CE Service Handbook
For
HP Series 6000
Mass Storage Systems

Models 330D/S and 660D/S

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Printing History

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition or a new update is published. No information is incorporated into a reprinting unless it appears as a prior update; the edition does not change when an update is incorporated.

Many product updates do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

April 1990	First Edition
March 1991	Second Edition

Safety Symbols and Conventions

The following conventions are used throughout this manual:

- **Bold** words in the text indicate a term defined in the Glossary in the back of this manual.

- *Italic* is used for emphasis or manual titles.

Note

Notes contain important information set off from the text.

Caution

Caution messages indicate procedures which, if not observed, could result in damage to equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Warning

Warning messages indicate procedures or practices which, if not observed, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

Scope of This Manual

This manual provides Hewlett-Packard Customer Engineers information for troubleshooting and repairing the HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems, and is divided into the following chapters:

- Chapter 1 describes the mass storage system in general, such as accessories, installation, power requirements, and SCSI interface connection.

- Chapter 2 describes environmental requirements for installation, setting SCSI device addresses, and preventive maintenance.

- Chapter 3 describes device configuration.

- Chapter 4 describes troubleshooting strategy including power-on self-test for each SCSI device, and location of the field-replaceable assemblies. It also shows power supply pinout information and voltages.

- Chapter 5 describes diagnostics, which includes use of the mass storage system diagnostics programs.

- Chapter 6 describes removal and replacement procedures as well as replaceable parts for each assembly and each SCSI device in the mass storage system.

- Chapter 7 describes reference documentation related to the mass storage system.

- Chapter 8 contains service notes.

- At the end of this manual are a comprehensive glossary and index.

This manual should be inserted into handbook binder part number 9282-1160.

FCC Statement (For U.S.A. Only)

The Federal Communications Commission (in 47 CFR 15.105) has specified that the following notice be brought to the attention of the users of this product.

FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

Note: This equipment has been tested and found to comply with 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 own expense.

The end user of this product should be aware that any changes or modifications made to this equipment without the approval of Hewlett-Packard could result in the product not meeting the Class A limits, in which case the FCC could void the user's authority to operate the equipment.

FTZ Statements

FUNKENTSTÖRUNGSVORSCHRIFTEN
FÜR DEUTSCHLAND
HERSTELLERBESCHEINIGUNG

Hiermit wird bescheinigt, daß das Gerät in Übereinstimmung mit den
Bestimmungen von Postverfügung 1046/84 funkentstört ist. Der Deutschen
Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die
Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen
eingeräumt.

Wird das Gerät innerhalb eines Systems betrieben, so muß bei
Inanspruchnahme der Allgemeinen Genehmigung FTZ 1046/84 das gesamte
System der oben genannten Genehmigung entsprechen. Wird das Gerät
innerhalb eines Systems betrieben das mit einer FTZ-Serienprüfnummer
gekennzeichnet ist, und für welches eine Betriebsgenehmigung vorliegt oder
beantragt wird, so sind in der Regel keine weiteren Schritte notwendig.

ELECTROMAGNETIC INTERFERENCE
REGULATIONS FOR GERMANY
MANUFACTURER'S DECLARATION

This is to certify that the equipment is in accordance with the Radio
Interference Requirements of Directive FTZ 1046/84. The German Bundespost
was notified that this equipment was put into circulation and the right to check
the series for compliance with the requirements was granted.

If this equipment is to be operated with a system, and if the General License is
being claimed, the complete system must comply with the General Licensing
requirements. If this equipment is to be operated with a system which has its
own FTZ-Serial-License, and for which an operating license has been submitted
or applied, usually no further steps are necessary.

VCCI Statements (For Japan Only)

この装置は，第二種情報装置（住宅地域又はその隣接した地域において使用

されるべき情報装置）で住宅地域での電波障害防止を目的とした情報処理装置

等電波障害自主規制協議会（ＶＣＣＩ）基準に適合しております。

しかし，本装置をラジオ，テレビジョン受信機に近接してご使用になると，

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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。

This apparatus is a class 2 ITE (information apparatus which may be used in residential and adjacent areas) which meets the VCCI standards to prevent radio interference in residential and adjacent areas. However, this apparatus may become a source of radio interference if used within close range of radio or television receivers. To ensure compliance, this apparatus must be operated according to instructions included with the product.

Communications Statement (For Canada Only)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

CDRH Regulations (For U.S.A. Only)

On December 18, 1989, the Department of Health and Human Services (DHHS) published a policy that stated: "A manufacturer which incorporates Certified Class 1 Laser products into their own product may be considered to be a Distributor." Therefore, DHHS Certification of their product is not necessary.

The Hewlett-Packard Series 6000 Mass Storage System Models 330S, 660S, 330D, and 660D will no longer be certified by the DHHS as Class 1 Laser Products. These products contain Class 1 Laser components that have already been certified by the manufacturer to the DHHS / FDA / CDRH. Therefore, Hewlett-Packard is only a distributor of these components.

Laser Safety

Warning

- Use of controls, adjustments, or performing procedures other than those specified in this manual may result in hazardous invisible laser radiation exposure. None of the mechanisms within the mass storage system contain customer or field-replaceable parts.

- Do NOT disassemble the CD-ROM drive for any reason. The CD-ROM drive becomes a Class 1 laser mechanism when disassembled. If the CD-ROM disk drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.

- Do NOT disassemble the rewritable optical disk drive for any reason. The rewritable optical disk drive becomes a Class 3B laser mechanism when disassembled. If the rewritable optical disk drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.

- Please observe the following warning label, which is located on the top of the rewritable optical disk drive:

  DANGER - Invisible laser radiation when open. Avoid direct exposure to beam.

Laser Safety Statement (For Finland Only)

TURVALLISUUSYHTEENVETO

LASERTURVALLISUUS

LUOKAN 1 LASERLAITE

KLASS 1 LASER APPARAT

HP Series 6000 Model 330D/S ja Model 660D/S massamuistiasemat ovat käyttäjän kannalta turvallisia luokan 1 laserlaitteita. Muistiasemat on tarkastanut Suomessa Työterveyslaitos ja tyyppihyväksynyt Työsuojeluhallitus, Työsuojeluhallituksen hyväksyntänumero TSH 222/6019/90.

Tarkastuksessa muistiasemien turvallisuusluokka on määrätty valtioneuvoston päätöksen N:o 472/1985 ja standardin SFS-IEC 825 mukaisesti. Normaalissa käytössä muistiaseman kotelo estää lasersäteen pääsyn laitteen ulkopuolelle.

Varoitus	Laitteen käyttäminen muulla kuin käyttöohjeessa mainitulla tavalla saatta altistaa käyttäjän turvallisuusluokan 1 ylittävälle näkymättömälle lasersäteilylle.

Varning	Om apparaten används på annat sätt än i bruksanvisning specificerats, kan användaren utsättas för osynlig laser-strålning, som överskrider gränsen för laserklass 1.

Laser Safety Statement Continued (For Finland Only)

HUOLTO

Muistiaseman sisällä ei ole käyttäjän huollettavissa olevia kohteita. Laitteen saa avata ja huoltaa ainoastaan sen huoltamiseen koulutettu henkilö. Muistiaseman sisälle mahdollisesti asennetun CD-ROM-yksikön tai optisen levymuistiyksikön koteloa ei tule avata huoltotoimenpiteiden yhteydessä.

Varo	**Mikäli CD-ROM-yksikkö tai optinen levymuistiyksikkö avataan ja suojalukitus ohitetaan, olet alttiina näkymättömälle laser-säteilylle laitteen ollessa toimintatilassa. Älä katso säteeseen.**

Tiedot laitteessa käytettävien laserdiodien säteilyominaisuuksista:

CD-ROM-yksikkö: Aallonpituus   780 nm
                                    Teho   0,4 mW
                                    Luokan 1 laser

Optinen levymuistiyksikkö: Aallonpituus   785 nm
                                    Teho   11,5 mW
                                    Luokan 3B laser

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Product Information

Product Description

The HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems contain a hard disk drive, power supply, and slots for storage devices such as additional hard disk drives, backup devices, or I/O (input/output) devices. All of these fit into a convenient box that is ideal for either rackmount or desktop operation. The HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems have been designated for use with Hewlett-Packard 9000 Series 300 technical workstations on HP-UX 7.0 or later, and Hewlett-Packard Apollo 9000 Series 400 technical workstations running the Domain Operating System SR10.2 with PSK7 or later.

The HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems adhere to the Small Computer System Interface (**SCSI**) standard bus, designed for use with small computer systems and workstations. The formatted storage capacity of the base HP Series 6000 Model 330D/S is 332 megabytes; the formatted storage capacity of the base HP Series 6000 Model 660D/S is 664 megabytes. The **mass storage system** can be used in either stand-alone desktop fashion, or can be installed into standard rackmount cabinets.

Product Structure

The base product structure of the HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems is a **power supply** with one **hard disk drive**. The left rear slot always contains the power supply. The other slots may contain a variety of embedded peripherals, such as a **rewritable optical disk drive**, **CD-ROM drive**, **quarter-inch cartridge tape drive**, or **DDS-format tape drive**. Table 1-1 shows the product structures allowed for add-on peripherals, and Figure 1-1 shows the slot locations.

Table 1-1. Product Structures

Slot	Position	Device Allowed
1	Right Front	Full-Height Hard Disk, or Rewritable Optical Disk Drive, or DDS-format Tape Drive, or Half-Height Quarter-inch Cartridge Tape Drive or CD-ROM Drive.
2	Right Rear	Full-Height Hard Disk Only.
3,4	Left Front	Full-Height Hard Disk, or DDS-format Tape Drive, or Half-Height Quarter-inch Cartridge Tape Drive, or CD-ROM Drive.
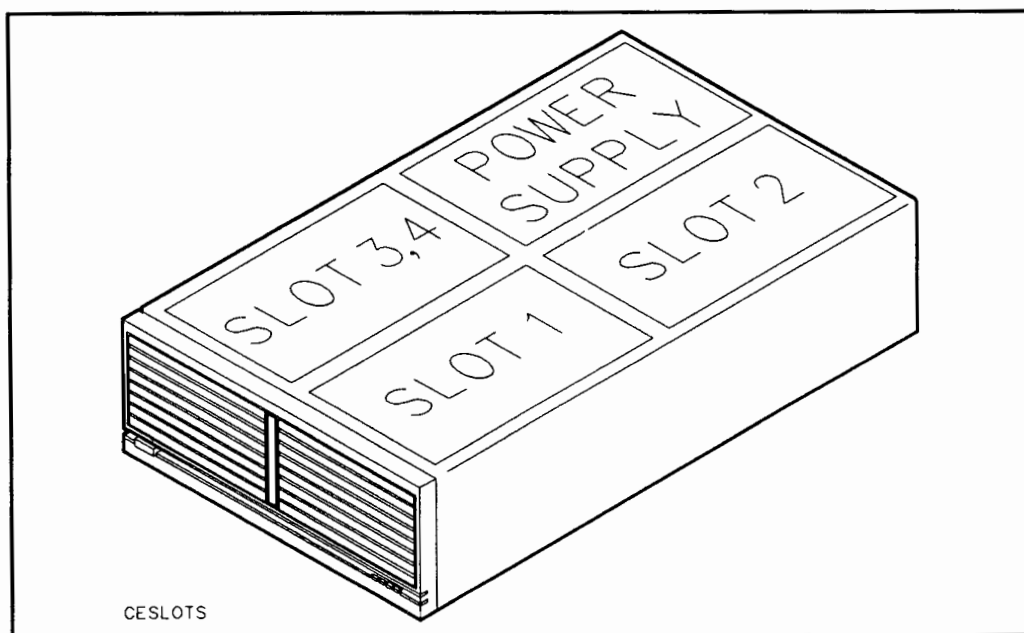
Figure 1-1. Slot Locations

1-2   Product Information

Product Features

The HP 6000 Series Mass Storage System Models 330D/S and 660D/S have the following features:

- 332-megabyte capacity (formatted) - HP 6000 Series Model 330D/S

- 664-megabyte capacity (formatted) - HP 6000 Series Model 660D/S

- Rugged, sealed hard disk head-media design, with 130-millimeter (5.12-inch) thin-film media and thin film heads and 16.5 ms average seek time

- DDS-format Tape Drive available

- Quarter-inch Cartridge Tape Drive available

- Rewritable Optical Disk Drive available

- CD-ROM Drive available

- Small Computer System Interface (SCSI)

- Built-in Diagnostic capability

Unless otherwise specified, "mass storage system" in this publication refers to all models of the HP 6000 Series Mass Storage System. For information about physical characteristics of the mass storage system, refer to either the *HP 6000 Series Mass Storage System Models 330S and 660S Owner's manual*, (HP-UX) part number C2212-90901, or the *HP 6000 Series Mass Storage System Models 330D and 660D Owner's manual*, (Apollo Domain) part number C2212-90911.

Options

Included with your mass storage system is a power cord and the Owner's Manual. The following are the available factory-installed options:

Model 330S HP-UX (HP C2212A)

Option:	Description:
Option 001	Adds one 332 Megabyte SCSI Hard Disk Drive.
Option 003	Adds one 1.3 Gigabyte SCSI DDS-format Tape Drive. Includes one 1.3 Gigabyte DDS-format cassette and a head cleaning cassette.
Option 004	Adds one 600 Megabyte SCSI CD-ROM Half-Height Drive. Includes one CD-ROM disk caddy.
Option 005	Adds one 650 Megabyte SCSI Rewritable Optical Disk Drive. Includes one 650 Megabyte rewritable optical disk cartridge.
Option 024	Adds two 600 Megabyte SCSI CD-ROM Half-Height Drives. Includes two CD-ROM disk caddies.
Option 303	Installed HP-UX 7.0 with 50 Megabytes of swap space, configured for a Hewlett-Packard 9000 Series 300. Includes AXE, PE, NS-ARPA, NFS, and X11.

Model 660S HP-UX (HP C2213A)

Option:	Description:
Option 001	Adds one 332 Megabyte SCSI Hard Disk Drive.
Option 002	Adds one 664 Megabyte SCSI Hard Disk Drive.
Option 003	Adds one 1.3 Gigabyte SCSI DDS-format Tape Drive. Includes one 1.3 Gigabyte DDS-format cassette and a head cleaning cassette.
Option 004	Adds one 600 Megabyte SCSI CD-ROM Half-Height Drive. Includes one CD-ROM disk caddy.
Option 005	Adds one 650 Megabyte SCSI Rewritable Optical Disk Drive. Includes one 650 Megabyte rewritable optical disk cartridge.
Option 022	Adds two 664 Megabyte SCSI Hard Disk Drives.
Option 024	Adds two 600 Megabyte SCSI CD-ROM Half-Height Drives. Includes two CD-ROM disk caddies.
Option 306	Installed HP-UX 7.0 with 75 Megabytes of swap space, configured for a Hewlett-Packard 9000 Series 300. Includes AXE, PE, NS-ARPA, NFS, and X11.

Model 330D Domain (HP C2212D)

Option: **Description:**

Option A01   Adds one 332 Megabyte SCSI Hard Disk Drive.

Option 003   Adds one 1.3 Gigabyte SCSI DDS-format Tape Drive. Includes
one 1.3 Gigabyte DDS-format cassette and a cleaning cassette.

Option 004   Adds one 600 Megabyte SCSI CD-ROM Half-Height Drive.
Includes one CD-ROM disk caddy.

Option 005   Adds one 650 Megabyte SCSI Rewritable Optical Disk Drive.
Includes one 650 Megabyte rewritable optical disk.

Option 006   Adds one Quarter-inch Cartridge Tape Drive. Includes one
quarter-inch tape.

Model 660D Domain (HP C2213D)

Option:	Description:
Option A01	Adds one 332 Megabyte SCSI Hard Disk Drive.
Option A02	Adds one 664 Megabyte SCSI Hard Disk Drive.
Option 003	Adds one 1.3 Gigabyte SCSI DDS-format Tape Drive. Includes one 1.3 Gigabyte DDS-format cassette and a cleaning cassette.
Option 004	Adds one 600 Megabyte SCSI CD-ROM Half-Height Drive. Includes one CD-ROM disk caddy.
Option 005	Adds one 650 Megabyte SCSI Rewritable Optical Disk Drive. Includes one 650 Megabyte rewritable optical disk.
Option 006	Adds one Quarter-inch Cartridge Tape Drive. Includes one quarter-inch tape.
Option A22	Adds two 664 Megabyte SCSI Hard Disk Drives.

Accessories Available

The following accessories must be ordered separately and are available from your Hewlett-Packard Sales and Support office, or directly from Apollo Direct Dealer (1-800-225-5290):

Host to Peripheral Cables

- HP K2286 0.9-meter SCSI Peripheral Interface Cable (host end: high density, squeeze lock connector; peripheral end: low density, bail lock connector). Order HP K2296 when available.

- HP K2285 1.5-meter SCSI Peripheral Interface Cable (host end: high density, squeeze lock connector; peripheral end: low density, bail lock connector). Order HP K2297 when available.

- HP K2296 0.9-meter SCSI Peripheral Interface Cable (host end: high density, thumb screw and squeeze lock connector; peripheral end: low density, bail lock connector).

- HP K2297 1.5-meter SCSI Peripheral Interface Cable (host end: high density, thumb screw and squeeze lock connector; peripheral end: low density, bail lock connector).

Peripheral to Peripheral Cables (daisy chain)

- HP 92222A 0.5-meter SCSI Peripheral Interface Cable (both ends: low density, bail lock connector).

- HP 92222B 1-meter SCSI Peripheral Interface Cable (both ends: low density, bail lock connector).

- HP 92222C 2-meter SCSI Peripheral Interface Cable (both ends: low density, bail lock connector).

- HP 92222D 1-meter SCSI Extender Cable (both ends: low density, bail lock connector).

Other Accessories

- SCSI Single-ended Terminator, part number K2291 (low density, bail lock).

- HP 92211-Series Design Plus Cabinets. A desk-height stand-alone cabinet series for the mass storage system and other desktop stackable peripherals and systems.

- HP 35199C Rack Adapter Kit. Allows the mass storage system to be mounted in a standard 19-inch EIA equipment rack.

- HP 9300-0794 Anti-Static Work Station. Conductive sheet and wrist ground strap kit.

- HP C2299A Vertical Installation Kit. Allows the mass storage system to be mounted in a vertical orientation.

- Quarter-inch Cartridge Tape Media, part number K1821

- Quarter-inch Cartridge Tape Drive Cleaning Kit, part number 92281C

- Quarter-inch Cartridge Tape Drive Extra Cleaning Supplies Kit, part number 92281D

- DDS-format Cassette Tape Media, part number 9164-0334

- DDS Head Cleaning Cassette, part number 92283K

- Rewritable Optical Media, part number 92280A

- CD Caddy, part number C2293-80001

Hewlett-Packard Headquarter Offices are listed at the back of this manual.

Related Documentation

The following documents pertain to the HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems:

- *HP Series 6000 Models 330S and 660S Mass Storage Systems Owner's Manual*, (HP-UX) part number C2212-90901, provides operating and installation instructions for your mass storage system and all options, accessories, and upgrade kits.

- *HP Series 6000 Models 330D and 660D Mass Storage Systems Owner's Manual*, (Apollo Domain) part number C2212-90911, provides operating and installation instructions for your mass storage system and all options, accessories, and upgrade kits.

- *HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems CE Service Handbook*, part number C2212-90905 (this manual), contains technical service information about your mass storage system. This manual is intended for Hewlett-Packard Customer Engineers, or others who are trained to service and repair your mass storage system.

- *HP Series 6000 Mass Storage Systems Vertical Installation Kit Manual*, part number C2299-90901, provides installation information for the C2299A Vertical Installation Kit.

- *Mass Storage System Diagnostic Reference Manual*, part number 5960-0163, describes the HP-UX diagnostic programs used to troubleshoot problems with your mass storage system.

Refer to Chapter 7, Related Documentation and Reference, for a complete list of related documents and their part numbers.

Kits Available for Models 330S/660S

The following kits are available as add-on peripherals for Models 330S and 660S. Option D02 deletes installation, and adds both antistatic and tool kits to each of these kits.

C2290A   Adds one 332 Megabyte SCSI Hard Disk Drive. This kit includes a 332 Megabyte SCSI hard disk drive, a mounting bracket with screws, and a power cable.

C2291A   Adds one 664 Megabyte SCSI Hard Disk Drive. This kit includes a 664 Megabyte SCSI hard disk drive, a mounting bracket with screws, and a power cable.

C2292A   Adds one 1.3 Gigabyte SCSI DDS-format Tape Drive. This kit includes a 1.3 Gigabyte SCSI DDS-format tape drive, a mounting bracket with screws, a power cable, DDS-format cassette, a head cleaning cassette, and a SCSI cable adapter.

C2293A   Adds one 600 Megabyte SCSI CD-ROM half-height Drive. This kit includes a 600 Megabyte SCSI CD-ROM drive, a mounting bracket with screws, a dual power cable, a SCSI cable adapter, and one CD-ROM disk caddy.

C2294A   Adds one 650 Megabyte SCSI Rewritable Optical Disk Drive. This kit includes a 650 Megabyte SCSI rewritable optical disk cartridge with SCSI controller PCA and cables, a mounting bracket with screws, a dual power cable, a media eject tool, and a SCSI cable adapter.

Kits Available for Models 330D/660D

The following kits are available as add-on peripherals for Models 330D and 660D. Option D02 deletes installation, and adds both antistatic and tool kits to each of these kits.

C2290D	Adds one 332 Megabyte SCSI Hard Disk Drive. Includes the hard disk drive, mounting bracket, screws, and power cable.
C2291D	Adds one 664 Megabyte SCSI Hard Disk Drive. Includes the hard disk drive, mounting bracket, screws, and power cable.
C2292A	Adds one 1.3 Gigabyte SCSI DDS-format Tape Drive. Includes the DDS-format tape drive, mounting bracket, screws, power cable, DDS-format cassette, cleaning cassette, and SCSI cable adapter.
C2293A	Adds one 600 Megabyte SCSI CD-ROM half-height Drive. Includes the CD-ROM drive, mounting bracket, screws, dual power cable, SCSI cable adapter, and one CD-ROM disk caddy.
C2294A	Adds one 650 Megabyte SCSI Rewritable Optical Disk Drive. This kit includes a 650 Megabyte SCSI rewritable optical disk cartridge with SCSI controller PCA and cables, a mounting bracket with screws, a dual power cable, a media eject tool, and a SCSI cable adapter.
C2296D	Adds one Quarter-inch Cartridge Tape Drive. Includes the cartridge tape drive, mounting bracket, screws, power cable, tape cartridge, and SCSI cable adapter.

Packaging

Mass Storage System

The following packaging items are required when repackaging the mass storage system for shipment:

C2200-80017   Shipping Carton

5180-0574   Anti-Static Sheets (2)

C2200-80016   Foam Cushions (2)

Kits and Exchange Assemblies

Individual SCSI mechanisms must be repackaged in their original box and packaging materials to ensure safe shipping.

Operating Specifications and Characteristics

Operating specifications and characteristics for the mass storage system are contained in the *HP Series 6000 Models 330S and 660S Mass Storage Systems Owner's manual*, (HP-UX) part number C2212-90901, or the *HP Series 6000 Models 330D and 660D Mass Storage Systems Owner's manual*, (Apollo Domain) part number C2212-90911.

Service Kit

The following items are recommended as a Product Support Package for the mass storage system.

Note	Disk Storage Systems Division does not supply this package with the mass storage system.

82441A	AC Adapter (for U.S.A. and Canada)
82441AB	AC Adapter (for West Germany, Finland, Sweden, Norway, Denmark and Switzerland)
82441AG	AC Adapter (for Australia)
82441AJ	AC Adapter (for Japan)
82441AU	AC Adapter (for UK)
5960-0163	Mass Storage System Diagnostic Reference Manual
5061-3166	HP-IL/SCSI Interface Assembly (includes HP-IL/SCSI module, field service SCSI cable, and Mass Storage System Diagnostic Manual)
8710-1426	TORX* Field Kit
9300-0794	Anti-static Work Station

TORX is a product of Camcar Division, Textron Inc.

2

Environmental/Installation/PM

Environmental Requirements

Environmental specifications for the mass storage system are given in the *HP 6000 Series Mass Storage System Models 330S and 660S Owner's manual*, part number C2212-90901 and the *HP 6000 Series Mass Storage System Models 330D and 660D Owner's manual*, part number C2212-90911.

Installation

First-time installation of the mass storage system requires the use of the following manuals:

- *Disk Product Specifications and Site Environmental Requirements Handbook*, part number 5955-3456.

- *HP 6000 Series Mass Storage System Models 330S and 660S Owner's Manual*, (HP-UX) part number C2212-90901 or the *HP 6000 Series Mass Storage System Models 330D and 660D Owner's Manual*, (Apollo Domain) part number C2212-90911

Installation Checklist

■ Connect SCSI cable(s) and set ADDRESS switches.

Note	The last mass storage system on the SCSI bus must have a single ended SCSI terminator (part number K2291) fitted on the unused SCSI connector to properly terminate the bus.

■ Switch on and observe the hard disk status indicators. Refer to chapter 4 for details.

Handling

While the mass storage system has been designed to withstand a certain shock level, it is still a delicate device. Care should be taken when handling or transporting the product. Observe the following precautions when handling or transporting the mass storage system. Failure to observe these handling precautions could result in loss of data or damage to the product.

■ Avoid sharp shocks to the mass storage system.

■ Always repackage the mass storage system in approved packaging (see Figure 2-1) when transporting the product from one area to another.
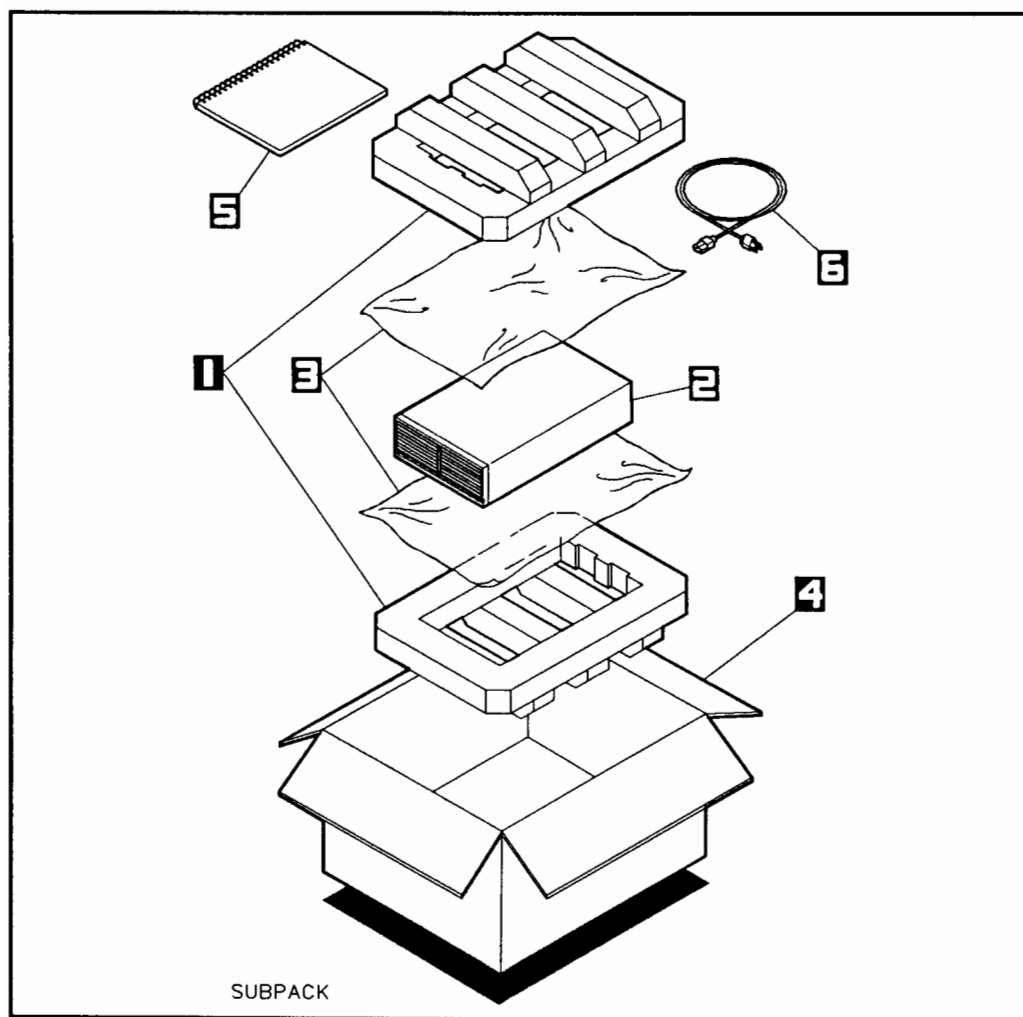
Figure 2-1. Packaging Details

1—Foam Cushions (C2200-80016)
2—Mass Storage System

3—Antistatic Sheets (5180-0574)

4—Shipping Carton (C2200-80017)
5—Manual (C2212-90901 or C2212-90911)
6—Power Cord (part number depends upon location)

Static Control

To ensure continuously successful operation of the mass storage system in a carpeted office environment, the use of anti-static mats and/or carpets is recommended.

Controls and Connectors

Figure 2-2 shows the location of the mass storage system controls and indicators.

AC Power

Connecting the Power Cord

The various power cords available are shown in the *Disk Product Specifications and Site Environmental Requirements Handbook*, part number 5955-3456.

Warning	■ **The ac branch service must be properly current protected by either a fuse or a circuit breaker.**
	■ **Use only a UL/CSA approved power cord, SVT type, rated for suitable voltage and current. These power cords have two conductors plus a ground. Failure to use the proper power cord could result in a shock or fire hazard.**

Warning	Do not open the power supply. The power supply contains no serviceable parts.

Note	The power supply in the mass storage system has an automatic voltage ranging feature that eliminates the need for an external fuse and voltage selector switch.

To attach the power cord:

1. Set the (LINE⁻) switch ① to the 0 (out) position.

2. Plug the female end of the power cord into the ⁻AC LINE connector ⑤ at the rear of the mass storage system.
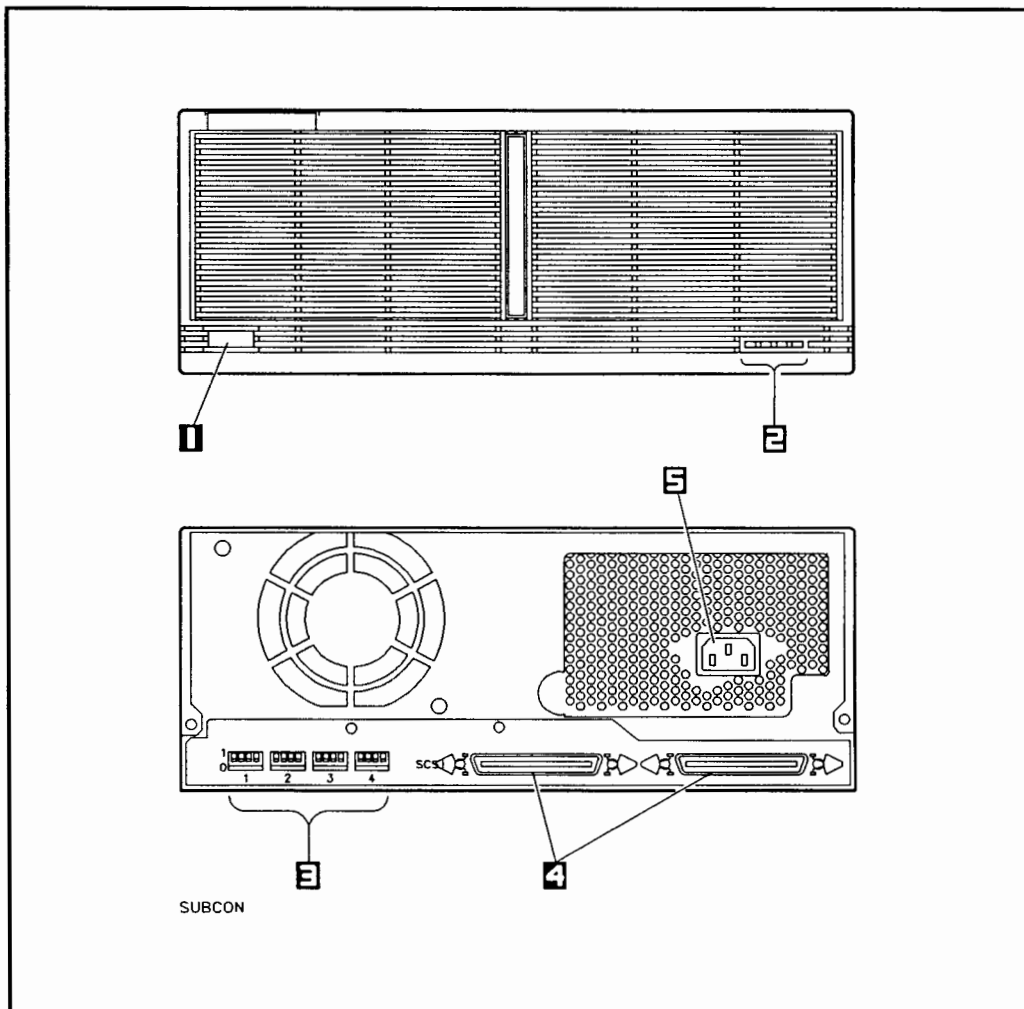
Figure 2-2. Controls and Connectors

1—(LINE˜) Switch   4—SCSI Connectors
2—Hard Disk Drive Status Indicators   5—˜AC LINE Connector
3—Hard Disk Drive Address Switches

Connection to SCSI Bus

Caution

- Ensure that power is removed from all units of the system before connecting (or disconnecting) the mass storage system.

- A Hewlett-Packard Series K22XX or Series 9222X SCSI Peripheral Interface Cable must be used to connect the mass storage system to the SCSI bus. Failure to use these shielded cables may result in failure of the drive to meet its radio frequency interference (RFI) specifications.

- After the mass storage system is connected, apply power to the mass storage system before applying power to the host computer. Failure to follow these precautions could result in a node failure, such as a system hang or a disk or controller problem.

Note

Individual devices in this product do not supply termination power to the SCSI bus. This may cause misleading self-test results when attached to HP 9000 systems. If self-test appears to fail, an accurate self-test can be verified by one of two methods:

1. Disconnect all external data cables and terminators from the mass storage system, then switch on power.
2. With cables and terminators connected, switch on host system power before switching on power to the mass storage system.

The mass storage system is connected to the computer via a SCSI interface cable plugged into one of the SCSI connectors on the rear panel of the drive. Both connectors are in parallel with all SCSI devices in the mass storage system. SCSI interface cables are available from HP Corporate Parts Center. The cables are listed in chapter 1, "Accessories Available."

Connecting the SCSI Cable

One or more mass storage systems can be connected to the host computer via SCSI interface cables. Before connecting the mass storage system to the host computer, ensure that the cabling conforms with the following SCSI cabling standards.

- The SCSI bus allows a maximum of eight devices, including the host computer system. Since your mass storage system can contain from one to four SCSI devices, you must make sure you know the number of SCSI devices within your mass storage system before connecting it to the system bus, since it is possible that two fully loaded mass storage systems could exceed the SCSI device limit.

- In addition to the cables between the host computer and the mass storage system(s), each mass storage system contains 1.5 meters of internal SCSI cabling. This dimension must be included in maximum cable length calculations. The maximum length of the SCSI cables when totaled must not exceed six meters (19.6 feet).

- The last mass storage system on the bus must have a SCSI terminator (part number K2289, high-density squeeze lock or part number K2291, low-density bail lock) fitted on its unused SCSI connector.

1. Check that power to the host computer and the mass storage system has been disconnected.

2. Connect the SCSI cable from the host computer to either of the two SCSI connectors on the rear panel of the mass storage system. Ensure that the connector retaining clips are locked in place.

3. Connect the next SCSI device or the SCSI terminator to the other SCSI connector on the mass storage system.

Caution	Make sure the address switch on each SCSI device is set to a unique SCSI address relative to the other devices in the mass storage system and on the host computer system. The mass storage system will not function properly if two devices in the mass storage system have the same SCSI address. The system disk is normally set to address number 6.

Setting Hard Disk Drive SCSI Address Switches

Note   The rear panel address switches are only for hard disk drives;
                  other SCSI devices have address switches or jumpers located on
                  the device itself.

The rear panel (see Figure 2-2) has four sets of SCSI address switches.
The mass storage system contains up to three hard disk drives, and these
switches are used to assign the address for each disk (the fourth switch is not
connected). Set the rear panel ADDRESS switches to program the desired
SCSI address for the hard disk drives in the mass storage system.

Note   Since the high-order bit of these switches is not connected,
                  ADDRESS switch settings 8 and 9 will select addresses 0 and 1,
                  respectively.

Setting the Rewritable Optical Disk Drive SCSI Address

The address switch on the rewritable optical controller PCA enables you to select a unique SCSI address for the rewritable optical disk drive.

Caution	Switches 1 through 5 should stay in the OFF (0) position. If any of switches 1 through 5 are set to the ON (1) position, the mode of operation is *not* supported.

To set the rewritable optical disk drive address, perform the following steps:

1. Verify that switches 1 through 5 are set to the OFF (0) position.

2. Set switches 6 through 8 to the ON (1) or OFF (0) position for the desired address (refer to Table 2-1 and Figure 2-3).

Table 2-1. Rewritable Optical Disk Drive Address Switch

SCSI Address	Switch 6	Switch 7	Switch 8
0	OFF	OFF	OFF
1	OFF	OFF	ON
2	OFF	ON	OFF
3	OFF	ON	ON
4	ON	OFF	OFF
5	ON	OFF	ON
6	ON	ON	OFF
7	ON	ON	ON
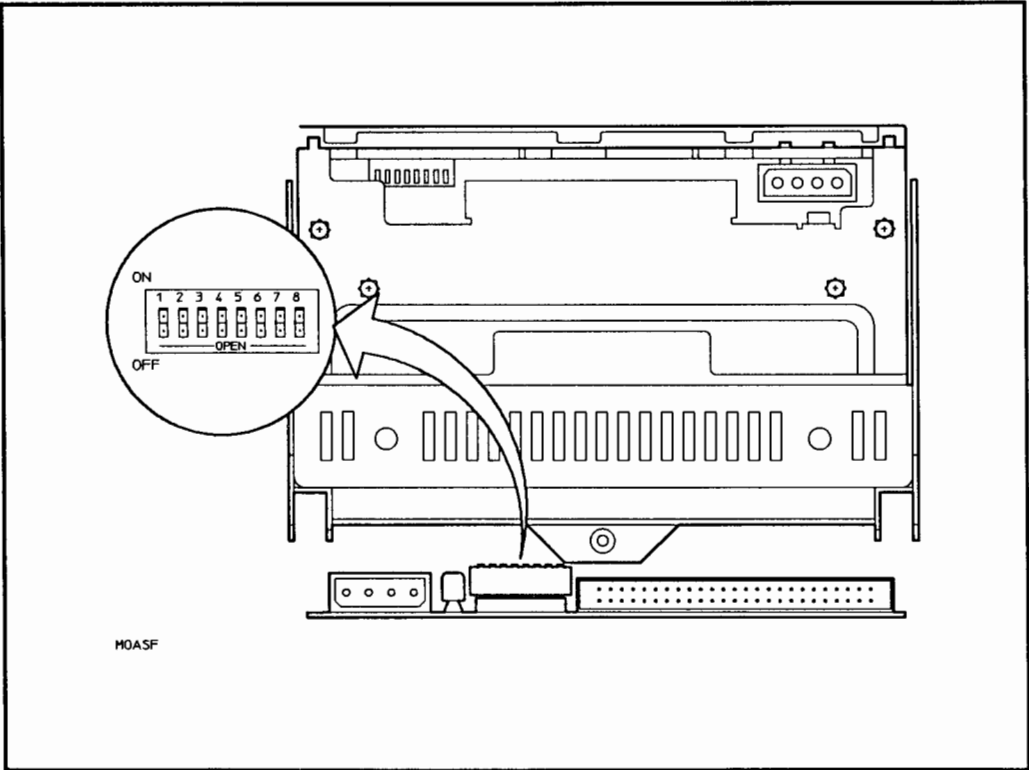
Figure 2-3. Rewritable Optical Disk Drive Address Switch

Setting the CD-ROM Drive SCSI Address

Note   Some CD-ROM Drives may have factory-preset PRTY, ARBT,
                   and TEST switches. These units will have SCSI ID address
                   jumpers instead of the switches as shown.

The SCSI-ID switches (see Figure 2-4) enable you to select a unique SCSI
address for the CD-ROM drive. The SCSI-ID switches are set to address 0 at
the factory, so all of the switches should be in the down (0) position when you
take the CD-ROM drive out of the anti-static bag.

To set the SCSI-ID switches to a different address, perform the following steps:

1. Verify that the PRTY and ARBT switches are set to 1, and the TEST
   switch is set to 0.

2. Set switches 1, 2, and 4 to 0 or 1 for the desired address (refer to Figure 2-4
   and Table 2-2).

Table 2-2. CD-ROM Drive SCSI-ID Switch Settings

SCSI Address	SCSI-ID 1	SCSI-ID 2	SCSI-ID 4
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1
6	0	1	1
7	1	1	1
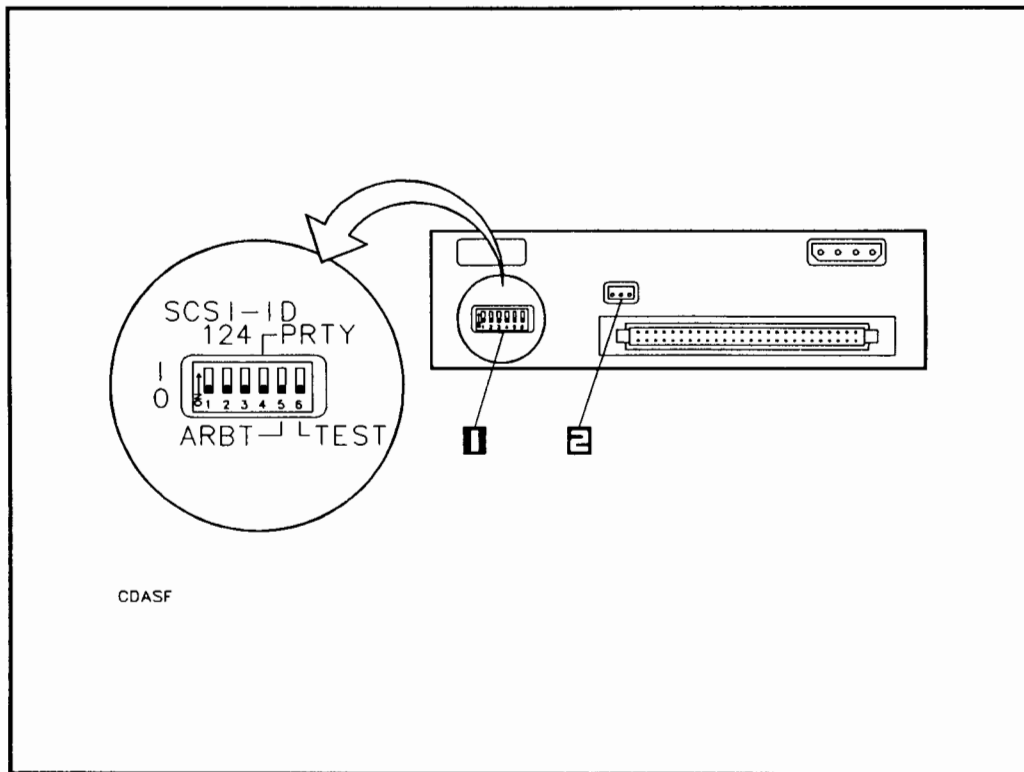
Figure 2-4. CD-ROM Drive Rear Panel Switches

1—SCSI/Options Switch   2—Audio Output Jack (not used)

Setting the PRTY Switch

The PRTY switch (see Figure 2-4) must be set to 1 for your CD-ROM drive to operate properly in your mass storage system. The following table shows the function of the PRTY switch for both switch positions:

PRTY	Function
0	No parity check executed.
1	Parity check executed.

Setting the ARBT Switch

The ARBT switch (see Figure 2-4) must be set to 1 for your CD-ROM drive to operate properly in your mass storage system. The following table shows the function of the ARBT switch for both switch positions:

ARBT	Function
0	Non-arbitration system.
1	Arbitration system.

Setting the TEST Switch

The TEST switch (see Figure 2-4) is used to activate the continuous audio mode in your CD-ROM drive. When the continuous audio mode is activated, you can play an audio CD in your CD-ROM drive (refer to "Playing Audio Compact Disks" in this chapter). If you do *not* want to activate the continuous audio mode, set the TEST switch to 0.

The following table shows the function of the TEST switch with the PRTY and ARBT switches for both switch positions:

PRTY	ARBT	TEST	Function
1	1	0	Normal operating mode.
0	0	1	Continuous audio mode.

Playing Audio Compact Discs

If you want to play an audio compact disc (CD) in your CD-ROM drive,
perform the following steps:

1. Place the CD-ROM Drive in continuous audio mode by setting the PRTY,
   ARBT, and TEST switches (refer to "Setting Switches to Continuous Audio
   Mode").

2. Connect a pair of miniature stereo headphones to the headphone jack.

3. Insert the audio CD into the disk caddy.

4. Move the volume switch from left to right to increase the volume level of the
   audio signal in three incremental steps.

Setting Switches to Continuous Audio Mode

The PRTY, ARBT, and TEST switches are used to activate the continuous
audio mode in your CD-ROM drive. Set the switches to the positions shown in
the following table:

Continuous Audio Mode

PRTY	ARBT	TEST	FUNCTION
0	0	1	Continuous audio mode.

When the CD-ROM drive is in continuous audio mode, press the eject button
for 0.1 to 1 second to switch to the next track (song). If you press the eject
button for longer than 1 second, the compact disc will be ejected.

Setting the DDS-format Tape Drive SCSI Address Jumpers

The address pin sets on the rear panel of the DDS-format tape drive enable you to select a unique SCSI address for your DDS-format tape drive (see Figure 2-5). The numbers 0, 1, and 2 above the pin sets correspond to SCSI address bits 0, 1, and 2. When a jumper is placed on a pin set, the corresponding address bit is set to 1. When no jumper is in place on a pin set, the corresponding address bit is set to 0. Your DDS-format tape drive is shipped from the factory with jumpers set to SCSI address 3, but can be altered if necessary.

To set your DDS-format tape drive to a different address before installing it into the mass storage system, install jumpers across address pin sets to set address bits to 1, or leave jumpers off address pin sets to set address bits to 0. Table 2-3 shows the SCSI address for the corresponding bit settings.

To set the address to a different setting after your DDS-format tape drive has been installed into your mass storage system chassis, perform the following steps:

1. Set the mass storage system ⦅LINE⁻⦆ switch to the 0 (out) position.

2. Disconnect the power cord from the mass storage system rear panel.

3. Remove the front panel and top cover.

4. Install jumpers across address pin sets to set address bits to 1, or leave jumpers off address pin sets to set address bits to 0.

5. Install the front panel and top cover (refer to "Installing the Front Panel and Top Cover" in this chapter).

6. Connect the power cord to the mass storage system rear panel.

7. Set the mass storage system ⦅LINE⁻⦆ switch to the 1 (in) position.

Parity Checking

To set parity checking ON, install jumpers across pin set marked "P" as shown in Figure 2-5. If this jumper is not set, the DDS-format tape drive will not check parity, even though the parity bits are still generated.

Table 2-3. DDS-format Tape Drive Address Pin Settings

SCSI Address	Bit 2	Bit 1	Bit 0
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1
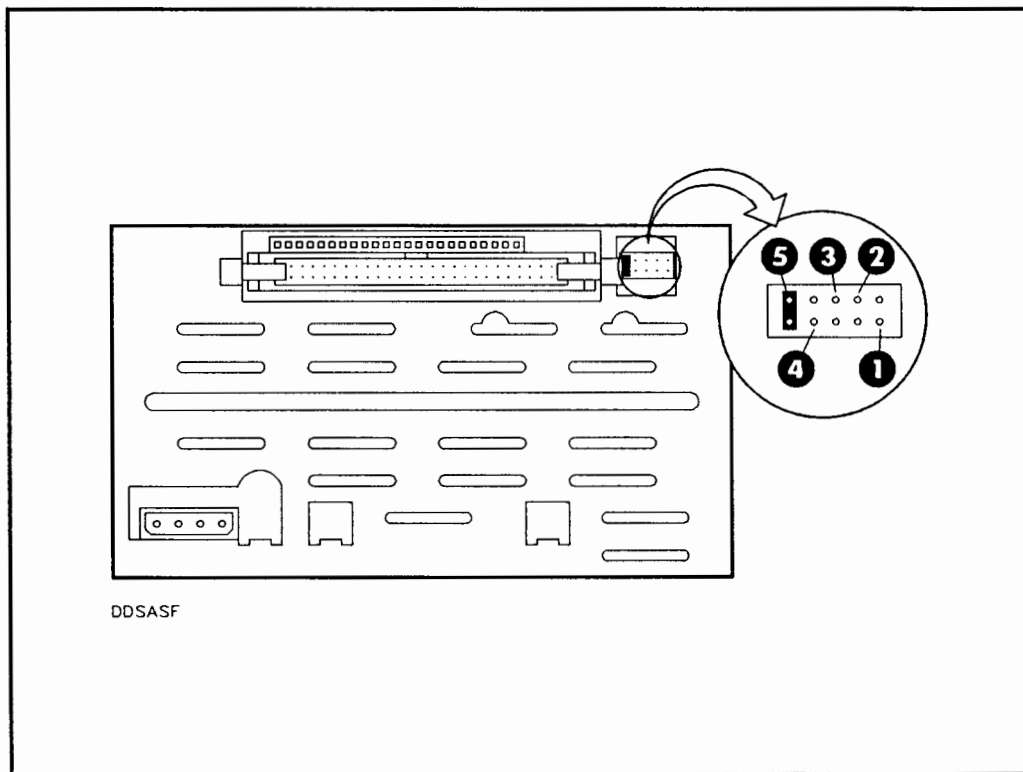
Figure 2-5. DDS-format Tape Drive Address Pins

1—SCSI Address Bit 0   4—Termination Power (not used)

2—SCSI Address Bit 1   5—Parity Checking (always jumpered)

3—SCSI Address Bit 2

DDS-format Tape Drive Vertical Orientation

If you are installing your mass storage system in a vertical orientation with the Vertical Installation Kit, part number C2299A, and your mass storage system contains a DDS-format tape drive, it must be configured for vertical operation before you place your mass storage system on its side. To configure the DDS-format tape drive for vertical operation, you must set the DDS-format tape drive orientation jumper.

Accessing the DDS-format Tape Drive Jumper

If the DDS-format tape drive is already installed, follow the procedure in chapter 8 for "Removing the DDS-format tape drive."

Note	Some mass storage systems have DDS-format tape drive brackets that cover up the orientation jumper access hole. DDS-format tape drives with these brackets must be removed from the mass storage system, and then taken out of their brackets to access the jumper. Figure 2-6 shows the DDS-format tape drive orientation jumper.

Setting the DDS-format Tape Drive Orientation Jumper

1. If the DDS-format tape drive is in slot 1 (the right front slot), it must be removed from the mass storage system, since the middle rail blocks access to the orientation jumper.

2. If the DDS-format tape drive is in slot 3 (the left front slot), it is possible to access the jumper without removing the drive from the mass storage system, provided your DDS-format tape drive bracket allows access to the jumper pins. Check to see if your bracket has this access hole. Otherwise, remove the drive from the mass storage system as described in chapter 8.

3. Remove the four T10 bracket screws from the DDS-format tape drive and separate the drive from its bracket.

4. For level operation, the orientation jumper is across the middle set of pins. To set for vertical operation (with the DDS-format tape drive eject switch in the upward position), remove the jumper using needle-nose pliers from the

middle set of pins, and place it across the pins that are toward the front panel of the DDS-format tape drive. See Figure 2-6.

5. If the DDS-format tape drive was removed from its bracket, reinstall it into the bracket with the four T10 screws, and reinstall the drive into the mass storage system chassis as described in chapter 8, "DDS-format Tape Drive in Slot 1."

| **Caution** | Be careful not to bend or dislodge any of the RFI clips on the tape drive bracket as shown in Figure 2-6. If the RFI clips are not in place, the mass storage system may not meet RFI emission requirements. |
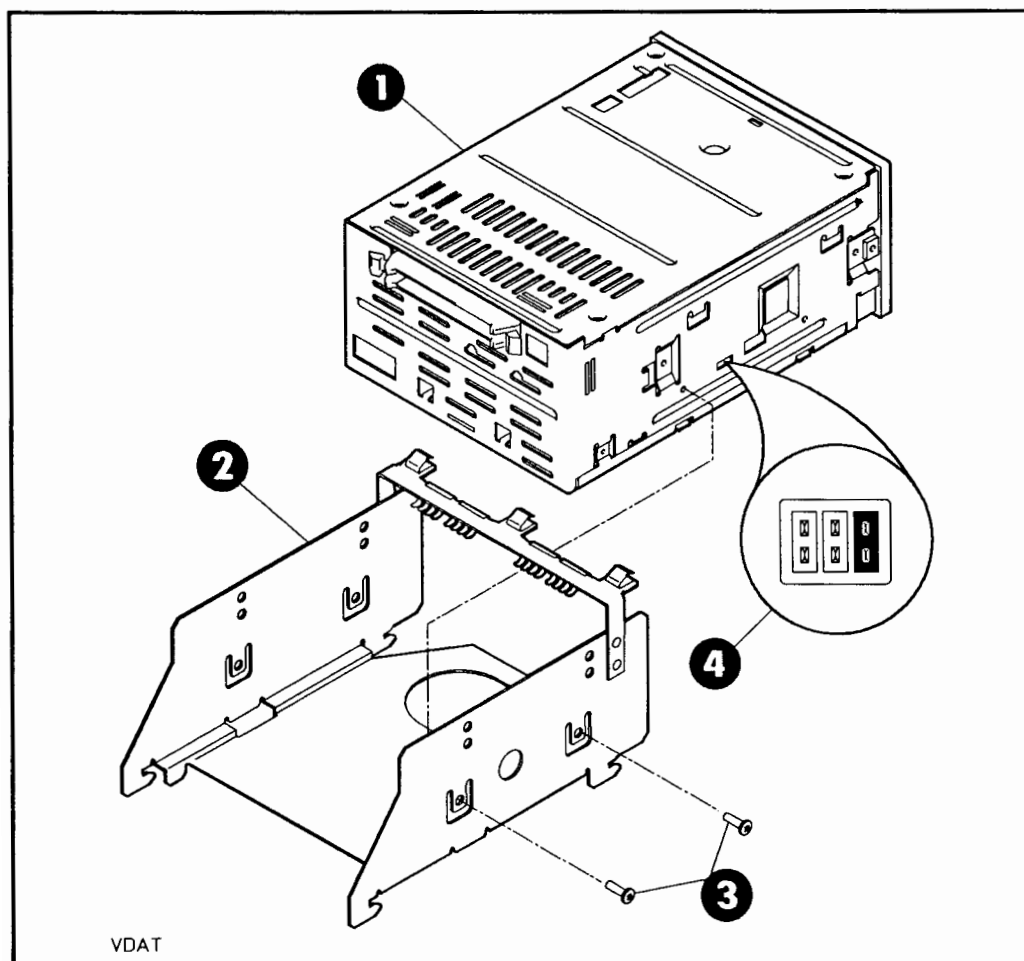
Figure 2-6. DDS-format Tape Drive Orientation Jumper (Vertical Operation)

1—DDS-format Tape Drive   3—T10 Bracket Screws (4)

2—DDS-format Tape Drive Bracket   4—Orientation Jumper

DDS-format Tape Drive Maintenance

The only preventive maintenance required is cleaning the head on the DDS-format tape drive with a head cleaning cassette.

Head Cleaning Cassette

During normal use of the DDS-format tape drive, the read/write heads pick up residue from the cassette. The heads should be cleaned at the following intervals:

■ After every 25 hours of use, or more frequently if required.

■ If the media warning is displayed by the busy lights.

You should clean the heads with a head cleaning cassette, HP part number 92283K. To clean the heads, follow the instructions on the head cleaning cassette case.

Setting the Quarter-Inch Cartridge Tape Address Jumpers

Note	The address switches on the back of your mass storage system are for hard disk drives only.

The address pin sets on the rear panel of the quarter-inch tape drive enable you to select a unique SCSI address for the drive (see Figure 2-7). The three pin sets, from top to bottom, ID2, ID1, and ID0, correspond to SCSI address bits 2, 1, and 0. When a jumper is placed on a pin set, the corresponding address bit is set to 1. When no jumper is in place on a pin set, the corresponding address bit is set to 0. Your quarter-inch cartridge tape drive is shipped from the factory with jumpers installed on the address pin pairs such that the SCSI address is set to 4.

Caution	Make sure your quarter-inch cartridge tape drive is set to a unique SCSI address relative to the other devices on the SCSI bus. The mass storage system will not function properly if two devices in the mass storage system have the same SCSI address.

To set your tape drive to a different address before installing the tape drive into the mass storage system, install jumpers across address pin sets to set address bits to 1, or leave jumpers off address pin sets to set address bits to 0. Table 2-4 shows the SCSI address for the corresponding bit settings.

To set the address to a different setting after your quarter-inch cartridge tape drive has been installed into your mass storage system chassis, perform the following steps:

1. Set the mass storage system (LINE⁻) switch to the 0 (out) position.

2. Disconnect the power cord from the mass storage system rear panel.

3. Remove the front panel and top cover.

4. Install jumpers across address pin sets to set address bits to 1, or leave jumpers off address pin sets to set address bits to 0.

5. Install the front panel and top cover (refer to "Reinstalling the Front Panel and Top Cover" in this chapter).

6. Connect the power cord to the mass storage system rear panel.

7. Set the mass storage system (LINE⁻) switch to the 1 (in) position.

Table 2-4.
Quarter-Inch Cartridge Tape Drive Address Pin Settings

SCSI Address	ID2	ID1	ID0
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
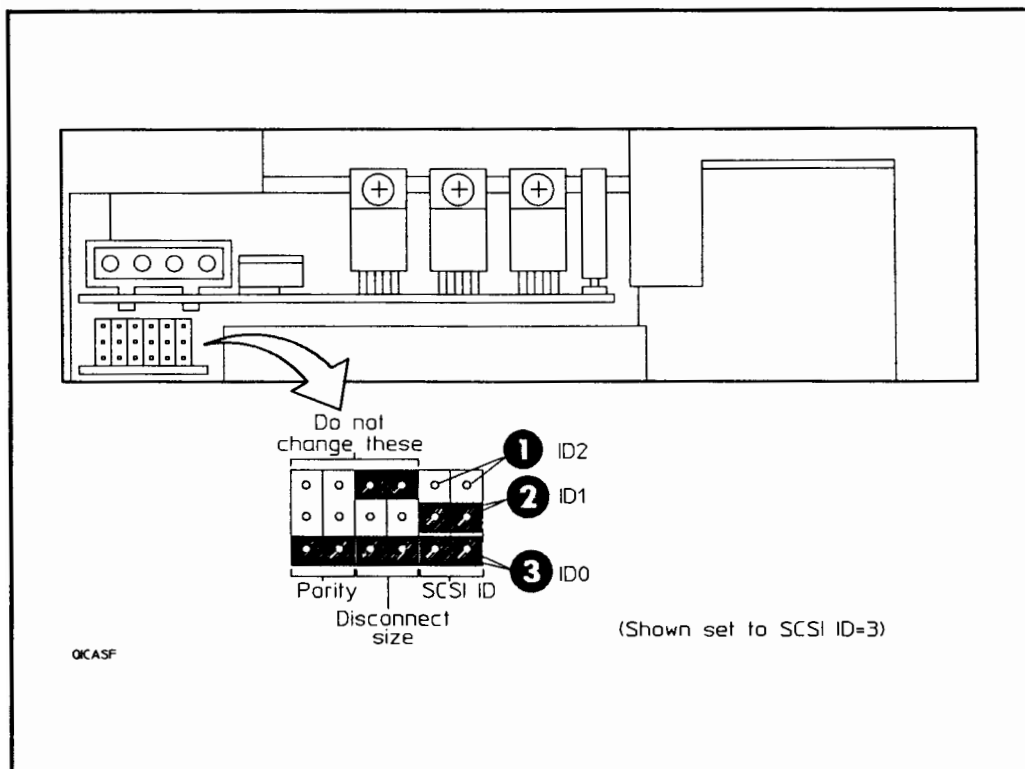
Figure 2-7. Quarter-Inch Cartridge Tape Drive Address Pins

1—SCSI Address Bit 2

2—SCSI Address Bit 1

3—SCSI Address Bit 0

Quarter-Inch Cartridge Tape Drive Maintenance

The only maintenance the quarter-inch tape drive requires is cleaning of the read/write heads.

The performance and reliability of the quarter-inch tape drive depend upon its operating environment. Make sure the tape drive operates within the environmental restrictions listed in the Owner's Manual.

Quarter-inch Tape Drive Cleaning Kit

We recommended use of the approved Hewlett-Packard Tape Head Cleaning Kit, HP part number 92281C, to clean the quarter-inch cartridge tape drive. This cleaning kit is readily available in the U.S. through the HP Direct Marketing Organization by dialing 1-800-538-8787. Outside the U.S., contact your local HP Sales Office or HP Direct Center. The kit includes a cleaning cartridge, cleaning solution (isopropyl alcohol), cleaning pads, and accessories.

The following instructions supplement those that come with the 92281C tape head cleaning kit. Use the 92281C instructions to assemble the cleaning cartridge, then use the following instructions for the actual cleaning operation.

Cleaning Recommendations

- During normal use of the quarter-inch tape drive, the read/write heads pick up residue from the tape cartridge.

- Your tape drive should be cleaned at least once a week or after eight hours of use, whichever comes first.

- Clean immediately if you are experiencing read/write data errors when using the tape drive.

Head Cleaning Instructions

1. Stop any processes on the system. Head cleaning should be the only computer process being executed while using the special cleaning cartridge.

2. Establish an Aegis Shell with this command: /com/sh

3. From the Aegis Shell command line, type in the following but *do not* press RETURN (or ENTER) until asked to issue the command in step 5:

```
rbak -dev ct -reten
```

4. Use the cleaning kit instructions to assemble the cartridge and cleaning pad. Wet the pad thoroughly with the cleaning solution.

5. Quickly insert the cleaning cartridge into the drive and issue the **rbak** command that was set up in step 3 above.

6. Let the cartridge run for 30 seconds, then eject the cartridge from the tape drive. You should see the following message on your screen:

   `" ? rbak no cartridge in drive (OS/cartridge tape manager)"`

7. Cleaning is now complete.

Important Maintenance Notes

Below are listed some important points about maintaining your tape drive:

- Replace the foam pad in the cleaning cartridge after every third cleaning.

- Included in the cleaning kit is a capstan roller cleaner. See the instructions shipped with the cleaning kit for proper application.

- When the tape drive is not in use, remove the tape cartridge or push the eject lever to the left. This reduces the possibility of a stretched tape.

Accessories

- HP 92281D — additional cleaning solution and pads for the 92281C Kit.

3

Configuration

The mass storage system is pre-configured at the factory. The mass storage system requires no configuration other than SCSI address switch settings. These operations are described in the installation instructions in chapter 2. For host computer system configuration information, refer to the configuration section of the system documentation.

Caution	If the mass storage system is ordered with a pre-configured operationg system (option 303 or 306), do NOT initialize the hard disk, as this will entirely erase the factory-installed operating system.

Note	The mass storage system must be powered up and in a ready state before powering up the host computer. For optimum performance on the HP 9000 Series 300 host, your system hard disk drive should be set to SCSI address number 6. The Unattended Mode autoboot process used by the Series 300 SCSI host computer starts searching for hard disk drives with the LOWEST SCSI address, therefore, if you have more than one hard disk drive, the autoboot may try to find the operating system on the wrong (lower numbered) disk. Refer to Chapter 2, System Startup, of the *HP-UX System Administration Concepts* manual, part number 98594-90062, for more information regarding the Unattended Mode autoboot process.

For host computer system configuration information, please refer to the *Peripheral Installation Guide*, part number 97005-90000. Additional configuration information can be found in the *Application Execution Environment User's Manual*, part number 98515-90002, and in Volume 1 of the *HP-UX System Administrator Manual*, part number 98594-90060.

For HP Apollo systems, consult the *Domain Hardware Utilities Reference Manual*, part number 014881, and the *HP Apollo 9000 Series 400 Domain OS Owner's Guide*, part number A1630-90005.

Factory Configuration

Table 3-1 shows the default factory settings for the various devices in the mass storage system.

Table 3-1. Device Address Factory Settings

Slot Location	Device Type	Device Address
1	Quarter-inch Cartridge Tape Drive (upper slot) or Rewritable Optical Drive or DDS-format Tape Drive or CD-ROM Drive or additional Hard Disk Drive	5
2	Primary HDA	6
3 (upper slot)	Quarter-inch Cartridge Tape Drive or CD-ROM Drive	3
3 (lower slot)	DDS-format Tape Drive or CD-ROM Drive or additional Hard Disk Drive	4

4

Troubleshooting

Troubleshooting Strategy

Troubleshooting is primarily done with the aid of the extensive built-in diagnostics, initiated when the mass storage system power is applied. The mass storage system may contain several replaceable SCSI devices: the hard disk drive, rewritable optical disk drive, CD-ROM drive, quarter-inch cartridge tape drive, or DDS-format tape drive. In addition, the BEND/flex assembly and the power supply are replaceable items. Each assembly is replaced as an entire unit, with the exception of the hard disk drive and rewritable optical disk drive, which both have replaceable controller PCAs. The hard disk controller PCA is attached to the hard disk drive mechanism, while the rewritable optical disk drive controller PCA is beneath the rewritable optical disk drive.

In normal mass storage system operation, SCSI drive and controller errors are reported to, and displayed by the host computer. For isolated testing, both the mechanisms and controller PCA have independent power-on self-tests.

The Mass Storage System Diagnostic Programs for the HP Portable Plus[1] are recommended as an offline troubleshooting aid for the mass storage system. Refer to chapter 5 for a description of the Diagnostics, how to connect them to the mass storage system, and a description of the commands available for troubleshooting. These commands allow access to various drive logs and media tests. The logs contain access, data error, and hardware fault information. The MEDIA TEST command will direct the hard disk drive to perform a number of different combinations of read-only and write-then-read tests.

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[1] Note: At the time this manual is being printed, the HP Portable Plus is in discontinuance. Alternate solutions are under investigation. Please consult the Hewlett-Packard Response Centers for further information.

Hard Disk Status Indicators

Results of the power-on self-test routines are displayed by the hard disk drive status indicators on the front panel of the mass storage system. See Figure 4-1. Details to interpret this display are presented in the following paragraphs.

The hard disk drive status indicators are front panel light-emitting diodes (LEDs) that signal to the operator: a) the status of the power-on diagnostics and b) hard disk drive activity. The LEDs on the front panel are for hard disk drives only. Each installed hard disk connects to one LED on the front panel.

Note	When troubleshooting a hard disk drive using the status indicators, disconnect the mass storage system from the host computer.
	Individual devices in this product do not supply termination power to the SCSI bus. This may cause misleading self-test results when attached to HP 9000 systems. If self-test appears to fail, an accurate self-test can be verified by one of two methods:
	1. Disconnect all external data cables and terminators from the mass storage system, then switch on power.
	2. With cables and terminators connected, switch on host system power before switching on power to the mass storage system.

When primary power is applied to the mass storage system, the power-on reset signal from the drive hardware illuminates the indicator. The indicator remains lit until extinguished by the microprocessor on the drive electronics/controller PCA. If the indicator remains on, a failure has occurred. The most probable cause of the failure is the drive electronics/controller PCA.

Once the servo processor has tested itself and its internal RAM, the indicator is extinguished. The indicator remains off for approximately one second while the processor performs additional hardware tests and establishes various operating parameters. Then the indicator is lit to signal that power is being applied to the spindle motor. The indicator remains lit until the spindle is up to speed.

Next, the indicator flashes for a short time to indicate that the controller is performing a number of internal diagnostic tests. Due to the short duration of these tests the flashing pattern may not be visible. If the indicator starts to flash continuously once per second, the controller has failed some portion of these tests. Also, refer to previous note.

Following successful completion of the power-on diagnostic, the hard disk drive status indicator functions as an activity light. When the indicator is illuminated, the hard disk drive is reading, writing, or executing a command. When the indicator is extinguished, the hard disk drive is idle. If the indicator begins to flash continuously once per second, a hard disk drive failure has occurred. Also, refer to previous note.

Hard Disk Drive Power On

When the mass storage system power is switched on, the hard disk drive automatically performs a self-test. The hard disk drive status indicator shows the status of the self-test and hard disk drive activity with the host computer. The hard disk drive status indicator is a light-emitting diode (LED) located on the mass storage system front panel. The hard disk drive status indicator displays the following sequence when the hard disk drive is switched on:

1. **ON**

   When the mass storage system power is switched on, the hard disk drive status indicator illuminates momentarily as the hard disk drive controller PCA is being tested.

2. **OFF**

   The hard disk drive status indicator goes off for 1 second after the hard disk drive controller PCA passes self-test.

3. **ON**

   The hard disk drive status indicator illuminates for about 10 seconds as the spindle motor starts and reaches maximum speed.

4. **OFF**

   The hard disk drive status indicator goes off when the spindle reaches maximum speed.

After the spindle reaches maximum speed, the hard disk drive status indicator shows hard disk drive activity with the host computer, and will appear to flash randomly. If the spindle is at maximum speed and the hard disk drive status indicator is off, that hard disk drive is idle.

Table 4-1 shows the operation of the hard disk drive status indicator during normal operation and fault conditions:
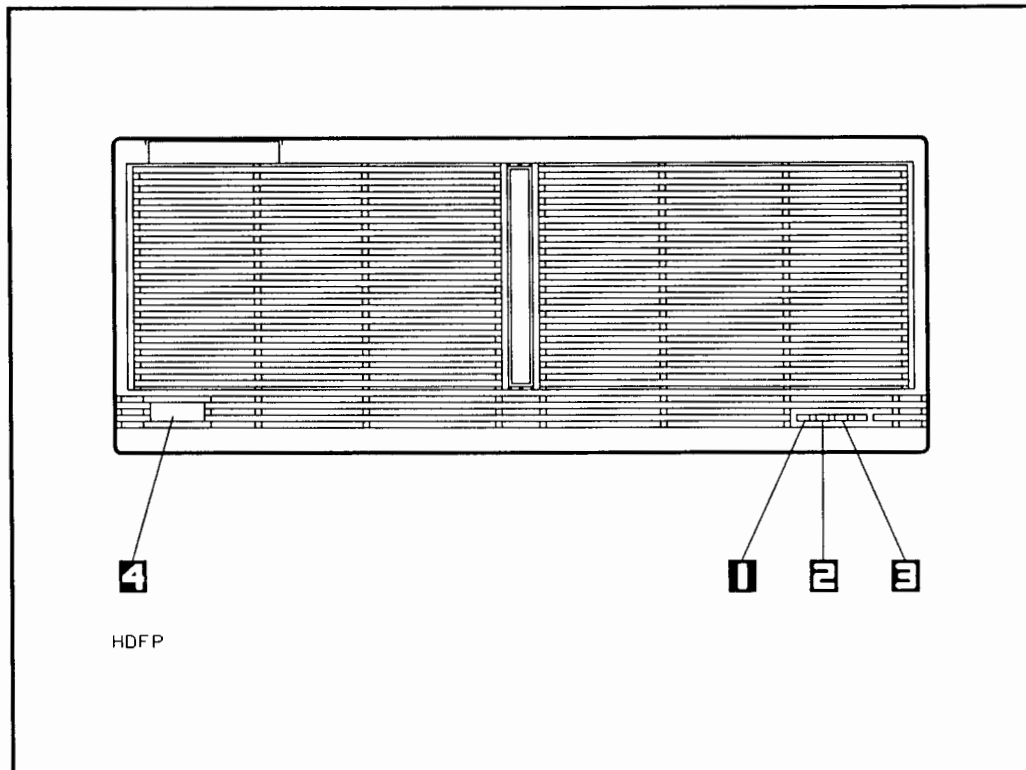
Figure 4-1. Hard Disk Status Indicators

1—Slot 1 Hard Disk Drive Status
Indicator

2—Slot 2 Hard Disk Drive Status
Indicator

3—Slot 3 Hard Disk Drive Status
Indicator

4—(LINE⁻) Switch

Caution	Always apply power to the mass storage system *before* you apply power to the host computer; always switch off the host computer *before* you switch off the mass storage system. Failure to follow these precautions could result in a node failure, such as a system hang or a disk or controller problem.

Note	Individual devices in this product do not supply termination power to the SCSI bus. This may cause misleading self-test results when attached to HP 9000 systems. If self-test appears to fail, an accurate self-test can be verified by one of two methods:

1. Disconnect all external data cables and terminators from the mass storage system, then switch on power.
2. With cables and terminators connected, switch on host system power before switching on power to the mass storage system.

Table 4-1. Hard Disk Drive Status Indicators

Status	Explanation
OFF	No mass storage system power, or no hard disk drive in mass storage system slot, or hard disk drive idle on SCSI bus.
ON	Self-test failed if indicator stays on 20 seconds after mass storage system power switched on. Probable cause is hard disk drive controller PCA.
FLASHING (1 Hz)	Self-test failed if indicator flashing at 1 Hz rate 20 seconds after mass storage system power switched on. Probable cause is hard disk drive controller PCA. Also, see note above.
FLASHING (10 Hz)	Hard Disk Drive Controller PCA performing diagnostic tests.
FLASHING (random)	Normal SCSI bus activity.

Sparing on the Hard Disk

Note that although the hard disk drive does not feature autosparing, defective media can be eliminated using the SCSIDISK Diagnostic REASSIGN BLOCK command.The hard disk drive controller supports sector sparing and track sparing.

Sector sparing is accomplished by "slip formatting" the track in question. There is one "extra" spare physical sector available at the end of each track. If a sector is bad, the recoverable data from that sector, and the data from the following sectors is shifted "downtrack" by one physical sector. The bad sector is no longer used, and the logical addresses of the following sectors are resequenced to match the original logical addresses.

Track sparing is implemented for tracks with more than one defective sector, or when logical block length is not equal to the physical sector length. Cross-head track sparing is supported out of a single spare track pool. This allows for one or more surfaces to have a higher than normal number of spare operations without loss of drive operation. Spare track access is via a RAM lookup table with no seek to the defective track to provide for high performance and reliability.

Rewritable Optical Disk Drive Power On

When the rewritable optical disk drive power is switched on, the rewritable optical disk drive and controller automatically perform a self-test. The rewritable optical busy light shows the status of the rewritable optical disk drive during the self-test and during activity with the host computer. The rewritable optical busy light is a light-emitting diode (LED) located on the front panel of the rewritable optical disk drive (see Figure 4-2).

To perform self-test, do the following:

1. Insert a know good optical disk.

2. Power on the drive and wait for self-test to complete.

3. If self-test completes successfully, both the front panel busy light, and the LEDs on the rewritable optical controller PCA will go off.

The rewritable optical busy light displays the following sequence when the mass storage system power is switched on:

1. **ON**

   The rewritable optical busy light illuminates when the self-test sequence starts. If there is a rewritable optical disk cartridge in the disk port, read/write tests are performed on the rewritable optical disk and the rewritable optical busy light stays on until the self-test sequence has completed. If there is no rewritable optical disk cartridge in the disk port, the rewritable optical busy light stays on until the self-test has completed.

2. **OFF**

   The rewritable optical busy light goes off when the self-test has completed.

After the self-test successfully completes, the rewritable optical busy light shows rewritable optical disk drive activity with the host, and will appear to flash randomly. If the rewritable optical busy light is off, the rewritable optical disk drive is idle.
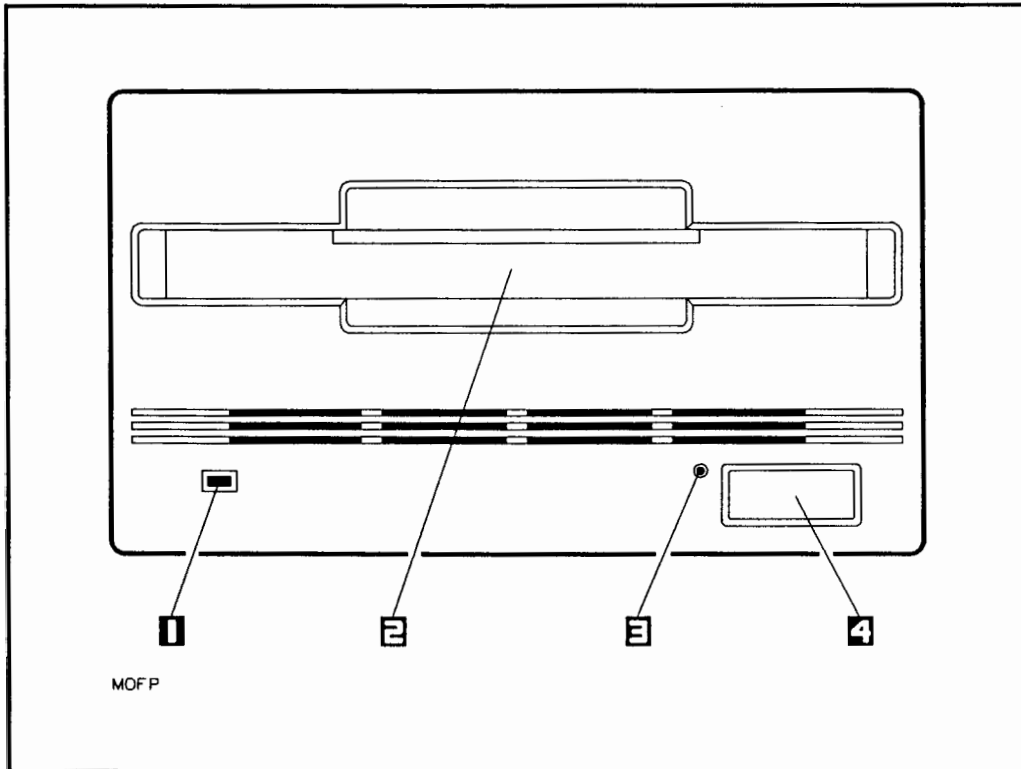
Figure 4-2. Rewritable Optical Disk Drive Front Panel

1—Rewritable Optical Busy Light   3—Emergency Disk Eject Access

2—Rewritable Optical Disk Port   4—Disk Eject Button

The following table shows the status of the rewritable optical busy light during normal operation and fault conditions:

Table 4-2. Rewritable Optical Busy Light Status

Status	Explanation
ON	Self-test failed if indicator stays on 40 seconds after mass storage system power switched on. Replace drive mechanism.
OFF	No rewritable optical disk drive power, or rewritable optical disk drive idle on SCSI bus.
FLASHING	Normal activity: rewritable optical disk drive reading, writing, or seeking.

When the controller tests complete successfully, the red test number LEDs on the controller PCA turn off. If one of the tests fail, the LEDs blink continuously or remain on. If the controller lights continue to blink or remain on, the controller PCA is should be replaced.

If the controller LEDs or busy light do not light up at all, check the voltage levels on the power supply.

If the power-on self-test seems to operate abnormally, the problem is usually a failed controller PCA.

CD-ROM Drive Power On

When the CD-ROM drive power is switched on, the CD-ROM drive automatically performs a self-test. The CD-ROM busy light shows the status of the CD-ROM drive during the self-test and during activity with the host computer. The CD-ROM busy light is a light-emitting diode (LED) located on the front panel of the CD-ROM drive (see Figure 4-3). The CD-ROM busy light displays the following sequence:

1. **ON**

   The CD-ROM busy light illuminates as the disk is loaded into the disk port.

2. **FLASHING**

   The CD-ROM busy light flashes six times while a read test is performed on the disk.

3. **OFF**

   The CD-ROM busy light goes off when the self-test completes.

Note	If a CD-ROM disk is *not* inserted into the disk port before or after the mass storage system power is switched on, the CD-ROM busy light will not illuminate.

If either of the following fault conditions is detected, the CD-ROM busy light will stay on after the self-test has completed:

■ The disk detecting function is disabled by a defective CD-ROM disk.

■ A disk insertion error is detected.

After the mass storage system power has been switched on and the self-test has completed, the CD-ROM busy light will flash either during CD-ROM drive activity with the host computer, or if the TEST switch is set to 1 for continuous audio mode. If the CD-ROM busy light is off, the CD-ROM drive is idle.
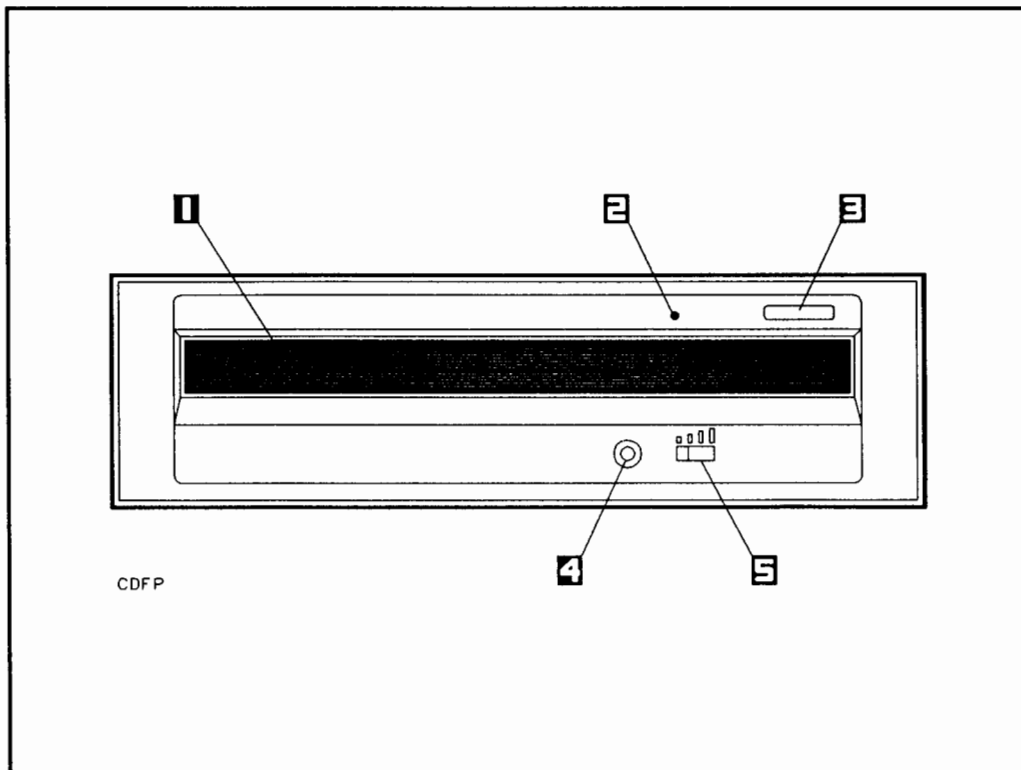
Figure 4-3. CD-ROM Drive Front Panel

1—Disk Port   4—Audio Headphone Jack

2—CD-ROM Busy Light   5—Volume Switch

3—Disk Eject Button

Table 4-3. CD-ROM Busy Light Status

Status	Explanations
ON	No disk detected (disk detection disabled by a defective CD-ROM disk) or disk insertion error detected or no disk in the disk port.
OFF	CD-ROM drive power failure or CD-ROM idle on SCSI bus.
FLASHING	Normal activity with the host or CD-ROM drive in continuous audio mode.

DDS-Format Tape Drive Power On

The front panel hardware consists of two bi-color (green/yellow) LEDs and an Unload button. The LEDs are green for normal status display and change to yellow to display fault information (see Figure 4-4).

Normal Operation DDS-format Tape Display

For status display, the two LEDs represent DRIVE status (lower LED) and CASSETTE status (upper LED) respectively. Each LED can be off, each can display a constant green or yellow, they can flash green at a variable rate, or they can pulse green (on for 0.25 seconds, off for 0.25 seconds). Table 4-4 shows the busy light activity during normal operation, and Table 4-5 shows the busy light activity during a fault condition.

DDS-format Cassette Handling Precautions

Only cassettes labeled **DDS** should be used in the DDS-format tape drive. *Never* use plain audio DAT cassettes in the tape drive, because the media is not certified. Also, plain DAT audio cassettes have a different mechanical specification, which can cause them to jam in the DDS-format tape mechanism.

The DDS-format tape drive has an autoloading mechanism. Cassettes should be inserted observing the following precautions:

1. To load the cassette, insert it into the slot in the front of the drive with the label uppermost. Apply *minimum* force when doing this.

2. Make sure the cassette is located squarely in the slot (not at an angle), and then press *gently* with one finger on the rear of the cassette. The autoloading mechanism will then take the cassette and load it into the drive.

Caution	▪ Do not hold the cassette with two fingers, either top and bottom or on the edges, when pushing in into the drive. This can restrain the cassette and cause it to jam.
	▪ Ensure that only *one* label is stuck to the label area of the cassette. Never use non-standard labels, and never stick anything to the cassette other than in the label area.

DDSFP
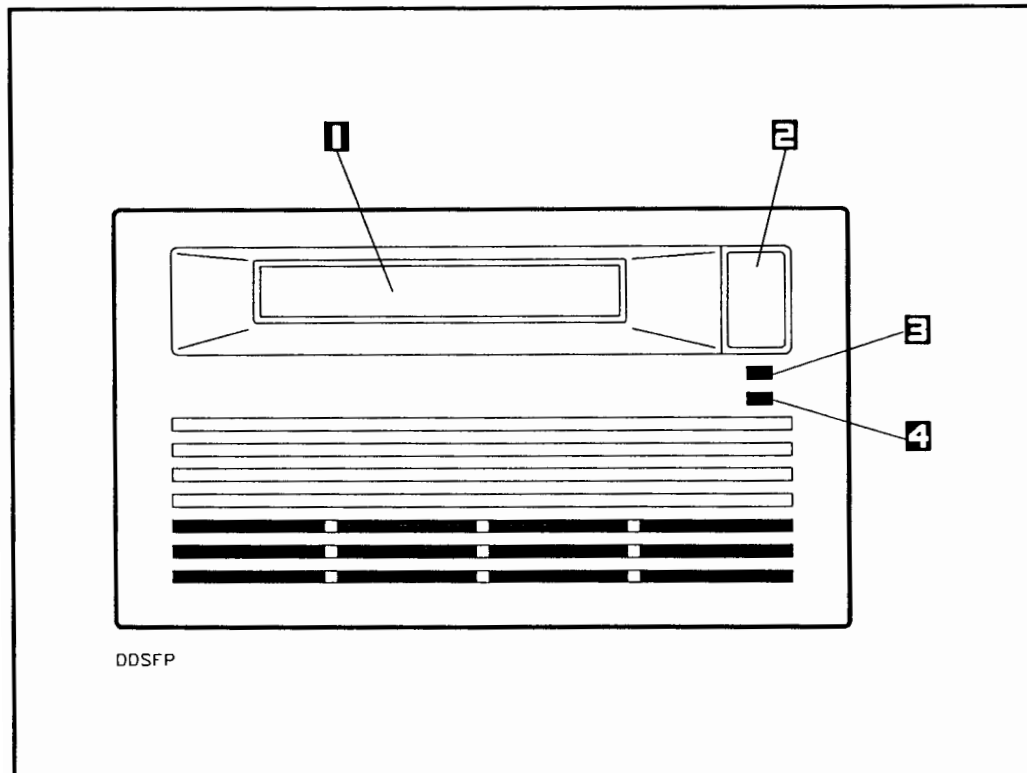
Figure 4-4. DDS-format Tape Drive Front Panel

1—Cassette Port   3—Cassette Busy Light

2—Cassette Eject Button   4—Drive Busy Light

Table 4-4.
DDS-format Tape Drive Busy Light Status In Normal Operation

Cassette (Upper) Busy Light	Drive (Lower) Busy Light	Explanation
OFF	OFF	No cassette loaded or power not switched on.
GREEN (FLASHING)	GREEN (FLASHING)	Loading or unloading a write-enabled cassette.
YELLOW (FLASHING)	GREEN (FLASHING)	Loading or unloading a write-protected cassette.
GREEN	OFF	Write-enabled cassette loaded and drive on-line.
YELLOW	OFF	Write-protected cassette loaded and drive on-line.
GREEN	GREEN (FLASHING)	Write-enabled cassette loaded and activity with host.
YELLOW	GREEN (FLASHING)	Write-protected cassette loaded and activity with host.
OFF	GREEN (FLASHING)	No cassette loaded and activity with host.

Table 4-5.
DDS-format Tape Drive Busy Light Status During Fault Conditions

Cassette (Upper) Busy Light	Drive (Lower) Busy Light	Explanation
GREEN ON 4.5 s / OFF 0.5 s	GREEN or YELLOW	MEDIA WARNING (use Cleaning Cassette or replace tape)
YELLOW	YELLOW	High humidity.
YELLOW (FLASHING)	YELLOW	Drive failed.

If during normal operation of the drive, an excessive number of read-after-write (RAW) or third level error correction errors are detected, a media warning will be displayed. The CASSETTE status LED display of constant green will be replaced by alternating green for 4.5 seconds and off for 0.5 seconds. This status will be cleared by unloading the cassette.

If high humidity is detected by the drive then a warning will be displayed as indicated above. As soon as the DDS-format tape drive detects acceptable humidity levels, then the drive will once again respond to media-access commands.

DDS-format Tape Drive Diagnostic Display

The diagnostic firmware tests the drive electronics for functionality. If the diagnostic request came from the host via the SCSI interface, then the results are reported via the SCSI interface.

If the electronics are not functioning, the diagnostic firmware tries to isolate the non-functional area to a specific Field Replaceable Assembly (FRA).

Power-Cycling the DDS-format Tape Drive

If the DDS-format cassette is not ejected from the drive before cycling power, the tape will be put into the semi-loaded and threaded state when the drive is next powered on. A PREVENT MEDIA REMOVAL command sent before cycling power will be reset at power-on so that the cassette will now be ejected when an UNLOAD command is received.

Quarter-inch Cartridge Tape Drive Power On

When the tape drive power is switched on, it is ready for a tape to be inserted. Once a tape has been inserted and a select command has been received by the host computer, a light-emitting diode (LED) located on the front panel of the tape drive (see Figure 4-5) goes on. This LED, or busy light, stays on until the tape cartridge is rewound to the load point by a rewind command. The tape cartridge should only be removed when the LED is off.
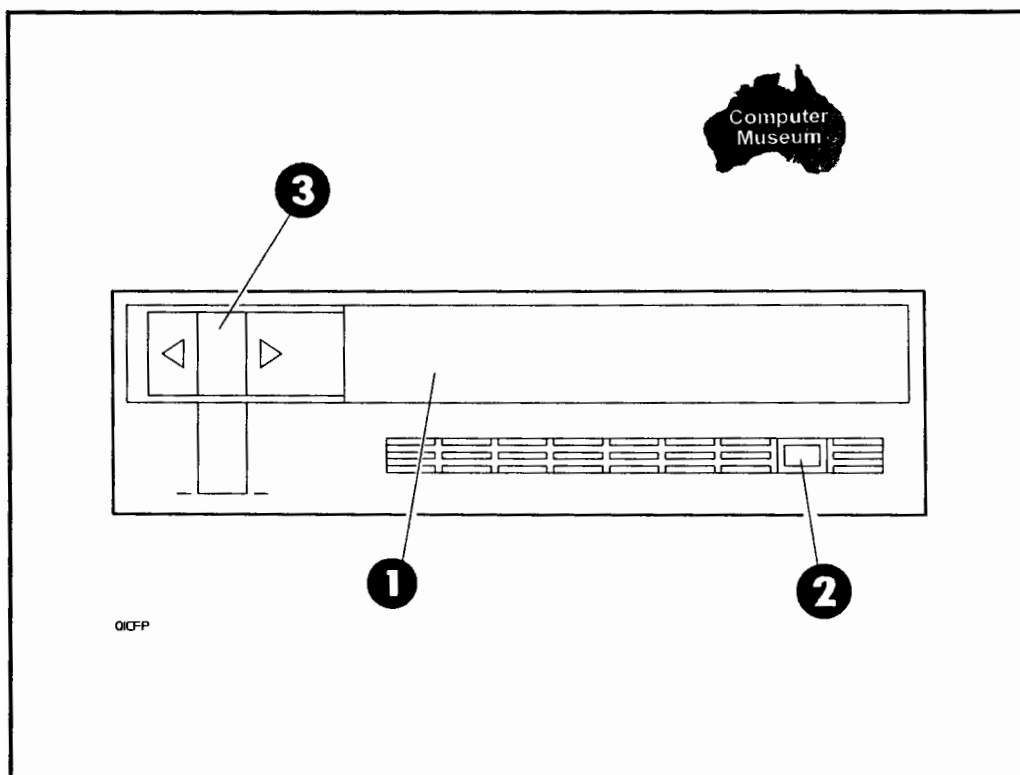
Figure 4-5. Cartridge Tape Drive Front Panel

1—Cartridge Port   2—Green Busy Light

3—Media Eject Lever

FRA Location and Layout

Caution	The field-replaceable assemblies (FRAs) in the mass storage system are electrostatic sensitive devices. Take appropriate precautions when removing an FRA from the mass storage system. Use of an anti-static pad and wrist strap is recommended. (These components are contained in the anti-static workstation, part no. 9300-0749.) Immediately after removal, store the FRA in an anti-static, conductive plastic bag.

- Figure 4-6 shows the location of the slots and power supply within the mass storage system chassis.

- Figure 4-7 shows the BEND/flex cable.

- Figure 4-8 shows the cable connections for the hard disk drive.

- Figure 4-9 shows the cable connections for the rewritable optical disk drive.

- Figure 4-10 shows the cable connections for the rewritable optical disk controller PCA.

- Figure 4-11 shows the cable connections for the CD-ROM drive.

- Figure 4-12 shows the cable connections for the DDS-format tape drive.

- Figure 4-13 shows the cable connections for the quarter-inch cartridge tape drive.

- Figure 4-14 and Figure 4-15 show the and cabling, connectors, and pinouts for the power supply.

BEND/flex Cable

Option/Address Connector

The Option/Address connector, located on the hard drive disk controller PCA
(see Figure 4-8), is a 7 pin-set connector used to establish the options and
select the SCSI address. The mass storage system is shipped from the factory
with a BEND/flex cable that connects these pins to the rear panel for selecting
hard disk drive addresses.

Synchronous Data Transfer Request (SDTR)

When pin-set 2 is shorted (binary 1) the drive will initiate an SDTR message
at power on and RESET. When open (binary 0), the drive will not initiate
an SDTR message. The drive will respond to a host-initiated SDTR message
whether this pin-set is open or shorted.

Parity Option Setting

When pin-set 3 is shorted (binary 1), the disk drive checks parity on commands
and data. When open (binary 0), the disk drive does not check for parity.
Parity bits are generated whether this pin-set is open or shorted.

Auto Spin Up Option

When pin-set 4 is shorted (binary 1), the hard disk drive will automatically
spin up at power on. If open (binary 0), the drive will not spin up until the
Intiator sends a Start Unit command. When not in the auto spin up mode the
drive will return "Not Ready" to all commands except REQUEST SENSE,
INQUIRY, RESERVE, RELEASE, and START UNIT until the drive is ready
for access.

Hard Disk Address Pins

Pin-sets 5, 6, and 7 select the disk drive SCSI address. The SCSI address is set
via the BEND/flex cable at the rear panel of the mass storage system. The
selection patterns are shown in chapter 2.

SCSI Connector

An unshielded 50-pin SCSI connector is located on the rear of disk controller PCA (see Figure 4-8). Table 4-6 shows each pin on the SCSI connector.

DC Power Connector

The dc power connector on the rear of disk controller PCA provides connection for dc power used by the hard disk drive. The pin assignments for the dc power supply are shown in Figure 4-15.

SCSI Termination

When installing multiple drives on a SCSI channel, the last device in the chain must have a single-ended SCSI terminator installed.

Table 4-6. SCSI Connector Pin Assignments

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
2	-DATA BIT 0	20	GROUND	36	-BSY
4	-DATA BIT 1	22	GROUND	38	-ACK
6	-DATA BIT 2	24	GROUND	40	-RST
8	-DATA BIT 3	26	TERMPWR	42	-MSG
10	-DATA BIT 4	28	GROUND	44	-SEL
12	-DATA BIT 5	30	GROUND	46	-C/D
14	-DATA BIT 6	32	-ATN	48	-REQ
16	-DATA BIT 7	34	GROUND	50	-I/O
18	-DATA BIT P				

Notes:
1. All odd numbered pins, except pin 25, must be connected to ground. Pin 25 should be left open.
2. Pin 26 is reserved for terminator resistor power source.

HDCHASS
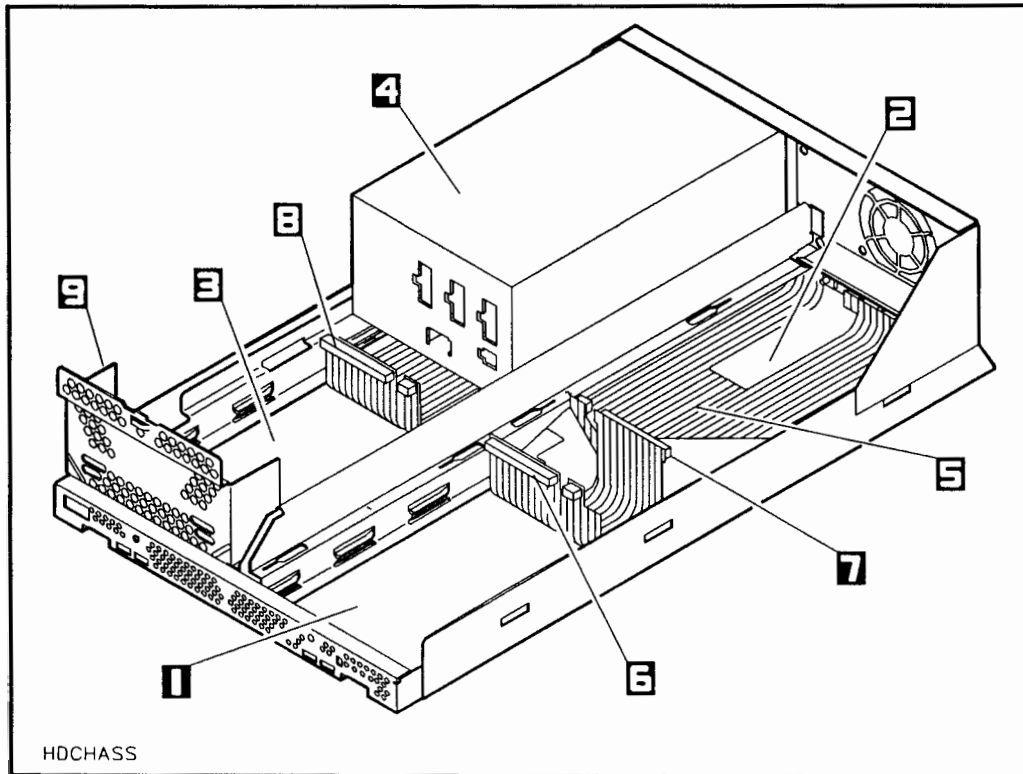
Figure 4-6. Mass Storage System Chassis Slot Locations

1—Slot 1	6—Slot 1 BEND/flex Connector
2—Slot 2	7—Slot 2 BEND/flex Connector
3—Slot 3	8—Slot 3 BEND/flex Connector
4—Power Supply	9—RFI Bracket
5—BEND/flex Cable	
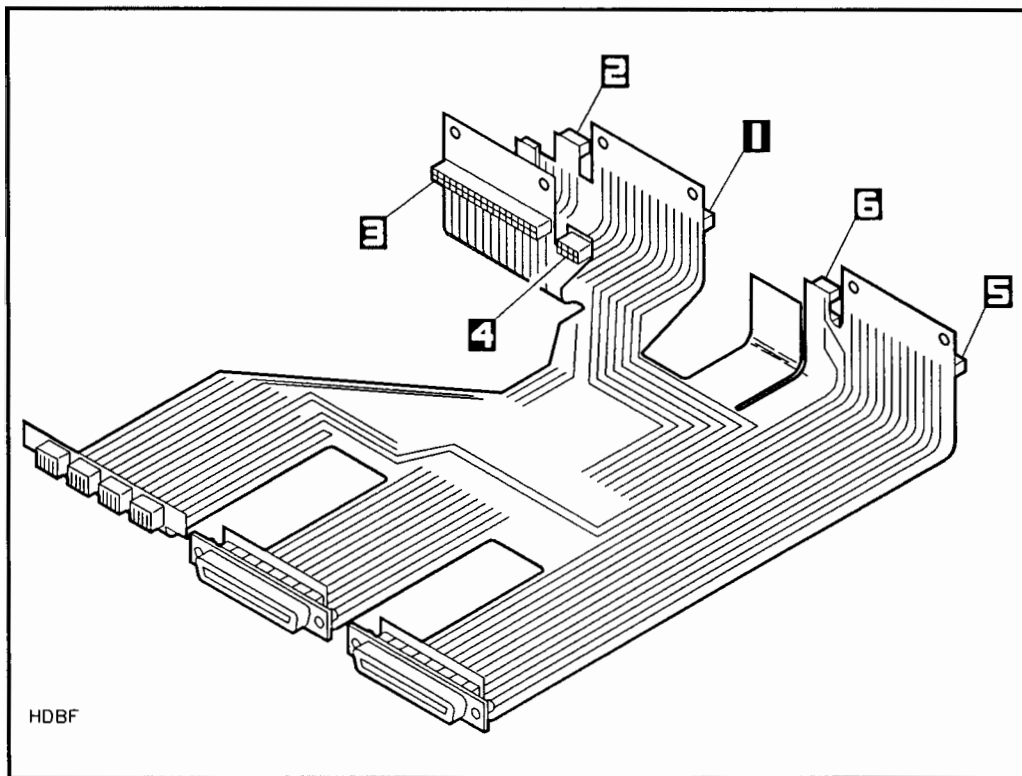
Figure 4-7. BEND/flex Cable Connectors

1—Slot 1 SCSI Connector   4—Slot 2 Address Connector

2—Slot 1 Address Connector   5—Slot 3 SCSI Connector

3—Slot 2 SCSI Connector   6—Slot 3 Address
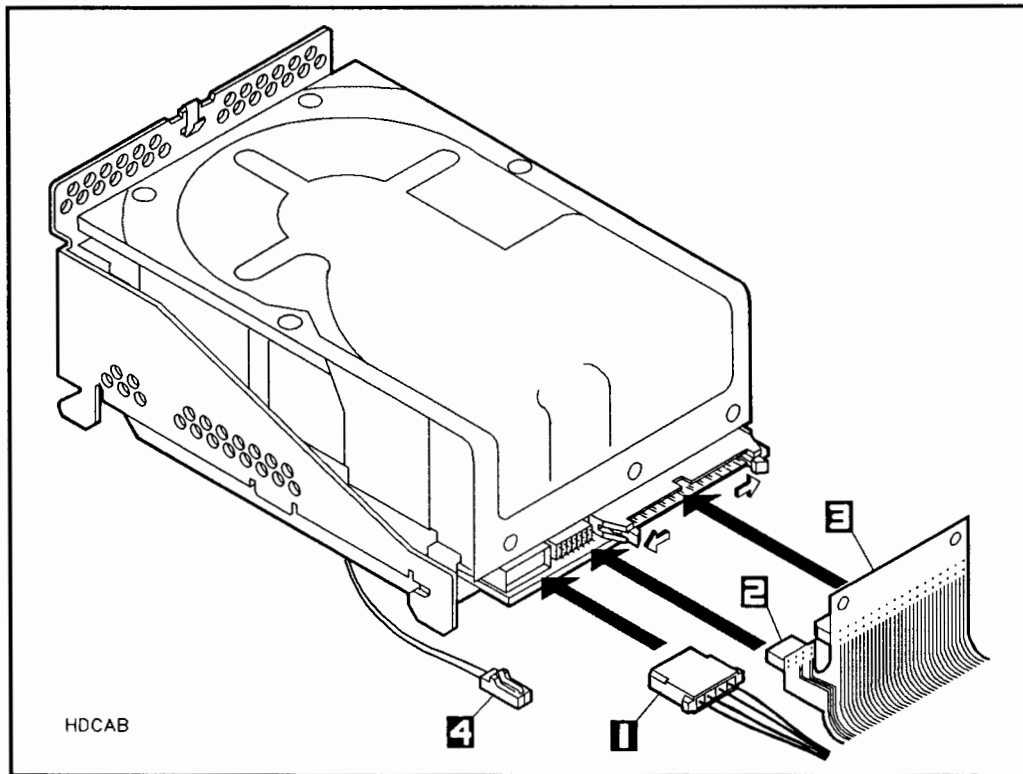
Figure 4-8. Hard Disk Drive Cabling

1—DC Power Cable   3—BEND/flex SCSI Cable

2—BEND/flex Option/Address Cable   4—Status Indicator Cable
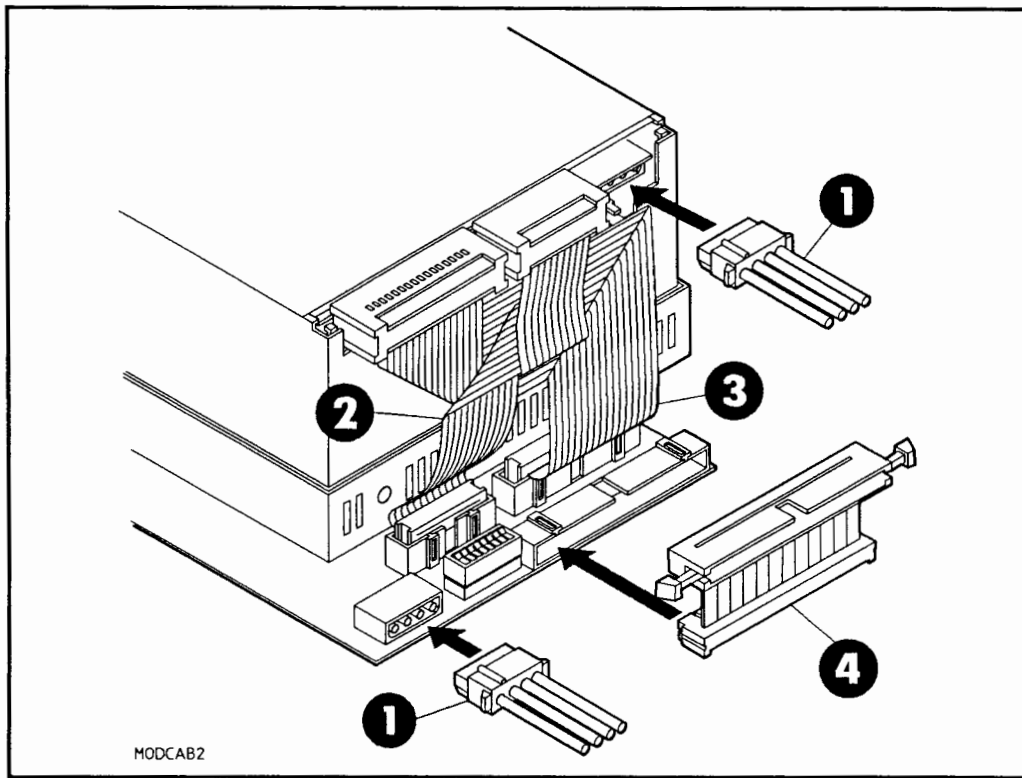
Figure 4-9. Rewritable Optical Disk Drive Cabling

1—DC Power Cable   3—Control Cable

2—Data Cable   4—BEND/flex Cable Adapter
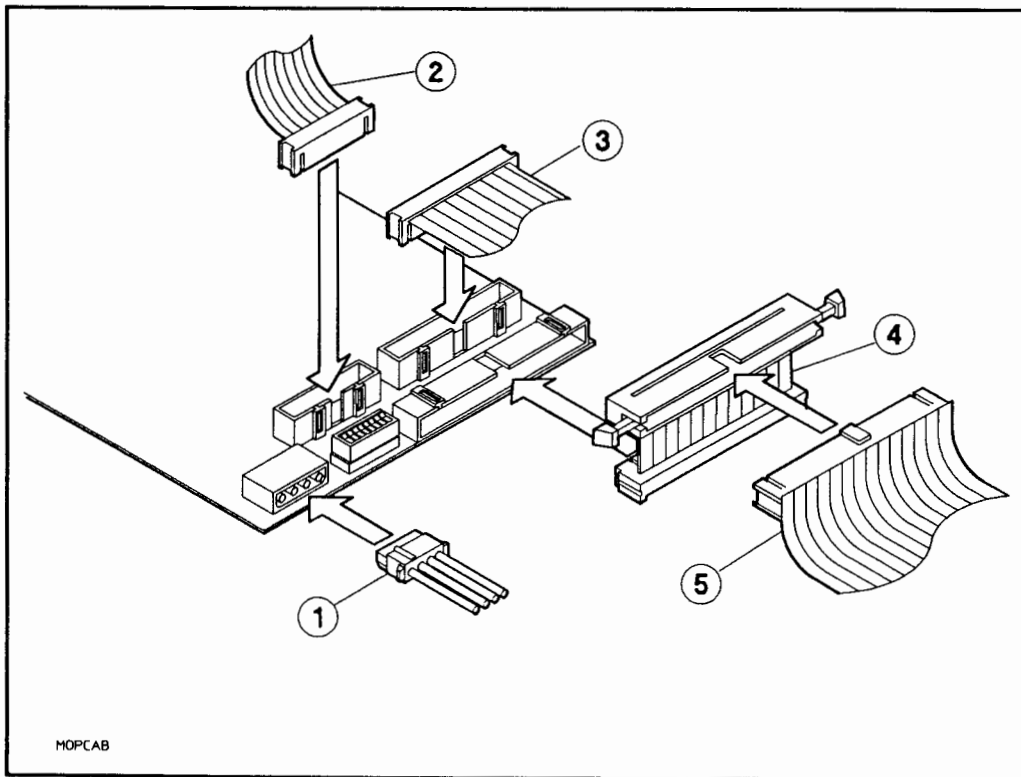
Figure 4-10. Rewritable Optical Controller PCA Cabling

1—DC Power Cable   4—BEND/flex Cable Adapter

2—Data Cable   5—BEND/flex Cable

3—Control Cable
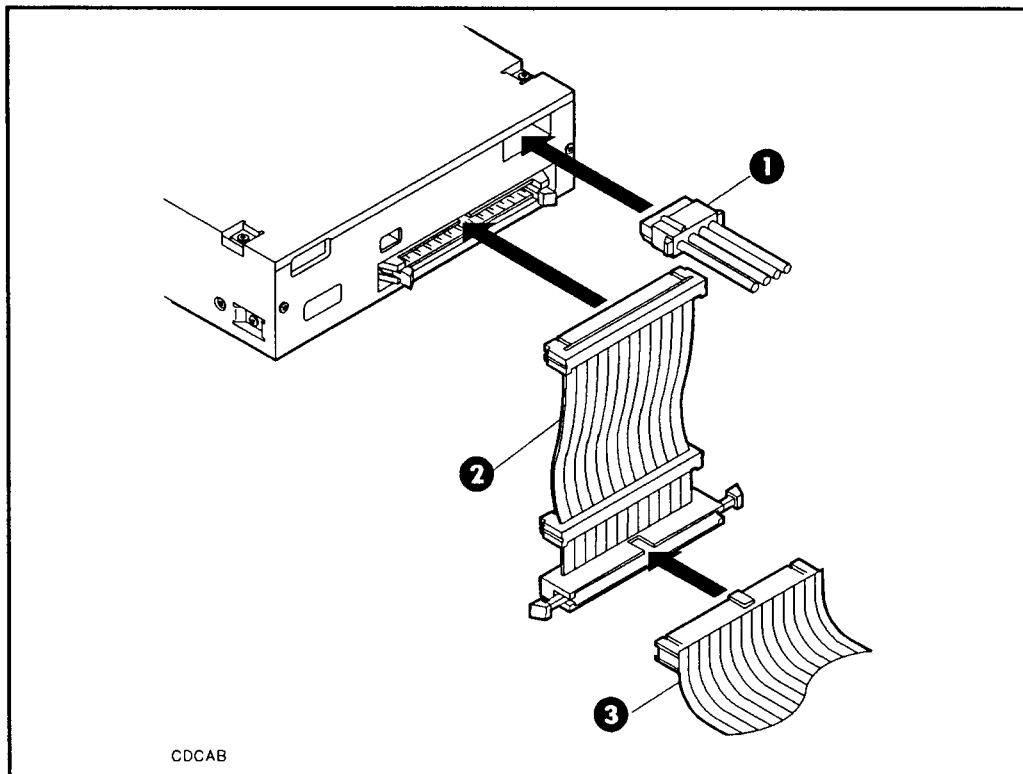
Figure 4-11. Connecting Cables to a CD-ROM Drive

1—DC Dual Power Cable

2—BEND/flex Cable Adapter

3—BEND/flex Cable
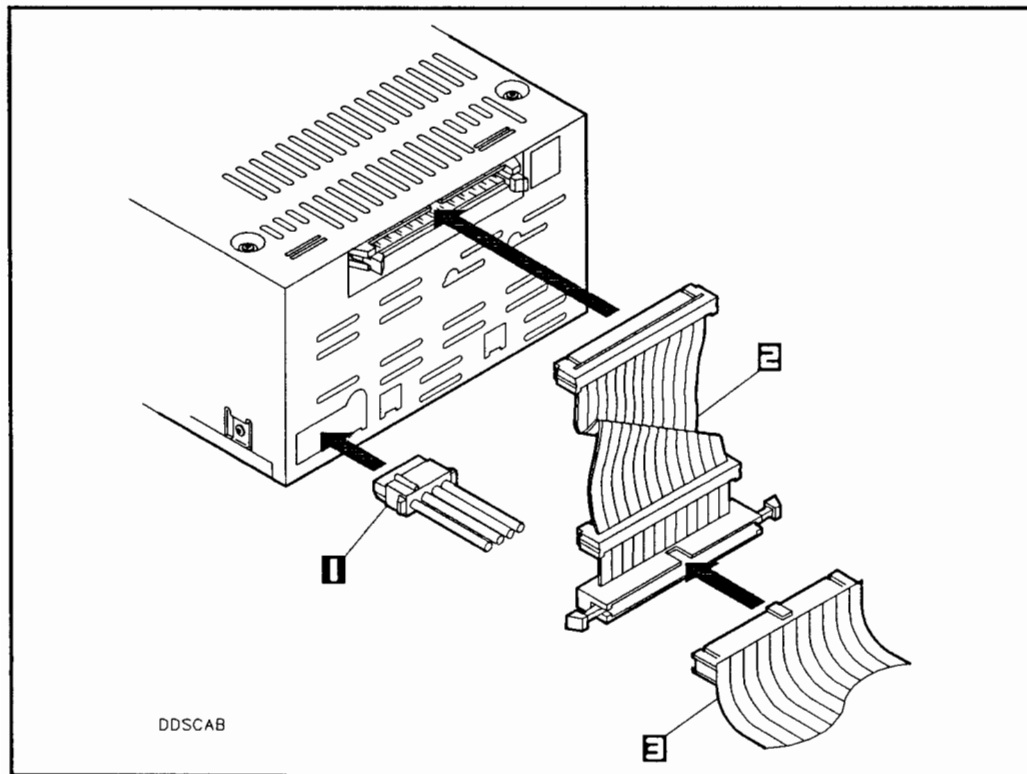
Figure 4-12. DDS-format Tape Drive Cabling

1—DC Power Cable   3—BEND/flex Cable

2—BEND/flex Cable Adapter
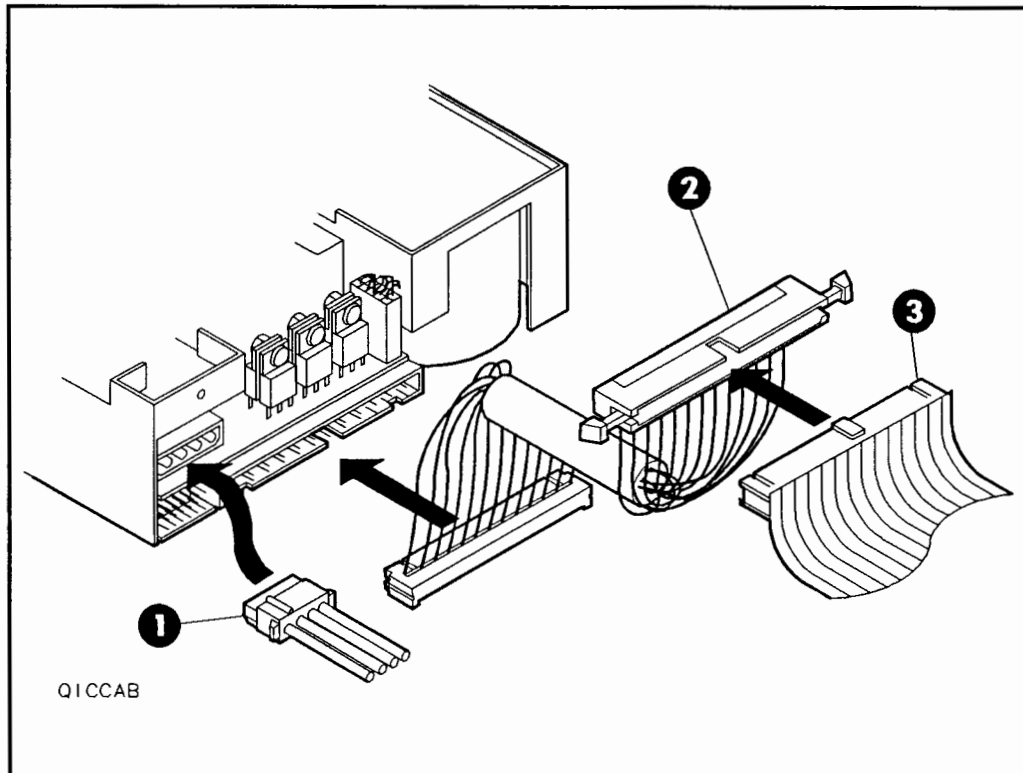
Figure 4-13. Quarter-inch Cartridge Tape Drive Cabling

1—DC Power Cable   3—BEND/flex Cable

2—BEND/flex Cable Adapter

Power Supply Voltage

Warning	With ac power applied, hazardous voltages are present within the power supply.

All power supply voltages can be measured at any of the power cable connectors on the side of the power supply.

Power Cables

It is important to install the proper length power cable for each slot and SCSI device type. The right-front slot, or slot 1, uses a long power cable for hard disk drives, quarter-inch cartridge tape drives, and DDS-format tape drives, or a dual power cable for the rewritable optical disk drive (the dual power cables only come in one length). For the right-rear slot, or slot 2, the hard disk drive uses a short power cable. The left-front slot, or slot 3, uses a short power cable for hard disk drives, quarter-inch cartridge tape drives, and DDS-format tape drives, or a dual power cable for either one or two CD-ROM drives. The power supply connectors are shown in Figure 4-14. Pinouts and proper dc voltages are shown in Figure 4-15.

Note	The power supply will NOT operate unless the external cooling fan is plugged into the 4-pin connector on the power supply and the fan is functioning.
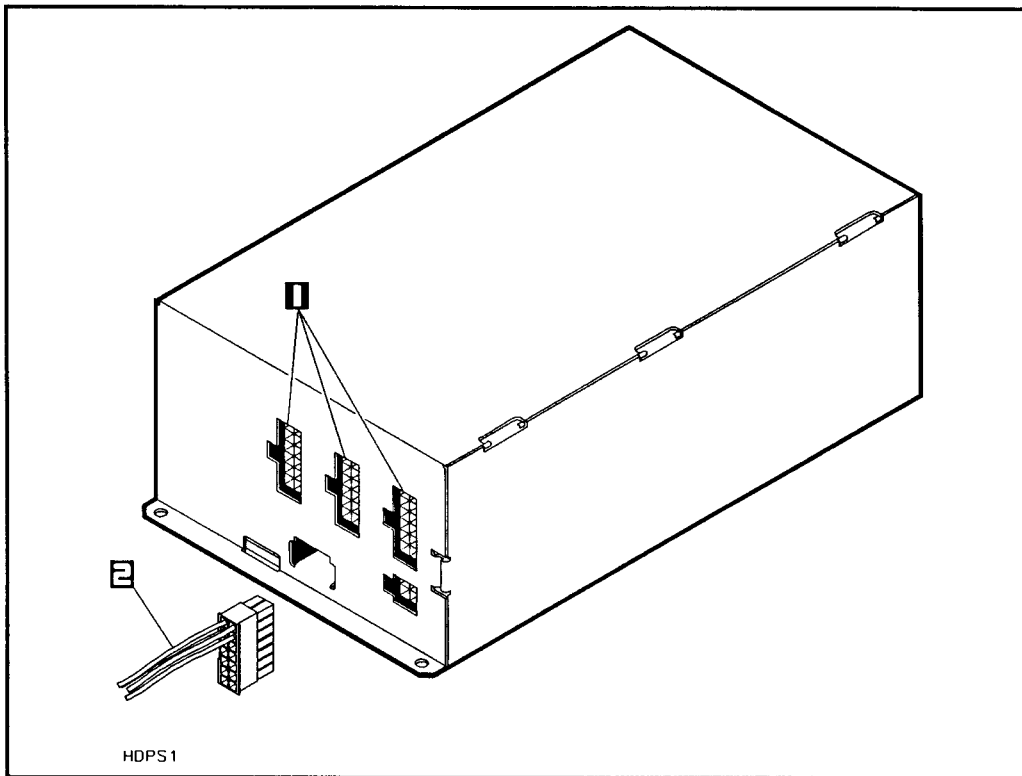
Figure 4-14. Power Supply Cabling

1—DC Power Connectors   2—DC Power Cable

POWER
SUPPLY

+12V [8] [1] GND
+5V [9] [2] GND
+5V [10] [3] GND
RESET [11] [4] N/C
N/C [12] [5] N/C
N/C [13] [6] N/C
-12V [14] [7] N/C

Fan Cable (B1)

Voltage	Maximum	Minimum
+5.0V	5.15V	4.85V
+12.0	12.6	11.4

CEPOWER
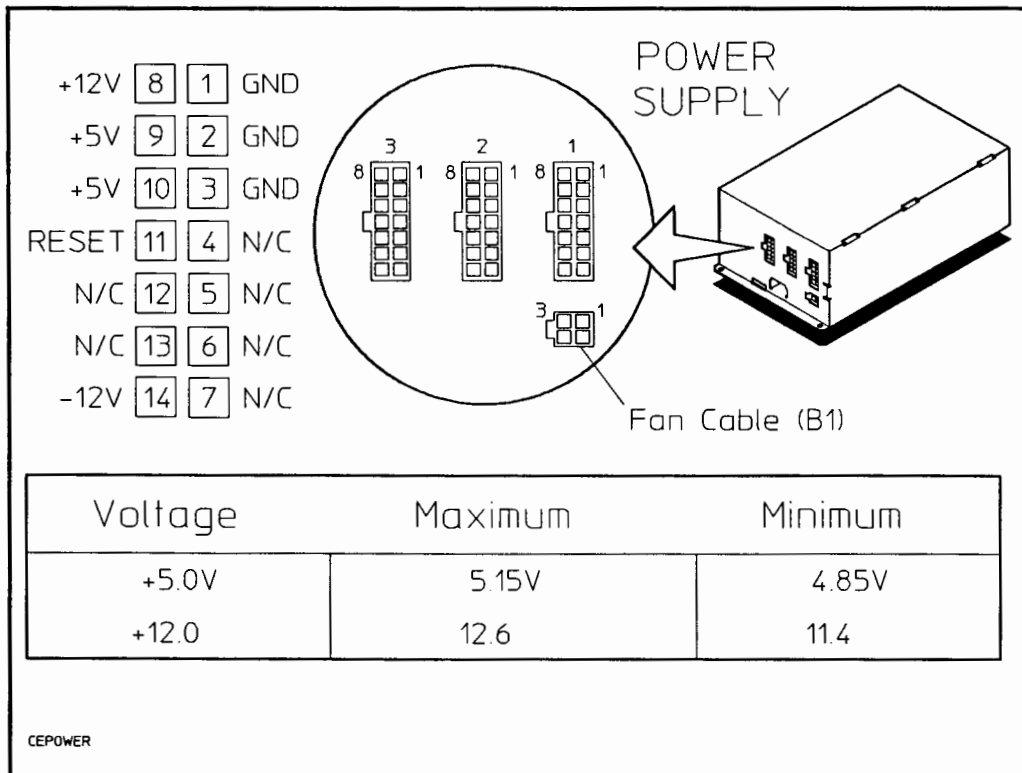
Figure 4-15. Power Supply Connector Pinouts

Note   Only pins 1, 2, 8, and 9 are used on each power supply
               connector. Voltages are present on some of the other pins (3-7
               and 10-14), but they are not used by the mass storage system.

5

Diagnostics

This chapter provides diagnostic information for devices included in the HP Series 6000 Mass Storage System. The purpose of this chapter is to provide information to diagnose those devices to the level of field-replaceable units.

Diagnostics are broadly classified as either "on-line" or "off-line." This chapter focuses primarily on "off-line" diagnostics, which are used to communicate with the mass storage system using the HP Portable PLUS computer instead of the host computer. A brief reference to "on-line" diagnostics is also provided. On-line diagnostics are available to any SPU platform with drivers that support "Sherlock On-line Diagnostics for SCSI." Consult the appropriate systems division for driver information.

Note	Some error codes in this chapter provide information which aids diagnosis below the level of field-replaceable units. Such information is provided *only* as a means of identifying specific failure modes. Information on specific failure modes may be useful when diagnosing some types of failures, and may aid in establishing a data base for those failures.

Required Documentation

The following documentation is required to test the HP 6000 Series Mass Storage System with the HP Portable PLUS Computer:

■ *Using Mass Storage System Diagnostics with the HP-IL Interface*, part number 5960-0163

The following documentation is required to test the HP 6000 Series Mass Storage System with the Domain Diagnostics:

■ *Using Domain Diagnostics*, part number D-9329-0

Diagnostic Programs

Note

The diagnostic programs listed below cannot be ordered by part number. The part numbers are provided *only* to aid in reporting defects in the diagnostic programs.

The following off-line diagnostic programs are used to test the HP 6000 Series Mass Storage System with the HP Portable PLUS Computer:

■ The SCSIDISK diagnostic program, part number 5010-0568S, is used to test the hard disk drive.

■ The DDSDIAG diagnostic program, part number C1511-90931, is used to test the DDS-format tape drive.

■ The SCSIMO diagnostic program, part number 5010-0570S, is used to test the rewritable optical disk drive.

■ The SCSICD diagnostic program, part number 5010-0571S, is used to test the CD-ROM drive.

The following on-line diagnostic program is used to test the HP 6000 Series Mass Storage System with the Domain Operating System:

■ The Storage Subsystem Test (SST) program, as described in *Using Domain Diagnostics*, part number D-9329-0.

Equipment Required

The following equipment is required to test mass storage system devices with mass storage diagnostic programs:

■ HP Portable PLUS Computer

■ HP Series 82241 AC Adapter

■ HP-IL/SCSI Interface Assembly, part number 5061-3066 (includes the HP-IL/SCSI Interface, the Field Service SCSI Cable, and the *Using Mass Storage Diagnostics with the HP-IL Interface* manual)

■ SCSI Terminator, part number 1252-2297

■ HP 82167B HP-IL Cables

■ HP-IL Printer (optional)

Note	If you are using the HP 150, you need to install the following:
	■ HP 45643A HP-IL/Parallel Card for HP 150
	■ HP Series 100 Extended I/O Applications, part number 45643-13001

Note	If you are using the HP Vectra PC, you need to install the following:
	■ HP 82973A HP-IL Interface Card for HP Vectra PC
	■ HP 82973A HP-IL Interface Software for HP Vectra PC, Rev. E, part number 82973-12005

Ordering Diagnostics

To obtain the "off-line" diagnostics, send an HPDESK message to DSSDISK. An automatic reply will be sent that contains all of the available off-line diagnostics.

Self-test Diagnostics

Hard Disk Drive Diagnostic Tests

The following sequence is performed during a power-on self-test, or when the DIAGNOSTIC command is executed using the off-line SCSIDISK Diagnostic Program:

1. Microprocessor Test
2. ROM Checksum
3. Microprocessor RAM Test
4. Buffer RAM Test
5. SCSI Interface Test
6. Internal Data Path Test
7. Data Controller Test
8. ECC Verification Test
9. Initialize Controller
10. Initialize Spare Table
11. Initialize Log
12. Initialize Saved Pages Information
13. Read/Write Access Test on each head

DDS-format Tape Drive Diagnostic Tests

The following sequence is performed during a power-on self-test, or when the DIAGNOSTIC command is executed using the off-line DDSDIAG Diagnostic Program:

1. Microprocessor Test
2. ROM Checksum
3. Non-Destructive RAM Test

  4. C3 ECC IC Test
  5. Sub-Area Microprocessor Test
  6. Mechanism Test
  7. Front Panel Check
  8. MD Connectivity Test
  9. Static Test
10. Recognition Switch Test
11. Voltage Test
12. Thread/Unthread Test
13. Reel Test
14. Drum Test
15. Capstan Test
16. Buffer Register Test
17. Buffer Function Test
18. Buffer RAM Test
19. SCSI Controller Test
20. SCSI Controller Loopback Test
21. Dual-Port RAM On-board Test
22. Dual-Port RAM Off-board Test
23. Interface-initiated Loopback Test
24. Buffer-initiated Loopback Test

Rewritable Optical Disk Drive Diagnostic Tests

The following sequence is performed during a power-on self-test, or when the DIAGNOSTIC command is executed using the off-line SCSIMO Diagnostic Program:

1. PROM Checksum Test
2. Host Interface Controller Chip Test
3. Drive Interface Controller Chip Test
4. ECC Chip Test
5. Buffer RAM Test
6. Disk Erase/Write/Read Test

CD-ROM Drive Diagnostic Tests

When the CD-ROM drive is powered on or when the DIAGNOSTIC command is executed using the off-line SCSICD Diagnostic Program, a self-test sequence is performed which includes the following two tests:

1. Buffer RAM Write/Read Test
2. CD-ROM Header Read Test

Quarter-inch Cartridge Tape Drive Diagnostic Tests

The quarter-inch cartridge tape drive is only supported on the Domain Operating System. No off-line diagnostic is available from Disk Storage Systems for this product. Consult the Apollo Systems documentation, "Using Domain Diagnostics" part number D-9329-0, for information about the Domain Operating System, and consult the host computer documentation for the supported SPUs. References to DEX, VMTEST, SAX, SST, or the Mnemonic Debugger may be useful as substitutes to a formal "off-line" diagnostic.

Hard Disk Drive Off-line Diagnostic Information

The following paragraphs provide information on the hard disk drive power-on self-test, logs, and Extended Sense data returned by the REQUEST SENSE command.

Power-on Self-test

When the mass storage system power is switched on, the hard disk drive automatically performs a self-test. The power-on self-test is also performed when the DIAGNOSTIC command is executed using the SCSIDISK diagnostic program. Refer to Chapter 4 for information on the status of the hard disk status indicator when the self-test passes or fails. When the self-test fails, the hard disk drive returns failure information to the Initiator via the REQUEST SENSE command.

Logs

The ACCESS LOGS command returns the contents of the Usage Log, the Data Error Log, and the Hardware Error Log. These logs are maintained in two locations: on the disk media, and in controller RAM. The controller RAM is initialized from the disk at power-on or following a reset. During disk drive operation, the controller RAM is continually updated. The contents of the controller RAM are only posted to the disk when an error entry is added. The ACCESS LOGS command always returns the contents of the controller RAM.

Usage Log

The Usage Log includes the following fields: Area, Access Count, Blocks Accessed, First Retry Count, Multiple Retry Count.

The Area field indicates which part of the hard disk media the Data Error Log is reporting on.

The Access Count field indicates the number of media accesses performed since the last data error occurred, or the last time the Usage Log was cleared. This field is reset to zero each time an entry is added to the Hardware Error Log. The total number of media accesses is equal to the Access Count of the Usage Log plus the Access Count of the Hardware Error Log. Table 5-2 lists the

access count ranges corresponding to the values that can be reported by the Access Count field.

The Blocks Accessed field indicates the number of blocks read from the hard disk drive.

The First Retry Count field indicates the number of times read retries were performed and data was recovered on the first retry.

The Multiple Retry Count field indicates the number of times data was not recovered on the first retry. This field is incremented only once per completed recovery.

Data Error Log

The Data Error Log includes the following fields: Logical Block Address, Error Type, Count, Error.

The Logical Block Address field contains the logical block address of a data block that encountered multiple read retries during one or more data error recovery attempts.

The Error Type field indicates the type of data error the block encountered (refer to Table 5-1).

The Count field is incremented each time a block is uncorrectable or requires multiple retries during a transaction. This field is incremented only once for each data recovery attempt.

The Error field contains encoded data error byte information (refer to Table 5-1).

Hardware Error Log

The Hardware Error Log includes the following fields: Logical Block Address, Internal Drive Status, Access Count.

The Logical Block Address field contains the logical block address of a data block that was being accessed when the error occurred.

The Internal Device Status field contains an error code corresponding to the Additional Sense Code field returned by the REQUEST SENSE command.

The Access Count field indicates the number of media accesses performed since the last data error or hardware error occurred, or the last time the Usage Log was cleared. The total number of media accesses is equal to the Access Count of the Usage Log plus the Access Count of the Hardware Error Log. Table 5-2 lists the access count ranges corresponding to the values that can be reported by the Access Count field.

Table 5-1. Hard Disk Drive Error Type and Error Byte

Error type:	
REC-E =	Recovered data with ECC
REC-R =	Recovered data with retrys
UNR =	Unrecoverable error
Error byte:	
1XXXXXXX =	Unclassifiable error
X1XXXXXX =	Error occurred in header field
XX1XXXXX =	Error occurred in data field
XXX1XXXX =	Unrecoverable data
XXXX1XXX =	Data recovered with ECC
XXXXX1XX =	Data recovered with retries
XXXXXX1X =	Write fault
XXXXXXX1 =	Reserved

Table 5-2. Hard Disk Drive Access Count Range Values

VALUE (HEX)	MINIMUM OF ACCESS RANGE	MAXIMUM OF ACCESS RANGE
0	No Accesses	No Accesses
1	1	1
2	2	10
3	11	100
4	101	1,000
5	1,001	10,000
6	10,001	100,000
7	100,001	500,000
8	500,001	1,000,000
9	1,000,001	5,000,000
A	5,000,001	10,000,000
B	10,000,001	50,000,000
C	50,000,001	100,000,000
D	100,000,001	500,000,000
E	500,000,001	1,000,000,000
F	1,000,000,001	>1,000,000,001

Extended Sense Data Fields

Table 5-3 shows the Extended Sense data fields returned by the REQUEST
SENSE command. The following paragraphs provide information for all
Extended Sense data fields except those fields which are unused. Unused fields
always contain zeros.

Note	The abbreviation "RES" in a field means the field is "Reserved".

Valid

A value of one for the Valid bit indicates the Information bytes contain valid
information. The significance of the Information bytes depends on the status of
the Sense Key field.

Error Class and Error Code

The only value returned by the Error Class and Error Code fields is 70h.

Sense Key

The Sense Key field indicates the type of error which occurred, and the
recovery action which should be taken by the Initiator (refer to Table 5-4).

Information

The Information fields contain the logical block address associated with the
Sense Key field.

Additional Sense Length

The Additional Sense Length field specifies the number of Additional Sense
bytes that will follow.

Additional Sense Code

The Additional Sense Code field provides additional information relative to the error condition reported in the Sense Key field (refer to Table 5-5). If the hard disk drive does not have further information, the Additional Sense Code field will contain zeros (00h).

Device Error Code

The Device Error Code fields provide error codes that indicate which subassembly caused an error or drive fault. The status of byte 18 indicates the contents of the bytes which follow. The specific error codes that appear in the Device Error Code fields are listed in the following three tables:

■ Table 5-6 lists error codes for the Head/Disk Assembly (HDA). This information may be returned with either the RECOVERED ERROR or HARDWARE ERROR Sense Keys.

■ Table 5-7 lists error codes for diagnostic failures. This information will normally be returned with a HARDWARE ERROR Sense Key after a Power-on, or a SEND DIAGNOSTIC command with self-test bit set.

■ Table 5-8 lists error codes returned by the Hard Disk Controller (HDC) chip. This information will normally be returned for RECOVERED ERROR or MEDIA ERROR Sense Keys.

Table 5-3.
Hard Disk Drive REQUEST SENSE Extended Data Format

BYTE	7	6	5	4	3	2	1	0
				BIT				
00	Valid	Error Class = 7			Error Code = 0			
01	Segment Number = 00h							
02	FM=0	EOM=0	ILI=0	RES=0	Sense Key			
03	Information (MSB)							
04	Information							
05	Information							
06	Information (LSB)							
07	Additional Sense Length = 14h							
08	Command-Specific Information = 00h							
09	Command-Specific Information = 00h							
10	Command-Specific Information = 00h							
11	Command-Specific Information = 00h							
12	Additional Sense Code							
13	Additional Sense Code Qualifier = 00h							
14	Field Replaceable Unit Code = 00h							
15	FPV=0	C/D=0	RES = 0		BPV=0	Bit Pointer = 0		
16	Field Pointer (MSB) = 00h							
17	Field Pointer (LSB) = 00h							
18	Device Error Code (First)							
19	Device Error Code							
20	Device Error Code							
21	Device Error Code (Last)							

Table 5-4. Hard Disk Drive Sense Key Codes

VALUE (HEX)	DESCRIPTION
0	NO SENSE. There is no specific sense key information to be reported for the designated logical unit.
1	RECOVERED ERROR. The last command completed successfully with some recovery action performed by the Target. Details may be determined by examining the Additional Sense Code bytes and the Information bytes.
2	NOT READY. The logical unit addressed cannot be accessed.
3	MEDIA ERROR. The command terminated with a nonrecoverable error condition that was probably caused by a flaw in the media or an error in the recorded data.
4	HARDWARE ERROR. The Target detected a nonrecoverable hardware failure (for example, controller failure, device failure, parity error, etc.) while performing the command or during a self-test.
5	ILLEGAL REQUEST. There was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands.
6	UNIT ATTENTION. The Target has been reset or there has been a power-on.
B	ABORTED COMMAND. The Target aborted the command due to Initiator request/action.
E	MISCOMPARE. Data in buffer may have been corrupted between READ BUFFER and WRITE BUFFER commands, or a MISCOMPARE occurred during a VERIFY (with BYTCK) enabled.

Table 5-5. Hard Disk Drive Additional Sense Codes

VALUE (HEX)	DESCRIPTION
00	No additional sense information.
01	No Index/Sector signal.
02	No Seek Complete.
03	Write fault.
04	Drive not ready.
08	Logical Unit communication failure.
10	ID CRC or ECC error.
11	Unrecovered Read error on data blocks.
14	No record found.
15	Seek positioning error.
17	Recovered Read data with Target read retries (not with ECC).
18	Recovered Read data with Target's ECC correction (not with retries).
19	Defect List error.
1A	Parameter Overrun.
1B	Synchronous Transfer error.
1D	Compare error.
20	Invalid command operation code.
21	Illegal logical block address (LBA). Address greater than the maximum LBA returned by the READ CAPACITY data with PMI not set.

Table 5-5. Hard Disk Drive Additional Sense Codes (continued)

VALUE (HEX)	DESCRIPTION
24	Illegal field in CDB.
25	Invalid LUN.
26	Invalid field in Parameter List.
27	Write-protected.
29	Power-on or Reset or Bus Device Reset occurred.
2A	Mode Select parameters changed.
31	Media format corrupted.
32	No defect spare location available.
33	Spare operation failed.
40	RAM failure.
41	Data path diagnostic failure.
42	Power-on diagnostic failure.
43	Message Reject error.
44	Internal controller error.
45	Select/Reselect failed.
46	Unsuccessful soft reset.
47	SCSI Interface parity error.
48	Initiator detected error.
49	Inappropriate/Illegal Message.

If the first byte of the Device Error Code field (byte 18) is in the range 00h through 3Fh then the device error bytes contain HDA status information. This information may be returned with either RECOVERED ERROR or HARDWARE ERROR sense keys and is defined in Table 5-6.

Table 5-6.
Hard Disk Drive Device Error Codes, Byte 18 = 00h–3Fh

Byte	Explanation
18	Bit 1 - Spindle motor stopped Bit 0 - Reset condition exists
19	Bit 7 - Command data parity fault Bit 6 - Interface fault Bit 5 - Invalid command fault Bit 4 - Seek fault Bit 3 - Write gate with track offset fault Bit 2 - Extended status available (refer to byte 21) Bit 1 - Write fault Bit 0 - zero
20	00h

Table 5-6.
Hard Disk Drive Device Error Codes, Byte 18 = 00h–3Fh
(continued)

Byte	Explanation
21	00h (except when byte 19 bit 2=1)
	01h = Spindle will not start
	02h = Spindle spinning but not at speed
	03h = Spindle at speed but no lock
	04h = Command interface timeout
	05h = Write while unsafe
	06h = Write while offtrack
	07h = Write while offspeed
	08h = Write when 2 STPs missing
	09h = Not used
	0Ah = Not used
	0Bh = Not used
	0Ch = Not used
	0Dh = Write while illegal head selected
	0Eh = Not used
	0Fh = Not used
	10h = Status Timeout
	11h = Target cylinder exceeds maximum
	12h = Wrong mode fault
	13h = Consecutive sectors skipped
	14h = Servo timeout for Gray code validation
	15h = Servo fine settle fault
	16h = Servo gross settle fault
	17h = Servo interrupt timeout
	18h = Seek while servo shut down
	19h = Write while protected (probably aggressive seek related)
	1Ah = Write while protected (probably offtrack)
	1Bh = Possible stuck latch (on power on)
	1Ch = Write while offtrack (aggressive seek related)
	1Dh = Write while offtrack (not seek related)
	1Eh = Unable to read Gray code

If the first byte of the Device Error Code field (byte 18) is in the range of 40h through 5Fh then the device error bytes contain diagnostic failure result information. These codes will normally be returned with a HARDWARE ERROR sense key after power on or a Send Diagnostic command. The device error information is defined in Table 5-7.

Table 5-7.
Hard Disk Drive Device Error Codes, Byte 18 = 40h–5Fh

Byte	Explanation	
18/19	If byte 18 value is:	41h = Microprocessor failure,
	Then byte 19 values are:	11h = Data register failure
		12h = Data register fade failure
		21h = Address register failure
		22h = Address register fade failure
		31h = Condition code failure
		32h = Addressing mode failure
18/19	If byte 18 value is:	42h = Microprocessor RAM failure,
	Then byte 19 values are:	11h = RAM failed walking 0's test
		12h = RAM failed walking 1's test
		20h = RAM failed marching test
		30h = RAM failed complement test
		40h = RAM failed address test
18/19	If byte 18 value is:	43h = ROM checksum failure,
	Then byte 19 values are:	00h

Table 5-7.
Hard Disk Drive Device Error Codes, Byte 18 = 40h-5Fh
(continued)

Byte	Explanation	
18/19	If byte 18 value is:	44h = SCSI interface chip failure,
	Then byte 19 values are:	30h = failed RAM test
		50h = failed register test
		51h = failed command test
		52h = failed message out test
		53h = failed message in test
		54h = functional failure
		55h = failed status test
		56h = failed data path test
18/19	If byte 18 value is:	45h = Buffer RAM failure,
	Then byte 19 values are:	11h = RAM failed walking 0's test
		12h = RAM failed walking 1's test
		20h = RAM failed marching test
		30h = RAM failed complement test
		40h = RAM failed address test
18/19	If byte 18 value is:	46h = HDC chip failure,
	Then byte 19 values are:	60h = HDC failed register test
18/19	If byte 18 value is:	47h = Write/Read failure,
	Then byte 19 values are:	00h-7Fh = defined as same as additional sense code
		81h = Buffer compare error
20-21	00h	

If the first byte of the Device Error Code field (byte 18) is in the range of 80h through FFh then the error information returned is from the Hard Disk Controller (HDC) chip. This information will normally be returned for RECOVERED ERROR or MEDIUM ERROR sense keys. The device error bytes contain the following information:

Table 5-8.
Hard Disk Drive Device Error Codes, Byte 18 = 80h–FFh

Byte	Explanation
18	Bit 7 - Error detected Bit 6 - Correction cycle active Bit 5 - Local command busy Bit 4 - Remote command busy Bit 3 - Local request Bit 2 - Header match complete Bit 1 - Next disk command Bit 0 - (Ignore)
19	Bit 7 - Late interlock Bit 6 - Correction failed Bit 5 - FIFO data lost Bit 4 - No data synch Bit 3 - Sector overrun Bit 2 - Sector not found Bit 1 - Data field error Bit 0 - Header failed although sector matched
20	00h
21	Number of retries attempted

DDS-format Tape Drive Off-line Diagnostic Information

The following paragraphs provide information on the DDS-format tape drive power-on self-test, logs, and Extended Sense data returned by the REQUEST SENSE command.

Power-on Self-test

When the mass storage system power is switched on, the DDS-format tape drive automatically performs a self-test. The power-on self-test is also performed when the DIAGNOSTIC command is executed using the DDSDIAG diagnostic program. Refer to Chapter 4 for information on the status of the cassette busy light and the drive busy light when the self-test passes or fails. When the self-test fails, the DDS-format tape drive returns failure information to the Initiator via the REQUEST SENSE command.

Logs

The READ LOG command returns the contents of the Fault Log, Error Rate Log, and Tape Log.

Fault Log

The Fault Log contains information about hardware faults since the Fault Log was last cleared. The Fault Log is located in buffer RAM and is *not* transferred to the tape. The Fault Log is cleared when the DDS-format tape drive power is cycled or reset, or when the CLEAR LOGS command is executed. The Fault Log has a maximum limit of 30 entries, and operates on a first-in-first-out (FIFO) basis.

Error Rate Log

The Error Rate Log contains information about the types and counts of errors that have occurred on the tape during the current tape load or since the Error Rate Log was last cleared. The Error Rate Log is cleared when the DDS-format tape drive power is cycled or reset, when the CLEAR LOGS command is executed, or as an option when initiating an error rate test. The log is not saved on the tape when the tape is unloaded.

Tape Log

The Tape Log contains information about the number of groups read, written, and retried for the current tape load and the last (previous) tape load. The Tape Log also contains the totals since the tape was initialized, including the current load. The Tape Log cannot be cleared. It is copied to RAM when the tape is loaded, updated in RAM during the load, then copied back to the tape during the unload sequence. This means that if the drive is power-cycled with the tape loaded, the "current" information is lost.

Extended Sense Data Fields

Table 5-10 shows the Extended Sense data fields returned by the REQUEST SENSE command. The following paragraphs provide information for all Extended Sense data fields except those fields which are unused. Unused fields always contain zeros.

Note   The abbreviation "RES" in a field means the field is
                   "Reserved".

Valid

A value of one for the Valid bit indicates the Information bytes contain valid information. The significance of the Information bytes depends on the status of the Sense Key field.

Error Code

The only two values which will be returned by the Error Code field are 70h and 71h. A value of 70h in the Error Code field indicates an error occurred that was associated with the last command received. A value of 71h indicates an error occurred that was associated with a previous command received.

Segment Number

The Segment Number field contains the number of the current segment descriptor if the REQUEST SENSE command is in response to a COPY command. Otherwise, the Segment Number field contains zeros.

Filemark (FM)

The Filemark bit indicates that the current command has read a filemark or a setmark. Reporting of setmarks is optional and is indicated by the RSMK bit in the Device Configuration Parameters page.

End of Media (EOM)

The EOM bit indicates that an End-of-Media condition exists. The warning is also given by setting the Sense Key to NO SENSE and the Additional Sense Code Qualifier to 02h for End of Partition or 04h for Beginning of Partition.

For write operations, the drive returns a CHECK CONDITION on any operation which occurs after detection of the Early Warning EOP marker. The EOM and Additional Sense Code fields will be set.

For read operations, the drive does not return a CHECK CONDITION until the drive encounters PEOT or synthetic PEOT. Note that at PEOT or synthetic PEOT, a WRITE FILEMARK command will cause the command to terminate with a CHECK CONDITION status with a sense key of VOLUME OVERFLOW.

Note

On a tape with DDS format, there are two marks at the end of the tape: LEOT, which provides an early warning, and, 500 mm closer to the end of the tape, PEOT, which indicates the end of usable tape. The drive *never* writes data to the tape after encountering PEOT. The drive uses LEOT to generate the early EOP warning during write operations. Approximately 10 megabytes of data can be written between the LEOT and PEOT marks.

Incorrect Length Indicator (ILI)

The Incorrect Length Indicator bit indicates that the requested logical record length did not match the logical record length of the data on the tape. Only the READ command or VERIFY command may cause this bit to be set.

Sense Key

The Sense Key field indicates the type of error which has occurred, and the recovery action which should be taken by the Initiator. The Sense Key codes are provided in Table 5-11.

Information

The Information fields contain the difference of the requested length minus the actual length in bytes, records, filemarks, or setmarks as determined by the command. Negative values are indicated by two's complement notation.

Additional Sense Length

The Additional Sense Length byte specifies the number of Additional Sense bytes that will follow.

Additional Sense Code

The Additional Sense Code field provides additional information about the error condition reported in the Sense Key field (refer to Table 5-11).

Additional Sense Code Qualifier

The Additional Sense Code Qualifier field provides detailed information about the Additional Sense Code field (refer to Table 5-11).

Sub-Assembly Code

The Sub-Assembly Code byte indicates the sub-assembly that has failed. A value of zero indicates that no sub-assembly has been identified as failing. The sub-assemblies and their values are listed in Table 5-9.

Table 5-9. DDS-format Tape Drive Sub-Assembly Codes

Value	Sub-Assembly
01h	Drive Electronics and Mechanism
02h	Buffer
03h	Interface

Table 5-10.
DDS-format Tape Drive REQUEST SENSE Extended Data Format

BYTE	BIT							
	7	6	5	4	3	2	1	0
00	Error Code							
01	Segment Number = 00h							
02	FM	EOM	ILI	RES=0	Sense Key			
03	Information (MSB)							
04	Information							
05	Information							
06	Information (LSB)							
07	Additional Sense Length= 0Bh							
08	Command-Specific Information = 00h (msb)							
09	Command-Specific Information = 00h							
10	Command-Specific Information = 00h							
11	Command-Specific Information = 00h (lsb)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							
14	Sub-Assembly Code							

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
0h			NO SENSE
	00	00	No specific sense key information to be reported for the specified logical unit. This would be the case for a successfully completed command.
	00	01	Filemark detected. Following reporting of this condition, the drive will be positioned either before or after the filemark, depending on the direction of travel.
	00	02	PEOT or Synthetic PEOT detected.
	00	03	Set Mark detected. Following reporting of this condition, the drive will be positioned either before or after the setmark, depending on the direction of travel.
	00	04	PBOT or LBOT detected.
	00	05	End-of-Data detected.
	0A	00	Error rate warning.
	81	00	Humidity warning.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
2h			DRIVE NOT READY
	04	00	Drive offline with media present. The drive returns this status following an UNLOAD with Immed bit set, or, if the front panel EJECT button has been pressed, for any subsequent commands which would cause tape motion. The drive continues to return this status while the tape is in the process of being unloaded, until it is fully ejected. Also, the drive continues to return this Sense information if the Host previously executed a PREVENT MEDIA REMOVAL command followed by an UNLOAD command. The Initiator cannot perform any operation which would cause tape motion, such as the WRITE, READ, VERIFY, or SPACE commands. The Initiator can load the tape when the drive is offline, and can execute any diagnostic commands which do not access the tape.
	04	01	Tape loading. The drive returns this status following a LOAD with Immed bit set for any subsequent commands which would cause tape motion, until the tape is fully loaded.
	3A	00	Media not present. This code is returned if any command which causes tape motion is executed and there is no cassette in the cassette port.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
3h			MEDIA ERROR
	00	02	PEOT or Synthetic PEOT encountered.
	0C	00	Write error encountered and retry limit exceeded. A nonrecoverable error condition was probably caused by a flaw in the tape or a dirty head. A hardware problem may cause this error, but it is most likely to be media-related.
	11	00	Unrecoverable Read error. The read error was caused by flaws in the tape, possibly resulting in an excessive number of uncorrectable tracks.
	14	03	End-of-Data not found. The drive encountered blank, unformatted tape during a read operation.
	14	04	Block Sequence error. The drive could not read the data from the tape because it encountered a format discontinuity. The drive checks that the group count since last LBOT always increments from one group to the next. If this does not happen, this error is reported after the group has been read.
	15	02	Positioning error detected during reading.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
3h			MEDIA ERROR
	30	02	Incompatible media installed. Unknown format. An unknown format (audio) was encountered, which terminated access to the tape.
	31	00	Tape format corrupted.
	33	00	Tape length error.
	3B	00	Sequential positioning error. The drive was incorrectly positioned to initialize a new tape, or it was incorrectly positioned for the requested ERT test.
	3B	08	Reposition error. The drive lost position during a read, verify, or space operation.
	50	00	Write error while appending new data. The drive either could not find the end of the group, or could not write the new group successfully.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
4h			HARDWARE ERROR
	03	00	Hardware failure during Write operation.
	09	00	Track following error occurred.
	11	08	Incomplete block read. The drive has read a group that had previously been overwritten.
	15	01	Mechanical positioning error.
	15	02	Positioning error detected during a read.
	30	02	Cannot read tape—incompatible format.
	44	00	Nonrecoverable hardware failure while performing a command. The Sub-Assembly Code field will identify which sub-assembly caused the error. If this field is zero, the Initiator should issue a SEND DIAGNOSTIC command with the self-test bit set, to test the drive thoroughly and identify the failing sub-assembly. This code is also returned if the drive failed a diagnostic. The SEND DIAGNOSTIC command will generate a CHECK CONDITION status if the drive fails a diagnostic. The RECEIVE DIAGNOSTIC RESULTS command will provide further information.
	52	00	Cassette fault.
	53	00	Media load/eject failed. The drive has been unable to complete its load sequence successfully. This may be due to mechanical problems, or because the drive could not successfully read and write from the test region of the tape.
	82	80	Moisture detected.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
5h			ILLEGAL REQUEST
	1A	00	Parameter Length error in the Command Descriptor Block, or the Parameter List length is too large for the specified command.
	20	00	Invalid command operation code.
	24	00	Invalid field in the Command Descriptor Block. Either the field is not supported, or a reserved field was used illegally. The Sense Key Specific Bytes should be checked, as the Field Pointer bytes will identify the illegal bit or field.
	25	00	Logical Unit not supported. The LUNTRN field in the Identify message was not set to zero.
	26	00	Invalid test number, header, or field in the Parameter List.
	26	01	Parameter page not supported. The Sense Key Specific bytes should be checked, as the Field Pointer bytes will identify the illegal bit or field.
	2C	00	Command sequence error.
	3D	00	Invalid bits in the Identify message. The Identify message was not set to either 80h or C0h.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
6h			UNIT ATTENTION
	28	00	Tape cartridge may have been changed.
	29	00	The drive has had a Reset or a Bus Device Reset.
	29	80	The drive failed its power-on self-test or diagnostics.
	2A	01	The Mode parameters may have changed.
	2A	02	The Log parameters may have changed.
7h			WRITE-PROTECTED
	27	00	A write command was attempted on a write-protected tape cartridge.
8h			BLANK CHECK
	00	00	Blank tape was encountered at LBOT.
	00	05	EOD was encountered during a read operation.
Ah			COPY ABORTED
	00	00	A COPY command was aborted due to an error condition on the source or the destination device.
	28	00	COPY command could not execute because the Initiator could not disconnect.

Table 5-11.
DDS-format Tape Drive Sense Key Codes, Additional Sense
Codes, and Additional Sense Code Qualifiers (continued)

SENSE KEY	BYTE 12	BYTE 13	DESCRIPTION
Bh			ABORT COMMAND
	00	00	This error will be returned if the Initiator aborted the current command by sending an ABORT message.
	2C	00	The Phase sequence was not expected during the execution of a command.
	43	00	The Message phase indicated by the communicating device was not expected by the drive.
	45	00	A SCSI Selection/Reselection error occurred.
	47	00	The drive detected a SCSI parity error and proceeded to the Status phase without completing execution of the command.
	48	00	The drive received an INITIATOR DETECTED ERROR message.
	49	00	The drive received an illegal message an proceeded to the Status phase without completing execution of the commands.
	4A	00	The Command phase indicated by the communicating device was not expected by the drive.
	4B	00	The Data phase indicated by the communicating device was not as expected by the drive. A DMA error could cause this report.
	4E	00	The Initiator sent a new command to the drive while a previous command was being executed.
Dh	00	02	PEOT or synthetic PEOT encountered during a WRITE FILEMARK command.

Rewritable Optical Disk Drive Off-line Diagnostic Information

The following paragraphs provide information on the rewritable optical disk drive power-on self-test and Extended Sense data returned by the REQUEST SENSE command.

Power-on Self-test

When the mass storage system power is switched on, the rewritable optical disk drive automatically performs a self-test. The power-on self-test is also performed when the DIAGNOSTIC command is executed using the SCSIMO diagnostic program. Refer to Chapter 4 for information on the status of the rewritable optical busy light when the self-test passes and when the self-test fails. When the self-test fails, the rewritable optical disk drive will pass failure information back to the Initiator via the Extended Sense Data Format of the REQUEST SENSE command.

Extended Sense Data Fields

Table 5-12 shows the Extended Sense Data Fields returned by the REQUEST SENSE command. The following paragraphs provide information for all Extended Sense Data Fields except those fields which are unused. Unused Extended Sense Data Fields always contain zeros.

Note

The abbreviation "RES" in a field means the field is "Reserved".

Valid

A value of one for the Valid bit indicates the Information bytes contain valid information. The significance of the Information bytes depends on the status of the Sense Key field.

Error Class and Error Code

The only value returned by the Error Class and Error Code fields is 70h.

Sense Key

The Sense Key field indicates the type of error which has occurred, and the recovery action which should be taken by the Initiator (refer to Table 5-13).

Information

The Information fields contain the logical block address associated with the Sense Key field.

Additional Sense Length

The Additional Sense Length byte specifies the number of Additional Sense bytes that will follow.

Additional Sense Code

The Additional Sense Code field provides additional information relative to the error condition reported in the Sense Key field (refer to Table 5-14). If the rewritable optical disk drive has no additional information, the Additional Sense Code field will contain zeros.

Device Error Code

The Device Error Code fields provide error codes that indicate which subassembly caused an error or fault. The Device Error Code fields can contain the following three types of error codes (refer to Table 5-15):

■ Type 0: Controller Diagnostics Error Codes (refer to Table 5-16).

■ Type 1: Drive Diagnostics Error Codes (refer to Table 5-17).

■ Type 2: Disk Access Error Codes (refer to Table 5-18 and Table 5-19).

Table 5-12.
Rewritable Optical Disk Drive REQUEST SENSE Extended Data
Format

BYTE	BIT
	7	6	5	4	3	2	1	0
00	Valid	\multicolumn{3}{c}{Error Class = 7}	\multicolumn{4}{c}{Error Code = 0}
01	Segment Number = 00h
02	\multicolumn{4}{c}{Reserved}	\multicolumn{4}{c}{Sense Key}
03	Information (MSB)
04	Information
05	Information
06	Information (LSB)
07	Additional Sense Length = 0Ch
08	Command-Specific Information = 00h
09	Command-Specific Information = 00h
10	Command-Specific Information = 00h
11	Command-Specific Information = 00h
12	Additional Sense Code
13	Reserved
14	Reserved
15	Reserved
16	Reserved
17	Reserved
18	Device Error Code (MSB)
19	Device Error Code (LSB)

Table 5-13. Rewritable Optical Disk Drive Sense Key Codes

VALUE (HEX)	DESCRIPTION
0	NO SENSE. There is no specific Sense Key information to be reported for the designated logical unit. The Sense Key code to be transferred does not exist, or the command executed prior to the REQUEST SENSE command was completed successfully.
1	RECOVERED ERROR. The last command completed successfully with some recovery action performed by the rewritable optical disk drive.
2	NOT READY. The logical unit cannot be accessed.
3	MEDIA ERROR. A READ command terminated with a nonrecoverable error condition caused by a defect on the rewritable optical disk.
4	HARDWARE ERROR. The controller detected a nonrecoverable hardware failure while executing a command or performing a self-test.
5	ILLEGAL REQUEST. There was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands.
6	UNIT ATTENTION. Media has been exchanged, the unit has been reset, or the MODE SELECT parameters have been changed.
7	DATA PROTECT. The unit attempted to write data on a write-protected disk.
A	COPY ABORTED. A COPY or COPY AND VERIFY command was aborted due to an error condition on the source device, the destination device, or both.

Table 5-14.
Rewritable Optical Disk Drive Additional Sense Codes

VALUE (HEX)	DESCRIPTION
00	No additional sense information (NO SENSE). No error to report.
02	No ESDI Command Complete (HARDWARE ERROR). ESDI Command Complete was not returned by drive.
03	Write fault (HARDWARE ERROR). Write command failed. The logical block address where the fault was detected may be returned in the Logical Block Address field or Information Byte field of the sense data.
04	Drive not ready (NOT READY). The media was not up to spinning speed, or the focus or slide servo was unlocked.
05	Drive not selected (NOT READY).
07	Multiple drives selected (HARDWARE ERROR).
08	Logical Unit communication failure (HARDWARE ERROR).
09	Track-following error (HARDWARE ERROR).
0A	No disk in disk port (NOT READY).
0B	Load/Unload failure (HARDWARE ERROR). A failure was detected during loading or unloading of the disk caddy.
0C	Spindle failure (HARDWARE ERROR). The spindle servo was not locked with the reference signal and the disk was not spun correctly.
0D	Focus failure (HARDWARE ERROR). The focus servo was missed. To restart the drive, issue a START/STOP UNIT command with the Start bit set to 1.
0E	Tracking failure (HARDWARE ERROR). Tracking servo could not be locked.
0F	Drive initialization failure (HARDWARE ERROR). The drive power-on diagnostics failed.

Table 5-14.
Rewritable Optical Disk Drive Additional Sense Codes
(continued)

VALUE (HEX)	DESCRIPTION
10	ID CRC error (HARDWARE ERROR).
11	Unrecoverable Read error (MEDIA ERROR). Unable to recover data with ECC. The logical block address where the error occurred may be returned in the Logical Block Address field or the Information Byte field of the sense data.
15	Seek positioning error (HARDWARE ERROR). A seek to the specified track failed after retries.
18	Recovered read data with ECC (RECOVERED ERROR).
20	Invalid command operation code (ILLEGAL REQUEST). The specified command operation code is not implemented or an invalid command is requested.
21	Illegal logical block address (ILLEGAL REQUEST). The maximum logical block address was exceeded.
23	Illegal function for media type (ILLEGAL REQUEST). The format parameter is invalid for the media type.
24	Illegal field in CDB (ILLEGAL REQUEST). The following field conditions are illegal: RESERVED field is not zero, invalid combination of parameters (e.g., both the Eject bit and the Start bit are set in the START/STOP UNIT command), illegal parameter in a state (e.g., a command with the Relative Address bit set to 1 is issued after a command with the Link bit set to 0).
25	Invalid LUN (ILLEGAL REQUEST).
26	Invalid field in Parameter List (ILLEGAL REQUEST).
27	Write-protected (DATA PROTECT). Erasing or writing was aborted because the write-protect switch was enabled.

Table 5-14.
Rewritable Optical Disk Drive Additional Sense Codes
(continued)

VALUE (HEX)	DESCRIPTION
28	Media changed (UNIT ATTENTION). Media was ejected from the disk port and the same media or new media was loaded since execution of the last command. This code implies Mode Select parameters changed (2A).
29	Power-on or Reset or Bus Device Reset occurred (UNIT ATTENTION). This code implies Mode Select parameters changed (2A).
2A	Mode Select parameters changed (UNIT ATTENTION). This code is used to notify the Initiator that the Mode Select parameters have been changed since execution of the last command.
30	Incompatible disk in disk port (MEDIA ERROR). ID hole on disk cartridge is in wrong position.
31	Media format corrupted (MEDIA ERROR). PEP, SFP, or the format information sector in the CDA is invalid.
32	No defect spare location available (MEDIA ERROR). The number of defect sectors listed in the PDL and SDL (DTA) exceeded 1024, or the number of defect sectors listed in the SDL exceeded the specified value calculated by the number of groups and spare blocks per group.
38	Recovered with automatic reallocation (RECOVERED ERROR). Automatic write reallocation was executed successfully.
39	Automatic reallocation failure (MEDIA ERROR). Automatic write reallocation failed after three retries.
3A	Defect List update failure (MEDIA ERROR). Updating of the defect table failed after a sector was spared successfully.
3D	Defect List not available (MEDIA ERROR or RECOVERED ERROR). Specified defect list is not available.
42	Power-on diagnostic failure (HARDWARE ERROR). Power-on diagnostic failed.

Table 5-14.
Rewritable Optical Disk Drive Additional Sense Codes
(continued)

VALUE (HEX)	DESCRIPTION
43	Message Reject error (HARDWARE ERROR). The command was aborted because the Initiator issued a MESSAGE REJECT.
44	Internal controller error (HARDWARE ERROR). The controller detected an error related to the controller hardware or firmware.
47	SCSI Interface parity error (HARDWARE ERROR). The command was aborted due to a parity error on the SCSI bus.
48	Initiator detected error (HARDWARE ERROR). The command was aborted because the INITIATOR DETECTED ERROR message was sent by the Initiator.
49	Inappropriate/illegal message (HARDWARE ERROR). The command was aborted due to an inappropriate or illegal message from the Initiator.
80	Limited laser life (HARDWARE ERROR). Overcurrent is detected in the laser diode or the laser power is below the under limit.
81	Focus coil overcurrent failure (HARDWARE ERROR). Overcurrent is detected in the focus coil of the optical pick up. The coil is protected by a relay.
82	Tracking coil overcurrent failure (HARDWARE ERROR). Over-current is detected in the tracking coil of the optical pick up. The coil is protected by a relay.
83	Temperature alarm (HARDWARE ERROR). Internal temperature of the drive exceeded 70°C.

Table 5-15. Rewritable Optical Disk Drive Error Code Scheme

BYTE 18								BYTE 19							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Error Source Error Codes (Type 2)				Error Level Error Codes (Type 2)				Detailed Error Codes (Type 2)							
Drive Self-test Error Codes (Type 1)															
Controller Self-test Error Codes (Type 0)															

Table 5-16.
Rewritable Optical Disk Drive, Controller Diagnostics Error Codes

VALUE (HEX)	DESCRIPTION
0100	ROM (CCP) test failure
0200	RAM test failure (pattern=FFh)
0300	RAM test failure (pattern=00h)
0400	HIC chip test failure
05XX	BMM chip test failure
06XX	DIC chip test failure
07XX	ECP chip test failure
08XX	Buffer memory test failure

Table 5-17.
Rewritable Optical Disk Drive, Drive Diagnostics Error Codes

VALUE (HEX)	DESCRIPTION
12XX	ROM (DCP) test failure
13XX	RAM test failure
18XX	IOP chip failure
19XX	MDA chip failure
21XX	Focus servo failure
22XX	Tracking servo failure
23XX	Slide servo failure
24XX	Spindle servo failure
30XX	BCN board failure

Table 5-18.
Rewritable Optical Disk Drive, Disk Access Error Source Error
Codes (Bits 12-15)

Bit	Error Source
15	Host
14	Controller
13	Drive
12	Media

Table 5-19.
Rewritable Optical Disk Drive, Disk Access Error Level Error
Codes (Bits 10-11)

Code	Error Level
00	Recovered Error
01	Recoverable Error 1
10	Recoverable Error 2
11	Unrecoverable Error

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0-9)

VALUE (HEX)	DESCRIPTION
001	INITIATOR DETECTED ERROR message received.
002	Illegal message received after ATTENTION.
003	RESTORE POINTERS incomplete after INITIATOR DETECTED ERROR message received.
004	RESTORE POINTERS incomplete after parity error detected.
005	Parity error detected.
008	Invalid write buffer header.
009	COPY ABORTED (invalid LUN from 2 to 7).
00A	COPY ABORTED (slot error).
00B	COPY ABORTED (check valid error).
00C	Illegal parameter (COPY command).
00D	Invalid COPY parameter list header.
00E	Invalid COPY parameter list.
018	Illegal parameter (READ BUFFER command).
019	Illegal parameter (WRITE BUFFER command).
080	DISCONNECT message rejected before comexc invoked.
081	LINKED COMMAND COMPLETE message or LINKED COMMAND COMPLETE WITH FLAG message rejected.
082	LUN in CDB different from previous command.
083	Received message contains parity error and retry failed.
084	MESSAGE REJECT message rejected.

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0–9) (continued)

VALUE (HEX)	DESCRIPTION
085	MESSAGE PARITY ERROR message received and retry failed.
086	Received command byte contains Parity Error 1.
087	Command code is Invalid 1.
088	Received command byte contains Parity Error 2.
089	Command code is Invalid 2.
08A	INITIATOR DETECTED ERROR message received and retry failed.
08B	Received data byte contains parity error.
08C	IDENTIFY message after reconnection rejected.
08D	RESTORE POINTERS message after reconnection rejected.
08E	Invalid field detected in CDB.
08F	Illegal logical block address in 6 bytes command.
090	RelAdr bit is set, but is illegal because the previous command is not linked or did not set address.
091	Illegal logical block address in 10 bytes command.
092	No disk (_dstat bit 0 is 0).
093	Incompatible Cartridge (_dstat bit 7 is 0).
094	Write-protected (_dstat bit 3 is 1).
095	Drive not ready (_dstat bit 6 is 0).
096	Drive not ready (_dstat bit 2 is 0).
097	Drive not ready (_dstat bit 1 is 0).

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0–9) (continued)

VALUE (HEX)	DESCRIPTION
098	Media format corruption (_dstat bit 5 is 0).
099	Address field or RelAdr bit is not 0 and PMI bit is 1 (READ CAPACITY command).
09A	_dstat is ok, but _svd_md_valid is invalid (READ DEFECT DATA command).
09B	Format specified in CDB is not physical format (READ DEFECT DATA command).
09C	Both P and G list bits are set (READ DEFECT DATA command).
09D	Attempted to save mode select parameters, but disk format is invalid or is Format Mode 3 (MODE SELECT command).
09E	Mode Select parameter length too large (MODE SELECT command).
09F	Mode Select parameter invalid (MODE SELECT command).
0A0	Saved mode parameter not available (MODE SELECT command).
0A1	Invalid field in CDB (FORMAT UNIT command).
0A2	User band size or spare band size is invalid (FORMAT UNIT command).
0A3	Number of D list is greater that 1024 (FORMAT UNIT command).
0A4	Invalid page requested (MODE SENSE command).
0A5	SP bit set with Format Mode 3 (MODE SELECT command).
0A6	Format Mode of the disk is not 2 or 3 (REASSIGN BLOCKS command).
0A7	First 2 bytes of defect list header is nonzero or defect list length is not multiple of 4 (REASSIGN BLOCKS command).

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0-9) (continued)

VALUE (HEX)	DESCRIPTION
0A8	Defect list length too long, total defective sectors will exceed 1024 (REASSIGN BLOCKS command).
0A9	Attempted to format the disk as Format Mode 2.
0AA	Total number of defects exceeds 1024 during the REASSIGN BLOCKS command.
0AB	Defective sector address larger than maximum logical block address (REASSIGN BLOCKS command).
0C0	alt_pird returned fatal error.
0C1	Cannot get first defect information sector.
0C2	Number of defect table entries corrupted.
0C3	Format Mode is not 2 or 3.
0C4	PEP error.
0C5	SFP error.
0C6	Erase error during Erase/Write/Read test.
0C7	Write error during Erase/Write/Read test.
0C8	Read error during Erase/Write/Read test.
0C9	Compare error during Erase/Write/Read test.
0CA	Buffer Memory Set error during Erase/Write/Read test.
0CE	BUSY LED off error during alt_setdinfo.
0CF	DDS is invalid.

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0–9) (continued)

VALUE (HEX)	DESCRIPTION
0D0	PDL is invalid.
0D1	SDL is invalid.
0D2	Format information sector is invalid.
0D3	Format type field in format mode information sector is not 0,1 or 2.
0D4	Retrieving skip sparing table failed.
0D5	Retrieving band sparing table failed.
0E0–0FF	LSB 5 bits indicate the following state: recovery sequence is invoked when reading format information sector (bit 0), recovery sequence is invoked when reading mode information sector (bit 1), mode information sector could not be read (bit 2), recovery sequence is invoked when reading skip sparing information sector (bit 3), recovery sequence is invoked when reading band sparing information sector (bit 4).
101	ECC error more than 0 bytes in any interleave.
102	ECC error more than 1 byte in any interleave.
103	ECC error more than 2 bytes in any interleave.
104	ECC error more than 3 bytes in any interleave.
105	ECC error more than 4 bytes in any interleave.
106	ECC error more than 5 bytes in any interleave.
107	ECC error more than 6 bytes in any interleave.
108	ECC error more than 7 bytes in any interleave.

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0-9) (continued)

VALUE (HEX)	DESCRIPTION
109	ECC error more than 8 bytes in any interleave
111	Recovered 1-byte error in any interleave.
112	Recovered 2-byte error in any interleave.
113	Recovered 3-byte error in any interleave.
114	Recovered 4-byte error in any interleave.
115	Recovered 5-byte error in any interleave.
116	Recovered 6-byte error in any interleave.
117	Recovered 7-byte error in any interleave.
118	Recovered 8-byte error in any interleave.
201	Address not detected (no address).
202	Address not detected ($<=1$).
203	Address not detected ($<=2$).
204	Illegal interrupt occurred (wait for no INT).
205	Illegal interrupt occurred (wait for start INT).
206	Illegal interrupt occurred (wait for end INT).
207	Illegal interrupt occurred (wait for start INT).
208	Illegal time-out (wait for no INT).
209	Illegal time-out (unknown INT state).
20A	Microprocessor hung up (before end INT).

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0–9) (continued)

VALUE (HEX)	DESCRIPTION
20B	Microprocessor hung up (before syndrome INT).
20C	SEQSTOP not enabled.
20F	Write-protect error.
280	Insufficient defect table area during automatic reallocation (the number of errors exceeds 1024).
281	Insufficient defect table area during automatic reallocation (insufficient band spare sectors).
282	Insufficient defect table area during automatic reallocation.
288	Recovered ID error with automatic write reallocation.
289	Recovered ECC error with automatic write reallocation.
28A	Automatic write reallocation failure.
28B	Defect List Update failure.
300	Write fault (ESDI).
301	Interface fault, Write fault (ESDI).
302	Seek fault.
303	Unimplemented Command fault (ESDI).
304	Invalid Command fault (ESDI).
305	Interface fault (ESDI).
306	Parity fault (ESDI).
307	Coarse seek failure.

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0-9) (continued)

VALUE (HEX)	DESCRIPTION
308	Focus failure, coarse seek failure.
309	Not track following.
30A	Not track following, tracking failure.
30B	Not track following, focus failure.
30C	Tracking failure.
30D	Focus failure, tracking failure.
30E	Focus failure.
30F	Focus failure, not track following, tracking failure.
310	Phaselock/tracking failure.
311	Not on correct track.
312	Not track following, spindle not at speed.
313	Not track following, tracking failure, spindle not at speed.
314	Not track following, focus failure, spindle not at speed.
315	Tracking failure, spindle not at speed.
316	Focus failure, tracking failure, spindle not at speed.
317	Focus failure, spindle not at speed.
318	Focus failure, not track following, tracking failure, spindle not at speed.
319	Spindle not at speed.
31A	Spindle not at speed, write was terminated.

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0-9) (continued)

VALUE (HEX)	DESCRIPTION
31B	Not track following, tracking failure, write was terminated.
31C	Not track following, tracking failure, spindle not at speed, write was terminated.
31D	Tracking failure, write was terminated.
31E	Tracking failure, spindle not at speed, write was terminated.
31F	Focus failure, tracking failure, spindle not at speed.
320	Focus failure, tracking failure, spindle not at speed, write was terminated.
321	Focus failure, not track following, tracking failure, spindle not at speed.
322	Focus failure, not track following, tracking failure, spindle not at speed, write was terminated.
323	Load/Unload failure.
324	Sensor failure.
325	Drive initialization failure.
326	Bias magnet failure.
327	Temperature Alarm 1.
328	Focus Overcurrent Failure 1.
329	Tracking Overcurrent Failure 1.
32A	Spindle motor stopped.
32B	LD Driver IL failure.
32C	LD Driver IL failure, LD Erase Power failure.

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0-9) (continued)

VALUE (HEX)	DESCRIPTION
32D	LD Driver IL failure, LD Erase Power failure, LD Read Power failure.
32E	PEP Optical Pickup Positioning error.
32F	PEP Focus failure.
330	PEP Searching Gap Time-out error.
331	PEP Data-capturing Time-out error.
332	PEP Syncing Data error.
333	PEP Unexpected Gap/EOD error.
334	PEP Decoded Byte Count error.
335	PEP CRC error.
336	Temperature Alarm 2.
337	Focus Overcurrent Failure 2.
338	Tracking Overcurrent Failure 2.
339	LD Erase Power failure.
33A	LD Read Power failure.
33B	No active media present.
33C	Media type not supported.
380	Req/Ack Handshake Time-out Error 0 (ESDI).
381	Req/Ack handshake Time-out Error 1 (ESDI).

Table 5-20.
Rewritable Optical Disk Drive, Disk Access Detailed Error Codes
(Bits 0–9) (continued)

VALUE (HEX)	DESCRIPTION
382	Req/Ack Handshake Time-out Error 2 (ESDI).
383	Req/Ack Handshake Time-out Error 3 (ESDI).
384	Parity error on CONFIG/STSTUS DATA (ESDI).
385	Drive not selected on.
386	Multiple drives selected.
387	Drive not selected off.
388	Drive not ready.
389	Command complete negated before sending command (ESDI).
38A	Command Complete Time-out error (ESDI).
38B	Command complete not negated after sending command (ESDI).
38C	Attention after command execution cannot recover (ESDI).
38D	Attention before command execution cannot recover (ESDI).
38E	Invalid status bit in optical standard status.
38F	Search error in optical disk standard status.
390	Invalid status bit in optical device status.
391	Search error in optical device status.
392	No error status available.
393	Search error in optical disk extended status.

CD-ROM Drive Off-line Diagnostic Information

The following paragraphs provide information on the CD-ROM drive power-on self-test and Extended Sense data returned by the REQUEST SENSE command.

Power-on Self-test

When the mass storage system power is switched on, the CD-ROM drive automatically performs a self-test. The power-on self-test is also performed when the DIAGNOSTIC command is executed using the SCSICD diagnostic program. Refer to Chapter 4 for information on the status of the CD-ROM busy light when the self-test passes and when the self-test fails. When the self-test fails, the CD-ROM drive will pass failure information back to the Initiator via the Extended Sense Data Format of the REQUEST SENSE command.

Extended Sense Data Fields

Table 5-21 shows the Extended Sense Data Fields returned by the REQUEST SENSE command. The following paragraphs provide information for all Extended Sense Data Fields except those fields which are unused. Unused Extended Sense Data Fields always contain zeros.

Note	The abbreviation "RES" in a field means the field is "Reserved".

Valid

A value of one for the Valid bit indicates the Information bytes contain valid information. The significance of the Information bytes depends on the status of the Sense Key field.

Error Class and Error Code

The only value returned by the Error Class and Error Code fields is 70h.

Sense Key

The Sense Key field indicates the type of error which has occurred, and the recovery action which should be taken by the Initiator (refer to Table 5-22).

Information

The Information fields contain the logical block address associated with the Sense Key field.

Additional Sense Length

The Additional Sense Length field specifies the number of Additional Sense bytes that will follow.

Additional Sense Code

The Additional Sense Code field provides additional information about the error condition reported in the Sense Key field (refer to Table 5-23).

Table 5-21.
CD-ROM Drive REQUEST SENSE Extended Data Format

BYTE	BIT
	7	6	5	4	3	2	1	0
00	Valid	\multicolumn{3}{c}{Error Class = 7}	\multicolumn{4}{c}{Error Code = 0}
01	Segment Number = 00h
02	FM=0	EOM=0	ILI=0	RES=0	Sense Key
03	Information (MSB)
04	Information
05	Information
06	Information (LSB)
07	Additional Sense Length= 0Ah
08	Command-Specific Information = 00h
09	Command-Specific Information = 00h
10	Command-Specific Information = 00h
11	Command-Specific Information = 00h
12	Additional Sense Code
13	Additional Sense Code Qualifier = 00h
14	Sub-Assembly Code = 00h
15	FPV=0	C/D=0	\multicolumn{2}{c}{RES = 0}	BPV=0	\multicolumn{3}{c}{Bit Pointer = 0}
16	Field Pointer (MSB) = 00h
17	Field Pointer (LSB) = 00h

Table 5-22. CD-ROM Drive Sense Key Codes

VALUE (HEX)	DESCRIPTION
0	NO SENSE. The Sense Key code to be transferred does not exist. Also indicates successful completion of command executed prior to the REQUEST SENSE command.
1	RECOVERED ERROR. The execution of the READ or READ EXTENDED command was completed successfully with retries or error correction. Details may be determinable by examining the additional sense bytes and the information bytes.
2	NOT READY. The CD-ROM drive cannot be accessed.
3	MEDIA ERROR. A READ command terminated with a nonrecoverable error condition caused by a defect on the CD-ROM disk.
4	HARDWARE ERROR. The controller detected a nonrecoverable hardware failure while executing a command or performing a self-test.
5	ILLEGAL REQUEST. There was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands.
6	UNIT ATTENTION. The CD-ROM media has been exchanged, the CD-ROM drive has been reset by a power-on or reset condition, or a BUS DEVICE RESET message.
B	ABORTED COMMAND. The CD-ROM drive aborted the command.

Table 5-23. CD-ROM Drive Additional Sense Codes

VALUE (HEX)	DESCRIPTION
00	No additional sense information (NO SENSE).
04	Drive not ready (NOT READY).
11	Unrecoverable read error (MEDIA ERROR). Unable to recover data with retries or ECC.
12	Unable to read header of target block (MEDIA ERROR).
15	Seek operation did not complete within specified time limit (HARDWARE ERROR or MEDIA ERROR).
17	Recovered data with read retries, not with ECC (RECOVERED ERROR).
18	Recovered data with ECC correction, not with retries (RECOVERED ERROR).
20	Invalid command operation code (ILLEGAL REQUEST).
21	Illegal logical block address (ILLEGAL REQUEST). Maximum logical block address exceeded.
24	Illegal field in CDB (ILLEGAL REQUEST).
25	Invalid LUN (ILLEGAL REQUEST).
26	Invalid field in parameter list (ILLEGAL REQUEST).
28	Media exchanged (UNIT ATTENTION). Tray OPEN/CLOSE operation was executed.
29	Power-on reset, reset condition, or BUS DEVICE RESET occurred (UNIT ATTENTION).
2A	Block length or error recovery parameter of MODE SELECT command changed (UNIT ATTENTION).

Table 5-23. CD-ROM Drive Additional Sense Codes (continued)

VALUE (HEX)	DESCRIPTION
30	Incompatible disk in disk tray (MEDIA ERROR).
44	Internal controller error (HARDWARE ERROR or ABORTED COMMAND).
45	Select/Reselect failed (HARDWARE ERROR or ABORTED COMMAND).
47	SCSI Interface parity error (HARDWARE ERROR or ABORTED COMMAND).
49	Inappropriate/illegal message (HARDWARE ERROR or ABORTED COMMAND).
88	Object address of an AUDIO TRACK SEARCH command is a data track address (ILLEGAL REQUEST).
89	Object address of a READ, SEEK, READ EXTENDED, or SEEK EXTENDED command is an audio track address (ILLEGAL REQUEST).
8A	The CD-ROM drive is not in continuous audio mode while on an audio track (ILLEGAL REQUEST).

6

Removal and Replacement

Replaceable Parts

Field Replaceable Assemblies (FRAs) and parts for the mass storage system
are listed in Table 6-2, Table 6-3, Table 6-4, and Table 6-5. Figure 6-13,
Figure 6-14, Figure 6-15, and Figure 6-16 illustrate all the parts in the mass
storage system. In the parts list, attaching parts are listed immediately
after the item to which they attach. Items in the DESCRIPTION column
are indented to indicate their relationship to the next higher assembly.
Identification of the items and the labels is as follows:

Major Assembly

*Replaceable Assembly

*Attaching Part for Replacement Assembly

**Subassembly or Component Part

**Attaching Part for Subassembly or Replacement Part

The replaceable parts listings provide the following information for each part:

1. FIGURE AND INDEX NO. The figure and index numbers which indicate
   where the replaceable part is illustrated.

2. HP PART NO. The Hewlett-Packard number for the replaceable part.

3. DESCRIPTION. The description of the replaceable part.

4. UNITS PER ASSEMBLY. The total quantity of each part used in the major
   assembly.

The Manufacturing Code for all Hewlett-Packard parts is 28480, Hewlett-
Packard Company, Palo Alto, California, U.S.A. Some items such as common
hardware can be obtained locally by their description.

Note	TORX* hardware is used in the mass storage system. This hardware requires the use of special drivers. In this manual, any reference to this type of hardware will be accompanied by the required driver size (for example, "T15").

TORX is a product of the Camcar Division of Textron, Inc.

Ordering Information

To order replaceable parts for the mass storage system, address the order to your local Hewlett-Packard Sales and Support Office. Headquarter Offices are listed at the back of this manual. Specify the following information:

1. Model and full serial number.

2. Hewlett-Packard part number.

3. Complete description of each part as provided in the replaceable parts listing.

Field Stocking Inventory

Table 6-1 shows the assemblies and parts that make up the recommended field stocking inventory for the mass storage system.

Table 6-1. Recommended Field Stocking Inventory

PART NO.	EXCHANGE NO.	QTY	Description
0515-0386	N/A	3	T25 TORX* Screws
C2212-60049	N/A	1	Cable, power, short (slots 2 and 3)
C2212-60058	N/A	1	Cable, power, long (slot 1)
C2212-60054	N/A	1	Cable, dual power
C2212-60057	N/A	1	Cable, BEND/flex**
C2200-60001	N/A	1	Fan
C2200-60044	N/A	1	Power Supply
C2212-60061	C2212-69061	1	Hard Disk Drive (332 Mbyte) 330S HP-UX
C2213-60061	C2213-69061	1	Hard Disk Drive (664 Mbyte) 660S HP-UX
C2212-60063	C2212-69063	1	Hard Disk Drive (332 Mbyte) 330D Domain
C2213-60063	C2213-69063	1	Hard Disk Drive (664 Mbyte) 660D Domain
97548-60307	97548-69307	1	Hard Disk Controller PCA (firmware not included)
C1700-60120	C1700-69120	1	Rewritable Optical Disk Drive (650 Mbyte)
C1700-60005	C1700-69005	1	Rewritable Optical Controller PCA
1150-1832	N/A	1	CD-ROM Drive, 600 Mbyte
C1502-67202	C1502-69202	1	DDS-format Tape Drive, 1.3 Gbyte
011778-001	011778-001R	1	Quarter-inch Cartridge Drive

*TORX is a product of the Camcar Division of Textron, Inc.
**BEND/flex is a product of Rogers Corporation.

Removal and Replacement Procedures

Removal and replacement procedures for the field-replaceable assemblies and parts in the mass storage system are given in the following paragraphs. To assist in the identification of parts, references are made to the index numbers in the referenced figures and tables.

Warning	**After disassembling any part of the mass storage system, the mass storage system must be carefully reassembled to ensure compliance with RFI emission requirements and to provide adequate protection against electrical shock and fire hazards.**

Caution	All attaching hardware must be in place in order for the mass storage system to meet its RFI specifications.

Removing the Front Panel and Top Cover

Remove the front panel (1) and top cover (3) as follows (see Figure 6-1):

1. Slide the front of the mass storage system chassis beyond the edge of the table top until the front panel locking tabs (2) are exposed.

2. Press up on the front panel locking tabs (2) until the front panel (1) releases from the mass storage system chassis.

3. Pull the bottom of the front panel forward, rotate the front panel up, and lift the front panel mounting tabs out of slots in the front edge of the top cover. (See notes below.)

4. Remove the two T15 top cover screws (4).

5. Slide the rear of the top cover (3) one half of an inch beyond the rear of the mass storage system chassis, then lift the front of the top cover up and off of the mass storage system chassis.

Note

- The bezels within the front panel push out through the rear of the panel if installing devices in the mass storage system that have their own front panel designed into the product.

- The lower bezel of the front panel may slightly contact the Quarter-inch Cartridge Drive eject lever when the panel is rotated upward; this is normal.

HDFPTCR
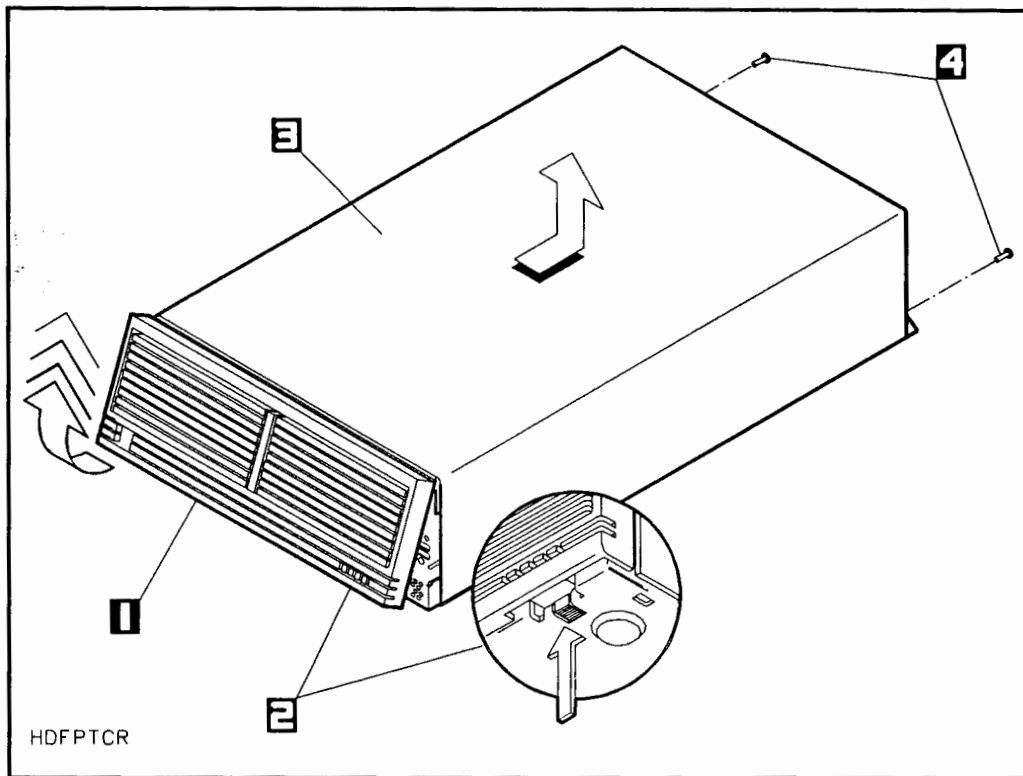
Figure 6-1. Removing the Front Panel and Top Cover

1—Front Panel   3—Top Cover

2—Front Panel Locking Tabs   4—T15 Top Cover Screws

Removing a Hard Disk Drive from the Mass Storage System

This section describes how to remove a hard disk drive from the mass storage system. Refer to Figure 6-2, Figure 6-3, or Figure 6-4 for hard disks located in slots 1, 2, or 3 respectively. Figure 6-13 and Table 6-2 shows parts for the entire mass storage system.

Handling Precautions

Caution	■ Electrostatic discharge (ESD) can damage the hard disk drive and its associated electronics. The installation procedure must be performed in areas with carpeting treated for ESD protection or in areas with conductive flooring. If you do not protect the hard disk drive against ESD, you may damage the hard disk drive and void the warranty.
	■ The hard disk drive is susceptible to mechanical shock and vibration when it is not secured in the mass storage system chassis. Place the hard disk drive on a foam pad to prevent damage from mechanical shock and vibration.

Caution	■ The mass storage system contains a BEND/flex* cable that is used to distribute signals to the drives in the mass storage system. When handling the BEND/flex cable, *do not* crease, twist, or stress its connectors. The BEND/flex cable tears easily when it is twisted. Grasp both sides of a BEND/flex connector and carefully push it onto the other connector.
	■ When installing hard disk drives, always connect the option/address (smaller) part of the connector before the SCSI cable.

*BEND/flex is a product of the Rogers Corporation.

Preparing to Remove a Hard Disk Drive

1. Shut down the host computer.

2. Power off the host computer and the mass storage system.

3. Disconnect the SCSI cable from the mass storage system rear panel.

4. Set the (LINE⁻) switch to the 0 (out) position and connect the power cord from the mass storage system rear panel to an ac power outlet.

5. Attach the wrist ground strap to your wrist and apply the other end to an unpainted area of the mass storage system chassis. The mass storage system chassis, the conductive sheet, and your hand are now at the same electrical potential.

Note	Keep the wrist strap on until you have performed all the steps in the removal procedure.

6. Place the rear of the mass storage system chassis on the conductive sheet.

7. Slide the foam pad beneath the loose end of the conductive sheet, while making sure the mass storage system chassis maintains contact with the conductive sheet.

8. Disconnect the ac power cord from the mass storage system rear panel.

Warning	**Ensure that the (LINE⁻) switch on the mass storage system front panel is in the 0 (out) position, and that the power cord is disconnected from the mass storage system rear panel. Electrical shock may result if the power cord is connected and the (LINE⁻) switch is in the 1 (in) position while the top cover is off.**

9. Remove the front panel and top cover from the mass storage system chassis (refer to "Removing the Front Panel and Top Cover" in this chapter).

Disconnecting the Cables

1. Disconnect the dc power cable (Figure 6-13, 10) from the dc power connector on the power supply (12) and from the dc power connector on the hard disk drive, then cut the power cable tie wrap (25).

2. Disconnect the hard disk drive status indicator cables (9) from the status LED assembly (19).

3. Disconnect the BEND/flex SCSI connector from the hard disk drive SCSI connector.

4. Disconnect the BEND/flex cable (20) address connector from the hard disk drive address connector.

Caution	When installing the BEND/flex cables to hard disk drives, always attach the option/address (smaller) connector of the BEND/flex *before* attaching the SCSI (larger) connector.

Removing the Hard Disk Drive

1. Remove the T25 screw (Figure 6-13, 11) from the front of the mass storage system chassis (26).

2. If you are removing a hard disk drive from slot 1 or slot 3, remove the T25 screw from the hole in the front of the mass storage system chassis (see Figure 6-2 or Figure 6-4).

3. If you are removing a hard disk drive from slot 2, remove the T25 screw from the hole in the rear of the mass storage system chassis (see Figure 6-3).

4. Use a flat-bladed screw driver to pry the front of the hard disk drive away from the mass storage system chassis.

5. Slide the hard disk drive on the chassis rails toward the center of the mass storage system chassis until the mounting tabs stop against the ends of the mounting slots.

6. Push the BEND/flex cable connectors toward the center of the chassis and lift the hard disk drive out of the mass storage system chassis and onto the conductive sheet.

7. If the hard disk drive is being replaced, remove the four T10 screws (8) that hold the mounting bracket (7) to the hard disk drive. Remove the bracket and install it on the new hard disk drive.
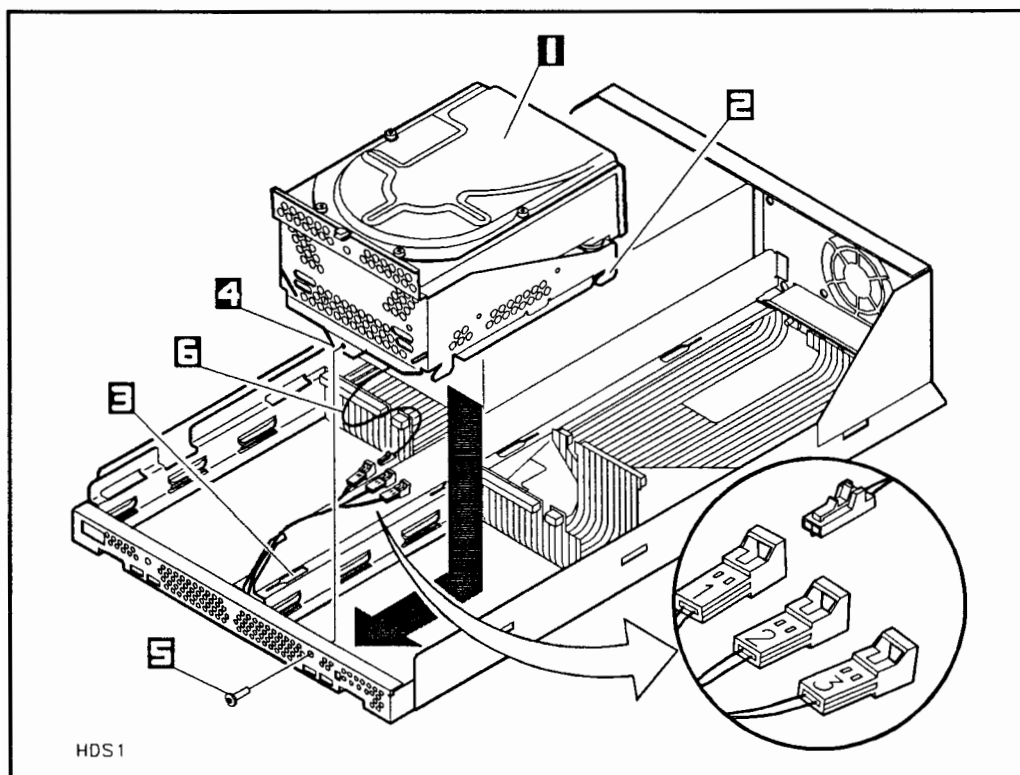
Figure 6-2. Hard Disk Drive in Slot 1

1—Hard Disk Drive   4—Securing Tab

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slot (1 of 4)   6—Status Cable
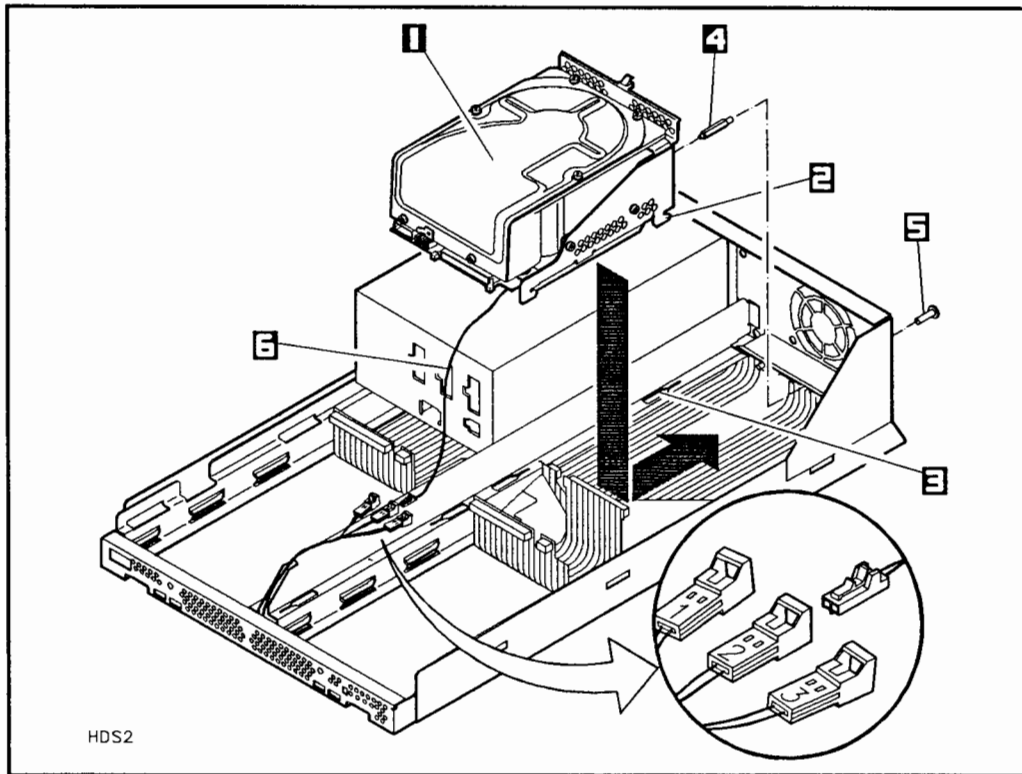
Figure 6-3. Hard Disk Drive in Slot 2

1—Hard Disk Drive   4—Standoff

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slot (1 of 4)   6—Status Cable

Note   On some mass storage systems, items 4 and 5 above, the
              standoff and the T25 screw, may have in their place a long
              TORX screw, part number C2212-20011.
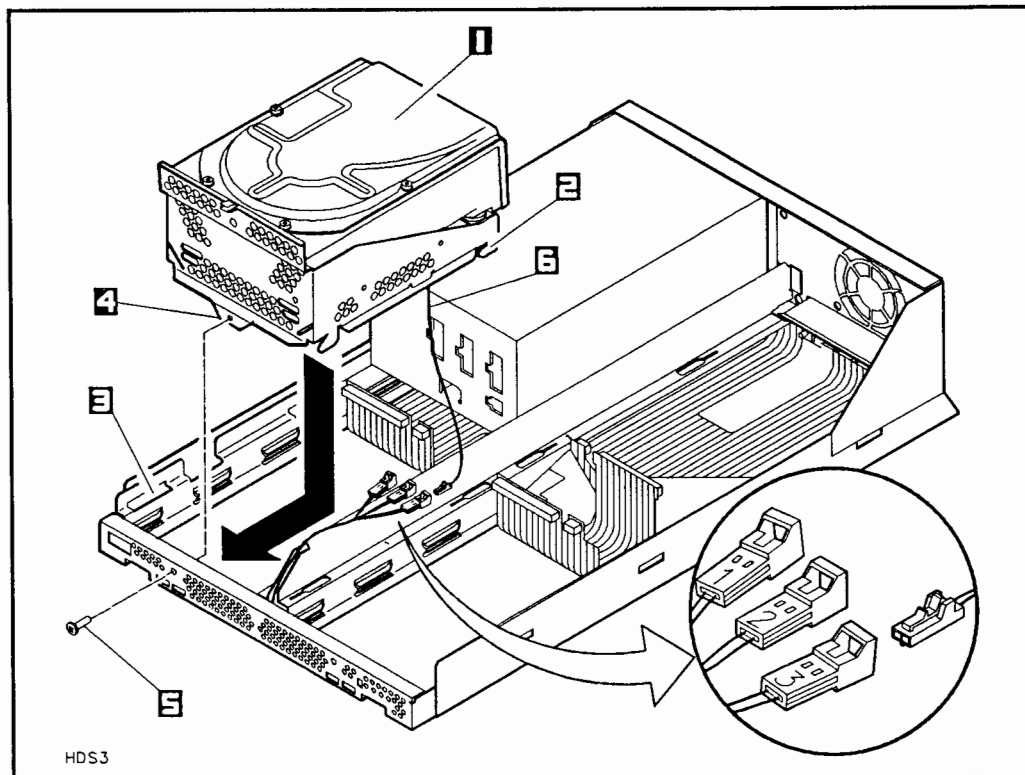
Figure 6-4. Hard Disk Drive in Slot 3

1—Hard Disk Drive   4—Securing Tab

2—Securing Tab (1 of 4)   5—T25 Screw

3—Securing Slot (1 of 4)   6—Status Cable

Hard Disk Controller PCA Removal

To remove a hard disk controller PCA from the hard disk drive, proceed as follows (see Figure 6-13 and Figure 6-5):

1. Place the foam pad, with the conductive sheet on top, on a level work surface. Attach the lead from the conductive sheet to a suitable ground. Attach the wrist ground strap to your wrist and carefully place the hard disk drive upside-down on the conductive sheet. Ground the hard disk drive to the conductive sheet.

2. Remove the four T10 screws (Figure 6-13, 8) that hold the mounting bracket (7) to the hard disk drive. Remove the bracket and set it aside.

3. Remove the two T10 screws (Figure 6-5, 2) inside the two access holes that secure the heat sink on the hard disk controller PCA (1) to the hard disk drive.

Note	Do not remove the two T10 screws that secure the heat sink to the hard disk controller PCA.

4. Remove the two T10 screws (2) that go through the controller PCA on the opposite side of the hard disk drive (near the SCSI connector).

5. Allow the hard disk controller PCA (1) to hinge up and away from the disk drive. See Figure 6-5. Support the hard disk controller PCA with one hand to ensure that no stress is placed on the wiring between the PCA and the hard disk drive.

6. Press the release tab on the 5-pin speed sense cable (4), and then unplug the speed sense cable from the controller PCA..

7. Remove the 8-pin spindle drive cable (5).

8. Remove the 26-pin data cable (3).

9. Remove the hard disk controller PCA (1).

Note	Before you ship the old controller PCA back to the exchange program, be sure to remove the SCSI Coupon Board (see 9, Figure 6-5) from the old controller PCA. The SCSI coupon

board must be removed and installed into the new controller
PCA. Refer to the removal procedure that follows.

Removing the SCSI Coupon Board

1. Remove the hard disk drive and hard disk controller PCA as described
   previously in this chapter (see Figure 6-5).

Caution	When removing the SCSI coupon board, grasp it by its edges, and remove it by pulling it straight up and off of the controller PCA. Note that the SCSI coupon board is keyed on pin 5, such that it will only fit over the pins in one position, which is over the sets of pins furthest from the heat sinks on the controller PCA, and in this position the ICs on the SCSI coupon board face away from the center off the controller PCA. Also, be sure not to catch your fingers or clothing on the unused pinsets near the edge of the controller PCA, as they are very sharp.

2. To replace the SCSI coupon board (9), remove the old coupon board. Be
   careful not to bend or damage the connector pins.

3. Check the new coupon board for a connector-key "plug" installed in the
   connector. If the corresponding male pin on the controller PCA has not
   been removed, carefully remove the plug with a small, sharp-pointed
   instrument before installing the new coupon board.

4. Carefully install the new SCSI coupon board as shown in Figure 6-5 (with
   the ICs facing outward).
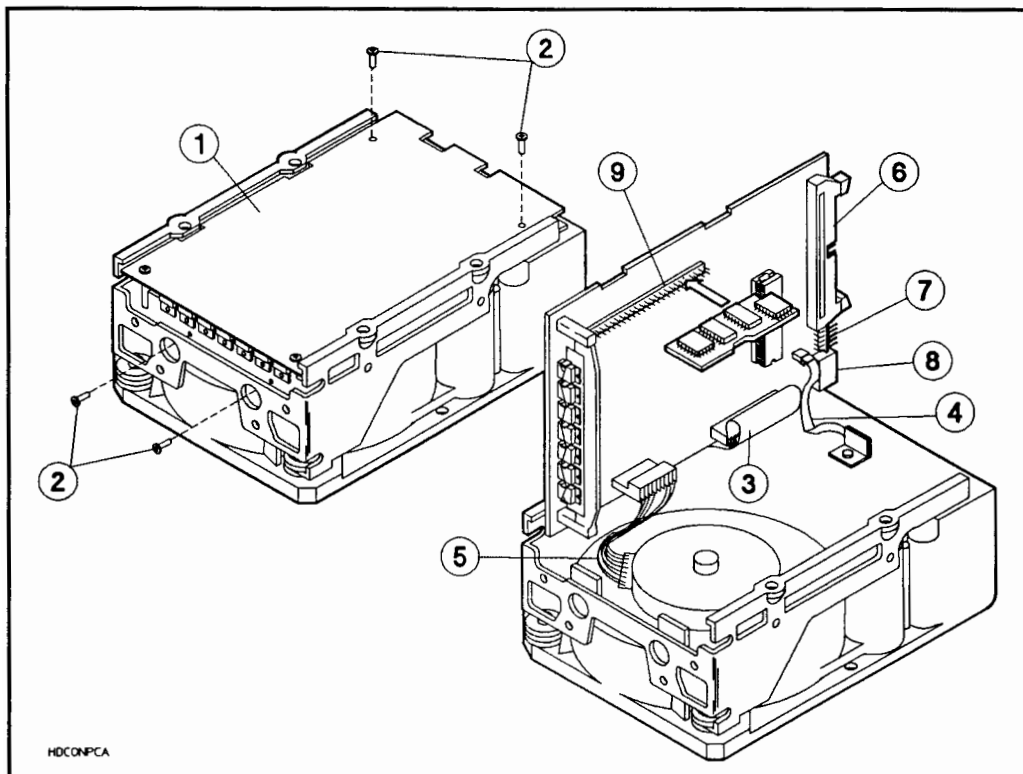
Figure 6-5. Hard Disk Drive Controller Removal

1—SCSI PCA

2—SCSI PCA mounting screws

3—Data Cable

4—Speed Sense Cable

5—Spindle Drive Cable

6—SCSI Connector

7—Option/Address Connector

8—DC Power Connector

9—SCSI Coupon Board

Hard Disk Controller PCA Replacement

1. Attach the 26-pin data cable (Figure 6-5, 3). Note that some of the pins on this cable are keyed for proper alignment.

2. Attach the 8-pin spindle drive cable (5).

3. Attach the 5-pin speed sense cable (4).

4. Reattach the hard disk controller PCA (1) to the hard disk drive with the four T10 screws removed (2) in steps 3. and 4.

5. If the hard disk status cable was removed, attach it again making sure that the red wire is toward the outside edge of the hard disk drive.

6. Attach the bracket to the hard disk drive with the four T10 screws removed in step 2.

7. If you are installing a new controller PCA, make sure that the address switches, terminator resistor, and SCSI coupon board are correct and in place (look at the old controller for switch settings).

8. Place the hard disk drive back into the mass storage system. When switched on, the hard disk drive will perform self-test.

Rewritable Optical Disk Drive Removal

Laser Safety

Warning	■ Use of controls, adjustments, or performing procedures other than those specified in this manual may result in hazardous invisible laser radiation exposure. None of the mechanisms within the mass storage system contain customer or field-replaceable parts.
	■ Do NOT disassemble the rewritable optical disk drive for any reason. The rewritable optical disk drive becomes a Class 3B laser mechanism when disassembled. If the rewritable optical disk drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.
	■ Please observe the following warning label, which is located on the top of the rewritable optical disk drive:
	DANGER - Invisible laser radiation when open. Avoid direct exposure to beam.

Make sure that power to the mass storage system has been removed before beginning this procedure. To remove a rewritable optical disk drive, proceed as follows (see Figure 6-6, Figure 6-7, Figure 6-8, Figure 6-14, and Table 6-3):

Note	Due to physical limitations of the chassis, the rewritable optical disk drive and its controller can only be placed in slot 1 (right-front) in the mass storage system. Refer to "Product Structures" in Chapter 1.

Handling Precautions

| **Caution** | ■ Because of incompatibilities between various revisions of mechanisms and their controllers, it is highly recommended that both the PCA and the mechanism be replaced as a pair, using the part number combinations provided in Table 6-1.

■ Never move the mass storage system with rewritable optical disk media in the drive. Damage to the optical read/write mechanism can occur if the drive is moved or bumped while the power is off and a disk is inserted.

■ Electrostatic discharge can damage the rewritable optical disk drive and associated electronics. The installation procedure must be performed in areas with carpeting treated for ESD protection or in areas with conductive flooring. If you do not protect the drive against electrostatic discharge, you may damage the rewritable optical disk drive and void the warranty.

■ Handle the rewritable optical disk drive with care. The rewritable optical disk drive is susceptible to mechanical shock, vibration, and electrostatic discharge until it is secured into the mass storage system chassis. Never set the rewritable optical disk drive upside-down or it will be damaged. Also, make sure that the rewritable optical controller PCA is handled only by its edges; it is very susceptible to electrostatic discharge.

Preparing to Remove a Rewritable Optical Disk Drive

1. Shut down the host computer system.

2. Power off the host computer and the mass storage system.

3. Disconnect the SCSI cable from the mass storage system rear panel.

4. Set the (LINE⁻) switch to the 0 (out) position and connect the power cord from the mass storage system rear panel to an ac power outlet.

5. Wrap one end of the ground strap around your wrist and apply the other end to a flat, unpainted area of the mass storage system chassis.

Note	Keep the wrist strap on until you have performed all the steps in the removal procedure.

6. Place the rear of the mass storage system chassis on the conductive sheet.

7. Ensure that the mass storage system chassis maintains contact with the conductive sheet while sliding the foam pad beneath the loose end of the conductive sheet.

8. Disconnect the ac power cord from the mass storage system rear panel.

Warning	**Ensure that the (LINE⁻) switch on the mass storage system front panel is in the 0 (out) position, and that the power cord is disconnected from the mass storage system rear panel. Electrical shock may result if the power cord is connected and the (LINE⁻) switch is in the 1 (in) position while the top cover is off.**

9. Remove the front panel and top cover from the mass storage system chassis (refer to "Removing the Front Panel and Top Cover" in this chapter).

Disconnecting the Cables

Disconnect the cables from the rewritable optical disk drive as follows (see Table 6-3 and Figure 6-14):

Caution	The BEND/flex cable tears easily when torque is applied to it. When handling the BEND/flex cable, be careful not to twist it. When disconnecting the BEND/flex cable from the rewritable optical disk drive, grasp both sides of the BEND/flex cable connector and carefully pull it off the rewritable optical disk drive connector.

1. Remove the front panel and top cover as described previously in this chapter.

2. The rewritable optical disk drive is always located in slot 1 (the right front corner). Locate the proper power cable connector on the power supply (they are labeled 1, 2, and 3). Remove the power cable (5) from the proper connector (number 1) on the power supply.

3. Disconnect the two 4-pin connectors on the power supply harness from the rewritable optical disk drive and the rewritable optical controller PCA.

4. Remove the BEND/flex SCSI cable adapter (8) connected between the BEND/flex cable and the rewritable optical controller PCA.

5. Remove the BEND/flex SCSI cable adapter (8) from the BEND/flex SCSI cable.

6. Remove the T25 screw (12) which goes through the front of the mass storage system. Once the screw has been removed, locate where the front of the rewritable optical disk drive meets the mass storage system chassis (above the screw that was removed). Use a flat-bladed screw driver to pry the front of the rewritable optical disk drive away from the mass storage system chassis.

Caution	Slide the rewritable optical disk drive out of its slot very carefully. Damage to the rewritable optical controller PCA or the BEND/flex cable beneath the rewritable optical disk drive may occur if the rewritable optical disk drive is not handled carefully.

7. Carefully raise the rewritable optical disk drive from its slot; once the screw has been removed, it can be slid out of place (toward the middle of the mass storage system).

8. Reinstallation is a reversal of the removal procedure. During reinstallation, make sure the BEND/flex cable is positioned properly before installing the rewritable optical disk drive.
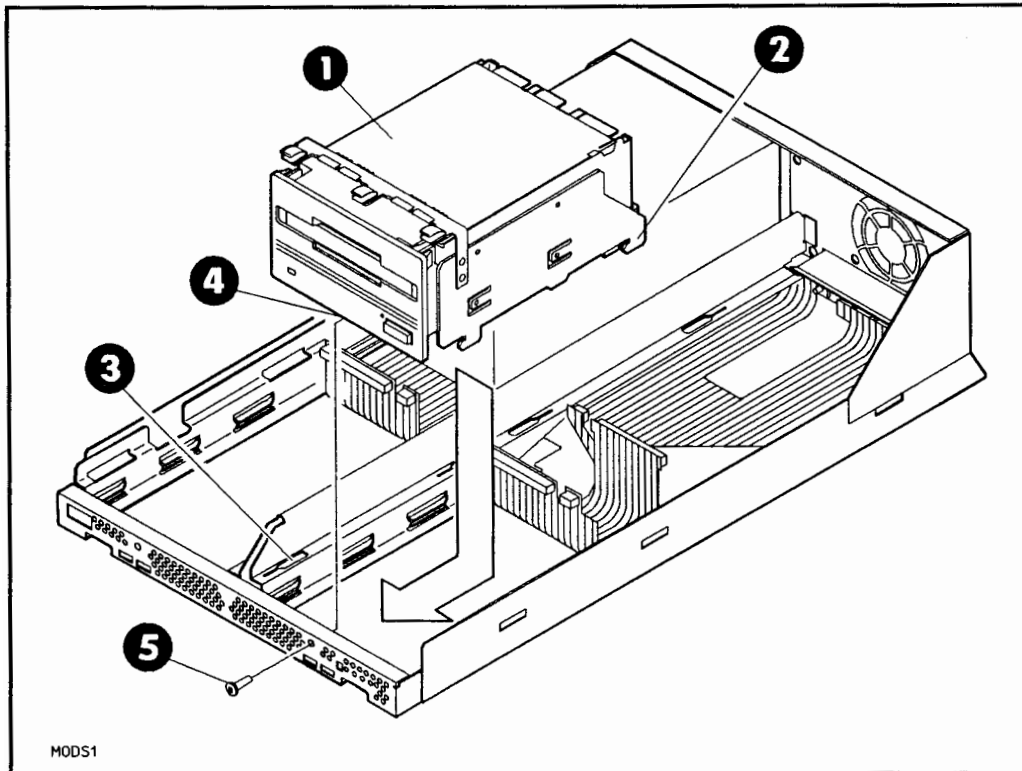
Figure 6-6. Rewritable Optical Disk Drive

1—Rewritable Optical Disk Drive   4—Securing Tab

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slots (1 of 4)

Rewritable Optical Controller PCA

Note	In order to completely remove the rewritable optical controller PCA (Figure 6-14, 2) from the mass storage system chassis, the BEND/flex cable must be removed first. This may involve removing other SCSI drives from the mass storage system. Refer to "BEND/flex Cable" in this chapter for removal instructions.

1. Remove the BEND/flex cable as described in "BEND/flex Cable" at the end of this chapter.

2. Remove the two T10 screws (5) (see Figure 6-7 and Figure 6-8) that hold the rewritable optical controller PCA to the mounting bracket.

3. Slide the rewritable optical controller PCA toward the rear of the mass storage system until it can be removed from the mass storage system chassis.

4. Reinstallation is reversal of the removal procedure.

MOPCAS1
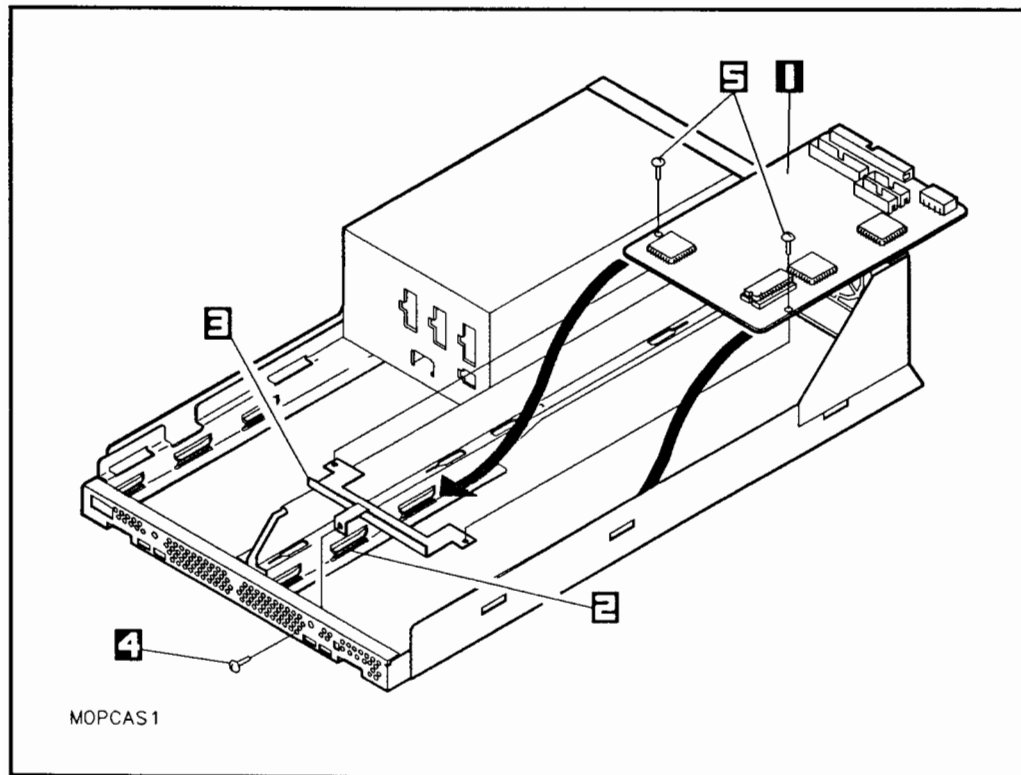
Figure 6-7. Rewritable Optical Controller PCA Removal and Installation

1—Rewritable Optical Controller   4—Bracket-to-Chassis Screw

2—Controller PCA Guides   5—Bracket-to-PCA Screws
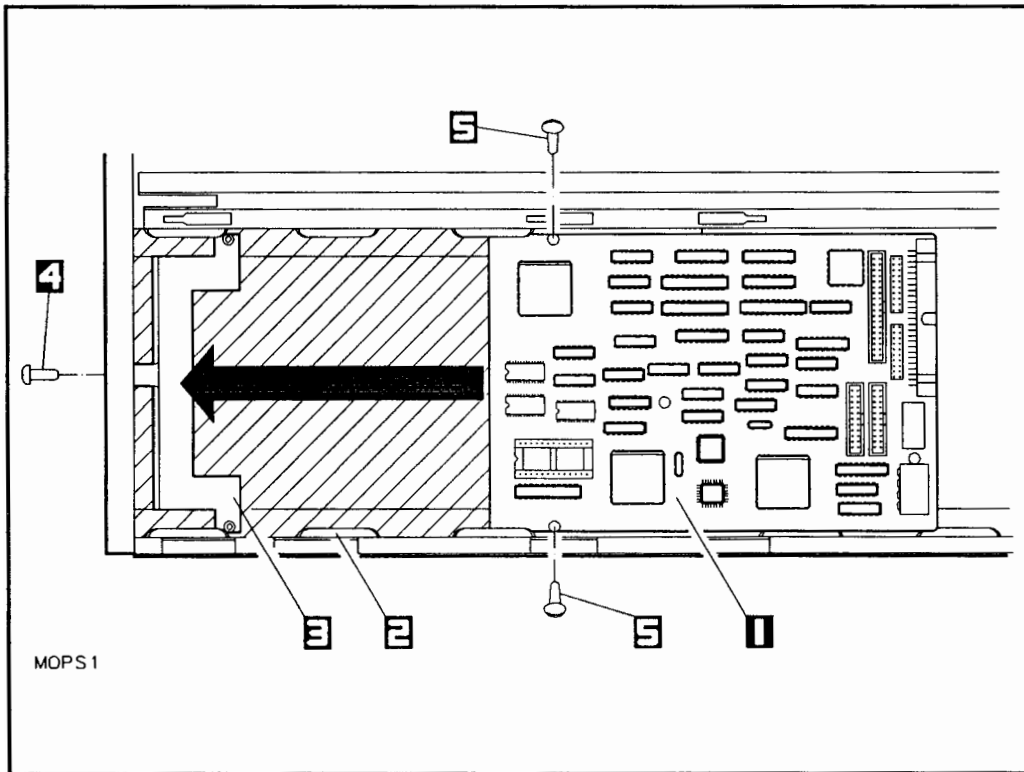
3—Mounting Bracket

Figure 6-8. Sliding the Rewritable Optical Controller PCA into the PCA Guides

1—Rewritable Optical Controller   4—Bracket-to-Chassis Screw

2—Controller PCA Guides   5—Bracket-to-PCA Screws

3—Mounting Bracket

CD-ROM Drive Removal

Laser Safety

Warning	■ Use of controls, adjustments, or performing procedures other than those specified in this manual may result in hazardous invisible laser radiation exposure. None of the mechanisms within the mass storage system contain customer or field-replaceable parts.
	■ Do NOT disassemble the CD-ROM drive for any reason. The CD-ROM drive becomes a Class 3B laser mechanism when disassembled. If the CD-ROM disk drive is disassembled, exposure to the invisible laser beam and hazardous invisible laser radiation could result in blindness.

This section describes how to remove a CD-ROM drive from the mass storage system. See Figure 6-15 and Table 6-4.

Caution	Handle the CD-ROM drive with care. When it is not secured in the mass storage system, the CD-ROM drive is very susceptible to any mechanical shock, vibration, or electrostatic discharge.

Handling Precautions

Caution	■ Electrostatic discharge can damage the CD-ROM drive and associated electronics. The installation procedure must be performed in areas with carpeting treated for ESD protection or in areas with conductive flooring. If you do not protect the drive against electrostatic discharge, you may damage the CD-ROM drive and void the warranty. ■ Handle the CD-ROM drive with care. The CD-ROM drive is susceptible to mechanical shock, vibration, and electrostatic discharge until it is secured into the mass storage system chassis. Never set the CD-ROM drive upside-down or the CD-ROM drive will be damaged.

Preparing to Remove a CD-ROM Drive

1. Shut down the host computer system.

2. Power off the host computer and the mass storage system.

3. Disconnect the SCSI cable from the mass storage system rear panel.

4. Set the (LINE⁻) switch to the 0 (out) position and connect the power cord from the mass storage system rear panel to an ac power outlet.

5. Wrap one end of the ground strap around your wrist and apply the other end to a flat, unpainted area of the mass storage system chassis.

Note	Keep the wrist strap on until you have performed all the steps in the removal procedure.

6. Place the rear of the mass storage system chassis on the conductive sheet.

7. Ensure that the mass storage system chassis maintains contact with the conductive sheet while sliding the foam pad beneath the loose end of the conductive sheet.

8. Disconnect the ac power cord from the mass storage system rear panel.

Warning	**Electrical shock may result if the power cord is connected and the (LINE⁻) switch is in the 1 (in) position while the top cover is off. Ensure that the (LINE⁻) switch on the mass storage system front panel is in the 0 (out) position, and that the power cord is disconnected from the mass storage system rear panel.**

9. Remove the front panel and top cover from the mass storage system chassis (refer to "Removing the Front Panel and Top Cover" in this chapter).

Disconnecting the Cables

Disconnect the cables from the CD-ROM drive as follows:

| Caution	The BEND/flex cable tears easily when torque is applied to it. When handling the BEND/flex cable, be careful not to twist it. When disconnecting the BEND/flex cable from the CD-ROM drive, grasp both sides of the BEND/flex cable connector and carefully pull it off the CD-ROM drive connector.

1. Disconnect the dc power cable (Figure 6-15, 4) from the dc power connector on the CD-ROM drive.

2. Disconnect the dc power cable from the connector on the power supply, then cut the power cable tie wrap.

3. Disconnect the BEND/flex SCSI cable adapter (5) from the BEND/flex SCSI cable.

Removing the CD-ROM Drive

Remove the CD-ROM drive from the mass storage system chassis as follows:

1. Remove the T25 screw (Figure 6-15, 6) from the front of the mass storage system chassis.

2. Use a flat-bladed screw driver to pry the front of the CD-ROM drive bracket away from the mass storage system chassis.

3. Slide the CD-ROM drive on the chassis rails toward the center of the mass storage system chassis until the mounting tabs stop against the ends of the mounting slots.

4. Push the BEND/flex cable connectors toward the center of the chassis and lift the CD-ROM drive out of the mass storage system chassis and onto the conductive sheet.
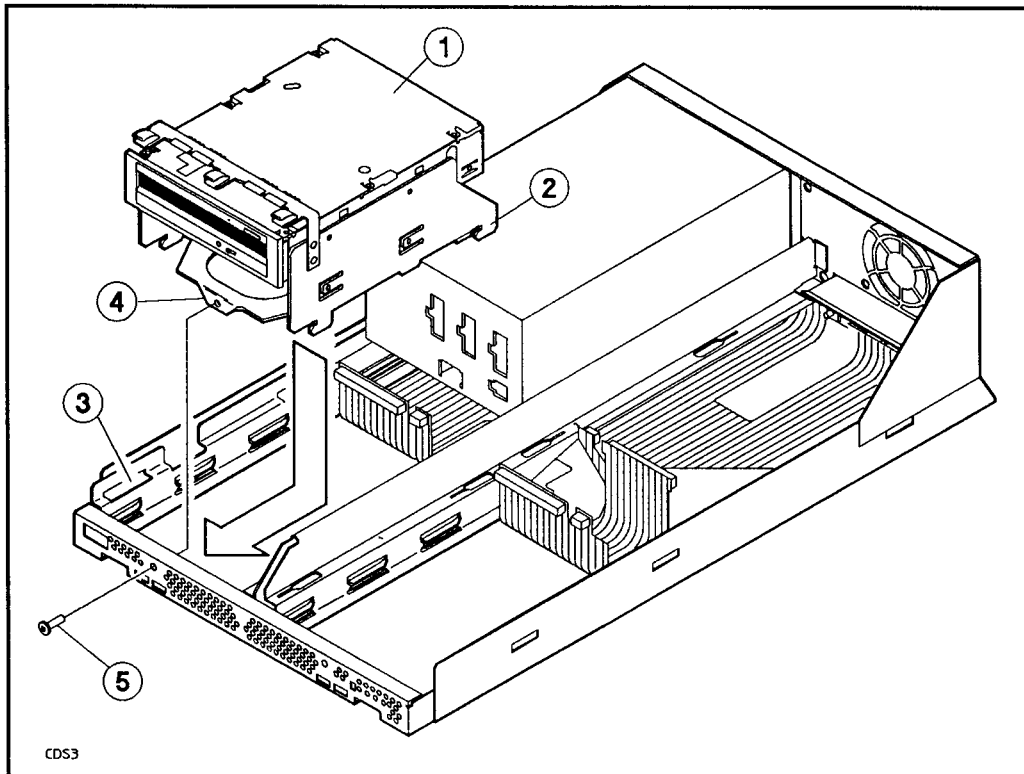
Figure 6-9. CD-ROM Drive

1—CD-ROM Drive   4—Securing Tab

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slot (1 of 4)

Removing the DDS-format Tape Drive

This section describes how to remove a DDS-format tape drive from the mass storage system. See Figure 6-16 and Table 6-5.

Handling Precautions

Caution	■ Electrostatic discharge can damage the DDS-format tape drive and associated electronics. The installation procedure must be performed in areas with carpeting treated for ESD protection or in areas with conductive flooring. If you do not protect the DDS-format tape drive against electrostatic discharge, you may damage the DDS-format tape drive and void the warranty.
	■ Handle the DDS-format tape drive with care. The DDS-format tape drive is susceptible to mechanical shock, vibration, and electrostatic discharge until it is secured into the mass storage system chassis. Never set the DDS-format tape drive upside-down or the DDS-format tape drive will be damaged.

Preparing to Remove a DDS-format Tape Drive

1. Shut down the host computer system.

2. Power off the host computer and the mass storage system.

3. Disconnect the SCSI cable from the mass storage system rear panel.

4. Set the (LINE⁻) switch to the 0 (out) position and connect the power cord from the mass storage system rear panel to an ac power outlet.

5. Wrap one end of the ground strap around your wrist and apply the other end to a flat, unpainted area of the mass storage system chassis.

Note   Keep the wrist strap on until you have performed all the steps
                   in the removal procedure.

---

6. Place the rear of the mass storage system chassis on the conductive sheet.

7. Ensure that the mass storage system chassis maintains contact with the conductive sheet while sliding the foam pad beneath the loose end of the conductive sheet.

8. Disconnect the ac power cord from the mass storage system rear panel.

Warning   **Electrical shock may result if the power cord is connected and
                  the (LINE⁻) switch is in the 1 (in) position while the top cover is
                  off. Ensure that the (LINE⁻) switch on the mass storage system
                  front panel is in the 0 (out) position, and that the power cord is
                  disconnected from the mass storage system rear panel.**

---

9. Remove the front panel and top cover from the mass storage system chassis (refer to "Removing the Front Panel and Top Cover" in this chapter).

Disconnecting the Cables

Disconnect the cables from the DDS-format tape (DAT) drive as follows:

Caution	The BEND/flex cable tears easily when torque is applied to it. When handling the BEND/flex cable, be careful not to twist it. When disconnecting the BEND/flex cable from the DDS-format tape drive, grasp both sides of the BEND/flex cable connector and carefully pull it off the DDS-format tape drive connector.

1. Disconnect the dc power cable (Figure 6-16, 4) from the dc power connector on the DDS-format tape drive.

2. Disconnect the dc power cable from the slot 1 power connector on the power supply, then cut the power cable tie wrap.

3. Disconnect the BEND/flex SCSI cable adapter (5) from the BEND/flex SCSI cable.

Removing the DDS-format Tape Drive

Remove the DDS-format tape (DAT) drive from the mass storage system chassis as follows:

1. Remove the T25 screw (Figure 6-16, 6) from the front of the mass storage system chassis.

2. Use a flat-bladed screw driver to pry the front of the DDS-format tape drive bracket away from the mass storage system chassis.

3. Slide the DDS-format tape drive on the chassis rails toward the center of the mass storage system chassis until the mounting tabs stop against the ends of the mounting slots.

4. Push the BEND/flex cable connectors toward the center of the chassis and lift the DDS-format tape drive out of the mass storage system chassis and onto the conductive sheet.
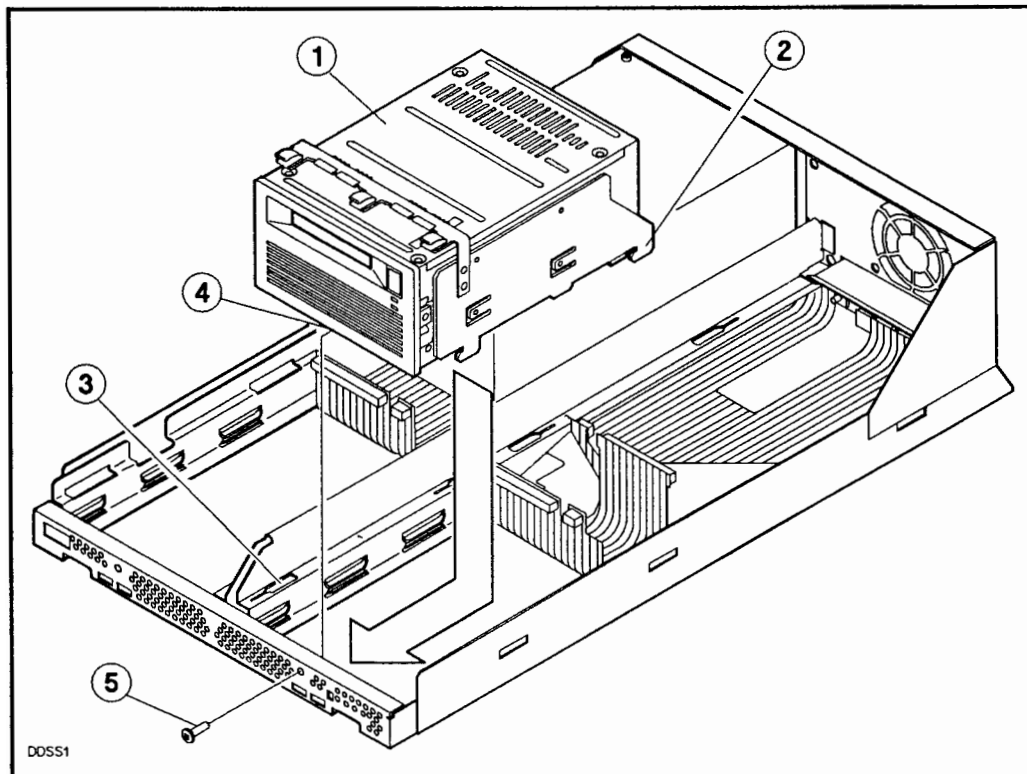
Figure 6-10. DDS-format Tape Drive in Slot 1

1—DDS-format Tape Drive   4—Securing Tab

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slot (1 of 4)

Removing the Quarter-Inch Cartridge Tape Drive

This section describes how to remove a quarter-inch cartridge tape drive from the mass storage system. See Figure 6-17 and Table 6-6.

Handling Precautions

Caution	■ Electrostatic discharge can damage the tape drive and associated electronics. The installation procedure must be performed in areas with carpeting treated for ESD protection or in areas with conductive flooring. If you do not protect the tape drive against electrostatic discharge, you may damage the tape drive and void the warranty.
	■ Handle the tape drive with care. The tape drive is susceptible to mechanical shock, vibration, and electrostatic discharge until it is secured into the mass storage system chassis.

Note	Due to physical limitations of the chassis, the quarter-inch cartridge tape drive can only be placed in the "upper" location of slot 3 (left-front) in the mass storage system. When a quarter-inch cartridge tape drive is installed, the "lower" location of slot 3 must remain vacant. Refer to "Product Structures" in Chapter 1.

Preparing to Remove a Quarter-Inch Cartridge Tape Drive

1. Shut down the host computer system.

2. Power off the host computer and the mass storage system.

3. Disconnect the SCSI cable from the mass storage system rear panel.

4. Set the (LINE⁻) switch to the 0 (out) position and connect the power cord from the mass storage system rear panel to an ac power outlet.

5. Wrap one end of the ground strap around your wrist and apply the other end to a flat, unpainted area of the mass storage system chassis.

Note	Keep the wrist strap on until you have performed all the steps in the removal procedure.

6. Place the rear of the mass storage system chassis on the conductive sheet.

7. Ensure that the mass storage system chassis maintains contact with the conductive sheet while sliding the foam pad beneath the loose end of the conductive sheet.

8. Disconnect the ac power cord from the mass storage system rear panel.

Warning	**Electrical shock may result if the power cord is connected and the (LINE⁻) switch is in the 1 (in) position while the top cover is off. Ensure that the (LINE⁻) switch on the mass storage system front panel is in the 0 (out) position, and that the power cord is disconnected from the mass storage system rear panel.**

9. Remove the front panel and top cover from the mass storage system chassis (refer to "Removing the Front Panel and Top Cover" in this chapter).

Disconnecting the Cables

Disconnect the cables from the quarter-inch cartridge tape drive as follows:

Caution	The BEND/flex cable tears easily when torque is applied to it. When handling the BEND/flex cable, be careful not to twist it. Traces may be broken with no visible damage. When disconnecting the BEND/flex cable from the tape drive, grasp both sides of the BEND/flex cable connector and carefully pull it off the tape drive connector.

1. Disconnect the dc power cable (Figure 6-17, 4) from the dc power connector on the tape drive.

2. Disconnect the dc power cable from the power connector on the power supply, then cut the power cable tie wrap.

3. Disconnect the BEND/flex SCSI cable adapter (5) from the tape drive SCSI connector.

Removing the Quarter-Inch Cartridge Tape Drive

Remove the quarter-inch cartridge tape drive from the mass storage system chassis as follows:

1. Remove the T25 screw (Figure 6-17, 6) from the front of the mass storage system chassis.

2. Use a flat-bladed screw driver to pry the front of the tape drive bracket away from the mass storage system chassis.

3. Slide the tape drive on the chassis rails toward the center of the mass storage system chassis until the mounting tabs stop against the ends of the mounting slots.

4. Push the BEND/flex cable connectors toward the center of the chassis and lift the tape drive out of the mass storage system chassis and onto the conductive sheet.
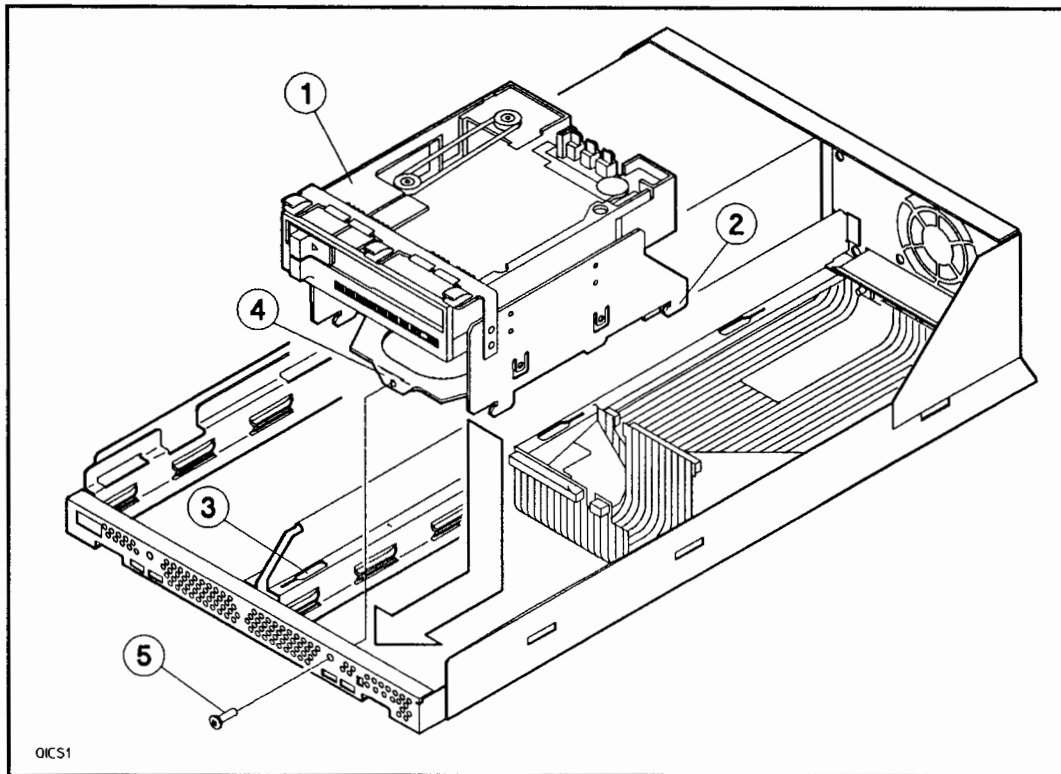
Figure 6-11. Quarter-Inch Cartridge Tape Drive in Slot 1

1—Tape Drive   4—Securing Tab

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slot (1 of 4)
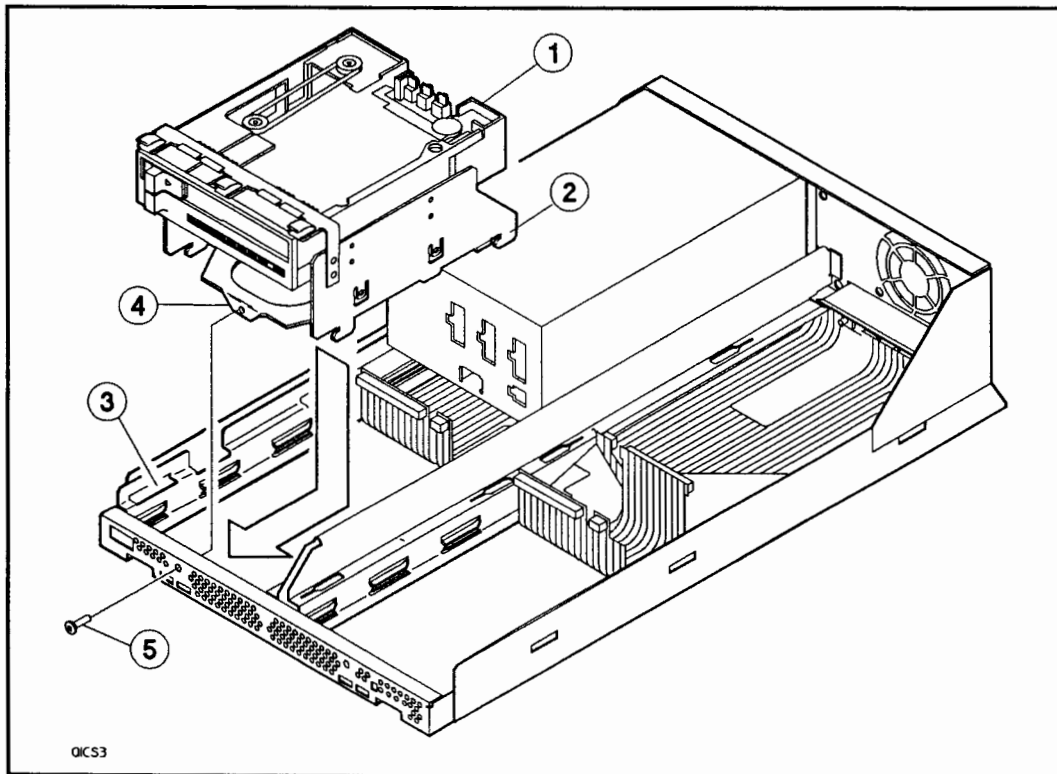
Figure 6-12. Quarter-Inch Cartridge Tape Drive in Slot 3

1—Tape Drive   4—Securing Tab

2—Mounting Tab (1 of 4)   5—T25 Screw

3—Mounting Slot (1 of 4)

BEND/flex Cable

To remove the BEND/flex cable (Figure 6-13, 20), proceed as follows:

Caution	■ When handling the BEND/flex cable, *do not* crease, twist, or stress its connectors. The BEND/flex cable tears easily when it is twisted. Traces may be broken with no visible damage.
	■ When connecting a BEND/flex connector to another connector, grasp both sides of the BEND/flex connector and carefully push it onto the other connector.
	■ When installing hard disk drives, always connect the option/address part of the connector before the SCSI cable.
	■ Handle the BEND/flex cable with care, especially when removing SCSI devices from the mass storage system. Never crease the BEND/flex cable.

1. Remove the front panel and top cover as described previously.

2. Remove the SCSI cable and the SCSI terminator (if present) from the rear panel of the mass storage system.

3. Remove the BEND/flex cable from each installed SCSI device.

4. Remove any cable adapters connected between the BEND/flex cable and the SCSI devices.

5. Remove the three T15 screws (18) from the SCSI Option/Address plate (17); one is in the top-center of the plate, and the other two face downward into the mass storage system chassis.

6. Gently push down each tab on the BEND/flex, so the tabs do not get caught between the mass storage system chassis and the SCSI devices.

7. Slide the BEND/flex cable out the rear of the mass storage system.

8. To separate the BEND/flex cable (20) from the option/address connector plate (17), remove two T15 screws (21) from behind the four SCSI address switches, and four T10 screws (22) from the two SCSI connectors.

9. Reinstallation is a reversal of the removal procedure.

Power Supply

To remove the power supply (Figure 6-13, 12), proceed as follows:

1. Remove the front panel and top cover as described previously in this chapter.

Note	Before removing the power supply, note how many SCSI devices are currently installed in the mass storage system and their location. There may be up to three devices, identified by slots 1, 2 and 3 on the side of the power supply next to each cable harness. For easier installation, label each connector with tape or pencil before it is removed.

2. When each cable is properly labeled, remove each SCSI device power cable (10) from the power supply.

3. Remove the fan power cable (14) from the power supply.

4. Remove one T15 screw (13) from the rear of the mass storage system (located in the lower-center of the power supply).

5. Remove two T15 screws (13) from the power supply below the power cable connectors (located near the center of the mass storage system).

6. Slide the power supply forward and then lift it up high enough so that there is access to all of the cable connectors.

7. Slide the power supply forward, and lift it up and out of the mass storage system.

8. When reinstalling the power supply, first be sure that the rocker arm (27) in the lower rear corner of the mass storage system chassis aligns properly with the switch on the power supply. Once aligned, reinstallation is a reversal of the removal procedure.

Note	The power supply has an internal cooling fan that is not a field-replaceable assembly.

Chassis Fan

To remove the chassis fan (Figure 6-13, 14), proceed as follows:

1. Remove the front panel and top cover as described previously in this chapter.

2. Disconnect the fan cable from the power supply.

3. Remove two T25 screws (15) from the back of the fan.

4. Pull the fan straight toward the front of the mass storage system and remove.

Note	Note the orientation of the fan with respect to the mass storage system (label on fan faces rear of mass storage system chassis, and fan power cable exits from side of fan closest to the power supply). Also, the fan power cable is routed through metal tabs in the mass storage system chassis. Note the arrow on the fan body indicating airflow direction (out the back of the mass storage system).

5. Reinstallation is a reversal of the removal procedure.

Note	The chassis fan **must** be connected to the power supply or the power supply will not come on when power is applied.

LED Assembly

To remove the status LED assembly (Figure 6-13, 19), proceed as follows:

1. Remove the front panel and top cover as described previously in this chapter.

2. Remove the hard disk drive from the right front corner (slot 1) of the mass storage system as described previously in this chapter.

3. Remove the indicator cables (9) from the hard disk status cables.

4. Pop out the LED assembly by pressing on the tab that secures the assembly at the outer edge of the mass storage system chassis, and remove the LED assembly and cable.

5. Reinstallation is a reversal of the removal procedure.

Table 6-2. Mass Storage System, Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-13-	C2212A	MASS STORAGE SYSTEM, 332 Mbyte SCSI	REF
	C2213A	MASS STORAGE SYSTEM, 664 Mbyte SCSI	REF
	C2212D	MASS STORAGE SYSTEM, 332 Mbyte Domain	REF
	C2213D	MASS STORAGE SYSTEM, 664 Mbyte Domain	REF
1	C2212-60040	*FRONT PANEL, Model 330S	1
	C2213-60040	*FRONT PANEL, Model 660S	REF
	C2212-60401	*FRONT PANEL, Model 330D	REF
	C2213-60401	*FRONT PANEL, Model 660D	REF
2	No Number	*NAME PLATE	1
3	C2200-60016	*TOP COVER	1
4	0515-0390	*SCREW[1], TORX, T15, M4.0x0.7, 6 mm	2
5	C2212-69061	*HARD DISK DRIVE, 332 Mbyte, HP-UX	1
	C2213-69061	*HARD DISK DRIVE, 664 Mbyte, HP-UX	REF
	C2212-69063	*HARD DISK DRIVE, 332 Mbyte, Domain	REF
	C2213-69063	*HARD DISK DRIVE, 664 Mbyte, Domain	REF
6	97548-69307	**HARD DISK CONTROLLER PCA[2]	1
7	C2200-60005	*BRACKET	1
8	0515-2111	*SCREW[1], TORX, T10, 6-32, 10 mm	4
9	C2212-60055	*HARD DISK STATUS CABLE	1
10	C2212-60058	*CABLE, POWER, long	1
11	0515-0386	*SCREW[1], TORX, T25, M5.0x0.8, 10 mm	1
12	C2200-60044	*POWER SUPPLY	1
13	0515-0390	*SCREW[1], TORX, T15, M4.0x0.7, 6 mm	4
14	C2200-60001	*FAN ASSEMBLY	1
15	0624-0661	*SCREW[1], TORX, T20, M5.0X0.8, 10 mm	2

[1]These parts may be obtained locally by their description.
[2]The hard disk controller does not include new firmware.

Table 6-2. Mass Storage System, Replaceable Parts (continued)

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
16	C2212-20011	*BRACKET SCREW (or HEX STANDOFF)	1
17	C2212-00006	*OPTION/ADDRESS CONNECTOR PLATE	1
18	0515-0390	*SCREW[1], TORX, T15, M4.0x0.7, 6 mm	3
19	C2212-60056	*STATUS DISPLAY ASSEMBLY	1
20	C2212-60057	*BEND/flex[2] CABLE ASSEMBLY	1
21	0515-0390	*SCREW[1], TORX, T15, M4.0x0.7, 6 mm	2
22	0515-2111	*SCREW[1], TORX, T10, 6-32, 10 mm	4
23	C2200-60005	*RFI BRACKET	1
24	0515-0386	*SCREW[1], TORX, T25, M5.0x0.8, 10 mm	1
25	1400-1567	*CABLE TIE	1
26	No Number	*CHASSIS, MASS STORAGE SYSTEM	1
27	07961-40003	*PUSH ROD	1
28	07961-40004	*ROCKER ARM	1
29	07961-60005	*PUSH BUTTON ASSEMBLY (includes spring)	1
30	1460-2216	**SPRING	1
31	8120-0698	*POWER CORD, NEMA5A/CEE	1
	8120-1351	*POWER CORD, BS 1363/CEE	REF
	8120-1369	*POWER CORD, ASC 112/CEE	REF
	8120-2371	*POWER CORD, NEMA5-15A/CEE	REF
	8120-1689	*POWER CORD, GMBH/CEE	REF
	8120-1860	*POWER CORD, CEE/CEE	REF
	8120-2104	*POWER CORD, SEV/CEE	REF
	8120-2956	*POWER CORD, MDPP/CEE	REF
	8120-4211	*POWER CORD, SABS/CEE	REF
	8120-4753	*POWER CORD, NEMA12A/CEE	REF

[1] These parts may be obtained locally by their description.
[2] BEND/flex is a product of Rogers Corporation.

Table 6-3. Rewritable Optical Disk Drive, Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-14-	C2294A	REWRITABLE OPTICAL DISK DRIVE KIT	REF
1	C1700-69120	*MAGNETO OPTICAL DRIVE II, SCSI	1
2	C1700-69005	*MAGNETO OPTICAL DRIVE CONTROLLER II, SCSI	1
3	C2212-60003	*DEVICE BRACKET ASSEMBLY	1
4	0515-0430	*SCREW[1], TORX, T10, M3.0x0.8, 6 mm	4
5	C2212-60054	*CABLE, DUAL POWER	1
6	C2294-60001	*CABLE, CONTROL	1
7	C2294-60002	*CABLE, DATA	1
8	C2294-60003	*CABLE, SCSI ADAPTER	1
9	C2294-00001	*PCA MOUNTING BRACKET	1
10	0515-0430	*SCREW[1], TORX, T10, M3.0x0.8, 6 mm	2
11	0515-2111	*SCREW[1], TORX, T10, 6-32, 10 mm	1
12	0515-0386	*SCREW[1], TORX, T25, M5.0x0.8, 10 mm	1
13	C1701-88800	*EMERGENCY EJECT TOOL	1
14	92280A	*REWRITABLE OPTICAL DISK CARTRIDGE	1
[1]These parts may be obtained locally by their description.			

6-50   Removal and Replacement

Table 6-4. CD-ROM Drive, Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-15-	C2293A	CD-ROM DRIVE KIT	REF
1	1150-1832	*CD-ROM DRIVE, 600 Mbyte, SCSI	1
2	C2212-60003	*DEVICE BRACKET ASSEMBLY	1
3	2360-0521	*SCREW[1], TORX, T10, 6-32, 10 mm	4
4	C2212-60054	*CABLE, DUAL POWER	1
5	C2212-60048	*CABLE, SCSI ADAPTER	1
6	0515-0386	*SCREW[1], TORX, T25, M5.0x0.8, 10 mm	1
7	C2293-80001	*CD-ROM DISK CADDY	1

[1]These parts may be obtained locally by their description.

Table 6-5. DDS-format Tape Drive, Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-16-	C2292A	DDS-FORMAT TAPE DRIVE KIT	REF
1	C1502-69202	*DDS-FORMAT TAPE DRIVE, SCSI	1
2	C2212-60003	*DEVICE BRACKET ASSEMBLY	1
3	0515-0430	*SCREW[1], TORX, T10, M3.0x0.8, 6 mm	4
4	C2212-60058	*CABLE, POWER, long	1
5	C2212-60048	*CABLE, SCSI ADAPTER	1
6	0515-0386	*SCREW[1], TORX, T25, M5.0x0.8, 10 mm	1
7	92283A	*DDS-FORMAT CASSETTE MEDIA	1
8	92283K	*DDS-FORMAT TAPE HEAD CLEANING CASSETTE	1
9	C2201-80006	*RFI END CLIP, BERYLLIUM COPPER	4

[1]These parts may be obtained locally by their description.

Removal and Replacement   6-51

Table 6-6. Quarter-Inch Cartridge Tape Drive, Replaceable Parts

FIG.& INDEX NO.	HP PART NO.	DESCRIPTION	UNITS PER ASSY
6-17-	C2296D	QUARTER-INCH CARTRIDGE DRIVE KIT	REF
1	011778-001R	*QIC DRIVE, SCSI	1
2	C2212-60003	*DEVICE BRACKET ASSEMBLY	1
3	0515-2111	*SCREW[1], TORX, T10, 6-32, 10 mm	4
4	C2212-60058	*CABLE, POWER, long	1
5	C2296-60401	*CABLE, SCSI ADAPTER	1
6	0515-0386	*SCREW[1], TORX, T25, M5.0x0.8, 10 mm	1
7	K1837	*QIC MEDIA (or K1838)	1
8	92281C	*QIC HEAD CLEANING KIT	1
9	C2296-80404	*HEAD RESTRAINT, SHIPPING (not shown)	1
[1]These parts may be obtained locally by their description.			
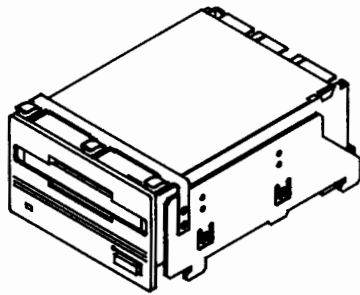
SEE FIGURE 6-14,
REWRITABLE OPTICAL
DISK DRIVE
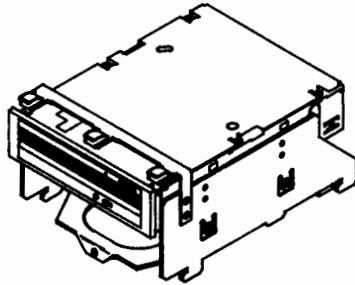
SEE FIGURE 6-15,
CD-ROM DRIVE
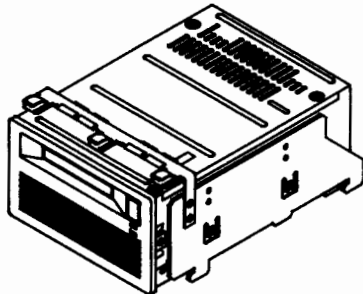
SEE FIGURE 6-16,
DDS-FORMAT
TAPE DRIVE

(
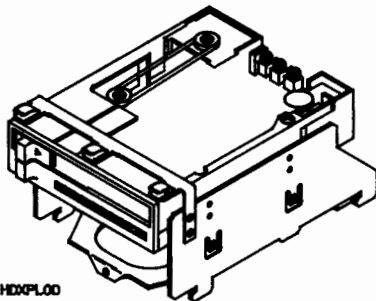
SEE FIGURE 6-17,
QUARTER-INCH
CARTRIDGE TAPE DRIVE

HDXPLOD
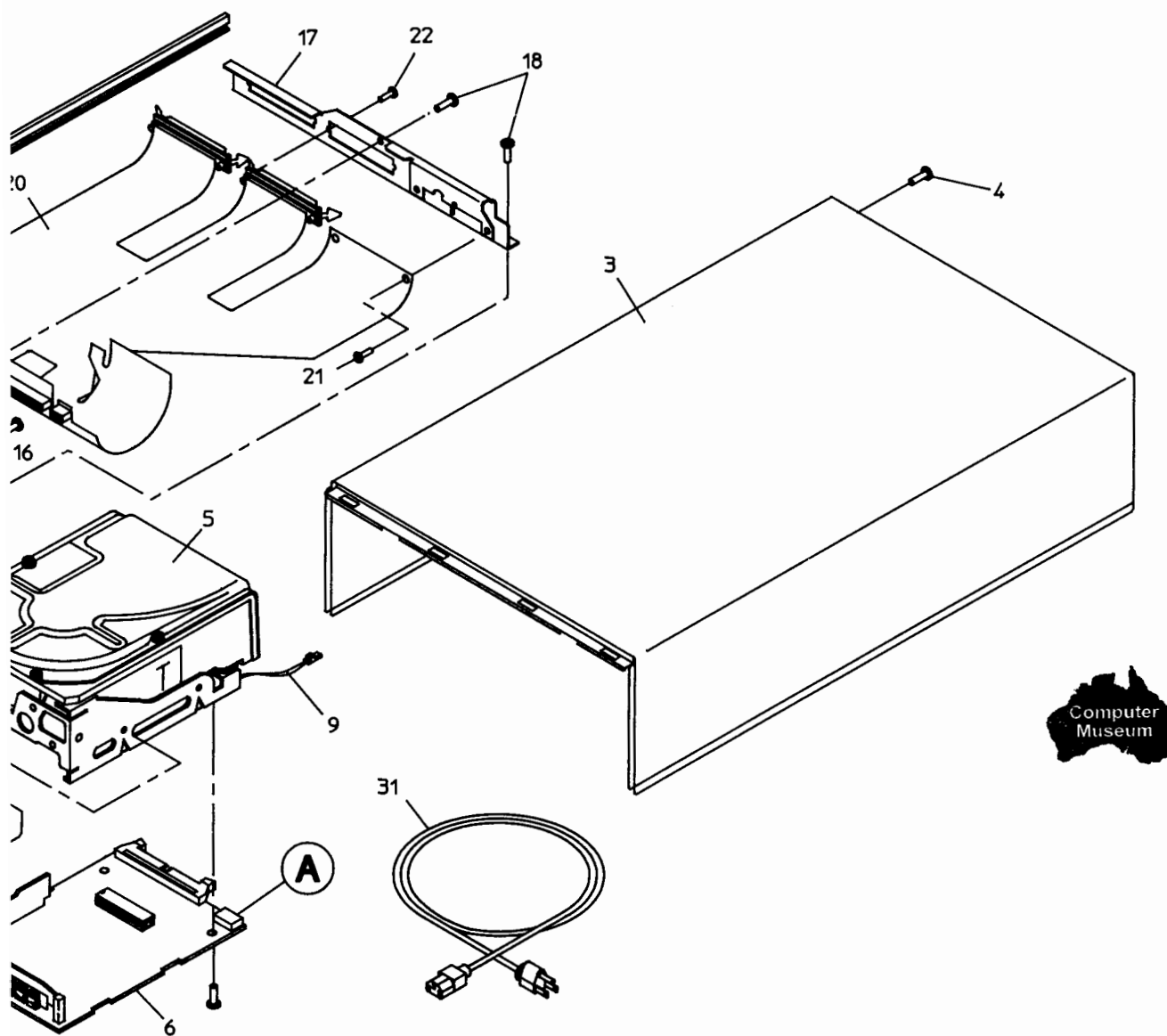
Figure 6-13. Mass Storage System, Exploded View
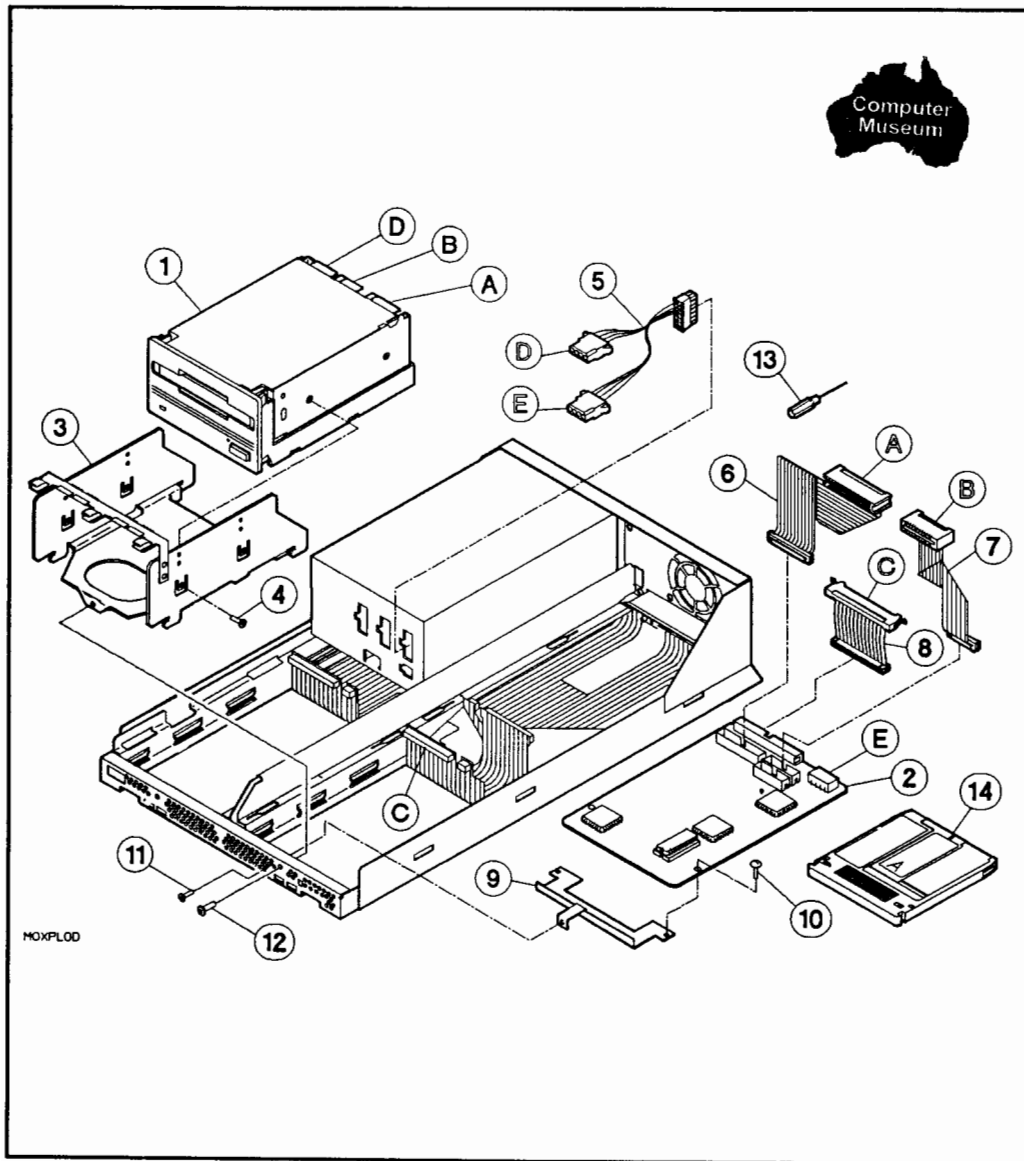
Figure 6-14. Rewritable Optical Disk Drive, Exploded View
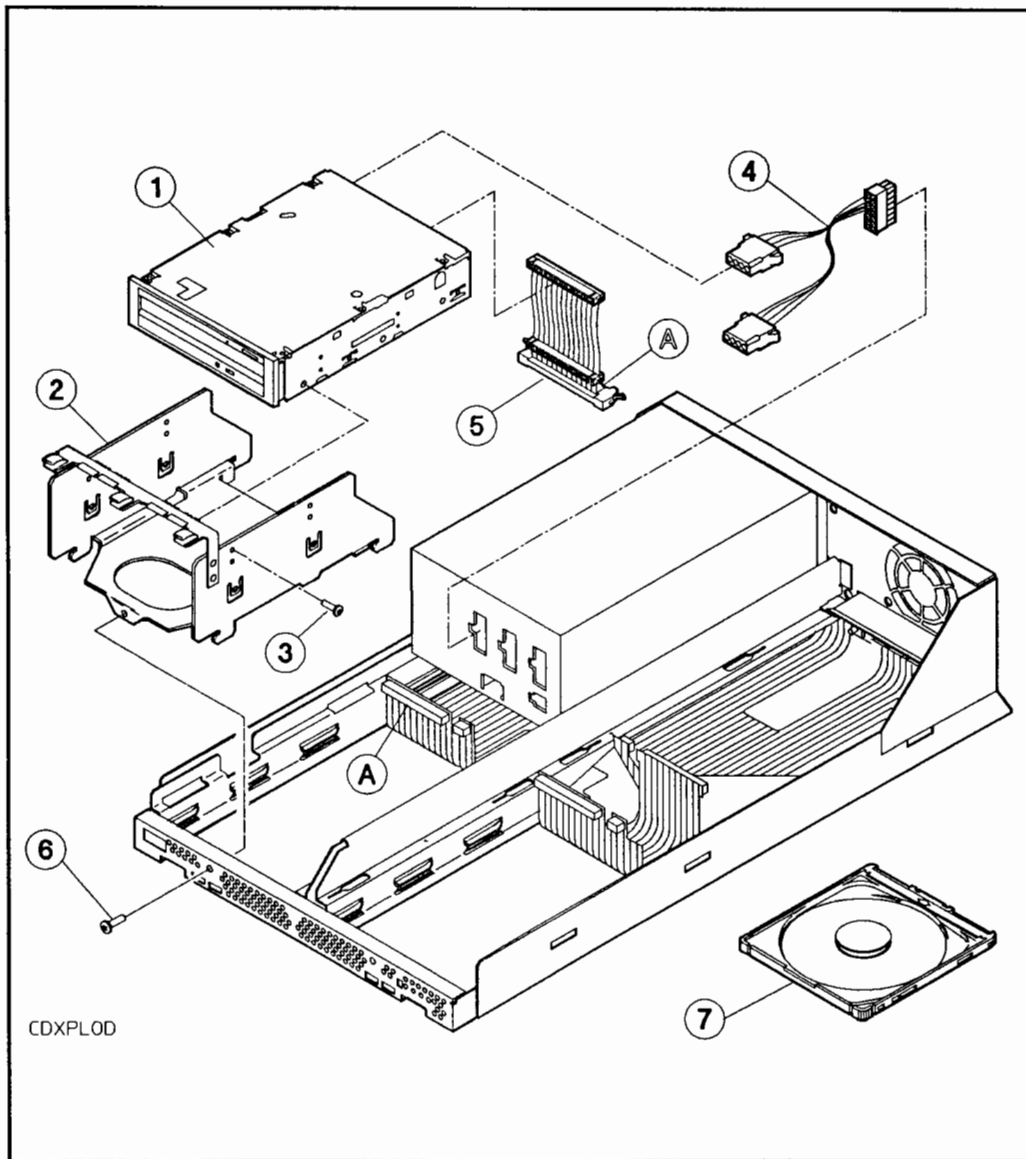
Figure 6-15. CD-ROM Drive, Exploded View

DDSXPLOD

Figure 6-16. DDS-format Tape Drive, Exploded View

QICXPLOD

Figure 6-17. Quarter-Inch Cartridge Tape Drive, Exploded View

Models 330D/S and 660D/S
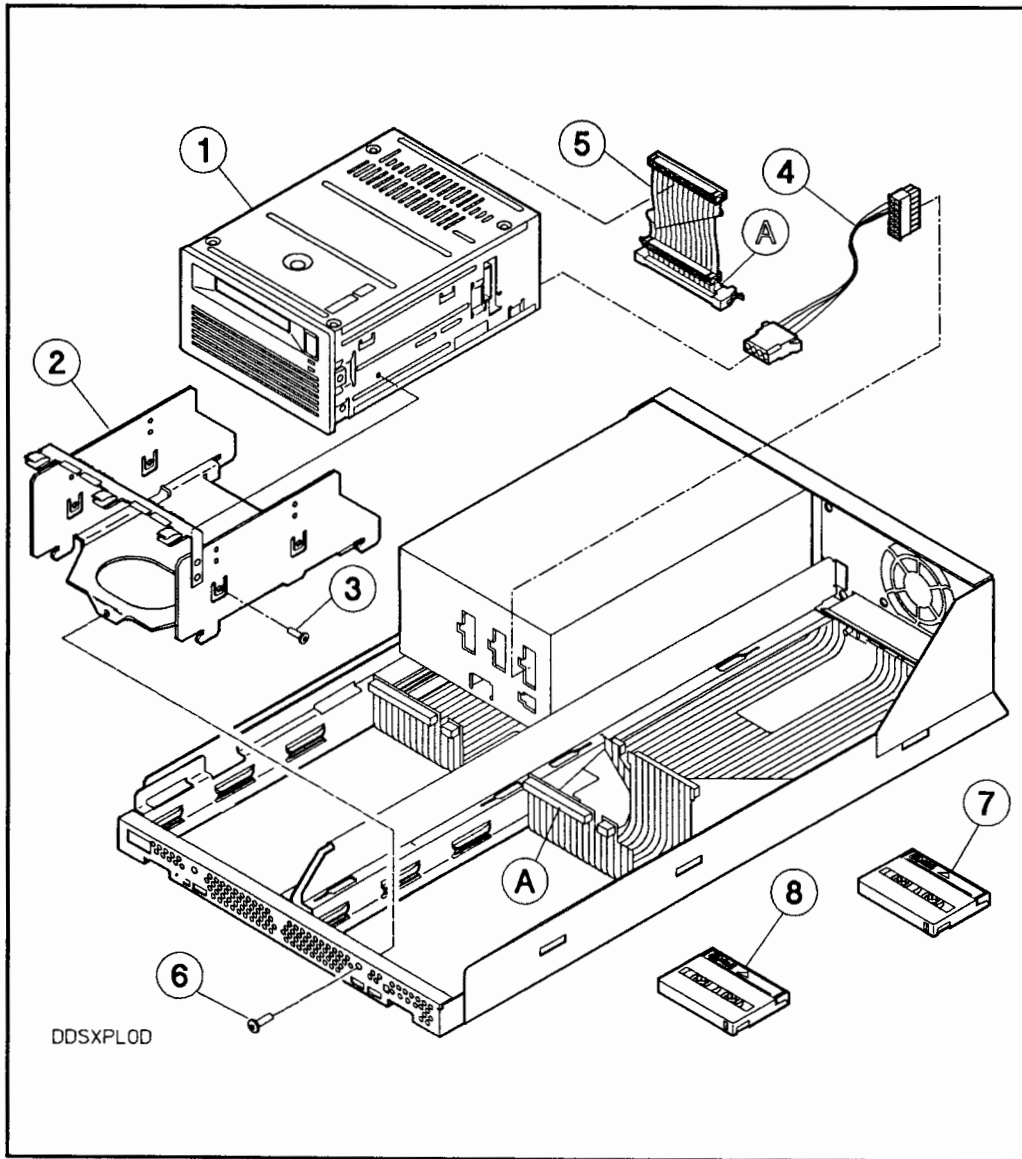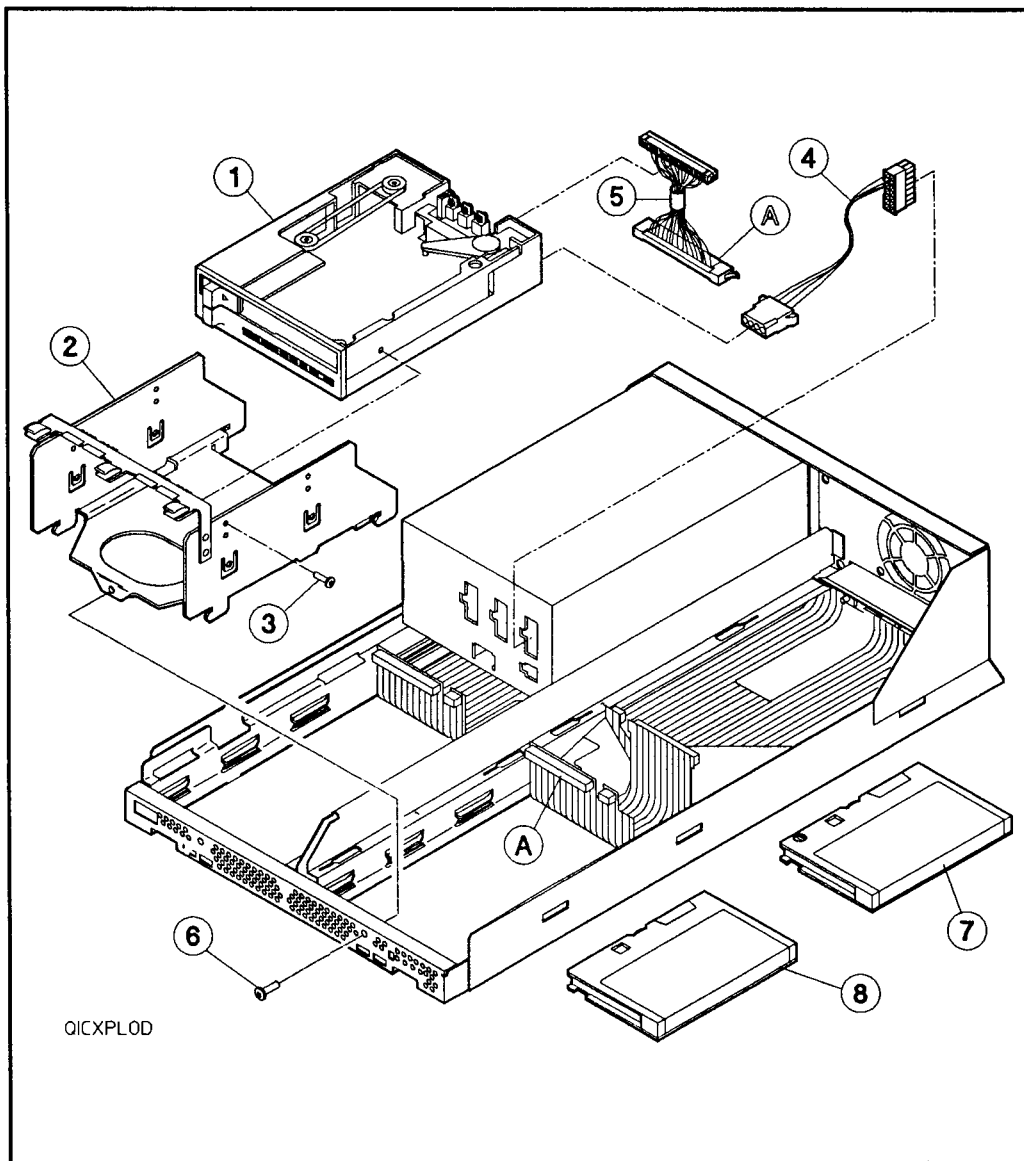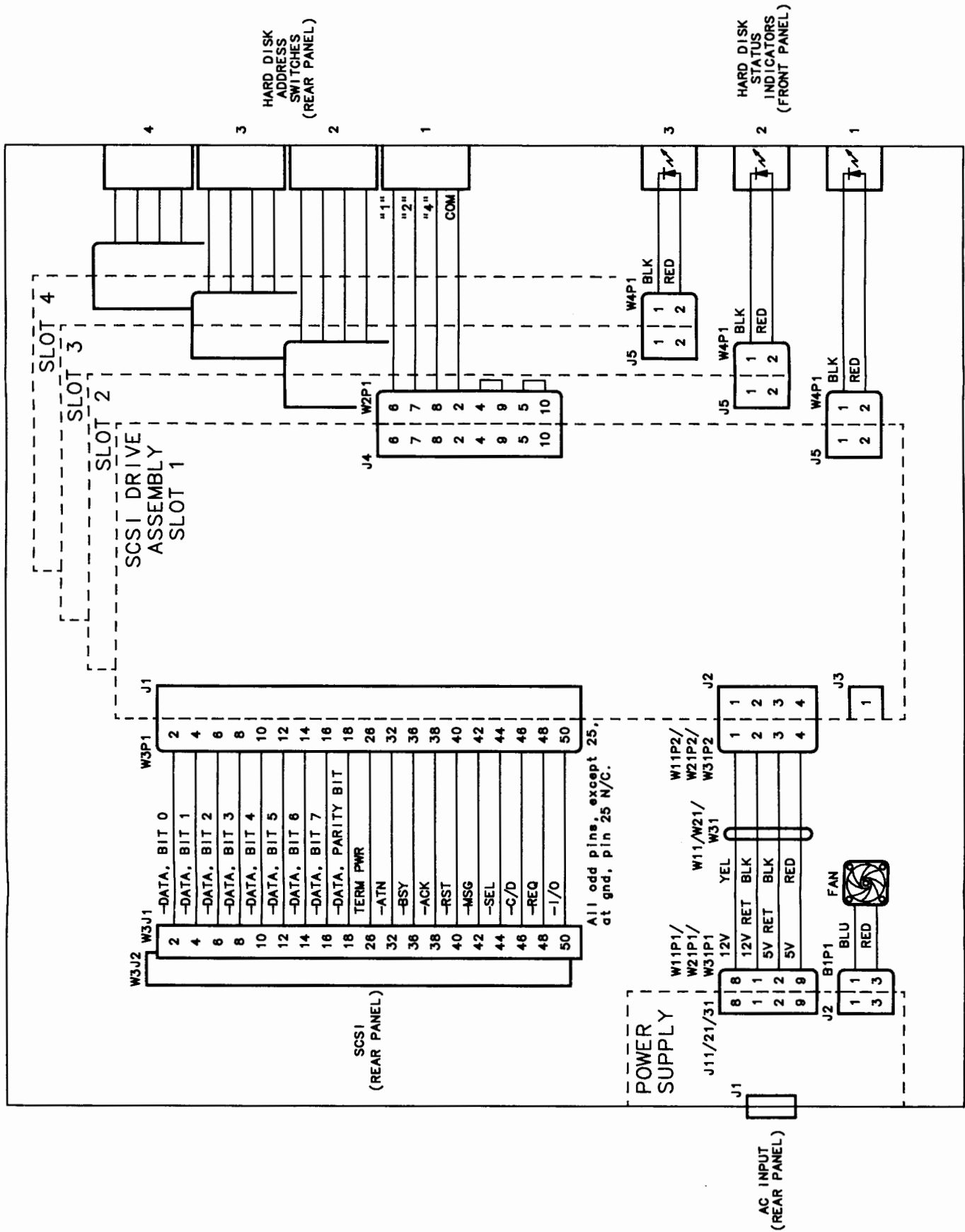
Figure 6-18. Mass Storage System Cabling Diagram

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Related Documentation and Reference

For more information regarding the mass storage system, refer to the publications listed below:

- *Disk Product Specifications and Site Environmental Requirements Handbook*, part number 5955-3456

- *HP Series 6000 Models 330S and 660S Mass Storage Systems Self-Paced Training Kit*, part number C2212+49A-90002

- *HP Series 6000 Models 330S and 660S Mass Storage Systems Owner's Manual*, part number C2212-90901

- *HP Series 6000 Models 330D and 660D Mass Storage Systems Owner's Manual*, part number C2212-90911

- *HP Series 6000 Models 330D/S and 660D/S Mass Storage Systems CE Handbook*, part number C2212-90905

- *Mass Storage System Diagnostic Reference Manual*, part number 5960-0163, describes the diagnostic program used to troubleshoot problems with your mass storage system. This manual covers the following diagnostic programs: SCSIDISK, DDSDIAG, SCSICD, SCSIMO.

- *HP Series 6300 Model 650/A Rewritable Optical Disk Drive Self-Paced Hardware Training Guide*, part number C1701+49A-90901

- *HP Series 6300 Model 650/A Rewritable Optical Disk Drive User's Guide*, part number C1701-90000

- *HP Series 6300 Model 650/A Rewritable Optical Disk Drive Service Manual*, part number C1701-90030

- *HP Series 6300 Model 650/A Rewritable Optical Disk Drive CE Handbook Insert*, part number C1701-90039

- *HP Series 6400 Model 1300S DDS-format Tape Drive Self-paced Training Guide*, part number C1511+49A-90101

- *HP Series 6400 Model 1300S DDS-format Tape Drive User's Manual*, part number C1512-90901

- *HP Series 6400 Model 1300S DDS-format Tape Drive CE Service Handbook*, part number C1500-90906

- *Domain Hardware Utilities Reference Manual*, part number 014881.

- *HP Apollo 9000 Series 400 Domain OS Owner's Guide*, part number A1630-90005

- Storage Subsystem Test (SST) for Domain Systems is described in *Using Domain Diagnostics*, part number D-9329-0

- *HP-UX System Administration Concepts*, part number 98594-90062

- *HP-UX Peripheral Installation Guide*, part number 97005-90000

- *HP-UX Application Execution Environment User's Manual*, part number 98515-90002

- *HP-UX System Administrator Manual*, part number 98594-90060

8

Service Notes

This chapter provides a listing of all released service notes for these products. No service notes have been issued at the time of this printing.

Glossary

Address Switches

Each device connected to the Small Computer System Interface (SCSI) bus must have its own unique address. The address switches on the rear panel of the mass storage system are connected to the installed hard disk drives. The SCSI address settings for devices other than hard disk drives are either switches or jumpers that are located on the device itself.

Automatic Ranging Power Supply

An automatic ranging power supply senses the voltage of the power in your area and automatically adjusts its internal circuits for that voltage, producing the proper internal working voltages regardless of external voltage applied. An automatic ranging power supply therefore does not require an external voltage selector switch or need an external fuse.

Backup

For recovering data in an emergency situation, important information on a hard disk drive is copied to another disk or tape medium. This copy is called a backup copy.

BEND/flex

BEND/flex cable is a brand name of flexible cabling used within your mass storage system. BEND/flex is a product of Rogers Corporation.

Bit

This is an abbreviation for binary digit.

BOM

This is an abbreviation for Beginning Of Media. A DDS-format cassette tape is said to be at the BOM when it has unthreaded and can be ejected, exactly the same way a video cassette is removed.

BOT

This is an abbreviation for Beginning Of Tape. Once a DDS-format cassette tape has been loaded and threaded and is ready to use, it is at BOT.

CD-ROM Drive

Compact Disc-Read Only Memory is the same as consumer (audio) Compact Disc technology, and is used to store large amounts of read-only computer data. (The spelling of Compact Disc with a "c" for *disc* is an accepted industry standard for audio media. In this manual, however, the more familiar term CD-ROM *disk* is used, unless referring explicitly to the playing of audio Compact Discs.)

Controller PCA

A controller PCA (printed circuit assembly) connects the SCSI bus cable and the power supply cable to a disk drive (or other SCSI device), and performs the SCSI commands as directed by the host computer system.

Curie Point

The temperature at which a magnetic material becomes easier to magnetize is its Curie point. Rewritable optical drives take advantage of this phenomenon: the laser quickly heats a spot on the Magneto-Optical (MO) disk to 150°C (its Curie point), allowing the drive's magnet to change the magnetic polarity of a bit.

DASS

This is an abbreviation for Direct Access Secondary Storage. This is an area of mass storage between magnetic hard disk primary storage and off-line magnetic tape storage. DASS is provided by the rewritable optical disk drive, and allows convenient access to a vast library of archived text, graphics, image, voice, and data files.

DDS-format Tape Drive

Digital Data Storage Format is a standard data formatting scheme for tape, originally developed by Hewlett-Packard and Sony Corporation. The cassettes used by the DDS-format tape drive are *not* the same as cassettes used by DAT players in the audio industry, because DDS-format cassettes are certified. Also, plain audio DAT cassettes have a different mechanical specification, which can cause them to jam in the DDS-format

tape mechanism. The DDS-format cassettes have a total data capacity of 1.3 gigabytes.

Error Detection and Correction

The identification and correction of data errors that occur in the reading and writing processes is called error detection and error correction. Redundant stored information is used to identify errors. Error Detection Codes along with Error Correction Codes are used to reconstruct the data if an error is detected.

Hard Disk Drive

A hard disk drive contains a nonremovable (hard) disk mechanism and its associated electronics necessary to perform reading and writing of data onto the disk. The hard disk drives referred to in this manual all have embedded SCSI controller PCAs attached to them, and are installed as a unit.

Hard Disk Drive Status Indicators

Three lights are visible in the lower right-hand corner of the mass storage system front panel. These Light Emitting Diodes, or LEDs, are connected to the hard disk drives in the slots corresponding to the number 1, 2, or 3. The lights show hard disk drive self-test status and activity. Lights for empty slots (or slots that contain devices other than hard disk drives) will remain off, since they are not connected. If a device other than a hard disk drive is installed, it will have its own indicator light or lights on its own front panel.

I/O

This is an abbreviation for Input/Output. A device that has removable media, such as a tape or removable disk, allows you to put files or information into your computer or take information out. This function of adding and removing data is called Input/Output, or simply I/O.

Laser Beam

A laser beam is a very narrow beam of intense, single-wavelength (coherent) light used in the process of reading and writing data on optical disk media. The laser used to write on a rewritable optical disk drive is set at a higher power than the laser used to read the same data.

Load

To load means to insert a removable disk or tape medium into a disk or tape drive.

Magneto-optical Disk

Refer to Rewritable Optical Disk Drive.

Mass Storage System

In this manual, mass storage system refers to the entire box, including the power supply, all internal SCSI devices, and associated cables and parts.

Off-line

When a host computer cannot access a particular storage device, that device is said to be off-line. This could be because a disk or tape has not been loaded.

On-line

When a host computer has the ability to access a particular storage device, that device is said to be on-line.

Power Supply

The power supply converts alternating current into the necessary direct current at the appropriate voltages needed by each internal device and its associated electronics and controller PCA.

Primary Storage

Primary storage typically refers to fixed hard disk drives, which are used for fast, random-access applications. The primary storage devices are used as on-line system disks.

Quarter-inch Cartridge Tape Drive

The Quarter Inch Cartridge Tape Drive is a sequential access streaming tape device that stores data on removable 1/4-inch tapes. The tape drive includes an embedded controller with a single-ended SCSI interface.

Rewritable Optical Disk Drive

Rewritable optical disk drives provide a removable disk medium that offers high storage density like CD-ROM memory, and can be erased and written to repeatedly like standard magnetic disk media. To write, spots on a magnetic layer on the disk are heated with a laser beam and magnetically

polarized by the drive's magnet in one of two directions. These two directions represent either digital 0s or 1s. To read the data, a detector sees the rotation of the beam reflected back from the magnetic layer.

SCSI

This is an abbreviation for Small Computer System Interface. SCSI is an industry standard interface that specifies the mechanical, electrical, and functional requirements for a small computer system bus.

Secondary Storage

Secondary storage devices are typically tape drives, used to back up and archive data stored on the system disks (see Primary Storage). Secondary storage is also used to log transactions, interchange data, and distribute software. Secondary storage devices always use removable media.

Self-test

Every time the mass storage system is powered on, each internal device performs a self-test. Various internal tests are attempted, and their status is returned via front panel indicators as to whether the self-test passed or failed. The self-test is only performed when the mass storage system is powered on.

Slot

The mass storage system contains four slots, which are available spaces for internal components to be mounted. The power supply always takes up one slot, so there are three remaining slots for peripherals such as hard disk drives.

Terminator

The back panel of your mass storage system has two SCSI connectors, which form a loop through the mass storage system, connecting to each internal SCSI device. If the mass storage system is the last (or only) device on the SCSI bus, it must have its unused (second) SCSI connector plugged with a SCSI bus terminator.

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If there is no Hewlett-Packard Sales and Support Office in your area, contact one of the headquarter offices listed below:

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C2212-90905
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Manufacturing Part Number

5960-0827