StorageTek®

4400 Automated Cartridge System

UNIX® Storage Server

System Administrator's Guide

PN 9035

PRELIMINARY

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PREFACE

PURPOSE

This manual provides the following information:

- Functional description of the StorageTek 4400 Automated Cartridge System and the UNIX Storage Server
- Instructions for installing and maintaining the 4400 ACS
- Descriptions of all operator commands
- Guidelines for detecting and recovering from errors

AUDIENCE

The *UNIX Storage Server System Administrator's Guide* is written for both the Storage Server System Administrator and for the ACS library operator. The reader must have a working knowledge of the following:

- UNIX file system hierarchy: understand the organization of UNIX files and directories.
- UNIX commands and utilities: know how to enter and use UNIX commands and utilities.
- UNIX administrative tasks: understand the basic tasks required to maintain a UNIX-based distributed processing system.

USING THIS MANUAL

This manual is organized as follows:

- *Chapter 1: ACS Overview.* Describes the 4400 ACS hardware components and the UNIX Storage Server software components.
- *Chapter 2: Controls and Indicators.* Describes the control switches and indicator displays on all 4400 ACS hardware components.
- *Chapter 3: Installing an ACS.* Describes how to plan, install, and configure the Storage Server software, and how to migrate tape cartridges into the library.
- *Chapter 4: Operating an ACS.* Describes the ACS operational modes and library operator procedures.

- *Chapter 5: Library Operator Commands*. Describes the purpose, syntax, and user interaction of all ACS library operator commands.
- *Chapter 6: Maintaining an ACS*. Describes routine maintenance tasks.
- *Chapter 7: Troubleshooting*. Describes how to detect, report and respond to library and Storage Server errors.
- *Appendix A: Event Log Messages*. Identifies and describes messages written to the Event Log by all Storage Server software components.
- *Appendix B: Library Command Summary*. Provides a quick-reference for all library operator commands.

CONVENTIONS

The following conventions are used throughout this manual for library and UNIX commands.

`command`	Literal user entries are shown in **`Courier bold`** type.
variable_entry	Variable entries (text that may vary each time it is entered) are shown in ***bold italic*** type. Do not enter the actual characters shown.
`message`	System messages are shown in `Courier plain` type.
variable_msg	Variable messages (text that may vary each time the message is displayed) are shown in *italic* type.
...	The text immediately preceding the ellipsis may be entered or displayed multiple times. Do not enter the ellipsis itself.
[***optional***]	Text presented between square brackets is optional. Do not enter the brackets themselves. Text that is *not* in brackets is always required.
text1* | *text2	The vertical bar represents "or". Only one of the text strings separated by a vertical bar can be entered or displayed. Do not enter the vertical bar itself.

All library commands and parameters are shown in lowercase letters. User entries can be any combination of lowercase and uppercase letters, however.

CHAPTER 1:
ACS LIBRARY OVERVIEW

INTRODUCTION

The StorageTek® UNIX® Storage Server / 4400 Automated Cartridge System (ACS) is a fully automated, cartridge-based, 18-track storage and retrieval system. It provides automated tape cartridge library services to a network of heterogeneous client systems. The client systems may range from workstations to supercomputers. They may be located in the same data center or spread across multiple locations.

The basic hardware component of the system is a Library Storage Module (LSM), a 12-sided structure containing the following:

- Storage cells for approximately 6000 tape cartridges.
- A robot that retrieves and moves the cartridges.
- Apertures in the walls of the structure, through which cartridges can be passed to load and unload cartridge drives outside the LSM.

Figure 1-1 shows an LSM with associated electronic modules and attached cartridge drives.

The system is controlled by the Storage Server software residing on a server system. The Storage Server receives mount and dismount messages from client systems or library operators and translates them into robot movement commands.

Figure 1-2 illustrates how an ACS is divided in terms of function.

ACS LIBRARY FUNCTIONS

The ACS library performs automated mounts and dismounts of tape cartridges in response to requests received from client applications or library users. The ACS library controls only the movement and locations of tape cartridges, not the data recorded on them. The library identifies cartridges by their external bar-coded labels; it does not verify the external labels against magnetically-recorded internal labels.

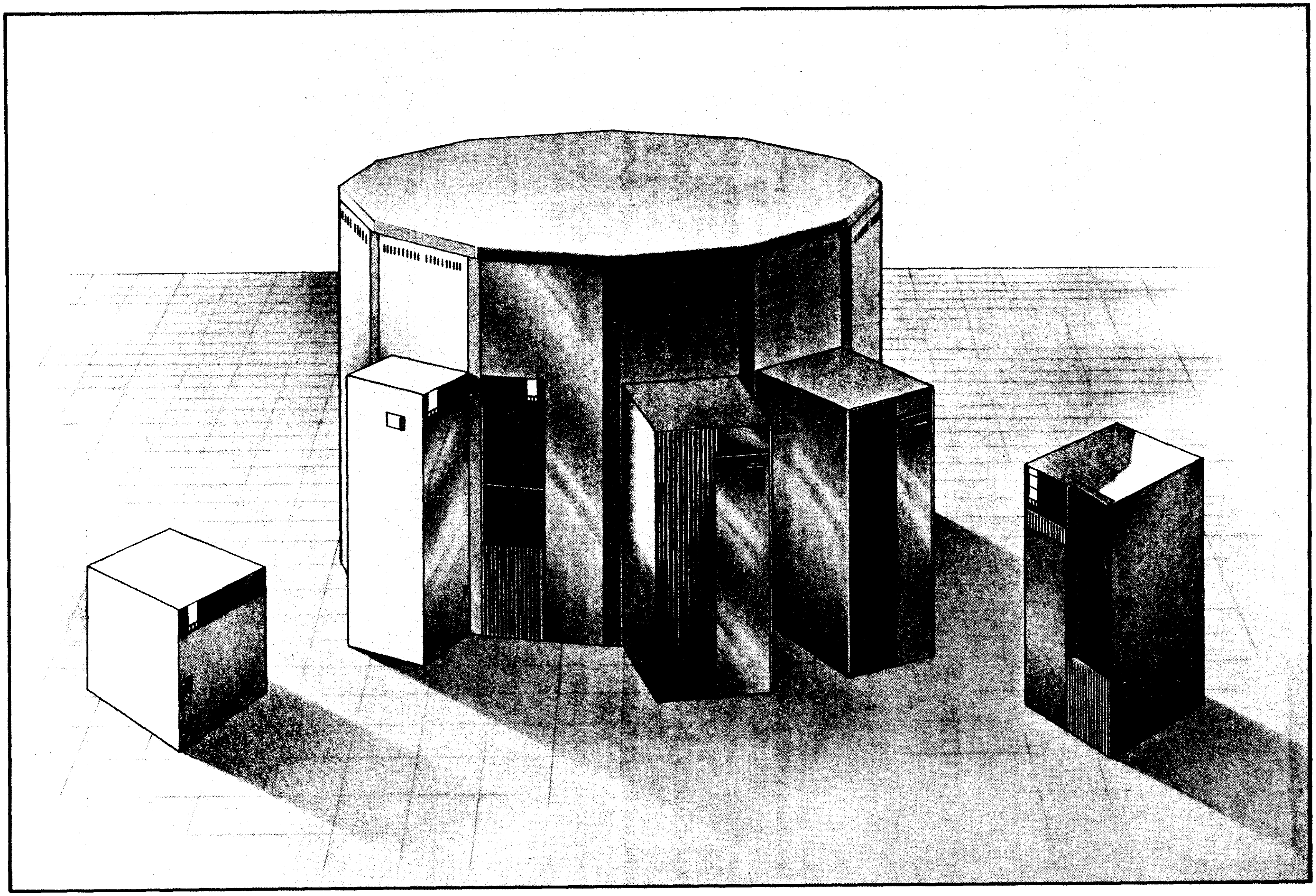

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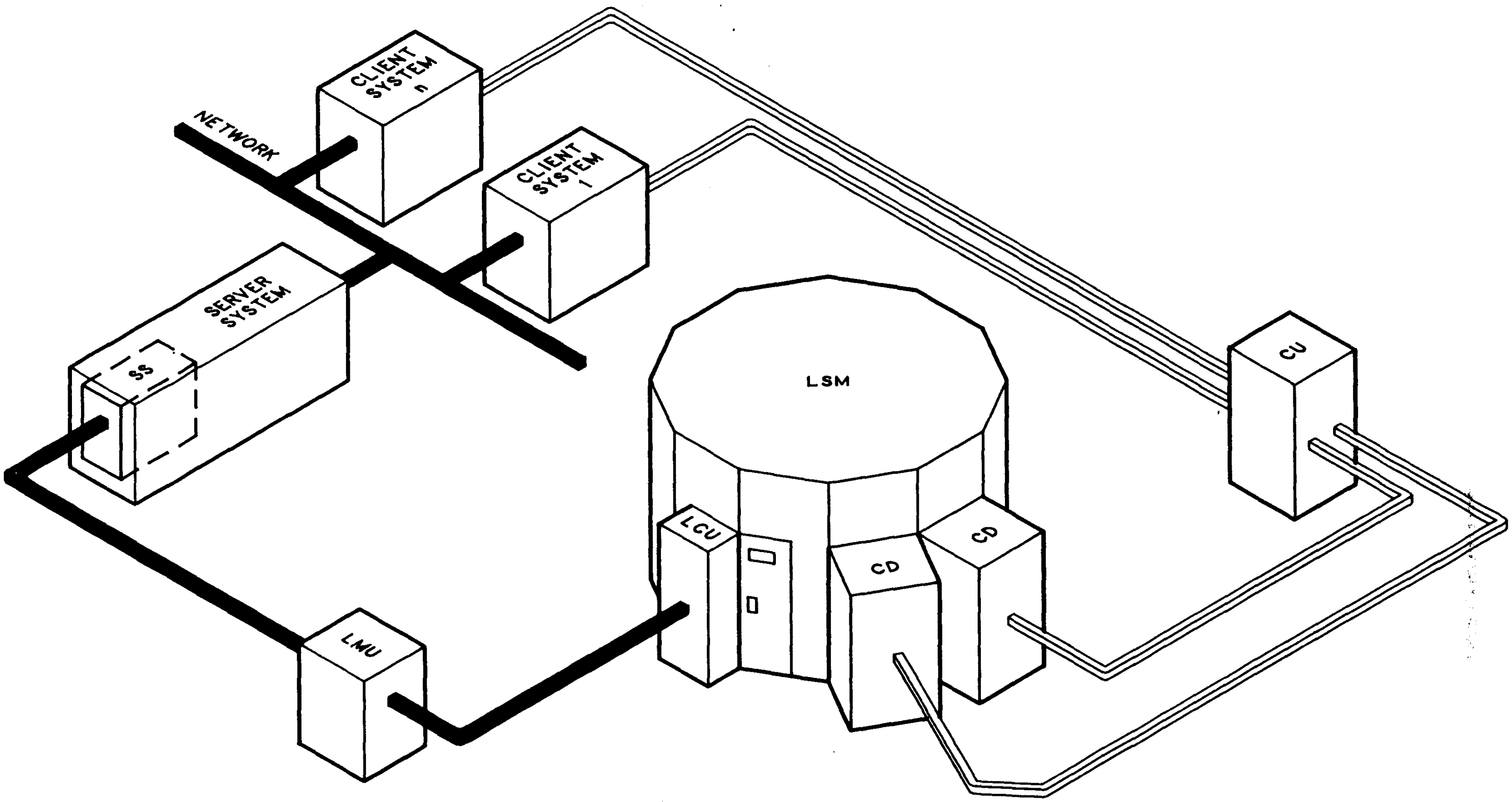
Figure 1-1. 4400 Automated Cartridge System



NOTES:

LSM = LIBRARY STORAGE MODULE
LCU = LIBRARY CONTROL UNIT
LMU = LIBRARY MANAGEMENT UNIT
CD = CARTRIDGE DRIVE
CU = CONTROL UNIT
SS = STORAGE SERVER

LEGEND:

LIBRARY CONTROL PATH (AUTOMATED MOUNTS/DISMOUNTS)

DATA PATH (READ/WRITE)

29036 A

Figure 1-2. 4400 ACS Library Control/Data Paths

Client applications determine when automated tape handling is required. They allocate specific library tape drives and resolve any resource deadlocks. The Storage Server software controlling the ACS library rejects any requests that specify cartridges or tape drives outside of the library.

The client applications control the library tape drives, including transfer of data to and from a cartridge, detecting and recovering from tape data transfer errors, and determining write protection for a cartridge. ACS control of tape drives is restricted to forcing rewinds and unloads.

BENEFITS

The 4400 ACS provides the following benefits:

- *Storage capacity is available in increments of approximately 6000 cartridges*. The maximum capacity of a library is approximately 24 million cartridges.
- *Faster tape access time than manual systems*. Cartridge select and mount time averages 11 seconds for a cartridge in the same LSM as the cartridge drive.
- *More dependable tape operations*. Automated cartridge handling reduces the potential of human error. Newer technology is less prone to the mechanical alignment problems of older automated tape libraries.
- *Less expensive tape operations*. Automated cartridge handling reduces the need for manual labor to handle tapes. Reduced floor space, power, and air conditioning requirements generate additional cost savings.
- *Broader access to ACS library services*. The Storage Server permits systems with appropriate data paths and software to store, mount, dismount and retrieve tape cartridges automatically.
- *Darkened data center*. The Storage Server can be located in a remote, "darkened," data center with entry by personnel required only for maintenance and entry and ejection of cartridges.

SAFETY FEATURES

Unless otherwise noted, the following are standard safety features on the LSM.

- *LSM Safety Interlocks.* If the access door to the LSM is opened, interlocks remove power from the robot to prevent injury to personnel.
- *LSM Entrance Safety Sign.* Just inside the access door to the LSM, an illuminated panel mounted on the ceiling directs an operator to enter when the electrical interlocks remove power to the robot, and all safety procedures have been followed.
- *Prevention of LSM Access Door Closing.* By following simple safety procedures, a worker inside the LSM can prevent anyone outside the LSM from closing the LSM access door.
- *LSM Internal EPO Switch.* Pressing a large, bright red knob on the inside of the LSM access door activates an Emergency Power Off (EPO) switch that removes AC power to the LCU/LSM. This extra safety feature is provided in case someone outside the LSM locks the access door when someone else is inside.
- *LSM Fire Detection.* In the rare case of fire in the LSM, sensors start an immediate subsystem shutdown (EPO). EPO does *not* disable the fire alarm system.
- *Internal Halon System Ports.* The LSM contains ports to which the user may connect a halon source. Sensors in the LSM turn on the source in case of fire. StorageTek does not supply the halon system. Additional information can be supplied by a StorageTek representative.
- *Theta Obstruction Search.* During initialization, the main (theta) arm moves slowly through its full range of motion. In this mode, current is limited and the mechanism can be stopped by hand. If any physical obstruction prevents the arm from moving for more than a few seconds, the arm shuts down and an error is posted. If motion is disturbed only momentarily, the mechanism continues to sweep, but posts an error at the end of initialization, without going into normal move mode. This system is not foolproof, and cannot detect all obstructions—for example, a tape cartridge on the floor of the LSM would not be detected.

ACS LIBRARY HARDWARE COMPONENTS

A 4400 ACS consists of the following hardware components:

- Library Storage Module (LSM)
- Library Control Unit (LCU)
- Library Management Unit (LMU)
- 4480 Cartridge Subsystem
- Server system

Library Storage Module (LSM)

The LSM (Figure 1-3) consists of the tape cartridge storage area and an internal robot for moving the cartridges. Each LSM provides storage cells for approximately 6000 cartridges and connections for up to 16 cartridge transports. Up to 16 LSMs can be interconnected through Pass-Thru Ports (PTPs) in adjacent LSM walls. See the *ACS Configurations* section in this chapter for details.

The robot can retrieve any cartridge in the LSM and deliver it to another cell, a transport, or a Pass-Thru Port (PTP). The robot has an optical system that identifies the correct cartridge by its external bar-code label and an electro-mechanical system that picks up the cartridge and delivers it to the correct location. Cartridges can be passed from one LSM to another through the Pass-Thru Ports.

Each LSM has doors in the outer and inner walls allowing access to the interior. The access door in the outer wall contains a cartridge access port (CAP) which is used to enter cartridges into and eject them from the LSM without opening the door. The CAP holds 21 cartridges at a time.

Cartridges are stored in cells located on both the outer and inner LSM walls. The outside wall contains twelve panels, while the inner wall contains eight panels. Figure 1-4 illustrates two typical panels with cartridge storage cells. Each panel is divided into columns and rows for cartridge storage. Cartridges are placed into a library location defined by an ACS identifier, an LSM number, a panel number, a row number, and a column number.

Pass-Thru Ports are also shown in Figure 1-3. Each PTP occupies half of two rows at the base of a special wall panel. A PTP is installed by a Customer Services Engineer in a master/slave relationship. In addition, circuitry to control the PTP is connected to the master. As viewed from inside the LSM, the master side of the PTP is on the right, while the slave side is on the left. In Figure 1-3, the LSM on the left is the master side of the PTP, while the LSM on the right is the slave. On the PTP panel, the half-rows adjacent to the PTP are used for storing cartridges. Each LSM can have up to four PTPs.

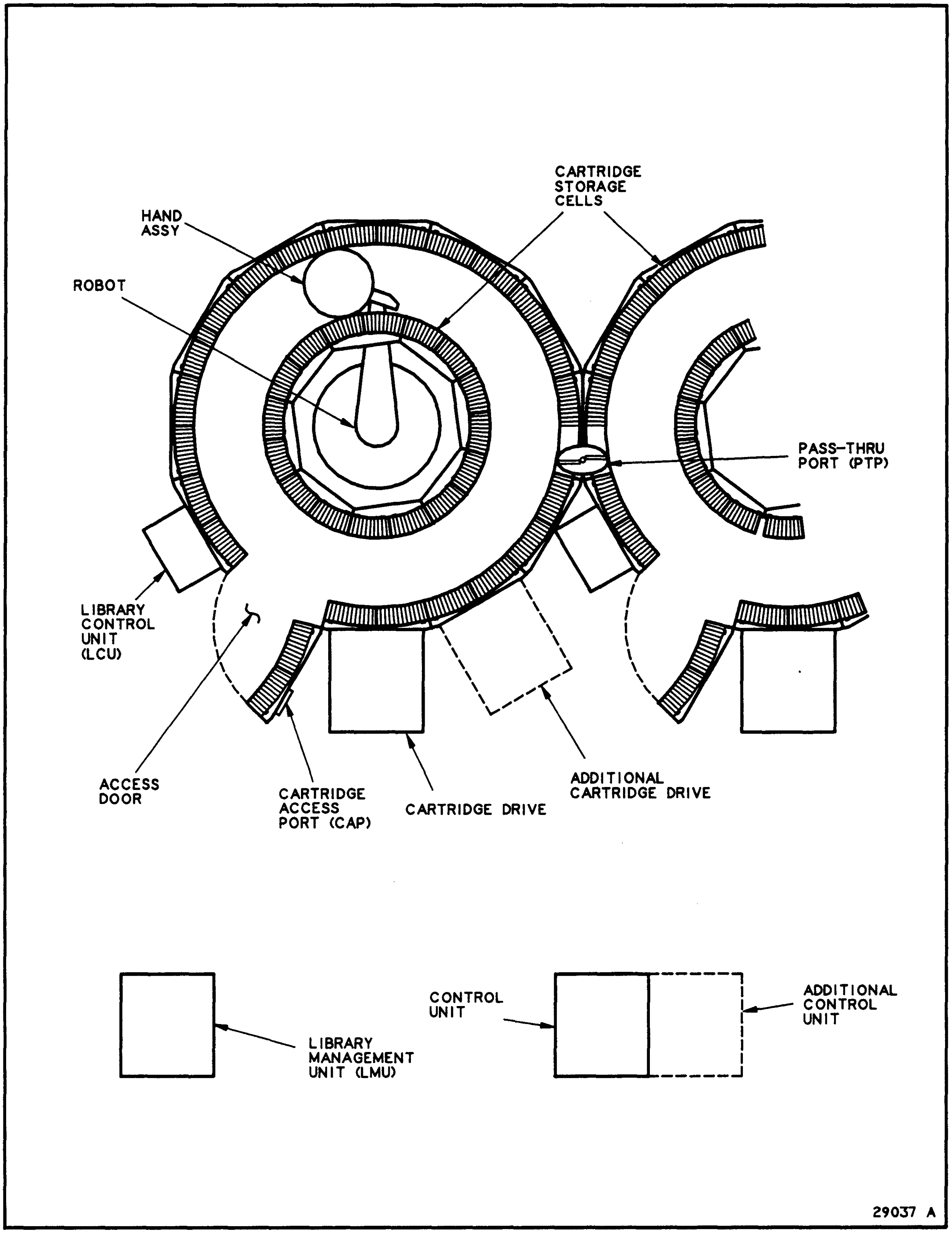


Figure 1-3. 4400 ACS Hardware

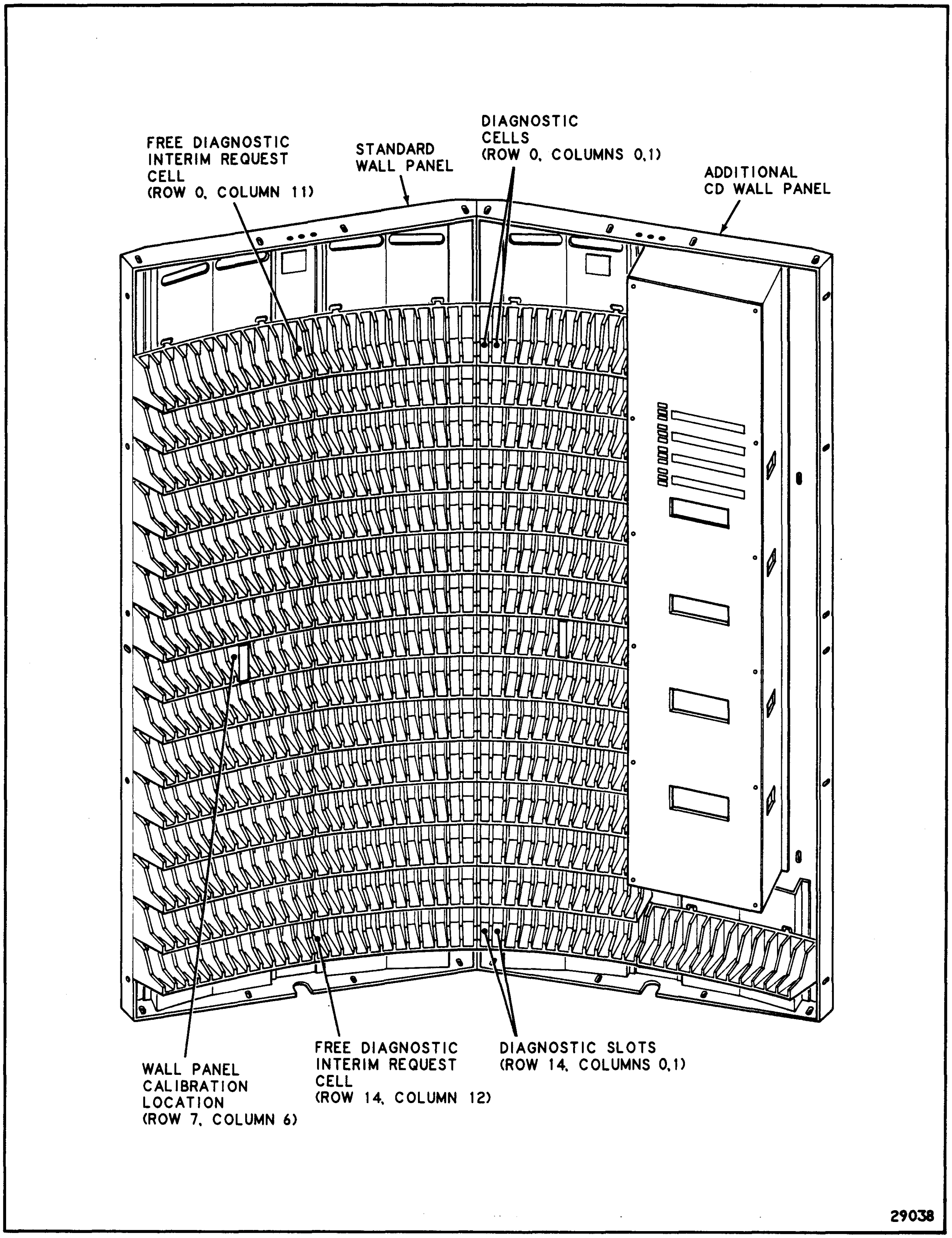


Figure 1-4. LSM Cartridge Storage Cells

Library Control Unit (LCU)

The LCU is a microprocessor that controls the robot's movements. There is one LCU per LSM. It is attached to the panel immediately to the left of the LSM access door.

The LCU translates gross movement requests received from the LMU into the discrete servo commands required to control the robot.

Library Management Unit (LMU)

The LMU manages all the LSMs in an ACS. There is one LMU per ACS. The LMU receives cartridge movement requests from the Storage Server, translates them into robot movement instructions, and relays these instructions to the correct LCU. The LMU also passes ending status from the LCU back to the Storage Server. The LMU allocates LSM resources (robot, CAP, ports, etc.) to optimize and coordinate cartridge movement within and among LSMs.

The LMU communicates with the LSMs through a Local Area Network (LAN). It communicates with the Storage Server through an RS423 interface.

4480 Cartridge Subsystem

The StorageTek 4480 Cartridge Subsystem consists of a control unit (CU) and at least one cartridge drive (CD) containing either two or four transports. There can be up to four cartridge drive units attached to each LSM. See the *4480 Cartridge Subsystem Operator's Manual* for details on the 4480 cartridge drives and CUs.

4480 Control Unit

The 4480 CU is the controller/interface between the client systems and up to eight transports. The CUs are connected to client systems either directly via I/O channels or indirectly via a data network. Each CU is controlled by dual microprocessors and contains a data buffer which is used to maximize transfer rates at the channel interface.

The CU interprets and distributes commands to the appropriate transport, provides data formatting (including error correction and detection) for the subsystem, and reports CU and transport status.

A CU coupler feature is available. This feature, along with two CUs and a maximum of sixteen transports (four cartridge drives), enables a configuration in which each CU is capable of directly addressing any of the sixteen transports, since each transport is attached by cables to both CUs.

4480 Cartridge Drive

The cartridge drive units contain two or four transports each, along with the supporting pneumatic equipment and power supplies. Library drives differ from manual drives only in that they are attached to an LSM and are controlled by the Storage Server rather than by an operator. All transports in a library drive can be operated concurrently.

Each transport performs the following functions:

- Read/Write functions (using a standard 18-track cartridge)
- Automatic threading and positioning of the tape
- Status reporting to the CU

The drive mechanism moves tape across the head at a precise speed through servo-driven motors. Rewind speed is also controlled by the servo electronics and drive motors.

Table 1-1. 4480 Performance Specifications

Tape Speed:	70 IPS (2 meters/sec) 158 IPS (4 meters/sec)	Read/Write Rewind & Search
Tape Density:	37,871 bytes/inch 1,491 bytes/millimeter	

Server System

The server system hardware is the residence for the Storage Server software. The server system consists of a UNIX-based processor, a network adaptor, one 1/4" cartridge tape drive, one hard disk, and a terminal. The network adaptor acts as a buffered communications controller to move messages between the server and the client systems. Examples of network adaptors include Ethernet™ controllers and HYPERchannel® processor adaptors.

The server system is the interface between any number of heterogeneous client systems and one library. No other system can be connected to the library. The server system is connected directly to each LMU through an RS423 connection. At least two connections between the server system and LMU are recommended for redundancy.

Data path connections between the server system and library drives are not supported.

ACS LIBRARY SOFTWARE COMPONENTS

Storage Server and Client Software Interaction

The client software resides on any number of distributed, heterogeneous client systems. This software manages tape cartridge contents, generates requests for cartridges, and transfers data to and from cartridges. The client software is *not* part of the Storage Server product. It must meet certain requirements, however, in order to be able to communicate with the Storage Server. See the *UNIX Storage Server Programmer's Guide* for these requirements.

The Storage Server software resides on the server system. It manages the storage and movement of tape cartridges and the use of library resources. It translates requests for tape cartridges, received from the client software, into cartridge movement requests for the LMU.

Figure 1-5 illustrates the Storage Server and client system software components and their interfaces. These components are described in detail in the paragraphs that follow.

A client application generates cartridge movement requests which are translated by the client Storage Server Interface (SSI) into a format that can be interpreted by the Storage Server. The requests are then passed from the client system to the server system via the network interfaces.

The Client System Interface receives the requests from the network interface, reformats them, and passes them to the ACS Library Manager. The ACSLM validates the requests, then translates and routes them to the LMU. If either the CSI or ACSLM encounters any errors, they are sent to the Event Logger. After the request is completed, a response is returned, through the same channels, to the client application.

Storage Server Software

The Storage Server software executes within a UNIX System environment that complies with the System V Interface Definition (SVID). One exception to SVID compliance is the use of BSD sockets as the interprocess communication mechanism.

The Storage Server consists of the following major components:

- ACS Library Manager (ACSLM)
- ACS System Administrator (ACSSA)
- Client System Interface (CSI)
- ACS Event Logger (ACSEL)
- Network Interface (NI)
- Storage Server data base

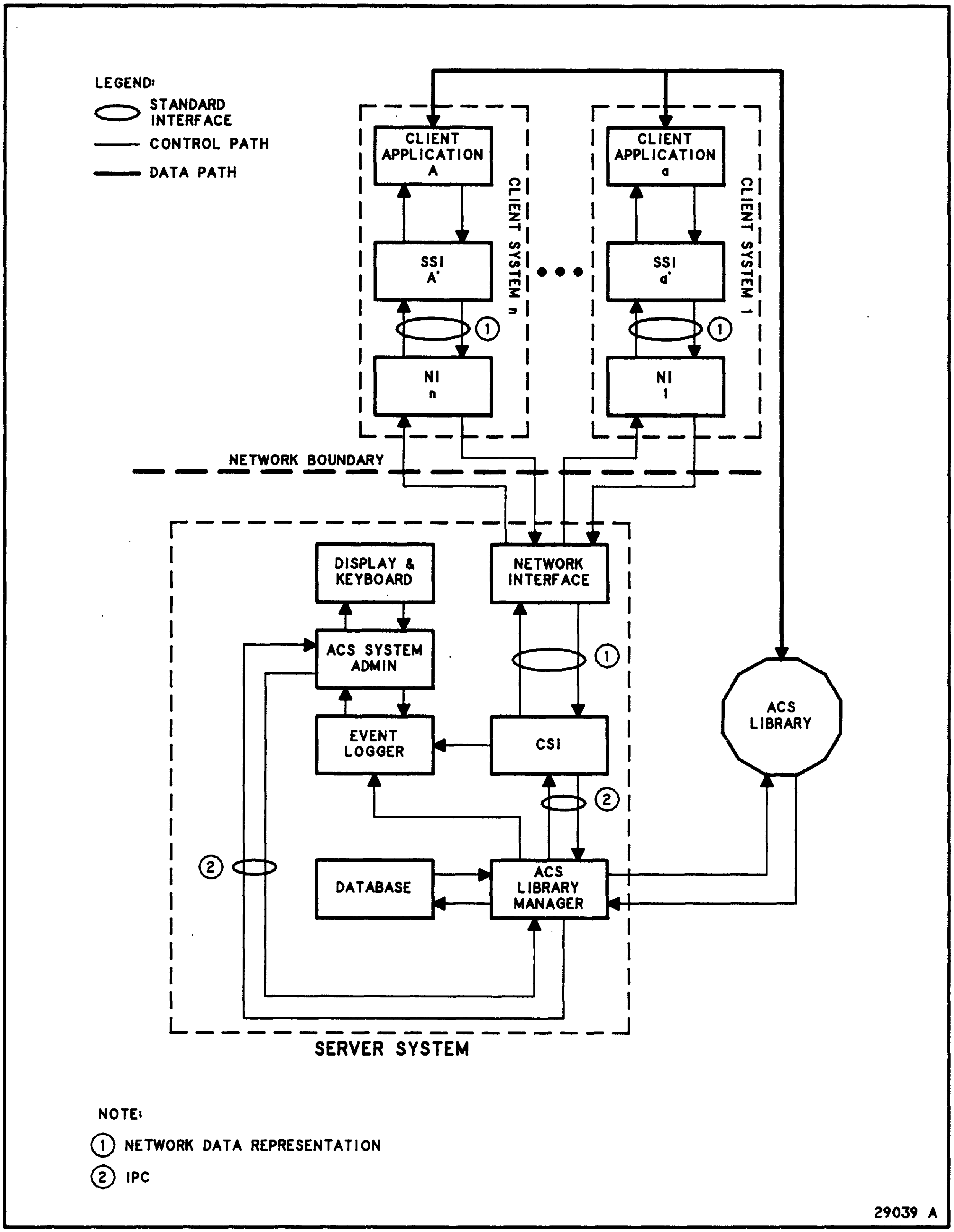


Figure 1-5. Storage Server / Client Software Components

All of the Storage Server components reside on one server system; distribution of these components across multiple server systems is not supported.

ACS Library Manager (ACSLM)

The ACSLM processes library requests originating from client applications (through the CSI) or library users (through the ACSSA). It validates these requests and routes valid ones to the LMU. When responses are returned from the LMU, the ACSLM routes them to the appropriate requestor (either the ACSSA or the CSI).

If the ACSLM encounters errors, it routes event messages to the Event Logger. Additionally, the ACSLM routes unsolicited messages to the ACSSA when it is notified of a significant event occurring in the library.

The ACSLM also maintains the configuration and cartridge location data base. The data base supports checkpointing and journaling to facilitate recovery from errors. See the *Maintaining the Data Base* section in *Chapter 6* for details.

The ACSLM performs the following functions to recover from errors with little or no operator intervention:

- Detects, notifies, and recovers from library failures. These include the loss of an LMU, LSM component, etc.
- Works with the LMU to recover an LSM after it has failed. In particular, this includes determining that there are volumes in-transit, discovering their external labels, and disposing of them properly.
- Detects, isolates, reports, and recovers from communication line failures (for example, loss of terminal port).
- Attempts to reestablish data paths if a communications failure occurs with a CSI or the ACSSA.
- Detects, isolates, reports, and recovers from software errors (for example, program interrupts, operator cancellations, process terminations).

ACS System Administrator (ACSSA)

The ACSSA provides a screen interface that enables library operators and users to monitor and control Storage Server operations. The screen interface is referred to as the Command Processor.

The Command Processor receives requests from a user and performs basic syntax validations on the input. If it detects errors in a request, the Command Processor displays error messages and prompts for the correct entry. If a request has no errors, the ACSSA passes it to the ACSLM for further processing.

The ACSSA also receives and processes responses from the ACSLM; resulting error messages are displayed by the Command Processor. When the ACSLM returns more than one response for a request, the ACSSA displays each one as it is received.

The ACSSA supports multiple Command Processors. That is, several users can be entering requests at one time through separate terminals or Command Processor windows.

See *Chapter 5: Library Operator Commands* for the specific commands supported by the Command Processor.

Client System Interface (CSI)

The CSI serves as the interface between the ACSLM and the Storage Server Interfaces (SSIs). The CSI presents a network- and host-independent control path message format to client applications. It receives requests from an SSI and translates them into a format that can be interpreted by the ACSLM. It also translates ACSLM responses and routes them to the appropriate SSI. The CSI communicates with the SSIs through the network interfaces.

The CSI attempts to reestablish communication paths if a communication failure occurs between the ACSLM and CSI or between the CSI and NI. The CSI can control the flow of messages when network or processor congestion occurs. It also routes error messages to the Event Logger.

ACS Event Logger (ACSEL)

The ACSEL records messages describing library errors and software errors not normally tracked by the operating system. This data can be used for later tracking and analysis.

The ACSLM and CSI independently notify the ACSEL of abnormal events. The ACSEL writes records of these events to a centralized file known as the Event Log. See the *Event Log* section in *Chapter 7* for details.

Network Interface (NI)

The NI implements a customer-specified network communications protocol. The NI resident on the server system interacts with the NIs on the client systems to maintain connections, control the flow of requests and responses, and perform error recovery as necessary.

Client Software

The client system software components described below are supplied by the customer and are *not* part of the Storage Server product. Their descriptions are provided only to clarify the differences between Storage Server and client application functions.

- Network Interface (NI)
- Storage Server Interface (SSI)
- Client applications

Network Interface (NI)

The NIs on the client systems function in the same manner as the NI on the server system. They implement a customer-specified network communications protocol to allow for the transfer of messages between the server and client systems.

Server System Interface (SSI)

Each SSI serves as the interface between the CSI and the client applications residing on that client system. Any number of client applications can issue Storage Server requests. The SSI processes these requests in the order that it receives them. It translates the requests into a format that can be interpreted by the CSI, and sends them to the CSI through the network interfaces.

The SSI also receives response messages from the CSI, translates them, and sends them to the appropriate client applications.

Client Applications

Any number of client applications can manage volumes contained in the ACS library. A Tape Library Management System (TLMS) is one example of a client application that would interact with the library. Consistency between multiple applications is maintained by the applications themselves, not by the Storage Server.

The client applications manage cartridge contents, whereas the Storage Server manages cartridge locations. The only information provided to client applications by the Storage Server are lists of volumes entered, ejected, or currently residing in the library.

Client applications gain access to tape cartridges by interacting with the Storage Server through the *control path.* They read and write data on tape cartridges by interacting directly with a cartridge drive through the *data path.* Data path interactions do not affect Storage Server operations. For example, an application issuing an unload request to a cartridge drive does not cause the Storage Server to move the unloaded cartridge to a library storage cell; the application must issue a separate request across the control path to move the cartridge.

ACS LIBRARY CONFIGURATIONS

This section describes and provides illustrations of some of the more common ACS configurations, emphasizing the grouping or clustering of LSMs. The shape of an LSM allows for a great deal of flexibility in the design of an LSM cluster, and the examples provided should not be considered as the only allowable configurations.

Single LSM Configuration

Figure 1-6 depicts a single LSM library configuration. A typical configuration provides cartridge storage, a CAP, and eight transports. Up to 16 transports may be connected to the LSM in this configuration.

Note that the placement of expansion LSMs, LCUs, PTPs, cartridge drives, and control units (indicated by dashes) has been preplanned. The planned expansion of the LSMs results in a dense-pack configuration.

Three LSM Configuration — Linear

Figure 1-7 depicts a library configuration with three LSMs connected in a straight line. This configuration provides cartridge storage, a CAP in each LSM, and two Pass-Thru Ports (PTPs). In this example of a linear LSM configuration, up to 16 transports may be attached to any LSM.

Three LSM Configuration — Dense-Pack

Figure 1-8 depicts a library configuration with three LSMs. This configuration provides cartridge storage, a CAP in each LSM, and three Pass-Thru Ports (PTPs). In this example of a three LSM configuration, sixteen transports are allowed on both LSM 0 and LSM 1 while eight transports are allowed on the third (enables addition of other LSMs to the configuration).

Sixteen LSM Configuration — Dense-Pack

See Figure 1-9. This is the maximum configuration that can be placed under control of a single Library Management Unit. Each LSM contains a CAP for entry/ejection of cartridges and PTPs. Each of the inner LSMs allow eight transports to be attached, while sixteen transports may be attached to the two LSMs on both the left (LSM 0 and LSM 1) and right ends (LSM 14 and LSM 15) of the configuration.

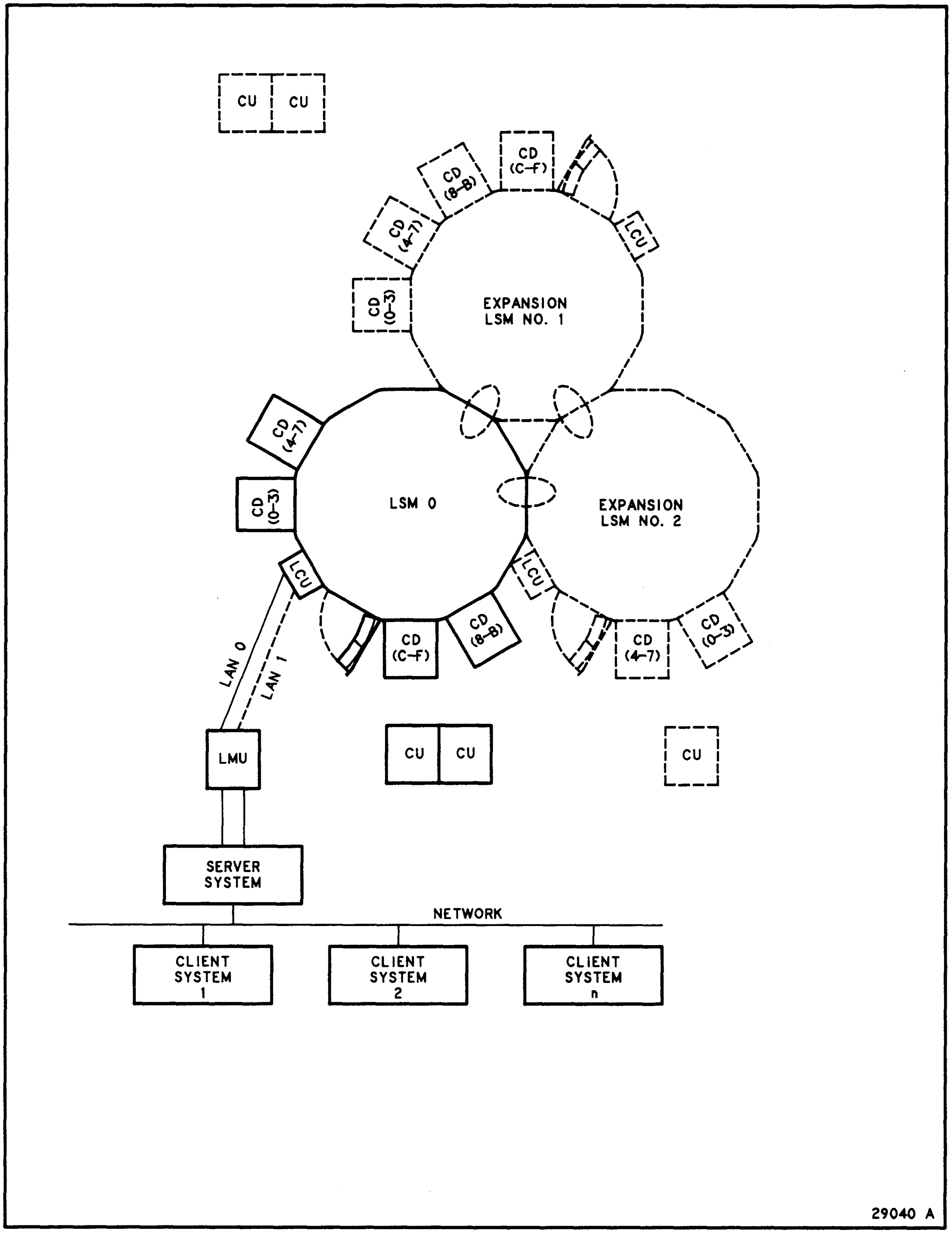


Figure 1-6. Single LSM Configuration

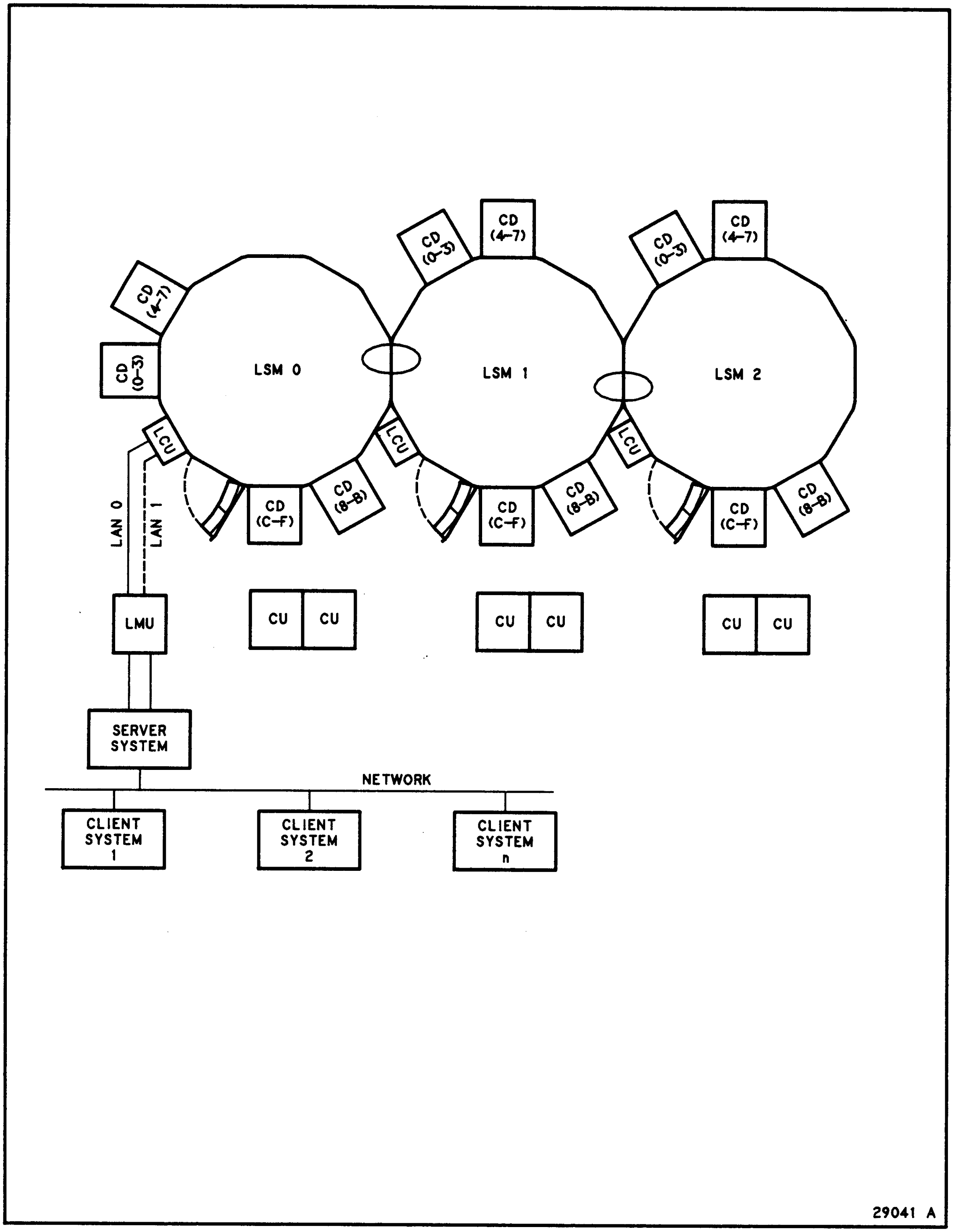


Figure 1-7. Three LSM Configuration — Linear

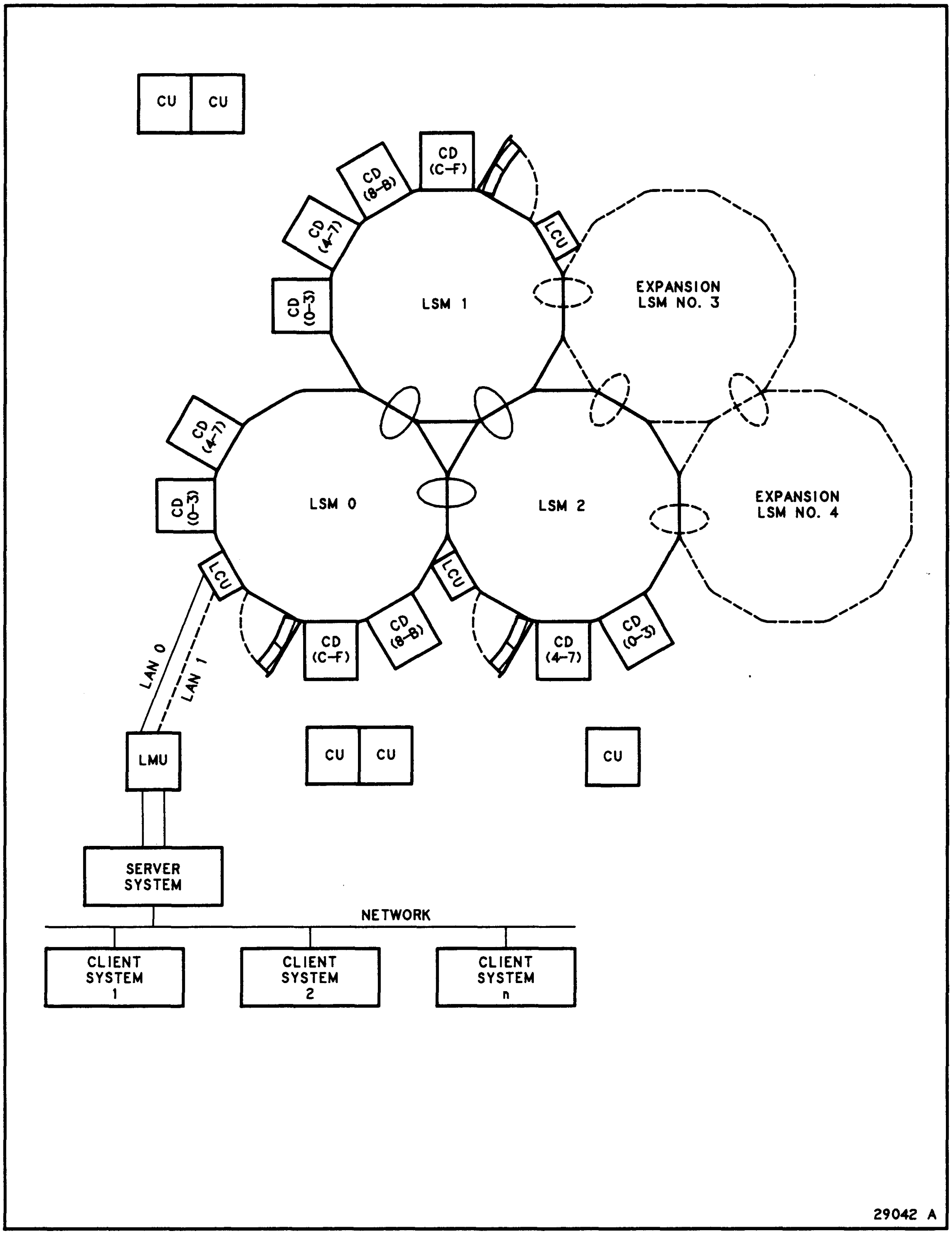


Figure 1-8. Three LSM Configuration — Dense-Pack

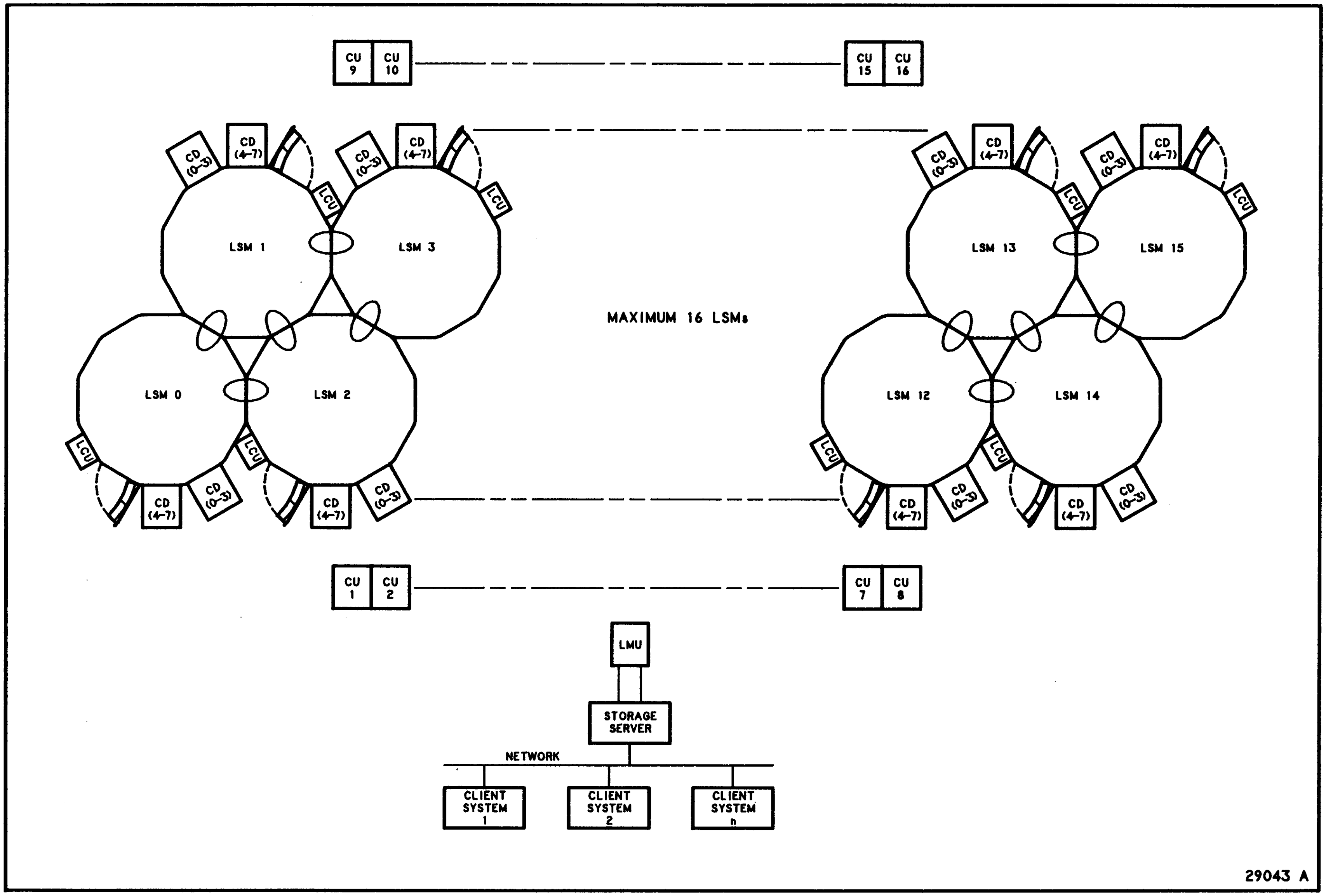


Figure 1-9. Sixteen LSM Configuration — Dense-Pack

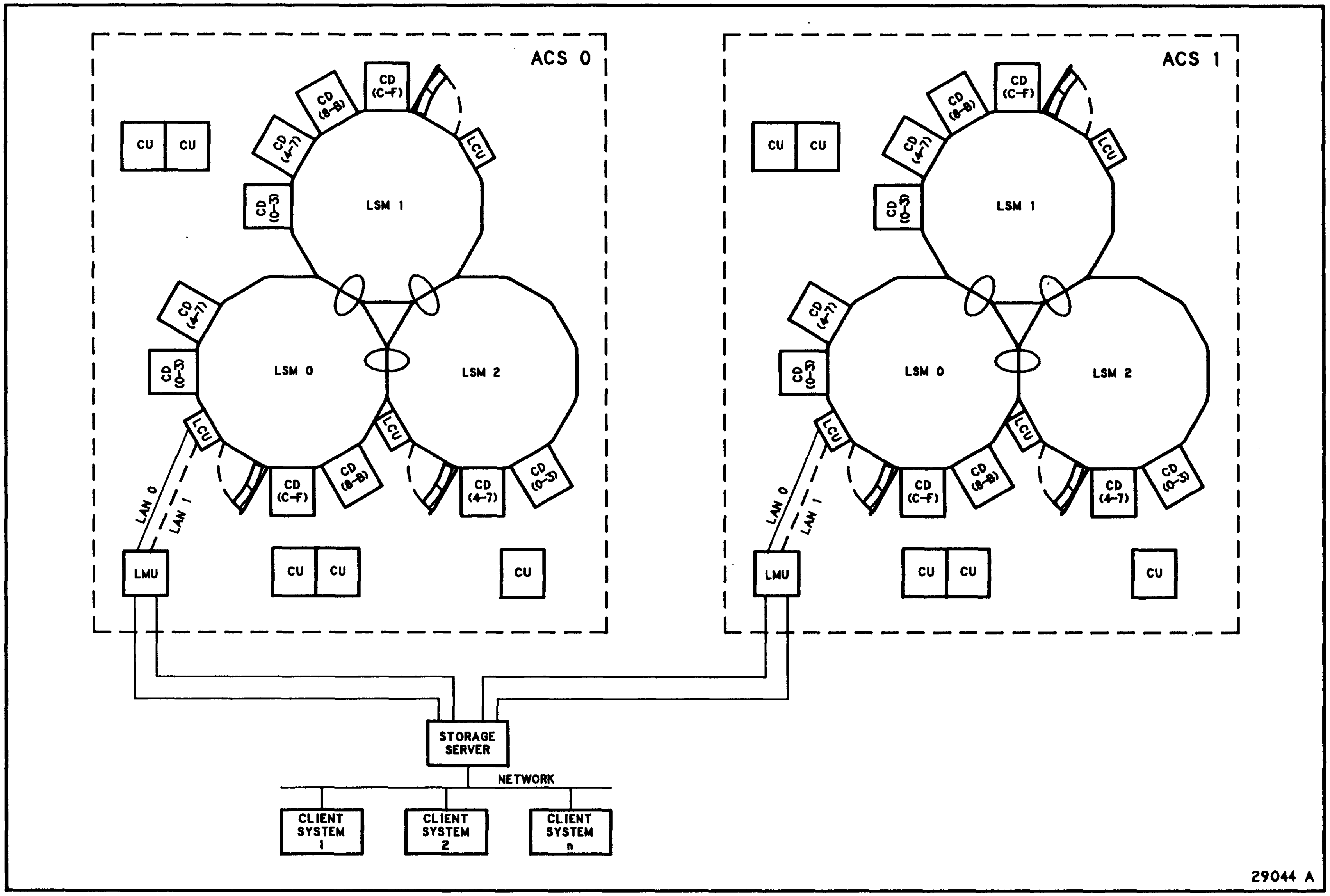


Figure 1-10. Multiple ACS Configuration

Multiple ACS Configuration

The maximum library size for the UNIX Storage Server is 128 ACSs. Each ACS can contain a maximum of 16 LSMs.

The configuration in Figure 1-10 illustrates a library with two LMUs and their attached LSMs. The server system is connected to both LMUs and may direct the mounting/dismounting of cartridges in either of the LSM clusters. As in the previous configurations, each LSM contains a CAP and can be attached to neighboring LSMs via PTPs, but a cartridge located in ACS1 cannot be passed to ACS0 automatically.

If a cartridge is to be relocated from ACS1 to ACS0, it must first be ejected (operator command) from ACS1 via the CAP. The cartridge must be retrieved from the CAP by the operator and then entered (operator command) into ACS0 through the CAP in ACS0.

Multiple Automated Libraries

It is conceivable that more than one library may be connected to an extensive client system network.

TAPE CARTRIDGE REQUIREMENTS

Specifications

The 4400 ACS uses a cartridge that meets the specifications defined in the ANSI publication, *American National Standard Unrecorded Magnetic Tape and Cartridge for Information Interchange 18 Track, Parallel, 12.65 mm (1/2"), 1491 cpmm (37 871 cpi), 8th Draft.*

External Labels

Each library tape cartridge must have an external label that is unique throughout the entire library. The Storage Server will cause cartridges with missing, defective, or duplicate labels to be ejected from the library. To change a cartridge label, the operator must eject the cartridge from the library, relabel it, and reenter it.

Valid external labels for tape cartridges can contain only uppercase letters (A through Z), numbers (0 through 9), and blanks (" "). A cartridge label must contain at least one nonblank character. Cartridge labels with one or more embedded blanks are reserved for maintenance and diagnostic use only. Leading and trailing blanks are ignored.

Figure 1-11 illustrates a tape cartridge label and its placement on a cartridge. Correct placement of the label is essential in order for the robot to read it accurately.

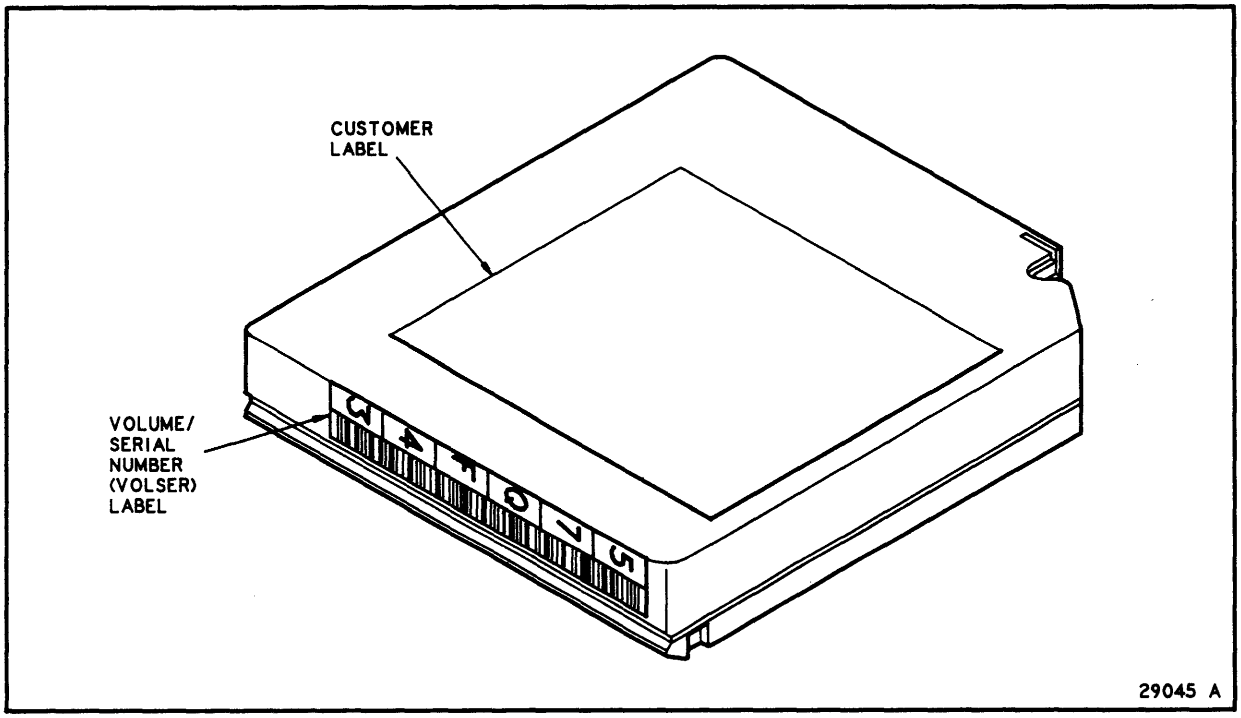


Figure 1-11. Cartridge OCR/Bar Code Label

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CHAPTER 2:
CONTROLS AND INDICATORS

OVERVIEW

This chapter displays and describes switches and indicators present on the control panels of the following ACS hardware components:

- LMU
- LCU
- CAP
- Control Unit
- Cartridge drive

LMU CONTROL PANEL

The LMU control panel contains switches and indicators to control and monitor the operation of the LMU. Figure 2-1 illustrates these controls while Table 2-1 lists and describes each item number.

LMU CSE CONTROL PANEL

A control panel containing switches and indicators, normally used only by an CSE, is mounted on the front of the LMU behind a hinged cover. Figure 2-2 is an illustration of this control panel, and Table 2-2 lists these switches and indicators by item number.

LCU CONTROL PANEL

The LSM control panel is located on the LCU. Figure 2-3 shows the switches and indicators on the panel, and Table 2-3 describes them by item number.

LCU CSE CONTROL PANEL

A control panel containing switches and indicators normally used only by a CSE is located on the left side of the LCU behind a sliding cover. Table 2-4 lists the switches and indicators. Figure 2-4 shows the location of the switches and indicators.

CARTRIDGE ACCESS PORT (CAP) INDICATORS

A control panel near the CAP contains several indicators. Table 2-5 lists the indicators. Figure 2-5 shows the location of the indicators.

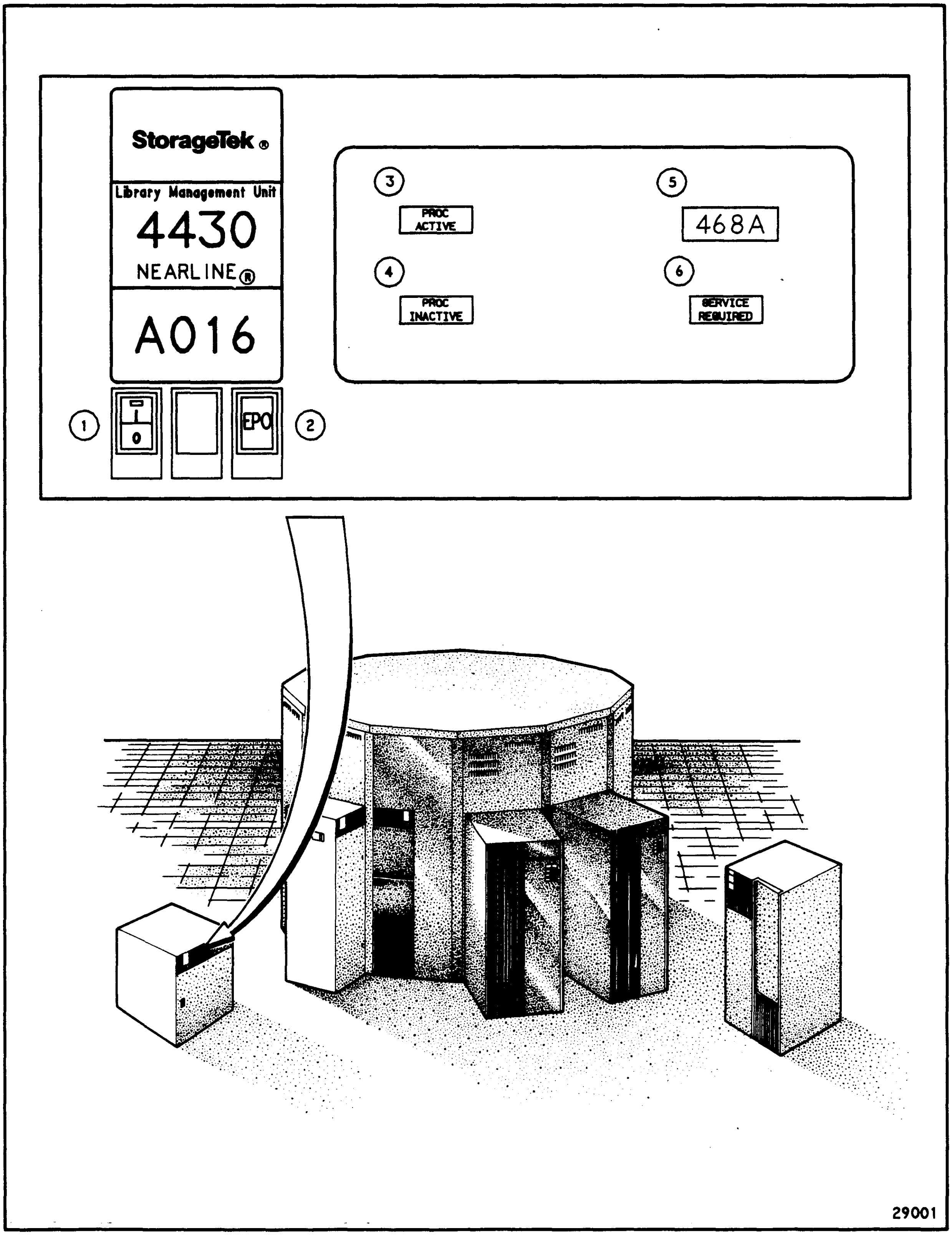

Figure 2-1. LMU Control Panel

Table 2-1. LMU Control Panel

ITEM[1]	LABEL	TYPE	FUNCTION
1	1/0	Rocker Switch/ Indicator	Controls DC power. SWITCH – Applies DC power to the LMU when set to "1" position; initiates controlled power down when set to the "0" position. INDICATOR – On when +5V DC power is applied to the LMU. Off when DC power is not applied to the LMU.
2	EPO	Momentary Switch	Emergency Power Off. Removes all power from LMU AC power supply. Use only in emergencies; can be reset only by a CSE.
3	PROC ACTIVE	Indicator	Indicates processor is operating
4	PROC INACTIVE	Indicator	Indicates that processor is not operating.
5		Alpha-numeric display	Four-character display of error codes and LMU modes.
6	SERVICE REQUIRED	Indicator	Illuminated when CSE is needed. Indicates that the processor has detected an error in the LMU that requires CSE attention. The LMU may or may not continue to operate.

NOTES:

[1] Numbers correspond to item numbers in Figure 2-1.

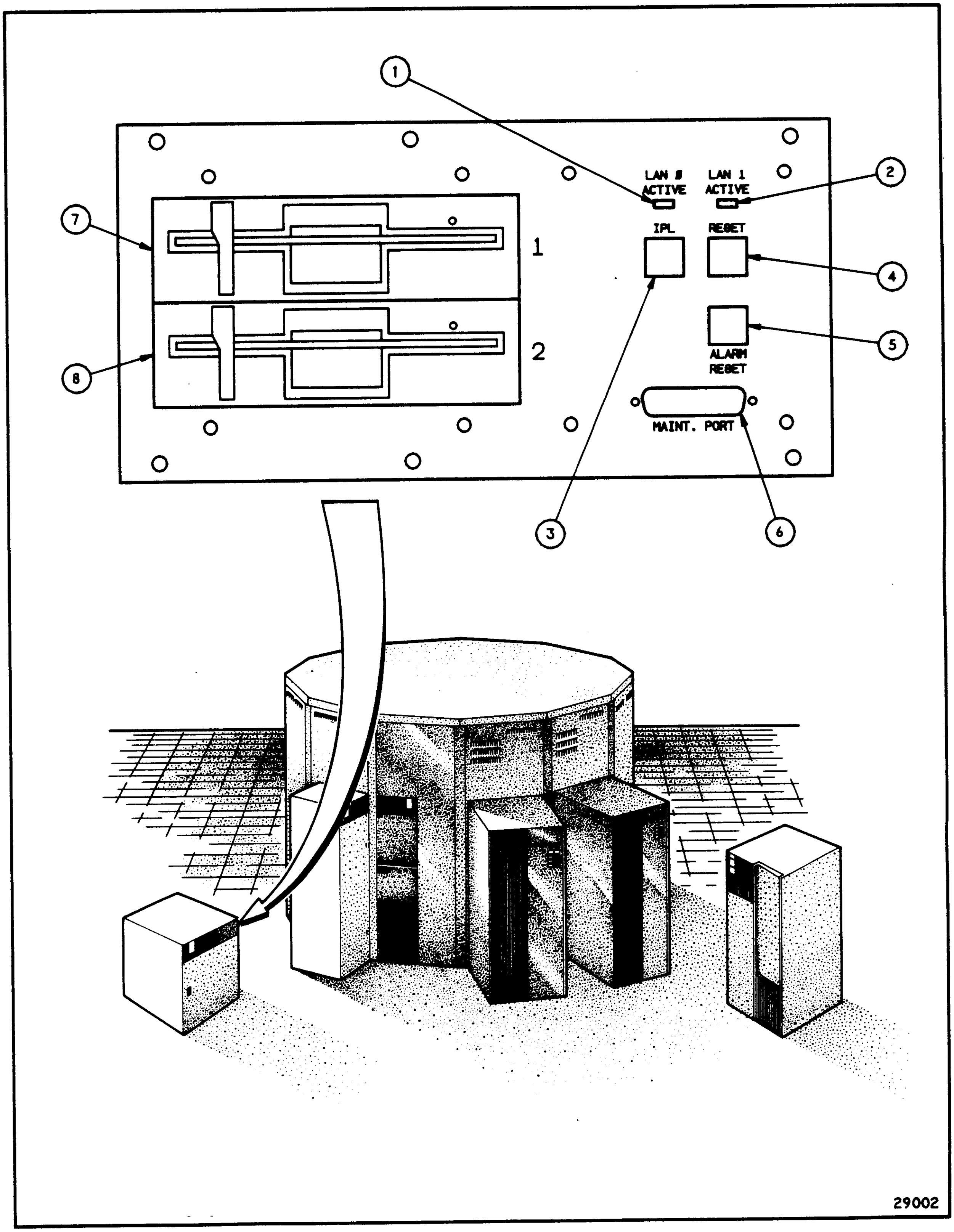

Figure 2-2. LMU CSE Control Panel

Table 2-2. LMU CSE Control Panel

ITEM[1]	LABEL	TYPE	FUNCTION
1	LAN 0 ACTIVE	Indicator	Indicates local area network (LAN) 0 is being used.
2	LAN 1 ACTIVE	Indicator	Indicates local area network (LAN) 1 is being used.
3	IPL	Switch/ Indicator	SWITCH – Resets microprocessor hardware and starts initial program loading. INDICATOR – Indicates when an IPL is in progress.
4	RESET	Switch/ Indicator	SWITCH – Use during IPL to bypass non-fatal errors. At other times, causes a log of LMU memory to floppy; in this case, re-IPL is necessary. INDICATOR – Indicates that the processor recognizes activation of the RESET switch.
5	ALARM RESET	Switch	Turns off audible alarm that the Remote Diagnostic Center activates.
6	MAINT PORT	RS232C Jack	To connect the LMU to a modem (for remote diagnostics) or 392X diagnostic device.
7,8	—	Floppy Drive	

NOTES:

[1] Numbers correspond to item numbers in Figure 2-2.

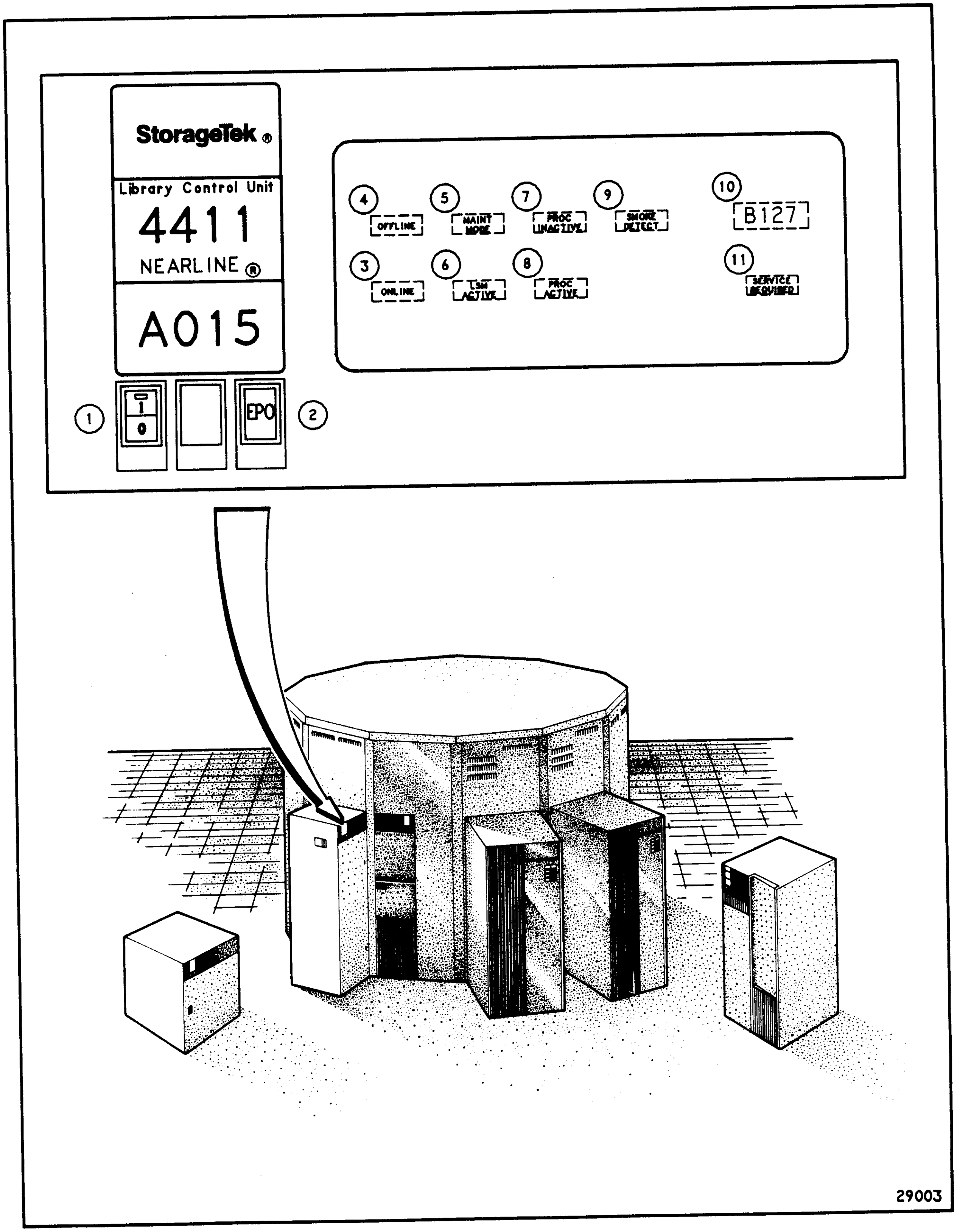

Figure 2-3. LCU Control Panel

Table 2-3. LCU Control Panel (Sheet 1 of 2)

ITEM[1]	LABEL	TYPE	FUNCTION
1	1/0	Rocker Switch and Indicator	Controls DC power. SWITCH – If AC power is on, setting the switch to "1" brings up DC power and starts wake up procedures. Setting it to "0" removes DC power to the LSM after all in-process commands are completed. INDICATOR – Illuminated when DC power is applied to the LSM.
2	EPO	Momentary Switch	Emergency Power Off. Pressing this momentary switch removes all AC power to the LSM and causes all activity within the LSM to halt immediately; any LSM activity in progress is terminated. Used only in an emergency. Another EPO switch is inside the LSM.
3	ONLINE	Indicator	Illuminates if LSM is online.
4	OFFLINE	Indicator	Illuminates if LSM is offline.
5	MAINT MODE	Indicator	Illuminates in maintenance mode. This indicator illuminates when the LSM is in maintenance mode, an LSM state in which diagnostic routines can be run. The only way to put an LSM into maintenance mode is with a software switch turned on from either a 392X diagnostic device or the Remote Diagnostic Center.

NOTES:

[1] Numbers correspond to item numbers in Figure 2-3.

Table 2-3. LCU Control Panel (Sheet 2 of 2)

ITEM[1]	LABEL	TYPE	FUNCTION
6	LSM ACTIVE	Indicator	Illuminates when robot is moving. DO NOT ASSUME THE LSM IS SAFE TO ENTER BECAUSE THIS INDICATOR IS NOT ILLUMINATED. FOLLOW THE SAFETY PROCEDURES IN the *Entering the LSM* section in *Chapter 4*.
7	PROC INACTIVE	Indicator	Illuminated if processor failure is detected.
8	PROC ACTIVE	Indicator	Illuminated if processor is functioning.
9	SMOKE DETECT	Indicator	Indicates that overhead smoke detectors have been tripped (causing emergency power off).
10		Alpha-numeric Display	Displays status error codes. During initialization it displays interim status codes for initialization, calibration, checking Pass-Thru ports or playgrounds. During normal operation, this four-character display is blank. When the SERVICE REQUIRED indicator is illuminated, this display shows an error code that points to the cause of the malfunction. If a failure generates multiple error codes, only the first error code is displayed. If possible, the software saves any undisplayed error codes for a CSE to retrieve.
11	SERVICE REQUIRED	Indicator	Illuminates when LSM needs service. The alphanumeric display indicates the appropriate error code.

NOTES:

[1] Numbers correspond to item numbers in Figure 2-3.

Table 2-4. LCU CSE Control Panel

ITEM[1]	LABEL	TYPE	FUNCTION
1	LAN 0 ACTIVE	Indicator	Illuminated when LCU is using LAN 0.
2	LAN 1 ACTIVE	Indicator	Illuminated when LCU is using LAN 1.
3	IPL	Switch/ Indicator	SWITCH – Resets LSM hardware and starts power on sequences. INDICATOR – Illuminated when IPL is being performed.
4	RESET	Switch/ Indicator	SWITCH – Presents an interrupt to LCU software. During initialization diagnostics, this switch clears a non-fatal diagnostic failure condition, allowing initialization to continue. At any other time, pressing this switch causes the LSM processor to log status information and post an error condition (unexpected reset); LSM must be re-IPL'd after this. INDICATOR – This indicator illuminates when the RESET switch is pressed, and remains on while the reset procedure is going on.

NOTES:

[1] Item numbers correspond to item numbers in Figure 2-4.

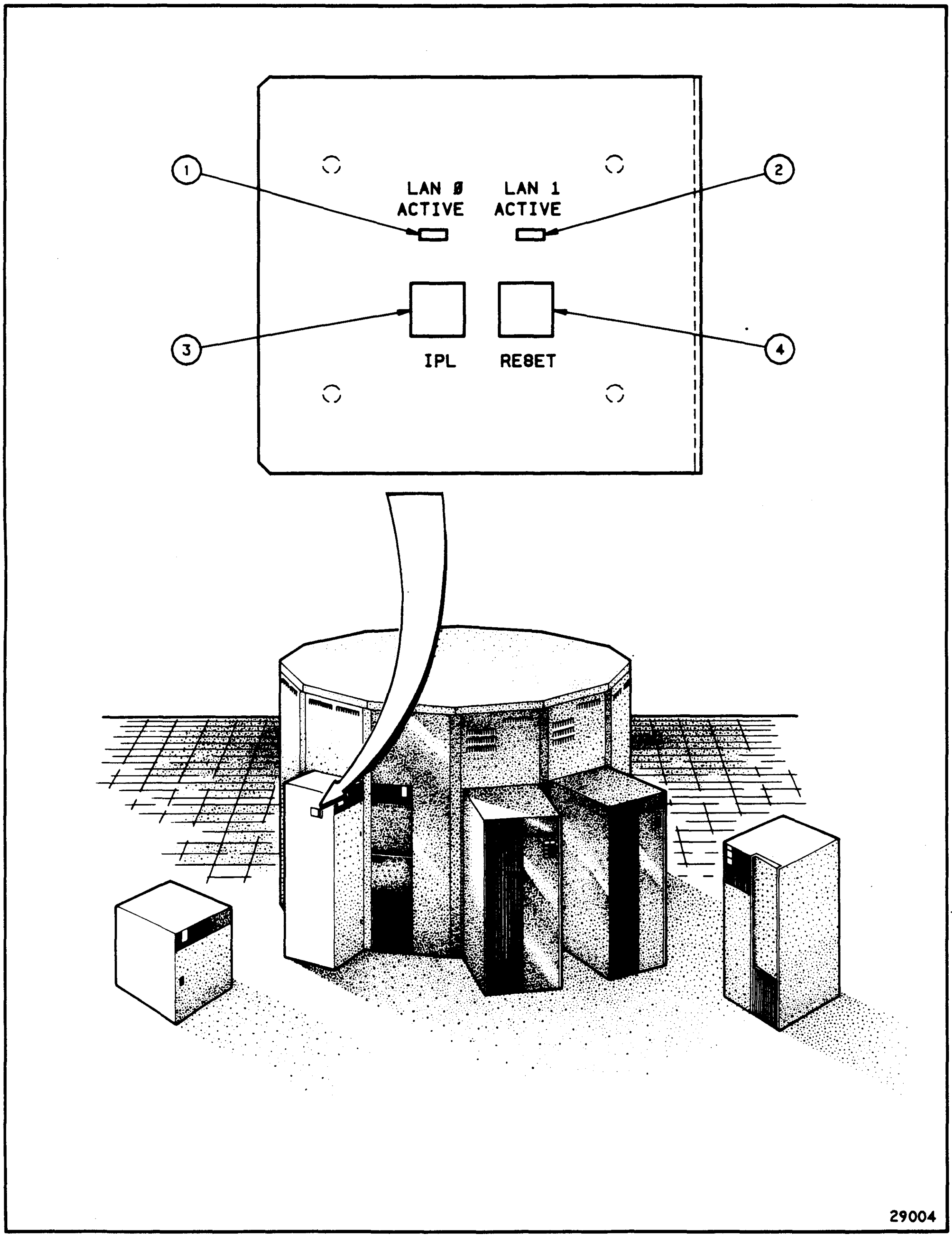

Figure 2-4. LCU CSE Control Panel

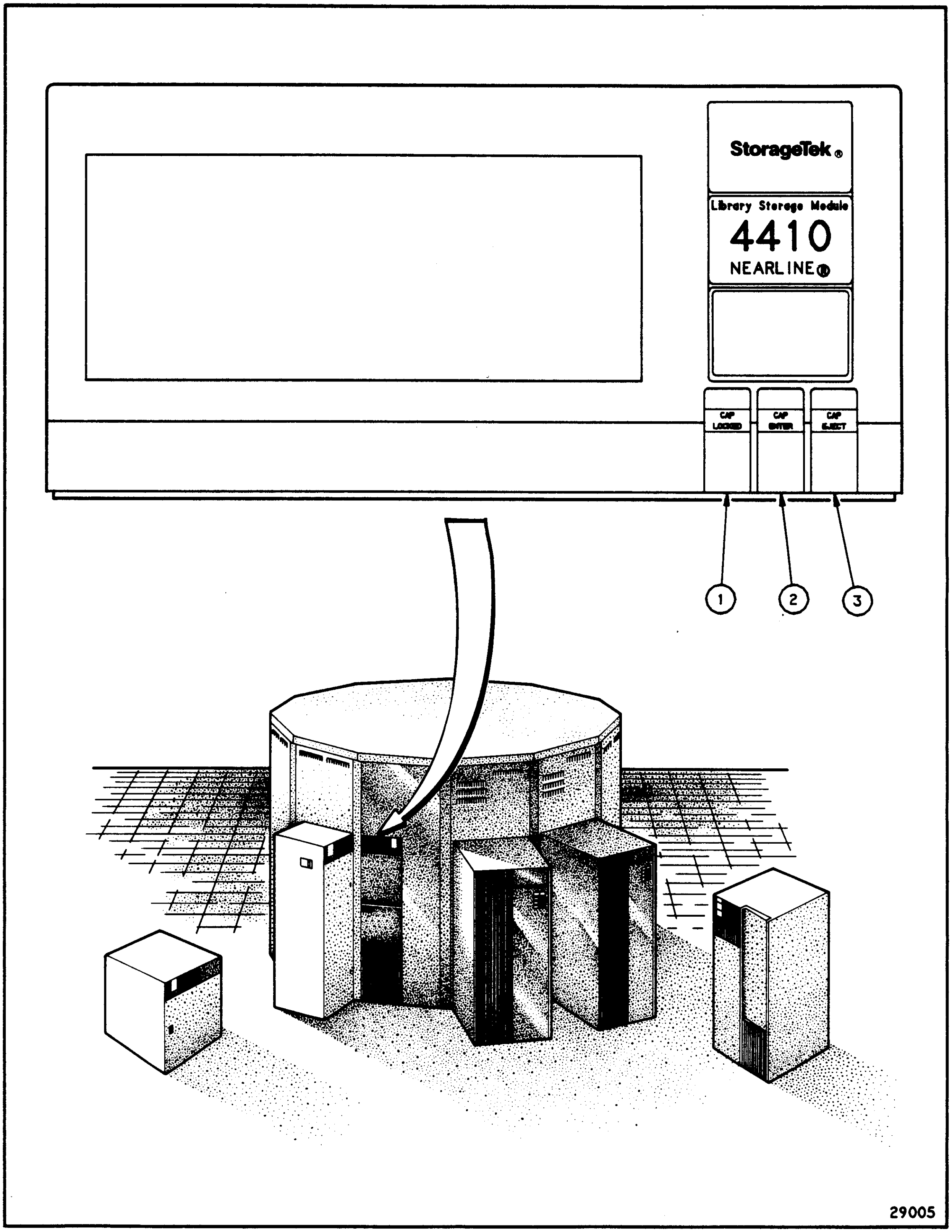

Figure 2-5. CAP Indicators

Table 2-5. CAP Indicators

ITEM[1]	LABEL	TYPE	FUNCTION
1	CAP LOCKED	Indicator	Illuminated when the LSM prohibits the CAP door from opening.
2	CAP ENTER	Indicator	When illuminated and the CAP LOCKED indicator is *not* illuminated, the CAP door may be opened and cartridges inserted.
3	CAP EJECT	Indicator	Illuminated when a CAP-eject is in progress.

NOTES:

[1] Item numbers correspond to item numbers in Figure 2-5.

EMERGENCY POWER OFF SWITCH – INTERNAL

A system of interlocks prevents unauthorized entry into the LSM. However, its ability to detect a person inside is limited; therefore, use extreme caution before you close the door.

Make a visual inspection for people or other obstructions just before you close the door. *Ask* in a loud voice if anyone is inside.

Because it is remotely possible that someone could override the many fail-safe devices, and someone else be trapped inside the LSM, there is a large red EMERGENCY POWER OFF push-button switch on the inside of the LSM access door to shut down the LSM. Pressing this switch removes power from all moving parts of the robot. Figure 2-6 shows the location of this switch.

As an additional safety feature, the access door latch is operable from the inside of the LSM, even if the door is locked on the outside.

CONTROL UNIT CONTROL PANEL

A control panel at the top of the CU behind the front cover contains switches and indicators. The switches control the operation, mode, and configuration of the control unit while the indicators display its status. There are two floppy disk drives in this panel. Figure 2-7 is an illustration of this panel. Table 2-6 briefly describes these switches and indicators.

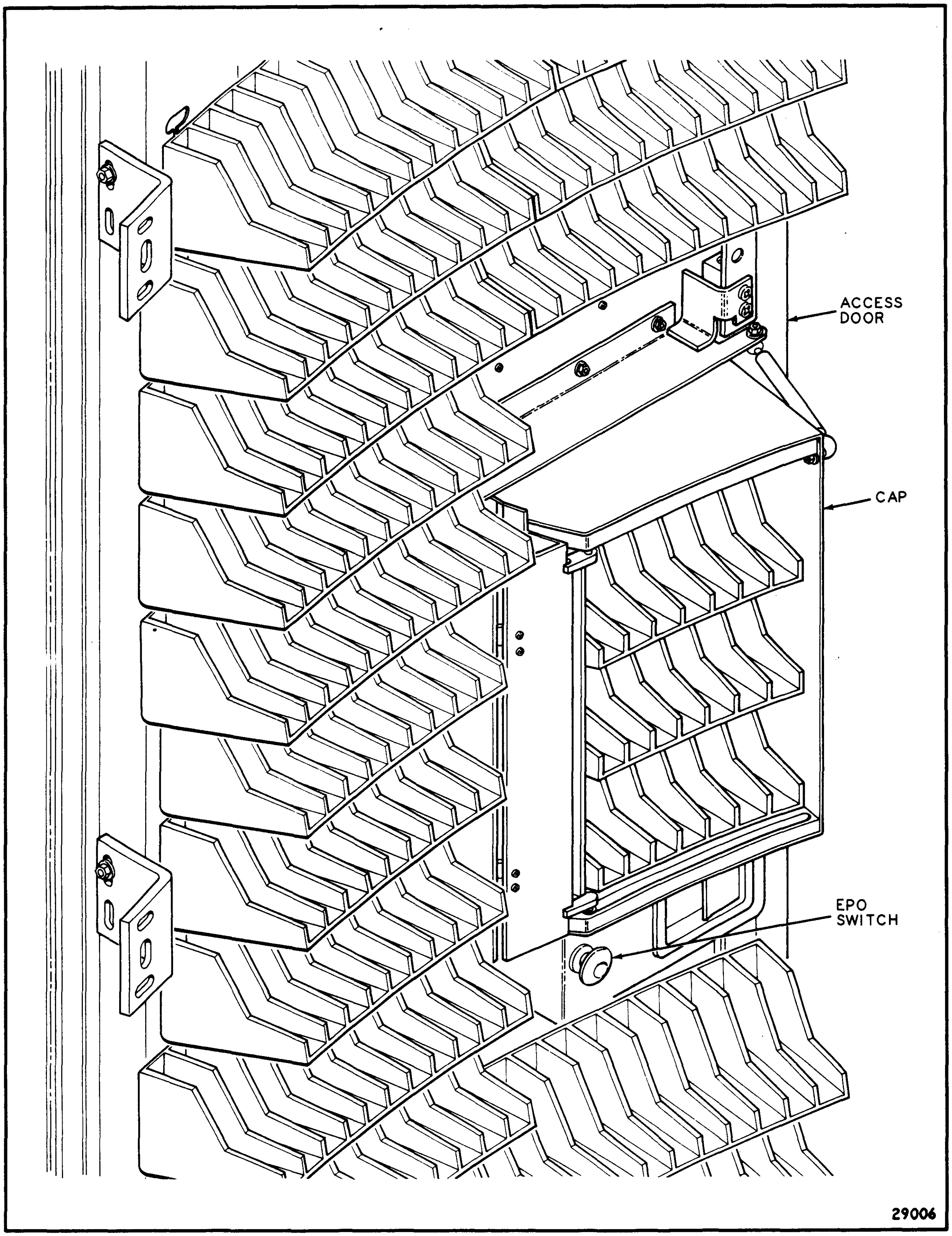

Figure 2-6. LSM Internal Emergency Power Off Switch

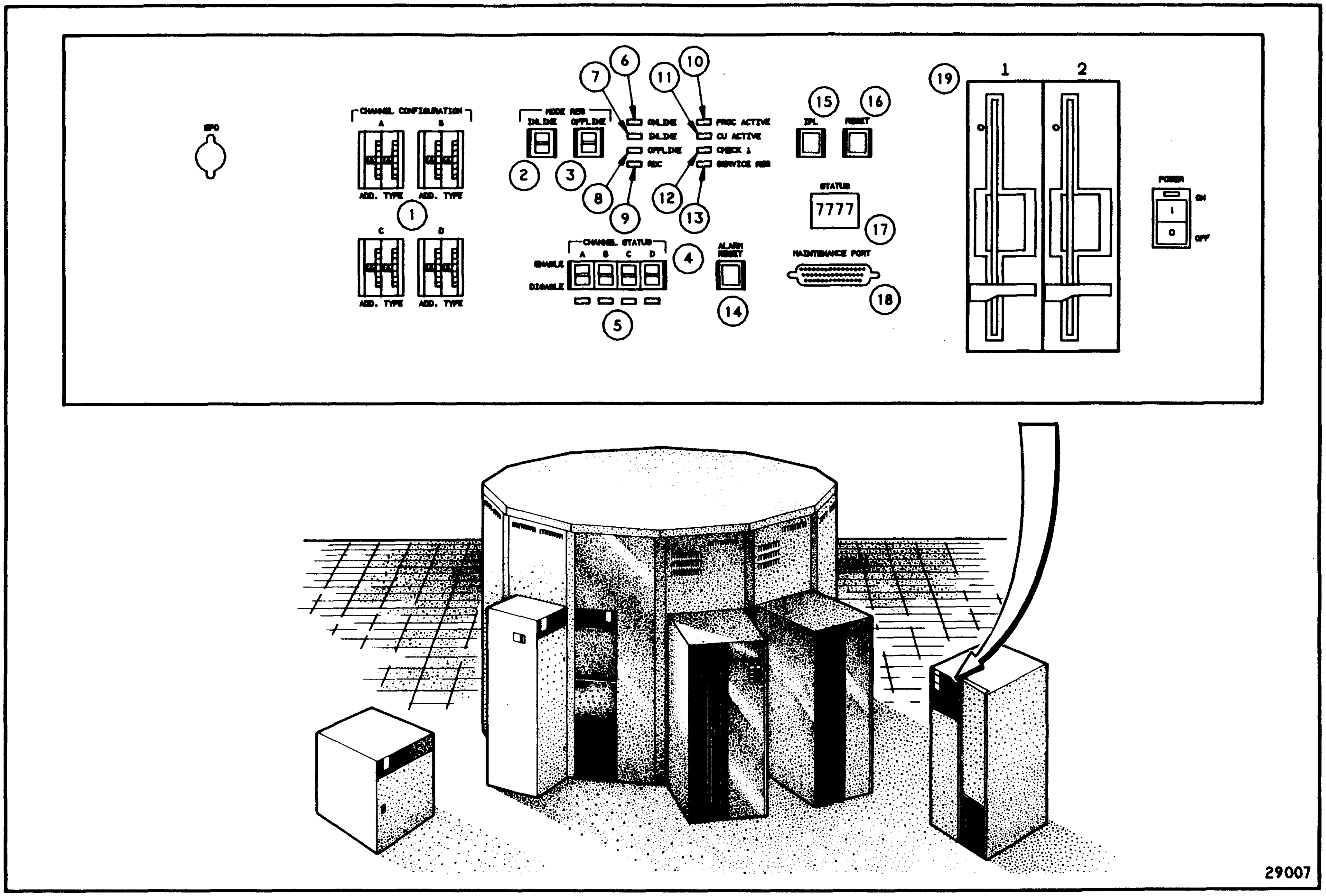

Figure 2-7. Control Unit Control Panel

Table 2-6. Control Unit Control Panel (Sheet 1 of 2)

ITEM[1]	LABEL	TYPE	FUNCTION
1	Channel Configuration	Thumb-wheel Switch	This is a 16-position thumbwheel rotary switch that moves a cylinder with 16 alpha-numeric characters. Each character represents one position of the switch. There are two switches per channel. Each set of two switches assigns an address and operation mode to the corresponding channel.
2	MODE REQ INLINE	Rocker Switch	When moved to INLINE, allows inline diagnostics to be executed.
3	MODE REQ OFFLINE	Rocker Switch	When moved to OFFLINE, prevents channel commands and data transfer, allows initial program load. When not set to OFFLINE, allows channel commands and data transfer.
4	CHANNEL STATUS	Rocker Switch	When moved to ENABLE, it allows the corresponding channel to transfer commands and data. When moved to DISABLE, it prevents the transfer of commands and data.
5	CHANNEL STATUS	Indicator	When illuminated: Corresponding channel is disabled.
6	ONLINE	Indicator	When illuminated: CU is online and can receive channel commands and transfer data.
7	INLINE	Indicator	When illuminated: Inline diagnostics can be run on the subsystem.
8	OFFLINE	Indicator	When illuminated: CU is offline and cannot receive channel commands or transfer data.
9	RDC	Indicator	When illuminated: Remote Diagnostic Center is communicating with the CU.

NOTES:

[1] Numbers correspond to item numbers in Figure 2-7.

Table 2-6. Control Unit Control Panel (Sheet 2 of 2)

ITEM[1]	LABEL	TYPE	FUNCTION
10	PROC ACTIVE	Indicator	When this indicator is illuminated, the microprocessor is controlling the CU; that is, the CU functional code is sequencing properly.
11	CU ACTIVE	Indicator	When illuminated: Data is being transferred between a channel adapter and the data buffer.
12	CHECK 1	Indicator	When illuminated: One of several failure conditions has been detected in the CU or CD.
13	SERVICE REQ	Indicator	When illuminated: System needs services of a CSE.
14	ALARM RESET	Momentary Switch	Resets audible alarm.
15	IPL	Momentary Switch/ Indicator	Switch: Begins IPL process; MODE REQ OFFLINE switch must be in OFFLINE position. Indicator: When illuminated, indicates that IPL is taking place.
16	RESET	Indicator	Pressing this momentary switch terminates the present program, stores the CU state on the diskette in drive 2, resets CU hardware, and returns the CU to its initial state.
17	STATUS	Display	Four-digit display of CU status code.
18	MAINT. PORT	D-25 Jack (RS232)	Accepts plug of cable from 392X maintenance device.
19		Floppy Diskette Drives	Loads functional and diagnostic programs into CU microprocessor. Stores error log and other information.

NOTES:

[1] Numbers correspond to item numbers in Figure 2-7.

CD MESSAGE DISPLAY AND INDICATORS

Message displays and indicators for the cartridge drive are mounted on the inside wall of the LSM, above the cartridge insertion ports. Figure 2-8 illustrates this display, and Table 2-7 describes it by item number.

- SELECT (1) – Illuminates when transport is selected by the CU.
- OPERATOR (2) – Signals that operator intervention is needed.
- OFFLINE (3) – Illuminates when transport is offline.

Transport Condition Messages

When the condition of a transport changes, the message display reflects this change. Table 2-8 lists these messages and their meanings.

Check Code Messages

When the subsystem detects a hardware error in the transport, it displays a check code message in the message display. A check code message is not replaced by another message until the problem is corrected. The format of the check code message is "CHK_XXXX," where XXXX is a hexadecimal error code.

CD Control Panel – Inside LSM

Three control switches and one indicator are located on the CD control panel inside the LSM. Figure 2-8 illustrates these switches and indicators, and Table 2-7 describes them by item number.

CD Control Panel – Outside LSM

A panel on the back of the cartridge drive contains switches that control the transport. Figure 2-9 is a drawing of this control panel, and Table 2-9 summarizes the functions of the switches.

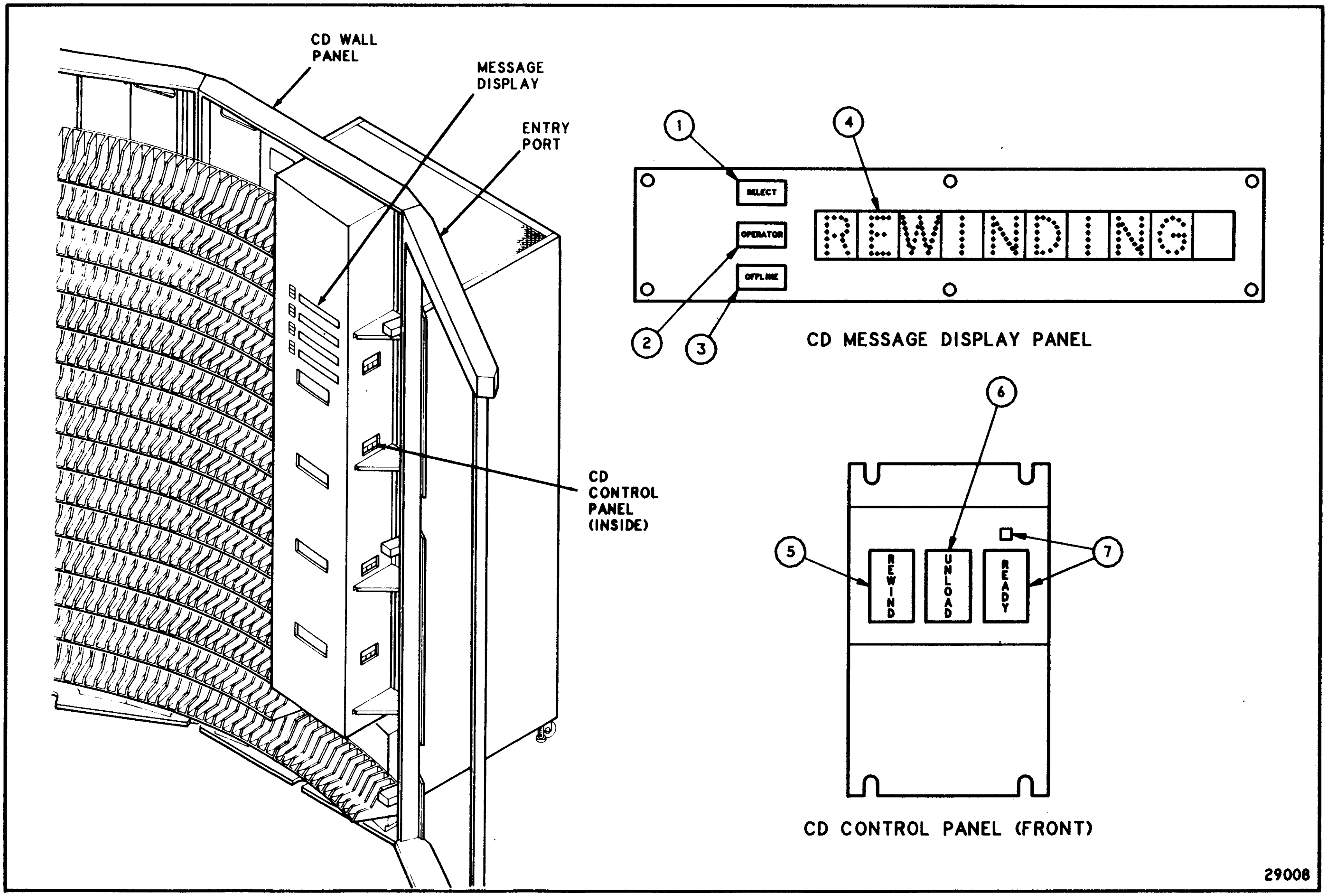

Figure 2-8. CD Control Panel – Inside LSM

Table 2-7. CD Control Panel – Inside (Sheet 1 of 2)

ITEM[1]	LABEL	TYPE	FUNCTION
1	SELECT	Green Light Bar	When illuminated: Transport is selected by a CU.
2	OPERATOR	Red Light Bar	When illuminated: Operator intervention is needed.
3	OFFLINE	Yellow Light Bar	When illuminated: Transport is offline.
4		Ten-character alpha-numeric display.	Presents messages concerning the state of the transport. See Table 2-8 for messages.

NOTES:

[1] Item numbers correspond to item numbers in Figure 2-8.

Table 2-7. CD Control Panel – Inside (Sheet 2 of 2)

ITEM[1]	LABEL	TYPE	FUNCTION
5	REWIND	Momentary Switch	Pressing this momentary switch rewinds tape into a cartridge as far as the logical BOT (beginning-of-tape).
6	UNLOAD	Momentary Switch	Pressing this momentary switch rewinds tape completely into a cartridge, releases the leader block, and raises the cartridge so it can be removed.
7	READY	Momentary Switch	Sets and resets the ready enable switch. When the ready state is set, the transport comes ready as soon as certain conditions are met. When the ready state is reset, either the transport is prevented from coming ready, or, if it is ready, it drops ready when it finishes the record it is processing.
7	READY	Green LED	Illuminates when ready enable switch is set.

NOTES:

[1] Item numbers correspond to item numbers in Figure 2-8.

Table 2-8. Transport Condition Messages

MESSAGE	MEANING
NT READY F	The transport is not ready, and a file protected cartridge is in the transport.
NT READY U	The transport is not ready, and an unprotected cartridge is in the transport.
READY F	The transport is ready, and a file protected cartridge is in the transport.
READY U	The transport is ready, and an unprotected cartridge is in the transport.
E.O.T	The logical end-of-tape (EOT) has been reached.
LOCATING	A high-speed locate operation is in progress.
ERASING	A data security erase operation is in progress.
REWINDING	A rewind operation is in progress.
UNLOADING	An unload operation is in progress.
CLEAN	Clean the tape path with a cleaning cartridge.
*	Microprogram loaded successfully after power up.
-WTM FAIL-	Manual write tape mark request.
CLOSE DOOR	Door must be closed for operation to continue.
LOADING	A load operation is in progress.
TESTING #X	Additional wakeup tests are being performed on drive "X" after drive code is downloaded.
CHK_XXX	Check code message.
StorageTek	CU is powering up and loading program.
CLEANING	Transport tape path is being cleaned.
DOWNLOAD*	Boot from wakeup tests was successful; transport needs code download from CU.
P.E.O.T.	Physical end of tape reached.

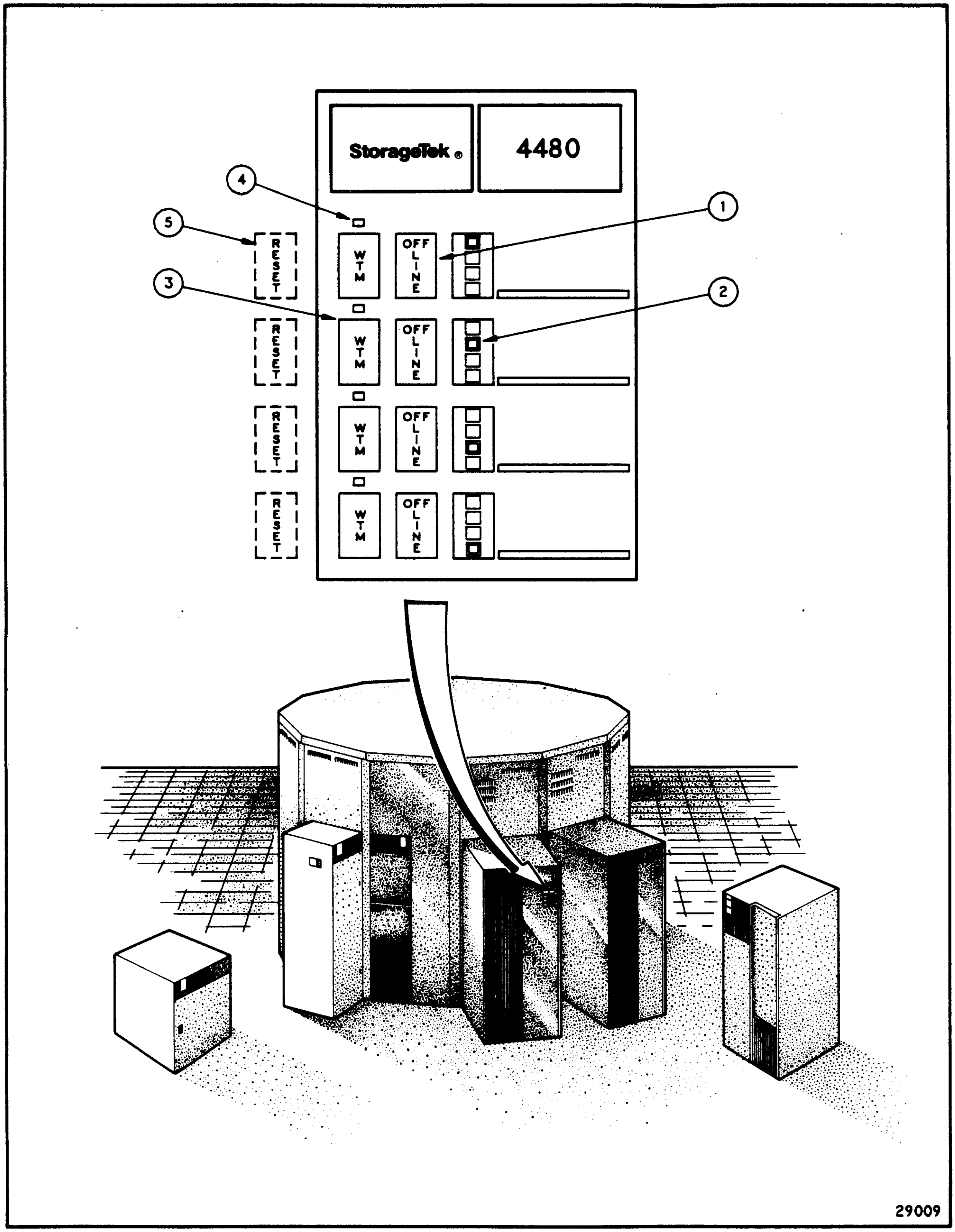

Figure 2-9. CD Control Panel – Outside

Table 2-9. CD Control Panel – Outside

ITEM[1]	LABEL	TYPE	FUNCTION
1	OFFLINE	Momentary Switch	Pressing this momentary switch changes the state of the machine from online to offline, or vice versa.
2	OFFLINE	Yellow LED	When the OFFLINE switch is pressed this yellow LED flashes until the transport changes state. If this LED is continuously illuminated, the transport is offline; if it is not illuminated, the transport is online.
3	WTM (Write Tape Mark)	Momentary Switch	Pressing this momentary switch requests the CU to write a tape mark on the tape in the transport. The transport must be offline and ready.
4	WTM (Write Tape Mark)	Green LED	When the WTM switch is pressed, the green LED remains illuminated until a tape mark is written on the tape in the corresponding transport.
5	RESET	Momentary Switch	Pressing this momentary switch resets the microprocessor in the transport. The CU automatically downloads microcode. (This switch is hidden behind the rear cover.)

NOTES:

[1] Item numbers correspond to item numbers in Figure 2-9.

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CHAPTER 3:
INSTALLING THE STORAGE SERVER

OVERVIEW

This chapter describes steps that must be performed in order to successfully complete an installation of StorageTek's 4400 Automated Cartridge System. There are five installation tasks that are performed before the library is operational. These five tasks are as follows:

- Configuration planning
- Loading the Storage Server installation tape
- Configuring the software
- Migrating tape cartridges into the library

These tasks are described in detail in the following sections.

CONFIGURATION PLANNING

Configuration planning involves ensuring that all hardware, hardware provisions, software, and installation requirements are predetermined and complete prior to the generation process.

This paragraph provides a list of tasks that must be completed to ensure a smooth installation of a 4400 Automated Cartridge System.

The customer and StorageTek personnel are each charged with the responsibility of checking each point and ensuring that each task is completed. The tasks which must be completed to ensure a smooth, error-free installation are:

- Verifying the physical plan
- Defining LSM/Pass-Thru Port relationships
- Calculating LSM cartridge capacity
- Defining tape drive interfaces (addresses)

Verifying the Physical Plan

The completed configuration plan is the installation's blueprint.

If the configuration plan is not available at the beginning of the installation, cease installation activities and obtain a completed configuration plan before proceeding.

Ensure that provisions are made for the following:

- Floor space requirements
- Power requirements
- Environmental requirements
- Required tape cartridges

Note: All space requirements are computed using the *Storage Technology Physical Planning Guide*, P/N EOF 01-5, and its templates. In the computations, provisions are made for each library component ordered, future components considered for add-ons, service areas, personnel clearances, and furniture.

Defining LSM / Pass-Thru Port Relationships

This task must be performed for all ACSs with more than one LSM.

Pass-Thru Ports (PTPs) provide a means for passing tape cartridges between two adjacent LSMs. Only one LSM actually controls a PTP. The controlling LSM is referred to as the "master," and the other LSM, which shares the PTP without controlling it, is referred to as the "slave." The terms master and slave refer to the LSMs, not the PTPs.

An LSM can have up to four PTPs, but it can be a master of only two. Therefore it is possible for one LSM to be both a master and a slave.

The LSM / PTP relationships are defined in the Configuration Plan. Verify that the Configuration Plan defines these relationships. If verification is confirmed, proceed with the installation. If verification of the LSM/PTP relationships is not confirmed, cease installation activity until resolution is achieved.

Calculating LSM Cartridge Capacity

Table 3-1 provides information necessary for determining the cartridge storage capacity of an LSM.

Note: Although installation can proceed without tape cartridges, it is a good idea to have some on-hand in order to verify system functionality.

Table 3-1. LSM Storage Cell Capacity

Number of PTPs	Number of Cartridge Drives 1	2	3	4
0	5970	5786	5602	5418
1	5946	5762	5578	5394
2	5922	5738	5554	5370
3	5898	5714	5530	5346
4	5874	5690	N/A	N/A

LOADING THE STORAGE SERVER INSTALLATION TAPE

Overview

The Storage Server installation tape contains the following files:

- Binary (executable) program files
- Command files for initiating and terminating the software
- Configuration files
- A directory hierarchy skeleton

The distribution media can either be either a 1/4-inch tape cartridge or a 1/2-inch tape reel (9-track, 1600 BPI). The tape is created with the standard UNIX tape utility `tar`.

If possible, it is a good idea to make a copy of the distribution tape to serve as a backup in case the original should be damaged.

Tape Identification

There is only one distribution tape for a given version of the Storage Server software. The tape is marked with a distinctive label of the form shown in Figure 3-1.

ACS STORAGE SERVER, V1.0 **PRODUCT NUMBER 1190-U01**

Figure 3-1. Storage Server Installation Tape Label

The version number on the tape, **V1.0** in Figure 3-1, uniquely identifies the release of the Storage Server software. This number is formatted as a major release number and a minor release number, separated by a period (.).

The major release number, to the left of the period, is incremented when major functional or performance enhancements are made to the software. The minor release number, to the right of the period, is incremented for bug fixes and minor enhancements. It is reset to "**0**" each time the major release number is incremented.

The product number is a unique StorageTek number associated with the software.

Proprietary Notice

All coded statements, instructions, and computer programs on the Storage Server distribution tape are the property of StorageTek; unauthorized use or distribution is strictly prohibited.

Installation Procedure

The Storage Server installation procedure uses the UNIX utility program `tar` to unload the distribution tape onto the server system. The destination directory must be created and proper ownership established prior to unloading the tape.

The `tar` program copies the directory structure from the distribution tape onto the server system file system, with resulting ownerships and access permissions based on those of the user making the `tar` request. Improper ownership or access permissions at installation may cause undesired events.

Use the following procedure to read the distribution tape into the UNIX file system. It is recommended that you read through the entire procedure first to become familiar with it. See your UNIX documentation for details on the referenced commands and files.

Note: The contents of the distribution tape will be read into the Storage Server home directory which is `/usr/ACSSS`.

1. Login as the superuser.

   `login root` (and enter the appropriate password)

2. Create the home directory for the user and group IDs.

   ```
   cd /usr
   mkdir ACSSS
   ```

3. Verify that there is enough free space on the destination file system to hold the entire distribution tape, which is 30K 1024-byte blocks.

4. Move to the directory you have just created and modify file ownerships as follows:

```
cd ACSSS
/etc/chown 200 ACSSS
chgrp 7 ACSSS
chmod ug+rwx ACSSS
cd ACSSS
```

5. Mount the distribution tape (cartridge or reel) in the drive.
6. Read the tape using `tar`.

```
tar xpf /dev/rst0
```

7. When `tar` has finished reading and rewinding the tape, dismount the tape and store it in a safe place. All files on the distribution tape are now installed in `/usr/ACSSS`.
8. Start the data base daemon process.

```
/usr/ACSSS/database/bin/lockmgr
```

9. Copy the pre-configured password and startup files from the `install` subdirectory into the system directory:

```
cd /usr/ACSSS/install
cp passwd rc /etc
```

   The password file (`passwd`) contains definitions for the `acssa`, `acsss`, and `ingres` user IDs.

   The startup file (`rc`) contains instructions to automatically initiate the Storage Server software whenever the system is brought up.

10. The installation procedure is completed, and you are now ready to configure the Storage Server software.

Errors

Improper ownership or access permission during installation can cause a failure of all or part of the installation sequence.

The following standard UNIX error messages may appear during the installation process and will appear at the server system console. See your UNIX documentation for explanations of these errors and their solutions.

```
identifier: bad directory
You do not have permission to su root. Sorry
chown: unknown user id: login_id
chown: ACSSS: not owner
chgrp: group_id: unknown group
tar: cannot create
tar: read error
tar: write error
```

Directory Structure

Successful loading of the Storage Server tape will result in the creation of a file system directory structure under the directory where the distribution tape was unloaded, usually `/usr/ACSSS`. The directory structure will include the following subdirectories:

- `./bin` – Contains Storage Server binary, and executable program and command files.
- `./config` – Contains Storage Server configuration executable programs and data files.
- `./database` – Contains the Storage Server data base support programs and data files.
- `./install` – Contains files that support Storage Server installation.
- `./log` – Contains Storage Server component Event Log files.

CONFIGURING THE SOFTWARE

Overview

Storage Server configuration is done in the following steps:

1. Configure Storage Server software
2. Configure Library communications
3. Build/Verify Library configuration

These steps are performed with the configuration program which is provided as part of the installation tape. This program is called

acsss_home`/config/acsss_config`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`. The program establishes an interactive dialogue with the user, prompting for the required data and validating the user's entries.

Each of these steps is described in detail in the following sections.

Running the Configuration Program

Use the following procedure to initiate the configuration program:

1. **`login acsss`**
2. **`cd /usr/ACSSS/config`**
3. **`acsss_config`**

The program actually consists of three separate configuration routines. The program will prompt for the routine you wish to perform. Figure 3-2 shows how these prompts will appear.

```
Configure storage server software? (y/n):

Configure library communications? (y/n):

Build/Verify library configuration? (y/n):
```

Figure 3-2. Configuration Program Prompts

Entering `Y` in response to any of these prompts indicates that you want to perform that routine. The program will enter that configuration routine; when the routine is finished, the program will display the next prompt shown in Figure 3-2. When the last routine is finished, the program will return to the UNIX shell.

Entering `N` to any of these prompts indicates that you do *not* want to perform that routine. The program will display the next prompt, or in the case of the last prompt, return to the UNIX shell.

When you run this program you may choose to perform only those configuration routines that are necessary for your situation. For the initial installation, however, all three routines must be performed.

To exit from this program or any of its routines at any time, enter **Ctl-C**. The program must be restarted and the configuration data redefined, however, or the Storage Server software may not be able to run.

Configure Storage Server Software

Description

This routine defines environment variables that the Storage Server software requires in order to run. Each of these variables has a default value which is displayed as part of the prompt. You can choose to accept the default by entering **Return**, or you can override the default by entering a different value at the `New Value?` prompt.

These variables are loaded into the `rc.acsss` file, which is the initiation file for the Storage Server software. This file is located in the directory where the Storage Server software was installed, usually `/usr/ACSSS`.

This routine usually only needs to be run once for an installation. It should be run as soon as the Storage Server installation tape has been unloaded.

Interaction

If you make an invalid entry in this routine, an error message will be displayed and the program will terminate; you will *not* be reprompted for a correct entry.

The prompts, and instructions for responding to them, are as follows:

1. ```
   Directory where distribution tape was unloaded:
   Currently:  /usr/ACSSS
   New Value?
   ```

   Enter the full pathname of the directory where the Storage Server installation tape was unloaded. Enter **Return** to accept the default value, `/usr/ACSSS`.

   This entry is the home directory for the Storage Server software.

2. ```
   Maximum storage server event log size in Kbytes:
   Currently:  64
   New Value?
   ```

   Enter the threshold size for the Event Log, expressed in Kbytes. Your entry must be a positive number. Enter **Return** to accept the default value, `64`.

   When the Event Log reaches this size, an unsolicited message will be displayed in the Display Area of the Command Processor, informing the System Administrator that the file has reached its threshold size. The Event Logger will continue to append messages to the file. See the *Event Log* section in *Chapter 7* for details. If your entry is too small, the Event Log will quickly reach the threshold, resulting in many messages to the Command Processor.

3. ```
   Storage server execution trace output file (full path)
   name:
   Currently:  /usr/ACSSS/log/acsss_trace.log
   New Value?
   ```

   Enter the full pathname of the Storage Server trace log. Enter **Return** to accept the default value, `/usr/ACSSS/log/acsss_trace.log`.

   This file is normally used only by a Customer Services Engineer as a tool for tracing software errors. See the *Maintainability and Diagnostics* section in *Chapter 7* for additional information about the trace log.
   ```

4. `Storage server execution trace value (hex):`
   `Currently: 0`

   `New Value?`

   Enter Return to accept the default value of `0`. Entering anything other than `0` may cause software tracing to be turned on. This will result in many messages being written to the trace log, using up valuable disk space.

   This value should be changed only by a Customer Services Engineer as part of a software error diagnostic process.

5. `Updating start-up file` *file_name*

   This message is displayed as the program adds the environment variables to the Storage Server startup file, usually `/usr/ACSSS/rc.acsss`.

6. The program then displays the next prompt shown in Figure 3-2, allowing you to select the next configuration routine.

Errors

Invalid inputs to the configuration program will prevent the program from finishing normally. When errors are detected, the program will not advance to the next step in the sequence. Terminating the sequence prematurely will prevent the `rc.acsss` initiation command file from being created, thus preventing the ability to start Storage Server operations.

This routine performs limited validity checking on your entries. The following error messages may appear at the server system console.

- The following message will be displayed if you do not enter a valid pathname for the Storage Server home directory.

  `Distribution directory` *entry* `does not exist`

- The following message will be displayed if you specify an Event Log file size less than 0.

  `Invalid value specified`

- The following message will be displayed if you do not specify a valid pathname for the trace log file.

  `Invalid trace file name` *entry*`, must specify full path`

- The following message will be displayed if the routine is unable to create the trace log file in the directory you specified.

  `Cannot create trace file` *entry*`, invalid path or permissions`

Configure Library Communications

Description

This routine defines the port connections between the server system and the library. There are no default values for the prompts in this routine.

Your entries are loaded into the Storage Server data base which is usually located in the directory `/usr/ACSSS/database`.

This routine should be run as soon as the Storage Server installation tape has been unloaded. It should also be run anytime the port configuration changes, such as when a new ACS is added.

Interaction

If you make an invalid entry in this routine, an error message will be displayed and the program will reprompt for a correct entry.

The prompts, and instructions for responding to them, are as follows:

1. `Storage server data base exists and will be overwritten, continue?`

   This prompt appears only if the data base already contains data defining the ACS port configuration. This prompt will *not* appear the *first* time you run the routine, but will appear every time you run it thereafter.

   Enter `Y` to overwrite the existing port configuration data. The program proceeds to the next step. **Note:** Modifying the port data does not affect the cartridge volume data.

   Enter `N` or **Return** to exit the routine without changing the existing data. The following message is displayed and the routine terminates.

   ```
   Storage server data base unchanged
   ```

2. `Number of ACSs to be supported:`

   Enter the number of ACSs in your library configuration. Your entry must be between `1` and `128`.

3. `Number of tty connections to ACS #`*nnn*`:`

   This prompt appears once for each ACS in the configuration. For example, if you specified in the previous prompt that three ACSs are to be supported, this prompt will appear three times. *nnn* is the identifier for each ACS.

   Enter the number of communications port (tty) connections to ACS *nnn*. Your entry must be between `1` and `16`.

4. `Device name - ACS #`*`nnn`*`, tty device #`*`dd`*`:`

   This prompt appears once for each port in the configuration. For example, if there are three ACSs in the configuration and each one has two ports, this prompt will appear six times. *nnn* is the identifier for each ACS. *dd* is the number of the port connected to that ACS.

   Enter the full pathname for the device attached to the port displayed in the prompt. Since devices are defined in the `/dev` directory, typical entries are `/dev/tty00` or `/dev/ttyab`.

5. `Storage server data base records being purged.`

   This message is displayed only if the routine terminates unexpectedly, either by a user **Ctl-C** entry or through an error. The program automatically backs out any updates it may have made up to this point; the port configuration files are left as they were before the routine was initiated.

6. The program then displays the next prompt shown in Figure 3-2, allowing you to select the next configuration routine.

Errors

This routine performs limited validity checking on your entries. It does *not* verify that the tty devices you specified have actually been configured in the operating system. You must configure these devices with the MAKEDEV utility before Storage Server operations can begin. See your UNIX documentation for details on the MAKEDEV utility and configuring tty devices.

The following error messages may appear at the server system console.

- The following message is displayed if the data base is inaccessible. This is probably due to incorrect permission rights on the data base directory or the files.

  `Cannot connect to storage server data base`

  You should verify that the

- The following message is displayed if you are running a *reconfiguration* and the program is unable to delete existing configuration records.

  `Cannot delete` *table_name* `records`

  table_name is either `acstable` or `porttable`.

- The following message is displayed if the program is unable to write new configuration records to the data base.

  `Cannot create` *table_name* `record`

table_name is either `acstable` or `porttable`.

- The following message is displayed if you entered an ACS quantity less than `1` or greater than `128`.

  `Invalid ACS quantity` *entry* `specified, must be from 1 to 128`

  entry is the quantity you entered.

- The following message is displayed if you entered a tty quantity less than `1` or greater than `16`.

  `Invalid tty quantity` *entry* `specified, must be from 1 to 16`

  entry is the quantity you entered.

- The following message is displayed if the tty device name you specified was too long.

  `Tty device name cannot exceed 32 characters`

- The following message is displayed if you enter a device name that does not exist in the `/etc/ttys` file.

  `Tty device` *entry* `does not exist`

  entry is the device name you entered.

- The following message is displayed if you specify a particular tty device name more than once. The device name for each port must be unique.

  `Tty device` *entry* `already specified`

  entry is the device name you entered.

Build/Verify Library Configuration

Description

This routine loads the library configuration into the Storage Server data base. The data loaded is based on the configuration defined in the LMU by a Customer Services Engineer. This data includes number of ACSs, LSMs, Pass-Thru Ports, tape drives, etc.

The data is loaded into the Storage Server data base, which is usually located in the directory `/usr/ACSSS/database`.

After the data base is updated, a formatted report listing the library configuration is appended to the configuration log. This log is located in the file

acsss_home`/log/acsss_config_log`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`. This report can be displayed or printed for historical use.

All library components are assigned an online state in the data base, regardless of what their state is in the LMU. This ensures that all library components are brought to an online state at initiation following a library reconfiguration.

This routine should be run as soon as the Storage Server installation tape has been unloaded. It should also be run anytime the number or location of any of the following hardware components changes:

- ACS
- LSM
- Pass-Thru Port
- Library tape drive

Interaction

The prompts, and instructions for responding to them, are as follows:

1. `Storage server data base exists, continue?`

   Note: This prompt appears only if the data base already contains library configuration data.

   Enter `Y` to overwrite the existing library configuration data with the configuration from the LMU. The program proceeds to the next step.

   Enter `N` or **Return** to exit the routine without changing the existing data. The following message is displayed and the routine terminates.

   ```
   Storage server data base unchanged
   ```

2. The program displays the following messages as it checks the configuration defined in each of the data base tables against the configuration defined in the LMU.

   ```
   Checking acstable
   Checking lsmtable
   Checking drivetable
   Checking celltable
   ```

3. As the program checks the `celltable` it displays one of the following messages for *each* panel in *each* LSM. The following message is displayed if you are performing a *reconfiguration* and the current and previous configurations of the panel are identical.

   `ACS` *nn*`, LSM` *mm*`, Panel` *pp* `unchanged`

The following message is displayed either if you are performing a *reconfiguration* and the current and previous configurations are different, or if you are performing an *initial configuration.*

```
ACS nn, LSM mm, Panel pp created
```

nn is the ACS ID. *mm* is the LSM number within this ACS. *pp* is the panel number within the LSM.

4. **Note:** This step occurs only if you are defining an *initial configuration.* The program displays the following messages as it creates the `volumetable` and `audittable` data base files.

```
Creating volumetable
Creating audittable
```

The `volumetable` contains tape cartridge ID and location data. This table is loaded by the `audit` command. See *Migrating Cartridges Into the Library* in this chapter for details.

The `audittable` is a table used only by the `audit` command.

5. The program displays the following message as a reminder that you should perform an audit because the library configuration has changed.

```
Audit may be required due to reconfiguration
```

See the *Performing a Cartridge Audit* section in *Chapter 6* for guidelines on the types of configuration changes that require an audit.

6. The routine creates a library configuration report and adds it to the end of the configuration log. The current date and time are included in the header of the report to aid in tracking changes to the library configuration. A sample of the report is shown in Figure 3-3.
7. The routine returns to the UNIX shell prompt.

Errors

This routine performs limited validity checking on your entries. The following error messages may appear at the server system console. Many of these errors indicate that some aspect of the Storage Server installation or configuration has not been completed correctly.

- The following message is displayed if there is a discrepancy between the ACS configuration defined in the data base and the configuration indicated by the LMU. You should verify that you have successfully completed the Configure Library Communications routine. See *Configure Library Communications* for details.

```
Acstable and library handler are inconsistent
```

- The following message is displayed if the routine is unable to access the data base.

  `Cannot access data base files`

- The following message is displayed if the program is unable to initiate the Event Logger. The Event Logger is used by the Library Handler portion of the ACSLM to log error messages during this routine.

  `Cannot create event logger process`

- The following message is displayed if the program is unable to initiate interprocess communications with the Library Handler portion of the ACSLM or with the Event Logger.

  `Cannot create inter-process communications`

- The following message is displayed if the program is unable to initiate the Library Handler portion of the ACSLM. The program uses the Library Handler to receive and interpret configuration data from the LMU.

  `Cannot create library handler process`

- The following message is displayed if the program is unable to create the temporary file it uses for recording panel configuration data.

  `Cannot create temporary file`

- The following message is displayed if an initialize message is not received from the Library Handler portion of the ACSLM.

  `Cannot establish library communications`

- The following message is displayed if the program is unable to execute the Event Logger. The Event Logger is used by the Library Handler to log error messages during the configuration verification.

  `Cannot execute event logger process`

- The following message is displayed if the program is unable to execute the Library handler portion of the ACSLM. The program uses the Library Handler to receive and interpret configuration data from the LMU.

  `Cannot execute library handler process`

- The following message is displayed if the program is unable to read the specified data base table. You should verify that you have successfully completed the Configure Library Communications routine. See *Configure Library Communications* for details.

  `Cannot read` *data_base_table*

data_base_table can be `acstable` or `lsmtable`.

- The following message is displayed if the program is unable to update the specified data base table with the new configuration data.

  `Cannot write` *data_base_table* `record`

  data_base_table can be `drivetable` or `lsmtable`.

- The following message is displayed if the Storage Server is unable to communicate with the LMU through the specified port.

  `Communications port` *port_id* `does not respond`

- The following message is displayed if the program is unable to read or write panel configuration data to or from the data base.

  `Could not count cell records`

- The following message is displayed if the program is unable to delete previous panel configuration data from the data base.

  `Could not delete cell records`

- The following message is displayed if the routine is unable to access the ACS configuration data in the data base. You should verify that you have successfully completed the Configure Library Communications routine. See *Configure Library Communications* for details.

  `Error encountered reading acstable`

- The following message is displayed if the routine is unable to access the data base.

  `Error encountered reading data base`

- The following message is displayed if the program is unable to successfully verify or update the configuration of the specified device.

  `Failed to configure` *device*

  device can be `LSMs`, `LDs`, or `LSM panels`.

- The following message is displayed if the routine is unable to write the configuration report to the configuration log. This is probably due to incorrect permission rights on the directory or the file. The report is displayed on the screen.

  `Failed to generate configuration report`

- The following message is displayed if the program is unable to read or write ACS configuration data to or from the data base. You should verify that you have successfully completed the Configure Library Communications routine. See *Configure Library Communications* for details.

  `Failed to verify ACSs`

- The following message is displayed if the Library Handler returns an unexpected status response to a request.

  `Invalid status response from library handler`

- The following message is displayed if an interprocess communications failure occurs any time during the routine.

  `IPC failure on input socket`

- The following message is displayed if an interprocess communications failure occurs any time during the routine.

  `IPC failure on input socket, count too small`

- The following message is displayed if an interprocess communications failure occurs any time during the routine.

  `IPC failure on output socket`

- The following message is displayed if the routine is unable to write to the configuration log. This is probably due to incorrect permission rights on the directory or the file. The report is displayed on the screen.

  `Cannot open configuration log file, using stdout`

- The following message is displayed if the LMU defines a panel type that is unknown to the Storage Server.

  `Invalid panel type detected`

- The following message is displayed if the routine is unable to establish contact with the LMU because it does not find any ports defined in the data base. You should verify that you have successfully completed the Configure Library Communications routine. See *Configure Library Communications* for details.

  `No ports in data base`

- The following message is displayed if an initialize message is not received from the Library Handler portion of the ACSLM.

  `Unable to synchronize communications with library`

```
                LIBRARY CONFIGURATION REPORT
                       MM-DD-YY HH:MM

ACS #0: 2 LSMs

PASSTHRU PORTS:     MASTER            SLAVE
                    LSM    PANEL     LSM    PANEL
                     0       6        1       8

LSM PANEL DEFINITIONS:

LSM #0:       PANEL        TYPE
                 0         LCU
                 1         CELL
                 2         CELL
                 3         DRIVE:  4 TRANSPORTS
                    .
                    .
                    .
                11         DOOR
                    .
                    .
                    .
                19         CELL

LSM #1:       PANEL        TYPE
               0           LCU
               1           CELL
                  .
                  .
                  .
               8           PASSTHRU:  SLAVE
                  .
                  .
                  .
```

Figure 3-3. Sample Library Configuration Report

Including the Storage Server in System Startup

Description

Part of the tape installation procedure includes copying the startup file (`rc`) provided on the installation tape into the server system `/etc` directory. This enables the Storage Server software to be initiated automatically when the server system is initiated. See *Loading the Storage Server Installation Tape* in this chapter for details.

MIGRATING CARTRIDGES INTO THE LIBRARY

Overview

This section covers the following topics:

- How to place external OCR/bar code labels on cartridges prior to loading them into the library
- How to load cartridges into the library and update the data base

Applying OCR/Bar Code Labels to Cartridges

In order to insure a successful migration of cartridges into an LSM, each tape cartridge must have a unique OCR/bar code label. These labels must be correctly positioned on the cartridge so that the robot vision system can read them accurately. See the *Using Tape Cartridges* section in *Chapter 4* for instructions on applying labels to the cartridges.

Loading Cartridges Into the Library

There are two methods for loading cartridges into the library during initial installation of the system:

- Using the `enter` operator command
- Manually loading the storage cells and issuing an `audit` command

Both methods are acceptable, but the manual method is preferred since it requires less overall time and virtually no operator supervision while the audit is running.

Using the enter Command

The `enter` command is used to enter cartridges into the library through a CAP. The cartridge ID and its storage location are added to the data base, and are therefore under library control, at the time of entry.

When the `enter` command is issued at the Command Processor, the CAP is released for inserting cartridges. You can insert 21 cartridges at a time into the CAP. The CAP must be loaded from left to right, and top to bottom.

The system will accept cartridges as long as there are free storage cells available. The Storage Server selects a storage cell location for each cartridge at the time of entry. Any cartridges with missing or unreadable labels will not be accepted into the LSM.

See *Chapter 5: Library Operator Commands* for details on using the `enter` command.

Manually Loading the Storage Cells

To manually load cartridges into the storage cells, you must enter the LSM. See the *Entering the LSM* section in *Chapter 4* for the correct procedure.

Not all cells in an LSM are available for cartridge storage. See Figure 4-16 for the location of reserved cells.

A cartridge must be loaded into a storage cell with its leader block to the top and away from you and its OCR/bar code label facing you.

Once all cartridges have been loaded, you must invoke the `audit` command to update the data base with the cartridge IDs and their locations. The cartridges are not actually under library control until the data base is updated. It is recommended that you vary the LSM(s) to the diagnostic state before performing the audit in order to reduce the time required for the audit.

See *Chapter 5: Library Operator Commands* for details on using the `audit` and `vary` commands. See the *Performing a Cartridge Audit* section in *Chapter 6* for details on performing an audit.

CHAPTER 4: OPERATING THE ACS LIBRARY

OVERVIEW

This chapter discusses the operational modes of the ACS and various operator procedures, such as:

- ACSLM states
- Device states
- Cartridge recovery
- Storage Server recovery
- Initiating the Storage Server software
- Terminating the Storage Server software
- Operating an LMU
- Operating an LCU
- Operating a tape control unit (CU)
- Using tape cartridges
- Using the CAP
- Entering the LSM

ACSLM STATES

Description

The ACSLM can be in one of four states, as described below:

Run	The normal operating state. The ACSLM processes all library requests received from a CSI or the ACSSA.
Idle	The ACSLM rejects all requests involving library operations. Only the following requests are processed: `cancel`, `idle`, `query`, `start`, and `vary`.
Idle-pending	A transition state that occurs when the Storage Server is taken from run to idle. All new requests involving library operations are rejected, but current and pending

requests are processed to completion. Only the following new requests are processed: `cancel`, `idle`, `query`, `start`, and `vary`.

Recovery A transition state that occurs when the Storage Server is taken from idle to run. The only request that will be processed is `query server`. All other requests are rejected while recovery processing takes place.

Table 4-1 identifies which requests the ACSLM processes when it is in each of the four states.

Table 4-1. Library Commands and ACSLM States

Request	Recovery	Run	Idle	Idle-Pending
`audit`		X		
`cancel`		X	X	X
`dismount`		X		
`enter`		X		
`eject`		X		
`idle`		X	X	X
`mount`		X		
`query`	X	X	X	X
`start`		X	X	X
`vary`		X	X	X

ACSLM State Transitions

The `start` and `idle` requests move the ACSLM between these states. These transitions occur as follows:

- The `start` request causes the ACSLM to go into the recovery state while it performs recovery procedures on the library (see the *Storage Server Recovery* section in this chapter for details). When all recovery procedures have been completed successfully, the ACSLM changes to the run state.
- An unqualified `idle` request (that is, without the `force` option) causes the ACSLM to go into the idle-pending state initially. The ACSLM processes all current and pending requests to completion before entering the idle state.

- An `idle` request with the `force` option puts the ACSLM in the idle state immediately, causing any current or pending requests to be aborted.

See the command descriptions in *Chapter 5: Library Operator Commands* for additional details on changing ACSLM states.

Initiation of the ACSLM puts the ACSLM in the recovery state, similar to the `start` request. See *Initiating the Storage Server Software* in this chapter for details on initiation.

DEVICE STATES

Description

Library devices include the following:

- An ACS
- An LSM
- A cartridge drive
- A port connection between the ACS and the LMU

A device can be in one of five states, as described below:

Online — The normal operating state. The device is available for library processing.

Offline — A state in which the device is logically disabled. Requests involving offline devices are rejected.

Offline-pending — A transition state that occurs when an ACS or LSM is taken from online to offline. All new requests for the device are rejected, but current and pending requests are processed to completion. This state is not valid for cartridge drives or ports.

Recovery — A transition state that occurs when an ACS or LSM is taken from offline or diagnostic to online. A recovery process is performed. New requests are rejected while the device is in this state. This state is not valid for cartridge drives or ports.

Diagnostic — A state in which the device is not available to client application requests, but is available to operator requests from the Command Processor. This state allows for diagnostic activity to be performed on the device without interference from client applications. This state is not valid for ports.

Table 4-2 identifies which states are valid for each device.

Table 4-2. Valid Device States

Device	Online	Offline	Offline-Pend.	Recovery	Diag.
ACS	x	x	x	x	x
LSM	x	x	x	x	x
Drive	x	x			x
Port	x	x			

Device State Transitions

The `vary` request moves a device between these states. The transitions occur as follows:

- A `vary online` request on a tape drive or communication port immediately places the device in the online state.
- An `vary online` request on an ACS or LSM places the device in the recovery state while it attempts to recover in-transit cartridges (see the *Cartridge Recovery* section in this chapter for details). When this recovery process has been completed successfully, the device is placed in the online state.
- A `vary offline` request with the `force` option puts the device in the offline state immediately, causing any current or pending requests for the device to be aborted.
- An unqualified `vary offline` request (that is, without the `force` option) is processed according to the type of device:
  - For an ACS or an LSM, the request causes the device to go into the offline-pending state initially. The ACSLM processes all current and pending requests for the device to completion before placing it in the offline state.
  - For a cartridge drive, the request is rejected if the drive is in use. If the drive is available, it is placed in the offline state immediately.
  - For a communication port, the request is rejected if the ACS it is connected to is online, and it is the only online port for that ACS. If the ACS is offline or if there are other ports online for that ACS, the port is placed in the offline state immediately.

- A `vary diagnostic` request places the device in the diagnostic state. The ACSLM processes all current and pending requests for the device to completion. It accepts new requests from the ACSSA, but rejects new requests from a CSI. A port cannot be varied to the diagnostic state, but all other devices can.

See the `vary` command description in *Chapter 5* for additional details on changing device states.

CARTRIDGE RECOVERY

In-Transit Cartridges

If cartridges are in the robot's hands at the time of an LSM failure, they are retained there until the LSM is readied. When the LSM is varied online, the Storage Server directs the robot to dispose of in-transit cartridges appropriately. In-transit cartridges are ones that are in the robot's hands, the Pass-Thru Ports (PTPs), or the Playground area of the LSM (located on Panel 0).

The following events may result in in-transit cartridges:

- Varying an LSM offline using the force option
- An unrecoverable error occurs in the LMU
- An unrecoverable error occurs in the LSM

Cartridge Recovery Process

If there are cartridges in the Playground cells or the Pass-Thru Ports (PTPs) and the robot's hands are empty, the robot scans the external labels of the cartridges in the Playground and the PTPs and then places the cartridges in available storage cells.

If the robot has cartridges in one or both of its hands, it attempts to place them in the Playground cells. If it is successful, it then scans the external cartridge labels and places the cartridges in available storage cells.

If the robot is unable to read external labels of cartridges in the Playground or the PTPs, or if it finds duplicates, the robot ejects the cartridges through the CAP. An unsolicited message is displayed in the Display Area of the Command Processor.

When an ACS is brought online, cartridge recovery is performed on all LSMs in the ACS automatically. The ACS will come online even if one or more of its LSMs fails to do so.

Cartridge Recovery Errors

If recovery of in-transit cartridges fails, the LSM is marked as online in the data base, but an error message is displayed in the Display Area of the Command Processor. These unrecorded in-transit cartridges may restrict the use of the robot's hands. Recovery of in-transit cartridges may fail for the following reasons:

- No available storage cells can be found for the in-transit cartridges
- A cartridge label fails to validate *and* the CAP is full or cannot accept the errant cartridges
- The robot has cartridges in both hands *and* the Playground cells are full

STORAGE SERVER RECOVERY

Overview

Storage Server recovery procedures take place automatically under the following circumstances:

- The Storage Server is initiated. See the *Initiating the Storage Server Software* section in this chapter for details on how this is done.
- A major Storage Server failure occurs

Recovery processing does *not* need to be initiated by the System Administrator.

During Storage Server recovery, the ACSLM performs the following processes for each ACS in the library:

- Verifies that all online ports can communicate with the ACS.
- Verifies that the library configuration recorded in the data base matches that recorded in the LMU.
- Varies the ACS and its LSMs online, if possible.
- Directs the LSM robot to scan the physical contents of each of the following locations, and updates the data base to match:
  - Playground
  - Pass-Thru Ports (PTPs)
  - Reserved storage cells
  - Cartridge drives
  - Last known location of each cartridge selected for use

Once these processes are completed successfully, request processing can resume.

Storage Server Recovery Process

The following are the steps the ACSLM goes through in performing Storage Server recovery. All data base changes that occur as a result of this procedure are logged in the Event Log. If the recovery fails, additional error messages detailing the reasons for the failure will also be found in the Event Log.

Note: The ACSLM will not be able to verify configuration or contents of LSMs that were in the offline or diagnostic state at the time the Storage Server failed or was terminated. This is because an offline LSM is unable to provide configuration data and the LSM robot is unable to scan storage cells and tape drives for their contents. The ACSLM will perform as much of the recovery procedure as possible and will note in the Event Log that the LSM is offline.

During recovery the ACSLM does the following:

1. Issues the following unsolicited message to the Display Area of the Command Processor:

   ```
   Server system recovery started
   ```

2. Updates all ACS records in the data base as follows:
   - ACSs in the recovery state are changed to online.
   - ACSs in the diagnostic or offline-pending states are changed to offline.
3. Attempts to communicate with the ACS, using each port that the data base indicates is online. The ACSLM must find at least one port that can successfully communicate with the library in order for recovery processing to continue.
4. Verifies that the LSM and drive configurations in the Storage Server data base match those defined in the LMU. Discrepancies will terminate Storage Server recovery and the Storage Server software. The discrepancies will be noted in the Event Log.
5. Varies online all LSMs attached to an online ACS, if possible. In-transit cartridge recovery is performed as part of this step. See the *Cartridge Recovery* section in this chapter for details.
6. Directs the LSM robot to scan the contents of all cell locations marked "reserved" in the data base. These are locations that tape cartridges were being moved either to or from at the time the system failure occurred. The ACSLM updates the data base to reflect the actual physical contents of these cells, as determined by the robot.
7. Updates the data base to reflect the true status of all library tape drives (that is, available, in use, offline).

8. Directs the LSM robot to scan the contents of all library drives that the data base indicates are in use. Updates the data base to reflect the true physical contents.
9. Directs the LSM robot to scan the contents of the last known location of each cartridge selected for use at the time of the system failure. Updates the data base with the true contents of these cells. If a cartridge is not found in its last known location it is deleted from the data base.
10. Displays either of the following unsolicited messages in the Display Area of the Command Processor, based on whether the recovery process was successful or not.

    `Server system recovery complete`
    – or –
    `Server system recovery failed`

Storage Server Recovery Errors

Recovery processing will not complete if the ACSLM encounters any of the following errors:

- Library configuration inconsistency
- Library communications failure
- IPC failure
- Process creation failure
- Data base failure

Other failures, such as failure of an LSM to go online, allow recovery to complete and the Storage Server to provide limited operations. See *Appendix A: Event Log Messages* for the messages that may be written to the Event Log.

INITIATING THE STORAGE SERVER SOFTWARE

Overview

Storage Server software initiation involves starting the ACSLM, ACSSA, and CSI components on the server system.

The Storage Server initiation command file is automatically installed as part of the Storage Server installation (see *Chapter 3: Installing the Storage Server*). The command file is called

acsss_home/`rc.acsss`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

Invoking Initiation

The command file can be invoked in two ways:

- *Manually* by invoking the command file at the server system console.
- *Automatically at system IPL* by referencing the initiation command file in the system startup file. See the *Configuring the Software* section in *Chapter 3* for instructions on how to do this.

Storage server initiation can only be invoked by the Storage Server user ID, `acsss`, or the server system superuser.

Normally, the ACSLM automatically enters the run state after initiation is complete. To automatically put the ACSLM in the idle state after initiation, the `IDLE` qualifier can be included in the invocation command. If initiation is invoked manually, the `IDLE` qualifier must be typed as part of the request:

```
/usr/ACSSS/rc.acsss IDLE
```

If initiation is invoked as part of system IPL, the *acsss_home*/`rc.acsss` file must be modified to include the `IDLE` qualifier.

Initiation Process

During initiation, the ACSLM performs the following functions:

- Ensures that only one copy of the Storage Server software is running at any given time.
- Establishes the Storage Server infrastructure. The CSI establishes communication paths with the NI and the ACSLM, and the ACSSA establishes communication paths with the ACSLM. Any failures in this process will halt initiation.
- Confirms the integrity of the data base. This includes examining the table structures and contents for consistency. It also includes checking for correct data base file access permissions and the existence and state of journal files. Any structural or access problems with the data base will halt initiation.
- Verifies the library configuration recorded in the LMU against that recorded in the data base. Inconsistencies will halt initiation.
- Performs ACSLM recovery procedures to bring the Storage Server to an operable state. This includes attempting to recover from CPU or operating system failures. See the *Storage Server Recovery* section in this chapter for details on Storage Server recovery.

- Attempts to put all library components online. Failure of a library component to go online is noted in the Event Log and initiation continues. If the data base indicates that a library component is offline, no attempt is made to put that component online.

Error messages will be generated for any LMU requests outstanding at the time of initiation.

Initiation Errors

The Event Log records the start and completion of initiation, as well as any significant events that occur during initiation. See *Appendix A: Event Log Messages* for the messages that may be written to the Event Log.

The following are messages that may be displayed at the server system console during initiation. The messages are listed in alphabetical order.

- This message indicates that initiation was attempted while the Storage Server was already running on the server system; the new initiation fails. Only one copy of the Storage Server can be running on the server system at one time.

  ```
  ACSLM already running
  ```

- This entry indicates that the ACSLM is unable to allocate space for its internal data structures. Initiation is stopped.

  ```
  Unable to allocate data structures
  ```

- This message indicates that the ACSLM is unable to create all necessary software processes. Initiation is stopped and all created processes are destroyed.

  ```
  Unable to create all ACSLM processes
  ```

TERMINATING THE STORAGE SERVER SOFTWARE

Overview

Storage Server software termination involves terminating the ACSLM, ACSSA and CSI components on the server system. The Storage Server is terminated through a command file which must be invoked manually through the Command Processor.

The Storage Server termination command file is automatically installed as part of the Storage Server installation (see *Chapter 3: Installing the Storage Server*). The command file is called

acsss_home/`kill.acsss`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

Invoking Termination

The command file can only be invoked manually at the server system console. Before termination is invoked, an `idle` request should be issued to place the Storage Server in a quiescent state.

Storage Server termination can only be invoked by the Storage Server user ID, `acsss`, or the server system superuser.

Termination Process

Storage Server termination performs the following functions:

- All current and pending library requests are aborted. New requests are ignored.
- All data base files and the Event Log file are closed.
- All Storage Server processes are destroyed.

The ACSLM should be in the idle state when the Storage Server is terminated, otherwise data base inconsistencies and unrecoverable in-transit cartridges may result.

It is also recommended that all LSMs be in the online state when the Storage Server is terminated; this will enable LSM and drive configurations and reserved cell contents to be verified completely when the Storage Server is reinitiated. See the *Storage Server Recovery* section in this chapter for details.

Termination Errors

The Event Log records the start of termination. If an error occurs during termination, the error is recorded in the Event Log and termination continues.

OPERATING AN LMU

The LMU responds to library requests from the Storage Server, and passes the request to the appropriate LSM, which performs the actual request.

Power On An LMU

To power on an LMU:

1. Press the DC power switch (labeled "1/0") on the LMU control panel.
2. The indicator light in the switch should illuminate. If it does not, call a StorageTek CSE to restore power.

Load The Functional Diskette – LMU

If there is a functional diskette in the floppy drive when the LMU is powered on, the program on the diskette is loaded into memory.

If the functional diskette is not in the floppy drive, see the *Inserting Functional Diskette Into Floppy Drive* section in this chapter.

Power Off An LMU

To power off an LMU:

1. Vary all ports to this ACS offline.
2. Press the DC power switch (labeled "1/0") on the LMU control panel. The indicator light in the switch will darken.

Power Off LMU – Emergency

To power off the LMU in an emergency, press the "EPO" switch on the LMU control panel. Call a StorageTek CSE to restore power to an LMU that has been powered down by the "EPO" switch.

OPERATING AN LCU

There is a communication link from the LMU to the LCU through the LAN cables. The LCU provides power to the LSM and interprets message commands to the LSM from the LMU.

Power On An LCU/LSM

To power on an LCU/LSM

1. Press the DC power switch (labeled "1/0") on the LCU control panel.
2. The indicator in the switch should illuminate. If it does not, call a StorageTek CSE to restore power.

Load The Functional Diskette – LCU/LSM

When the LMU is powering up, if there is a functional diskette in the LMU floppy drive and the LMU is communicating with the LSM, the LCU code is downloaded from the LMU. Code download and LCU/LSM initialization takes 10 to 15 minutes.

Power Off An LCU/LSM

To power off an LCU/LSM,

1. Vary the LSM offline (see *Chapter 5: Library Operator Commands* for details on the `vary` command).
2. Press the DC power switch (labeled "1/0") on the LCU control panel. The indicator in the switch darkens.

Power Off LCU/LSM – Emergency

To power off the LCU/LSM in an emergency, press the "EPO" switch on the LCU control panel. Call a StorageTek CSE to restore power to an LCU/LSM that has been powered down by the "EPO" switch. There is also an "EPO" switch inside the LSM. It is a large red button on the panel inside the LSM access door. Pushing this switch removes all power to the robot in the LSM and to the LCU; power to the emergency lighting and fire alarm systems remains, however.

OPERATING A CU

The following paragraphs describe how to operate the control unit and cartridge drives.

Power On CU and CD

1. Move the "OFFLINE" switch on the CU control panel upward.
2. Move all "CHANNEL STATUS" switches on the CU control panel to DISABLE.
3. Move the "POWER" switch on the CU control panel to "ON".

Note: If there is a functional diskette in floppy drive number one, the control unit will IPL itself and load the program on the functional diskette into its memory.

If there is no functional diskette in floppy drive number one, perform the steps in *Inserting Functional Diskette Into Floppy Drive.*

4. Wait for the IPL process to end (the "IPL" indicator will darken).
5. Move the "OFFLINE" switch on the CU control panel downward. The "OFFLINE" indicator will darken and the "ONLINE" indicator should illuminate.
6. Move appropriate "CHANNEL STATUS" switches on the CU control panel to "ENABLE".
7. Use the `vary` command to vary the transports online.

Load the Functional Diskette After Turning On the CU

If there is a functional diskette in floppy drive number one when the subsystem is powering up, during the procedure described in the previous paragraph, the program on the functional diskette is automatically loaded into the CU storage. If not, IPL the CU as described in *Load a Functional Diskette (IPL)* later in this chapter.

Power Off CU and CD

1. Vary all subsystem transports offline:
   - 1.1 Perform a `query drive` to determine whether there are cartridges mounted.
   - 1.2 If there are cartridges mounted, issue a `dismount force` for each one, to unload and dismount them.
   - 1.3 Issue a `vary offline` for each drive.
2. Move the "OFFLINE" switch on the CU control panel to "OFFLINE". The "OFFLINE" indicator should illuminate and the "ONLINE" indicator should darken.

3. Move all "CHANNEL STATUS" switches on the CU control panel to "DISABLE".
4. Turn off the CU by moving the "POWER" switch on the CU control panel to "OFF".

Power Off CU and CD – Emergency

The CU controls power to the CD. Press the "EPO" switch (the one labeled "EMERGENCY/PUSH") located on the front cover of the control unit to Power Off the CU and CD together.

Call a StorageTek CSE to restore power to a CU and CD that is powered down by the "EPO" switch.

Load a Functional Diskette (IPL)

If a functional diskette is in the floppy drive when a CU, LCU, or LMU is powered up, the program on the diskette is loaded into memory.

If a functional diskette is not in the floppy drive:

1. Insert the diskette. (See the following section.)
2. Press the "IPL" switch on the LMU CSE control panel, the LCU CSE control panel, or the CU control panel, whichever is appropriate.

Note: While the CU is loading from the functional diskette, the indicator in the "IPL" switch remains illuminated and the 4-digit display shows different alphanumeric characters. When the loading process is complete, the "IPL" indicator darkens and the 4-digit display becomes blank.

If the loading is unsuccessful, the "IPL" indicator remains illuminated, and the 4-digit display shows a hexadecimal error code.

Inserting Functional Diskette Into Floppy Drive

To insert a functional diskette into a floppy drive,

1. Make sure the lever at the entry slot of the floppy drive is rotated as far counterclockwise as it will go.
2. Insert the diskette into the floppy drive, as shown in Figure 4-1.

> **Caution**
>
> In the following step, do not push against the diskette if there is any resistance. Damage may occur to either the diskette, the floppy drive, or both.

3. Push the diskette in until it is completely in the floppy drive.
4. Rotate the lever one-quarter turn clockwise.

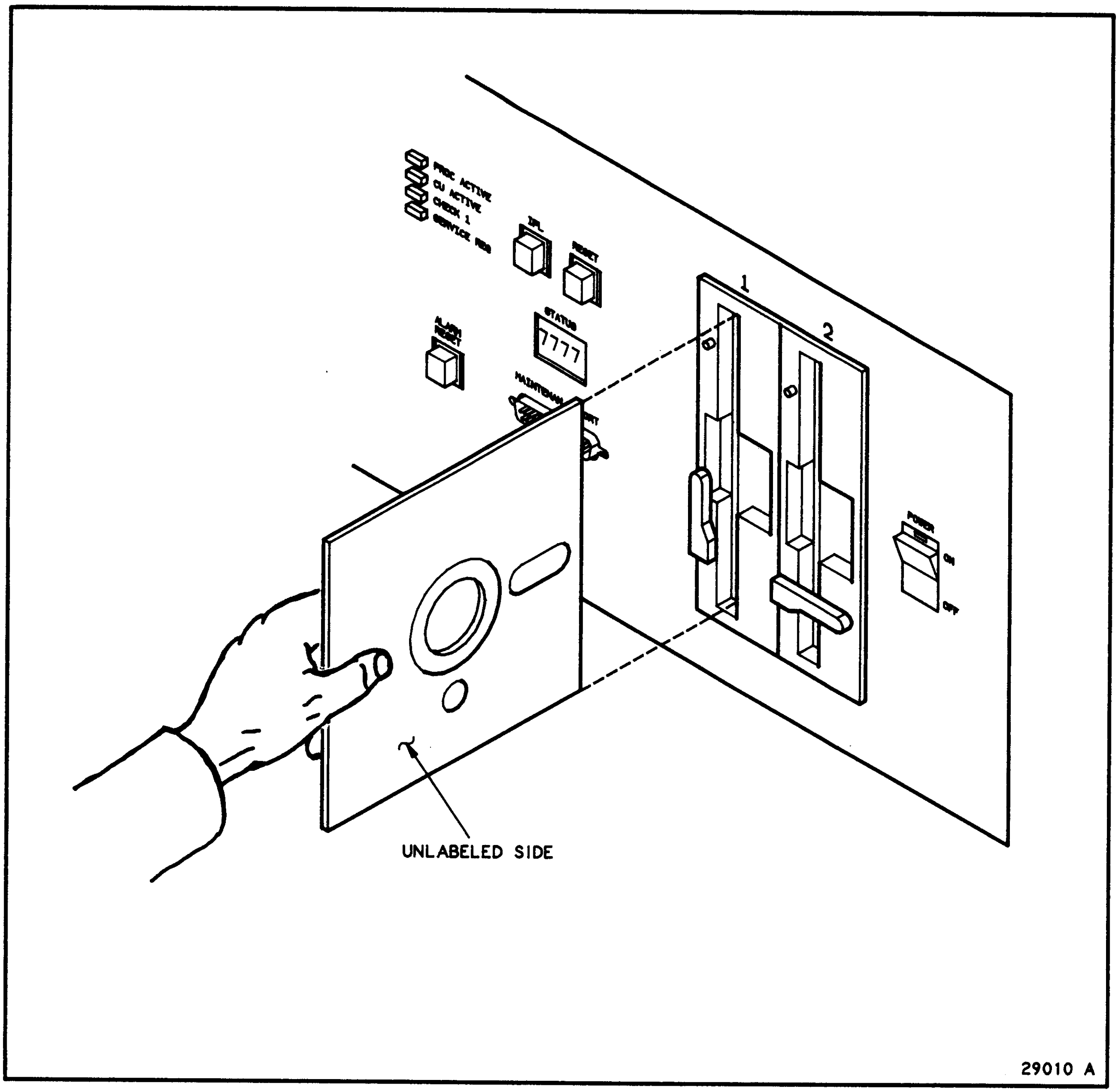

Figure 4-1. Insert Functional Diskette Into Floppy Drive

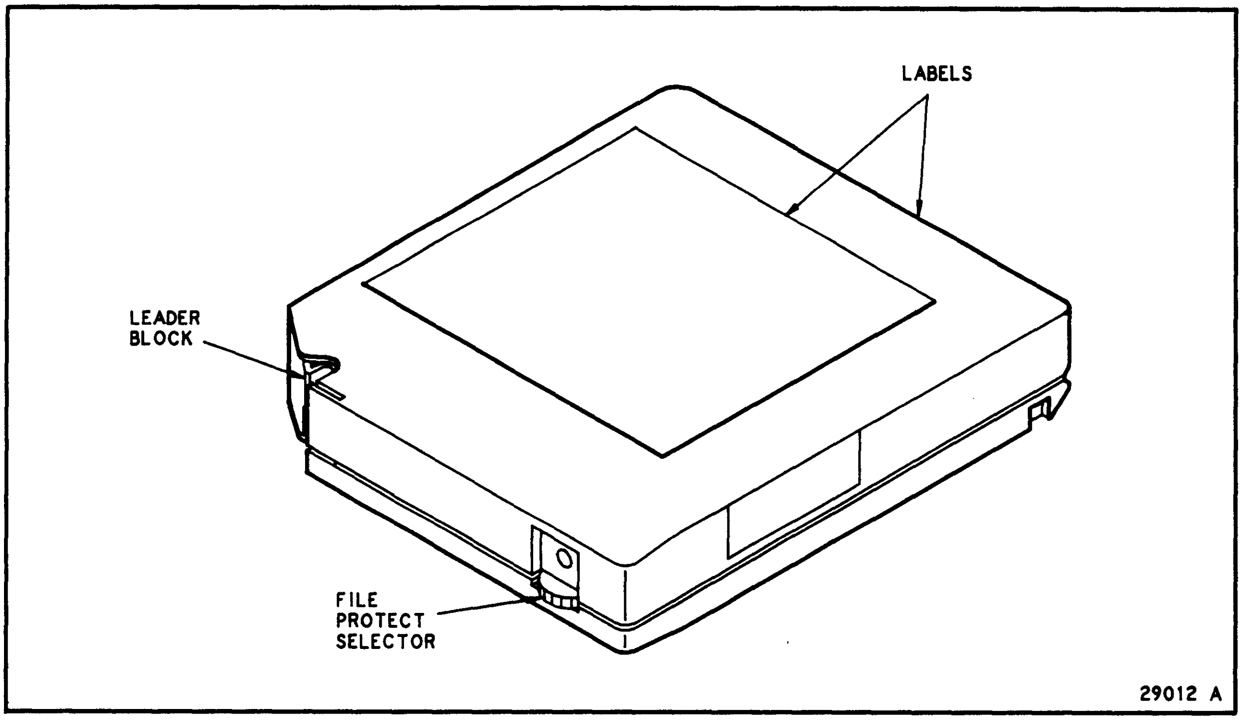

Figure 4-2. Tape Cartridge

USING TAPE CARTRIDGES

The following paragraphs explain how to prepare a cartridge for use in an ACS.

Inspecting a Cartridge

Since a defective or dirty cartridge can damage a tape transport, always inspect a cartridge before inserting it into a CAP or LSM storage cell. When inspecting, look for the following problems (see Figure 4-2 for the location of the cartridge parts mentioned in the following items):

- Cracked or broken cartridge
- Broken leader block
- Broken leader block latch
- Damaged file protect selector
- Liquid in the cartridge
- Any other obvious damage

Handling a Cartridge

Careless handling can damage a cartridge, data, or transport. Always observe the following rules:

- Do not carry several cartridges loosely in a container, because leader blocks can catch on other cartridges and become unlatched.
- Make sure the leader block is latched before you pick up a cartridge.
- Keep cartridges clean.
- Inspect a cartridge before each use, and never put a damaged cartridge into a transport.
- Never release a leader block and pull tape from a cartridge.
- Never open a cartridge.
- Do not handle tape that is outside the cartridge because the tape edge may become damaged.
- Do not expose the tape or cartridge to direct sunlight or to moisture.
- Do not expose a recorded cartridge to magnetic fields. This may destroy data on the tape.
- Store and ship cartridges in an upright position (resting on the edges, not on the flat sides).

Cartridge Labels

There are two kinds of cartridge labels:

- An OCR/Bar Code label (it contains a volume serial number).
- A customer label.

The OCR/Bar Code label goes on the side opposite the file protect selector. Place the customer label on the top surface of the cartridge (see Figure 4-3).

Note: These are the only areas of the cartridge where a label may be applied. Ensure that labels are not affixed elsewhere on the cartridge surface.

Applying the OCR/Bar Code Label

External labels must be correctly positioned on the cartridge and they must be printed clearly; the bar coding should not be obscured by dirt or marks. Labels that are unreadable or difficult to read will result in a degradation of library performance because the LSM robot will have to take extra time to adjust its vision system and re-read the labels.

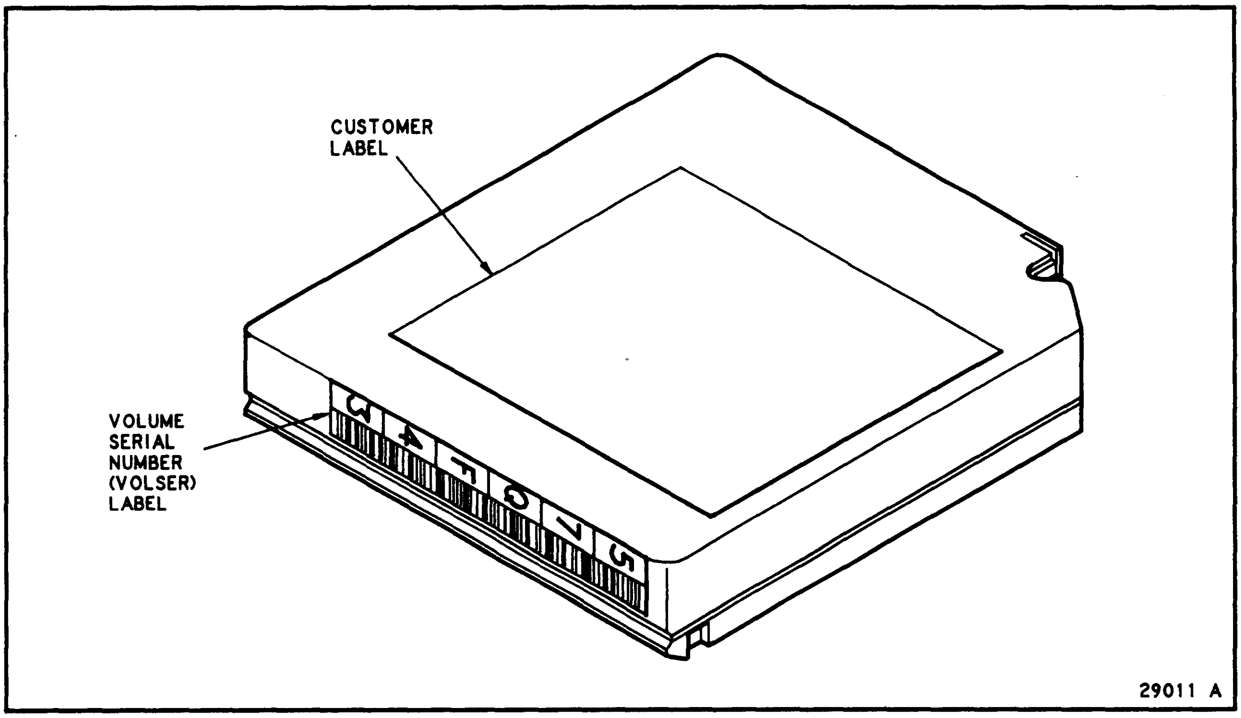

Figure 4-3. Cartridge Labels

To place an OCR/Bar Code label on the cartridge, see Figure 4-4 and

1. Hold the cartridge so that the customer label is on the left and the leader block is pointing up and away from you. The recessed area on the cartridge surface is where the label must be positioned.
2. Clean the surface where the label will be placed, using a cleaning solution made for this purpose.
3. Peel the backing from the label.
4. Center the label, adhesive side toward the cartridge surface, on the back of the cartridge opposite the file protect selector, as shown in Figure 4-4.
5. Make sure the label is within the indented area on the back of the cartridge, and that the edges of the label are parallel to the edges of the cartridge.
6. The label should be close to the inside edge of the indented area, but it should *never* overlap the edge of this area.
7. The edges of the label must not curl up — this will cause the cartridge to stick in the transport loader.

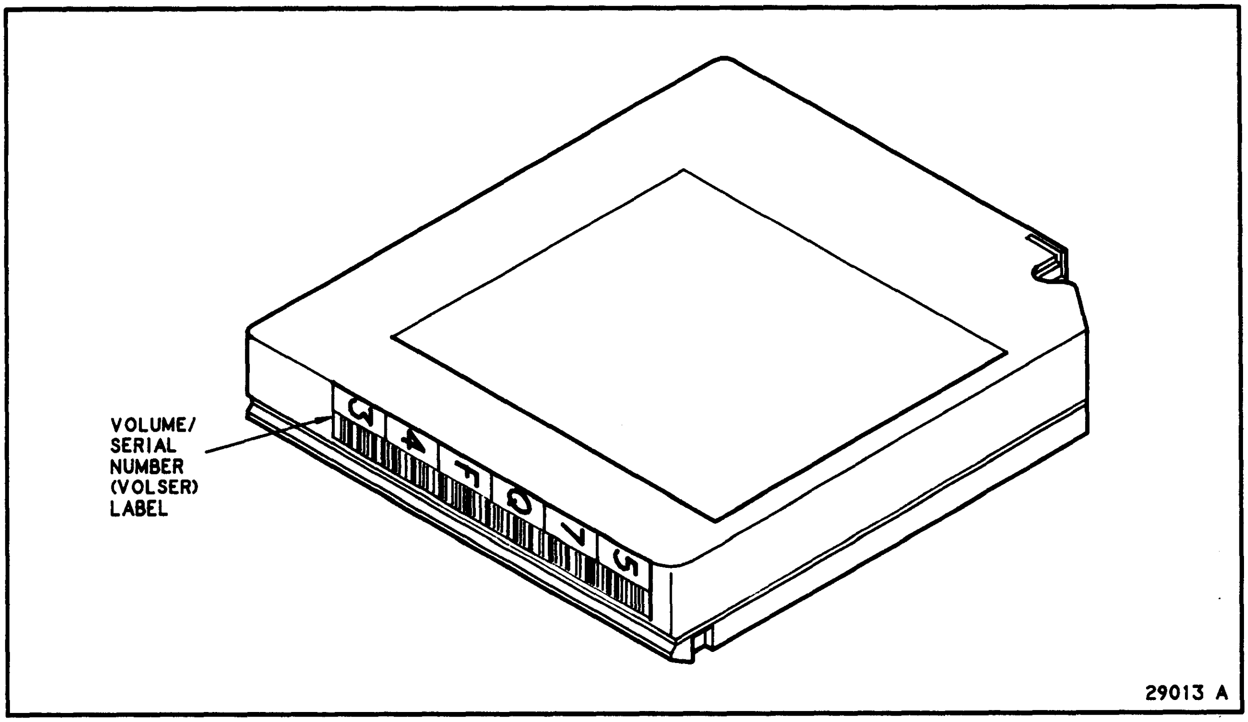

Figure 4-4. OCR/Bar Code Label Placement

Applying the Customer Label

1. Clean the surface where the label will be placed, using a cleaning solution made for this purpose.
2. Peel the backing from the label.
3. Center the label, adhesive side toward the cartridge surface, on the top of the cartridge .
4. Make sure the label is within the indented area on the top of the cartridge, and that the edges of the label are parallel to the edges of the cartridge.
5. The label should *never* overlap the edge of this area.
6. The edges of the label must not curl up — this will cause the cartridge to stick in the transport loader.

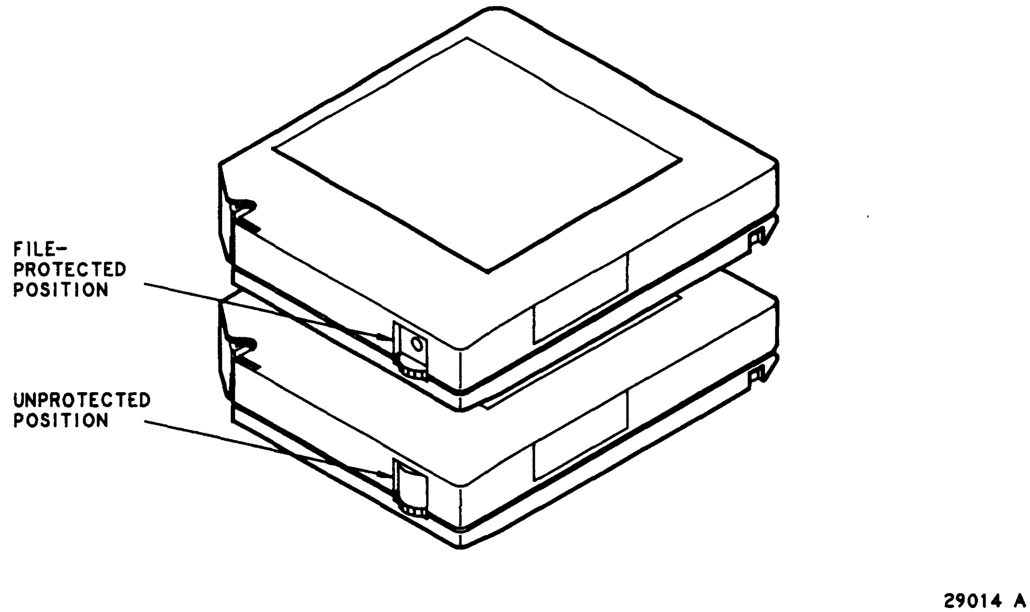

Figure 4-5. File Protect Switch

Setting the File Protect Selector

Setting to Read Only

To set the file protect selector on a tape cartridge to file protect, so that nothing can be written on it, turn the wheel on the side of the cartridge until a white dot in a dark background appears, as in Figure 4-5. In this mode, the transport can only read data from the tape and cannot write data.

Setting To Read/Write

To reset the file protect switch so that the cartridge can be written on, turn the wheel on the side of the cartridge until the white dot above the wheel disappears, as shown in Figure 4-5. In this mode, the transport can write as well as read data.

Storing Cartridges

- Do not take a cartridge out of its protective wrapping until it is used. Use the tear string, not a sharp instrument, to remove the wrapping.
- Store cartridges in a dirt free environment that duplicates the conditions of the room in which they are used.
- Before using a cartridge, ensure it has been in its operating environment for at least 24 hours.
- Store a cartridge on its edge.

Repairing a Detached Leader Block

Whenever a tape is damaged, you should use a backup tape. However, if a leader block is detached, you have no backup, and there is no obvious damage to the cartridge or tape, you may repair the cartridge and use it one time to make a copy. Your supplier should have a kit for this purpose.

Exterior Cleaning

Caution

Certain solvents should not be used for removing labels because they may damage the cartridges. Do *not* use 3M Adhesive Cleaner, acetone, trichloroethave, toluene, or similar products to remove labels.

Do use Hub and Transport Cleaner Fluid or Tape Transport Cleaner Fluid (available through StorageTek).

Wipe all dust, dirt, and moisture from the cartridge with a lint free cloth to which a small amount of cleaning solution has been applied. Use only cleaning solutions made specifically for cleaning cartridges. Do not let any solution touch the tape.

USING THE CARTRIDGE ACCESS PORT (CAP)

Entering Cartridges Through the CAP

1. Type an `enter` *cap_id* command. The following should occur:
   - When the CAP door is unlocked, a message in the Display Area indicates that you can open the CAP.
   - The "CAP ENTER" indicator on the CAP panel illuminates.
   - The "CAP LOCKED" indicator on the CAP panel darkens.
   - The CAP door unlocks.
2. Open the CAP door by depressing the CAP latch (see Figure 4-6).

> **WARNING**
>
> Do not remove the protective plates that separate the CAP from the inside of the LSM.

3. Place the cartridge into storage cells in the CAP (see Figure 4-7). Insert the cartridges in the cell so that the OCR/Bar Code faces outward. The leader block and file protect switch are facing inward and the customer label is on the left.

> **Caution**
>
> Do not skip any cells on a given row. Failure to follow this rule will result in subsequent cartridges not being entered in the LSM.

   Fill the CAP starting with the top left-most cell. Fill each row from left to right, and fill each row completely before starting with the next row. If you have more than 21 cartridges to enter, you will have to use more than one `enter` command; each `enter` must be processed to completion before the next one can be started.

4. Close the CAP door. The "CAP LOCKED" indicator on the CAP panel illuminates, indicating that the door is locked.
5. To discontinue this operation:

   5.1 If cartridges are left in the CAP, remove them.

   5.2 If the CAP is open, close the CAP door. The CAP door will lock. At this time, the "CAP LOCKED" indicator will illuminate and the "CAP ENTER" indicator will darken.

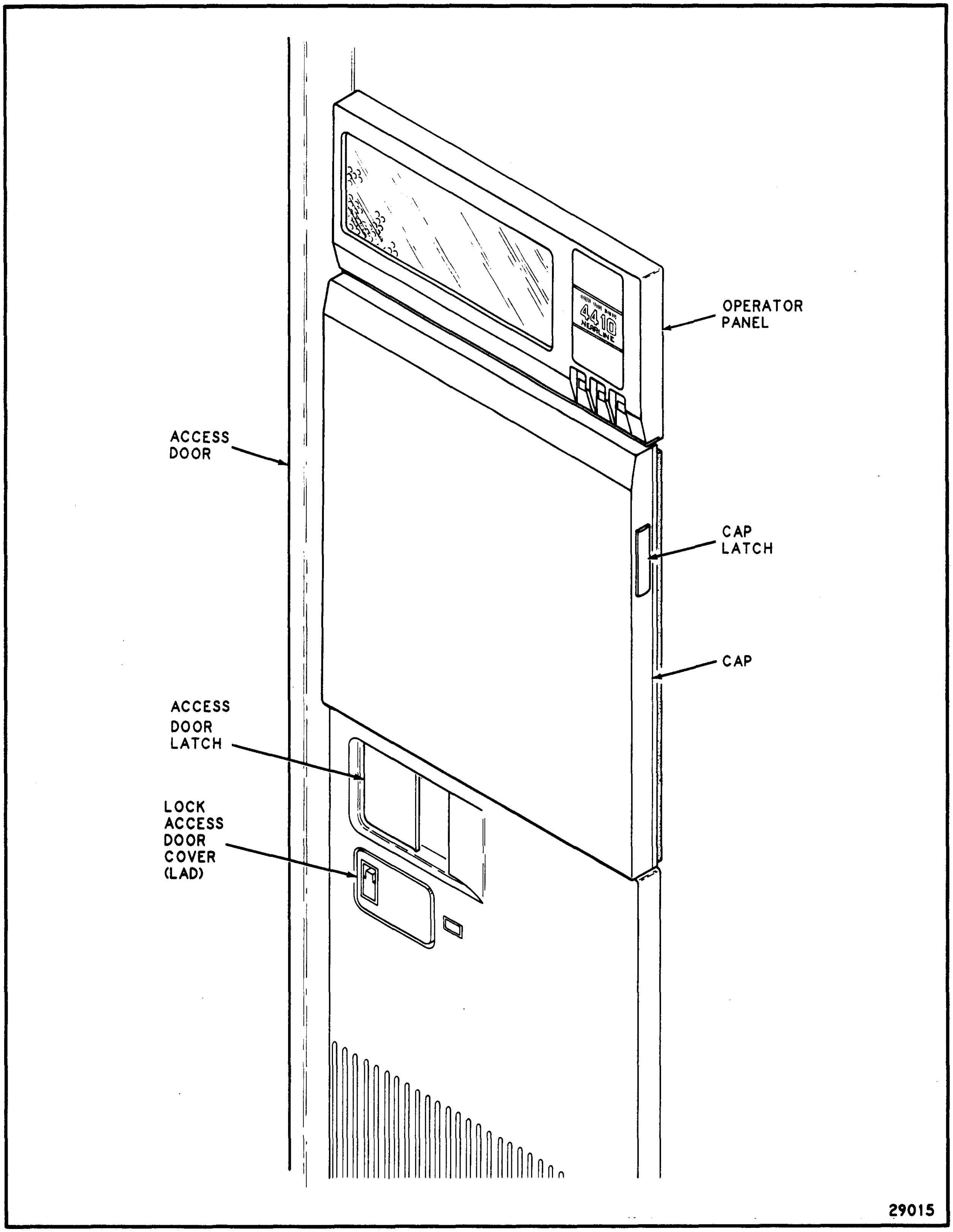

Figure 4-6. Cartridge Access Port — Closed

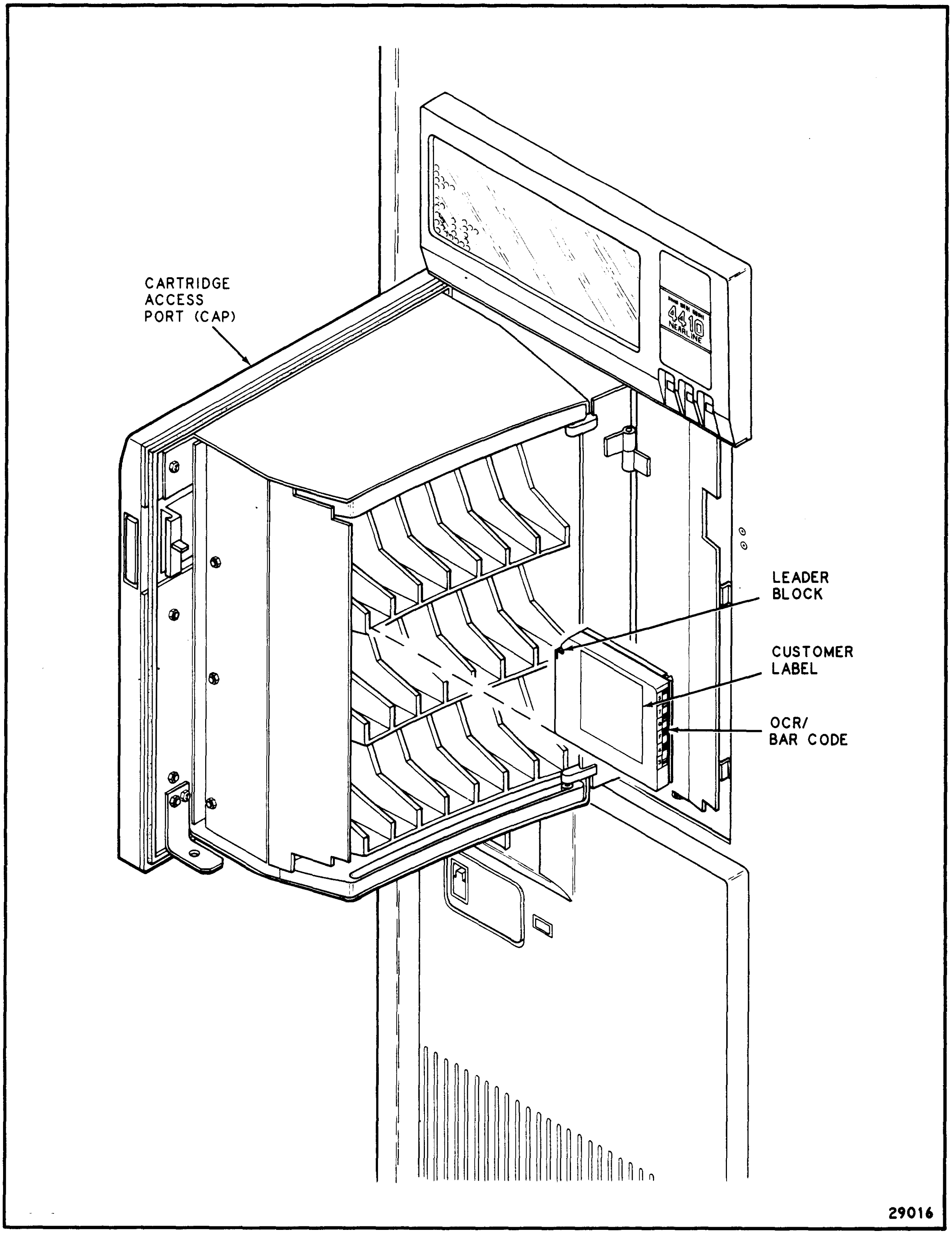

Figure 4-7. Cartridge Access Port — Opened

Ejecting Cartridges Through The CAP

To eject cartridges with the `enter` command:

1. Use the `eject` operator command to eject specified cartridges from the LSM. After entering the `eject` command, wait for the "CAP EJECT" indicator on the CAP panel to illuminate and the "CAP LOCKED" indicator to darken. This indicates that the robot has placed all the selected cartridges into the CAP or the CAP is full. The CAP door can now be opened.
2. Open the CAP door and *remove all cartridges*. It is important that no cartridges be left in the CAP, as this will interfere with subsequent CAP operations.
3. Close the CAP door.

To unload cartridges ejected by the `audit` command:

1. After the robot has finished scanning all storage cells specified for the `audit`, it will automatically eject cartridges with duplicate or unreadable labels. When all selected cartridges have been placed in the CAP, the "CAP EJECT" indicator on the CAP panel will illuminate and the "CAP LOCKED" indicator will darken.
2. Open the CAP door and *remove all cartridges*. It is important that no cartridges be left in the CAP, as this will interfere with subsequent CAP operations.
3. Close the CAP door.
4. If there are additional cartridges to be ejected, wait until the CAP door is unlocked, and repeat Step2 and Step 3.

Terminating CAP Processing

Use the `cancel` command to cancel `enter`, `eject`, and `audit` commands at any point in the process.

- For an `enter`, you will be required to remove from the CAP all cartridges that have not yet been placed in storage cells. Cartridges already placed in storage cells will remain in the LSM under library control.
- For an `eject` and an `audit`, you will be required to remove from the CAP all cartridges that have already been taken from their storage cells and placed in the CAP; these cartridges will no longer be under library control.

See the `cancel` command description in *Chapter 5: Library Operator Commands* for details.

ENTERING THE LSM

> **WARNING**
>
> Do not enter the LSM until you are thoroughly familiar with this procedure.

There are three types of primary safety devices to protect you before you enter an LSM: software interrupts, power removal switches, and disconnecting and shorting of motors.

Before you enter the LSM, see Figure 4-8 and familiarize yourself with the access door and its components.

When you begin the procedure to enter the LSM, the LED warning sign on the face of the access door, next to the lock access door (LAD), displays the words "DO NOT OPEN." Do the following:

1. Vary the LSM offline using the **`vary lsm`** ***lsm_id*** **`offline`** command. The "DO NOT OPEN" warning display darkens and the robot stops. This finishes all outstanding library requests.
2. Wait for the message,

   `Vary: lsm` *lsm_id* `varied offline.`

   If the LSM does not come offline, enter (through a different Command Processor)

   `query lsm` *lsm_id*`.`

   If the number displayed in the `C/P` column is greater than `0`, there are still outstanding requests to be processed or an outstanding reply.
3. Open the lock access door (LAD) and expose the key lock, see Figure 4-9. Opening the LAD activates a switch which automatically causes a software interrupt and stops the robot.
4. Insert the key and unlock the access door.

> **WARNING**
>
> Do not attempt to override any of the electrical or mechanical safety devices in this machine.

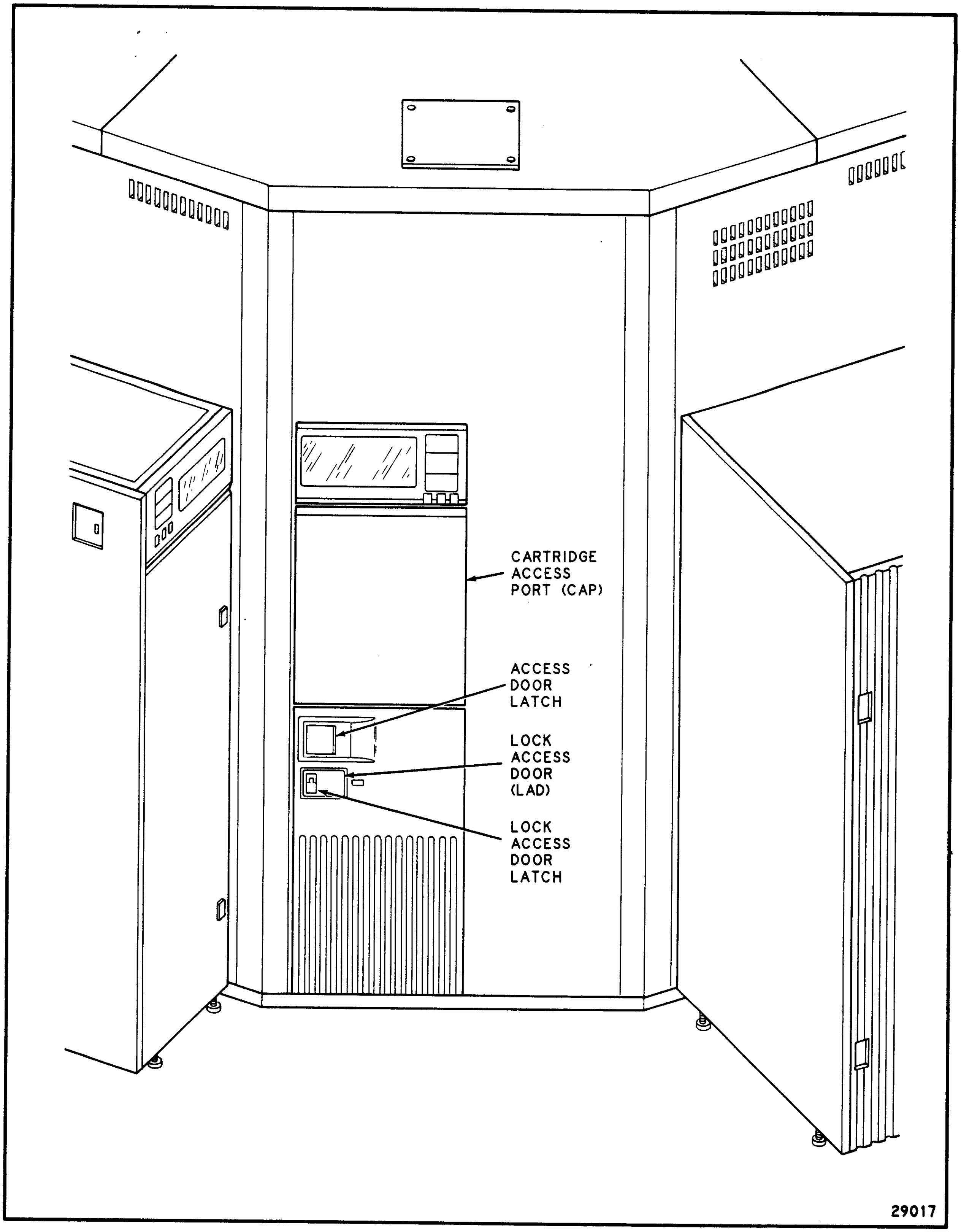

Figure 4-8. LSM Access Door — External View

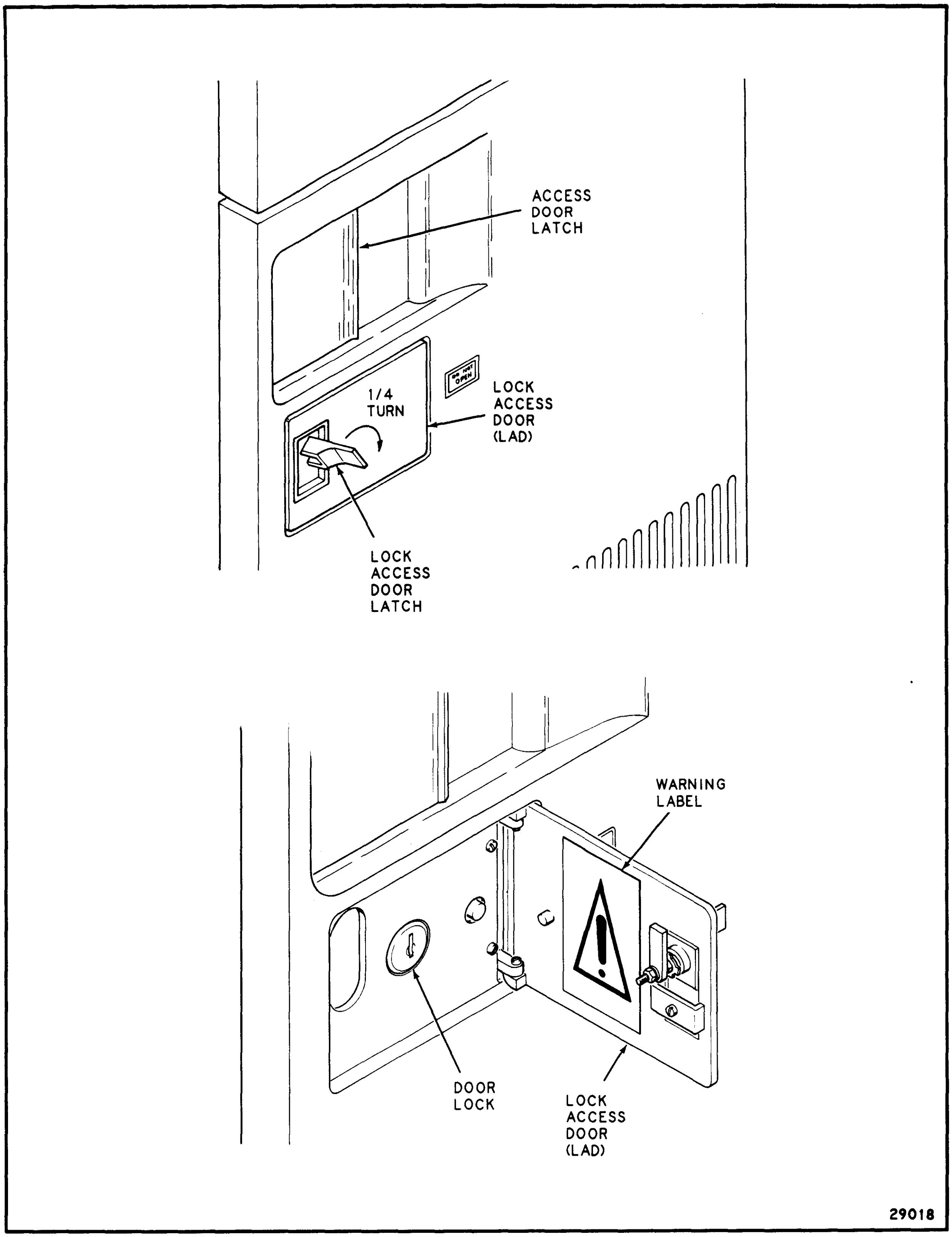

Figure 4-9. LSM Access Door Latch And Door Lock Cover

Pull the paddle handle to activate the opening mechanism. The access door will open. At this time, several things happen:

- The Door-Seated (ajar) switch is activated by the locking pins.
- After 2 °of door rotation, power to the robot is removed.
- Two serial interlock switches in the circuit that powers the robot's rotation are deactivated. The robot's rotation is the only motion that presents real danger. Deactivating either of these switches is sufficient to remove rotational power. One switch cannot be accessed by tool or hand and overridden; the other can be overridden only by force. Deactivating these switches shorts together all motors and disconnects them from their amplifiers.
- The Door-Has-Been-Opened (HBO) switch is activated, causing an interrupt to software.
- The Safety Sign switch activates the "DO NOT ENTER" sign inside the library (see Figure 4-10).

5. Return the key lock to the "LOCKED" position. Remove the key and close the LAD. This causes the sign inside the LSM to display "SAFE TO ENTER", jams the locking pins outward to prevent anyone's closing the door, and activates safety switches. Also, you have the key in your hand so that no one else can close the door.

> **WARNING**
>
> Do not enter the LSM without informing someone in the immediate area.

6. Put the key in your pocket and enter the LSM.

In the unlikely event that someone becomes locked inside and the system begins to initialize, lights flash for 30 seconds, providing enough time and light to find the door and open it using the interior latch, or by pushing the Emergency Power Off ("EPO") switch located next to the interior latch. Either of these actions stops any further power up.

Note: The inside door latch always allows someone to exit, regardless of the positions of the exterior key.

In addition, when the robot becomes powered, it slowly sweeps the corridor in search of any obstruction (tool box, oscilloscope, etc.). Stopping the robot, even momentarily, shuts it down.

There are, therefore, three types of primary safety systems: 1) software interrupts (LAD open, door seat, and HBO), 2) two power removal switches (door frame and door hinge), and 3) motors disconnected and shorted.

There have to be four simultaneous failures or deliberate jumperings of multiple interlock switches to cause any personal danger. If all of the above occur, the interior lights flash before the robot moves, and the EPO switch and internal latch provide an additional measure of safety.

WARNING

Do not attempt to override any of the electrical or mechanical safety devices in this machine.

WARNING

Never shut the LSM door without first making sure the LSM is unoccupied. Inspect the interior of the LSM visually, and then ask in a loud voice if anyone is inside.

Note: You may make as many LSM keys as you wish. Record the key number and store it in a safe place. Order copies from Illinois Lock Co. An experienced locksmith can open the lock.

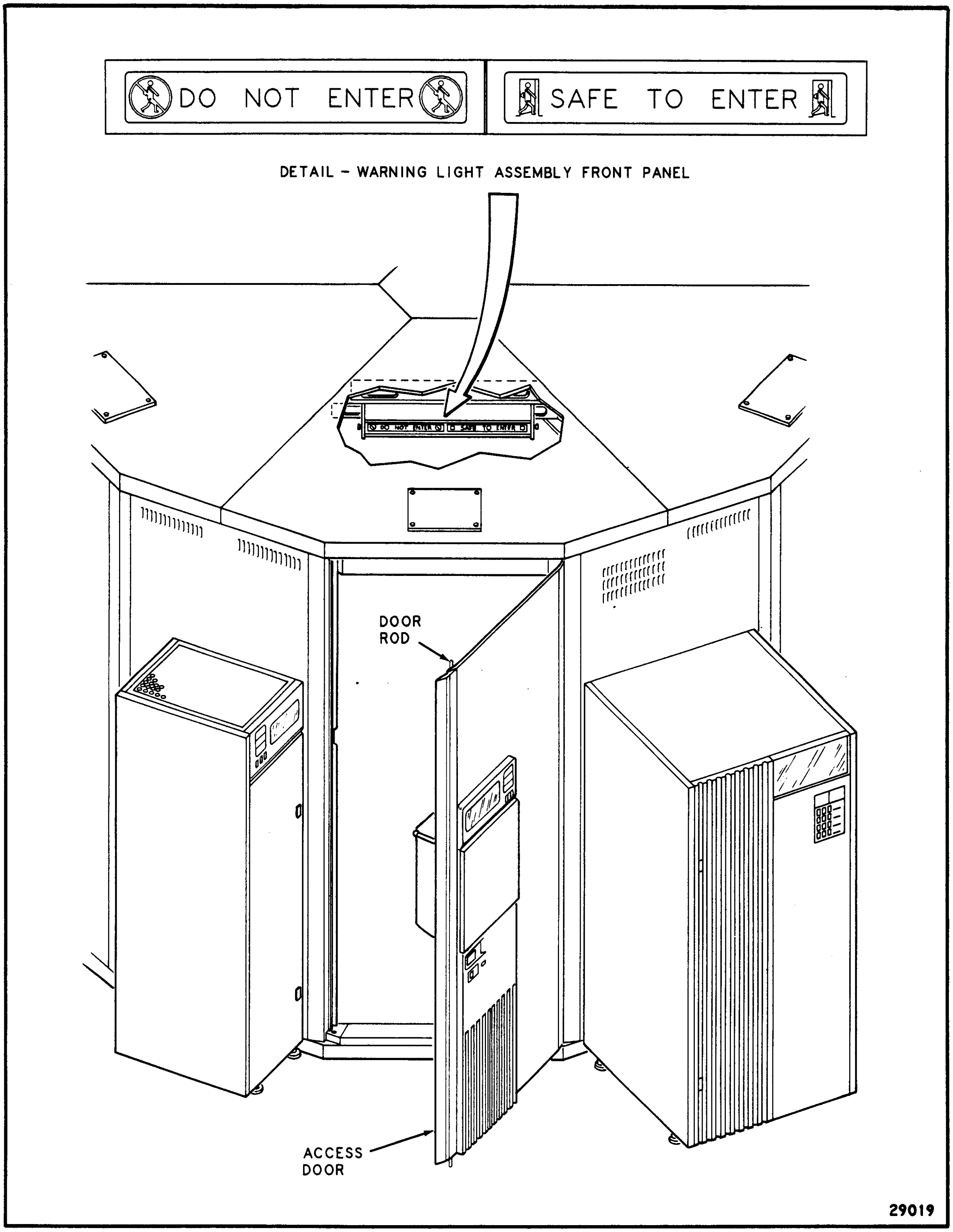

Figure 4-10. LSM Access Door — Internal View

Moving the Robot

WARNING
Do not enter the LSM without following the procedure in *Entering the LSM*. Do not enter the LSM or move any of its robotic mechanisms if you have any reason to suspect they are enabled.

Caution
Do not touch any shiny polished surfaces. Body oils can destroy the lubrication on these surfaces. Do not touch any lubricated parts. Push or pull the robotic carriage only as shown in Figures 4-11 thru 4-12.

1. If vertical movement of the robot is necessary:
   - *Gently* pull down or push up by placing your hand under the Z Arm as shown in Figure 4-11.
   - Make sure your hand is placed at a point where none of the electrical components are exposed. Use extreme caution.
2. If lateral movement of the robot is necessary:
   - *Gently* push or pull by placing your hand above the calibration fixture as shown in Figure 4-12.
   - Make sure your hand is placed at the point where the theta arm joins the Z channel as shown in Figure 4-12.
   - Be very careful! If you meet resistance when pushing or pulling the robot, *do not force the robot*; the arm has probably encountered a stopping mechanism. Move the robot in the opposite direction.
   - If the robot has stopped directly across (180 degrees) from the access door, pull the robot from the left side of the LSM (counterclockwise) and do not pass the access door. See Figure 4-13.
   - If the robot has stopped on the left side of the LSM and less than 180 degrees from the access door, pull the robot from the left side of the LSM (counterclockwise) and do not pass the access door. See Figure 4-14.

- If the robot has stopped on the right side of the LSM and less than 180 degrees from the access door, pull the robot from the right side of the LSM (clockwise) and do not pass the access door. See Figure 4-15.

> **Caution**
>
> If the robot is pushed 240 ° (measured from the access door), an EPO switch in the LCU is engaged and the CSE must be called to reset the LCU/LSM.

- The robot contains a braking assembly which prevents continuous rotation. The allowable range is roughly 240°.
- It is not necessary to leave the robot arms in any particular position when you leave the LSM, except that if you leave it more than 240 ° (measured from the access door), the LSM will not power up.

> **WARNING**
>
> Before you close the door, make certain that nobody is inside. Look and us ask in a loud voice. Make certain no extraneous material—manuals, eyeglasses, etc.—are left inside.

Locating a Cartridge in the LSM

Figure 4-16 illustrates how LSM panels, rows, and columns are numbered. In addition, the special-purpose cartridge cells are identified. See these figures before manually placing a cartridge in a storage cell to avoid entering the cartridge into an unauthorized location.

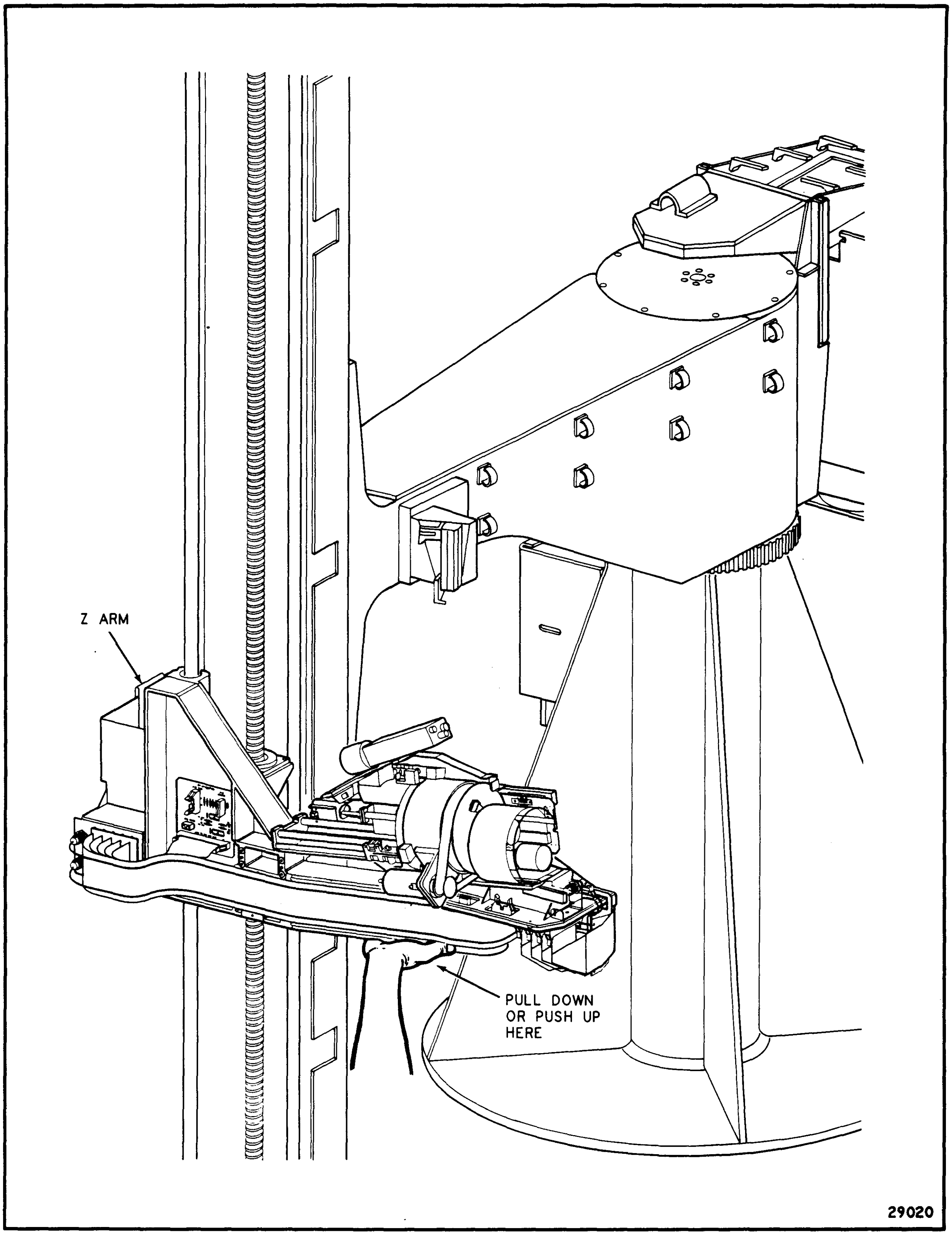

Figure 4-11. Moving The Robot — Vertically

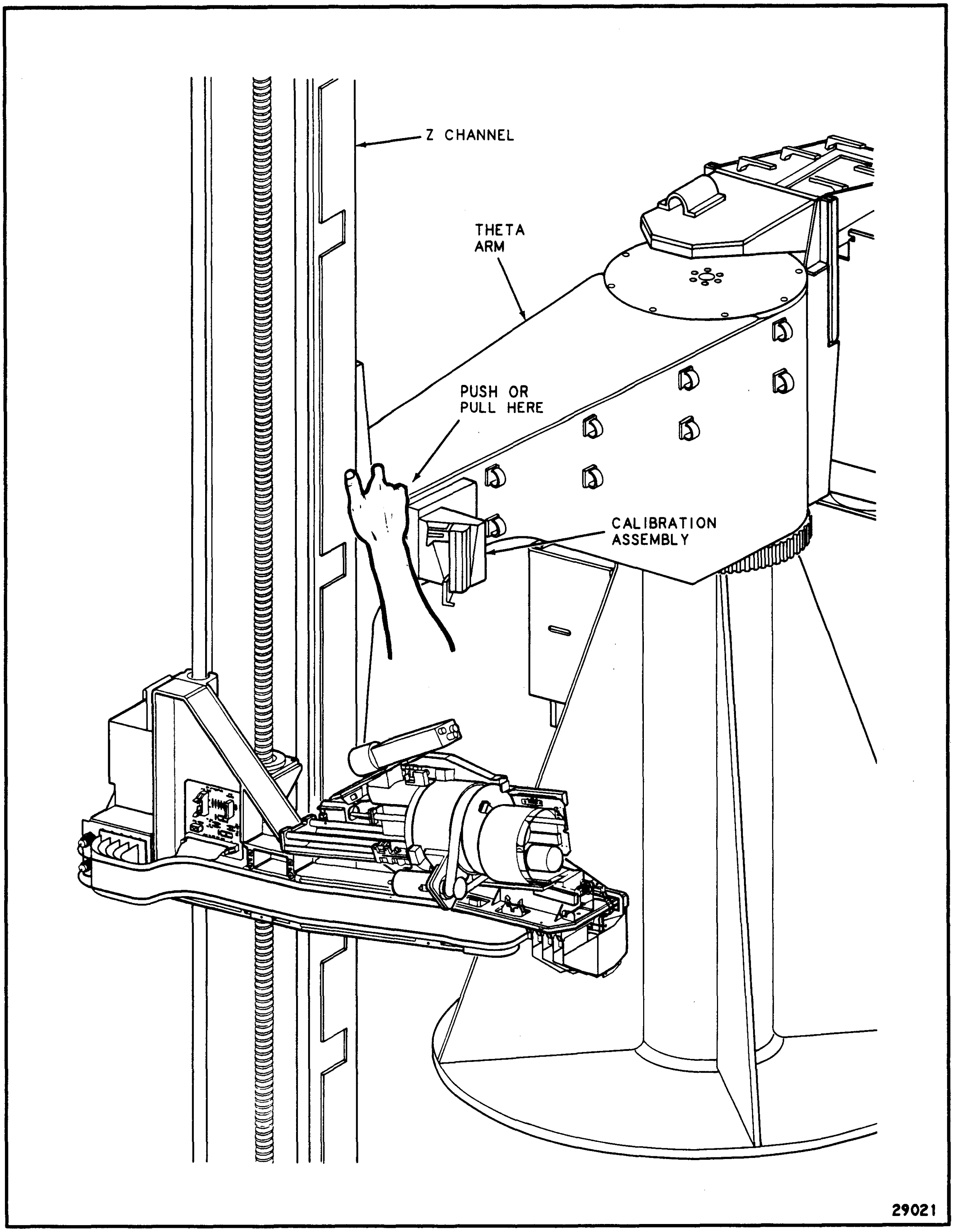

Figure 4-12. Moving The Robot — Laterally

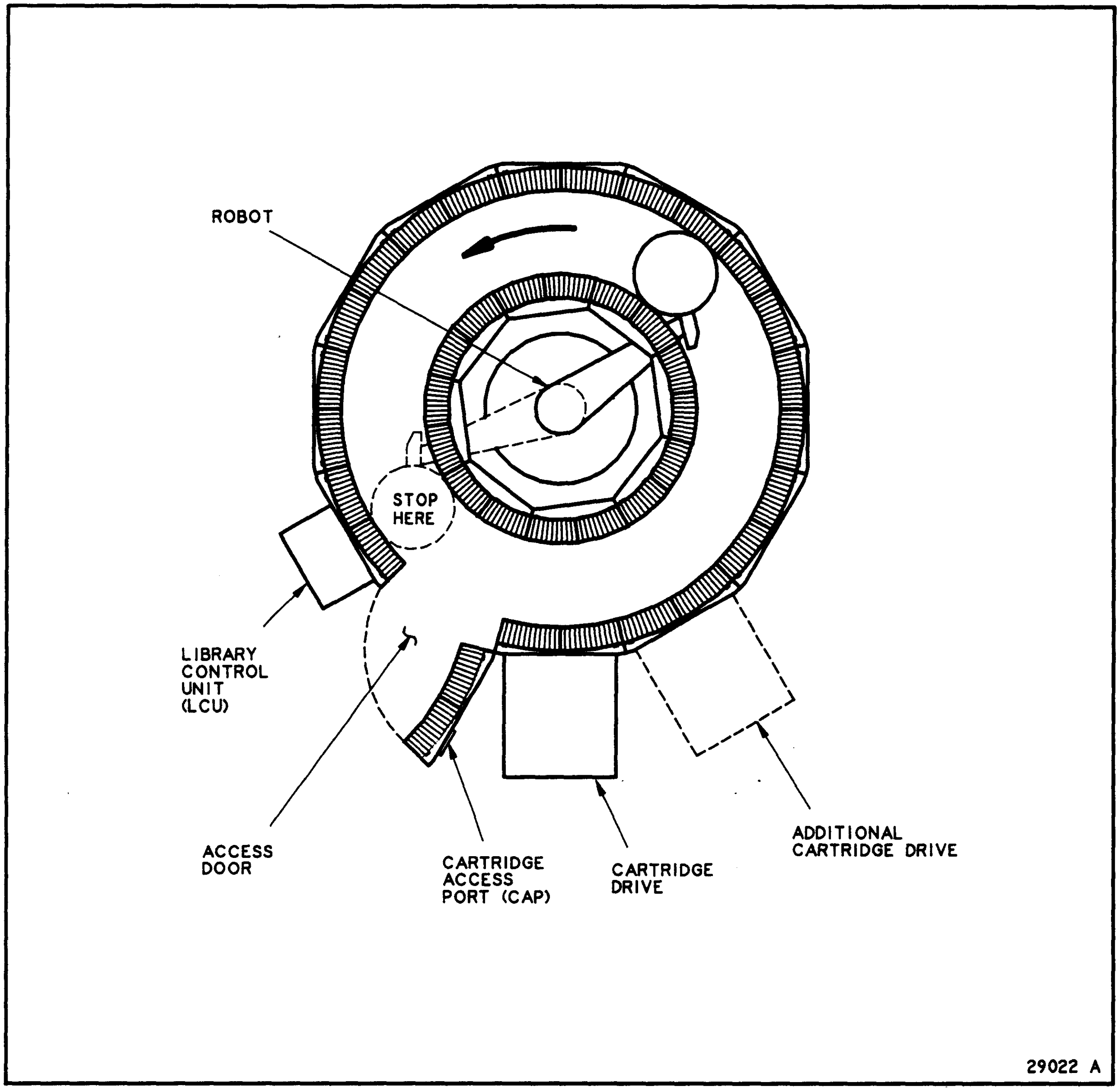

Figure 4-13. Moving The Robot — Laterally 180 Degrees

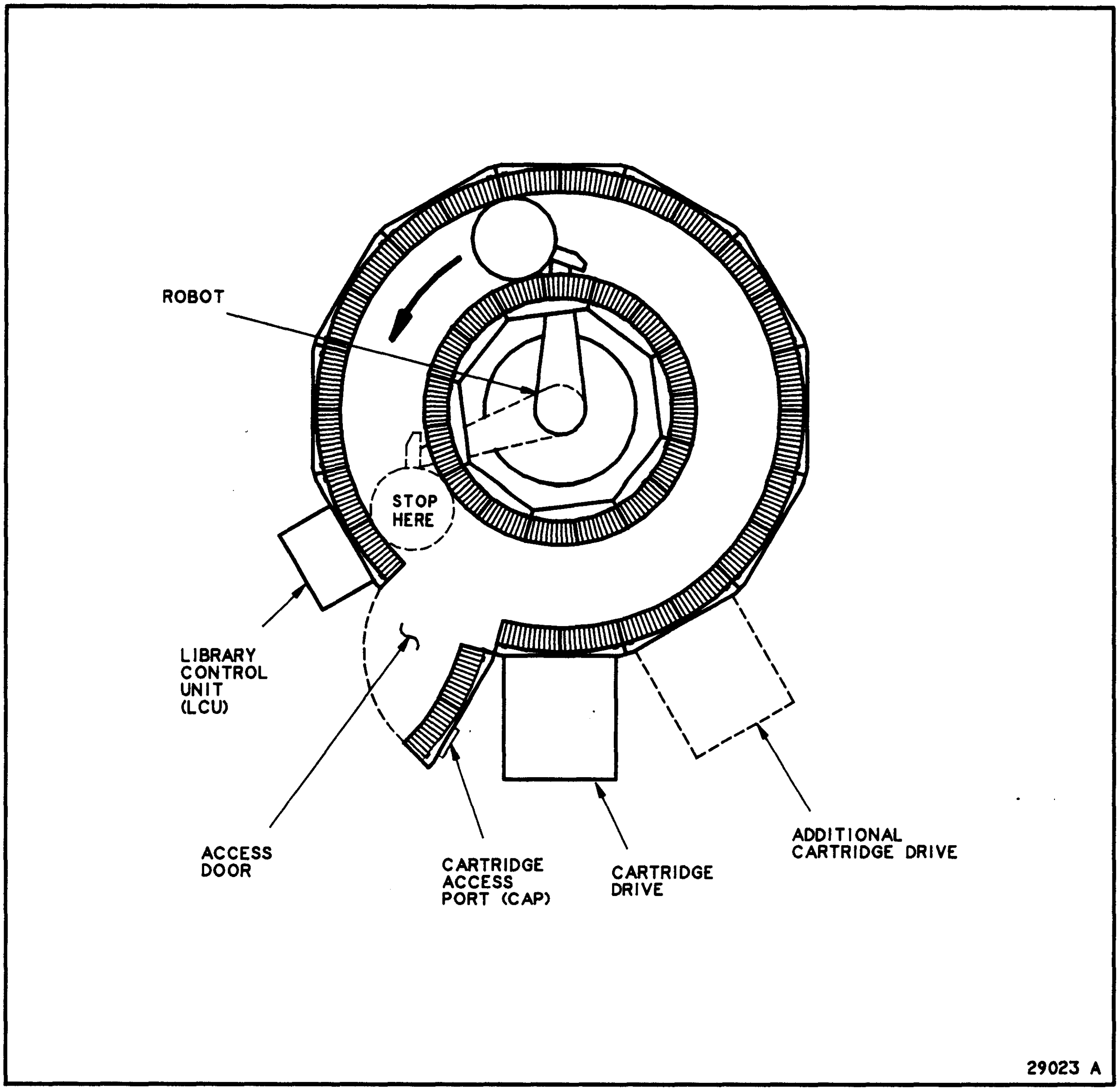

Figure 4-14. Moving The Robot — Laterally Counterclockwise

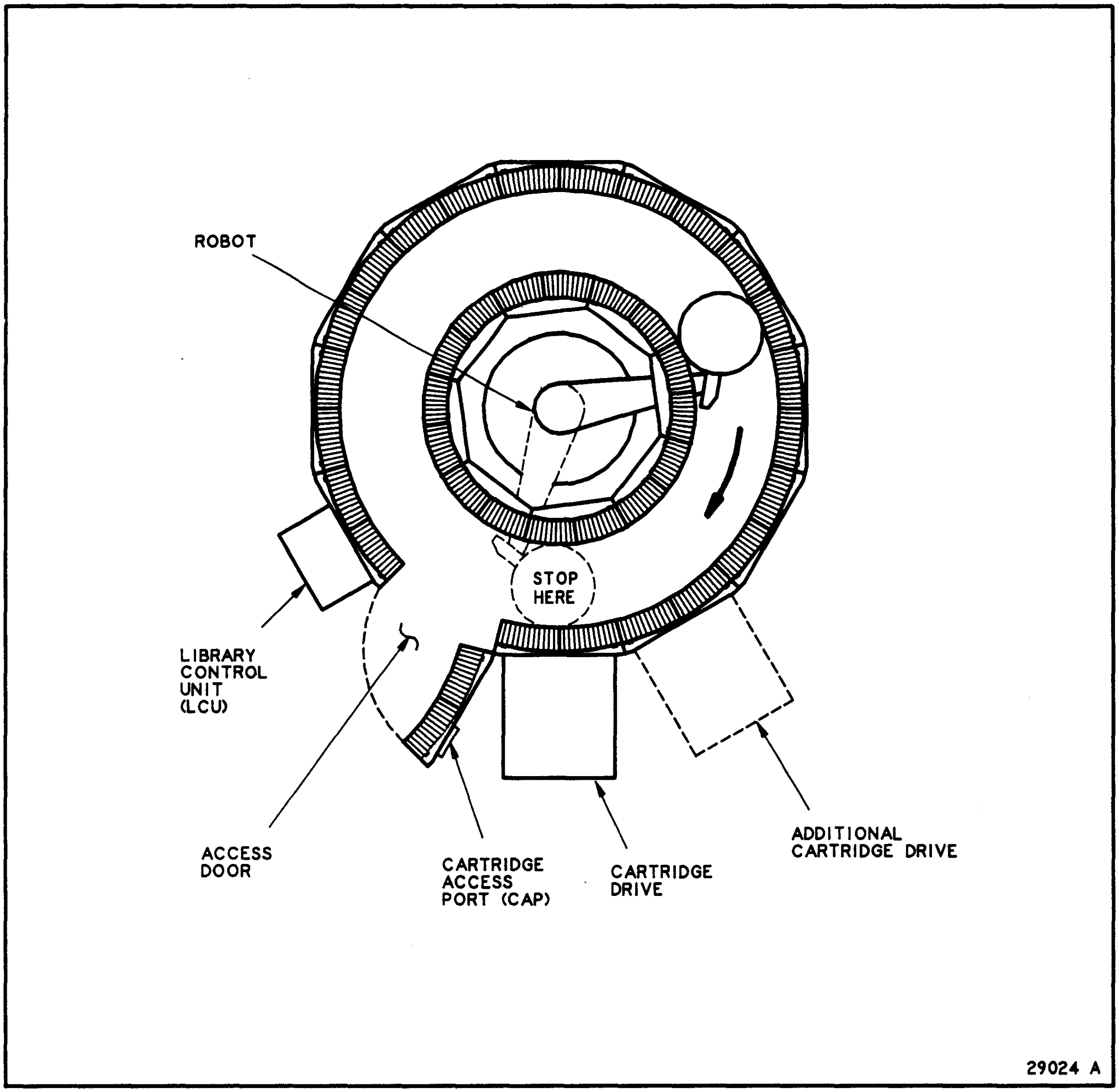

Figure 4-15. Moving The Robot — Laterally Clockwise

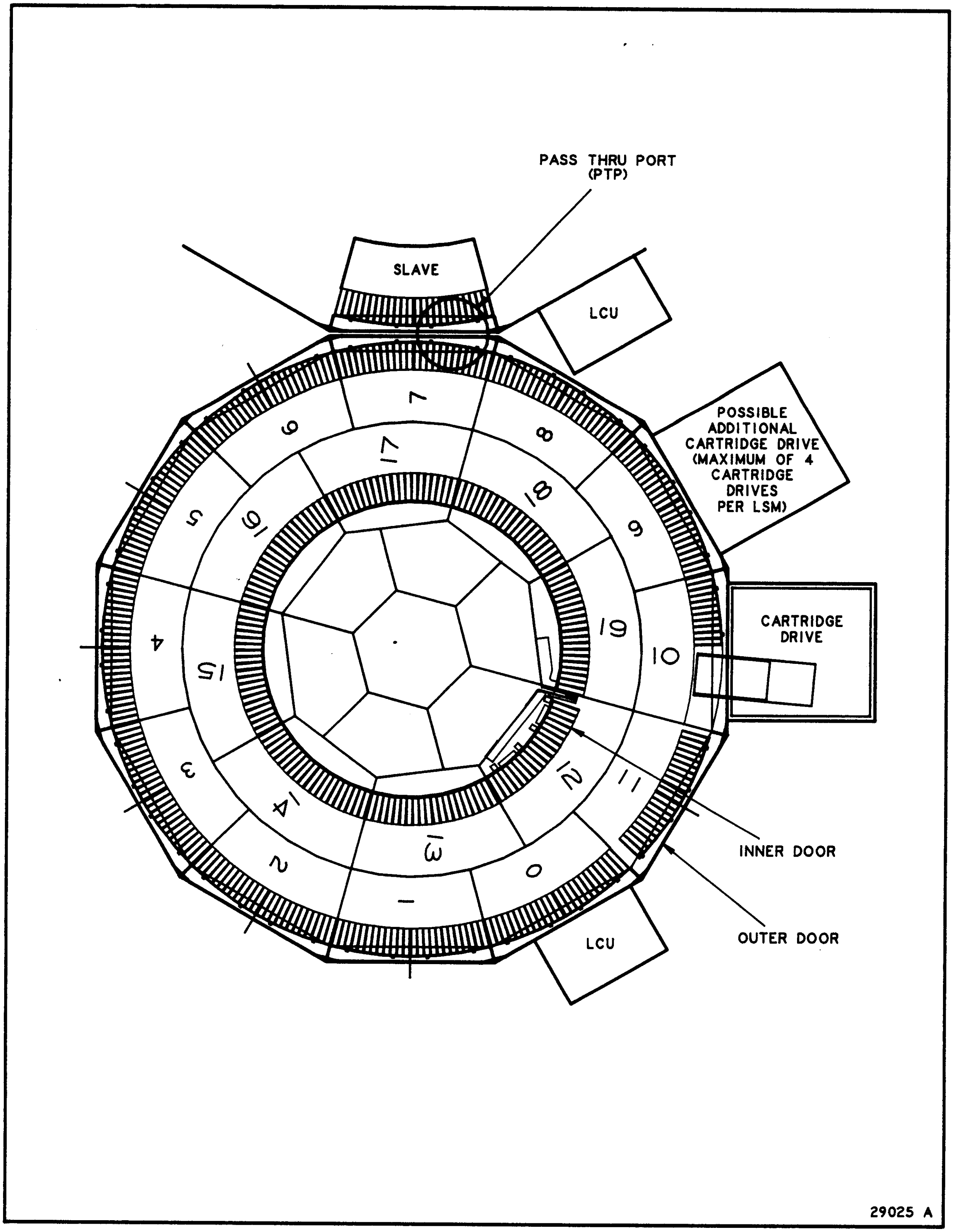

Figure 4-16. Cartridge Locations (Sheet 1 of 5)

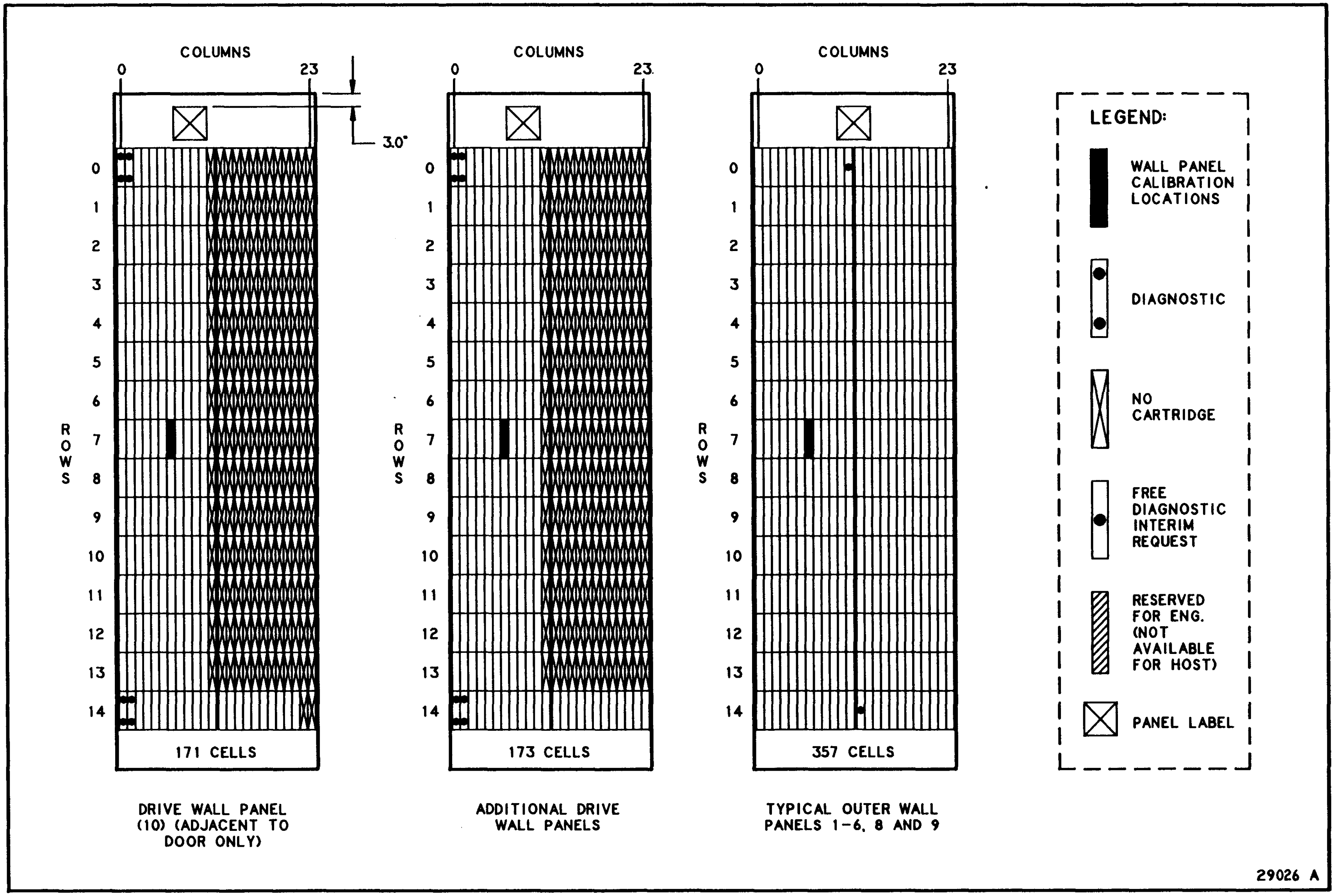

Figure 4-16. Cartridge Locations (Sheet 2 of 5)

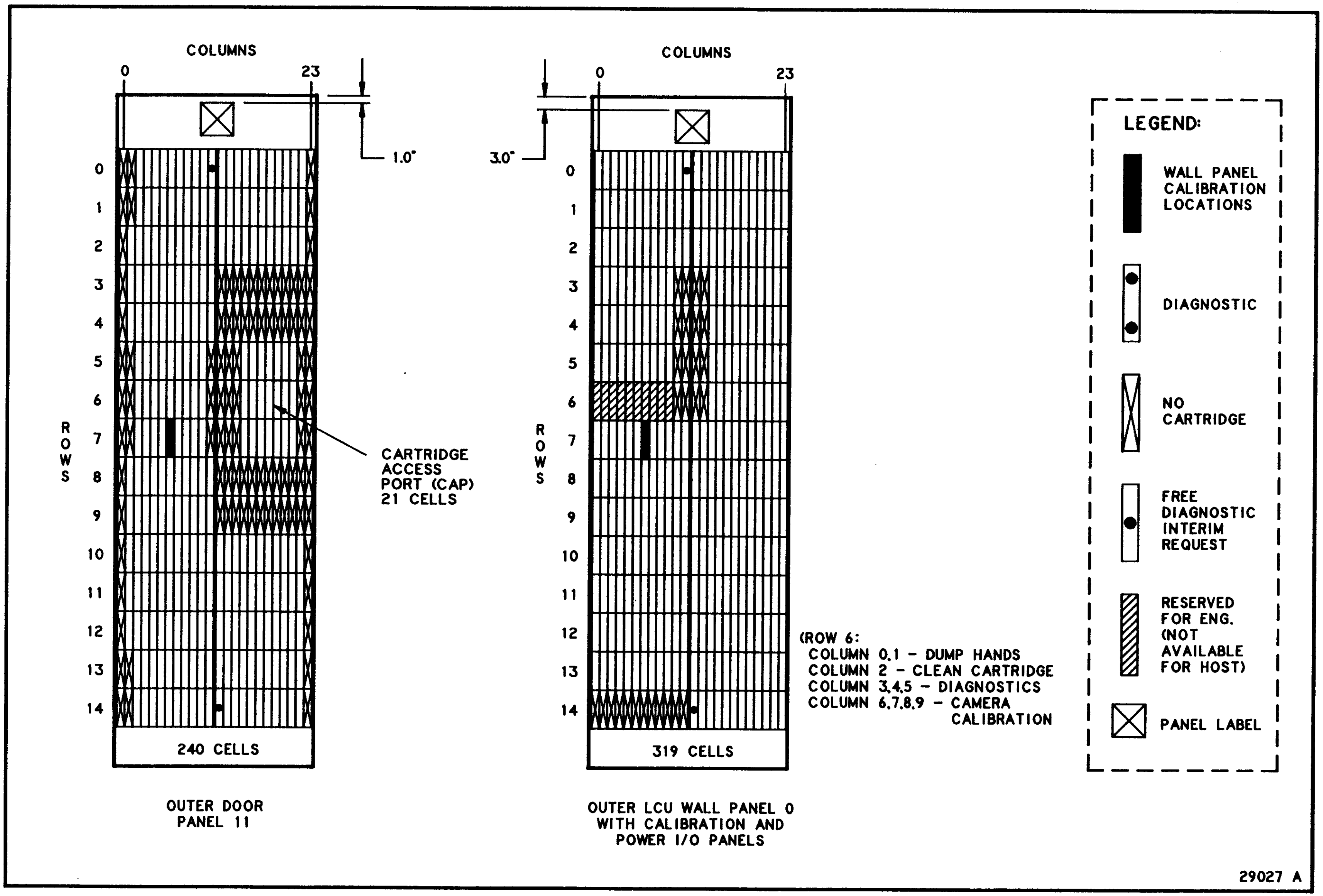

Figure 4-16. Cartridge Locations (Sheet 3 of 5)

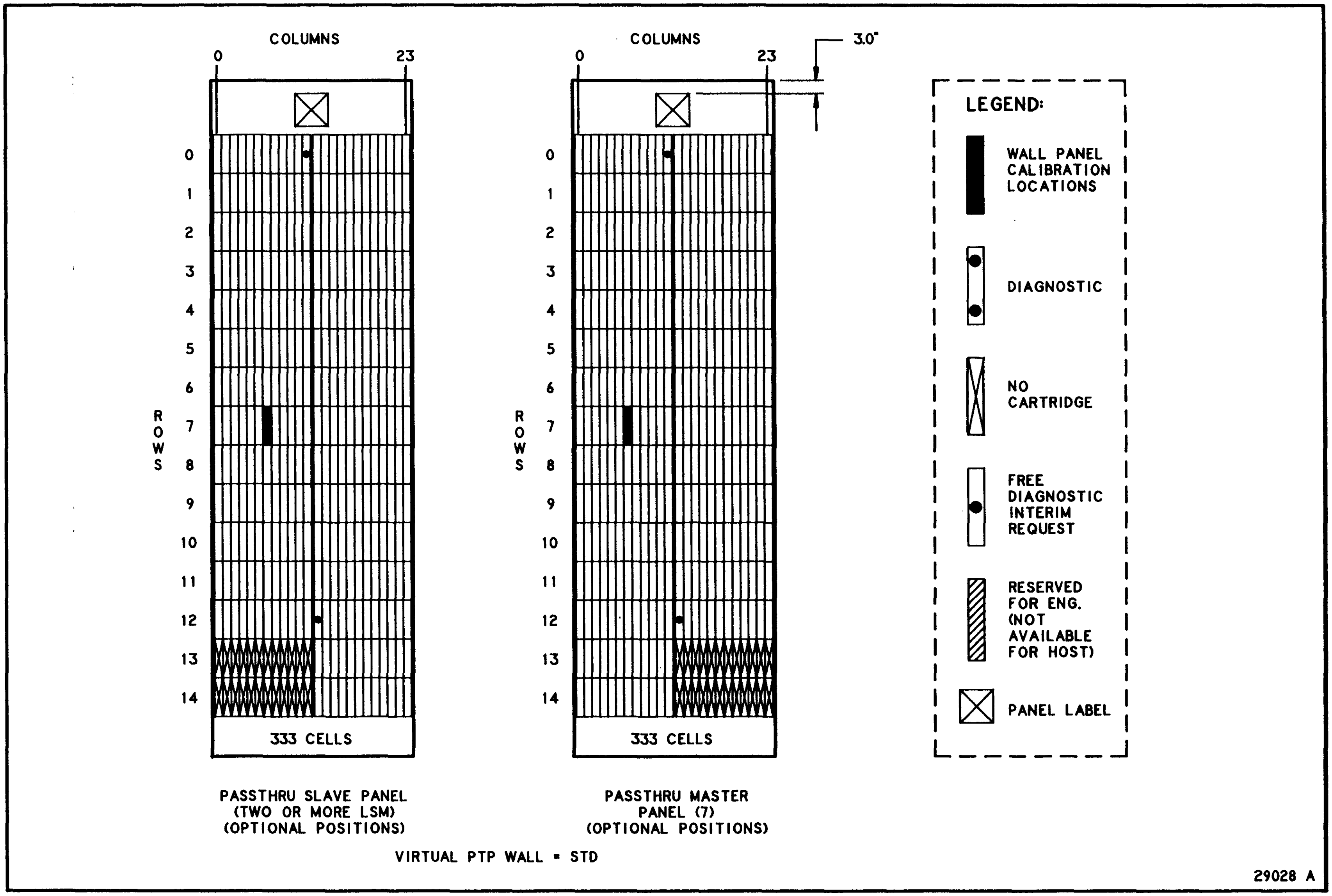

Figure 4-16. Cartridge Locations (Sheet 4 of 5)

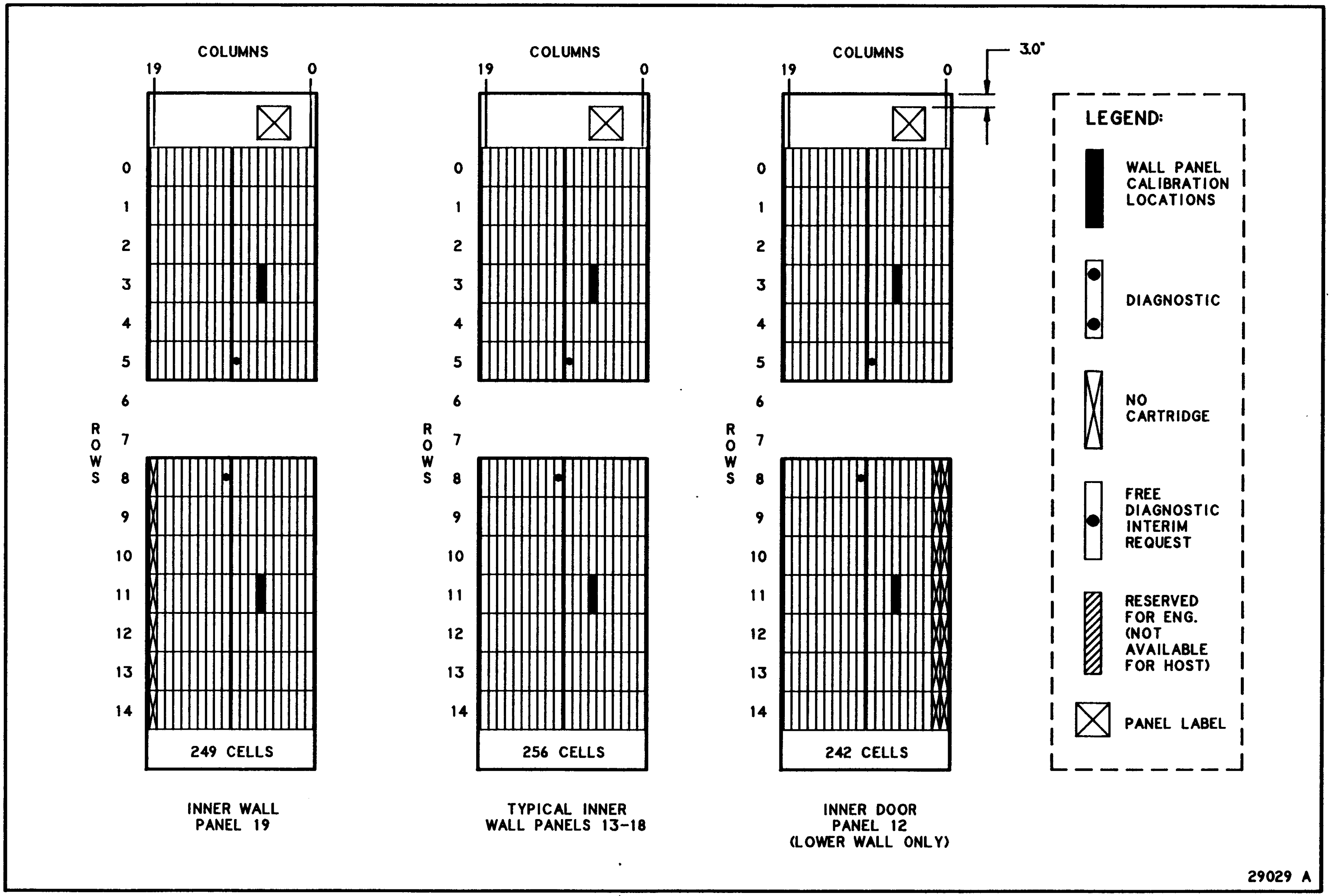

Figure 4-16. Cartridge Locations (Sheet 5 of 5)

Exiting The LSM

Before you leave the LSM, check and make sure there are no tools, foreign objects, or any cartridges outside of the cartridge cells. Make sure nothing is lying on the top portion (the ledge) of the bottom inner wall. Then do the following:

1. Take all cartridges out of the CAP, if applicable.
2. Step outside the LSM. *Ask* if anyone is inside.
3. Open the LAD, insert the key in the lock, and turn the key to the "UNLOCKED" position.
4. Pull the latch handle and *gently* close the door-release handle; push the door, top and bottom, so that it clicks shut. Do not slam the door!
5. Turn the key to the "LOCKED" position.
6. Remove the key from the lock and close the LAD.
7. Vary the LSM online.

Inserting Cartridges After LSM Returns to Online State

There are several ways to return cartridges to the LSM that were removed while the LSM was in the Offline State:

- Before you exit the LSM, place all cartridges in the cartridge cells of *one* panel, and run the `audit` command for that panel. This is the quickest way to get the cartridges back into the LSM if there is a panel with enough empty cells for all the cartridges.
- Before you exit the LSM, place the cartridges in empty cells at random on several different panels, and run the `audit` command on the entire LSM, or at least on all panels with added cartridges. This takes longer than the previous procedure.
- After leaving the LSM, insert the cartridges through the CAP. See *Using the Cartridge Access Port (CAP)* in this chapter.

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CHAPTER 5:
LIBRARY OPERATOR COMMANDS

OVERVIEW

This chapter describes the following topics:

- What the Command Processor does and how to use it to enter operator requests
- How the Command Processor and ACSLM process requests
- Common error messages
- Unsolicited messages
- Individual library operator commands

The available library operator commands are:

```
audit
cancel
dismount
eject
enter
idle
logoff
mount
query
start
vary
```

COMMAND PROCESSOR

Description

The Command Processor is a user interface that enables an operator or end user to enter library commands to the Storage Server. Several Command Processors can be running at one time; the number is limited only by available server system resources.

Initiating the Command Processor

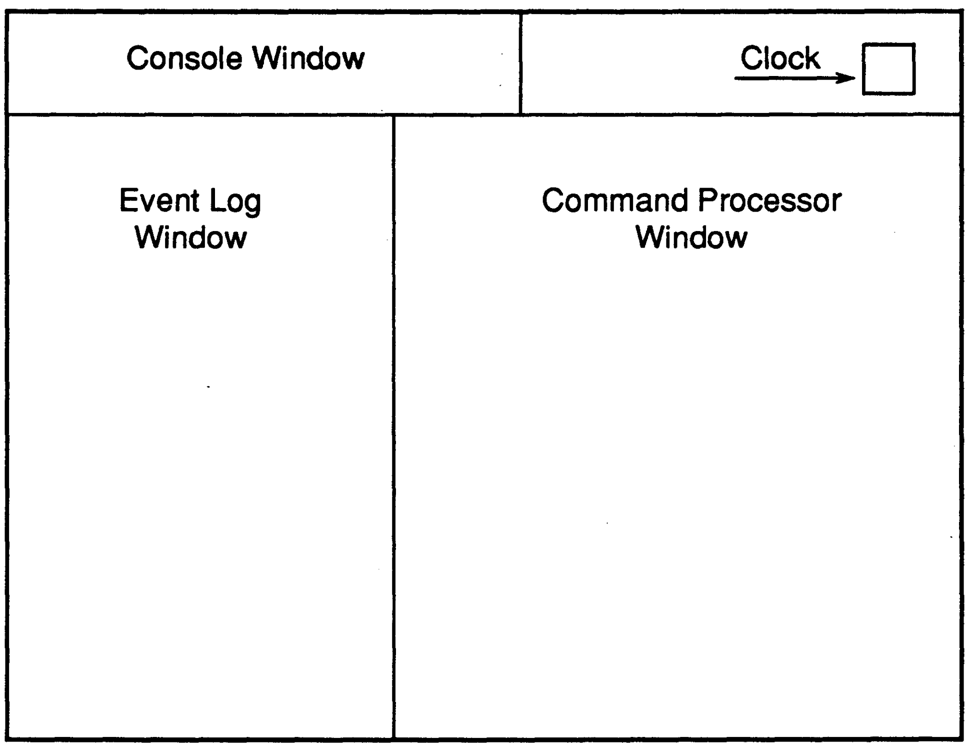
A Command Processor can be initiated from any video terminal capable of logging in to the Storage Server. The method and display of the window varies depending on the network node to which the terminal is attached. The terminal type must be cursor-addressable and defined in the server system's `/etc/termcap` file. The terminal must support a minimum display size of 24 rows by 80 columns.

From the Server System Terminal

Logging in as the `acssa` user automatically sets up a terminal display with the following windows:

- A Command Processor window.
- A window performing a `tail` on the Event Log. This window can be used to monitor significant Storage Server and library activities. See the *Event Log* section in *Chapter 7* for a description of the Event Log.
- A console window. This window can be used to monitor significant operating system activities.

The display appears as follows:



From a Client System Terminal

Performing a remote login to the `acssa` user automatically creates a Command Processor window on the terminal display. This is done by typing the following from the terminal

rlogin ***server_name*** **-l acssa**

where ***server_name*** is the name of the server system.

Before displaying the Command Processor, the system will prompt for your terminal type, as follows:

```
Enter terminal type:
```

Enter the type and a **Return**. Your entry must have been defined previously in the `/etc/termcap` file. An example of a terminal type is `vt100`. If your entry is valid, the system displays a Command Processor.

Command Processor Window

When first invoked, the Command Processor automatically performs a `query server` which displays the status of the entire Storage Server system. When the `query` is finished, the Command Processor prompt, `ACSSA>`, appears. Following is an example of how the Command Processor screen appears when it is first invoked.

```
(c) copyright 1988 Storage Technology Corporation All Rights Reserved






------------------------------ACSSA V1.0--------------------------------
ACSSA> query server
                         Server Status
 Identifier    State    Free Cell  Audit  Mount  Dismount  Enter  Eject
                        Count      C/P    C/P    C/P       C/P    C/P
               run      100        0/1    1/2    2/3       1/3    1/2

ACSSA>
```

The Command Processor offers a split-screen interface that both displays messages from and accepts user requests to the Storage Server. The top section of the screen is the Display Area, and the bottom section is the Command Area. Information in these two areas scrolls independently: as new information appears at the bottom of an area, old information scrolls off the top.

Display Area

The Display Area displays unsolicited messages regarding the status of the library. The messages in this area are "asynchronous," meaning that the timing of their display is not necessarily related to the processing of a particular request. These messages, and possibly additional detail, are also written to the Event Log. See the *Unsolicited Messages* section in this chapter for descriptions of the messages appearing in this area. The user cannot make entries in the Display Area.

Command Area

The Command Area is where the user enters requests and the Storage Server returns responses. Messages shown in this area appear in response to the current command.

COMMAND SYNTAX

This section describes the general format of library operator commands. See the individual command descriptions in this chapter for the specific format of each command.

General Format

The basic format of each command is:

command ***parameters***

parameters are generally defined as:

type identifiers state [***options***]

parameters must be entered in the order listed. That is, ***type*** must come before ***identifiers***, which must come before ***state***, etc. Not all commands use all the ***parameters***, however. See the individual command descriptions in this chapter for details.

Types

The valid *types* and their definitions are:

`se[rver]`	The entire Storage Server library
`ac[s]`	An ACS within a library
`ls[m]`	An LSM within an ACS
`cap`	The cartridge access port (CAP) for an LSM
`pa[nel]`	An inner or outer panel in an LSM
`su[bpanel]`	Part of an LSM panel, identified by the upper-left and lower-right corners of a rectangular area of cells wholly contained within a panel.
`dr[ive]`	A cartridge transport under library control
`vo[lume]`	A tape cartridge under library control
`po[rt]`	A port providing communication between the Storage Server and an ACS
`r[equest]`	A current or pending library request
`m[ount]`	Drives available for mounting a specified tape cartridge

Not all *types* are valid for all commands. See the individual command descriptions in this chapter for details.

Identifiers

Each *identifier* corresponds to a *type*, and each *identifier* is actually made up of one or more components. The components must be separated by commas (,). The *identifiers*, their components, and valid component values are:

acs_id	acs (`0-127`)
lsm_id	acs (`0-127`), lsm (`0-15`)
cap_id	acs (`0-127`), lsm (`0-15`)
panel_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`)
subpanel_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`), startrow (`0-14`), startcolumn (`0-23`), endrow (`0-14`), endcolumn (`0-23`)
cell_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`), row (`0-14`), column (`0-23`)
drive_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`), drive (`0-3`)
vol_id	six-character cartridge identifier; can be any combination of numbers (`0-9`), letters (`A-Z`), and spaces ( ). IDs with embedded spaces must be enclosed in single quotes (`''`) or double quotes (`""`).
port_id	acs (`0-127`), port (`0-15`)
request_id	Unique numeric (`0-65535`) request identifier assigned by the ACSLM.

States

states are device states. The valid ***states*** and their definitions are:

dia[gnostic]	The device is available for diagnostic activities originating from the Command Processor, but not available for client application requests.
on[line]	The device is online to normal library control.
of[fline]	The device is offline to all library commands.

Options

The valid ***options*** and their definitions are:

al[l]	Indicates that the request should be applied to all ***identifiers*** for the specified ***type***.
f[orce]	Indicates that the request should be performed abruptly, without the usual pending processing.

Not all commands accept ***options***. See the individual command descriptions in this chapter for details. ***options*** are always optional.

Abbreviations

All commands, and most parameters, have abbreviations. As described in the *Conventions* section, the optional portion is represented in the documentation enclosed in square brackets. The user can choose to enter any of the following:

- The entire command/parameter. For example, **subpanel**.
- Just the required portion of the command/parameter. For example, **su**.
- The required portion, *plus* any of the optional portion of the command/parameter; the only restriction is that the characters in the optional portion must be entered in sequence. For example, **sub**, **subp**, and **subpa** are all valid entries, whereas **supan** or **subpn** are not.

REQUEST PROCESSING

This section describes how the user submits requests through the Command Processor, and how the Storage Server processes the requests.

Entering Requests

Library requests can only be entered in response to the Storage Server prompt:

```
ACSSA>
```

This prompt indicates that the Storage Server is ready to accept user input. If the prompt is not displayed, this means that the Storage Server is busy processing a previous request and should be available momentarily.

To make a request, the user can enter a command and all, some, or none of the parameters, followed by **Return**. The Command Processor will proceed as follows.

- If all required parameters have been supplied, the Command Processor processes the entry. The following **mount** and **dismount** requests are examples.

```
ACSSA> mount SPE007 0,1,10,2
Mount:  SPE007 mounted on  0, 1,10, 2.
ACSSA> dismount SPE010 0,1,10,3 force
Dismount: SPE010 dismounted from    0, 1,10, 3.
ACSSA>
```

- If any or all of the required parameters are missing, the Command Processor prompts for them, one at a time. It stops prompting and begins processing the request once all required parameters have been supplied. The following **mount** and **dismount** requests are examples.

```
ACSSA> mount
       volume identifier(volume label): SPE007
       drive identifier(acs,lsm,panel,drive): 0,1,10,2
Mount: SPE007 mounted on  0, 1,10, 2.
ACSSA> dismount SPE010
       drive identifier(acs,lsm,panel,drive): 0,1,10,3
Dismount: SPE010 dismounted from    0, 1,10, 3.
ACSSA>
```

Since the Command Processor will prompt for parameters, it is not necessary to memorize exact request syntax. Users who have memorized requests, however, can enter them all at once, bypassing the prompts in order to save time.

Requests are variable in length and may be longer than the screen line length. The request length is restricted only by the maximum number of parameters for the command. The maximum number of parameters is 21; the request will fail if more than 21 parameters are entered.

Special Characters

Special characters are entered by holding down the **Control** key while pressing the specified letter key. For example **Ctl-C** is entered by holding down the **Control** key while pressing the "C" key (either uppercase or lowercase).

The Command Processor accepts the following special characters:

Ctl-C Cancels the previously-entered request. This performs the same function as the `cancel` command, but it only cancels the request that was most recently entered through the Command Processor. As with the `cancel` command, this function is valid only with the `audit`, `eject`, `enter`, and `query` commands.

Ctl-D Abandons request processing. If the request has already been submitted by the user, it is abandoned. If the user has not yet submitted the request, the Command Processor stops displaying command prompts and prompts for a new request. If the command is already complete, the Command Processor ignores the request.

Ctl-H Deletes the previous character. On most keyboards, this is the same as the **Delete** or **Back Space** key.

Ctl-L Repaints the entire Command Processor window. This function is useful if spurious characters have appeared on the screen as the result of "noise" on the communications lines.

Ctl-R Redisplays the current command line. This function is useful if spurious characters have appeared on the command line as the result of "noise" on the communications lines.

Ctl-U Deletes the current line.

Request Validation Process

Requests are first validated by the Command Processor, then by the ACSLM. If the Command Processor encounters errors that prevent it from processing the request, it does not pass the request to the ACSLM.

Command Processor Validations

The Command Processor validates request syntax in a series of steps. If the Command Processor encounters an error at any point in this process, it displays an error message in the Command Area of the screen. Refer to the *Common Errors* section of this chapter for the specific error messages that may be displayed during the validation process.

The Command Processor first verifies that the user has entered a valid command. If the command is valid, the Command Processor evaluates each parameter based on the required parameter list for that particular command. If it encounters an error in any of the parameters, it displays a common error message and reprompts for that parameter. It then prompts for each additional required parameter, one at a time, until the request has been completed. If the user responds to a prompt with an invalid entry, the Command Processor displays a common error message and reprompts for the entry. The following example illustrates this process.

```
ACSSA> vary drove 1,1,10,4 online
       Invalid type drove.
       Type(acs/drive/lsm/port): drive
       drive identifier(acs,lsm,panel,drive): 1,1,10,4
       Drive identifier 1,1,10,4 invalid.
       drive identifier(acs,lsm,panel,drive): 1,1,10,3
       drive identifier(acs,lsm,panel,drive):
       state(diagnostic/offline/online): online
Vary: drive   1, 1,10, 3 varied online.
ACSSA>
```

Although the user had initially entered the command completely, the Command Processor detected an error in the first parameter, causing it to reprompt for that parameter and all subsequent ones.

For most commands, **Return** is considered an invalid entry. **Return** is valid, however, for commands that accept multiple *identifiers*, as follows:

- The `audit`, `query`, and `vary` commands will accept **Return** at the *identifier* prompt.
- The `eject` command will accept **Return** at the *vol_id* prompt.
- An *option* prompt will accept **Return** because *options* are always optional.

In these cases, the Command Processor continues prompting until the user enters **Return** in response to the prompt. **Return** indicates that the user has finished entering *identifiers* or *options*. The following example illustrates valid and invalid uses of **Return** in the **`eject`** command.

```
ACSSA> eject
       CAP identifier(acs,lsm):
       CAP identifier(acs,lsm): 2,2
       volume identifier(volume label): SPE001
       volume identifier(volume label): SPE002
       volume identifier(volume label): SPE003
       volume identifier(volume label):
Eject: SPE001 Ejected From 2,2
Eject: SPE002 Ejected From 2,2
Eject: SPE003 Ejected From 2,2
Eject: Eject complete, 3 cartridges ejected.
ACSSA>
```

Return at the `CAP identifier` prompt causes the Command Processor to reprompt for the entry. **Return** at the `volume identifier` prompt, however, indicates that the user has finished entering *vol_ids* and causes the Command Processor to send the request to the ACSLM.

ACSLM Validations

If a request passes the Command Processor validations, it is sent to the ACSLM. The ACSLM then processes the request. If a request cannot be completed because of an error condition, the ACSLM returns an error message to the Command Processor which then displays the message in the Command Area. See the *Common Error Messages* section and the individual command descriptions in this chapter for the specific messages.

Command Area Messages

Command Area messages are displayed in response to specific request errors. They can be up to 80 characters in length. All messages are displayed as ASCII characters.

The following types of Command Area messages may be displayed:

- *Success messages.* These messages are displayed when the request has been processed successfully to completion. See the individual command descriptions in this chapter for these messages.
- *Intermediate messages.* The `audit` command generates intermediate messages when it encounters error conditions that do not cause it to terminate processing. See the `audit` command description in this chapter for these messages.
- *Error messages.* These messages are displayed when either the Command Processor or the ACSLM encounters an error condition that causes it to terminate processing of the request. Error messages may be common to all commands or unique to a command. See the *Common Error Messages* section and the individual command descriptions in this chapter for the specific messages.
- *Displays.* The `query` command displays formatted status output. See the `query` command description in this chapter for these displays.

COMMON ERROR MESSAGES

This section identifies error messages that may appear in the Command Area in response to any Storage Server request. These messages are grouped as follows:

- *Validation errors.* Errors that result from format and syntax validation performed by the Command Processor.
- *Library errors.* Errors that occur because the library is offline, has suffered hardware failure, or is otherwise unavailable.
- *Processing errors.* Errors that result from processing or network communication failures.

See the individual command descriptions in this chapter for the error messages that are unique to each command.

Validation Errors

Validation errors appear in the Command Area of the screen in response to request syntax validations. They are generated by the Command Processor or the ACSLM. These messages are listed below in the order in which they may occur.

- The following message is displayed if the ***command*** is not **`audit, cancel, dismount, enter, eject, idle, logoff, mount, query, start,`** or **`vary`**.

  `Invalid command` *command*

- The following message is displayed if the *type* is not valid (that is, it is not **server, acs, lsm, cap, panel, subpanel, drive, volume, port, request,** or **mount**), or it is not supported by the particular command.

  ```
  Invalid type type
  ```

- One of the following messages is displayed if the *identifier* is entered with the wrong format or has an invalid value.

  ```
  ACS identifier acs_id invalid
  LSM identifier lsm_id invalid
  Panel identifier panel_id invalid
  Subpanel identifier subpanel_id invalid
  Drive identifier drive_id invalid
  Volume identifier vol_id invalid
  Port identifier port_id invalid
  Request identifier request_id invalid
  ```

- One of the following messages is displayed if the *identifier* specified is valid but is not found in the library configuration.

  ```
  ACS identifier acs_id not found
  LSM identifier lsm_id not found
  CAP identifier cap_id not found
  Drive identifier drive_id not found
  Volume identifier vol_id not found
  Port identifier port_id not found
  Request identifier request_id not found
  ```

- The following message is displayed if the *state* is not valid (that is, it is not **online**, **offline**, or **diagnostic**).

  ```
  Invalid state state
  ```

- The following message is displayed if the *state* is valid but is not supported for the particular device type (for example, specifying **diagnostic** on a **port**).

  ```
  Unsupported state state
  ```

- The following message is displayed if the *option* is not valid (that is, it is not **force** or **all**).

  ```
  Invalid option option
  ```

- The following message is displayed if the *option* is valid but is not supported by the particular command (for example, specifying **force** on a **mount**).

  ```
  Unsupported option option
  ```

- The following message is displayed if the number of request *identifiers* sent by the Command Processor to the ACSLM is invalid.

  ```
  Count too large.
  ```

- The following message is displayed if the number of request *identifiers* sent by the Command Processor to the ACSLM is invalid.

  `Count too small.`

- The following message is displayed if the ACSSA receives input from the user that has too many *identifiers*.

  `Too many identifiers.`

- The following message is displayed if the ACSSA receives input from the user that has too few *identifiers*.

  `Too few identifiers.`

- The following message is displayed if the user enters a request that is more than approximately 2000 characters long.

  `Command too long.`

- The following message is displayed if the Command Processor window has been resized to a size that is too small to permit display of the entire screen. The window must be at least 80 characters wide by 24 lines high.

  `Display window too small.`

- The following message is displayed if you enter any character while the Command Processor is processing a request. Typing **Ctl-C** will cancel the outstanding request and allow you to enter a new one.

  `Request outstanding, type controlC to cancel.`

- The following message is displayed while the Command Processor processes your **Ctl-C** (cancel) request.

  `Processing cancel request.`

Library Errors

Library errors appear in the Command Area of the screen in response to library communications failures. Depending on the situation, an unsolicited message may also appear in the Display Area, and/or an entry may be written to the Event Log. These messages are listed below in alphabetical order.

- The following message is displayed if the ACS specified in a request is in an offline or offline-pending state.

  ACS identifier *acs_id* offline.

- The following message is displayed if the drive specified in a request is in an offline or offline-pending state.

  Drive identifier *drive_id* offline.

- The following message is displayed if the ACSLM is unable to communicate with the ACS. The message appears only after the ACSLM has attempted the appropriate number of retries.

  `Library busy.`

- The following message is displayed if the ACSLM is in an idle, idle-pending, or recovery state. No commands requiring library resources will be accepted while the ACSLM is in the idle or idle-pending state, and only the **`query server`** request will be accepted while it is in the recovery state.

  `Library not available.`

- The following message is displayed if the LSM specified in a request is in an offline or offline-pending state.

  `LSM identifier` *lsm_id* `offline.`

Processing Errors

Processing errors appear in the Command Area of the screen in response to communication and software process failures. These messages are listed in alphabetical order.

- The following message is displayed if the ACSSA receives a response from the ACSLM that is less than the expected size. The ACSSA is unable to translate the message.

  `Decoding error, check the event log.`

- The following message is displayed if the Command Processor is unable to access a request that was previously accessed. This is a fatal error which causes the Command Processor to terminate.

  `Internal error in request queue.`

- The following message is displayed if the ACSSA receives a response from the ACSLM with a status that is invalid for that command.

  `Invalid status` *status*`.`

  status is the status code received by the ACSSA.

- The following message is displayed if the ACSLM is unable to spawn a process to handle a request, or if a spawned process fails.

  `Process failure.`

- The following message is displayed if the Command Processor is unable to establish contact with the ACSSA. Request processing through the Command Processor is suspended.

  `Unable to communicate with system administrator.`

UNSOLICITED MESSAGES

Unsolicited messages appear in the Display Area of the screen. They are "asynchronous," meaning that the timing of their display is not necessarily related to the processing of a particular request.

Most unsolicited messages indicate an error, although some (particularly those related to CAP processing) serve to notify the library operator when a particular routine action can be taken.

All unsolicited messages have a corresponding Event Log entry which may show additional detail concerning the event. The Event Log entry also serves as a more permanent record of the event, since a message will scroll off the screen as additional messages are displayed in the Display Area.

The unsolicited messages are listed in alphabetical order.

- The following message is displayed if cartridges are detected in the CAP during initiation or recovery. See the *Storage Server Recovery* section and the *Initiating the Storage Server* section in *Chapter 4* for details.

  `CAP` *cap_id*`: Cartridges detected in CAP.`

  cap_id is the ID of the CAP.

- This message indicates that the specified CAP is ready to receive cartridges. The message will be repeated at approximately one-minute intervals.

  `CAP` *cap_id*`: Place cartridges in the CAP.`

  cap_id is the ID of the CAP.

- This message indicates that the specified CAP contains cartridges and is ready for the operator to remove them. The message will be repeated at approximately one-minute intervals.

  `CAP` *cap_id*`: Remove cartridges from the CAP.`

  cap_id is the ID of the CAP.

- This message indicates that the ACSLM is unable to access the data base; the ACSLM will automatically begin Storage Server recovery processing. A data base error code, indicating the reason for the failure, will also be written to the Event Log.

  `Data base failure.`

- This message indicates that the specified drive needs to be cleaned.

  `Drive` *drive_id*`: Clean drive.`

  drive_id is the ID of the library drive.

- This message indicates that the Event Logger is unable to open or write to the Event Log file. This message will be displayed at approximately one minute intervals until you reduce the size of the Log. See the *Event Log* section in *Chapter 7* for details.

  `Event log access failed.`

- This message indicates that the Event Log has reached the maximum size defined during installation. This message will be displayed at approximately one minute intervals until you reduce the size of the Log. See the *Event Log* section in *Chapter 7* for details.

  `Event log is full.`

- This message indicates that the ACSLM or ACSSA cannot communicate with another Storage Server software component.

  `IPC failure on socket` *socket_id*.

  socket_id is the ID of the failing socket.

- This message indicates that the library configuration specified in the data base is not the same as that defined in the LMU by a Customer Services Engineer, or if a component appears in the data base but fails to respond to LMU commands. The ACSLM will automatically begin Storage Server recovery processing

  `Library configuration error.`

- This message indicates that the specified LSM has failed to recover in-transit cartridges during Storage Server recovery. See the *Cartridge Recovery* and *Storage Server Recovery* sections in *Chapter 4*.

  `LSM` *lsm_id*`: In-transit cartridge recovery incomplete.`

  lsm_id is the ID of the LSM containing the in-transit cartridges.

- This message indicates that the ACSLM has been placed in the idle state and is therefore unavailable for requests using library resources.

  `Server System idle.`

- This message indicates that the ACSLM is in an idle-pending state and is therefore unavailable for requests using library resources.

  `Server system idle is pending.`

- This message indicates that a timeout has occurred during network data handling. Data may have been lost.

  `Server System network interface timeout.`

- This message indicates that Storage Server recovery has been completed successfully. See the *Storage Server Recovery* section in *Chapter 4* for details.

  `Server system recovery complete.`

- This message indicates that Storage Server recovery has failed. See the *Storage Server Recovery* section in *Chapter 4* for details.

  `Server system recovery failed.`

- This message indicates that Storage Server recovery has been initiated. See the *Storage Server Recovery* section in *Chapter 4* for details.

  `Server system recovery started.`

- This message indicates that the CSI has encountered a Remote Procedure Call (RPC) failure. Data may have been lost.

  `Server system RPC failure.`

- This message indicates that the ACSLM has been placed in the run state.

  `Server system running.`

- This message indicates that the library hardware is operable, but with degraded performance.

  type identifier: `Degraded mode` *fault_symptom_code*.

  type is the device type. *identifier* is the device ID. *fault_symptom_code* is a four-character hexadecimal code that provides a Customer Services Engineer with information needed to troubleshoot the problem.

- This message indicates that the specified device has been varied to the diagnostic state and is therefore available for requests submitted through the Command Processor only. See the `vary` command description in this chapter for additional details.

  type identifier: `Diagnostic.`

- This message indicates that a library hardware error occurred.

  type identifier: `Library error` *status*.

  type is the device type. *identifier* is the device ID. *status* is a description of the error.

- This message indicates that the specified device has been varied offline. See the `vary` command description in this chapter for additional details.

  type identifier: `Offline.`

  type is the device type. *identifier* is the device ID.

- This message indicates that the specified device has been varied online. See the `vary` command description in this chapter for additional details.

  type identifier: `Online.`

  type is the device type. *identifier* is the device ID.

AUDIT

Name

`audit` – Performs a physical inventory of the tape cartridges in a library, ACS, LSM, panel, or subpanel.

Format

au[dit] ***cap_id type identifier ...***

The possible `audit` requests are:

audit ***cap_id*** **se[rver]**

audit ***cap_id*** **ac[s]** ***acs_id ...***

audit ***cap_id*** **ls[m]** ***lsm_id ...***

audit ***cap_id*** **pa[nel]** ***panel_id ...***

audit ***cap_id*** **su[bpanel]** ***subpanel_id ...***

Description

The `audit` request performs a physical inventory of one or more specified ACSs, LSMs, LSM panels, or LSM subpanels. It can be used to resolve inconsistencies between the data base and the physical contents of the library. These inconsistencies may be the result of a person physically entering the LSM and manually adding, removing, or moving cartridges in the storage cells. **Note:** `audit` does *not* audit the contents of tape drives or CAPs.

cap_id is the CAP reserved for processing of errant volumes found during the `audit`; one CAP is required. ***cap_id*** format is:

cap_id	acs (`0-127`), lsm (`0-15`)

Only one device ***type*** at a time can be audited. Within that ***type***, up to 21 different devices can be specified in each request. Valid ***types*** for this command are:

se[rver]	The entire library; does not have an ***identifier***.
ac[s]	A more specific ACS(s) within the library; requires an ***acs_id***. The ***acs_id*** and the ***cap_id*** must be in the same ACS.
ls[m]	One or more specific LSM(s) within an ACS; requires an ***lsm_id***.
pa[nel]	One or more specific panel(s) within an LSM; requires a ***panel_id***.
su[bpanel]	One or more specific subpanel(s) within an LSM; requires a ***subpanel_id***. A subpanel can be as small as a single storage cell or as large as an entire panel.

The *identifier* is the ID of the specific device being audited. Valid *identifiers* for each *type* are:

acs_id	acs (`0-127`)
lsm_id	acs (`0-127`), lsm (`0-15`)
panel_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`)
subpanel_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`), startrow (`0-14`), startcolumn (`0-23`), endrow (`0-14`), endcolumn (`0-23`)

If *type* is **`server`**, no *identifiers* are specified. Otherwise, *identifiers* are required, and the maximum number is 21. The identifiers within a single request can reference the same LSM, but they must not overlap. For example, a request that specifies panel 9

Multiple panels and subpanels within an LSM can be specified in one request, but they must not overlap. Once an `audit` request is submitted, additional `audit` requests on that LSM will be rejected.

The LSM robot physically scans each cell in the specified *identifier*. The cell contents are compared with the contents recorded in the data base. If there is a difference, or if the robot finds a duplicate or unreadable external label, the physical contents of the cell are *rechecked*. If there is still a discrepancy, the data base is corrected and a record of the change is written to the Event Log. Through this process, the data base is updated to reflect the observed contents in cell storage. It is recommended that the data base be backed up after the completion of an audit.

Any cartridges with duplicate or unreadable external labels are ejected through the specified *cap_id*. The CAP is reserved for the entire audit. The audit process does not begin ejecting cartridges until after it has made all necessary data base updates.

A record of the audit is written to the Event Log. Unsolicited messages may be displayed in the Display Area, and intermediate messages may be displayed in the Command Area.

Command Area Messages

Success Message

- The following message is displayed when the audit completes successfully.

```
Audit: Audit completed, Success.
```

In addition, for each ***identifier*** in the request, one of the following messages is displayed, based on the ***type***.

```
Audit: Audit of server, status_string
Audit: Audit of ACS acs_id, status_string
Audit: Audit of LSM lsm_id, status_string
Audit: Audit of panel panel_id, status_string
Audit: Audit of subpanel subpanel_id, status_string
```

Intermediate Messages

- Intermediate messages consist of a two-line display. The following message is displayed on the first line.

```
Audit: Intermediate response: Audit activity.
```

One of the messages listed below is displayed on the second line.

- The following message is displayed when the robot encounters a cartridge with an unreadable or nonexistent external label. A message is also written to the Event Log.

```
Audit: Cartridge ejected, unreadable label.
```

- The following message is displayed when the robot finds a cartridge with a duplicate external label. The `audit` only finds duplicates within the range of cells being audited at the time. A message is also written to the Event Log.

```
Audit: Cartridge vol_id ejected, duplicate label
```

vol_id is the tape cartridge with the duplicate label.

- The following message is displayed when a tape cartridge not listed in the data base is found in the ACS. The cartridge is added to the data base and a message is written to the Event Log.

```
Audit: Cartridge vol_id found
```

vol_id is the external label of the tape cartridge.

- The following message is displayed when a tape cartridge listed in the data base is *not* found in the ACS. The cartridge is removed from the data base and a message is written to the Event Log.

```
Audit: Volume identifier vol_id not found
```

vol_id is the external label of the tape cartridge.

Error Messages

- A common error message is displayed if the **audit** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the request is rejected because another `audit` request referencing the same LSM is already being processed.

  `Audit in progress.`

- The following message is displayed if the request is rejected because the specified CAP is being used by an **`eject`**, **`enter`**, or another **`audit`** request.

  `CAP` *cap_id* `in use.`

- The following message is displayed if the request is rejected because it references more than one ACS.

  `Multiple ACS audit.`

- The following message is displayed if the request is rejected because the ***cap_id*** and the ***identifier*** specified are not in the same ACS.

  `Not in same ACS.`

Display Area Messages

- The following unsolicited message is displayed if the CAP is filled during the audit; ejection of cartridges is suspended until the operator empties the CAP.

  cap_id`: Remove cartridges from the CAP.`

  The *cap_id* is the CAP used to eject the cartridges. Audit processing is resumed when the CAP is closed.

Notes

- When cancelling a current audit, if cartridges are being ejected, the audit halts, and a message to remove the cartridges is displayed. Cartridges already ejected are not reentered.
- Cartridges marked for ejection but not ejected due to a **`cancel`** request or a hardware or software failure cannot be accessed by any library operation. The audit must be repeated.
- Early termination of the audit (due to either an error condition or a **`cancel`** request) may leave discrepancies between the data base and the contents of the library. The audit should be repeated to eliminate the discrepancies.
- Normal library processing (including mounts and dismounts) can be performed at the same time as an audit. The only restriction is that the CAP reserved for the audit cannot be used by any other

process. In a multi-LSM environment, enters and ejects may be performed on an LSM undergoing an audit by using a CAP from a different LSM.

- A single `audit` request can specify multiple LSMs, multiple panels, or multiple subpanels. Overlapping subpanels or duplicate LSMs, panels, or subpanels will cause the request to be rejected, however.
- With multi-part requests, the system processes each device in ascending order by *acs_id, lsm_id, panel_id, subpanel_id*, regardless of the order they were entered in the request. Also, the system will wait until all parts of the request are processed before sending an unsolicited message to unload the CAP.
- Once a request has been submitted, additional requests against the same LSM, panel, or subpanel will be rejected.
- If an `audit` request is submitted while the specified ACS or LSM is in the diagnostic state and a discrepancy is found between the data base and the physical contents of a cell, the cell is *not* rechecked. The audit assumes that the first scan of a cell reflects the correct contents.
- When performing an audit on a newly loaded LSM, it is recommended that the operator vary the device to the diagnostic state prior to submitting the audit request. This will reduce the time required to perform the audit. See the *Migrating Cartridges Into the Library* section in *Chapter 3* for details.
- If the system attempts to audit a cell that the data base indicates is reserved by another process, it will recheck the data base at two-second intervals until it finds that the cell is available. If the cell is still not available after 60 attempts, the system will display an error message indicating that the cell is reserved by another process. The robot will continue to the next cell.
- Table 5-1 shows *average* elapsed times for an audit under various conditions. Times are shown for an entire LSM, an average panel, and a single cell. Times are an average only. Your times may vary depending on the number of cartridges involved, the number of data base changes to be made, and the configuration of your system. In general, the more cartridges involved, the less time required. Panel statistics will also vary by panel type (for example, a drive panel will take less time to audit than a standard outside panel).

Table 5-1. Audit Elapsed Times

	LSM	Panel	Cell
While no other processes are running:	8.5 hrs	25 min	15 sec

See Also

- The `cancel` command for details on cancelling a pending or current `audit` request.
- *Appendix A: Event Log Messages* for entries made by this command.

CANCEL

Name

cancel – Terminates a current or pending **audit, eject, enter,** or **query** request.

Format

can[cel] ***request_id***

Description

The **cancel** request terminates current or pending `query`, `eject`, `enter`, or `audit` activity. A cancellation function is provided for these requests because they can take an extended period of time to complete. This command must be issued from a different Command Processor than the one that issued the initial command.

The ***request_id*** is the request to be cancelled. The entry must be the ID of an `audit`, `eject`, `enter`, or `query` command. ***request_id*** format is:

request_id numeric (0-65535)

The cancelled request may continue to run while it releases allocated resources. Activity is terminated before the next LMU command is issued. Current LMU commands are processed to completion. No attempt is made to undo any activity that was completed *before* the **cancel** request was received by the ACSLM.

The requestor must know the request ID of the request to cancel. The request ID can be determined by issuing a **query** request, which displays a list of all current and pending requests.

Any user can cancel a request. No password is required.

When *pending* requests are cancelled they are removed from the ACSLM's request queue and are not processed.

When *current* requests are cancelled the following activities occur:

- *Cancelling a current* `audit` – The audit halts (including all processing by the robot), and, if cartridges have been moved to the CAP, a message is displayed to remove the cartridges. Cartridges already ejected are not reentered. Cancelling a current audit may result in inconsistencies between the data base and the actual physical contents of the LSM.
- *Cancelling a current* `eject` – The eject is halted, and a message to remove the cartridges is displayed. After the CAP is emptied and closed, a message indicating the number of cartridges acted on is displayed. Cartridges already ejected are not reentered.

- *Cancelling a current* `enter` – The enter is halted. If cartridges are in the CAP, a message to remove the cartridges is displayed. After the CAP is emptied, a message indicating the number of cartridges acted on is displayed. Cartridges already entered into the LSM are not ejected.
- *Cancelling a current* `query` – The processing of status information is aborted.

Command Area Messages

Success Message

- The following message is displayed if the request is successfully cancelled.

  `Request` *request_id* `cancelled.`

  The *request_id* is the request identifier specified.

Error Messages

- A common error message is displayed if the **cancel** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- If the request cannot be cancelled, the following message is displayed.

  `Request` *request_id* `can not be cancelled:` *status*

  The *request_id* is the request identifier specified. The *status* is the reason for the failure. The possible *statuses* follow in alphabetical order.

- The following *status* is displayed if the request identifier specified is not in the correct format.

  `Request identifier` *request_id* `invalid.`

  The *request_id* is the request identifier specified.

- The following *status* is displayed if the request identifier specified is not currently being processed (current or pending).

  `Request identifier` *request_id* `not found.`

  The *request_id* is the request identifier specified.

Display Area Messages

No unsolicited messages unique to this command are displayed in the Display Area.

Notes

- Cancelling a current `audit` request may result in inconsistencies in the data base and discrepancies between the data base and the physical contents of the ACS.

See Also

- The `query`, `eject`, `enter`, and `audit` commands for details on their functions.
- A `query server` request cannot be cancelled.

DISMOUNT

Name

dismount – Dismounts a tape cartridge from a library drive.

Format

dis[mount] ***vol_id drive_id*** **[force]**

Description

The **dismount** request dismounts a tape cartridge from a library drive.

The ***vol_id*** is the external label of the tape cartridge to be dismounted. ***vol_id*** format is:

vol_id six-character cartridge identifier; can be any combination of numbers (0-9), letters (A-Z), and spaces ( ). IDs with embedded spaces must be enclosed in single quotes ('') or double quotes ("").

The ***drive_id*** is the library drive from which the cartridge is to be dismounted. ***drive_id*** format is:

drive_id acs (0-127), lsm (0-15), panel (0-19), drive (0-3)

The optional parameter **force** is used to automatically dismount the tape cartridge from the specified library drive, even if its ***vol_id*** does not match that in the drive, and even if the drive is not unloaded.

Upon receipt of a **dismount** request, the LSM robot does the following:

1. Moves to the specified drive and validates the external tape cartridge label.
2. Dismounts the tape cartridge from the drive.
3. Returns the tape cartridge to an available storage cell in the library.

Once the dismount is completed, the data base is updated with the new location of the cartridge, and a success message is displayed in the Command Area.

Unforced Dismount

All of the following conditions must be met for a successful unforced dismount:

- Both the cartridge and the drive must be in the same ACS
- The library drive must be online to ACSLM control
- The cartridge must be in the specified library drive
- The drive must be unloaded

Forced Dismount

When the `force` option is used, the system does not verify the tape cartridge label or data base information. It also does not require that the library drive be ready for dismounting. The Storage Server automatically rewinds, unloads, and dismounts whatever tape cartridge is found in the specified library drive.

This option can be used to dismount a cartridge with an unreadable or unknown label, or a cartridge that, for some reason, did not get unloaded by the client application system.

Note: A forced dismount may result in a read failure to an application using the tape.

The following conditions must be met for a successful forced dismount:

- The drive must be in the library configuration
- The library drive must be currently online to ACSLM control

Command Area Messages

Success Messages

- The following message is displayed when a normal dismount is successful.

  `Dismount:` *vol_id* `dismounted from` *drive_id.*

  The *vol_id* is the external label of the tape cartridge being dismounted. The *drive_id* is the library drive used to dismount the tape cartridge.

- The following message is displayed when a forced dismount is successful.

  `Dismount: Forced dismount of` *vol_id* `from` *drive_id.*

  The *vol_id* is the external label of the tape cartridge actually in the drive. The *drive_id* is the library drive used to dismount the tape cartridge.

Error Messages

- A common error message is displayed if the `dismount` request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the dismount is unsuccessful.

  `Dismount: Dismount failed,` *status.*

The *status* is the reason for the failure. The possible *statuses* follow in alphabetical order.

- The following *status* indicates that the data base shows no free cell locations available for dismounting the cartridge. The cartridge is left in the tape drive.

  `ACS` *acs_id* `full.`

- The following status indicates that an **`audit`** process has locked out access to the last unoccupied cell location in the ACS.

  `Audit in progress.`

- The following *status* indicates that the library drive does not contain a tape cartridge.

  `Drive identifier` *drive_id* `available.`

  drive_id is the tape drive specified in the request.

- The following *status* indicates that a normal dismount fails because the tape cartridge label is unreadable. A message is also written to the Event Log.

  `Cartridge in drive` *drive_id*, `unreadable label`

- The following *status* indicates that a normal dismount fails because the tape cartridge is not rewound and unloaded. The client system must either rewind and unload the tape cartridge before issuing a dismount request, or use the **`force`** option.

  `Drive identifier` *drive_id* `in use.`

  drive_id is the tape drive specified in the request.

- The following *status* indicates that the external label of the tape cartridge in the library drive is not the same as the volume identifier recorded in the data base. The data base is updated with the volume identifier of the tape cartridge in the library drive.

  `Misplaced tape.`

- The following *status* indicates that a normal dismount fails because the data base shows that the requested volume identifier is not in the requested drive.

  `Volume not in drive.`

  The *drive_id* is the library drive containing the tape cartridge.

Display Area Messages

No unsolicited messages unique to this command are displayed in the Display Area.

Notes

None.

See Also

- The `mount` command for details on mounting a cartridge on a library drive.
- *Appendix A: Event Log Messages* for entries made by this command.

EJECT

Name

`eject` – Ejects from one to 21 tape cartridges from the ACS.

Format

`ej[ect]` *cap_id vol_id ...*

Description

The `eject` request ejects tape cartridges from the library, removing them from library control.

The *cap_id* is the CAP through which the cartridges are to be ejected. *cap_id* format is:

cap_id	acs (`0-127`), lsm (`0-15`)

The *vol_id* is the external label of the tape cartridge to eject. From one to 21 cartridges can be ejected at a time. *vol_id* format is:

vol_id	six-character cartridge identifier; can be any combination of numbers (`0-9`), letters (`A-Z`), and spaces ( ). IDs with embedded spaces must be enclosed in single quotes (`''`) or double quotes (`""`).

For each cartridge to be ejected, the LSM robot does the following:

1. Moves to the cell location indicated in the data base.
2. Reads the external label of the cartridge and verifies that it is the specified cartridge,
3. Moves the cartridge to an available cell in the specified CAP.

When all specified cartridges have been moved to the CAP, the cell locations of the ejected cartridges are deassigned, and the cartridges are removed from the data base. The Command Processor then displays an unsolicited message in the Display Area to remove the cartridges from the CAP.

After the cartridges are removed and the CAP door is closed, the Command Processor displays one message in the Command Area for each cartridge designated for ejection. In each message, the status indicates whether or not the cartridge was actually ejected.

If, for any reason, a specified cartridge cannot be ejected, an error message is displayed in the Command Area, and an entry is made in the Event Log.

Command Area Messages

Success Message

- The following message is displayed for a successful eject. The second line of the message appears once for each tape cartridge successfully ejected from the LSM.

  `Eject: `*vol_id*` Ejected From `*cap_id*
  `Eject complete, `*nn*` cartridges ejected`

  nn is the number of cartridges ejected. The *vol_id* is the external label of the tape cartridge being ejected. The *cap_id* is the CAP through which the tape cartridge is ejected.

Error Messages

- A common error message is displayed if the **`eject`** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed for each cartridge that is not successfully ejected.

  `Eject: `*vol_id*` Eject failed, `*status*

  The *vol_id* is the volume identifier of the tape cartridge. The *status* is the reason for the failure. The possible *statuses* follow.

- The following *status* indicates that the CAP is full before all *vol_ids* have been processed. An unsolicited message to remove the cartridges is displayed in the Display Area.

  `CAP `*cap_id*` full.`

  The *cap_id* is the CAP through which the tape cartridge is ejected.

- The following *status* indicates that the CAP is being used by `enter` or `audit` processing, or by another `eject` request.

  `CAP `*cap_id*` in use.`

  The *cap_id* is the CAP identifier specified in the request.

- The following *status* indicates that the tape cartridge is in a library drive. The tape cartridge is not ejected.

  `Volume in drive.`

- The following *status* indicates that the tape cartridge is reserved for use by another request. The cartridge is not ejected.

  `Volume `*vol_id*` in use.`

  vol_id is the tape cartridge specified in the request.

- The following *status* indicates that a different tape cartridge is in the location specified by the data base. The data base is updated with the external tape cartridge label of the cartridge found in the storage location.

  `Misplaced tape.`

- The following *status* indicates that the CAP and volume specified are not in the same ACS.

  `Not in same ACS.`

- The following *status* indicates that the specified tape cartridge is not in the location specified by the data base, nor in-transit, nor in a library drive. The data base entry is removed.

  `Volume identifier` *vol_id* `not found.`

Display Area Messages

- The following message is displayed when all requested cartridges have been moved to the CAP, or if the CAP is full.

  cap_id`: Remove cartridges from the CAP.`

  The *cap_id* is the CAP used to eject the cartridges.

Notes

- Cartridges should not be left in the CAP after unloading it, as any such cartridges will be unaccounted for in the data base.
- The **`eject`** must be processed completely before using the CAP to enter cartridges. That is, the CAP must be completely unloaded and the door closed before an **`enter`** can be processed.

See Also

- The `cancel` command for details on cancelling a current or pending **`eject`** request.
- The `enter` command for details on entering cartridges into the ACS.
- *Appendix A: Event Log Messages* for entries made by this command.

ENTER

Name

`enter` – Enters one to 21 tape cartridges into the ACS.

Format

en[ter] ***cap_id***

Description

The **enter** request enters tape cartridges into the ACS, placing them under library control. From one to 21 cartridges can be entered at a time.

The ***cap_id*** is the CAP through which the cartridges are to be ejected. ***cap_id*** format is:

cap_id	acs (0-127), lsm (0-15)

Upon receiving an **enter** request, the CAP is unlocked, and an unsolicited message is displayed, instructing the operator to place the cartridges in the CAP.

The cartridges should be loaded from left to right, top to bottom, starting with the upper left-most CAP cell. The first row should be filled completely before beginning with the next row, etc. The robot stops looking for cartridges in the CAP once it encounters an empty CAP cell, so skipping CAP cells will cause all cartridges after the empty cell not to be entered into the LSM. All cartridges should be loaded with the leader block to the top and away from you, and its OCR/bar code label facing you.

After the CAP is closed, the LSM robot does the following for each cartridge in the CAP:

1. Verifies that the external label is readable.
2. Verifies that the label is not a duplicate.
3. Moves the cartridge from the CAP to an unassigned cell in the ACS.
4. Assigns the location to the cartridge and adds the cartridge to the data base.

Once the robot has finished unloading the CAP, the external label of each cartridge found in the CAP is displayed in the Command Area. For each cartridge in the list, the status indicates whether or not the cartridge was actually entered into the LSM.

At the completion of `enter` processing, if any cartridges have unreadable or duplicate labels, the CAP is unlocked, and an unsolicited message is displayed, instructing the operator to remove the cartridges from the CAP.

Command Area Messages

Success Message

- The following message is displayed for a successful enter. The second line of the message appears once for each tape cartridge successfully entered into the LSM.

```
Enter complete, nn cartridges entered
Enter: vol_id Entered through cap_id
```

nn is the total number of cartridges entered with this command. The *vol_id* is the external label of the tape cartridge entered. The *cap_id* is the CAP through which the tape cartridge was entered.

Error Messages

- A common error message is displayed if the **enter** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed for each cartridge that is not successfully entered.

```
Enter: vol_id Enter failed, status
```

The *vol_id* is the volume identifier of the tape cartridge. The *status* is the reason for the failure. The possible *statuses* follow.

- The following *status* indicates that there are no unoccupied cells in the ACS to store the tape cartridge. The cartridge is left in the CAP.

```
ACS acs_id full.
```

The *acs_id* is the identifier of the ACS.

- The following status indicates that an **audit** process has locked out access to a cell location required for the enter. The tape cartridge is not entered and remains in the CAP.

```
Audit in progress.
```

- The following *status* indicates that the CAP is being used for `eject` or `audit` processing, or by another `enter` request.

```
CAP cap_id in use.
```

The *cap_id* is the CAP identifier specified in the request.

- The following *status* indicates that the external label of the cartridge in the CAP is already found in the data base. The cartridge is left in the CAP.

  `Duplicate label.`

- The following *status* indicates that the external tape cartridge label is unreadable. The cartridge is left in the CAP.

  `Unreadable label.`

Display Area Messages

- The following message is displayed after the request is entered.

  cap_id`: Place cartridges in CAP.`

  cap_id is the CAP being used to enter the cartridges.

- The following message is displayed if one or more cartridges are rejected. The cartridges remain in the CAP.

  `CAP` *cap_id*`: Remove cartridges from CAP.`

Notes

None.

See Also

- The `cancel` command for details on cancelling a current or pending **`enter`** request.
- The `eject` command for details on removing cartridges from the ACS.
- *Appendix A: Event Log Messages* for entries made by this command.

IDLE

Name

idle – Stops ACSLM request processing.

Format

i[dle] [force]

Description

The **idle** request is used to place the Storage Server in a quiescent state prior to maintenance activity or Storage Server termination. It will remain in that state until it receives a **start** request.

The ACSLM can be in one of the four following states: run, idle, idle-pending, and recovery. See the *ACSLM States* section in *Chapter 4* for details on these states.

idle

Upon receipt of an unforced **idle** request, the ACSLM is immediately placed in the idle-pending state. While the ACSLM is in this state, new requests involving library operations are rejected, and current and pending requests are processed to completion. The ACSLM is not placed in the idle state until all current and pending requests have been completed.

idle force

An **idle** request with the **force** option abruptly puts the ACSLM in the idle state. Current and pending requests are aborted, not processed to completion. New requests are rejected.

Command Area Messages

Success Message

- The following message is displayed when ACSLM request processing is successfully stopped.

  `ACSLM Request Processing Stopped: Success`

Error Messages

- A common error message is displayed if the **idle** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the idle is unsuccessful.

  `ACSLM Request Processing Stopped:` *status*

  status is the reason for the failure. See the Common Errors section of this chapter for possible common messages that can serve as *status* values.

Display Area Messages

- The following message is displayed when the ACSLM successfully enters the idle state.

  `Server system idle.`

- The following message is displayed when an unforced idle request is received and the ACSLM has current or pending requests to process.

  `Server system idle is pending.`

Notes

- The `cancel`, `idle`, `query`, `start`, and `vary` requests can be processed while the ACSLM is in an idle or idle-pending state. The `audit`, `dismount`, `eject`, `enter`, and `mount` requests, however, require that the ACSLM be in a run state.
- Whenever possible, an idle command should be issued before terminating the Storage Server software. This ensures that the data base is consistent prior to termination.

See Also

- The `query` command for details on displaying the current state of the ACSLM.
- The `start` command for details on bringing an idle ACSLM into the run state.

LOGOFF

Name

`logoff` – Exits from the Command Processor.

Format

`lo[goff]`

Description

`logoff` is used to exit from the current Command Processor. The `logoff` command has no options.

If the `logoff` is successful, the Command Processor window from which the request was entered is terminated. If the `logoff` is unsuccessful, an undesired event occurred.

Command Area Messages

Success Message

There is no success message for this request.

Error Messages

- A common error message is displayed if the `logoff` request is rejected because of a syntax error, processing error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.
- No error messages unique to this command are displayed in the Command Area.

Display Area Messages

No unsolicited messages unique to this command are displayed in the Display Area.

Notes

- `logoff` is valid in any ACSLM state.

See Also

None.

MOUNT

Name

`mount` – Mounts a tape cartridge onto a specified library drive.

Format

`m[ount]` *vol_id drive_id*

Description

The `mount` request mounts a specified tape cartridge on a specified library drive.

The *vol_id* is the external label of the tape cartridge to mount. *vol_id* format is:

vol_id	six-character cartridge identifier; can be any combination of numbers (`0-9`), letters (`A-Z`), and spaces ( ). IDs with embedded spaces must be enclosed in single quotes (`''`) or double quotes (`""`).

The *drive_id* is the library drive on which the cartridge is to be mounted. *drive_id* format is:

drive_id	acs (`0-127`), lsm (`0-15`), panel (`0-19`), drive (`0-3`)

Upon receipt of a `mount` request, the LSM robot does the following:

1. Moves to the appropriate cell location and validates the external label of the tape cartridge.
2. Mounts the tape cartridge on the drive.

Once the cartridge is successfully mounted, the data base is updated with the status of the drive and the current location of the cartridge. A response message is also displayed in the Command Area.

If for any reason the `mount` cannot be completed, the tape cartridge is returned to its original location, if possible, or to another available storage cell.

All of the following conditions must be met for a successful `mount`:

- Both the cartridge and the drive must be in the same ACS
- The library drive must be online to ACSLM control and available
- The cartridge must be available

Command Area Messages

Success Message

- The following message is displayed when a mount is successful.

  `Mount:` *vol_id* `mounted on` *drive_id*

  The *vol_id* is the external label of the tape cartridge being mounted. The *drive_id* is the library drive used to mount the tape cartridge.

Error Messages

- A common error message is displayed if the **mount** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the mount is unsuccessful.

  `Mount: Mount failed,` *status*.

  The *status* is the reason for the failure. The possible *statuses* follow.

- The following status indicates that an **audit** process has locked out access to the cell location of the tape cartridge required for the mount.

  `Audit in progress.`

- The following *status* indicates that the mount fails because the data base shows that the requested volume identifier is already mounted in a drive.

  `Volume in drive.`

- The following *status* indicates that the mount fails because the library drive already contains a tape cartridge or the data base shows that the requested volume identifier is reserved for use by another request.

  `In use.`

- The following *status* indicates that the volume identifier specified is not found in the location indicated in the data base. The data base is updated with the volume identifier of the tape cartridge in the location.

  `Misplaced tape.`

- The following *status* indicates that the tape cartridge and the library drive are not in the same ACS.

  `Not in same ACS.`

- The following *status* indicates that the mount fails because the tape cartridge label is unreadable.

```
Unreadable label.
```

Display Area Messages

No unsolicited messages unique to this command are displayed in the Display Area.

Notes

None.

See Also

- The `dismount` command for details on dismounting a cartridge from a library drive.
- The `query` command for details on displaying the closest library drive to a specified tape cartridge.
- *Appendix A: Event Log Messages* for entries made by this command.

QUERY

Name

`query` – Displays status information about the Storage Server, an ACS, an LSM, a port, a CAP, a library drive, a tape cartridge, or a request.

Format

`q[uery]` *type* `[`*identifier* `...|all]`

The possible `query` requests are:

- `query se[rver]`
- `query ac[s]` `[`*acs_id* `...|all]`
- `query ls[m]` `[`*lsm_id* `...|all]`
- `query cap` `[`*cap_id* `...|all]`
- `query dr[ive]` `[`*drive_id* `...|all]`
- `query po[rt]` `[`*port_id* `...|all]`
- `query vo[lume]` `[`*vol_id* `...|all]`
- `query r[equest]` `[`*request_id* `...|all]`
- `query m[ount]` *vol_id* `...`

Description

General

type is the type of device or object being queried. There can be only one *type* per `query` request. Possible *types* for this command are:

`se[rver]`	The entire library; does not have an *identifier*.
`ac[s]`	One or more specific ACS(s) within the library; requires an *acs_id*.
`ls[m]`	One or more specific LSM(s) within an ACS; requires an *lsm_id*.
`cap`	One or more specific CAP(s) within an ACS; requires a *cap_id*.
`dr[ive]`	One or more specific drive(s) within an ACS; requires a *drive_id*.
`vo[lume]`	One or more specific tape cartridge(s) within the library; requires a *vol_id*.
`po[rt]`	One or more specific ports(s) for an ACS; requires a *port_id*.
`r[equest]`	One or more pending or current requests; requires a *request_id*.

`m[ount]`	Displays the drives available for mounting one or more specific tape cartridge(s); requires a *vol_id*.

identifier is the specific ID for the ***type***. With the exception of the **`server`** and **`mount`** ***types***, the **`all`** option can be used to display all ***identifiers*** of a given ***type***. ***identifier*** formats are:

acs_id	acs (**`0-127`**)
lsm_id	acs (**`0-127`**), lsm (**`0-15`**)
cap_id	acs (**`0-127`**), lsm (**`0-15`**)
drive_id	acs (**`0-127`**), lsm (**`0-15`**), panel (**`0-19`**), drive (**`0-3`**)
vol_id	six-character cartridge identifier; can be any combination of numbers (**`0-9`**), letters (**`A-Z`**), and spaces ( ). IDs with embedded spaces must be enclosed in single quotes (**`''`**) or double quotes (**`""`**).
port_id	acs (**`0-127`**), port (**`0-15`**)
request_id	numeric (**`0-65535`**)

The user can specify more than one ***identifier*** in a single request, as long as they all have the same ***type***. For example, a single request can specify two ACSs, but not an ACS and a library drive. The maximum number of ***identifiers*** that can be specified in a single request is 21.

The system displays as many responses as needed to provide all the requested information. For example, the command, **`query request all`**, will result in a display consisting of one response for each request being processed. Examples of each request follow.

query acs

When the **`query acs`** `[`*acs_id* `|` **`all`**`]` request is issued, the following information is displayed for each ACS specified in the command.

```
                                   ACS Status
Identifier  State   Free Cell      Audit    Mount    Dismount    Enter    Eject
                    Count          C/P      C/P      C/P         C/P      C/P

acs_id      state   free_cell_count n/n     n/n      n/n         n/n      n/n
```

acs_id is the ACS identifier.

The *state* is the current run condition of the ACS. Valid *states* are:

`diagnostic`	The ACS is in the diagnostic state; it can only be controlled through the Command Processor.
`offline`	The ACS is offline to Storage Server control.
`offline pending`	The ACS is in the process of going offline to Storage Server control
`online`	The ACS is online to Storage Server control.
`recovery`	The ACS is in the process of going online to Storage Server control.

The *free_cell_count* is the number of unoccupied cells in the ACS.

n indicates the number of current (`C`) and pending (`P`) requests for the ACS. This information is shown for each request that requires library resources (`audit`, `mount`, `dismount`, `enter`, and `eject`). Current and pending are defined as:

`C` (current)	Requests actively being processed.
`P` (pending)	Requests waiting to be processed.

query cap

When the **`query cap [`*`cap_id`*` | all]`** request is issued, the following information is displayed for each CAP specified in the command.

```
              CAP Status
Identifier              Status

cap_id                  status
```

The *cap_id* is a CAP identifier.

The *status* indicates whether the CAP is available for use or reserved by another process. Valid *statuses* are:

`enter`	Currently reserved for `enter` processing.
`eject`	Currently reserved for `eject` processing.
`audit`	Currently reserved for `audit` processing.
`available`	Currently available for use.

query drive

When the `query drive [`*drive_id*` | all]` request is issued, the following information is displayed for each library drive specified.

```
                              Drive Status
           Identifier      State    Status   Volume Identifier

        drive_id           state    status   vol_id
```

The *drive_id* is the library drive identifier.

The *state* the current state of the drive. Valid *states* are:

`online`	The drive is online to Storage Server control.
`offline`	The drive is offline to Storage Server control.
`diagnostic`	The drive is in the diagnostic state; it can only be controlled through the Command Processor.

The *status* is the current use status of the library drive. Valid *statuses* are:

`In use`	The drive contains a tape cartridge or is reserved for a `mount`.
`Available`	The drive does not contain a tape cartridge and has been released after a `dismount`.

The *vol_id* is the external label of the tape cartridge in the library drive. This field is blank if there is no cartridge in the drive or if the cartridge's external label is unreadable or unknown.

query lsm

When the `query lsm [`*lsm_id*` | all]` request is issued, the following information is displayed for each LSM specified in the command.

```
                                    LSM Status
Identifier  State   Free Cell    Audit    Mount    Dismount   Enter    Eject
                    Count        C/P      C/P      C/P        C/P      C/P

lsm_id      state   free_cell_count n/n   n/n      n/n        n/n      n/n
```

The *lsm_id* is an LSM identifier.

The *state* is the current run condition of the LSM. Valid *states* are:

`diagnostic`	The LSM is in the diagnostic state; it can only be controlled through the Command Processor.
`offline`	The LSM is offline to Storage Server control.
`offline pending`	The LSM is in the process of going offline to Storage Server control
`online`	The LSM is online to Storage Server control.
`recovery`	The LSM is in the process of going online to Storage Server control.

The *free_cell_count* is the number of available cells in the LSM.

n indicates the number of current (`C`) and pending (`P`) requests for the LSM. This information is shown for each request that requires LSM resources (`audit`, `mount`, `dismount`, `enter`, and `eject`). Current and pending are defined as:

`C` (current)	Requests actively being processed.
`P` (pending)	Requests waiting to be processed.

query mount

When the **`query mount`** *vol_id* request is issued, the following information is displayed for each tape cartridge specified in the command.

```
               Mount Status
      Identifier          Drive

     vol_id               drive_id
                          drive_id
                          drive_id
```

The *vol_id* is the external label of the tape cartridge.

drive_id is a list of library drive identifiers. Only online, available library drive identifiers are listed. Library drive identifiers are listed in order of proximity to the current location of the *vol_id*.

query port

When the **query port** [*port_id* | **all**] request is issued, the following information is displayed for each port specified.

```
                    Port Status
    Identifier                State

    port_id                   state
```

The *port_id* is the port identifier.

The *state* is the current state of the port. Valid *states* are:

`online`	The port is online to Storage Server control.
`offline`	The port is offline to Storage Server control.

query request

When the **query request** [*request_id* | **all**] request is issued, the following information is displayed for each request specified.

```
                        Request Status
    Identifier                Command  Status

    request_id                command  status
```

The *request_id* is the request identifier assigned by the Storage Server.

The *command* is the request function being processed. Valid commands are:

AUDIT	IDLE
CANCEL	MOUNT
DISMOUNT	QUERY
EJECT	START
ENTER	VARY

The *status* is the current disposition of the request. Valid *statuses* are:

`Current`	The request is actively being processed.
`Pending`	The request is waiting to be processed.
`Not found`	The specified request is not currently being processed.

query server

When the **query server** request is issued, the following information is displayed for the library.

```
                              Server Status
Identifier  State   Free Cell     Audit    Mount    Dismount   Enter   Eject
                    Count         C/P      C/P      C/P        C/P     C/P

            state   free_cell_count n/n    n/n      n/n        n/n     n/n
```

The `Identifier` field is blank for this display.

The *state* is the state of the ACSLM. The valid *states* are:

`idle`	The ACSLM is idle and is therefore not processing any requests.
`idle pending`	The ACSLM is in the process of going idle.
`recovery`	The ACSLM is in the process of coming out of an idle state.
`run`	The ACSLM is in a normal run state and is therefore available to process requests.

The *free_cell_count* is the number of unoccupied storage cells in the library.

n indicates the number of current (`C`) and pending (`P`) requests for the ACS. This information is shown for each request that requires library resources (`audit`, `mount`, `dismount`, `enter`, and `eject`). Current and pending are defined as:

`C` (current)	Requests actively being processed.
`P` (pending)	Requests waiting to be processed.

query volume

When the **query volume** [*vol_id* | **all**] request is issued, the following information is displayed for each tape cartridge specified in the command.

```
                        Volume Status
Identifier                 Status   Current Location

vol_id                     status   location
```

The *vol_id* is the external label of the tape cartridge.

The *status* is the current location of the cartridge:

`home`	The cartridge is in a storage cell.
`in drive`	The cartridge is in a library drive.
`in transit`	The cartridge is being moved.

The current location is either a storage cell ID or a library drive ID, depending on the *status*:

- If the status is `home`, the location is a storage cell ID.
- If the status is `in transit`, the location is the source location of the tape cartridge, either a cell ID or a library drive ID.
- If the status is `in drive`, the location is a library drive ID.

Command Area Messages

Success Message

There is no success message for this command. If the request is successful, the formatted displays shown above will appear.

Error Messages

- A common error message is displayed if the **query** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the request is rejected because the ACSLM is in the recovery state and the *type* is not **server**.

  `Library not available.`

- The following message is displayed for a **query mount** if the tape cartridge specified in the command is not found in the library.

  `Volume identifier` *vol_id* `not found.`

  vol_id is the cartridge specified in the request.

Display Area Messages

No unsolicited messages unique to this command are displayed in the Display Area.

Notes

- If a **cancel** request is issued against pending or current **query** request, the display of information is halted.

See Also

- The `cancel` command for details on canceling a current or pending `query` request.
- A `query server` request cannot be cancelled.

START

Name

start – Initiates ACSLM request processing.

Format

st[art]

Description

The **start** request places the ACSLM in the run state, enabling processing of Storage Server requests. The **start** command has no options.

If the **start** is successful, the ACSLM becomes ready to receive requests. If the **start** is unsuccessful, the ACSLM does not become ready to receive requests.

See the *ACSLM States* section in *Chapter 4* for details on the possible ACSLM states.

Command Area Messages

Success Message

- The following message is displayed when the ACSLM is successfully started.

  `ACSLM Request Processing Started: Success`

Error Messages

- A common error message is displayed if the **start** request is rejected because of a syntax error, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the **start** is unsuccessful.

  `ACSLM Request Processing Not Started:` *status*

  The *status* is the reason for the failure. The possible *statuses* are listed in the *Common Errors* section of this chapter.

Display Area Messages

- The following unsolicited message is displayed when the ACSLM is successfully started:

  `Server system running`

Notes

- Issuing this command when the ACSLM is already in the run state will not have any effect.

See Also

- The `idle` command for information on placing the ACSLM in the idle state.
- The `query` command for details on displaying the current state of the ACSLM.

VARY

Name

vary – Changes the state of an ACS, LSM, library drive, or port.

Format

va[ry] *type identifier ... state* **[force]**

The possible **vary** requests are:

> **vary ac[s]** *acs_id ... state* **[force]**
>
> **vary ls[m]** *lsm_id ... state* **[force]**
>
> **vary dr[ive]** *drive_id ... state* **[force]**
>
> **vary po[rt]** *port_id ... state* **[force]**

Description

The **vary** request changes the state of an ACS, LSM, library drive, or port. A device can be in one of the following five states: online, offline, offline-pending, recovery, or diagnostic. See the *Device States* section in *Chapter 4* for details on these states.

type is the type of device to be varied. Only one device *type* at a time can be varied. Within that *type*, up to 21 different devices can be specified in each request. Valid *types* for this command are:

ac[s]	A specific ACS within the library; requires an *acs_id*.
ls[m]	A specific LSM within an ACS; requires an *lsm_id*.
dr[ive]	A specific drive within a library; requires a *drive_id*.
po[rt]	A specific port within a library; requires a *port_id*.

The *identifier* is the specific device ID. Valid *identifiers* are:

acs_id	The device ID for the ACS.
lsm_id	The device ID for the LSM.
drive_id	The device ID for the drive.
port_id	The device ID for the port.

The *state* can be **of[fline]**, **on[line]**, or **dia[gnostic]**. **dia[gnostic]** is not valid when the *type* is **port**.

The optional option **force** changes the state of the device abruptly. **force** is valid only when the *state* is **of[fline]** and the device is an ACS or an LSM.

An ACS, LSM, or library drive can be changed to online, offline, or diagnostic. A port can be changed to online or offline.

vary offline

An unforced `offline` request for an ACS or LSM immediately places the specified device in the offline-pending state. While the device is in this state, current and pending requests involving the device are processed to completion and new requests are rejected. The device is not placed in the offline state until all current and pending requests have been completed.

An unforced offline request for a library tape drive immediately places the drive in the offline state if it is available. If the drive is in use, the request is rejected.

An unforced offline request for a port immediately places the port in the offline state if either: 1) there are other ports online for that ACS, or 2) the ACS has been varied offline. If the ACS is not offline *and* the specified port is the one only online for the ACS, the request is rejected.

vary offline force

An `offline` request with the `force` option abruptly stops all current activity involving the specified device. Pending requests are aborted, not processed to completion; new requests are rejected. This option is useful if the device must be taken to the offline state while it is involved in extended activity (for example, during an audit).

vary diagnostic

A `diagnostic` request places the specified component in the diagnostic state. In this state, the device can only be accessed through the Command Processor. Current and pending requests are processed to completion; new requests from client applications are rejected. This state can be requested through the Command Processor only.

vary online

An `online` request on a drive or port immediately places the device in the online state. The device is then available for normal library processing.

An `online` request on an offline ACS or LSM immediately places the device in the recovery state while it undergoes a recovery process. During this process, the LSM robot determines the physical contents of certain key areas of the LSM, such as tape drives, the Playground area, Pass-Thru Ports, and the robot's hands. The data base is updated with this information. The ACS or LSM is not placed in the online state until the recovery is complete. See the *Storage Server Recovery* section in *Chapter 4* for details.

An `online` request on an ACS or LSM in the diagnostic state immediately places the device in the online state.

Command Area Messages

Success Message

- The following message is displayed for each device successfully varied to a different state.

  `Vary:` *type identifier* `Varied` *state*

  The *type* is `acs`, `lsm`, `drive`, or `port`. The *identifier* is an *acs_id*, an *lsm_id*, a *drive_id*, or a *port_id*. The *state* is `offline`, `online`, or `diagnostic`.

Error Messages

- A common error message is displayed if the **vary** request is rejected because of a syntax error, invalid identifier, type, or option, process failure, data base error, etc. Refer to the *Common Errors* section of this chapter for a list of possible messages.

- The following message is displayed if the LSM robot is unable to dispose of in-transit cartridges while the LSM or its ACS was varied online. If you are varying an ACS online, the ACS state will be changed to online immediately, but any LSMs that are unable to complete in-transit cartridge recovery will remain offline. There will be no message or Event Log entry to reflect the final state of the ACS and its LSMs.

  `In-transit cartridge recovery incomplete.`

- The following message is displayed if the device state could not be changed successfully.

  `Vary: Vary` *type identifier* `failed,` *status*

  The *status* is the reason for the failure. The possible *statuses* are listed below.

- The following *status* indicates that the ACS, LSM, library drive, or port is already in the requested state.

  `State unchanged.`

- The following *status* indicates that the request is not valid.

  `Vary disallowed`

  This may occur for any of the following reasons:

  - The request is to place an ACS or LSM offline or online, but the device is currently in the offline-pending or recovery state.
  - The request is to vary an ACS online, but all ports connecting the server system to that ACS are offline.

- The request is to vary an LSM online, but the ACS to which the LSM is attached is offline.
- The request is to place a port offline, but the ACS is online and this is the only online port for the ACS.
- The request is to place a library drive offline, but the drive is in use.
- The request is to place an ACS, LSM, or library drive in the diagnostic state, but the request is not originating from the Command Processor.

Display Area Messages

- One of the following messages is displayed when an ACS, LSM, library drive, or port changes state.

  ACS *acs_id*: *state*
  LSM *lsm_id*: *state*
  Drive *drive_id*: *state*
  Port *port_id*: *state*

  The *acs_id*, *lsm_id*, *port_id*, and *drive_id* is the ACS, LSM, port, or library drive identifier. The *state* is `Online`, `Offline`, `Diagnostic`, or `Pending`.

- The following message is displayed if, during recovery of in-transit cartridges, a cartridge label is unreadable or duplicate. The cartridge is moved to the CAP.

  CAP *cap_id*. Remove cartridges from CAP.

  cap_id is the CAP containing the cartridges.

Notes

- The current state of each ACS, LSM, library drive, and port is recorded in the data base. IPLing the system does not change the state of these components. Installing or reconfiguring the Storage Server places all components in the online state by default.
- Any request to change the state of an ACS is interpreted as a request to change the state of all subordinate LSMs.
- An LSM attached to an offline ACS cannot be varied online.
- Varying a port offline makes the port unavailable for transferring requests and replies between the ACSLM and the ACS.
- When more than one port is active to an ACS, varying a port offline does not affect ACS operations. If only one port is active to the ACS, however, varying the port offline is not allowed unless the ACS is first varied offline.

- When bringing an ACS or LSM online, recovery of in-transit cartridges may fail for any of the following reasons:
  - No available storage cells can be found for the in-transit cartridges
  - A cartridge label fails to validate and the CAP is full or cannot accept errant cartridges

  The device is marked as online in the data base, but unrecorded in-transit cartridges may restrict use of Pass-Thru Ports or the robot's hands.

See Also

- The `query` command for details or displaying the current state of a library device.
- *Appendix A: Event Log Messages* for entries made by this command.

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CHAPTER 6:
MAINTAINING THE ACS LIBRARY

OVERVIEW

This chapter describes routine maintenance tasks which may be performed on a pre-scheduled or as-needed basis. Exceptional situations and error resolution are covered in *Chapter 7: Troubleshooting*.

PERFORMING A CARTRIDGE AUDIT

Overview

An audit is a physical inventory of the contents of all or part of a library. An audit can be performed at any time without interrupting normal library operations. The only restriction is that the CAP reserved by the audit for ejecting errant cartridges cannot be used for other activities while the audit is running.

An audit of an entire LSM will take approximately eight or nine hours, depending on how much other activity is taking place in the library. Therefore, it is advantageous to limit an audit to an individual panel or subpanel whenever possible.

When an LSM is online during an audit, the robot will rescan a cell if it finds a discrepancy between the physical contents of the cell and the contents recorded in the data base. When an LSM is in the diagnostic state, however, the robot will *not* rescan a cell if it finds a discrepancy; the data base is updated with the physical contents of the cell as determined from the first scan. New, manually loaded LSMs will have many "discrepancies" since the data base indicates that these LSMs are empty. It is therefore recommended that you vary new LSMs to the diagnostic state before performing an audit. This will significantly reduce the time required for the audit. See *Chapter 5: Library Operator Commands* for details on the `vary` command.

When To Do an Audit

An audit must be performed whenever cartridges are moved *manually* due to changes in the library configuration. Examples of these kinds of configuration changes include:

- Adding or removing an ACS or an LSM
- Adding or removing a Pass-Thru Port (PTP)
- Adding or removing a cartridge drive

An audit should also be run any time a major hardware or software failure has occurred, or any time you suspect discrepancies between the cartridge data base and the physical contents of an LSM. Examples of these situations include:

- After a Storage Server recovery.
- After you perform a data base recovery.

An audit will ensure that the Storage Server data base is consistent with the physical contents of the library.

Note: You may want to perform an audit any time the LSM access door has been opened. This is because opening the door allows for manual movements of cartridges which are not recorded in the data base. You should review the Event Log periodically for messages indicating that the door has been opened. See the *Event Log* section in *Chapter 7* for details on the Event Log.

See *Chapter 5: Library Operator Commands* for details on using the `audit` command.

RECONFIGURING A LIBRARY

Overview

Reconfiguring the library consists of updating the Storage Server data base to reflect the physical configuration of the library and the port connections between the library and the server system.

When to Do a Reconfiguration

The Storage Server data base must be updated whenever the physical configuration of the library is changed. The Storage Server will not run if the configuration defined in its data base does not match that defined in the LMU by a Customer Services Engineer.

Examples of configuration changes requiring an update to the data base include:

- Adding or removing an ACS
- Adding or removing an LSM
- Adding or removing a Pass-Thru Port (PTP)
- Changing the "master/slave" relationship between two LSMs
- Adding or removing a cartridge drive
- Adding or removing a port connection between the server system and the LMU

How To Do a Reconfiguration

The data base is reconfigured by running the Configuration program

acsss_home`/config/acsss_config`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`. This is the same program that was originally used to configure the system at installation. See the *Configuring the Software* section in *Chapter 3* for details on using the program.

Use the Build/VerifyLibrary Configuration routine to update the data base with all configuration changes *except for* adding or removing port connections. Use the Configure Library Communications routine to reconfigure ports. Use both routines if you have added or removed an ACS.

Both of these routines will warn you that existing configuration data will be overwritten.

In most cases, you should perform an audit after using the Build/VerifyLibrary Configuration routine to reconfigure the library. See the *Performing a Cartridge Audit* section in this chapter for details on the specific types of configuration changes that require an audit.

MAINTAINING THE DATA BASE

Overview

The data base contains all information regarding the library configuration and the location of all library tape cartridges. Careful management of the data base will provide better system performance and will ensure full recovery of data from system errors.

The Storage Server data base is managed by a third-party relational data base management system (RDBMS). The data base stores all information the Storage Server needs, including the following data:

- Library configuration
- Tape cartridge IDs and locations

The ACSLM communicates with the RDBMS to control all updates to the data base. The data base supports an industry-standard SQL command language.

Library Configuration Data

This data is initially loaded during installation of the Storage Server software. It is changed only when the configuration of the library changes (a cartridge drive or LSM is added, for example) and the reconfiguration utility is run. Configuration data includes the following attributes:

- *ACS data.* The number of ACSs in the library, their identifiers, and the number of communication lines (ports) to each ACS. All ACSs in a library share the same data base.
- *LSM data.* The number of LSMs in each ACS and their identifiers; the location of each library drive, CAP, and PTP attached to each LSM; and the location and identifiers of adjacent LSMs.
- *Device states.* The state and activity of each hardware component.
- *Cell map.* A map of all storage cells in the library and their contents.

Tape Cartridge IDs and Locations

This data is initially loaded by a full system audit. It is continuously updated by the ACSLM as cartridges are moved, entered, and ejected. This data includes the following attributes for each tape cartridge:

- *Volume identifier.* Equivalent to the cartridge's external label.
- *Current location.* This can be a cell location or a library drive.
- *State.* Indicates whether the cartridge is in use, reserved by a process, or available.

Installing the Data Base

The data base manager software and the data base itself is included on the Storage Server software installation tape. There are no special procedures required to install the data base apart from the rest of the tape. See the *Loading the Storage Server Installation Tape* section in *Chapter 3* for details.

Checkpointing and Journaling

Operator or system errors can cause data corruption that includes the loss of an entire disk. Together, checkpointing and journaling provide a method for ensuring that logical or physical errors in the data base can be corrected with minimal impact to library operations.

A *checkpoint* is a backup copy of the entire data base. It captures the data base as of a certain point in time. *Journals* are transaction records of all data base changes made since the last checkpoint. The checkpoint serves as a static backup, whereas journals provide dynamic backups. A data base can be fully recreated by sequentially applying journal records to the checkpoint. During installation, all data base tables are automatically flagged for journaling.

The checkpoint is written to tape. There can be only one checkpoint per tape.

Journal files are written to disk in the data base directory that was created when the Storage Server software was installed. This directory is called

acsss_home`/database`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

The RDBMS actually creates a series of journal files in this directory. Only one journal file is updated at a time, and as that file reaches its optimum size, the RDBMS automatically creates a new file. This process is entirely transparent to system users. This method of journaling ensures that no journal file gets large enough to degrade system performance. It also ensures that available disk space is the only limitation to the number of journal records that can be created between checkpoints.

Data Base Utilities

The following utilities are provided to allow for data base backup and recovery.

- `bdb.acsss` – Initializes the checkpoint and journal files and performs general data base cleanup. This utility is described in this chapter.
- `rdb.acsss` – Restores the data base in the event of data base corruption. See the *Data Base Recovery* section in *Chapter 7* for a description of this utility.

These utilities are located in the directory

acsss_home/`database`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

Backing Up the Data Base

Description

Backing up the data base, which is done with the `bdb.acsss` utility, consists of initializing the checkpoint and journal files.

This utility can be used by `root` or `acsss` only.

The utility performs the following functions:

- Cleans up extraneous pointers and temporary files created by the RDBMS.
- Collects data base statistics which are used by the RDBMS to determine the most efficient methods for storing and accessing the data.
- Creates a new checkpoint by copying the current data base to tape.
- Deletes old journal files.
- Rebuilds the data base tables for more efficient storage.

By cleaning up pointers and temporary files, and rebuilding data base tables, this utility helps to optimize data base performance.

Detailed status and error messages, which are generated as this utility runs, are written to the file

acsss_home/`log/bdb_event.log`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`. This file is rewritten every time the utility is run; therefore it contains detail for the *most recent* use of the utility only. In general, you need to review this file only if an error occurs during the backup.

When Backups Should Be Done

The frequency at which checkpoint and journal files should be initialized depends on the amount of library activity and the amount of disk space available for journal files. If this utility is not run frequently enough, system performance will become degraded and disk space will fill up with journal records. This utility should not be run too frequently, however, because library operations must be suspended while it runs.

In addition to a regular backup schedule, this utility should be run when you initially load the data base and whenever the data base changes significantly. Significant changes include adding a new ACS or LSM, or performing audits.

Backup Procedure

Note: This utility will not begin until the data base is free, and it will lock the data base to all other users while it is running.

1. Login as `root` or `acsss`.
2. From a Command Processor, use the `idle` command to bring the Storage Server to the idle state. This will ensure that no users are trying to use library resources while the backup is in progress. See *Chapter 5: Library Operator Commands* for details on the `idle` command.

   Note: This utility will also run if the Storage Server software has been terminated. See the *Terminating the Storage Server Software* section in *Chapter 4* for details on termination.
3. Verify that the checkpoint cartridge is inserted in the server system tape drive.
4. At the shell prompt, enter

   `bdb.acsss`
5. The utility verifies that you are the superuser or the `acsss` user and verifies that a tape is inserted in the tape drive. If these conditions are met, the utility displays the following message as it initiates:

   ```
   +---------------------------------+
   | Entering database backup utility |
   +---------------------------------+
   ```

   Note: The next two steps apply only if the Storage Server software is running.
6. The utility displays the following warning message to remind you that the Storage Server must be idle before the utility will run.

   ```
   **** WARNING ****

   Storage Server must be in the IDLE state to perform
   database backups.
   [ Hit RETURN to continue ]
   ```

   Enter **Return** if the Storage Server is idle; the utility will continue. If the Storage Server is not idle, you can do either of the following:

   – Exit the utility by entering **Ctl-C**, or

- Issue the `idle` command from a Command Processor, wait for the Storage Server to go idle, then enter **Return** in response to the backup utility prompt.

7. After you enter **Return**, the utility displays the following message as it verifies that the Storage Server is idle.

   ```
   Verifying State of Storage Server...
   ```

   If the Storage Server is idle, the following message is displayed:

   ```
   Storage Server State Confirmed!
   ```

   If the Storage Server is *not* idle, the following message is displayed and the utility returns to Step 6.

   ```
   Storage Server NOT in IDLE State!
   ```

8. If no errors occur, the utility proceeds normally. Figure 6-1 shows the messages that the utility displays as it runs. Normal library operations can resume when the utility is finished. **Note: Ctl-C** is disabled during this phase of the utility.

```
Beginning Backup Phase
Backup Phase Complete
Beginning Optimization Phase
Optimization Phase Complete
Exiting database backup utility
```

Figure 6-1.Backup Utility Messages

Following are descriptions of the processes that take place as these messages appear.

8.1 `Beginning Backup Phase`

The RDBMS deletes extraneous files and pointers. Then the tape in the server system drive is automatically rewound. The data base is copied to the tape, overwriting any existing checkpoint on the tape.

8.2 `Backup Phase Complete`
`Beginning Optimization Phase`

The RDBMS rebuilds the most frequently used tables, to make access and update more efficient.

8.3 `Optimization Phase Complete`

The RDBMS gathers statistics used for optimizing data base access and storage.

8.4 `Exiting database backup utility`

The utility finishes and the RDBMS releases the data base locks.

9. Use the `start` command to place the Storage Server in the run state. See *Chapter 5: Library Operator Commands* for details on the `start` command.

Backup Errors

Following are descriptions of error messages that may appear while the utility is running.

- The following message appears if you did not login as `root` or `acsss`.

```
                    **** WARNING: ****
** user_id not authorized to use this utility **
```

  The utility terminates with this message. *user_id* is the login ID that you used when you logged in.

- The following message appears, and the utility terminates, if the RDBMS utilities required to perform the backup are not found.

```
                  **** FATAL ERROR: ****
** Path name to DATABASE utilities is incorrect,
Aborting utility **
```

  You should verify that the current path includes the following directory:

  acsss_home`/database`

  where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

- The following message appears if no cartridge is detected in the server system tape drive or if there is a problem with the tape.

```
                    **** WARNING: ****
st0: no tape loaded or drive offline
Check Tape Device (device_name): Problem with
Checkpoint Tape.
[ Hit RETURN to continue ]
```

  device_name is the address of the server system tape drive.

  You should check the drive and insert the correct tape. If there is a tape in the drive, you should make sure that the drive is online. Enter **Return** when you are ready to continue.

- The following message appears if the RDBMS detects that the data base is in use.

```
                **** WARNING: ****
Backup will wait for all database users to EXIT --
Ctrl-C to Exit
```

  You can enter **Ctl-C** to exit the utility. Otherwise, the utility will wait until the data base is no longer in use, and will then immediately begin the backup.

INSTALLING STORAGE SERVER UPGRADES

Upgrades to the Storage Server software are distributed periodically. These upgrades may involve fixes and/or product enhancements. Each upgrade is identified by a new Storage Server version number. This version number appears on the tape label.

The procedure for installing and implementing upgrades will vary depending on the types of changes included in the new version. For example, major enhancements that include changes to the data base structure will require that the data base be rebuilt as part of the upgrade.

Generally, installing an upgrade involves the following steps:

1. Terminating the Storage Server.
2. Loading the upgrade tape onto the server system.
3. Editing product startup files, as necessary.
4. Reinitiating the Storage Server.

Note: Upgrading product software does not destroy information contained in the data base. An audit is generally not required after upgrading the software.

CLEANING THE TRANSPORT TAPE PATH

Overview

Usually the tape path requires cleaning because either a certain period of time has elapsed since it was last cleaned, or the CU decides, based on the amount of use, that the path needs cleaning. A message is passed from the CU to the LMU to the ACSLM. The ACSLM, in turn, issues a Display Area message to clean the transport.

The tape path of a transport may be cleaned any time the transport is not in use or reserved for use. Each transport should be cleaned at least once a week even without a message.

Cleaning Tape Path – Automatic Mode

Use the following procedure when the Storage Server sends a Display Area message to clean the tape path of a transport:

1. Issue a `mount` request (see *Chapter 5: Library Operator Commands*) to mount a cleaning tape (previously entered under a known external label in the LSM) on the designated transport.
2. When the cleaning operation is complete, issue a `dismount` command for the appropriate transport.

Cleaning a Tape Path – Manual Mode

To clean the tape path of a transport in a manual mode:

1. Use the standard LSM entry procedures to open the LSM access door and enter the LSM. See the *Entering the LSM* section in *Chapter 4* for this procedure.
2. Insert a cleaning cartridge into the transport.
3. When the cleaning tape is rewound and unloaded, remove the cartridge.
4. Close the LSM access door according to the standard procedures.

MAINTENANCE TOOLS

Overview

The maintenance structure for the 4400 Automated Cartridge System consists of:

- Machine Initiated Maintenance
- Customer Initiated Maintenance
- Regularly scheduled preventive maintenance

Machine Initiated Maintenance (MIM)

A new, unique feature of the 4400 Automated Cartridge System is machine initiated maintenance (MIM). An artificial intelligence system, known as an expert system, enables the subsystem to monitor its activity, predict problems, and respond according to a customer-selected threshold set by the StorageTek Customer Services Engineer.

The expert system continually monitors numerous areas and characteristics of the subsystem, such as number and kind of intermittent errors, environmental and operating parameters, stack pointers, and the number of automatic retries. It helps correct problems before they impact a customer's operations by sending an alert message and error code to the Central Support Remote Center (CSRC) or Storage Server Display Area when certain undesirable conditions or degraded performance levels occur.

The expert system can automatically download performance statistics to the CSRC at scheduled intervals.

Customer Initiated Maintenance (CIM)

Customer Initiated Maintenance (CIM) begins with a telephone call from a customer to the StorageTek Central Support Remote Center (CSRC). The customer receives immediate attention from an expert troubleshooter who can run all diagnostics remotely and either tell the customer how to remedy the problem, or dispatch a CSE with the necessary part to repair the subsystem.

Preventive Maintenance

Table 6-1 shows the suggested schedule of preventive maintenance of ACS components.

Table 6-1. Schedule of Preventive Maintenance

Component	Preventive Maintenance Schedule
LMU	None
LSM	1 hour every 6 months
CU	None
CD	Clean tape path in each transport once a week or when Storage Server issues a Display Area message, whichever comes first.

All system components are self-calibrating. This minimizes, and in some cases eliminates, regularly scheduled preventive maintenance.

CHAPTER 7: TROUBLESHOOTING

OVERVIEW

This chapter describes how to detect, report, and respond to library and Storage Server errors. Some errors can be resolved by the library operator or system administrator; others will require intervention by a StorageTek Customer Services Engineer (CSE) or Software Support Representative (SSR).

The 4400 ACS Library and the UNIX Storage Server offer the following tools which aid in the detection and resolution of errors:

- Internal diagnostics
- System-wide Event Log
- Data base recovery utility

ERROR RECOVERY

Description

If an individual process or a non-critical library component fails, the Storage Server records the error in the Event Log and continues to offer library services using the unaffected parts of the system. These errors have minimal impact on the user. If a major system failure occurs, however, library operations are suspended until the error is corrected.

Library failures can be in any of the following categories:

- Communications failures
- Hardware failures
- Software failures

These failures are described in the following sections.

Communications Failures

Communications failures include the failure of communications lines between the server system and an LMU or between an LMU and an LCU. These failures may be due to either hardware or software errors.

Communications failures also include the failure of interprocess communications mechanisms between the ACSLM and the CSI or ACSSA. These are software errors.

If the Storage Server is unable to communicate with another library component, it will log an error and retry until contact is established or until a system-defined timeout period is reached.

Hardware Failures

Hardware redundancy and self-correction schemes allow library operations to continue even if one component fails; the redundant component will take over for the failed one, allowing the library to continue operations in a degraded mode. An LSM will become unavailable, however, if one of its primary hardware components fails, or possibly if multiple secondary components fail.

Some examples of hardware errors are:

- *LSM robot failure.* Total loss of a robot makes the affected LSM unavailable.
- *Loss of robot hands, cameras, or lights.* Library processing in an LSM can continue in a degraded mode if the robot loses only one hand, camera, or light. If both hands, cameras, or lights fail, however, the LSM becomes unavailable.
- *CAP failure.* Failure of a CAP makes it impossible to enter and eject tape cartridges directly into the affected LSM. All other library processes can continue normally, however.
- *LMU failure.* If an LMU fails, the ACS becomes unavailable, and all current or pending Storage Server requests to the ACS are aborted.

New requests to a failing component are attempted until the component or the entire LSM or ACS is varied offline. Recovery of failed library tape drives is the responsibility of the client systems.

Software Failures

Major software failures include a system crash, a data base failure, or a library configuration inconsistency. These errors result in loss of library operations in all affected ACSs. As soon as the problem is corrected, the Storage Server goes through automatic recovery procedures (see the *Storage Server Recovery* section in *Chapter 4* for details).

MAINTAINABILITY AND DIAGNOSTICS

Central Support Remote Center (CSRC)

The Central Support Remote Center (CSRC) is an exclusive service of StorageTek. It responds to customer and Customer Services Engineers (CSE) calls 24 hours a day, 7 days a week. A direct/connect modem and telephone allows communications between the customer site and the CSRC across normal, voice-grade telephone lines.

The modem and telephone can be placed anywhere within 250 feet (76 meters) of the LMU or CU.

The CSRC is accessible through a toll-free WATS line and offers the following services:

- Resident experts who specialize in hardware and software are on duty around the clock to answer questions and help solve problems.
- A Remote Diagnostics Center that can run all diagnostics and interpret the results.
- Error log analyses collected by the LMU and CU are written on the functional diskette. The CSRC can obtain a dump of these statistics remotely.
- A symptom/fix database. The CSRC has a computerized history of solutions to ACS problems. A special program uses this data to pinpoint the source of a problem, based on the history of symptoms and subsequent solutions.
- Remote call up can activate an audible signal in the LMU or CU when the diagnostician wants to talk to someone in the data center over the CSRC phone line.
- Complete control of all calls from initial contact to the final step, which usually is the dispatching of an CSE with a part to remedy the problem.

Tracking Software Problems

All Storage Server components support the following methods of problem determination and correction.

- *An Event Log*. This log contains a time-stamped history of significant events to assist problem determination. See the *Event Log* section in this chapter for a detailed description of this log and its uses.

- *An execution trace log*. Execution tracing can be enabled for Storage Server software components to provide a finer granularity of detail than the Event Log. The file to which execution traces are logged is defined during Storage Server configuration. See the *Configuring the Software* section in *Chapter 3* for details.
- *Standard UNIX utilities*. UNIX utilities can be used to create core files of suspect processes and inspect those files for further information. Examples of such utilities are `kill` and `adb` (or `sdb`).

Access to the information in these files can be obtained via any standard terminal (or modem) interface, assuming access privileges are granted by the customer.

Distributing Software Corrections

Field patching of binary modules is not supported. Even in the case of command files, the preferred method of field correction is by issuing a new software release, requiring a full installation. For severe field errors, individual binary or command files can be issued and replaced. With customer consent, this can be accomplished remotely, via a modem interface.

EVENT LOG

Overview

One system-wide Event Log contains information about library events and errors. All Storage Server software components log events to the Log through the centralized Event Logger.

The information in this Log permits later analysis and tracking of normal library events as well as errors. Logged events include:

- *Library errors*. Both fatal and nonfatal hardware and software errors are logged. Examples include LSM failures, problems with cartridges, data base errors, interprocess and library communications failures, and software failures not normally handled by the operating system.
- *Significant events*. These are normal events that may be of significance in monitoring library operations. For example, events are logged when an `audit` is initiated or terminated, a device changes state, or a CAP is opened or closed.

The Event Log is automatically created when the Storage Server software is installed. The Log exists in the file

```
acsss_home/log/acsss_event.log
```

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`. When you login to the server system as the `acssa` user, a window with a `tail` of the Event Log is included on the standard terminal display.

How Events Are Logged

To log an event, a Storage Server component such as the ACSLM, ACSSA, or CSI, sends a message to the centralized Event Logger. The Event Logger accepts the message and updates the Event Log in the following manner.

1. Reformats the message by applying the prefix.
2. Opens the Event Log file, or creates it if it does not already exist.
3. Appends the Event Log message to the end of the file.
4. Checks the current file size against the limit parameter specified at installation. If the current size exceeds the specified limit, the Event Logger sends an unsolicited message to the Display Area of the Command Processor to alert the System Administrator.
5. Closes the Event Log file.

Updating the Event Log in this manner keeps the Log entries sequential and allows the System Administrator to truncate or delete the file at any time during system operation.

Event Log Size Limit

The Event Log size threshold is defined during installation. See the *Configuring the Software* section in *Chapter 3* for details. If the current Event Log file size exceeds its limit, the following unsolicited message is displayed:

```
Event log is full.
```

This message will be displayed in the Display Area every minute until the file is reduced in size. Note that the Event Logger continues to make entries to the Log even after the file has reached the size limit specified at installation. This limit serves only as a trigger to notify the System Administrator that the file needs to be reduced in size. The only absolute limit to the size of the Event Log is determined by available disk space.

When you see this message you should immediately move the file to a different name and then archive it according to your procedures.

You do not need to create a new Event Log after moving the old one, as the Event Logger will automatically create the file if it does not find one in the appropriate directory.

Event Log Errors

The following are errors that may occur as part of Event Log processing.

- If a communication failure occurs while the Event Logger is sending a message to the Command Processor, the unsolicited message will be lost.
- The following unsolicited message is displayed if the Event Logger is unable to access or write to the Event Log file. This may be due to incorrect permissions on the directory or the file.

  ```
  Event log access failed
  ```

Using the Event Log

The System Administrator should review the Event Log periodically to monitor library operations.

In addition, the Event Log should be reviewed any time an unsolicited message appears in the Display Area of the Command Processor. The Event Log entry will contain more detail than the message in the Display Area.

The following are times when Event Log entries are especially useful:

- After an `audit`
- After a hardware or software failure
- After Storage Server recovery

See *Appendix A: Event Log Messages* for descriptions of significant Event Log messages.

DATA BASE RECOVERY

Overview

Checkpoint and journal files provide a means of recovering the data base in the case of a major error. See the *Maintaining the Data Base* section in *Chapter 6* for details on checkpointing and journaling.

Data Base Utilities

The following utilities are provided to allow for data base backup and recovery.

- `bdb.acsss` – Initializes the checkpoint and journal files and performs general data base cleanup. See the *Maintaining the Data Base* section in *Chapter 6* for a description of this utility.
- `rdb.acsss` – Restores the data base in the event of data base corruption. This utility is described in this chapter.

These utilities are located in the directory

acsss_home/`database`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

Using the Recovery Utility

Description

Recovering the data base is done with the `rdb.acsss` utility. This utility recreates the data base by sequentially applying all current journal transaction records to the current checkpoint.

This utility can be used by `root` or `acsss` only.

The `rdb.acsss` utility performs the following functions:

- Copies the checkpoint data base from tape to a temporary area on the disk.
- Sequentially applies the journal records to the checkpoint copy.
- Moves the newly updated data base from the temporary area to the "live" data base.
- Writes a new checkpoint to tape, removing the old checkpoint.
- Deletes the old journal files.

As it applies journal records, the `rdb.acsss` utility backs out any incomplete transactions; it does not leave the data base in an inconsistent state.

Detailed status and error messages, which are generated as this utility runs, are written to the file

acsss_home/`log/rdb_event.log`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`. This file is rewritten every time the utility is run; therefore it contains detail for the *most recent* use of the utility only. In general, you need to review this file only if an error occurs during the recovery.

When the Recovery Utility Should be Used

The `rdb.acsss` utility should be used if there is a physical or logical error in the data base. This may be the result of a software error or of a system failure.

Data base errors are recorded in the Event Log which should be reviewed to determine whether recovery is necessary. You should perform a data base recovery whenever you see the following message in the Event Log:

```
Database is inconsistent.  Please run restoredb -q
db_name.
```

where *db_name* is the name of the Storage Server data base, usually `lib1`.

If there has been physical damage to the area of the disk where the data base software resides, it may be necessary to reload the software and rebuild all or part of the file system in order to restore the system to full functioning. It is recommended that you contact your Software Support Representative prior to performing a recovery.

Recovery Procedure

Note: This utility will not begin until the data base is free, and it will lock the data base to all other users while it is running.

1. Login as `root` or `acsss`.
2. Invoke the `kill.acsss` command file to terminate the Storage Server. This utility will not run while the Storage Server is active. See the *Terminating the Storage Server Software* section in *Chapter 4* for details on termination.
3. Verify that the most recent checkpoint cartridge is inserted in the server system tape drive.
4. At the shell prompt, enter

   `rdb.acsss`

5. If no errors occur, the utility proceeds normally. Figure 7-1 shows the messages the utility displays as it runs. Normal library operations can resume when the utility is finished.

```
                 +------------------------------------+
                 | Entering database recovery utility |
                 +------------------------------------+

Beginning Database Recovery.
Database Recovery Complete.
Please insert a NEW Checkpoint Tape into the tapedrive (device_name).
[ Hit RETURN to continue ]
Beginning Backup Phase.
Backup Phase Complete.
Exiting database recovery utility.
```

Figure 7-1.Recovery Utility Messages

Following are descriptions of the processes that take place as these messages appear. **Note: Ctl-C** is disabled during this phase of the utility.

5.1 `Beginning Database Recovery.`

The data base is copied from the checkpoint tape to a temporary area on the disk. The journal files are then applied sequentially to this copy of the data base.

When all journals have been applied, the new data base is copied to the "live" data base area, and the temporary file is deleted.

5.2 `Database Recovery Complete.`
`Please insert a NEW Checkpoint Tape into the tapedrive (`*device_name*`).`
`[ Hit RETURN to continue ]`

The utility prompts you to remove the old checkpoint tape and insert a new one into the server system tape drive. *device_name* is the address of the tape drive. This new tape will be used to make a checkpoint of the fully restored data base.

Enter **Return** when the new tape is in the drive.

5.3 `Beginning Backup Phase.`

The new checkpoint tape is automatically rewound, and the new data base is copied to the tape.

The old journal files are deleted from the disk. Also, any extraneous or expired files and pointers are deleted.

5.4 `Backup Phase Complete.`
`Exiting database recovery utility.`

The utility finishes and the RDBMS releases the data base locks.

6. Invoke the `rc.acsss` command file to initiate the Storage Server. See the *Initiating the Storage Server Software* section in *Chapter 4* for details on initiation.

Recovery Errors

Following are descriptions of error messages that may appear while the utility is running.

- The following message appears if you did not login as `root` or `acsss`.

```
                **** WARNING: ****
** user_id not authorized to use this utility **
```

The utility terminates with this message. *user_id* is the login ID that you used when you logged in.

- The following message appears, and the utility terminates, if the utilities required to perform the recovery are not found.

```
              **** FATAL ERROR: ****
Path name to DATABASE utilities is incorrect,
Aborting utility!
```

You should verify that the current path includes the following directory:

acsss_home`/database`

where *acsss_home* is the directory in which the Storage Server software was installed, usually `/usr/ACSSS`.

- The following message appears if no cartridge is detected in the server system tape drive or if there is a problem with the tape. This message can appear during either the recovery or the backup phase of this utility.

```
                **** WARNING: ****
st0: no tape loaded or drive offline
Check Tape Device (device_name): Problem with
Checkpoint Tape.
[ Hit RETURN to continue ]
```

device_name is the address of the server system tape drive.

You should check the drive and insert the correct tape. If there is a tape in the drive, you should make sure that the drive is online. Enter **Return** when you are ready to continue.

- The following message appears if the utility detects that the Storage Server has not been terminated.

```
                    **** WARNING: ****
Storage Server is running, it cannot be running to
perform recovery -- pid_file exists to indicate this.
[ Hit RETURN to continue ]
```

pid_file is the name of the Storage Server process ID file which is created when the Storage Server is initiated.

The utility will not continue until you terminate the Storage Server by invoking the `kill.acsss` command file. You can do this from another window or terminal. To terminate the Storage Server from the *current* window or terminal you must first exit the recovery utility by entering **Ctl-C**.

Enter **Return** when the Storage Server is no longer running.

- The following message appears if the RDBMS detects that the data base is in use.

```
                    **** WARNING: ****
RECOVERY can not proceed until all database users
have EXITED.
```

You can enter **Ctl-C** to exit the utility. Otherwise, the utility will wait until the data base is no longer in use, and will then immediately begin the recovery.

REMOVING A CARTRIDGE FROM THE ROBOT'S FINGERS

> **WARNING**
>
> Do not enter the LSM without following the procedure in the *Entering the LSM* section in *Chapter 4*.
>
> Do not enter the LSM or move any of its robotic mechanisms if you have any reason to suspect the LSM is enabled.

Caution

Be extremely careful when you remove a cartridge from the robot's fingers (gripper assembly). Perform the following procedure *exactly*.

In particular, do not bend the fingers; use the knob on the stepper motor to release the grip. Failure to do so will cause mechanical damage to the finger mechanism.

Caution

Do not touch any shiny polished surfaces. Body oils can destroy the lubrication on these surfaces.

Do not touch any lubricated parts.

Do not push or pull the cartridge, fingers, plunger, camera or any other part of the reach function mechanism except as shown in Figures 7-2, 7-3 and 7-4.

If it is necessary to remove a cartridge from the fingers of the robot, follow these procedures:

1. Rotate the reach function mechanism counterclockwise so that the cartridge and fingers are in the horizontal position as shown in Figure 7-3.
2. To extend the gripper assembly forward, grasp the cartridge with the left hand and pull, until the gripper assembly has extended to its maximum length as shown in Figure 7-3.
3. Grasp the gripper assembly with the right hand, then hold it in the extended position as shown in Figure 7-3.
4. Grasp the fingers with the left hand and then hold that position.
5. Turn the gripper motor dial counterclockwise to release the cartridge from the fingers as shown in Figure 7-4.
6. Remove the cartridge.

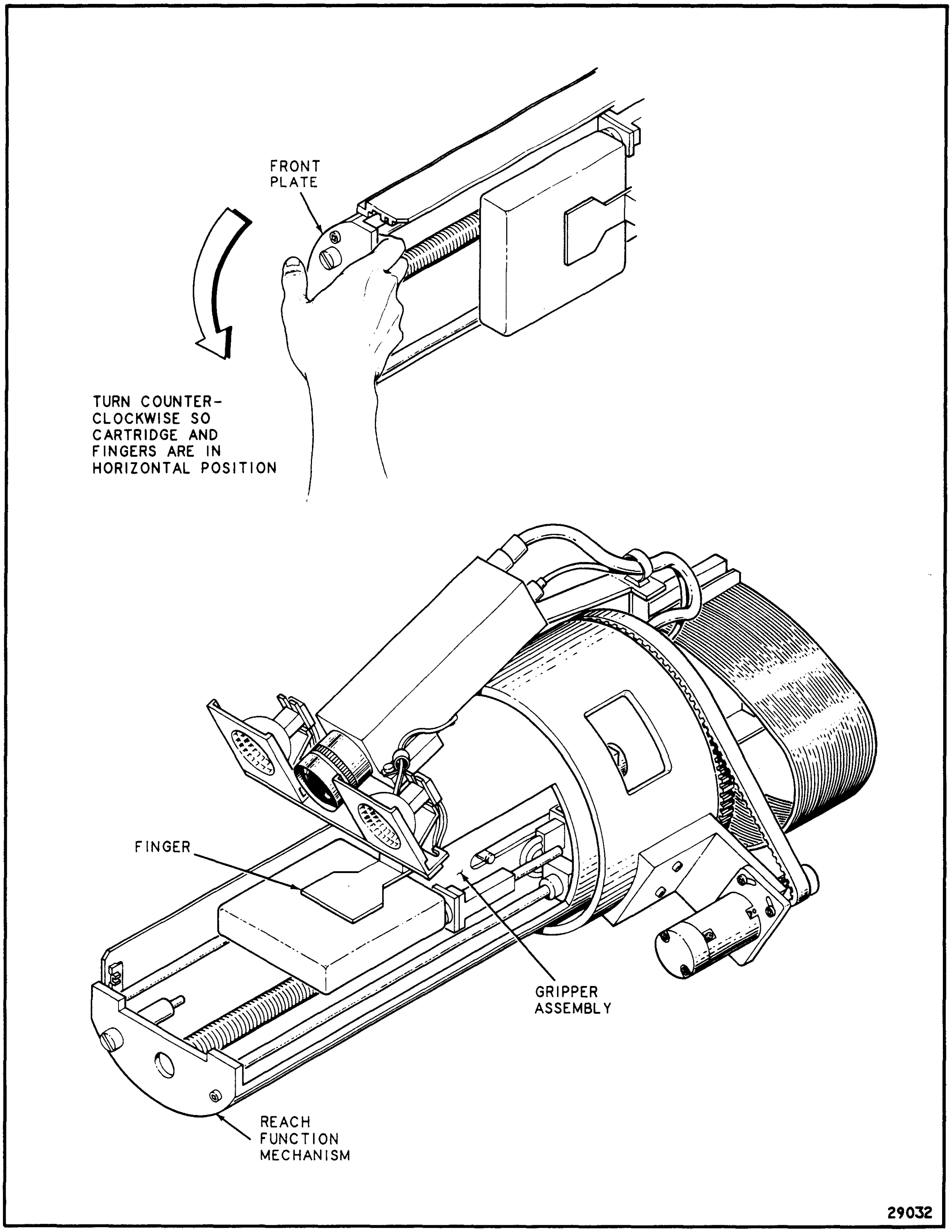

Figure 7-2. Reach Function Mechanism

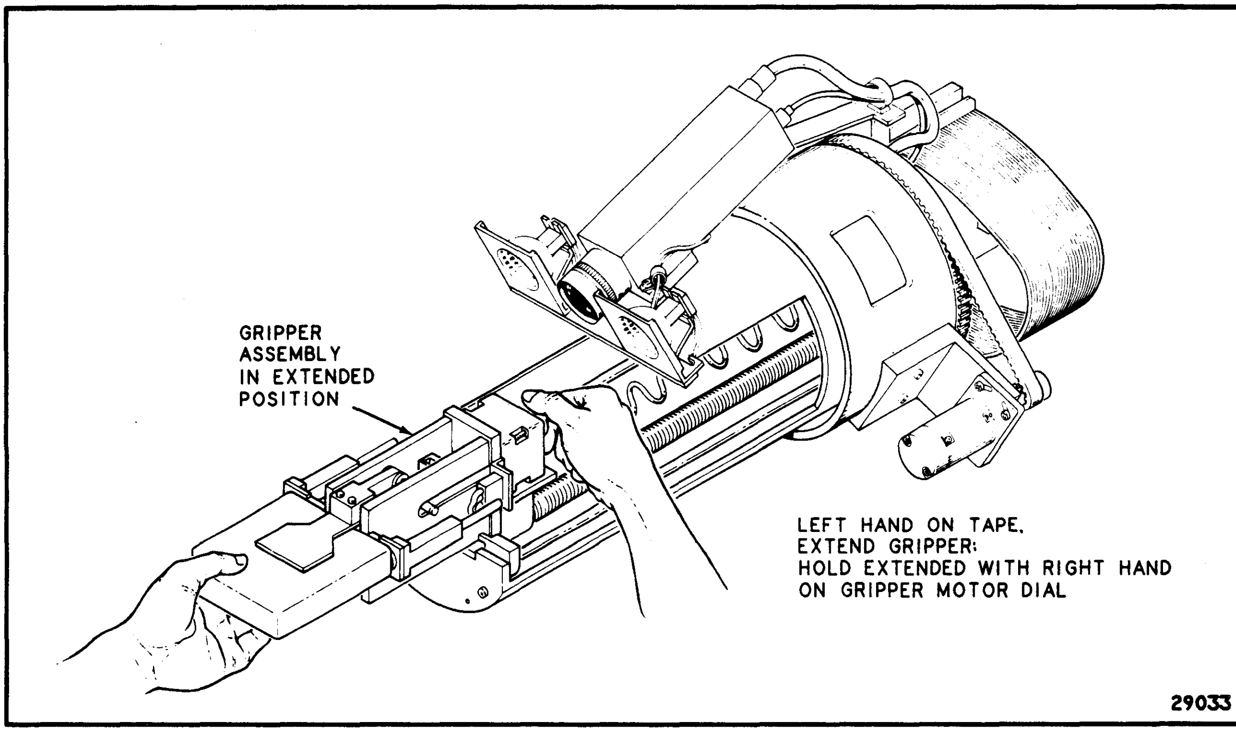

Figure 7-3. Gripper Assembly — Extended

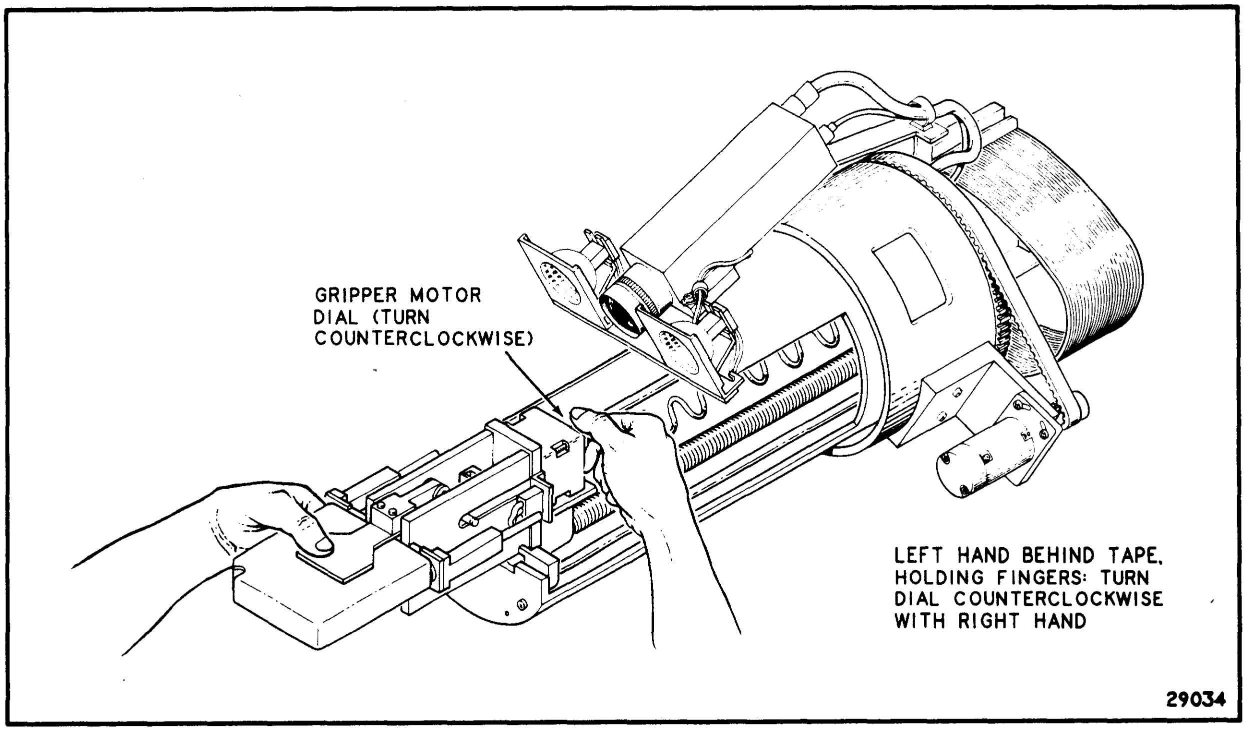

Figure 7-4. Gripper Motor Dial

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APPENDIX A:
EVENT LOG MESSAGES

EVENT LOG FORMAT

Event Log entries are ASCII text, allowing the Log to be viewed at any terminal or printed to any printer.

All Event Log entries have a consistent format. Each entry contains a one-line prefix, followed by one or more lines of message text. Figure A-1 is an example of some Event Log entries.

```
mm-dd-yy hh:mm:ss component_name [nn]:
module_name: One or more lines of message text ...

06-01-89 17:59:15 CSI[0]:
csi_init(); Initiation started

06-01-89 18:01:02 ACSSA[0]:
sa_demux: CAP   0, 0: Place cartridges in CAP.

06-01-89 18:02:13 AUDIT[1]:
au_initiate: audit started
```

Figure A-1. Sample Event Log

The one-line prefix is broken down as follows:

- *mm-dd-yy hh:mm:ss* are the date and time of entry.
- *component_name* is an abbreviation for the originating Storage Server component. This could be ACSLM, ACSSA, CSI etc.
- [*nn*] is the request ID enclosed in square brackets. This ID is generated by the ACSLM when it receives a valid request and is displayed by a `query` request.

The *module_name* that precedes the message text is the name of the Storage Server program module that generated the message. This is included to help a Customer Services Engineer isolate the cause of the problem; it is not intended to be used by System Administrators or library users.

EVENT LOG ENTRIES

The following Event Log messages are of particular interest to a System Administrator or a programmer. They are not the only ones that may be written to the Event Log, but they are ones most frequently sent. Messages not listed here indicate a low-level error and should be brought to the attention of a Software Support Representative or a Customer Services Engineer.

The messages are grouped by the software component that generates them (the *component_name* in the one-line message prefix). Within software component, the messages are listed alphabetically. Common messages which may be generated by any component comprise the first group.

COMMON ENTRIES – UNSOLICITED MESSAGES

The following are Event Log messages that can occur during Storage Server processing. The *component_name* in their message prefix is the Storage Server component that generated the message. The entries are listed in alphabetical order. **Note:** These entries also appear in the Display Area of the Command Processor as unsolicited messages.

- This message indicates that cartridges are detected in the CAP during initiation or recovery.

  `CAP` *cap_id*`: Cartridges detected in CAP.`

  cap_id is the ID of the CAP.

- This message indicates that the specified CAP is ready to receive cartridges. This message is repeated at approximately one minute intervals until the CAP door is opened.

  `CAP` *cap_id*`: Place cartridges in the CAP.`

  cap_id is the ID of the CAP.

- This message indicates that the specified CAP contains cartridges and is ready for the operator to remove them. This message is repeated at approximately one minute intervals until the CAP door is opened.

  `CAP` *cap_id*`: Remove cartridges from the CAP.`

  cap_id is the ID of the CAP.

- This message indicates that the ACSLM is unable to access the data base. A data base error code, indicating the reason for the failure, will also be written to the Event Log.

  ```
  Data Base Failure.
  EXEC SQL sql_command
  ```

  sql_command is the SQL statement on which the error occurred. **Note:** The second line of the message is *not* included in the Display Area message.

- This message indicates that the library hardware is operable, but with degraded performance.

  type identifier`: Degraded mode` *fault_symptom_code*`.`

  type is the device type. *identifier* is the device ID. *fault_symptom_code* is a four-character hexadecimal code that provides a Customer Services Engineer with information needed to troubleshoot the problem.

- This message indicates that the specified device has been varied to the diagnostic state and is therefore available for requests submitted through the Command Processor only.

  type identifier`: Diagnostic.`

- This message indicates that the specified drive needs to be cleaned.

  `Drive` *drive_id*`: Clean drive.`

  drive_id is the ID of the library drive.

- This message indicates that the Event Logger is unable to open or write to the Event Log file.

  ```
  Event log access failed.
  ```

- This message indicates that the Event Log has reached the maximum size defined during installation. This message will be displayed at one minute intervals until you reduce the size of the Event Log.

  ```
  Event log is full.
  ```

- This message indicates that the ACSLM or ACSSA cannot communicate with another Storage Server software component.

  `IPC failure on socket` *socket_id*`.`

  socket_id is the ID of the failing socket.

- This message indicates that a library hardware error occurred.

  type identifier`: Library error` *status*.

  type is the device type. *identifier* is the device ID. *status* is an explanation of the error.

- This message indicates that the library configuration specified in the data base is not the same as that defined in the LMU by a Customer Services Engineer, or if a component appears in the data base but fails to respond to LMU commands. This error causes the Storage Server to terminate.

  `Library configuration error.`

- This message indicates that the specified LSM has failed to recover in-transit cartridges during Storage Server recovery.

  `LSM` *lsm_id*`: In-transit cartridge recovery incomplete.`

  lsm_id is the ID of the LSM containing the in-transit cartridges.

- This message indicates that the specified device has been varied offline. See the `vary` command description for additional details.

  type identifier`: Offline.`

  type is the device type. *identifier* is the device ID.

- This message indicates that the specified device has been varied online. See the `vary` command description for additional details.

  type identifier`: Online.`

  type is the device type. *identifier* is the device ID.

- This message indicates that the ACSLM has been placed in the idle state and is therefore unavailable for requests using library resources.

  `Server System idle.`

- This message indicates that the ACSLM is in an idle-pending state and is therefore unavailable for requests using library resources.

  `Server system idle is pending.`

- This message indicates that a timeout has occurred during network data handling. Data may have been lost.

  `Server System network interface timeout.`

- This message indicates that Storage Server recovery has been completed successfully.

  `Server system recovery complete.`

- This message indicates that Storage Server recovery has failed.

  `Server system recovery failed.`

- This message indicates that Storage Server recovery has been initiated.

  `Server system recovery started.`

- This message indicates that the CSI has encountered a Remote Procedure Call (RPC) failure. Data may have been lost.

  `Server system RPC failure.`

- This message indicates that the ACSLM has been placed in the run state.

  `Server system running.`

COMMON ENTRIES

- This entry indicates that a process has received an invalid status from another process.

  calling_module: *module_called* unexpected status = *status*

  calling_module is the software module making the call. *module_called* is the module that was called. *status* is the invalid status received.

ACSLH

The following messages are generated by the ACS Library Handler (ACSLH) component of the ACSLM. The *component_name* in their message prefix is ACSLH. The entries are listed in alphabetical order.

- This entry indicates that the ACSLH has detected an invalid CAP door status value in an LSM status response from the LMU.

  `bad LSM STATUS cap door status value.`

- This entry indicates that the ACSLH has detected an invalid LSM door status value in an LSM status response from the LMU.

  `bad LSM STATUS door status value.`

- This entry indicates that the ACSLH has detected an invalid hand indicator value in an LSM status response from the LMU.

  bad LSM STATUS hand *n* indicator value.

  n is the number of the robot hand with the invalid indicator. *n* is either 0 or 1.

- This entry indicates that the ACSLH has detected an invalid hand status value in an LSM status response from the LMU.

  `bad LSM STATUS hand` *n* `status value.`

  n is the number of the robot hand with the invalid status. *n* is either `0` or `1`.

- This entry indicates that the ACSLH has detected an invalid line value in an LSM status response from the LMU.

  `bad LSM STATUS line value.`

- This entry indicates that the ACSLH has detected an invalid ready value in an LSM status response from the LMU.

  `bad LSM STATUS ready value.`

- This entry indicates that the ACSLH has experienced an overflow in its message buffer. The LMU will automatically resubmit the message to the ACSLH, so there should be no loss of data. This message should be a cause for concern only if it appears frequently, in which case you should contact your Customer Services Engineer.

  `buffer overrun ... lmu messages will be lost.`

- The ACSLH has received a message from the LMU that it is unable to interpret. This may be a problem with the way the ACSLH is handling LMU messages.

  `Invalid message code received:` *message_code*`.`

  message_code is the code received.

- The following entry indicates a problem with the RS423 line that runs between the server system and the LMU. This message is issued after the ACSLH has been unable to establish communications with the LMU for approximately five minutes. It is reissued every five minutes thereafter until communications are reestablished.

  `LMU communication failure.`

- The following entry indicates that the Storage Server data base indicates an LSM that does not appear in the library configuration defined in the LMU. This error will most likely occur in response to a library request.

  `lsm:` *lsm_id* `not configured !!!`

  lsm_id is the LSM ID from the data base.

- The following entry indicates that the number of circuits defined in the library configuration exceeds the maximum limit.

  `maximum number of circuits are already open.`

- The following entry indicates that the library configuration defined in the LMU indicates a Pass-Thru Port (PTP) that the LSM robot is unable to locate. This error will most likely occur during Storage Server initialization or recovery.

  `No Pass-Through ports exist.`

- The following entry indicates a problem with the RS423 line that runs between the server system and the LMU. This message is issued after the ACSLH has been unable to establish communications with the LMU for approximately one minute. It is reissued every minute thereafter until communications are reestablished.

  `Possible LMU communication failure.`

- This entry indicates that the ACSLH did not detect a "start of frame" character at the beginning of a message from the LMU. The LMU will automatically resubmit the message to the ACSLH, so there should be no loss of data. This message should be of concern only if it appears frequently, in which case you should contact your Customer Services Engineer.

  `Start of frame character not found.`

- This entry indicates that the ACSLH has detected an invalid error response from the LMU.

  `unexpected LMU error response` *lmu_response*.

  lmu_response is the response received from the LMU.

- This entry indicates that the ACSLH has detected an invalid response from the LMU.

  `unexpected response received (tran_code=`*lmu_response*`).`

  lmu_response is the response code received from the LMU.

ACSLM

The following messages are generated by the ACSLM. The *component_name* in their message prefix is ACSLM. The entries are listed in alphabetical order.

- This entry indicates that the ACSLM has received a message that is too small from a CSI or the ACSSA. The ACSLM does not attempt to interpret the message because it does not have enough information.

  `byte count(`*byte_count*`) too small for min packet size(`*min_size*`) ignored.`

byte_count is the number of bytes in the message. *min_size* is the minimum size of a valid, readable message.

- This entry indicates that the CAP door has been closed after having been opened.

  `CAP Door Closed.`

- This entry indicates that the CAP door has been opened.

  `CAP Door Opened.`

- This entry indicates that the LSM access door has been closed after having been opened.

  `LH_MSG_TYPE_DOOR_CLOSED received for` *lsm_id*.

  lsm_id is the LSM that has been closed.

- This entry indicates that the LSM access door has been opened.

  `LH_MSG_TYPE_DOOR_OPENED received for` *lsm_id*.

  lsm_id is the LSM that has been opened.

- This entry indicates that an LMU has been placed online.

  `LH_MSG_TYPE_LMU_READY received for` *acs_id*.

  acs_id is the ACS to which the LMU is connected.

- This entry indicates that the LSM has been taken offline.

  `LH_MSG_TYPE_LSM_NOT_READY received for` *lsm_id*.

  lsm_id is the LSM that has gone offline.

- This entry indicates that the LSM has been placed online.

  `LH_MSG_TYPE_LSM_READY received for` *lsm_id*.

  lsm_id is the LSM that is online.

- This entry indicates that a port between the server system and the LMU has been taken offline.

  `LH_MSG_TYPE_PORT_OFFLINE received for` *port_id*.

  port_id is the identifier of the port that has gone offline.

- This entry indicates that the ACSLM has encountered a fatal error, such as a data base failure or an inconsistency in the library configuration. This is a fatal error to the ACSLM. The ACSLM will automatically initiate recovery processing if it is able. If recovery does not start automatically, the system must be rebooted.

  `Severe Error (`*status*`), Exiting to ACSSS.`

  status is a message indicating the nature of the sever error.

- This entry indicates that the ACSLM has received a library degraded mode message with an invalid device type.

  ```
  Unexpected LH_ADDR_TYPE(device_type) received on
  DEGRADED MODE Msg.
  ```

  device_type is the invalid device type received in the message.

- This entry indicates that the ACSLM has detected a request with an `IPC_HEADER` *module_type* not set to `TYPE_CSI` or `TYPE_SA`. The ACSLM will only process requests received from a client application through the CSI or from a user through the ACSSA.

  ```
  Unsupported module type module_type detected: discarded
  ```

  module_type is the invalid entry.

ACSSA

The following messages are generated by the ACSSA. The *component_name* in their message prefix is `ACSSA`. The entries are listed in alphabetical order.

- This entry indicates that the ACSSA has received a message packet with an IPC identifier not found in the request queue. The ACSSA is unable to process the message.

  ```
  Unknown packet received, command = command,
  identifier = ipc_id.
  ```

  command is the entry in the `MESSAGE_HEADER`. *ipc_id* is the identifier assigned to this message (used to synchronize requests and responses).

CSI

The following messages are generated by the CSI. The *component_name* in their message prefix is `CSI`. The entries are listed in alphabetical order. **Note:** Since these messages are of special interest to SSI programmers, the message status code for each is shown under the message text.

- This entry indicates that the CSI has detected a message from the ACSLM but is unable to read it.

  ```
  Cannot read message from the ACSLM: discarded.
  ```

- This entry indicates that the ACSLM IPC mechanism is unable to accept a message from the CSI. The CSI discards the message after the appropriate number of retries with timeouts.

  ```
  Cannot send message to ACSLM: discarded.
  ```

- This entry indicates that the CSI is unable to communicate with the ACSSA. The CSI discards the message after the appropriate number of retries with timeouts.

  `Cannot send message to ACSSA: discarded.`

- This entry indicates that the NI's communications mechanism is unable to accept a message from the CSI. The CSI discards the message after the appropriate number of retries with timeouts.

  `Cannot send message to NI: discarded.`

- This entry indicates that the CSI was unable to create the network output queue which is used for messages between the CSI and the SSI.

  `Creation of network output queue failed.`

- This entry indicates that the CSI has encountered a process that is older than the connection time limit. This limit is defined by the `CSI_CONNECT_AGETIME` environment variable in the `rc.acsss` file. The CSI drops the process.

  `Dropping from Queue: Address:` *address*`, Port:` *port_id*`,`
  `ssi_identifier:` *ssi_id*`, Protocol:` *protocol*

  address is the return address of the requesting SSI. *port_id* is the identifier of the port on the server system that provides communications with the SSI. *ssi_id* is the identifier for the SSI. *protocol* is type of network transmission protocol.

- This entry indicates that the CSI has received a duplicate IPC packet. It automatically drops the duplicate packet.

  `Duplicate packet from ACSLM detected: discarded.`

- This entry indicates that the CSI has received a duplicate packet from the Network Interface. The duplicate is dropped.

  `Duplicate packet from Network detected: discarded`
  `address:` *address*`, process-id:` *process_id*

  address is the return address of the packet. *process_id* is the process ID of the packet.

- This entry indicates that CSI initiation has completed successfully. Communications with the ACSLM have been successfully established, and the CSI has been established as an RPC server.

  `Initiation Completed.`

- This entry indicates that CSI initiation has failed.

  `Initiation of CSI Failed.`

- This entry indicates that CSI initiation has been started.

  `Initiation Started.`

- This entry indicates that neither environment variable for the two available communication services has been defined. These variables are `CSI_TCP_RPCSERVICE` and `CSI_UDP_RPCSERVICE` in the `rc.acsss` file.

  `Invalid communications service.`

- This entry indicates that the CSI has received a message from the NI that has an invalid value in a key field. The CSI is unable to convert the message representation, so it truncates the message to the incorrect field and passes it to the ACSLM for processing.

  `Invalid message contents from NI: truncated.`

- This entry indicates that the CSI has received a message that is too small. The CSI is unable to use this message, therefore it discards it.

  `Invalid message size,` *size*`, from NI: discarded.`

  size is the size of the message received from the NI.

- This entry indicates that the CSI has received a message that too large. The CSI truncates the message to a valid size and attempts to use it.

  `Invalid message size,` *size*`, from NI: truncated.`

  size is the size of the message received from the NI.

- This entry indicates that the calculated network timeout is not a usable number. The timeout is calculated by combining the figures assigned to the `CSI_RETRY_TIMEOUT` and `CSI_RETRY_TRIES` environment variables in the `rc.acsss` file.

  `Invalid network timeout value.`

- This entry indicates that a program is trying to use the CSI but it is not using one of the two valid procedure numbers.

  `Invalid procedure number.`

- This entry indicates that the CSI has detected a message from the ACSLM for an invalid or unknown SSI client. The message is discarded.

  `Message for unknown client discarded.`

- This entry indicates that the CSI has encountered an error in communicating with the operating system. This message is indicative of a problem with the operating system itself, not with the CSI or the Storage Server.

  `Operating system error.`

- This entry indicates that the attempted TCP connection is not possible.

  `RPC TCP client connection failed:` *rpc_error_msg*.

  rpc_error_msg is a detailed error message generated by the RPC service itself. In most cases this message will be `Program number not registered`, which indicates that either the CSI or the SSI is not running.

- This entry indicates that the attempted UDP connection is not possible.

  `RPC UDP client connection failed:` *rpc_error_msg*.

  rpc_error_msg is a detailed error message generated by the RPC service itself. In most cases this message will be `Program number not registered`, which indicates that the CSI or SSI is not running.

- This entry indicates that The CSI has begun the process of purging old processes from its connection queue. The CSI routinely searches for processes older than `CSI_CONNECT_AGETIME` and purges them.

  `Starting cleanup of connection queue, Q-id` *queue_id*

  queue_id is the identifier of the CSI connection queue; currently this value is always `1`.

- This entry indicates that the CSI has encountered a message from the ACSLM or the NI that cannot be delivered because of incorrect message format or a CSI failure. The message is discarded.

  `Undefined messaged detected: discarded.`

- This entry indicates that CSI termination has been completed successfully.

  `Termination Completed.`

- This entry indicates that CSI termination has been started.

  `Termination Started.`

- This entry indicates that the CSI has been initiated. It notifies you that an RPC number previously assigned to the CSI still exists. The CSI unmaps this number and remaps to a new one as a normal part of the initiation.

  `Unmapped previously registered RPC service.`

- This entry indicates that a packet that the CSI XDR translation routines are unable to translate a message because it has been damaged. The CSI attempts to translate the message up to the point defined by the client application.

  `XDR message translation failure.`

AUDIT

The following entries are generated by the `audit` request. The *component_name* in their message prefix is `AUDIT`. The entries are listed in alphabetical order.

- This entry indicates that audit processing has been cancelled. The data base may have discrepancies or errant cartridges may not have been ejected, therefore the `audit` should be rerun.

  `Audit cancelled`

- This entry indicates that audit processing has completed successfully.

  `Audit completed`

- This entry indicates that audit processing has terminated due to some error condition. The description of the error is displayed in the Command Area. The data base may have discrepancies or errant cartridges may not have been ejected, therefore the `audit` should be rerun.

  `Audit failed`

- This entry indicates that `audit` processing has begun.

  `Audit started`

- This entry indicates that the robot has found a cartridge with a duplicate external label.

  `Cartridge` *vol_id* `ejected from location` *cell_id*`,`
  `duplicate label.`

  The *vol_id* is the tape cartridge with the duplicate label. The *cell_id* is the storage cell location where the cartridge was found.

- This entry indicates that the robot has encountered a cartridge with an unreadable or nonexistent external label.

  `Cartridge` *vol_id* `ejected from location` *cell_id*`,`
  `unreadable label.`

  The *vol_id* is the external label of the tape cartridge; question marks (`?`) are substituted for the characters that the robot is unable to read. The *cell_id* is the storage cell location where the cartridge was found.

- This entry indicates that a tape cartridge *not* listed in the data base is found in the ACS. The cartridge is added to the data base.

  `Cartridge` *vol_id* `found at location` *cell_id*`.`

  The *vol_id* is the external label of the tape cartridge. The *cell_id* is the storage cell location where the cartridge was found.

- This entry indicates that a tape cartridge is not in the location defined by the data base. The cartridge is not moved in the ACS; instead, the data base is updated to the new storage location.

  `Cartridge` *vol_id*`, new location` *cell_id*

  The *vol_id* is the external label of the tape cartridge. The *cell_id* is the assigned storage cell location of the cartridge.

- This entry indicates that a tape cartridge listed in the data base is *not* found in the ACS. The cartridge is removed from the data base.

  `Cartridge` *vol_id* `not found`

  The *vol_id* is the external label of the tape cartridge.

- This entry indicates that another process has reserved a cell record in the data base and the `audit` process is unable to access it after the appropriate number of retries and timeouts. The `audit` continues with the next cell.

  `cell` *cell_id* `reserved by another process.`

  cell_id is the ID of the cell record.

- This entry indicates that the LSM robot has unexpectedly found a cartridge in a CAP cell during ejection of cartridges. This will occur if the operator did not completely empty the CAP during a previous `eject` operation. The `audit` process will issue an unsolicited message to empty the CAP, and will then resume ejecting cartridges after the CAP door is closed.

  `Destination location full: CAP cell` *cell_id*`.`

  cell_id is the location of the CAP cell.

- This entry indicates that the LSM robot has detected that a storage cell is missing from the LSM. This is a library configuration error and causes the Storage Server to terminate. The `audit` should be rerun after the error has been corrected and the Storage Server has gone through recovery.

  `missing cell` *cell_id* `detected.`

  cell_id is the location of the missing cell.

- This entry indicates that a spawned `audit` process has sent an incomplete or unintelligible message to the parent `audit` process. As a result, some errant cartridges may not be ejected. The `audit` should be rerun, unless the *audit_status* is `Audit complete.`

  audit_status`.`
  `Not all cartridges were ejected, messages lost.`

  audit_status can be either `Audit cancelled`, `Audit complete`, or `Audit failed`.

- This entry indicates that the `audit` process is unable to eject cartridges. Possible causes are the LSM being forced offline or suffering a failure while the `audit` is ejecting cartridges. The `audit` should be rerun, unless the *audit_status* is `Audit complete.`

  audit_status`.`
  `Not all cartridges were ejected, status =` *status_msg*`.`

  audit_status can be either `Audit cancelled`, `Audit complete`, or `Audit failed`. *status_msg* is the reason for the failure.

- This entry indicates that a cartridge marked for ejection is no longer found in its storage cell when the robot goes to move it to the CAP. The `audit` terminates and should be rerun.

  `Source location empty: Cell` *cell_id*`.`

  cell_id is the assigned storage cell location of the cartridge.

DISMOUNT

The following entries are generated by the `dismount` request. The *component_name* in their message prefix is `DISMOUNT`. The entries are listed in alphabetical order.

- This entry indicates that the storage cell to which a cartridge was to be dismounted is full, although the data base indicates it was empty. The robot will retry the dismount until it finds an available cell.

  `Destination location full:` *cell_id*

cell_id is the storage cell location indicated in the data base. An `audit` should be performed on this cell location in order to reconcile the data base with the physical contents of the cell.

- This entry indicates that the LSM robot was unable to find a tape cartridge in a tape drive, although the data base indicates that it is in the drive. The request fails.

  `Source location empty:` *drive_id*

  drive_id is the ID of the tape drive.

EJECT

The following entries are generated by the `eject` request. The *component_name* in their message prefix is `EJECT`. The entries are listed in alphabetical order.

- This entry indicates that the LSM robot unexpectedly found a cartridge in a CAP cell. This will occur if the operator did not completely empty the CAP during a previous `eject` operation. The robot will attempt to place the cartridge in the next CAP cell. If it is unable to find an available CAP cell, the `eject` process will issue an unsolicited message to empty the CAP.

  `CAP cell destination location occupied.`

- This entry indicates that a client application submitted an `eject` request while the LSM was in the diagnostic state. The request is rejected; only requests submitted from the Command Processor are processed while the LSM is in the diagnostic state.

  `LSM` *lsm_id* `STATE_DIAGNOSTIC.`

  lsm_id is the ID of the LSM.

- This entry indicates that the LSM is offline and is therefore unavailable for ejecting tape cartridges.

  `LSM` *lsm_id* `STATE_OFFLINE.`

  lsm_id is the ID of the LSM.

- This entry indicates that the LSM robot was unable to find a tape cartridge in the location indicated by the data base. The request fails.

  `Source location empty:` *cell_id*

  cell_id is the storage cell location indicated in the data base. If you suspect that the cartridge is in the library an `audit` should be performed on the entire library in order to reconcile the data base with the physical contents of the cell.

ENTER

The following entries are generated by the `enter` request. The *component_name* in their message prefix is ENTER. The entries are listed in alphabetical order.

- This entry indicates that the LSM robot has found a tape cartridge in a location that the data base indicated was empty. The tape cartridge is not entered into the library.

  `Destination location full:` *cell_id*

  cell_id is the storage cell location indicated in the data base.

- This entry indicates that the LSM is offline and is therefore unavailable for entering tape cartridges.

  `LSM` *lsm_id* `= STATE_OFFLINE.`

  lsm_id is the ID of the LSM.

MOUNT

The following entries are generated by the `mount` request The *component_name* in their message prefix is MOUNT. The entries are listed in alphabetical order.

- This entry indicates that the LSM robot has found a cartridge in the tape drive, although the data base indicates that the drive is available. The request fails.

  `Destination location full:` *drive_id*.

  drive_id is the ID of the tape drive. An `audit` should be performed in order to reconcile the data base with the physical contents of the library.

- This entry indicates that the LSM robot was unable to find the tape cartridge in the location indicated by the data base. The request fails.

  `Source location empty:` *cell_id*.

  cell_id is the storage cell location indicated in the data base. If you suspect that the cartridge is in the library an `audit` should be performed on the entire library in order to reconcile the data base with the physical contents of the cell.

STORAGE SERVER INITIATION

The following messages are generated by the Storage Server Initiation process performed by the ACSLM. The *component_name* in their message prefix is ACSSS_DAEMON. The entries are listed in alphabetical order.

- This entry indicates that the daemon has received an unexpected exit status from a Storage Server process.

  `exit status (`*status*`), `*status_code*`, received from `*process_id*`.`

  status is the numeric exit status from the process. *status_code* is the Storage Server status code that was generated as a result of the exit. *process_id* is the Storage Server process.

- This entry indicates that Storage Server initiation has completed successfully.

  `Initiation completed.`

- This entry indicates that Storage Server initiation has begun.

  `Initiation started, `*acsss_version*`.`

  acsss_version is the version number of the Storage Server software.

- This entry indicates that a Storage Server process has been automatically restarted.

  process_id `restarted.`

  process_id is the Storage Server process.

- This entry indicates that a Storage Server process has been terminated.

  `signal(`*signal*`) terminated `*process_id*`.`

  signal is the UNIX signal that caused the termination. *process_id* is the Storage Server process that was terminated.

- This entry indicates that Storage Server termination has begun.

  `Termination invoked, `*status_code*`.`

  status_code is the Storage Server status code which indicates the reason for the termination.

STORAGE SERVER RECOVERY

The following entries are generated by the Storage Server Recovery process performed by the ACSLM. The *component_name* in their message prefix is RECOVERY. The entries are listed in alphabetical order.

- This entry indicates that the ACS configuration in the Storage Server data base does not match the configuration defined in the LMU. Recovery processing terminates.

  `ACS (acs_id) configuration failed to verify.`

  acs_id is the unique ID of the ACS.

- This entry indicates that an ACS status in the data base is changed from the diagnostic state to offline. The ACS was in the diagnostic state at the time the Storage Server went into recovery, but it will be offline when recovery completes.

  `ACS acs_id in STATE_DIAGNOSTIC, marked STATE_OFFLINE.`

  acs_id is the ACS that was updated.

- This entry indicates that an ACS status in the data base is changed from the recovery state to online. The ACS was in the recovery state at the time the Storage Server went into recovery, but it will be online when recovery completes.

  `ACS acs_id in STATE_RECOVERY, marked STATE_ONLINE.`

  acs_id is the ACS that was updated.

- This entry indicates that the server system is not able to communicate with any ports for the specified ACS. Recovery will continue, but the ACS and its LSMs are marked offline in the data base.

  `ACS acs_id, no ports online.`

  acs_id is the ACS that was updated.

- This entry indicates that the server system is not able to communicate with a port to an ACS. The port is marked offline in the data base/

  `ACS acs_id, port <port_id> failed to go online.`

  acs_id is the unique ID of the ACS. *port_id* is the port that failed to go online.

- This entry indicates that the recovery process was unable to successfully verify the drive configuration in the data base against the configuration defined in the LMU. This may be because the LSM is offline or because there is an actual configuration mismatch.

  `DRIVE configuration failed to verify.`

- This entry indicates that a drive has a status of empty, but was marked in use in the data base. The data base is updated to indicate that the drive is available.

  drive (*drive_id*) error, status unloaded, marked empty.

  drive_id is the drive that was updated.

- This entry indicates that a drive for an online LSM has a status of empty or not communicating, but was marked in use in the data base. The data base is updated to indicate that the drive is available, and any volume records referencing the drive are deleted from the data base.

  drive (*drive_id*) marked available.

  drive_id is the drive that was updated.

- This entry indicates that a drive for an offline LSM is updated in the data base to indicate that it is available. The LMU cannot report drive statuses for an offline LSM; therefore all drives for the LSM are marked available in the data base.

  drive (*drive_id*) marked available, LSM offline.

  drive_id is the drive that was updated.

- This entry indicates that a drive has a status of loaded, but was marked available in the data base. The data base is updated to indicate that the drive is in use.

  drive (*drive_id*) marked in use, loaded.

  drive_id is the drive that was updated.

- This entry indicates that a drive has a status of in use and unloaded, but was marked available in the data base. The external label of the cartridge in the drive is readable. The data base is updated to indicate that the drive is in use.

  drive (*drive_id*) readable, marked in use.

  drive_id is the drive that was updated.

- This entry indicates that a drive has a status of in use and unloaded, but was marked available in the data base. In addition, the LSM robot is unable to read the external label of the cartridge in the drive. The data base is updated to indicate that the drive is in use.

  `drive (`*drive_id*`) unreadable, marked in use.`

  drive_id is the drive that was updated.

- This entry indicates that a cartridge that was selected for use by a request process is not physically located in the storage cell indicated by the data base. The volume record is deleted from the data base.

  `in-transit volume (`*vol_id*`) deleted.`

  vol_id is the volume record that was deleted.

- This entry indicates that a cartridge that was selected for use by a request process is not physically located in the storage cell indicated by the data base. In addition, the LSM is offline. The volume record is deleted from the data base.

  `in-transit volume (`*vol_id*`) deleted from location cell (`*cell_id*`), LSM offline.`

  vol_id is the volume and *cell_id* is the cell location updated.

- This entry indicates that a cartridge that was selected for use by a request process is not physically located in the tape drive indicated by the data base. In addition, the LSM is offline. The volume record is deleted from the data base.

  `in-transit volume (`*vol_id*`) deleted from location drive (`*drive_id*`), LSM offline.`

  vol_id is the volume and *drive_id* is the tape drive updated.

- This entry indicates that a cartridge that was selected for use by a request process is found in the storage cell indicated by the data base. The volume record is updated to indicate that the cartridge is in the storage cell, not in-transit.

  `in-transit volume (`*vol_id*`) marked home.`

  vol_id is the volume record that was updated.

- This entry indicates that a cartridge with an unreadable label is found in a storage cell location that the data base indicates contains a cartridge that was reserved by a request process. The volume record is updated to indicate that the selected (in-transit) cartridge is in the storage cell.

  `in-transit volume (`*vol_id*`) unreadable, marked home.`

vol_id is the volume record that was updated.

- This entry indicates that the LSM configuration in the data base does not match the configuration defined in the LMU. Recovery processing terminates.

  `LSM configuration failed to verify.`

- This entry indicates that an LSM status in the data base is changed from the diagnostic state to offline. In addition, the ACS is online. The LSM was in the diagnostic state at the time the Storage Server went into recovery, but it will be offline when recovery completes.

  `LSM` *lsm_id* `in STATE_DIAGNOSTIC, marked STATE_OFFLINE.`

  lsm_id is the LSM that was updated.

- This entry indicates that an LSM status in the data base is changed from the recovery state to offline. In addition, the ACS is online. The LSM was in the recovery state at the time the Storage Server went into recovery, but it will be offline when recovery completes.

  `LSM` *lsm_id* `in STATE_RECOVERY, marked STATE_ONLINE.`

  lsm_id is the LSM that was updated.

- This entry indicates that the server system is not able to communicate with any ACS. Recovery continues, but all ACSs and their LSMs are marked offline.

  `No server ports online, marked offline.`

- This entry indicates that a cell marked reserved in the data base is found to be empty. The cell record is updated to empty.

  `reserved cell (`*cell_id*`) marked empty.`

  cell_id is the cell record that was updated.

- This entry indicates that a cell marked reserved in the data base is updated to empty because the LSM is offline. The recovery process is unable to verify the cell contents of an offline LSM.

  `reserved cell (`*cell_id*`) marked empty, LSM offline.`

  cell_id is the cell record that was updated.

- This entry indicates that a cell marked reserved in the data base is found to contain a cartridge with a readable label. The cell record is updated to full.

  `reserved cell (`*cell_id*`) readable, marked full.`

  cell_id is the cell record that was updated.

- This entry indicates that a cell marked reserved in the data base is found to contain a cartridge with an unreadable label. The cell record is updated to full.

  `reserved cell (`*cell_id*`) unreadable, marked full.`

  cell_id is the cell record that was updated.

- This entry indicates that recovery processing terminates because the ACSLM is unable to receive a response from the ACS Library Handler (ACSLH).

  `timed out awaiting ACSLH response.`

- This entry indicates that an LSM has failed to vary online.

  `unexpected identifier status = `*status_code*` for LSM `*lsm_id*

  status_code is the final status of the LSM. *lsm_id* is the unique ID for the LSM.

- This entry indicates that a drive marked as containing a tape cartridge is found to be empty. The volume record is deleted from the data base.

  `volume (`*vol_id*`) not in drive (`*drive_id*`), deleted`

  vol_id is the volume record that was deleted. *drive_id* is the tape drive that the data base indicated contained the cartridge.

- This entry indicates that a cell or drive marked reserved is found to contain a tape cartridge that does not exist in the data base. A record is created for the new volume.

  `volume (`*vol_id*`) record created.`

  vol_id is the volume record that was created.

- This entry indicates that a cell or drive marked reserved is found to contain a different tape cartridge than the one indicated in the data base. The data base is updated with the correct volume ID.

  `volume (`*vol_id*`) record updated.`

  vol_id is the volume record that was updated.

VARY

The following entries are generated by the `vary` request. The *component_name* in their message prefix is VARY. The entries are listed in alphabetical order.

- This entry indicates that a client application submitted a `vary` request while the ACS was in the diagnostic state. The request is rejected; only requests submitted from the Command Processor are processed while the ACS is in the diagnostic state.

  `ACS` *acs_id* `incorrect requestor type: vary disallowed`

  acs_id is the ACS in the request.

- This entry indicates that a `vary` request was received while the ACS was in the recovery or offline-pending state. The request is rejected.

  `ACS` *acs_id* `is in transitional state: vary disallowed`

  acs_id is the ACS in the request.

- This entry indicates that a `vary offline` request was received while the ACS was already in the offline state. The request is rejected.

  `ACS` *acs_id* `is offline: vary disallowed.`

  acs_id is the ACS in the request.

- This entry indicates that a request was received to vary offline the last online port for an online ACS. The request is rejected. The ACS must be varied offline before the last online port can be varied offline.

  `Attempted to vary last port` *port_id* `for online ACS: vary disallowed.`

  port_id is the port in the request.

- This entry indicates that a device was forced offline while it was in the offline-pending state. The `vary` request that placed the device in the offline-pending state is overridden.

  `Current vary request overidden by a vary with the FORCE option.`

- This entry indicates that a client application submitted a `vary` request while the drive was in the diagnostic state. The request is rejected; only requests submitted from the Command Processor are processed while the drive is in the diagnostic state.

  `Drive` *drive_id* `incorrect requestor type: vary disallowed.`

  drive_id is the drive in the request.

- This entry indicates that a `vary` request was received against a tape drive that the data base indicates is in use. The request is rejected.

  `Drive` *drive_id* `not available: vary disallowed.`

drive_id is the drive in the request.

- This entry indicates that a request to vary an LSM offline was processed to completion, but the LSM failed to vary offline.

  `LSM:` *lsm_id* `failed to vary offline.`

  lsm_id is the LSM in the request.

- This entry indicates that a request to vary an LSM online was processed to completion, but the LSM failed to vary online.

  `LSM:` *lsm_id* `failed to vary online after an online request.`

  lsm_id is the LSM in the request.

- This entry indicates that a client application submitted a `vary` request while the LSM was in the diagnostic state. The request is rejected; only requests submitted from the Command Processor are processed while the LSM is in the diagnostic state.

  `LSM` *lsm_id* `incorrect requestor type: vary disallowed.`

  lsm_id is the LSM in the request.

- This entry indicates that a `vary` request was received while the LSM was in the recovery or offline-pending state. The request is rejected.

  `LSM` *lsm_id* `is in transition state: vary disallowed.`

  lsm_id is the LSM in the request.

- This entry indicates that in-transit cartridge recovery completed successfully while an LSM was varied online.

  `LSM` *lsm_id*`: recovery complete.`

  lsm_id is the LSM varied online.

- This entry indicates that the LSM robot was unable to dispose of in-transit cartridges while an LSM was varied online. The LSM is successfully brought online, but there may be cartridges left in the robot's hands.

  `LSM` *lsm_id*`: recovery incomplete.`

  lsm_id is the LSM varied online.

- This entry indicates that, during LSM recovery, the robot finds a cartridge in-transit, but the data base indicates that the cartridge is *not* in-transit. The volume record is deleted from the data base, and the robot places the cartridge in the Playground area of the LSM. You must enter the LSM and remove the cartridge.

  `Misplaced tape. Removed volume record for volid` *vol_id* `from database.`

  vol_id is the ID of the volume record deleted from the data base.

- This entry indicates that a `vary` request was received while all ports to the ACS were offline. The request is rejected. At least one port must be online in order for a `vary` request to be processed.

  `No port online for ACS` *acs_id*`: vary disallowed`

  acs_id is the ACS in the request.

- This entry indicates that a request to vary a port offline was processed to completion, but the port failed to vary offline.

  `port` *port_id* `failed to vary offline.`

  port_id is the port in the request.

- This entry indicates that a request to vary a port online was processed to completion, but the port failed to vary online.

  `port` *port_id* `failed to vary online.`

  port_id is the port in the request.

APPENDIX B:
LIBRARY COMMAND SUMMARY

COMMANDS

audit

Performs a physical inventory on the tape cartridges in a library, ACS, LSM, panel, or subpanel.

au[dit] *cap_id type identifier ...*

audit *cap_id* **se[rver]**
audit *cap_id* **ac[s]** *acs_id ...*
audit *cap_id* **ls[m]** *lsm_id ...*
audit *cap_id* **pa[nel]** *panel_id ...*
audit *cap_id* **su[bpanel]** *subpanel_id ...*

cancel

Terminates a current or pending **audit**, **eject**, **enter**, or **query** request.

can[cel] *request_id*

dismount

Dismounts a tape cartridge from a library drive.

dis[mount] *vol_id drive_id* **[force]**

eject

Ejects from one to 21 tape cartridges from the ACS.

ej[ect] *cap_id vol_id ...*

enter

Enters one to 21 tape cartridges into the ACS.

en[ter] *cap_id*

idle

Stops ACSLM request processing.

i[dle] [force]

`logoff` Exits from the Command Processor.

`lo[goff]`

`mount` Mounts a tape cartridge onto a specified library drive.

`m[ount]` *vol_id drive_id*

`query` Displays status information about the Storage Server, an ACS, an LSM, a port, a CAP, a library drive, a tape cartridge, or a request.

`q[uery]` *type* `[`*identifier* `...|all]`

`query se[rver]`
`query ac[s]` `[`*acs_id* `...|all]`
`query ls[m]` `[`*lsm_id* `...|all]`
`query cap` `[`*cap_id* `...|all]`
`query dr[ive]` `[`*drive_id* `...|all]`
`query po[rt]` `[`*port_id* `...|all]`
`query vo[lume]` `[`*vol_id* `...|all]`
`query r[equest]` `[`*request_id* `...|all]`
`query m[ount]` *vol_id* `...`

`start` Initiates ACSLM request processing.

`st[art]`

`vary` Changes the state of an ACS, LSM, library drive, or port.

`va[ry]` *type identifier* ... *state* `[force]`

`vary ac[s]` *acs_id* ... *state* `[force]`
`vary ls[m]` *lsm_id* ... *state* `[force]`
`vary dr[ive]` *drive_id* ... *state* `[force]`
`vary po[rt]` *port_id* ... *state* `[force]`

IDENTIFIERS

acs_id	acs (0-127)
lsm_id	acs (0-127), lsm (0-15)
cap_id	acs (0-127), lsm (0-15)
panel_id	acs (0-127), lsm (0-15), panel (0-19)
subpanel_id	acs (0-127), lsm (0-15), panel (0-19), startrow (0-14), startcolumn (0-23), endrow (0-14), endcolumn (0-23)
cell_id	acs (0-127), lsm (0-15), panel (0-19), row (0-14), column (0-23)
drive_id	acs (0-127), lsm (0-15), panel (0-19), drive (0-3)
vol_id	six-character cartridge identifier; can be any combination of numbers (0-9), letters (A-Z), and spaces ( ).
port_id	acs (0-127), port (0-15)
request_id	Unique numeric (0-65535) request identifier assigned by the ACSLM.

TYPES

```
se[rver]
ac[s]
ls[m]
cap
pa[nel]
su[bpanel]
dr[ive]
vo[lume]
po[rt]
r[equest]
m[ount]
```

STATES

```
dia[gnostic]
on[line]
of[fline]
```

OPTIONS

```
al[l]
f[orce]
```

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GLOSSARY OF TERMS

A

AC — Alternating Current.

ACS — See *Automated Cartridge System.*

ACSEL — See *ACS Event Logger.*

ACS Event Logger (ACSEL) — The Storage Server software component that receives messages from other Storage Server components and writes them to an Event Log.

ACS ID — A unique identifier for an ACS.

ACSLH — See *ACS Library Handler.*

ACS library — A library is composed of one or more ACSs, attached 4480 tape cartridge drives, and cartridges residing in the ACSs.

ACS Library Handler (ACSLH) — The part of the ACS Library Manager that communicates directly with the LMU.

ACS Library Manager (ACSLM) — The Storage Server software component that validates and routes library requests and responses.

ACSLM — See *ACS Library Manager.*

ACSSA — See *ACS System Administrator.*

ACS System Administrator (ACSSA) — The Storage Server software component that provides a screen interface enabling library operators and users to monitor and control Storage Server operations.

Automated Cartridge System (ACS) — The library subsystem consisting of one LMU, and one to sixteen LSMs connected to that LMU.

Automated library — See *Library.*

B

Bar code — A code consisting of a series of bars with varying widths. This code appears on the external label attached to the spine of a cartridge, and its value is equivalent to the volume serial number. This code is read by the robot's machine vision system.

Beginning of Tape — The location on a tape where written data begins.

BOT — See *Beginning of Tape*.

BSD — Acronym for Berkeley Software Distribution, a version of the UNIX operating system.

C

CAP — See *Cartridge Access Port*.

CAP ID — A CAP ID uniquely identifies the location of a CAP by the LSM on which it resides. A CAP ID consists of the ACS ID and the LSM number.

Cartridge — A plastic housing containing a length of data recording tape. It is approximately 4 inches (100mm) by 5 inches (125 mm) by 1 inch (25mm). The tape is threaded automatically when loaded in a transport. A plastic leader block is attached to the tape for automatic threading. The spine of the cartridge contains an OCR/Bar Code label listing the volume ID.

Cartridge Access Port (CAP) — A bidirectional port, built into the door panel of a LSM, which provides for the manual entry or automatic ejection of tape cartridges.

Cartridge drive — A device containing two or four cartridge transports and their associated power and pneumatic supplies.

Cartridge transport — An electromechanical device that moves tape from a cartridge over a head that writes data on and reads data from the tape. A transport is distinct from the power and pneumatic sources that supply the electricity and air it needs to function. See *Cartridge drive*.

Cell — A receptacle in the LSM in which a cartridge is stored.

Central Support Remote Center (CSRC) — An installation whose operators can access and test StorageTek products over telephone lines.

Channel — A device that connects the host and main storage with the input and output control units.

Checkpoint — A static backup of a data base.

Client applications — Software applications that manage tape cartridge contents. They access tape cartridges by interacting with the Storage Server. Any number of client applications can be resident on a client system.

Client System Interface (CSI) — The Storage Server software component that translates and routes messages between the ACS Library Manager and the Storage Server Interfaces.

Client system user — A person who executes applications on a client system.

Command Processor — The screen interface of the ACS System Administrator. The Command Processor performs basic syntax validations on user input.

Control Unit — A microprocessor-based unit logically situated between a channel and up to sixteen cartridge transports. It translates channel commands into transport commands and sends transport status to the channel.

CSE — Acronym for Customer Services Engineer.

CSI — See *Client System Interface.*

CSRC — See *Central Support Remote Center.*

CU — See *Control Unit.*

D

Data base — A collection of interrelated data files.

Data base catalog — A file that keeps track of data base files.

Data base management system (DBMS) — The process that accesses, controls, organizes, and modifies a data base.

DC — Direct Current.

E

EOT — Acronym for End of Tape.

EPO — Acronym for Emergency Power Off.

Event Log — A file, maintained by the ACS Event Logger, that contains messages describing significant library and Storage Server events; these events include errors.

External label identifier — A six-character alphanumeric label adhered to an outside edge of a tape cartridge. It is used to identify a physical tape volume. It may consist of upper case letters A through Z, numerals 0 through 9, and blanks.

F

FIFO — First In/First Out

G

H

Home location — The cell in an LSM in which a cartridge is currently stored.

I

ID — Identifier or identification.

Initial Program Load (IPL) — A process that activates a machine reset, initiates wake up diagnostics (from EPROMs) and, upon completion of wake up, loads functional code from a floppy disk.

Inline diagnostics — Routines that test components of a subsystem while operating on a time-sharing basis with the functional microcode in the subsystem component.

I/O — Input/Output

IPC — Acronym for Interprocess Communication

IPL — See *Initial Program Load.*

J

Journal — A sequential log of changes made to the data base since the last checkpoint.

K

L

LAN — See *Local Area Network.*

LCU — See *Library Control Unit.*

Library — A library is composed of one or more ACSs, attached 4480 cartridge drives, volumes placed in to the ACSs, the Storage Server software that controls and manages the ACSs, and the data base that describes the states of the ACSs.

Library Control Unit (LCU) — The portion of the LSM that controls the picking, mounting, dismounting, and replacing of tape cartridges.

Library drive — A cartridge transport that is attached to an LSM and is connected to, and controlled by, a client system. Library drives interact with the LCU during automated tape cartridge mount and dismount operations. Library drives interact with a client application during tape data transfer operations. Library drives are individually addressable by the ACSLM and are individually accessible by client applications. See *Cartridge Transport.*

Library Management Unit (LMU) — The portion of an ACS that manages the LSM, allocates its resources, and communicates with the Storage Server.

Library Storage Module (LSM) — The portion of an ACS that provides the storage area for cartridges and the robot necessary for moving them.

Light Emitting Diode (LED) — A light emitting device that uses little energy and is used mainly to indicate on/off conditions.

LMU — See *Library Management Unit.*

Local Area Network (LAN) — A computer network in which any component in the network can access any other component. This is the type of interface between an LMU and attached LSMs.

LSM — See *Library Storage Module.*

LSM ID — A unique identifier for an LSM. The LSM ID consists of the ACS ID and the LSM number.

M

Machine Initiated Maintenance (MIM) — A unique feature of the 4400 ACS in which an expert system monitors conditions and performance of the subsystem and requests attention before a problem becomes serious enough to impact operations. The customer can set threshold levels.

MIM — See *Machine Initiated Maintenance.*

N

Network Adapter — Equipment that provides an electrical and logical interface between a network and specific attached equipment.

Network Interface (NI) — An interface between the server system and the client systems that maintains network connections and controls the exchange of messages. A Network Interface is resident on the server system and each client system.

NI — See *Network Interface.*

O

OCR — Optical Character Recognition.

OCR label — An external label attached to the spine of a cartridge that is both human- and machine-readable.

OSI — Acronym for Open Systems Interconnection, a software architecture model of the International Organization for Standardization. The OSI model provides standards for the interconnection of data processing systems.

P

Pass-Thru Port (PTP) — Mechanism that allows a cartridge to be passed from one LSM to another in a multiple LSM ACS.

PTP — See *Pass-Thru Port.*

Q

R

Relational data base — A data base that is organized and accessed according to relationships between the data items; relationships are represented by tables.

RPC — Acronym for Remote Procedure Call.

S

Server system — The part of the library that is the residence for the Storage Server software. The server system acts as an interface between a library and any number of client systems.

Servo — A system that uses feedback to control a process.

Server system user — A person who invokes ACS Storage Server commands, utilities or procedures, on the server system. Server system users are generally site and maintenance personnel (for example, library operators, tape librarians, system administrators, CSEs, and systems personnel).

SQL — See *Structured Query Language*.

SSI — See *Storage Server Interface*.

SSR — Acronym for Software Support Representative.

Storage Server — The software that interprets library commands from client applications or library operators and routes them to the appropriate LMU. The Storage Server consists of the following software components: ACS Library Manager (ACSLM), ACS System Administrator (ACSSA), Client System Interface (CSI), ACS Event Logger (ACSEL), Network Interface (NI), and Storage Server data base.

Storage Server data base — A data base used by the Storage Server to track the library configuration and the locations and IDs of all tape cartridges in the library.

Storage Server Interface (SSI) — A software component, resident on a client system, that translates and routes messages between client applications and the Client System Interface.

Structured Query Language (SQL) — A language used to define, access, and update data in a data base.

SVID — Acronym for System V Interface Definition.

T

TCP — Acronym for Transport Connect Protocol.

TLMS — Acronym for Tape Library Management System, a type of client application.

Transport — An electromechanical device capable of threading tape from a cartridge, moving the tape across a read/write head, and writing data onto or reading data from the tape.

U

UNIX — An operating system originally developed by Bell Laboratories and used by a variety of computer systems.

UDP — Acronym for User Datagram Protocol.

V

Volume ID — A six-character string that uniquely identifies a tape cartridge to the data base.

Volume serial number — A synonym for external label identifier.

W

X

XDR — Acronym for External Data Representation.

Y

Z

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