

AS/400e series



# Automated Tape Library Planning and Management

*Version 4*



AS/400e series



# Automated Tape Library Planning and Management

*Version 4*

**Note**

Before using this information and the product it supports, be sure to read the information in "Notices" on page 127.

**Third Edition (September 1998)**

This edition applies to version 4, release 3, modification 0 of IBM Operating System/400 (product number 5769-SS1) and to all subsequent releases and modifications until otherwise indicated in new editions.

This edition replaces SC41-5309-01. This edition applies only to reduced instruction set computer (RISC) systems.

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## About Automated Tape Library Planning and Management (SC41-5309-02)

This document provides information on the following:

- Features and functions of tape automation on your AS/400 business computing system
- Specific tape automation applications
- Designing your tape automation setup to maximize the derived benefits
- How a tape automation system may be used
- Enhancing your tape automation setup by using an application such as Backup Recovery and Media Services (BRMS) for AS/400.

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### Who should read this book

This book is intended for programmers and support personnel who are responsible for configuring and maintaining a tape automation system.

Before using this book, you should be familiar with general programming concepts and terminology, and have a general understanding of the AS/400 system and the OS/400 licensed program.

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### Conventions and terminology used in this book

The AS/400 displays in this book could be shown as they are presented through Graphical Access for AS/400, which is part of Client Access on the personal computer. The example displays in this book could also be shown without Graphical Access for AS/400 available. Figure 1 on page xii shows both types of displays.

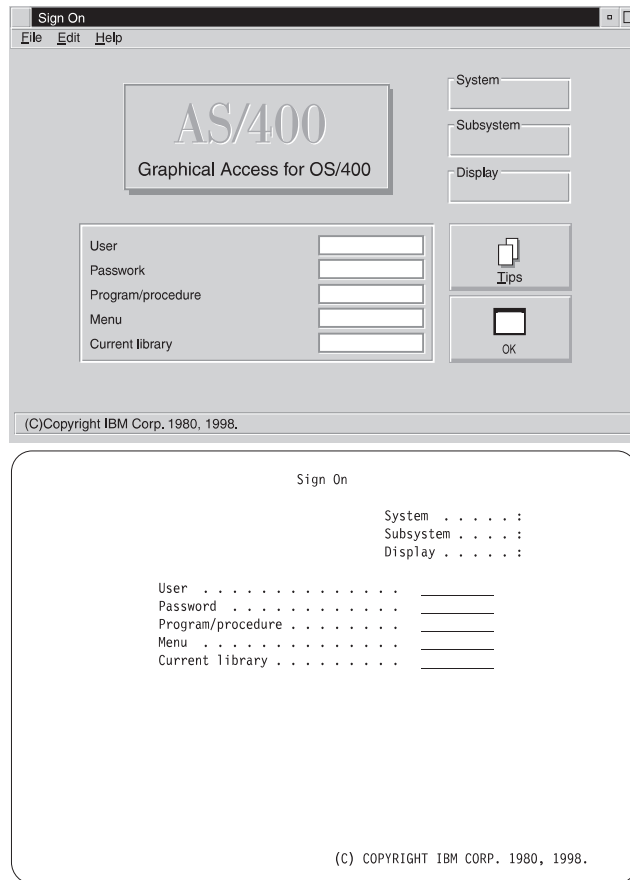


Figure 1. Types of AS/400 Displays

## AS/400 Operations Navigator

AS/400 Operations Navigator is a powerful graphical interface for Windows 95/NT clients. With AS/400 Operations Navigator, you can use your Windows 95/NT skills to manage and administer your AS/400 systems.

- You can work with basic operations (messages, printer output, and printers), job management, system configuration, network administration, security, users and groups, database administration, file systems, and multimedia.
- You can schedule regular system backups, work with Interprocess Communication through application development, and manage multiple AS/400 systems through a central system by using Management Central. You can also customize the amount of Operations Navigator function that a user or user group can use through application administration.
- You can create a shortcut to any item in the explorer view of Operations Navigator. For example, you can create a shortcut either to **Basic Operations** or to the items that are listed under **Basic Operations (Messages, Printer Output, and Printers)**. You can even create a shortcut to an individual printer or use a shortcut as a fast way to open the item.

Figure 2 on page xiii shows an example of the Operations Navigator display:

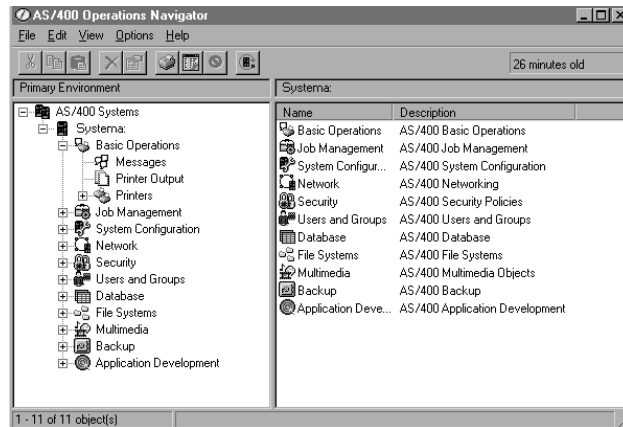


Figure 2. AS/400 Operations Navigator Display

IBM recommends that you use this new interface. It has online help to guide you. While we develop this interface, you will still need to use either of the following to do some of your tasks:

- Graphical Access (which provides a graphical interface to AS/400 screens). Graphical Access is part of the base Client Access.
- A traditional emulator such as PC5250.

## Installing Operations Navigator subcomponents

AS/400 Operations Navigator is packaged as separately installable subcomponents. If you are upgrading from a previous release of AS/400 Operations Navigator, only those subcomponents that correspond to the function that is contained in the previous release will be installed. If you are installing for the first time and you use the **Typical** or **Minimum** installation options, the following options are installed by default:

- Operations Navigator base support
- Basic operations (messages, printer output, and printers)

To install additional AS/400 Operations Navigator subcomponents, either use the **Custom** installation option or use **selective setup** to add subcomponents after Operations Navigator has been installed:

1. Display the list of currently installed subcomponents in the **Component Selection** window of **Custom** installation or selective setup.
2. Select AS/400 Operations Navigator and click **Details**.
3. Select any additional subcomponents that you want to install and continue with **Custom** installation or selective setup.

**Note:** To use AS/400 Operations Navigator, you must have Client Access installed on your Windows 95/NT PC and have an AS/400 connection from that PC. For help in connecting your Windows 95/NT PC to your AS/400 system, consult *Client Access for Windows 95/NT - Setup*, SC41-3512.

## Accessing AS/400 Operations Navigator

To access Operations Navigator after you install Client Access and create an AS/400 connection, do the following:

1. Double-click the **Client Access** folder on your desktop.

2. Double-click the **Operations Navigator** icon to open Operations Navigator. You can also drag the icon to your desktop for even quicker access.

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## Prerequisite and related information

Use the AS/400 Information Center as a starting point for your AS/400 information needs. It is available in either of the following ways:

- The Internet at this uniform resource locator (URL) address:  
<http://publib.boulder.ibm.com/html/as400/infocenter.html>
- On CD-ROM: *AS/400e series Information Center*, SK3T-2027.

The AS/400 Information Center contains browsable information on important topics such as Java, program temporary fixes (PTFs), and Internet security. It also contains hypertext links to related topics, including Internet links to Web sites such as the AS/400 Technical Studio, the AS/400 Softcopy Library, and the AS/400 home page.

For information about Advanced 36 publications, see the *Advanced 36 Information Directory*, SC21-8292, in the AS/400 Softcopy Library.

For information about other AS/400 publications (except Advanced 36), see either of the following:

- The *Publications Reference*, SC41-5003, in the AS/400 Softcopy Library.
- The AS/400 online library is available on the World Wide Web at the following uniform resource locator (URL) address:  
<http://as400bks.rochester.ibm.com/>

For a list of related publications, see the “Bibliography” on page 125.

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## How to send your comments

Your feedback is important in helping to provide the most accurate and high-quality information. If you have any comments about this book or any other AS/400 documentation, fill out the readers’ comment form at the back of this book.

- If you prefer to send comments by mail, use the readers’ comment form with the address that is printed on the back. If you are mailing a readers’ comment form from a country other than the United States, you can give the form to the local IBM branch office or IBM representative for postage-paid mailing.
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  - United States and Canada: 1-800-937-3430
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Be sure to include the following:

- The name of the book.
- The publication number of the book.
- The page number or topic to which your comment applies.



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## Summary of Changes

Changes have been made to *Automated Tape Library Planning and Management* to support the following:

- New functionality provided by Version 4 Release 3 Modification 0
- New fields on the Create Device Description Media Library (CRTDEVMLB) screen
- Revised information on importing cartridges
- Revised information on using a tape resource as a stand-alone device
- New media library resource allocation attributes and new commands and APIs to manipulate them
- New \*MLBA option on the Display Job (DSPJOB) and Work with Job (WRKJOB) command



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# Part 1. Overview of Tape Automation



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# Chapter 1. Introduction to Tape Automation

This chapter describes the function and purpose of tape automation in your business. Both automated tape libraries (ATL) and random access cartridge loaders (RACL) with proper media management can be used for unattended save and restore operations, archival and retrieval, spool archiving, and other tape related tasks.

---

## Description of Tape Automation

This topic describes the common components and differences of tape automation. An Automated Tape Library (ATL) is one form of tape automation. Typically an ATL supports multiple systems across different platforms and large quantities of cartridges. A Random Access Cartridge Loader (RACL) is another form of tape automation. Generally a RACL device supports one or two systems and contains a small number of cartridges.

- For a single host system and a limited DASD capacity, the random access cartridge loader can be more appropriate.
- For larger data centers with a collection of host systems and large DASD capacities, the automated tape library can be more appropriate.

It is not uncommon to mix the two solutions according to the availability and backup scheduling requirements of each host system.

## Common Components of Tape Automation

Tape automation has the following main components:

### Slot

A space that contains a cartridge.

### Drive

A device, including a transport and heads, for reading and writing data to a cartridge.

### Accessor

The mechanism for detecting, gripping, removing, and transporting a cartridge between a slot, drive and other elements of the ATL or RACL.

### Cartridge

A self-contained, removable unit that contains the readable or writable media. A single cartridge has a minimum of two identifiers. The **logical volume identifier** is the identifier of the volume written in the volume header information on the media (normally with an Initialize Tape command). The **cartridge identifier** is the identifier of the volume described on a label attached to the cartridge (normally a bar-coded version of that identifier). You should ensure that the logical volume ID and the cartridge ID are identical.

OS/400 issues an:

- Inquiry message when the logical volume ID and the cartridge ID do not match for output operations, such as the save library operation
- Informational message when the logical volume ID and the cartridge ID do not match for input operations, such as the restore library operation.

**Magazine**

A removable cartridge holder that aids in the insertion and removal of multiple cartridges.

**Input/Output stations**

I/O stations are needed to assist with the movement of cartridges to and from the cartridge storage area. Following are the types of I/O stations:

**Convenience I/O station**

This feature allows the transfer of cartridges directly in and out of the storage area or device without interrupting the operation of the library. It may contain a single or multiple cartridges.

**High-capacity output area**

This is a special reserved area in the main cartridge storage. This area is used for removal of large quantities of cartridges. This may require automatic library operation to be halted to gain access to the high capacity area.

## Automated Tape Library

Figure 3 on page 5 shows the parts of an automated tape library and how it relates to the parts of an AS/400 business computing system. The smaller automated tape library is similar to the random access cartridge loader shown on Figure 4 on page 7. Consider the following when reviewing Figure 3:

- A convenience I/O station (not shown), is typically an optional feature of an automated tape library.
- The automated tape library is controlled by its own management software. Control of the automated tape library is achieved by using:
  - OS/400 control language (CL) commands
  - Backup Recovery and Media Services/400 (BRMS for AS/400) commands

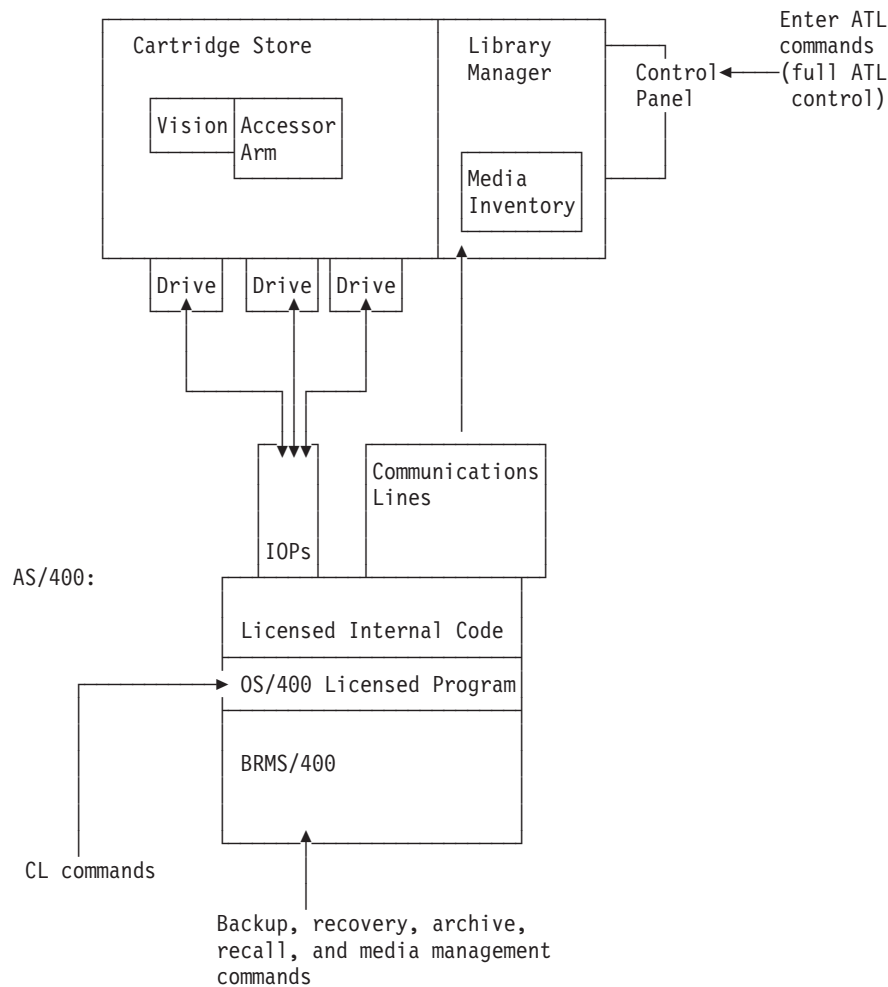


Figure 3. Automated Tape Library

## Components of an Automated Tape Library

The automated tape library comprises the following:

### Inventory database

The larger automated tape library has its own inventory list of cartridges and slot locations. This enables management, seek, and mount operations to continue even if the host system is disabled. The smaller automated tape library (RACL) depends on the host system to keep track of cartridge locations.

### Library manager

The larger automated tape library has its own software for controlling and managing the inventory. The smaller automated tape library (RACL) does not have a library manager.

### Vision system

The automated tape library has a vision system that reads the external labels on the cartridges to determine the physical cartridge identifier.

### Input/output station

The input/output station is used to add/remove cartridges from the inventory of the ATL without interrupting operations.

### **Shared systems**

Because the inventory of a larger ATL is kept by the library manager, an ATL can generally be shared with multiple systems and multiple platforms. Smaller automated tape libraries may have the inventory kept by the host that is using it. It may be up to the user to manage the inventory.

### **Automated cartridge facility within an automated tape library**

For the largest automated tape library solutions, it can be appropriate to house drives with their own automated cartridge facility. This is a form of random access cartridge loader within the automated tape library. In these cases, the random access cartridge loader cartridges act as higher speed access, cache-type devices for the automated tape library.

## **Operating States of Tape Automation**

During operation, the automated tape library can be in any one of the following states:

### **Online**

The library receives host commands.

### **Offline**

No host commands are accepted, and no status messages are sent to the attached hosts.

## **Operating Modes of the Automated Tape Library**

An automated tape library has several modes in which it can operate. Not all automated tape libraries have all these modes. The possible modes for an automated tape library are:

### **Pause**

The library is paused from all operations to allow manual intervention to correct a problem or open the storage area to add or remove cartridges.

### **Automatic or Random**

The library responds automatically to all requests sent by any attached hosts.

### **Manual**

All physical motion of the library components is stopped. The library still receives requests from attached hosts, but an operator needs to respond to these requests by manually locating, loading, unloading, and replacing cartridges. This mode is most often used when the Accessor has failed and tape functions need to be done prior to the repair.

### **Stand-Alone Mount mode or Sequential mode**

In this mode the device is allocated to a set of cartridges, where this set of cartridges are loaded sequentially to the device. This set of cartridges may be from the inventory or from the I/O station.

## **Random Access Cartridge Loader**

Figure 4 on page 7 shows the parts of a random access cartridge loader and how they relate to the parts of the AS/400 system that is connected.



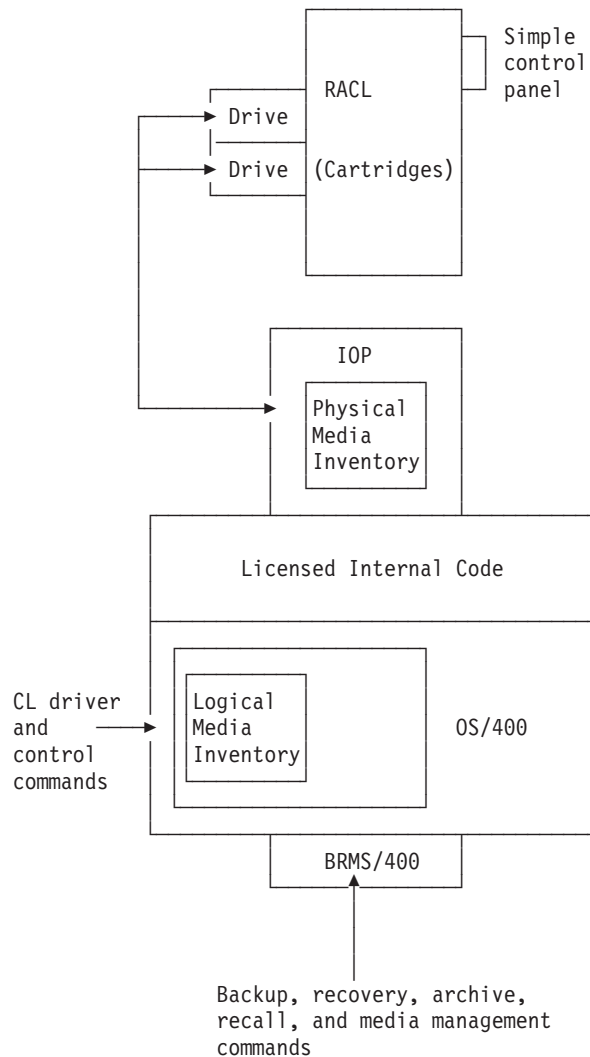


Figure 4. Drive with Random Access Cartridge Loader

## Components of a Random Access Cartridge Loader

The random access cartridge loader comprises the following:

### Inventory database

The random access cartridge loader and some smaller automated tape libraries depend on the host to keep track of the cartridge locations.

### Vision system

The random access cartridge loader generally does not have a vision system (for example, no laser bar-code reader). The random access cartridge loader relies on OS/400 to specify which tape cartridges to load.

### Input/output slot

The input/output slot is used to add/remove a cartridge from the RACL inventory without interrupting operations.

### **Shared systems**

Because the inventory of a random access cartridge loader is kept by the host that uses it, additional complexity is created when the device is shared with another host. It is likely that a random access cartridge loader is dedicated to a single host.

## **Operating Modes of the Random Access Cartridge Loader**

A random access cartridge loader has several modes of operation. Not all random access cartridge loaders have all these modes. The possible modes for a random access cartridge loader are:

### **Accumulate**

Cartridges are placed in the I/O slot for loading into the device. When the device is unloaded the cartridge is moved to a storage slot.

### **Automatic/sequential**

The storage slots act as an automatic cartridge loader (similar to the automated cartridge loader on the 3490E drives).

### **Library**

A drive installed in an automated tape library that has its own local magazine within a tape library. An Automatic Cartridge Facility (ACF) may not be installed. If an ACF is installed, it is used as a quick-access cache.

### **Manual**

No automatic functions are available. The drives must be individually loaded by the operator.

### **Random**

The local magazine on the drive is used as a mini library. The drive is in random access cartridge loader mode.

### **System**

The drive is in automatic mode, but requires a specific system request to load the next cartridge.

**Note:** The AS/400 business computing systems support all these modes except the system mode.

---

## **Getting Your Automated Tape Library Up and Running**

You can performing the following steps once your Automated Tape Library has been set up and connected to your AS/400 system. These steps will allow you to begin working with your Automated Tape Library. You should consult the documentation for your device for more specific information.

1. Ensure that the tape library is set to random mode. If it is not, use the device panel to set it to random mode.
2. Type WRKMLBSTS and press the Enter key. This allows you to work with the status of the device.
3. In the option field next to each resource, select 4=Allocate and press the Enter key.
4. In the option field next to the tape library device, select 9=Work with volumes and press the Enter key. This will bring up the Work with Tape Cartridges screen.
5. On the Work with Tape Cartridges screen, you may choose an option such as 11=DSPTAP.

---

## Tape Automation and BRMS for AS/400

The combination of BRMS for AS/400 with a tape automation system provides a total automatic solution for all your tape requirements. Using tape automation and the BRMS for AS/400 licensed program, you can design and carry out a solution that shows the results in the following ways:

### **Reduced operational cost**

Less manual intervention is required to operate tape units because most of your tape operation is automated and unattended.

### **Improved system availability**

The reduction in time for tape mounting and backup times. BRMS for AS/400 enables you to streamline your backups.

### **Reduced capital cost**

Archiving and retrieving functions enable you to increase the quantity of on line (on-disk) data that can be moved to less expensive tape media.

### **Improved service**

You can experience faster and more accurate responses to your tape-related requests. You can gain more control of your tape management operation.

### **Reduced management cost**

Day-to-day operations, such as tape and disk capacity management, are more automated and simplified.



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## Chapter 2. Tape Automation Supported on AS/400

This chapter discusses the hardware characteristics and attachment limitations of the various types of tape automation supported on AS/400.

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### 3494 Automated Tape Library Dataserver

The 3494 Automated Tape Library Dataserver provides automated tape solutions for the AS/400 system user as well as for users of the ES/9000, RISC System/6000, and some non-IBM systems. The 3494 Automated Tape Library Dataserver supports the 3490E models C1A, C2A, F1A, and 3590 Tape Subsystem model B1A devices.

The 3494 Automated Tape Library Dataserver is modular and can grow along with your storage and usage requirements. For example, the entry-level configuration of one drive can hold as many as 240 cartridges and can be expanded to as many as 6240 or more cartridges.

### Tape Drives of the 3494 Automated Tape Library Dataserver

#### 3490E CxA Tape Drives

The 3490E CxA tape drives provide high-capacity, 36-track bidirectional recording and improved data recording capability (IDRC). This can provide as much as 2.5GB of data on a cartridge, depending on the data pattern. The 3490E can read cartridges recorded in 18-track format, but it cannot write in 18-track format.

#### 3490E F1A Tape Drives

The 3490E F1A tape drives provide high-capacity, 36-track bidirectional recording, and improved data recording capability (IDRC). This can provide as much as 2.5GB of data on a cartridge, depending on the data pattern. The 3490E can read cartridges that are recorded in 18-track format, but it cannot write in 18-track format.

The 3490E F1A device will report in as a 3490E C1A device. Native F-mode is not supported in the 3494 library.

#### 3590 B1A Tape Drive

The 3590 Tape Subsystem provides a high-capacity, high-performance, 128 track interleaved serpentine recording format. Lempel Ziv (LZ1) data compaction is used to achieve a capacity of up to 30 GB of data. The 3590 Tape Subsystem does not support reading or writing of the 3480 or 3490E 18 track or 36 track tapes.

### Capacities and Configurations of the 3494 Automated Tape Library Dataserver

#### Control Unit (Models L10/L12)

The 3494 Automated Tape Library Dataserver control unit includes the library manager, operator control panel, tape drives, cartridges, tape cartridge accessor and an optional convenience I/O station. It has the capacity for as many as 240 cartridges. The model L10 has 1 or 2 3490E Cxx/F1A tape drives. The model L12 has 1 or 2 3590 B1A tape drives. The optional convenience I/O stations makes it easier for you to insert or remove as many as 10 or 30 cartridges from the library in

a single operation. This is useful for archive and recovery operations. If this is not installed, cartridges may be inserted or removed to or from the 3494 Automated Tape Library Dataserver only by opening the front door. Opening this door stops the accessor and automatically initiates a rechecking of the 3494 Automated Tape Library Dataserver inventory of cartridges when the door is closed. This takes time and disrupts the availability of the 3494 Automated Tape Library Dataserver.

### **Drive Unit (Models D10/D12)**

The drive unit (formally feature 5300) consists of tape drives and storage for the cartridges. 1 or 2 3490E drives can be put in the model D10 drive unit. 1 to 6 3590 drives can be put in the model D12 drive unit. The drive unit has space for storing 300 tape cartridges.

### **Storage Unit (Model S10)**

The storage unit (formally feature 5400) contains only cartridges. Each storage unit can store 400 cartridges.

For additional information, refer to the *3494 Tape Library Dataserver Operator's Guide*.

## **System Attachment of the 3494 Automated Tape Library Dataserver**

The 3494 Automated Tape Library Dataserver is attached to the AS/400 system with one connection for the library manager and one or more connections for the tape drives. The library manager connection uses a communications line (either EIA-232 or LAN). Only one communications line is required for each AS/400 system. The tape drive connection can be a S/370 parallel channel or SCSI attachment.

**Note:** The Electronic Communications Support (ECS) adapter on the AS/400 system should not be used to support the 3494 Automated Tape Library Dataserver. It is reserved for obtaining electronic customer support.

Figure 5 on page 13 shows how the 3494 Automated Tape Library Dataserver is supported by an AS/400 system.

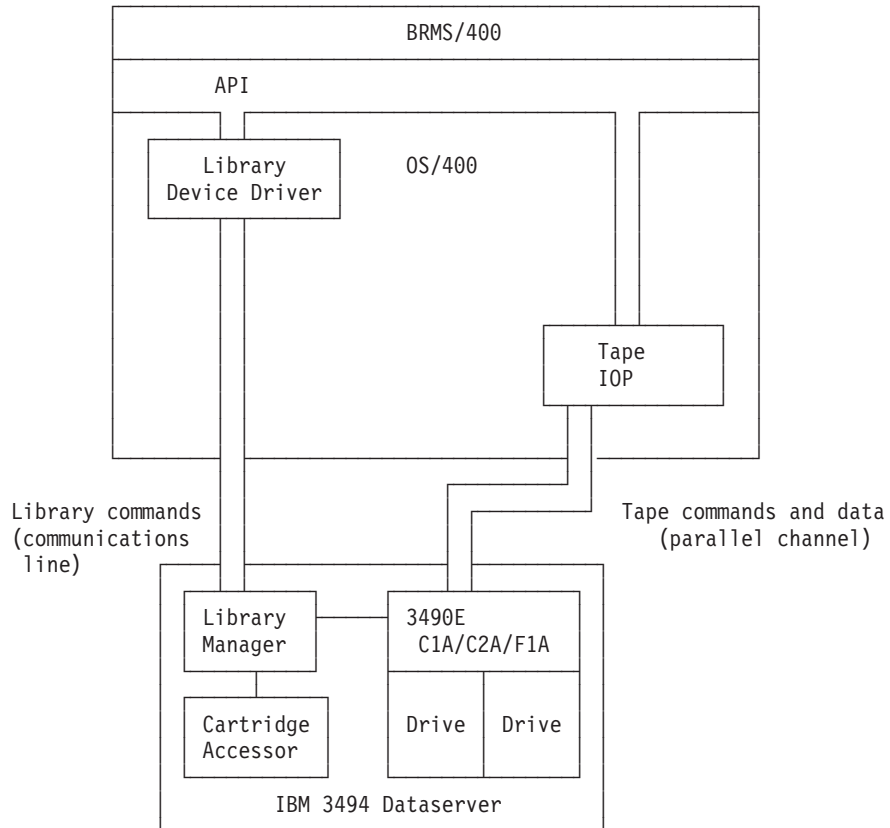


Figure 5. 3494 Automated Tape Library Dataserver (AS/400 Environment)

## Cable Length Restrictions for the 3494 Automated Tape Library Dataserver

The 3494 Automated Tape Library Dataserver requires a minimum of 2 host attachments, one for the library interface and one for the tape device. When calculating the maximum interface distance both connections must be considered.

### RS232

The 3494 Automated Tape Library Dataserver EIA-232 communications cable has a limit of 50 feet, unless a modem is used to boost the signals. If you need to locate your 3494 Automated Tape Library Dataserver more than 50 feet away from an AS/400, you should seek advice on the modems and communications equipment required to support this environment. The 3494 Automated Tape Library Dataserver has a feature that provides a 400 foot cable for the RS232 attachment on AS/400.

**Note:** The 3494 Automated Tape Library Dataserver EIA-232 cable is not connected directly to the AS/400 communications port. The EIA cable that is shipped with the AS/400 communications hardware connects into the 3494 Automated Tape Library Dataserver EIA-232 cable.

### LAN

The 3494 Automated Tape Library Dataserver LAN communications cable limit

is determined by the type of LAN implemented. Typical LAN technology supports connections at a distance of 1000 meters. Be sure to verify your particular LAN before installation.

### S/370 Parallel Channel

The 3490E device cable has a limit of 400 feet. Various features are provided for the 3490E cabling. You should ensure that the correct ones are ordered for your particular setup.

### SCSI

The 3590/3490E Tape Subsystem device cable has a limit of 25 meters. Various features are provided for the 3590/3490E Tape Subsystem cabling. You should ensure that the correct ones are ordered for your particular setup.

## Configurations of Multiple Systems to Multiple 3494 Automated Tape Library Dataservers

### Multiple AS/400 Systems Sharing a 3494 Automated Tape Library Dataserver

The 3494 Automated Tape Library Dataserver can be shared by as many as sixteen AS/400 systems. Each AS/400 requires one communications line and one tape drive attachment. With BRMS for AS/400 controlling the 3494 Automated Tape Library Dataserver, the cartridges within the library can be shared among any of the attached AS/400 systems when you use the common media inventory function of BRMS for AS/400.

Figure 6 shows two AS/400 systems sharing the 3494 Automated Tape Library Dataserver.

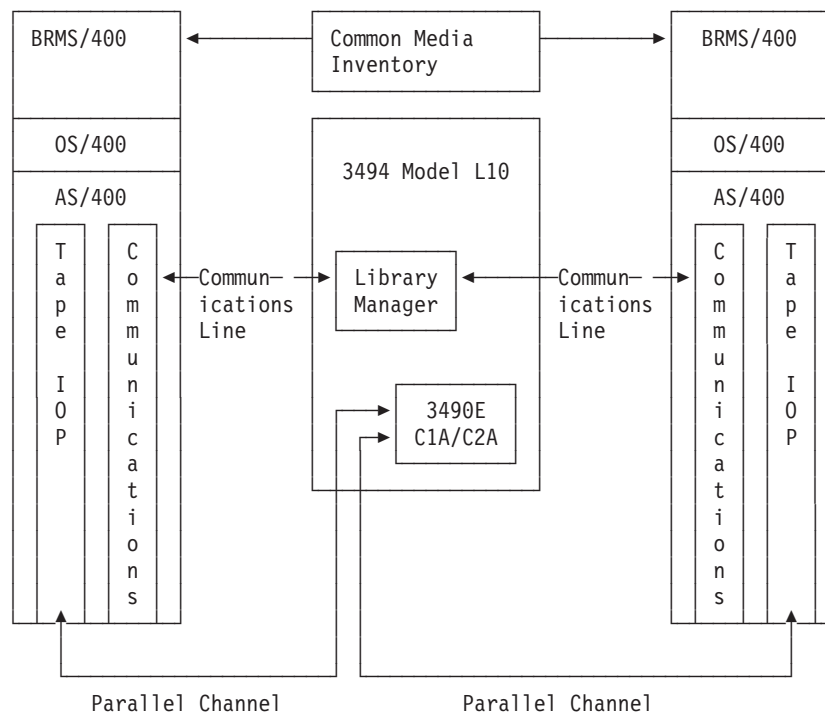


Figure 6. 3494 Automated Tape Library Dataserver (Multiple AS/400 Library Attachments)



## Multiple 3494 Automated Tape Library Dataservers on One AS/400 System

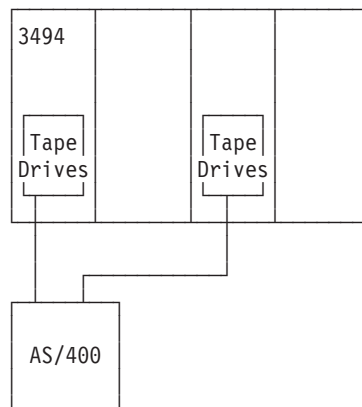
The AS/400 system can support attachment to multiple 3494 Automated Tape Library Dataservers. Each 3494 Automated Tape Library Dataserver must have at least one communications line and at least one tape drive connection to the AS/400. The number of 3494 Automated Tape Library Dataservers that can be attached to an AS/400 system depends on the number of tape IOP features that can be installed and supported on a given AS/400 system. BRMS for AS/400 provides support for multiple 3494 Automated Tape Library Dataservers attached to a single AS/400 system.

## Multiple Tape Drives in one 3494 Automated Tape Library Dataserver

Larger AS/400 systems can reduce backup times by breaking the operation into multiple concurrent saves to multiple devices.

Not all connections between an AS/400 system and the 3494 Automated Tape Library Dataserver are valid. A single AS/400 system can be connected to multiple tape drive controllers. However, a single AS/400 system cannot be connected twice to the same tape drive controller, as this creates a serial number conflict and results in nonfunctional drives. This scenario may be evident during an IPL.

Figure 7 shows a supported configuration. The cable is shown attaching the AS/400 system to the tape drives.



*Figure 7. AS/400-System-to-3494 Automated Tape Library Dataserver Supported Configuration*

Figure 8 shows an unsupported configuration. The cable attaches the AS/400 system to the tape drives.

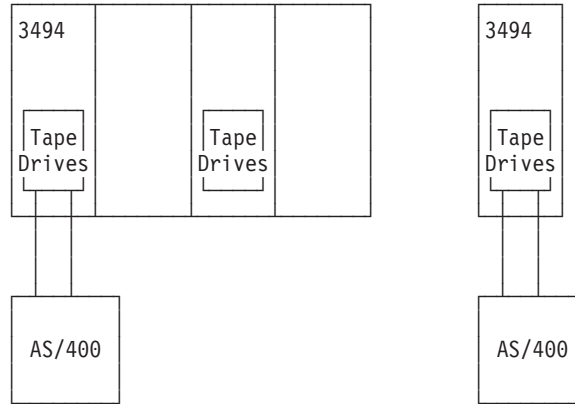


Figure 8. AS/400-System-to-3494 Automated Tape Library Dataserver Unsupported Configuration

## Alternate IPL (AIPL) Requirements for the 3494 Automated Tape Library Dataserver

The 3494 Automated Tape Library Dataserver devices can be used for AIPL functions of the AS/400. For the 3494 Automated Tape Library Dataserver devices to be used as an alternate IPL device, the following conditions must exist:

- For the 2644 attached 3490E, the control unit address must be set to address "7" and then device address 0 can be used for AIPL.
- For the 6501, 6534, or 2729 Input/Output Adapter (IOA) attached 3590 Tape Subsystem or 3490E, the device must be at SCSI address 0.
- The SCSI device must be cabled to port 0 (bottom) of the 6501 IOP card.
- The IOP must be located in a valid alternate-IPL slot in the system.

For more information on using an alternate installation device, refer to *Backup and Recovery*, SC41-5304.

## Configurations of Different Platforms with the 3494 Automated Tape Library Dataserver

The 3494 Automated Tape Library Dataserver can be shared by AS/400 systems, RISC System/6000 systems and ES/9000 systems for a total of 16 systems. The AS/400 systems can share cartridges in the library as described in "Multiple AS/400 Systems Sharing a 3494 Automated Tape Library Dataserver" on page 14. The other systems can share the library by partitioning the 3494 Automated Tape Library Dataserver, and individual cartridges can be assigned to a particular processor. This is done by assigning each cartridge to a category.

## Problem Handling for the 3494 Automated Tape Library Dataserver

Under normal operational conditions, the library manager is not used very often by the operator. The software manages the 3494 Automated Tape Library Dataserver from requests sent from AS/400. For most purposes, the best function to have active on the display of the library manager is the System Summary pop-up window. The system summary gives you indications of the 3494 Automated Tape Library Dataserver status, including whether operator intervention is required in

case of errors. If the Intervention Required LED on the front operator panel is flashing, check the System Summary window. If intervention is required, the *Intervention* field on the lower right-hand side of Figure 9 would show *Required* instead of *None*.

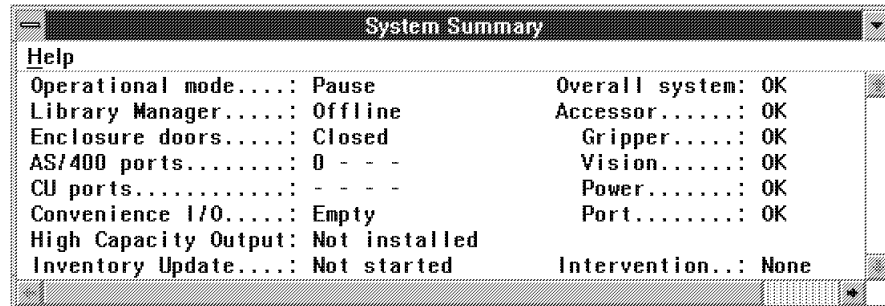


Figure 9. System Summary Pop-Up Window

To check errors and problems, click on the Commands pull-down and select the Operator Intervention command. Problems are likely when a condition occurs from which the 3494 Automated Tape Library Dataserver cannot recover on its own. Depending on the type of error or exception condition experienced, some or all of the 3494 Automated Tape Library Dataserver operations are suspended until the problem is corrected.

To respond to an error, select the condition from the list on the Operator Intervention pop-up window and highlight the items. After the problem has been resolved (often by manual intervention that may require you to open the front door of the 3494 Automated Tape Library Dataserver), select the OK button. Repeat this until all error conditions are resolved.

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## 9427 Tape Library

The 9427 Tape Library is a low cost 8mm automated tape library designed for unattended tape operations. The 9427 Tape Library is a 20 cartridge tape library based on the 8mm helical scan technology. It is available in two models: 9427 Tape Library Models 210 and 211. Model 210 is a stand-alone version of the tape library and model 211 is the rack mounted version.

The 9427 Tape Library supports one or two of the 7GB 8mm drives, so it is capable of providing for a 140GB (uncompressed) unattended tape operation. It includes a barcode reader that reads the labels on the cartridges to determine the cartridge identifier without the need to load the cartridges in the tape drives. Unlike the 3494, the 9427 Tape Library does not have an input/output slot. The 9427 Tape Library Model 211 stands in a vertical arrangement and uses half of the rack width. Two 9427 Tape Libraries may be installed side by side. The tape drives from the 7208 and feature drive 6390 cannot be removed from a stand-alone unit or system enclosure and moved into a 9427 Tape Library.

## Tape Drives for the 9427 Tape Library

The drives used in the 9427 Tape Library are the 8mm helical scan 7GB drives. Each cartridge has an uncompressed capacity of 7GB. The drive demonstrates a 500 KB/s transfer rate (uncompressed data stream). Onboard IDRC may provide twice the capacity and performance.

The 7GB tape drive is based on the 7208 half-height product. Hardware changes were made to support the 160 meter tape media. The 160 meter tape media is required for 7GB (uncompressed) data storage. It must be initialized by using the INZTAP command and specifying \*FMT7GB for the density value. The 160 meter tape media cannot be written to or read by the 7208 Models 002, 012, and 232. The 7GB drive also supports 112 meter tapes with formats \*FMT2GB and \*FMT5GB

**Note:** You must use the 112 meter tape for interchange between the devices.

Save operations performed on multiple volumes must be initialized to the same format.

The 160 meter cartridge has the media recognition system (MRS). Non-MRS 160 meter tapes are rejected by the 7GB tape drives.

## Hardware Configurations of the 9427 Tape Library

The 9427 Tape Library attaches to all AS/400 system models that support the 2621 or 6534 IOP cards or the 2729 IOA. The AS/400 system models must be running Version 3 Release 1 or a later release of OS/400. Ensure that all the necessary PTFs are installed on your system.

The supported hardware configurations are shown in the following illustrations.

**Note:** The 6534 IOP card and the 2729 IOA are not shown in the following illustrations. This is because the 6534 and 2729 only have one port. Ports 1 and 2 of the 9427 Tape Library are associated with drive 1 (address 07) and ports 3 and 4 are associated with drive 2 (address 05).

Figure 10 on page 19 shows how one 9427 Tape Library with one drive is attached to one port of the 2621 Tape IOP feature. Another external tape device could be attached to the other port, but not another 9427 Tape Library.

To create this configuration:

- Attach port 1 of the 9427 Tape Library to a port on the 2621 TAPE IOP Controller.
- Install the jumper to ports 2 and 3 of the 9427 Tape Library
- Install a terminator on port 4 on the 9427 Tape Library

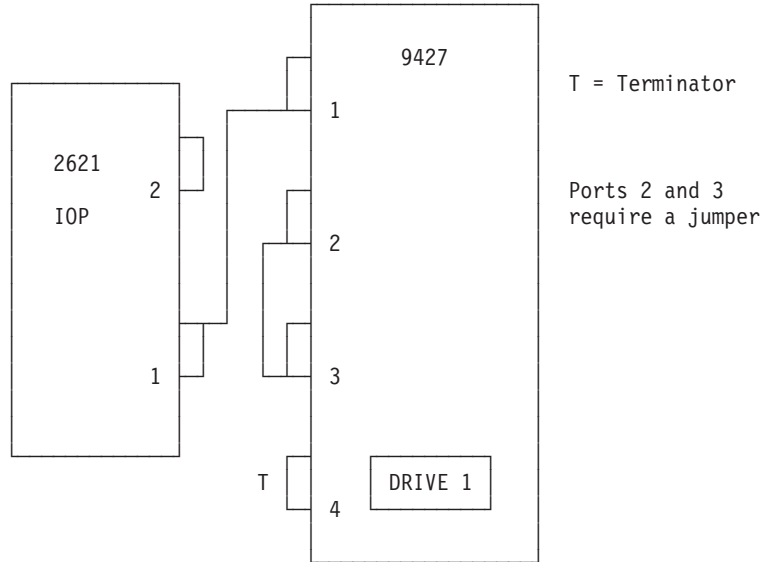


Figure 10. One Drive in 9427 Tape Library Attached to One Port of the 2621

Figure 11 on page 20 shows how one 9427 Tape Library with two drives is attached to both ports of the 2621 Tape IOP Controller.

To create this configuration:

- Attach one external SCSI cable from port 1 of the 2621 IOP to port 1 of the 9427 Tape Library.
- Attach the other external SCSI cable from port 2 of the 2621 IOP to port 4 of the 9427 Tape Library.
- Install a terminator on ports 2 and 3 of the 9427 Tape Library.

This configuration does not allow you to share the 2621 IOP with other external drives, but it provides:

- Improved drive performance.
- Ability to run two jobs at the same time.
- Library functions for both drives.

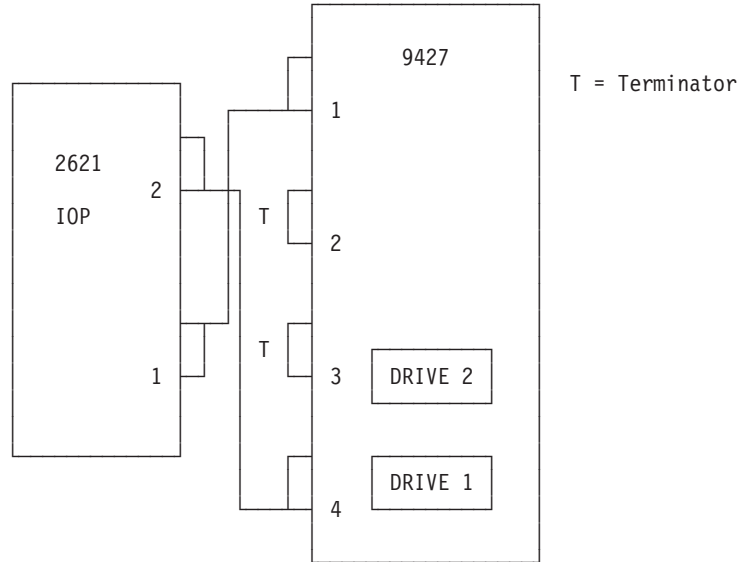


Figure 11. Direct Attach - Two Drives in 9427 Tape Library Using Both Ports of the 2621

Figure 12 on page 21 shows how one 9427 Tape Library with two drives is attached to one port of the 2621 Tape IOP Controller.

To create this configuration:

- Attach one external SCSI cable from port 1 of the 2621 IOP to port 1 of the 9427 Tape Library.
- Install the jumper to ports 2 and 3 of the 9427 Tape Library.
- Install a terminator on port 4 on the 9427 Tape Library.

This configuration can lower the performance of the tape drive, but it does give you the advantage of:

- Sharing the 2621 with other external drives.
- Running two jobs simultaneously.
- Providing library functions for both drives.

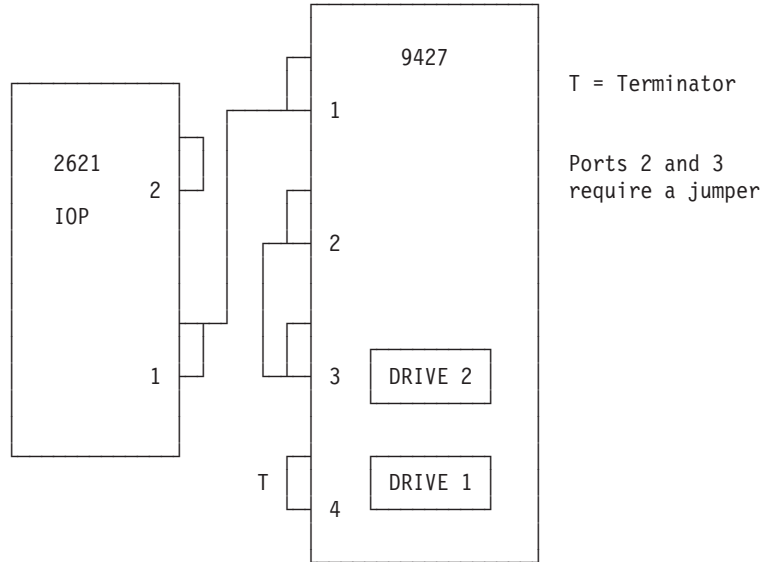


Figure 12. Two Drives in 9427 Tape Library Attached to One Port of the 2621

Figure 13 shows how one 9427 Tape Library with two drives is shared between two AS/400 systems.

To create this configuration:

- Attach one external SCSI cable from port 1 of the 2621 IOP controller of one AS/400 to port 1 of the 9427 Tape Library.
- Attach the other external SCSI cable from port 1 of the 2621 Tape IOP Controller from the second AS/400 system to port 4 of the 9427 Tape Library.
- Install a terminator on ports 2 and 3 of the 9427 Tape Library.

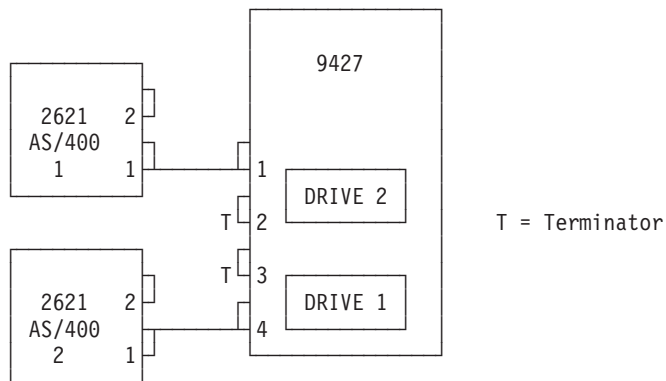


Figure 13. One 9427 Tape Library Attached to Two AS/400 Systems

# Configurations of Multiple AS/400 Systems and Multiple 9427 Tape Libraries

## Multiple AS/400 Systems on One 9427 Tape Library

One 9427 Tape Library can be shared by two AS/400 systems. Both systems are allocated 1 tape drive and 10 cartridge slots (one magazine per system). The bonus or cleaning slots are shared by the 2 systems.

**Note:** The 9427 Tape Library must be in the Split-Mode configuration for dual system attach.

## Multiple 9427 Tape Libraries on One AS/400 System

OS/400 and BRMS for AS/400 supports multiple 9427 Tape Libraries attached to a single AS/400 system. The 9427 Tape Library is connected to a 2621 or 6534 tape IOP feature or 2729 IOA on the AS/400 system. The number of tape drives attached to an AS/400 system depends on the number of 2621 or 6534 tape IOP features or 2729 IOAs installed and supported on the AS/400 model.

## AIPL Requirements for AS/400 Systems with the 9427 Tape Library

To use the 9427 Tape Library as an alternate IPL device, the following conditions must exist:

- Port 1 of the 9427 Tape Library must be cabled to Port 1 of the 2621 IOP card (bottom port). If a 6534 IOP card or 2729 IOA is used, port 1 of the 9427 Tape Library must be cabled to the port on the 6534 or the 2729.
- The 2621, 6534, or 2729 must be located in the valid alternate-IPL slot in the system.

The alternate IPL support for the 9427 Tape Library is the same as any Model of the 7208.

- The 9427 Tape Library must be put in the sequential mode for multivolume unattended tape operations. See the *IBM 9427 Tape Library Operator's Guide* for information on how to set the 9427 Tape Library in sequential mode. The 9427 Tape Library acts as an automated cartridge loader.
- The tape cartridges must be mounted in the 9427 Tape Library magazine in the correct order. The first data cartridge of the installation must be placed in the first slot for the 9427 Tape Library drive.

## Problem Handling for the 9427 Tape Library

In Version 3 Release 1 the 9427 Tape Library is not reported to the system. All library failures are logged under the 8mm tape drive 7208 1012 being used when the problem is detected.

**Note:** 7208 is the machine type, 012 is the model number, and a 1 in front of the model number distinguishes the 7208 in the 9427 Tape Library from the stand-alone 7208-012.

Any library problems that are logged under 7208 1012 are direct 'call outs' for parts that can be exchanged, or you are referred to the *9427 Tape Library Service Guide* for more problem analysis.



The 9427 Tape Library is managed by the AS/400 host to which it is attached. However, the library and individual drives can be serviced while the AS/400 system remains online.

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## 3590 with Automated Cartridge Facility

The 3590 model B11 tape drive utilizes a 16-track longitudinal recording technique and LZ1 data compaction to store up to 30 GB of data on a single cartridge. The 3590 B11 is a rack mounted tape device that includes a 10 cartridge Automatic Cartridge Facility (ACF) that can be used in Random mode as a mini-library providing up to 300 GB of unattended storage.

The 3590 with Automated Cartridge Facility, operates as a RACL with the following features;

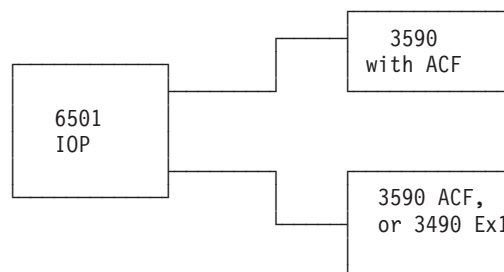
- Contains up to 10 cartridges in a removable magazine.
- One 3590 Tape Subsystem
- Two host attachments.

## Hardware Configurations of the 3590 Tape Subsystem

The 3590 with Automated Cartridge Facility attaches to all AS/400 models that support the 6501 or 6534 IOP cards or the 2729 IOA with OS/400 Version 3 Release 1 or later.

The 3590 Tape Subsystem can be attached to the 6501 or 6534 IOP cards or the 2729 IOA with any SCSI cable up to 25m in length.

Figure 14 and Figure 15 on page 24 show the hardware configurations that are supported for the 3590 with Automated Cartridge Facility:



*Figure 14. 3590 with Automated Cartridge Facility Shares the 6501 IOP with Other External Devices*

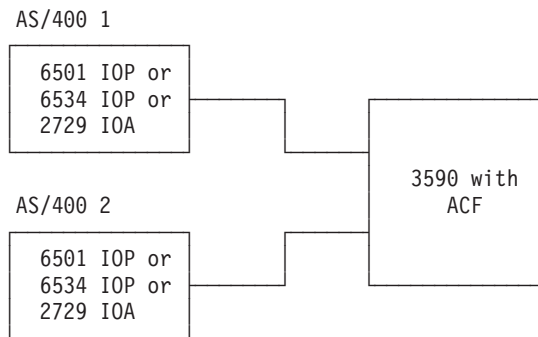


Figure 15. 3590 with Automated Cartridge Facility Attached to Two Different AS/400 Systems

## Configurations of Multiple Systems with Multiple 3590 Tape Subsystems

### Multiple AS/400 Systems to One 3590 Tape Subsystem

The 3590 with Automated Cartridge Facility has two different ports that can be used by two different AS/400 systems. These systems use a 6501 or 6534 IOP card or the 2729 IOA to connect to the 3590 with Automated Cartridge Facility.

### Multiple 3590 Tape Subsystems to One AS/400 System

Multiple 3590 Tape Subsystems can be attached to a single AS/400 system by connection to the 6501 or 6534 tape IOP feature or the 2729 IOA feature on the AS/400 system.

**Note:** The 6534 IOP and 2729 IOA each have one port and will only allow attachment of one 3590 Tape Subsystem.

The number of tape drives attached to an AS/400 system depends on the number of AS/400 6501 or 6534 tape IOP or 2729 IOA features that are installed and supported.

### Attaching Different Platforms to the 3590 with Automated Cartridge Facility

One 3590 with Automated Cartridge Facility can be shared by both an AS/400 system and a RISC System/6000 for a maximum of two host systems. The RISC System/6000 can share the library by partitioning the 3590 with Automated Cartridge Facility. You can assign individual cartridges to a particular processor by assigning each cartridge to a different slot.

**Note:** The AS/400 does not support the reserving of slots.

A 3590 with Automated Cartridge Facility that is attached to an AS/400 system does not attach to an ES/9000 system.

## Alternate IPL Considerations for AS/400 Systems with a 3590 Tape Subsystem

The 3590 with Automated Cartridge Facility is a backup and recovery drive. The 3590 Tape Subsystem media is not used for distribution.

For the 3590 Tape Subsystem to be used as an alternate IPL device, the following conditions must exist:

- A valid system save must exist on 3590 media.
- The 3590 Tape Subsystem must be at system address 7 (device address 0).
- The 3590 Tape Subsystem must be cabled to port 0 (bottom) of the 6501 IOP card.
- The 6501, 6534, or 2729 IOA must be located in a valid alternate-IPL slot in the system.
- During an Alternate IPL the 3590 with Automated Cartridge Facility must be in Manual or Auto mode. Refer to the device documentation to select the operating modes.

For more information on using an alternate installation device, refer to *Backup and Recovery*, SC41-5304.

## Problem Handling for the 3590 with Automated Cartridge Facility

The 3590 with Automated Cartridge Facility has full AS/400 online service support such as:

- Service information message (SIM)  
The 3590 Tape Subsystem contains a parts list and other information about hardware failures. The AS/400 online service package reports the parts list through electronic customer support.

---

## 3490E Model Fxx with Autoloader

The 3490E model Fxx is the latest product among the 3490 tape products. The new model Fxx provides a wide range of products to cover the various IBM system platforms. The AS/400 supports attachments for the F00, F01, F11, and F1A models. The AS/400 only supports the SCSI attachment for this device. The AS/400 will not support ESCON or OEMI attachment.

As of February 1997, the 3490 F00, F01, and F11 are only supported in Model E emulation mode. In E-emulation mode each of these devices will report as a 3490 E01. All functions and operations are the same as the 3490 E01. These devices do not support 18-track write capability in E-emulation mode.

As of October 1997, the 3490 F1A device is designed for use in the 3494 Tape Library. The 3490 F1A emulates the 3490 C1A device, and does not allow 18-track write capability. All other functions and operations are the same as a 3490 C1A.

New code will be available during the first quarter of 1998 to support the 3490 Fxx device in its natural mode (F-mode). Once this code has been loaded, the Fxx device will support the following:

- 18-track read and write capability
- Device code downloading capability

- Large block support
- Random mode (F01 and F11 models)

The model F1A will continue to emulate the 3490 C1A when attached to the AS/400.

## Hardware Configurations of the 3490E Tape Subsystem

The 3490E Tape Subsystem attaches to all AS/400 models that support the 6501 or 6534 IOP cards or the 2729 IOA with OS/400 Version 3 Release 1 or later releases.

The 3490E Tape Subsystem can be attached to the 6501 or 6534 IOP cards or the 2729 IOA with any SCSI cable up to 25m in length.

Figure 16 shows the hardware configurations that are supported for the 3490E Tape Subsystem:

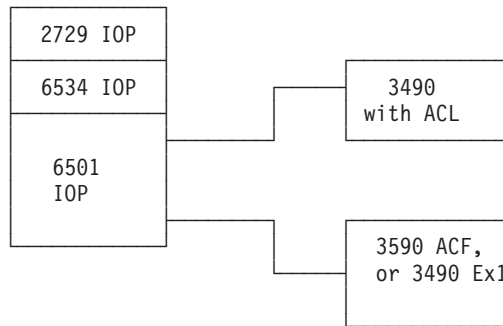


Figure 16. 3490E Tape Subsystem Shares the 6501 IOP with Other External Devices

## Configurations of Multiple Systems with Multiple 3490E Tape Subsystems

### Multiple AS/400 Systems to One 3490E Tape Subsystem

The 3490E Tape Subsystem has one port that can connect to one AS/400 system. The system uses a 6501 or 6534 IOP card or the 2729 IOA to connect to the 3490E Tape Subsystem.

### Multiple 3490E Tape Subsystems to One AS/400 System

Multiple 3490E Tape Subsystems can be attached to a single AS/400 system by multiple connections to the 6501 IOP tape feature. Multiple 3490E Tape Subsystems can also be attached to a single AS/400 system by setting up multiple 6534 tape IOP features or 2729 IOA features on the AS/400 system.

**Note:** The 6534 IOP and 2729 IOA each have one port and will only allow attachment of one 3490E Tape Subsystem.

The number of tape drives attached to an AS/400 system depends on the number of AS/400 6501 or 6534 tape IOP or 2729 IOA features that are installed and supported.

## Attaching Different Platforms to the 3490E Tape Subsystem

One 3490E Tape Subsystem can not be shared by both an AS/400 system and a RISC System/6000.

A 3490E Tape Subsystem that is attached to an AS/400 system does not attach to an ES/9000 system.

## Alternate IPL Considerations for AS/400 Systems with a 3490E Tape Subsystem

The 3490E Model Fxx is a backup and recovery drive.

For the 3490E Tape Subsystem to be used as an alternate IPL device, the following conditions must exist:

- A valid system save must exist on 3490E media.
- The 3490E Tape Subsystem must be at system address 7 (device address 0).
- The 3490E Tape Subsystem must be cabled to port 0 (bottom) of the 6501 IOP card.
- The 6501, 6534, or 2729 IOA must be located in a valid alternate-IPL slot in the system.
- During an Alternate IPL from the 3490E the autoloader can not be in Random mode. Refer to the device documentation to select the operating modes.

For more information on using an alternate installation device, refer to *Backup and Recovery*, SC41-5304.

## Problem Handling for the 3490E Tape Subsystem

The 3590 with Automated Cartridge Facility has full AS/400 online service support such as:

- Support based on device sense data, similar to 3490 Cxx/Exx devices
- Device display panel messages
- Error log data

---

## Magstar MP 3570 Tape Library

**Note:** The AS/400 system refers to the Magstar MP Tape Library by its machine type, which is 3570. This book will refer to the "3570 Tape Library" when discussing this tape device in the context of AS/400 devices and configurations. Keep in mind, however, that both terms are referring to the same device.

The IBM Magstar MP 3570 Tape Library models B01/B02/B11/B12 and C01/C02/C11/C12 are designed to provide a midrange tape solution with a lower price than 3590. The 3570 Tape Subsystem uses a new and unique data cartridge that is approximately half the size of the 3480/3490/3590 cartridges. The capacity is 5 GB per cartridge and up to 15 GB per cartridge with LZ1 compaction. The 3570 Tape Library is designed to operate with two 10-cartridge magazines that provide access to 100-300 GB of data. In addition to the data cartridges, a cleaner cartridge is stored in the subsystem and is available for automatic cleaning of the tape device.

The following table provides a comparison between the 3570 B and C models.

*Table 1. Comparison of 3570 Model B and 3570 Model C*

<b>Model Bxx</b>	<b>Model Cxx</b>
Uses "F" cartridge type in 4 track mode	Uses "F" cartridge type in 4 track mode
Rejects "G" cartridge type	Uses "G" cartridge types in 8 track mode
Linear tape speed = 2 M/s	Linear tape speed = 3 M/s
2.2 MB/s native	7 MB/s native with "G" cartridges
	3.2 MB/s native with "F" cartridges
6.6 MB/s with 3:1 data compaction	14 MB/s with 3:1 data compaction and "G" cartridges
	9 MB/s with 3:1 data compaction and "F" cartridges
20 MB/s 2-byte Fast Wide SCSI attachment	20 MB/s 2-byte Fast Wide SCSI attachment
5 GB per cartridge uncompact	5 GB per cartridge uncompact
15 GB per cartridge with 3:1 compaction	15 GB per cartridge with 3:1 compaction
Models B00, B01, B11, B02, B12, and B1A	Models C00, C01, C11, C02, C12, and C1A
Bar code reader is optional	Bar code reader is standard

The 3570 Tape Library operates as a random automatic cartridge loader (RACL). The features that are supported by each model are as follows:

- - Model B00/C00, stand-alone without RACL
  - Model B01/C01, table top with 19+1 RACL
  - Model B02/C02, 2 drive, table top with 19+1 RACL
  - Model B11/C11, rack mount with 19+1 RACL
  - Model B12/C12, 2 drive, rack mount with 19+1 RACL
  - Model B1A/C1A, drive for the 3575 tape library
- The B01/C01 is a stand-alone, table top device. The B11/C11 is a rack-mount device. Both of these models contain one 3570 Tape Subsystem and support single-host connectivity.
- The B02/C02 and B12/C12 models contain two 3570 Tape Subsystems and support dual-host or single-host connectivity. The B02/C02 is a stand-alone, table top device. The B12/C12 is a rack-mount device.
- There are two data cartridges for the 3570 devices. These are the model B and the model C cartridges. They can be identified by the external label. The model B cartridges are labeled with a cartridge type of "F". The model C cartridges are labeled with a cartridge type of "G". The 3570 model Bxx will only read and write to the "F" type media. The 3570 model Cxx will read and write to the "G" cartridges in 8-track format, and to the "F" cartridges in 4-track format. The capacity of either cartridge in either format is 5 GB native and up to 15 GB with compaction.

## Hardware Configurations of the Magstar MP 3570 Tape Library

The Magstar MP 3570 Tape Library attaches to all AS/400 models (running V3R1 or a later release of OS/400) that support the 6501 or 6534 IOP card or 2729 IOA.

The 3570 Tape Subsystem can be attached to the 6501 or 6534 IOP card or 2729 IOA with any SCSI cable up to 25m in length.

The B02/B12/C02/C12 may be configured in Base configuration or Split configuration. Figures 17 through 20 show the hardware modes and configurations that are supported for the 3570 Tape Library.

**Note:** The 6534 IOP card and the 2729 IOA are only included in 19. This is because the 6534 and 2729 only have one port.

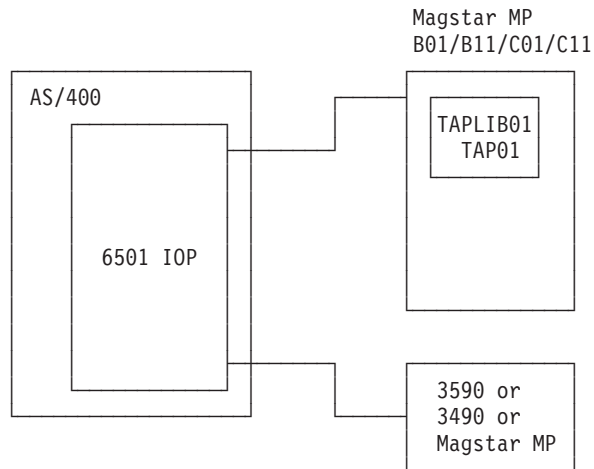


Figure 17. 3570 Tape Library Model B01/B11/C01/C11 — Base Configuration On A Single Host

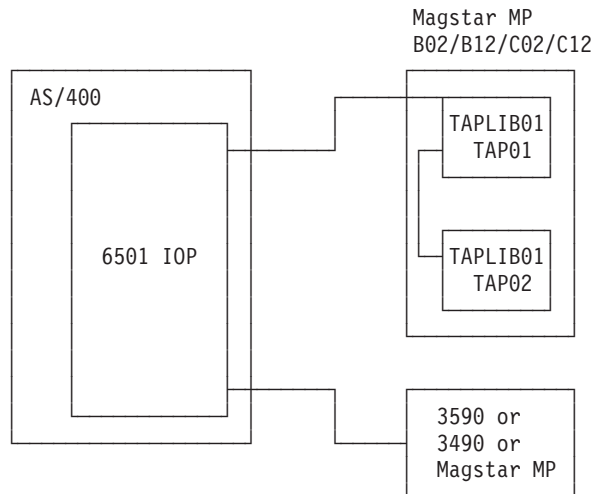


Figure 18. 3570 Tape Library Model B02/B12/C02/C12 — Base Configuration On A Single Host

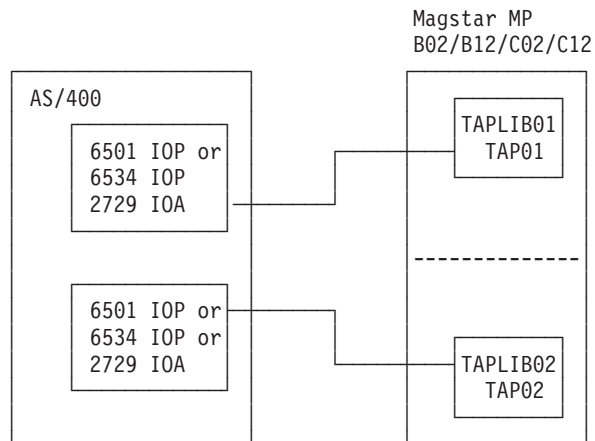
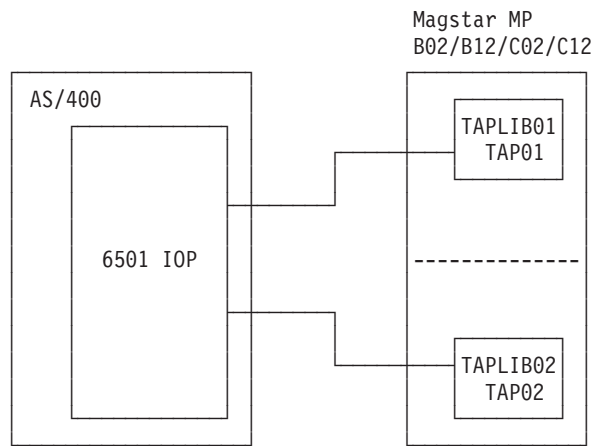
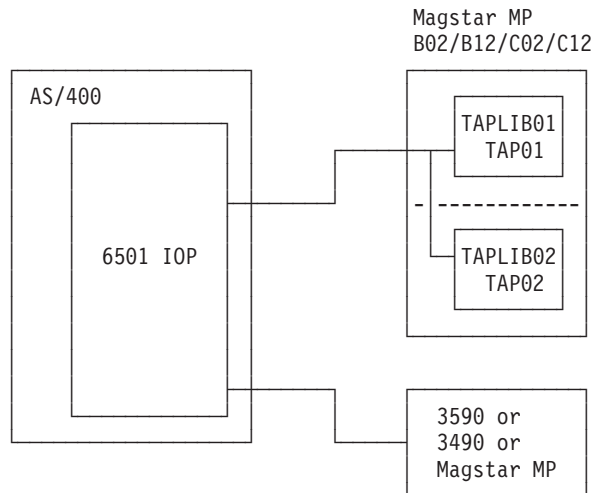


Figure 19. 3570 Tape Library Model B02/B12/C02/C12 — Split Configuration On A Single Host



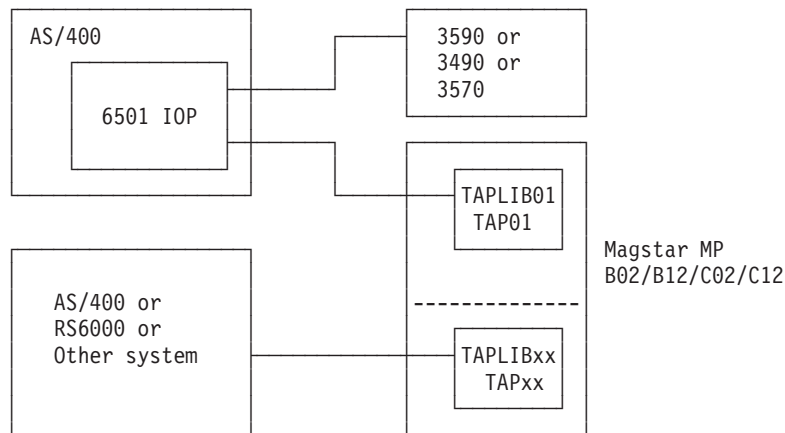


Figure 20. 3570 Tape Subsystem Model B02/B12/C02/C12 — Split Configuration On Two Hosts

## Configurations of Multiple Systems with Multiple 3570 Tape Subsystems

### Multiple AS/400 Systems to One 3570 Tape Subsystem

Each device on the 3570 Tape Library has one SCSI port that is used for connection to an AS/400 system. Therefore, only models B02/B12/C02/C12 will support multiple AS/400 host connections. The 3570 must be in the split configuration.

### Multiple 3570 Tape Subsystem to One AS/400 System

Multiple 3570 Tape Subsystems can be attached to a single AS/400 system by connecting to each of the SCSI ports on the 6501 tape IOP feature in the AS/400 system. Multiple 3570 Tape Subsystems can also be attached to a single AS/400 system by installing multiple 6501, 6534, or 2729 features on the AS/400 system. The maximum number of tape IOP features that are supported on a given AS/400 system model controls the number of tape drives attached to that system.

### Attaching Different Platforms to the 3570 Tape Library

The 3570 Tape Library model B02/B12/C02/C12, when running under split configuration, may be shared between an AS/400 system and another platform.

## Alternate IPL Considerations for AS/400 Systems with a 3570 Tape Library

The 3570 Tape Library is a backup and recovery drive. The 3570 Tape Subsystem media is not used for distribution.

In order to use the 3570 Tape Subsystem as an alternate IPL device, the following conditions must exist:

- A valid system save must exist on 3570 media.

- The 3570 Tape Subsystem must be at system address 7 (device address 0).
- The 3570 Tape Subsystem must be cabled to port 0 (bottom) of the 6501 IOP card.
- The 6501, 6534, or 2729 must be located in a valid alternate-IPL slot in the system.
- During an Alternate IPL the 3570 Tape Library must be in Manual or Auto mode. Refer to the device documentation to select the operating modes.

For more information on using an alternate installation device, refer to *Backup and Recovery*, SC41-5304.

## Problem Handling for the 3570 Tape Library

The 3570 Tape Library has full AS/400 online service support such as:

- Service information message (SIM)

The 3570 Tape Subsystem contains a parts list and other information about hardware failures. The AS/400 online service package reports the parts list through electronic customer support.

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## Magstar MP 3575 Tape Library Dataserver

**Note:** The AS/400 system refers to the Magstar MP 3575 Tape Library Dataserver by its machine type, which is 3575. This book will refer to the "3575 Tape Library" when discussing this tape device in the context of AS/400 devices and configurations. Keep in mind, however, that both terms are referring to the same device.

The 3575 Tape Library was developed by IBM specifically for the mid-range environment. This technology combines automated tape handling with newly introduced Magstar MP 3570 tape devices to provide an automated tape library with high reliability and fast data access. There are five models in the 3575 product:

- Model L06: 1–2 drives, 60 slots
- Model L12: 1–4 drives, 120 slots
- Model L18: 1–6 drives, 180 slots
- Model L24: 1–6 drives, 240 slots
- Model L32: 1–6 drives, 324 slots

These models provide for a range of 300GB to 1.6TB of uncompressed data.

The 3575 Tape Library can attach to as many as six AS/400s with either separate or shared cartridge inventories. The 3570 tape devices that are used are the 3570 Model B1A and 3570 device. The 3570 Model B1A supports data transfers of 2.2MB/s, but can support up to 6MB/s when using data compression. The 3570 C1A device supports data transfers of 7MB/s, but can support up to 14MB/s when using data compression.

## Hardware Configurations of the Magstar MP 3575 Tape Library Dataserver

The 3575 Tape Library attaches to all AS/400 models that run V3R1 or a later release of OS/400.

The 3575 Tape Library attaches to the 6501 or 6534 IOP card or 2729 IOA with SCSI cables up to 25m in length.

**Note:** The 6534 IOP card and the 2729 IOA only have one SCSI port. The 6501 IOP card has two SCSI ports, but only one port may be used when the 3575 Tape Library is attached.

Some models of the 3575 Tape Library offer up to six tape devices. For performance reasons, only two devices per logical library are supported on the AS/400.

The 3575 Tape Library provides many configuration options. These options are implemented with the Logical Library and Multiple Control Path functions. The Logical Library support provides partitioning of the library inventory into separate independent portions. Up to three logical libraries are supported. The Multiple Control Path support provides the access path to the media mover. Each control path creates a library device description on the AS/400. Each logical library must have at least one control path. By configuring multiple control paths per logical library, several hosts may share a common library inventory.

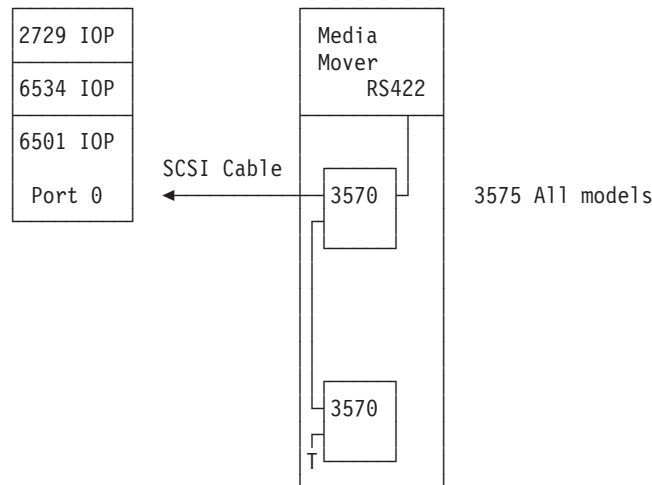


Figure 21. 3575 Single Logical Library, Single Control Path

In Figure 21, two drives and all slots are attached to one and only one host.

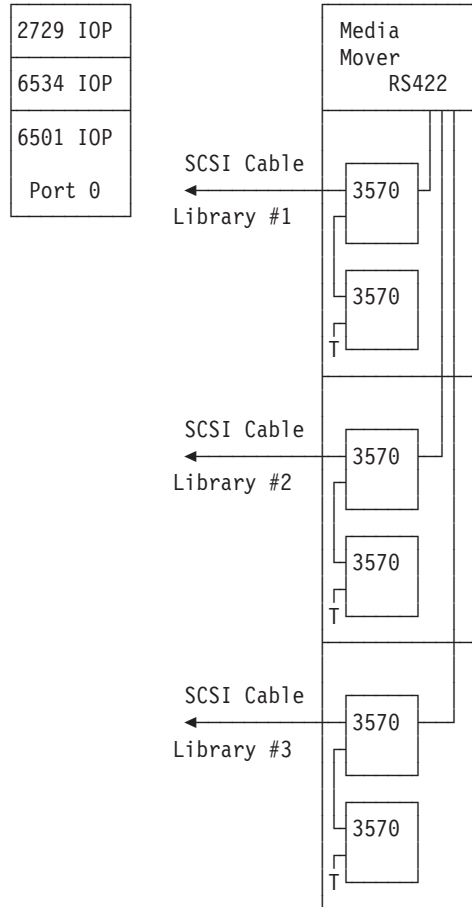


Figure 22. 3575 Multiple Logical Libraries with One Control Path Each

The following considerations apply to Figure 22:

- A separate control path exists for each logical library. Each logical library appears as a separate device.
- The devices within the logical library are connected on one SCSI bus to the host.
- With multiple logical libraries, all hosts do not have access to all slots.
- If 3570 B and C devices are mixed within one 3575 Tape Library, the library must be configured with at least two logical libraries. One logical library will be used for the B devices, and the other will be used for the C devices.

The following table lists the logical library configuration capabilities for each of the 3575 models. The Model L06 is not listed, since it does not support more than one logical library.

Model	Capabilities
L12	<ul style="list-style-type: none"> <li>• Two logical libraries</li> <li>• 1 to 2 drives per logical library</li> <li>• 60 slots each</li> </ul>
L18	<ul style="list-style-type: none"> <li>• Two or three logical libraries</li> <li>• 1 to 2 drives per logical library</li> <li>• 60/120 slots or 60/60/60 slots each</li> </ul>

Model	Capabilities
L24	<ul style="list-style-type: none"> <li>• Two or three logical libraries</li> <li>• 1 to 2 drives per logical library</li> <li>• 80/160 slots or 80/80/80 slots each</li> </ul>
L32	<ul style="list-style-type: none"> <li>• Two or three logical libraries</li> <li>• 1 to 2 drives per logical library</li> <li>• 108/216 slots or 108/108/108 slots each</li> </ul>

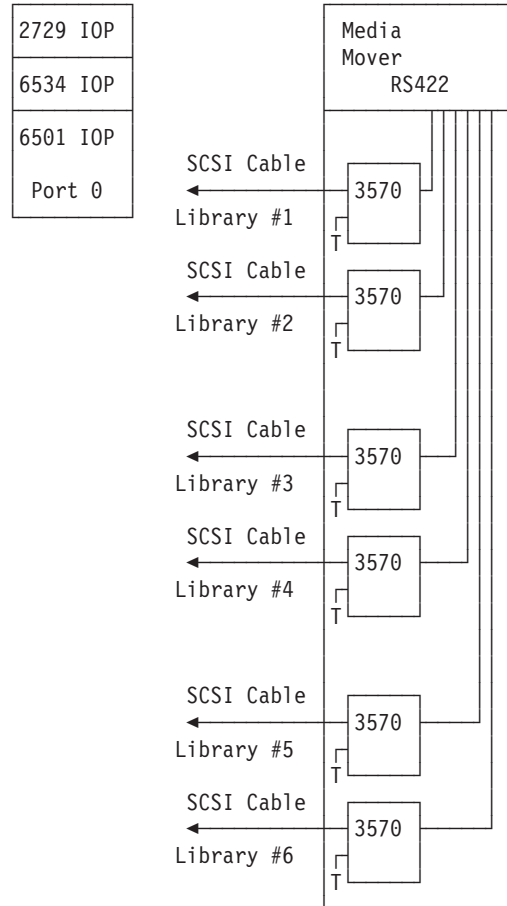


Figure 23. 3575 Multiple Control Path Library Connections, One Logical Library— Example 1

The following considerations apply to Figure 23:

- All models support multiple control path attachment. With multiple control paths any device or groups of devices can access all slots.
- This provides multiple host attachment with a shared media inventory.
- The maximum number of attachments for each model is as follows:

Model L06	2 hosts, 60 slots
Model L12	4 hosts, 120 slots
Model L18	6 hosts, 180 slots
Model L24	6 hosts, 240 slots

Model L32

6 hosts, 324 slots

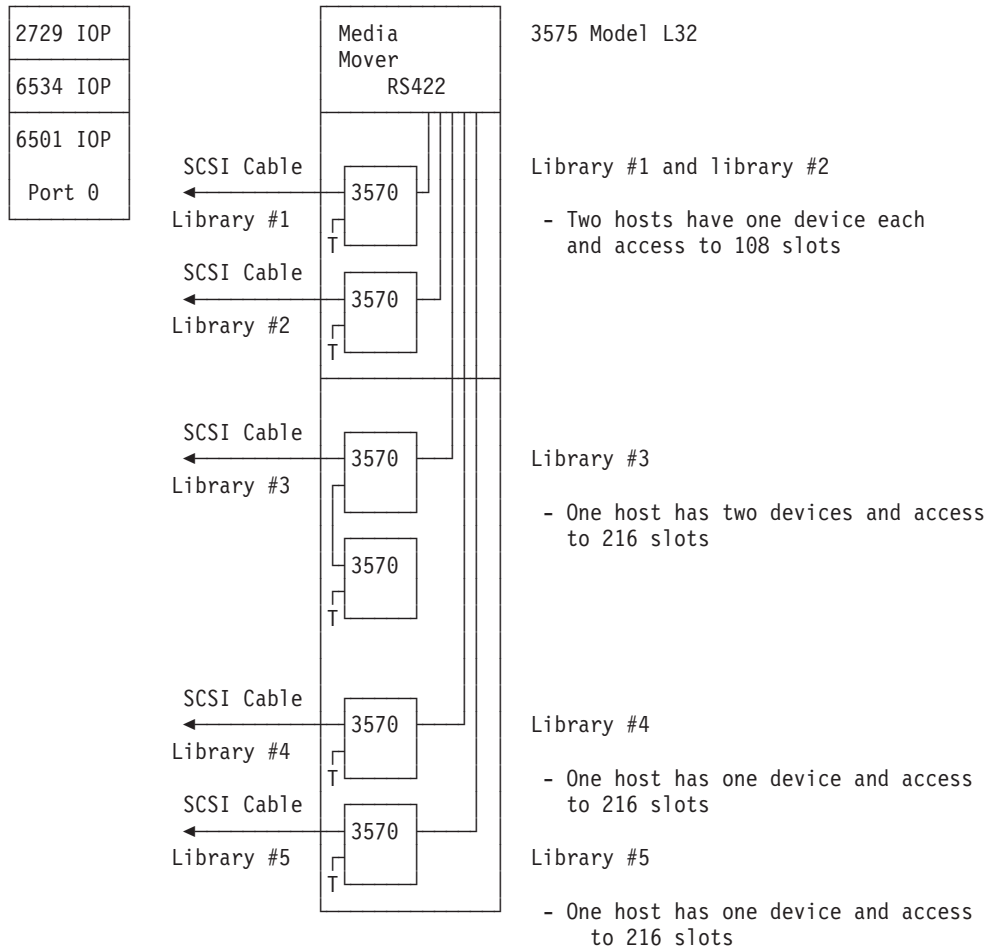


Figure 24. 3575 Multiple Control Path with Multiple Logical Library Connections

The following considerations apply to Figure 24:

- Libraries #1 and #2 share 108 slots.
- Libraries #3, #4, and #5 share 216 slots.
- Libraries #1 and #2 do not share any slots with libraries #3, #4, and #5.

## Configurations of Multiple Systems with Multiple Magstar 3575 Tape Library Dataservers

### Multiple AS/400 Systems to One Magstar MP 3575 Tape Library

Each tape device in the 3575 Tape Library has one SCSI port and a control path for the library media mover. The 3575 Tape Library can be configured with either separate or shared inventory. For performance reasons, only one Model C1A or two Model B1A tape devices can be attached to any 6501, 6534, or 2729.

### Multiple Magstar MP 3575 Tape Libraries to One AS/400 System

Multiple 3575 Tape Libraries can be attached to a single AS/400 system by setting up multiple 6501, 6534, or 2729 features on the AS/400 system. The maximum

number of tape IOP features that are supported on a given AS/400 system model controls the number of tape drives that are attached to that system.

The 6501 IOP has two SCSI ports. Only one port may be used when connected to a tape drive in the 3575 Tape Library.

### **Attaching Different Platforms to the Magstar MP 3575 Tape Library**

The 3575 Tape Library models L12/L18/L24/L32 may be shared between an AS/400 system and another platform. Each system platform can attach to a separate logical library.

## **Alternate IPL Considerations for AS/400 Systems with a Magstar MP 3575 Tape Library Dataserver**

The 3575 Tape Library is a backup and recovery drive. The 3575 Tape Library media is not used for distribution.

In order to use the 3575 Tape Library as an alternate IPL device, the following conditions must exist:

- A valid system save must exist on 3570 media.
- The 3570 tape device must be at system address 7 (device address 0).
- The 3570 tape device must be cabled to port 0 (bottom) of the 6501 IOP card.
- The 6501, 6534, or 2729 must be located in a valid alternate-IPL slot in the system.
- During an alternate IPL, the 3575 Tape Library will be in offline mode. Refer to the device documentation to select the operating modes.
- For more information on using an alternate installation device, refer to *Backup and Recovery*.

## **Problem Handling for the Magstar MP 3575 Tape Library**

The 3575 Tape Library has full AS/400 online service support such as Service Information Message (SIM).

The 3575 Tape Library contains a parts list and other information about hardware failures. The AS/400 online service package reports the parts list through electronic customer support.

- FID based support (for 3570)
- Device maintenance information
- Display panel error codes
- Display Problem Details support
- Error log support
- EXPERT system support





## Chapter 3. Software Support for Automated Tape Libraries

In addition to the necessary tape automation hardware, several software components are needed for a total AS/400 solution. They are:

- BRMS for AS/400 (requires Media and Storage Extensions (MSE))
- OS/400 CL commands and application program interfaces (APIs)
- Library manager (device code)

Figure 25 shows the components involved.

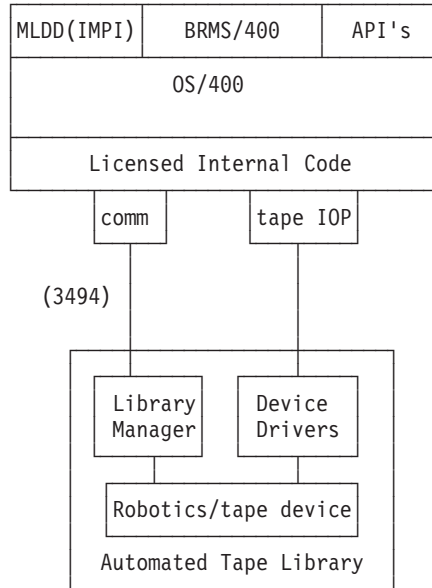


Figure 25. Overview of Automated Tape Library Software Driver Components

### Considerations for Specific Releases

#### MLDD and 64 bit PowerPC technology (RISC)

MLDD is not required when you attach the 3494 Tape Library Dataserver to the RISC-based AS/400 models. All of the MLDD commands, jobs, or subsystems have been replaced with LIC software. The LAN transaction program remains as QMLD/QMLDSTRCC and is contained internal to LIC software.

### Version 3 Release 7

Version 3 Release 7 functions the same as Version 3, Release 6. Some usability enhancements have been made to the Work with Media Library Status (WRKMLBSTS) panels and to the Display Tape Status (DSPTAPSTS) panels. See “Varying on the Media Library” on page 47 for details on WRKMLBSTS and “Determining Status: Slots, Stations, and Mounted Categories” on page 61 for details on DSPTAPSTS.

## Version 4 Release 1

The Retrieve Device Capabilities (QTARDCAP) API has been enhanced. The QTARDCAP API is used to determine device capabilities of an MLB and its resources. A new API, Retrieve Device Information (QTARDINF), assists tape management systems in determining the current status of tape library devices. For further information on these and other APIs, refer to *System API Reference*, SC41-5801.

## Version 4 Release 3

Version 4 Release 3 gives you more control over the way resources are allocated. There are two new commands and two new APIs that allow you to manipulate the resource allocation attributes. The commands are Change Job Media Library Attributes (CHGJOBMLBA) and Work with Media Library Resource Queue (WRKMLBRSCQ). The APIs are Retrieve Job Media Library Attributes (QTARJMA) and Change Job Media Library Attributes (QTARJMA). A new option called \*MLBA (Media Library Attributes) has been added to the Display Job (DSPJOB) and Work with Job (WRKJOB) commands. The \*MLBA option allows you to work with and display the media library attributes.

---

## Backup Recovery and Media Services for AS/400 and Tape Management

For management of your backup, archive, and recovery strategies, a media management application such as BRMS for AS/400 is needed. The BRMS for AS/400 product manages all your backup and archive activity, guides your recovery, manages and tracks your media inventory, and provides full audit trails for all tape activity.

As part of the backup, archive, and retrieval activity, tape cartridges are mounted, used, demounted, stored, and moved among locations. BRMS for AS/400 manages and controls this media activity, and causes the necessary commands and APIs to enable any IBM automated tape library device used on the AS/400 system. BRMS for AS/400 works out the commands needed to control the automated tape library when any tape activity is required. BRMS for AS/400 monitors these activities and tracks error conditions.

A full description of the BRMS for AS/400 program and how to set up and carry out your business requirements is found in *Backup Recovery and Media Services*, SC41-4345. Additional information is also available in the IBM Redbook, *A Practical Approach to Managing Backup Recovery and Media Services for OS/400*, SG24-4840-00.

---

## OS/400 Support for Automated Tape Libraries

This section describes the AS/400 automated tape library implementation. It describes the function provided by OS/400. This function can be used without a media management application such as BRMS for AS/400.

**Note:** If BRMS for AS/400 is used, it provides a set of user level commands for using the tape libraries.

If you do not have BRMS for AS/400 and are planning on developing your own media management application, OS/400 provides a tape library command interface with APIs. The OS/400 Media and Storage Extensions feature (library QMSE) provides additional media management functions. For more information on APIs, see the *System API Programming* book.

**Note:** The remainder of this section describes the OS/400 support provided for Automated Tape Libraries. This description applies to Version 3, Release 6 and later releases for 64 bit PowerPC based systems.

## Media Library Device Configuration

Media Library (MLB) device descriptions are fully implemented and are required for all library devices. The MLB device descriptions will be created automatically if auto-configuration is enabled (\*YES). They will be created as a TAPMLBxx device description, where xx is the next available device description number. The tape devices within the library will be configured as media library resources (MLBRSCs) with tape resources that are named TAPxx. In addition to the MLB device description with tape resources, tape device descriptions will be created for each tape resource. These tape device descriptions are used for stand-alone operations such as 3494 in Stand-alone mode or 3590/3570 in Auto mode.

**Note:** 3494 MLB devices cannot be varied on until the ROBOTDEV (robot device) parameter is updated. This parameter refers to the communications line associated with the library and is only applicable to the 3494. Use the CFGDEVMLB command to update the ROBOTDEV parameter. See “Creating a Robot device description (ROBOTDEV)” on page 44 for details.

The 3494 Automated Tape Library Dataserver supports multiple 3490 and 3590 devices within the same physical library unit. If a system is attached to multiple devices within the same 3494 library unit and auto-configuration is enabled, one MLB device description will be created for each device connection. This will result in multiple MLB device descriptions being created for the one library unit. When one of the MLB device descriptions is varied on, all available like devices are associated with the MLB device description. See “Managing multiple device attachments in a single 3494” on page 49 for details. One MLB device description must exist for each tape device type. Therefore, there will be one device description for the 3490 devices, and another for the 3590 devices.

To create a MLB device description use the following command:

```
CRTDEVMLB MLB(TAPMLB01) RSRNAME(TAPMLB01) DEVCLS(*TAP)
```

Figure 26 on page 42 shows the Create Device Description (Media Library) (CRTDEVMLB) display that is shown after you press F4=Prompt.

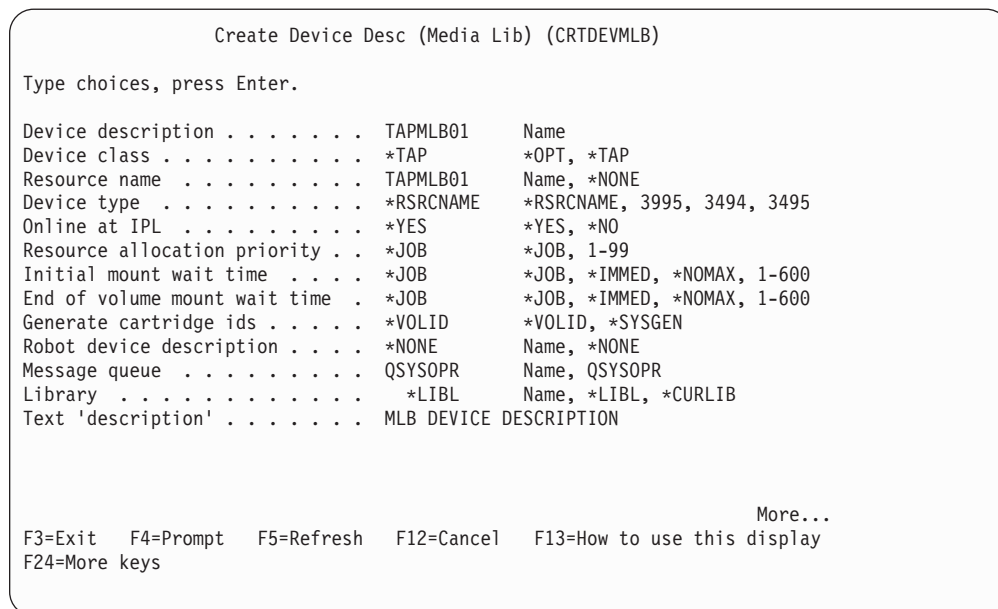


Figure 26. Create Device Media Library

The fields of the device description are defined as follows:

**DEVDD** Device Description — Specifies the name of the device description to be created.

**DEVCLS** Device Class — Specifies the class of the media library being created, \*TAP refers to a tape device class.

**RSRCNAME** Resource Name — Specifies the resource name that identifies the hardware that the description represents. A resource name must be provided before the device can be varied on. Use the Work with Hardware Resources (WRKHDWRSC) command with TYPE(\*STG) specified to determine the resource name.

**TYPE** Device Type — Specifies the type of device that this description represents.

**ONLINE** Online at IPL — Specifies whether this object is automatically varied on at initial program load (IPL).

**Note:** The 3494 will be auto-configured ONLINE(\*NO). Use the Configure Device Media Library (CFGDEVMLB) command to update the ROBOTDEV parameter and to change the ONLINE parameter to \*YES.

**RSCALCPTY** Resource Allocation Priority — Specifies the resource allocation priority.

**Note:** This parameter is valid only when DEVCLS(\*TAP) is specified.

**\*JOB** The priority of the job is used as the resource allocation priority.

**Resource allocation priority**  
Specify the priority that this job is given when requesting a resource. Valid values range from 1 (highest) to 99 (lowest).

### **INLMNTWAIT**

Initial mount wait time — Specifies the maximum amount of time that a request will wait for a tape resource to be allocated for the initial mount.

**Note:** This parameter is only valid when DEVCLS(\*TAP) is specified.

**\*JOB** The default wait time attribute of the job requesting the allocation determines the allocation wait time, rounded up to the nearest minute.

#### **\*IMMED**

The request will not wait for a tape resource to become available.

#### **\*NOMAX**

The request will wait until a tape resource is available.

#### **Initial mount wait time**

Specify the number of minutes that a request will wait for a tape resource to be allocated. Valid values range from 1 to 600 minutes.

### **EOVMNTWAIT**

End of volume mount wait time — Specifies the maximum amount of time that a request will wait for allocation of a tape resource for the end of volume mount.

**Note:** This parameter is only valid when DEVCLS(\*TAP) is specified.

**\*JOB** The default wait time attribute of the job requesting the allocation determines the allocation wait time, rounded up to the nearest minute.

#### **\*IMMED**

The request will not wait for a tape resource to become available.

#### **\*NOMAX**

The request will wait until a tape resource is available.

#### **End of volume mount wait time**

Specify the number of minutes that a request will wait for a tape resource to be allocated. Valid values range from 1 to 600 minutes.

### **GENCTGID**

Generate Cartridge Identifiers - This field is only valid for media library devices that do not have vision systems or bar code readers for reading cartridge labels.

#### **\*VOLID**

Volume identifier mode - When an inventory change is detected, the system will use the media library device to load all tape volumes to attempt to read the volume identifiers from the media. Non-labeled tapes, blank tapes, cleaning tapes and other error situations will result in system generated cartridge identifiers. See "Cartridge and Volume Identifiers" on page 55 for further details.

#### **\*SYSGEN**

System generate mode - In this mode cartridges are referenced by slot number. Each cartridge present will be assigned a cartridge ID of the form SLTxxx, where xxx is the slot number of the device. The SLTxxx value is used for the VOL parameter of the OS/400 commands. Once cartridges are processed, if they have a volume ID the volume ID or SLTxxx can be used for the OS/400 commands.

**Note:** \*SYSGEN mode is not compatible with BRMS for AS/400 and most other tape management programs. It is an option when BRMS for AS/400 is not being used.

**ROBOTDEV**

Robot device description - Specifies the name of the device description for the communications line for the 3494 Automated Tape Library Dataserver.

**MSGQ**

Shadowing Message queue - Specifies the qualified name of the message queue to which messages are sent.

**TEXT** Text description - Specifies the text that briefly describes the object.

## Creating a Robot device description (ROBOTDEV)

The 3494 Automated Tape Library Dataserver requires a communications line for the library functions. The communication line can be either RS232 ASYNC or LAN. Before the 3494 MLB device can be varied on the communication line needs to be specified in the ROBOTDEV parameter in the MLB device description. To create this communications line use the CL command CFGDEVMLB (Configure Device MLB). This command uses the required input parameters to configure and connect the communications line to the MLB device description and attempts to vary on the MLB device.

### Creating the RS/232 ASYNC Configuration

To configure the ROBOTDEV parameter for an MLB using an RS232 ASYNC line, use the following command:

```
CFGDEVMLB DEV(TAPMLB01) ADPTTYPE(*RS232) RSRNAME(CMN02)
```

Figure 27 shows the Configure Device Media Library (CFGDEVMLB) display that is shown after you press F4=Prompt.

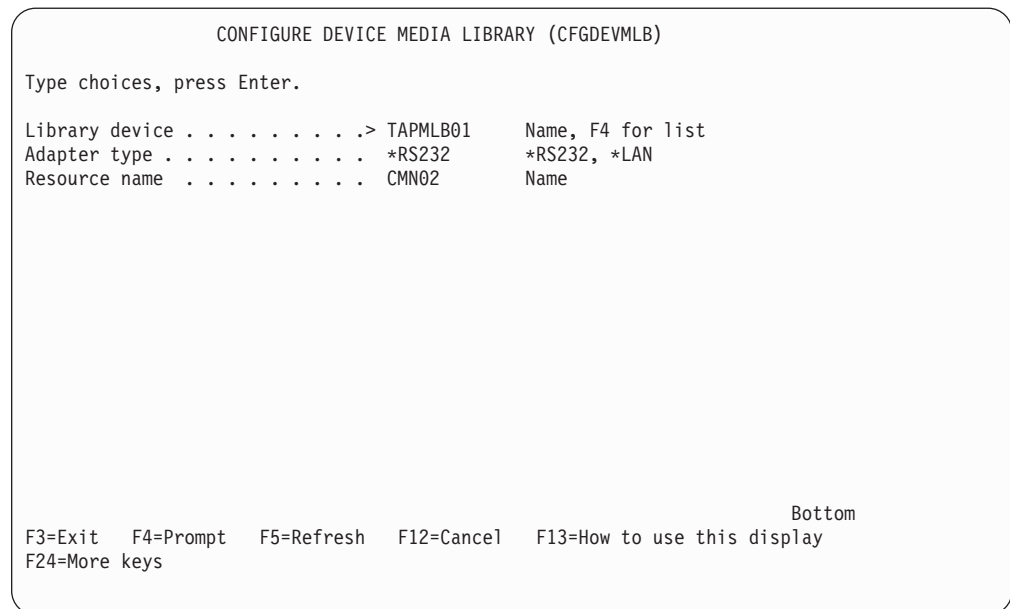


Figure 27. Configure Device Media Library - RS232.

**DEV** Device - Specifies the name of the MLB device description.

**ADPTTYPE**

Adapter Type - (\*RS232) indicates that this MLB is attached via an RS232 ASYNC line.

**RSRCNAME**

Resource Name - Specifies the resource name of the RS232 port. Use WRKHDWRSC TYPE(\*CMN) to determine what resource name is used.

**Note:** The RS232 ASYNC line, controller and device descriptions will be created ONLINE(\*NO). DO NOT VARY THEM ON. They will be varied on as needed internal to the operating system when the MLB device is varied on.

### LAN Configuration Details

To configure the ROBOTDEV parameter for an MLB using a LAN line, use the following command:

```
CFGDEVMLB DEV(TAPMLB01) ADPTTYPE(*LAN) LIND(TRNLINE)
RMTLOCNAME(APPN.MLD01) ADPTADR(0123456789AB)
```

Figure 28 shows the Configure Device Media Library (CFGDEVMLB) display that is shown after you press F4=Prompt.

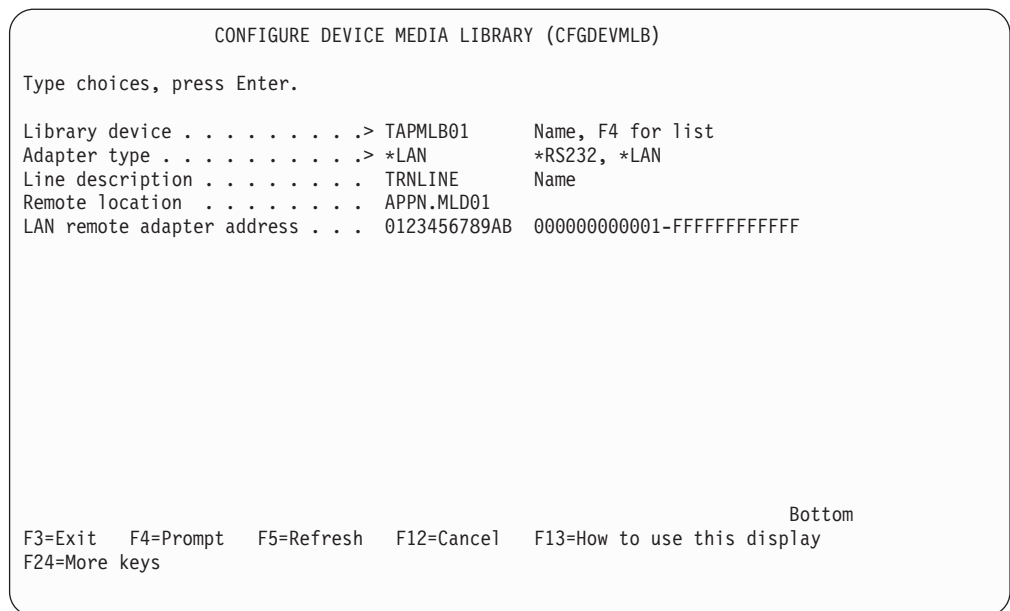


Figure 28. Configure Device Media Library - LAN.

**DEV** Device - Specifies the name of the MLB device description.

**ADPTTYPE**

Adapter Type - (\*LAN) indicates that this MLB is attached via a LAN line.

**LIND**

Line Description - Specifies the line description name for the LAN line being used. Use WRKCFGSTS CFGTYPE(\*LIN) to display the list of valid LAN line descriptions. The line description for the LAN must be created before using the CFGDEVMLB command.

### **RMTLOCNAME**

Remote Location Name - Refers to the name of the Library Manager that is connected via the LAN line. It is of the form nnnnnnnn.cccccc where nnnnnnnn is the network id and cccccc is the remote location name. If no network ID is specified DSPNETA is used to determine the default value. This parameter can be obtained from the 3494 Library Manager console using the pull downs COMMANDS, LAN options, LM LAN information.

### **ADPTADR**

Adapter Address - Specifies the LAN adapter address of the Library Manager. This parameter can be obtained from the 3494 Library Manager console using the pull downs COMMANDS, LAN options, LM LAN information.

**Note:** The LAN transaction program remains as QMLD/QMLDSTRCC and is contained internal to LIC software.

To display LAN information required to Add LAN Host on the 3494 Library Manager, use the following command:

```
DSPLANMLB LIND(TRNLINE) OUTPUT(*)
```

Figure 29 shows the Display LAN Media Library Information display that is shown after you press the Enter key.

```
Display LAN Media Library Information

Host transaction program name . . . . . : QMLD/QMLDSTRCC
Host network id . . . . . : APPN
Host location name . . . . . : SYSNAME
Host adapter address . . . . . : 0123456789AB

Press Enter to continue.

F3=Exit
(C) COPYRIGHT IBM CORP. 1980, 1995.
```

Figure 29. Display LAN Media Library Information.

#### **Attention!**

Use the Display Network Attributes (DSPNETA) command to check the values of the network attributes. If the current system name, local control point name, and default local location name are all different, you will need to perform additional configuration steps. Contact your first level of support for assistance.



## Changing MLB device descriptions

In the case of a shared media library device it is sometimes desirable to change the device descriptions to a common set across the attached network of systems. This can be accomplished easily if the following things are taken into consideration.

For Version 3 Release 6 and later releases, the MLB device descriptions are fully implemented. All tape commands (such as SAVLIB and SAVCHGOBJ) and tape library commands (such as WRKTAPCTG and DSPTAPSTS) are issued with the MLB device specified. To change the MLB device description they must be varied off. Use the Work with MLB Status command (WRKMLBSTS) to vary off the MLB device to be changed. Once the MLB device is varied off, use option 8 (Work with Description), then option 7 (Rename). Or the Change Device Description Media Library (CHGDEVMLB) command can be used to change the media library device.

**Note:** If the 3494 Automated Tape Library Dataserver is attached via LAN, do not use the same name for MLB device description and the Library Manager remote location name. This results in duplicate device description error.

The tape devices are configured as MLB resources (MLBRSC) and with tape device descriptions. The MLBRSC is for library operation and the tape device description is for non-library (stand-alone) operations. To change the resource names, use System Service Tools (SST). Vary off the affected device and then start SST (STRSST). Use the following steps as a guide for changing the resource names.

- option 1 (Start a Service Tool)
- option 7 (Hardware Service Manager)
- option 2 (Logical Hardware Resources)
- option 1 (System Bus Resources)
- option 9 (Resources associated with IOP) for the appropriate IOP
- option 2 (Change Detail) for the resource to be renamed.
- enter the new resource name.
- Use F3 (exit), to back out of SST.

**Note:** Once a resource name has been changed, the "old" name can not be reused until a system IPL occurs.

To change the tape device description use the WRKCFGSTS \*DEV \*TAP command. Vary off the device description, select option 8 (Work with Device Description), then option 7 (Rename). Once the device description is renamed vary on the new device description and it is ready for use.

**Note:** Extra steps are required to update BRMS for AS/400 when changing the device descriptions. These details are covered in *Backup Recovery and Media Services*, SC41-4345.

## Varying on the Media Library

In Version 3 Release 6 and later releases, the media library device is fully implemented. MLB devices have all of the typical functions and support of other OS/400 devices. Two interactive commands are provided for working with MLB device status. The Work with Configuration Status command (WRKCFGSTS) has been updated to handle the new MLB devices. To work with only media library devices, specify CFGTYPE(\*DEV) and CFGD(\*MLB). This will display the media library devices on the system and their current status and activity. For media

libraries, the preferred command is Work with Media Library Status (WRKMLBSTS). It provides the same functions as WRKCFGSTS, plus new functions to manage the tape resources associated with the media library.

```

Work with Media Library Status

Type options, press Enter.
 1=Vary on   2=Vary off  3=Reset resource   4=Allocate resource
 5=Allocate unprotected 6=Deallocate resource 8=Work with description

Opt   Device/Resource   Status           Allocation       Job Name
-----
TAPMLB01  VARIED ON
TAP01     OPERATIONAL      ALLOCATED
TAP02     OPERATIONAL      DEALLOCATED
TAPMLB02  VARIED OFF
TAP03     OPERATIONAL      ALLOCATED

More...

Parameters or command
====>
F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Position to
F23=More options
(C) COPYRIGHT IBM CORP. 1980, 1995.

```

Figure 30. Work Media Library Status.

Each tape resource has an ALLOCATION STATUS associated with it. There are several values for allocation status.

### ALLOCATED

The tape resource is available for use in the library device and the resource has been assigned (or reserved) to this system. No other system can use this tape resource. The tape resource is available to the resource manager. The allocation status change and assign are done at vary on of the media library device. Or, if the MLB device is varied on, whenever the device resource status is changed from WRKMLBSTS.

**Note:** The resource manager will choose ALLOCATED resources before UNPROTECTED resources.

### UNPROTECTED

The tape resource is available for use in the library device and the resource has NOT been assigned/reserved to this system. The tape resource is available to the resource manager. Any attached system can share this tape resource. As a request comes to the resource manager for a tape resource, an assign/reserve command is attempted to the device. If the system cannot obtain an assign/reserve, other available resources will be used. If no other resources are available, the system will wait for an available resource to successfully obtain an assign/reserve to the system. The wait time is based on the INLMNTWAIT and EOVMNTWAIT parameters in the MLB device description. It is possible for a resource to be released and reassigned by another system before this system can obtain a successful assign.

### DEALLOCATED

The tape resource is NOT available to the resource manager. Requests to MLB devices with no tape resources in ALLOCATED or UNPROTECTED status will result in an error message.

### STAND-ALONE

The tape resource is not available to the resource manager. It has been DEALLOCATED and the tape resource has been varied to the stand-alone tape device description.

### ACTIVE

The tape resource is being used by a job that is performing an input or output operation.

It is possible to change the status of the tape resource with the MLB device varied on or off. It can either be done directly from the WRKMLBSTS panel or with the Vary Configuration (VRYCFG) command with a TYPE of \*MLBRSC. See the Vary Configuration section in the CL Reference Guide.

Option 8, Work with description, allows you to work with the tape device description associated with the tape device resource.

Option 10, Configure device, invokes the Configure Device Media Library (CFGDEVMLB) command used to configure the 3494 Library Manager communication line (ROBOTDEV).

### Managing multiple device attachments in a single 3494

When multiple 3490/3590 tape subsystems are present in single 3494 Automated Tape Library Dataserver special steps must be followed when operating with Version 3 Release 6 or later systems. Figure 31 shows two systems attached to two tape subsystem located in a single 3494 Automated Tape Library Dataserver.

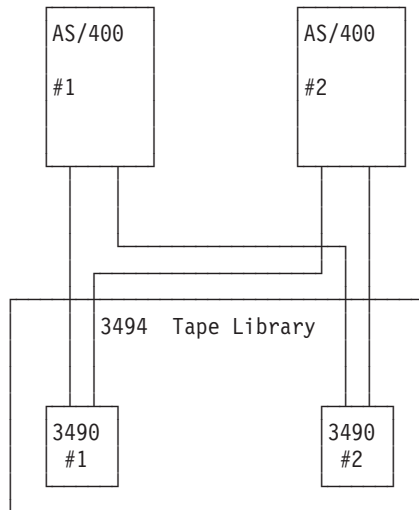


Figure 31. One AS/400 attached to two 3490 tape subsystems in a single 3494.

Each system would have two MLB devices configured, one for each 3490 tape subsystem. See Figure 32 on page 50 for the resultant configuration as displayed by WRKMLBSTS.

```

Work with Media Library Status

Type options, press Enter.
 1=Vary on   2=Vary off  3=Reset resource   4=Allocate resource
 5=Allocate unprotected  6=Deallocate resource  8=Work with description

  Opt   Device/      Status           Allocation      Job
       Resource      VARIED OFF
  -     TAPMLB01
  -     TAPMLB02      VARIED OFF

                                     More...

Parameters or command
====>
F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Position to
F23=More options

```

Figure 32. Work with Media Library Status - MLB varied off

When the 3494 Library Manager connection is configured and the MLB device is varied on, the complete configuration is determined and all like devices are then associated with the MLB device description. See Figure 33 on page 51 for the resultant configuration as displayed by WRKMLBSTS.

**Note:** When sharing tape devices, IBM recommends that you leave the MLB device description in the varied on state and manage the tape resources individually.

To share all tape resource between the 2 hosts. Both systems should have the MLB device description varied on and the tape resource be set to UNPROTECTED status. The second MLB device description can be deleted or ignored. However, if the second MLB is deleted and automatic configuration is on, the MLB will be recreated at the next IPL.

```

Work with Media Library Status

Type options, press Enter.
 1=Vary on   2=Vary off  3=Reset resource   4=Allocate resource
 5=Allocate unprotected  6=Deallocate resource  8=Work with description

Opt   Device/Resource   Status           Allocation       Job name
-     TAPMLB01           VARIED ON
-     TAP01              OPERATIONAL     DEALLOCATED
-     TAP02              OPERATIONAL     DEALLOCATED
-     TAP03              OPERATIONAL     DEALLOCATED
-     TAP04              OPERATIONAL     DEALLOCATED
-     TAPMLB02           VARIED OFF

Bottom

Parameters or command
====>
F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Position to
F23=More options

```

Figure 33. Work with Media Library Status - TAPMLB01 varied on

If more control is needed for complex setups where performance or some other concern needs to be addressed, the second MLB device description can be utilized to manage the device resource independently. See Figure 34 for the resultant configuration as displayed by WRKMLBSTS. In this setup TAP01 and TAP02 are being shared while TAP03 and TAP04 are dedicated. The second system could share TAP01 and TAP02, but could not use TAP03 or TAP04. See “Sharing Media Library (MLB) Devices” on page 57 for more details.

**Note:** Remember the tape resources can only be allocated or unprotected to one MLB device description at a time on given system.

```

Work with Media Library Status

Type options, press Enter.
 1=Vary on   2=Vary off  3=Reset resource   4=Allocate resource
 5=Allocate unprotected  6=Deallocate resource  8=Work with description

Opt   Device/Resource   Status           Allocation       Job name
-     TAPMLB01           VARIED ON
-     TAP01              OPERATIONAL     UNPROTECTED
-     TAP02              OPERATIONAL     UNPROTECTED
-     TAP03              OPERATIONAL     DEALLOCATED
-     TAP04              OPERATIONAL     DEALLOCATED
-     TAPMLB02           VARIED ON
-     TAP01              OPERATIONAL     DEALLOCATED
-     TAP02              OPERATIONAL     DEALLOCATED
-     TAP03              OPERATIONAL     ALLOCATED
-     TAP04              OPERATIONAL     ALLOCATED

Bottom

Parameters or command
====>
F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Position to
F23=More options

```

Figure 34. Work with Media Library Status - TAPMLB01 and TAPMLB02 varied on

## Using Cartridges in the MLB

Any OS/400 command that has a VOL parameter will cause the cartridge identifier specified to be mounted. If the cartridge identifier does not match the logical volume identifier for standard labeled tapes, an informational message will be signalled on input operations and an inquiry or escape message, based on command, will be signalled for output operations. All AS/400 tapes are initialized with volume identifier matching the cartridge identifier.

The easiest way to find existing cartridges for use in the MLB inventory is to use the Work with Tape Cartridges (WRKTAPCTG) command. It allows you to work with individually specified cartridges, all cartridges, or cartridges in a certain category. For more information, see “Cartridge Categories” on page 53.

WRKTAPCTG DEV(TAPMLB01) CTG(\*ALL) will display a complete inventory of cartridges for the device type that is associated with TAPMLB01.

```
Work with Tape Cartridges
12/11/95 12:18:12
Library Device: TAPMLB01
Type options, press Enter.
  1=Add  2=Change  4=Remove  5=Display  6=Print ...

  Cartridge  Volume
Opt ID       ID       Status
VOL001     VOL001   Mounted
VOL002     VOL002   Available
VOL003     VOL003   Available
VOL004     *UNKNOWN Inserted
VOL005     *UNKNOWN Inserted
VOL006     *UNKNOWN Inserted
VOL007     *UNKNOWN Inserted

More...

Parameters or command
===>

F3=Exit    F4=Prompt  F5=Refresh  F9=Retrieve  F11=Show category
F12=Cancel F17=Top    F18=Bottom  F23=More options
(C) COPYRIGHT IBM CORP. 1980, 1995.
```

Figure 35. Work with Tape Cartridge

The work with panel above shows the inventory of cartridges, the logical volume identifiers that have been processed or \*UNKNOWN on those that have not and the status of the cartridges.

## Cartridge Status

### Inserted

The cartridge has been moved into the media library device and has been placed in the \*INSERT category (see “Cartridge Categories” on page 53). The cartridge is not available to any user until you add it to a usable category with the Add Tape Cartridge (ADDTAPCTG) command.

### Available

The cartridge exists in a usable category and is available for use.

### Mounted

The cartridge exists in usable category and is currently in a tape resource.

The tape resource may not be attached to this system. This is common for large 3494 configurations. If a cartridge is mounted in a device that is not attached to this system, the system would return an error when the cartridge is requested.

#### **Duplicate**

The cartridge identifier exists more than once in the inventory. Only one entry is established for the cartridge id. This error should not occur on the 3494 because the Library Manager software does not allow duplicate cartridge identifiers in the device. When a 3590 with Automated Cartridge Facility is operating in Random mode with GENCTGID(\*VOLID) parameter in the device description, this error could happen often. One of the duplicate cartridge identifiers has to be removed either physically or with the Remove Tape Cartridge (RMVTAPCTG) command.

#### **Not Available**

The 3494 Library Manager software has determined that the cartridge is not available for use. A possible reason could be that it has been lost or misplaced in the inventory.

**Error** The cartridge is in error. See the QSYSOPR message queue to determine why the cartridge would be in error.

#### **Ejected**

The cartridge has been removed or is in the process of being removed.

## **Cartridge Categories**

Categories are a logical groupings of cartridges of the same status or the same usage. They allow the user to refer to a group of cartridges by category name versus the individual cartridge IDs.

For library devices without a library manager, categories have a very limited purpose. There is no security that is provided without the library manager. Cartridges that are added to one system's categories are not known to other attached systems. Therefore, when operating with libraries that do not have a library manager, only the following categories are of interest:

- \*INSERT
- \*EJECT
- \*CNV
- \*SHARE400

Note that \*NOSHARE can be used but does not prevent other systems from accessing the cartridges. The remaining categories do not apply for library devices without library managers. Categories that are created for non-library manager library devices are only known to the system where they are created and not across all attaching systems. For these type libraries the cartridges must be added to each system and then managed across all the systems by the tape management software.

Categories are intended for library devices like the 3494 where there is a library manager function that uses categories to provide security and special functions. With the 3494, several special considerations must be remembered when dealing with categories.

Category names are of the form "name.sysname", where the name is the category name and sysname is name of the system that owns the category (the first host

that created the category). If the system name is changed, the cartridges in the associated categories will become unavailable until a category is created with the previous system name. Refer to "**Are You Changing Your System Name?**" below for more information. Cartridges in the \*NOSHARE category will not be accessible. It is highly recommended that all cartridges be removed from the MLB or changed to the \*SHARE400 category prior to changing the system name.

**\*INSERT**

The cartridge has been moved into the media library device and has been placed in the \*INSERT category. The cartridge is not available to any user until you add it to a usable category with the Add Tape Cartridge (ADDTAPCTG) command.

**\*NOSHARE**

The cartridge has been assigned to a category that is only available to the system defined as the primary owner. Only media library devices with Library Manager software that contains category information (i.e. 3494) and has access to multiple systems can ensure that the cartridge is only used by the primary owning system

**\*SHARE400**

The cartridge has been assigned to a category that is available to all AS/400 systems attached to the media library device.

**\*EJECT**

The cartridge has been removed from the inventory with the RMVTAPCTG command and is awaiting physical removal or waiting for the convenience station or high capacity output area to be cleared.

**\*CNV**

The cartridge has been assigned to the convenience category. The convenience category is designed for the user who just needs to use a tape quick and get it out of the media library device. A tape in the \*CNV category, it will be ejected (removed) after it has been mounted and then unloaded. The ejecting process will take place when a user specifies an end option (ENDOPT) parameter of \*UNLOAD. The cartridge will not be ejected when OS/400 unloads the tape resource for another request. See "End Option (ENDOPT) Setting" on page 56 for more details.

**\*IPL**

The cartridge has been assigned to the IPL category. This category is provided by OS/400 for tape cartridges that would be used for a load source (D-mode) IPL. The tapes in this category must be maintained by the user, that is, OS/400 does not guarantee or verify that the tape cartridges really have the appropriate data on them.

**\*NL**

The cartridge has been assigned to the \*NL category. Tapes in this category must be non-labeled tapes. A non-labeled tape is a tape volume with no logical volume identifier.

**\*SYSGEN**

The cartridge is assigned to the \*SYSGEN category. All cartridge identifiers are assigned to this category when the device description has the GENCTGID parameter set to \*SYSGEN. This feature allows media library devices with no bar code reader to bypass all system category checks on the cartridge for fast use of cartridges. Cartridges cannot be added or changed to this category.

**User-defined**

User defined categories can be created and deleted. These categories allow users to create their own "logical groupings" of tape cartridges. The Create Tape Category (CRTTAPCGY) and Delete Tape Category



(DLTTAPCGY) commands are used for this function. Display Tape Category (DSPTAPCGY) command displays a list of user defined and system defined categories on a given system.

**Note:** If you are using BRMS for AS/400, you should not attempt to use user-defined categories.

## Cartridge and Volume Identifiers

Every cartridge and volume ID can contain the following characters A through Z, 0 through 9, \$, @. Only the first six characters are recognized by OS/400, therefore the uniqueness of the cartridge ID must be within the first six characters of the name. The first six characters of the cartridge ID should match the volume ID for the tape.

Special generated cartridge IDs have been put into effect for the MLBs that do not have a bar code reader or are missing the bar code label.

### **NLTxxx**

Non-Labeled Tape - This cartridge contains data written in non-Standard Tape Label format.

### **CLNxxx**

Cleaning - This cartridge has been identified as a cleaning tape.

### **BLKxxx**

Blank - This cartridge contains no data.

### **UNKxxx**

Unknown - This cartridge was not identifiable.

### **IMPxxx**

Import - Refers to the cartridge that is in the Priority slot of the 3570 or 3590 Auto Cartridge Facility.

### **SLTxxx**

Slot - Refers to the cartridge by slot number. If the device description is created with the GENCTGID parameter set to \*SYSGEN mode then the cartridges in the media library inventory will appear as SLTxxx where xxx is the slot number.

## End of Volume Considerations

To be a fully automated solution without a tape management system, each volume that will be needed must be specified on the command in the VOL parameter. If the system runs out of tape cartridges specified in the volume list, an error is signalled that cannot be recovered. Tape management systems have the ability to provide more volumes through exit points in the OS/400 tape functions.

Version 3, Release 7 enhanced the "end of volume list" situation, message CPA6798, to accept a cartridge ID and continue processing.

## VOL(\*MOUNTED) Usage

Tape commands are issued to a media library device. If the MLB has all available tape resources loaded with media, it is meaningless to use VOL(\*MOUNTED). For

this reason the VOL parameter must contain a valid cartridge ID when issuing a command to a media library device. If VOL(\*MOUNTED) is specified, the system returns an error.

If a tape management system is installed on the system, VOL(\*MOUNTED) is typically used to signal that a scratch tape should be used. Tape management systems have the ability to override the VOL(\*MOUNTED) value with a scratch tape before an error is signalled.

If a category is mounted on the media library device (see “Mounted Category”), then VOL(\*MOUNTED) informs OS/400 to use the next tape cartridge in the “mounted” category.

**Note:** BRMS for AS/400 does not use categories and does not mount categories in its operations.

## End Option (ENDOPT) Setting

The end option (ENDOPT) parameter has a significant effect on the operation of the media library device.

End options on OS/400 commands include \*REWIND, \*UNLOAD, and \*LEAVE.

### \*REWIND

At the end of the command, the cartridge is rewound and left loaded in the tape resource. At this point the tape resource is available for other media library requests. If the next request requires a different cartridge, the present cartridge is unloaded, and the new cartridge is mounted.

### \*UNLOAD

At the end of the command, the tape resource is unloaded and the cartridge is demounted. At this point the tape resource is available for other media library requests.

### \*LEAVE

At the end of the command, the media is positioned at the last point accessed. The tape resource is only available to commands that are using the same cartridge identifier. Commands that require a tape resource, but do not mount tapes (such as WRKTAPCTG), could be given a resource that is in \*LEAVE processing as long as the resource is not in use.

**Note:** The Check Tape (CHKTAP) command is the only OS/400 command that defaults to \*LEAVE. OS/400 does not honor the \*LEAVE processing of the CHKTAP command unless a file is specified by file name or sequence number. This prevents CHKTAP commands from locking up all of the tape resources.

## Mounted Category

Mounted category allows a group of tapes to automatically be loaded into a tape device. The media is mounted in the order in which they were placed into the category. It is similar in function to a Automatic Cartridge Loader (ACL) on the stand-alone 3490 devices. This function is available with the Set Tape Category (SETTAPCGY) command. Mounted category is provided for all media library devices.

For 3494 devices the Library Manager software performs this function. For libraries other than the 3494, OS/400 performs this function. Because of this difference, the 3494 Library Manager software loads the next tape as soon as the previous tape is unloaded. For all other libraries, the tape resource is not loaded until a tape command requiring media is issued to the media library device.

With a category mounted, a tape resource is dedicated for category mount operations until a SETTAPCGY (\*DEMOUNTED) is issued. Once the SETTAPCGY has been issued, any OS/400 command to the media library device with VOL(\*MOUNTED) will be directed to the tape resource set up for mounted category. Only one category can be mounted per media library device description per host assuming each host can get a tape resource.

**Notes:**

1. Tape management systems are notified when a category is mounted and demounted. When a command comes from a user to VOL(\*MOUNTED), the tape management system has the ability to accept or reject the operation.
2. BRMS for AS/400 does not use mounted categories to perform its processing. Using mounted categories in combination with BRMS for AS/400 functions is not recommended. Mounting a category while concurrently using BRMS for AS/400 to perform save operations can have unpredictable results.

## Sharing Media Library (MLB) Devices

### Sharing MLB Devices on the Same System

The major design change for RISC is that the media library devices have been implemented with a resource manager to support multiple concurrent users. As commands are issued to the MLB device the resource manager checks for the cartridge and a tape resource. If they are available the cartridge is mounted and command processing begins. If all tape resources are in use the request is queued first in, first out with a priority and time limit. The time limit is specified by the INLMNTWAIT and EOVMTWAIT parameters in the MLB device description, and the priority is based on the RSCALCPTY parameter in the MLB device description. The time limit is specified by the MAXDEVTIME parameter in the MLB device description and the priority is based on the job attributes. The priority is referenced on each request for a tape resource. Changing the run priority of the job after the request has been queued will only affect the subsequent requests if the RSCALCPTY parameter is set to \*JOB. Commands that require multiple volumes will generate multiple media library requests. So, changing the run priority would affect the priority of the requests for subsequent tape mounts.

This function is a big conceptual change and will dramatically enhance backup strategies. Sharing devices on the system becomes automatic. An example of this concept is that ten save operations (SAVLIBs) could be issued, with ten different cartridges, to a tape library device description (TAPLIB01). If TAPLIB01 has only 4 tape resources available to it, the first four requests would be issued, one to each tape resource. The remaining 6 are placed on a queue and will be issued as tape resources become available. The order that they are placed on the queue is based on the RSCALCPTY parameter in the MLB device description. The resource manager eliminates any idle time between jobs due to early completion, from either changing data or job failure. The time limit value can be of special interest. In the example above, the 10 save operation are started at a given time and known, through estimates or bench marking, to complete in 6 hours. Set the MLB device time limit to 6 hours. Now if any of the save operations do not complete in 6 hours,

an escape message is signalled to the job(s). A pager system could monitor for this message and page an operator to determine the necessary recovery actions.

## Sharing MLB Devices Between Systems

The RISC design allows more flexibility for sharing MLB tape resources between systems. Tape resources can be set to ALLOCATED, UNPROTECTED or DEALLOCATED. See "Varying on the Media Library" on page 47 for more details. To better facilitate sharing between systems the concept of UNPROTECTED was added to the RISC systems. When the tape resource is set to UNPROTECTED status, the tape resource is not "assigned" until it is needed. This prevents a tape resource from being "assigned" to a system that is not presently using it.

## Sharing MLB Devices Between Systems and on the Same System

From the previous two sections it can be seen how the RISC design provides more flexibility for sharing devices in a complex setup. When sharing devices between systems and on the same system, each system has a resource manager with its queue controlled by the priority and time out values. And between the systems the tape resources are set to UNPROTECTED status. While the sharing between systems does not have a priority concept, the concept of UNPROTECTED and the fact that tape resources are only assigned when they are in use will allow the systems to effectively share the tape resources. The resource manager automatically tries to get a resource by attempting to assign it. If another system has the resource, the job is placed back in the queue and waits. In a few seconds another assign is attempted. If the job now gets the resource, the save continues.

## Importing cartridges

A process that is called importing adds cartridges to the inventory of the media library. Most media libraries provide an I/O station for adding cartridges without interrupting any automatic operations. An I/O station can have multiple slots or just a single slot. Some media libraries have no I/O station. For these media libraries, cartridges are added by stopping the automation and opening the door to access the open storage slots.

Tape cartridges that are placed in the 3494 I/O station are automatically moved to a storage slot by the 3494 Library Manager software. For other media libraries, the tape cartridges will remain in the I/O station until the Add Tape Cartridge (ADDTAPCTG) command is used. The ADDTAPCTG command is used to add the cartridge ID to a specified category of media. See "Cartridge Categories" on page 53 for more details. The ADDTAPCTG command changes the cartridge status. See "Cartridge Status" on page 52 for further details.

The following examples explain import operations when you are using a cartridge in the I/O station of a non-3494 media library, and the media library does not have a bar code reader. Since there is no bar code reader, the generated ID IMP001 is used. Refer to "Cartridge and Volume Identifiers" on page 55 for more information. The VOLSER recorded on the media is known to be TAPE01. If the media library has a bar code reader, then some of these examples would not apply because the cartridge ID would be known.

```
ADDTAPCTG DEV(TAPLIB01) CTG(IMP001) CGY(*SHARE400) CHKVOL(*NO)
```

- The cartridge in the priority cell is moved to the first available slot in the magazine inventory. The cartridge is not loaded in the device because CHKVOL(\*NO) was specified. The cartridge identifier remains IMP001.

ADDTAPCTG DEV(TAPLIB01) CTG(IMP001) CGY(\*CNV) CHKVOL(\*NO)

- IMP001 is added to the \*CNV category. The cartridge remains in the priority slot because CHKVOL(\*NO) was specified. The cartridge will be loaded if a command is issued with IMP001 as the VOL parameter. When the cartridge is unloaded (ENDOPT(\*UNLOAD)), it is moved to the priority slot.

ADDTAPCTG DEV(TAPLIB01) CTG(IMP001) CGY(\*SHARE400) CHKVOL(\*YES)

- The cartridge is moved from the priority cell to the tape drive, CHKVOL(\*YES). The logical volume identifier is found to be TAPE01 and the cartridge identifier is changed to be TAPE01. The cartridge is added to the \*SHARE400 category. When the cartridge is unloaded (ENDOPT(\*UNLOAD)), the cartridge will be moved to the first available magazine slot.

ADDTAPCTG DEV(TAPLIB01) CTG(IMP001) CGY(\*CNV) CHKVOL(\*YES)

- The cartridge is moved from the priority cell to the tape drive, CHKVOL(\*YES). The logical volume identifier is found to be TAPE01 and the cartridge identifier is changed to be TAPE01. The cartridge is added to the \*CNV category. When the cartridge is unloaded (ENDOPT(\*UNLOAD)), the cartridge will be returned to the priority slot.

ADDTAPCTG DEV(TAPLIB01) CTG(TAPE01) CGY(\*NOSHARE) CHKVOL(\*YES)

- If no cartridge identifier TAPE01 exists in the inventory for this MLB, OS/400 will search the device starting with the priority slot and then any cartridge IDs with the volume id of \*UNKNOWN. When the cartridge in the priority slot is loaded it is found to be TAPE01. The cartridge identifier is changed to TAPE01 and the cartridge is added to the \*NOSHARE category. When the cartridge is unloaded (ENDOPT(\*UNLOAD)), the cartridge will be moved to the first available magazine slot.

ADDTAPCTG DEV(TAPLIB01) CTG(TAPE01) CGY(\*NOSHARE) CHKVOL(\*NO)

- If no cartridge identifier TAPE01 exists in the inventory for this MLB, OS/400 will search the device starting with the priority slot and then any cartridge IDs with the volume id of \*UNKNOWN. When the cartridge in the priority slot is loaded it is found to be TAPE01. The cartridge identifier is changed to TAPE01 and the cartridge is added to the \*NOSHARE category. When the cartridge is unloaded (ENDOPT(\*UNLOAD)), the cartridge will be moved to the first available magazine slot.

SAVOBJ DEV(TAPLIB01) OBJ(QCLSRC) LIB(QGPL) VOL(IMP001)

- The cartridge in the priority slot is loaded and the SAVOBJ command is executed. When the cartridge is unloaded is returned to the priority slot. The cartridge defaults to \*CNV category so it is not kept in the inventory.

SAVOBJ DEV(TAPLIB01) OBJ(QCLSRC) LIB(QGPL) VOL(TAPE01)

- If no cartridge identifier TAPE01 exists in the inventory for this MLB, OS/400 will search the device starting with the priority slot and then any cartridge IDs with the volume id of \*UNKNOWN. When the cartridge in the priority slot is loaded it is found to be TAPE01. The cartridge identifier is changed to TAPE01 and defaults to the \*CNV category. It will be returned to the priority slot when the device is unloaded.

## Exporting cartridges

Cartridges that have been removed from the media library inventory are referred to as exported. All media library devices use the Remove Tape Cartridge (RMVTAPCTG) command to change media to the \*EJECT category. The STATION parameter then controls where the \*EJECT cartridges are placed.

**\*DEV** The cartridges are moved to the I/O station if the device has one. If not, then they are moved to the high capacity output area. If the device does not support a high capacity output area the cartridges are left in the device in the \*EJECT category.

**\*CNV** The cartridges are moved to the I/O station.

**\*HIGHCAP**

The cartridges are moved to the high capacity output area of the device. If the device does not have a high capacity output area, then the cartridges are left in the device in the \*EJECT category.

Cartridges in the \*EJECT category can be changed to \*INSERT category by physically removing and reinserting the cartridges. Forcing a "physical" re-inventory (i.e. opening the door), will also change cartridges from the \*EJECT category to the \*INSERT category for use.

## Restricted State Automation

Version 3 Release 6 and later releases no longer use MLDD and the associated subsystems for running the 3494. This change allows for automation to work in restricted state once the device descriptions exist.

Tape automation uses special files located in QUSRSYS. If these files do not exist on the system, a limited set of automation function is supported. Cartridges can be mounted by specifying the cartridge identifiers in the VOL parameter of the OS/400 commands. This subset of automation does not support the use of the cartridge commands such as WRKTAPCTG or DSPTAPCTG. This enables automation for early stages of recovery scenarios. During a save of QUSRSYS these files can be seized and unavailable for use. This can result in a deadlock and eventually abort the save operation. To avoid this situation, the save of QUSRSYS must not cross a volume boundary. It must fit on the mounted volume. Alternately, you can save QUSRSYS by using the save while active functions.

## Using a Tape Resource as a Stand-alone Device

Occasionally, it may be necessary to use the tape devices in a media library without the benefit of the automation. An example of this would be when you perform an alternate IPL. Another example would be when a media library is disabled. Using the tape device in this fashion is referred to as stand-alone mode. In stand-alone mode, the tape device operates like devices that are not in a media library. Most media library devices provide modes or commands to move media to the tape device. Examples of the modes and commands include the 9427 Sequential mode, 3570/3590 Auto or Manual mode, or the 3494 Stand-alone commands. In these modes, the media library operates as an automatic cartridge loader for the tape device and loads cartridges singly or sequentially in the device.

Media library devices are typically configured with media library device descriptions for the tape device resources. There are also separate tape device descriptions for

the tape device resources. These tape device descriptions are the devices that are used for stand-alone operation. To use the tape resources in stand-alone mode, the resource must be available to the tape device description. This is done by either deallocating the tape resource from the media library device or varying off the media library device. (Refer to “Varying on the Media Library” on page 47 for additional information on varying off a media library device.) Once the tape resource is available, you can vary on the tape device description, and issue commands to this device. The device resource on the WRKMLBSTS screen will now show a status of STAND ALONE. No media library function will operate for this device. The device will need to have cartridges mounted manually, by a device mode, or by device operator panel commands.

## Determining Status: Slots, Stations, and Mounted Categories

To determine the number of drives, slots, stations, or if there is a category mounted, use the Display Tape Status (DSPTAPSTS) command. It will return this information along with a list of tape resources in the media library device and cartridge identifier if any is loaded in the resource.

```

                                Display Tape Status Information
Library device . . . : MLB01          Category . . . . . : *NONE
Number of drives . . : 2             Category system . . :
Total slots . . . . : 740           Cartridge order . . : *NONE
Available slots . . : 380           Target category . . : *NONE
Number of stations : 10             Target system . . . :

Tape      Device  Device  Cartridge
Resource  Type    Model  ID
TAP09     3490   C2A    *NONE
TAP10     3490   C2A    *NONE

                                Bottom

Press Enter to continue.

F3=Exit
(C) COPYRIGHT IBM CORP. 1980, 1995.

```

Figure 36. Display Tape Status

For Version 3, Release 7 the Display Tape Status (DSTAPSTS) command has been enhanced to display the category mounted on the device, if any, or if the device is in Stand-alone mode. In addition, if the tape mounted is in \*LEAVE processing, that is now displayed with this command. This is useful for identifying devices that are not being used due to the resource being left in \*LEAVE processing see “End Option (ENDOPT) Setting” on page 56 for additional information on \*LEAVE processing.

```

                                Display Tape Status Information
Library device . . . : TAPMLB01      Category . . . . . : *NONE
Number of drives . . : 1             Category system . . :
Total slots . . . . : 740           Cartridge order . . : *NONE
Available slots . . . : 559         Target category . . : *NONE
Number of stations : 10             Target system . . . :

Tape      Device  Device  Cartridge  Category  Leave
Resource  Type    Model   ID         Mounted   Processing
TAP01     3590    B1A    *NONE     NO        NO

                                Bottom

Press Enter to continue.

F3=Exit
(C) COPYRIGHT IBM CORP. 1980, 1996.

```

Figure 37. Display Tape Status - V3R7.

---

## Library Manager Software

Every automated tape library has some form of controlling software that is integral to the unit itself. Depending on the type of automated tape library, library manager software may be:

- A simple control program (to operate the accessor arm) that is built into the hardware of the device,
- A complex application that may run on a separate personal computer and manage inventory databases, manage queue commands, control automated tape library status reporting, or assist in fault diagnosis.

Typically you can access and control the library manager software by using a control panel attached to the automated tape library device. This control panel can vary from a simple set of menu selection buttons to a complex application-type interface.

The type of library manager software and the procedure for accessing and controlling are unique to each individual automated tape library device. See your specific automated tape library operations guide for the necessary details. Some details are in the relevant topic area in “Chapter 2. Tape Automation Supported on AS/400” on page 11.



---

## Media Library Resource Allocation Attributes

At V4R3 and later releases, you have the ability to control the following when you are using tape resources within a tape media library:

- Resource allocation priority
- Initial mount wait time
- End-of-volume mount wait time

The resource allocation priority is defined as the precedence that a request will be given in relation to other requests for a tape resource within a tape media library. The requests with a higher priority (a lower value) will be given consideration first. The initial mount wait time is defined as the amount of time that the tape resource scheduler will wait to obtain a resource to mount the first cartridge for a tape operation. The end-of-volume mount wait time is defined as the amount of time that the tape resource scheduler will wait to obtain a resource to mount the next cartridge after the end-of-volume switch.

---

## Working with Media Library Attributes

At V4R3 and later releases, there are two commands and two APIs that allow you to manipulate the resource allocation attributes. The commands are Change Job MLB Attributes (CHGJOBMLBA) and Work with MLB Resource Queue (WKRMLBRSCQ). The APIs are Change Job Media Library Attributes (QTACJMA) and Retrieve Job Media Library Attributes (QTARJMA). Refer to “QTARJMA and QTACJMA APIs” on page 66 for further information on the QTACJMA and QTARJMA APIs.

The CHGJOBMLBA command allows you to change the resource allocation attributes for your own job or another user’s job if you have \*JOBCTL special authority. The resource allocation priority can be used to change the priority of requests to use a tape resource within a tape media library. You can assign a higher priority to certain jobs to allow them to get a tape resource as soon as one becomes available. You can assign a lower priority to jobs that can wait until a tape resource becomes available. Typically, very short—running tape operation such as the dynamic retrieval of an object that was saved storage free should be assigned a high resource allocation priority. Very long—running jobs that are not required to finish quickly, such as Duplicate Tape (DUPTAP) or Display Tape (DSPTAP), can be assigned a lower resource allocation priority.

The WRKMLBRSCQ command allows a user to manipulate the requests to use a tape resource with a tape media library. The WRKMLBRSCQ command shows the resources that are currently processing a request, have a category mounted, or are waiting to be assigned a tape resource. You can change the resource allocation attributes for requests that are waiting to use a tape resource by using option 2 on the Work with MLB Resource Queue screen. The attributes for the next request can be changed by using the CHGJOBMLBA command to change the resource allocation attributes for the job that is currently using the tape resource. You can do this by using option 5 on the Work with MLB Resource Queue screen, and then selecting option 21, Work with media library attributes.

```

Work with MLB Resource Queue
mm/dd/yy hh:mm:ss
Library Device: TAPMLB28
Type options, press Enter.
  2=Change Request MLB Attributes  5=Work with Job

Opt   User           Priority  Wait   Media   Resource
  _   USERNAME       10      *NOMAX VOL003  TAP54

Parameters or command
====>

F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Top
F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1998.

```

There are times when a request will show a zero priority. These requests are for when a tape resource is required to communicate with the media mover for a tape media library. An example is when the Change Tape Cartridge (CHGTAPCTG) command is used to change the category for a cartridge. The following screen shows a resource (TAP54) that is no longer associated with a job that is still in use, waiting for a cartridge to unload. Another job is waiting for a resource to become available to send a request to the media mover.

```

Work with MLB Resource Queue
mm/dd/yy hh:mm:ss
Library Device: TAPMLB28
Type options, press Enter.
  2=Change Request MLB Attributes  5=Work with Job

Opt   User           Priority  Wait   Media   Resource
  _   *SYSTEM        10      20     C00024  TAP54
  _   USERNAME       0        1     *NONE

Parameters or command
====>

F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Top
F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1998.

```

## Display Job (DSPJOB) Option(\*MLBA)

At V4R3 and later releases, option \*MLBA is available on the DSPJOB command. This option allows you to display the resource allocation attributes that will be used when using a tape library from the specified job.

```

                                Display MLB Attributes
                                mm/dd/yy  hh:mm:ss
Job: QPADEV0002   User:  USERNAME   Number:  013145

Library           Resource      Initial      End of volume
Device            Allocation  Mount       Mount
Device            priority   Wait time   Wait time
DJWTEST           20         1           1
TAPMLB21          20         1           1
TAPMLB22          20         1           1
TAPMLB23          20         1           1
TAPMLB24          20         1           1
TAPMLB25          20         1           1
TAPMLB26          20         1           1
TAPMLB27          20         1           1

                                Bottom

F3=Exit  F5=Refresh  F12=Cancel  F17=Top  F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1998.

```

## Work with Job (WRKJOB) Option(\*MLBA)

At V4R3 and later releases, option \*MLBA is available on the WRKJOB command. This option allows you to display or change the resource allocation attributes for a specific library for your current job or a specific job.

```

                                Work with MLB Attributes
                                mm/dd/yy  hh:mm:ss
Job: QPADEV0002   User:  USERNAME   Number:  013145

bType options, press.
 2=Change  5=Display

Library
Opt  Device
-   DJWTEST
-   TAPMLB21
-   TAPMLB22
-   TAPMLB23
-   TAPMLB24
-   TAPMLB25
-   TAPMLB26
-   TAPMLB27

                                Bottom

Parameters for option 2, 5 or command:
====>

F3=Exit  F4=Prompt  F5=Refresh  F9=Retrieve  F12=Cancel  F17=Top
F18=Bottom
(C) COPYRIGHT IBM CORP. 1980, 1998.

```

If you select option 2 and press F4 to prompt, you are shown the following screen. This screen allows you to change the attributes for the media library.

```

Change Job MLB Attributes (CHGJOBMLBA)

Type choices, press Enter.

Job name . . . . . > QPADEV0002   Name, *
User . . . . . > USERNAME       Name
Number . . . . . > 013145       000000-999999
Library device . . . . . > DJWTEST  Name, *ALL
Resource allocation priority . . *DEV  1-99, *SAME, *DEV, *JOB
Initial amount wait time . . . *DEV  1-600, *SAME, *DEV, *JOB...
End of volume mount wait time . *DEV  1-600, *SAME, *DEV, *JOB...

F3=Exit  F4=Prompt  F5=Refresh  F12=Cancel  F13=How to use this display
F24=More keys

```

---

## QTARJMA and QTACJMA APIs

The QTARJMA and QTACJMA APIs can be used to retrieve and change the tape media library resource allocation attributes for a specific job. For more information about the fields for the APIs, refer to *System API Reference* .

Special attention to authority requirements is required when retrieving and changing the resource allocation attributes. The following figure provides examples of using both APIs.

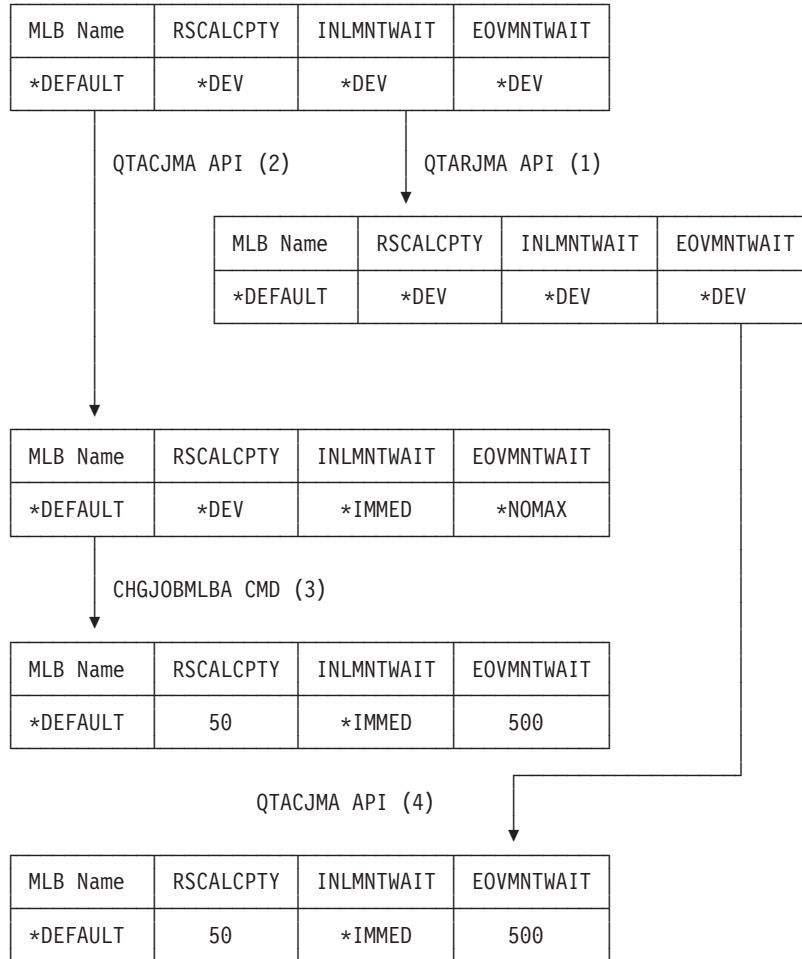


Figure 38. Retrieving and Changing Allocation Attributes

**Notes:**

1. An application using the QTARJMA API retrieves the current job MLB attribute information.
2. The application then changes the initial mount wait time (INLMNTWAIT) and the end of volume mount wait time (EOVMNTWAIT).
3. A system administrator with \*JOBCTL special authority changes the resource allocation priority (RSCALCPTY), initial mount wait time, and the end of volume mount wait time.
4. The application tries to restore the MLB attributes it retrieved earlier by using the QTACJMA API's \*REPLACE option. However, this function will fail with an error message of CPF67B4 because the user does not have \*JOBCTL special authority. None of the attributes will be changed.



---

## Part 2. Using Tape Automation





## Chapter 4. Using Tape Automation without a Media Management Application

This chapter describes how to use tape automation in an AS/400 environment with OS/400 support. It covers basic steps used to perform simple save and restore operations with tape automation.

Table 2 shows the typical setup and operational tasks and associated CL commands for the automated tape library.

These commands will need to be used if a media management application such as BRMS for AS/400 is not used.

*Table 2. Automated Tape Library Tasks and Commands*

Task	Command
Setting up a 3590 B11 or 9427 or Magstar MP	Auto-configured or use CRTDEVMLB
Setting up the 3494	Auto-configured or use CRTDEVMLB
Displaying RS232/LAN resource/description	Display Hardware Resources (DSPHDWRSC)
Configuring the 3494 communication (RS232/LAN)	Configure Device Media Library (CFGDEVMLB)
Display LAN information for 3494 Add LAN Host	Display LAN Media Library (DSPLANMLB)
Removing a 3590 B11 or 9427 or Magstar MP	Delete Device (DLTDEVD)
Removing a 3494	Delete Device (DLTDEVD)
Changing the MLB device description	Change Device Media Library (CHGDEVMLB)
Checking the configuration of an ATL.	Display Tape Status (DSPTAPSTS)
Checking the status of the media library	Work Media Library Status (WRKMLBSTS)
Setting up user categories.	Create Tape Category (CRTTAPCGY)
Mounting a category	Set Tape Category (SETTAPCGY) *MOUNTED.
Demounting a category	Set Tape Category (SETTAPCGY) *DEMOUNTED.
Deleting a user category.	Remove all the cartridges from the category, the use the Delete Tape Category (DLTTAPCGY) command
Listing all user or system categories	Display Tape Category (DSPTAPCGY)
Changing the category of a single cartridge	Change Tape Cartridge (CHGTAPCTG)
Changing the category of a group of cartridges	Work with Tape Cartridge (WRKTAPCTG), option 2 or Change Tape Cartridge (CHGTAPCTG)
Inserting a new cartridge	Add Tape Cartridge (ADDTAPCTG) or WRKTAPCTG, option 1
Inserting a group of new cartridges	WRKTAPCTG, option 1
Ejecting a single cartridge	Remove Tape Cartridge (RMVTAPCTG)

Table 2. Automated Tape Library Tasks and Commands (continued)

Task	Command
Ejecting a group of cartridges	RMVTAPCTG
Mounting cartridges for output or input commands	Specify MLB device and cartridge ID with the commands
Demounting a cartridge	Demounting is implicit with ENDOPT(*UNLOAD) or a new mount request
Working with a list (or subset) of cartridges within an automated tape library	WRKTAPCTG
Displaying information about a cartridge	DSPTAPCTG or WRKTAPCTG, option 5

For more detail on the OS/400 commands and their basic operation refer to “Chapter 3. Software Support for Automated Tape Libraries” on page 39 and the *CL Reference (Abridged)*.

Although a media management application program is not required to operate a automated tape library, an application program such as BRM Services/400 should be used for a total AS/400 solution. “Chapter 5. Using Tape Automation with BRMS for AS/400” on page 79 discusses how to use your tape automation with BRMS for AS/400.

The BRMS for AS/400 application uses many of the OS/400 support functions to drive the automated tape library. BRMS for AS/400 automatically calls groups of instructions that are needed to complete one output operation. BRMS for AS/400 selects the right cartridge and enters all the media handling commands needed at the appropriate time. BRMS for AS/400 also aids you in:

- Tracking and managing your entire multiple system media inventory
- Organizing and accomplishing your enterprise-wide backup strategy
- Guiding and controlling all recovery actions
- Organizing and accomplishing your archive requirements
- Managing and implementing all your dynamic recalls of archived data
- Networking and identifying the available tapes
- Pooling the various devices available

While BRMS for AS/400 links your corporate availability strategy to real-life tasks using policies and groups, it simplifies and automates the operation of your IBM automated tape libraries.

---

## Setting up an Automated Tape Library

Before the automated tape library can be used, it must have media in it. If a automated tape library is empty, open the door and insert all available media into the empty slots. This can be done to save time rather than inserting only a small number at a time through the convenience I/O station. When the door is closed, the automated tape library will inventory the contents. Each cartridge ID is noted and recorded in the operating system and Library Manager (if present).

From the AS/400, this information can be viewed using the WRKTAPCTG command. This command shows the status of the volumes that are currently in the

automated tape library. The Work with Tape Cartridge display is shown in Figure 39.

```
Work with Tape Cartridges                                RCHAS400
Library Device:                                         MLB01
Type options, press Enter.
  1=Add   2=Change   4=Remove   5=Display   6=Print...

  Cartridge Volume
Opt  ID      ID      Status
--  -
  BCD161  BCD161  Available
  BCD164  BCD164  Not Available
  BCD165  BCD165  Available
  BCD166  *UNKNOWN Available
  BCD168  BCD168  Available
  BCD170  *UNKNOWN Not Available
  BCD173  BCD173  Available
```

Figure 39. Work with Tape Cartridge Display

Options from this display are used to manipulate the volumes within the automated tape library. The \*UNKNOWN value in the volume ID either represents a cartridge that has not been used by this library or indicates that there is an error.

Press the F11 key to display the category information, including volume category and category system name.

If you press F11 again, the volume history information is displayed, which includes the last reference and last change date and time. If you press F11 for the third time, the volume information, including volume owner ID, cartridge density, and write protect information is shown.

The volume owner is the owner identifier in the volume labels of the tape. This identifier is set or changed on the Initialize Tape (INZTAP) command.

- \*UNKNOWN means that the tape has not been mounted and had its volume labels read.
- \*NL (non labeled) means that it is a non labeled volume and has no owner identifier.
- \*BLANK means that the default owner ID of \*BLANK was accepted on the INZTAP command and blanks were written in the volume labels for the owner ID. The owner ID is a good place to enter text that describes what is on the cartridge.

When you press F11 for the fourth time, you return to the status display shown in Figure 39.

When new cartridges are inserted into the automated tape library device they are placed in the \*INSERT category. Cartridges in the \*INSERT category cannot be used or mounted.

---

## Adding New Media (Cartridges) to an Automated Tape Library Device

From the Work with Tape Cartridge display (WRKTAPCTG command), select option 1 (Add) against each newly inserted cartridge in the automated tape library. This allows you to change the category of a newly inserted volume from \*INSERT to a more usable category. The choice of category depends on your planning. You can choose a system-created category such as \*SHARE400 or \*NOSHARE, or you may use one of your own defined categories.

When you press F4, the ADDTAPCTG prompt display is shown. You may then change the defaults from the ones shown in Figure 40. If you do not press F4, these defaults are accepted and the cartridge is added.

```

                                Add tape cartridge (ADDTAPCTG)
Type choices, press Enter.
Library device . . . . . > MLB01           Name
Cartridge ID . . . . . > BCD989           Character value

Category:
  Category name . . . . . *NOSHARE         *NOSHARE, *SHARE400, *IPL...
  Category system . . . . . *CURRENT       *CURRENT
  Check Volume ID . . . . . *YES           *YES, *NO
```

Figure 40. Add Tape Cartridge using Display

You must initialize each new tape with option 10. If you do not prompt the option, the defaults are taken. This includes the end of tape option (\*REWIND), check for active files(\*YES), and the name of the first device that OS/400 allocates during the WRKTAPCTG operation. This device may or may not be available when you select option 10.

Once the newly inserted volumes have been added and initialized, they can be used, based on the category in which they are placed, for tape operations on certain systems.

---

## Save and Restore Tasks

When performing any save or restore operation with an automated tape library, consider the following.

### Performing a Normal Save Operation

If you use an automated tape library for a save operation with the Save commands, it is not that different than one from a typical tape drive save operation.

To perform a save operation you need to:

1. Select a cartridge that is in the automated tape library. (Use the WRKTAPCTG command to produce a list of media within your tape automation.)
2. Identify whether the cartridge is in an appropriate category (press F11 on the WRKTAPCTG display).

3. Ensure that the cartridge does not contain unexpired data. You may be able to determine this from operations knowledge or from the last dates referred to on the WRKTAPCTG display (F11 again). You can display the cartridge by using DSPTAP with option 11.
4. Ensure that a tape resource is either allocated or marked as unprotected for the MLB.
5. Enter the save command and specify the cartridge ID(s) in the volume ID parameter. Take into consideration the ENDOPT parameter. The option \*UNLOAD may be appropriate.
6. Release the tape resource to its original state by using one of the following options:
  - Vary off the MLB device
  - Deallocate the tape resource
  - If the tape resource was in an unprotected state, it will return to that state automatically

Steps 1 and 2 are additional tasks that are needed when using a automated tape library. Steps 3 through 6 are steps that would be needed for any normal tape operation.

An end-of-tape option of \*UNLOAD for any of the save commands causes the cartridge to be returned to its cell when the save operation has completed processing. When using \*REWIND the cartridge remains in the drive after the save has completed. However, this cartridge is unloaded if another cartridge has been requested. When using \*LEAVE the cartridge remains in the drive after the save has completed.

## Performing a Save System Operation

To perform a SAVSYS operation, perform the following steps:

1. Enter ENDSBS \*ALL, and specify OPTION(\*IMMED) or OPTION(\*CNTRLD) to end subsystems.
2. Enter the SAVSYS command. The volume IDs are specified as part of the SAVSYS command. The SAVSYS operation will then mount the proper cartridge(s). When the subsystems end, requests for additional cartridges will fail, as the link to the library manager is not available. In this case the 3494 Automated Tape Library Dataserver should be used in Stand Alone mode.
3. When the SAVSYS operation is complete, restart all of the subsystems.

## Using the Save Storage Command

The SAVSTG command does not support tape automation. All operations must be done in Stand Alone mode or with a category mounted to the automated tape library.

## Using the Save Licensed Program Command

The SAVLICPGM command does not support tape automation. All operations must be done in Stand Alone mode or with a category mounted to the automated tape library.

Special considerations apply if you are saving any automated tape library device-driver licensed programs.

## Recovery Process Using Tape Automation

Using an automated tape library for basic restore operations (for example, RSTLIB, RSTOBJ, or RSTDLO commands) involves actions similar to those that are performed during the save process. A typical process may consist of the following steps:

1. Identify the required cartridges by pressing F10, for additional parameters, and specify the volume IDs. The cartridge required should be the most current save cartridge.
2. Locate the cartridges.
3. If cartridges are not in the automated tape library:
  - a. Get them from the original location.
  - b. Insert the cartridge into the automated tape library.
  - c. Use the ADDTAPCTG for each newly inserted cartridge.
4. Ensure that a tape resource is either allocated or marked as unprotected for the MLB.
5. Start the restore operation.
6. The cartridge ID is specified by the restore command.
7. Release the tape resource to its original state by using one of the following options:
  - Vary off the MLB device
  - Deallocate the tape resource
  - If the tape resource was in an unprotected state, it will return to that state automatically

## Recovering an Entire System (Starting with Licensed Internal Code)

The Alternate IPL portion of the recovery process must occur with the media library in Stand Alone mode (3494), Auto mode (3590/3570/3575/3490 Model F) or Sequential mode (9427). See the device documentation for setting up the proper mode.

### Completing the Recovery

Once the Alternate IPL portion of the recovery is complete, the remainder of the recovery can be automated when the following conditions are met:

- The 3494 device and communication configurations are restored or recreated.

**Note:** If you are using a LAN configuration on your system, you must manually vary on the line for the LAN. The system will not do this automatically.

- The configuration data for your MLB has been restored or recreated.

If you are using BRMS for AS/400 on your system, follow the BRMS for AS/400 recovery report.

The recovery when using an automated tape library is as follows in Table 3 on page 77. In general, automation can not occur until step 7. Tape automation can start after step 2 if the MLB configuration has been created. The tape library must be in Random mode or Library mode, and you must specify the volume identifier on the Restore commands to use tape automation.

**Notice!**

Do not use Table 3 as a checklist to perform your system recovery! The steps in Table 3 are an overview of the steps that are required to perform a system recovery. The *Backup and Recovery* book contains checklists for recovering your system.

Table 3. AS/400 Recovery Steps When Using an Automated Tape Library

Recovery Steps	Description	Commands
1	Recover Licensed Internal Code	<ul style="list-style-type: none"> <li>Control Panel Function (02-D IPL) in manual mode</li> <li>Function code 24 for IMPI-based systems</li> <li>Install Licensed Internal Code menu for RISC-based systems               <ul style="list-style-type: none"> <li>Option 2 if restoring on a different system</li> <li>Option 3 if restoring to the same system</li> </ul> </li> </ul>
2a	Recover operating system	IPL or Install the System (menu option 2)
2b	Perform disk configuration	Refer to the <i>Backup and Recovery</i> book for more information.
3a	Recover MLDD, 3494 library driver code (not needed for RISC AS/400 systems)	<ul style="list-style-type: none"> <li>RSTLIB QMLD (3494 Automated Tape Library Dataserver only)</li> <li>RSTLIB QUSRMLD (3494 Automated Tape Library Dataserver only)</li> </ul>
3b	Recover OS/400 Media and Storage Extensions	RSTLIB QMSE
4	Recover user profiles	RSTUSRPRF
5	Recover tape-related system libraries	RSTLIB QGPL RSTLIB QUSRSYS RSTLIB QSYS2
6	Recover configuration data	RSTCFG
7	Tape automation is now operational. Start MLDD for IMPI.	STRSBS QMLDSBS (3494 Automated Tape Library Dataserver only)
8	Recover IBM product libraries	RSTLIB SAVLIB(*IBM)
9	Recover user libraries	RSTLIB SAVLIB(*ALLUSR)
10	Recover document library	RSTDLO
11	Recover object in directories (V3R1 and later releases)	RST
12	Apply journal changes	Refer to the <i>Backup and Recovery</i> book for information on how to apply journal changes.

Table 3. AS/400 Recovery Steps When Using an Automated Tape Library (continued)

Recovery Steps	Description	Commands
13	End subsystems (optional at V4R1)	ENDSBS SBS(*ALL) OPTION(*IMMED)
14	Recover authorizations	RSTAUT
15	Return the system to normal mode.	PWRDWNSYS OPTION(*IMMED) RESTART(*YES)

**Note:** Step 3a is only required for a 3494 library device on IMPI-based systems.

Step 8 through step 15 require no manual intervention.

Steps 10 and 11 can be combined into RSTLIB SAVLIB(\*NONSYS) if SAVLIB(\*NONSYS) was specified for the save.

## Tasks for Archiving

Without a media management package such as BRMS for AS/400, archiving is a difficult task. To archive you need to record every item that is saved and deleted, including the volume ID and location of the volume. This could be a significant amount of work. The recall of data is a manual task that involves both the user to locate the data required and the operations staff to understand that the data is archived and not deleted.

When a automated tape library is introduced, the task of locating an archived piece of data can be reduced. However, even with a automated tape library, you should use BRMS for AS/400 for archiving.

## Archiving When Using Tape Automation

If you choose to continue with archiving without using BRMS for AS/400, follow the guidelines for saving with a automated tape library found in “Performing a Normal Save Operation” on page 74. Either use the storage freed parameter set to \*YES to keep the header (this gives you a chance to understand exactly what has happened to the data) or delete the object.

## Duplicating Archive Tapes with Tape Automation

Once the archive tapes have been created, there are other considerations to ensure data integrity that are related to duplicating the archive tape.

You should duplicate archive data tapes to prevent the loss of the archived copy. Ensure that one copy is removed from the automated tape library immediately after the copy is made.

The best approach is to note the cartridges that you used for archiving and then initiate a Duplicate Tape command for each one of them. When using the DUPTAP command in a tape automation environment, the TOVOL parameter for the command cannot be either \*FROMVOL (the default), or a volume ID that already exists in your automated tape library.



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## Chapter 5. Using Tape Automation with BRMS for AS/400

This chapter describes the methods that you can use with BRMS for AS/400 to drive a automated tape library. Using a media management application is recommended when using your tape automation. If you do not use any media management application (such as BRMS for AS/400), refer to Chapter 4. Using Tape Automation without a Media Management Application.

---

### Setting up BRMS for AS/400

Before any work can be done with your tape automation and BRMS for AS/400, you must have installed and initialized the BRMS for AS/400 licensed program. You must also have Media and Storage Extensions (MSE) installed. For details on installing and setting up BRMS for AS/400, refer to the *Backup Recovery and Media Services* book, SC41–4345.

### Using BRMS for AS/400 for the First Time

If you are using BRMS for AS/400 for the first time, read the *Backup Recovery and Media Services* book thoroughly. This allows you to make full preparations and complete a thorough design for the implementation of BRMS for AS/400 on your systems.

### Adjustments to BRMS for AS/400 When Using Tape Automation

If you were using BRMS for AS/400 before installing a automated tape library, you need to make a few adjustments.

If you use BRMS for AS/400 to manage and control daily operations, you will not notice many changes when you begin to use an automated tape library. After you set up the tape library and vary it on, you can use the INZBRM \*DATA command. These commands allow BRMS for AS/400 to update itself with all the proper defaults for the new device. Once the automated tape library is set up and the media is appropriately enrolled, BRMS for AS/400 assumes control of the tape library.

You do not need to alter your BRMS for AS/400 control groups, scheduling, or reporting. As part of your initial setup, you may need to adjust the following:

- Locations
- Devices
- Move policies
- Media policies
- Control group attributes

You should review your backup and archive strategy, based on using a automated tape library. For example you may want to:

- Alter the size of backup groups
- Alter the frequency of backups
- Increase the size of archive groups
- Alter the frequency of archive operations
- Introduce dynamic recall

---

## Setting up Tape Automation with BRMS for AS/400

This topic describes some of the actions required in setting up a automated tape library before you use it with BRMS for AS/400.

This topic assumes that a automated tape library is installed and operational. For full planning and installation instructions, consult the IBM publication associated with a automated tape library device.

### Creating Tape Automation on Your System

Initially, you need to create a automated tape library device on your AS/400 system. This is covered in “Media Library Device Configuration” on page 41. If you plan to group your cartridges into logical sets (for example, weekly and daily backup sets), you want to create user categories.

See *Backup Recovery and Media Services*, SC41–4345, for instructions on adding the device to the BRMS for AS/400 table.

### Updating BRMS for AS/400 Device Information

If updating the device information for the 9427 Tape Library is required, do the following:

- Enter the GO BRMS command.
- Select Media Management.
- Select Work with Device Information.
- Find the device name for the tape drive and change this information.
- Change the Type information to 9427 Model 210 or 211 (whichever is installed on your system).
- Change the Read and Write density entries to \*FMT7GB.
- Create media class FMT7GB by using the Work with Media Class command. Specify \*FMT7GB for density.
- Ensure that your media policy specifies media of class FMT7GB.
- Enroll your 160m media as media of class FMT7GB. To enroll media, use the ADDMLBRM, WRKMLBRM, or WRKMEDBRM commands.

### Basic Setup of an Automated Tape Library with BRMS for AS/400

Before a automated tape library can be used, you must add media to it and enroll that media into BRMS for AS/400. If the automated tape library is empty, open the door and add all available media into empty cells rather than add only a small number at a time through the convenience I/O station. When closing the door, the automated tape library checks each cell and records the volume ID of each cartridge. This information is kept in the library manager database for the 3494 in OS/400 for the other MLB devices.

From the AS/400, you can view this same information by using the Work with Media Library BRM (WRKMLBBRM) command. This command lists all media library devices on your system that are enrolled in BRMS for AS/400. If you select option 8 (Work with MLB Media), the status of the volumes that are currently in the automated tape library is displayed. The Work with MLB Media display is shown in Figure 41 on page 81. (The WRKMLBRM command can be used to go directly to

this display.) When setting up an automated tape library for the first time, the Media Class is \*NONE because the cartridge is not enrolled in BRMS for AS/400.

```

Work with MLB Media                                RCHAS400

Media library device . . . : MLB01
Position to . . . . . _____ Starting characters

Type options, press Enter.
 1=Add MLB media      2=Work with media    5=Initialize
 6=Change category   7=Eject             8=Mount      9=Demount

---BRM Information---
Opt  Volume  Category  Media Class  Expired  Status
-    BCD161  *SHARE400 CART3490E   *YES     Available
-    BCD164  *SHARE400 *NONE      Available
-    BCD165  *SHARE400 CART3490E   *YES     Available
-    BCD166  *SHARE400 *NONE      Available
-    BCD167  *SHARE400 *NONE      Available
-    BCD168  *SHARE400 *NONE      Available
-    BCD170  *INSERT   *NONE      Available
-    BCD173  *INSERT   *NONE      Available
More...

```

Figure 41. Work with MLB Media Display

Other options from this display; including mount, demount, and eject; can be used to manipulate the volumes within a automated tape library.

BRMS for AS/400 communicates changes in its media inventory to be reflected in the automated tape library media inventories. For example, when you change the shared media attribute of a media class, BRMS for AS/400 enters the CHGTAPCTG command to change the category of all volumes of that media class in any tape automation.

## Enrolling Tape Automation Media (Cartridge) into BRMS for AS/400

From the Work with Media Libraries display (WRKMLMBRM command), select option 11 (Add MLB media) against the MLB device that is attached to your system. The ADDMLMBRM prompt display in Figure 42 is shown.

```

Add MLB Media using BRM (ADDMLMBRM)

Type choices, press Enter.

Media library device . . . . . > MLB01 Name
Volume identifier . . . . . > *INSERT Character value, *INSERT
+ for more values
Add volume to BRM . . . . . > *YES *NO, *YES
Initialize tape . . . . . > *NO *NO, *YES
Media class . . . . . > CART3490E CART3490E, QIC120...
Last moved date . . . . . > *NONE Date, *NONE
Move policy . . . . . > *NONE *NONE, OFFSITE

```

Figure 42. Add MLB Media using BRM Display

You can enroll all newly-inserted volumes into the BRMS for AS/400 media inventory. If you use the default value for the VOL parameter (\*INSERT) and change the *Add volume to BRM* field to \*YES, all volumes that were previously in

the \*INSERT category (from the Work with MLB Media display) are enrolled into the BRMS for AS/400 media inventory and are available for use.

---

## Save and Restore Tasks

When performing a save or restore operation with a automated tape library and BRMS for AS/400, consider the following.

### Performing a Normal Save Operation

Using an automated tape library for either a control group save operation or a save operation with the SAVOBJBRM, SAVLIBBRM, SAVOBJLBRM, SAVSYSBRM, or the SAVMEDIBRM commands provides certain advantages. Specifically, the save operation and save media are easier to track than if you were to use OS/400 save commands and save to a library. The save command or control group defines the objects to be saved. The media policy specifies a media class that is defined with a drive which is found within the tape automation. BRMS for AS/400 supports the location as a media qualifier in both the media policy and the SETMEDBRM command. When coupled with \*MEDCLS as a device identifier in a media policy, BRMS for AS/400 attempts to select a tape drive that is at the same location as the media. An example of this would be a drive in the automated tape library.

Output operations to a tape drive in an automated tape library may require nonspecific (\*MOUNTED) cartridges when no cartridge is in the drive. If this occurs, BRMS for AS/400 refers to its inventory of available scratch media to select one that is in the automated tape library. It then requests a mount of that tape.

An end option of \*UNLOAD (the default for a backup control group) causes the cartridge to be returned to its cell when the control group has completed processing. If a BRMS for AS/400 save command is used, the end option default of \*REWIND should be accepted. The control group attributes or backup policy may be changed to \*REWIND. In either case, the cartridge remains in the drive after the save operation has completed.

### Save Storage and BRMS for AS/400

BRMS for AS/400 does not support the use of the Save Storage (SAVSTG) command.

The SAVSTG command does not support tape automation. All operations must be done in Stand Alone mode or with a category mounted to the media library.

### Using the Save Licensed Program Command

The SAVLICPGM command does not support tape automation. All operations must be done in Stand Alone mode or with a category mounted to the media library.

BRMS for AS/400 does not support the SAVLICPGM command. For system recovery, the product libraries are saved under the \*IBM grouping. You cannot restore these with the RSTLICPGM command. Consult your BRMS for AS/400 recovery report for further details.

## Recovery Process Using Tape Automation

Using an automated tape library is quite simple, whether the STRRCYBRM, RSTLIBBRM, RSTOBJBRM, or RSTDLOBRM commands are used, or if recovery is performed from the WRKMEDIBRM, WRKOBJBRM or WRKFLRBRM displays. As long as the required cartridge is in the automated tape library, the restore operation is automatic, with no message being sent to the QSYSOPR message queue to load the cartridge. A message is sent to the BRMS for AS/400 log to notify the status of the restore operation. When the restore operation is complete, the last cartridge used remains in the tape drive unless otherwise specified. The end-of-tape option \*UNLOAD returns the cartridge to its storage cell.

If the required cartridge has been moved to another location, an inquiry message is sent to the QSYSOPR message queue. The message prompts the operator to insert the cartridge in the convenience I/O station or the high-capacity I/O area. If the cartridge is off-site, the operator can cancel the restore operation from this message. Once the cartridge is in either the convenience or high-capacity I/O areas, the tape automation places it in a storage cell, and BRMS for AS/400 mounts it in the drive to complete the restore operation.

## Recovering an Entire System (Starting with Licensed Internal Code)

Ensure that your MLB device is in stand-alone, sequential, automatic, or manual mode. See the device documentation on how to properly change the mode for the MLB.

The volume ID for the Licensed Internal Code tape is on the latest BRMS for AS/400 Recovery Analysis report. For the 3494 Automated Tape Library Dataserver, select the Commands pull-down and the Setup Stand alone Device window as shown in figures 43 44.

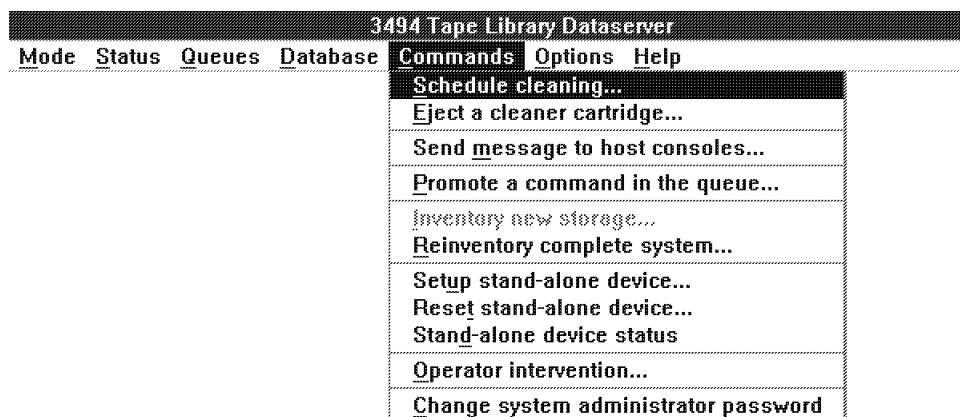


Figure 43. Commands Pull-Down Window

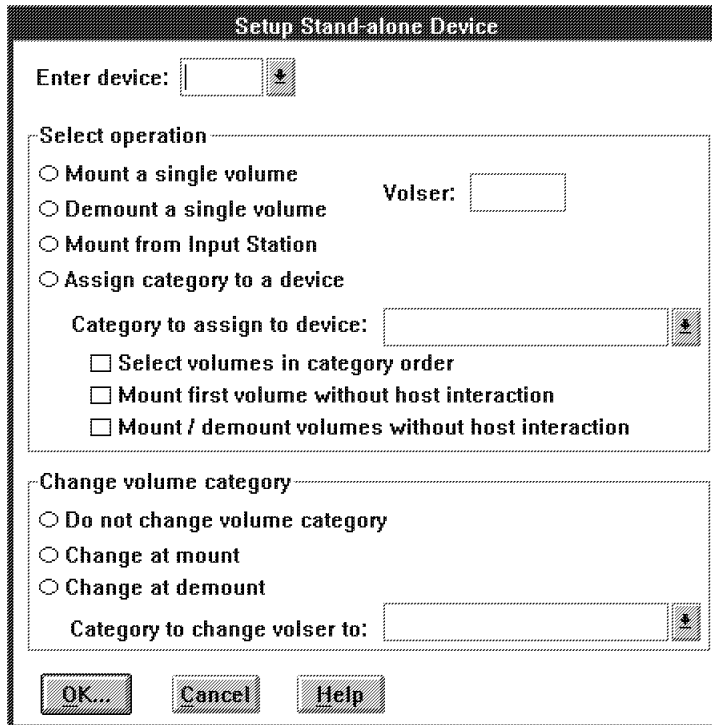


Figure 44. Setup Stand Alone Device Pop-Up Window

From this window, do either of the following:

- Enter the 3-digit device name as known by the library manager, or
- Click on the arrow to the right of the box and select the 3-digit device name by clicking on it.

Then do the following:

1. Select the Mount a single volume operation.
2. In the *Volser* field, enter the volume ID of the SAVSYS tape that contains the licensed internal code.

Select the required option on the front AS/400 control panel. When a new cartridge is required, the tape automation automatically demounts the currently mounted volume. You can use the Demount a single volume operation if you are processing just one cartridge at a time. When you have finished using the stand alone mode, reset it.

For 3494 Automated Tape Library Dataserver, select the Reset stand alone device operation, as seen in Figure 45 on page 85. Specify the tape unit by number.



Figure 45. Reset Stand Alone Device Pop-Up Window

Once the mount operation has been requested, the Stand alone Device Status window appears. This window displays the library manager activity as shown in Figure 46.

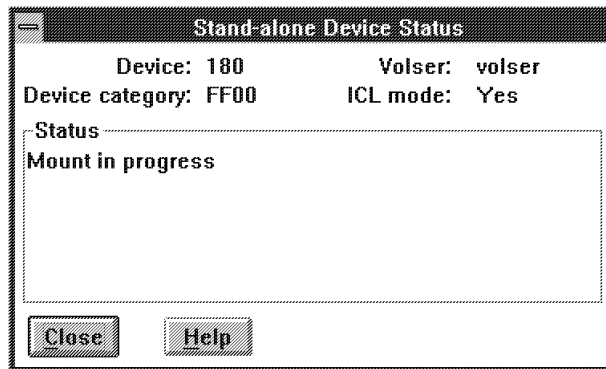


Figure 46. Stand Alone Device Status Pop-Up Window

## Completing the Recovery

When the restricted state portion of the recovery is complete, tape automation can be used when the following conditions are met:

- The 3494 device and communication configurations are restored or re-created.
- The media library configuration data has been restored or re-created.

The recovery when using BRMS for AS/400 and tape automation is as follows in Table 4 on page 86. Tape automation requires a minimum level of system function to be recovered before an automatic cartridge mounting can occur. In general, automation can not occur until step 7. For Version 3 Release 6 and later releases, tape automation can start after step 2b if the MLB configuration has been created.

### Notice!

Do not use Table 4 on page 86 as a checklist to perform your system recovery! The steps in Table 4 on page 86 are an overview of the steps that are required to perform a system recovery. You should use the *BRMS for AS/400 Recovering Your Entire System* report in addition to the *Backup and Recovery* book to assist you in recovering your system.

Table 4. AS/400 Recovery Steps When Using BRMS for AS/400 and a Tape Library Data Server

BRMS for AS/400 Recovery Steps	Description	Commands
1	Recover Licensed Internal Code	<ul style="list-style-type: none"> <li>• Control Panel Function (02-D IPL) in manual mode</li> <li>• Install Licensed Internal Code menu                             <ul style="list-style-type: none"> <li>– Option 2 if restoring on a different system</li> <li>– Option 3 if restoring to the same system</li> </ul> </li> </ul>
2a	Recover operating system	IPL or Install the System menu (option 2)
2b	Perform disk configuration	If your system is running at V3R6, refer to the <i>Backup and Recovery - Advanced</i> book. If your system is running at V3R7, refer to the <i>Backup and Recovery - Basic</i> book. If your system is running at V4R1 or a later release, refer to the <i>Backup and Recovery</i> book.
3a	Recover the BRMS for AS/400 licensed program and data. You may also need to recover libraries named Q1ABRMSFnn. These libraries will be listed in your BRMS for AS/400 recovery report.	<ul style="list-style-type: none"> <li>• RSTLIB QUSRBRM</li> <li>• RSTLIB QBRM</li> <li>• RSTLIB Q1ABRMSFnn</li> </ul>
3b	Recover OS/400 media and storage extensions	RSTLIB QMSE
4	Recover BRMS for AS/400 recovery data	RSTOBJ *ALL QUSRBRM
5	Recover user profiles	STRRCYBRM *SYSTEM *RESTORE (Ensure that *SAVSECDTA is recovered)
6	Recover tape-related system libraries	<ul style="list-style-type: none"> <li>• RSTLIB QGPL</li> <li>• RSTLIB QUSRSYS</li> <li>• RSTLIB QSYS2</li> </ul>
7	Recover configuration data	STRRCYBRM *SYSTEM *RESTORE
8	Recover IBM product libraries	STRRCYBRM *IBM *RESTORE
9	Recover user libraries	STRRCYBRM *ALLUSR *RESTORE
10	Recover document library	STRRCYBRM *ALLDLO *RESTORE



Table 4. AS/400 Recovery Steps When Using BRMS for AS/400 and a Tape Library Data Server (continued)

BRMS for AS/400 Recovery Steps	Description	Commands
11	Recover objects in directories. This option is not available on V3R1 or V3R6. Refer to IBM publication <i>A Practical Approach to Managing Backup Recovery and Media Services for OS/400</i> , SG24-4840-00.	STRRCYBRM *LNKLIST *RESTORE
12	Recover spooled files	WRKSPLFBRM
13a	Apply journal changes	Refer to the <i>Backup and Recovery</i> book for information on how to apply journal changes.
13b	End subsystems (optional at V4R1)	ENDSBS SBS(*ALL) OPTION(*IMMED)
14	Recover authorizations	RSTAUT
15	Return the system to normal mode.	PWRDWNSYS OPTION(*IMMED) RESTART(*YES)

**Note:** Steps 8 through 15 require no manual tape drive intervention.

## Tasks for Archiving

When you use tape automation with BRMS for AS/400, this opens more opportunities for archiving. Full tape automation allows archiving to be performed quickly and effortlessly while appearing seamless in its operation. The introduction of dynamic retrieval further enhances archiving potential.

### Archiving When Using Tape Automation

To provide the most acceptable recall performance, you must minimize the tape location and the load delays. You will probably keep a large portion of your archived data within the tape automation. This uses a large amount of capacity. When establishing a move policy, you should consider the following:

- How often will you access your data?
- How long will you need to have access to your data?

For example, you might access a monthly report only up until the time that the next month's report is created. You might have other information that you need to access at all times yet access only occasionally. Your move policy will be based on the needs of your business. If you adjust the movement delay periods, this changes the population levels of the automated tape library.

### Duplicating Archive Tapes with Tape Automation

BRMS for AS/400 enables you to archive infrequently used objects to tape. The selection of output cartridges for archiving works the same way as a backup operation. Once the archive tapes have been created, consider the following points related to duplicating the archive tape to ensure data integrity.

Duplicate the archive data tapes to prevent the loss of the archived copy. Ensure that one copy is removed from the tape automation immediately after the copy is made.

You cannot automatically perform a DUPMEDBRM operation on tapes that were created during the processing of an archive (or backup) control group. One way to do this is for the operations staff to enter WRKMEDIBRM SAVTYPE(\*ARC) and use option 6 (Work with media) to work with the media volumes that are used in the archive operation. If you select option 14 (Duplicate data) from this display, you can duplicate a tape or set of tapes. Operators should check for an asterisk (\*) character in the *Dup* column to see if the volume has been duplicated. The duplicate option takes you into the DUPMEDBRM command (depending on whether you selected an individual volume or a set). Use the tape automation to select scratch volumes that are automatically mounted for this process.

Another way to do this is to specify a media policy that says Duplicate Media \*YES. Then run the DUPMEDBRM \*SEARCH command and BRMS for AS/400 will find the tapes that need to be duplicated. This automatically marks the tape to be duplicated when it is created.

After the duplication is complete, you should assign a move policy to the output volumes so that they are moved to an off-site location.

## Using Dynamic Retrieval

To further improve your archive and retrieval performance, use the dynamic retrieval function within BRMS for AS/400. This function allows on-demand retrieval of the file members that have been archived and now need to be accessed again.

**Note:** Not every type of item can be dynamically retrieved. Consult the book, *Backup Recovery and Media Services*, SC41–4345, for more information.

To accomplish this, change your archive control group such that the archiving requested keeps the object descriptions. This is known as **save with storage free**. To do this, change the retain object description parameter on either the archive control-group options or the archive policy to \*YES.

You must set up your BRMS for AS/400 retrieval policy with the appropriate retrieval modes (\*VERIFY, \*NOTIFY, \*DELAY or \*SBMJOB), preferred devices, restore options, and authorities. The *Backup Recovery and Media Services* book contains more information on these modes. You can find additional information on dynamic automatic retrieval in the IBM Redbook publication, *Implementing Hierarchical Storage on the AS/400*, GG24-4450.

### Application Considerations for Archive and Dynamic Retrieval

The dynamic retrieval function works at the file-member level. Many implications lead from this, including the fact that for any record-type archiving or retrieval operations, you may need to develop a complex solution. These implications are discussed in the IBM Redbook, *Implementing Hierarchical Storage on the AS/400*, GG24-4450.

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## Chapter 6. Operational Tips

For day-to-day operations in using the tape automation system with or without BRMS for AS/400, this chapter lists some useful tips.

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### Opening a Tape Automation System

When accessing a tape automation system (whether for manual intervention or for the insertion or removal of cartridges), it may be necessary to open a main front door or disengage some type of locking device that keeps cartridges from being removed. When opening the door of a tape automation system, ensure it is first placed in a pause (or similar) mode.

When using the 9427 Tape Library in random mode and the door is opened and closed, ensure that cartridges loaded in the tape drive are not removed or changed. The bar code scanner cannot read the bar code label on the cartridge loaded in the drive. If the 9427 Tape Library is in random mode and the tape cartridge was manually loaded in the tape drive, tape commands using VOL(\*MOUNTED) parameter may not work. To change this, unload the cartridge from the drive by doing a Move Tape from the 9427 Tape Library front panel and move the cartridge to an empty slot and reload the cartridge again.

---

### When Moving Cartridges Into and Out of Your Tape Automation System

#### Moving Cartridges with BRMS for AS/400

When BRMS for AS/400 operations such as Add media or Confirm move require media to be moved to or from a tape automation system, BRMS for AS/400 prompts operators as needed. It instructs them to place media into, or remove media from the automated tape library and then uses CL commands to verify that the operation is successful.

For devices such as 3494 Automated Tape Library Dataserver, a move policy or manual move of media causes the library manager to eject the tape into the convenience I/O station or the high-capacity I/O area of the automated tape library. Additional prompting and verification is done when media, ejected from one automated tape library location, are inserted into another. When a cartridge is moved into the automated tape library, the library manager shows that the cartridge is in \*INSERT category.

If you move a cartridge to a tape automation system when media movements are to be confirmed, BRMS for AS/400 attempts to change the category of cartridges from \*INSERT to \*SHARE400 or \*NOSHARE, as applicable to the media class. If at the time of the confirm move, the cartridge has not been placed in your tape automation, a message is logged in the BRMS for AS/400 log. These cartridges must be changed to \*SHARE400 before they can be used by BRMS for AS/400.

If move verification is not enabled, BRMS for AS/400 attempts to change the category of cartridges that move into an MLB from \*INSERT to \*SHARE400 or \*NOSHARE immediately. This can cause a problem, as common maintenance (STRMNTBRM command) is run at night after backups have completed, and cartridges have not been moved offsite. In this case, it may be worthwhile to use

the PRTMOVBRM command during the day before the move is to take place. Use the PRTMOVBRM command to ensure that you collect the cartridges and insert them into the 3494 Automated Tape Library Dataserver before the MOVMEBDM is actually processed.

## Moving Cartridges without BRMS for AS/400

To insert media into a tape automation system, first place the cartridges into the automated tape library. Use the convenience I/O station, if it is set up. Otherwise, open the main door and insert the cartridges into the high-capacity I/O area. For random access cartridge loaders, open the front door and insert the cartridges. When you have inserted the cartridges, issue an ADDTAPCTG command for each cartridge to change the category from \*INSERT to a usable category. To eject media from a tape automation system, first process the RMVTAPCTG command for each cartridge required. This places each cartridge in the \*EJECT category, and then moves them to the convenience I/O station (if it is set up) or the high-capacity I/O station. You can either remove the cartridges from the convenience I/O station or open the main door and remove them from the high-capacity I/O area (whichever is applicable).

---

## When the System Name is Changed

If you change your system name, you **must** move the cartridges from the categories that were owned by the old system name to categories that are owned by the new system name. If you do not do this, the cartridges will not appear in the inventory when using the default for the CGY parameter on the Work with Tape Cartridge (WRKTAPCTG) command. (The default is WRKTAPCTG CGY(\*ALL \*CURRENT).)

If you have already changed the system name, and need to recover the cartridges, perform the following steps:

1. Use the Display Tape Category (DSPTAPCGY) command to display all of the tape categories, then exit.
2. Temporarily change the system name back to the previous name by using the CHGNETA command. **DO NOT** perform an IPL.
3. If you were using user-defined categories with the old system name, use the Create Tape Category (CRTTAPCGY) command to create the same user-defined categories for the new system name.
4. Use the Work with Tape Cartridge (WRKTAPCTG) command to work with all of the categories that are associated with the old system name.  

```
WRKTAPCTG DEV(mlb-name)  
           CGY(*ALL old_system_name)
```
5. Change the category system name to the new system name. Use option 2=Change with the parameter CGY(\*SAME *new\_system\_name*).
6. Use the CHGNETA to return the system name to the new system name. **DO NOT** perform an IPL.
7. This ends the procedure.

---

## Restricted State Processing

The Alternate IPL portion of the recovery process must occur with the media library in Stand Alone mode (3494), Auto mode (3590/3570/3575/3490 Model F), or Sequential mode (9427). See the device documentation for setting up to the proper mode.

---

## When to Discard Tape Media

If a cartridge begins to demonstrate a regular media error rate, discard it from your media inventory. You may need to keep a log of all media errors to achieve this.

The BRMS for AS/400 product tracks all read and write errors for every cartridge used. You can specify error threshold levels at which BRMS for AS/400 will report to operators to remove the error-prone cartridge from the inventory. The threshold settings are found in the Media Class parameters.

The 3494 Automated Tape Library Dataserver's library manager keeps a record of bar-code read errors to aid in identifying inventory-related errors in your tape library system.

---

## Problem Handling

When problem analysis or problem isolation is required, you should collect and send the following information to the appropriate service support personnel.

- For BRMS for AS/400, create:
  - Joblogs by entering `DSPJOBLOG *PRINT`.
  - A BRMS for AS/400 log by entering `DSPLOGBRM *PRINT`.
  - Location information by using `WRKLOCBRM *PRINT`.
  - BRMS for AS/400 and Automated Tape Library information by using the `DMPBRM` command and the `QTADMPDV` API.

If a network problem is suspected, dump the journal receivers (`QUSRBRM/QJR*`). If required, send a copy of the `QUSRBRM` library so that your problem can be duplicated by the appropriate service support personnel.

- Library Manager:

Copy the transaction logs, time and date of the failure, and information about the volumes in question:

  - Insert a blank diskette in drive A of the personal computer.
  - Select `Service`.
  - Select `Copy files`.
  - Select the transactions logs to be copied.
  - Select `OK`.
  - Select drive A. Type the file name and description of the problem.
  - Select `Copy files`.
- Dump Device (`QTADMPDV`) API:

Obtain information on the device problem from the Dump Device (`QTADMPDV`) API. For more information on this API, refer to *System API Reference*.
- OS/400:

Copy joblogs by entering DSPJOBLOG \*PRINT. This should be done by trained personnel.

- Copy the source/sink trace for the problem by entering STRSST and following the menu. The source/sink trace can only be copied if it was started prior to the problem recreation.

**Note:** Only trained personnel should do this.

- IOP card: Obtain error log information and the IOP dump for the problem by entering the STRSST command. This should be done by trained personnel.

---

## Performing a Release Upgrade and Loading PTFs

Because distribution and PTF tapes that are sent by IBM have cartridge IDs that are not unique, they should not be enrolled into BRMS for AS/400. They should be kept out of a tape automation system and in a known place. These may need to be used as indicated by the BRMS for AS/400 Recovery Analysis report in the case of a recovery if the SAVSYS and SAVLIB LIB(\*IBM) tapes have a media error during a restore operation.

**Note:** Do not use Library mode or Random mode when performing a release upgrade or installing a new release from a tape library device. The 3494 device should use Stand-alone mode. The 9427 device, 3590 device, 3570 device, 3575 device, and 3490 Model F device should use either Automatic, Sequential, or Manual mode. Refer to the operator's guide for your media library device for information on setting up and using the correct mode.

For complete instructions on upgrading from one release to another, refer to the book, *System Upgrade Road Map (RISC to RISC)*, SA41-5155.

## Group PTFs

A group PTF is a collection of fixes for a specific solution. One PTF number is assigned for a particular solution for each release. This is not the same as a cumulative package. Group PTFs are updated more frequently than cumulative packages, and only contain PTFs for certain interrelated products.

You can order a group PTF by using the Send PTF Order (SNDPTFORD) command on the AS/400 if you use Electronic Customer Support (ECS). The PTFs in the group will be shipped to you by mail on CD-ROM or tape. The files are not available for download via ECS.

The list of PTFs in the group PTF is updated every Wednesday so that it can be ordered in time for a weekend load of PTFs and an IPL, if needed. The PTF information page contains a last change date that indicates when the PTF list was updated. You can use this list to determine when you should re-order the group PTF.

In a typical situation, at least one of the PTFs in the group will require an IPL. The PTFs that require an IPL begin with the prefix MF or SF. The cover letters and instructions that are delivered with the PTFs will tell you what to specify when you load the PTFs.

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## How a MULIC or FULIC Licensed Internal Code Cartridge Should Be Stored

**Note:** This section applies to IMPI-based systems only. The model-unique Licensed Internal Code (MULIC) cartridge or feature-unique Licensed Internal Code (FULIC) cartridge should not be placed in a tape automation system. It does not have a unique volume ID or cartridge ID suitable for an automated tape library bar-code reader to recognize. BRMS for AS/400 does not protect the data on this tape for you. It should be kept in a safe place onsite. The only time this tape is required is if a load source disk unit fails on the system that it is shipped with. If there is a site disaster and another AS/400 is used for recovery, the MULIC tape or FULIC tape that is licensed to that system is used.

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## Sharing Tape Automation with AS/400, RS/6000, and ES/9000 Systems

An AS/400 can share cartridges in each automated tape library. Other host platforms can share the library by partitioning the automated tape library, and individual cartridges can be assigned to a particular processor. This is done by assigning each cartridge to a particular category. As a category may be used by only one platform at a time, cartridges would not be shared between the AS/400 systems and the other system types.

### Sharing Cartridges Among Platforms

When an AS/400 is using a cartridge, the cartridge must be in either the \*SHARE400 category or in a user-defined category. When an ES/9000 system uses a cartridge, it must be in an ES/9000-defined category. An ES/9000 cannot use a cartridge in an AS/400 category. The operator must change the category of the cartridge for the purpose of data interchange. Use either the WRKMLMBRM command and option 6 or the CHGTAPCTG (Change Tape Cartridge) CL command. (There is an equivalent ES/9000 command.) Although this requires operator involvement, it offers a level of integrity to ensure that data is not inadvertently corrupted. The CHGTAPCTG command updates the library manager database information for the cartridge concerned to reflect the required category.

You cannot perform a media move from one category to another (so a host of a different type to the AS/400 may access it) by using a BRMS for AS/400 move policy.

### Volume Protection Among Platforms

When initializing a tape, systems other than AS/400 are able to write a one-character security flag to the tape label. This is to restrict users who may read data from tapes initialized this way. Even though this function is not available in OS/400, OS/400 can read tapes written with this security flag in the tape label. When OS/400 detects the security flag, it decides whether that user may read the data, depending on the user's special authorities.

When the tape contains EBCDIC data, all users may read the tape when the security flag contains a space (hexadecimal 40), a zero (hexadecimal F0) or a hexadecimal 00. If it contains any other value, the user needs \*ALLOBJ and \*SECADM authority to read data from the tape. If the tape contains ASCII data, all

users may read the tape if the security flag contains a space. If it contains any other value, the user requires \*ALLOBJ and \*SECADM authority to read data from the tape.

You cannot specify this security flag when a tape is initialized on an AS/400 system and is to be read on another system type.

## Sharing Cartridges Among AS/400s

When interchanging tapes between AS/400 systems, volume security is available through BRMS for AS/400. Specify the *Secure volume* field in the media policy. This is honored only when all AS/400 systems are in the same BRMS for AS/400 common media management environment.

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## Disaster Recovery Using Tape Automation

If you were to experience a disaster and your AS/400, tape automation system, and tapes inside were destroyed, your recovery would be based on the tapes that you have stored offsite. For disaster recovery purposes, it is very important that you do not overlook the need for off-site storage of your backup tapes.

If you are trying to recover your system after a disaster, your latest BRMS for AS/400 recovery analysis report may show cartridges that were located in the tape library. If you move to a disaster recovery site, you need to create a new recovery analysis report based on those cartridges that you have left (the ones stored in off-site locations).

IBM recommends that you keep two daily recovery reports, one locally and one off-site. Always keep the off-site report at the off-site location with the off-site media.

This report shows only volumes that are available to assist with the recovery. Depending on your backup and media movement procedures, there may be data loss.

## Disaster Recovery Options

Consider the following disaster recovery options when using the tape automation system:

- Off-site storage

As soon as save processing is complete, eject the cartridges and remove them to an off-site location. For large volumes of data saved, a convenience I/O station is invaluable. The use of BRMS for AS/400 greatly automates the processing of cartridges when you insert and eject into and out of a tape automation.

Only low-priority data and one copy of the archive tapes should stay in the tape library.

- Remote tape automation

If the tape automation is removed from the main computer room, and placed in a highly protected environment (for example, an underground, protected area) it is more acceptable to keep a limited amount of recent data in the tape automation. You should still never keep all your business-critical data in one place.



Consult Chapter 2. Tape Automation Supported on AS/400 and the tables in Appendix A. Tape Automation Hardware Summaries for details on the connectivity options and maximum distances allowed for each tape automation model.

- Twin sites

If processors share a media inventory and are physically separated by sufficient distance, each processor can own and manage its own tape library. Cartridges can be frequently exchanged between automated tape libraries. The use of BRMS for AS/400 network grouping and media movement greatly assists this process, especially where distance limitations allow the networking of the processors but not the automated tape libraries.

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## Installation Tips for 3494 Automated Tape Library Dataserver

BRMS for AS/400 on the 3494 Automated Tape Library Dataserver is a solid solution for customers with large cartridge capacity in a complex environment. It is important that system operators and support personnel are properly trained in BRMS for AS/400 and the 3494 Automated Tape Library Dataserver environment.

BRMS for AS/400 with the 3494 Automated Tape Library Dataserver is designed for reduced operator involvement. Certain error conditions, including write protect enabling, are handled by BRMS for AS/400. However, there are some error conditions that are more significant than what automatic handling is designed for. If you are likely to experience any of the following problems, your unattended operations will stop:

- Damaged objects
- Tape device failure or load failure
- Tape drive device description damaged
- Volume label errors
- Volume damaged or unusable
- Invalid value type on drive

## Hardware Tips

- A convenience I/O station feature is highly recommended for the 3494 Automated Tape Library Dataserver. Without the feature the 3494 will have to be paused and reinventoried every time the door is opened to add or remove any tape cartridges.
- The RS232 cable from the 3494 Automated Tape Library Dataserver must be connected into the communications line cable (for example, two cables plugged together), but not directly into the communications IOP.
- If you are using tape IOP #2604, ensure that it is one of the following part numbers: 21F3975, 21F3976, 21F3986, 21F3987.

## Software Tips

- OS/400 V2R3 or later is required.
- Use BRMS for AS/400 or another tape management system that supports the 3494 Automated Tape Library Dataserver.
- BRMS for AS/400 should be installed prior to installing the 3494 so that you can gain some familiarity with this product.
- Ensure that all current PTFs for BRMS for AS/400 are loaded.

## Special Problem Determination

- CPF415E Device allocation timed out on device TAPLIB01.

The request for a tape resource was ended due to the time interval specified in the MAXDEVTIME parameter being expired.

Problems could be:

- More commands than resources are requesting resources and the resources are too busy with too short of a time, increase the time in the MAXDEVTIME parameter in the device description using the CHGDEVMLB command.
  - A tape resource is in \*LEAVE processing. The resource will not be freed until a command is sent to the cartridge that is in the tape unit with an end positioning of rewind or unload.
  - A category is mounted in the media library device tying up one of the resources until a demount category is done with the SETTAPCGY OPTION(\*DEMOUNTED) command. To determine if a category is mounted, use the DSPTAPSTS command.
  - There is only one tape resource in the media library and there is a category mounted. This fact means that the one resource is allocated solely to functions requesting a mounted category. If this is the problem, commands requesting a mount will fail, but requests to VOL(\*MOUNTED) would be successful. Determine why the category is mounted and demount the category if necessary. DSPTAPSTS would also not work to a one resource media library because a device resource is required for DSPTAPSTS to complete.
- A requested function to the media library device has not completed and seems to hang the job  
The requested function may be waiting for an available resource
    - See the recovery for CPF415E problem determination. No Device allocation timeout has occurred, but if the MAXDEVTIME is set to a value of \*NOMAX, then the error will not occur and resolutions suggested in the CPF415E problem, may be of value here.
    - All resources are set to a status of \*UNPROTECTED and a requested function cannot ever obtain an assign (or reserve) command to any tape resource. Another system may have the resources assigned. Find the system with the assign, and release them.
  - CPF416A No device available.
    - No devices are allocated (or unprotected) to the device description. Use the WRKMLBSTS and allocate devices to be available to the media library device
    - A category is mounted and someone is currently using a command with the VOL(\*MOUNTED) specified. If the job requested also used VOL(\*MOUNTED), then it is not correct, only one user can be using a mounted category at a time.
  - Cartridge status is displayed as MOUNTED, but when a command attempts to use it , NOT AVAILABLE is returned.  
The cartridge may be mounted in a tape resource that is not attached to this system, but is in the same physical media library enclosure. The cartridge must be unloaded from the other device first.
  - CPF415A \*MOUNTED not correct.  
The requested command specified VOL(\*MOUNTED), and for media library devices, VOL(\*MOUNTED) is not valid unless a category is mounted. The media library device must be told which cartridge to use. Since there are multiple tape

resources, there is no way to determine which tape cartridge should be referred to as \*MOUNTED (many cartridges could be mounted).

## Cartridge Tips

- Order cleaning cartridges (have at least 2 inside the 3494 Automated Tape Library Dataserver).
- Determine the cartridge migration strategy for the 3494 Automated Tape Library Dataserver by the following:
  - Existing cartridges with data
  - Load the 3494 Automated Tape Library Dataserver with scratch cartridges
  - A combination of the previous options
- Order cartridge labels for data and cleaning cartridges.
- Consider purchasing new cartridges preinitialized and prelabeled.
- Ensure that all 3494 cartridges have the seventh character label installed. This is required by the 3494 software to support both 3490 and 3590 media in the inventory.
  - 1 = Cartridge System Tapes (3490)
  - E = Enhanced Capacity Cartridge System Tapes (3490E)
  - J = High Performance Cartridge System Tapes (3590)
- Insert cartridges into the 3494 Automated Tape Library Dataserver and enroll them into BRMS for AS/400. Initialize the cartridges, if required.
- If you are applying volume labels to cartridges yourself, note the stringent alignment requirements of these labels.



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## Part 3. Appendixes



## Appendix A. Tape Automation Hardware Summaries

### The 3494 Automated Tape Library Dataserver

Library Device: 3494 Automated Tape Library Dataserver		Drive within the Library	
		3490E/F	3590
Maximum number of ATLS per AS/400		8 (depends on system models)	
Maximum expansion units allowed per library (with a single controller)	Drive units (DU)	11	
	Storage units (SU)	11	
	Total units	16	
Maximum number of drives	Per controller (CU)	2	2
	Per drive unit (DU)	2	6
	Per storage unit (SU)	0	0
Total maximum number of drives		16	16
Maximum number of cartridges	Per controller (CU)	240	
	Per drive unit (DU)	300	
	Per storage unit (SU)	400	
Total maximum number of cartridges		6000	
Data compression system type		IDRC	LZ1
Storage per cartridge (GB)	Compressed	2.5	25
	Uncompressed	1	10
Maximum total storage (GB)	Compressed	15000	185000
	Uncompressed	6000	60000
Maximum AS/400 attachments	Per device	2 (1 for Fxx)	
	Per ATL	16	
Tape IOP types		2604, 2622, 2644, 6501, 6534	
Drive connection		SCSI or Parallel	
RS232/LAN library manager attachment		either	
Maximum distance from host		122M	25M

### The 9427 Tape Library Automated Tape Library

Library Device: 9427 Tape Library		Drive
		7GB drive
Maximum number of ATLS per AS/400		4 (depends on system models)
Total maximum number of drives		2
Total maximum number of cartridges		20
Total maximum number of cartridges		20
Data compression system	Type	IDRC
	Maximum ratio	2:1 (typical)
Storage per cartridge (GB)	Compressed	14
	Uncompressed	7

<b>Library Device: 9427 Tape Library</b>		<b>Drive</b>
		<b>7GB drive</b>
Maximum total storage (GB)	Compressed	280
	Uncompressed	140
Tape IOP types		2621
SCSI or parallel drive connection		SCSI-Differential
Maximum distance from host		20m
Bar-code reader		Standard

## The 3590 with Automated Cartridge Facility

<b>Library Device: 3590 with Automated Cartridge Facility</b>		<b>Drive</b>
		<b>3590 Tape Subsystem</b>
Maximum number of ATLS per AS/400		8 (depends on system models)
Total maximum number of drives		1
Total maximum number of cartridges		10
Data compression system		LZ1
Storage per cartridge (GB)	Compressed	30 (typical)
	Uncompressed	10
Maximum total storage (GB)	Compressed	300 (typical)
	Uncompressed	100
Tape IOP types		6501, 6534, 2729
SCSI or parallel drive connection		SCSI-Differential
Maximum distance from host		25m

## The Magstar MP 3570 Bxx/Cxx

<b>Library Device: Magstar MP 3570 Bxx/Cxx</b>		<b>Drive</b>
		<b>Magstar MP 3570 Tape Subsystem</b>
Maximum number of ATLS per AS/400		8 (depends on system models)
Total maximum number of drives		2
Total maximum number of cartridges		19 + 1
Data compression system		LZ1
Storage per cartridge (GB)	Compressed	15 (typical)
	Uncompressed	5
Maximum total storage (GB)	Compressed	300 (typical)
	Uncompressed	100
Tape IOP types		6501, 6534, 2729
SCSI or parallel drive connection		SCSI-Differential
Maximum distance from host		25m



## The 3490 Fxx (in F-mode)

Library Device: 3590 with Automated Cartridge Facility		Drive
		3590 Tape Subsystem
Maximum number of ATLS per AS/400		8 (depends on system models)
Total maximum number of drives		1
Total maximum number of cartridges		10
Data compression system		IDRC
Storage per cartridge (GB)	Compressed	2.4 (typical)
	Uncompressed	1
Maximum total storage (GB)	Compressed	24 (typical)
	Uncompressed	10
Tape IOP types		6501, 6534, 2729
SCSI or parallel drive connection		SCSI-Differential
Maximum distance from host		25m

## The Magstar MP 3575 Tape Library Dataserver

Library Device: Magstar MP 3570 Bxx/Cxx		Drive
		Magstar MP 3570 Tape Subsystem
Maximum number of ATLS per AS/400		8 (depends on system models)
Total maximum number of drives		L06 = 2; L12 = 4; L18, L24, L32 = 6
Total maximum number of cartridges		L06 = 60; L12 = 120; L18 = 180; L24 = 240; L32 = 324
Data compression system		LZ1
Storage per cartridge (GB)	Compressed	15 (typical)
	Uncompressed	5
Maximum total storage (GB)	Compressed	L06 = 900; L12 = 1800; L18 = 2700; L24 = 3600; L32 = 48600
	Uncompressed	L06 = 300; L12 = 600; L18 = 900; L24 = 1200; L32 = 1620
Tape IOP types		6501, 6534, 2729
SCSI or parallel drive connection		SCSI-Differential
Maximum distance from host		25m



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## Appendix B. Migrating to a Tape Automation Environment—Planning

This appendix describes the organization of an example planning team and the allocation of tasks and activities to achieve a successful migration to a tape library environment. These tasks may be performed by an individual or by a team; it is important to ensure that all the tasks are done.

The migration from a tape library environment that is not automated to a tape automation system involves the following tasks:

- Select a planning team with assigned responsibilities to ensure all installation planning and migration tasks are completed. See “Selecting a Planning Team”.
- Select the appropriate library model and features to satisfy the requirements of the applications used.
- Plan for the migration of tape subsystems into the tape automation system.
- Determine the software necessary to support both the control of and the applications used with the tape automation system.
- Plan the physical environment for the installation of the tape automation system.
- Plan for any operational changes that may be necessary in the tape automation system environment.
- Plan for required supplies and equipment necessary for host control and to support the tape automation system and proposed applications.
- Plan for the data migration from a non-tape automation system to the tape automation system.

---

### Selecting a Planning Team

For an efficient tape automation system installation, migration process, and operations, select a planning team or individual to define the required tasks. Suggested members (or skills required) include:

- 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 marketing representative and your IBM installation planning representative.

- Physical planner

The physical planner is responsible for determining the location of the tape automation system. This person ensures that the correct environmental, electrical, and space requirements are met. This person should work closely with your installation planning 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 tape automation system. The system programmer works with the storage administrator to define storage-management policy for the installation.

The application programmer creates and modifies specific application programs as needed.

- Storage administrator

The storage administrator defines a storage-management policy and plans for data migration.

The storage administrator must locate information to:

- Plan your migration of data.
- Analyze your business environment.
- Analyze your processing environment.
- Estimate your resource requirements.

A plan must be completed to:

- Describe and control the steps necessary to complete migration.
- Migrate tape subsystems into the tape automation system environment.

- **Tape library operator**

The tape automation system operator is responsible for the daily operation of the tape automation system.

Typical tasks include loading and unloading tape cartridges from the tape automation system input/output station. During manual mode operations, the operator mounts and demounts cartridges from library drives.

## Task Assignments

Tables 5 through 12 identify many of the tasks associated with installation planning and the migration to a tape automation system. Individuals responsible for the tasks are identified.

*Table 5. Tasks before Ordering the Automated Tape Library*

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Select team members.	●				
Determine the tape automation system configuration. Identify host attachments and the channel cable layout.	●	●	●	●	●
Plan for how to migrate the tape subsystems into the tape automation environment.	●	●	●	●	●
Identify the location for the tape automation system and arrange for any site modification.		●			
Identify the delivery route to the planned location of the tape automation system.		●			
Identify the staging area for the components of the tape automation system.		●			
Prepare the physical layout (floor plan) diagram.		●			
Determine required licensed programs.			●	●	
Determine cable requirements.	●	●			
Determine electrical requirements.		●			
Determine cooling requirements.		●			
Determine fire-suppression requirements.		●			

Table 5. Tasks before Ordering the Automated Tape Library (continued)

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
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 output facility requirements.			●		●

Table 6. Tasks at Order Time

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Order the tape automation system.	●				
Order the language group feature if other than English.	●				
Order the specific features.	●				
Order the optional 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 7. 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 tape automation system.			●	●	●
Determine who installs the electrical wiring and outlets.		●			
Confirm the tape automation system and the supply orders.	●				

Table 8. Tasks 10 Weeks before Delivery

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Meet with your IBM marketing representative to discuss any concerns about the planning process.	●	●	●	●	●

Table 8. Tasks 10 Weeks before Delivery (continued)

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Arrange for the installation of the electrical wiring and outlets.		●			●

Table 9. 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 marketing 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 10. 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 tape automation system operator.	●				●
Complete regression testing of the operating system and application software.			●	●	

Table 11. Tasks at Arrival Time of the Automated Tape Library

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
Ensure that the tape automation system is placed as close to the final location as possible.		●			
Arrange for the service representative to install the hardware.	●				

Table 12. Tasks after Installation of the Automated Tape Library

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.	●				●

Table 12. Tasks after Installation of the Automated Tape Library (continued)

Activity	Planning Coordinator	Physical Planner	System Programmer	Application Programmer	Storage Administrator
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.	●	●	●	●	●

## Configuration Approaches—Disaster Recovery

To configure your automated tape libraries for disaster recovery, following are suggested approaches:

- Eject immediately

When save processing is complete, eject the cartridges and place them in offsite storage. If you are saving large volumes of data, a convenience I/O station is very helpful. Using BRMS for AS/400 greatly automates the processing of cartridges when you insert and eject them in and out of a tape automation system.

Only low-priority data and one copy of the archive tapes should stay in the tape automation system.

- Remote tape automation system

If the tape automation system is removed from the main machine room site and placed in a highly protected environment (for example, underground, fire and bomb protected, unattended area) it is more acceptable to keep a limited amount of recent data in the tape automation system. You should never keep all of your critical business data in one place.

Refer to Chapter 2. Tape Automation Supported on AS/400 and the tables in Appendix A. Tape Automation Hardware Summaries for details on the connectivity options and maximum distances allowed for each tape automation system.

- Twin sites

If processors share a media inventory and are physically separated by sufficient distance, then each processor could own and manage its own tape automation system. Cartridges could then be swapped between tape automation systems frequently. The use of BRMS for AS/400 network grouping and media movement would greatly assist in this, especially where distance limitation allowed the networking of the processors but not the automated tape libraries.

---

## Configuration Approaches—Performance

You can tailor the performance of your tape automation system by using work management and load balancing techniques. You may attempt to improve the performance by using different connection configurations.

## How Physical Layout Affects Performance

The physical layout of your tape automation system can influence performance. The distribution of the three modules (control, drive, and storage modules) among the overall configuration can affect both the times to mount, and the seek times for cartridges.

You can locate all of your tape drive units in one physical area of the tape automation system. This area could store the high usage cartridges, or highly critical cartridges, most of the automated tape libraries have only limited algorithms on which to base cartridge positioning for optimum performance. You will have no direct control of which slot a cartridge is stored in.

If you spread the drive units evenly across the configuration, you will even out the chances of any cartridge being close to a drive.

You may even have an tape automation system with more than one picker unit on the accessor arm. This increases the performance because an unload and new mount can be performed in one physical motion.

## How the Connection Configuration Affects Performance

Some automated tape libraries may provide options in connectivity. You may see options including:

- Drive channel attachment, with an EIA-232 library manager attachment
- Drive channel attachment, with LAN library manager attachment (T/R or ENet)
- Drive and library manager attached through one SCSI channel

Typically the EIA-232 attachment limits the number of attachable hosts, according to the communications limits of the PC or library manager hardware. The LAN connection may open up the connectivity limits, which will only be limited by the drive attachment limits (for example, 3490E supplies only two channels per drive), coupled with the maximum drives allowable.

A direct and single SCSI attachment allows more flexibility with maximum configurations and makes setup a simpler task. When the drives are being driven to maximum capacity you may see performance limitations constrained by the fact that the library manager commands must be transmitted down the same lines as the tape data.

## How System Tuning Affects Performance

Some automated tape libraries have their own device driver application code, with separate subsystems and libraries. You can address the system work management functions to monitor and tune the subsystem activity for the device driver software. Refer to the *Work Management* book.



---

## Appendix C. Automated Tape Library Configurations

This appendix shows the types of configurations that you can consider when connecting a more complex automated tape library. When specific device characteristics do not permit a certain configuration, it is mentioned in the description for that device. For details on maximum configuration limits, see the configuration topics in the hardware overviews for each device in “Chapter 2. Tape Automation Supported on AS/400” on page 11.

---

### Single AS/400 System—Configuration Examples

An AS/400 system can connect to one tape drive within a tape library. This connection is either through a parallel channel or a small computer system interface (SCSI). Usually there is a separate connection to the library manager controller. This connection is either through an EIA-232 line or a local area network (LAN). Figure 47 shows an example configuration.

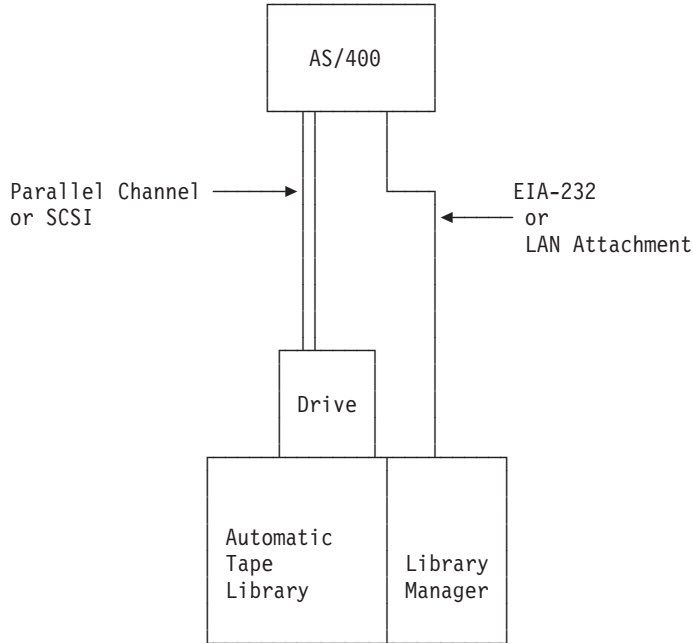


Figure 47. One AS/400 System Attached to One Drive in One Automated Tape Library

A single AS/400 system can connect to several different drives within the same tape library. You need to supply enough tape IOP (input/output processor) cards to provide sufficient numbers of parallel or SCSI channels for the tape drive attachment. When attaching self-contained drive units that are not part of a tape library, the numbers required do not vary from the conditions. Figure 48 on page 112 shows an example configuration.

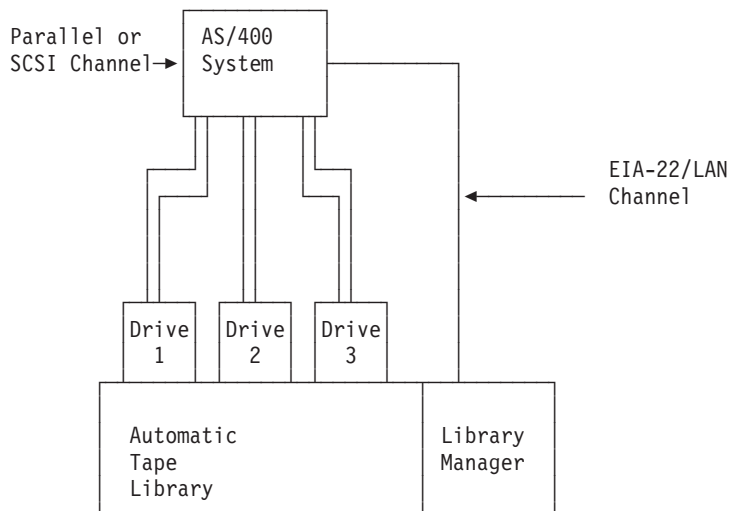


Figure 48. One AS/400 System Attached to Multiple Drives in One Automated Tape Library

You can attach a single AS/400 system to many drives in different tape libraries. You need to supply as many EIA-232 (V24) ports as there are tape libraries, unless you attach the libraries by a LAN. Figure 49 shows an example configuration.

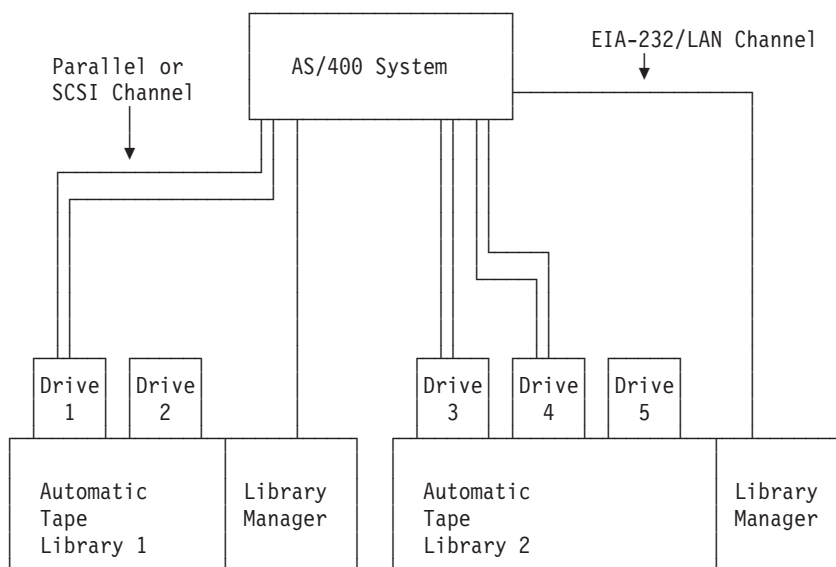


Figure 49. One AS/400 System to Multiple Drives in Multiple Automated Tape Libraries

## Multiple AS/400 Systems—Configuration Examples

Depending on the drive type, you can attach two AS/400 systems to the same drive in an automated tape library. For some drives, you may need to fit an additional channel attachment feature. Figure 50 on page 113 shows an example configuration.

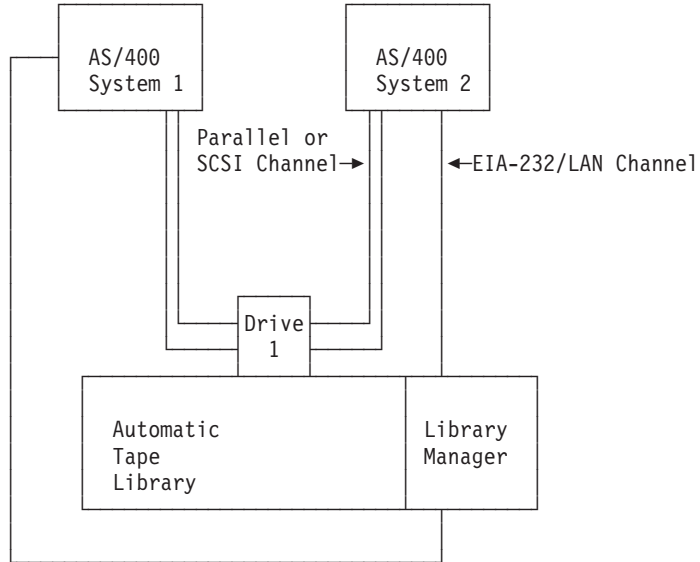


Figure 50. Multiple AS/400 Systems Attached to One Drive in One Automated Tape Library

You can attach many AS/400 systems to different drives within the same automated tape library. You need to supply a sufficient number of removable media IOP cards for the number of drives required. If you do not use a LAN attachment, supply an EIA-232 port on each AS/400 to connect to the library manager. For details on the maximum number of AS/400 systems that you can attach to a library manager, see the hardware overview of the library device that you are using. Figure 51 shows an example configuration:

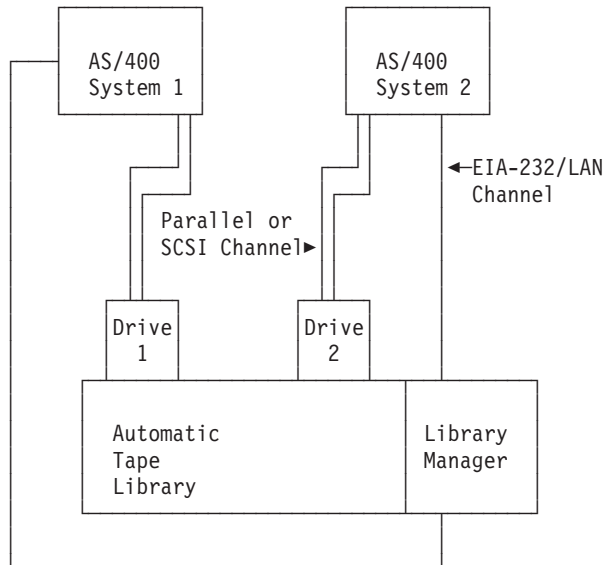


Figure 51. Multiple AS/400 Systems Attached to One Drive Each in One Automated Tape Library

You can attach multiple AS/400 systems to multiple automated tape libraries. Ensure that sufficient IOPs are attached to each AS/400 and sufficient communications channels are fitted to connect to the library manager from every

AS/400 to every tape library that it uses. You should stay within certain configuration limits (maximum number of AS/400 systems, maximum number of automated tape libraries) specified for each library device in “Chapter 2. Tape Automation Supported on AS/400” on page 11. Figure 52 shows an example configuration.

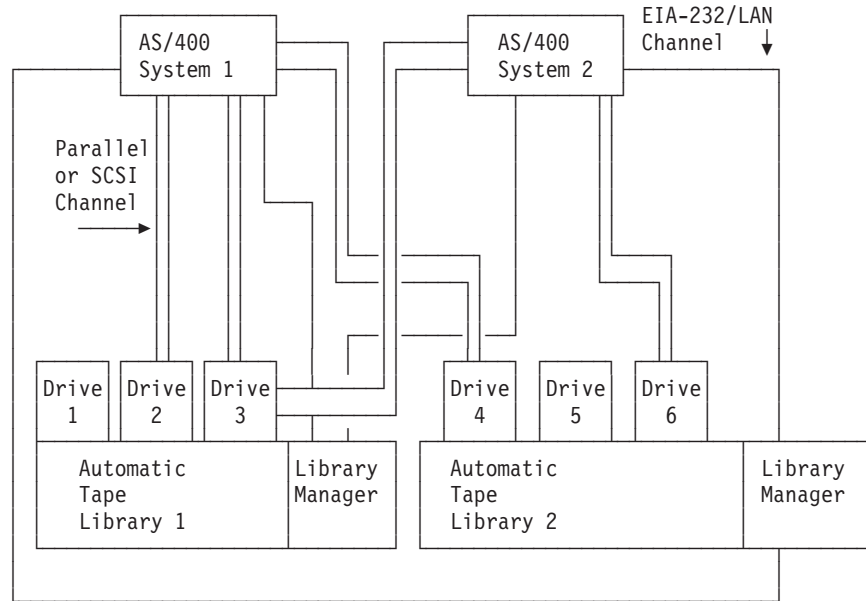


Figure 52. Combination of AS/400 Systems and Automated Tape Libraries

## Multiple Platforms—Configuration Examples

Automated tape libraries can be shared between different types of host platforms such as AS/400, ES/9000, and RISC System/6000 systems. Both ES/9000 and RISC System/6000 connect directly to the library manager and tape drive through a single connection. Different platforms can share the same drive. Figure 53 on page 115 shows an example configuration.

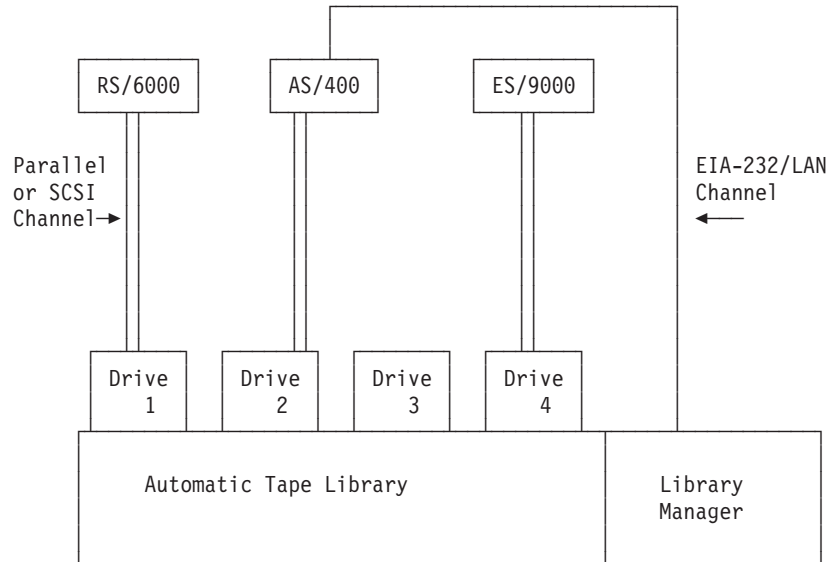


Figure 53. Multiple Host Platforms Sharing an Automated Tape Library

Different platforms can share the different drives within one tape library. Figure 54 shows an example configuration.

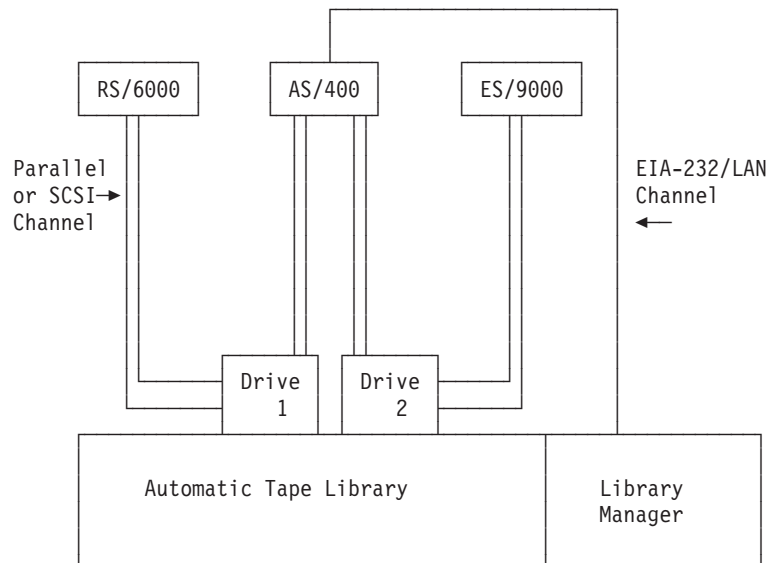


Figure 54. Multiple Host Platforms Sharing Drives on an Automated Tape Library

A complex sharing environment can be created. For example, Figure 55 on page 116 shows a configuration. Different platforms mix and match with a variety of drives within multiple automated tape libraries.

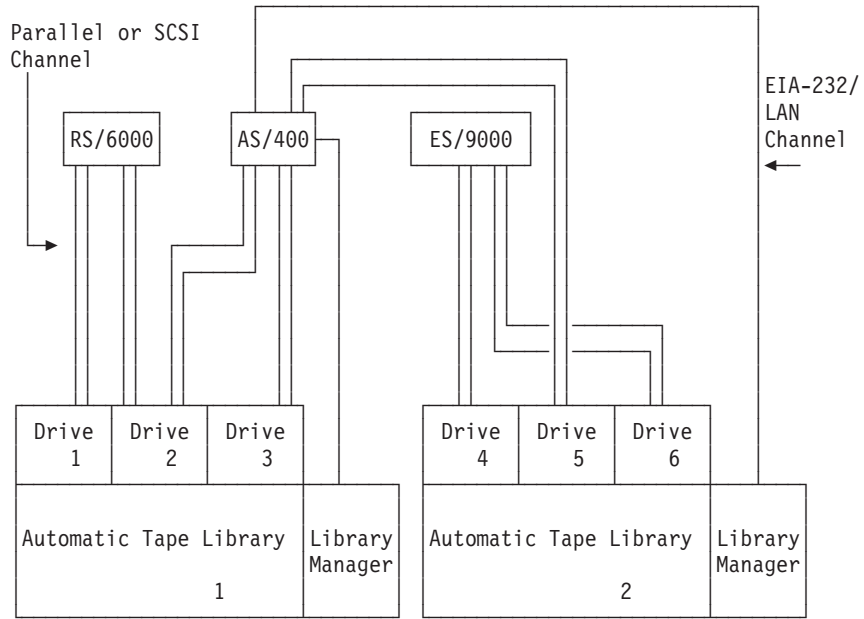


Figure 55. Multiple Host Platforms Sharing Multiple Drives on Multiple Automated Tape Libraries

# Appendix D. Example of Tape Automation Usage

This appendix provides an example of the various information, including configuration, scheduling, and processes that you will need to consider when using tape automation.

**Note:** The information that is provided in this appendix is only intended for example purposes. The information that is provided is not intended to be a recommendation of a specific backup strategy. Every user scenario is different based on numerous factors, including number of systems, number of tape devices, amount of data to be stored, and time constraints.

## Simple MLB Usage Scenario

The scenario that is shown in figure 56 will be used throughout this appendix for example purposes.

In this example, there are three systems that are connected to one 3494 Tape Library Dataserver

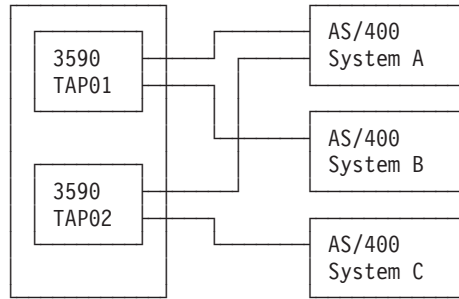


Figure 56. Example Scenario Configuration

Library Data Server. The 3494 has two 3590 devices. Because each 3590 device only has two ports, systems B and C only have one connection to the 3494 Tape Library. System A has two connections to the 3494 Tape Library.

## Example Usage Needs

Suppose that, in our example, you need to complete the save operations in 13 in one evening. (For example purposes, assume that each save operation is running at the same priority and each save operation will complete.)

Table 13. Example Scenario Time Requirements

Save Backup Group	System	Approximate Time Required
1	A	5 hours
2	A	3 hours
3	B	3 hours
4	B	2 hours
5	C	1 hour
6	C	2 hours

Let us also suppose that the available save window for each system is as follows:

- System A: 10pm to 6am

- System B: 10pm to 6am
- System C: 10pm to 6am

If systems A and B or systems A and C need to perform save operations simultaneously, a problem could arise. If system A begins its save operation first and accesses device TAP01, system B has no access to a tape drive. Similarly, if system A were to begin first and access device TAP02, system C has no access to a tape drive. Resolving this conflict is dependent on which release of OS/400 each system is running, as explained below.

---

## Managing Tape Resources

Each system in the example will report two tape subsystems, or "resources". These tape resources are connected to the tape library resource (in this example, the 3494 Data Server). The 3494 Data Server then generates an automatic configuration of a Media Library (MLB) device description. In this situation, any request to the tape library device (the 3494 Data Server) results in the tape library resource manager allocating which tape resources to use. This simplifies tape management tasks for most users since the system is responsible for the majority of those tasks.

**Note:** Users with multiple systems and limited attachment capabilities may still need to "force" the use of specific resources. See "Forcing Use of Specific Resources" on page 120 for more information.

The Work with Media Library Status (WRKMLBSTS) command allows you to view the tape libraries and associated tape resources from a configuration standpoint. Using this command on each of the three systems in our scenario would result in the following screens:

```

Work with Media Library Status
System:  XMPYSYA
Type options, press Enter.
1=Vary on   2=Vary off  3=Reset resource   4=Allocate resource
5=Allocate unprotected  6=Deallocate resource  8=Work with description
9=Work with volumes    10=Configure device

Device/
Opt  Resource  Status      Allocation
TAPMLB01  VARIED ON
TAP01     OPERATIONAL UNPROTECTED
TAP02     OPERATIONAL UNPROTECTED

```

Figure 57. System A View of the Tape Library TAPMLB01



```

Work with Media Library Status
System: XMPSYSB
Type options, press Enter.
1=Vary on 2=Vary off 3=Reset resource 4=Allocate resource
5=Allocate unprotected 6=Deallocate resource 8=Work with description
9=Work with volumes 10=Configure device

Device/
Opt Resource Status Allocation
TAPMLB01 VARIED ON
TAP01 OPERATIONAL UNPROTECTED

```

Figure 58. System B View of the Tape Library TAPMLB01

```

Work with Media Library Status
System: XMPSYSC
Type options, press Enter.
1=Vary on 2=Vary off 3=Reset resource 4=Allocate resource
5=Allocate unprotected 6=Deallocate resource 8=Work with description
9=Work with volumes 10=Configure device

Device/
Opt Resource Status Allocation
TAPMLB01 VARIED ON
TAP02 OPERATIONAL UNPROTECTED

```

Figure 59. System C View of the Tape Library TAPMLB01

There are three possible values for the allocation of each resource. Each value assumes that the tape library is varied on. The values are:

**ALLOCATED**

A tape resource that is assigned to a particular system and cannot be accessed by another system is considered allocated. (This state is analogous to a stand-alone device that is varied on with the value ASSIGN(\*YES).)

**UNPROTECTED**

A tape resource that is not assigned to a particular system and is available to respond to requests to its tape library device is considered unprotected. (This state is not analogous to a stand-alone device that is varied on with the value ASSIGN(\*NO).) If a request is made to the tape library device and the tape resource is selected by the tape library device resource manager, the tape resource will be ALLOCATED while it is being used.

**DEALLOCATED**

A tape resource that is not assigned to a particular system and is unavailable to respond to requests to its tape library device is said to be deallocated. If the tape library is varied off, all of its tape resources are considered deallocated. The deallocated state allows use of a tape resource in stand-alone mode. It also allows temporary use of a tape resource if a malfunction occurs with the robotic components of the tape library.

When a tape resource that is shared between systems is not in use, it should remain in an unprotected state with the tape library device varied on. If the tape resource is left in an allocated or deallocated state, a command request to utilize the resource may result in an error stating that no resources are available.

If you are using BRMS for AS/400, you should not use SHARED \*YES for media libraries. Use UNPROTECTED to share your resources. You can also use a combination of UNPROTECTED and ALLOCATED on the network to ensure that each system has the proper device that is required for backup operations. Leave the tape libraries varied on at all times, and use the allocation status to control usage.

## Forcing Use of Specific Resources

One issue to consider in the scenario is the issue of cable limitations. One system could potentially prevent another from accessing tape resources even when one is available. The difference is in how a user can force a system to use a specific resource. The ways to force a system to use a specific resource are:

- Schedule jobs based on time
- Use the fact that ALLOCATED resources are selected before UNPROTECTED resources
- Disable single library support

### Scheduling jobs based on time

One method of resolving this issue is to manipulate the start times of save operations on each system. In our example, system A and system B could be contending for tape resource TAP01. Starting the save operation on system B first would ensure that system B has access to a tape resource.

Table 14 shows how our strategy chart would appear if this method was used in the example scenario.

*Table 14. Schedule to Meet System and Device Constraints on RISC-based Systems Using Time Management*

Start Time	Approximate Complete Time	Backup Group	System	Device	Tape Resource Forced
10:05 pm	1:00 am	2	A	TAPMLB01	TAP01 (TAP02 is busy on system C)
10:00 pm	11:00 pm	5	C	TAPMLB01	TAP02
11:00 pm	1:00 am	6	C	TAPMLB01	TAP02
1:05 am	6:00 am	1	A	TAPMLB01	TAP02 (TAP01 is busy on system B)
1:00 am	4:00 am	3	B	TAPMLB01	TAP01
4:00 am	6:00 am	4	B	TAPMLB01	TAP01

### Using the resource selection sequence

Since ALLOCATED resources are selected for use before UNPROTECTED resources, we can utilize this aspect to our advantage. On system A in our example, we can simply put an \*EXIT in the BRMS control group to change TAP02 from UNPROTECTED to ALLOCATED. The next save request will then attempt to

access TAP02 first. When the save operation completes, we would put an \*EXIT at the end of the control group to change the resource back from ALLOCATED to UNPROTECTED.

In order to accomplish this in our example, we would simply keep all the resources in UNPROTECTED status and change two backup groups. In this situation, you only need to worry about systems that are attached to more than one resource. Only systems that are attached to more than one resource can produce a resource access conflict.

1. Change Save backup group #2
  - a. \*EXIT — change TAP01 from \*UNPROTECTED to \*ALLOCATED:  
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(\*MLBSRC) STATUS(\*ALLOCATE) RSRNAME(TAP01)
  - b. Perform the save operation
  - c. \*EXIT — change TAP01 from \*ALLOCATED to \*UNPROTECTED:  
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(\*MLBSRC) STATUS(\*UNPROTECTED) RSRNAME(TAP01)
2. Change Save backup group #1
  - a. \*EXIT — change TAP02 from \*UNPROTECTED to \*ALLOCATED:  
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(\*MLBSRC) STATUS(\*ALLOCATE) RSRNAME(TAP02)
  - b. Perform the save operation
  - c. \*EXIT — change TAP02 from \*ALLOCATED to \*UNPROTECTED:  
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(\*MLBSRC) STATUS(\*UNPROTECTED) RSRNAME(TAP02)

Table 15 shows how our strategy chart would appear if this method was used in the example scenario.

*Table 15. Schedule to Meet System and Device Constraints on RISC-based Systems Using ALLOCATE before UNPROTECT*

Start Time	Approximate Complete Time	Backup Group	System	Device	Tape Resource Forced
10:00 pm	1:00 am	2	A	TAPMLB01	TAP01
10:00 pm	11:00 pm	5	C	TAPMLB01	TAP02
11:00 pm	1:00 am	6	C	TAPMLB01	TAP02
1:00 am	6:00 am	1	A	TAPMLB01	TAP02 (TAP01 is busy on system B)
1:00 am	4:00 am	3	B	TAPMLB01	TAP01
4:00 am	6:00 am	4	B	TAPMLB01	TAP01

## Disabling Single Library Support

Single library support is the mechanism by which each 3590 tape device reports itself to the system as a tape subsystem. This generates a TAPMLBxx RESOURCE in which to create a tape library MLB. Therefore, if you have four 3590 tape devices in a 3494 Tape Library Data Server, you will get four TAPMLBxx device descriptions. A 3590 tape resource generates each device description. Single library support allows a system to recognize that all four tape resources are in the same 3494 Data Server. It also allows that system to put the four resources under each TAPMLBxx device that was generated. Normally, you should use one TAPMLBxx and assign all the tape resources to it. However, system A in our example would differ from this. The following screen shows the configuration that is generated on system A.

```

Work with Media Library Status
System: XMPSYSA
Type options, press Enter.
1=Vary on 2=Vary off 3=Reset resource 4=Allocate resource
5=Allocate unprotected 6=Deallocate resource 8=Work with description
9=Work with volumes 10=Configure device

Device
Opt Resource Status Allocation
TAPMLB01 VARIED OFF
TAPMLB02 VARIED OFF

```

After the command CFGDEVMLB(TAPMLB01) completes, you will see both resources under TAPMLB01, even though TAP02 actually generated TAPMLB02. Notice that both resources have been set to UNPROTECTED.

```

Work with Media Library Status
System: XMPSYSA
Type options, press Enter.
1=Vary on 2=Vary off 3=Reset resource 4=Allocate resource
5=Allocate unprotected 6=Deallocate resource 8=Work with description
9=Work with volumes 10=Configure device

Device
Opt Resource Status Allocation
TAPMLB01 VARIED OFF
TAP01 OPERATIONAL UNPROTECTED
TAP02 OPERATIONAL UNPROTECTED
TAPMLB02 VARIED OFF

```

If you varied on TAPMLB02, it would also recognize TAP01 and TAP02. However, since only one media library can utilize a resource, TAP01 and TAP02 would have to be set to DEALLOCATED in TAPMLB02, as shown on the following screen:

```

Work with Media Library Status
System: XMPSYSA
Type options, press Enter.
1=Vary on 2=Vary off 3=Reset resource 4=Allocate resource
5=Allocate unprotected 6=Deallocate resource 8=Work with description
9=Work with volumes 10=Configure device

Device
Opt Resource Status Allocation
TAPMLB01 VARIED OFF
TAP01 OPERATIONAL UNPROTECTED
TAP02 OPERATIONAL UNPROTECTED
TAPMLB02 VARIED OFF
TAP01 OPERATIONAL DEALLOCATED
TAP02 OPERATIONAL DEALLOCATED

```

In order to actually disable single library support, you would simply have TAP01 set to UNPROTECTED in TAPMLB01 and TAP02 set to UNPROTECTED in TAPMLB02, as shown below.

```

Work with Media Library Status
System: XMPSYSA
Type options, press Enter.
1=Vary on 2=Vary off 3=Reset resource 4=Allocate resource
5=Allocate unprotected 6=Deallocate resource 8=Work with description
9=Work with volumes 10=Configure device

Device
Opt Resource Status Allocation
TAPMLB01 VARIED OFF
TAP01 OPERATIONAL UNPROTECTED
TAP02 OPERATIONAL DEALLOCATED
TAPMLB02 VARIED OFF
TAP01 OPERATIONAL DEALLOCATED
TAP02 OPERATIONAL UNPROTECTED

```

Table 16 shows how our strategy chart would appear if this method was used in the example scenario.

*Table 16. Schedule to Meet System and Device Constraints on RISC-based Systems With Single Library Support*

Start Time	Approximate Complete Time	Backup Group	System	Device	Tape Resource Forced
10:00 pm	1:00 am	2	A	TAPMLB01	TAP01
10:00 pm	11:00 pm	5	C	TAPMLB02	TAP02
11:00 pm	1:00 am	6	C	TAPMLB02	TAP02
1:00 am	6:00 am	1	A	TAPMLB02	TAP02
1:00 am	4:00 am	3	B	TAPMLB01	TAP01
4:00 am	6:00 am	4	B	TAPMLB01	TAP01



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## Bibliography

The following publications provide additional information about topics described or referred to in this book.

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### AS/400 Publications

*Backup and Recovery*, SC41-5304, contains information about save and restore procedures.

*Backup Recovery and Media Services*, SC41-4345, describes the purpose and use of Backup Recovery and Media Services.

*A Practical Approach to Managing Backup Recovery and Media Services for OS/400*, SG24-4840-00.

*CL Reference (Abridged)*, SC41-5722, contains information on all CL commands used by OS/400.

*Hierarchical Storage Management*, SC41-5351. This book provides an overview of hierarchical storage management principles. It also describes considerations for planning for the use of dynamic retrieval that is supplied with Backup Recovery and Media Services for AS/400. The book also provides information on the implementation of hierarchical storage management.

*System API Programming*, SC41-5800, contains information about application programming interfaces.

*Work Management*, SC41-5306, describes work and job management concepts.

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### Other IBM Publications

*IBM 3494 Tape Library Dataserver Introduction and Planning Guide*, GA32-0279.

*IBM 3494 Tape Library Dataserver Operator's Guide*, GA32-0280.

*IBM 3494 Tape Library Dataserver User's Guide*, GC35-0153.

*Implementing Hierarchical Storage on the AS/400*, GG24-4450.

*IBM 9427 Installation Guide*, SA26-7107.

*IBM 9427 Tape Library Operator Guide*, SA26-7108.

*IBM 9427 Service Guide*, SA26-7109.

### 3570 Bxx

*IBM Magstar MP 3570 Tape Subsystem Introduction and Planning Guide, B-series Models*, GA32-0348.

*IBM Magstar MP 3570 Tape Subsystem Operator Guide, B-series Models*, GA32-0345.

*IBM Magstar MP 3570 Tape Subsystem Hardware Reference, B-series Models*, GA32-0365.

### 3570 Cxx

*IBM Magstar MP 3570 Tape Subsystem Introduction and Planning Guide, C-series Models*, GA32-0392.

*IBM Magstar MP 3570 Tape Subsystem Operator Guide, C-series Models*, GA32-0393.

*IBM Magstar MP 3570 Tape Subsystem Hardware Reference, C-series Models*, GA32-0394.

### 3590

*IBM Magstar MP 3590 Tape Subsystem Introduction and Planning Guide*, GA32-0329.

*IBM Magstar MP 3590 Tape Subsystem Operator Guide*, GA32-0330.

*IBM 3590 High Performance Tape Subsystem Hardware Reference*, GA32-0331.

### 3575

*IBM Magstar MP 3575 Tape Library Dataserver Introduction and Planning*, GA32-0380.

*IBM Magstar MP 3575 Tape Library Dataserver Operator Guide*, GA32-0381.

*IBM Magstar MP 3575 Tape Library Dataserver Hardware Reference*, GA32-0382.

## **3490E**

*IBM 3490E Tape Subsystem Models F00, F01, F02, and F11 Installation, Planning, and Operator's Guide, GA32-0378.*

*IBM 3490E Model F Tape Drive Hardware Reference Guide, GA32-0379.*



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## Notices

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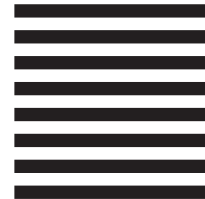
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