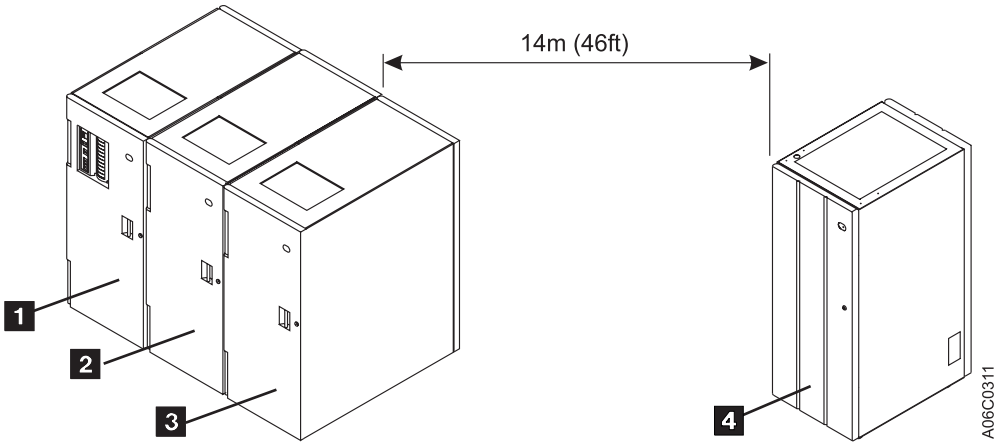


Figure 2. Magstar 3494 Tape Library (Typical Configuration)

The 3494 configuration must include at least one tape subsystem or Virtual Tape Server. The configuration can include a maximum of 62 IBM® 3590 tape drives or 32 IBM 3490E tape transports. With the 3590 Model A60 Controller, the configuration can include a maximum of 60 IBM 3590 tape drives. The control unit frame contains cartridge cells, zero to two tape drives, and a cartridge accessor. Cartridge cells on the inside walls of the control unit frame provide storage for the tape cartridges.

The 3494 Model L12 and D12 frames support a mix of 3590 Model B1A and E1A tape drives within a frame. However, if the Model D12 frame is associated with a Virtual Tape Server, you may not mix 3590 Model B1A and E1A tape drives within the frame. Similarly, you may not mix 3590 Model B1A and E1A tape drives within a Model L14 or D14 frame. You may combine frames that contain tape drives of one type with frames that contain a different type of tape drive in order to configure a complete library.

A gripper attached to the cartridge accessor moves cartridges between the storage cells, the tape subsystems, and the input/output areas. A vision system on the cartridge accessor identifies the cartridge or the presence of an empty cell in front of the gripper. An optional second gripper is available for installation.

The optional Convenience Input/Output Station feature allows up to ten or 30 cartridges to be added or removed from the 3494 without interrupting the operation of the library.

The customer can specify a High-Capacity Input/Output Facility at installation time to support cartridge groups of several cartridge sizes (see “High-Capacity Input/Output Facility” on page 8). When the High-Capacity Input/Output Facility is specified, it reduces the number of available cartridge storage cells. When the

High-Capacity Input/Output Facility is used, it requires library operations to be interrupted while cartridges are inserted or removed.

If the Convenience Input/Output Station feature is not installed and the High-Capacity Input/Output Facility is not specified, one cartridge cell in the 3494 is reserved for output operations. Reserving only one cell allows the maximum amount of storage for the installation that has low requirements for output operations. Any empty and unassigned cell can be used for input operations.

The 3494 allows emulation of a cartridge loader by assigning a specified category of cartridges to a specific tape drive for the automatic mounting and demounting of cartridges without host intervention.

The 3494 allows transient cartridges to be moved from the Convenience Input/Output Station directly to a specified tape drive without host intervention by using the Mount from Input Station function. This function allows the tape drives inside the library to be used for cartridges that do not reside in the library for stand-alone operations. The function allows one or more cartridges to be placed into the Convenience Input/Output Station and mounted on a specific drive in the library. The cartridges can be used for either reading or writing data. As each cartridge is unloaded from the drive, it is returned to the input/output station. Cartridges mounted in this manner do not require any machine-readable external labels. The Mount from Input Station function is primarily intended to support stand-alone software, for example, initial program load (IPL), stand-alone dump restore, and stand-alone interchange.

The Magstar Virtual Tape Server subsystem uses virtual tape drives for all interaction with host software. Although virtual tape drives are only embodied in licensed code in the Magstar Virtual Tape Server subsystem, they show the functional characteristics of a 3490 Enhanced Capability tape drive. To the host operating system and application programs, a virtual drive looks like a physical tape drive.

The difference between a virtual tape drive of the Magstar Virtual Tape Server subsystem and a real 3490E drive is that the data written to or read from the virtual drive resides on a virtual volume in the tape volume cache (not on a physical volume mounted on a physical drive). Tape operations that are gated by physical movement of tape will see significant improvements in performance.

The functionality of the 3490E integrated cartridge loader is also included in the virtual drive's capability. All virtual tape drives indicate that they have a cartridge loader. Each virtual tape drive can be associated with a pool of scratch volumes that will allow fast mount access for scratch mounts. The active status of the cartridge loader depends on the availability of scratch volumes in the assigned pool.

The Magstar Virtual Tape Server subsystem uses virtual volumes for all interaction with host software. Virtual volumes reside in the tape volume cache and show the characteristics of a Cartridge System Tape or an Enhanced Capacity Cartridge System Tape. A maximum of 150,000 logical volumes can be inserted into each of two attached Virtual Tape Servers in a 3494 library. This provides a maximum library capacity of 300,000 logical volumes. Each Virtual Tape Server is assigned a range of volsers for its use. The tape volume cache consists of a high performance array of Disk Storage and control software. Virtual volumes are held in the tape volume cache when they are being used by the host system. Outboard storage

management software manages which virtual volumes are in the tape volume cache and the movement of data between the tape volume cache and physical 3590 tape drives.

When a virtual volume is moved from the tape volume cache to a 3590 cartridge, the process is called a copy. The volume becomes a logical volume. When a logical volume is moved from a 3590 cartridge to the tape volume cache, the process is called a recall. The volume becomes a virtual volume again.

The Model HA1 (High Availability) consists of a second Library Manager and two Service Bay Frames for parking inactive accessors. The configuration requires a left service bay and a right service bay. The right service bay, as you view the library from the front (I/O station side), contains the second Library Manager. This second Library Manager is a “hot standby” unit that automatically assumes control of the 3494 when the primary Library Manager fails. The second accessor is also held in “Hot Standby” mode to assume the function should the first accessor fail. With an optional feature (FC 5050), the Model HA1 allows both accessors to be active at the same time.

The cartridge storage cells, cartridge accessor, and tape subsystem are accessed by opening the door on the front of the unit. Maintenance activity and Manual mode are performed by using this door. The operator can perform Manual mode operations if the cartridge accessor is not operational.

Requests issued from the host may result in cartridge movement in the library. The primary requests issued are for mounting and demounting volumes to and from the tape drives and for ejecting volumes from the library. The following methods are used:

- Requests are sent to the library by using the channel attachments of the tape subsystem. The 3494 provides status and other information to the host through the tape subsystem.
- Library requests are sent directly to the Library Manager by using RS-232 or LAN interfaces from an attached host. The 3494 provides status and other information to the host through these interfaces.

Note: The VTS logical volume mounts and demounts are virtual and do not necessarily result in physical cartridge movement.

In either case, all tape subsystem requests and responses are sent to the tape subsystem through the tape subsystem channel attachment.

The host has no knowledge of the physical location of a cartridge or volume in the library. The physical location is managed exclusively by the library. When a virtual volume is moved from a tape volume cache to a 3590 cartridge, it becomes a logical volume. A 3590 cartridge that contains logical volumes is referred to as a stacked volume. The Magstar Virtual Tape Server subsystem maintains the relationship of logical volumes and the physical volume on which they reside. Each physical cartridge inserted into the library must have an operator-readable and machine-readable external label to identify the cartridge in the library during inventory operations and when the cartridge is added to the library by using the input facility.

Note: Unlabeled tape cartridges can be used in the library, but they must be carefully controlled by using the unlabeled tape facility (see “Unlabeled Tape Facility” on page 13).

The library stores the physical location of the cartridge in an inventory database based on the cartridge volser (volume serial number). Logical volumes are also stored in the same database. Host requests for operations involving movement or use of a cartridge need only reference the cartridge volser for the library to perform the request. (Hosts must also specify the drive to be used.)

With the addition of the Magstar Virtual Tape Server subsystem, the number of volumes (physical and logical) that the Library Manager must manage and contain within its inventory greatly increases. Overall performance of the library slows as the size of the inventory increases, therefore you should define only the logical volumes required.

The 3494 can consist of the following:

- Library Manager
- Cartridge Storage
- Cartridge Accessor
- Convenience Input/Output Station
- High-Capacity Input/Output Facility
- Dual Library Manager/Dual Accessors
- Dual Active Accessors
- Cartridge System Tape
- Enhanced Remote Service Support
- Unlabeled Tape Facility
- Simple Network Management Protocol (SNMP) Messaging
- 3494 Tape Library Configurations
- Cartridge Storage Configurations
- Tape Subsystems
- Virtual Tape Servers

Library Manager

The Library Manager or the remote console (if the subsystem is so equipped) controls all of the operations in the 3494, including the interaction between the 3494 and its operators. The Library Manager hardware consists of a controller, display unit, keyboard and pointing device, and the hardware to support communication with the other units in the 3494.

During normal operations, the controls on the operator panel are sufficient to operate the 3494. The Library Manager is used for error recovery, for service, and for displaying operational status.

The 3494 Model HA1 provides a second set of hardware (controller, display unit, and keyboard with its pointing device) to improve Library Manager availability. The second Library Manager takes control of the library automatically if the first Library Manager fails.

Cartridge Storage

The 3494 contains cartridge storage cells in all of the attached frames. In addition to storage cells, the control unit frame and the drive unit frame each can contain tape subsystems. Cartridges (of any supported media type) can be placed in any

frame. The control unit frame must be included in any configuration (see “Cartridge Storage Configurations” on page 19 for details).

Cartridge Accessor

The cartridge accessor identifies and moves cartridges between the storage cells, tape drives, and input/output facilities. The optional Dual Gripper feature may be installed on the cartridge accessor to provide increased performance and improved data availability (see “Dual Gripper” on page 55).

The Model HA1 provides a second accessor, which acts as a “hot standby”. The library can invoke the second accessor automatically when the first accessor fails. This allows library operations to continue without operator intervention. The second accessor can push the defective unit to a service bay. A service representative can then perform concurrent maintenance and return the accessor to “hot standby” status. With an optional feature (FC 5050), the Model HA1 allows both accessors to be active at the same time.

Convenience Input/Output Station

The optional Convenience Input/Output Station feature is available for inserting or ejecting cartridges without interrupting the normal automated operations. Selection of the 10-cartridge Convenience Input/Output Station feature reduces cartridge capacity by 30 cartridges. Selection of the 30-cartridge Convenience Input/Output Station feature reduces cartridge capacity by 80 cartridges.

High-Capacity Input/Output Facility

Two types of high-capacity cartridge handling facilities can be defined in the library:

- High-Capacity Output Facility
- High-Capacity Input/Output Facility

Note: The library may define only one type of high-capacity facility.

A teach operation configures the High-Capacity Output Facility. It reserves a section of the cartridge storage area on the control unit frame door (wall 2) for ejecting cartridges. The size of the selected area can be 10, 20, 40, 80, or 160 (full door) storage cells. If the optional Dual Gripper feature is installed, the usable area is 10, 20, 36, 72, or 144 storage cells.

A teach operation configures the High-Capacity Input/Output Facility. It reserves an area on an inside wall of a frame other than the control unit frame so that both Inserts (input) and Ejects (output) can be performed. A storage unit or the Model B16 VTS frame can be configured to use the upper storage racks (100 cells without the Dual Gripper feature) or the whole wall (200 cells without the Dual Gripper feature) as input/output cells. A drive unit frame is configured to use the available storage cells on the whole wall (50 to 135 cells depending on the model and the drive configuration).

Cartridge cells allocated to a high-capacity facility are not available for normal cartridge storage. The operator puts the 3494 in Pause mode and opens the appropriate library door when unloading or loading a high-capacity facility.

Single-Cell Output Facility

If a Convenience Input/Output Station is not installed and a High-Capacity Output Facility or High-Capacity Input/Output Facility is not defined, a single cell in the door of the control unit frame is provided for output. Without the Dual Gripper feature installed, this single cell is the top storage cell in the left-most column of storage cells. With the Dual Gripper feature installed, this single cell is the third storage cell from the top of the left-most column of storage cells. Any empty and unassigned cell can be used for input operations.

Dual Library Managers/Dual Accessors

The Model HA1 adds a second Library Manager (LM) to the 3494 tape library to improve availability when an LM failure occurs. It also adds a second accessor so that the system may stay in Auto mode when an accessor failure occurs. The system continues to operate in Auto mode during service on the failed accessor. This also reduces the amount of time the library must be offline in order to install Library Manager code fix packs.

See Figure 3 on page 10 for a block diagram of the configuration for the Model HA1. Under normal operation (no elements have failed or are degraded), the *Active* LM will be in the LM A machine. The *Standby* LM will be in the LM B machine. The *Active* accessor will be A (Local) and will be controlled from the active LM. LM A receives host commands over the serial interfaces (RS-422) from direct-attached hosts and serially-attached controllers. LM A also receives commands over the internal Ethernet™ LAN and Convenience I/O through the hardware switch with the Digital Input/Digital Output (DI/DO) lines. Through the hardware switch, the Accessor Manager on LM A knows that the standby accessor was safely parked in its service bay.

Two Ethernet LANs provide a Primary Link and an Alternate Link. The Primary Link keeps the secondary database in sync using database services. It also provides component-to- component communication and “heartbeat” messages. The Alternate Link is used to pass accessor commands to the remote accessor, as a backup for component to component communication, and heartbeat messages. Heartbeat messages are messages the *Active* LM sends to the *Standby* LM, letting it know that it is still functioning. If the heartbeat messages stop on both links, the Standby LM takes over and becomes the Active LM.

The Accessor Manager in LM A performs move operations using Accessor A. When the Dual Active Accessors feature (FC 5050) is installed, the active Library Manager controls both accessors by queueing commands to both the local and remote accessor manager. The active database is continually backed up onto LM B across the Primary link. The Non-Volatile Memory (NVRAM) element keeps track of the current state of the active and standby LMs and is used when a LM cannot communicate with the second LM on either of the links to decide whether this LM is active.

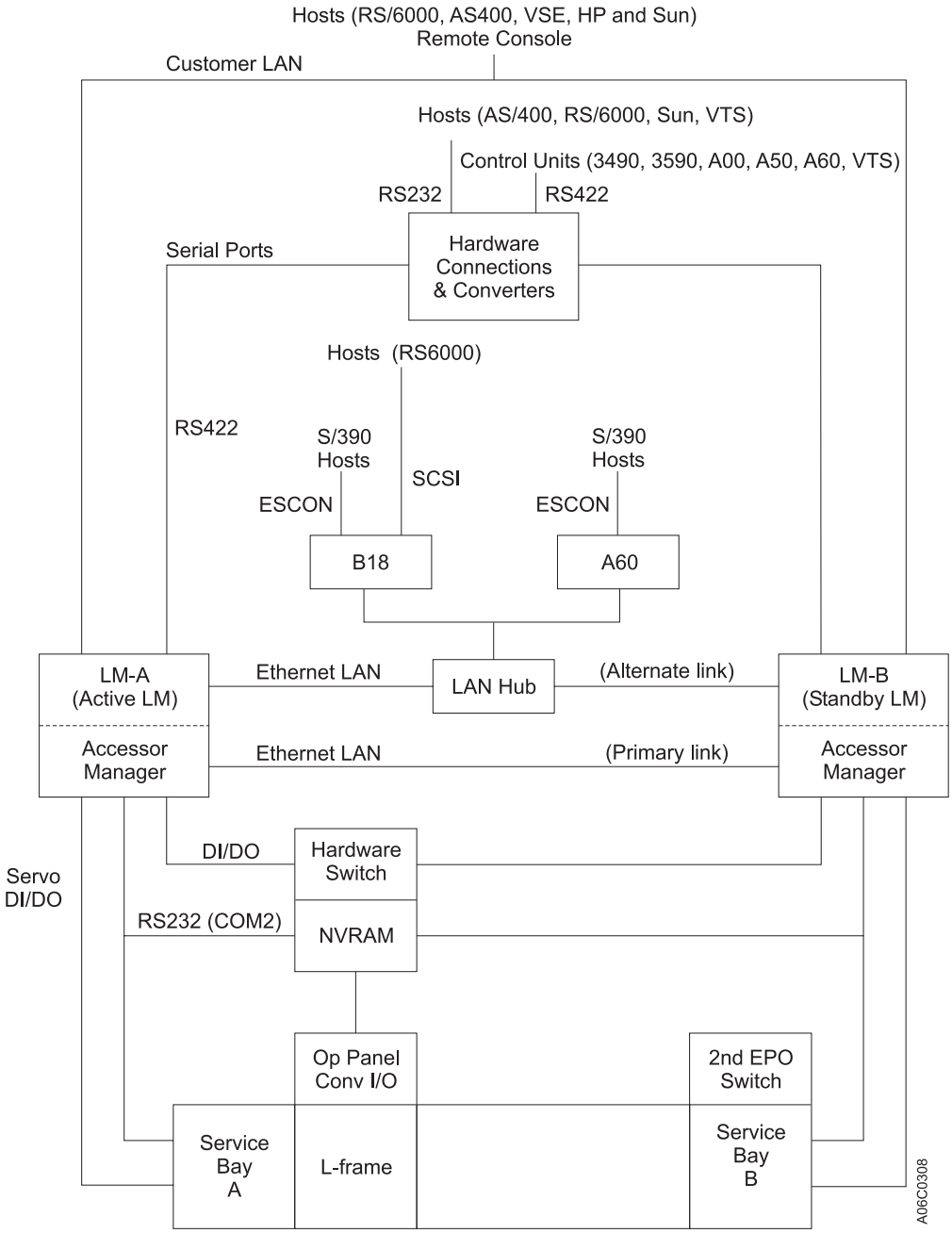


Figure 3. Dual Library Manager (DLM) with Dual Accessors

Dual Active Accessors

The Dual Active Accessors feature is a performance enhancement follow-on to the Model HA1. This feature allows one accessor to work while the other is in its service bay, ready if the active accessor fails. The Model HA1 (High Availability) solution allows a reduction in system outages when an accessor fails. However, it does not take full advantage of having two accessors available. The Dual Active Accessors feature allows both accessors to be active at the same time.

In order to reduce interference between accessors, the Library Manager divides the library into two zones, each designating a preferred accessor work area. The

boundary between the two zones is established at library initialization and may change over time as the Library Manager attempts to keep the accessors equally busy.

The Library Manager performs accessor selection in one of three ways:

- For drive-specific commands, the accessor zone in which the drive is located determines which accessor the Library Manager will select. If the drive is in a frame in the Accessor A zone, the Library Manager selects Accessor A for mount commands to this drive. Optimally, this is a nonspecific mount, and the Library Manager will select the cartridge from near the drive. Regardless, Accessor A will perform the entire operation, assuming that there is no error.
- For Convenience Input/Output Station Inserts and Ejects, the accessor controlling the operator panel will handle the operation.
- For accessor commands that are not tied to a drive or to the Convenience Input/Output Station, the Library Manager uses the source cell to select the appropriate accessor. As such, the accessor working in the zone that contains the High-Capacity Input/Output cells handles High-Capacity Inserts. The accessor working in the zone that contains the cartridge to be ejected handles High-Capacity Ejects.

Home Cell and Cartridge Selection

The Library Manager uses three basic techniques when placing and selecting tapes to better optimize performance of Dual Active Accessors:

- High-Capacity Inserts

  When designating a home cell for the cartridge, the Library Manager considers the cartridge media type and the location of the tape drives that use the particular media type.
- Category Mounts (scratch)

  The Library Manager considers the zone in which the tape drive is located when selecting the accessor. Volume selection prefers cartridges within the selected accessor's zone.
- Demounts

  The Library Manager looks for a free cell within the same zone as the drive for the demount, effectively allowing floating home cell mode even with single gripper accessors. Volumes will eventually collect around the subsystems on which they are used.

Dual Active Accessors Optimization

The Library Manager uses a boundary initially located at roughly the midpoint of the library drive unit frames to establish the two accessor work zones. The Library Manager monitors the workload of each accessor and changes the zone boundary if one accessor is significantly busier than the other.

The Library Manager continually calculates a **workload factor** for each accessor to determine how busy each one is in relation to the other. Since mounts have the highest priority of all library operations, they are the biggest factor in establishing and maintaining the moveable boundary. Thus, the Library Manager gives mounts a heavier weight in calculating the workload factor for each accessor.

If Accessor B is performing a certain number of mounts and Accessor A is performing an equal number of Ejects, Accessor B's workload factor will actually increase at approximately double the rate of Accessor A's workload factor.

Eventually, Accessor B's workload factor will be significantly higher than that of Accessor A. This will cause the Library Manager to move the boundary in the direction of Accessor B's service bay, thus increasing the size of Accessor A's work zone. The rate of Ejects will then decrease as Accessor A receives more mounts to process.

Drive Selection

When the Library Manager receives a host request for volume data, the information sent back to the host includes a list of subsystems in order of distance from the volume. Certain host applications (such as MVS) use this list to attempt to allocate a drive close to the cartridge on the subsequent mount request. For systems with the Dual Active Accessors feature installed, the subsystem list will additionally be ordered by zone. Hosts will then prefer to mount volumes on tape drives within the same zone, even though there are tape drives in the other zone that may be closer. This method minimizes interference by attempting to make the host choose a tape drive that is in the same zone as the cartridge.

Inventory

The operation of inventory and inventory update are the same, except that both accessors are used to perform the scanning function. The only time both accessors are not used is when the vision system on one accessor is not operational.

Cartridge System Tape

The 3494 automates the storage and movement of tape cartridges (volumes). The 3494 tape library supports the following tape cartridges:

- Cartridge System Tape (CST) – media type **1**
- Enhanced Capacity Cartridge System Tape (ECCST) – media type **E**
- High Performance Cartridge Tape (HPCT) – media type **J**

See "Appendix A. Cartridge System Tape and Cartridge Labels" on page 117 for a description of these tape cartridges and their labeling requirements.

Enhanced Remote Service Support

Remote service allows field support personnel to access the Library Manager transaction and error logs remotely to diagnose difficult hardware problems or to analyze microcode problems. It provides faster emergency fixes by using fix packs for code problems. This eliminates the time required for sending the logs to the IBM Support Center and for re-creating the error at the Support Center.

FC 2710, 2711, or 2712 provide remote support for the 3494 Model L1x. These features allow authorized personnel to access the logs normally available to the service personnel through the 3494 operator and service menus.

Remote Support Access Security

The Library Manager does not have access to customer data other than information about where individual tapes are located in the library. The tape drive passes customer data on the tapes directly to the host. The data does not pass through the Library Manager.

Three levels of protection are available to prevent unauthorized access to the Library Manager logs, VTS, and Axx controllers when the remote support features are installed:

- Modem password protection
- Switch password protection
- Library Manager and VTS/Axx controller remote access password protection:
  - For Library Manager remote access: storage administrator password protection is required to enable remote access.
  - For VTS and Axx remote access: a system of tiered password protection in which local access by the service representative and remote access by the support center are protected by up to four passwords, based on experience level and authority. This ensures that local service personnel never have access to customer data within the subsystem.

The modem can be configured to have password protection so that only dial-in users with the password can gain access. The modem can accept up to 50 unique passwords, if desired.

In addition, the switch (if installed) allows selection of one unique password. This switch is online with the modem, and either or both can be password-enabled.

Finally, the storage administrator password is required to activate the remote support access capability in the Library Manager.

Unlabeled Tape Facility

Unlabeled tape operations are designed to allow the operator to add occasional volumes that do not have a valid volser or external media-type label to the library. These volumes may be mounted and ejected in the same manner that regular, properly labeled volumes are handled.

The operator must first select the unlabeled tape option that adds the volser and media-type information for each unlabeled cartridge. Unlabeled tapes to be added to the database are then placed in the Convenience Input/Output Station. The data from the console is added to the database, and the cartridges are moved from the input/output station to their designated cells. All further operations with the cartridge are handled as if the cartridge had a valid label. The inventory update operation only verifies that all unlabeled cartridges are in cells that previously contained unlabeled cartridges.

Note: The unlabeled tape facility should not be used for a large number of cartridges or for cartridges that are stored in the library for a long time. See *Magstar 3494 Tape Library Operator Guide* for additional information.

Simple Network Management Protocol (SNMP) Messaging

Many different host systems with various operating systems that communicate with the library using different types of connections can attach the 3494 tape library. The 3494 may encounter situations that the user would want to know about, such as a door being opened, which causes the library to stop. Because there are many attachment methods, the 3494 provides a standard TCP/IP protocol called Simple Network Management Protocol (SNMP) to send alerts (called SNMP traps) over a TCP/IP LAN network to SNMP monitoring stations. These monitoring stations, along with other customer-supplied software, can alert operations staff of possible

problems or operator interventions that occur at the library. Figure 4 shows a basic SNMP block diagram.

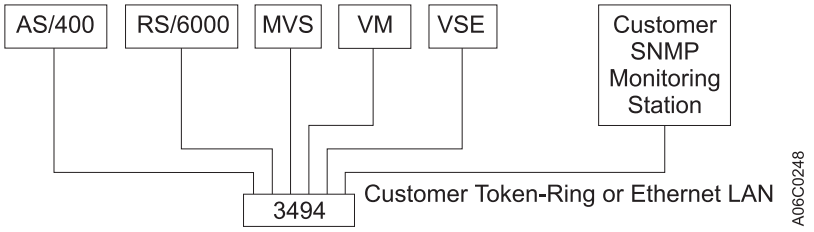


Figure 4. SNMP Basic Block Diagram

With this method, one or more locations can monitor the 3494, along with other equipment (both IBM and non-IBM) that also supports the SNMP protocol. Monitoring is independent of the host system that controls the equipment and independent of the 3494 location.

3494 Tape Library Configurations

Various frame types (each a model of the 3494) are available to customize the library capabilities to customer requirements. The models of the 3494 fall into the following groupings:

- Library Control Unit Frames (Models L10, L12, and L14). See Table 2 on page 15.
- Drive Unit Frames (Models D10, D12, and D14). See Table 3 on page 15.
- Virtual Tape Servers (Models B16 and B18). See Table 4 on page 16.
- Storage Unit Frames (Models S10 and D1x without tape drives). See Table 5 on page 16.
- Service Bay Frames (Model HA1). See Table 6 on page 16.

A 3494 configuration consists of one Control Unit Frame and optional additional frames from the other four groupings (see Table 2 on page 15).

Table 2 describes the Magstar 3494 Tape Library Control Unit Frame.

Table 2. Magstar 3494 Tape Library Control Unit Frame

Name	Description
Model L10	The Model L10 Control Unit Frame contains: • Cartridge storage cells • One 3490E Model C1A, C2A, or one to two Model F1A tape drives (the first 3490E Model F1A may contain the FC 3000 Controller) • Library Manager • Cartridge accessor • Optional Convenience Input/Output Station feature (if installed)
Model L12	The Model L12 Control Unit Frame contains: • Cartridge storage cells • Zero to two 3590 Model B1A or E1A tape subsystems • Library Manager • Cartridge accessor • Optional Convenience Input/Output Station feature (if installed)
Model L14	The Model L14 Control Unit Frame contains: • Cartridge storage cells • Zero to one 3590 Model A00 or A50 Controller • Zero to two 3590 Model B1A or E1A tape subsystems • Library Manager • Cartridge accessor • Optional Convenience Input/Output Station feature (if installed) **Note:** The 3590 Model A00 or A50 Controller is required if any 3590 Model B1A or E1A tape subsystem is installed in the frame.

Table 3 describes the Magstar 3494 Tape Library Drive Unit Frame.

Table 3. Magstar 3494 Tape Library Drive Unit Frame

Name	Description
Model D10	The Model D10 Drive Unit Frame contains: • Cartridge storage cells • Zero to one 3490E Model C1A, C2A, or zero to two Model F1A tape drives (the first 3490E Model F1A may contain the FC 3000 Controller)
Model D12	The Model D12 Drive Unit Frame contains: • Cartridge storage cells • Zero to six 3590 Model B1A or E1A tape subsystems
Model D14	The Model D14 Drive Unit Frame contains: • Cartridge storage cells • Zero to one 3590 Model A00, A50, or A60 Controller • Zero to four 3590 Model B1A or E1A tape subsystems **Note:** The 3590 Model A00, A50, or A60 Controller is required if any 3590 Model B1A or E1A tape subsystem is installed in the frame.

Table 4 describes the Magstar 3494 Tape Library Virtual Tape Server Frame.

Table 4. Magstar 3494 Tape Library Virtual Tape Server Frames

Name	Description
Model B16 (withdrawn from marketing)	The Model B16 Virtual Tape Server Frame contains: • 400 cartridge storage cells • One Virtual Tape Server controller • Disk Storage • 32 virtual 3490E drives
Model B18	The Model B18 Virtual Tape Server Stand-Alone Frame contains: • One Virtual Tape Server controller • Disk Storage • 32 or 64 virtual 3490E drives

Table 5 describes the Magstar 3494 Tape Library Storage Unit Frame.

Table 5. Magstar 3494 Tape Library Storage Unit Frame

Name	Description
Model S10	The Model S10 Storage Unit Frame contains 400 cartridge storage cells.

Table 6 describes the Magstar 3494 Model HA1 (High Availability) Frame.

Table 6. Magstar 3494 Model HA1 (High Availability) Frame

Name	Description
Model HA1	The Model HA1 includes two Service Bay Frames, one of which holds a second Library Manager and accessor.

Before the release of Models D10, D12, D14, and S10, drive and storage frames were added to the Model L10 through features. These features have been superseded by model designations. However, there is no conversion of the features to models. Table 7 shows these features and their equivalent model designations.

Table 7. Magstar 3494 Features

Feature Code	Description
FC 5300	Similar to the 3494 Model D10.
FC 5302	Similar to the 3494 Model D12. This feature converts FC 5300 to FC 5302 and provides for installation of 3590 Model B1A subsystems.
FC 5304	Similar to the 3494 Model D14. This feature converts FC 5300 to FC 5304 and provides for installation of 3590 Model B1A subsystems and one 3590 Model A00 Controller.
FC 5400	Equivalent to the 3494 Model S10.

When a Model B16 VTS is upgraded to a Model B18 VTS, one of the following must be done:

- FC 5500 must also be ordered on the Model L1x Control Unit Frame to convert the remaining frame to a Storage Unit on the 3494 tape library. FC 5500 is similar to a Model D12 Drive Unit without FC 9630, FC 9631, or MES 4630.
- FC 5502 must also be ordered on the Model L1x Control Unit Frame to convert the remaining frame to a drive unit for the Model B18. FC 5502 is similar to a Model D12 Drive Unit with four of FC 9630, FC 9631, or MES 4630 and the SCSI Extenders for attachment to a Model B18.

- FC 5503 must also be ordered on the Model L1x Control Unit Frame to convert the remaining frame to a SCSI Drive Unit (similar to a Model D12 Drive Unit).
- FC 5504 must also be ordered on the Model L1x Control Unit Frame to convert the remaining frame to an ESCON Drive Unit (similar to a Model D14 Drive Unit).

In each of the 3494 Model L12, L14, D12, and D14 frames, installation of a 3590 tape subsystem is optional. As tape subsystems are added, cartridge storage cells are displaced. If the Model L14 frame has any 3590 tape subsystem installed, it must have the 3590 Model A00 or A50 Controller. If the Model D14 frame has any 3590 tape subsystem installed, it must have the 3590 Model A00, A50, or A60 Controller. The 3590 Model A00, A50, or A60 Controller can connect only to the tape subsystems in the same frame.

In each of the 3494 Model L10 and D10 frames, installation of a 3490E tape subsystem is optional. The 3490E Model F1A FC 3000 Controller can connect only 3490E Model F1A tape subsystems in the same frame.

VTS configuration rules require a Model B16 VTS frame to be installed to the right (when viewed from the front of the library) of the Model D12 frame that houses the 3590 Model B1A tape drives it uses. The library configuration may contain only one Model B16.

You can locate the Model B18 VTS frame up to 14 m (46 ft) from the Model D12 Drive Unit (or FC 5502) associated with the VTS. You may include a maximum of two Model B18 VTSs or one Model B16 VTS and one Model B18 VTS in this configuration.

Figure 5 shows the permitted 3494 model configurations.

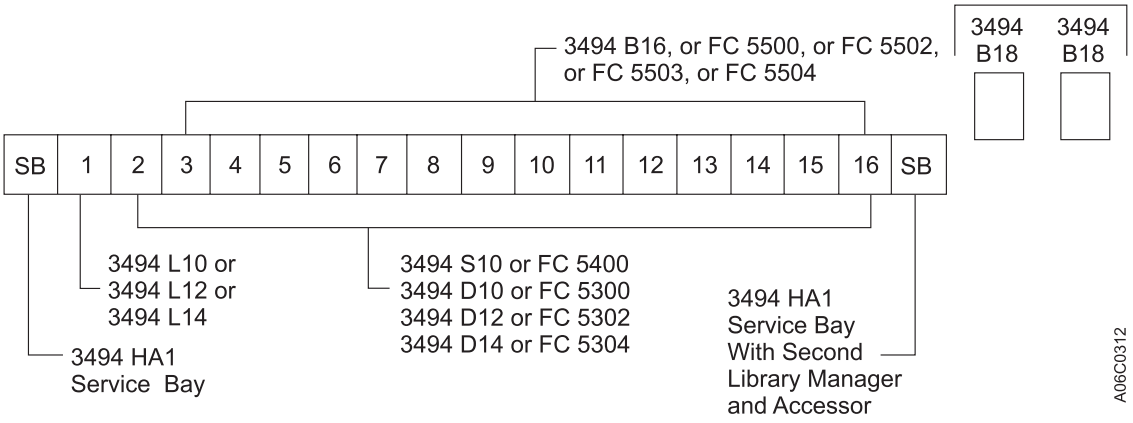


Figure 5. Permitted 3494 Model Configurations

Notes:

1. Configurations without the 3494 Model HA1 are limited to 1–8, 10, 12, or 16 frames.
2. Configurations with the 3494 Model HA1 are limited to 3, 4, 6, 8, 10, 12, or 16 frames, not including the Service Bay Frames.
3. The Model B18 VTS frame is remote from the main string.
4. Configuration rules allow two Virtual Tape Servers in a 3494 tape library with a maximum of one Model B16.

Library Manager Communication Paths

Hosts can issue library commands to the Library Manager over three different paths:

- By ESCON or parallel channel attachment through a tape subsystem controller (for example, a 3590 Model A00, A50, A60, or a VTS)
- Directly via an RS-232 serial connection (for example, a direct-attached host or a 3490E Model F1A FC 3000 Controller)
- Directly via an Ethernet or token-ring local area network (LAN) (direct-attached host)

All tape drives in the library must have a path to the Library Manager to communicate drive status and control information. There are three different paths for drive communication:

- Through a controller (for example, a 3490E Model CxA or a 3590 Model A00, A50, or A60) when multiple tape drives are combined under the controller. The controller attaches to the Library Manager through a single RS-422 connection.
- Through a controller (for example, a 3590 Model A60 or a Model B18 VTS) when multiple tape drives are combined under a controller. The controller attaches to the Library Manager through an internal LAN Attachment Concentrator
- For 3490E Model F1A or 3590 Model B1A or E1A, directly through a serial connection (RS-422)

The number and type of communication paths limit the number of tape drives that you can install in a 3494 tape library. If the library has a Model B16 Virtual Tape Server subsystem, it requires two control unit paths and one RS-232 direct-attached host port. In addition, each 3590 Model B1A tape drive associated with the Model B16 subsystem requires a control unit path.

The Model B18 VTS and its associated 3590 Model B1A or E1A tape drives connect to the Library Manager via an internal LAN Attachment Concentrator. The 3590 Model A60 Controller can be attached in the same way.

Table 8 on page 19 defines the number of serial (RS-232 or RS-422) connections available versus the features that are installed in the library.

Table 8. Library Manager Serial Communication Paths

Number of FC 5228	RS-232 Direct-Attached Host Ports	Control Unit or Direct-Attached Drive Connection	Features Required
0	4	4	None
0	8	8	5229 Expansion Attachment Card
1	0	8	If SCSI Host Attachment, then FC 5219 or 5220 LAN Attachment is required for control path
1	4	12	FC 5229 Expansion Attachment Card
2	0	16	FC 5229 and if SCSI Host Attachment, then FC 5219 or 5220 LAN Attachment is required for control path

Each FC 5228 converts up to four RS-232 direct-attached host ports to be used to support control unit or direct-attached drive connections. Depending on the number of features that are installed, you can install up to 32 IBM 3490E or 16 direct-attached 3590-type tape drives. You can install up to 62 IBM 3590 tape drives that are attached through 3590 Model A00 or A50 Controllers by way of serial connections. The library can contain up to 60 IBM 3590 tape drives that are attached through 3590 Model A60 Controllers by way of serial connections.

Cartridge Storage Configurations

The 3494 allows for expandable configurations. For example, it can hold from 160 to 6240 cartridges (see Table 9 on page 20). The storage capacity is determined by the number of frames, installation of the optional Convenience Input/Output Station feature, installation of the optional Dual Gripper feature, the number of tape subsystems installed, and the definition of the High-Capacity Input/Output Facility area configuration.

The 3494 can have a maximum of 16 frames plus two attached Service Bay Frames. Without the Model HA1, allowable configurations are one to eight, 10, 12, and 16 frames. With the Model HA1, allowable configurations are three, four, six, eight, 10, 12, or 16 plus the two attached Service Bay Frames. All configurations must have one library control unit frame. The subsystem can include up to sixteen additional frames (not including the Model HA1) in any combination of:

- Drive unit frames
- A maximum of one Model B16 VTS frame
- Storage unit frames

In addition, the configuration can have one Convenience Input/Output Station (as part of the control unit frame).

The 3494 contains cartridge storage cells in each frame. In addition:

- The control unit frame contains a tape subsystem, the Library Manager, the cartridge accessor, and the optional Convenience Input/Output Station feature (if installed).
- The drive unit frame contains a tape drive subsystem (see “Tape Subsystems” on page 21).
- The Virtual Tape Server frame contains a controller and the Disk Storage drawers and disk drives.
- Service Bay Frames have storage cells for use while servicing the accessors. These cells are not usable for customer cartridges.

Table 9 shows the cartridge capacity of each frame.

Table 9. 3494 Tape Library Cartridge Capacity

Model or Frame	**Without Dual Gripper**	**With Dual Gripper**
Model L10, L12, or L14	240 (see notes 1, 4, 5, and 6)	216 (see notes 2, 4, 5, and 6)
Model S10, FC 5400	400	360
Model D10 (without 3490E Model CxA or F1A)	400	360
Model D10, FC 5300 (with 3490E Models CxA or F1A)	300	270
Model D12, FC 5500	400	360
Model D12, FC 5302 (without 3590 Models B1A or E1A)	400	360
Model D12, FC 5302 (with one or two 3590 Models B1A or E1A)	335	305
Model D12, FC 5302 (with RPQ), FC 5502 or 5503 (with three or four 3590 Models B1A or E1A)	290	260
Model D12, FC 5302 (with RPQs), FC 5502 or 5503 (with RPQ and five or six 3590 Models B1A or E1A)	250	230
Model D14, FC 5304 (without 3590 Models B1A or E1A)	400	360
Model D14, FC 5304 or 5504 (with one or two 3590 Models B1A or E1A)	345	305
Model D14, FC 5304 or 5504 (with RPQ and three or four 3590 Models B1A or E1A)	305	275
Model B16	400	360
Model B18	0	0
Model HA1 (service bays)	0	0

Table 9. 3494 Tape Library Cartridge Capacity (continued)

Model or Frame	Without Dual Gripper	With Dual Gripper
Notes: 1. The optional Convenience Input/Output Station feature reduces the cartridge capacity by 30 cartridges (FC 5210) or 80 cartridges (FC 5230). 2. With dual grippers installed, the optional Convenience Input/Output Station feature reduces the cartridge capacity by 26 cartridges (FC 5210) or 72 cartridges (FC 5230). 3. Selecting the High-Capacity Input/Output Facility reduces the cartridge capacity, depending on the options chosen (see "High-Capacity Input/Output Facility" on page 8). 4. One cell is reserved for ejecting cartridges if the optional Convenience Input/Output Station feature is not installed and the High-Capacity Output Facility is not defined. 5. A maximum of two cells are reserved for certain service representative functions. When the Model HA1 is installed, there are no cells reserved in the Model L1x Control Unit Frame for service functions. 6. One cell is reserved for error-recovery operations for configurations without the Model HA1. Two cells are reserved for error-recovery operations for configurations with the Model HA1.		

Tape Subsystems

Tape Subsystems Compatibility

The 3494 tape library currently supports the following tape subsystems to perform the tasks of reading and writing customer data that is stored on tape cartridges:

- 3490E tape subsystem with Models C1A, C2A, and F1A (with or without the Model F1A Controller)
- 3590 tape subsystem with Models B1A and E1A (each with or without a 3590 Model A00, A50, or A60 Controller)
- 3494 Model B16 and B18 Virtual Tape Servers

3590 Tape Subsystems

The 3494 supports the 3590 Model B1A and E1A tape subsystems. Each Model B1A and E1A has a single tape drive with a dynamic buffer and two SCSI interfaces. The 3590 Model A00, A50, and A60 Controllers provide an ESCON host attachment for the tape subsystem.

All data communication is processed either through SCSI attachments integral to the tape subsystem or through ESCON if a controller is part of the subsystem. Data communication cannot be processed through both a direct-attached SCSI interface and a controller. When a Model B1A or E1A is direct-attached to a host through its SCSI interface, the RS-232 or LAN interface provides a communication path between the host and the Library Manager. When a Model B1A or E1A is attached through a controller, the communication path is through the ESCON channels.

3590 Model B1A Tape Subsystem: The Model B1A performs read and write operations on the High Performance Cartridge Tape.

The Model B1A attaches in one of the following ways:

- To a host system directly through one of its two SCSI interfaces
- To a 3590 Model A00, A50, or A60 Controller
- To a Model B16 or B18 Virtual Tape Server

The 3494 tape library, with the 3590 Model B1A tape subsystem, offers the high capacity of 128-track bidirectional recording, auto-blocking, and data compression. See the *Magstar 3590 Tape Subsystem Introduction and Planning Guide*.

3590 Model E1A Tape Subsystem: The Model E1A performs read and write operations on the High Performance Cartridge Tape. Data written by a Model B1A can be read by a Model E1A. However, the Model B1A cannot read data written by the Model E1A.

The Model E1A attaches in one of the following ways:

- To a host system directly through one of its two SCSI interfaces
- To a 3590 Model A50 or A60 Controller
- To a Model B18 Virtual Tape Server

The 3494 tape library, with the 3590 Model E1A tape subsystem, offers the high capacity of 256-track bidirectional recording, auto-blocking, and data compression. See the *Magstar 3590 Tape Subsystem Introduction and Planning Guide*.

3490E Tape Subsystem

The 3494 supports the 3490E Models C1A, C2A, and F1A. Each Model C1A, C2A, or F1A has its own control unit. The Model C1A has a single tape transport, the Model C2A has two tape transports. The Model F1A drive consists of a single SCSI tape transport and may have a FC 3000 Controller. A second Model F1A drive may attach to the FC 3000 on the first Model F1A.

In addition to reading and writing customer data stored on Cartridge System Tape, the 3490E provides a communication path between hosts that do not use the RS-232 or LAN interface and the Library Manager. All communication is processed through the channel interfaces integral to the tape subsystem that handles all the protocols and speed matching required by the attaching host. Hosts that use the RS-232 or LAN interface communicate with the Library Manager over the RS-232 or LAN interface. Models C1A, C2A, and F1A can read cartridges written by other 3480, 3490, and 3490E base models. Automatic cartridge loaders are not supported. However, a cartridge loader mode that emulates cartridge loader operation can be activated.

The 3494, with 3490E tape subsystems, offers the high capacity of 36-track bidirectional recording, Improved Data Recording Capability (IDRC), and the use of both standard Cartridge System Tape and Enhanced Capacity Cartridge System Tape, all in an automated environment. The 3490E tape subsystem Model F1A can also read, but not write, 18-track Cartridge System Tape.

IDRC (which is standard on Models C1A, C2A, and F1A) may increase storage capacity from two to five times (typically three times) compared to the 3480 tape subsystems without this capability, depending on the characteristics of the data and operating environment.

The Enhanced Capacity Cartridge System Tape contains double the capacity of the Cartridge System Tape. The combination of the 36-track write capability, the Enhanced Capacity Cartridge System Tape, and IDRC can improve the effective cartridge capacity up to 12 times when compared to a Cartridge System Tape without IDRC written in 18-track format.

To address high performance needs, the Performance Enhancement feature improves the Model C1A and C2A buffer performance and uses enhanced

microcode with SCSI and ESCON channels to achieve an instantaneous data rate of up to 9 MB per second. See also the *IBM 3490 Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C1A, C22, and C2A Introduction*.

3494 Virtual Tape Server

The 3494 Virtual Tape Server (Model B16 or B18) provides a higher utilization of 3590 tape technology than current tape controller concepts enable. It provides the improvement in utilization without impacting current operating system or third-party software. The subsystem combines the random access and high performance characteristics of Disk Storage with outboard hierarchical storage management and virtual tape drives to provide significant reductions in the number of physical cartridges, tape drives, and automated libraries needed to store the customer tape data. The key functions for the architecture of the subsystem are:

- Emulation of 3490E-type tape drives (32 or 64 virtual tape drives)
- Tape volume cache
- Storage management of the tape volume cache
- Maintaining fragments of copied volumes
- Fast response for nonspecific mount requests
- A maximum of 150,000 logical volumes in each of two attached Virtual Tape Servers in a 3494 library for a maximum 3494 library capacity of 300,000 logical volumes
- Data compression (ESCON High Performance Option or Extended High Performance Option for Model B18)
- The Virtual Tape Server uses only **J**-type (HPCT) cartridges

Note: Customers migrating from the Model B16 Virtual Tape Server to the Model B18 VTS using the Model B16 to Model B18 upgrade should contact their IBM representative to establish a migration plan.

Emulation of 3490E Tape Drives: From an ESCON host perspective, the Model B16 Virtual Tape Server subsystem looks like two 3490E control units, each with 16 tape drives. The Model B18 Virtual Tape Server subsystem looks like two or four 3490E control units. From a SCSI host perspective, each SCSI host attachment feature is configurable to eight 3490E control units, each with two 3490E tape drives. For more information, see “VTS SCSI Host Attachments” on page 30.

Each emulated drive is called a virtual tape drive. The subsystem handles all 3490 tape commands. Emulating a 3490-type tape drive eliminates the need for host software changes to support the 3590-type tape drive. There is no direct relationship between a virtual tape drive and a real 3590 tape drive.

Data is written and read as if it is stored on a real Cartridge System Tape or an Enhanced Capacity Cartridge System Tape. However, within the subsystem, data is stored on DASD. All tape read and write commands are translated to read and write data records from or to DASD. Tape marks are stored as special records on the Disk Storage as well. Volumes residing on the Disk Storage are called virtual volumes.

The amount of data stored on a virtual volume is variable up to a maximum as determined by the media type selected. Two media types are supported (standard Cartridge System Tape and Enhanced Capacity Cartridge System Tape). They can hold up to 400 MB or 800 MB of customer data, respectively.

All host interactions with data in a Virtual Tape Server subsystem are through virtual volumes and associated virtual tape drives; there is no direct access to the data on a physical cartridge or drive.

Tape Volume Cache: The size of the Disk Storage can be made large enough so that more virtual volumes can be retained in it than just the ones currently associated with the virtual tape drives. After an application closes a virtual volume, if it was modified, a copy of it is made by the storage management software in the subsystem onto a physical tape. The virtual volume remains available on the Disk Storage until the space it occupies is needed to satisfy another mount request. Leaving the virtual volume in the Disk Storage allows for fast access to it during a subsequent request for the volume. The Disk Storage and the management of that space to keep volumes available after they are closed is called the tape volume cache. The performance for mounting of a volume that is in the tape volume cache is quicker than if a real physical volume is mounted. The DASD, in effect, caches your tape volumes and provides for fast access.

Storage Management of the Tape Volume Cache: Storage management software in the subsystem manages the contents of the tape volume cache. A virtual tape volume is copied from the tape volume cache to physical tape when the volume is closed by the application and is recalled from the physical tape to the tape volume cache when the volume is requested to be mounted, if it is not still resident in the tape volume cache.

Maintaining Fragments of Copied Volumes: The data space in the tape volume cache is not automatically freed when the data occupying that space has been copied to a stacked volume. Once the tape volume cache has filled with tape volumes, space taken up by older volumes is freed for new allocations using a “least recently used” algorithm. When the VTS is freeing space for new volumes, it maintains a small portion of an older volume (referred to as a fragment) in the tape volume cache. This fragment includes enough information about the copied virtual volume so that it can easily be recalled, and it also includes the first several records from the last use of the volume. Normally, the first few records on a tape contain the tape volume label, and enough data records are maintained to contain an IBM standard tape label plus any unique user label records.

Fast Response for Nonspecific Mount Requests: When a nonspecific mount is requested, the customer application is going to write data from the beginning of tape, overwriting any existing data on the tape. Within a Virtual Tape Server subsystem, a nonspecific mount request is satisfied by accessing the data fragment in the tape volume cache associated with the virtual volume selected by the Library Manager to satisfy the request. No recall of the data from the previous usage of the volume is performed because the fragment contains the label information needed by the host tape management software to validate the use of the volume for a nonspecific mount request. The subsystem signals the host that the mount is complete when the fragment is accessed. The result is a very low mount response time because no physical movement or mounting of a cartridge is involved.

300,000 Logical Volumes: Up to 300,000 logical volumes are allowed per 3494 tape library. The volumes are assigned to, but not shared by, the Virtual Tape Servers in the library. Each VTS in the library may have a maximum of 150,000 logical volumes.

Data Compression: FC 3200 (ESCON High Performance Option) for the Model B18 provides data compression capability for improved performance with two

enhanced ESCON host channel attachments. Two additional enhanced ESCON host channel attachments are available with FC 3302.

FC 3400 (Extended High Performance Option) with FC 3412 (Extended Performance ESCON Channels) provides data compression capability (similar to FC 3200) for the Model B18 Virtual Tape Server.

VTS Logical Volume Import and Export: VTS Advanced Function Import/Export (FC 4000) provides import and export of logical volumes, allowing movement of data between Virtual Tape Servers. The Import operation allows the library to import a set of logical volumes that were exported previously from a VTS. The Export operation allows the library to export a set of logical volumes from a VTS to physical volumes for backup, archival, or transfer purposes.

- Only the Convenience Input/Output Station can be used for volumes being imported.
- The Convenience Input/Output Station operates in Import mode in systems that support Import and Export operations.
- User interface provides a way to assign **J**-type (HPCT) cartridges to the Import or Insert categories.
- At least four physical tape drives that are associated with the VTS must be available for Import/Export operations.
- Only one Import operation is allowed at a time in the entire library.
- One Export operation may be in progress for each VTS in the library at any given time.
- An Import operation is not allowed in a VTS partition that is performing an Export operation.
- Requires host software support.
- Import and Export operations provide additional statistical data on Import and Export activity for each VTS.
- Import and Export operations are supported only for ESCON-attached hosts.
- Import and Export operations require FC 3200 (ESCON High Performance Option) or FC 3400 (Extended High Performance Option).
- During Import and Export operations, the library sends status messages to the host that requested the Import or Export operation.
- Exported stacked volumes created on 3590 Model B1A tape drives can be imported into 3590 Model E1A configurations. However, exported stacked volumes created on 3590 Model E1A tape drives cannot be imported into 3590 Model B1A configurations.

Other Key Functions: A Virtual Tape Server subsystem must be installed as part of an IBM library because the physical assets used by the subsystem are managed by the Library Manager in the library. The physical assets include the 3590 tape drives and the 3590 cartridges used for stacking logical volumes. The Library Manager provides several other key functions involving a Virtual Tape Server subsystem. These functions include:

- Logical library partitioning
- Operator interface
- Logical volume inventory

Logical Library Partitioning: To support the product requirement that a Virtual Tape Server subsystem can coexist with current 3490E and native 3590 subsystems in the same library, the Library Manager partitions the physical library into logical

libraries. This must be done because a Virtual Tape Server subsystem presents the image of 3490-type tape drives, yet cannot read or write a real 3490E cartridge. By placing a Virtual Tape Server subsystem in its own logical library, host software will not be able to attempt to allocate a Virtual Tape Server drive for a real 3490E mount and vice versa.

A logical library can contain **either** of the following:

- A single Virtual Tape Server subsystem
- A current 3490E or native 3590 subsystem

Each logical library will have its own unique library sequence number and will look like a separate physical library to the hosts attached to the subsystems in that partition.

Operator Interface: The Library Manager console is used to perform the setup, management, and status functions needed to support a Virtual Tape Server subsystem.

Logical Volume Inventory: The database in the Library Manager is expanded to handle the large number of logical volumes that a Virtual Tape Server subsystem uses. There are also new operator functions that allow you to add logical volumes by specifying a volume serial number range through the Library Manager console.

SCSI Attachment Capabilities: The Model B18 has SCSI attachment capabilities, which expands the types of host systems that can attach to a Virtual Tape Server subsystem.

3590 Model A50 Controller

The 3494 incorporates the 3590 Model A50 Controller to provide a high-performance ESCON attachment of 3590 Models B1A and E1A to ES/3090™, ES/9000®, and S/390® systems in a 3494 tape library. The architecture of this controller combines building blocks such as RS/6000®, AIX®, and PCI bus architecture in a single controller. This controller has remote support capabilities to enable quick diagnostic tests, problem analysis and verification, and a means to upgrade 3590 microcode from remote sites through a modem. The 3590 Model A50 Controller is integrated in a 3494 Model L14 or D14 to automate up to four 3590 Model B1A or E1A tape drives. You can configure a 3494 with up to 16 Model A50 Controllers and up to 62 IBM 3590 Model B1A or E1A tape drives.

The 3590 Model A50 Controller provides a single data transfer path with one or two ESCON channel adapters, each with up to 64 logical channels. It has a maximum channel distance of 43 kilometers (27 miles) and supports multiple logical paths per MVS image.

A required feature provides the first ESCON channel adapter, and an optional feature provides the second ESCON channel adapter for increased configurability.

3590 Model A60 Controller

The 3590 Model A60 Controller provides a single data transfer path with two or four ESCON channel attachments, each with up to 64 logical channels. It has a maximum channel distance of 43 kilometers (27 miles) and supports multiple logical paths per MVS image.

Each 3590 Model A60 Controller requires one Dual ESCON Attachment feature, which provides the first two ESCON channel attachments. A second feature is available to provide two additional ESCON channel attachments for increased configurability. The 3590 Model A60 Controller is integrated in a 3494 Model D14 to automate up to four 3590 Model B1A or E1A tape drives.

You can configure a 3494 with up to 15 3590 Model A60 Controllers and up to 60 3590 Model B1A or E1A tape drives.

Host Attachments

ES/9000 and SCSI Host Systems

The tape subsystem control unit provides attachment by using either Enterprise System Connection (ESCON), small computer system interface (SCSI), or parallel channel adapters. All host processors attach to the 3494 through the tape control units in the 3494 or through the RS-232 or LAN interface. See “Tape Subsystems” on page 21 for more information.

Except for direct-attached processors (for hosts using the RS-232 or LAN attachment), no additional attachments are required for the library. A separate channel or communication link to the Library Manager from each attached host is not required because existing channels to the tape subsystems are used to pass commands to the Library Manager.

The AS/400® and the RS/6000 SCSI-attached processors also require the RS-232 or LAN attachment for passing library commands directly to the Library Manager. ES/9000 processors using VSE/ESA™ also require the LAN attachment. The RS-232 attachment, with the extended length cable (FC 5213), allows an attachment distance of up to 122 m (400 ft) on the AS/400. The SCSI-2 attachment allows an attachment distance of up to 25 m (82 ft).

The tape subsystems can be attached through either an ESCON channel, a parallel channel, a SCSI fast wide interface, or any combination. The Library Manager is controlled through the tape subsystem channels or through the RS-232 or LAN attachment. Up to four hosts (or eight hosts with FC 5229) can be connected to the Library Manager through the RS-232 attachment. In addition, up to 32 hosts can be connected to the Library Manager through the LAN (FC 5219 or 5220).

The 3490E Model C1A, C2A, and F1A tape subsystems can attach up to two channels per tape subsystem and can intermix ESCON, parallel, and SCSI attachments.

The 3590 Model B1A and E1A tape drives can attach up to two SCSI channels per tape drive. Multiple 3590 units can be attached with 3590 Model A00, A50, and A60 Controllers to allow ESCON host attachment. 3590 tape drives can be direct-attached for SCSI host processor attachment. Intermixing of SCSI or ESCON host attachments for the 3590 Model B1A or E1A tape drives is not permitted within a frame. The library does not support parallel channel attachment of 3590 Model A00, A50, and A60 Controllers.

Note: The Virtual Tape Server subsystem can be attached via ESCON or SCSI to host processors. Two ESCON channel attachments are standard for Model

B16 and B18 Virtual Tape Servers. For more information on VTS SCSI host attachments, see “VTS SCSI Host Attachments” on page 30.

Two enhanced ESCON host channel attachments with data compression capability are available for the Model B18 with FC 3200. Two additional enhanced ESCON host channel attachments are available with FC 3302. FC 3302 can be converted to FC 3412.

FC 3400 (Extended High Performance Option) with one or two FC 3412 (Extended Performance ESCON Channels) provides two or four host channel attachments with data compression capability for the Model B18.

ESCON, parallel, or SCSI channel adapters provide support for processors such as the ES/9000, AS/400, RS/6000, RS/6000 SP™, and Sun processors. Parallel channels can be installed up to 122 m (400 ft) from the processor in most environments. However, when attaching parallel channels to the RS/6000 processor, the distance is limited to a maximum of 61 m (200 ft). ESCON-connected tape subsystems that use 3590 Model A00, A50, and A60 Controllers can be installed up to 43 kilometers (27 miles) from the host.

Note: See the *Magstar 3590 Tape Subsystem Introduction and Planning Guide*.

The 3494 tape library control path can be attached by two methods:

- Method one uses the channel attachment of the tape subsystem to also send requests to the 3494 Library Manager. The 3494 also sends status and other information back to the host through the tape subsystem attachment. Multiple hosts can simultaneously request operations and request status from the 3494.
- Method two uses the RS-232 or LAN attachment between the host and the 3494 Library Manager to control the tape library. All normal tape commands, data, and responses are transmitted via the tape subsystem attachments while the tape library commands and responses are transmitted via the RS-232 or LAN attachment.

The 3494 allows both methods of attachment to be used in the same library and provides maximum configuration flexibility. Figure 6 on page 29 shows an illustration of 3494 attachments to host processors. Table 10 on page 30 shows the supported host attachments.

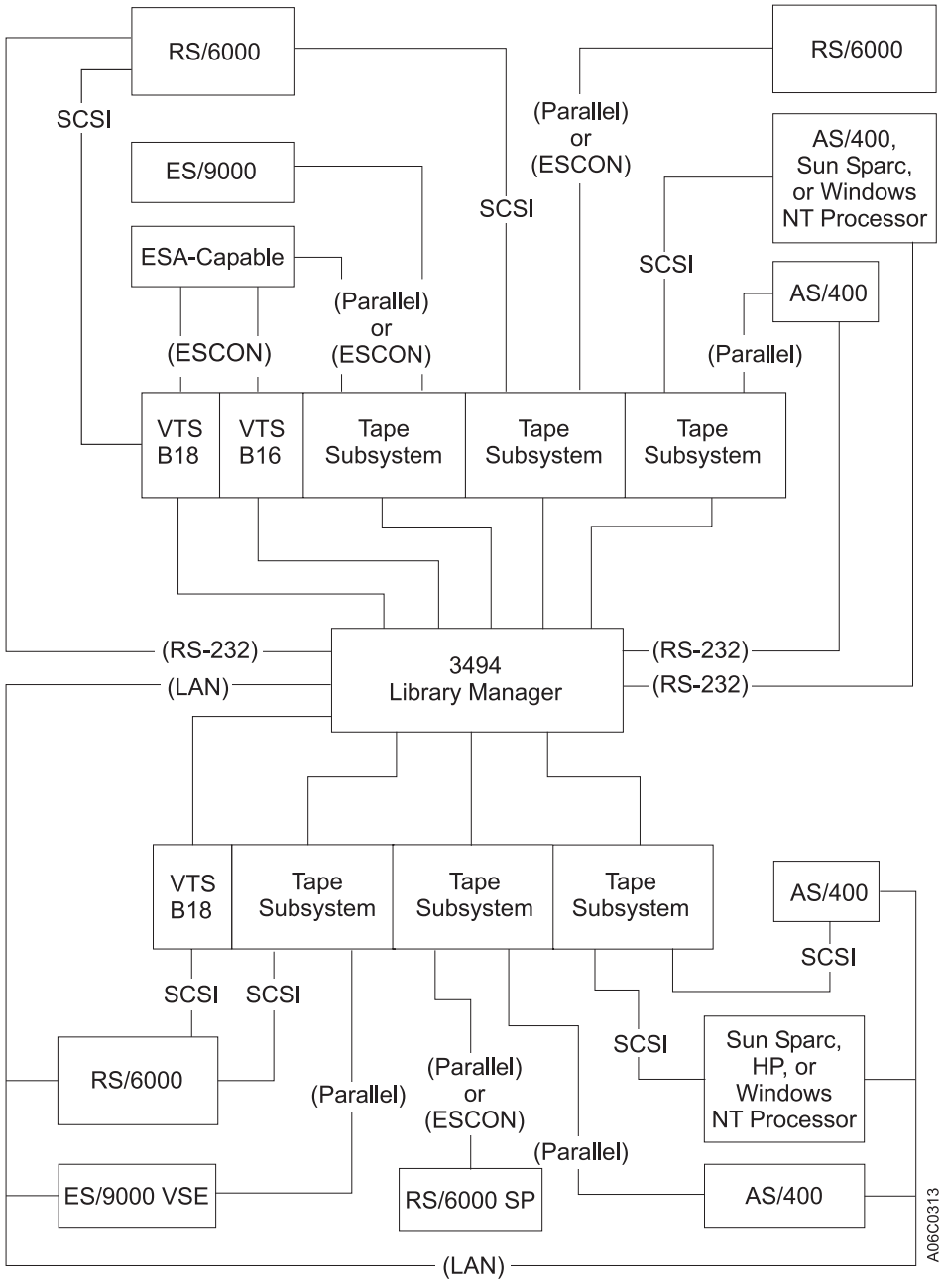


Figure 6. Host Connections

LAN attachment to the library is offered as an alternative to the use of the RS-232 interface in applications that do not use the tape subsystem channels to transmit requests. The LAN connection is used for library commands. The SCSI, ESCON, or parallel channel connection is used for data transmission. The Token-Ring or Ethernet LAN attachment supports both Transmission Control Protocol/Internet Protocol (TCP/IP) and advanced program-to-program communication (APPC) protocols.

Table 10. Host Processor Attachment

Host Processor	Parallel	ESCON	SCSI-2	RS-232	LAN
ES/9000	Yes	Yes	–	–	–
ES/9000 VSE (VM Guest)	Yes	Yes	–	–	–
ES/9000 VSE (Native)	Yes	–	–	–	Yes
ESA-Capable	Yes	Yes	–	–	–
AS/400	Yes	–	–	Yes	–
AS/400	Yes	–	–	–	Yes
AS/400	–	–	Yes	Yes	–
AS/400	–	–	Yes	–	Yes
RS/6000	Yes	Yes	–	–	–
RS/6000	–	–	Yes	Yes	–
RS/6000	–	–	Yes	–	Yes
Sun	–	–	Yes	–	Yes
Sun	–	–	Yes	Yes	–
HP	–	–	Yes	–	Yes

Notes:

1. All host processors must attach to the tape subsystem through parallel, ESCON, or SCSI-2 interfaces for data communication.
2. Direct-attached processors must also attach to the 3494 Library Manager through RS-232 or LAN interfaces for library control communication.
3. Parallel attachments are not supported by the 3590.

VTS SCSI Host Attachments

SCSI Host Attachment (FC 3422) is a feature for the Model B18 VTS that permits open-systems host attachment through industry-standard SCSI (Small Computer System Interface) buses. An operational ESCON host must be attached via FC 3200 (ESCON High Performance Option). FC 3302 (Additional Enhanced ESCON Channel Attachment) must not be installed. Up to two of FC 3422 may be specified, allowing a maximum of four SCSI attachments per VTS.

Initial SCSI host support is for RS/6000 or RS/6000 SP models running AIX® 4.2.1 and above with the adapter feature codes that are shown in Table 11. FC 9201 (VTS Open System Device Drivers) provides device driver support for the RS/6000 host adapters that are shown in Table 11.

Table 11. RS/6000 Host Adapter Feature Codes

RS/6000 Feature Code	Host Bus	SCSI Type
2412	Micro Channel®	Fast Wide
6209	PCI	Fast Wide
6207	PCI	Wide Ultra Differential

3490E drive commands, status, and data are passed on the SCSI bus, and communications between the host and Library Manager are performed over a separate LAN or serial connection, bypassing the VTS. Figure 7 on page 31 shows the components and connections used by this feature.

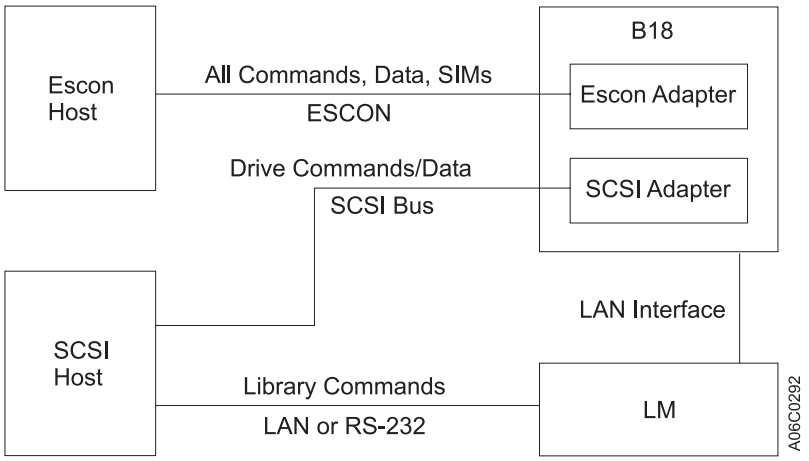


Figure 7. VTS Attachments

The VTS logical tape drives are emulated 3490E tape drives. This emulation is used for both ESCON and SCSI attachments. Behavior on the ESCON interface is not changed by this feature. Behavior on the SCSI bus is based on that of a 3490E Model C2A as described in *IBM 3490 Magnetic Tape Subsystem Enhanced Capability Models C10, C11, C1A, C22, and C2A Hardware Reference*. Open systems device drivers are described in *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers: Installation and User's Guide*.

SCSI Bus

FC 3422 supports the SCSI-2 (Fast, Wide, Differential) 20 MB per second standard interface, as well as the 40 MB per second Differential Wide Ultra SCSI interface. Connection to the VTS controller is through a 0.8 mm SCSI connector. Supported cable lengths are 4.5 m (14.8 ft), 10 m (32.8 ft), and 20 m (65.6 ft). FC 5004 provides a 10-m (32.8-ft) SCSI cable for daisy-chaining two VTS libraries to the same SCSI bus. The maximum allowable cable length for a VTS SCSI connection is 20 m (65.6 ft).

The SCSI host attachment feature on the VTS controller must be terminated externally using the provided terminators. Adapter cards are fitted with connection blocks to permit daisy-chain connections or external terminators.

SCSI Target Addressing

The SCSI target addresses to be used on each bus are configurable through a service panel by an IBM service representative upon installation of the VTS with a SCSI Host Attachment feature or installation of the SCSI Host Attachment feature in the field.

Each adapter provides two SCSI interfaces. One or two adapter cards may be installed in the VTS controller. Each adapter is restricted to accessing no more than sixteen logical tape drives. Each bus may be configured to address any even number of up to sixteen contiguous logical tape drives, starting with an even drive number. Note that, internally, logical tape drives are numbered from zero to sixty-three. The target addresses for each bus of a SCSI Host Attachment feature must be contiguous.

The division of the tape drives between logical control units is done for ESCON addressing purposes. Therefore, drive zero for one logical control unit is contiguous to drive fifteen of the previous (lower-numbered) logical control unit. There may be overlap between the logical tape drives accessed on each bus or adapter. A detailed representation of SCSI drive addressing is shown in Figure 8. Hosts are expected to use the SCSI Reserve Unit and Release Unit commands to prevent use of a single drive by multiple initiators and contention with ESCON-attached hosts.

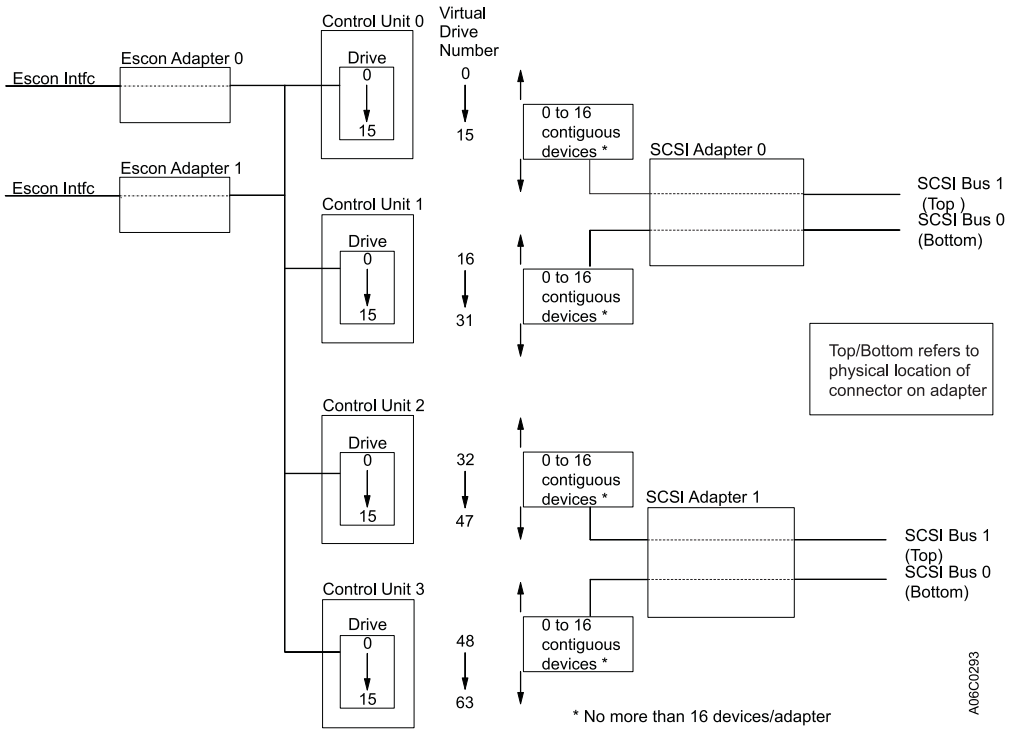


Figure 8. SCSI Drive Addressing

The adapter cards use one SCSI target address for every two logical tape drives configured, starting with the specified base address for the bus. LUN (Logical Unit Number) 0 and 1 are used for logical tape drives at each target address. The base target address for each bus may be set to 0 through 16 minus the number of tape drives addressed on the bus divided by two (16-[number of tape drives/2]). That is, no target address on the adapter may exceed 15. Each bus is independently configurable. An example of addressing on SCSI bus 0, base SCSI target address = 4, starting logical drive = CU 1, drive 14, eight tape drives is shown in Table 12 on page 33.

For a detailed discussion on sharing a tape library between S/390 and SCSI hosts, see the *Guide to Sharing and Partitioning IBM Tape Library Dataservers*. This reference includes considerations about sharing tape drives, sharing volumes, and related software implementation steps.

Table 12. SCSI Addressing Example

Control Unit ID	Drive Number	Virtual Drive Number	SCSI Target Address	Logical Unit Number
1	14	30	4	0
1	15	31	4	1
2	0	32	5	0
2	1	33	5	1
2	2	34	6	0
2	3	35	6	1
2	4	36	7	0
2	5	37	7	1

The initial SCSI device addressing for each bus of a SCSI Host Attachment feature is set for eight devices, starting at target address 8. Table 13 shows the initial assignments of target addresses for SCSI host attachment features. These initial assignments may be changed from a service panel by an IBM service representative.

Table 13. Initial SCSI Host Attachment Address Assignments

SCSI Adapter	Bus on Adapter	SCSI Target Address Range	Logical Unit Number Range	Virtual Drive Number Range	Control Unit (CU)	Drive Range within CU
0	0	8–11	0–1	0–7	0	0–7
0	1	8–11	0–1	8–15	0	8–15
1	0	8–11	0–1	16–23	1	0–7
1	1	8–11	0–1	24–31	1	8–15

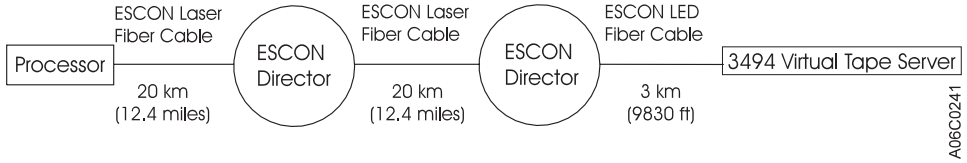
Attachments for 3494 Virtual Tape Server Models

Host Systems Attachment

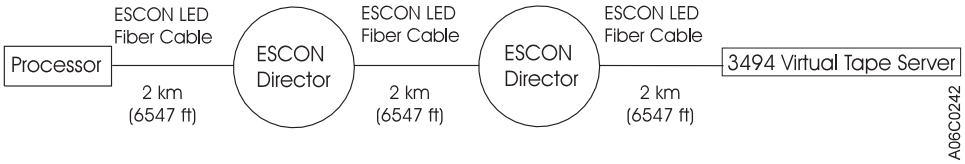
The 3494 Model B16 and B18 Virtual Tape Servers attach to ES/9000 host systems through ESCON channels. As part of your installation plan, analyze your performance and distance requirements carefully. The following considerations may be used as a starting point for a discussion with your IBM representative.

With ESCON, you have numerous options for the physical distance between the Virtual Tape Server and your ESCON-capable processor. Several configuration options are indicated below.

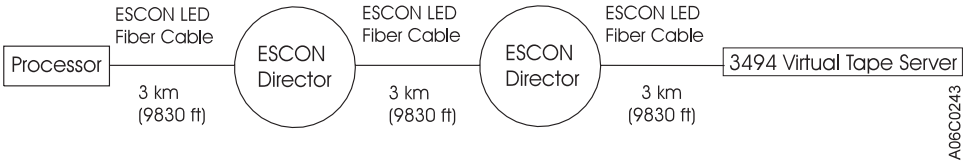
You can locate a Virtual Tape Server up to 43 kilometers (27 miles) from a processor when using the ESCON laser fiber cable and two ESCON directors:



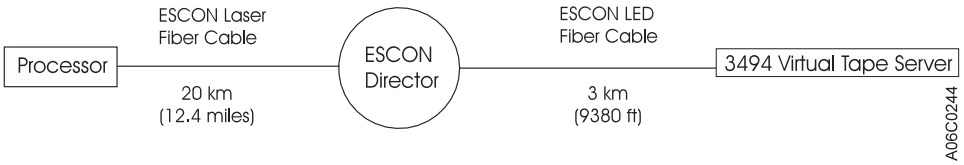
You can locate a Virtual Tape Server up to six kilometers (3.7 miles) from a processor when using the ESCON LED 50-micron cables and two ESCON directors:



You can locate a Virtual Tape Server up to nine kilometers (5.6 miles) from a processor when using the ESCON LED 62.5-micron cables and two ESCON directors:



You can locate a Virtual Tape Server up to 23 kilometers (14.3 miles) from a processor when using ESCON laser fiber cable, an ESCON director, and an ESCON LED fiber cable:



The 3494 Model B16 Virtual Tape Server contains two standard ESCON host channel attachments. With ESCON directors, each subsystem ESCON host channel attachment provides for up to 64 logical attachments.

The 3494 Model B18 Virtual Tape Server contains either two standard ESCON host channel attachments or two or four enhanced ESCON host channel attachments.

For additional information about ESCON attachments, see *IBM Fiber-Optic Channel Link Planning and Installation*.

Cabling for 3494 Virtual Tape Servers

Each Model B16 and B18 provides two 30-m (100-ft) ESCON cables. FC 3302 and 3412 for the Model B18 with FC 4010 provide two additional 30-m (100-ft) ESCON cables. If cables of other lengths are required, order the cable Group Number and Connection ID in the table below and specify a length.

Fiber optic jumper cables are used to attach the 3494 Virtual Tape Server to ESCON channels. Duplex-to-duplex 62.5/125-micron fiber optic jumper cables are available from IBM in the following fixed lengths:

4 m (13 ft)	7 m (23 ft)	13 m (43 ft)	22 m (73 ft)
31 m (102 ft)	46 m (151 ft)	61 m (200 ft)	77 m (253 ft)
92 m (302 ft)	107 m (352 ft)	122 m (400 ft)	

Customized cables from 122 m (400 ft) to 500 m (1640 ft) in length are also available.

	Group Number	**Number of Cables**	**Connection ID**	**Maximum Length**	**Model**
Interface 1	3797	1	55	122 m (400 ft)	B16
Interface 2	3797	1	57	122 m (400 ft)	B16
Interface 1	3797	1	151	122 m (400 ft)	B18
Interface 2	3797	1	153	122 m (400 ft)	B18
Interface 3 (FC 3302 or 3412)	3797	1	155	122 m (400 ft)	B18
Interface 4 (FC 3302 or 3412)	3797	1	157	122 m (400 ft)	B18

Host Processor Support

The 3494, with additional drive units, supports attachment of multiple host processors.

Note: The host processor support may change. Contact your IBM representative for current information.

The 3494 supports parallel attachments to the following hosts:

- ES/9000 Models 9221, 9121, and 9021 (all models)
- All ESA-capable S/370™ and S/390 systems
- AS/400 Models 9404 and 9406 (all models)
- RS/6000 Models
- Scalable POWERparallel Systems® RS/6000 SP

Note: The AS/400 system also requires the RS-232 or LAN attachment for library control.

The 3494 supports ESCON attachments to the following hosts:

- ES/9000 Models 9221, 9121, and 9021 (all models)
- All ESA-capable S/370 and S/390 systems
- RS/6000 Models

The 3494 supports SCSI attachments to the following hosts:

- RS/6000 Processors
- Sun Microsystems Processors
- HP 900 Series 800 Business Servers
- AS/400 Processors
- Windows NT™ Processors

All SCSI-attached processors require the RS-232 or LAN attachment for library control. For Sun, HP, and AS/400 systems, the LAN is not supported in the Model HA1.

The 3494 Model B16 and B18 Virtual Tape Servers support ESCON attachments to the following hosts:

- ES/3090
- ES/9000
- S/390

The 3494 Model B18 supports SCSI attachments to selected RS/6000 and RS/6000 SP hosts.

Chapter 2. Specify and Special Features

The 3494 is available in several configurations. The Model L1x Control Unit Frame contains a tape subsystem, the cartridge accessor, the Library Manager, storage for cartridges, and the optional Convenience Input/Output Station feature. The tape subsystem can be attached to SCSI, ESCON, and parallel channels in any combination.

Additional drive unit frames or the Model B16 Virtual Tape Server Frame in a 3494 provide increased storage and increased performance. Additional storage unit frames in a 3494 provide increased storage.

The Model B18 VTS Frame is installed as a stand-alone frame with external cabling to the library frames.

Language Group Features

Language features are factory-installed only. The default language is English, if it is not otherwise specified. Depending on the country, some or all of the user documentation may be available in the country language. Table 14 shows the keyboard and operator panel language features for the 3494.

Note: At installation, the customer specifies the language for the Library Manager display and the service representative enables the selected language.

Table 14. Language Group Features

Feature Code	Language
FC 2924	English
FC 2928	French
FC 2930	Japanese (operator panel only)
FC 2931	Spanish
FC 2932	Italian
FC 2935	French Canadian (keyboard only)
Note: A maximum of one language may be specified.	

Safety Labels

Languages on safety labels in the operator access area are country specific. The appropriate safety label language is selected at the factory based on the order destination country code. Table 15 shows the list of available languages and language groups for the safety labels.

Table 15. Safety Labels

English	Italian	French
German	Spanish	Dutch and French
Danish	Finnish	Norwegian
Portuguese	Swedish	French and English
Japanese	Brazilian Portuguese	Italian, German, and French

Specify Features

To populate the drive and control unit frames with tape subsystems, the features shown in Table 16 are provided. These features only provide the hardware to install the subsystems in the 3494 frames; the actual tape drives and control units (and their associated features) must be ordered separately. Specify features are selected when ordering a 3494.

Notes:

1. The design of the 3494 is for connection to Impedance Transformer (IT) power subsystems.
2. For language feature codes, see “Language Group Features” on page 37.

Table 16. Magstar 3494 Specify Features

Feature Code	Maximum Quantity	Description
FC 9002	7 (see note 7)	Storage Unit Attach frames 2 through 8
FC 9003	7 (see note 7)	Drive Unit Attach frames 2 through 8
FC 9004	4 (see note 6)	Storage Unit Attach frames 9 through 16
FC 9005	4 (see note 6)	Drive Unit Attach frames 9 through 16
FC 9006	1 (see notes 8 and 13)	Virtual Tape Server Attachment < 9 frames
FC 9007	1 (see notes 8 and 13)	Virtual Tape Server Attachment > 8 frames
FC 9010	1 (see note 9)	Attached to a Model B16 or B18
FC 9020	2 (see notes 20 and 21)	3494 B18 VTS Attachment
FC 9040	1 (see note 12)	High Availability Attachment
FC 9041	1 (see note 14)	High Availability Direct Attachment (Withdrawn)
FC 9060	15 (see note 22)	Attach A60 to 3494 Concentrator
FC 9061	15 (see note 22)	Attach A60 to 3494 RS-422
FC 9104	1 (see note 10)	AS/400 Processor Attachment
FC 9106	1 (see note 10)	RS/6000 Processor Attachment
FC 9109	1 (see note 10)	ES/9000 Processor Attachment
FC 9200		Open System Device Drivers
FC 9201		VTS Open System Device Drivers
FC 9203	32	Virtual Storage Extended LAN Device Driver
FC 9204	32	Sun Device Driver (Withdrawn)
FC 9210	32	Attach to HP-UX
FC 9211	32	Attach to Sun
FC 9212	32	Attach to Windows NT
FC 9540	1 (see note 11)	No Additional Data Cartridges
FC 9601	1 (see note 2)	3490E Model CxA/F1A Factory Installation
FC 9602	1 (see note 15)	3490E Model F1A Factory Installation
FC 9630	x (see notes 1, 3, and 4)	Field Merge Drives
FC 9631	x (see notes 1, 3, and 4)	3590 Model B1A Drive Factory Installation
FC 9632	1 (see note 15)	3490E Model F1A Attachment Hardware for Field Merge
FC 9633	1 (see note 18)	3490E Model F1A FC 3000 Controller for Field Merge

Table 16. Magstar 3494 Specify Features (continued)

Feature Code	Maximum Quantity	Description
FC 9634	1 (see note 18)	3490E Model F1A FC 3000 Controller Factory Installation
FC 9635	1 (see note 5)	3590 Model A00 Attachment Hardware for Field Merge (Withdrawn)
FC 9636	1 (see note 5)	3590 Model A00 Controller Factory Installation (Withdrawn)
FC 9655	1 (see note 16)	3590 Model A50 Attachment Hardware for Field Merge
FC 9656	1 (see note 16)	3590 Model A50 Controller Factory Installation
FC 9663	x (see notes 1, 3, and 4)	3590 Model E1A Drive Factory Installation
FC 9665	1 (see note 19)	3590 Model A60 Attachment Hardware for Field Merge
FC 9666	1 (see note 19)	3590 Model A60 Controller Factory Installation
FC 9702	4	Interposer, Double-Byte Wide
FC 9799	4	VHDCI Cable/Interposer
FC 9986	1 (see note 17)	Special power cord for Chicago, Illinois, U.S.A.

Table 16. Magstar 3494 Specify Features (continued)

Feature Code	Maximum Quantity	Description

Notes:

1. A maximum of two FC 9630, 9631, 9663, MES 4630 or 4663 is permitted on a Model L12 or L14.
2. A maximum of one FC 9601 or MES 4630 is permitted on a Model D10.
3. A maximum of six FC 9630, 9631, 9663, MES 4630 or 4663 is permitted on a Model D12. When attached to a Model B16, the Model D12 must contain three, four, five, or six Model B1A drives. When attached to a Model B18, the Model D12 must contain three, four, five, or six Model B1A or E1A drives.
4. A maximum of four FC 9630, 9631, 9663, MES 4630 or 4663 is permitted on a Model D14.
5. A maximum of one FC 9635, 9636, or MES 4635 is permitted on a Model D14 or L14.
6. The library may be expanded to 10, 12, or 16 frames by the addition of any combination of FC 9004, 9005, and one 9007 per library.

   When the Model HA1 is installed, the library may be expanded to 12, 14, or 18 frames, including the Model HA1 Service Bay Frames, by the addition of any combination of FC 9004, 9005, and one 9007 per library.
7. A maximum of seven FC 5300, 5302, 5304, 5400, 9002, 9003, and one 9006 can be configured in any combination.

   When the Model HA1 is installed, the library may be expanded to five, six, eight, or 10 frames, including the Model HA1 Service Bay Frames, by the addition of FC 9002, 9003, and one 9007.
8. To add a Model B16 VTS to a library, a maximum of one FC 9006 or 9007 must be specified for the Model L1x Control Unit Frame to track the number of frames installed in the library and to provide any necessary hardware.
9. This feature for the Model D12 Drive Unit Frame indicates that the 3590 drives in it are to be used by a Virtual Tape Server subsystem.
10. A minimum quantity of one FC 9104, 9106, or 9109 must be specified.
11. Either FC 9540, 8410, 8420, 8510, or 8520 must be specified for each frame.
12. Within the Model L1x Control Unit Frame, a maximum of one FC 9040 is required if the Model HA1 is in the library subsystem. FC 9040 may also be an MES. The Enhanced Library Manager is included with FC 9040 when the existing Library Manager is not an Enhanced Library Manager.
13. FC 5214, 5228, and 5229 are required for Model B16 VTS Frame attachment.
14. If ordered on a Model HA1, it indicates LAN or SCSI attachment and must be ordered on all 3494 frames.
15. A maximum of two FC 9602, 9632, or MES 4632 is permitted on a Model D10.
16. A maximum of one FC 9655, 9656, or MES 4655 or 4650 is permitted on a Model D14 or L14.
17. There is a maximum of one FC 9986 per model except for Model S10, which cannot have any, and Model HA1, which requires two.
18. There is a maximum of one FC 9633, 9634, or 4634.
19. A maximum of one FC 9665, 9666, or MES 4665 or 4660 is permitted on a Model D14.
20. FC 9020 must be on the Model L1x for each Model B18 attached.
21. There is a maximum of two FC 9006, 9007, and 9020.
22. The maximum of 15 FC 9060 or 9061 applies only to Model L1x. A maximum of one FC 9060 or 9061 applies only to Model D14s that contain the 3590 Model A60 Controller.

Storage Unit Attach (2–8 Frames)

In order to install the correct length accessor and control cables for the library, the factory must know the total number of frames in the planned 3494 library. FC 9002 must be specified for each storage unit frame included in the first eight frames of the library configuration.

Drive Unit Attach (2–8 Frames)

In order to install the correct length accessor and control cables for the library, the factory must know the total number of frames in the planned 3494 library. FC 9003 must be specified for each drive unit frame included in the first eight frames of the library configuration.

Storage Unit Attach (9–16 Frames)

FC 9004 is used along with FC 9002, 9003, 9005, or 9006 to determine the library length so that the factory can provide the correct supporting hardware. FC 9004 must be specified for each storage unit frame included in the second eight frames of the library configuration.

Drive Unit Attach (9–16 Frames)

FC 9005 is used along with FC 9002, 9003, 9004, or 9006 to determine the library length so that the factory can provide the correct supporting hardware. FC 9005 must be specified for each drive unit frame included in the second eight frames of the library configuration.

Virtual Tape Server Attach < Nine Frames

In order to install the correct length accessor and control cables for the library, the factory must know the total number of frames in the planned 3494 library. FC 9006 must be specified for library configurations with a Model B16 Virtual Tape Server installed in the first eight frames.

Virtual Tape Server Attach > Eight Frames

In order to install the correct length accessor and control cables for the library, the factory must know the total number of frames in the planned 3494 library. FC 9007 must be specified for library configurations with a Model B16 Virtual Tape Server installed in the frames beyond eight.

Attached to a Model B16 or B18

FC 9010 (with FC 9630, 9631, 9663, 4630, or 4663 also specified) allows the factory to provide the appropriate internal SCSI cables for installation of 3590 Model B1A or E1A tape drives. You do not need to order the SCSI cables separately for each 3590 Model B1A or E1A. A Model D12 Drive Unit Frame attached to a Model B16 or B18 VTS frame requires one feature.

3494 Model B18 Attachment

FC 9020 for the Model L1x Control Unit Frame indicates that a Model B18 Virtual Tape Server is included in the library system. One FC 9020 is required for each Model B18 attached.

High Availability Attachment

FC 9040 provides connection between the Library Manager in the Model L1x Control Unit Frame and the Library Manager in the Model HA1 right Service Bay Frame when viewing the library from the front (input/output station side).

High Availability Direct Attach (Withdrawn from Marketing)

FC 9041 must be specified if there is a Model HA1 on the 3494 with direct attachment for library control (AS/400, RS/6000, or a VSE/LAN). This feature must be specified on all frames of the 3494.

Model A60 Attachment to 3494 Concentrator

FC 9060 indicates that the 3590 Model A60 Controller connects to the Library Manager through the 3494 Attachment Concentrator (FC 5232). Each 3590 Model A60 Controller installed in the 3494 library requires one FC 9060 or 9061. A maximum of 15 FC 9060 applies to the Model L1x. A maximum of one FC 9060 applies to Model D14s containing the 3590 Model A60 Controller.

Model A60 Attachment to 3494 RS-422

FC 9061 indicates that the 3590 Model A60 Controller connects to the Library Manager through an RS-422 port. When connected this way, the 3590 Model A60 Controller uses one controller serial communication path (see “Library Manager Communication Paths” on page 18). Each 3590 Model A60 Controller installed in the 3494 library requires one FC 9060 or 9061. A maximum of 15 FC 9061 applies to the Model L1x. A maximum of one FC 9061 applies to Model D14s containing the 3590 Model A60 Controller.

AS/400 Processor Attachment

FC 9104 must be specified if the library is to be attached to an AS/400 system.

RS/6000 Processor Attachment

FC 9106 must be specified if the library is to be attached to an RS/6000 system.

ES/9000 Processor Attachment

FC 9109 must be specified if the library is to be attached to an ES/9000, ES/3090, or S/390 system.

Open System Device Drivers

FC 9200 provides device drivers to permit HP-UX, RS/6000, Sun, and Windows NT processors to attach and drive the 3494 over a LAN or RS-232 connection. One driver is included for each host attachment type and for tape drives attaching to HP-UX, RS/6000, Sun, and Windows NT processors. An RS-232 cable (if required) is ordered separately with FC 5217. A maximum of 32 host LAN attachments is allowed.

VTS Open System Device Drivers

FC 9201 provides a device driver to support SCSI attachment of the Model B18. It also provides device drivers to permit RS/6000 processors to attach and drive the 3494 over a LAN or RS-232 connection. An RS-232 cable (if required) is ordered separately with FC 5217. A maximum of 32 host LAN attachments is allowed.

Virtual Storage Extended LAN Device Driver

FC 9203 provides the function for an ES/9000 to support native VSE/ESA over a LAN. One driver is required for each host attachment. A maximum of 32 host LAN attachments is allowed.

Sun Device Driver (Withdrawn from Marketing)

FC 9204 permits all Sun Sparc processors operating with Solaris OS Version 2.3 or above to attach and drive the 3494 over the RS-232 or LAN. One driver is required for each host attachment. The RS-232 cable is ordered separately with FC 5217. A maximum of 32 host LAN attachments is allowed.

Attach to HP-UX

FC 9210 indicates that HP processors operating with HP-UX 10.0x through HP-UX 10.3x are attached and drive the library over a LAN or RS-232 connection. FC 9200 must be specified with FC 9210. An RS-232 cable (if required) is ordered separately with FC 5217. A maximum of 32 host LAN attachments is allowed.

Attach to Sun

FC 9211 indicates that Sun processors operating with SunOS 5.X (Solaris 2.X) or above are attached and drive the library over a LAN or RS-232 connection. FC 9200 must be specified with FC 9211. An RS-232 cable (if required) is ordered separately with FC 5217. A maximum of 32 host LAN attachments is allowed.

Attach to Windows NT

FC 9212 indicates that Windows NT processors are attached and drive the library over a LAN or RS-232 connection. FC 9200 must be specified with FC 9212. An RS-232 cable (if required) is ordered separately with FC 5217. A maximum of 32 host LAN attachments is allowed.

No Data Cartridges

FC 9540 must be specified if no cartridges are to be shipped with a 3494 model frame.

3490E Model CxA Drive Factory Installation

FC 9601 causes the factory to install one 3490E Model CxA in a 3494 Model L10 or D10 frame.

3490E Model F1A Factory Installation

FC 9602 causes the factory in install hardware to allow for factory installation of one or two 3490E Model F1A tape drives in a 3494 Model L10 or D10 frame. A quantity of one or two can be ordered for Model D10 and one for Model L10.

Field Merge Drives

FC 9630 is provided so that the factory will install the hardware needed to allow the field merge of one 3490E Model CxA in a Model L10 Control Unit Frame. In a Model L12, L14, D12, or D14 frame, FC 9630 instructs the factory to install the hardware needed to allow the field merge of one 3590 Model B1A or E1A. If FC 9630 is ordered for a Model L14 or D14, one of FC 9655, 9656, 9665, or 9666 must also be ordered.

3590 Model B1A Drive Installation

FC 9631 is provided so that the factory will install one 3590 Model B1A in a Model L12, L14, D12, or D14 frame. If you order FC 9631 for a Model L14 or D14, you must also order one of the following:

- FC 9636 for a 3590 Model A00 Controller
- FC 9656 for a 3590 Model A50 Controller
- FC 9666 for a 3590 Model A60 Controller

3490E Model F1A Attachment Hardware for Field Merge

FC 9632 causes the factory to install hardware to allow for field merge of one or two 3490E Model F1A tape drives in a Model L10 or D10 frame. A quantity of one or two can be ordered for the Model D10 and one for the Model L10.

3490E Model F1A FC 3000 Controller for Field Merge

FC 9633 allows the field merge of an 3490E Model F1A FC 3000 Controller into the Model L10 Control Unit Frame or the Model D10 Drive Unit Frame. This feature notifies the factory to leave a mounting slot available and to provide the hardware for a field merge of the 3490E Model F1A FC 3000 Controller prior to completion of installation.

3490E Model F1A FC 3000 Controller Factory Installation

FC 9634 instructs the factory to install a 3490E Model F1A FC 3000 Controller into the Model L10 Control Unit Frame or the Model D10 Drive Unit Frame.

3590 Model A00 Attachment Hardware for Field Merge (Withdrawn from Marketing)

FC 9635 is provided so that the factory will install the hardware needed in a 3494 model frame to allow one 3590 Model A00 to be field merged. This feature applies only to Model L14 and D14 frames.

3590 Model A00 Controller Factory Installation (Withdrawn from Marketing)

FC 9636 is provided so that the factory will install one 3590 Model A00 Controller in a 3494 model frame. This feature applies only to 3494 Model L14 and D14 frames.

3590 Model A50 Attachment Hardware for Field Merge

FC 9655 causes the factory to install the hardware needed in a 3494 model frame to allow for field merge of one 3590 Model A50 Controller. This feature applies only to Model L14 and D14 frames.

3590 Model A50 Controller Factory Installation

FC 9656 causes the factory to install one 3590 Model A50 Controller in a 3494 model frame. This feature applies only to Model L14 and D14 frames.

3590 Model E1A Drive Installation

FC 9663 causes the factory to install one 3590 Model E1A in a 3494 Model L12, L14, D12, or D14 frame. If you order FC 9663 for a Model L14 or D14, you must also order one of the following:

- FC 9656 for a 3590 Model A50 Controller
- FC 9666 for a 3590 Model A60 Controller

3590 Model A60 Attachment Hardware for Field Merge

FC 9665 causes the factory to install the hardware that is needed in a 3494 model frame to allow for the field merge of one 3590 Model A60 Controller. This feature applies only to the Model D14 frame.

3590 Model A60 Controller Factory Installation

FC 9666 causes the factory to install one 3590 Model A60 Controller in a 3494 model frame. This feature applies only to the Model D14 frame.

Interposer, Double-Byte Wide

FC 9702 provides connection from an industry standard high-density 68-pin (HD-68) connector to a 68-pin ribbon connector host system adapter, such as the RS/6000 Enhanced SCSI-2 Differential Fast/Wide Adapter/A (FC 2412). There is a maximum of four interposers.

VHDCI Cable/Interposer

FC 9799 provides an industry standard high-density 68-pin cable connector, typically used on Fast/Wide devices, to SUN PCI Dual-Channel Differential Ultra SCSI host adapter with VHDCI connector for the Model B18. The assembly is less than 0.3 m (1 ft) long and requires the use of a SCSI cable with a high-density 68-pin (HD68) connector.

Chicago Power Cord

FC 9986 provides a special 1.8-m (6-ft) power cord for 3494 installations in Chicago, Illinois, U.S.A.

Field MES Features

Table 17 shows the field MES features for adding tape drives, controllers, or VTS controllers to, or removing them from, frames in the 3494 library.

Table 17. Field MES Features

Feature Code	Description
FC 4630	This feature provides the hardware needed to allow for field installation of one 3490E Model C1A or C2A in a 3494 Model L10 or D10, or one 3590 Model B1A or E1A tape subsystem in a 3494 Model L12, L14, D12, or D14. If this feature is ordered for a Model L14 or D14, one of the following must have been installed previously or must be ordered: • FC 4635 • FC 9635 • FC 9636 • FC 4655 • FC 9655 • FC 9656 • FC 4665 • FC 9665 • FC 9666
FC 4632	This feature provides the hardware needed to allow for field installation of one 3490E Model F1A tape drive. This feature is ordered for the 3494 Model L10 (maximum of one) or Model D10 (maximum of two). A prerequisite on the Model L10 is FC 9602 or 9632.
FC 4633	This feature provides the hardware needed in a 3494 Model D10 to replace a 3490E Model C1A or C2A with a Model F1A. There is maximum quantity of one.
FC 4634	This feature allows field installation of a 3490E Model F1A Control Unit into the Model L10 Control Unit Frame or Model D10 Drive Unit Frame. There is a maximum quantity of one for FC 9633, 9634, or 4634.
FC 4635	This feature provides the hardware needed in a 3494 Model L14 or D14 to allow for field installation of one 3590 Model A00. If this feature is ordered for a Model L14 or D14, FC 4630 must also be ordered.
FC 4650	This feature provides the hardware needed in a 3494 Model L14 or D14 to replace a 3590 Model A00 Controller with a 3590 Model A50 Controller.
FC 4655	This feature provides the hardware needed in a 3494 Model L14 or D14 to allow for field installation of one 3590 Model A50 Controller. If this feature is ordered for a Model L14 or D14, FC 4630 must also be ordered.
FC 4660	This feature provides the hardware needed in a 3494 Model D14 to replace a 3590 Model A00 or A50 Controller with a 3590 Model A60 Controller.

Table 17. Field MES Features (continued)

Feature Code	Description
FC 4663	This feature is required to replace a 3590 Model B1A tape drive with a 3590 Model E1A tape drive in a currently installed 3494 library frame. The Model B1A and E1A tape drives cannot be attached to the same 3590 Model A50 or A60 Controller, so both types of drives cannot be installed together in the Model L14 or D14 frame.
FC 4665	This feature provides the hardware needed in a 3494 Model D14 to allow for field installation of one 3590 Model A60 Controller. If this feature is ordered for a Model D14, FC 4630 must also be ordered.
FC 4701	This feature removes a 3490E Model F1A tape drive from a 3494 Model L10 or D10.
FC 4730	This feature removes a 3590 Model B1A tape drive from a 3494 Model L12, L14, D12, or D14.
FC 4734	This feature allows removal of a 3490E Model F1A Control Unit from the Model L10 Control Unit Frame or Model D10 Drive Unit Frame. There is a maximum of one.
FC 4735	This feature removes a 3590 Model A00 Controller from a 3494 Model L14 or D14.
FC 4755	This feature removes a 3590 Model A50 Controller from a 3494 Model L14 or D14.
FC 4765	This feature removes a 3590 Model A60 Controller from a 3494 Model D14.
Note: The 3590 Model B1A or E1A tape subsystem, or the 3490E Model CxA or F1A tape drives, or the 3590 Model A00, A50, or A60 Controller must be ordered separately.	

Model and Feature Conversions

The following model and feature conversions are supported for the 3494 library:

- 3494 FC 3302 to FC 3412
- 3494 FC 3702 to FC 3704
- 3494 FC 3702 to FC 3705
- 3494 FC 3703 to FC 3704
- 3494 FC 3704 to FC 3705
- 3494 FC 5300 to FC 5302
- 3494 FC 5300 to FC 5304
- 3494 FC 5500 to FC 5502
- 3494 FC 5500 to FC 5503
- 3494 FC 5500 to FC 5504
- 3494 FC 5502 to FC 5503
- 3494 FC 5502 to FC 5504
- 3494 Model L10 to Model L12
- 3494 Model L10 to Model L14
- 3494 Model L12 to Model L14
- 3494 Model L14 to Model L12
- 3494 Model D10 to Model D12
- 3494 Model D10 to Model D14

- 3494 Model D12 to Model D14
- 3494 Model D14 to Model D12
- 3494 Model B16 to Model B18

If a conversion is not listed, it must be requested through the RPQ process. Features cannot be upgraded to models. Any model upgrades that are not listed must be requested through the RPQ process.

Special Features

Table 18 shows the special features for the 3494 library. These features can be ordered from the factory, or they can be field installed.

Table 18. Magstar 3494 Special Features

Feature Code	Maximum Quantity	Description
FC 2710	1 (see note 1)	Remote Support Facility
FC 2711	1 (see note 1)	Remote Support Switch
FC 2712	1 (see note 1)	Remote Support Attachment
FC 3200	1	ESCON High Performance Option (Withdrawn)
FC 3302	1	Additional Enhanced ESCON Channel Attachment (Withdrawn)
FC 3400	1	Extended High Performance Option
FC 3412	2	Extended Performance ESCON Channels
FC 3422	2	SCSI Host Attachment
FC 3701	4 (see note 12)	36 GB Disk Storage Capacity for Tape Volume Cache, Model B16 (Withdrawn)
FC 3702	4 (see note 13)	Disk Storage Capacity for Model B18
FC 4000	1	Advanced Function (Import/Export)
FC 5001	4	4.5-Meter SCSI Cable
FC 5002	4	10-Meter SCSI Cable
FC 5003	4	20-Meter SCSI Cable
FC 5004	4	10-Meter SCSI VHDCI Cable
FC 5045	1 (see note 17)	Enhanced Library Manager
FC 5050	1 (see note 16)	Dual Active Accessors
FC 5210	1 (see note 11)	10-Cartridge Convenience Input/Output Station
FC 5211	8 (see note 2)	AS/400 Host Attachment
FC 5212	8 (see note 2)	RS/6000 Host Attachment (Withdrawn)
FC 5213	8 (see notes 2 and 5)	Extended Length RS-232 Host Attachment for AS/400
FC 5214	1 (see note 10)	Second Disk Drive for the Library Manager
FC 5215	1 (see note 9)	Dual Gripper
FC 5216	1	Remote Power Sequence for AS/400
FC 5217	8	RS-232 15-m (50-ft) Extension Cable
FC 5219	1 (see notes 6 and 9)	Token-Ring Adapter
FC 5220	1 (see notes 6 and 9)	Ethernet Adapter
FC 5224	16 (see note 3)	AIX Parallel Channel Tape Attachment/6000
FC 5226	1	Remote Library Manager Console
FC 5228	2 (see note 8)	Tape Control Unit Expansion
FC 5229	1 (see notes 6, 8, and 9)	Expansion Attachment Card
FC 5230	1 (see note 11)	30-Cartridge Convenience Input/Output Station
FC 5232	1 (see notes 14 and 18)	Attachment Concentrator
FC 5233	1	SCSI Extender

Table 18. Magstar 3494 Special Features (continued)

Feature Code	Maximum Quantity	Description
FC 5234	1	18-Meter SCSI Cables
FC 5236	1	Performance Accelerator
FC 5300	7 (see notes 4 and 7)	Additional Drive Unit Frame (similar to Model D10) [Withdrawn]
FC 5302	7 (see notes 4 and 7)	Additional Drive Unit Frame (similar to Model D12)
FC 5304	7 (see notes 4 and 7)	Additional Drive Unit Frame (similar to Model D14)
FC 5400	7 (see notes 4 and 7)	Additional Storage Unit Frame (similar to Model S10) [Withdrawn]
FC 5500	1 (see notes 4, 7, and 15)	Additional Storage Unit (similar to Model D12 without Model B1As)
FC 5502	1 (see notes 4, 7, and 15)	Drive Unit for B18
FC 5503	1 (see notes 4, 7, and 15)	SCSI Drive Unit
FC 5504	1 (see notes 4, 7, and 15)	ESCON Drive Unit
FC 8002	10	One 3590 Cleaning Cartridge
FC 8005	10	One 3490E Cleaning Cartridge
FC 8410	1	210 3490E Data Storage Cartridges (Withdrawn)
FC 8420	1	420 3490E Data Storage Cartridges (Withdrawn)
FC 8510	2	210 3590 Data Storage Cartridges
FC 8520	1	420 3590 Data Storage Cartridges (Withdrawn)

Table 18. Magstar 3494 Special Features (continued)

Feature Code	Maximum Quantity	Description

Notes:

1. Each 3494 Model L10, L12, L14, HA1, B16, or B18 must specify one of either FC 2710, 2711, or 2712.
2. Any combination of FC 5211, 5212, and 5213 can total no more than eight with FC 5229. If the LAN attachment is used, up to 32 host processors can be attached with the appropriate drive switching equipment.
3. Licensing is required for each attached RS/6000. In addition, up to eight RS/6000 features are available to permit AIX ESCON Tape Attachments.
4. A maximum 3494 configuration consists of sixteen frames, one library control unit frame, and any combination of up to fifteen additional frames.
5. Four attachments are standard (up to eight attachments with FC 5229).
6. Expansion attachment card and either Token-Ring or Ethernet may be selected.
7. A maximum of fifteen FC 5300, 5302, 5304, 5400, 5500, 5502, 5503, 5504, 9002, 9003, 9004, 9005, 9006, and 9007 can be configured.
8. FC 5228 and 5229 are required when a Model B16 VTS is installed in the library.
9. If FC 5215, 5219, 5220, or 5229 exist in the Library Manager, they also need to be ordered for the Model HA1.
10. If a Model B16, B18, or HA1 is in the subsystem, FC 5214 is required on the Model L1x. FC 5214 does not apply to Model L1xs manufactured after October 1999.
11. Either FC 5210 or 5230 may be selected.
12. FC 3701 provides for 36 GB of usable storage capacity for the Tape Volume Cache. A quantity of two or four must be ordered.
13. FC 3702 must be ordered in a quantity of one, two, three, or four for the Model B18 or when converting a Model B16 to a Model B18.
14. FC 5232 must be ordered for the Model L1x when Model B18 or FC 9060 is present.
15. FC 5500, 5502, 5503, or 5504 must be ordered for the Model L1x when converting a Model B16 to a Model B18.
16. FC 5050 is available only when the 3494 library includes a Model HA1. This feature is available only for systems with at least four frames, not including Service Bay Frames and Model B18 VTS Frames.
17. If a Model HA1 is installed and FC 5045 is ordered, it must be ordered for **both** the Model L1x and the Model HA1.
18. If the Model L1x was shipped before August 1998, FC 9020, 9040, or 5045 is a prerequisite.

Notes:

1. The following feature codes are available only as field conversions:
   - FC 5302
   - FC 5304
   - FC 5045
   - FC 5500
   - FC 5502
   - FC 5503
   - FC 5504
2. The following feature codes are factory order only:
   - FC 8410
   - FC 8420
   - FC 8510
   - FC 8520

All other feature codes are available as field conversions, or they can be factory installed.

Remote Support Facility

The Remote Support features (FC 2710, 2711, and 2712) provide rapid diagnostic and remote support capability. The same modem and switch may be shared between the following units:

- 3494 Models B16, B18, HA1, L10, L12, and L14
- 3590 Model A00, A50, or A60 Controller
- 3490E Model F1A Controller (FC 3000)

One of these three features should be selected based on the number of units in the installation. FC 2710 supplies a cable and connectors for connection to an IBM-supplied modem to enable remote diagnostic support. This feature should be specified only on the first unit of each set of fourteen units in an installation. Each 3494 Model B16, B18, L10, L12, L14, and HA1 must specify either FC 2710, 2711, or 2712.

Remote Support Switch

FC 2711 provides cables, connectors, and a switch for the attachment of multiple units through the switch to a modem. It should be ordered on the second unit attached to the modem in an installation. One switch should be specified for every set of fourteen units in an installation site. Each 3494 Model B16, B18, L10, L12, L14, and HA1 must specify either FC 2710, 2711, or 2712.

Remote Support Attachment

FC 2712 provides an additional cable and connector to attach to the Remote Support Switch (FC 2711). It should be ordered on the third through the fourteenth unit attached to the Remote Support Switch in an installation site. Each 3494 Model B16, B18, L10, L12, L14, and HA1 must specify either FC 2710, 2711, or 2712.

ESCON High Performance Option (Withdrawn from Marketing)

FC 3200 for the Model B18 provides data compression capability for improved performance with two enhanced ESCON host channel attachments. Two additional enhanced ESCON host channel attachments are available with FC 3302.

Additional Enhanced ESCON Channel Attachments (Withdrawn from Marketing)

FC 3302 for the Model B18 provides two additional enhanced ESCON host channel attachments with two 30-m (100-ft) ESCON cables. A quantity of one of FC 3302 may be ordered (factory or field). FC 3200 ESCON High Performance Option is a prerequisite to FC 3302.

Extended High Performance Option

FC 3400 for the Model B18 enables data compression capability, which provides larger effective disk capacities and improved performance. This feature also enables virtual addressing of 64 tape drives.

Extended Performance ESCON Channels

FC 3412 provides two Extended Performance ESCON Channel attachments for the Model B18. Either FC 3200 ESCON High Performance Option or FC 3400 Extended High Performance Option is a prerequisite to FC 3412. One FC 3412 may be ordered with FC 3200. A maximum of two FC 3412 may be ordered with FC 3400. FC 3412 includes two 30-m (100-ft) ESCON cables.

SCSI Host Attachment

FC 3422 provides two SCSI host attachments on a single card for the Model B18. A maximum of two FC 3422 may be ordered (factory or field). Either FC 3200 ESCON High Performance Option or FC 3400 with FC 3412 is a prerequisite to FC 3422. An operational ESCON host must be attached through FC 3200 (or FC 3400 with FC 3412). FC 3302 must not be installed.

36 GB Disk Storage Capacity for the Tape Volume Cache in Model B16 (Withdrawn from Marketing)

FC 3701 provides the Disk Storage arrays for 36 GB of usable storage capacity for the tape volume cache in the Model B16. A quantity of two or four must be ordered.

Disk Storage Capacity for Model B18

FC 3702 provides the Disk Storage arrays for 72 GB of usable storage capacity for the tape volume cache in a Model B18. You must order FC 3702 in quantities of one, two, three, or four for the Model B18, and for the Model B16 to Model B18 conversion.

Advanced Function (Import/Export)

FC 4000 provides Import and Export of logical volumes via physical stacked volumes. FC 4000 requires the following:

- A minimum of four 3590 Model B1A or E1A tape drives associated with the VTS
- For the Model B18, FC 3200 (ESCON High Performance Option) or FC 3400 (Extended High Performance Option) with FC 3412 (Extended Performance ESCON Channels)
- FC 5210 or 5230, the 10-Cartridge or 30-Cartridge Convenience Input/Output Station feature

4.5-Meter SCSI Cable

FC 5001 provides one 4.5-m (14.8-ft) SCSI cable for Model B18 with FC 3422. It has an HD-68 standard 68-pin straight housing connector for host attachment and a VHDCI 0.8-mm connector for Model B18 attachment. There is a maximum of four FC 5001 per Model B18.

10-Meter SCSI Cable

FC 5002 provides one 10-m (32.8-ft) SCSI cable for Model B18 with FC 3422. It has an HD-68 standard 68-pin straight housing connector for host attachment and a VHDCI 0.8-mm connector for Model B18 attachment. There is a maximum of four FC 5002 per Model B18.

20-Meter SCSI Cable

FC 5003 provides one 20-m (65.6-ft) SCSI cable for Model B18 with FC 3422. It has an HD-68 standard 68-pin straight housing connector for host attachment and a VHDCI 0.8-mm connector for Model B18 attachment. There is a maximum of four FC 5003 per Model B18.

10-Meter SCSI VHDCI Cable

FC 5004 provides one 10-m (32.8-ft) SCSI cable with VHDCI 0.8-mm connectors on both ends for daisy-chaining two Model B18s on the same SCSI bus. There is a maximum of four FC 5004 per Model B18.

Enhanced Library Manager

FC 5045 is an MES that provides an enhanced Library Manager for performance improvement in Models L1x of a 3494 tape library. If a Model HA1 is installed and FC 5045 is ordered, it must be ordered for **both** the Model L1x and the Model HA1.

Dual Active Accessors

FC 5050 allows both accessors in a Model HA1 to be active at the same time. Model HA1 must be present in the library system. This feature is available only for systems with at least four frames, not including Service Bay Framesor Model B18 VTS Frames.

10-Cartridge Convenience Input/Output Station

FC 5210 allows an operator to add or remove up to ten tape cartridges from the 3494 tape library without interrupting normal operations. Installation of the 10-Cartridge Convenience Input/Output Station feature reduces the cartridge capacity in the control unit frame by 30 cartridges.

AS/400 Host Attachment

FC 5211 or 5213 is required when AS/400 processors are attached to the 3494 via RS-232 and using OS/400® software prior to version 3 release 6. FC 5211 provides communication between the AS/400 host and the 3494 Library Manager by using a 15-m (50-ft) cable. This feature includes the Media Library Device Driver (MLDD) for OS/400 (Program 5798-RZH).

The AS/400 LAN Device Driver is included as part of this feature and provides the function for AS/400 to drive the 3494 over the LAN. One driver is required for each AS/400 system. A maximum of 32 host LAN attachments is allowed.

RS/6000 Host Attachment (Withdrawn from Marketing)

Note: FC 9200 has replaced this feature.

FC 5212 provides communication of library commands between the host RS/6000 and the 3494 Library Manager via RS-232 or LAN attachments. This optional feature also includes the library device driver for AIX. A maximum of 32 host LAN attachments is allowed.

The RS/6000 LAN Device Driver is included as part of this feature and provides library attachment support through a LAN connection.

Extended Length RS-232 Host Attachment

FC 5213 for AS/400 systems allows the RS-232 link to be extended to 122 m (400 ft). This feature includes the Media Library Device Driver (MLDD) for OS/400 (Program 5798-RZH). This feature is used in place of FC 5211 when the host is located more than 15 m (50 ft) from the 3494. A maximum of 32 host LAN attachments is allowed.

The AS/400 LAN Device Driver is included as part of this feature and provides the function for AS/400 to drive the 3494 over a LAN. One driver is required for each AS/400 system.

Second Disk Drive for the Library Manager

FC 5214 allows a backup copy of the Library Manager database to be maintained. FC 5214 does not apply to Model L1xs manufactured after October 1999.

Dual Gripper

FC 5215 allows for an additional gripper to be mounted on the accessor. This feature eliminates the need for the accessor to store a demounted cartridge before mounting the next cartridge, thereby increasing performance and data availability. This capability is particularly useful with 3494 configurations of more than three frames. Tape storage capacity is slightly reduced when the optional Dual Gripper feature is installed (see Table 9 on page 20).

Remote Power Sequence for AS/400

FC 5216 permits power on/off sequencing by attached AS/400 host processors.

Note: When FC 5216 is installed in a shared host environment, the AS/400 is the only host that controls power to the 3494 library.

Extended RS-232 Cable

FC 5217 adds a 15-m (50-ft) RS-232 cable to the 3494 library.

Token-Ring Adapter

FC 5219 allows the 3494 library to connect to a customer's Token-Ring LAN. A maximum of 32 host LAN attachments is allowed.

Ethernet Adapter

FC 5220 allows the 3494 library to connect to a customer's 10 Mb per second Ethernet LAN. A maximum of 32 host LAN attachments is allowed.

AIX Parallel Channel Tape Attachment/6000

FC 5224 is a device driver that, together with the System/370™ Channel Emulator/A adapter (RS/6000 FC 2759), allows attachment of 3490E Models C1A and C2A to the RS/6000. FC 5224 also allows attachment of the RS/6000 SP processor to the 3494 library.

Remote Library Manager Console

FC 5226 allows remote access to the Library Manager functions and data when a LAN attachment feature is installed.

The Remote Library Manager Console feature allows the customer to control or monitor the operations and status of the 3494 Library Manager from a remote location through a local area network (LAN) attachment feature. The remote terminal can be located anywhere on a customer-supplied IBM Token-Ring LAN Attachment or Ethernet LAN Attachment. Connection to the Library Manager is password-controlled. The remote terminal can control or monitor the status of up to 16 Library Managers at a time. A separate feature is required for each 3494 that is connected to the LAN. If the Model HA1 is installed, the software must be installed on both Library Managers.

The installation process for the Remote Library Manager Console feature requires the customer's LAN administrator to provide the LAN addressing to the service representative before the Remote Library Manager Console feature is installed.

To install a Remote Library Manager Console feature, the customer is responsible for providing the following:

- An IBM Token-Ring or Ethernet local area network (LAN) that meets one of the following specifications:
  - SNA logical unit type 6.2 TCP/IP, or Advanced Program-to-Program Communication (APPC).
  - Token-Ring LAN that meets IEEE 802.5 specifications. See the *IBM Token-Ring Network Introduction and Planning Guide* for the cable distance.

    OR
  - Ethernet LAN that meets IEEE 802.3 specifications. See the IEEE 802.3 standard for the cable distance.
- A personal computer dedicated to the Remote Library Manager Console feature with the following minimum configuration:
  - Processor capable of running OS/2® Version 2.1, WARP 3.0, or WARP 4.0
  - 12 MB of random access memory (RAM)
  - 60 MB hard disk
  - LAN attachment card
  - Network Transport Services (NTS/2) LAN Adapter and Protocol Support (LAPS) software, Release 1.1 or higher, or Multi-Protocol Transport Services (MPTS)
  - Operating System/2® (OS/2) Version 2.1, WARP 3.0, or WARP 4.0
  - Communication Manager (CM) Version 2.0 or higher, or IBM Communications Server for OS/2 WARP

Supporting information is available in the following publications:

- *CM/2 Network Administration and Subsystem Management Guide*

- *CM/2 Message Reference*
- *CM/2 Problem Determination Guide*
- *NTS/2 LAN Adapter and Protocol Support Configuration Guide*
- *NTS/2 Message and Problem Determination Guide*
- *DCAF Target User's Guide*
- *DCAF Installation and Configuration Guide*
- *DCAF User's Guide*
- *Magstar 3494 Tape Library Operator Guide*

Tape Control Unit Expansion

FC 5228 converts up to four RS-232 host attachment ports on either the base Library Manager or the Expansion Attachment Card (FC 5229) to four RS-422 control unit attachment ports. Use of two of these features (along with the Expansion Attachment Card) provides for a total of 16 control unit attachment ports. This feature allows you to install up to 16 SCSI-attached 3590 Model B1A or E1A or 3490E Model C2A or F1A tape drives in the library. If the Model F1A tape drives are ESCON- or OEMI-attached, the maximum number of Model F1A tape drives that you can install is ten. You must also install FC 5219 or 5220 (LAN attachment) to provide for library control from a SCSI host when the library has two FC 5228 installed. For additional information, see Table 8 on page 19.

Expansion Attachment Card

FC 5229, when added to the Library Manager, allows up to four additional RS-232 host attachments and four additional RS-422 control unit attachments bringing the total for each to eight. FC 5229 allows the library to support the following maximum numbers of tape drives:

- Sixteen 3490E Model C2A tape drives
- Eight 3490E Model C1A or SCSI Model F1A tape drives
- Five 3490E Model F1A ESCON-attached tape drives
- Eight SCSI-attached 3590 Model B1A or E1A tape drives
- Thirty 3590 Model B1A or E1A tape drives and the 3590 Model A00, A50, or A60 Controller

The above maximum numbers do not include any 3590 tape drives associated with the Model B18. For additional information see "Tape Control Unit Expansion".

30-Cartridge Convenience Input/Output Station

FC 5230 allows an operator to add or remove up to 30 tape cartridges from the 3494 tape library without interrupting normal operations. Installation of the optional 30-Cartridge Convenience Input/Output Station feature reduces the cartridge capacity in the control unit frame by 80 cartridges.

Attachment Concentrator

When a Model B18 is attached to a 3494 library, FC 5232 provides the required LAN attachment to the Library Manager. The 3590 Model A60 Controller may also attach to the 3494 library through the Attachment Concentrator. One FC 9060 is

required on the Model L1x for each Model B18 or 3590 Model A60 Controller attached to the concentrator. If the Model L1x was shipped before August 1998, FC 9020, 9040, or 5045 is a prerequisite.

SCSI Extender

FC 5233 must be specified for a Model D12 when attaching to the Model B18 Virtual Tape Server control unit.

18-Meter SCSI Cable

FC 5234 provides two 18-m (59-ft) SCSI cables for attachment of a Model B18 to the 3590 Model B1A or E1A tape drives in a Model D12. One feature must be specified for the Model B18 and for the Model B16 to Model B18 conversion.

Performance Accelerator

FC 5236 provides a high performance streaming file system and enables new levels of performance for the Model B18 VTS. The following are the prerequisites for FC 5236:

- Four 3590 Model B1A or E1A tape drives in the associated 3494 Model D12 Drive Unit Frame
- Two or four FC 3702
- One of the following:
  - FC 3200 and FC 3412
  - Two FC 3412
  - FC 3412 and two FC 3422
  - FC 3200 and two FC 3422

Additional Drive Unit Frame (Withdrawn from Marketing)

Each FC 5300 permits the attachment of an additional drive unit frame (up to a maximum of seven frames) to the 3494 library. If more than four tape subsystems are specified, the Expansion Attachment Card feature is also required. Each frame can contain a tape subsystem (see “Tape Subsystems” on page 21) and additional cartridge storage for 300 tape cartridges. 3494 Model D10 has replaced FC 5300. FC 5300 can be upgraded to FC 5302 or 5304 for use with 3590 subsystems.

Additional Drive Unit Frame (Similar to Model D12)

FC 5302 upgrades FC 5300 and provides the necessary hardware and installation instructions to install one or two IBM Magstar 3590 Model B1A tape drives. The 3590 Model B1A tape drives must be ordered separately. This frame contains cartridge storage for up to 335 tape cartridges. An RPQ should be submitted to prepare FC 5302 to accept the third and fourth 3590 Model B1A tape drives. An RPQ should be submitted also to prepare FC 5302 to accept the fifth and sixth 3590 Model B1A tape drives.

Additional Drive Unit Frame (Similar to Model D14)

FC 5304 upgrades FC 5300 and provides the necessary hardware and installation instructions to install one or two 3590 Model B1A tape drives and one 3590 Model

A00 Controller. The 3590 Model B1A tape drives must be ordered separately. This frame contains cartridge storage for up to 345 tape cartridges. An RPQ should be submitted to prepare FC 5304 to accept the third and fourth 3590 Model B1A tape drives.

Additional Storage Unit Frame (Withdrawn from Marketing)

Each FC 5400 permits the attachment of a storage unit frame (up to a maximum of seven frames) to the 3494 tape library. Each frame contains additional storage for 400 tape cartridges. 3494 Models S10 and D1x have replaced FC 5400.

Additional Storage Unit

FC 5500 must be ordered on an MES for the 3494 Model L1x Control Unit Frame when a Model B16 VTS is upgraded to a Model B18 and the Model B16 frame is to be converted to a storage unit frame, which becomes a feature on the Model L1x. This storage unit is a frame that contains additional cartridge storage (up to 400 cartridges) and attaches to the 3494 tape library. FC 9006 or 9007 must be removed from the Model L1x when this feature is installed. This feature is for field installation only (when a Model B16 is upgraded to a Model B18).

Drive Unit for B18

FC 5502 must be ordered on an MES for the Model L1x Control Unit Frame when a Model B16 VTS is upgraded to a Model B18 and the Model B16 frame is converted to a drive unit frame for the Model B18. The converted frame becomes a feature (FC 5502) on the Model L1x. This drive unit frame contains additional cartridge storage (up to 290 cartridges) and provides the necessary hardware for installation of three or four 3590 Model B1A or E1A tape drives and SCSI Extender hardware for attachment to a Model B18 VTS. You must submit an RPQ for hardware and instructions to prepare FC 5502 to accept the fifth and sixth 3590 Model B1A or E1A tape drives. When this feature is installed, FC 5500, 9006, or 9007 must be removed from the Model L1x. This feature is for field installation only.

SCSI Drive Unit

FC 5503 must be ordered on an MES for the Model L1x Control Unit Frame when a Model B16 VTS is upgraded to a Model B18 and the Model B16 frame is converted to a SCSI drive unit frame (similar to a Model D12). The converted frame becomes a feature (FC 5503) on the Model L1x. This drive unit frame contains additional cartridge storage (up to 290 cartridges) and provides the necessary hardware for installation of up to four 3590 Model B1A and E1A tape drives. You must submit an RPQ for hardware and instructions to prepare FC 5503 to accept the fifth and sixth 3590 Model B1A or E1A tape drives. When this feature is installed, FC 5500, 5502, 9006, or 9007 must be removed from the Model L1x. This feature is for field installation only.

ESCON Drive Unit

FC 5504 must be ordered on an MES for the Model L1x Control Unit Frame when a Model B16 VTS is upgraded to a Model B18 and the Model B16 frame is converted to an ESCON drive unit frame (similar to a Model D14). The converted frame becomes a feature (FC 5504) on the Model L1x. This drive unit frame contains additional cartridge storage (up to 345 cartridges) and provides the necessary

hardware for installation of up to two 3590 Model B1A or E1A tape drives and one 3590 Model A50 Controller. You must submit an RPQ for hardware and instructions to prepare FC 5504 to accept the third and fourth 3590 Model B1A or E1A tape drives. When this feature is installed, FC 5500, 5502, 9006, or 9007 must be removed from the Model L1x. This feature is for field installation only.

Co-requisite Features

When the Model B16 Virtual Tape Server is installed, the features shown in Table 19 are also required for the 3494 library.

Table 19. Co-requisite Features for Virtual Tape Server Model B16

Feature Code	Description
FC 5214	Second Disk Drive for the Library Manager
FC 5228	Tape Control Unit Expansion
FC 5229	Expansion Attachment Card
FC 9006	Virtual Tape Server Attachment <9 frames
FC 9007	Virtual Tape Server Attachment >8 frames
FC 9010	3494 Model D12 Attached to Model B16/B18

When the Model B18 Virtual Tape Server is installed, the features shown in Table 20 are also required for the 3494 library.

Table 20. Co-requisite Features for Virtual Tape Server Model B18

Feature Code	Description
FC 5214	Second Disk Drive for the Library Manager
FC 5232	Attachment Concentrator
FC 5233	SCSI Extender
FC 5500	Additional Storage Unit
FC 5502	Drive Unit for B18
FC 5503	SCSI Drive Unit
FC 5504	ESCON Drive Unit
FC 9010	3494 Model D12 Attached to Model B16/B18
FC 9020	3494 B18 VTS Attachment

Cleaning Cartridge Features

3590 Cleaning Cartridge

FC 8002 supports one cleaning cartridge for the Magstar 3590 Tape Drive.

3490E Cleaning Cartridge

FC 8005 supports one cleaning cartridge for the Magstar 3490E Tape Drive.

Data Cartridge Features

If the following features are specified, the factory will ship data storage cartridges with the 3494 frame type. Customers can also order labeled and initialized cartridges via machine type 3499 or 3599.

Note: The following feature codes do not provide pre-labeled or initialized cartridges but include labels that customer personnel can apply.

210 Cartridges (3490E Data Cartridges) [Withdrawn from Marketing]

If FC 8410 is specified, the factory will ship 210 cartridges (3490E Enhanced Capacity Cartridge System Tape) with the ordered frame. One and only one of the following features must be specified: FC 9540, 8410, or 8420.

420 Cartridges (3490E Data Cartridges) [Withdrawn from Marketing]

If FC 8420 is specified, the factory will ship 420 cartridges (3490E Enhanced Capacity Cartridge System Tape) with the ordered frame. One and only one of the following features must be specified: FC 9540, 8410, or 8420.

210 Cartridges (3590 Data Cartridges)

If FC 8510 is specified, the factory will ship 210 cartridges (3590 High Performance Cartridge Tape) with the ordered frame. One and only one of the following features must be specified: FC 9540 (maximum of one) or FC 8510 (maximum of two).

420 Cartridges (3590 Data Cartridges) [Withdrawn from Marketing]

If FC 8520 is specified, the factory will ship 420 cartridges (3590 High Performance Cartridge Tape) with the ordered frame. One and only one of the following features must be specified: FC 9540, 8510, or 8520.

Chapter 3. Programming Support

Programming support for the 3494 includes the following programs at the version and release levels given, as well as all later releases and future program upgrades.

Support for the 3494 library is provided in the MVS, VM, VSE, AIX, OS/400, TPF, HP-UX, Sun (Solaris), and Windows NT operating environments.

3590 Tape Subsystem Support

Minimum support for the 3590 tape subsystem in the 3494 tape library environment includes:

MVS/ESA™ Support

3590 Model B1A

- MVS/ESA SP 5.1.0 or 5.2.0 (for JES3: JES3 5.1.1 or 5.1.2 is required) plus SPEs
- OS/390® Release 1
- DFSMS™/MVS® 1.2.0 plus SPEs or 1.3.0 plus SPEs or 1.4.0
- Basic Tape Library Support (BTLS) for DFSMS/MVS 1.2.0 and above plus SPEs, or 1.3.0 plus SPEs
- EREP 3.5 plus PTFs

Note: Refer to Washington Systems Center Flash 9421 for information on BTLS with JES3.

3590 Model E1A

- MVS/ESA SP 5.1.0 or 5.2.0 (for JES3: JES3 5.1.1 or 5.1.2 is required) plus SPEs
- OS/390 Release 1, Version 3, Release 2 Versions 4, 5, 6, 7 (includes support for JES3) plus SPEs
- DFSMS/MVS 1.3.0 plus SPEs or 1.4.0 plus SPEs or 1.5.0 plus SPEs
- Basic Tape Library Support (BTLS) for DFSMS/MVS 1.2.0 and above plus SPEs, or 1.3.0 plus SPEs
- EREP 3.5 plus PTFs

Note: Refer to Washington Systems Center Flash 9421 for information on BTLS with JES3.

VM/ESA® Support

- VM/ESA 2.2.0
- DFSMS/VM® Function Level 221 plus PTFs (for native VM support)
- EREP 3.5 plus PTFs

Transaction Processing Facility (TPF) Support

- TPF 4.1 plus PTFs

VSE/ESA Support

- VSE/ESA 2.2.0

- DFSMS/VM Function Level 221 plus PTFs and VM/ESA 2.2.0 for VSE guest support
- 3494 FC 9203 VSE Library Control Device Driver, Version 3 for VSE native support
- EREP 3.5 plus PTFs

OS/400 Support

- OS/400 3.1.0 plus PTFs
  - 3494 FC 5211 AS/400 Host Attachment needed for releases prior to V3R6
- BRMS/400 V3R1, optional but recommended
- R/DARS 1.3.0 and above
- V4R4 needed for Model HA1

RS/6000 and RS/6000 SP Support

- Micro Channel® SCSI Adapters
  - RS/6000 FC 2412 - Enhanced SCSI-2 Differential Fast/Wide Adapter/A
  - RS/6000 FC 2416 - SCSI-2 Differential Fast/Wide Adapter/A
  - RS/6000 FC 2420 - SCSI-2 Differential High-Performance External I/O Controller (limited to seven SCSI IDs)
- PCI SCSI Adapters
  - RS/6000 FC 6209 - PCI SCSI-2 Fast/Wide Differential Adapter
  - RS/6000 FC 6207 - PCI Differential Ultra SCSI Adapter
  - RS/6000 FC 2409 - PCI SCSI-2 Differential Fast/Wide Adapter

AIX Support

- AIX 4.1.5 and above releases
- 3494 FC 9200 Open System Device Drivers and FC 9106 attached to RS/6000
- ADSM for AIX Version 2.1 + PTF 12, ADSM Version 3

Note: Contact IBM for the current list of non-IBM software supporting the 3494.

Sun Systems Support

- Sun Microsystems Differential SCSI-2 adapter or compatible
- Solaris 2.4, 2.51, 2.6
- 3494 FC 9200 Open System Device Drivers and FC 9211 Attached to Sun
- ADSM for Sun Solaris Version 2.6 + PTF 12, ADSM Version 3

Note: Contact IBM for the current list of non-IBM software supporting the 3494.

HP Systems Support

- HP-PB Fast/Wide Differential 28696A Adapter
- HP-UX 10.0x through 10.3x
- 3494 FC 9200 Open System Device Drivers and FC 9210 attached to HP-UX

Note: Contact IBM for the current list of non-IBM software supporting the 3494.

Microsoft™ Windows NT Support

- Adaptec AHA-2944UW SCSI Host Adapter
- Microsoft Windows NT 4.0 with Service Pack 3 or above
- 3494 FC 9200 Open Systems Device Drivers and FC 9212 attached to Windows NT

3490E Tape Subsystem Support

Minimum support for the 3490E tape subsystem in the 3494 tape library environment includes:

MVS/ESA Support

- MVS/ESA SP 5.1.0 or 5.2.0 (for JES3: JES3 5.1.1 or 5.1.2 is required)
- OS/390 Release 1 or higher
- DFSMS/MVS 1.2.0 or higher
- Basic Tape Library Support (BTLS) for:
  - DFSMS/MVS 1.2.0, 1.3.0, or 1.4.0 with MVS/ESA SP 4.3.0 and higher
- EREP 3.5 plus PTFs

Note: Refer to Washington Systems Center Flash 9421 for support information BTLS with JES3.

VM/ESA Support

- VM/ESA 2.2.0
- DFSMS/VM Function Level 221 for native VM support
- EREP 3.5 plus PTFs

Transaction Processing Facility (TPF) Support

- TPF 4.1

VSE/ESA Support

- VSE/ESA 1.4.0 or higher
- DFSMS/VM Function Level 221 plus PTFs and VM/ESA 2.2.0 or higher for VSE guest support
- EREP 3.5 plus PTFs
- 3494 FC 9203 VSE LAN Library Control Device Driver Version 2 for native VSE

OS/400 Support

- OS/400 2.3.0
  - 3494 FC 5211 AS/400 Host Attachment needed for releases prior to V3R6
- BRMS/400 2.3.0 and above (optional but recommended)
- R/DARS 1.3.0 and above

RS/6000 and RS/6000 SP Support

- Micro Channel Adapters
  - RS/6000 FC 2412 - Enhanced SCSI-2 Differential Fast/Wide Adapter/A
  - RS/6000 FC 2416 - SCSI-2 Differential Fast/Wide Adapter/A

  - RS/6000 FC 2420 - SCSI-2 Differential High-Performance External I/O Controller (limited to seven SCSI IDs)
  - RS/6000 FC 2759 - S/370 Channel Emulator/A Adapter
  - RS/6000 FC 2754 - S/390 ESCON Channel Emulator
- PCI SCSI Adapters
  - RS/6000 FC 2409 - PCI SCSI-2 Differential Fast/Wide Adapter
  - RS/6000 FC 6209 - PCI SCSI-2 Fast/Wide Differential Adapter
  - RS/6000 FC 6207 - PCI Differential Ultra SCSI Adapter

AIX Support

- AIX 4.1.1 and above releases
- 3494 FC 9200 Open System Device Drivers and FC 9106 attached to RS/6000
- 3494 FC 5224 - AIX Parallel Channel Tape Attachment/6000 (for use with RS/6000 FC 2759)
- RS/6000 RPQ 8A1016 - ESCON Channel Tape Attachment (for use with RS/6000 FC 2754)
- ADSM for AIX Version 2.1 + PTFs, ADSM Version 3

Note: Contact IBM for the current list of non-IBM software supporting the 3494.

Sun Systems Support

- Sun Microsystems Differential SCSI-2 adapter or compatible
- Solaris 2.4, 2.51, 2.6
- 3494 FC 9200 Open System Device Drivers and FC 9211 attached to Sun
- ADSM for Sun Solaris Version 2.6 + PTF 12, ADSM Version 3

Note: Contact IBM for the current list of non-IBM software supporting the 3494.

Virtual Tape Server Subsystem Support

Minimum support for the Virtual Tape Server subsystem in the 3494 tape library environment includes:

MVS/ESA Support

- MVS/ESA SP 5.1.0 or 5.2.0 (for JES3: JES3 5.1.1 or 5.1.2 is required)
- OS/390 Release 1 or higher
- DFSMS/MVS 1.2.0 or higher

  Note: DFSMS/MVS 1.4.0 or higher is required for functional exploitation of the VTS Advanced Function feature .
- Basic Tape Library Support (BTLS) for:
  - DFSMS/MVS 1.2.0, 1.3.0, or 1.4.0 with MVS/ESA SP 4.3.0 and higher
- EREP 3.5 plus PTFs

Note: Refer to Washington Systems Center Flash 9421 for support information BTLS with JES3.

VM/ESA Support

- VM/ESA 2.2.0
- DFSMS/VM Function Level 221 for native VM support
- EREP 3.5 plus PTFs

VSE/ESA Support

Note: Supported only as a guest under VM/ESA.

- VSE/ESA 1.4.0 or higher
- DFSMS/VM Function Level 221 plus PTFs and VM/ESA 2.2.0 or higher
- EREP 3.5 plus PTFs

RS/6000 and RS/6000 SP Support

- Micro Channel SCSI Adapters
  - RS/6000 FC 2412 - Enhanced SCSI-2 Differential Fast/Wide Adapter/A
- PCI SCSI Adapters
  - RS/6000 FC 6209 - PCI SCSI-2 Fast/Wide Differential Adapter
  - RS/6000 FC 6207 - PCI Differential Ultra SCSI Adapter

AIX Support

- AIX 4.2.1 and above releases
- 3494 FC 9201 (VTS Open System Device Drivers) and FC 9106 (RS/6000 Processor Attachment)
- ADSM for AIX Version 2.1 + PTFs, ADSM Version 3

Note: Contact IBM for the current list of non-IBM software supporting the 3494.

Operating System/400® for Application System/400®

Magstar 3494 Tape Library support for the AS/400 IMPI Technology (SISC Architecture) is supplied in the Media Library Device Driver (MLDD). For systems with AS/400 64-bit PowerPC® Technology (RISC Architecture) support is provided as part of the OS/400 operating system. Both technologies provide a set of library functions that allow control of the 3494 by either media management software or through command invocation by a library administrator.

Backup Recovery Media Services/400 (BRMS/400) uses the 3494 interface to serve 3494 operations for applications for end users. This approach provides optimum, unattended use of the 3494.

3494 cartridge category definitions are used to improve control over media sharing when a specific 3494 is connected to multiple hosts. This feature allows for designation of a specific cartridge to any attached AS/400 or limitation to a specific host.

The Command interface supports the following tasks associated with 3494 usage.

- Defining the 3494 libraries

  RS-232 and LAN interfaces are supported between the 3494 Library Manager and AS/400.
- Requesting library information

Requested library information includes:

- 3494 tape libraries known to the AS/400, their associated units, and associated status
- Tape cartridges in a specific 3494 library (for a specific cartridge, a list of cartridges, or all cartridges in a specific category [or logical group])
- Operation status of a specific 3494 library
- Categories currently defined
- LAN configuration information

- Selecting user-defined categories

  The user defines categories that are owned by specific systems. Sharing of categories by any set of AS/400 systems attached to a library is possible. Placement of volumes, in user-defined categories for specific purposes, is also permissible. A tape management system (such as BRMS/400) coordinates access to volumes shared between systems.

- Controlling cartridge accessibility

  Specific cartridges change from shared (by multiple attached hosts) to non-shared or a user-defined category.

- Mounting and demounting cartridges

  The user can request specific cartridge mounts on a specific drive. Although the cartridge demount is typically handled automatically by the 3494 after an unload operation, explicit requests for a cartridge demount on a specific tape unit is supported.

- Managing cartridge inventory in the 3494

  For new cartridges placed in the 3494, the Insert function designates cartridges for shared use among all attached AS/400 systems or reserves them for use only by the AS/400 or a user-defined category issuing the Insert request.

  An Eject function specifies ejection of cartridges.

- Mounting of transient tape cartridges

  The 3494 function supports special usage of the 3494 Convenience Input/Output Station for tapes that are not part of the 3494 cartridge inventory. In this special-use mode, cartridges (with or without external labels) placed in the Convenience Input/Output Station are sequentially mounted, used (read or written), demounted, and returned to the Convenience Input/Output Station. Transient cartridges are intended for one time usage and are not intended to remain in the library.

- Using the unlabeled tape cartridge facility

  This facility allows the insertion of tape cartridges without an external or non-machine readable label into the library for temporary use. Unlabeled tape operations are designed to allow the operator to add occasional volumes that do not have a machine-readable label to the library. These volumes are mounted and ejected in the same manner that regular, properly labeled volumes are handled. Do not use this facility for a large number of cartridges or for cartridges that are stored in the library for long periods. See “Unlabeled Tape Facility” on page 13 for additional information.

- Running in automatic cartridge load mode

  Although the 3494 tape drives do not have automated cartridge loaders, it is possible to mount tapes in a predefined sequence or in a random order, into a specific library tape drive. Function is available to support the assignment to cartridges to a special category, assignment of a specific tape drive for restricted use with the special category, and ending the restricted use of a tape drive.

Based on user-defined policies, BRMS/400 with Media Storage Extensions (MSE) installed automatically recalls database files from tape drives to Disk Storage. No change is required to the requesting application, which resumes after restoration of the file on Disk Storage. This capability is especially useful with tape automation as provided by the Magstar 3494 Tape Library, which provides the capability for unattended operation and improves end-user access time to archived information.

The automatic migration of database files between Disk Storage and tape drives essentially treats removable tape media as an extension of Disk Storage (from an application point of view). Vast amounts of additional data are available at a lower cost per megabyte than Disk Storage but at a reduced performance level. New mass storage applications now become more affordable than previous applications.

Fast search is supported by BRMS/400 for the IBM 3490E and 3590 tape drives in the Magstar 3494 Tape Library. The location of a file on tape is kept with the BRMS/400 tape inventory, allowing these tape drives to do a fast forward to the location of the requested file. The total time required to restore data from tape is reduced.

Advanced Interactive Executive (AIX)

AIX support for the 3494 is available on the following processor platforms:

ES/9000
Native support in the AIX operating system

RS/6000
Support in the IBM AIX operating system with the RS/6000

RS/6000 SP
Support in the IBM AIX operating system

Note: Some non-IBM processors can attach to the 3494 tape library and control the library by communicating through the RS/6000 system.

For all AIX platforms, user-supplied programs control the 3494 through a defined application programming interface (API) for device driver functions. The AIX software supports the integration of a tape management system (TMS) for controlling the 3494.

The AIX application programming interface supports:

- Mounting and demounting cartridges

  A mount function requests that a specified cartridge be mounted on a specified library tape drive, or that the next sequential cartridge in a scratch category (pool) be mounted. Cartridge demount is handled by an AIX function for an explicit cartridge demount request from a specified tape unit.
- Requesting library information

  Information can be requested for:
  - Specified volumes
  - Library statistics
  - Library inventory
  - Specific category inventory
- Placing a cartridge in a logical group (category)

  An interface function assigns specified cartridges to a specified library category.

- Managing asynchronous communication with the 3494 library

  An interface function allows the user to check on the progress of an asynchronous request such as a mount operation.

Basic Tape Library Support Program for MVS/DFP

Basic Tape Library Support (BTLS) enables MVS customers to benefit from the 3494 automation capabilities on their existing MVS/DFP software levels and can be used as an aid in the migration to DFSMS, if desired. BTLS is available for selected levels of DFSMS/MVS and MVS/DFP. Contact your IBM representative for detailed support information. Existing tape applications can use the 3494 without change. See the *Basic Tape Library Support User's Guide and Reference* for details.

The library command, in the access method services, provides the control interface for 3494 operations. The functions available through the library command include:

- Defining library tape drives and rules for tape drive allocation

  Command functions are provided for defining the 3494 tape drive addresses and for specifying rules for tape drive allocation. BTLS uses catalog records to describe 3494 tape drive configurations and allocation rules. BTLS allocation can be enabled or disabled. Either 3494 tape drives or manual tape drives may be specified for scratch allocation, and dynamic drive re-configuration (DDR) may be enabled or disabled.

  MVS uses DDR to move a volume to another tape drive following a permanent I/O error, and a library command option allows DDR to be enabled. The DDR does not allow a volume to be swapped between a library tape drive and a non-system-managed (manual) tape drive.
- Cataloging and managing 3494 volumes

  Library command functions allow creation and deletion of catalog entries that specify that volumes are located in a 3494 library. Thus, for a specific volume request (private volume), if the volume is cataloged as a library volume, only tape drives in the 3494 can be used to satisfy the allocation. If a volume is not cataloged as a library volume, only non-system-managed (manual) tape drives can be used to satisfy the allocation. An additional library function allows all catalogued volumes in a specified 3494 to be listed.
- Managing volume mounts and demounts

  Library command functions are used to request that a volume be mounted or demounted. A mount request may specify either a designated volume (private volume) or a scratch volume, in which case any volume in a scratch pool can satisfy the mount request. As part of library command demount processing, volumes that were mounted as scratch volumes may be changed to private volumes. Mount and demount operations for 3494 are handled by BTLS in connection with message display handling.

  In handling attention messages sent by the 3494, BTLS alerts the system operator of any error status not associated with normal operation completions.

Multiple Virtual Storage/Enterprise System Architecture (MVS/ESA)

Multiple Virtual Storage/Enterprise System Architecture (MVS/ESA) programming support for the 3494 tape library is provided in the appropriate versions and releases of the following prerequisite products:

- Multiple Virtual Storage/Enterprise System Architecture (MVS/ESA)

- Data Facility Storage Management Subsystem (DFSMS/MVS) including DFSMSdfp™
- Environmental Record Editing and Printing Program (EREP)

Note: Refer to the PSP bucket for D/T 3494 for the latest required and recommended software PTFs.

The following optional components of the DFSMS/MVS program product also support the 3494:

- DFSMSdss™
- DFSMShsm™
- DFSMSrmm™

MVS/ESA support for 3494 is fully integrated with system-managed tape cartridges residing within the 3494. Programming, cataloging of tape data sets, and job control language (JCL) statements do not need to be changed. Drive allocations for new data sets created on tape are controlled by customer-written automatic class selection (ACS) routines. Specific requests for existing data sets within the library are allocated to tape drives in the library. Mount and demount commands are directed to the appropriate library rather than to a host operator's console.

The prerequisite products provide the general functions for:

- Managing the tape library
- Managing volumes
- Managing tape drives

Managing the Tape Library

The library management function recognizes automated tape drives and associates them with the 3494 in which they reside. All tape drives must be defined by using Hardware Configuration Definition (HCD) dialog. With the SMS display or SMS vary commands, the operator can request the following information about the 3494 library:

- Configuration status
- Operational status
- Storage contents summary

Access method services provide the storage administrator commands to create and maintain the tape configuration database. Interactive Storage Management Facility (ISMF) panels allow the storage administrator to interactively change and display volume attributes and to set processing defaults. An interface allows tape management systems to change the category of volumes so that the volumes can be mounted in response to a request for a scratch volume. Environmental Record Editing and Printing Program (EREP) formats and prints 3494 environmental and error information stored in the SYS1.LOGREC data set.

Managing Volumes

Volumes that are resident in a 3494 library require new management functions because the tape volumes and tape drives are located in an enclosure with normal operator activities performed automatically. The operator messages normally associated with tape mount and demount actions for volumes residing in a 3494 library are directed to a log rather than to the operator's console.

When cartridges are inserted in either the Convenience Input/Output Station or in any available cell within the library, the tape configuration database (TCDB) is updated to indicate the presence of the inserted volumes in the 3494. Similarly, when a volume is moved to either the Convenience Input/Output Station or the High-Capacity Input/Output facility, the volume's TCDB entry is kept or purged based on what is specified in the parameters set during installation.

When a tape cartridge (without an internal label) is inserted in a 3494 library, the software labels it as a scratch volume on its first use. An interface allows a tape management system to change a volume's status (in the TCDB and 3494) from scratch to private, or private to scratch. It may also be used to eject a volume from the 3494 tape library.

Managing Tape Drives

Allocation of new data sets to drives within the 3494 library is controlled by customer-written automatic class selection (ACS) routines to assign a tape storage group to one or more 3494 tape libraries. Requests for existing data sets stored on volumes in a 3494 library are allocated to a tape drive in the appropriate 3494. The allocation process searches the inventory for the volume in a 3494 library and limits the list of eligible tape drives to the automated tape drives in the 3494. Dynamic drive re-configuration (DDR) is also aware of automated tape drives and prevents tape drive swapping between automated and non-automated tape drives or between automated tape drives in different libraries.

DFSMShsm

DFSMShsm is an optional functional component of the DFSMS/MVS program product that supports the 3494. The following DFSMShsm functions can direct output to tape drives in a 3494 library:

- Migration
- Backup
- Spill
- Backup of DFSMShsm control data sets
- Recycle
- Full volume dump
- Aggregate backup
- Copy of DFSMShsm tape volumes

DFSMSrmm

DFSMSrmm is an optional functional component of DFSMS/MVS program product and provides the functions of a tape management system. DFSMSrmm software keeps track of DFSMS/MVS configurations that contain either system-managed or non-system-managed tape libraries. DFSMSrmm functions include:

- Scratch tape management
- Automatic tape record keeping
- Vital record management
- Control of tape movement between sites
- Registration of software product tapes
- Installation exit support

Virtual Machine/Enterprise System Architecture (VM/ESA)

Virtual Machine/Enterprise System Architecture (VM/ESA) programming includes support for guest operating systems and native VM environments.

Note: Refer to the PSP bucket for D/T 3494 for the latest required and recommended software PTFs.

Support for Guest Operating Environments

VM/ESA software provides basic support for a guest operating system, such as MVS, that issues its own Start Subchannel (SSCH) commands to control the tape library. The VM host can support multiple guest operating environments that use the 3494, with the tape library drives generated as supported tape drives.

Multiple operating system guests and multiple 3494 tape libraries are supported by a VM host. The ability to share a 3494, when running as a guest, is determined by the native-sharing capabilities of the operating environment.

Note: The 3494 tape library can be shared only if all MVS guests are in the same DFSMS/MVS configuration.

The VM/ESA basic support for guest includes:

- CCW translation
- Attention message reflection
- Error recovery
- Library authorization checking

The guest operating environment is expected to provide its own full error recovery.

Support for the Native VM Environment

VM/ESA software for the native VM environment provides a high-level interface to the 3494 to make hardware functions accessible to CMS users and service machines or guest operating systems such as VSE. This interface is in the DFSMS/VM Removable Media Services (RMS) component. The interface is designed to connect the user's tape management software to the capabilities of the 3494 or to allow individual users to request 3494 cartridge mounts.

A high-level interface is packaged as both a set of interactive commands and a set of callable services library (CSL) routines. These interface functions shield the VM user and the tape management system from the details of the hardware interface. The DFSMS/VM software handles all communication with the 3494, including management of asynchronous library protocols and full 3494 error recovery operations. With VM/ESA 2.2.0, synchronous library commands (for example querying the library or setting volume categories) do not require attachment of a free tape drive for library-control communication.

The DFSMS/VM RMS interface functions support the following tasks associated with 3494 usage. See the *VM/ESA: DFSMS/VM FL221 Removable Media Services User's Guide and Reference* for details about the following capabilities and supported functions:

- Mounting and demounting cartridges

A mount function requests that a specified cartridge be mounted on a specified library tape drive, or that the next sequential cartridge in a scratch category (pool) be mounted. Although the cartridge demount is typically handled automatically by the 3494 when a volume is unloaded, RMS allows an explicit request for a cartridge on a specified tape unit to be demounted.

- Changing the category assignments of volumes

  A set-volume-category function assigns a specified cartridge or a list of cartridges to a specified scratch category or removes cartridges from a scratch category. Up to 16 scratch categories (pools) may be used.
- Assigning cartridge categories to tape drives

  A set-tape drive-category function allows a specified scratch category (pool) to be associated with a specified tape drive in the 3494.
- Requesting information from the library

  The query function returns information about:
  - Specified volumes
  - Library tape drives
  - Inventory by specific category or for the entire 3494 library
  - Operational status of the 3494 library
- Managing the library's cartridge inventory with the set-volume-category function:
  - Incoming (inserted) cartridges can be either assigned to scratch pools or retained as private volumes.
  - Library cartridges can be directed to a 3494 output facility (ejected).

  The set-volume-category function can operate on a list of volumes specified in a named file. Insert processing can also be set up to run automatically, according to predefined target category specifications.

The interface functions for controlling 3494 operations are intended to work with a tape management system, without duplicating normal tape management tasks. Because a variety of tape management systems with a diversity of functions are in use by VM users, DFSMS/VM RMS support is flexible and can be customized to meet individual needs. For a user without a tape management system, DFSMS/VM RMS can function as a hub for tape-mount requests and provide a platform for accessing individual tape management functions through user exits.

Virtual Storage Extended/Enterprise System Architecture (VSE/ESA)

Virtual Storage Extended/Enterprise System Architecture (VSE/ESA) programming includes support for native and VM/ESA guest operating environments. The application programming interface (API) for 3494 functions is provided by VSE/ESA. The API is a front end for both native and guest library control architectures and is designed to allow tape management products to use the 3494 functions and to maintain cartridge inventory synchronization between tape management catalogs and the 3494.

Note: Refer to the PSP bucket for D/T 3494 for the latest required and recommended software PTFs.

Native Support

Native VSE support for the 3494 tape library uses the LAN attachment to the 3494 tape library for library control of the 3494 by one or more VSE hosts. The VSE

3494 library control device driver (LCDD) runs as an VTAM application in its own partition. The library control commands are transmitted on the LAN as packets to the Library Manager by using LU6.2 advanced program-to-program communication (APPC). The channel attachment to the 3494 control unit provides the tape data path.

The VSE/ESA 3494 API is the main programming interface for controlling the library through the LCDD. In addition, LCDD supports a full set of interactive functions for operations use.

Both native and guest VSE/ESA systems attached to 3494 subsystems may use the LAN library control connection and use the LCDD support application.

See the *Magstar 3494 Tape Library User's Guide: Library Control Device Driver for VSE/ESA* for more information.

Guest Support

The capabilities of DFSMS/VM RMS extend 3494 support to VSE/ESA guests of VM/ESA. VSE guest support for the 3494 includes scratch pool exploitation, inventory management operations, and 3494 information retrieval.

The DFSMS/VM RMS component provides library control through the 3494 tape subsystem's host channel attachment, which is also the tape data path.

DFSMS/VM provides a VSE/ESA guest server (VGS) virtual machine to facilitate VSE guest usage of CMS interfaces for DFSMS/VM with RMS. The VSE/ESA 3494 API is the programming interface for controlling the library through VGS. Operator commands for controlling the 3494 interactively are available through DFSMS/VM RMS, as well as through VSE attention routines.

Functional Summary

The following functions and features are available for VSE/ESA control of the 3494, with both the native and the guest library control architectures:

- Mount services

  Specific volume serial numbers and scratch mounts are supported. When support is provided for guest by VM/ESA, the 16 scratch pools supported by DFSMS/VM RMS are available for use. With the library control device driver, 32 scratch pools are available.
- Inventory management

  Options in both the library control device driver and DFSMS/VM RMS allow inserted volumes to be assigned automatically to a designated category (for example, a scratch pool). Or, disposition of inserted volumes can be handled by explicit requests from operations staff or under program control by the tape management product.

  Vaulting or scratching of cartridges can be handled by individual explicit requests, or by requesting that a list of volsers be processed.
- Library information retrieval

  Query functions return status information about 3494 tape units and cartridges, as well as status of the 3494 Library Manager. In addition, cartridge count information or complete lists of cartridges with status information can be requested by category or for the entire library.

3494 Resource Sharing

The 3494 can be accessed concurrently by multiple operating environments. The 3494 resources must be shared by the hosts according to the following guidelines:

- An individual tape drive (virtual or real) must be dedicated to one system at any one time. The tape drives are varied offline from one system and varied online to another system as processing workloads change.
- Similar groups of cartridges or volumes (virtual or real) are owned by individual attached hosts, but access is available to other systems through tape inventory management practices by the host. DFSMS/MVS provides the capability for multiple hosts to share attached libraries within a single DFSMS/MVS environment.

The 3494 permits the concurrent attachment of supported host-processor environments (MVS/ESA, VM/ESA, AIX, VSE/ESA, and OS/400 platforms) including LAN-attached host-processor environments (OS/400, AIX, VM/ESA, Sun, and RS/6000 SP). Typically, a shared 3494 is attached to a subset of these operating environments or to multiple hosts within the same operating environment.

In addition to the platform attachments described above, some non-IBM processors can attach to the 3494 tape subsystems and control the library by communicating with a RS/6000 system or a VM/ESA system.

The 3494 must be present at IPL time or the customer must do an IPL again to get tape drive support. Therefore, at least one path must be available from each host to the 3494 when the 3494 IPL is executed. For additional information, see the *Guide to Sharing and Partitioning IBM Tape Library Dataservers*.

Software Tools

The following software tools are available to plan for (and optimize) the 3494 tape library installation:

Volume Mount Analyzer
: The volume mount analyzer is available as a component of DFSMS/MVS software. It provides reports on data sets by size and frequency of use to determine if tape is the best storage media for the analyzed data sets and if its frequency of access warrants it residing within a tape library.

Hands-on Network Environment
: Hands-on network environment (HONE) is an aid to ensure that 3494 configurations are ordered with correct features.

Configuration Aids
: The CFAS400, CFSystem, and CFRS6000 configuration aids are available to eligible users through IBMLink™ to help evaluate a customer workload and desired level of automation. They also provide accurate 3494 configurations to get the desired throughput and response times.

Chapter 4. Site Planning and Preparation

The following section describes the planning requirements for installing the 3494 tape library. See “Chapter 6. Physical Planning and Specifications” on page 97 for physical planning specifications.

Additional information is available in the planning manuals associated with the various processors and operating systems. These manuals describe the physical environmental characteristics required for installing the processors and related tape drives. See “Related Information” on page xi for a list of these manuals.

Physical Characteristics

The physical structure of the 3494 is built on the library control unit, tape drive unit, Virtual Tape Server control unit, storage unit, and service bay frames.

Height Requirements

The minimum floor-to-ceiling clearance required for the 3494 is 2 m (78.7 in.) including all installation, operating, and service clearances.

Each frame is moved on casters and has four leveling pads. Each frame has a nominal height of 1815 mm ±15 mm (71.5 in. ±0.6 in.) from the bottom of the leveling pads to the top of the frame. The frame height can be varied up to 30 mm (1.2 in.) by using the leveling pads. The leveling pads are completely raised when the 3494 is shipped so that the 3494 may roll on its casters. The shipping height of the 3494 on its casters is 1.8 m (70.9 in.).

The 3494 Model B18 Virtual Tape Server is a stand-alone frame with a nominal height of 1.8 m (70.9 in.). It moves on casters and does not require leveling pads.

Floor Requirements

A 3494 tape library can be installed on a raised or solid floor that meets the minimum leveling and floor-loading capacity requirements. The floor under the 3494 must have a smooth surface and must not have ventilation panels under the leveling pads.

If the floor is carpeted, the carpeting must be approved for use in the computer room (low electrostatic discharge).

Floor Level Requirements

The 3494 can be adjusted to account for unevenness in the floor where the library is being installed. The maximum out-of-level condition must not exceed 25.4 mm (1 in.) over the entire length and width of any library.

Note: IBM strongly recommends that stringers be installed between all corner posts. In addition, a post should be placed under the areas where the 3494 leveling pads will sit. As an alternative to placing posts under the leveling pads, a post may be placed at the midpoint of the stringers in the areas where the 3494 will sit.

Weight Distribution and Floor Loading

If the 3494 will be installed on a raised floor, the raised floor should be stabilized to prevent a horizontal shift of the raised floor structure. The minimum overall floor load rating should be 256 kg/m² (52.6 lb/ft²). However, IBM recommends a floor load rating of 341 kg/m² (70 lb/ft²). These ratings do not include additional loading by people and equipment traffic.

In addition, the floor must support point loads, exerted by the leveling pads, of up to 4.8 kg/cm² (68.4 lb/in²). The 3494 has four point loads on each frame.

Site Preparation

Use the following information to prepare a physical location for the installation of a 3494 tape library.

Prepare a floor plan that includes the following information:

- Operator area that shows work areas for the Library Manager, I/O station, and access doors
- Power outlet types, locations, and power ratings
- Locations of emergency power-off (EPO) switches (see “Emergency Power Off Switches” on page 82)
- Frame locations
- Operator and service clearances
- Dimensions of the total area for the 3494 library

Before actual hardware installation can begin, the local installation planning representative verifies that all installation planning and preparation is completed.

Additional customer responsibilities include planning for:

- Cabling and wiring for connections to the host processor
- Cabling for connection of the Remote Library Manager Console feature
- Cooling and heating
- Telephone service
- Safety and security
- Fire detection and suppression
- Floor, raised or not raised, that meets the operational and structural requirements imposed by the 3494
- Associated tape library cartridge storage for non-automated tape library activities

Lighting Considerations

The 3494 is designed for lights-out operation. No special lighting considerations are required.

Upgrade Considerations

Consider future growth or upgrades for the 3494 during initial installation planning. Consider the allowable frame considerations and addition of Service Bay Frames

for the Model HA1. Refer to “Multiple Frame Subsystems” on page 89 for allowable Model HA1 configurations and “3494 Tape Library Subsystem” on page 100 for overall physical dimensions.

Consult your IBM representative for current planning information about upgrading the 3494.

Earthquake Effects

There is no guarantee against equipment damage as a result of an earthquake. Many factors influence the seismic forces experienced by the computer equipment, including:

- Intensity and duration of an earthquake
- Structural strength and fragility of equipment
- Building type and soil conditions
- Location of equipment in a building
- Equipment installation method

Guarantees of equipment reliability cannot be made for all earthquakes and conditions. The damaging effects of an earthquake are minimized by appropriate installation and planning techniques.

Significant sliding and rocking of equipment during an earthquake may directly or indirectly result in damage. Minimize the damage potential by taking the following steps:

- Locate equipment sufficiently far from walls or other equipment to minimize damage from collision.
- Ensure that power and accessory cables to equipment are long enough to accommodate some sliding of the equipment during an earthquake. Also, check that cable clamps or other strain reliefs are properly secured to the equipment.
- Improve the stability of tall equipment that can overturn in a severe earthquake by tying several units together to form a stable structure.
- Use a flexible restraint that allows a limited amount of movement, approximately 75 mm to 150 mm (3 in. to 6 in.), to de-couple the earthquake energy.

Tape Library Installation Requirements

The following section describes installation requirements and clearances for the 3494 library.

Service and Operator Clearances

Clearances are required around the library for the operator to perform operator tasks and for the service representative to perform service. Operator and service clearances are required on all sides of the library. See Table 21 for specific clearance requirements and “Chapter 6. Physical Planning and Specifications” on page 97 for additional information about each frame type.

Table 21. Operator and Service Clearance Requirements

Area Description	Area Size (Width x Depth, see note 1)
Control Unit, Front	1092 x 1016 mm (43 x 40 in.)
Control Unit, Rear (see notes 2 and 3)	750 x 1016 mm (29.5 x 40 in.)

Table 21. Operator and Service Clearance Requirements (continued)

Area Description	Area Size (Width x Depth, see note 1)
Service Bay, Rear	750 x 1016 mm (29.5 x 40 in.)
Service Bay, Front	1092 x 1016 mm (43 x 40 in.)
Drive Unit, Front and Rear (see note 2)	750 x 1016 mm (29.5 x 40 in.)
Virtual Tape Server Models B16 and B18 Front and Rear (see note 6)	750 x 1016 mm (29.5 x 40 in.)
Storage Unit, Front (see note 2)	750 x 1016 mm (29.5 x 40 in.)
Storage Unit, Rear (see note 4)	None Required
All Units, Side (see note 5)	762 x 610 mm (30 x 24 in.)

Notes:

1. Size is described by the depth from the outside of the frame and width along the library. The width is on a frame-to-frame basis; space required in front or behind each frame is additive. The access space for the individual frames overlaps.
2. Control unit, drive unit frames using 3590 drives, require additional left and right rear service clearances of 610 x 1016 mm (24 x 40 in.). Left and right rear service clearances may overlap when frames are placed side by side.
3. Operator clearance is the space required for the operator to have access to the units to perform required tasks.
4. No service or operator clearance is required behind the storage unit frames.
5. No service or operator clearance is required at the right side of the subsystem unless the subsystem contains three or more frames. In this case, a right-side service clearance (equal to the left-side service clearance) must be added.
6. The Model B18 Virtual Tape Server stand-alone frame requires additional weight distribution areas of 330 x 1036 mm (13 x 40.8 inches) on both sides.

Aisle and Door Clearances

It is recommended that two people be available to move the 3494 frames between locations in a building. The minimum aisle and door dimensions for moving frames from the unloading area to the installation site are:

Roof height
1830 mm (72 in.)

Width
864 mm (34 in.)

Corner radius
2237 mm (88 in.)

Ramp inclines
15°

Fire-Suppression Provisions

The 3494 tape library allows for mechanical connections to permit third-party installation of fire-suppression equipment. Implementation of this facility and selection of equipment is a customer decision based on applicable local and national standards and regulations.

Each tape library unit frame has an allowable area on the top that may be cut to allow entrance of pipes, conduits, or other parts. Within the frame unit, a depth of 175 mm (6.9 in.) is available for installing pipes, sensors, sprinklers, or other

components. Piping, conduits, and cabling can be run from frame to frame as long as it stays within the allowable area and does not interfere with library components.

Figure 9 shows the allowable area for mounting of fire-suppression equipment. The measurements are shown in millimeters.

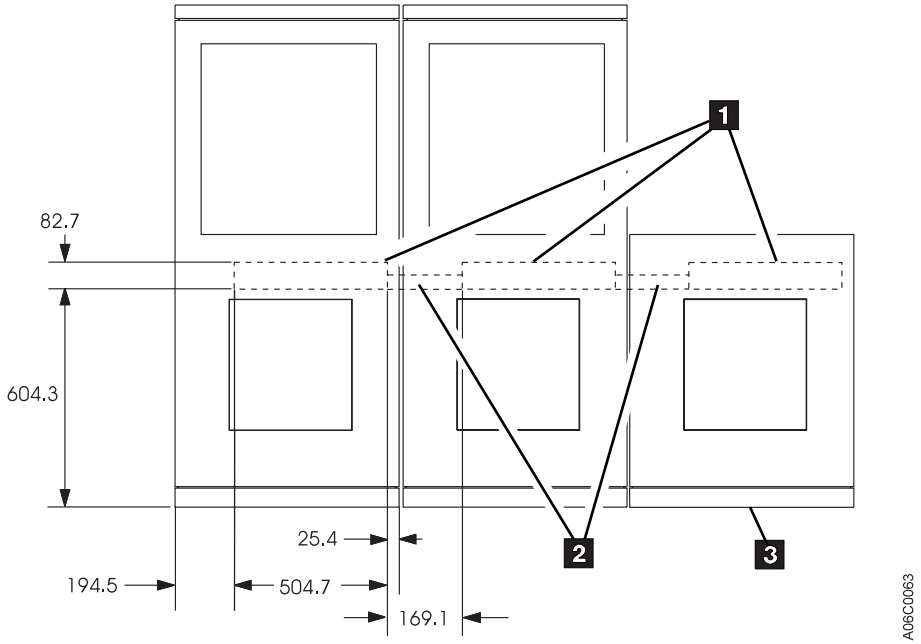


Figure 9. Fire-Suppression Facility (Top View of Frame Units)

1 shows the area available for entrance into the frame and to locate the fire-suppression equipment. This area is 82.7 mm (3.3 in.) wide by 504.7 mm (19.8 in.) long. The equipment can extend through the top cover for a maximum intrusion of 175 mm (6.9 in.).

Note: The opening should not be cut larger than required for the entrance of the fire-suppression pipes, conduits, or cables.

2 shows the area available for running cables, wiring, and pipes between frames. This area is a triangular section 81 x 140 mm (3.2 x 5.5 in.), as shown at **1** in Figure 10 on page 82.

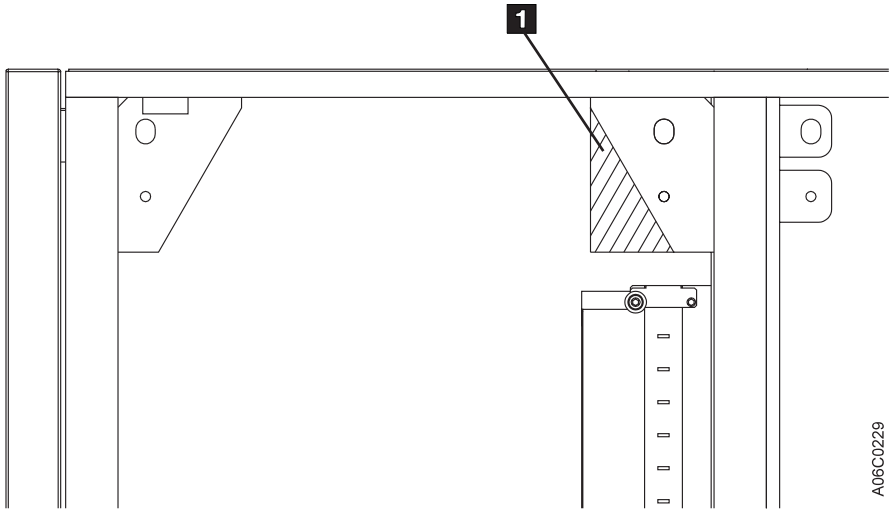


Figure 10. Location for Fire Suppression Facility between Frames

Customer fire-suppression mechanical equipment must fit within the allowable area designated or be installed outside the library.

All water systems must be external to the library enclosure with mechanical support for piping provided by the facility. Sprinkler heads that extend through the top of the frame must not extend more than 175 mm (6.9 in.) below the frame top.

Gaseous system piping with discharge nozzles can be routed on the top of the frames or inside the frames, just below the top of the frame within the 175-mm (6.9-in.) specification. The discharge nozzles can extend vertically no lower than 175 mm (6.9 in.) from the top of the frame. Gas cylinders and control equipment must be external to the library. IBM does not supply heat detectors.

Emergency Power Off Switches

Two types of emergency power-off switches are used in the 3494 environment.

Emergency Power-Off (EPO) Switch

This switch removes all electrical power from a designated area of a building, except for the lights. Emergency power-off (EPO) switches are the customer's responsibility.

Unit Emergency Switches

The 3494 library has one Unit Emergency switch located on the control panel of the library control unit frame and a second one located on the right hand Service Bay Frame when the Model HA1 is installed. For 3494s with more than eight frames without the Model HA1, a second Unit Emergency switch is mounted on the right-most frame.

Note: Either switch can be used to turn off power immediately (including an attached stand-alone Model B18 Virtual Tape Server) and should be used only in an emergency.

The stand-alone Model B18 Virtual Tape Server has one Unit Emergency switch, which removes power only to the Model B18. The Unit Emergency switch on the

Model B18 VTS should be turned OFF only in an emergency and must be ON to allow the 3494 library to power on the Model B18 VTS remotely.

Power Requirements

The maximum power consumption is dependent on the number of tape subsystems in the configuration. See “Chapter 6. Physical Planning and Specifications” on page 97 for details.

All service and circuit breakers must be installed according to national and country standards. Examples of certifiers are:

- Canadian Standards Association
- Technischer Überwachungs-Verein
- Underwriters Laboratories
- Verband Deutscher Elecktrotechniker

UPS Considerations

The 3494 tape library does not provide its own Uninterruptible Power Supply (UPS). However, customers may provide their own UPS facilities to provide ac power to the 3494 frames. In the case of battery backup UPS systems that have limited backup time, the customer may wish to supply an external signal to the 3494 to request an orderly shutdown and ac power off. This customer-supplied signal is equivalent to using the Unit Power On/Off switch on the 3494 operator panel. Customers choosing to supply this external signal should be aware of the following:

- Depending on subsystem configuration and operations in progress at the time the signal is applied, the 3494 may take up to 20 minutes to complete the shutdown and turn off its internal ac power.
- Under certain error conditions, the Library Manager software may be unable to complete the subsystem shutdown and will not turn off internal ac power.
- The use of the circuit described below requires that the Local/Remote switch located on the 3494 Operator Panel be switched to the Remote position.
- Malfunctions in the customer circuit may cause unintentional 3494 shutdown and power off sequences.
- If the customer circuit opens and causes the 3494 to shutdown and power off, and the 3494 Unit Emergency Off and Unit Power switches are left on, the 3494 will execute an ac power-on sequence as soon as the customer circuit closes again.

The customer-supplied external signal must be provided through a single pair of dedicated relay contacts. The 3494 will pass a 24 V dc, 10 mA signal through these contacts. When the contacts are closed, the 3494 will operate normally; when the contacts are opened, the 3494 Library Manager will respond by executing a shutdown process that ultimately concludes by shutting off the 3494 internal ac power distribution.

In addition to the relay contacts, the customer must supply the cable and connector to plug into the 3494. See Figure 11 on page 84 for a description of the required parts. The customer cable plugs into connector P9 on the LPC card or on P9 of the DSW card if the 3494 has the Model HA1. Refer to the LOC section of the *Magstar 3494 Tape Library Maintenance Information* for the location of the LPC or DSW cards.

Note that the P9 connector on the LPC or DSW card is normally filled with a jumper plug, IBM P/N 62G1175, which must be removed in order to install the customer-supplied cable.

Note that a different interface cable is required if the customer's 3494 also has the Remote Power Control (RPC card) optional feature installed. Contact IBM 3494 Product Field Engineering for information on a fire-suppression electrical interface compatible with the RPC feature.

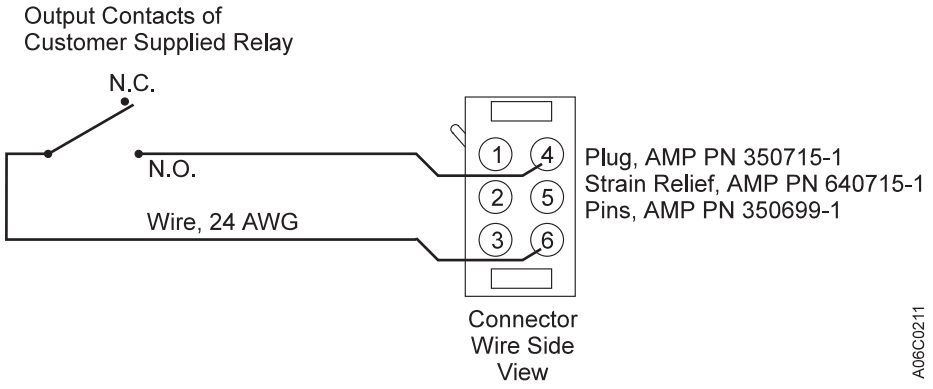


Figure 11. Schematic for Customer-Supplied Remote Power Control

Security Considerations

Controlling access to the 3494 tape library and the tape cartridges in the 3494 tape library is the customer's responsibility. Be sure to place the 3494 tape library in a controlled-access area to prevent unauthorized access to the 3494 tape library internal components and to prevent unauthorized removal of the tape cartridges.

Data security can be controlled by the Resource Access Control Facility (RACF®) program or a similar data-security program. See *Resource Access Control Facility (RACF) General Information* for an overview of RACF and its requirements.

Chapter 5. Migration to the 3494 Environment

Migration from a non-automated tape environment to an automated 3494 tape library involves the following tasks:

1. Select the appropriate library features to satisfy the performance requirements for the applications used.
2. Determine the software necessary for host control and to support the applications used with a 3494 tape library.
3. Plan for any application changes that may be necessary when used with a 3494 tape library.
4. Plan the physical environment for the installation of the 3494 tape library.
5. Plan for any operational changes that may be necessary in a 3494 tape library environment.
6. Plan for the data migration from a non-automated tape environment to a 3494 tape library.

Planning for Operations

The following section contains operational information. Detailed operational information for the tape subsystems and the supported software products is included in the appropriate publications that support these products.

Planning requirements include modifications in physical layout, subsystem operations, and operator procedures.

The operations department can play a significant role in subsystem migration. Operations and production control personnel can perform many of the tasks described in other sections of this guide, including data migration and media conversion.

Operations requirements can include equipment removal and installation, tape drive assignment schedules, cartridge external labeling, and cartridge initialization. Additional tasks include managing tape cartridges in the computer room, developing procedures where required, and providing training.

Maintenance and Drive-Cleaning Operations

Tape drive cleaning is an automated operation in the 3494 that the Library Manager controls. A cleaning schedule may be established during installation or at any other time. The cleaning schedule can be established on the Library Manager console. See the *Magstar 3494 Tape Library Operator Guide* for details. Two cleaning schedules are available for selection:

Time of Week
: The library cleans the tape drives based on specific times of the day and specific days of the week.

Usage
: The library cleans the tape drives after a specified number of mounts, which it counts from the time you set the option.

Besides the cleaning schedule that the operator establishes, the tape subsystem control unit examines performance to determine if a tape drive needs cleaning.

When the tape subsystem control unit determines that a tape drive needs cleaning based on the temporary read error count (degraded performance), the Library Manager schedules a clean operation for that tape drive.

The Library Manager screen is used to specify a value for the maximum uses of a cleaning cartridge before it is ejected from the 3494. The default value is 200, and the maximum is 500.

Note: Cleaning cartridges used in the 3494 for the 3490E and 3590 tape drives are different. The 3490E tape drive cleaning cartridge can be used only with 3490E tape drives, and the 3590 tape drive cleaning cartridge can be used only with 3590 tape drives. See “Identification of Cartridge System Tape Cartridges” on page 119 for more information.

After a cleaning operation is started, the Library Manager selects the cleaner volume based on a least-recently-used algorithm and mounts it on the tape drive. When the clean operation completes, the cartridge is unloaded and returned to storage. Thus, all cleaning cartridges are used equally as they are rotated through clean operations. When the number of mounts on a cleaner cartridge exceeds the number of allowed uses, that cartridge is automatically ejected from the library.

Each Model L1x or D1x frame that contains tape drives provides one cleaning cartridge.

Care and Handling of Cartridges

General handling instructions, operational and storage environment, and cartridge cleaning considerations are described in *Care and Handling of the IBM Magnetic Tape Cartridge*. For cartridge label requirements, see “Appendix A. Cartridge System Tape and Cartridge Labels” on page 117.

Planning for Supplies and Equipment

The following supplies and equipment are needed for the successful operation of the 3494 tape library:

- Order scratch cartridges.

  Have a three-month supply of tape cartridges available. Additional information is available in the planning manuals associated with the various processors and operating systems. See “Related Information” on page xi for a list of these manuals.
- Order 3490E and 3590 cleaning cartridges for the 3494 tape library.
- Order additional cleaning cartridges, to ensure that one cartridge is always available for each frame that contains tape drives.
- Order labels for cartridges to populate the 3494. The labels contain the volume serial number that is assigned to the tape cartridge and, optionally, the media-type identifier.
- Order media-type labels (single character) for existing tape volumes if needed due to the presence of multiple media types in the same library.

  Note: Cartridges, including cleaning cartridges, can be ordered with bar code labels attached. See “Cartridge Labels” on page 120 for label details.

Planning for Library Operator Training

Training for tape library operators should start before the 3494 tape library is installed, and the training tested after the 3494 is installed. Train the tape library operators for the following tasks:

- Using the operator's panel on the control unit frame
- Using the Library Manager operator menu and help screens
- Inserting and removing tape cartridges from the High-Capacity Input/Output Facility
- Inserting and removing cartridges from the Convenience Input/Output Station
- Placing labels on tape cartridges
- Starting, stopping, and pausing the 3494
- Varying the 3494 tape library online and offline using the Library Manager
- Using the Library Manager to communicate with the host system
- Working on hardware inside the tape library frames
- Performing problem determination
- Handling operator intervention requests
- Performing Manual mode operations

See *Magstar 3494 Tape Library Operator Guide* for more information. Additional information is available in the manuals associated with the various processors and operating systems (see "Related Information" on page xi).

Error Recovery Procedures

Ensure that the operators and system administrators know the error recovery and manual intervention procedures. See *Magstar 3494 Tape Library Operator Guide* for more information.

Hardware Migration

Hardware migration includes the following tasks:

1. Select a planning team with assigned responsibilities to ensure all pre-installation planning and migration tasks are completed.
2. Select the appropriate library configuration to satisfy the application requirements.
3. Prepare the physical environment for the 3494 tape library.
4. Determine required supplies, equipment, and training necessary to support the 3494 tape library and proposed applications.

Additional information is available in the manuals associated with the various processors and operating systems (see "Related Information" on page xi).

See "Chapter 4. Site Planning and Preparation" on page 77 for additional physical planning information.

Configuration Planning

The following section contains the information required to perform the configuration planning for the 3494. The 3494 includes all safety and appearance covers, access doors, top covers, and windows.

Configuring the Physical Library for Dual Active Accessors

The following is a list of physical configuration and setup suggestions to minimize accessor interference when Dual Active Accessors is installed:

- Balance tape subsystems across both halves of the library, with the intent of having approximately the same mount activity for each half of the library. For example, do not put all tape drives in one half of the library and all storage frames in the other half.
- Intermix storage frames with the tape subsystems, or at least try to place one storage frame at the center of the library.
- Grouping 3490E tape drives at one end and 3590 tape drives at the other end will help migrate cartridges for these tape drives to the appropriate end of the library.
- If a host has access to only a subset of the tape subsystems in a library, attempt to keep all those subsystems in the same half of the library so that the volsers associated with the subsystems remain in the same zone.
- On initial loading of cartridges into the library, group the cartridges around the tape subsystems based on planned usage.
- For Inventory Update Inserts, place cartridges as near as possible to the tape subsystems on which they intend to issue mounts for those volsers. When adding 3590 cartridges that will be used as stacked volumes for a particular VTS system, place them in cells close to those tape drives associated with the VTS.
- Place the High-Capacity Input/Output Facility near tape drives used for writing tapes that will be ejected.
- The Dual Gripper feature and floating home cell mode of operation are highly recommended for systems with dual active accessors.
- If the system only has a single gripper, it should still be taught with floating home cell mode.

Sample Library Configurations for Dual Active Accessors

3494 systems should be configured to enhance performance. Several examples of performance-enhancing configurations follow. In the examples, the first row shows the frame number, and the second row shows the frame type.

Note: In the following examples, **SU** refers to a storage unit (either a Model S10 Storage Unit Frame or a Model D1x Drive Unit Frame with no tape drives). For increased configuration flexibility, we recommend that these actually be drive unit frames without tape drives. **HIO** refers to a High-Capacity Input/Output Facility.

This configuration has all 3590 media, and every tape drive and every cartridge is accessible from every host image.

```
1    2    3    4    5    6    7    8    9    10   11   12
L14  SU   D14  SU   D14  SU   SU   D14  SU   D14  D14  SU
```

In this configuration the 3590 media is on the left half and the 3490E media is on the right half. All hosts are MVS.

```
1   2   3   4    5   6   7   8   9   10   11   12   13   14   15   16
L14 D14 SU  D14  SU  D14 SU  SU  SU  D10  SU   D10  SU   D10  D10  SU
                                          HI0
```

In this configuration the 3590 media is on the left half and the 3490E media is on the right half. All hosts are MVS.

```
1     2     3    4     5    6     7    8
L14   D12   SU   D14   SU   D10   D10  D10
      VTS              HIO
```

In this configuration the 3590 media is on the left half and the 3490E media is on the right half. The direct-attached host tape subsystems are grouped in the left half.

```
1     2     3    4     5    6     7    8
L12   D12   D12  D14   SU   D10   D10  D10
                       HIO
AS400       RISC             MVS        MVS
      AS400       MVS              MVS
```

In this configuration there is a mix of media type and tape drives on the left half but only 3590 media on the right half. The direct-attached host tape subsystems are grouped in the right half.

```
1     2     3    4     5    6     7    8
L10   D12   D10  SU    SU   D12   D12  D12
      VTS              HIO
MVS         MVS              RISC       RISC
      MVS         MVS              RISC
```

Multiple Frame Subsystems

Without a Model HA1, the 3494 can have a total of one to eight, 10, 12, or 16 frames. With a Model HA1, the 3494 can have a total of three, four, six, eight, 10, 12, or 16 frames plus the attached Service Bay Frames of the Model HA1. The library consists of a control unit frame and combinations of drive unit frames, storage unit frames, and service bay frames.

Note: The Model B18 Virtual Tape Server is a stand-alone frame and is not included in the frame totals given above.

If you plan to add additional tape drives to the library eventually, it is highly recommended to include additional drive unit frames (Model D10, D12, or D14) in the initial configuration. This will eliminate the re-configuration time associated with adding additional frames (especially important in the Model HA1 configuration). The additional drive unit frames can be used as storage unit frames until the additional tape drives are added.

Selectable Facilities

At installation time, the customer must choose how to define the cartridge facilities. The service representative sets up the 3494 according to the customer's choices.

High-Capacity Input/Output Facility

The 3494 has a High-Capacity Input/Output Facility that reserves a section of the cartridge storage area for inserting and ejecting cartridges. The customer defines the amount of storage to reserve, and the service representative enables the

reserved area in the control unit frame during installation. See “High-Capacity Input/Output Facility” on page 8 for details.

One cartridge cell is reserved in the control unit frame for ejecting cartridges if the optional Convenience Input/Output Station feature is not installed and the High-Capacity Input/Output Facility is not defined.

Home-Cell Mode

The 3494 operates in the fixed home-cell mode if neither the Dual Gripper feature nor the Dual Active Accessors feature is installed. If at least one of these features is installed, the customer can select either fixed home-cell mode or floating home-cell mode.

Fixed home-cell mode
: A tape volume is assigned a fixed storage-cell location when it is entered into the library. The volume is always returned to that location after it is used.

Floating home-cell mode
: A tape volume is put into the most convenient storage-cell location to optimize performance.

Regardless of the selected mode, the library operates in fixed home-cell mode during Manual mode operations.

Password

The password function enables the customer to password protect the service portion of the Library Manager.

Default Media Type

This option allows the user to set the default media type to standard Cartridge System Tape, Enhanced Capacity Cartridge System Tape, High Performance Cartridge Tape, or none.If there are only standard Cartridge System Tape or Enhanced Capacity Cartridge System Tape drives in the library and the default media type is set to Enhanced Capacity Cartridge System Tape, any standard Cartridge System Tape **must** have **1** as the seventh character on the external tape label to prevent the system from trying to access beyond the end of the tape. If the library contains only High Performance Cartridge Tape drives, select the default media type of High Performance Cartridge Tape.

Note: Take care to label properly any of the cartridges added to the library that are not the default media type to avoid reporting the incorrect media type and possibly causing job abends.

A character following the volser on the external cartridge label identifies the cartridge type. This identifying character is:

- **1** for standard Cartridge System Tape
- **E** for Enhanced Capacity Cartridge System Tape
- **J** for High Performance Cartridge Tape

Disable Inventory Update

This option allows the user to disable the inventory update process and speed up the process of changing modes after the doors on the library have been opened. The option is selected from the Commands pull-down.

Notes:

1. This option is not recommended for users who open the library doors for adding and removing cartridges because no changes in the library inventory will be recorded until an inventory update is performed. In addition, requesting an inventory update from the Commands pull-down results in either a full or partial inventory update. Partial checks only frames whose doors have been opened (plus adjacent frames if selected).
2. During a cold start, the library inventory update process can be disabled, thereby speeding up the power-on process. The option is selected from the Library Manager initialization panel and is valid only for the duration up the power-on sequence.

Adjacent Frame Inventory Update

This option allows the library inventory update to include frames that are adjacent to the frame that had a door opened.

Tape Subsystem Support

The 3494 supports the following:

- 3490E Model C1A, C2A, and F1A Tape Drives
- 3590 Model B1A and E1A Tape Drives
- 3590 Model A00, A50, and A60 Controllers

See “Tape Subsystems” on page 21 for details.

- No additional channel paths are needed if existing tape subsystems are used.
- The 3494, by using Enterprise System Connection (ESCON) channels, can be located up to 23 kilometers (14 miles) from the host with 3490E subsystems or up to 43 kilometers (27 miles) from the host with 3590 subsystems or VTS subsystems.

Table 22 shows the tape drive and controller attachments for the 3494.

Table 22. Summary of Tape Drive and Controller Attachments

Description	3494 Library					
	Model L10 Frame	**Model D10 Frame**	**Model L12 Frame**	**Model D12 Frame**	**Model L14 Frame**	**Model D14 Frame**
3490E CxA	1 to 2 Transports	0 to 2 Transports	—	—	—	—
3490E F1A	1 to 2 Transports	0 to 2 Transports	—	—	—	—
3490E F1A FC 3000	1 to 2 Transports	1 to 2 Transports	—	—	—	—
3590 B1A	—	—	0 to 2 Transports	0 to 6 Transports	0 to 2 Transports	0 to 4 Transports
3590 E1A	—	—	0 to 2 Transports	0 to 6 Transports	0 to 2 Transports	0 to 4 Transports
3590 A00	—	—	—	—	0 to 1	0 to 1

Table 22. Summary of Tape Drive and Controller Attachments (continued)

Description	3494 Library					
	Model L10 Frame	**Model D10 Frame**	**Model L12 Frame**	**Model D12 Frame**	**Model L14 Frame**	**Model D14 Frame**
3590 A50	—	—	—	—	0 to 1	0 to 1
3590 A60	—	—	—	—	—	0 to 1

Notes:

1. One to eight, 10, 12, or 16 frames may be configured, one of which must be a Model L10, L12, or L14; others may be a mix of Models S10, D10, D12, D14, and B16, or FC 5300, 5302, 5304, or 5400.

   When a Model HA1 (High Availability) is installed, three, four, six, eight, 10, 12 or 16 frames may be configured, one of which must be a Model L10, L12, or L14; others may be a mix of Models S10, D10, D12, D14, and B16, or FC 5300, 5302, 5304, or 5400.
2. The 3590 Model A00 has been withdrawn from marketing.

The following examples are maximum tape drive configurations; other configurations are possible:

- The following are maximum ESCON-attached 3590 subsystem configurations:
  - With FC 5228 and FC 5229:
    - 60 IBM 3590 Model B1A or E1A tape drives with 15 IBM 3590 Model A60 Controllers
    - 62 IBM 3590 Model B1A or E1A tape drives with 16 IBM 3590 Model A00 or A50 Controllers
  - Without FC 5228 and FC 5229:
    - 16 IBM 3590 Model B1A or E1A tape drives with four 3590 Model A00, A50, or A60 Controllers
- The following are maximum SCSI-attached 3590 subsystem configurations:
  - With FC 5228 and FC 5229: 16 IBM 3590 Model B1A or E1A tape drives
  - Without FC 5228 and FC 5229: four IBM 3590 Model B1A or E1A tape drives
- The following are maximum SCSI-attached 3490E subsystem configurations:
  - With FC 5228 and FC 5229: 16 IBM 3490E Model F1A tape drives
  - Without FC 5228 and FC 5229: four IBM 3490E Model F1A tape drives

  When each 3490E Model F1A FC 3000 Controller attaches two 3490E Model F1A tape drives, the library can contain a maximum of ten 3490E Model F1A tape drives.
- If the library uses only 3490E Model CxA subsystems, it can contain a maximum of 32 tape drives.

Host Processor Support

Host processors supported include AS/400, RS/6000, ES/4381™, ES/3090, ES/3090-9000, ES/9000, RS/6000 SP, and Sun. See “Host Processor Support” on page 36 for details.

Software Support

See “Chapter 3. Programming Support” on page 63 for a description of available software. Contact your IBM representative for the current support, release schedules, and versions for the associated software product.

Software Migration

You should be familiar with the topics in one or more of the host system publications. Contact your IBM representative to order IBM publications.

- For AIX publications, see “AIX” on page xii.
- For AS/400 and OS/400 publications, see “AS/400” on page xii.
- For RS/6000 publications, see “RS/6000” on page xii.
- For DFSMS/MVS and MVS/ESA publications, see “MVS” on page xii.
- For VM/ESA publications, see “VM/ESA” on page xiii.
- For VSE/ESA publications, see “VSE/ESA” on page xiii.

Thorough testing of the revised software environment must be completed before full-scale data migration is implemented and the 3494 tape library is brought online.

Host library control and tape management software require certain migration activities. These processes vary in kind and magnitude, depending on the specific operating environment, and include the following tasks:

- Reconciling the Library Manager’s inventory with the host software inventory
- Pre-defining the handling of inserted volumes
- Customizing usage options and exits provided by the software

For example, software migration in an MVS environment with SMS includes the following tasks:

1. Define the I/O configuration to the system by using the Hardware Configuration Definition (HCD) dialog.
2. Allocate the control data sets, by using access methods services (AMS), to contain the Storage Management Subsystem (SMS) configuration.
3. Define the tape configuration database by using AMS.
4. Define the 3494 tape library by using the ISMF library management application. If Model B16 or B18 Virtual Tape Servers are installed, more than one library is defined.
5. Define tape storage groups by using the ISMF storage group application.
6. Modify and test the installation of data class, storage class, and storage group ACS routines to select tape storage groups for data sets that must reside in the 3494 tape library.
7. Define the data class for media type and IDRC requirements.
8. Write the cartridge entry by changing the use attribute and cartridge eject installation exits as part of the initial bring-up process.
9. Activate the SMS configuration containing the library definition.
10. Activate the Object Access Method (OAM) address space. If the 3494 tape library drives are not online at IPL, then activate the I/O configuration.
11. Run a job stream that uses 3494 resident volumes.

For the tape drives inside a 3494 tape library to be recognized by the host, the library and the tape drives must not be busy and its associated tape subsystems must be powered on. The library must be in the Online state when the host is in IPL status or I/O activation is performed. If a subsystem in a library was not recognized, I/O activation must be performed when it is subsequently powered on or not busy.

Migrating Data

Data migration in a tape environment is the process of moving volumes (data cartridges) from a non-automated tape environment to a 3494 tape library environment.

The following section, although specific for DFSMS/MVS, describes the techniques for implementing a general migration strategy.

Analyzing the Library Composition

Most tape libraries consist of common categories of tapes that are defined by the characteristics of how they are used. Determining the common categories is the first step in developing a migration strategy.

Each category is unique because of special criteria applied to its use and handling in a data-processing environment. The criteria can include life-cycle, security requirements, special handling, or various application dependencies.

See the *IBM 3490 Planning and Migration Guide* or *Magstar 3590 Tape Subsystem Introduction and Planning Guide* for details.

Coexistence

The 3494 tape library can coexist with automated and non-automated tape libraries installed in the same host environment if the host system software to support the libraries is installed and operational.

Migration Approaches

Consider how to introduce your current tape processing to the new environment. You can either start processing with all scratch tapes or you can introduce some or all of your current tape volumes into the library and continue with your most current tapes.

Creating New Volumes in the 3494 Tape Library

Data migration can be achieved by processing existing data volumes on non-automated tape drives and populating the 3494 with scratch cartridges:

1. Replace the label on existing scratch volumes (placed in the 3494) with one of the supported label types.
2. Populate the 3494 tape library with scratch volumes that have bar code volser and media-type labels.
3. Define the new volser range to the tape management system if required.
4. Initiate the cartridge inventory process.
5. Use the automatic class selection (ACS) routines in DFSMS/MVS to direct the selected output data sets to the 3494.

Migration for a Virtual Tape Server Subsystem

If your 3494 has a Virtual Tape Server subsystem, only the scratch tape processing option is available for the volumes managed by the subsystem. This procedure also assumes the library that contains the Virtual Tape Server subsystem has been already defined. The following steps must be performed to set up the Virtual Tape Server subsystem for use:

1. Define the new volser range for the logical volumes that the Virtual Tape Server subsystem will manage. If required, also add the VOLSER range to the tape management system.
2. Define the new volser range of the 3590 cartridge tapes that the Virtual Tape Server subsystem will manage.
3. Add the defined logical and 3590 cartridge tape ranges to the Library Manager inventory from a panel on the Library Manager console. The logical volumes will be added to the inventory database and also uploaded to the host systems. The 3590 cartridge tape range does not add inventory records at this point. It only provides a range that the Library Manager will check when cartridges are added to the library. Any 3590 cartridge tape whose volser falls within the range when added to the library will be added to the Library Manager's inventory as a stacked volume and is not reported to the host systems.
4. Add 3590 cartridge tape to the library with any volser that falls within the defined range.
5. Use the automatic class selection (ACS) routines in DFSMS/MVS to direct the selected new output data sets to the 3494 library that contains a Virtual Tape Server subsystem.

Moving Existing Tape Volumes to the 3494 Tape Library

Data migration can be achieved by selecting a set of tape volumes with active data and moving the selected volumes into a 3494. Also, a set of scratch volumes should be moved into a 3494 to allow creation of new data in the 3494 tape library.

Migration of existing data to a 3494 includes the following tasks:

1. Select the volumes to be moved.

   The volumes to be moved into a 3494 are chosen by using selected criteria (that is, all the volumes used by particular applications, such as DFSMShsm or all the volumes produced by a particular application).
2. Replace external labels with bar code labels for cartridges going into a 3494.

   Because the selected volumes are distributed throughout the existing non-automated library, volumes to be moved must be relabeled with one of the supported label types when they are moved. Supported bar code labels must be available for the entire range of volume serial numbers residing in the 3494 tape library. To save time, label the tape cartridges before the 3494 is installed.

   Note: For DFSMS/MVS, the internal labels of private and scratch volumes must match their external labels. For scratch volumes, the internal label is written when the volume is first opened for output.
3. Load the 3494 with scratch cartridges, appropriately labeled, and start the inventory process. See the *Magstar 3494 Tape Library Operator Guide* for details.
4. Change the ACS routines.

   In an DFSMS/MVS environment, the ACS routines must be coded to direct selected output data sets to a 3494.

Verifying that the Data Migrated

Application programming personnel may need to perform several tasks when transferring data to the subsystem. Ensuring that the data is correctly transferred is the highest priority in the overall migration.

Application personnel may need to participate in some of the following activities:

1. Set up the data test plan so project control personnel can monitor the migration.
2. Process the test jobs with subsets of production jobs.
3. Verify the results with the actual production run of the same application.

A migration strategy may include a consideration of multiple recording formats and a choice of cartridge system tapes. See *IBM 3490 Planning and Migration Guide* or *Magstar 3590 Introduction and Planning Guide* for details about:

- Improved Data Recording Capability (IDRC)
- 18-track, 36-track, 128-track tapes, and 256-track tapes
- Standard Cartridge System Tape, Enhanced Capacity Cartridge System Tape, High Performance Cartridge Tape

Chapter 6. Physical Planning and Specifications

The following section includes the cooling, power, environmental requirements, and the physical dimensions of the different frames.

Cooling Requirements

The 3494 requires ambient room temperatures that are consistent with the environmental specifications. See “Environmental Specifications” on page 98 for additional information. The specifications starting on page “3494 Control Unit Frame” on page 104 give the heat load for each library frame. The total heat load is the sum of all frames in the subsystem.

Power Requirements

The control unit frame and the drive unit frames can contain either single- or multiple-drive tape subsystems. Table 25 on page 99 gives specifications for subsystems to be added to the library frame specification values beginning at “Specifications” on page 105.

Each 3494 frame (except the storage unit frame) includes a power cord that is connected to a customer-supplied outlet.

The frame power supplies operate from a nominal 200 to 240 V single-phase 30-amp ac service at 50 or 60 Hz. The minimum voltage input is 180 V ac, and the maximum voltage input is 259 V ac RMS.

The ac power for the tape subsystems contained in the control unit frame and drive unit frames is provided by the ac power distribution compartment located in the individual frame.

The Library Managers, located in the control unit frame, or right-hand service bay frame receive ac power from the ac distribution box in the control unit frame. The Virtual Tape Server controller and its associated Disk Storage drawers located in the Virtual Tape Server frame receive ac power from the ac distribution box.

The Remote Support Facility (FC 2710) requires an input voltage of 115 V ac, supplied by a customer-provided external outlet. It uses 16 watts of power. Its dimensions are 200 mm x 225 mm x 50 mm (8 in. x 9 in. x 2 in.).

The Remote Support Switch (FC 2711) requires an input voltage of 115 V ac, supplied by a customer-provided external outlet. It uses 5 watts of power. Its dimensions are 200 mm x 400 mm x 50 mm (8 in. x 16 in. x 2 in.).

Acoustic Specifications

The 3494 tape library is classified as a Category 1 product as defined in C-S 1710-006. Table 23 shows the acoustic specifications for the 3494.

Table 23. Acoustic Specifications

L_{WAd}		$<L_{pA}>_m$	
Operating (bels)	Idling (bels)	Operating (dB)	Idling (dB)
6.8	6.5	48	47
Note: For definitions of levels, see the *IBM General Information Manual: Installation Manual–Physical Planning* for details.			

Environmental Specifications

The temperature and humidity ranges for the 3494 vary according to environmental conditions.

The environments shown in Table 24 apply to the components of the tape library subsystem (not to the tape and cartridges). For specifications on the environmental limits of the media, see the following:

- *Tape and Cartridge Requirements for the IBM Magnetic Tape Cartridge Drives*
- *Tape and Cartridge Requirements for the IBM Enhanced Capacity Magnetic Tape Cartridge Drives*

Table 24. Environmental Specifications

Condition	Temperature	Relative Humidity	Maximum Wet Bulb
Operating (not Model B18	10°C to 38°C (50°F to 100.4°F)	20% to 80%	23°C (73.4°F)
Operating (only Model B18)	10°C to 32°C (50°F to 89.6°F)	20% to 80%	23°C (73.4°F)
Non-operating	10°C to 52°C (50°F to 125.6°F)	8% to 80%	27°C (80°F)
Storage	1°C to 60°C (34°F to 140°F)	5% to 80%	29°C (84°F)
Shipping	-40°C to 60°C (-40°F) to 140°F)	5% to 100% (excluding precipitation)	29°C (84°F)

Cabling Information

All of the cables for the optional AS/400 Remote Power Sequence feature (FC 5216) are included as part of the feature. All of the cables for the optional AS/400 Host Attachment features (FC 5211 and FC 5213) are included as part of the features.

Cables for the optional RS/6000 Host Attachment feature (FC 5212) are included as part of the feature.

See “Chapter 2. Specify and Special Features” on page 37 for additional information on the 3494 features. For additional host system cable attachment information, refer to “Cabling for 3494 Virtual Tape Servers” on page 34.

Specifications Reference

For each tape drive or controller (Model C1A, C2A, F1A, F1A with FC 3000, B1A, E1A, A00, A50, or A60) mounted in a frame, add the values shown in Table 25.

Table 25. Specifications Reference

Specification	C1A	C2A	F1A	F1A with FC 3000	B1A	E1A	A00	A50	A60
Weight: kg (lb)	96.4 (212)	106 (234)	27.2 (60)	20 (44.0)	28.6 (58)	30 (66)	28.3 (52)	18 (40)	75 (165)
Heat Output: kw (kBTU/hr)	0.7 (2.38)	0.7 (2.38)	0.3 (1.02)	0.21 (0.7)	0.3 (1.02)	0.225 (0.77)	0.3 (1.02)	0.25 (0.8)	0.5 (1.7)
Air Flow: m^3/min (CFM)	6.2 (210)	9.9 (350)	0.9 (30)	–	1.3 (45)	3.4 (120)	–	–	1.4 (49)
Power: kV·A Maximum	0.7	0.7	0.48	0.25	0.3	0.225	0.3	0.4	0.75

3494 Tape Library Subsystem

Figure 12 shows the plan view of a representative 3494 configuration with the optional drive unit and frames for storage. Table 26 on page 101 shows the total length for dual accessor libraries of up to 18 frames, including the required service clearance at both ends of the library. (This is the distance A in Figure 12.) Table 27 on page 102 shows the total length for single accessor (non-Model HA1) libraries of up to 16 frames, including the required service clearance at both ends of the library and the EPO switch end panel, which is required for single accessor libraries with a length of nine frames or more. Figure 13 on page 103 shows a representative 3494 configuration with the Model HA1 installed.

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.

Note: See “Service and Operator Clearances” on page 79.

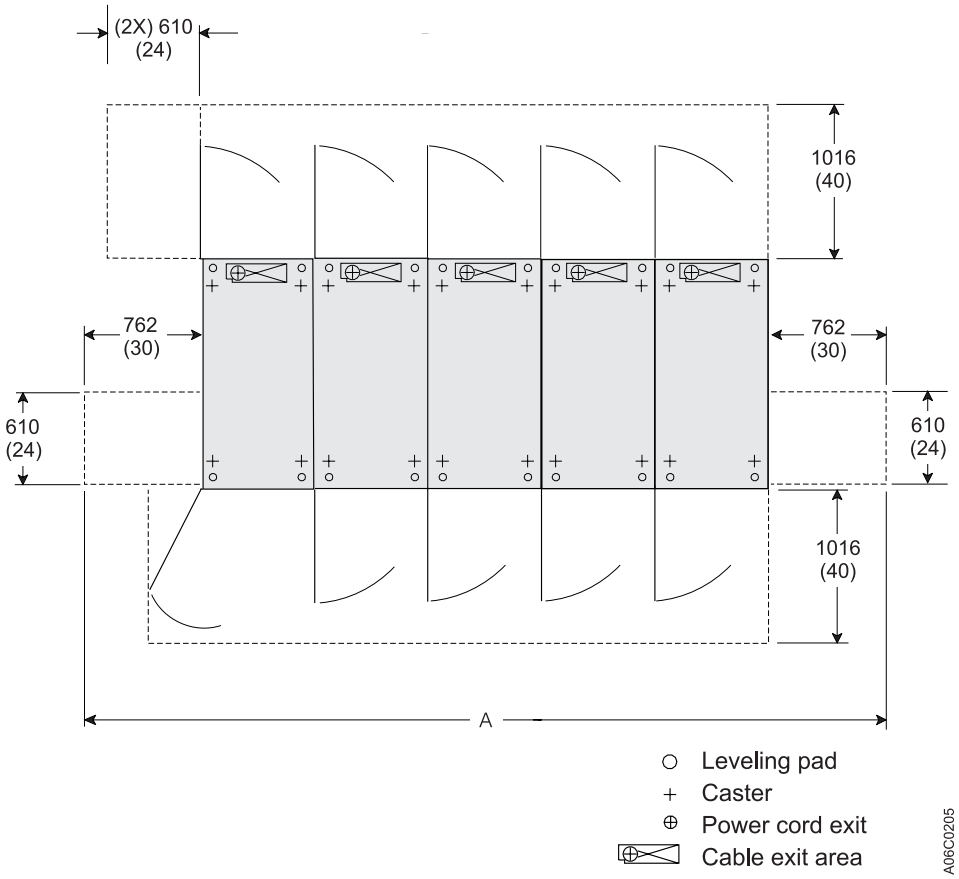


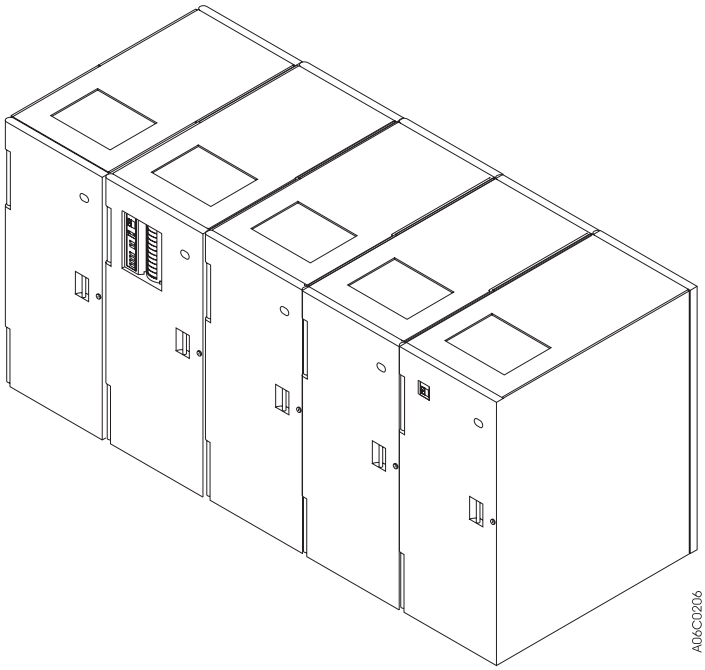
Figure 12. 3494 Plan View with Clearance Requirements

Table 26. Total Required Length for 3494 Libraries (Dual Accessor)

Number of Frames	Length A (mm)	Length A (in.)
1	2249	88.5
2	3004	118.3
3	3759	148.0
4	4514	177.7
5	5269	207.4
6	6024	237.2
7	6779	266.9
8	7534	296.6
9	8289	326.3
10	9044	356.1
11	9799	385.8
12	10554	415.5
13	11309	445.2
14	12064	475.0
15	12819	504.7
16	13574	534.4
17	14329	564.1
18	15084	593.9

Table 27. Total Required Length for 3494 Libraries (Single Accessor)

Number of Frames	Length A (mm)	Length A (in.)
1	2249	88.5
2	3004	118.3
3	3759	148.0
4	4514	177.7
5	5269	207.4
6	6024	237.2
7	6779	266.9
8	7534	296.6
9	8375	330.1
10	9130	359.9
11	9885	389.6
12	10640	419.3
13	11395	449.0
14	12150	478.8
15	12905	508.5
16	13660	538.2



Service Bays Attached

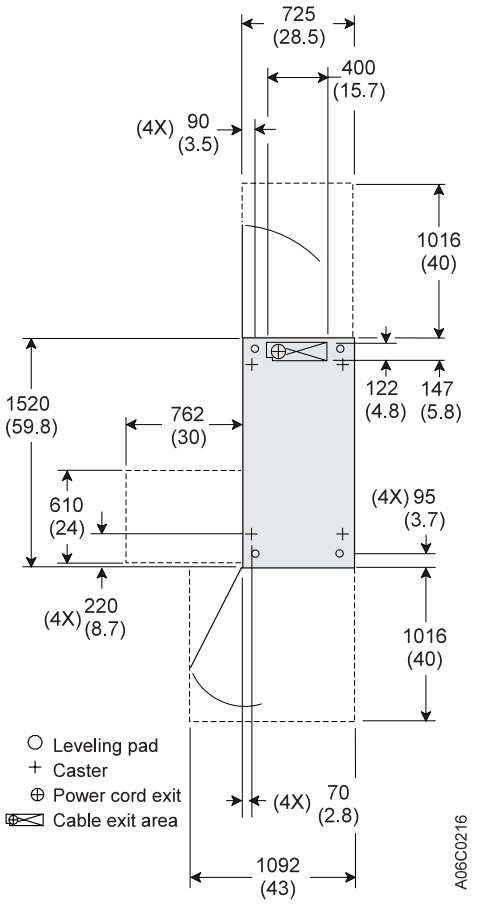
Figure 13. 3494 Tape Library System with Model HA1

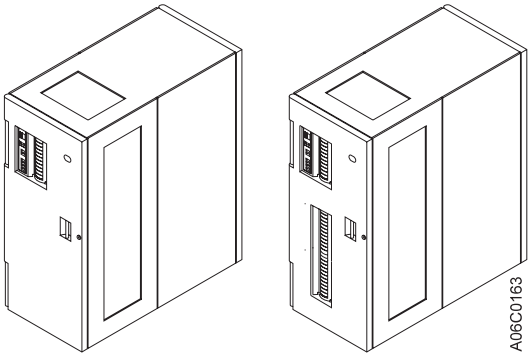
3494 Control Unit Frame

Model L10, L12, or L14

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.





Specifications

The following specifications are for the control unit frame only. To calculate total weights, power requirements, and so on, you must add the equivalent values for each tape subsystem mounted in the frame. The illustrations to the left show the two configurations of the Convenience Input/Output Stations.

Dimensions:

	Front[6]	Side[7]	Height
mm	725	1520	1800
(in.)	(28.5)	(59.8)	(70.9)

Operator/Service Clearances:

	Front	Rear[1]	Side[2]
mm	1092 x 1016	750 x 1016	762 x 610
(in.)	(43 x 40)	(29.5 x 40)	(30 x 24)

Weight without Drives and Controllers:[3]

kg	444 (see Table 25 on page 99)
(lb)	(999)

Heat Output:

kw	0.3 (see Table 25 on page 99)
(kBTU/hr)	(1.0)

Air Flow: (see Table 25 on page 99)

Power Requirements:

kV·A	0.3 (add values from Table 25 on page 99)
Phases	1

Frame Power Attachments:[4,5]

Plug Type (US default)	R&S 3750
Receptacle Type (US default)	R&S 3753
Inline Connector (US default)	R&S 3933

Notes:

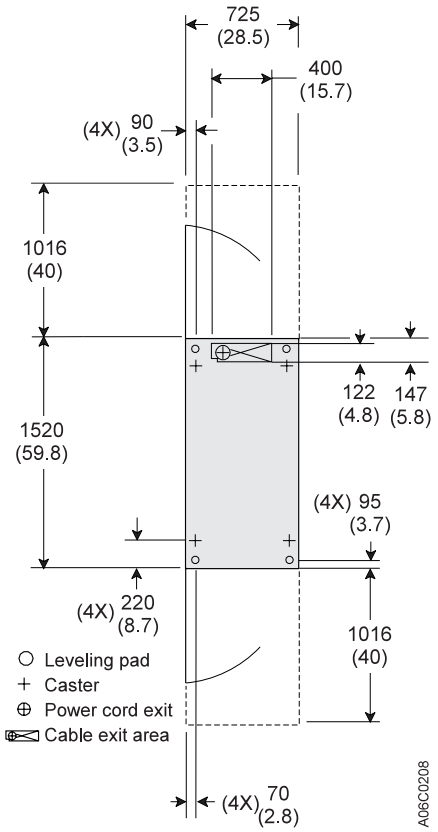
1. Control unit frames using 3590 drives require left and right rear service clearances of 610 x 1016 mm (24 x 40 in.). Left and right rear service clearances may overlap when frames are placed side by side.
2. Only a left-side service clearance is required.
3. With 210 cartridges, add 50 kg (110 lb).
4. The appropriate power cord is attached at the factory based on the order destination country code.
5. Chicago, Illinois, U.S.A. requires FC 9986.
6. This is frame width only. Additional interframe spacing of 30 mm (1.2 in.) is required.
7. Dimension includes front and rear doors.

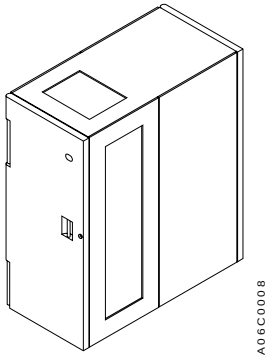
3494 Drive Unit Frame

Model D10, D12, or D14 (see notes 6 and 9)

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.





Specifications

The following specifications are for the drive unit frame only. To calculate total weights, power requirements, and so on, you must add the equivalent values for each tape subsystem mounted in the frame.

Dimensions:

	Front[7]	Side[8]	Height
mm	725	1520	1800
(in.)	(28.5)	(59.8)	(70.9)

Operator/Service Clearances:

	Front	Rear[1]	Side[2]
mm	750 x 1016	750 x 1016	762 x 610
(in.)	(29.5 x 40)	(29.5 x 40)	(30 x 24)

Weight without Drives and Controllers:[3]

kg	320 (add values from Table 25 on page 99)
(lb)	(704)

Heat Output:

kw	0.1 (add values from Table 25 on page 99)
(kBTU/hr)	(0.34)

Air Flow: (see Table 25 on page 99)

Power Requirements:

kV·A	0.1 (add values from Table 25 on page 99)
Phases	1

Frame Power Attachments:[4,5]

Plug Type (US default)	R&S 3750
Receptacle Type (US default)	R&S 3753
Inline Connector (US default)	R&S 3933

Notes:

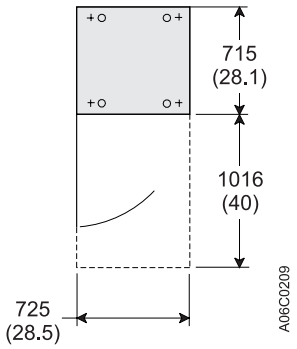
1. Drive unit frames using 3590 tape drives require left and right rear service clearances of 610 x 1016 mm (24 x 40 in.). Left and right rear service clearances may overlap when frames are placed side by side.
2. No side service clearance is required unless the subsystem consists of three or more frames. In this case, a right-side service clearance of 762 x 610 mm (30 x 24 in) is required.
3. With 300 cartridges, add 72 kg (159 lb). Each cartridge weighs 0.24 kg (0.52 lb).
4. The appropriate power cord is attached at the factory based on the order destination country code.
5. Chicago, Illinois, U.S.A. requires FC 9986.
6. FC 5300, 5302, and 5304 are similar to 3494 Models D10, D12, and D14.
7. This is frame width only. Additional interframe spacing of 30 mm (1.2 in.) is required.
8. Dimension includes front and rear doors.
9. FC 5500 and 5502 are similar to the 3494 Model D12.

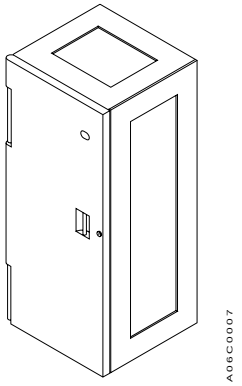
3494 Storage Unit Frame

Model S10 (see note 4)

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.





Specifications

Dimensions:

	Front[5]	Side[6]	Height
mm	725	715	1800
(in.)	(28.5)	(28.1)	(70.9)

Operator/Service Clearances:

	Front	Rear[1]	Side[2]
mm	750 x 1016		762 x 610
(in.)	(29.5 x 40)		(30 x 24)

Weight:[3]

kg	281
(lb)	(618)

Heat Output: None

Air Flow: None

Power Requirements: None

Notes:

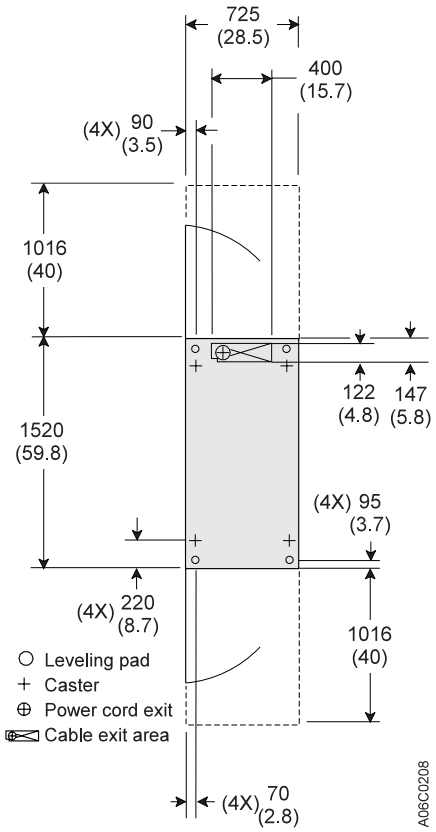
1. No rear service clearance is required.
2. No side service clearance is required unless the subsystem consists of three or more frames. In this case, a right-side service clearance of 762 x 610 mm (30 x 24 in.) is required.
3. With cartridges, add 95 kg (210 lb).
4. FC 5400 is similar to 3494 Model S10.
5. This is frame width only. Additional interframe spacing of 30 mm (1.2 in.) is required.
6. Dimension includes front door and rear cover.

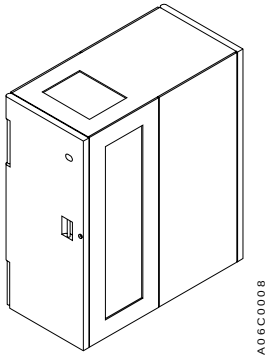
3494 Virtual Tape Server Frame

Model B16

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.





Specifications

Dimensions:

	Front[5]	Side[6]	Height
mm	725	1520	1800
(in.)	(28.5)	(59.8)	(70.9)

Operator/Service Clearances:

	Front	Rear	Side[1]
mm	750 x 1016	750 x 1016	762 x 610
(in.)	(29.5 x 40)	(29.5 x 40)	(30 x 24)

Weight:[2]

	Disk Storage capacity features	
	2	4
kg	450	524
(lb)	(990)	(1150)

Heat Output:

	Disk Storage capacity features	
	2	4
kw	1.95	3.03
(kBTU/hr)	(6.55)	(10.17)

Power Requirements:

	Disk Storage capacity features	
	2	4
kV·A	2.16	3.45
Phases	1	1

Frame Power Attachments:[3,4]

Plug Type (US default)	R&S 3750
Receptacle Type (US default)	R&S 3753
Inline Connector (US default)	R&S 3933

Notes:

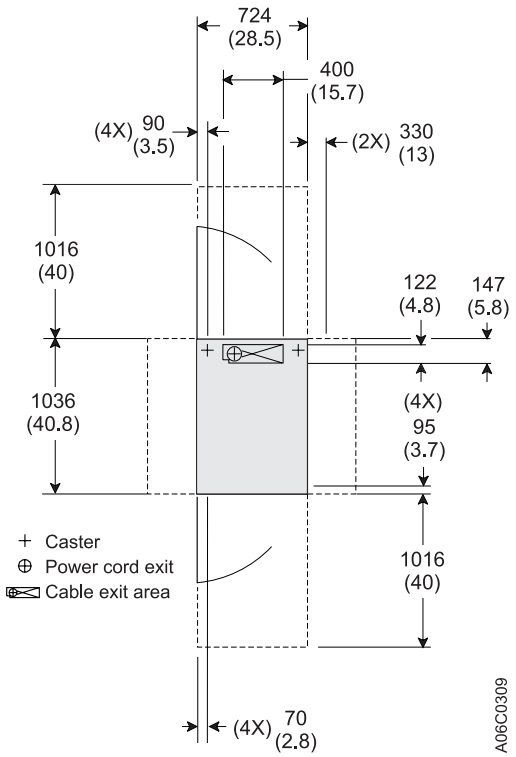
1. No side service clearance is required unless the subsystem consists of three or more frames. In this case, a right-side service clearance of 762 x 610 mm (30 x 24 in.) is required.
2. With 400 cartridges, add 95 kg (210 lb).
3. The appropriate power cord is attached at the factory based on the order destination country code.
4. Chicago, Illinois, U.S.A. requires FC 9986.
5. This is frame width only. Additional interframe spacing of 30 mm (1.2 in.) is required.
6. Dimension includes front and rear doors.

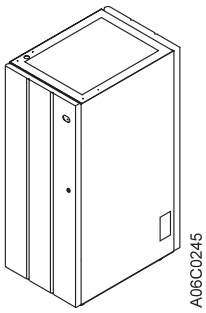
3494 Virtual Tape Server Frame (Stand-Alone)

Model B18

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.





Specifications

Dimensions:

	Front	Side[2]	Height
mm	724	1036	1800
(in.)	(28.5)	(40.8)	(70.9)

Operator/Service Clearances:

	Front	Rear	Side[1]
mm	750 x 1016	750 x 1016	330 x 1036
(in.)	(29.5 x 40)	(29.5 x 40)	(13 x 40.8)

Weight:

	Disk Storage capacity features			
	1	2	3	4
kg	485	540	595	650
(lb)	(1067)	(1188)	(1309)	(1430)

Heat Output:

	Disk Storage capacity features			
	1	2	3	4
kw	1.08	1.53	1.98	2.43
(kBTU/hr)	(3.69)	(5.22)	(6.76)	(8.29)

Power Requirements:

	Disk Storage capacity features			
	1	2	3	4
kV·A operating	1.2	1.7	2.2	2.7
Phases	1	1	1	1

Frame Power Attachments[3,4,5]:

Plug Type (US default)	R&S 3750
Receptacle Type (US default)	R&S 3753
Inline Connector (US default)	R&S 3933

Notes:

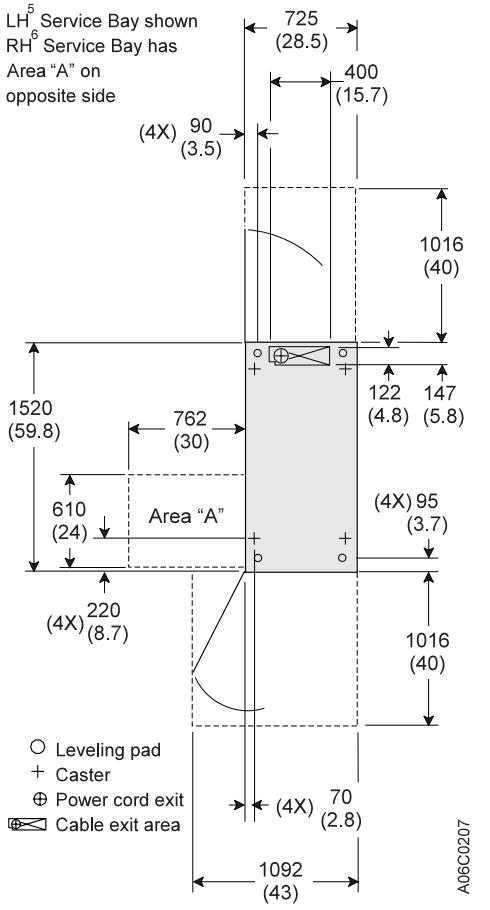
1. Clearance on each side is required for weight distribution to meet the IBM-recommended floor loading of 345 kg/m^2 (70 lb/ft^2). These areas may not overlap.
2. Dimension includes front and rear doors.
3. The appropriate power cord is attached at the factory based on the order destination country code.
4. Chicago, Illinois, U.S.A. requires FC 9986.
5. Model B18s shipped with two primary control compartments and two power cords allow connection to two power sources.

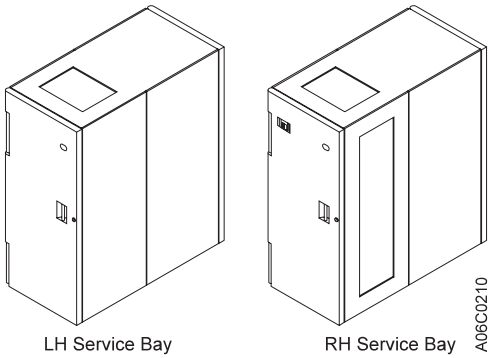
3494 Service Bay Frame

Model HA1

Plan View (Metric Scale: 10 mm = 0.5 m)

English measurements are shown in parentheses.





Specifications

Dimensions:

	Front[3]	Side[4]	Height
mm	725	1520	1800
(in.)	(28.5)	(59.8)	(70.9)

Operator/Service Clearances:

	Front	Rear	Side
mm	1092 x 1016	750 x 1016	762 x 610
(in.)	(43 x 40)	(29.5 x 40)	(30 x 24)

Weight:

	LH[5]	RH[6]
kg	366	484
(lb)	(805)	(1065)

Heat Output:

	LH[5]	RH[6]
kw	0.1	0.3
(kBTU/hr)	(0.3)	(1.0)

Air Flow:

	LH	RH
m^3/min	---	1.5
(cfm)	---	(55)

Power Requirements:

	LH	RH
kV·A	0.1	0.3
Phases	1	1

Frame Power Attachments:[1,2]

Plug Type (US default)	R&S 3750
Receptacle Type (US default)	R&S 3753
Inline Connector (US default)	R&S 3933

Notes:

1. The appropriate power cord is attached at the factory based on the order destination country code.
2. Chicago, Illinois, U.S.A. requires FC 9986.
3. This is frame width only. Additional interframe spacing of 30 mm (1.2 in.) is required.
4. Dimension includes front and rear doors.
5. Service bay is attached to the left-hand end of the 3494.
6. Service bay is attached to the right-hand end of the 3494.

Appendix A. Cartridge System Tape and Cartridge Labels

The 3494 tape library is designed to automate the storage and movement of the IBM Cartridge System Tape or its American National Standards Institute (ANSI) or world trade equivalent. The 3494 tape library supports the following data cartridges:

- Cartridge System Tape (only with the 3490E tape subsystem)
- Enhanced Capacity Cartridge System Tape (only with the 3490E tape subsystem)
- High Performance Cartridge Tape (only with the 3590 tape subsystem)

All tape cartridges in the library should have an external label that is operator readable and machine readable. The label identifies the volume serial number (volser) of the cartridge and is used to identify the cartridge to the 3494 tape library. All communication with the control program relating to a specific cartridge uses the volser that is read from the external label. Also, for the 3494, a separate, single-character external media-type label is used to identify the cartridge as standard Cartridge System Tape, Enhanced Capacity Cartridge System Tape, or High Performance Cartridge Tape.

The number **1** on the media-type label identifies the standard Cartridge System Tape. The letter **E** on the media-type label identifies the Enhanced Capacity Cartridge System Tape. The letter **J** on the media-type label identifies the High Performance Cartridge Tape.

In the absence of the media-type label, the cartridge is assumed to be the default media type. This function causes all library cartridges without the media-type labels to have their media type set to the default value. Take care not to insert cartridges without a media-type label into the library unless they are of the same type as the default value. The unlabeled tape facility can be used to insert cartridges with media-type labels that do not match the default media type. See “Unlabeled Tape Facility” on page 13 for additional information.

The volser ranges are used to determine a volser media type when it is inserted into the library. When a range is added or modified, the system automatically combines overlapping ranges with the same media type and checks for range conflicts.

When a volser range changes, the media types for existing volumes in the library do not change. Volumes that are inserted subsequently will reflect the new set of ranges and associated media types.

The volser media type is determined by using the following rules:

1. The media type returned by the vision system is the first choice unless **J** is present.
2. If the media type is **J** and there are multiple partitions, the volser ranges are checked for whether to assign the volser to a Virtual Tape Server or a non-Virtual Tape Server partition.
3. The volser ranges are used to determine a volser media type if it cannot be determined by the vision system. If the volser being inserted appears within one of the ranges, the range’s associated media type is used. The search of the ranges is an inclusive search.
4. The system uses the default media type defined during the teach process to determine the media type if the volser does not fall into one of the ranges.
5. The volser is ejected if there is no default media type.

Unlabeled tape cartridges can be used in a library, but they must be carefully controlled. See “Unlabeled Tape Facility” on page 13 for additional information.

Cleaning cartridges must also have operator-readable and machine-readable external labels that uniquely identify the volume and media type. See “Cartridge Labels” on page 120 for a description of the labeling requirements.

Cartridge System Tape

The Cartridge System Tape cartridge, shown in Figure 14, contains the magnetic tape for the tape subsystems. The cartridge is closed by a leader block **1** (attached to the end of the tape) to protect the tape from contamination when the cartridge is out of the tape drive. When the cartridge is inserted in a tape drive, the threading mechanism uses the leader block to pull the tape out of the cartridge, across the read/write head, and onto a non-removable machine reel.

Note: Do not attempt to pull the leader block away from the cartridge. You can damage the tape and reduce the reliability of the cartridge.

Each tape cartridge includes a file-protect selector **2** that, when set to the file-protect position, prevents data from being written on or erased from the tape. Place all volumes in the 3494 tape library in non-file-protect mode and use the software file-protect facility for dynamic control.

A tape cartridge can be visually identified by a volume serial number label on the edge of the cartridge **3** . Also, a customer information label **4** can be used on the top of the cartridge.

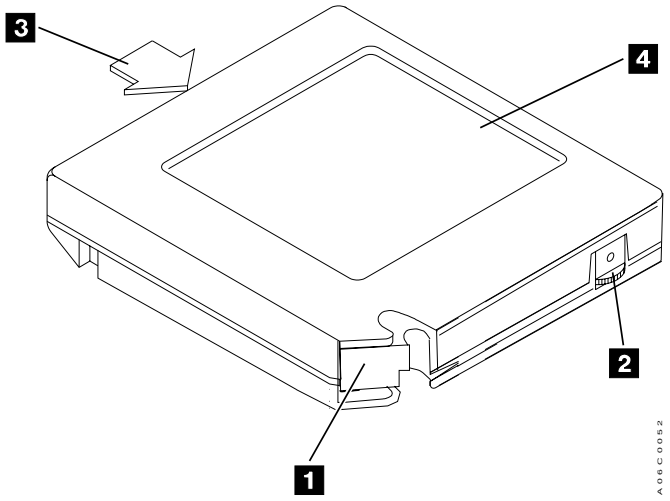


Figure 14. IBM Cartridge System Tape

Identification of Cartridge System Tape Cartridges

The 3494 tape library supports an intermix of standard Cartridge System Tape, Enhanced Capacity Cartridge System Tape, and, with 3590 tape subsystems, High Performance Cartridge Tape.

In addition to the external labels, the Enhanced Capacity Cartridge System Tape has a unique two-tone case that allows the 3494 tape library operator to identify it as an Enhanced Capacity Cartridge System Tape cartridge. The High Performance Cartridge Tape data cartridge has a black case, a blue leader block, and two blue inserts with identification notches on the edge of the cartridge case. The 3590 cleaning cartridge has gray inserts with identification notches that are offset from the position of the notches on the data cartridge. See Figure 15 for the location of the identification notches on the 3590 tape subsystem data cartridges and cleaning cartridges.

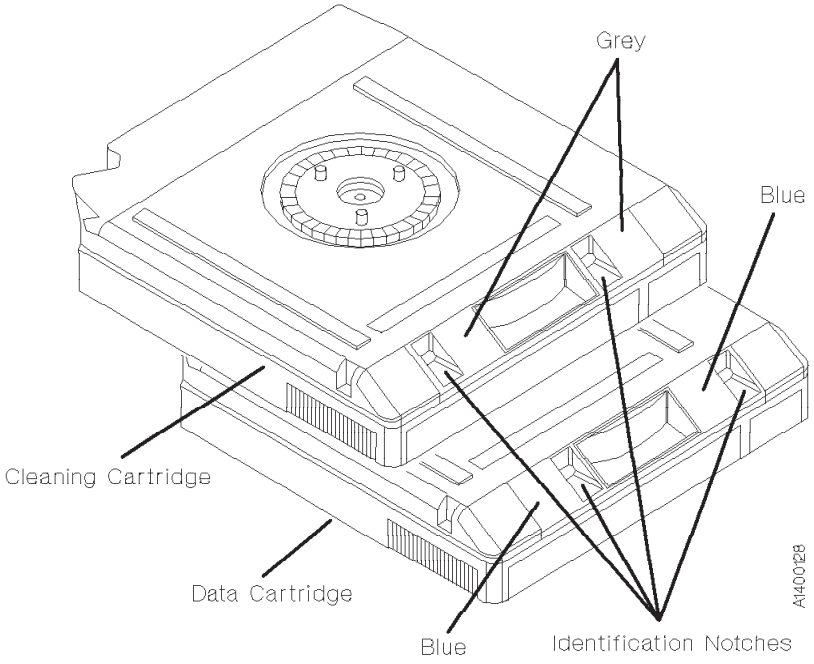


Figure 15. High Performance Cartridge Tape Identification

The vision system identifies the type of cartridge during an inventory operation by reading the separate, media-type label to distinguish between standard Cartridge System Tape cartridges, Enhanced Capacity Cartridge System Tape cartridges, and High Performance Cartridge Tape cartridges.

Figure 16 on page 120 shows the standard Cartridge System Tape **1**, the Enhanced Capacity Cartridge System Tape **2**, and the High Performance Cartridge Tape **3** cartridges. Note the distinctive case coloring of the cartridges and the placement of the media-type labels.

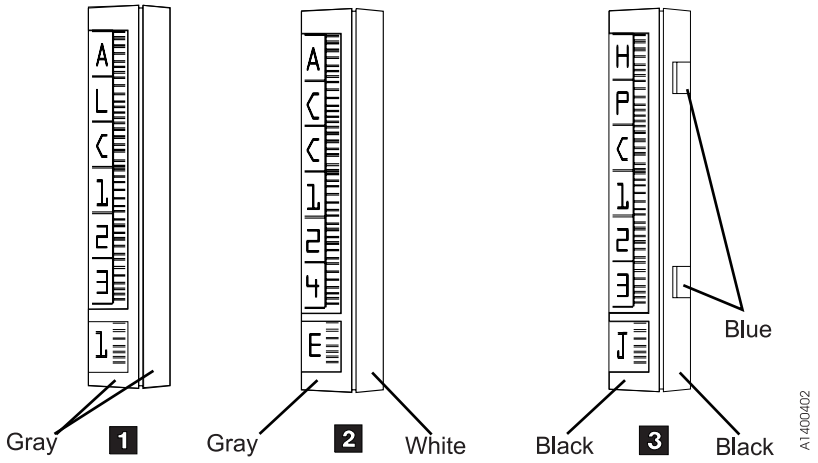


Figure 16. Tape Cartridge Identification

Cartridge Labels

Most operating systems require the volser label to correspond to the internally written label on the volume. The 3494 tape library uses the external volser bar code to identify cartridges in the library during inventory operations.

Currently, the 3494 tape library supports the labels that three U.S.A. label manufacturers supply. Printing your own labels is not recommended. Contact your IBM representative for manufacturers in other countries. The three labels have similar characteristics and can be intermixed in a library. See “Label Manufacturer Information” on page 122 for the addresses of the manufacturers of the following labels:

- Engineered Data Products (EDP) Tri-Optic™
- Wright Line Tri-Code™
- Information Data Storage

Figure 17 shows a sample label.

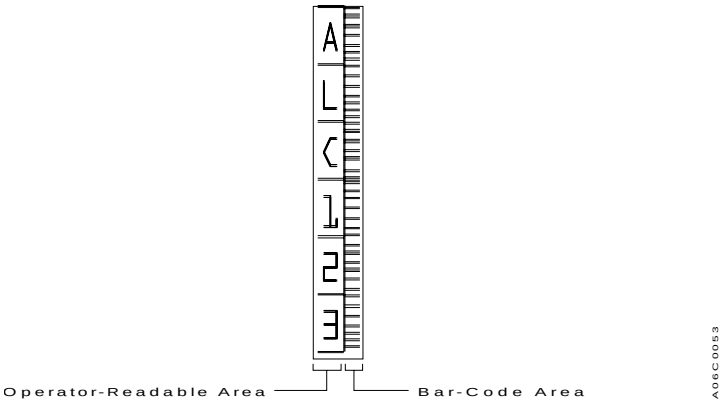


Figure 17. External Volume Serial Number Label

Supported Characters for External Labels

The external bar code label for the 3494 contains up to six characters. The volser can be from one to six characters, with blanks padded on the right for a volser with fewer than six characters. Characters can be uppercase A–Z and numerics 0–9.

The separate media-type label that identifies the tape data cartridges uses the following characters:

1 Standard Cartridge System Tape (3480 or 3490)

E Enhanced Capacity Cartridge System Tape (3490E)

J High Performance Cartridge Tape (3590)

Service Volume Labels

Service volumes are shipped with the 3494. Service volumes in the library have a unique volser label that distinguishes them from any other type of volume. The service volumes have the prefix CE followed by a blank, then the number of the service volume. For example, CE 005 is a valid volser for a service volume.

Note: Typically, an imbedded blank in a volser label results in the volume being flagged as having an invalid volser; however, a blank in the service volume label ensures that it does not conflict with a customer volume label.

Cleaning Volume Labels

Customers can order cleaner cartridges that have labels installed from their normal supplier. Also, cleaner cartridge labels can be ordered from one of the suppliers in “Label Manufacturer Information” on page 122.

After a library is installed, an inventory operation must be performed before the 3494 is placed in the Online state. Before an inventory operation can begin, one or more masks identifying the volsers that are cleaning volumes must be defined from the Library Manager console. The option to define the cleaner masks is presented whenever one of the following selections is made from the Library Manager console:

- **Cleaner masks** is selected from the Commands pull-down.
- **Inventory new storage** is selected and none of the components in the library configuration have been inventoried.
- **Re-inventory complete system** is selected.

A dialog box is displayed on the Library Manager console with ten cleaner mask entry fields. When the masks are presented for the first time, the first mask is set to a default value of CLN*** and the other nine masks are set to blanks. The CLN prefix is not required; any valid volser is acceptable. The customer should select a valid volser that the operator can easily remember. The asterisk (*) character can be used in the mask and is interpreted as a wild card (pattern matching) character. When the masks are set, any volser labels that match any of the masks are considered cleaning volumes. See *Magstar 3494 Tape Library Operator Guide* for details.

Cleaner cartridges are assumed to be 3490E cleaners unless a media-type label indicates a **J**-type cleaner, which the 3590 tape subsystems use.

Note: The 3490E cleaner cartridges can only be used with 3490E tape subsystems, and the 3590 cleaner cartridges can only be used with 3590 tape subsystems.

Label Colors

The color of the characters is black on a white, pastel, or bright background.

Label Placement Requirements

The volser label must be placed totally within the label recess on the cartridge. It must be flat to within 0.5 mm (0.02 in.) over the length of the label and can have no folds, missing pieces, tears, or any extraneous markings. Failure to follow the placement requirements will result in degraded label verification reliability.

Optional Label Requirements

Optional customer labels are restricted to the label area on the top surface of the cartridge and must not contain bar codes. Labels must be contained entirely within the label recess and not interfere with the cartridge gripper's ability to engage the front lip of the label recess.

Label Manufacturer Information

For specific information about the labels, contact the appropriate manufacturer or contact your IBM representative for manufacturers in other countries.

Engineered Data Products Corp.
2550 West Midway Blvd.
Broomfield, CO 80020, U.S.A.

Wright Line Inc.
160 Gold Star Blvd.
Worcester, MA 01606, U.S.A.

Information Data Storage
Bldg. 224 - SN - 38
P.O. Box 33224
St. Paul, MN 55133, U.S.A.

Appendix B. Physical Planning Template

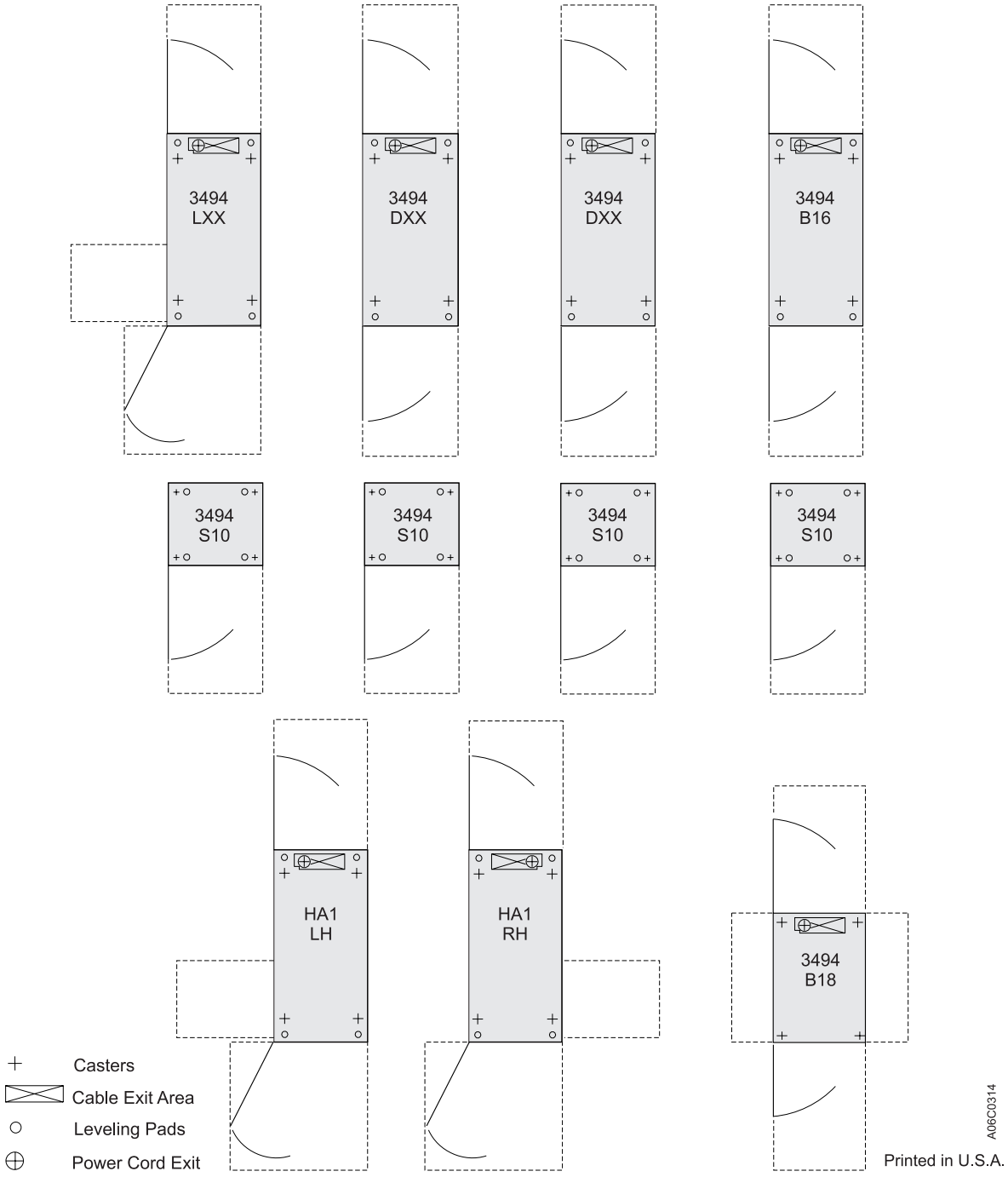
The following illustrations are copies of the *3494 Tape Library Physical Planning Template*. These templates are used during initial physical planning activities to determine the appropriate layout for the subsystem and space requirements.

The template illustrations can be copied as transparent foils and used in the same manner as the actual templates. However, some copiers do not produce exact-sized copies that can cause your templates to be slightly oversized or undersized.

Physical Planning Template

3494 Tape Library

METRIC SCALE: 10 mm = 0.5 m



Printed in U.S.A.

Physical Planning Template

3494 Tape Library

ENGLISH SCALE: ¼ inch = 1 foot

Appendix C. Planning for the 3494 and Task Allocation

The following section describes the organization of the planning team and the allocation of tasks and activities to achieve a successful migration to a 3494 tape library environment. These tasks may be performed by an individual or by a team; the important thing is to ensure that all the tasks are done.

Migration from a non-automated tape library environment to a 3494 automated tape library involves the following tasks:

- Select a planning team with assigned responsibilities to ensure all installation planning and migration tasks are completed. See “Select a Planning Team”.
- Select the appropriate library model and features to satisfy the requirements of the applications used (see “Chapter 1. Introduction” on page 1).
- Plan for the migration of tape subsystems into the 3494 tape library (see “Tape Subsystems” on page 21).
- Determine the software necessary to support the control of and applications used with the 3494 tape library (see “Chapter 3. Programming Support” on page 63).
- Plan the physical environment for the installation of the 3494 tape library (see “Tape Library Installation Requirements” on page 79).
- Plan for any operational changes that may be necessary in the 3494 tape library environment (see “Planning for Operations” on page 85).
- Determine required supplies and equipment necessary for host control and to support the 3494 tape library and proposed applications (see “Planning for Supplies and Equipment” on page 86).
- Plan for the data migration from a non-automated tape library to the 3494 tape library (see “Migrating Data” on page 94).

Select a Planning Team

To ensure an efficient 3494 installation, migration process, and operations, select a planning team or individual and define the required tasks. Suggested members (or skills required) include:

- Planning coordinator
- Physical planner
- System and application programmers
- Storage administrator
- Tape library operator

Planning Coordinator

The planning coordinator is responsible for ensuring that all planning and ordering activities proceed smoothly and on schedule. This person should work closely with your IBM representative.

Physical Planner

The physical planner is responsible for determining the location of the 3494 tape library. This person ensures that the correct environmental, electrical, and space requirements are met. This person should work closely with your IBM representative.

System and Application Programmers

The system and application programmers are responsible for choosing the licensed programs for the host system. The system programmer installs and tests the licensed programs to be used with the 3494. The system programmer also works with the storage administrator to define an installation's storage-management policy.

The application programmer creates and modifies specific application programs as needed. This person should work closely with your IBM representative.

Storage Administrator

The storage administrator defines a storage-management policy and plans for data migration.

See "Software Migration" on page 93 to locate information about:

- Planning your migration of data
- Analyzing your business environment
- Analyzing your processing environment
- Estimating your resource requirements

A plan must be completed to describe and control the steps necessary to complete migration. Also, a plan must be completed to migrate tape subsystems into the 3494 environment.

Tape Library Operator

The 3494 tape library operator is responsible for the daily operation of the 3494 tape library. The operator is typically not involved in the planning tasks and is not included in "Task Assignments" on page 128.

Typical tasks include loading and unloading tape cartridges from the 3494 input/output facility. During Manual mode operations, the operator mounts and demounts cartridges from library tape drives. For additional operator tasks, see "Planning for Library Operator Training" on page 87.

Task Assignments

Figures 28 through 35 identify many of the tasks associated with installation planning and migrating to a 3494 tape library. Individuals responsible for tasks are identified.

Table 28. Tasks before Ordering the 3494

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Select team members.	●				
Determine the 3494 library configuration. Identify host attachments and the channel cable layout.	●	●	●	●	●
Plan for how to migrate the tape subsystems into the 3494 environment.	●	●	●	●	●
Identify the location for the 3494 and arrange for any site modification.		●			
Identify the delivery route to the planned location of the 3494.		●			
Identify the staging area for the components of the 3494.		●			
Prepare the physical layout (floor plan) diagram.		●			
Determine required licensed programs.			●	●	
Determine cable requirements.	●	●			
Determine electrical requirements.		●			
Determine cooling requirements.		●			
Determine fire-suppression requirements.		●			
Consider end-user requirements.	●	●	●	●	●
Determine the required number of tape cartridges.			●		●
Determine the required number of cleaning cartridges.			●		●
Determine cartridge-label requirements.			●		●
Determine High-Capacity Input/Output Facility requirements.			●		●

Table 29. Tasks at Order Time

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Order the 3494 tape library.	●				
Order the conversion features needed.	●				
Order the language group feature if other than English.	●				
Order the specify features.	●				
Order the special features.	●				
Order units as necessary for tape subsystem migration.	●				
Order supplies (labels, cartridges, and cleaners).	●				
Conduct a systems assurance review with the IBM account team.	●	●	●	●	●
Order licensed programs.	●				

Table 30. Tasks 15 Weeks before Delivery

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Upgrade the operating system with IBM and appropriate original equipment manufacturer (OEM) support.			●		
Define storage-management policies, and plan for data conversion and migration.			●		●
Identify applications for migration to the 3494.			●	●	●
Determine who will install the electrical wiring and outlets.		●			
Confirm the 3494 and the supplies orders.	●				

Table 31. Tasks 10 Weeks before Delivery

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Contact your IBM representative to discuss any concerns about the planning process.	●	●	●	●	●
Arrange for the installation of the electrical wiring and outlets.		●			●

Table 32. Tasks 6 Weeks before Delivery

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Review the progress of the installation with your IBM representative. Identify and resolve any scheduling problems.	●	●	●	●	●
Customize the software installation, for example, object access method (OAM) exits and automatic class selection (ACS).			●		
Start the installation of electrical wiring and outlets.		●			

Table 33. Tasks 4 Weeks before Delivery

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Complete the installation and testing of the electrical wiring and outlets.		●			
Complete the site preparation.		●			
Have your installation planning representative verify the site preparation.		●			
Complete the software test, and test on the production host processors.			●	●	
Train the 3494 tape library operator.	●				●
Complete regression testing of the operating system and application software.			●	●	

Table 34. Tasks at Arrival Time of the 3494

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Ensure that the 3494 tape library is placed as close to final location as possible.		●			
Arrange for the service representative to install the hardware.	●				

Table 35. Tasks after Installation of the 3494

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Load test cartridges in library.	●				●
Verify tape library operator training.	●				●
Identify data volumes to load in library.	●				●
Identify scratch volumes to load in library.	●				●
Load production cartridges in library.	●				●
Set the drive-cleaning schedule.	●				●
Set the preventive maintenance (PM) schedule.	●				●
Install fire-suppression equipment as required.		●			
Conduct a post review of the planning process to identify problems that can be avoided with future installations.	●	●	●	●	●

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DFSMSrmm
DFSMS/MVS
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ES/3090
ES/4381
ES/9000
IBM
IBMLink
Magstar
Micro Channel
MVS/ESA
Operating System/2
Operating System/400
OS/2
OS/390
OS/400
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Glossary

This glossary defines the special terms, abbreviations, and acronyms used in this publication. If you do not find the term you are looking for, refer to the *Dictionary of Computing*, New York: McGraw-Hill, 1994.

A

advanced program-to-program communication (APPC). A protocol that allows systems or tape drives to be attached to the token-ring network so that they may communicate and process the same programs.

automatic cartridge loader. A tape drive that allows multiple cartridges to be loaded and unloaded from a tape drive without operator intervention.

available. The term used to indicate that a component is available for use by the Library Manager. Components in the tape library (cartridge accessor, grippers, input/output facilities, and tape drives) are either available or unavailable for use. Compare with *online*. Contrast with *unavailable*.

C

cartridge. Term used to refer to the IBM Cartridge System Tape, the IBM Enhanced Capacity Cartridge System Tape, or the IBM High Performance Cartridge Tape.

cartridge accessor. The physical mechanisms, within the tape library, that identify, retrieve, and move tape cartridges. It consists of a gripper, vision system, picker, and accessor mechanism.

cartridge automation. The process where the tape library automatically performs actions for inserting, ejecting, mounting, demounting, loading, and unloading of tape cartridges.

Cartridge System Tape (CST). The base tape cartridge media that is used with 3480, 3490, and 3490E tape subsystems.

category. A grouping of volumes with a common attribute such as volumes to eject, volumes newly added to the library, and volumes to clean tape drives.

cell. See *storage cell*.

code. The term used to refer to the internal programs that comprise the Library Manager application.

command. A control signal that initiates an action or the beginning of a sequence of actions.

component. A part of a functional unit, for example, the gripper mechanism is a component of the cartridge accessor.

control program. The program in the host system that schedules and supervises the execution of application programs.

convenience input. The term used when loading small numbers of tape cartridges into the tape library using the Convenience Input/Output Station. See *convenience input/output station*.

convenience input/output station. An optional feature of the tape library used to load or unload small numbers of cartridges into or out of the tape library. The station supports only one type of operation at a time, either input or output.

convenience output. The term used when unloading small numbers of tape cartridges from the tape library using the Convenience Input/Output Station. See *convenience input/output station*.

D

database. A collection of data that can be accessed by a data processing system for a specific purpose.

demount. A host command to remove a cartridge from a tape drive.

disk drive. See *hard disk*.

diskette. A thin, flexible magnetic disk and a protective jacket, in which the disk is permanently enclosed. See also *hard disk*.

dump. To record data, at a particular instant, for the purpose of safeguarding or analyzing.

E

eject. The operation of moving a cartridge to an output station in the tape library. See also *insert*.

Emergency Power Off (EPO). A switch that removes all power from the equipment in the 3494 tape library but does not affect power to lighting circuits.

enable. To provide the means or opportunity. The modification of system, control unit, or tape drive action through the change of a software module or a hardware switch (circuit jumper) position.

Enhanced Capacity Cartridge System Tape (ECCST). Cartridge system tape with increased capacity that can be used only with 3490E enhanced capability models. Visually identified by a two-tone cartridge case.

Enterprise Systems Connection (ESCON). A set of IBM products and services that provide a dynamically connected environment within an enterprise.

Ethernet. A local area network that allows multiple stations to access a data transmission without prior coordination.

export. An Advanced Function that moves VTS logical volumes to an Exported Stacked Volume, which may be removed from the tape library.

exported stacked volume. A High Performance Cartridge Tape cartridge that is a “container” for VTS exported logical volumes.

F

FC. Feature code.

file protected. Pertaining to a tape volume from which data can be read only. Data cannot be written on or erased from the tape.

frame. (1) A housing for machine or tape drive elements. (2) The hardware support structure, covers, and all parts mounted therein that are packaged as one entity for shipping.

G

gripper. A part attached to the picker of the cartridge accessor that loads, unloads, and moves cartridges between storage cells, tape drives, and the Convenience Input/Output Station.

H

hard disk. A rigid, non-removable disk residing in the Library Manager.

high availability unit. A second Library Manager, a second accessor, and service bay frames, which improve library availability.

High Performance Cartridge Tape (HPCT). Cartridge system tape with increased capacity that can be used with 3590 tape subsystems only. Visually identified by a blue leader block and two blue inserts with identification notches on the edge of the cartridge case.

host system. A data processing system that is used to prepare programs and the operating environments for use on another computer or controller.

I

import. An Advanced Function that moves previously exported logical volumes from an Exported Stacked Volume back into the VTS.

improved data recording capability (IDRC). A data recording mode that, if installed and enabled on the 3490E Magnetic Tape Subsystem, can increase the effective cartridge data capacity and the effective data rate if invoked.

initial program load (IPL). The initialization procedure that causes an operating system to commence operation.

insert. The operation of adding cartridges to the tape library. See also *eject.*

inventory. The operation of identifying the location of each tape cartridge contained in the tape library.

invoke. To start a command, procedure or program. The request for a feature or function to be used in future processing activities through the use of software or hardware commands.

L

Library Manager. The controller for the 3494. It manages the location of tape cartridges, monitors performance, issues commands to the hardware, displays status, and performs other functions. It communicates with host systems through the tape control unit in each 3494 or, in AS/400 systems, directly through the RS-232 interface. The Library Manager also provides operator and service panel functions.

load. (1) The process, performed by an operator or by the cartridge accessor, of placing a cartridge into a location within the tape library for later use or retrieval. (2) The term used when describing the action of the tape transport when it removes the leader block from a cartridge and threads the media through the internal tape path.

local area network (LAN). A computer network located on a user’s premises within a limited geographical area. Communication within a LAN is not subject to external regulations; however, communication across a LAN boundary may be subject to regulation.

M

manual mode. A mode of operation, where the operator, under the direction of the Library Manager, manually locates and moves tape cartridges to and from storage cells and tape units. This mode allows data to be retrieved when normal tape library operations are interrupted by unexpected conditions.

MES. Miscellaneous Equipment Specification.

mount. A host command to insert a cartridge into a tape unit.

mount from input station. A function available through the Commands pull-down on the Library Manager. It allows transient cartridges outside the library to be mounted on tape drives within the library and is used to support stand-alone programs that do not require the support of a full operating system.

N

NEMA. National Electrical Manufacturers' Association.

O

offline. Pertaining to the operation of a unit when not under the direct control of a host system. Compare with *unavailable*. Contrast with *online*.

online. Pertaining to the operation of a unit when under the direct control of a host system. Compare with *available*. Contrast with *offline*.

original equipment manufacturers interface (OEMI). A common communication interface that allows connection from a host to a tape drive.

R

Reduced Instruction Set Computer (RISC). A computer that uses a small, simplified set of frequently used instructions for rapid execution.

remote library manager console. The Remote Library Manager Console feature permits control or monitoring of the 3494 Library Manager from a location that is remote from the library.

reserved storage cell. A cell in the control unit frame that is reserved for use by the service representative or for error recovery operations.

S

setup. The preparation of a computing system to perform a job or job step.

small computer system interface (SCSI). An adapter that supports the attachment of various direct access storage drives and tape drives to the RS/6000.

storage. (1) A drive into which recorded information can be entered, retained, and processed, and from which it can be retrieved. (2) The action of placing data into a storage drive. (3) A facility in which data can be retained.

storage cell. A location in the tape library where a cartridge can be loaded or unloaded. This includes the storage cells in a storage frame and the Convenience Input/Output Station.

T

tape cartridge. A container holding magnetic tape that can be processed without separating it from the container.

tape drive. A drive that is used for moving magnetic tape and includes the mechanisms for writing and reading data to and from tape. See also *tape unit* and *transport*.

tape library. (1) A term used to refer to the customer's collection of tapes. Within the 3494 tape library, it describes the set of cartridges contained within the enclosure. (2) An automated tape library (for example, the Magstar 3494 Tape Library) that consists of cartridge storage frames, tape subsystems, and controlling hardware and software. The tape library performs host-directed tape cartridge mounts and demounts without operator intervention.

tape management software. A program that controls the scratch status of tape volumes.

tape subsystem. A tape unit that includes the logic interface hardware necessary to operate with a host processor, for example, 3490E Model CxA.

tape unit. A drive that contains tape drives and their associated power supplies and electronics.

token-ring network. A local area network (LAN) that uses ring topology, where tokens are passed from node to node. A node that is ready to send can capture a token and insert data for transmission.

transient mount. See *mount from input station*.

Transmission Control Protocol/Internet Protocol (TCP/IP). A set of communication protocols that supports peer-to-peer connectivity functions for both local and wide area networks.

transport. The mechanism inside a tape drive that moves tape media. It is comprised of loading, threading, and guiding mechanisms and motors.

U

unavailable. A term used to indicate that a component in the tape library (for example, the cartridge accessor) is unavailable for use by the Library Manager. Compare with *offline*. Contrast with *available*.

unit. (1) An entity that can accomplish a specific purpose, for example, 3490E tape drive. (2) An individual part of the tape library that can be added or

deleted from a tape library configuration, for example, 3490E control unit, 3490E tape unit, storage frame, or input/output station.

Unit Emergency Power Off (UEPO). The 3494 control unit switch that, when operated in an emergency, causes all subsystem frames to be disconnected from the ac power source.

Unit Power Off (UPO). A switch that removes all power from a specific unit of the tape library. For example, a 3490E UPO removes power from a 3490E subsystem.

unload. To remove cartridges from a 3490E tape drive or its integrated cartridge loader.

V

vision system. A component mounted on the cartridge accessor picker that is used to read the bar code labels on the tape cartridges. These labels must conform to the *Automation Identification Manufacturer's Uniform Symbol Description Version 3*, also known as code 39.

volser. Volume serial identifier. The physical label on the cartridge. Also, the same or different identifier encoded on the magnetic tape.

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Introduction and Planning Guide

Publication No. GA32-0279-11

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