HP 35401A
¼-inch Cartridge Autochanger Tape Subsystem
User's Manual

HEWLETT PACKARD

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Manual Part No.
35401-90902

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- reorient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, consult the dealer or an experienced radio/television technician for additional suggestions.

Manufacturer's Declaration (West Germany only)

This is to certify that this product (HP 35401A ¼-inch Cartridge Autochanger Tape Subsystem) meets the radio frequency interference requirements of directive 1046/84. The German Bundespost has been notified that this equipment has been put into circulation and has been granted the right to check the product type for compliance with these requirements.

Hersteller-bescheinigung

Hiermit wird bescheinigt, daß das Gerät/System HP 35401A (Magnetbandeinheit für ¼-Zoll-Kassetten mit automatischem Kassettenwechsel) in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

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1 DESCRIPTION

1.1 The HP 35401A

This section covers what the HP 35401A does, what it looks like, and what you might use it for.

What It Is

The HP 35401A is a data storage device using quarter-inch tape cartridges, up to eight of which are held in a removable magazine in the drive. An autochanger mechanism loads cartridges to and from the magazine so that they can be used for the storage and retrieval of data. In this way, a single magazine gives up to 536 Mbytes of storage capacity, while providing a convenient means of handling and storing a set of cartridges.

The cartridge tapes are the same as those used by the HP 9144A Tape Drive and HP Disc/Tape Drives such as HP 7911, HP 7912, HP 7914 and HP 7942/6 and are interchangeable between these devices.

The autochanger mechanism can access cartridges from the magazine in two operating modes, given a suitable host computer and software:

- Sequential, in which the cartridges are automatically loaded in turn. The order in which they are loaded is fixed by their positions in the magazine, although you can manually over-ride this.
- Selective, in which cartridges are loaded entirely under

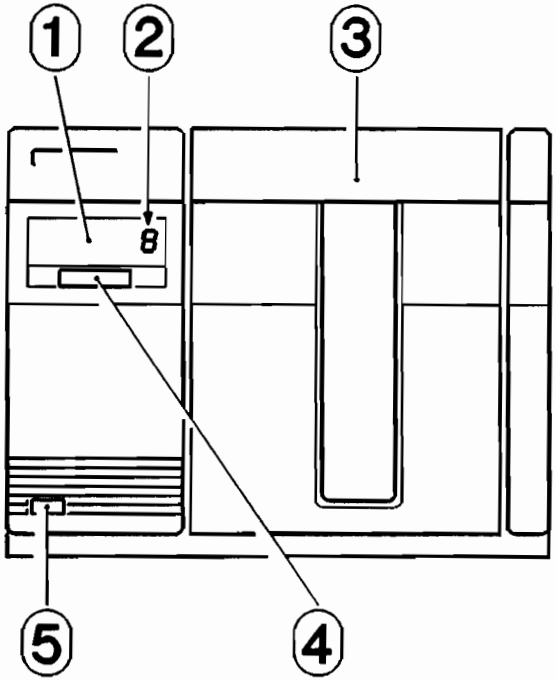
computer control. The order of access is determined by the host computer.

Safety and reliability of data storage are provided by:

- read-while-write capability (verifying data immediately after it is written),
- auto-sparing (automatic avoidance of bad tape blocks),
- a check on the condition of each cartridge, warning you if it is near the end of its useful life,
- write-protection, for preventing erasure or over-writing of master tapes.

What It Looks Like

The Front Panel



① . . . . . Lights (LEDs)
② . . . . . Cartridge Number Display
③ . . . . . Front Door
④ . . . . . EJECT Button and Indicator
⑤ . . . . . AC line Switch

Figure 1.1 The Front Panel

The door on the front panel ③ opens to allow you to install the cartridge magazine. Only the drive itself can open the door; you cannot open it manually. You may, however, start a procedure which opens the door (see *Section 3.2*). The door will remain

locked in a power failure and can only be opened by pressing [EJECT] after power has been restored again.

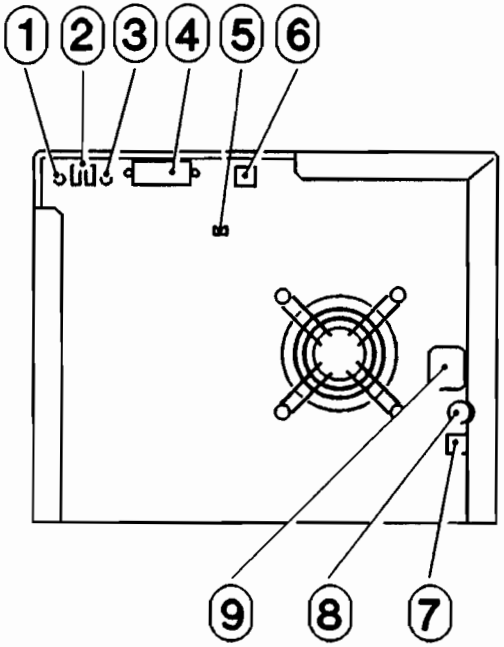
The display panel to the left of the door has six lights (LEDs) which tell you what the drive is doing, or when a fault occurs. These lights display the words **LOAD**, **UNLOAD**, **READY**, **BUSY**, **PROTECT** and **FAULT**. Their meaning is usually self-explanatory. For full details, please see *Section 3.4.1.*

There is also a seven-segment display (the Cartridge Number Display) which either shows the number of the cartridge being used, or one of the letters U, F, C, P or E. The cartridge number refers to the position of the cartridge in the magazine, the bottom position being 1, the top 8. The letters generally stand for Unloading or Unloadable, Fault, Cleaning Cartridge, Pass and Empty. *Section 3.4.1* gives details.

Below the display panel is the [EJECT] button. You would usually press this in order to start unloading procedures. If the drive is being accessed by the host computer and cannot yet EJECT, the indicator light above the button will light. Again, see *Section 3.4.1* for more information.

Finally, there is the **AC Line Switch** at the lower left of the panel. This turns the drive on and off. When the power is ON, the switch is IN. When the power is OFF, the switch is OUT.

The Rear Panel



① . . . . . Display Self-test Results (DSR) Button
② . . . . . Self-test Displays
③ . . . . . Initiate Self-test Button
④ . . . . . HP-IB Cable Socket
⑤ . . . . . Mode Selector
⑥ . . . . . Device Address Switches
⑦ . . . . . Voltage Select Switch
⑧ . . . . . Fuse Holder and Fuse
⑨ . . . . . Power Input Socket

Figure 1.2 The Rear Panel

The displays, switches and sockets on the rear panel fall into four groups.

The first, ①, ② and ③ on *Figure 1.2*, relate to the built-in self-tests of the HP 35401A. They are there for the convenience of Service Engineers, but if you are interested, **Chapter 4** explains them in detail.

The second group, ④ and ⑥, concern HP-IB, the communication cable that links the drive to the host computer. They are covered in *Sections 2.3* and *2.4*.

Next, there is ⑤, the Mode Selector Switch, which sets the drive into Sequential or Selective Mode. See *Section 1.3*.

The final group, ⑦, ⑧ and ⑨, is for power input: the Voltage Select Switch, the Power Input Socket and the Fuse. These are covered in *Sections 2.2*, *2.5* and *5.1.3*.

All the rear panel features are further discussed in *Section 3.4.2*.

Possible Uses

The large storage capacity of a full magazine together with its easy division into eight separate sections (the eight cartridges), makes the HP 35401A suitable for the following:

- it could automatically backup a mid-range system while the system is not in use - for example, over night or during the week-end. A mid-range system is typically one with a storage capacity of 100 to 500 Mbytes which serves several users all within the same general application.

- it could backup a low-end system (typically less than 67 Mbytes) daily, with only one media change (i.e. magazine change) per week. In this way, each cartridge would represent the backup for one day.

- it could be used very easily for rotational backup of up to 132 Mbytes, where two cartridges would be the backup for the first day, the next two the second day, and so on. One magazine would then hold all the generations of the rotational backup.

- with suitable software, it could provide backup for a network of users having separate computers linked in to a central computer for use of shared storage, printing, etc. In this case, each cartridge within the magazine could be dedicated to a separate user or department.

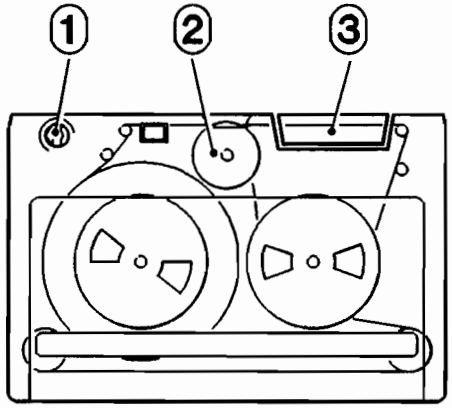
- again with suitable software, it could produce multiple copies of programs, data or updates of these for software manufacturers and distributors.

- it could act as a low-cost large-capacity store for files which are not used often. This is particularly appropriate in archival use, where large amounts of data are stored but infrequently accessed.

1.2 The Cartridge and the Magazine

The HP 35401A uses cartridge tapes for storing data. Up to eight of these cartridges are put into a magazine, which can itself be thought of as a higher-capacity storage medium - portable and interchangeable cartridge sets.

The Cartridge



① . . . . . Write-protect Switch
② . . . . . Drive-wheel (Capstan)
③ . . . . . Head Access Door

Figure 1.3 A Tape Cartridge

The quarter-inch cartridge tapes are the same as those used in the HP 9144A and HP Disc/Tape drives (but note that cartridges used in the HP 9142A Disc Drive are formatted differently and are NOT compatible). They have write-protect switches to prevent accidental erasure of data - see *Section 3.3* .

They are available in two capacities:

```
type L   67.1 Mbytes  600ft  part no. 88140LC (box of 5)
type S   16.7 Mbytes  150ft  part no. 88140SC (box of 5)
```

One type L (600 foot) is supplied with the drive.

When you receive cartridges, they are in hard plastic cases wrapped in cellophane. You should always store cartridges in their plastic cases if they are not in a magazine.

Sections 3.1 and *3.2* tell you how to use cartridges in the drive. Before you can use a cartridge, it must be

- **formatted and certified**, processes which divide the tape magnetically into areas for data. The two types of cartridge listed above are formatted and certified at the factory before you buy them.

- **initialized**, which sets up a volume name and file directory on the tape. You must do this through your computer.

Formatting and Certifying

These processes encode the tape so that it is magnetically divided into sixteen tracks along its length, eight of which are read from and written to in one direction, and the other eight in the other direction. Each track is split into blocks, and each block into six frames. Within each block, four of the frames carry data, 256 bytes each. The other two frames hold correction information. At each end of the tape, blocks are set aside for recording information about the condition and age of the tape.

Formatting sets up the blocks, and can **only** be done at the factory before you buy the cartridge.

Certifying defines the tracks and frames on the tape and also checks each block on the tape in order to see if it is good. If it is

faulty, this information is recorded on the tape so that the drive will automatically bypass the faulty block. This is known as *auto-sparing*.

While it is possible for you to certify cartridges by sending an `Initialize Media` command through the host computer, the recommended cartridges (88140LC and 88140SC) are already certified by the factory before you buy them. Certifying a single cartridge can take up to 40 minutes, so buying the approved certified cartridges saves a lot of time.

Caution

Don't erase, bulk-erase, degauss or otherwise destroy the block sectors on the tape. Once the blocks are erased, the tape is useless. Only the factory can format cartridges.

Initializing

Initializing sets up a volume label and file directory on the tape. You **MUST** initialize a cartridge before you use it. To do this, consult instructions for your particular computer and the operating system that you are using.

The process only destroys the data on the cartridge, not the blocks and tracks set up by the formatting process, so re-initializing a cartridge is a good way of removing old data while still leaving the cartridge usable.

Caution

If you re-initialize a cartridge, you will destroy any data stored on it.

The Magazine

The magazine is a holder for up to eight cartridges, with a carrying handle at the top. It has clips inside to hold the cartridges in place, so that it is easily transportable.

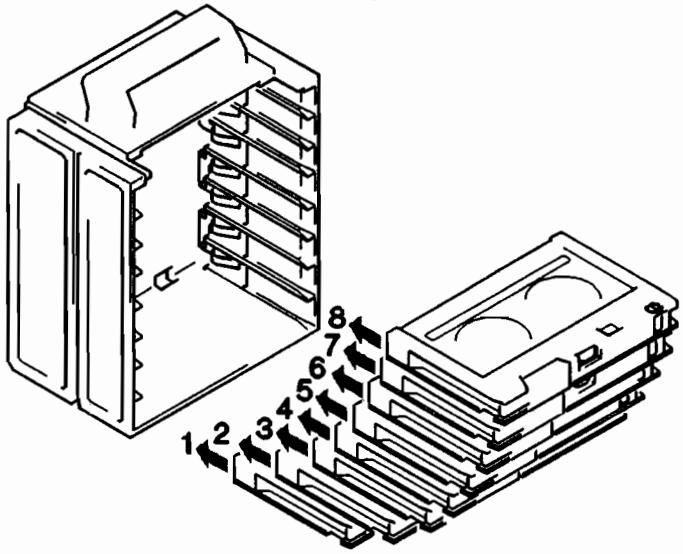


Figure 1.4 The Cartridge Magazine

The cartridge positions in the magazine are numbered 1 to 8, starting at the bottom, and it is through these numbers that the host computer can address each cartridge.

It is a good idea to have several magazines, each with its complement of cartridges, so that each can provide one phase in a rotational backup system. Magazines are also an excellent way of storing cartridge sets so that they can be handled as units.

One magazine is supplied with the drive. It is padded with a foam block and packed *inside* the drive for shipping to prevent damage. This foam block must be removed before use. See

Section 2.1 for details of how to do this. You can order replacement magazines as part number HP 92192C.

1.3 Modes of Operation

There are two modes of operation, Sequential and Selective, which you can select before power-up by a switch on the rear panel of the HP 35401A.

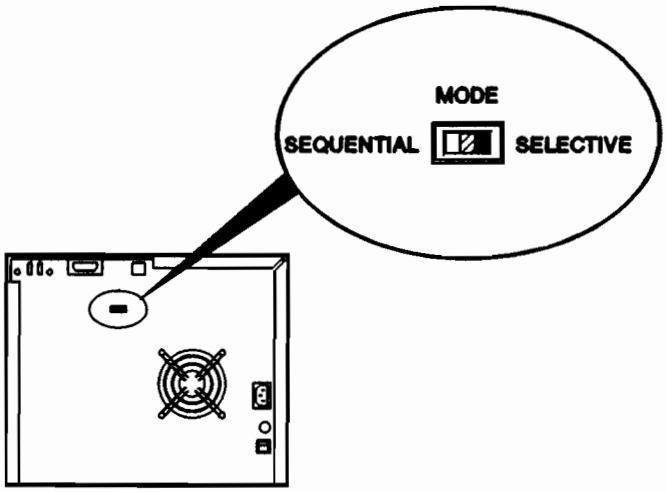


Figure 1.5 The Mode Select Switch

Sequential Operation

In Sequential Operation, the cartridges are put into the magazine in the sequence in which they are to be accessed, starting at the bottom. The HP 35401A automatically loads them in that order, unless the operation is aborted (either by you or the host computer).

During Sequential Operation, the host computer only has knowledge of the cartridge currently loaded in the drive. Because of this, the order of access is determined by the sequence in which you put cartridges into the magazine. It is possible to over-ride the sequence manually; see *Section 3.1.4*.

Selective Operation

In Selective Operation, all loading and unloading operations are controlled by or through the host computer. Consequently the order of access of cartridges depends entirely on the computer program, and need not be a predetermined sequence. This is a more powerful facility, and requires suitable software.

Note that not all host computers will support Selective Operation. **Appendix D** explains how it can be used to provide Sequential Operation on some HP 9000 computers.

2 SETTING UP

Caution

You may damage the drive if you attempt to turn on power before all the following checks and steps have been completed.

When you receive your HP 35401A, you should

A. unpack the equipment - *Section 2.1*

B. check it for damage - *Section 2.1*

C. check whether the voltage is set correctly for your local power (115V or 230V) - *Section 2.2*

D. alter the device address if necessary - *Section 2.3*

E. connect the HP 35401A to the host computer - *Section 2.4*

F. connect the power supply - *Section 2.5.*

It is important that you carry out these steps in this sequence, in order to avoid damaging the drive.

The sections which follow (*Sections 2.1* to *2.5*) take you through these steps in detail.

2.1 Unpacking and Checking

The following equipment is supplied with the HP 35401A:

- 1 cartridge, 600 ft.
- 1 cleaning cartridge kit (92193E)
- 1 one metre HP-IB cable (10833A)
- 1 power cord as appropriate
- 1 cartridge magazine (92192C)
- 1 User's Manual (35401-90902)
- 1 Quick Reference Guide (35401-90903)
- 1 Installing the HP 35401A with HP 3000 Series 37 Systems (35401-90907)

The magazine is packed *inside* the drive for shipping.

Before you follow the following steps for unpacking the drive, inspect the box for water-stains or other signs of damage during transit. If there appears to be damage, insist on a representative of the carrier being present while you unpack the drive.

A. Open the box and lift out the box of accessories packed on top of the drive.

B. Carefully lift the drive out complete with the foam packing round its ends.

Caution 

The drive is heavy. To avoid injuring yourself or damaging the drive it is a good idea for two people to lift it out of the box, and to lift it with straight backs.

C. Carefully remove the foam packing from the ends of the drive.

D. Remove the plastic bag covering the drive.

E. The front door of the drive will open when the plastic bag is removed. Inside the door you will see two red plastic clips which prevent the door from locking when it is shut. Remove these clips and then lift out the cartridge magazine. Attached to the bottom of the magazine is a cord tied to a black, plastic- coated clip which holds a platform inside the tape drive steady while it is being shipped. Pull the cord and remove the clip. Discard the cord and remove the foam block from inside the magazine. Save the red plastic clips, the black plastic-coated clip and the foam block for use if you move the tape drive in the future.

F. Check that no equipment is missing.

G. Inspect all the equipment for any physical damage that may have occurred during shipment.

H. If any equipment is missing or appears to be damaged, tell your dealer or local Hewlett-Packard Sales Office. File a claim with the carrier as well.

I. Save the shipping carton and packing, so that you can use it to protect the drive if you move it in future. In particular, save the clip which holds the interior platform steady. It is important that the platform is held by this clip while the drive is moved.

Caution 

IMPORTANT: The tape drive can be damaged if it is not properly packed in its carton when moved or shipped. In particular, the interior platform MUST be secured with the black plastic-coated clip to prevent movement.

2.2 Adjusting the Voltage Select Switch

The Voltage Select Switch is on the rear panel of the tape drive, and can be set to 115V or 230V. The switch is usually preset to 115V (Alternating Current) for the U.S.A., and 230V for Europe. The 115V setting covers a voltage range of 90 to 125V. The 230V setting covers 180 to 250V.

Caution 

To avoid damaging the drive, you MUST check the voltage setting before connecting power to the drive.

A. Check the position of the Voltage Select Switch.
B. If it is incorrect for your local power supply, alter the voltage setting by sliding the switch upwards or downwards with a screwdriver, so that it displays the correct voltage.

The **fuse holder** is above the Voltage Select Switch on the rear panel. The correct fuse is installed before shipping, so there is no need to alter it, whatever your local power voltage. If you do need to replace it later, *Section 5.1.3* describes how.

2.3 Changing the Device Address

Each device connected to the host computer through the HP-IB cables has an **address** (a number from 0 to 7) by which the computer identifies the device. When the drive is connected to the power supply and turned on, the right-hand display on the back of the drive will show the address to which the drive is set.

- The HP 35401A is preset to address 3 on delivery.
- You only need to change this preset address if you already have a device with address 3 connected to your computer.
- If you do need to change the address:

  A. Turn off the drive by the switch on the front panel.
  B. Ensure that the address that you have chosen is not already used for another device connected to the computer.
  C. Find the Address Switches on the rear panel of the drive.
  D. Using the tip of a pen or similar object, alter the switches to match the pattern given in the table on the next page for the address you want.
  E. When the drive is next turned on, look at the right-hand display on the rear panel, and ensure that you have set the device address correctly. It should show the number you have chosen.

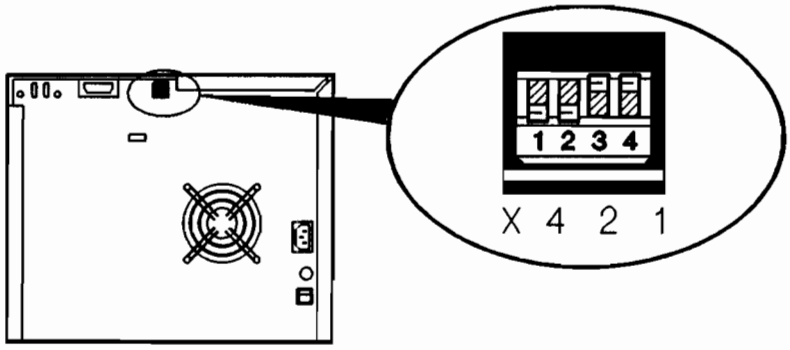


Figure 2.1 The Device Address Switches

This view of the rear panel shows the Device Address Switches as they are preset in the factory to **Down, Down, Up, Up**, giving address 3.

The figures on the switches themselves are irrelevant; look only at the figures printed on the rear panel to understand the weighting of each switch. You may find the following table easier to follow:

Drive Address	Position of the four switches			
	Left	Middle Left	Middle Right	Right
0	Down	Down	Down	Down
1	Down	Down	Down	Up
2	Down	Down	Up	Down
3	**Down**	**Down**	**Up**	**Up**
4	Down	Up	Down	Down
5	Down	Up	Down	Up
6	Down	Up	Up	Down
7	Down	Up	Up	Up

2.4 Connecting to the Host Computer

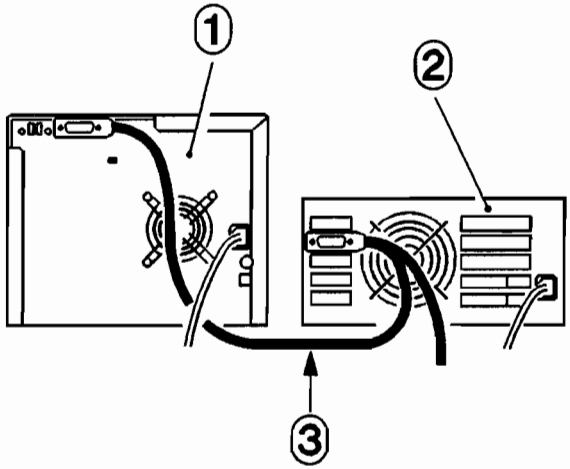
The drive must be connected to your computer using an HP-IB cable. A one metre HP-IB cable (10833A) is supplied with the HP 35401A. You could also use a two metre cable (10833B) if necessary, but avoid using cables longer than two metres. In general, the shorter the connecting cables, the better.

Caution 

To avoid damaging either your computer or tape drive, turn the drive OFF before connecting them together. If possible, turn the computer OFF as well.

A. Turn the host computer OFF if possible.
B. Ensure that the tape drive is switched OFF by checking that the AC Line switch on the front panel is OUT.
C. Connect one end of the HP-IB cable to the socket on the rear of the tape drive. The plug is tapered and can only fit one way round.
D. Once the plug is in position, screw the two knobs on the plug in with your fingers to hold the connection securely. Do NOT use a screwdriver to tighten these locking knobs. The screwdriver slots in the tops of the knobs are only there to aid unscrewing.
E. Connect the other end of the cable to the HP-IB socket on your computer. Again, screw the two knobs in to hold the plug in place. If you already have an HP-IB cable connected to this socket, the new cable can plug into the top of it. The plugs are designed to "piggy-back" over each other.

Fig.2.2 shows how the cables might look with an HP 3000 Series 37 computer. With another computer, the sockets may be in a different position.



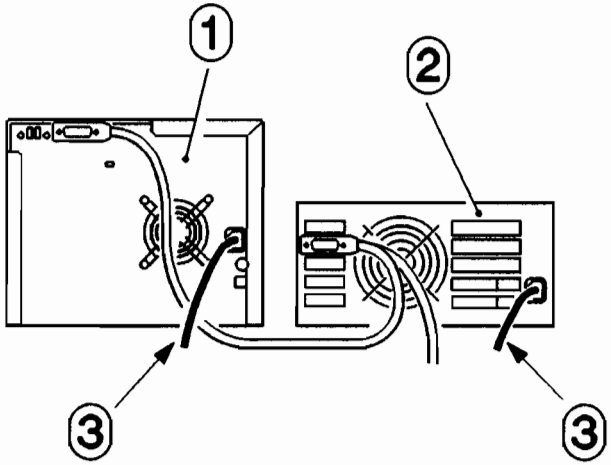
① . . . . . HP 35401A Tape Drive
② . . . . . HP 3000 Series 37 Computer
③ . . . . . HP-IB Cables

Figure 2.2 HP-IB Connections

2.5 Connecting to the Power Supply

Caution 

To avoid damaging the tape drive, always ensure that the power (AC line) switch is OFF before connecting to the power supply.



① . . . . . HP 35401A Tape Drive
② . . . . . HP 3000 Series 37 Computer
③ . . . . . Power Lines

Figure 2.3 Power Connections

A. Ensure that the tape drive is switched OFF by checking that the AC Line switch on the front panel is OUT.
B. Plug the power cord securely into the socket labeled **AC LINE** on the rear panel of the drive.
C. Plug the other end of the power cord into the power supply.

2.6 Switching On

Once you have completed the steps in *Sections 2.1* to *2.5*, you can switch the drive ON by pressing the **AC Line Switch** on the front panel. The drive is **ON** when the switch is **IN**, and **OFF** when the switch is **OUT**.

A. Ensure that the ventilation grille on the rear panel is free from obstruction.

B. Ensure that the power supply to which the drive is connected is switched ON.

C. Switch ON the tape drive by pressing the AC Line Switch.

D. The drive will now go through a self-test routine, which takes about 20 to 50 seconds, depending on whether there is a magazine in the drive or not. During this, all the lights and displays on the drive will light in sequence.

E. **If there is no magazine in the drive, or the door is open,** the **READY** light will be lit and the Cartridge Number Display will show E at the end of the 20 seconds.

If there is a magazine in the drive, another self-test - the pre-load routine - checks each position in the magazine to see whether there is a cartridge there. If there is, it determines whether it is write-protected or not, illuminating the **PROTECT** light if it is. The pre-load routine also identifies a cleaning cartridge if there is one in the magazine, and if so, immediately starts a head-cleaning cycle which ends with the door opening again. The pre-load routine takes up to 2 minutes, and you will find full details in *Section 3.1.2.*

F. If, at the end of the self-test, the FAULT light remains lit, then the drive has failed the test for some reason. Turn the drive OFF and then ON again, so that the self-test will be repeated. If it continues to fail, contact your local HP Sales and Service Office. *Section 4* gives more details about the self-test routine.

2.7 Positioning the Drive

It is important that the drive has adequate ventilation. It is designed to fit into the HP Design Plus mobile mini-rack system (part number **HP 92211R**), leaving space for another similar sized device. Using this cabinet will ensure adequate air circulation and help to keep cables secure and unobtrusive. In addition to the cabinet, you will need the following accessories:

HP 92211S	Rail Kit (containing four sets of rails and module locks)
HP 92211T	Filler Panel Kit (snap-in panels to fill space not occupied by equipment)
HP 92199B	(optional) Multiple Power Outlet Strip (US and Canada only).

Caution 

If you use the Design Plus cabinet, ensure that the leveling feet are properly adjusted to give adequate stability. This is particularly important if the HP 35401A is the only equipment in the cabinet and is installed in the top position.

Please see **Appendix F** for details of ordering.

Sudden temperature changes could affect the integrity of data while reading from and writing to cartridge tapes, so it is advisable to place the drive in a position where temperature is reasonably stable (for example, away from windows and exterior doors that are frequently opened). **Appendix C**, Tape Cartridge Guidelines, gives details of recommendations from HP's factory tests concerning temperature and environment.

3 USE

This chapter covers:

- the various loading and unloading operations concerned with cartridges and the magazine,
- the protection of cartridges from accidental erasure of data,
- the significance and function of the controls and indicators on the drive.

Because of the variety of applications and systems available, this manual does not describe the commands you will use to backup and transfer your data. Refer to the software and systems manuals for this information.

Appendix D gives some notes for using the HP 35401A with HP 9000 computers, in particular how Selective Mode can be used to mimic Sequential Mode on Series 200 and 300 computers with HP-UX 5.1 operating systems.

3.1 Loading Cartridges and Magazines

There are three distinct loading operations:

A. You put cartridges into the magazine.

B. You then install the magazine in the HP 35401A. At this point, the drive performs a **pre-load** routine to find how many cartridges there are and if they are write-protected.

C. Cartridges are loaded individually from the magazine into the drive itself, where they can be read from and written to. This loading is usually under computer control, but you can over-ride it when working in Sequential Mode. Each time a cartridge is loaded into the drive, a **loading routine** tests the cartridge and, if the cartridge is not write-protected, the read/write circuitry.

MANUAL loading operations:

- putting cartridges into the magazine - *Section 3.1.1*
- installing the magazine in the HP 35401A - *Section 3.1.2.*

AUTOMATIC or HOST CONTROLLED loading operation:

- loading a cartridge into the drive - *Section 3.1.3.*

OPERATOR INITIATED loading operation:

- loading a specific cartridge when in Sequential Mode - *Section 3.1.4.*

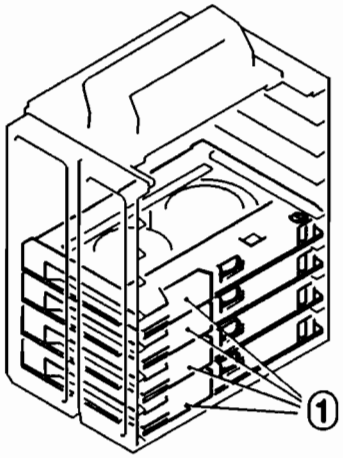
3.1.1 Putting Cartridges in the Magazine

Caution

If the label on a cartridge is crumpled or torn, it may cause the cartridge to jam in the autochanger mechanism. Avoid using such cartridges. Similarly, do not stick new labels on top of old labels on a cartridge; the increased height could also jam the cartridge.

Note

The instinctive way of inserting a cartridge is **wrong** for the HP 35401A. You will probably be used to holding the cartridge so that the head-access doors face away from you. To insert a cartridge in the magazine, hold the cartridge so that the **head-access door is towards you.**



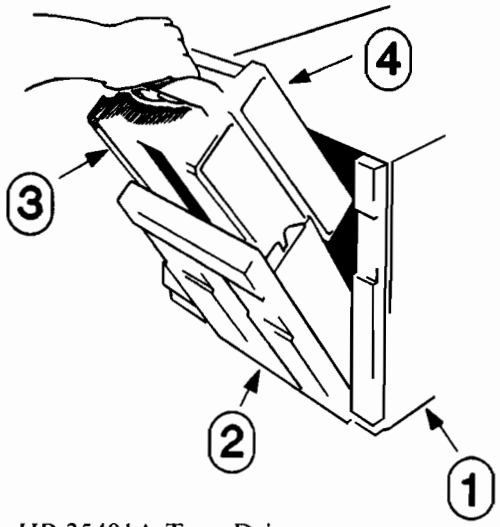
1. . . . . Head Access Doors

Figure 3.1 Cartridges in the Magazine

Insert cartridges into the slots in the magazine so that:

- each cartridge is fitted correctly. **Figure 3.1** shows how cartridges should look when inserted properly. The metal plate should face downwards, the Write-protect Switch upwards, and the Head Access Door and Drive Wheel towards you as you put each cartridge into the magazine.
- they are in the correct order, bottom to top, if they are to be used in Sequential Mode.
- if they are to be used in Selective Mode, they are in positions expected by the computer program.

3.1.2 Installing the Magazine



① . . . . . HP 35401A Tape Drive
② . . . . . Front Door
③ . . . . . Cartridge Magazine
④ . . . . . Open Side of the Magazine

Figure 3.2 Installing a Magazine

To install a magazine:

A. Open the front door, by pressing EJECT. If it does not open, see *Section 5.2* (page 5-10).

B. Install the magazine by lowering it into the drive. Make sure that the open side of the magazine is facing the back of the drive, and that the magazine slides down the guides in the door. The magazine handle should be on top.

C. Push the door shut. It will automatically be held in place and locked.

D. The HP 35401A now performs its pre-load sequence, which determines:

- which cartridge positions are filled, if any
- if the cartridges are write-protected.

While this pre-load sequence is happening, the **LOAD** light flashes slowly, and the Cartridge Number Display shows the number of each cartridge as it is found and checked. If a cartridge is write-protected, **PROTECT** will be lit while it is checked. The sequence takes approximately one minute.

E. If **Sequential Mode** has been selected, the **LOAD** light will then flash at a faster rate for five seconds, during which you can manually select which cartridge is to be loaded next. If you do nothing, the lowest cartridge in the magazine will be loaded after the five seconds. You can manually select the cartridge to be loaded as follows:

- Repeatedly press the [EJECT] button down, and the Cartridge Number Display will slowly cycle through the letter ⏏ and the numbers 1 to 8, leaving out any numbers for which there are no cartridges in the magazine.
- Stop either when the number of the cartridge you want to load is showing, or on ⏏ if you want to open the door.
- After five seconds during which you have **not** pressed the [EJECT] button, if a number is showing on the Cartridge Number Display, then the cartridge in that position in the magazine will be loaded into the drive. If ⏏ is showing on the Cartridge Number Display, the **READY** light will be lit and you can open the door by pressing [EJECT] again.

F. If **Selective Mode** has been selected, the HP 35401A now waits for a **load** command from the host computer. The Cartridge Number Display will show the number of the last cartridge checked.

3.1.3 Loading a Cartridge into the Drive

A cartridge is loaded from the magazine into the drive when one of the following happens:

- in Selective Mode, the host computer issues a **load** command
- in Sequential Mode, a magazine has just been installed, the door closed, and you do not press [EJECT] for five seconds after the pre-load sequence
- in Sequential Mode, you designate a specific cartridge (see *Section 3.1.4*)
- as part of the natural sequence of using the cartridges in Sequential Mode.

Assuming that the HP 35401A is free to load (i.e. there is no cartridge already in the drive), the following sequence of actions occurs:

A. The **LOAD** light is lit.

B. The **Cartridge Number Display** shows the number of the cartridge to be loaded.

C. The auto-changer mechanism selects the required cartridge and loads it into the drive. (10 to 30 seconds)

D. The HP 35401A performs its **loading routine** to prepare the cartridge for use. See *Section 3.1.5* for details. (1½ to 3 minutes)

E. The **LOAD** light goes out and the **READY** light is lit. This indicates that the HP 35401A is waiting for a command from the host computer.

3.1.4 Loading a Specific Cartridge (Sequential Mode)

In Sequential Mode, there are two ways to over-ride the normal cartridge sequence and choose the next cartridge to be loaded:

- when a cartridge is already in the drive (i.e. the drive is in mid-sequence),
- immediately after the pre-load routine which follows installing a magazine or turning the power back on.

When a cartridge is already in the drive:

To select the next cartridge, start the unloading procedure for the current cartridge, and make the selection while the unloading is in progress.

A. Press the [EJECT] button. If there is still a task to finish executing, the HP 35401A will acknowledge by illuminating the [EJECT] light. It will take no further action until the task is finished.

B. The UNLOAD light is lit, and the **Cartridge Number Display** changes to show the next cartridge that would normally be loaded, or ☐, if the present cartridge is the last in sequence. The HP 35401A performs its **unloading routine** to prepare the cartridge for unloading. See *Section 3.2.4* for details. (1½ to 2½ minutes)

C. While the unloading routine is in progress, press the [EJECT] button repeatedly. The Cartridge Number Display will cycle through 1 2 3 4 5 6 7 8 9 1 2 3 4 . . . . etc., omitting the numbers of any empty positions in the magazine. Stop when the number you want is showing.

D. When the unloading routine has finished, the HP 35401A will load the cartridge chosen in step **C**. If ☐ was chosen, no further cartridge will be loaded and the door will open if you press [EJECT]. See *Section 3.2.2.*

Note

This procedure only works in Sequential Mode, and can operate whenever the UNLOAD light is lit, whether this is as a result of you pressing [EJECT], or following a host computer command.

After installing a new magazine, or after power-on:

Following the pre-load routine, the LOAD light will start to flash at a faster rate and the Cartridge Number Display will show the number of the last cartridge checked. If you take no action, this condition will remain for five seconds, and then the lowest numbered cartridge will be loaded as normal.

To select the cartridge to be loaded:

A. Repeatedly press the [EJECT] button. The Cartridge Number Display will cycle through 1 2 3 4 5 6 7 8 9 1 2 3 4 . . . . etc., omitting the numbers of any empty positions in the magazine.

B. Stop pressing the [EJECT] button when the number of the cartridge that you want is showing. If you stop when 9 is showing, the process will end with READY lit. Pressing [EJECT] again will open the door.

C. Do not touch the [EJECT] button for five seconds, and then the cartridge that you have chosen will be loaded into the drive.

Note

This procedure only works in Sequential Mode when the LOAD light is flashing quickly.

3.1.5 HP 35401A's Loading Routine

Every time a cartridge is loaded into the drive, the HP 35401A automatically performs various tests and reads information from the tape concerning its condition. The routine is as follows:

A. The read circuitry is tested.
B. The tape is wound to the end.
C. The tape is wound backwards and forwards a little in order to calibrate the tape speed, since friction can vary between cartridges.
D. The automatic gain control is set to compensate for weak signals on old tapes.
E. The tape is wound to the beginning, where the following information is read:
- length of tape (600ft or 150ft)
- information on any bad blocks
- information on available spare blocks.

F. If the cartridge is not write-protected, a write-read test is performed in a special test area on the tape.

The whole routine takes approximately 1½ minutes for a 150 foot cartridge, and 3 minutes for a 600 foot cartridge.

Note

If either or both of the tests in steps **A** and **F** fail, the FAULT light will light, and, when the routine has finished in Selective Mode, the cartridge will be unloaded to the magazine and the door opened. In Sequential Mode, the next cartridge will be loaded, if there is one.

3.2 Unloading Cartridges and Magazines

There are three unloading operations, corresponding to the three loading operations.

A. Cartridges are unloaded from the drive back into the magazine, a process initiated either by the host computer, by an operator over-ride, or as the result of a fault. An **unloading routine** is performed, which updates the information stored on the tape concerning its condition.

B. When all the cartridges are in the magazine, you can remove the magazine.

C. After the magazine has been removed, you can take out the cartridges.

COMPUTER, OPERATOR or FAULT INITIATED unloading operation:

- unloading a cartridge into the magazine - *Section 3.2.1.*

MANUAL unloading operations:

- removing the magazine - *Section 3.2.2*
- taking cartridges out of the magazine - *Section 3.2.3.*

3.2.1 Unloading a Cartridge Back Into the Magazine

A cartridge is unloaded from the drive back into the magazine in any of the following circumstances:

- the host computer issues an **UNLOAD** command
- you press the [EJECT] button
- a read or write fault occurs in testing the cartridge.

If you press the [EJECT] button, there may be a delay before the **unloading routine** is executed. This will happen if the drive is currently engaged on a task under the control of the host computer. The [EJECT] press is acknowledged by the [EJECT] light being lit, and is acted upon when the current task is finished.

The sequence of actions in unloading is as follows:

A. Unloading is initiated (by the host computer, by pressing [EJECT], or by fault detection).

B. When the HP 35401A is free to unload, the **UNLOAD** light is lit and the **Cartridge Number Display** changes to one of the following:

- ⊡ if the unloading was initiated by pressing [EJECT]
- ⊡ in Sequential Mode, if the cartridge being unloaded is the last in sequence
- a **number** in Sequential Mode, to show the next cartridge to be loaded
- a **number** in Selective Mode, to show the cartridge being unloaded.

C. HP 35401A performs its **unloading routine** to prepare the cartridge for unloading. See *Section 3.2.4* for details. (1.5 to 2.5 minutes)

D. At the end of the routine, all cartridges will be back in the magazine.

E. If there are instructions to load another cartridge, this will now happen. Such instructions might be generated by

- the host computer, in Selective Mode
- being in mid-sequence in Sequential Mode
- a selection over-ride in Sequential Mode as described in *Section 3.1.4.*

F. If there are no further instructions, the door will open automatically if the unloading was started by pressing [EJECT] in Sequential Mode. Otherwise, you can open the door by pressing [EJECT] again. See *Section 3.2.2.*

Following step **F**, the Cartridge Number Display will show [E] if the door is open. Otherwise, when the door is unlatched, there are four possible states for the front panel lights:

LIGHTS	CARTRIDGE NUMBER DISPLAY	MEANING
READY	**U**	Normal indication - no fault.
READY, with PROTECT flashing	**Number or Numbers Flashing**	The indicated cartridges are past their useful life, and should be copied and replaced.
FAULT	**Number(s)**	The indicated cartridges are faulty.
FAULT	**F**	The hardware is faulty.

3.2.2 Removing the Magazine

At any time when all the cartridges are in the magazine, pressing EJECT will open the front door. The Cartridge Number Display will then show the letter E and the magazine can be lifted out.

There are three patterns of lights which show that you can open the door:

- READY lit. The Cartridge Number Display shows E.
- READY lit. PROTECT is flashing. The Cartridge Number Display flashes a number or a sequence of numbers. This is a warning to you that those cartridges whose numbers are shown are past their useful life. You should copy their data onto new cartridges and discard the old ones.
- READY lit. FAULT lit. The Cartridge Number Display either shows a number or sequence of numbers indicating faulty cartridges or shows E, indicating a hardware fault.

3.2.3 Taking Cartridges Out of the Magazine

Push through the slots at the back of the magazine to release and remove the cartridges. After taking them out, it is good practice to protect the cartridges by putting them in their plastic cases.

3.2.4 HP 35401A's Unloading Routine

Every time a cartridge is unloaded from the drive back into the magazine, the drive updates the information stored on the tape concerning its condition. If, as a result, it is discovered that the cartridge is nearing the end of its useful life, you are given a warning by the **PROTECT** light flashing.

A. If the cartridge is not write-protected, the tape is wound to the beginning. Any errors that have occurred during the session (e.g. bad blocks) are recorded.

B. The tape is wound to the end.

C. The number of sessions and tape-life information are updated.

D. The cartridge is removed from the drive and replaced in its position in the magazine.

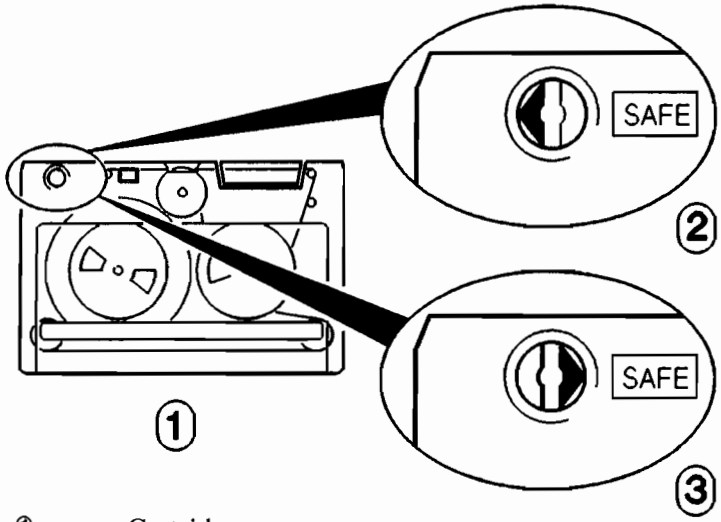
Note 

If the cartridge is write-protected, the number of sessions and tape-life information will *not* be updated. As a result, this information will then be inaccurate.

3.3 Write-protecting Cartridges

You might be using the cartridges as a master store which must not be altered or overwritten. To prevent them from being written to, you must write-protect the cartridges.

To write-protect a cartridge.



①. . . . . Cartridge
②. . . . . The Write-protect Switch is OFF. The cartridge CAN be written to.
③. . . . . The Write-protect Switch is ON. The cartridge is write-protected and SAFE. Data on it can neither be erased nor altered.

Figure 3.3 Write-protecting a Cartridge

Rotate the write-protect switch with a screwdriver or coin until the arrow points towards the word **SAFE**. The switch clicks into place when in the correct position. If a cartridge is write-protected, the **PROTECT** light on the front panel will be lit whenever the cartridge is in the drive or being examined in the pre-load sequence.

Caution

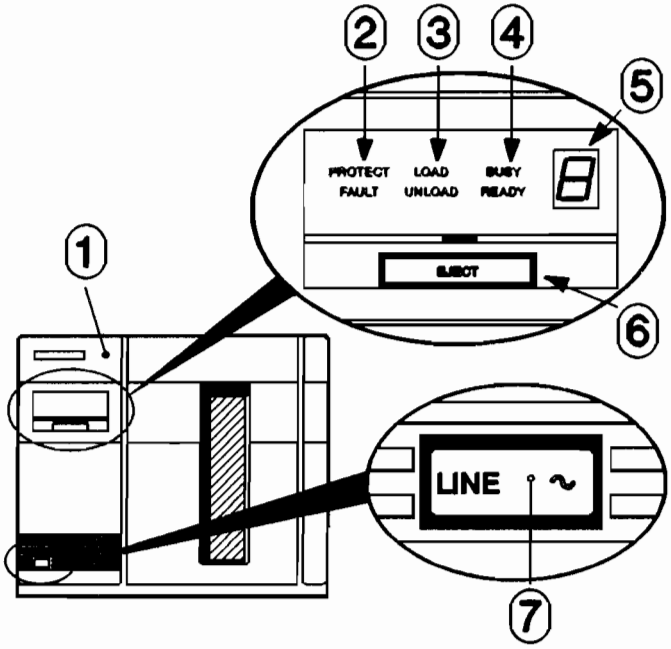
- When changing the state of the write-protect switch, make sure that the switch clicks into position with the arrow pointing **directly** towards or away from the word **SAFE**. If the switch is left in any other position, it is possible for the detector mechanism to jam. In such a case, the drive will have to be dismantled in order to remove the cartridge.
- Write-protection will not prevent a cartridge being erased by bulk-erasure or degaussing.

Note

Write-protection is a crucial method of protecting data, but take care not to write-protect cartridges when using them for backup. A useful way to check at an early stage whether cartridges are write-protected or not is to watch the pre-load routine when the magazine is loaded. The **PROTECT** light will show whether each cartridge is write-protected or not as it is checked.

3.4 Controls and Indicators

3.4.1 Front Panel



①. . . . . Front Panel
②. . . . . Red lights (LEDs)
③. . . . . Amber lights (LEDs)
④. . . . . Green lights (LEDs)
⑤. . . . . Cartridge Number Display
⑥. . . . . EJECT button and indicator
⑦. . . . . AC Line Switch

Figure 3.4 Front Panel Lights

The front panel has six lights (LEDs), a single digit Cartridge Number Display (a seven-segment display), an [EJECT] button, and the AC line switch. The function and significance of each of these is as described below:

AC line switch ⑦

turns the power to the device on and off.

[EJECT] ⑥

- initiates the unloading of a cartridge from the drive back into the magazine. The light above the button is lit if there is a task being performed which must be finished before unloading can begin.
- opens the door, if all the cartridges are in the magazine.
- serves to scroll through the cartridge numbers while the **UNLOAD** light is lit, allowing you to choose the next cartridge in Sequential Mode (see *Section 3.1.4*).
- serves to scroll through the cartridge numbers while **LOAD** is flashing quickly, again allowing you to choose the next cartridge. This happens after a pre-load routine in Sequential Mode.

LOAD ③

is lit continuously from the moment the autochanger mechanism begins to select a cartridge in the magazine to the moment when the **loading routine** (see *Section 3.1.5*) is finished. The **Cartridge Number Display** shows which cartridge is being loaded. **LOAD** flashes slowly while the pre-load sequence is happening; that is, after a magazine is installed, or power is reconnected following a power failure. In Sequential Mode, **LOAD** flashes more quickly for five seconds afterwards. During this fast flashing, the next cartridge to be loaded can be manually selected - see *Section 3.1.4*.

UNLOAD ❸

is lit from the moment the **unloading routine** (see *Section 3.2.4*) begins, until the cartridge is back in the magazine.

The Cartridge Number Display shows:

- the cartridge being unloaded, in Selective Mode
- the next cartridge to be loaded, in Sequential Mode
- ⊡ if the cartridge being unloaded is the last in sequence, in Sequential Mode
- ⊡ if the unloading was initiated by pressing [EJECT].

READY ❹

is lit to indicate generally that the drive is ready for a command, either from you or from the host computer. Specifically, it is lit when one of the following happens:

- a cartridge is in the drive and the HP 35401A is waiting for a command from the host computer. The Cartridge Number Display shows the cartridge number.
- all cartridges are in the magazine. Pressing [EJECT] will open the door and allow you to remove the magazine. At that point, if the Cartridge Number Display shows:
  - ⊡ then all is well.
  - a number or sequence of numbers, this means that those cartridges are past their useful life and should be copied onto new cartridges. If **FAULT** is lit as well, then those cartridges are faulty.
- the door is open, or there is no magazine in the drive. The Cartridge Number Display shows ⊡
- in Sequential Mode, a pre-load sequence has finished and the drive is waiting to see if you press [EJECT] in order to select a particular cartridge. **LOAD** will be flashing quickly, and the Cartridge Number Display will show the number of the last cartridge checked.

BUSY ❹

is lit while the drive is executing a host-initiated command.

PROTECT ②

is lit **continuously** if the cartridge whose number is shown on the Cartridge Number Display is write-protected. It **flashes** to warn you that the cartridges shown on the Cartridge Number Display have exceeded their useful life and should be copied and replaced.

FAULT ②

is lit when there is a fault. If the Cartridge Number Display shows F, the fault is in the hardware. If, while there is no cartridge in the drive, the Cartridge Number Display shows a number from 1 to 8, or shows a sequence of those numbers, this indicates that the cartridges in those positions in the magazine are faulty.

CARTRIDGE NUMBER DISPLAY ⑤

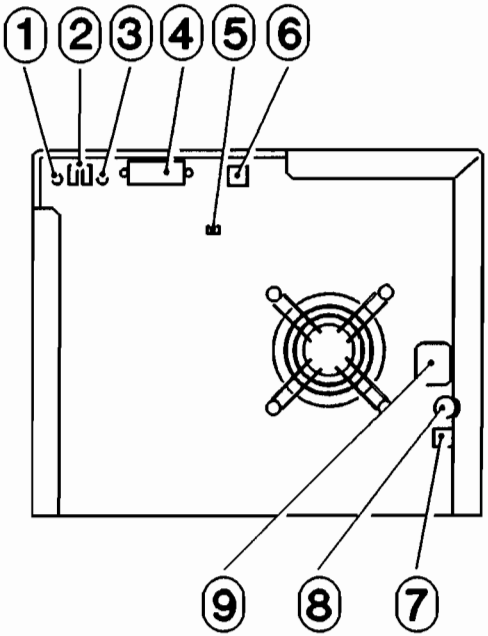
displays either a number from 1 to 8 or one of the letters U, E, C, P or F. A number from 1 to 8 means that the numbered cartridge is either

- in the drive, or
- being loaded, unloaded or next to be loaded into the drive, or
- faulty, or past its useful life.

U means either that the magazine is ready to be removed by pressing EJECT, or that the final cartridge in Sequential Mode is being unloaded, after which the magazine may be removed.
E means the door is open, or that there is no magazine present. It will also occur when through some fault, the drive *thinks* one of these is true, when in fact neither is.
C means that the drive has detected or is using a cleaning cartridge.
F indicates a hardware fault.
P indicates that the tests which occur when the drive is switched on have passed or are in progress.

The exact meaning of the Cartridge Number Display depends on what lights are lit:

3.4.2 Rear Panel



① . . . . . Display Self-test Results (DSR) button
② . . . . . Self-test Displays
③ . . . . . Initiate Self-test Button
④ . . . . . HP-IB Cable Socket
⑤ . . . . . Mode Selector
⑥ . . . . . Device Address Switches
⑦ . . . . . Voltage Select Switch
⑧ . . . . . Fuse Holder and Fuse
⑨ . . . . . Line Input Socket

Figure 3.5 Rear Panel Displays and Switches

The rear panel has the following sockets, switches and displays:

DISPLAY SELF-TEST RESULTS SWITCH ①
cycles through the self-test results. For each unit that fails, each press of the switch shows the numbers of the assemblies most likely to be faulty, and, finally, the code number of the test that failed. See **Chapter 4** for more information.

SELF-TEST DISPLAYS ②
show the results of self-tests and the address of the device. Usually, the left display will show the device address and the right display will show [P], meaning that the drive passed the self-test. If the drive proves faulty, the right display will show [F]. In this case, when used in conjunction with the Display Self-test Results Switch, the same displays can show the numbers of the internal assemblies that most probably caused the failure. See **Chapter 4**.

SELF-TEST INITIALIZATION SWITCH ③
activates the self-test. See **Chapter 4**.

MODE SELECT SWITCH ⑤
selects between Sequential and Selective modes of operation. See *Section 1.3*.

ADDRESS SWITCHES ⑥
are set to the device address number (0-7) on the HP-IB. The address is set to 3 at the factory and is only likely to be altered when the device is installed. See *Section 2.3*.

VOLTAGE SELECT SWITCH ⑦
is set to the local power supply voltage. See *Section 2.2*.

FUSE ⑧
is 3.0 Amp Fast Blow, 250 Volts AC, whatever the local power supply voltage.

4 SELF-TESTS

Note

Interpretation of the self-test results and diagnosis of faults is best left to trained HP Service Engineers. Beyond the actions detailed in *Section 4.3*, there is nothing you can do to correct faults, and you should contact your HP Sales and Service Office for help. The details of the self-test which follow in *Sections 4.1* and *4.2* are included in case you wish to state a problem more clearly on the telephone to a Service Engineer, in order that he or she may arrive with any necessary replacement assemblies.

The self-test routine tests all the major assemblies within the HP 35401A. If all is well, it returns a **Pass Condition** [P] on the right-hand rear panel display. If the test reveals a fault, the display shows a **Fail Condition** [F] and the FAULT light on the front panel is lit. Pressing the **Display Self-test Results Switch** will allow you to see which assemblies are most likely to be at fault.

A Fail Condition remains until the drive is turned off, or you start another self-test. If a cartridge is faulty, for example, you could load another one. This action would automatically initiate a write-read self-test, and reset the Pass/Fail Condition.

The full test can be initiated in three ways:

- by turning on the power to the drive,
- by pressing the **Self-test Initialization Switch**,
- by sending an `initiate diagnostic` command from the host computer.

If a cartridge is actually *in* the drive and not write-protected, the test will include a write-read test to detect whether the reading and writing assemblies are working. This write-read test also occurs every time a cartridge is loaded, and detects faulty cartridges.

The **Self-test Initialization Switch** and the **Display Self-tests Results Switch** are recessed behind the rear panel. Use the tip of a pen or similar object to press them.

The entire self-test takes about one minute.

4.1 The Self-test Sequence

If you watch the displays on the rear panel during the self-test, you will see the following:


off


Indicates that the displays are working correctly.


Indicates that the power supply is supplying ±5V.


or

Pass or Fail. ? is the HP-IB address of the device.

You can display further details of the self-test results by repeatedly pressing the Display Self-test Results button (**DSR**).

Note

While results are being displayed, communication between the host computer and the HP 35401A is disabled.

If the test resulted in a Pass Condition:


Pass on address ?

--- Computer Communication Disabled ---

Press DSR⟶ 
Unit 0 (drive mechanism)

Press DSR⟶ 
Unit 1 (autochanger)

Press DSR⟶ 
Unit 2 (internal controller)

Press DSR⟶ 
Return to Pass Display

--- Computer Communication Enabled ---

4.3 What Action To Take

Suspected Cartridge Faults

Clean the tape head first and then repeat the test once or twice. If a fault is still reported, try another cartridge. If this, too, produces a fault on repeated tests, call your HP Sales and Service Office.

Other Faults

Repeat the test a few times, turning the drive off and on again between tries. If the tests continue to report a Fail Condition, call your HP Sales and Service Office.

5 CARE AND PROBLEMS

5.1 Care and Maintenance

Apart from cleaning the tape head, which is discussed in *Section 5.1.2* below, no maintenance is necessary.

The drive itself has **no operator serviceable parts**. Service must be carried out by HP Service Engineers. Care must be taken in installing it, and the front and back must be kept free from obstructions to ensure adequate ventilation. Installing the drive in the HP Design Plus mobile mini-rack system cabinet will help to ensure proper operating conditions (see *Section 2.7* for details).

5.1.1 Care of Cartridges

In addition to the following recommendations, please see **Appendix C** for guidelines in conditions where the temperature varies.

- Do not touch the tape, or attempt to clean the tape path or tape guides within the cartridge.
- Do not leave cartridge tapes in excessively warm, dry or humid locations. Do not leave them in direct sunlight, or on areas where magnetic fields are present (e.g. near transformers, motors or CRTs).
- Do not use cartridges at temperatures less than 5°C (41°F) or greater than 40°C (104°F).
- Do not store cartridges at temperatures less than -40°C (-40°F) or greater than 45°C (113°F).
- Do not drop cartridges or handle them roughly.
- Do not stick extra labels onto cartridges; they could cause the autochanger mechanism to jam.

- Keep magazines containing cartridges upright when not in use, with the carrying handle on top, and protect them from dust and dirt.
- If you remove cartridges from the magazine, always store them in their protective plastic cases.
- Always keep the cartridges in a clean environment. Exposure to dust and other particles, such as food and cigarette smoke, degrades the tape and makes it less reliable.
- To prevent overwriting data stored on the cartridge, use the write-protect switch. See *Section 3.3.*

Caution 

The performance and reliability of the tape drive depends on the quality of the media used. Tape drive specifications can only be assured when using HP media. The use of improper media can result in premature tape failure or damage to the tape drive. On some tape products, HP may approve other non-HP media. When tested, this media met HP specifications, but HP does not warrant or support it, and cannot control changes in its specifications or quality. The selection and use of such products is the customer's responsibility. HP reserves the right to exclude from warranty and maintenance agreement coverage any repairs which HP reasonably determines or believes were caused by the use of media not provided by HP. On request, HP will provide such repairs on a time and material basis. Warranty and maintenance agreement coverage of repairs not caused by the use of non-HP media is unaffected.

5.1.2 Care of Equipment

General

- Do not turn the AC Line Switch ON or OFF while the system is transferring data on the HP-IB interface. You may corrupt the cartridge and the data.
- Do not turn the AC switch ON and OFF unnecessarily.
- Do not connect or disconnect HP-IB cables from the tape drive while the system is transferring data.
- Do not attempt to force the front door open to remove the magazine. It may only be opened by pressing [EJECT] when all the cartridges are in the magazine. If you lose power with the drive in operation, you will have to wait for the power to be restored before you can begin unloading operations.

Caution 

To avoid damaging the tape drive or the host computer, always turn off the computer and the tape drive when attaching or removing the interface cables.
Use only cables designed by Hewlett-Packard for the purpose - **Appendix F** gives details of those available.
Keep the front and back of the drive free from obstructions to avoid restricting the air-flow. Failure to do so could cause the drive to overheat and be damaged.

Cleaning the Tape Head

A **cleaning cartridge kit** is provided with the HP 35401A for cleaning the tape head. You should always use this cartridge and never attempt to clean the tape head by any other method.

It is a good idea to clean the tape head:

- **every week,**
- **after using approximately eight new cartridges** - they can carry loose particles which could adhere to the tape head when first used,
- **if you are experiencing data errors.**

This will ensure that reading from and writing to cartridges remain reliable and trouble-free.

Cleaning Solvent

LIQUID Freon TF* (trichlorotrifluorethane) is the **only** solvent that HP approves for cleaning the tape head and tape path. It dissolves oil and grease, evaporates quickly, leaves no residue, and will not damage the tape transport mechanism. If you use Freon TF from a supplier other than HP, make sure that it is of high-quality and pure, not mixed with other solvents.

Caution

Do not use cleaner solutions which contain lubricants. They deposit lubricant on the tape head and degrade performance.
Do not use soap and water on the tape path. Soap leaves a thick film, and water may damage the electronic parts.
Do not use standard hub cleaners or strong alcohol solutions (>20% alcohol). These solutions damage the capstan.
Do not use aerosol cleaners, even of Freon TF. The spray is difficult to control and often contains metallic particles which damage the tape head.

Trademark of Dupont Corporation

Cleaning Materials

Only use the cleaning cartridge provided with the drive for cleaning the tape head. You can obtain a complete Cleaning Cartridge Kit from your local HP Computer Supplies Center by ordering part number HP 92193E, or a Replenishment Kit (Foam Pads and Cleaning Fluid) with part number HP 92193P. See **Appendix F** for ordering details.

Warning 

Do not attempt to clean the tape head with swabs, cloths or tissues. The tape head are virtually inaccessible from the front door, and you are likely to damage the autochanger mechanism.

Method of Cleaning the Tape Head

A. Thoroughly moisten the foam pad in the cleaning cartridge with Freon TF.
B. Place the cleaning cartridge in the lowest position in a magazine. If you place it in a higher position, the fluid may evaporate before the tape head can be cleaned.
C. Install the magazine in the drive, and close the front door.
D. The drive then performs the usual pre-load routine, during which it detects and identifies the cleaning cartridge. It then loads the cartridge and cleans the tape head for about 5 seconds. Then the cleaning cartridge is returned to the magazine, and the front door opens.
E. Remove the magazine from the drive.
F. Take the cleaning cartridge out of the magazine and discard the used foam pad. Replace the cartridge in its protective plastic case.

Cleaning the Case

The front panel of the drive is made of colored plastic and is unpainted. The case and rear panel are painted in a durable, non-toxic paint. With occasional cleaning, the finish should be preserved for many years, but if it does become damaged, consult your local HP Sales and Support Office for available touch-up paints. To clean the case:

A. **DISCONNECT THE POWER CORD AND CONNECTING CABLES.**
B. Dampen a clean, soft, lint-free cloth in a solution of clean water and mild soap.
C. Wipe the soiled areas of the case, making sure that no cleaning solution gets inside the case.
D. Remove the soap solution by wiping with another clean, soft, lint-free cloth moistened only with clean water.
E. Dry the case with a soft, clean cloth.

You can remove pen and pencil marks with a non-abrasive eraser.

Caution

Do not use chemical spray-on cleaners or other chemical cleaners. They may damage the case finish.
Do not use detergents that contain ammonia, benzenes, chlorides or abrasives.

5.1.3 Replacing the Fuse

Warning 

To avoid electrical shock, unplug the power cord before replacing the fuse.

For either voltage setting, the fuse is 3A Fast Blow 250 Volt rating.

A. Turn the drive OFF.
B. UNPLUG THE POWER CORD.
C. Locate the fuse holder on the rear panel, just below the AC Power Line socket.
D. Using a small screwdriver, press in the central part of the fuse holder, and twist it counter-clockwise.
E. Remove the screwdriver, and the fuse holder will spring outwards. Remove it with your fingers.
F. Remove the old fuse and discard it.
G. Insert a new fuse (3A Fast Blow 250V) into the holder.
H. Replace the holder in its hole.
I. Using the screwdriver, press in the holder and twist it clockwise, so that it catches securely.
J. Plug the power cord back in.

Suitable fuses may be obtained from HP Sales Offices by ordering part number HP 2110-0003.

5.2 Problems and Solutions

How do I destroy or remove data from a cartridge?

Use the *initialize* or *format* command from your computer. This will destroy all the data on the cartridge, but leave the formatting blocks which the manufacturer put on the tape. Do NOT erase, bulk-erase, degauss, or otherwise destroy the formatting blocks, which would leave the cartridge useless.

I want to store information, but the WRITE- PROTECT light is on *or* the computer returns a message that the cartridge is write-protected.

The cartridge is write-protected, and you should ask yourself whether you are quite sure that you want to write to it and possibly erase data already on the cartridge. If you do, you must change the write-protect state of the cartridge, which involves removing the magazine from the drive, the cartridge from the magazine, and then twisting the write-protect switch.

To accomplish this:

1. Press the [EJECT] button.
2. Wait for **READY** to light. Depending on whether the cartridge was actually in the drive or not, this may take up to two minutes.
3. Press [EJECT] again, and the door will open.
4. Take the magazine out.
5. Remove the appropriate cartridge by pushing it out from the back.
6. Using a coin or screwdriver, rotate the write-protect switch so that the arrow on it points *away* from the word **SAFE**. Make sure that the switch clicks into position.
7. Put the cartridge back into the magazine.
8. Put the magazine back into the HP 35401A.

9. Close the front door. Wait about one minute while the pre-load routine takes place.
10. If in Selective Mode, you must load the cartridge into the drive by commands from the computer.
11. If in Sequential Mode, wait until the pre-load sequence has finished, when the **LOAD** light starts flashing quickly. Repeatedly press [EJECT] until the Cartridge Number Display shows the number of the cartridge that you want. Wait five seconds, after which the **LOAD** light will light steadily and the cartridge will be loaded.

The computer displays a message saying "*Tape or Disc Not Present*", or "*No Tapes or Discs Were Found*", or "*No Mass Storage Found*", or "*Tape or Disc Drive is Empty, Off, or Undefined*".

1. Ensure that the tape drive is turned ON.
2. Ensure that the **FAULT** light is OFF.
3. Switch OFF the drive and ensure that the cables are properly and securely connected. Switch ON the drive again.
4. Ensure that there *is* a cartridge in the magazine position being accessed (or that the cartridge has been loaded into the drive).
5. Ensure that the cartridge has been initialized.
6. Ensure that the left-hand display on the back of the drive shows ⚄, indicating a self-test Pass.
7. Ensure that the drive is set to the correct address on the HP-IB. The address is shown on the right-hand display on the back of the drive.
8. If all these things are correct, the cartridge itself may be faulty. Try using another cartridge.

The computer displays a message saying "*Tape or Disc Error Reading Drive x*". What should I do?

The most likely cause is a worn or damaged cartridge. Check whether this is so by seeing if you receive the same message with other cartridges. If the error still occurs, the fault may well be in the drive itself, and you should contact your dealer or HP Sales Office. If the other cartridges function correctly, the original cartridge must be at fault. You should copy the cartridge *immediately* and then discard the original. Note that the copy may not work either, if the original was in poor condition.

The FAULT light remains on after the drive's self-test, showing that the test failed. What should I do?

Repeat the self-test several times, to see if the failure persists. You can do this by turning the drive OFF and then ON again several times. Each time you turn it ON, the self-test is repeated, and you should wait for it to finish (READY light on) before turning the drive OFF again. If the test persistently fails, the FAULT light will remain lit each time, and you should contact your dealer or HP Sales Office.

I can't unload a cartridge from the drive back into the magazine, or remove the magazine (the door won't open).

If the power is off, the door will remain locked, so ensure that the drive is turned ON, or, if there is a power failure, wait for power to be restored. Your only manual control over unloading cartridges or removing the magazine, is by using the EJECT button. Pressing it should start the unloading sequence if there is a cartridge in the drive, or should open the door if all the cartridges are in the magazine. If the drive is busy executing a command from the computer, it will finish before acting on your EJECT signal. Meanwhile, the EJECT button will be lit, showing that it has recognized your signal.

Be prepared to wait for the drive to finish what it is doing before responding to [EJECT].

If, despite this, the drive does not respond to the [EJECT] button, contact your dealer or HP Sales Office.

What should I do if the power fails while the drive is in operation?

If the power fails while the drive is in operation, action is suspended. This means that the door remains locked, and any cartridge in the drive stays there. When power is restored:

- in Sequential Mode, the drive will continue from exactly the point it left off,
- in Selective Mode, any incomplete actions will be aborted; so that a cartridge which was in the process of being loaded will be unloaded. Normally, the end result will be that all cartridges are in the magazine.

While the power is off, then, there is nothing you can do, but it would be wise to turn the drive OFF as a safety precaution.

The FAULT light comes on. What does this mean?

Usually this means that one of two tests in the loading routine has failed. The most likely cause is that a cartridge was found to be faulty. This will be accompanied by the left-hand display on the back of the drive showing  , a Pass Condition. Try using another cartridge.

If the read/write head was found to be faulty, which is less likely, the display on the back of the drive will show . If this is the case, contact your dealer or HP Sales Office.

5.3 Warranty and Service

Warranty

The complete warranty statement is included in the front of this manual. If you have questions concerning the warranty, please contact your dealer, or HP Sales Office. There is a list of these offices at the back of this manual.

Service

There are no operator serviceable parts within your HP 35401A, except for the cleaning of the read/write head. If at any time you suspect that your tape drive is malfunctioning, run the self-tests available on the drive. If a malfunction is confirmed or still suspected, and you have cleaned the read/write head and replaced the cartridge, call your HP Sales Office.

A Product Specification

Physical

Net Weight:	22.5 kg (50.5 lbs)
Height:	260 mm (10.2 in)
Depth:	575 mm (22.6 in)
Width:	325 mm (12.8 in)

Interface

HP-IB (IEEE-488 1978) using CS/80 protocol

Format and Density

Encoding Technique:	MFM
Speed:	60 inches/sec reading and writing
	90 inches/sec searching and rewinding
Bit Density:	10 000 bits/inch (bpi)
Maximum Sustained Transfer Rate:	2 Mbytes/minute (system dependent)

Capacity

Bytes/Frame:	256
Frames/Block:	6 (4 blocks for user data, 2 blocks for error correction)
Tracks/Tape:	16
User Blocks/Track	
88140SC:	1024 maximum
88140LC:	4096 maximum
Bytes/Magazine:	536.8 Mbytes maximum
Tapes/Magazine:	8 maximum

Power Requirements

90-125 volts or 180-250 volts @ 125 watts RMS (102 voltamps)
48-66 Hertz
Fuse 3A Fast Blow, 250 Volt Rating

Environmental Specifications

Operating Limits

Temperature:	5°C to 40°C (40°F to 104°F)
Humidity:	20 to 80% with maximum wet bulb temperature (non-condensing) not to exceed 26°C (79°F)
Altitude:	0 to 4572m (0 to 15 000 ft)
Shock:	25G maximum 11 milliseconds duration
Vibration:	5 to 350 Hz 0.0001 G^2/Hz

Non-operating Limits

(Storage and Transit of Drive)

Temperature:	-40°C to 75°C (-40°F to 167°F)
Shock:	30G maximum 11 milliseconds duration
Vibration:	5 to 350 Hz 0.008 G^2/Hz

(Storage and Transit of Tape)

Temperature:	-40°C to 45°C (-40°F to 113°F)
Altitude:	-304 to 15240m (-1 000 to 50 000 ft)
Noise Level:	Less than 50 dbA Sound Power

Electromagnetic Emissions

Radiated and Conducted Interference

USA:	meets FCC Rules Part 15 Class A computing devices requirements
Europe:	meets FTZ 1046/84 computing devices

Sound Power

Noise Power Emission:	<5 Bels averaged over a typical operation cycle

B HP-IB Restrictions

The exchange of data between the host computer and the HP 35401A is at a high transfer rate (a burst rate greater than 500 kbytes/second). Because of this high rate, the following restrictions and cautions apply to devices connected to the HP-IB:

- ALL AC line switches (both on the computer and on peripherals) must be turned OFF when connecting and disconnecting devices.
- ALL devices on the system must be turned ON for any transfer of data at high transfer rate. If the transfer is at a lower rate (e.g. to a floppy disc drive or to a printer), at least two-thirds of the devices on the HP-IB should be turned ON.
- The HP-IB cables which connect devices should be as short as possible. For this reason, HP-IB cables of 4m and longer are NOT recommended.
- Do not turn any device ON or OFF while there is activity on the HP-IB.

All HP-IB cables which are sold by HP are completely shielded in order to prevent Radio Frequency Interference (RFI). If you use unshielded cables, RFI will be greater in the area near them. See the Federal Communications Commission statement at the front of this manual.

C Cartridge Guidelines

One of the advantages of cartridge tapes is that they are portable. Because of this, they may be exposed to rapid changes in environmental conditions. The guidelines in this Appendix are recommended in order that the HP 35401A should continue to perform in its usual highly reliable manner, and that you can be confident of a high standard of data integrity.

Cartridge Specifications

The ANSI X3.55 - 1982 specification applies to HP 35401A cartridge tapes. In part, this states:

```
Temperature . . . . . 41°F to 113°F (5°C to 45°C)
Relative Humidity . . . . . 20% to 80% non-condensing
Maximum Wet Bulb Temperature. 79°F (26°C)

The cartridge shall be conditioned by exposure to the
operating environment for a time equal to or greater than the
time away from the operating environment (up to a maximum of
8 hours). If a user of a data cartridge knows or suspects
that the cartridge has been exposed to a drop in temperature
exceeding 30°F (16.7°C) since last used, it is recommended
that the cartridge be rewound one complete cycle on the tape
transport before it is used for data interchange.
```

This specifies the normal operating limits for cartridges, but does not clarify restrictions relating to changing conditions within those limits.

Hewlett-Packard has tested cartridges in order to determine conditions for reliable data recovery after temperature changes. Stable conditions will obviously help to ensure data integrity, but where they are not possible, the following precautions are recommended.

Cartridge Guidelines

The following three conditions refer to changes in the room temperature, or the temperature surrounding the tape drive. It is assumed that:

- the cartridges have been stabilized to the temperature of the room before the change; that is, they have been in the room long enough to reach room temperature,
- the magazine plus cartridges is installed in the drive,
- the drive is turned on,
- the temperature never leaves the specified operating range for the HP 35401A drive: 5°C to 40°C (40°F to 104°F).

In each case, the ANSI specification requires up to 8 hours stabilization time after the temperature has changed and before the cartridges should be used.

HP's factory tests have explored the stabilization times necessary to ensure excellent performance, and these times are given for each condition.

Controlled Temperature Environment

The temperature varies within ±5°C.

HP's factory tests show that no stabilization is necessary.

Moderately Varying Temperature Environment

The temperature variation is between 5°C and 16.6°C.

HP's factory tests show that 35 minutes stabilization is sufficient.

Extremely Varying Temperature Environment

The temperature varies more than ±16.6°C while remaining within the specified range of 5°C to 40°C.

HP tests recommend stabilizing for one hour, followed by retensioning the cartridge. Retensioning is achieved by doing a load/unload sequence on the cartridge.

Conditions To Be Avoided

- Do not place the tape drive in or near the flow of air from a heater or air conditioner. The cycling of the heater or air conditioner can cause data recovery problems.
- Do not place the tape drive near a door which is often used, and which separates different temperature conditions. If the drive is placed near an outside door, for example, the blast of hot or cold air when the door is opened can affect data recovery.
- Do not leave cartridges in severe temperature conditions for any length of time; for example in a car standing in

the cold overnight or in sunlight during the day. If it is unavoidable, then before you use the cartridge for data recovery, stabilize it for one hour and then retension it by performing a load/unload sequence.

- Avoid transferring data (reading from and writing to cartridges) when the temperature is changing by more than 3°C per hour.

D Use with the HP 9000

HP 9000 Series 500

HP 9000 Series 500 computers with operating system **HP-UX 5.0** will only support Sequential Mode and require you to press [Return] to load each new cartridge.

After a cartridge is unloaded from the drive back into the magazine, the message

```
Enter device or press RETURN for same device.
```

appears on the screen. Press [Return] to load the next cartridge.

HP 9000 Series 200 & 300 Computers

With **BASIC** or **PASCAL** operating systems, Series 200 and 300 computers have the same limitations as the Series 500 above.

With **HP-UX 5.1** operating systems, Sequential Mode behaves in the same way as the Series 500 above, but Selective Mode can provide unattended Sequential Operation as follows:

1. Switch OFF the HP 35401A tape drive and set it to **Selective Mode** (see *Section 1.3*). Switch the drive ON again.

2. Alter the Backup Script (**/etc/backup**) so that the line

   ```
   cpio/tcio-o 1
   ```

   near the end of the file, reads

   ```
   cpio/tcio-ol 1.
   ```

This will direct the output of a backup command to the HP 35401A. The number **1** points to the cartridge to be used for the backup and is incremented (to **2**, **3**, **4**, etc.) automatically, so that the tape drive appears to be working in Sequential Mode. If you want the backup to start with cartridge **3**, change the line to read

```
cpio/tcio-ol 3.
```

E Glossary

Address

A number, by means of which the computer identifies a peripheral. Every disc drive, tape drive, printer, etc. to which the computer is attached has a unique address so that the computer knows unambiguously with which it is exchanging data.

Autochanger

The mechanism by which the HP 35401A selects cartridges from the magazine and loads and unloads them to and from the drive.

Auto-sparing

An automatic method of avoiding bad sections of tape.

Backup

A copy of data or files made to guard against damage to the original. Tape is often used to backup discs.

Booting

A procedure in which a small program permanently in the computer loads in the operating system, usually from disc. The computer is then ready to communicate with you, run programs, etc.

Bus

A wire or set of wires which carries data.

Byte

A unit of data which could represent a single letter, digit or other symbol.

Cable

A flexible connector between devices for the transmission of data, power, etc.

Cartridge

A housing containing magnetic tape wound between two spools and which incorporates a write-protect switch.

Cartridge Number Display

A seven-segment display on the front panel which indicates which cartridge is in the drive, and also displays various other information concerning errors, etc.

CRT

The Cathode Ray Tube, or video screen.

Degauss

A method of destroying magnetic patterns (e.g. on tape or disc) electromagnetically.

DDC

Device-Dependent Controller. The circuitry in the drive which controls those operations which the drive can perform without reference to the host computer.

Directory

An index to the contents of a tape, stored in a special block on the tape.

DSR

Display Self-test Results. A button on the rear panel which shows detailed results of a self-test when repeatedly pressed.

Formatting

A process by which a tape is magnetically divided into blocks in which data can be stored. Special blocks are set up for the Directory, for testing purposes and for recording information about the tape's history of usage. Formatting is done before you receive the tape.

FRA

Field Replaceable Assembly. The drive consists of several FRAs, each of which can be replaced as a unit by a Field Engineer if it is faulty.

Hardware

Computer equipment that can be physically handled.

HDC

Host-Dependent Controller. The circuitry in the drive which interprets instructions from the host computer, and which controls the transmission and reception of data to and from the computer.

Host Computer

The computer to which the drive is connected by the HP-IB cable and which controls it.

HP-IB

The Hewlett-Packard Interface Bus. A cable with standard connectors for transfer of data between the computer and peripherals. It is HP's implementation of IEEE Standard 488-1978.

Initializing

The process by which a tape directory and name is set up on a tape. In other words, it gives the tape an identity. A tape is initialized by commands from the host computer.

Interface

The means of bridging the gap between computer and peripheral in terms of communication and data interchange.

K/Kbytes

A kilobyte is a unit of data, equal to 1024 bytes. It is used to measure memory or storage capacity.

LEDs

Light Emitting Diodes. These are the indicator lights on the

front and rear panels. Some display a word (BUSY, LOAD, etc.), others are seven-segment displays showing a digit or letter.

Load

To read data or programs into the computer, or, within the HP 35401A, to perform the loading procedure which moves a cartridge from the magazine into the tape drive and tests it ready for reading and writing.

Load Routine

The steps necessary to make a tape ready for use (including compensating for the condition of the tape, testing the read/write head, etc.).

Low-end System

A small computer system for one or more users with disc space of up to approximately 100 Mbytes.

Magazine

The portable and removable carrier capable of holding up to eight cartridges.

Mbyte

Short for Megabyte, a unit of data approximately equal to a million bytes (in fact 1048576 bytes).

Mid-range System

A multi-user computer system with storage capacity of between 100 and 400 Mbytes.

MSFRA

Most Suspect Field Replaceable Assembly. An assembly which the self-test considers to be most likely to be faulty.

Peripherals

Devices controlled by a computer, usually through cables, but not physically part of that computer (e.g. printers, plotters, disc and tape drives).

Pre-load Sequence

The procedure followed after a magazine is installed, by which the drive discovers which positions in the magazine are occupied by cartridges, and whether those cartridges are write-protected or not.

Program

A series of instructions telling a computer how to handle a problem or task.

Read

To decode data magnetically from a tape or disc.

Read-after-write

A method of verifying data immediately after it is written.

R/W

Read/Write. The process of magnetically encoding or decoding data on a tape.

Read/Write Head

The part of the tape drive that magnetically encodes or decodes data on the tape.

Selective Mode

The drive accesses cartridges under computer instruction. The order of access is independent of the order of the cartridges in the magazine.

Sequential Mode

The drive accesses each cartridge in turn in the order in which they are put in the magazine, starting at the bottom.

Seven-segment Display

Seven LEDs arranged to form more or less the shape of the figure 8. By lighting different combinations of the LEDs, any digit and several letters can be displayed. There is also an eighth, smaller LED providing a full-stop or decimal point after the figure eight arrangement.

Software

Programs or sets (suites) of programs, sometimes called **applications**.

Tape Head

See Read/Write Head.

Unload

The process by which the HP 35401A removes a tape from the drive and replaces it in the magazine.

Unload Routine

The steps which the drive performs to make a tape ready for removal from the drive back into the magazine (including updating the information stored on the tape concerning its life and condition).

Write

To encode data magnetically onto a tape or disc.

Write-Protect

A method of preventing information from being erased from or added to a tape.

F Supplies & Accessories

Supplies

It is advisable to keep a supply of cartridges and cleaning materials in stock at all times. The following HP products are recommended for use with the HP 35401A. They are listed with their part numbers.

Cartridges and Magazines

16.7 Mbyte (150 ft) Cartridge, formatted and certified (Box of 5).....HP 88140SC
67.1 Mbyte (600 ft) Cartridge, formatted and certified (Box of 5).....HP 88140LC
Cartridge Magazine ..... HP 92192C

Cleaning Supplies:

Cleaning Cartridge Kit ..... HP 92193E
Replenishment Kit (Foam Pads and Cleaning Fluid) ..... HP 92193P

Cables (HP-IB):

0.5 m..... HP 10833D
1 m ..... HP 10833A
2 m ..... HP 10833B

Cabinet and Accessories

Design Plus Mobile Mini-rack System Cabinet ..... HP 92211R
Rail Kit (four sets of rails and module locks)..... HP 92211S
Filler Panel Kit..... HP 92211T
This contains snap-in panels to fill space not occupied by equipment
Multiple Power Outlet Strip (US/Canada only) ..... HP 92199B
This is an optional accessory for the cabinet.

Ordering

The following list gives addresses and telephone numbers of the main computer supplies centers. Further telephone numbers will be found in the list of Worldwide Sales Offices at the end of this manual.

The telephone numbers in the following list are given in a standard format: **(ccc) rrr-nnnnnnnn**. **(ccc)** is the country code and should only be used when calling from outside the country. **rrr** is the regional code. If you are in the country, you may need to prefix the regional code with zero. **nnnnnnnn** is the actual telephone number.

Australia

Hewlett-Packard (Australia) Ltd.
31-41 Joseph St.
BLACKBURN, Victoria 3130
Tel: (61) 3-895 2895

Austria

Hewlett-Packard Ges.m.b.H
Lieblgasse 1
P.O.Box 72
A-1222 VIENNA
Tel: (43) 222-2500 615
(43) 222-2500 616

Belgium

Hewlett-Packard Belgium S.A./N.V.
Boulevard de la Woluwe 100
Woluwedal
B-1200 BRUXELLES
Tel: (32) 2-762 32 00

Canada

Hewlett-Packard (Canada) Ltd.
3710 Nashua Dr., Units A-E
MISSISSAUGA
Ontario L4V IM5
Tel: (1) 416-671 8383

Denmark

Hewlett-Packard A/S
Datevej 52
DK-3460 BIRKERØD
Tel: (45) 2-81 66 40 (ext.258)

Finland

Hewlett-Packard Oy
Revontulentie 7
SF-02100 ESPOO 10
Tel: (358) 0-4550211

France

Hewlett-Packard
Département Fournitures
Consommables
B.P. 19
91941 LES ULIS CEDEX
Tel: (33) 6-928 32 64

German Federal Republic

Hewlett-Packard GmbH
Computer-Zubehoer
Dornierstr. 7
7030 BöBLINGEN
Tel: (49) 130-3322

Italy

Hewlett-Packard Italiana S.p.A.
Prodotti Ausiliari
Via G. di Vittorio 9
1-20063 CERNUSCO
SUL NAVIGLIO (MI)
Tel: (39) 2-92 369 437
(39) 2-92 369 478

The Netherlands

Hewlett-Packard Nederland B.V.
Van Heuven Goedhartlaan 121
NL-1181 KK AMSTELVEEN
Tel: (31) 20-47 06 39

Norway

Hewlett-Packard Norge A/S
P.O.Box 34
Østerndalen 18
N-1345 ØSTERÅS
Tel: (47) 2-17 11 80

South Africa

Hewlett-Packard So Africa Ltd.
Private Bag, Wendywood
SANDTON 2144
Tel: (27) 11-802 5111

Spain

Hewlett-Packard Española SA
Calle Jerez 3
E-MADRID 16
Tel: (34) 1-637 4013

Sweden

Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
Box 19
S-16393 SPÅNGA
Tel: (46) 8-750 2028

Switzerland

Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 WIDEN
Tel: (41) 57-31 22 54
(41) 57-31 22 59

United Kingdom

Hewlett-Packard Ltd.
Eskdale Rd.
Winnersh
WOKINGHAM
Berkshire RG11 5DZ
Tel: (44) 734-697201

U.S.A.

Computer Supplies Operations
1320 Kifer Road
SUNNYVALE, CA 94086
Tel: (1) 800-538 8787
(1) 406-738 8858

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