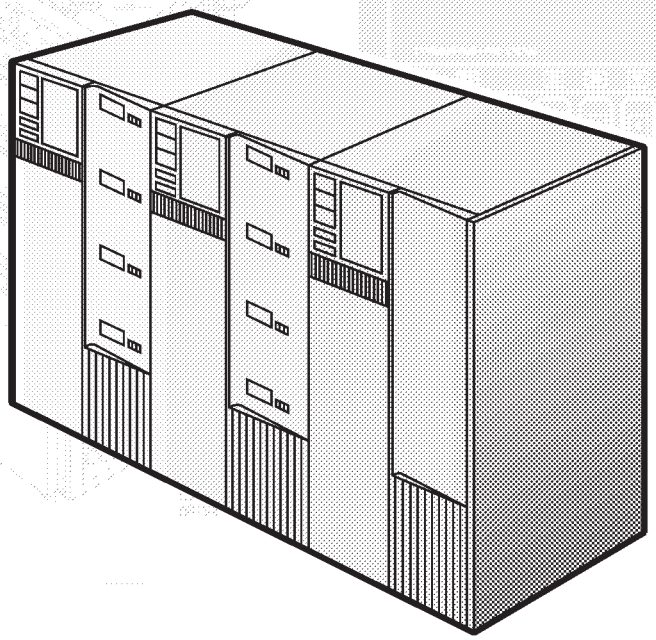
StorageTek

OPERATOR'S GUIDE

4791/4490

Cartridge Subsystem



Document 9786

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Notices

FCC Compliance Statement

Following is the compliance statement for the Federal Communications Commission:

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

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

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

■ Japanese Compliance Statement

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取扱説明書に従って正しい取り扱いをして下さい。

C26930

This equipment is in the First Class category (information equipment to be used in commercial and/or industrial areas) and conforms to the standards set by the Voluntary Control Council for Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in commercial and/or industrial areas.

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

About This Manual

This manual is intended for anyone whose job is to operate the 4791/4490 Cartridge Subsystem. It includes an overview of the subsystem components, procedures for routine subsystem operation, and helpful information in case something goes wrong.

Organization of Information

This guide has seven chapters and one appendix, organized as follows:

Chapter 1 "General Information" provides a description about the components of the 4490 Cartridge Subsystem and includes some different configurations.

Chapter 2 "Controls and Indicators" explains what the various controls and indicators do and where they are.

Chapter 3 "Routine Maintenance" describes the routine maintenance procedures for operators, such as cleaning the tape path and how to take care of the cartridge tapes.

Chapter 4 "Operating Procedures" contains *how to* information for the operator to maintain the cartridge subsystem, such as how to power-on and power-off the subsystem, load and unload a transport, and file-protect a cartridge.

Chapter 5 "Cartridge Scratch Loader" describes *how to* operate a StorageTek 2511 Cartridge Scratch Loader and includes a list of fault symptom codes the operator can clear without placing a service call.

Chapter 6 "Status and Error Information" describes the messages that may appear in the indicators and displays.

Chapter 7 "Responding to Subsystem Problems" describes *how to* respond to the messages that may appear in the indicators and displays.

Appendix A "Specifications and Environment" provides information about the cartridge subsystems and operating environments.

Glossary Contains a list of terms and abbreviations found in this guide.

Index Helps you find information.

A Reader's Comment Form is located at the back of this guide for communicating suggestions or requests for change. We encourage and appreciate your feedback.

Alert Messages

This guide contains alert messages that *must* be read carefully and followed:

Notes Provide additional information that might be of special interest. A note can point out exceptions to rules or procedures. A note usually, but not always, follows the information to which it relates.

Cautions Inform the user of conditions that might result in damage to hardware, corruption of customer data or application software, or long-term health hazard to people. A caution precedes the information it relates to.

Warnings Alert the user to conditions that might result in injury. A warning *always* precedes the information it relates to.

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General Information

1

This chapter introduces the 4791/4490 Cartridge Subsystem by providing an overview of the subsystem and describing its components and configurations.

Subsystem Overview

The 4791/4490 Cartridge Subsystem is a storage and retrieval subsystem using 36-track magnetic-tape cartridges for its storage medium. The subsystem attaches to its host system by an industry-standard Small Computer System Interface (SCSI).

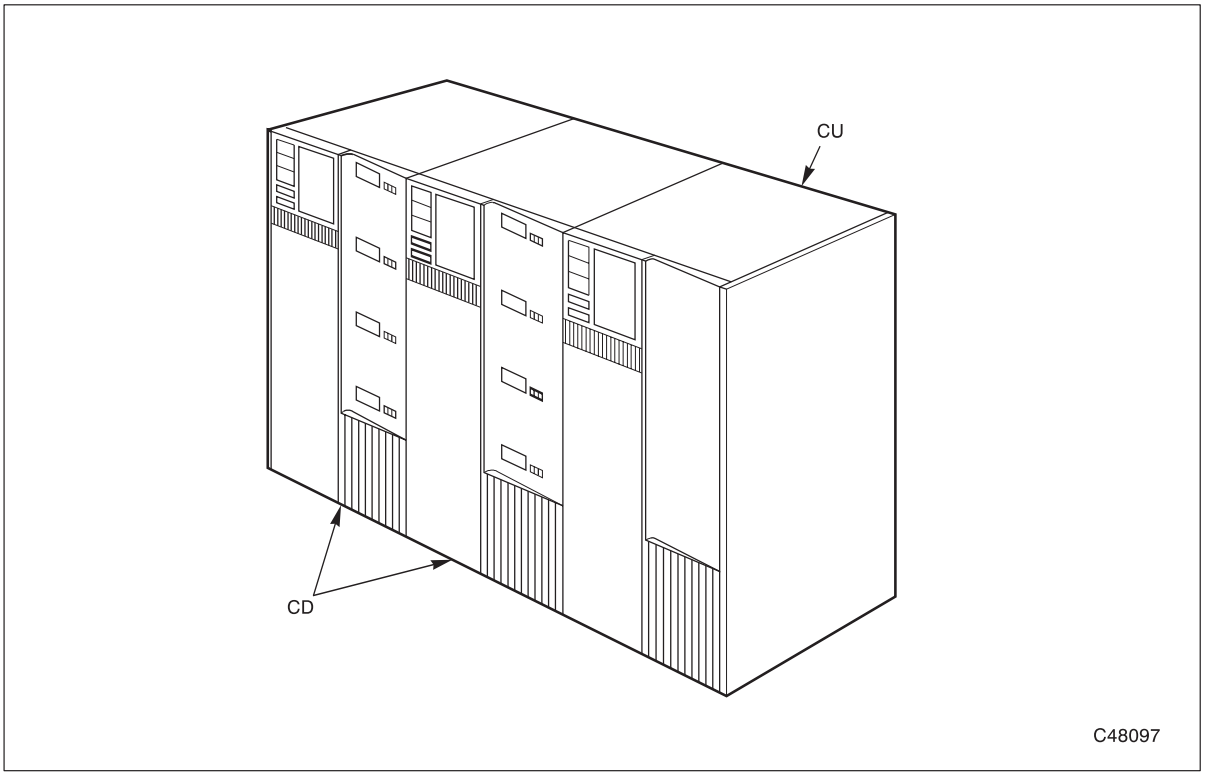


Figure 1–1. Stand–alone 4791/4490 Cartridge Subsystem

The subsystem's 4791 Control Unit (CU) can have from one to four 4490 Cartridge Drives (CDs) attached (depending on the model). Two models of CDs are available:

- M32, which has two transports
- M34, which has four transports

The subsystem uses both standard cartridge tapes (used in 18-track subsystems) and Enhanced Capacity cartridge tapes (E-Tapes, used in 36-track subsystems), which can contain twice the tape length of standard cartridges.

The 4791/4490 Cartridge Subsystem supports three tape-recording formats:

- 18-track, standard (read only)
- 18-track, extended (read only)
- 36-track, extended (read and write)

All three formats comply with American National Standards Institute (ANSI) and European Computer Manufacturers Association (ECMA) specifications.

SCSI Bus

The 4791/4490 Cartridge Subsystem supports both single-ended and differential SCSI-bus alternatives using SCSI-1 protocol.

Note: The protocol used is SCSI-1, but the 4791/4490 Cartridge Subsystem supports all SCSI-2 commands. Refer to the 4781/4791 18- and 36-Track Small Computer System Interface Manual for more information about the commands and protocol supported by this subsystem.

The single-ended interface can be either a 50-conductor flat cable or a 25-signal twisted pair. The maximum cable length is 6 meters (20 feet).

A 25-pin twisted pair is recommended for the differential interface. The maximum cable length is 25 meters (82 feet).

Configurations

The 4791/4490 can be installed in one of three configurations:

- Standalone (Figure 1–1)
- Standalone with an optional cartridge scratch loader (Figure 1–2)
- Attached to one of StorageTek's automated cartridge subsystems (ACS) also called a library (Figure 1–3)

Cartridge Scratch Loader

Figure 1–2 shows a subsystem with CSLs attached.

The 2511 Cartridge Scratch Loader (CSL) enables automatic loading and unloading up to 10 cartridge tapes. The CSL has three operating modes:

Auto Cartridges are automatically loaded. The operator must know the sequence which these tapes are to be mounted.

System The operating system controls the loading of the cartridges.

Manual The operator controls the loading of the cartridges by pressing the START button.

Note: The CSL attaches only to an M32 CD.

Refer to Chapter 5 for more information about the CSL.

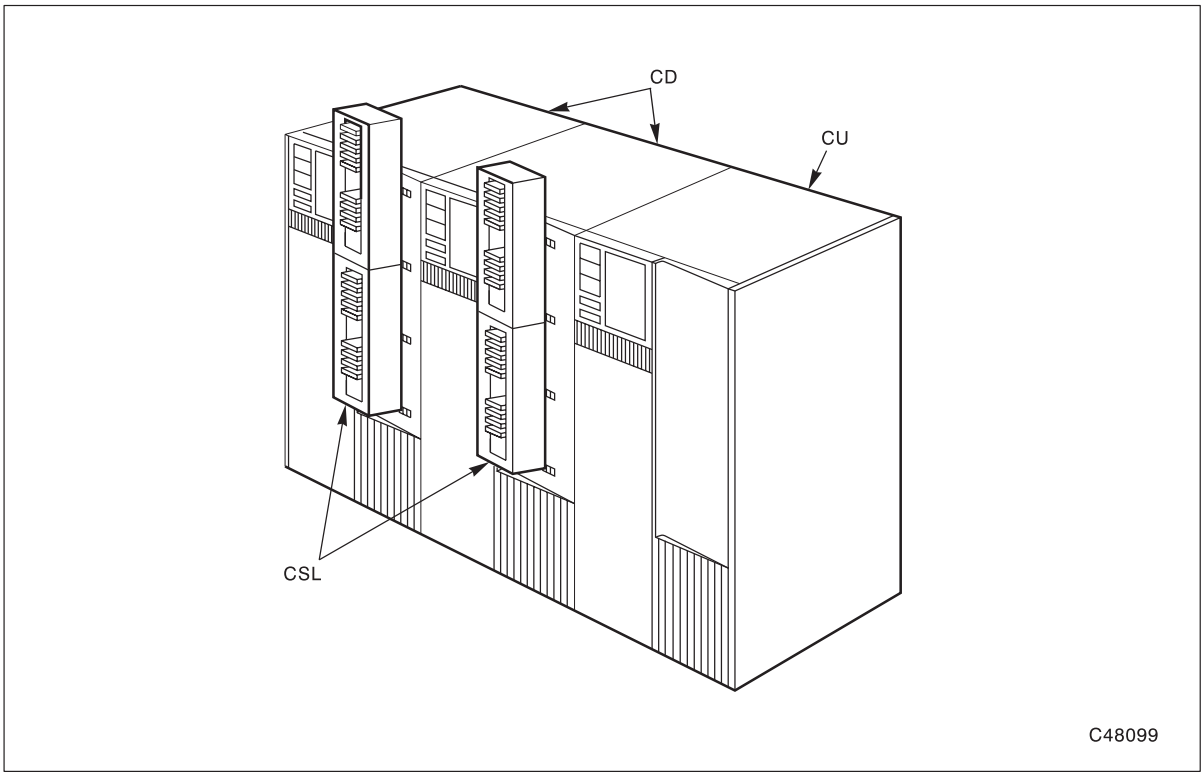


Figure 1–2. Subsystem with Four CSLs Attached

Automated Cartridge Subsystem

Figure 1–3 shows a 4791/4490 Cartridge Subsystem attached to a 4400 Automated Cartridge Subsystem (library). The cartridge drives are attached to the sides of the library. A robot located in the center of the library loads and unloads cartridges at the transports. Up to 6,000 cartridges can be stored in the library shown.

The major components of the library are:

- Library Management Unit (LMU)
- Library Control Unit (LCU)
- Library Storage Module (LSM)
- Host Software Component (HSC)
- Cartridge Access Port (CAP)

Several types and sizes of libraries are available.

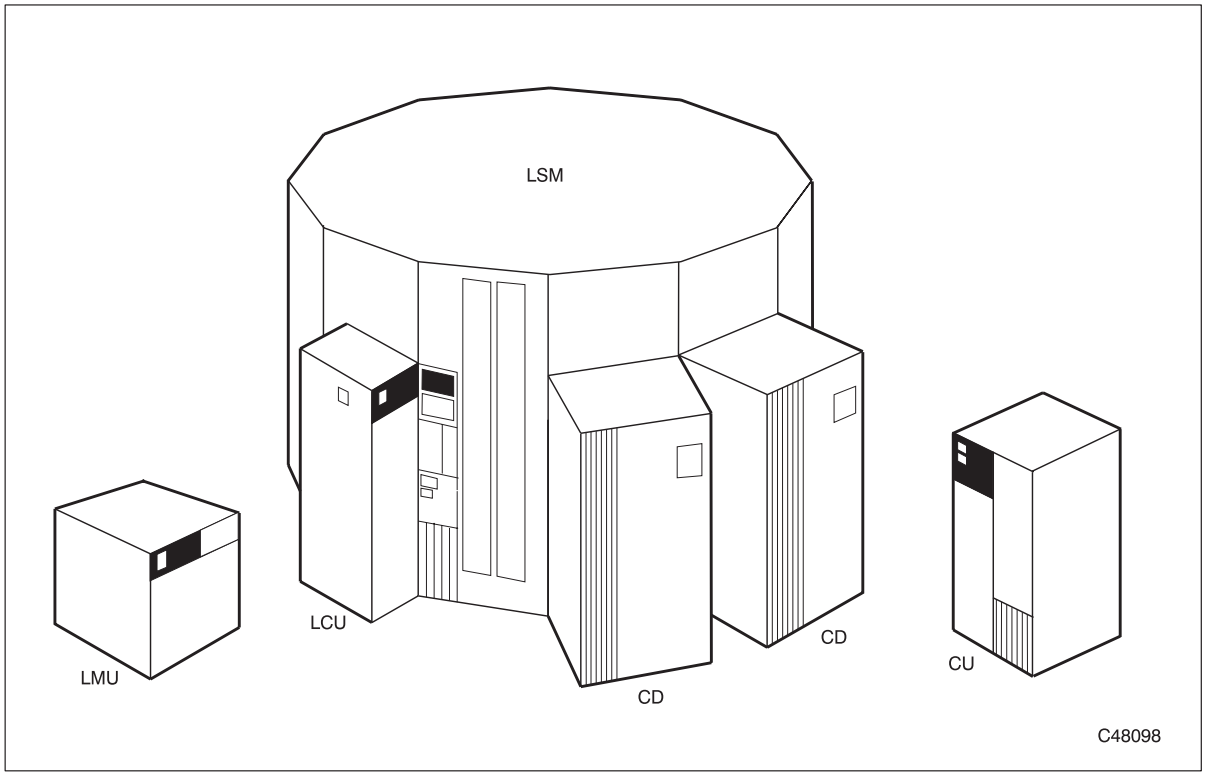


Figure 1–3. Nearline–Attached Subsystem

Control Unit

The 4791 Control Unit connects to a single SCSI bus. The control unit manages the storage and retrieval of data between the system and transports.

These activities include:

- Receiving and interpreting host commands
- Selecting a transport
- Sending commands to a transport
- Passing data from the host to a transport through the CU buffer
- Sending status and error information to the host
- Passing data from a transport to the host through the CU buffer
- Detecting and correcting errors in data

A control unit contains:

- Multiple processors that work independently
- AC and DC power supplies
- Data compression logic
- A 4-megabyte data buffer
- Separate read and write sequencers
- A device interface that supports two to eight transports

Cartridge Drive

A cartridge drive contains:

- One AC power distribution unit
- One DC power distribution unit
- One DC power regulator for each transport
- One pneumatic supply for every two transports
- Controls and indicators
- Message display
- Two or four transports (depending on the model)

Transport

The transport consists of mechanical and electrical parts that store and retrieve data from the cartridge tape. Each transport within the cartridge drive is virtually independent.

A transport contains:

- Mechanical and electronic components
- Digital servo-controlled motors that ensure precise tape speeds
- Microprocessor control of all functional elements of the transport
- A read/write head that writes data on and reads data from the tape

Cartridge Tape

Figure 1–4 shows the cartridge tapes the subsystem uses to store data. These tapes meet the specifications defined in the ANSI publication *American National Standard for Information Interchange Unrecorded, 36-track, Parallel, 12.57 mm (0.495 in.), 1,944 ftpmm (49,378 ftpi) Group-coded Recording.*

The standard length cartridge tape is:

- 12.65 ±0.025 mm (0.5 ±0.001 in.) wide
- 165–245 m (541–807 ft) long
- Has a recording density of 1491 characters per millimeter (37,871 characters per inch), in group code recording (GCR)
- Nominal capacity of the standard tape is 200 MB

The Enhanced Capacity cartridge tape (known as E–Cart or E–Tape) is:

- 12.573 ±0.025 mm (0.495 ±0.001 in.) wide
- Must be at least 332 m (1089 ft) long
- Has a recording density of 1944 flux transitions per millimeter (49,378 flux transitions per inch), in group code recording (GCR)
- Nominal data capacity of an E–Cart is 800 MB

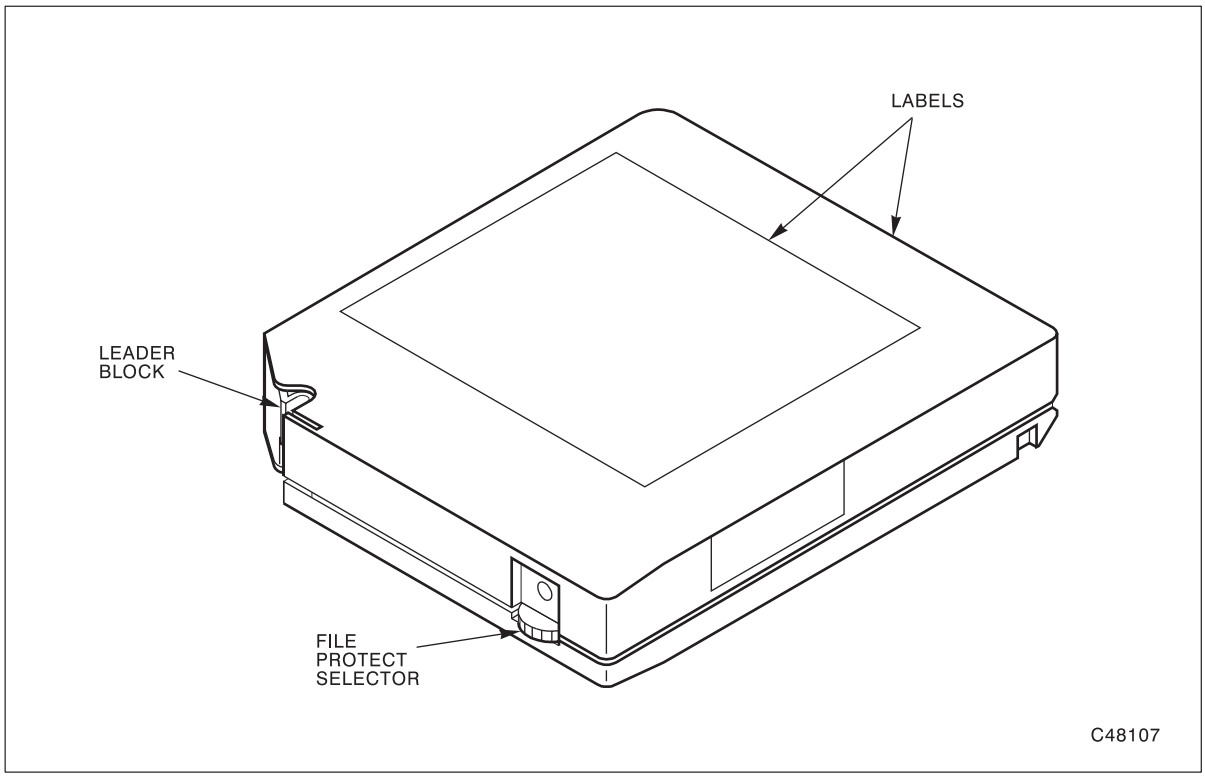


Figure 1–4. Cartridge Tape

Controls and Indicators

2

This chapter describes the controls and indicators for the 4791 Control Unit (CU) and 4490 Cartridge Drive (CD).

Control Unit Controls and Indicators

Figure 2–1 shows the 4791 Control Unit Operator Panel. This panel has an integrated Liquid Crystal Display (LCD) panel behind the front cover. The LCD panel supports different functions using function keys and a hexadecimal keypad to enter data and selections. These function keys operate two ways:

- They alter the display on selection.
- They are used as toggle switches and darken to indicate a selection was made. To de-select an item, press that function key again.

Online and offline status is controlled from the LCD Operator Panel using function key 9.

The Operator Panel has RESET and IPL switches located to the left of the LCD panel and above the hexadecimal keypad. These switches should only be used if a problem exists or the subsystem requires reloading of the microcode. Pressing these buttons during normal operation could cause unpredictable results.

A SERVICE REQUIRED indicator is located below the hexadecimal keypad. When on, this indicates a problem in the control unit and the subsystem has stopped functioning.

The Operator Panel has two diskette drives located to the right of the operator panel.

- Drive 1 loads functional programs
- Drive 2 loads diagnostic programs

For normal subsystem operation both diskettes should be installed, but the subsystem requires only the functional diskette to operate. StorageTek customer services engineers use the diagnostic diskette to help isolate problems that may occur.

Table 2–1 describes the appearance and functions of the switches and indicators.

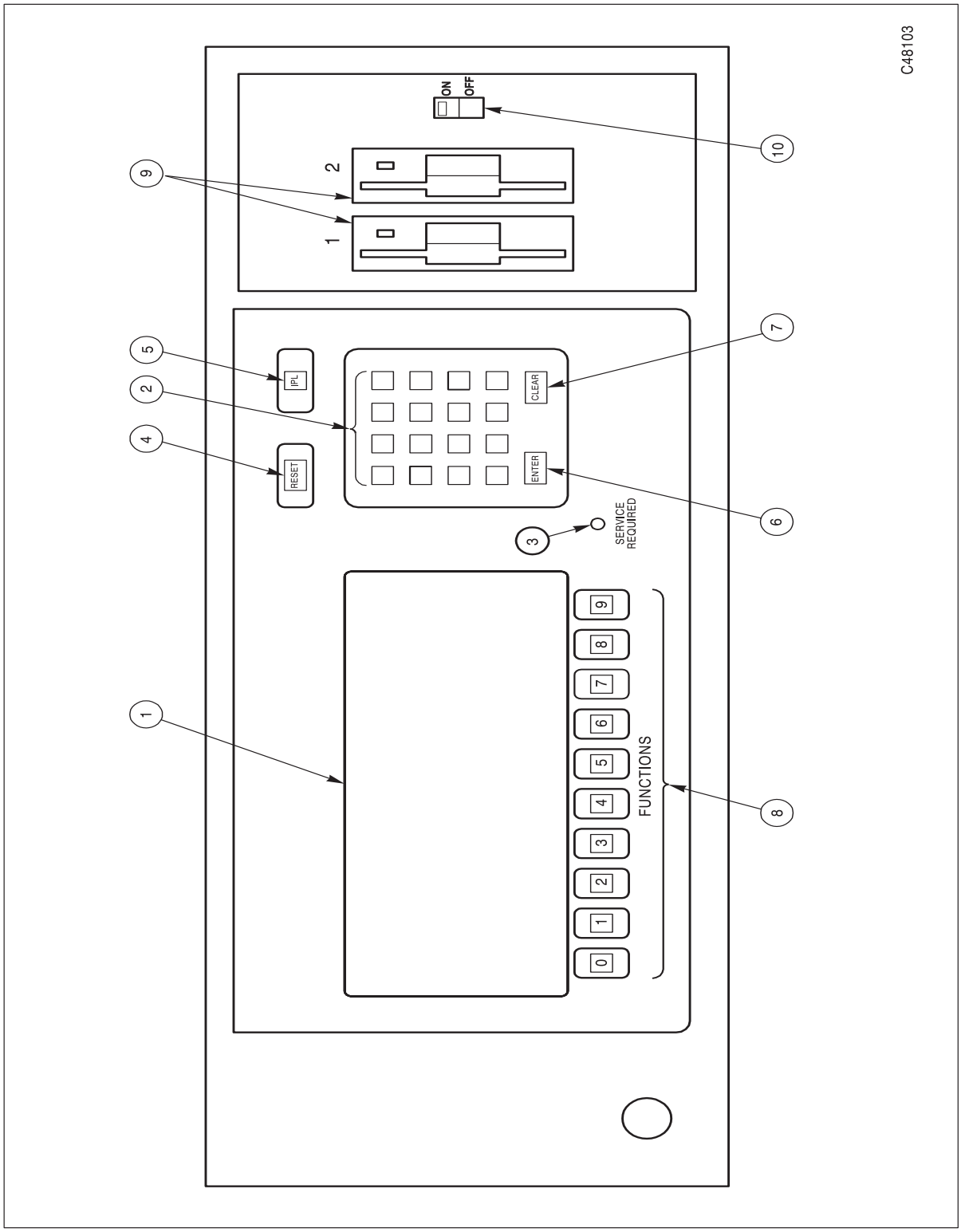


Figure 2–1. Control Unit Operator Panel

Table 2–1. Control Unit Operator Panel

Item	Label	Type	Function
1	DISPLAY PANEL	LCD Panel	Displays menus for testing and configuring the subsystem.
2	HEXADECIMAL KEYPAD	Momentary Switch	Selects parameters and values for testing and communication.
3	SERVICE REQUIRED	Indicator	Lights when the 4791 requires service or when the IPL switch is pressed.
4	RESET	Momentary Switch	Restarts the microprocessor programs, stops tape motion, clears data memory, resets error status, and dumps error information to diagnostic diskette.
5	IPL	Momentary Switch	Carries out an IPL of microprocessor programs from functional diskette.
6	ENTER	Momentary Switch	Transmits information loaded from data entry keypad to the CU.
7	CLEAR	Momentary Switch	Clears the data entry keypad.
8	FUNCTIONS	Momentary Switches	Each display names the function of the associated function key directly above each function key.
9	1 2	Diskette Drives	Loads functional and diagnostic programs into CU microprocessor. 1=Functional 2=Diagnostic
10	POWER	Rocker Switch Indicator	Turns ON the AC power supply in the CU and supplies AC to the CD. Turns OFF and starts a controlled power-off of the CU and attached CDs. The indicator is ON or OFF according to the position of the switch.

Note: Items correspond to call-out numbers in Figure 2–1.

Emergency Power-Off Switch

Figure 2–2 shows the location of the Emergency Power-Off (EPO) switch. The EPO switch must only be used in a situation when saving a life or protecting the equipment from damage is more important than saving data.

CAUTION:
***Loss of data*. Use the EPO switch only in an emergency! Pressing this switch starts an uncontrolled power-off. Data may be lost and system problems may occur. If this happens, notify your supervisor and place a service call. Only a customer services engineer can restore power to the subsystem after this switch is pressed.**

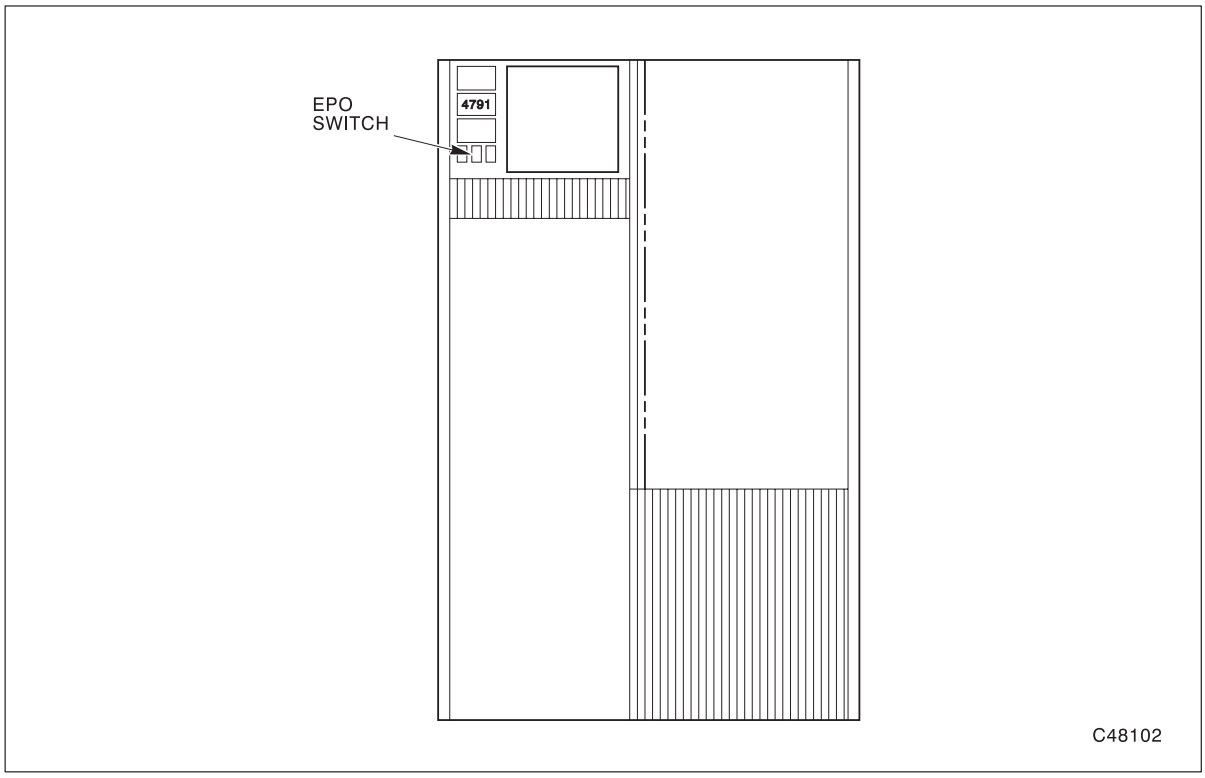


Figure 2–2. EPO Switch on the Control Unit Front Cover

Cartridge Drive Controls and Indicators

There are controls and indicators on *both* the front and rear doors of the cartridge drive.

Figure 2–3 shows the front controls and indicators.

Figure 2–4 shows the rear controls and indicators.

Front Panel

Figure 2–3 shows the transport control panel and Table 2–2 describes the functions of these displays and indicators.

The controls and indicators located on the front of the cartridge drive are used during normal operation. These controls and indicators help the operator load and unload the transport, identify which cartridge tape should be loaded, and provide status and error information for the transports.

A message display located in the upper left-hand corner of the cartridge drive provides status and information about the transport. Three indicators located next to each message display help further define the message displayed. See "Control Unit" in Chapter 6 for a description of the messages that can appear in this display.

The transport control panel is on the front of the cartridge drive next to the cartridge door for each transport.

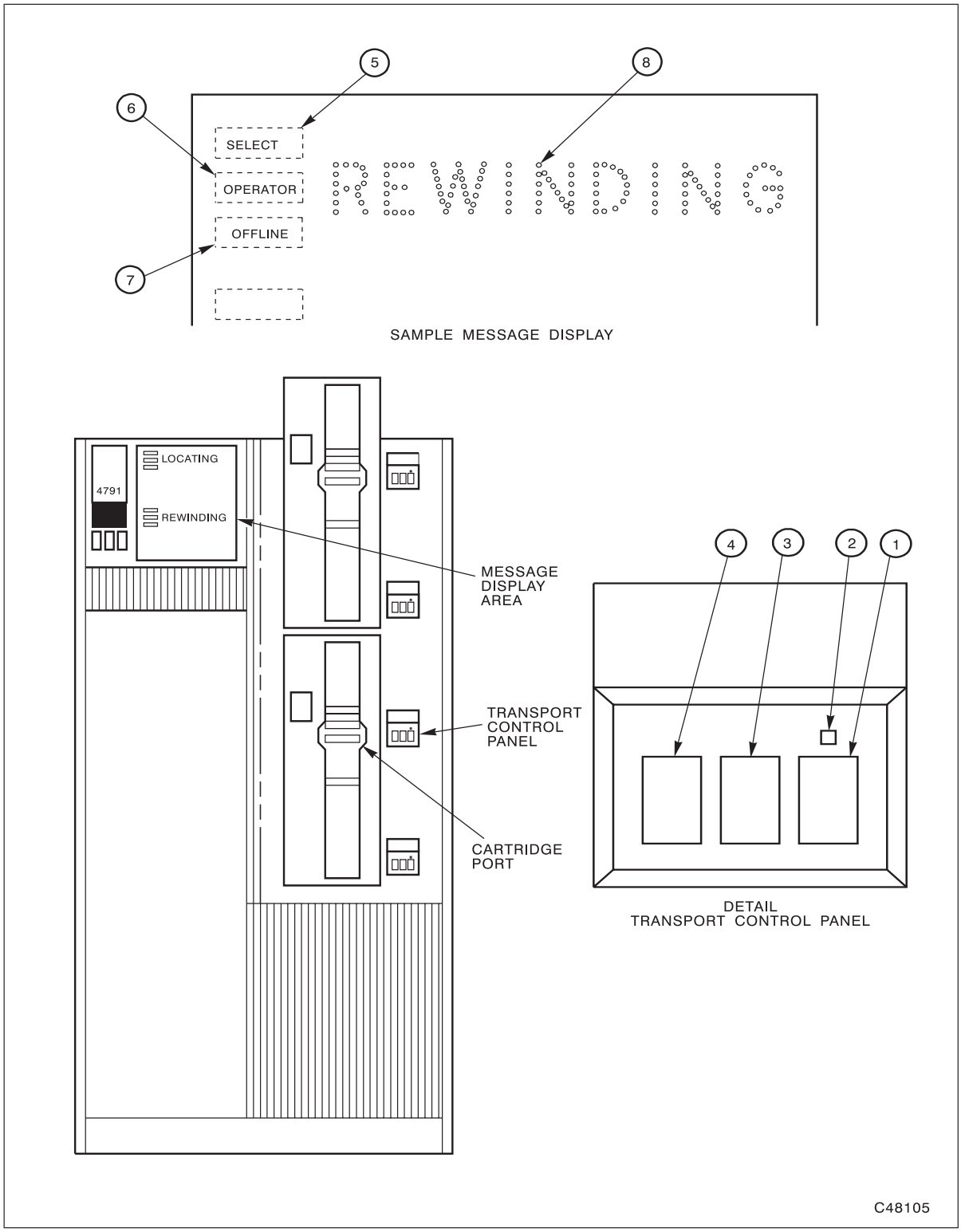


Figure 2–3. Cartridge Drive Message Display and Front Operator Panel

Table 2–2. Cartridge Drive Front Controls and Indicators

Item	Label	Type	Function
1	READY	Switch	Toggles the ready state of the transport.
2	READY	Green LED	On = Ready, Off = Not Ready
3	REWIND	Switch	Initiates a rewind to the beginning of tape (BOT) — Ready indicator must be off and the tape loaded for this to work. The ready switch also controls display brightness if the Ready indicator is on.[2]
4	UNLOAD	Switch	Initiates an unload of the cartridge. Ready indicator must be off for this switch to work when the tape is loaded. The unload switch also controls display brightness if the Ready indicator is on.[2]
5	SELECT	Green Light Bar	Selects the transport.
6	OPERATOR	Red Light Bar	Indicates operator intervention is required. **Note:** When the transport is first powered-on, this indicator is on.
7	OFFLINE	Yellow Light Bar	Indicates the transport is offline.
8		Alphanumeric Display Panel	Presents message concerning state of transport and system messages.

Notes:

1. Item numbers correspond to call-outs in Figure 2–3.

2. To adjust the intensity of the CD message display, press the REWIND and UNLOAD switches together. The intensity changes from 100% to 50%, 25% and 0% (off) in 2-second intervals.

Rear Panel

Figure 2–4 shows the Rear Switch Panel. The controls and indicators on the rear of the cartridge drive help the operator or customer services engineer.

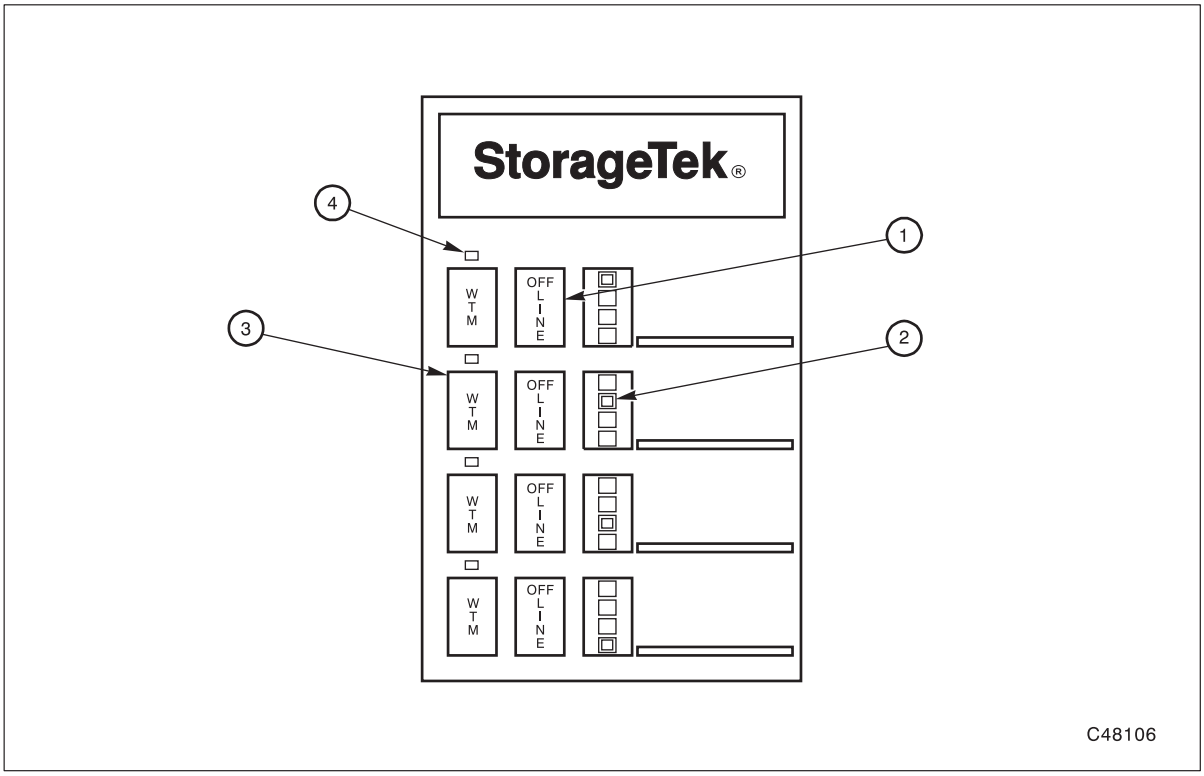


Figure 2–4. Cartridge Drive Rear Controls and Indicators

Table 2–3. Cartridge Drive Rear Controls and Indicators

Item	Label	Type	Function
1	OFFLINE	Momentary Switch	Requests CU to toggle transport Online/Offline status (change to the opposite state the transport is in).
2	OFFLINE	Yellow LED	On = transport offline. Off = transport online. Flashing = transport is changing state.
3	WTM	Momentary Switch	Requests the CU to write a tape mark on the tape if transport is offline, tape is loaded, and READY LED is on.
4	WTM	Green LED	On = CU has not completed writing the tape mark Blinking = A WTM failure has occurred
Notes: Items correspond to call-out numbers in Figure 2–4.			

Routine Maintenance

3

This chapter describes suggested, periodic maintenance to be performed on the 4791/4490 Cartridge Subsystem including:

- Cleaning the tape path in the transports
- Maintaining cartridge tapes

Tape Path

Keeping the transport clean is important because it improves the overall performance of the subsystem. Clean the tape path at periodic intervals as described in the following:

- After 100 hours of operation
- Every seven days
- When the *CLEAN* message appears in the message display on the front panel of the cartridge drive

The control unit keeps track of transport use and, each time an established usage threshold is reached, the control unit sends a “CLEAN” message to the cartridge drive message display. The threshold is based on the amount of tape that has passed over the read/write head. Table 3–1 compares tape-to-head exposure with the approximate equivalent number of cartridges processed by a transport.

Table 3–1. Tape Usage and Cartridges Processed

Length of Tape	Standard Cartridges
1,650 m (5,410 ft)	10
4,120 m (13,525 ft)	25
8,380 m (27,500 ft)	50

The default threshold is 4,120 meters (13,525 feet) of tape; however, this threshold can be changed by a customer services engineer (CSE). The CLEAN message counter can be set to display a message after 10, 25, or 50 standard-length cartridge tapes have been completely run, or a certain amount of tape footage has been run. Frequent cleaning of the tape path adds significantly to subsystem performance.

To clean the tape path:

1. Unload the transport.
2. Insert a cleaning cartridge into the transport. The transport threads the cleaning tape, runs it through the tape path, rewinds it, and unloads it.

   `*CLEANING*` appears in the message display while the cleaning cartridge is installed.
3. Remove the cartridge when the cartridge door opens.
4. Update the usage count label on the cleaning cartridge.

Maintenance and Care of Cartridge Tapes

Damaged cartridge tapes can cause loss of data. Follow the instructions in this chapter to avoid problems caused by dirty, defective, or damaged cartridges.

Storing Cartridges

When storing cartridges:

1. Do not take a cartridge out of its protective wrapping until needed. Use the tear-string, not a sharp instrument, to remove the wrapping.
2. Store cartridges in a dirt-free environment that, if possible, duplicates the conditions of the data processing center. Maintain the storage conditions listed in “Component Specifications”.
3. Ensure the cartridge has been in its operating environment for at least 24 hours before using it.

Handling Cartridges

Careless handling can damage cartridges and damaged cartridges can harm both data and equipment.

Always observe the following rules:

- Keep the cartridges clean.
- Inspect the cartridge each time it is used.
- Ensure the leader block is latched each time you pick up a cartridge.
- 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 carry cartridges loosely in a container because leader blocks can snag on other cartridges and become unlatched.
- Do not handle tape outside the cartridge. The tape edge could be damaged.
- Do not expose the tape or cartridge to direct sunlight or moisture.
- Do not expose a recorded cartridge to magnetic fields because this could destroy data on the tape.
- When moving cartridges, temporarily stack them horizontally (no more than six in a stack).
- Store and ship cartridge tapes in a vertical position.

Inspecting a Cartridge

Before loading a cartridge into a transport:

- Cracked or broken cartridge
- Dirty cartridge
- Broken leader block
- Broken leader block latch
- Damaged file-protect selector
- Liquid in the cartridge
- Gum label loose or extending over the cartridge edge
- Any other obvious damage

Report any problems immediately.

Cleaning a Cartridge

CAUTION:
Damage to Cartridges. **Do not use certain solvents for removing labels because they can damage the cartridges.**

Do not use acetone, toluene, xylene, benzene, ketone, methylethyl ketone, methylene chloride, ethyldichloride, esters, ethyl acetate, or 1,1,1, trichloroethane. StorageTek Hub and Transport Cleaner Fluid or Tape Transport Cleaner Fluid are recommended.

Wipe all dust, dirt, and moisture from the cartridge with a lint-free cloth. When using a cleaning solution, be sure it is made specifically for cleaning cartridges and that the solution does not touch the tape or enter the cartridge.

Repairing Detached Leader Block

If a leader block detaches from a tape, repair it by using a Leader Block Repair Kit or an equivalent kit approved by your media manufacturer. Instructions are in the kit.

Note: This allows the tape to be used *one more time* to copy the data onto another cartridge.

Setting the File–Protect Switch

To protect a tape from being erased or overwritten, turn the thumbwheel on the side of the cartridge until a white dot or lock symbol is visible. The tape can now be read from but not written on.

CAUTION:
If the dot is not visible, the tape is unprotected and can be written on.

Note: Make sure the file-protect selector is in the correct position before the cartridge is loaded into the transport.

Applying Cartridge Labels

Figure 3–1 shows two kinds of labels that can be applied to a cartridge:

- The volume/serial number label goes on the opposite side of the file protect selector.
- The customer label goes on the top surface of the cartridge.

These are the only areas of the cartridge to apply a label. Do not apply labels elsewhere on the cartridge surface.

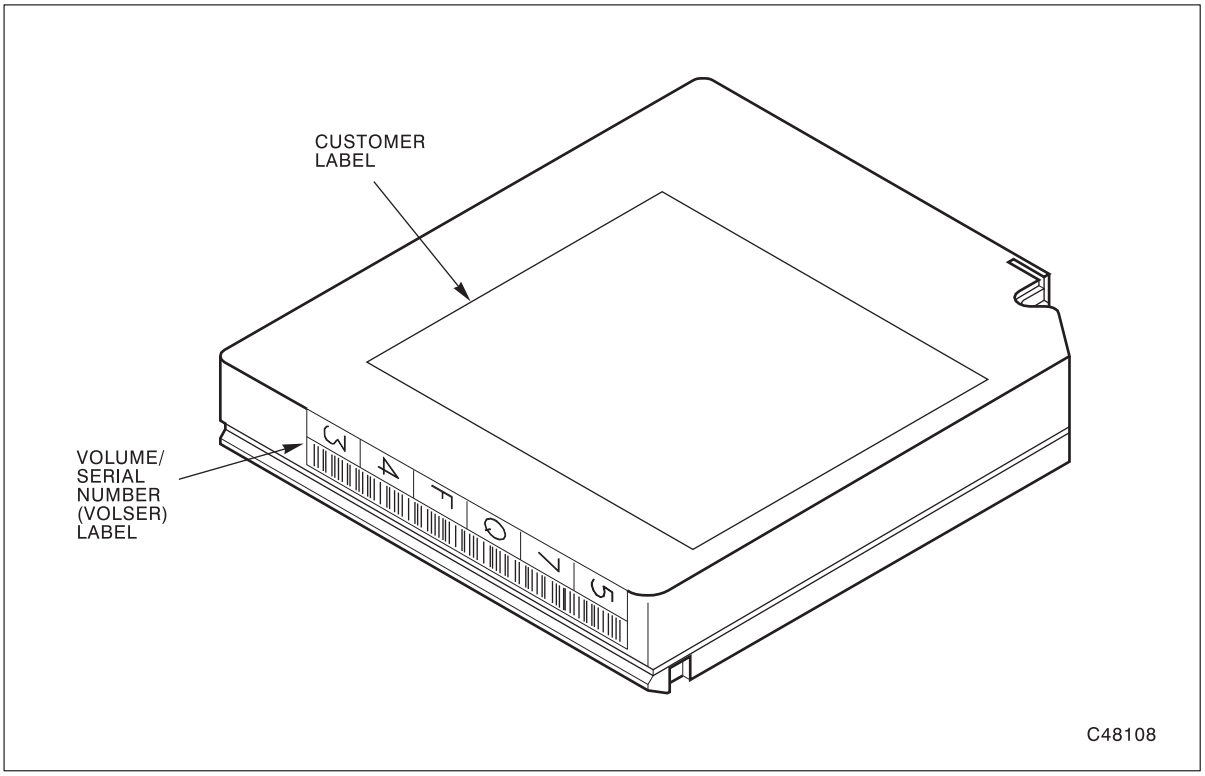


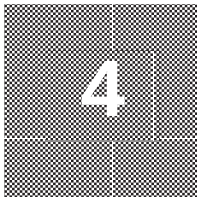
Figure 3–1. Cartridge Labels

Observe these guidelines when applying cartridge labels:

- Use labels that leave little or no residue when you remove them.
- Remove residue using approved procedures.
- Write on the labels with a non-smear marker.
- Do not write on a label already on a cartridge.
- To change the writing on a label:
  - –l Remove the existing label
  - –l Fill out a new one
  - –l Put the new label on the cartridge

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Operating Procedures



This chapter describes the following operating procedures:

Table 4–1. List of Operating Procedures	
Procedure	**Refer to Page**
Powering-off the subsystem in an emergency	4–2
Powering-off the subsystem under normal conditions	4–3
Powering-on the subsystem	4–4
Inserting a diskette into a diskette drive	4–5
IPLing the Control Unit	4–6
Placing the Control Unit online	4–7
Placing the Control Unit offline	4–8
Placing a transport online	4–8
Placing a transport offline	4–8
Loading a transport	4–9
Unloading a transport	4–10
Making a transport ready	4–10
Rewinding tape in a cartridge	4–11
Rewinding a loosely wound tape	4–11
Opening a Cartridge Drive door	4–11
File-protecting a cartridge	4–12
Writing a tape mark	4–13
Changing the transport message display intensity	4–13

Being familiar with the operator panels helps you perform these operations. Additional help is available in:

- Chapter 2. Controls and Indicators
- Chapter 6. Status and Error Information
- Chapter 7. Correcting Subsystem Problems

Powering-Off the Subsystem in an Emergency

Figure 4-1 shows the EPO switch on the control unit front cover.

CAUTION:
***Loss of Data*. Use this switch only in an emergency! Pressing this switch starts an uncontrolled power-off. Data may be lost and system problems may occur. If this happens, notify your supervisor and place a service call. Only a customer services engineer (CSE) can restore power to the system.**

To power off the subsystem in an emergency:

1. Press the EPO switch on the control unit front cover.
2. Notify your manager or supervisor immediately.
3. Place a service call.

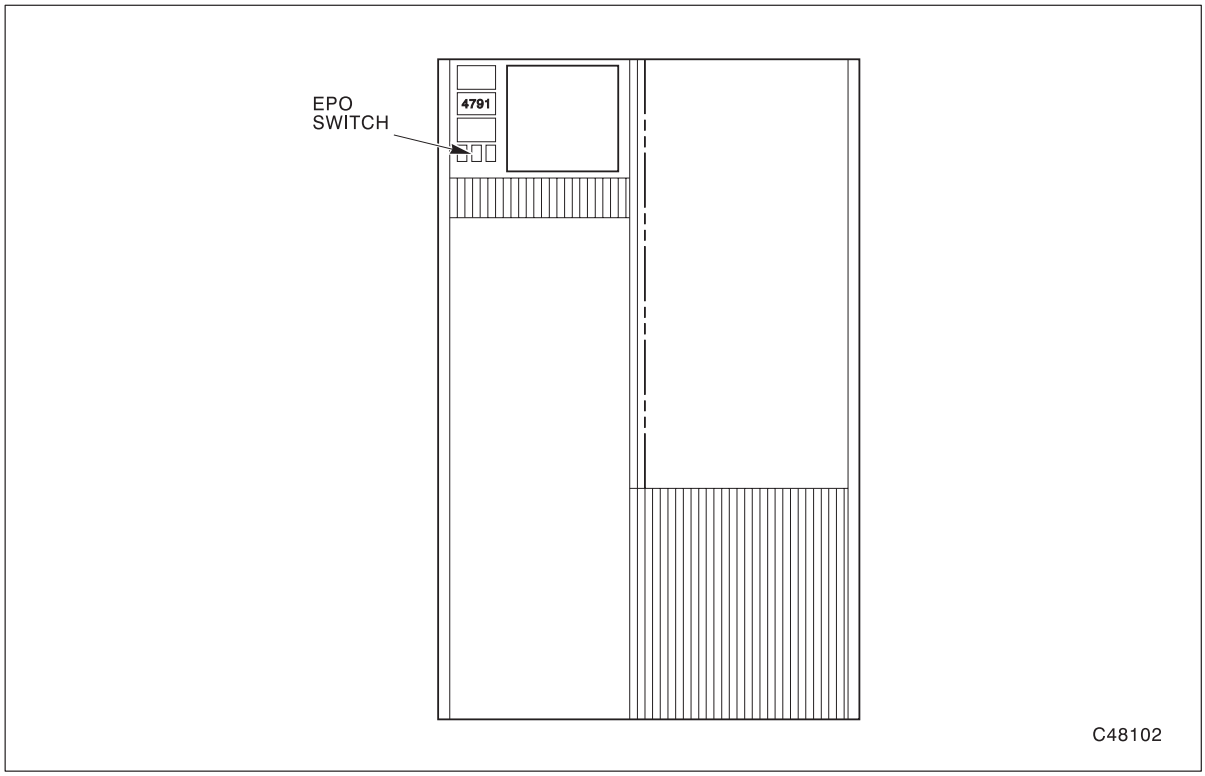


Figure 4–1. EPO Switch on Control Unit Front Cover

Powering-Off the Subsystem

Observe the following notes before powering–off the subsystem:

Note:

- Place a service call to power off *only* the control unit and *no* cartridge drives.
- Place a service call to power-off *one or more transports or cartridge drives*, and not the control unit.

To power off the subsystem under normal conditions:

1. Make sure no operating system activity is taking place on the subsystem you want to power off.
2. Unload all transports if they are not already unloaded.
3. Press the LCD panel ONLINE function key and verify that the OFFLINE indicator is displaying.
4. Verify that the access light on the diskette drive is off.
5. Release the diskettes by pressing the button on the side of the diskette drives.
6. Turn off the POWER switch on the operator panel of the control unit.

   The control unit and the cartridge drives are now powered off.
7. Pace a service call if problems occur.

Powering-On the Subsystem

To power on the subsystem:

1. Turn the POWER switch on (located on the Operator Panel).
2. Place a service call if power does not come on.
3. Insert the functional diskette in Drive 1 and diagnostic diskette in Drive 2 (see "Inserting a Diskette into a Diskette Drive" for more information on how to insert the diskettes).
4. Press the IPL switch located above the hexadecimal keypad.

   Note: At this time, the IPL procedure automatically begins and downloads the functional microcode.

5. Watch for the following indications to occur:

   - SERVICE REQUIRED indicator comes on, then goes off.
   - LCD panel begins to clear and a medium contrast bar scrolls from the bottom to the top of panel.
   - `IPL1` through `IPL8` appear in the center of the display as the different steps of the functional code are loaded.

   Note:

   a. If the control unit was in an offline state before the IPL, a Diagnostic Menu displays on the panel. To continue the IPL process, press function key 9 (LOAD FUNC). Functional code will continue to download and a series of diagnostic tests will run.

   b. If the control unit was in an online state before the IPL, a series of diagnostic tests begin to run after IPL8.

   c. The diagnostic test numbers and titles display on the panel as the tests start. Allow the diagnostic tests to complete and functional code to finish loading.

   d. Place a service call if an error occurs.

   e. Inform the customer services engineer about the problem and the error code displayed.

6. `LOADING FUNCTIONAL CODE` displays in the operator panel when the diagnostic tests finish.
7. `STARTUP IN PROGRESS` displays when the functional code is loaded.

   When the functional code has loaded, the control unit maintains an online state. To obtain an offline state, press function key 9 (ON LINE).

Inserting a Diskette into a Diskette Drive

Figure 4–2 shows the two $3^1/_2$ inch diskette drives for the functional and diagnostic diskettes.

To insert a diskette into the diskette drive:

1. Check to see if diskettes are already installed.

   The functional diskette should be in drive 1; the diagnostic diskette should be in drive 2.

2. Insert the diskette into the drive with the label side facing *left* (toward the LCD Panel).

   Note: Do not force the diskette if it meets resistance.

3. Push the diskette into the drive until the button beside the diskette drive pops out.

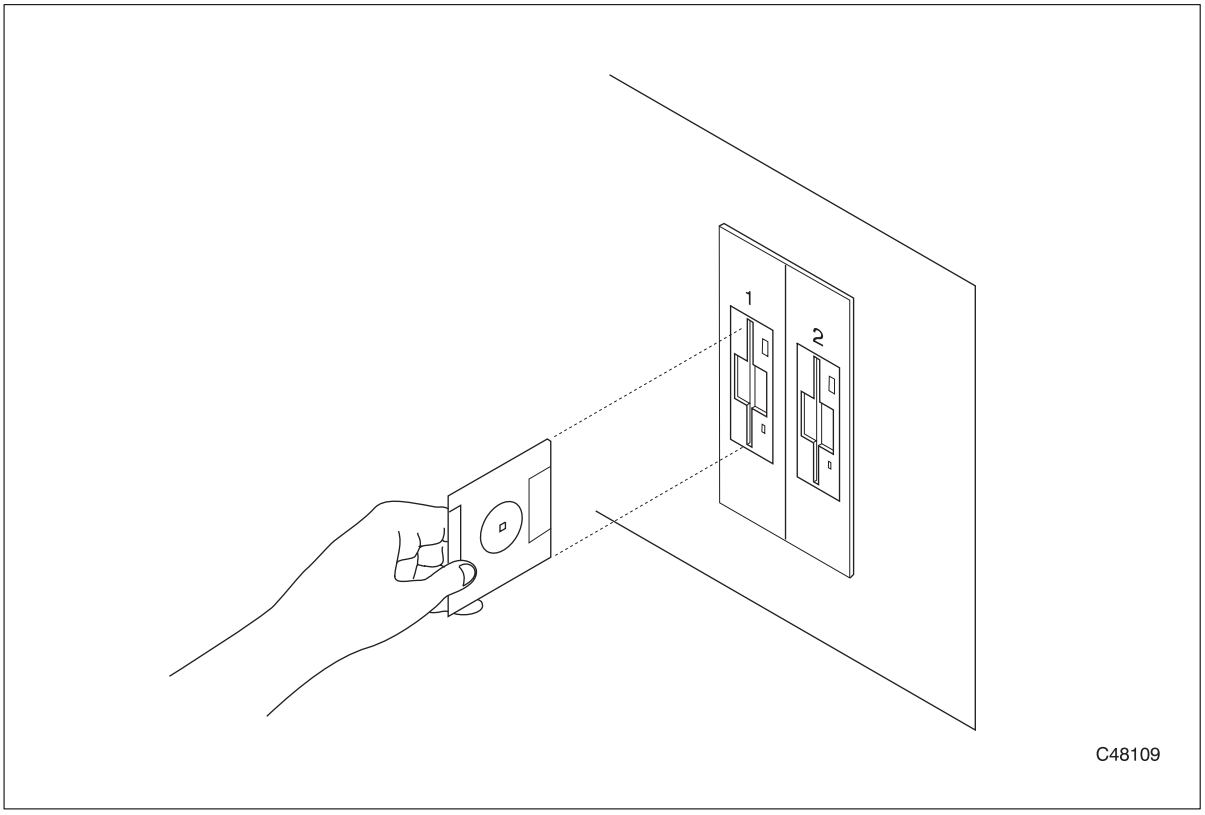


Figure 4–2. Diskette Drives

IPLing the Control Unit

Operators do not usually need to IPL the subsystem, but under the following conditions you might want to re-IPL the control unit or subsystem:

- At the request of the Customer Services Remote Center (CSRC)
- At the request of a Customer Services Engineer (CSE)
- Power problems at the customer site
- To load new microcode
- To correct a problem

If the control unit is not powered on, see "Powering-On the Subsystem."

Note: Re-IPLing the subsystem should be performed by, or under the guidance of, a StorageTek CSE or trained representative.

To re-IPL the subsystem:

1. Press function key 9 (ON LINE) to place the control unit offline.
2. Insert the functional and diagnostic diskettes into the diskette drives if necessary (refer to "Inserting a Diskette into a Diskette Drive").
3. Press the IPL switch located above the hexadecimal keypad.

   At this time, the IPL procedure automatically begins and the functional microcode downloads.
4. Watch for the following indications to occur:

   a. SERVICE REQUIRED indicator comes on, then goes off.

   b. LCD panel begins to clear and a medium contrast bar scrolls from the bottom to the top of panel.

   c. `IPL1` through `IPL8` appear in the center of the display as different steps of the functional code load.

      Because the control unit was placed offline before the IPL switch was pushed, a Diagnostic Menu displays on the panel. To continue the IPL process, press function key 9 (LOAD FUNC). Functional code will continue downloading and a series of diagnostic tests will run.

      The diagnostic test numbers and titles display on the panel as the tests start. Allow the diagnostic tests to complete and functional code to finish loading.

      Place a service call and inform the CSRC, CSE, or other trained representatives about the problem and the error code displayed.
5. When the diagnostic tests have completed, the panel clears and displays `LOADING FUNCTIONAL CODE`.

6. When the functional code loads, `STARTUP IN PROGRESS` displays.
7. When the functional code has loaded, the control unit maintains an online state.

Note: When re-IPLing the subsystem, to clear a SERVICE REQUIRED indication or control unit hang (where processing has stopped), follow these guidelines:

1) Write down all error information and pass this information on to the CSRC, CSE, or other trained representatives.
2) Press the RESET switch.

   Pressing the the reset switch causes the control unit to download memory to diskette drive 2 (trace dump). Make sure you install the correct diagnostic diskette.

   This information can be a valuable tool for engineering to recreate the problem and provide a resolution.
3) Press the IPL switch.
4) Watch for the indications listed in the previous procedure or "Powering-On the Subsystem."

Placing the Control Unit Online

Following are three situations when you might have to place a control unit online:

- If the 4791 CU is completely powered off, see "Powering–On the Subsystem"
- If the CU needs an IPL, see "IPLing the Control Unit."
- If the 4791 CU is powered on, but indicates it is offline, press function key 9 (ON LINE/OFF LINE).

Placing the Control Unit Offline

CAUTION:
***Loss of Data*. Do not power-off the control unit or allow any service to be performed unless the OFFLINE indicator is on. Data may be lost on any attached transport.**

When placing the control unit offline (for service, assignment to another system, or some other reason), press function key 9 (ON LINE) in the bottom right–hand corner of the Operator Panel.

There may be a delay in the control unit actually going offline as it completes any processing and updates status on the diagnostic diskette.

Observe the red light on drive 2 and the indication that the control unit is offline before proceeding.

Placing a Transport Online

To place a transport online:

1. Verify that all transports are enabled.
2. Observe the OFFLINE indicators on the front of the transports. All OFFLINE indicators should be off.
3. Press the OFFLINE switch on the Rear Switch Panel on the back of the cartridge drive if the transport indicate offline.

   Place a service call if the indicator remains on.
4. Ask the system operator to verify that all transports are back online.

Placing a Transport Offline

CAUTION:
***Damage to equipment.* Do not perform maintenance on a transport unless it is offline. If a transport is not offline, removing it from online status by pressing the OFFLINE switch on the rear of the cartridge drive can cause problems with the operating system and transport.**

To place a transport offline:

1. Verify the transport you are going to take offline will not be needed. If you are taking it offline because of a problem, place a service call.
2. Press the OFFLINE switch on the Rear Switch Panel located on the back of the cartridge drive.
3. Verify the OFFLINE indicator on the Message Display Panel is on.

Loading a Transport

Figure 4–3 shows how to load or unload a cartridge into the transport.

To load a cartridge into a transport:

1. Inspect the cartridge for damage (see "Inspecting a Cartridge" for information on how to do this).
2. Press the UNLOAD switch if the cartridge door is closed.
3. Insert the cartridge.
4. Close the door by grasping the door handle and sliding it down until the door clicks shut.
5. Make sure the READY indicator is on.

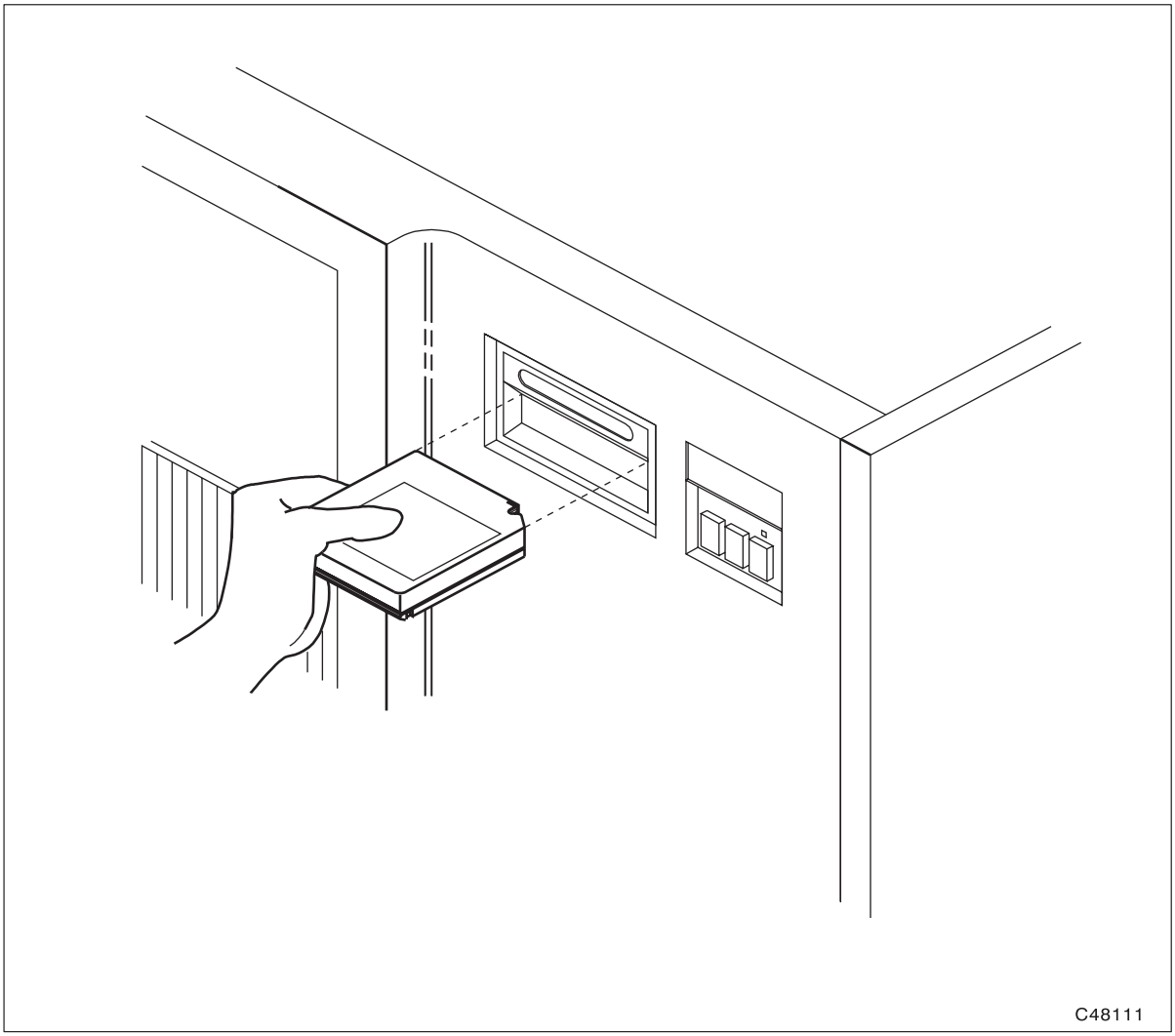


Figure 4–3. Loading a Cartridge into a Transport

Unloading a Transport

At the end of a job, the operating system issues a command that automatically rewinds and unloads the cartridge tape and opens the cartridge door.

If a job finishes, but the cartridge door stays shut:

1. Press the READY switch if the READY indicator is on. The indicator will go out.
2. Press the UNLOAD switch on the CD front panel. `REWINDING` appears in the message display while the transport is rewinding the tape. `UNLOADING` appears while the transport is unloading the tape.

   The door to the cartridge slot opens in a few seconds unless the transport has to rewind the tape. When it does open, remove the cartridge.
3. Place a service call if the door remains closed.

Making a Transport Ready

Under normal conditions, a transport is ready when:

- The subsystem is powered on
- The microcode is downloaded to the drive
- A cartridge is loaded
- The READY indicator on the CD front panel is on

If the subsystem is powered off:

1. Power the subsystem on and wait for the functional microcode has been downloaded (refer to "Powering–On the Subsystem").
2. Load a cartridge in the transport when "STORAGETEK" or an "*" appears in the message display (indicating that microcode has been downloaded to the transport).
3. Press the READY switch if the READY indicator is not on.
   - If the message display shows `READY F`, the transport is ready and the cartridge is file protected.
   - If the message display shows `READY U`, the transport is ready and the cartridge is not file protected.

If the subsystem is powered on:

1. Insert a cartridge into the transport. If there is a cartridge in the transport, unload it (refer to "Unloading a Transport") and reinsert it.
2. Press the READY switch if the READY indicator is off. When `READY F` or `READY U` appears in the message display, the transport is ready.
3. Place a service call if the transport is not ready.

Rewinding Tape in a Cartridge

When a job finishes, the operating system issues a rewind/unload command that rewinds the tape in a cartridge. If this does not occur, the operator must intervene.

To rewind the tape in the cartridge:

1. Press the READY switch *if* the READY indicator is on (located on the front panel). The READY indicator goes out.
2. Press the REWIND switch on the front panel.

   `REWINDING` appears in the message display while the transport is rewinding the tape. When the tape is rewound, this message disappears.
3. Press the UNLOAD switch to remove the cartridge.
4. Place a service call if the tape still does not rewind and unload.

Rewinding a Loosely Wound Tape

If the tape in a cartridge becomes loose from handling, insert the cartridge into a transport. Transport sensors detect the loss of tension and the transport rewinds the tape.

If a tape becomes too loose or too tight when being threaded in the transport, the transport may stop. In this case, unload the cartridge according to the steps in "Unloading a Transport."

Place a service call if the transport stops and you cannot clear the problem.

Opening a Cartridge Drive Door

To open a cartridge drive door when a cartridge is not in a transport:

1. Press the UNLOAD switch on the front panel of the CD.
2. Place a service call if the door does not open.

File-Protecting a Cartridge

Figure 4–4 shows the location of the file–protect switch.

To protect a cartridge: Turn the thumbwheel on the side of the cartridge until the white dot appears (see). When the dot is visible, a transport can read the tape but *not* write on it.

To unprotect the cartridge: Turn the thumbwheel until the white dot disappears. The transport can now read from *and* write on the tape.

CAUTION:
If the dot is not visible, the tape is unprotected and can be written on.

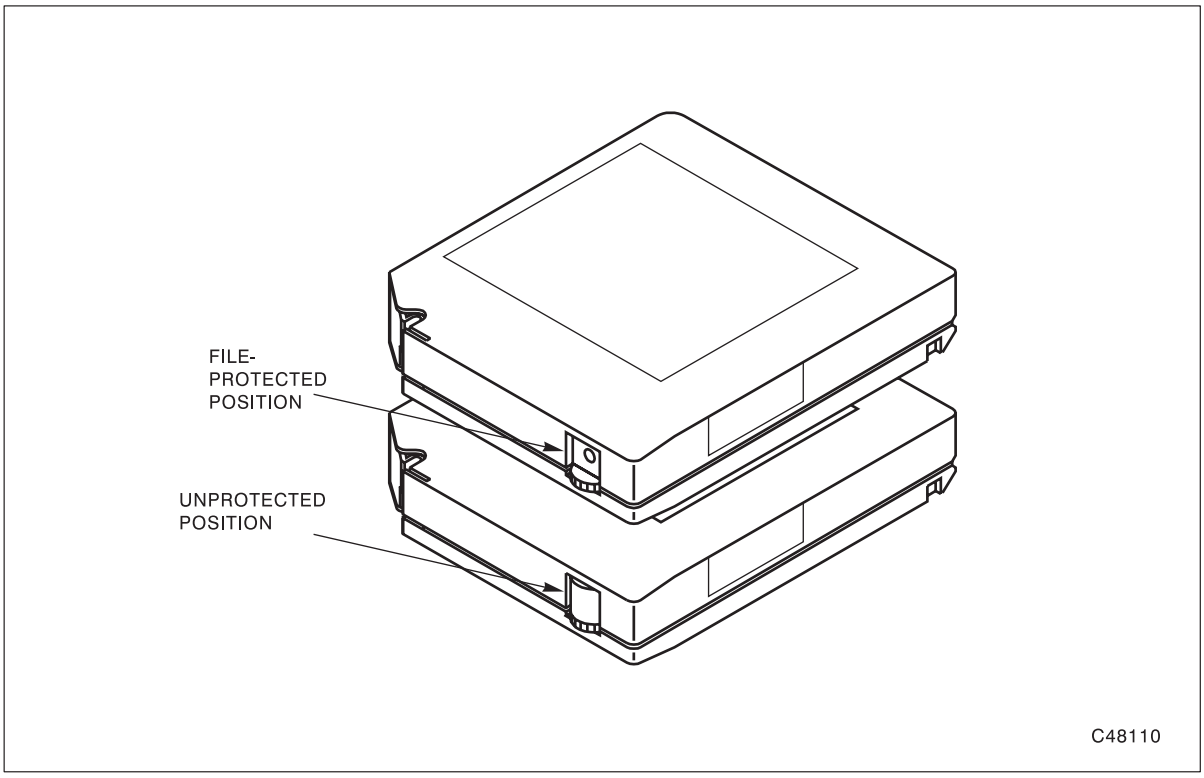


Figure 4–4. File–Protect Switch

Writing a Tape Mark

A tape mark can be written on a tape without having to run a job from the operating system. Writing a tape mark can be done from the Rear Control Panel on the cartridge drive (the WTM switch).

Write a tape mark when:

- An operating system requires an initial tape mark to be written on the tape before it can be used for data processing.
- The operating system goes down while a job is in progress. A tape mark *must* be written on the tape where the job stopped.

To write tape marks on cartridge tapes:

1. Place the transport offline (refer to "Placing a Transport Offline."
2. Load and make the transport ready (see "Loading a Transport."
3. Press and release the WTM (Write Tape Mark) switch on the Rear Control panel of the cartridge drive for the selected transport.

   The indicator next to the WTM switch comes on and stays on until the tape mark is written.
4. Rewind and unload the cartridge tape (refer to "Unloading a Transport" if necessary).
5. Remove the cartridge tape from the transport.

Changing the Message Display Intensity

The transport message display on the CD defaults to a 100% brightness when the transport is powered on.

To change the display intensity:

1. Check that the READY LED is on.
2. Press the REWIND and UNLOAD switches together and hold for 2 seconds. The intensity changes from 100% to 50%, 25%, and 0% (off) in 2 second intervals.
3. Release the switch when the desired brightness shows.

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Cartridge Scratch Loader

5

This chapter describes how to operate the 2511 Cartridge Scratch Loader (CSL). The CSL is an electromechanical device capable of loading and unloading up to 10 cartridges into and from a 4490 Cartridge Drive.

Note: A CSL can *only* be attached to an M32 because the CSL covers the other two transport doors on an M34.

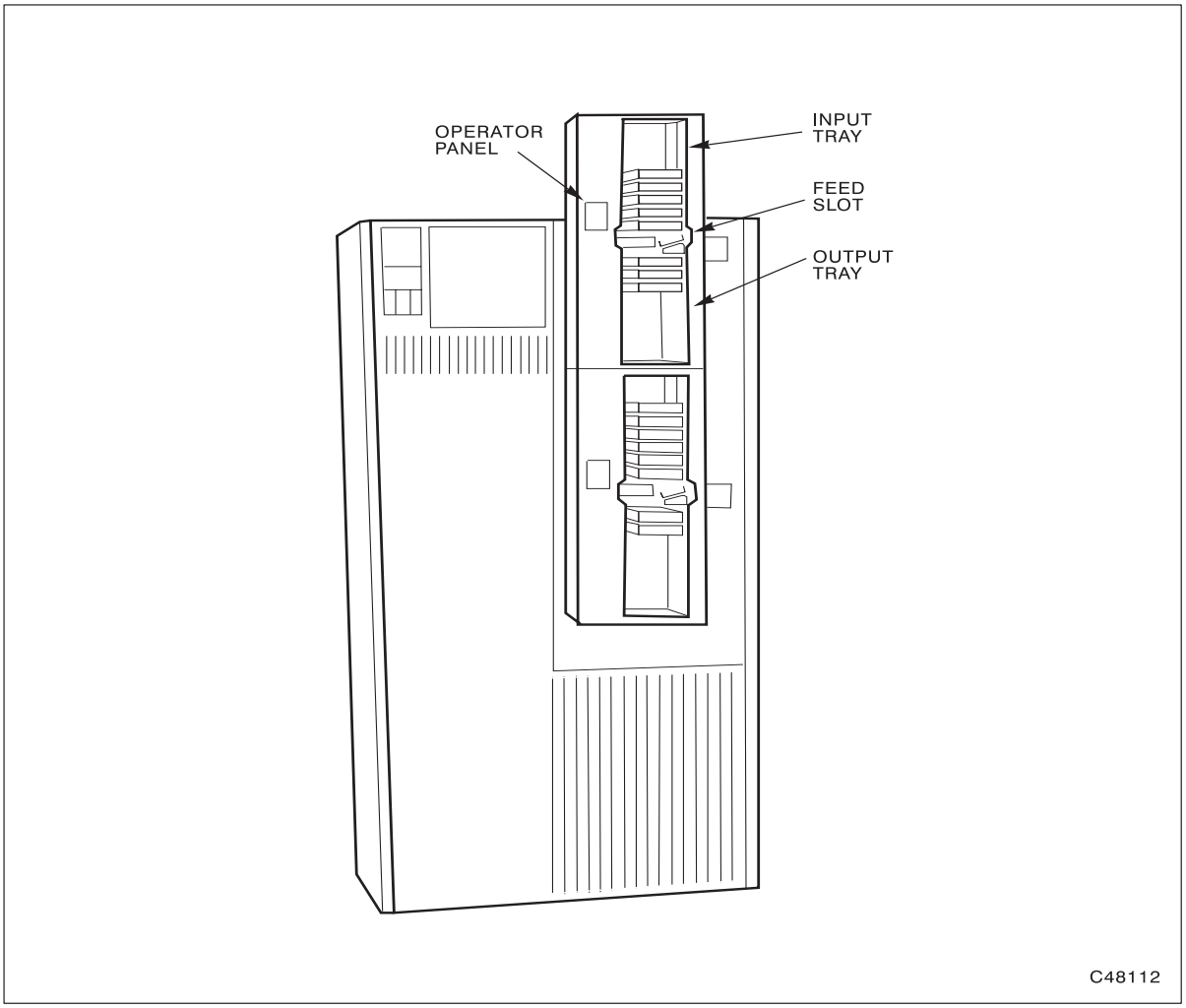


Figure 5–1. Cartridge Scratch Loader

Controls and Indicators

Figure 5–2 shows the CSL Operator Panel. The controls and indicators for the CSL include:

- A MODE switch:

  The mode switch controls the three different operating the modes of the CSL: AUTO, SYSTEM, and MANUAL.
- A green LED is used to indicate the current mode selection.
- A START switch:

  The start switch is used to start the CSL when AUTO or MANUAL modes are selected.
- A red OPERATOR LED used to indicate operator intervention is required.

Table 5–1 lists the appearance and functions of the CSL controls and indicators.

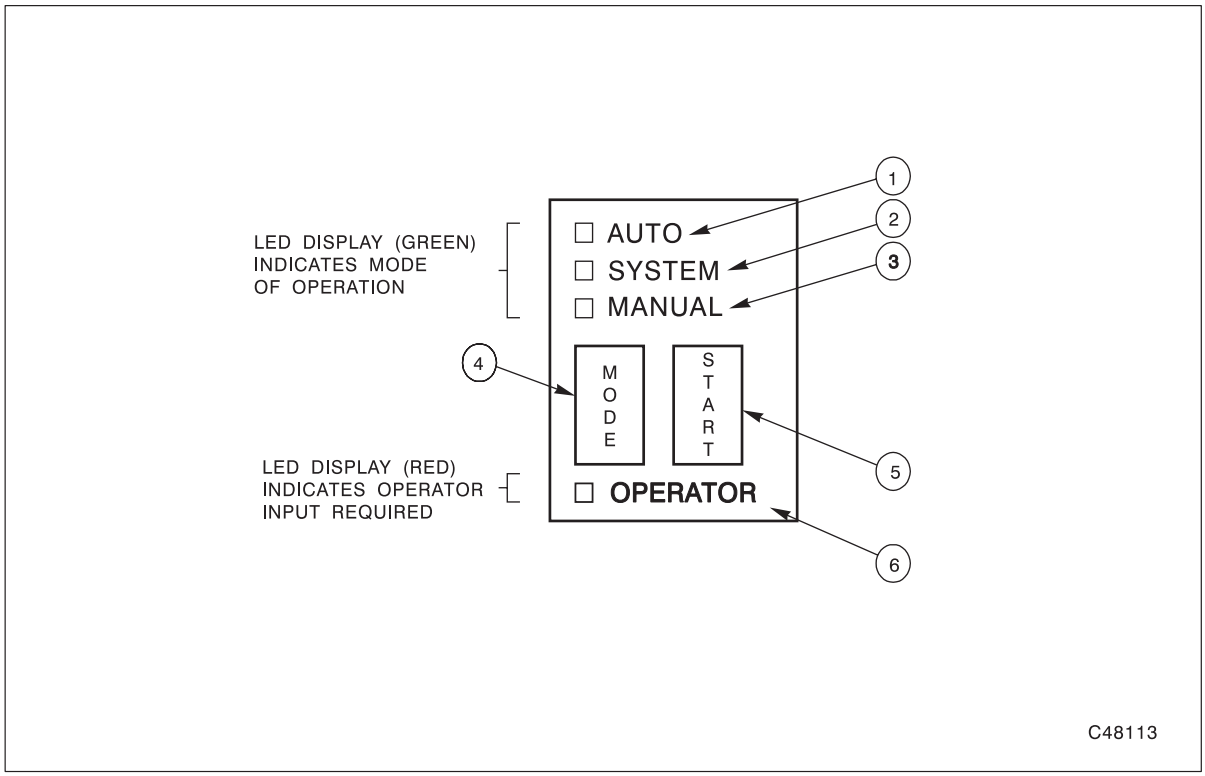


Figure 5–2. Cartridge Scratch Loader Controls and Indicators

Table 5–1. Cartridge Scratch Loader Controls and Indicators

Item	Label	Type	Function
1	AUTO	Indicator	When operating in AUTO mode, the CSL loads cartridges from the input tray. No operator action is required other than loading the input tray.
2	SYSTEM	Indicator	When operating in SYSTEM mode, the CSL's operating system controls the loading of cartridges to the transport. The CSL automatically mounts tapes in response to request messages sent to the transport's message display.
3	MANUAL	Indicator	When operating in MANUAL mode, the CSL accepts manually-loaded cartridges. Press the START switch each time you load a cartridge.
4	MODE	Switch	Selects the operating mode of the CSL: AUTO, SYSTEM, or MANUAL.
5	START	Switch	When the CSL is operating in AUTO or MANUAL mode, pressing the START switch initiates load activity. In SYSTEM mode, no action occurs unless a cartridge is in the feed slot and the system issues a mount request.
6	OPERATOR	Indicator	Indicates that the operator needs to intervene (for example, to remove a cartridge or load the input tray). When on, the display shows one of the following messages: IN EMPTY — Input Tray is empty OUT FULL — Output Tray is full PUSH START — START must be pressed

Note: Item numbers correspond to Figure 5–2.

Operating Modes

There are three modes of operation for the CSL:

- Auto
- Manual
- System

Auto Mode

When in Auto mode, the CSL does most of the operations automatically. Usually, you receive a written or verbal request, or have a process in place for specific cartridges to be mounted for a specific job. Load the requested cartridges into the input tray in the order in which they will be used and press the START switch. The CSL automatically inserts cartridges into the transport in the correct order and ejects them into the output tray when the system has finished with each tape. Unload the output tray when necessary.

To place the CSL in Auto mode:

1. Press the mode selection switch until the green AUTO LED indicator comes on.

   Note: If the input tray is empty in AUTO mode, -IN EMPTY- is displayed in the Message Display area for the appropriate transport until cartridges are inserted.

2. Load up to nine cartridges in the input tray in the requested sequence.

   Note: If no cartridge is in the input tray, the loader OPERATOR LED display flashes and the CD Message Display area displays an -IN EMPTY- message.

3. Press the START switch.

Manual Mode

In Manual mode, you have complete control over the CSL operation.

- You can wait for a cartridge mount request and then mount that single cartridge.
- You can receive requests for multiple cartridge mounts and load the requested volumes into the input tray.
- You can remove individual cartridges as the transport ejects them or wait until the output tray is full before removing cartridges.

In Manual mode, however, you must press START each time to insert a new cartridge into the transport.

To place the CSL in Manual mode:

1. Press the mode selection switch until the green MANUAL LED indicator comes on.
2. When a mount message appears on the transport display or system console, place the requested volumes in the feed slot.
3. Press the START switch.

System Mode

When in System mode, the CSL loads scratch tapes into the transport. Load up to nine scratch tapes into the input tray and press the START switch. The CSL will feed cartridges into the transport in response to operating system commands. When the job completes, unload the output tray.

To place the CSL in System mode:

1. Press the mode selection switch until the green SYSTEM LED indicator comes on.

   Note: If the input tray is empty in SYSTEM mode, -IN EMPTY- displays in the CD Message Display area for the appropriate transport.

2. Fill the input tray with up to nine scratch cartridges.
3. Press the START switch.

Note: The CSL does not respond to the START switch if:

- No cartridge is in the input tray of the loader.
- A cartridge is already loaded in the transport.
- No cartridge is in the feed position but a cartridge is in the input tray of the loader.

Loading the Input Tray

Figure 5–3 shows how to load the cartridge tapes.

A maximum of nine cartridges can be loaded into the CSL input tray. The tenth cartridge can be in the feed slot or transport elevator.

CAUTION:
Do not place a cartridge into the feed slot when a cartridge is loaded in the transport elevator.

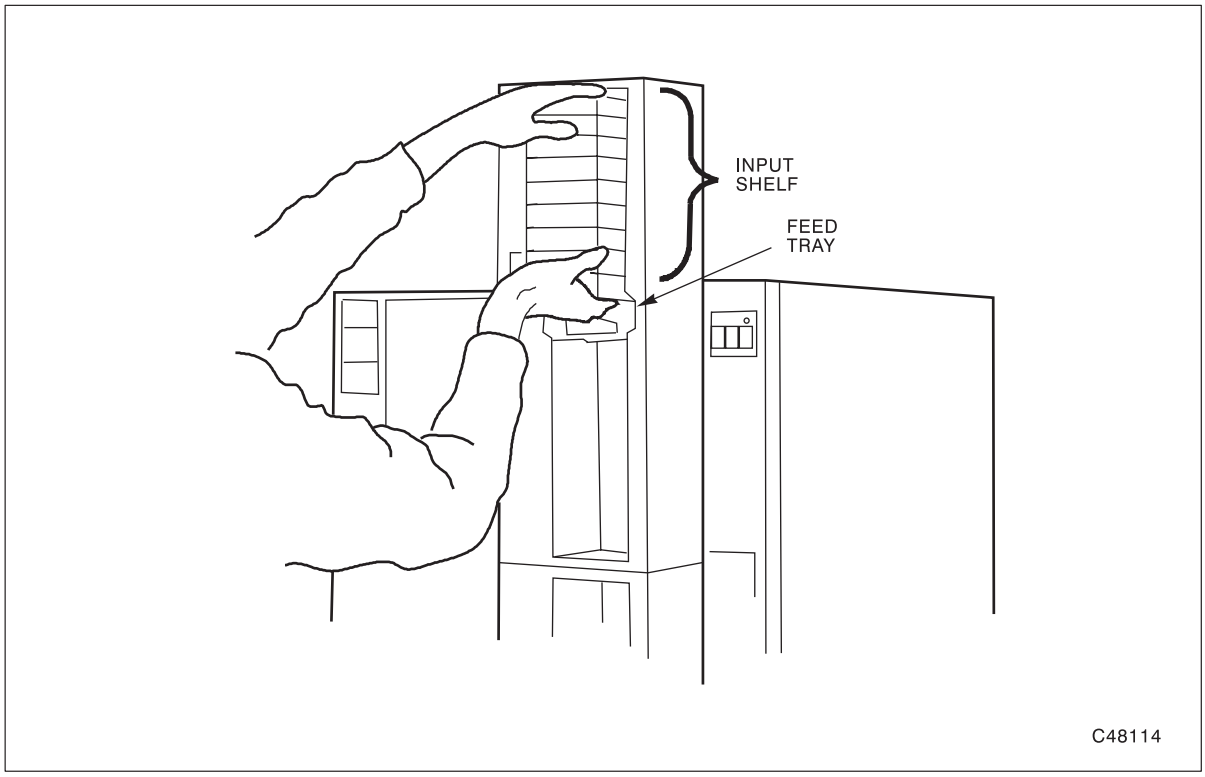


Figure 5–3. Loading Cartridges into the CSL

To load the input tray:

1. Assemble a stack of cartridges. Make sure the customer label is up and the leader block is on the right-hand side of the stack.
2. Grasp the top and bottom of the cartridge stack while holding the cartridges firmly together.
3. Load the stack into the input tray.

Note: When in AUTO mode, cartridges must be loaded into the input tray in the sequence required (from bottom to top in the order needed).

Unloading the Output Tray

Figure 5–4 shows how to unload the output tray.

The output tray can be unloaded at any time; however, you normally unload it on completion of the job, or if the OPERATOR LED indicator is on and the transport message display contains the message -OUT FULL-.

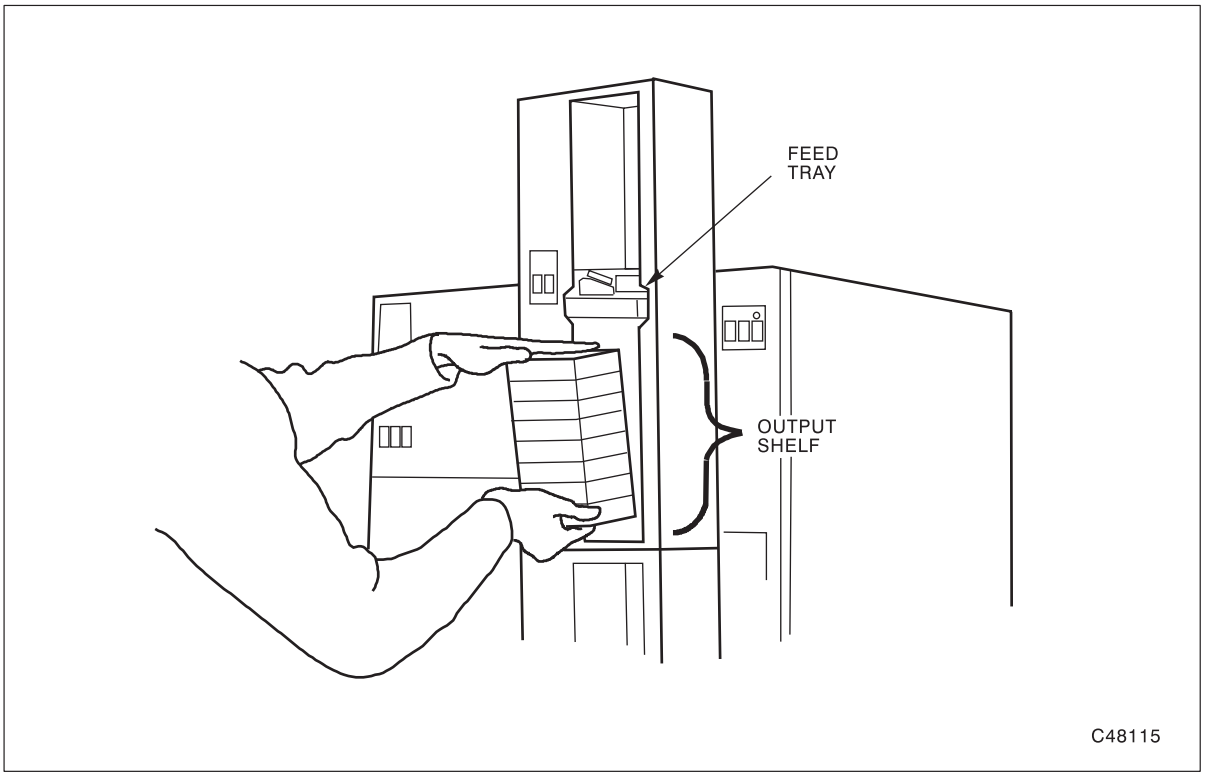


Figure 5–4. Unloading Cartridges from the CSL

Remove the cartridges only when the CSL is not operating, such as when a cartridge tape is loaded and being processed or when a cartridge is not being loaded or unloaded from the transport.

To remove cartridges from the output tray:

1. Wait until the CSL is not operating, such as when a cartridge tape is loaded and being processed by the transport or when the job is complete.
2. Remove cartridges by placing one hand on the top of the stack and the other hand under the bottom of the stack.
3. Hold the cartridges firmly together and pull them out from the output tray.

   The `OUT FULL` message disappears when cartridge tapes are removed from the output tray.

Removing a Jammed Cartridge

If a cartridge becomes jammed in the feed slot, grasp the input stack and lift the cartridges upward and press the START switch.

If the unit fails to clear, grasp the cartridge and firmly, but gently, pull the cartridge from the feed slot.

Place a service call if the cartridge does not pull out of the feed slot.

Fault Symptom Codes

By monitoring the CSL, an operator or customer services engineer (CSE) can be alerted to and resolve a variety of error conditions. Fault symptom codes (FSCs) display in the Message Display area of the cartridge drive.

Figure 5–5 shows a typical error message. An FSC of 4A07 displays. This FSC requests the operator to remove the cartridges from the output tray and press the START switch.

Table 5–2 lists the CSL FSCs that you can resolve without help from a CSE. Place a service call if you cannot resolve them on your own or if you receive any other FSCs or errors.

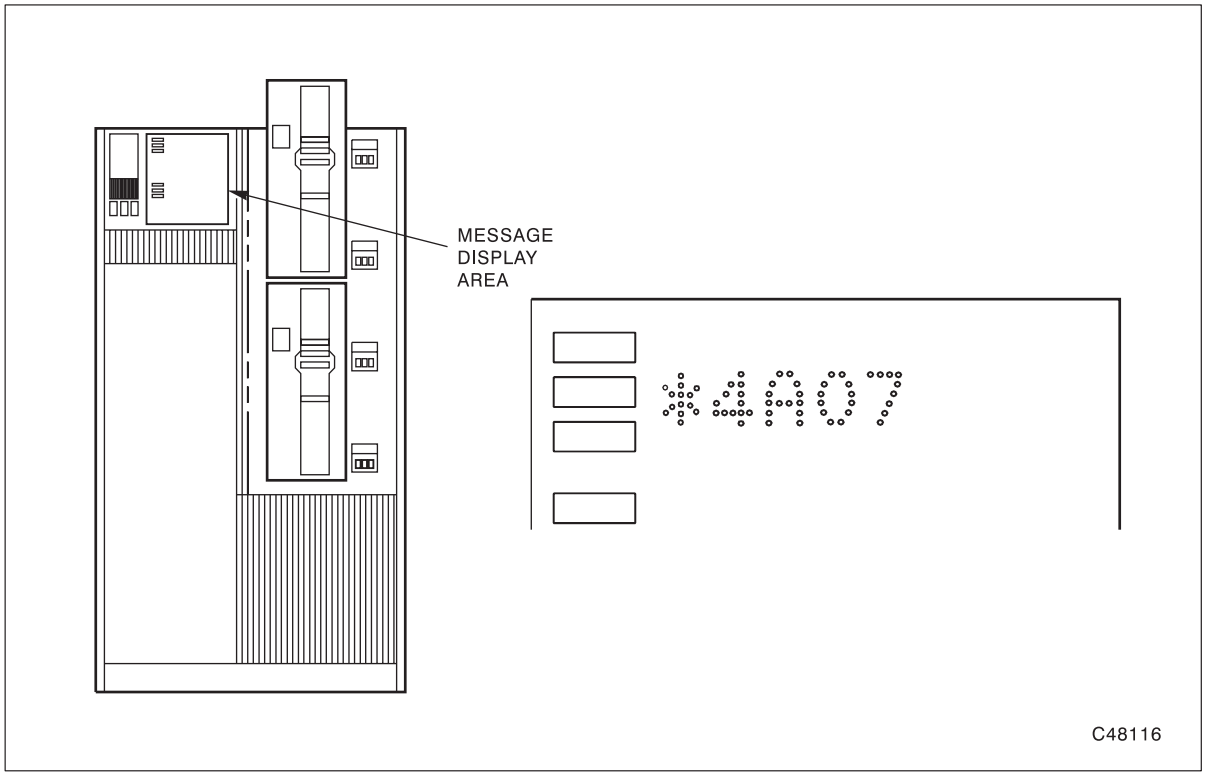


Figure 5–5. Cartridge Drive Error Message Display

Table 5–2. Cartridge Scratch Loader Fault Symptom Codes	
FSC	**Operator Action**
4A00	Press the START switch. Place a service call if error fails to clear.
4A01 4A02	Press the START switch to clear cartridge from feed slot. Cartridge will be moved to output tray. Cartridge was previously written on, and if no KEEP message was issued, it may be reused as a scratch tape.
4A03 4A04	Remove cartridge from feed slot and press the START switch. Failure to clear feed slot results in another FSC.
4A05	Press the START switch. Place a service call if error fails to clear.
4A06 4A07	Remove cartridges from output tray and press the START switch.
4A08 4A09	Ensure cartridges are clear of the feed slot and press the START switch. Place a service call if error fails to clear.
4A0A 4A0B	Press the START switch to clear cartridge from feed slot.
4A0C 4A16	Press the START switch to clear the FSC. Place a service call if error fails to clear.
4A17	Remove cartridge from feed slot and press the START switch.
4A18	Clear cartridge from feed slot or positioning arms and press the START switch.
4A19	Press the START switch or UNLOAD to remove a cartridge from transport elevator. Place a service call if error fails to clear.
4A1A	Remove cartridge from feed slot and press the START switch. When unit clears, insert correctly oriented cartridge into the feed slot and press the START switch.
4A1B	Remove cartridge from feed slot and press the START switch.
4A1C 4A1D	Press the START switch to clear unit.
4A1E	Remove cartridges from feed slot or output tray and press the START switch to clear unit.
4A1F	Lift input tray upwards and press the START switch to clear unit. If unsuccessful, remove cartridge from feed slot and press the START switch.
4A24	Remove and re-insert cartridge.
4A25	Remove cartridge from the feed slot.
4A2B	Select AUTO mode.
4A2C	Select SYSTEM mode.
4A2D	Select MANUAL mode.
4A2E	Re-select AUTO mode.
4A36	Check for jammed cartridge or any other obstruction. Place a service call if error fails to clear.
Note: The Fault Symptom Codes (FSCs) listed in the table are the only ones you should attempt to resolve. Place a service call for all other FSCs.	

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Status and Error Information

6

This chapter describes the information that appears on the different panel displays in the subsystem. Chapter 7 "Correcting Subsystem Problems" explains how to respond to this information.

Control Unit

The control unit Operator Panel provides three kinds of information:

- Status of the IPL process
- Wake-up diagnostic testing
- Error codes

Status of IPL Process

The system performs PROM wake-up diagnostic tests when IPL begins, and before the CU microprocessor loads the functional program from the diskette into memory. As these diagnostics proceed, the control panel display shows, successively: `IPL1, IPL2, IPL3, ...,` to `IPL9`.

Wake-up Diagnostic Testing

At IPL8, wake-up diagnostic tests are loaded and executed. The display indicates the test number and name of the diagnostic routine currently running.

If an error is found in any of the routines, the error code and text describing the error are displayed on the LCD panel. When the diagnostic tests end (after approximately two minutes) the status display goes blank and functional code is loaded.

Error Codes

The error code describes the type of error detected. Write down all error information and report it to the Central Support Remote Center (CSRC) or Customer Services Engineer (CSE).

Cartridge Drive

The alphanumeric display panel on the front of the CD displays the following type of messages:

- Messages from the operating system
- Transport condition messages
- Transport check code messages
- CSL messages and codes (if a CSL is installed)

Messages from the Operating System

The operating system sends a message to the transport display using the load display command. Operating system software determines the meaning of this message. Examples of these messages are:

- Mount and dismount messages
- Label status
- Dismount disposition
- Volume serial number (VOLSER)
- Scratch volume indicator

Transport Check Code Messages

When the subsystem detects a hardware error in the transport, it displays a check code in the transport message display such as `CHK XXXX` where `XXXX` is a four digit hexadecimal number. The check code remains in the display until the problem is corrected or until the transport is reset, unloaded, or powered-off. For most check codes, record it, place a service call, and report the check code to the CSE.

CSL Messages

See Chapter 5 "Cartridge Scratch Loader" and Table 5–2 for more information about CSL messages and codes.

Transport Condition Messages

When the condition of a transport changes, the message display reflects this change. Table 6–1 lists messages and meanings.

Table 6–1. Cartridge Drive Condition Messages	
Message	**Description**
CHK XXXX	The transport detected a Fault Symptom Code of XXXX.
CLEAN	Clean the transport with a cleaning cartridge.
CLEANING	A cleaning cartridge is loaded and running.
CLOSE DOOR	Close the transport door.
DOWNLOAD n	Functional code must be downloaded to transport ("n" is the transport number).
E.O.T.	The end of tape (EOT) has been reached.
ERASING	Data Security Erase is being performed.
FUNCTIONAL	The transport is initializing functional code downloaded from the CU.
-IN EMPTY-	Input stack of the CSL is empty. Install cartridges.
LOADING	A cartridge is being loaded.
LOCATING	The transport is searching for a sector (a command from the CU).
NT READY F	The transport is not ready and the cartridge is file-protected.
NT READY U	The transport is not ready and the cartridge is not file-protected.
-OUT FULL-	Output stack of the CSL is full. Remove cartridges.
P.E.O.T.	The transport is at the Physical End of Tape.
PUSH START	Push the START switch to continue CSL operations.
READY	The transport is ready.
READY F	The transport is ready and the cartridge is file-protected.
READY U	The transport is ready and the cartridge is not file-protected.
REWINDING	The transport is rewinding.
RWD *CLEAN	Rewind Clean. This message was added because of the quick load/unload operations performed by the CSL indicating cleaning is required by the operator.
SELFTEST	The transport is running boot PROM diagnostics.
*	IPL is complete on 4490 M32 and M34 transport.
TEST DONE	The transport has successfully completed servo diagnostics and is waiting for functional code to be downloaded from the CU.
TESTING n	The transport is running diagnostics. ("n" is the transport number).
UNLOADING	The transport is unloading.
-WTM FAIL-	Request to Write a Tape Mark (WTM) failed. Place a service call.
	The transport is unloaded or powered off.

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Correcting Subsystem Problems

7

Problems in a subsystem may or may not be accompanied by a message in any of the displays. This chapter describes what to do if the following problems occur.

Table 7–1. Subsystem Problems Reference

Problem	Refer to Page
CU displays an error code	7–2
CD displays a condition message	7-2
CD message displays a message from the host	7–3
CD displays a check code	7–3
Cartridge does not load into transport	7–4
Cartridge door does not close	7–4
Tape does not rewind	7–4
Cartridge does not unload	7–5
Leader block becomes detached from tape	7–5
Tape winds completely out of the cartridge	7–5
Message display is blank	7–5
Transport does not become ready	7–6

You might encounter equipment problems that you cannot resolve on your own. If that happens, you or your supervisor should contact the StorageTek Central Support Remote Center (CSRC).

The StorageTek Central Support Remote Center helps you resolve problems over the telephone or dispatches a customer services engineer (CSE) to help you locally.

When you call, the CSRC's representative will ask you several questions about your problem. See "Customer Initiated Maintenance" in this chapter, which explains what you can expect when you call the CSRC.

Problems Accompanied by a Message

Messages accompanying a problem might be displayed on the CU LCD display, the CD message display, or both.

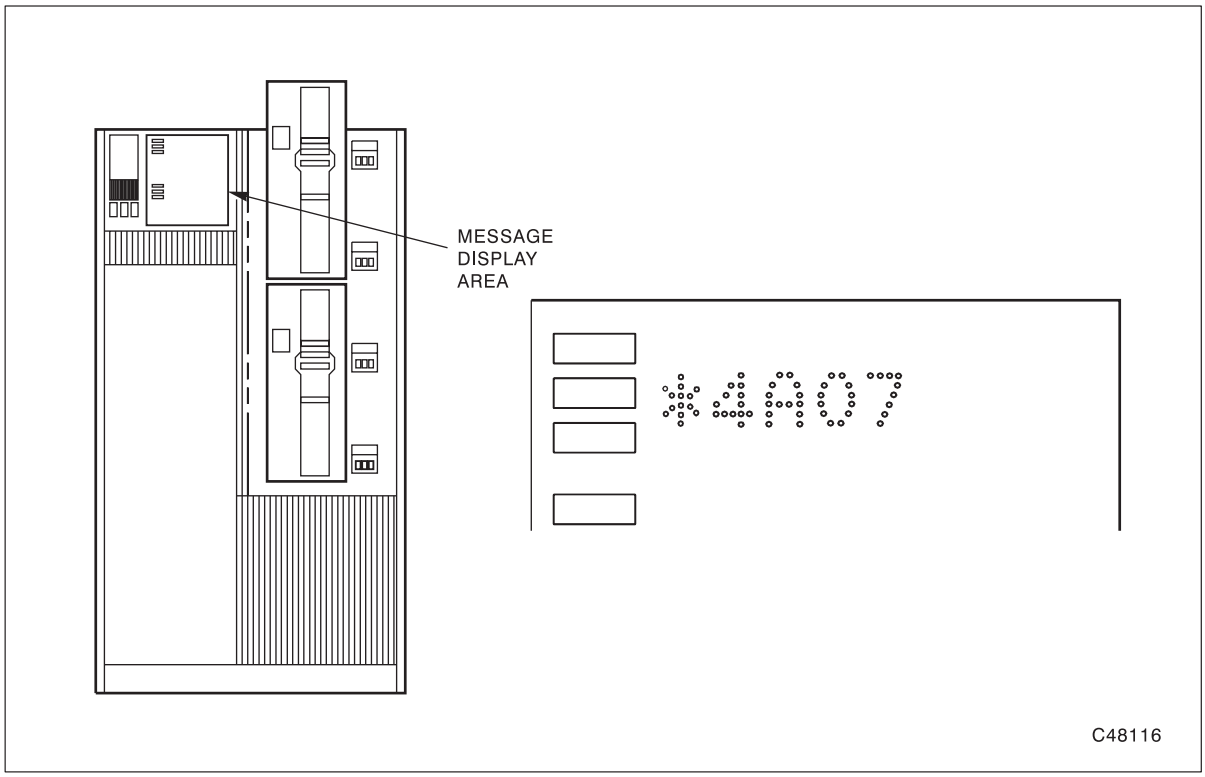


Figure 7–1. Cartridge Drive Message Display Panel

Control Unit Displays an Error Code

Place a service call if an IPL fails during the diagnostic tests. Write down all error information on the LCD panel display, such as: test name, test number, and error code.

To perform an IPL of the subsystem, press the reset switch and refer to "IPLing the Control Unit" on page 4–6 for more information.

If the IPL still fails, place a service call.

Part of the IPL process is downloading a microprogram to the CD. The CD indicates a successful download by displaying an *. If an error message (instead of an asterisk) appears in the CD message display when you try to IPL the subsystem, place a service call.

Cartridge Drive Displays a Condition Message

Not all CD condition messages indicate a need for CSE assistance; some of them identify a condition that an operator can resolve without the need of a service call.

Table 6–1 lists some codes operators can attempt to resolve before placing a service call.

Messages from the Host

The CD message display can receive different messages from the host. These messages vary according to the software the operating system is running.

Table 7–1 shows a typical message from the host on the Message Display.

Check Codes

Press UNLOAD for the affected transport. If the check code does not clear, press UNLOAD again. If the condition does not clear after the second attempt, note the code and place a service call.

Errors and Problems Without Messages

Some errors and problems are obvious and need no message to alert you. The following paragraphs list some of these problems and the appropriate action to take.

Cartridge Does Not Load into Transport

There are several reasons a cartridge cannot be loaded into a transport:

- The transport door does not open
- The cartridge is inserted upside down
- A cartridge is already loaded
- The cartridge is inserted backwards
- There is an obstruction in the feed slot or elevator

If the door is closed:

1. Verify there is no cartridge in the transport. If there is a cartridge already in the transport, rewind and unload the cartridge (refer to "Unloading a Transport" in Chapter 4).
2. Press UNLOAD if the transport is empty.

If the door is open:

1. Verify there is no cartridge in the transport.
   Place a service call if there is a stuck cartridge in the transport.
2. Try another cartridge.
3. Place a service call if that cartridge does not go into the transport.
   If the second cartridge goes in, the first cartridge is probably damaged.

Cartridge Door Does Not Close

Place a service call if the transport door does not close after inserting a cartridge.

Tape Does Not Rewind

If a transport does not rewind a cartridge after a job, perform the steps in "Rewinding Tape in a Cartridge" in Chapter 4.

Place a service call if the cartridge still does not rewind.

Cartridge Does Not Unload

When a job is done, the host instructs the subsystem to rewind the tape and open the door.

If the cartridge does not unload:

1. Try to unload the cartridge manually (refer to "Unloading a Transport" in Chapter 4).
2. Place a service call if you cannot unload the cartridge manually.

Leader Block Becomes Detached from the Tape

If the leader block comes off the end of the tape when a cartridge is out of the transport, you can re-attach the leader block to the tape and use the cartridge *one more time* to copy data onto another cartridge. Refer to "Repairing Detached Leader Block" in Chapter 3.

If the leader block comes off the tape while the cartridge is in the transport and remains in the transport when you remove the cartridge, do not try to remove the leader block. Place a service call.

Tape Winds Completely Out of the Cartridge

If the tape has come completely out of a cartridge while the cartridge is in a transport, do not try to remove the tape. Place a service call.

If the tape comes out of a cartridge when the cartridge is outside a transport, rewind the tape into the cartridge with the special tool made for this purpose. Contact the manufacturer of the tape to obtain this tool.

Message Display is Blank

If the message display on a CD is blank:

1. Attempt to increase the intensity by using the procedure in "Changing the Transport Message Display Intensity" in Chapter 4. If this does not work, then proceed to the next three steps.
2. Load and unload the transport and watch for messages. Place a service call if this does not work or the transport does not load/unload
3. Look at the other message displays on the CD. Place a service call if at least one other message display is on.
4. If no message displays are on, verify that the CD is powered on. If it is not, power it on (see "Powering–On the Subsystem" in Chapter 4)
5. Place a service call if power is on but the display is blank.

Transport Does Not Become Ready

A transport is ready when a cartridge is loaded and the transport hardware and software are prepared to read from and write on the tape. This is indicated by `READY U` or `READY F` in the message display.

If a transport does not come ready when it should:

1. Make certain the cartridge is inserted all the way into the cartridge holder and the door is closed. If it is not, insert it properly.
2. Make certain the corresponding message display is on. If it is not, refer to the previous section.
3. If the transport still does not become ready and the `SERVICE REQUIRED` indicator on the CU operator panel is flashing rapidly, try to IPL the CU. (See "Powering–On the Subsystem" on page 4–4 for instructions.)
4. Place a service call if the IPL does not work.

■ Central Support Remote Center

The Central Support Remote Center (CSRC) is an exclusive service of the Storage Technology Corporation. The CSRC is available 24 hours a day, seven days a week to customers and customer services engineers (CSEs).

Note: All StorageTek customers with StorageTek maintenance contracts have access to the CSRC.

The CSRC is staffed by diagnostic experts who have at their disposal a computerized history of solutions to all StorageTek equipment problems.

The CSRC connects to the facility by a modem, telephone, and voice-grade telephone line. The CSRC staff can run diagnostic tests on the subsystem remotely, give suggestions for solving a problem, and dispatch a CSE with a repair part.

The CSRC saves the customer time and money by minimizing equipment downtime.

Procedures for Customer Initiated Maintenance (CIM) are listed on the following page. A CIM call occurs when a customer observes a problem on StorageTek equipment and calls the CSRC for assistance.

Customer Initiated Maintenance

Customer Initiated Maintenance begins with a telephone call from a customer to the CSRC. The customer receives immediate attention from an expert troubleshooter who can analyze performance statistic logs in the unit, run all diagnostic tests remotely, and either tell a customer how to remedy the problem or can dispatch a CSE with the necessary repair part.

Note: Outside the United States, contact the StorageTek support group for that country or your local StorageTek representative.

In the United States, contact the CSRC with the information listed on the following page.

1. Use the telephone at the modem connected to the subsystem and call the StorageTek central dispatcher at the number listed below.
2. Tell the central dispatcher why you are calling.

   The dispatcher will ask several questions and then transfer your call to the Customer Services Remote Engineer (CSRE).

   If you have this information at hand when placing a service call, the process is much faster and smoother. The information includes:

   - Account Name _____
   - Site Location Number _____
   - Contact Name _____
   - Telephone Number _____
   - Equipment Model Number _____
   - Problem Description _____
   - Urgency of Problem _____

3. Describe the problem to the CSRE.

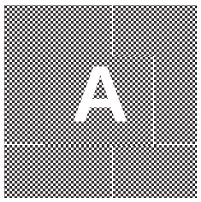
   The engineer may ask questions and give you instructions to try to resolve the problem by telephone if possible.



StorageTek Central Dispatch: 1-800-525-0369

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Subsystem Specifications



Performance

Tape Speed	2 m/sec (79 ips) read and write 4 m/sec (158 ips) high speed search/rewind 48-second rewind time (full cartridge)
Interface protocol	SCSI (Synchronous/Asynchronous)
SCSI Bus	Single-ended or Differential

Transfer Rates

Transport-to-buffer	3.0 MB/sec
Interface-to-buffer	1.0 MB/sec to 5.4 MB/sec

Configurations and Capacities

Host interfaces per CU	Individual: 1
Cartridge drives per CU	Individual: 1, 2, 3, or 4
Transports per CD	Individual: 2 or 4 Subsystem: 8 maximum
Transports per CU	Individual: 2 to 8

Construction

Microprocessors	Z8000 series (CSCP, DSCP, and transport) BCP 8344 RISC Interface Processor (BZ2)
Data buffer size	4 MB
Read/write heads	Thin-film, 36-track
Servo	Fully digital

Diskettes (2)	$3^1/_2$ inch Double-sided Double-density

Service

Service Clearances	
CU	810 mm front and rear (32 in.)
CD	810 mm rear (32 in.)
Operator Intervention	
CU	1 Control panel
CD	2 Control panels

Physical Dimensions

Item	CU	CD
Height	1.6 m (63.5 in.)	1.6 m (63.5 in.)
Width[1]	737 mm (29.0 in.)	737 mm (29.0 in.)
Depth[1&2]	813 mm (32.0 in.)	813 mm (32.0 in.) 750 mm (29.5 in.)
Weight	158.8 kg (350.0 lb)	**2 Transports** 295.0 kg (650.0 lb) **4 Transports** 385.5 kg (850.0 lb)

[1]With front and rear panels on
[2]Without front cover (library mode)

Power Requirements

CU/CD (Full configuration: 1 CU and 8 cartridge transports)

Line Voltage	Phase/Amperage
200 VAC ±10%	3 phase, 24 A rms (max)
208 VAC +10%, –15%	3 phase, 24 A rms (max)
220 VAC +10%, –15%	3 phase, 24 A rms (max)
230 VAC ±10%	3 phase, 24 A rms (max)
240 VAC +10%, –15%	3 phase, 24 A rms (max)

200 VAC ±10%	3 phase, 24 A rms (max)
380 VAC +10%, –15%	3 phase plus neutral, 15 A rms
415 VAC +10%, –15%	3 phase plus neutral, 15 A rms

Typical Operating Power Consumption

CU and 8 transports	3.50 kW, 3.8 kVA
CU	0.70 kW, 1.0 kVA
8 transports	2.80 kW, 3.04 kVA
6 transports	2.15 kW, 2.41 kVA
4 transports	1.40 kW, 1.56 kVA
2 transports	0.75 kW, 0.85 kVA
Line current	12.2A @ 180 VAC (200 VAC nominal) 6.8A @ 323 VAC (380 VAC nominal)
Line frequencies	Between 47 and 63 Hz
Power connectors	US/Canada: Russellstoll® 3760 male; 3934/3754 female

Operating Heat Output

CU/CD	3,010 kcal/hr (11,950 Btu)
CU	600 kcal/hr (2,390 Btu)
8 transports	2,400 kcal/hr (9,560 Btu)
6 transports	1,850 kcal/hr (7,340 Btu)
4 transports	1,200 kcal/hr (4,780 Btu)
2 transports	650 kcal/hr (2,560 Btu)

Environmental Limits

Temperature

Storage	4.4° to 32°C (40° to 90°F)
Shipping	–10° to 48° C (–23° to 120°F)
Operating	16° to 32°C (60° to 90°F)

Temperature Change	
Storage	≤15°C/hr (≤27°F/hr)
Shipping	≤15°C/hr (≤27°F/hr)
Operating	≤ 5°C/hr (≤ 9°F/hr)
Relative Humidity	
Storage	10% to 90%
Shipping	5% to 100%
Operating	20% to 80%
Wet Bulb Maximum	
Storage	26.7°C (80°F)
Shipping	26.7°C (80°F)
Operating	25.6°C (78°F)
Altitude	
Storage	0 to 3,050 m (0 to 10,000 ft)
Shipping	0 to 15,240 m (0 to 50,000 ft)
Operating	0 to 3,050 m (0 to 10,000 ft)

Cartridge Tape Characteristics

Number of tracks	36 (18 forward and 18 backward)
Tape character density	1,491 characters/mm (37,871 characters/in.)
Tape construction	12.57 mm chromium-oxide (CrO_2) (0.495 inch)
Length:	
Standard Cartridge	165 – 245 m (541 – 807 ft)
Enhanced Capacity (E-Tape)	Not less than 332 m (1,089 ft)
Thickness:	
Standard Cartridge	25.9 – 33.7 µm (1,020 – 1,330 µin.)
Enhanced Capacity (E-Tape)	16.1 – 18.0 µm (635 – 710 µin.)

Glossary

B

Symbols

@. At.

©. Copyright.

°. Degrees.

≤. Less than or equal to.

µ. Micro; 10^6.

–. Minus or negative notation.

%. Percent.

±. Plus or minus.

+. Plus or positive notation.

®. Registered trademark.

A

A. Amperes.

AC. Alternating current.

ACPS. Alternating-current power supply.

ACS. Automated Cartridge System. The library subsystem consisting of one LMU and at least one LSM attached to that LMU.

ANSI. American National Standards Institute.

B

bit. Unit of information, equal to a 1 or a 0.

BOT. Beginning of tape. A point on the tape where written data begins.

Btu British thermal units.

byte A group of bits. Nine-bit bytes (8 data bits, plus a parity bit) are transferred from the host system to the cartridge subsystem.

C

C. Celsius or degrees Celsius (°C).

cartridge. Plastic housing around the tape.

Cartridge Drive A device containing two or four cartridge transports with associated power and pneumatic supplies.

Cartridge Scratch Loader. StorageTek's 2511 CSL holds up to 10 cartridge tapes. *See* Chapter 5 for more information.

Cartridge Subsystem. A control unit, one or more cartridge drives, with two or four transports operating together as a data storage and retrieval subsystem as commanded by the host system it is attached to.

cartridge 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. A CD contains either two or four transports.

CD. *See* cartridge drive.

cell. A storage place in the LSM used to store a cartridge.

Central Support Remote Center. An operational unit at StorageTek in Louisville from which call-up and testing of StorageTek products may be done over remote communication lines.

Channel Side Control Processor Microprocessor used in the 4791 CU to control communication between the host interface and the CU.

check. A detection of an error condition or test for correct condition. *See also* Fault Symptom Code.

CHECK1. An error condition.

CHK. *See* Check.

CIM. Customer initiated maintenance. A StorageTek maintenance agreement for customer support. A form is located in Chapter 7 "Correcting Subsystem Problems" to help you.

cleaning cartridge. A cartridge tape containing special material used to clean the tape path in a transport. Cleaning cartridges normally have a limited number of use label. Each time that cleaning cartridge is used, update the label and discard the cartridge when the label is full.

CNTL. Control.

compaction. A process used to group several blocks of data into a larger block called a Superblock. This grouping reduces the number of interblock gaps and empty data fields on tape.

compression. A method for encoding data. This process removes most of the redundancy by encoding it into smaller, bit-oriented code.

condition messages. A message displayed on the Cartridge Drive Message Display indicating the status of a transport.

Control Unit. A microprocessor-based unit situated logically between a host system and a CD. It functions to translate host commands into cartridge-transport commands, send transport status to the host, and pass data between the host and the transport.

CSA. Canadian Standards Association.

CSCP. *See* Channel Side Control Processor.

CSE. Customer Services Engineer.

CSL. StorageTek 2511 Cartridge Stacker Loader.

CSRC. *See* Central Support Remote Center.

CU. Control unit.

D

data. A representation of facts, concepts, or instructions used to communicate, interpret, or process information.

data block. Group of encoded bytes (data and non-data) that are recorded on tape to represent a specific record, such as a data record, preamble, or postamble.

data transfer control. Logic providing supervision for movement of data between a selected host interface and the CU Data Buffer.

DC. Direct current.

DCPS. Direct-current power supply.

DEV. Device.

Device Side Control Processor. Microprocessor used in the 4791 CU to control operations between the CU and 4490 transport.

diagnostic. Pertaining to the detection and isolation of errors or faults in the 4791/4490 Cartridge Subsystem.

diagnostic diskette. A diskette used by service personnel to diagnose hardware problems.

differential. A SCSI Bus alternative. Provides better signal quality with less crosstalk and noise but requires more power to drive the signal. Maximum cable length is 25 meters (82 feet).

DPE. Data Processing Equipment.

DSCP *See* Device Side Control Processor.

E

E-Cart. Another name for E-Tape. *See* Enhanced Capacity Tape.

E-Tape. *See* Enhanced Capacity Tape.

EC. Engineering change.

ECC. *See* error correction code.

ECMA. European Computer Manufacturers Association

EMI. Electromagnetic interference.

Enhanced Capacity Tape (E-Tape). A 12.6-mm-wide tape that has a physical recording density of 1,944 flux transitions per millimeter, Group-Coded Recording, with a minimum length of 332 meters per cartridge.

EOF. End of file.

EOR. End of record.

EOT. End of tape.

EPO. Emergency power-off.

ERG. Erase record gap.

error. A discrepancy between a computed, observed, or measured value or condition and the true, specified, or theoretically correct value or condition.

error correction code (ECC). Generation of an error code (from data) that is compared to the error code generated on read back of the original data.

error messages. A message or code describing a problem. *See also* fault symptom code.

ESD. Electrostatic discharge.

Extended format. ANSI-proposed standard in recording format, provided by StorageTek's Improved Cartridge Recording Capability (ICRC).

F

F. Fahrenheit or degrees Fahrenheit (°F).

fault symptom code. Hexadecimal code generated by the drive for CU microcode in response to a detected subsystem error.

FCC. Federal Communication Commission

feet. Units of measure equal to 304.8 millimeters, 30.4 centimeters, or 0.304 meters.

field replaceable unit. An assembly that can be replaced in its entirety when any one of its components fails.

file. A set of related records treated as a unit.

file-protect. To prevent the destruction or overwriting of data stored on cartridge tape.

FRU. *See* field-replaceable unit.

FSB. Forward space block.

FSC. *See* fault symptom code.

ft. *See* feet.

ftpi. Flux transitions per inch.

ftpmm. Flux transitions per millimeter.

functional diskette. A diskette used to load a sequence or group of micro–instructions that when executed preforms a preplanned function or action.

H

Hertz. A unit of frequency equal to one cycle per second. Example: In the United States, line frequency is 60 Hz, or a change in voltage polarity 120 times per second.

hex. *See* Hexadecimal.

Hexadecimal. A base-16 numbering system using digits 0 - 9 and characters A - F. A represents 10 and F represents 15.

host interface. A device that connects the host and main storage with the input and output CUs.

host interface adapter (BZ2 Card). The common link between a host interface and the Data Transfer Control.

hr. Hour or per hour (/hr).

HSC. Host Software Component.

Hz. *See* Hertz.

I

IBG. Interblock gap. The space between two consecutive blocks of data.

IBM. International Business Machines.

ICRC. *See* Improved Cartridge Recording Capability.

ID. Identifier or identification.

ID area. Area at the beginning of tape that includes the Density ID Mark and ID Separator Mark.

ID burst. Host interface status line asserted during operations within the ID Area.

IEC. International Electrotechnical Commission.

Improved Cartridge Recording Capability. A feature provided by StorageTek that compacts and compresses data for reading/writing in extended recording format. This feature improves the storage capacity of data on cartridge tapes.

in. *See* inch.

inch. A unit of measure equal to 25.4 millimeters or 2.5 centimeters.

intervention required. Manual action is needed.

I/O. Input/output.

IPL. Initial program load. The action of loading microcode from a diskette into memory and other functional areas of the control unit.

ips. Inches per second.

K

kb. Kilobit; 1,024 (2^{10}) bits.

kB. Kilobyte; 1,024 (2^{10}) bytes.

kcal/hr. Kilocalories per hour.

kg. Kilogram: 1 kilogram equals 2.2 lbs.

kVA. Kilovolt-amperes.

kW. Kilowatts

L

lb. Pound: 1 pound equals 0.454 kilograms.

LCD. Liquid crystal display.

LCU. *See* Library Control Unit.

leader block. The mechanism used to load a tape through the tape path of a transport.

LED. Light-emitting diode.

LEOT. Logical end of tape.

library. A library contains one or more ACSs, attached transports, volumes placed into the ACSs, host software that controls and manages the ACSs and associated volumes, and the library control data sets that describe the state of the ACSs.

Library Control Unit. The portion of the LSM that controls the picking, mounting, dismounting, and replacing of cartridges.

list of effective pages. The list of effective pages in the front of this manual used as a revision record and an aid in incorporating changes and updates to this manual. This identifies the level of the manual.

LMU. Library Management Unit. The portion of the ACS that controls the LSM and communicates with the host CPU.

LSI. Large-scale integration.

LSM. Library Storage Module. Provides the storage area for cartridges plus the robotics necessary for movement of the cartridges.

LUN. Logical unit number (address).

LWR. Loop write to read.

M

Maintenance Facility. The CU/LMU component providing the logic necessary for local and remote diagnostic interface and communication with the CU/LMU Operator Panel.

Mb. Megabit; 1,048,576 (2^{20}) bits.

MB. Megabyte; 1,048,576 (2^{20}) bytes.

MB/sec. Megabytes per second. Usually used to describe the speed of data transfer.

meters. A metric measurement equal to 1.09 yards, 3.28 feet or 39.36 inches.

MF. *See* Maintenance Facility.

millimeter. A unit of measure equal to one thousandth of a meter or 0.04 inches.

mm. *See* millimeter.

monitor. Device that observes and verifies the operations of a system to indicate any significant departure from the norm.

ms. Milliseconds. 10^3 seconds.

N

Nearline. A StorageTek trademark commonly used in association with StorageTek's Automated Cartridge Systems (ACS) pertaining to data stored on cartridge tapes.

NRZ. Non-return-to-zero.

NRZI. Non-return-to-zero inverted.

NVI. Non-vectored interrupt.

O

offline. A functional unit or subsystem not under direct control of the operating system. Not capable of being accessed by the operating system.

online. A functional unit or subsystem under direct control of the operating system. Capable of being accessed by the operating system.

op. Operation, operational, or operator.

operating system. Software that controls program execution.

P

P. Parity.

PEOT. Physical end of tape.

POR Power-on reset.

PROM. Programmable read-only memory.

R

RAM. Random access memory.

read sequencer. Converts ANSI-format data into host-interface data and sends it to the data buffer for transmission to the host interface.

recoverable error. An error condition that can be automatically corrected (such as a retry operation) and, when corrected, allows continual processing of a job, program, or hardware function.

rew. Rewind.

RFI Radio frequency interference.

RISC. Reduced Instruction Set Controller technology.

ROM. Read-only memory.

Russellstoll®. A power connector type used in 4791/4490 Cartridge Subsystems.

R/W. Read/write.

S

s. Second.

scratch tape. A tape cartridge that has all of its data erased or its identification deleted, is not file-protected, and is available for new data storage.

SCSI. Small Computer System Interface. The 4791 Cartridge Subsystem complies with ANSI specification X3.131-1986 for SCSI-1.

single-ended. A SCSI Bus alternative. An inexpensive bus requiring less power than the differential alternative. Maximum cable length is 6 meters (20 feet).

standard cartridge. A 12.6-mm-wide tape having a physical recording density of 1,491 characters per millimeter, Group-Coded Recording, with a typical length of 165–245 meters per cartridge.

standard format. Normal recording format following ANSI specification X3.180-1991.

STK StorageTek

StorageTek. Storage Technology Corporation

T

tape mark. Coded block written on tape used to separate files.

TM. *See* tape mark.

trace dump. An exhibit of the sequence of subsystem activity, recorded under predefined conditions, on the 4791 Control Unit's Diagnostic diskette.

transport. The mechanical, electro-mechanical, and electrical components combined used to store and retrieve data from cartridge tape. The 4490 Cartridge Drive holds either two or four transports.

U

UL. Underwriters Laboratory.

unrecoverable error. Error condition that cannot be automatically corrected and requires an external operation for possible correction. It causes termination of a job, program, or hardware function.

V

VAC. Volts AC

VOLSER. Volume serial number assigned to a cartridge tape.

W

wake-up diagnostics. A series of tests used to detect and isolate any problems that may exist in the subsystem during IPL.

WTM. Write tape mark.

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