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Manage tape libraries





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Manage tape libraries

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Manage tape libraries

iSeries servers support several types of tape libraries, ranging from relatively simple solutions that can automatically load tapes during operation and maintain a limited cartridge inventory to tape automation systems capable of supporting many systems and managing vast cartridge inventories.

Use the following topics to learn about using tape libraries on your iSeries server.

What's new

Find a description of new content and changes for this release.

Print this topic

This topic is also available for printing in PDF format.

Tape library concepts

There are several types of tape libraries and options available. Learn about tape library configurations, and how OS/400 supports them with or without a media management application.

Install tape library

Most of the information you will need to set up your tape library will be included in your device documentation. Find links to the required manuals, and iSeries specific implementation information.

Configure tape library

After a tape library is installed and connected to the iSeries, it needs to be configured. Learn how to make tape libraries available for use in different iSeries environments.

Use tape library

Learn how to manage tape library resources. Also learn how to manage cartridges in a tape library.

Troubleshoot tape library

Some errors may occur within the tape library environment. This article will provide information on these errors and how to troubleshoot them.

For an introduction to Tape Library terminology, refer to the Tape library terms and definitions.

What's new

This information was formerly included in Automated Tape Library Planning and Management (SC41-5309-02) with its last update for V4R3. This new Information Center topic for V5R2 includes updated information on general concepts, tape library configuration, and how to use tape libraries.

Features added since Automated Tape Library Planning and Management was last updated in V4R3

- The grouping of multiple tape resources within a physical tape library that share the same cartridge inventory
- The ability to mount a category to every tape resource within a tape library
- Tape support in iSeries Navigator
- TCP/IP support for the 3494 tape library

Print this topic

To view or download the PDF version of the Manage tape libraries topic, select Manage tape library (about 151 KB or 38 pages).

To save a PDF on your workstation for viewing or printing:

1. Open the PDF in your browser (click the link above).
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3. Click Save As...
4. Navigate to the directory in which you would like to save the PDF.
5. Click Save.

If you need Adobe Acrobat Reader to view or print these PDFs, you can download a copy from the Adobe web site (www.adobe.com/prodindex/acrobat/readstep.html)

Tape library concepts

Tape libraries can help you perform unattended save and restore operations, archival and retrieval, spool archiving, and other tape related tasks. Tape libraries are often used with some form of automation software, and are capable of supporting multiple systems across different platforms and large quantities of cartridges. In these environments, a media management application often maintains the cartridge inventory and handles most of the tape library tasks. However, tape libraries may also be used without a media management application. In these environments the tape library can still support some automated tape functions.

The following topics introduce the major elements of a tape library, and the related information required for implementing a tape library solution.

Tape library types and major components

Use this topic to learn about the major components of a typical tape library configuration, and how they relate to OS/400. You can also find information about a tape libraries modes of operation.

Tape library operating modes

This topic provides a description of the tape library operation modes.

Common configuration types

This topic provides a description of several common tape library configurations.

Tape library automation with BRMS

This topic provides a brief description of the advantages of using BRMS with a tape library.

Tape library performance considerations

Plan your tape library configuration for optimum performance. There are several configuration issues and resource management considerations that effect the performance of your tape library solution.

OS/400 support for tape libraries

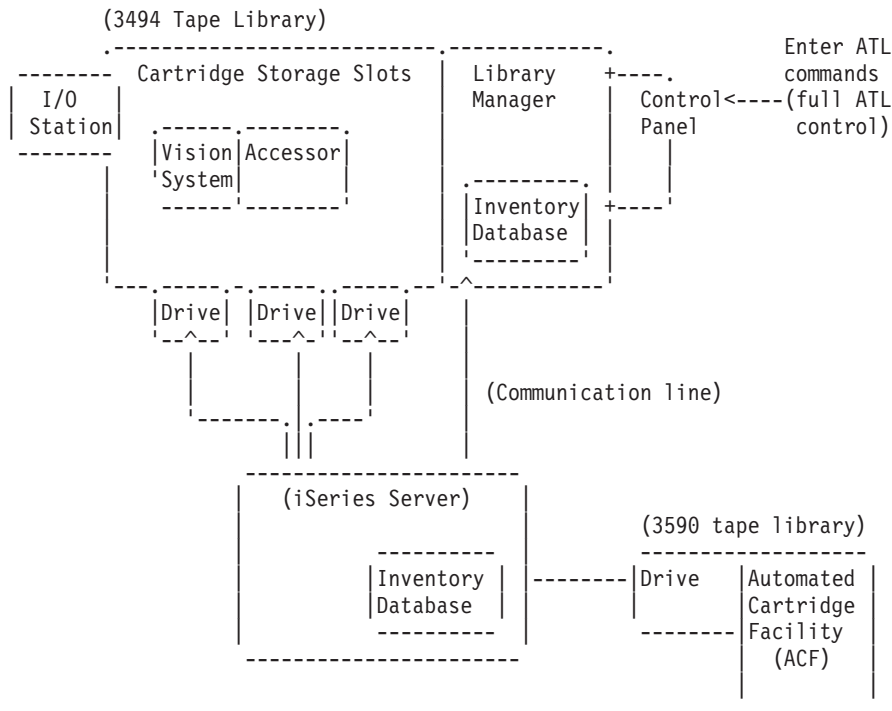
Find information for OS/400 support and requirements for using and managing tape libraries, including which functions may be supported without using a media management application like BRMS.

iSeries implementation notes

Find important implementation notes that will help you avoid and resolve problems when implementing a tape library on your iSeries server.

Tape library types and major components

The following graphic illustrates the parts of a tape library. This illustration shows some typical tape libraries, but does not cover all possible configurations.



See 29 for a description of the components.

Tape library operating modes

Most tape library devices support 3 basic modes of operation:

- A manual mode
- An automatic cartridge loader mode
- A library mode

The terminology used to describe these operational modes varies with the type of tape library, but the concepts are the same.

Manual mode

When a tape library is in manual mode it behaves like a stand-alone tape device and all cartridges must be manually loaded. See Using a tape resource as a stand-alone device for more information on using a tape library as a stand-alone device.

Automatic cartridge loader mode

When a tape library is in this mode it behaves like a stand-alone tape device with an automatic cartridge loader. When a cartridge is unloaded, the next cartridge is automatically loaded until all cartridges have been used.

Library mode

When a tape library is in library mode, tape automation is available.

You will need to refer to the operators manual for your tape library for specific information on how to configure these modes on your tape library.

Common configuration types

The connection to the tape drive is through a parallel channel, SCSI, or Fiber Channel interface. For a 3494 tape library a separate connection, either through an EIA-232 line or a local area network (LAN) is required to communicate with the library manager.

When more than one drive of the same type within a tape library is connected to the same OS/400 partition, the drives are pooled together to form a single logical library.

iSeries servers commonly support the following tape library configurations.

- A single iSeries server connected to a dedicated tape library.
- Multiple iSeries servers or logical partitions connected to the same tape library.
- Multiple system types connected to the same tape library.

Single iSeries connected to a dedicated tape library

An iSeries server can connect to one or more drives within a tape library.

Multiple iSeries servers or logical partitions connected to the same tape library

For a tape library with multiple drives it is possible to attach multiple iSeries servers or logical partitions to the same tape library.

Multiple system types connected to the same tape library

Automated tape libraries can be shared between different types of host platforms such as iSeries and pSeries servers.

When more than one system or logical partition is connected to the same tape library it is recommended that a Tape Management application such as BRMS be used to manage and secure the tape cartridges. For more detailed information on BRMS, refer to the Backup, Recovery and Media Services articles in the Information Center, and the Backup, Recovery and Media Services



web site.

Tape automation with BRMS

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

- **Reduce operational costs**
Less manual intervention is required to operate tape units because most of your tape operation is automated and unattended.
- **Improve system availability**
The reduction in time for tape mounting and backup times. BRMS enables you to streamline your backups.
- **Reduce 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.
- **Improve service**
You can experience faster and more accurate responses to your tape-related requests. You can gain more control of your tape management operation.

- **Reduce management cost**

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

For more detailed information on BRMS, refer to the Backup, Recovery and Media Services articles in the Information Center, and the Backup, Recovery and Media Services



web site.

Planning for 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.

Note: If you attach a library containing high speed tape drive resources (such as 3590, 358x) to a 6501 or 6534 I/O Processor, you should not attach any other high speed tape drive resources to I/O Processors on the same bus, or performance will be impacted.

For more detailed information on performance refer to the Resource Library section of the Performance Management



web site.

OS/400 support for tape libraries

In addition to the necessary tape automation hardware, software components are needed for a total iSeries server solution. They are:

- OS/400 CL commands and application program interfaces (APIs). See Use a tape library without a media management application for more information on the CL commands and APIs.
- A Tape Management application, such as BRMS. For more detailed information on BRMS, refer to the Backup, Recovery and Media Services articles in the Information Center, and the Backup, Recovery and Media Services



web site.

iSeries implementation notes

Most of the information necessary to set up your tape library is included in the product documentation. However, when implementing a solution on the iSeries, there are several considerations you should keep in mind.

- Cartridge assignment when the iSeries system name changes
- Alternate IPL (AIPL) requirements
- Problem handling for 3494 tape libraries
- Configurations with multiple connections for 3494 tape libraries

Cartridge assignment when the iSeries system name changes

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 for the new system name. Note, for some library types the cartridges may appear when using parameter CGY(*ALL *ALL) for the WRKTAPCTG or DSPTAPCTG command but you will not be able to use the cartridges.

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, record the names of the user defined categories for use in step 3 below, 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, from step 1 above, 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.

Alternate IPL (AIPL) requirements for tape libraries

The devices in a tape library can be used for AIPL when they are attached to an IOP/IOA in a position that supports AIPL and are set to the correct address. For more information on the IOP/IOA positions and device addresses that support AIPL, refer to Alternate IPL Device.

Alternate installation can be used for tape libraries that are attached to an IOP/IOA that is not in a position that supports AIPL. For more information on using an alternate installation device, refer to Backup and Recovery



Problem handling for 3494 tape libraries

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 an iSeries server. 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 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 the display would show *Required* instead of *None*.

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 tape library Dataserver cannot recover on its own. Depending on the type of error or exception condition experienced, some or all of the 3494 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 tape library Dataserver), select the OK button. Repeat this until all error conditions are resolved.

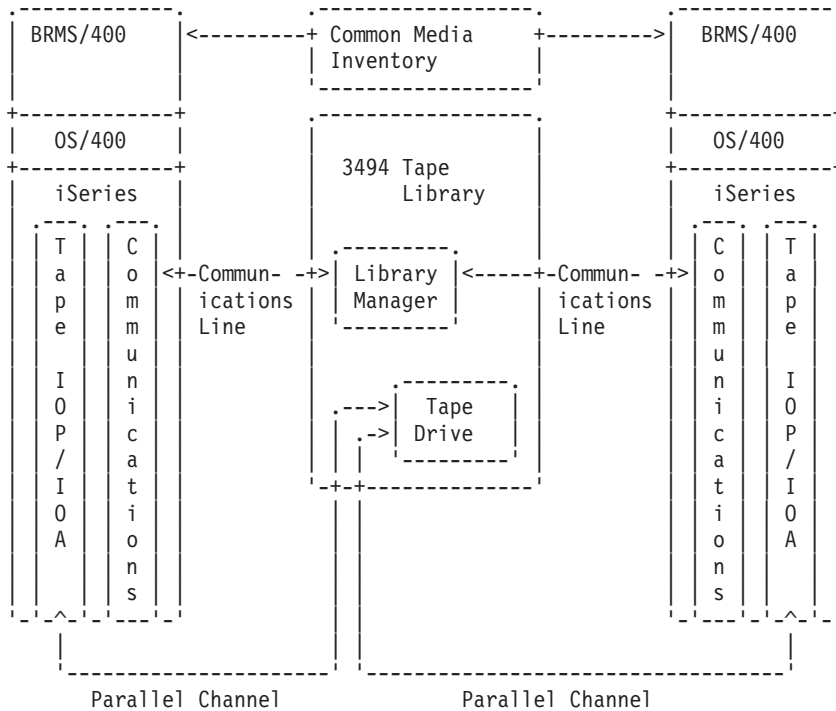
Configurations with multiple connections for 3494 tape libraries

You can connect multiple iSeries servers to a single 3494 library, or multiple 3494 libraries to a single iSeries system. See the following information for recommendations about these configurations.

Multiple iSeries servers sharing a 3494 tape library dataserver

The 3494 tape library dataserver can be shared by as many as sixteen iSeries servers. Each iSeries server requires one communications line and one tape drive attachment. With BRMS controlling the 3494 tape library dataserver, the cartridges within the library can be shared among any of the attached iSeries servers when you use the common media inventory function of BRMS.

Two iSeries servers sharing the 3494 tape library dataserver (Multiple iSeries server library attachments):



Multiple 3494 tape library dataservers on one iSeries server

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

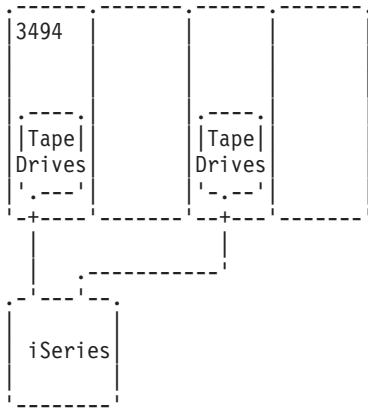
Multiple tape drives in one 3494 tape library dataserver

Larger iSeries servers can reduce backup times by breaking the operation into multiple concurrent saves to multiple devices.

Not all connections between an iSeries server and the 3494 Automated Tape Library Dataserver are valid. A single iSeries server can be connected to multiple tape drive controllers. However, a single partition in an iSeries server 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.

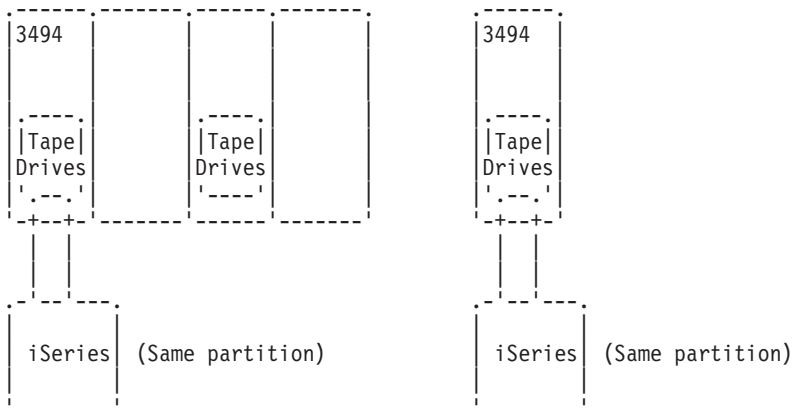
The following illustration shows a supported configuration. The cable is shown attaching the iSeries server to the tape drives.

iSeries server-to-3494 tape library Dataserver — Supported Configuration



The following figure shows an unsupported configuration. The cable attaches the iSeries server to the tape drives.

iSeries server-to-3494 tape library dataserer unsupported configuration



Configurations of different platforms with the 3494 tape library dataserer

The 3494 tape library Dataserver can be shared by iSeries servers, RISC System/6000 systems and ES/9000 systems for a total of 16 systems. The iSeries servers can share cartridges in the library. The other systems can share the library by partitioning the 3494 tape library Dataserver, and individual cartridges can be assigned to a particular processor. This is done by assigning each cartridge to a category.

Install the tape library

The iSeries server will automatically configure and vary on an attached tape library. For complete documentation on setting up and cabling the tape library, refer to the user's guide for your tape automation system.

- 3490E Model F Tape Subsystem



- Magstar 3494 Tape Library



- Magstar 3570 Tape Subsystem



- Magstar 3575 Tape Library Dataserver



- IBM 3581 Ultrium Tape Autoloader



- IBM 3583 Ultrium Scalable Tape Library



- IBM 3584 UltraScalable Tape Library



- Magstar 3590 Enterprise Tape System



If you plan to use the tape library as an alternate IPL device, refer to Alternate IPL (AIPL) Requirements.

Configure tape library

Once you've set up the tape library and connected it to your system, the iSeries server will automatically configure it. The system creates a device description named TAPMLBxx, where xx is the next available device description number, and will configure any associated tape resources (MLBRSC) and tape device descriptions (TAPxx). In addition to the tape library 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.

Once automatically configured, you need to perform several configuration steps to make the tape library available to your iSeries server. If you are sharing the tape library between multiple systems refer to Sharing tape library resources for more information.

Configure a tape library (other than type 3494)

Complete the following procedure to ready your tape library for use:

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, enter option 4 (ALLOCATE) or option 5 (UNPROTECTED) and press the Enter key. This will make the resource available to the tape library.
4. Add cartridges to the tape library. See the documentation for your media management application, or the topic Working with cartridges for more information.

Configure type 3494 tape libraries

Type 3494 tape library supports connections to multiple 3490 and 3590 tape devices within the same physical unit. When the iSeries server auto-configures these devices, it will create a unique device description for each type of tape devices in the physical 3494 tape library, one for any 3490 tape devices,

and another for any 3590 devices. When either of these device descriptions is varied on, all devices of that type within that 3494 tape library will be associated with it.

Complete the following procedure to make the 3494 tape library ready for use:

1. Ensure that the tape library is set to automated mode. If it is not, use the device panel to set it to automated mode.
2. Create a communications link for a 3494 tape library description for the 3494 tape library. This will define the communication line associated with the tape library.
3. Type WRKMLBSTS and press the Enter key. This allows you to work with the status of the device.
4. In the option field next to each resource, enter option 4 (ALLOCATE) or option 5 (UNPROTECTED) and press the Enter key. This will make the resource available to the tape library.
5. Add cartridges to the tape library. See the documentation for your media management application, or the topic Working with cartridges for more information.

Sharing tape library resources

You can share tape library devices between multiple systems and users.

Sharing tape library resources on the same system

With tape libraries users are allowed to run more jobs that use a tape library than there are resources in the library. As commands are issued to the tape library requests to use a resource are sent to a tape resource manager. The request will wait until a resource becomes available and when one does the job will be assigned the resource to complete that step. The order in which requests are given a resource is based on the RSCALCPTY for the request. The length of time a request will wait for a resource to become available is controlled by the INLMNTWAIT and EOVMTWAIT times for the request. The RSCALCPTY, INLMNTWAIT, and EOVMTWAIT times can be set either in the tape library device description so they can be used as a default or for a particular job using the CHGJOBMLBA command or the QTACJMA API. These values are used when a request is first sent to the resource manager. Once a request has been sent to the resource manager and is waiting to be processed it can be monitored and changed using the WRKMLBRSCQ command.

Sharing tape library resources on the same 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 (TAPMLB01). If TAPMLB01 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 tape library 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 operations are started at a given time and known, through estimates or bench marking, to complete in 6 hours. Set the INLMNTWAIT time limit to 6 hours. Now if any of the save operations do not complete in 6 hours, an escape message is signaled to the job(s). A pager system could monitor for this message and page an operator to determine the necessary recovery actions.

Sharing tape library resources between systems

The iSeries server tape library design allows for sharing tape library resources between systems. Tape resources can be set to ALLOCATED, UNPROTECTED or DEALLOCATED. To better facilitate sharing between systems the concept of UNPROTECTED was added. 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 Tape Library Resources Between Systems and on the Same System

When sharing tape resources 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 tape operation continues.

Create a communication link for a 3494 tape library

The 3494 tape library requires a communications line for the Library Manager functions. The communication line can be either RS232 ASYNC or LAN. Before the 3494 tape library can be varied on, the communication line needs to be specified in the ROBOTDEV or ROBOTHOST parameter in the tape library device description.

To create the communications link between the tape library and the Library Manager use the Configure Device MLB (CFGDEVMLB) command. This command uses the required input parameters to configure and connect the communications line to the tape library device description and attempts to vary on the tape library.

Note: If your 3494 tape library has the high availability option installed so there are two Library Manager personal computers you need to configure two communication lines, one for each Library Manager personal computer.

Creating a RS/232 ASYNC connection

To configure a RS/232 ASYNC connection to communicate with the 3494 Library Manager, use the following command:

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

- DEV(TAPMLB01)
Specifies the name of the tape library device description.
- ADPTTYPE(*RS232) Indicates that this tape library is attached via an RS232 ASYNC line.
- RSRCNAME(CMN02)
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 tape library is varied on.

Creating a LAN connection using APPC

To configure a LAN connection using APPC to communicate to the 3494 Library Manager, use the following command:

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

- DEV(TAPMLB01)
Specifies the name of the MLB device description.
- ADPTTYPE(*LAN)
Indicates that this MLB is attached via a LAN line.

- **PROTOCOL(*APPC)**
Specifies that APPC will be used as the communications protocol for the LAN connection to the 3494 tape library.
- **LIND(TRNLINE)**
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(APPN.MLD01)**
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 identifier and cccccc is the remote location name. If no network identifier is specified, use DSPNETA to determine the default value. Obtain this parameter from the 3494 Library Manager console using the pull downs COMMANDS, LAN options, LM LAN information.
- **ADPTADR(0123456789AB)**
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.

Note: Any routers between the iSeries server and the 3494 tape library need to allow SNA traffic. (APPC only)

DSPLANMLB LIND(TRNLINE) OUTPUT(*)

For detailed information about working with this information, refer to LAN media library information.

Creating a TCP/IP connection

To configure a LAN connection using TCP/IP to communicate to the 3494 Library Manager, use the following command:

To display the required LAN information on the iSeries, use the following command:

```
CFGDEVMLB DEV(TAPMLB01) ADPTTYPE(*LAN) PROTOCOL(*TCP) ROBOHOST(MLD01) LCLINTNETA(192.168.5.10)
```

- **DEV(TAPMLB01)**
Specifies the name of the MLB device description.
- **ADPTTYPE(*LAN)** Indicates that this MLB is attached via a LAN line.
- **PROTOCOL(*TCP)**
Specifies that TCP/IP will be used as the communications protocol for the LAN connection to the 3494 tape library.
- **ROBOHOST(MLD01)**
Specifies the TCP/IP host name for the 3494 tape library. The host name can be a fully qualified domain and host name.
- **LCLINTNETA(192.168.5.10)**
Specifies the local internet address of the interface that is connecting to the 3494 Library Manager. This is the interface the iSeries server will start when TCP/IP needs to be started to use the 3494 tape library.

Note: To use the LAN connection, you must also add the LAN host to the 3494 Library Manager. For complete instructions, refer to the 3494 documentation.

Media library LAN details

To add the LAN host on the 3494 library, you will need the LAN connection information from the iSeries server. To get that information, use the following command:

DSPLANMLB LIND(TRNLINE) OUTPUT(*)

The command will display the following information:

Field	Description
Communication protocol	APPC
Host transaction program name	QMLD/QMLDSTRCC
Host network identifier	APPN
Host location name	SYSNAME
Host adapter address	0123456789AB

Add the LAN host to the 3494 library using the Communication protocol given by the DSPLANMLB command.

Note: If you rename the Default local location name or the Local control point name on your iSeries server, the Communication protocol type used will change. The 3494 library will need to be restarted for these changes to take affect.

Use tape library

You can use tape libraries to manage large amounts of data, either as part of a backup, archival and recovery system, or as part of normal IT operations. Media management software, such as BRMS, automates many tape library functions. However, operating the tape library still requires that you manage both how the tape library resources are utilized and how it uses resources on the system. Moreover, maintaining cartridges is an integral part of tape library automation.

Use a tape library without a media management application

OS/400 includes the commands necessary to control a tape library. Use this topic to learn how to manage a tape library using only the functions included in base OS/400.

Use a tape library resource as a stand alone tape drive

Most tape libraries provide methods for using resources in the library without the controlling automation software. Use this topic to find out how to use a tape resource in this mode of operation.

Save/Restore considerations

Save and restore operations have some special considerations that need to be followed. In some situations you must observe some additional restrictions to avoid aborting your save operation.

Changing tape library attributes

You can change the tape library attributes used to assign resources to tape requests in order to manage them efficiently. Use this topic to learn how to work with tape library attributes.

Working with cartridges

Maintaining cartridges is an important and routine part of operating your tape library. Use this topic to learn how to add and remove cartridges from your library, organize the cartridges with categories and volumes, and integrate the cartridges into your tape library operations.

Scenario: Manage tape resources

This topic provides an example configuration with multiple devices in a 3494 library managing save operations for several systems.

Using a tape library without a media management application

While a media management application greatly simplifies and extends a tape libraries capabilities, you can perform many tape functions in an iSeries environment with commands included in OS/400. The following table shows the typical setup and operational tasks and associated CL commands for the tape library.

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

Task	Command
Creating a tape library device description	Auto-configured or use Create Device Desc (Media Library) (CRTDEVMLB)
Displaying RS232/LAN resource/description	Display Hardware Resources (DSPHDWRSC)
Configuring the 3494 communication (RS232/LAN/TCP)	Configure Device Media Library (CFGDEVMLB)
Display LAN information for 3494 Add LAN Host	Display LAN Media Library (DSPLANMLB)
Removing a tape library device description	Delete Device Description (DLTDEVD)
Changing the tape library device description	Change Device Desc (Media Library) (CHGDEVMLB)
Changing the tape library device attributes for a job	Change Job MLB Attributes (CHGJOBMLBA) command or Change Job MLB Attributes (QTACJMA) API
Displaying the tape library device attributes for a job	Display Job (DSPJOB) OPTION(*MLBA) or Work with Job (WRKJOB) OPTION(*MLBA)
Retrieving the tape library device attributes for a job	Retrieve Job MLB Attributes (QTARJMA) API
Display tape library information	Display Tape Status (DSPTAPSTS)
Checking the status of the tape library	Work with Media Library Status (WRKMLBSTS)
Creating user categories.	Create Tape Category (CRTTAPCGY)
Mounting a category	Set Tape Category (SETTAPCGY) OPTION(*MOUNTED)
Demounting a category	Set Tape Category (SETTAPCGY) OPTION(*DEMOUNTED)
Assigning a mounted category to a different job	Set Tape Category (SETTAPCGY) OPTION(*ASSIGN)
Releasing a mounted category from a job	Set Tape Category (SETTAPCGY) OPTION(*RELEASE)
Deleting a user category.	Remove all the cartridges from the category. Use the Delete Tape Category (DLTTAPCGY) command
Listing all user or system categories	Display Tape Category (DSPTAPCGY)
Changing the category for cartridges	Change Tape Cartridge (CHGTAPCTG) or Work with Tape Cartridges (WRKTAPCTG), option 2
Inserting cartridges	Add Tape Cartridge (ADDTAPCTG) or Work with Tape Cartridges (WRKTAPCTG), option 1
Ejecting cartridges	Remove Tape Cartridge (RMVTAPCTG) or Work with Tape Cartridges (WRKTAPCTG), option 4
Mounting cartridges for output or input commands	Specify the tape library device and cartridge identifier 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 a tape library	Work with Tape Cartridges (WRKTAPCTG)
Displaying information about a cartridge	Display Tape Cartridge (DSPTAPCTG) or Work with Tape Cartridges (WRKTAPCTG), option 5
Working with the tape library resource manager queue	Work with MLB Resource Queue (WRKMLBRSCQ)
Retrieving the capabilities for a tape library device or resource	Retrieve Device Capabilities (QTARDCAP) API
Retrieve the status for a tape library device or resource	Retrieve Device Status (QTARDSTS) API
Retrieving the information for a tape library	Retrieve Device Information (QTARDINF) API

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

Using a tape resource as a stand-alone device

Occasionally, it may be necessary to use the tape resources in a tape library without the benefit of the automation. An example of this would be when you perform an alternate IPL. Another example would be when the tape library automation is disabled. Using the tape resource in this fashion is referred to as stand-alone mode. In stand-alone mode, the tape resource operates like other tape devices that are not in a tape library. Most tape libraries provide modes or commands to move media to a tape resource. Refer to the operator information for your tape library for the different operating modes available. When automation is not used, the tape library operates as an automatic cartridge loader for the tape device and loads cartridges individually or sequentially in the device.

Tape library devices are configured with tape library device descriptions for the tape library. There are also separate tape device descriptions for the tape 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 tape library or varying off the tape library device. Once the tape resource is available, you can vary on the tape device description, and issue commands to this device. The tape resource on the WRKMLBSTS screen will now show a status of UNAVAILABLE. No tape library functions will operate for this tape resource. The tape resource will need to have cartridges mounted manually, by a device mode, or by device operator panel commands.

Note: You can use iSeries navigator to determine the status for your stand alone tape device.

Save/Restore considerations

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.

Changing tape library attributes

Depending on your business environment you may wish to control the use of tape resources to allow important jobs to finish quickly. OS/400 provides several features for this. You can use the Change Job Media Library Attributes (CHGJOBMLBA) command to change the priority of tape resource requests for a particular job, and the Work with MLB Resource Queue (WRKMLBRSCQ) command to work with the tape resource manager queue.

Changing tape library job attributes

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 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 all other higher priority jobs finish using the tape resources. Typically, very short-running tape operations 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.

You can also add *MLBA to either WRKJOB or DSPJOB in order to view or adjust your tape library attributes.

Changing access to a tape resource within a library

The WRKMLBRSCQ command allows a user to manipulate the requests to use a tape resource within a tape media library. The WRKMLBRSCQ command shows the resources that are currently processing a request, have a category mounted, or the requests that 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 (Change Request MLB Attributes) on the Work with MLB Resource Queue (WRKMLBRSCQ) 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 (Work with job) on the Work with MLB Resource Queue (WRKMLBRSCQ) screen, and then selecting option 21, Work with media library attributes.

There are times when a request will show a zero priority. These requests are for when a tape resource is being used by the system for a tape operation. An example is a tape command using ENDOPT(*UNLOAD) completes and the system is still unloading the cartridge.

Changing tape library attributes with APIs

You can use the APIs QTARJMA and QTACJMA to control tape library attributes programmatically. For a more detailed description and an example, see Changing Tape Library Attributes with APIs.

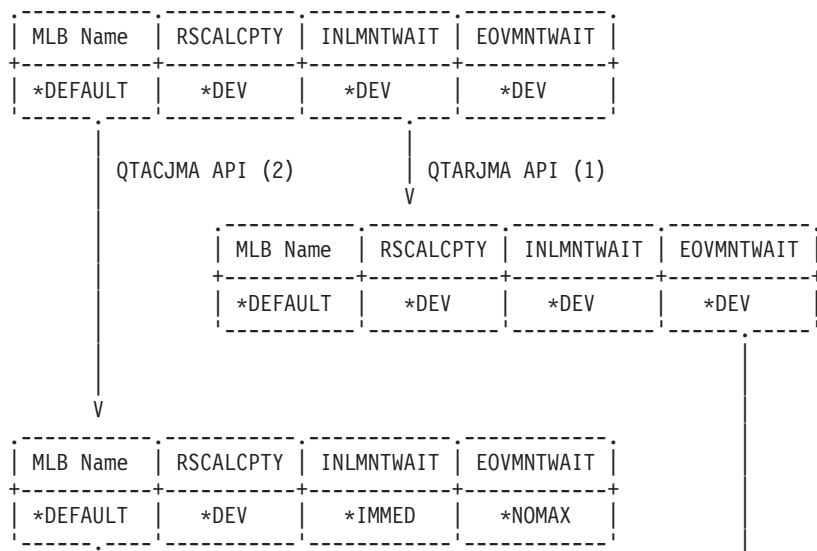
Changing tape library attributes with APIs

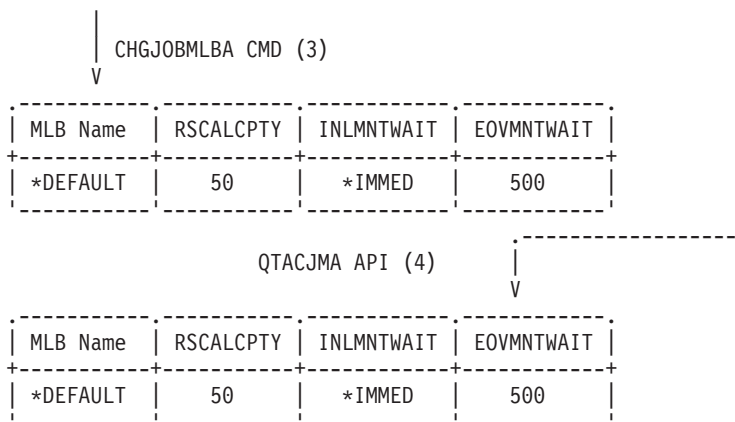
The QTARJMA and QTACJMA APIs can be used to retrieve and change the tape library attributes for a specific job. For more information about the fields for the APIs, refer to:

- QTARJMA
- QTACJMA

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

Retrieving and Changing Tape Library Attributes





Sequence

1. An application using the QTARJMA API retrieves the current job tape library attribute information where the user running the job does not have *JOBCTL special authority.
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 tape library 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.

Working with cartridges

Before the tape library can be used, it must have media in it. If a 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 tape library will inventory the contents. Each cartridge ID is noted and recorded in the operating system and Library Manager (if present).

You can use iSeries navigator to perform most cartridge functions. To work with cartridges in iSeries Navigator:

1. Click Configuration and Service
2. Click Hardware
3. Click Tape devices
4. Click Tape Library
5. Click Cartridges

For a detailed description of how to work with cartridges, refer to the iSeries Navigator online help. You can also work with cartridges by entering WRKTAPCTG from the command-line interface.

Use the following topics to learn about how to configure and organize your cartridges

- Import cartridges
- Export cartridges
- Cartridge status
- Cartridge categories
- Cartridge and volume identifiers

Use the following topics to help you work with cartridges in Media Libraries

- Use cartridges in a media library
- Use mounted categories
- Sharing cartridges
- End of volume considerations

Importing cartridges

A process that is called importing adds cartridges to the inventory of the tape library. Most tape libraries provide an Input/Output (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 tape libraries have no I/O station. For these tape libraries, cartridges are added by stopping the automation and opening the door to access the 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 tape 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 to a specified category of media. See Cartridge Categories for more details. The ADDTAPCTG command changes the cartridge status. See Cartridge Status 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 tape library does not have a bar code reader. Since there is no bar code reader, the generated identifier IMP001 is used. Refer to Cartridge and Volume Identifiers for more information. The volume identifier recorded on the media is known to be TAPE01. If the tape library has a bar code reader, then some of these examples would not apply because the cartridge identifier would be known.

Examples:

```
ADDTAPCTG DEV(TAPMLB01) 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(TAPMLB01) CTG(IMP001) CGY(*CNV) CHKVOL(*NO)
```

- IMP001 is added to the *CNV category. The cartridge remains in the priority slot because CGY(*CNV) was specified. The cartridge is not loaded in the device 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)), the cartridge will be returned to the priority slot.

```
ADDTAPCTG DEV(TAPMLB01) 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(TAPMLB01) 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(TAPMLB01) CTG(TAPE01) CGY(*NOSHARE) CHKVOL(*YES)
```

- If no cartridge identifier TAPE01 exists in the inventory for this tape library, OS/400 will search the device starting with the priority slot and then any cartridge identifier with the volume identifier 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(TAPMLB01) CTG(TAPE01) CGY(*NOSHARE) CHKVOL(*NO)

- If no cartridge identifier TAPE01 exists in the inventory for this tape library, OS/400 will search the device starting with the priority slot and then any cartridge identifiers with the volume identifier 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(TAPMLB01) 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 it is returned to the priority slot. The cartridge defaults to *CNV category so it will be moved back to the priority slot when the cartridge is unloaded using (ENDOPT(*UNLOAD)).

SAVOBJ DEV(TAPMLB01) OBJ(QCLSRC) LIB(QGPL) VOL(TAPE01)

- If no cartridge identifier TAPE01 exists in the inventory for this tape library, OS/400 will search the device starting with the priority slot and then any cartridge identifiers with the volume identifier 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 using ENDOPT(*UNLOAD)).

Exporting cartridges

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

***DEV** The cartridges are moved to the I/O station if the device has one. If the device does not have an I/O station 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, the cartridges are left in the device in the *EJECT category.

Cartridges in the *EJECT category can be changed to the *INSERT category by physically removing the cartridges, reinventorying the tape library, and reinserting the cartridges. Cartridges can also be changed back to a usable category using the Change Tape Cartridge (CHGTAPCTG) command.

Note: Cartridges that are in the *CNV category will automatically be exported when they are unloaded from a tape resource for a tape command that is using ENDOPT(*UNLOAD). If a cartridge in the *CNV category is unloaded from a tape resource by the system to load another cartridge the cartridge that was in the tape resource will not be ejected from the tape library.

Cartridge status

A cartridge can have the following status:

Inserted

The cartridge has been moved into the media library device and has been placed in the *INSERT category (see Cartridge Categories). 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 a 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 identifier. 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

A category is a logical grouping of cartridges. They allow the user to refer to a group of cartridges by category name versus the individual cartridge identifiers.

For tape libraries 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 a category on one system are not necessarily in the same category on other attached systems. Therefore, when operating with tape 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 tape libraries without library managers. Categories that are created for non-library manager tape libraries are only known to the system where they are created and not across all attaching systems. For these types of tape 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 tape libraries 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. 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. Refer to Cartridge assignment when the iSeries system name changes for more information about changing the system name.

***INSERT**

The cartridge has been moved into the tape 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 tape 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 iSeries systems attached to the tape library device.

***EJECT**

The cartridge has been removed from the inventory with the Remove Tape Cartridge (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 quickly and get it out of the tape library device. A tape in the *CNV category 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.

***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, 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 tape library device description has the GENCTGID parameter set to *SYSGEN.

This feature allows tape 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, you should not attempt to use user-defined categories.

Cartridge and volume identifiers

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

Special generated cartridge identifiers have been put into effect for the tape libraries that do not have a bar code reader, are missing the bar code label, or the bar code reader can not read the 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 a cartridge that is in an Input/Output station of the tape library.

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 tape library inventory will appear as SLTxxx where xxx is the slot number.

Using cartridges in a tape library

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 signaled on input operations and an inquiry or escape message, based on command, will be signaled for output operations. All iSeries tapes are initialized with the volume identifier matching the cartridge identifier.

The easiest way to find existing cartridges for use in a tape library 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.

WRKTAPCTG DEV(TAPMLB01) CTG(*ALL *ALL) will display a complete inventory of cartridges for tape library TAPMLB01.

Using 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 tape 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 tape 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 tape library device with VOL(*MOUNTED) will be directed to the tape resource set up for mounted category.

One category can be mounted per available tape resource. To mount more than one category for a tape library the MNTID parameter must be used with the SETTAPCGY command to identify the mounted category operations. A job can only have one mounted category session active at a time. The mounted category session can be released from the job that mounted the category and assigned to another job by using the *RELEASE and *ASSIGN options on the SETTAPCGY command.

Notes:

1. Tape management systems are notified when a category is mounted and de-mounted. 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 does not use mounted categories to perform its processing. Using mounted categories in combination with BRMS functions is not recommended. Mounting a category while concurrently using BRMS to perform tape operations can have unpredictable results.

Sharing cartridges

You can share the cartridges in a tape library between multiple platforms or iSeries servers. When an iSeries server is using a cartridge in a 3494 tape library, the cartridge must be in a category assessable to the iSeries server. This can be the *SHARE400 category or a user-defined category.

Volume protection between platforms

When initializing a tape, systems other than the iSeries server 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 writing this security flag 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 an ASCII space (hexadecimal 20). 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 iSeries server and is to be read on another platform.

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, a CPA6798 inquiry message is issued allowing the user to supply an additional cartridge allowing the tape operation to continue. If the cartridge supplied is not found or not available a CPA6797 inquiry message is issued allowing the user to supply an alternate cartridge to continue the tape operation. Tape management systems have the ability to provide more volumes through exit points in the OS/400 tape functions.

See Save/Restore considerations for other end of volume concerns.

Scenario: Manage tape resources

Each system in the following scenario 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 resource 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.

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:

System A View of the Tape Library TAPMLB01

```

+-----+
|                                     |
|                               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     |
|                                     |
| Opt  Device/      Status           Allocation           Job                |
|      Resource     Status           Allocation           name                |
|      TAPMLB01     VARIED ON         UNPROTECTED         |
|      TAP01        OPERATIONAL       UNPROTECTED         |
|      TAP02        OPERATIONAL       UNPROTECTED         |
|                                     |
+-----+

```

System B 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     |
|                                     |
| Opt  Device/      Status           Allocation           Job                |
|      Resource     Status           Allocation           name                |
|      TAPMLB01     VARIED ON         UNPROTECTED         |
|      TAP01        OPERATIONAL       UNPROTECTED         |
|                                     |
+-----+

```

System C 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

  Opt   Device/      Status           Allocation      Job
       Resource     Status           Allocation      name
TAPMLB01  VARIED ON
TAP02     OPERATIONAL  UNPROTECTED
```

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 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 assigned 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, 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
- Use multiple tape library device descriptions

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.

The following table shows how our strategy chart would appear if this method was used in the example scenario.

Schedule to meet system and device constraints using time management

Start Time	Approximate Complete Time	Backup Group	System Device	Tape Resource Forced
10:05 pm	1:00 am	2	A	TAPMLB01TAP01 (TAP02 is busy on system C)
10:00 pm	11:00 pm	5	C	TAPMLB01TAP02
11:00 pm	1:00 am	6	C	TAPMLB01TAP02
1:05 am	6:00 am	1	A	TAPMLB01TAP02 (TAP01 is busy on system B)
1:00 am	4:00 am	3	B	TAPMLB01TAP01
4:00 am	6:00 am	4	B	TAPMLB01TAP01

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

- *EXIT — change TAP01 from *UNPROTECTED to *ALLOCATED:
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(*MLBRSC) STATUS(*ALLOCATE) RSRNAME(TAP01)
- Perform the save operation
- *EXIT — change TAP01 from *ALLOCATED to *UNPROTECTED:
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(*MLBRSC) STATUS(*UNPROTECTED) RSRNAME(TAP01)

2. Change Save backup group #1

- *EXIT — change TAP02 from *UNPROTECTED to *ALLOCATED:
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(*MLBRSC) STATUS(*ALLOCATE) RSRNAME(TAP02)
- Perform the save operation
- *EXIT — change TAP02 from *ALLOCATED to *UNPROTECTED:
 VRYCFG CFGOBJ(TAPMLB01) CFGTYPE(*MLBRSC) STATUS(*UNPROTECTED) RSRNAME(TAP02)

The following table shows how our strategy chart would appear if this method was used in the example scenario.

Schedule to meet system and device constraints 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	

Using multiple tape library device descriptions

You can also use the multiple tape library device descriptions that are created when a tape library is configured. As each tape resource in a tape library reports in to the iSeries server a separate tape library description may be created. 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 |
|                                     |
| Opt  Device/Resource  Status  Allocation  Job name |
|      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 |
|                                     |
| Opt  Device/Resource  Status  Allocation  Job name |
|      TAPMLB01         VARIED ON |
|      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 tape 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

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

```

In order to use the TAPMLB02 device description 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

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

```

The following table shows how our strategy chart would appear if this method was used in the example scenario.

Schedule to meet system and device constraints using multiple tape library descriptions

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

Troubleshoot tape library

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

- The tape flight recorder information.
- If you are using BRMS, collect the BRMS flight recorder information.
- If you are using a 3494 tape library, collect the library manager transaction logs.

Tape flight recorder

Use the following command to collect the tape flight recorder information for your tape library: CALL QTADMPDV TAPMLBxx (substitute the name of your tape library for TAPMLBxx)

BRMS flight recorder

Use the DMPBRM command to collect the BRMS flight recorder information.

Library manager transaction logs

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 transaction logs to be copied.
- Select OK.
- Select drive A. Type the file name and description of the problem.
- Select Copy files.

Terms and definitions

The following terms are used to describe the major components of a tape library:

Component	Description
Accessor	The mechanism for detecting, gripping, and transporting a cartridge between a slot, drive and other elements of the tape library.
Automated cartridge facility (ACF)	A unit that attaches to a tape drive to provide tape library functions (such as random cartridge access) and also provides storage slots for the cartridges.
Cartridge	A cartridge containing tape media. A single cartridge has a minimum of two identifiers: a cartridge identifier and logical volume identifier.
Control Panel	An interface on the tape library device that allows for manual control and configuration of the tape library.
Drive	A device, including a transport and heads, for reading and writing data to a cartridge.
Inventory Database	Some tape libraries may contain software that maintains a database of cartridges and slot locations. Other tape libraries depend on the host system to keep track of cartridge locations.
I/O Station	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 area. 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.
Library manager	Hardware and software within a tape library for controlling and managing the inventory and accessor functions.
Magazine	A removable cartridge holder that aids in the insertion and removal of multiple cartridges.
Slot	A storage location for a cartridge.
Vision system	A barcode scanner that reads the external labels on the cartridges to determine the physical cartridge identifier.

The following list of terms and definitions are commonly used in reference to tape library topics.

Term	Definition
accumulate mode	For some tape libraries this setting causes the tape library to operate in a mode where cartridges that are placed in the I/O station will be moved to a storage slot after they are unloaded from a tape drive in the tape library.
automatic mode	For some tape libraries this setting causes the tape library to operate as an automatic cartridge loader.
BRMS (Backup, Recovery and Media Services)	For more detailed information on BRMS, refer to the Backup, Recovery and Media Services articles in the Information Center, and the Backup, Recovery and Media Services  web site.
cartridge identifier	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. (also refer to logical volume identifier)
logical volume identifier	The identifier of the volume written in the volume header information on the media, normally with an Initialize Tape command. (also refer to cartridge identifier)
manual mode	For some tape libraries this setting causes the tape library to be in a mode where all cartridge operations must be controlled manually by using the control panel.
offline (operating state)	No host commands are accepted, and no status messages are sent to the attached hosts.
online (operating state)	The library receives host commands.
pause mode	For some tape libraries this setting causes the tape library to be in a mode where all automatic operations are halted to allow manual intervention to correct a problem or open the storage area to add or remove cartridges.
Pooling	The grouping together of multiple tape resources within a physical tape library that share the same cartridge inventory.
random mode	For some tape libraries this setting causes the tape library to operate in library mode.
sequential mode	For some tape libraries this setting causes the tape library to operate as an automatic cartridge loader.



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