64000

HP64000 Logic Development System

Model 64941A Flexible Disc Drive Reference Manual

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Flexible Disc Drive Reference Manual

LOGIC SYSTEMS DIVISION
COLORADO SPRINGS, COLORADO, U.S.A.

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Chapter 1
Flexible Disc Media

Introduction

This manual discusses the two flexible disc drives. In this first chapter, handling precautions for the flexible disc media are defined. Chapter 2 discusses disc drive operation and Chapter 3 discusses flexible disc commands. Chapter 4 explains the disc routines. Chapter 5 has an explanation of the system generator. Chapter 6 concludes the manual with a discussion of logical interchange format.

The Model 64000 uses a flexible disc, commonly called a minifloppy. The flexible disc is 133.4 mm (5-1/4 in.) in diameter with a 27.5 mm (1-1/8 in.) diameter hole for alignment on the disc drive spindle. The disc is enclosed in a protective plastic jacket with a slot for head access to the recording surface.

The flexible disc is a double-sided double-density type. Storage capacity of the unformatted disc is 420 kilobytes. After formatting, storage capacity is 280 kilobytes. Each disc must be formatted before it can be used. For convenience, format a supply of discs for future use. If a disc must be formatted, you must leave the current program and enter the disc routines. The formatting procedure is explained in Chapter 4, Flexible Disc Routines.

CAUTION

The selection and use of media is the customer's responsibility. For a package of ten HP media, order HP Part Number 92110A. HP reserves the right to exclude from warranty or agreement any repairs for damage to HP products, which HP reasonably determines or believes was caused by use of non-HP media. HP will upon request repair such damage on a time and materials basis.

To avoid potential damage or data loss, operate the system in a clean environment. Dust, smoke, moisture, oil, chemical vapor, or other foreign matter will cause your disc to wear out prematurely and cause unreliable data storage and retrieval.

Disc Handling Precautions

The flexible disc is maintenance free; however, it is delicate and requires CAREFUL HANDLING. Observe the following precautions to protect your valuable data and programs.

Back up Discs Frequently

Because there is always the possibility of losing data when mass storage devices are accessed, back up discs frequently. Data loss can occur in many ways. Examples are: programming bugs, hardware or power failure, or operator error. In addition, flexible disc media can fail from contamination or wear. Frequent backup of disc files is good protection against data loss.

Store Discs in Protective Envelopes

One of the most important handling precautions is to return discs to their storage envelopes for protection from dust and scratches. Discs should also be filed upright in a dust free container when not being used.

Clean Operating Environment

Airborne contaminants or particles dropped on a disc cause premature wear and can interfere with data storage and retrieval. Common contaminants are dust, smoke, ashes, and eraser crumbs. Chemical vapors can also cause premature wear.

Proper Temperature and Humidity

The discs require the temperature be between +10° C (50° F) and +44° C (111° F) with 20% to 80% relative humidity. Discs will operate outside the normal humidity range; however, they will have a shortened life and a higher error rate.

Magnetic Fields

Avoid magnetic fields. Data is stored as a pattern of magnetic fields on a disc, which can be erased by an external magnetic field. Keep discs away from power transformers, magnets, or large disc memories. In addition, avoid placing discs on top of CRTs with magnetic deflection systems.

Labeling Discs

Use a soft, felt-tip pen to label a disc rather than a ball-point pen, which might damage the disc surface. Write only in the label area or write on labels before applying them to the disc.

Replace Discs Frequently

Discs are designed for several million revolutions of useful life. However, disc life depends heavily on how it is handled as well as how often it is used. For insurance, copy data to a new disc and discard the old disc every three months for heavily used discs (more than two hours a day). For lightly used discs, back them up at least once a year. If discs show wear, they should be backed up immediately.

Don't Touch the Disc Surface

Avoid touching the disc surface through the slot in the plastic jacket. The thickness of a fingerprint can lift the head off the disc and cause errors. Also, the oil in a fingerprint can collect dust, which will cause premature wear.

Don't Bend or Fold a Disc

Discs are flexible, but a crease will prevent proper operation. To avoid creases, ball-point pens, rubber bands, and paper clips should not be used.

Don't Try to Clean a Disc

The disc is cleaned automatically by the inside surface of the disc jacket. Any attempt to clean a disc can damage it, causing a loss of data. If a disc becomes dirty or scratched, back it up and dispose of the old disc.

Disc Structure

The flexible disc is a circular piece of plastic sealed in a plastic jacket. Bonded into the surface of the disc is a ferromagnetic iron oxide with characteristics similar to magnetic tape. Information is stored on the tracks of the disc in binary format as magnetized spots. A modified frequency modulation (MFM) technique is used to increase bit density. The information is stored and retrieved by read/write heads that contact the upper and lower surfaces of the disc.

Data is stored in concentric tracks on each side of the disc. Each disc has 35 tracks per side, numbered 0 through 34. One track on each side is not used, leaving 34 tracks for storage. The outermost track is track 0. Every track is subdivided into 16 sectors using the HP format. Each sector contains 256 bytes of information, which is the smallest amount of information that can be written at one time. The disc is soft sectored; one index hole is punched in the disc to indicate the start of the first sector. This hole is detected by an optical sensor in the disc drive. There is no hardware indication of where the remaining sectors start; this is indicated by information recorded on the disc.

Chapter 2
Operating the Disc Drive

Inserting and Removing a Disc

The disc only rotates during access; so, it can be left in the drive without concern for unnecessary wear. The indicator light on each drive only lights during data access. Follow these steps to insert a disc. Directions for horizontally mounted drives are in parentheses.

a. Open the door of the drive by pushing right (up) on the door lip.

b. Remove the disc from its protective envelope and carefully slide it into the drive, label side to the right (top) and notch up (to left), until a soft click is heard.

c. Close the door by pushing left (down) on the door lip until the door locks. A disc can be inserted while power is on without harming the disc.

To remove a disc, push to the right (up) on the door lip and pull the disc out. Always store the disc in its protective envelope to prolong disc life.

Write Protection

Data and programs that are stored on a flexible disc can be protected from being inadvertently written over. This write protection is obtained by covering a notch in the sealed protective jacket as shown in figure 2-1. To cover the notch any opaque tape can be used. Be certain not to touch the disc surface. As mentioned earlier, fingerprints can cause errors by lifting the head off the disc and collect dust causing premature wear. To write on the disc, the notch must be uncovered. HP discs are supplied with the notch uncovered, so that the disc can be written on.

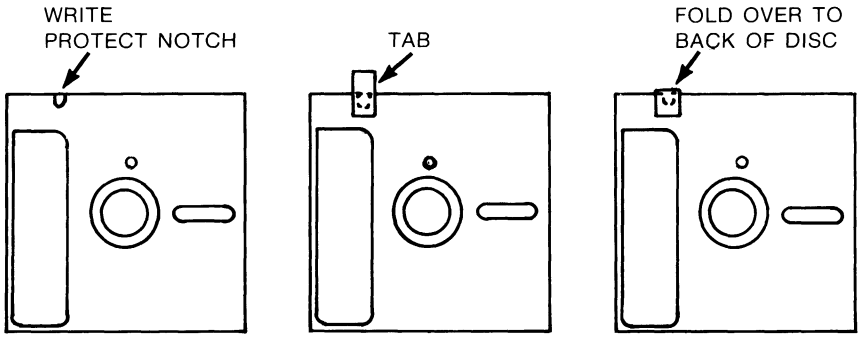


Figure 2-1. Disc Write Protection

Chapter 3
Flexible Disc Commands

NOTE

Except for the floppy command, these commands only apply to the Model 64000 used with a bus disc. They do not apply to a stand-alone station.

Introduction

There are six disc commands: store, restore, verify, delete, floppy, and directory. To access the commands, press the monitor soft key -backup-- . None of the commands reference a flexible disc drive by number. If a valid disc is present in one of the drives, the operation will use this disc. If both drives have a valid disc, the operation will use both discs, as required, starting with drive 0. If disc 0 is write protected, delete will terminate immediately. If both discs are present, and only disc 1 is write protected, the file(s) on disc 0 will be deleted and then delete will terminate.

The commands are explained on the following pages in alphabetical order. Refer to the System Software Reference Manual for more details on the parameters in the commands.

SYNTAX

delete <FILE> **[**:<file type>**]**

Default Values

<file type> Defaults to all types.

Examples:

delete SAM Deletes all types of files named SAM with current userid.

delete FILEA:source Deletes source file FILEA, current userid.

FUNCTION

Remove designated files from flexible discs.

DESCRIPTION

If only the file name is specified, all types with current userid are removed. If a file type is specified, only that file name and type with current userid is removed.

STATUS MESSAGE

Deletion complete, files deleted = N of M

where:

N is the number of files actually deleted; M is the number of files on flexible disc.

SYNTAX

directory floppy_files **[**listfile <list destination>**]**

Default Values

<list destination>	Defaults to user specified listfile default option.

Example:

directory floppy_files listfile printer

Lists all flexible disc files to the printer.

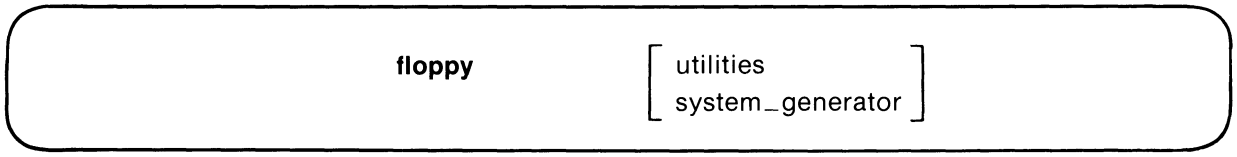
FUNCTION

Lists all flexible disc files.

DESCRIPTION

The directory command provides a means of listing the files that are on flexible disc. The destination of the file listing can be another file, the station CRT display, the printer, or null. If no listfile is specified, the user specified listfile default option is used.

SYNTAX



FUNCTION

Floppy allows entry into the flexible disc routines (see Chapter 4) or the system generator (see Chapter 5).

DESCRIPTION

The soft key **utilities** accesses the five utility routines: format, read test, write test, duplicate, and compare. The soft key **sys_gen** accesses the system generator. The system generator allows the operator to show, copy, or remove system modules on the bus disc(s) or flexible disc(s).

SYNTAX

restore [<file group>**[**:<file type>**][**<date qualifier>**]** *from_dc600
[<DC600#>**][**into_disc <DISC#>**]**]

[listfile <list destination>**]**

*Appears only on systems with a bus disc that includes an integral streaming tape unit.

Default Values

<DC600#>	Defaults to the first streaming tape backup drive on system bus; logical unit 8 (8 to 15 is allowed).
<DISC#>	Defaults to bus disc logical unit 0 (0 to 7 is allowed).
<file group>	Defaults to files of any name with current userid on all bus discs.
<file type>	Default is to all types.
<date qualifier>	If no date qualifier is specified, dates are ignored and do not affect files stored to flexible disc.
<list destination>	Defaults to user specified listfile default.

Examples:

restore Restores from flexible disc, all files with current userid and all types to first available bus disc, starting with logical unit 0. Only one copy of each file is restored.

restore FILEA:source Restores from flexible disc, source file FILEA with current userid to first available bus disc, starting with logical unit 0.

restore FILEB:absolute
Restores from flexible disc, file FILEB, current userid, type absolute to first available bus disc, starting with logical unit 0.

FUNCTION

Restore is used to copy a file(s) on flexible disc to the bus disc. Information must be in HP 64000 Disc Format.

DESCRIPTION

The restore command allows the user to retrieve backup files from flexible disc. Files stored on flexible disc with another system can be restored, providing HP 64000 Disc Format was used in creating the files.

Users with bus discs that include a tape backup can restore from backup if the disc has been stored to backup. This can be done all at once or by FILENAME.

STATUS MESSAGE

Restore complete, files restored = N of M

where:

N is the number of files actually restored to the bus disc; M is the number of files on flexible disc.

ERROR MESSAGES

NOT restored file exists

NOT restored corrupt file

NOT restored corrupt file on floppy disc

NOT restored illegal disc

SYNTAX

store [[<file group>][:<file type>][<date qualifier>]
[*to_dc600 [<DC600#>] [from_disc <DISC#>] [certify]]

[listfile <list destination>]

*Appears only on systems with a bus disc that includes an integral streaming tape unit; if certify is not specified, no certify is performed unless streaming tape has never been certified.

Default Values

<DC600#>	Defaults to the first streaming tape backup drive on system bus; logical unit 8 (8 to 15 allowed).
<DISC#>	Defaults to bus disc logical unit 0.
<file group>	Defaults to files of any name with current userid on all bus discs.
<file type>	If no file type is specified, the types "source", "emul_com", "link_com", and "trace" are assumed.
<date qualifier>	If no date qualifier is specified, dates are ignored and do not affect files stored to flexible disc.
<list destination>	Defaults to user specified listfile default.

Examples:

store	Stores (overwriting previous files) all "source", "emul_com", "link_com" and "trace" type files to flexible disc.

store X:all userids:source

Stores all files named X with any userid of type "source" to flexible disc from all bus discs.

store all_files modified after 15/4/80

Stores all files of type "source", "emul_com", "link_com", and "trace" with current userid modified after 15 April, 1980 to flexible disc from all bus discs.

store all_files:1:DON

Stores all "source", "emul_com", "link_com", and "trace" type files from bus disc #1 with userid DON to flexible disc.

FUNCTION

Store is used to copy a bus disc file(s) to flexible disc.

DESCRIPTION

The information is stored in HP 64000 Disc Format. To facilitate a regular "backup" of files on bus disc, it is possible to store to flexible disc only those files modified (or accessed) since the last backup. The third example above shows a command for storing only those files modified after a given date.

STATUS MESSAGE

Store complete, files stored = N of M

where:

N is the number of files actually stored on flexible disc. M is the number of files on bus disc.

It is important to remember only "source", "emul_com", "link_com", and "trace" type files are stored as the default. Other file types can be regenerated and do not require backup.

ERROR MESSAGES

NOT stored file exists

NOT stored corrupt file

NOT stored corrupt file on floppy disc

NOT stored illegal disc

SYNTAX

verify [<file group>[:<file type>][<date qualifier>]]

[listfile <list destination>]

Default Values

<file group>	Defaults to files of any name with current userid on all bus discs.
<file type>	Default is to all types.
<date qualifier>	If no date qualifier is specified, dates are ignored and do not affect files compared.

Examples:

verify All flexible disc files are compared with files on bus disc with current userid and all types.

verify FILEA:source

Flexible disc source file FILEA, current userid is compared with the first copy of this file found on bus disc.

FUNCTION

Compares a file(s) on flexible disc with the same file(s) on bus disc(s).

DESCRIPTION

The verify command will compare files on flexible disc with the same files on bus disc. The file or files can be qualified by name, userid, bus disc number, type, and date. Source and listing files will verify with differences in the number of trailing blanks in their records. All other files must match exactly.

STATUS MESSAGE

Verify complete, files verified = N of M

where:

N is the number of files actually verified between flexible disc and bus disc; M is the number of files on flexible disc.

ERROR MESSAGES

NOT verified file not found

NOT verified corrupt file

NOT verified corrupt file on floppy disc

NOT verified illegal disc

NOT verified files not identical

Chapter 4
Flexible Disc Routines

Introduction

There are five utility routines available for the flexible disc drives: format, read test, write test, duplicate, and compare. The Model 64000 uses soft-sectored flexible disc media. Each disc must be formatted with the format routine before it can be used for storage. In soft sectoring, there is one index hole on the disc and software divides the disc into sectors. The read test reads random areas on the disc and reports errors. It does not destroy the information on the disc. The write test writes to random areas on the disc and then checks what was written by reading these areas. The duplicate routine duplicates an entire disc to another disc (any information on this disc would be overwritten). Both discs must have no unreadable or unwritable tracks. The compare routine compares the information on one disc to the information on another disc. In the following paragraphs, each of the utilities is explained with illustrations and accompanying text.

CAUTION

Format or write test will destroy any information on a disc. Use a scratch disc for the write test. After a write test, reformat the disc. Discs that are partially copied or partially formatted must be reformatted before being used.

Accessing the Routines

If the Model 64000 is used with a bus disc, the routines are accessed by pressing the monitor soft keys -backup-- and then floppy. If the Model 64000 is a stand-alone station, just press the floppy soft key. At this point, utilities and sys_gen soft keys will be displayed. Press the utilities soft key and the command line will display:

floppy utilities

After pressing RETURN figure 4-1 shows the resulting display. The soft key template at the bottom offers a choice of format, read_test, wrt_test, duplicate, or compare. Pressing end and RETURN returns the Model 64000 to the monitor mode.

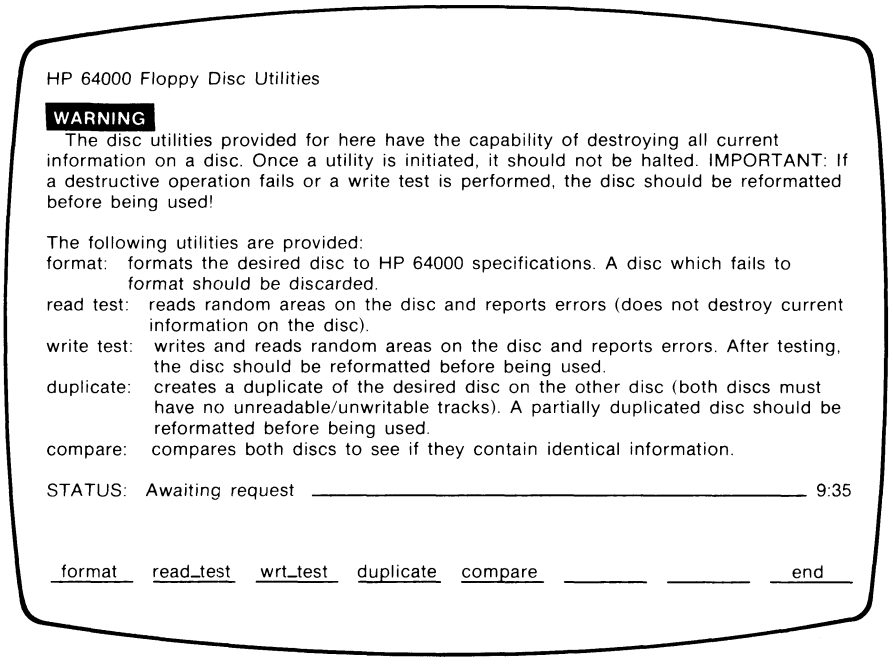


Figure 4-1. Soft Key Template for Utility Routines

Format Routine

Figure 4-2 shows the display after the format soft key is pressed. Note in the command line the disc number to be formatted must be entered (0 or 1). The soft key <DISC> replaces the STATUS line with:

ENTER: Disc number (0 or 1) NO DEFAULT

NOTE

Remember, the format routine will destroy any information on the disc.

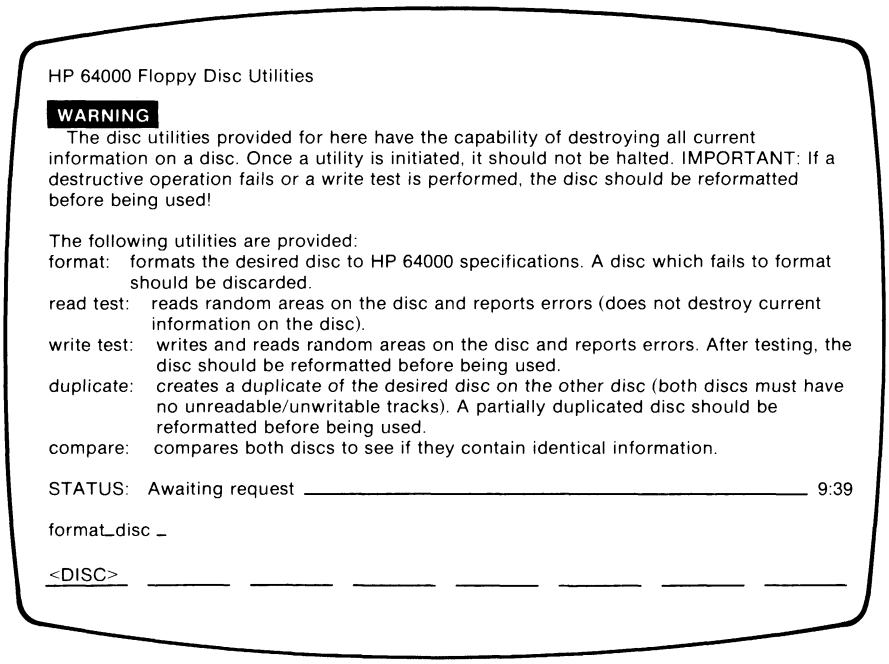


Figure 4-2. Selecting Disc to be Formatted

After entering 1 to format disc 1, the soft key template changes to [mult_pass] (multiple pass). You have a choice at this point. If you press [RETURN], the disc will be formatted in the normal manner; a data pattern is written to each track and then read back. A display similar to figure 4-3 results. After all tracks and both sides are formatted, the pages are formatted and a STATUS line similar to the following is displayed.

STATUS: creating free list on disc 1, page 83 (# prev. pages = 12)

If both the [mult_pass] and [RETURN] keys are pressed, data patterns are written to each track and read back four times (four passes). The formatting process will take four times as long, but you can have a higher degree of confidence in the disc. The only difference in the display between the two methods, is the addition of "(pass = pass no.)" in the STATUS line with multiple pass.

If there is a problem with the disc, the status line will read:

ERROR: Disc 1 bad: format failed

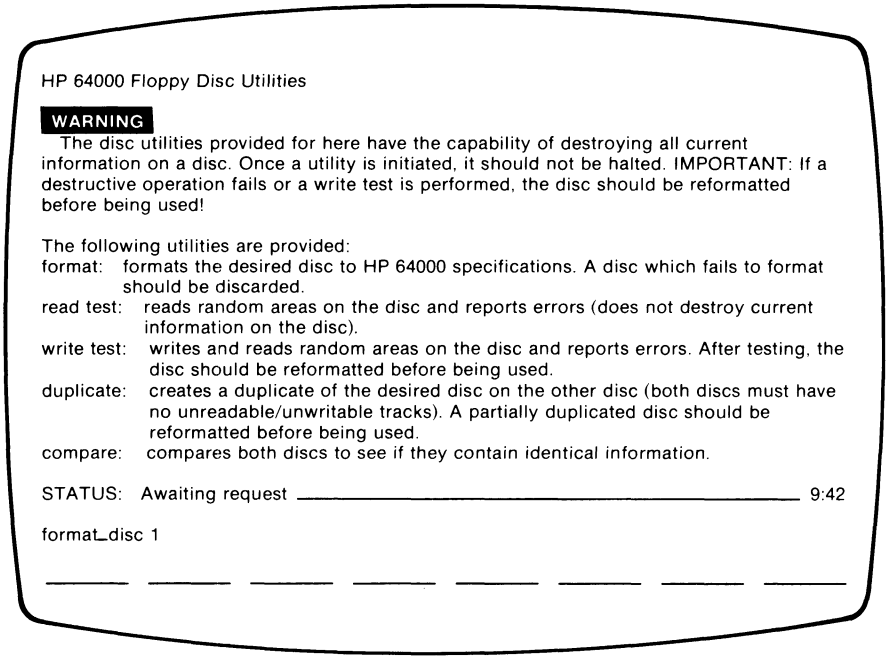


Figure 4-3. Formatting Tracks

The display in figure 4-4 signifies the disc has been formatted.

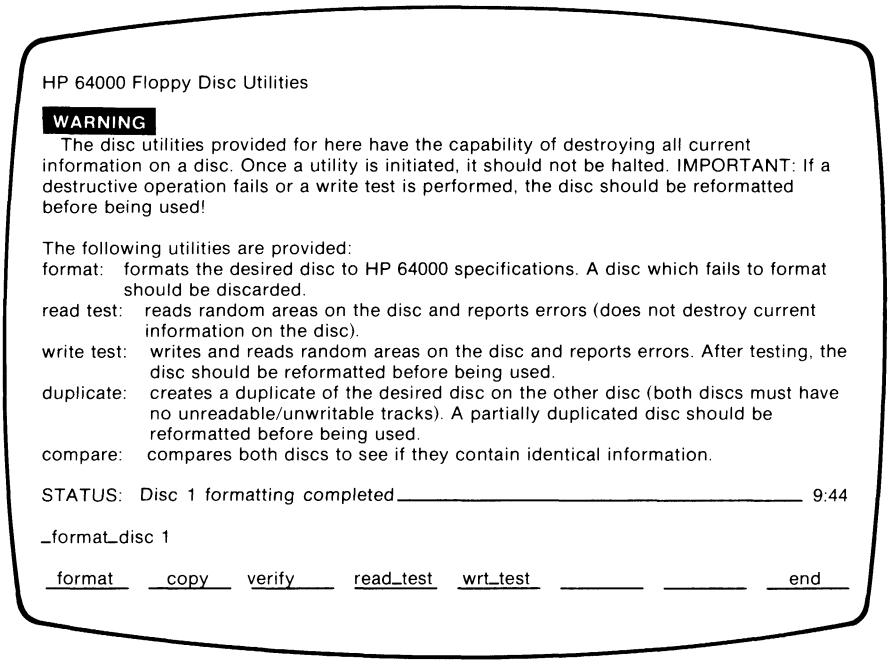


Figure 4-4. Disc Formatting Complete

Read Test and Write Test Routines

Because the displays are similar, only examples of the write test will be given. In figure 4-5, the **wrt_test** soft key has been pressed. At this point, the disc number for the write test must be entered in the command line. The **<DISC>** prompt will ask for disc 0 or 1. Remember, the write test will destroy any information on the disc. Also, reformat the disc after a write test.

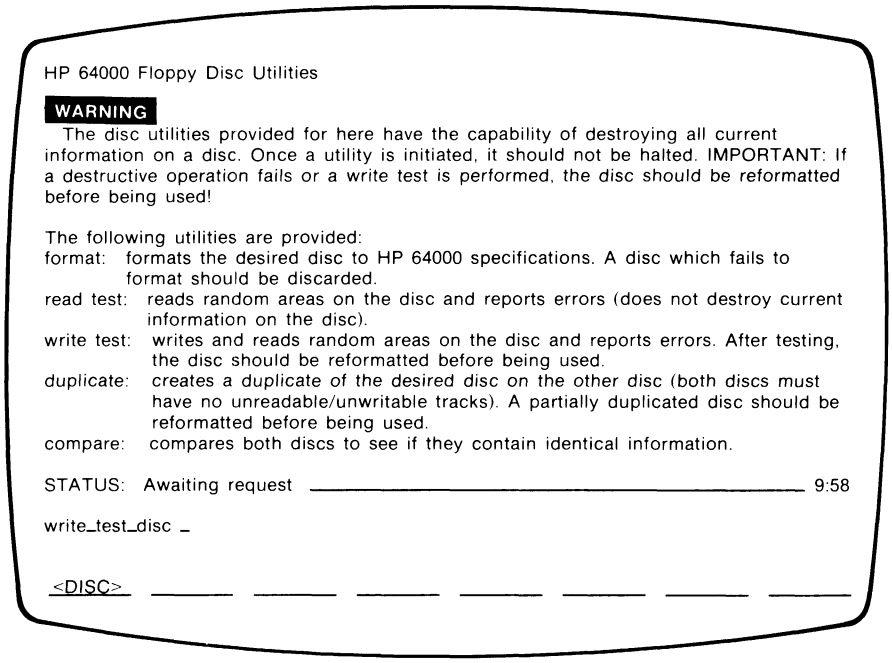


Figure 4-5. Selecting Disc for Write Test

In the example in figure 4-6, disc 1 has been selected for the write test. The soft key template now offers a choice of a time limit test or test indefinitely. In this example, a time limit test will be selected.

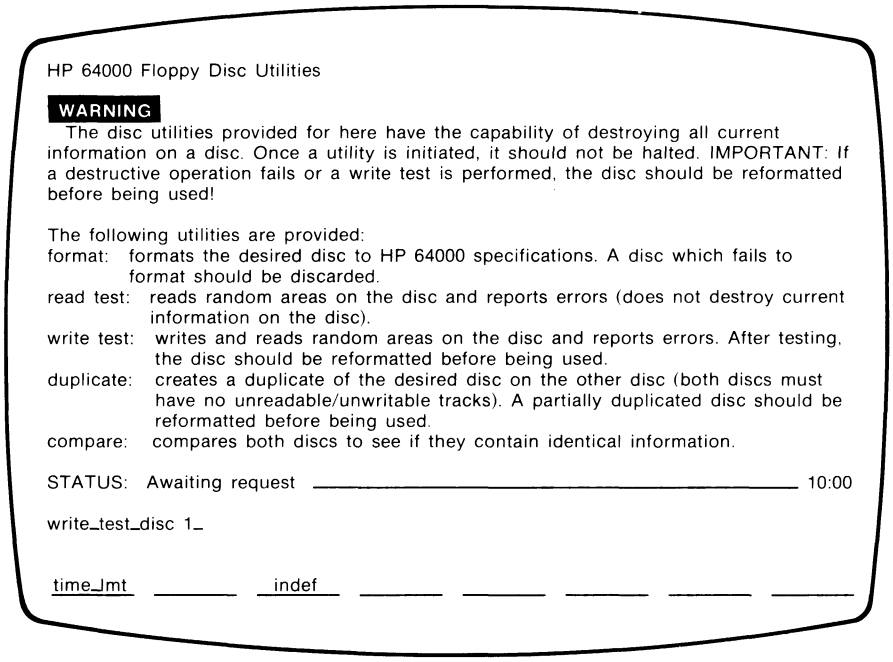


Figure 4-6. Time Limit Test or Test Indefinitely

In figure 4-7, the time_lmt soft key has been pressed. Now the number of minutes for the test must be entered in the command line. The <MINUTES> prompt will replace the STATUS line with:

ENTER: Minutes of testing NO DEFAULT

The time limit for the test can be 0 to 32767 minutes.

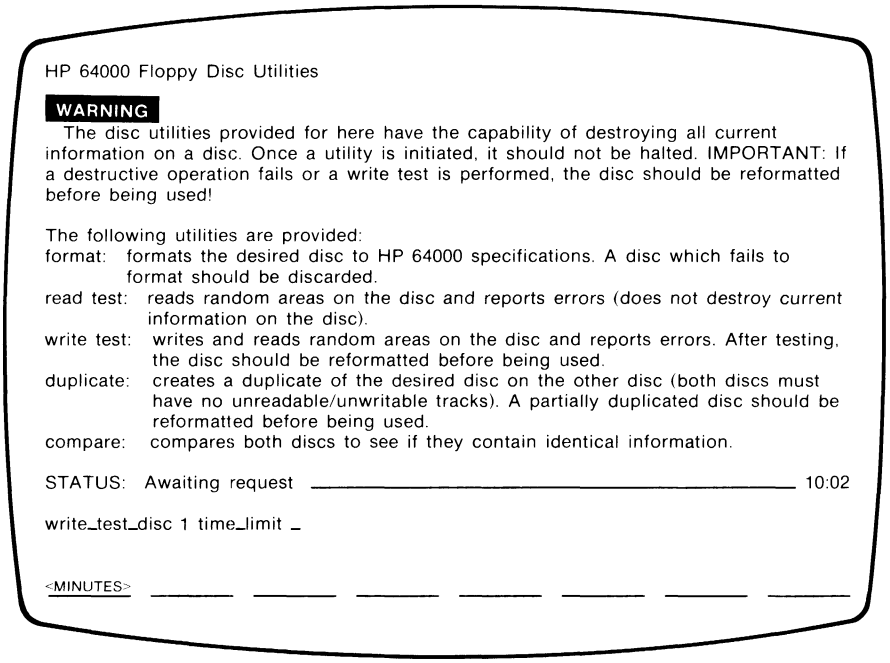


Figure 4-7. Selecting Write Test Time Limit

In this example, 2 (minutes) was entered and RETURN pressed. A display during the test is shown in figure 4-8. At the completion of the test, the STATUS line will show:

STATUS: disc 1 test completed

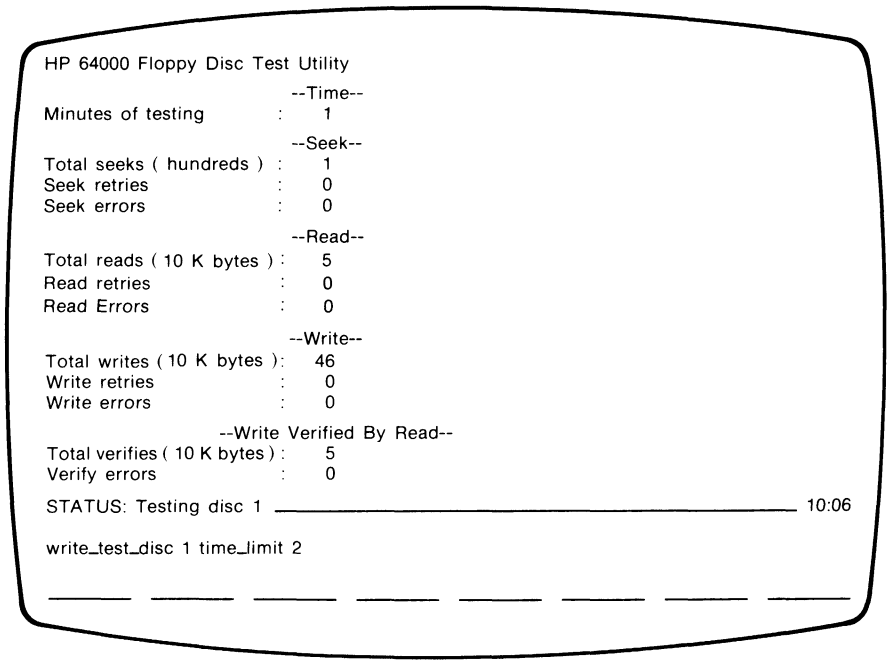


Figure 4-8. Two Minute Write Test of Disc 0

In figure 4-8, the term "retries" signifies a soft error. The software tried to seek, read, or write and failed, but recovered. Seek, read, and write errors are hard errors where the software failed to recover. Total verifies are the total number of 10k bytes written to the disc successfully, read successfully, and what was written and read is the same (verifies). In a verify error, the software writes and reads successfully, but they do not match.

Duplicate Routine

Figure 4-9 shows the display after the **duplicate** soft key is pressed. Note in the command line the disc number to be duplicated must be entered (0 or 1). The **<DISC>** prompt will ask for disc number 0 or 1.

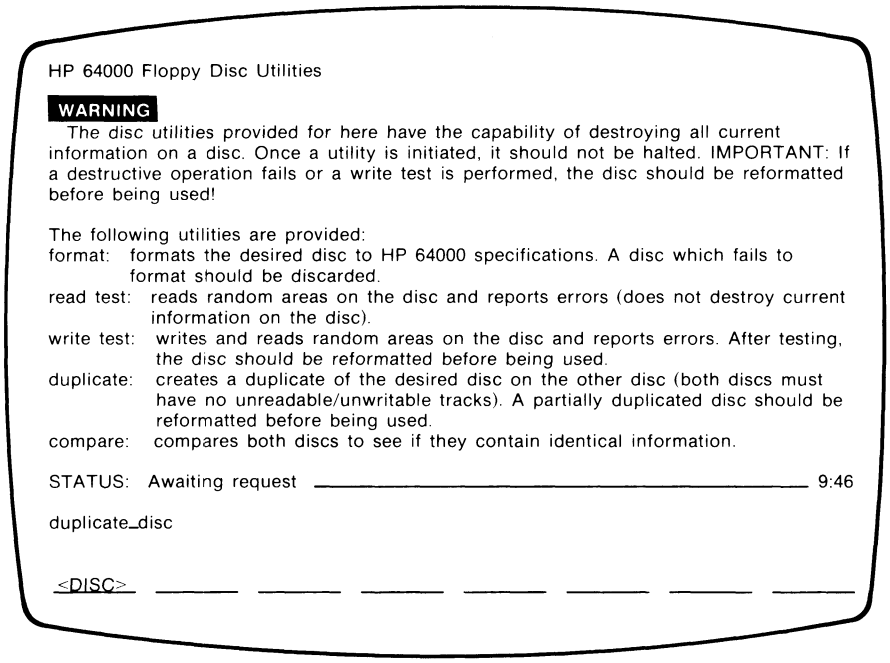


Figure 4-9. Selecting Disc to be Duplicated

In this example, disc 0 is to be duplicated. After entering 0 and pressing 

the duplication process begins. Figure 4-10 shows a sample display.

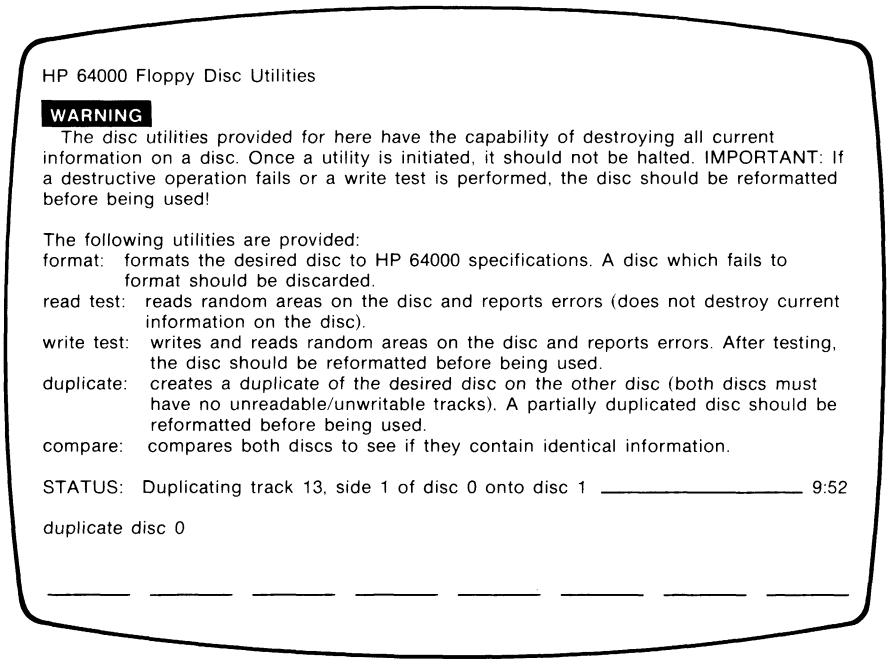


Figure 4-10. Duplicating Disc 0 onto Disc 1

After the disc has been duplicated, a display similar to figure 4-11 signifies the process is complete. At this point, the soft key template with all the routines returns.

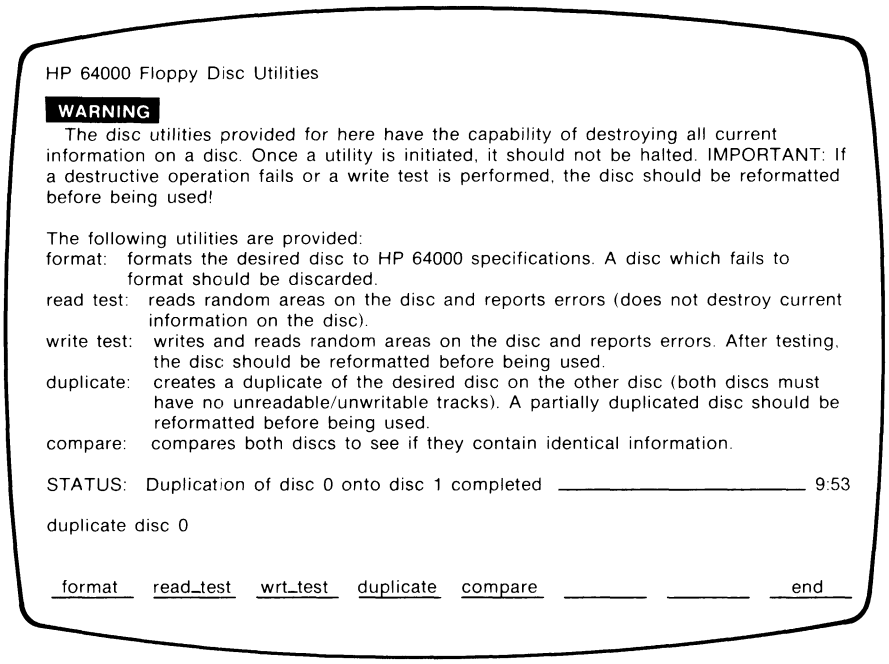


Figure 4-11. Duplication Process Complete

Compare Routine

NOTE

Unless the disc to be compared was duplicated with the duplicate routine, it may not compare. This could be caused by a difference in date qualifier or physical location of the file(s) on the disc.

When the **compare** soft key is pressed, the command line changes to:

compare_discs_

After pressing RETURN, a display similar to figure 4-12 results if the discs are identical.

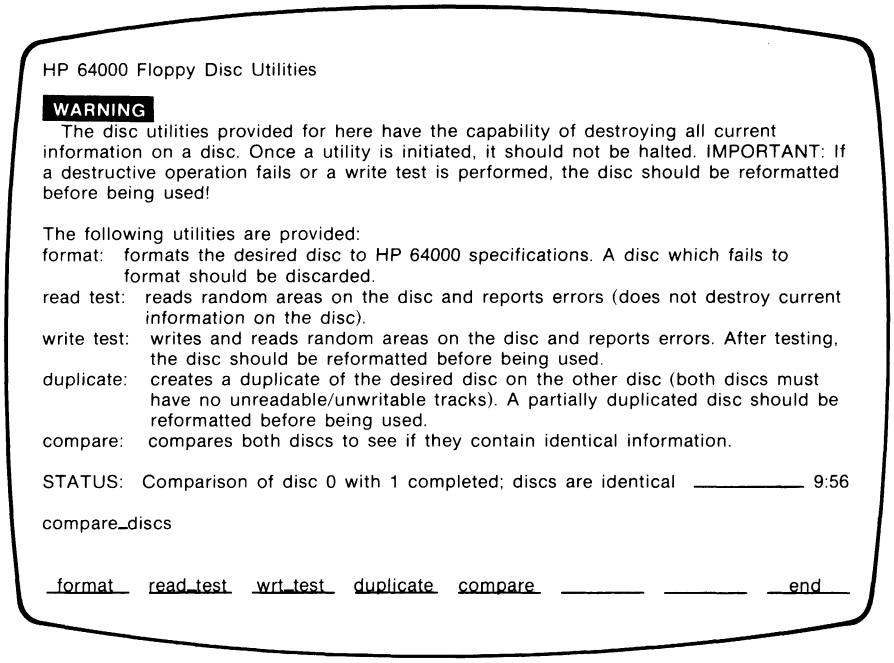


Figure 4-12. Disc 0 Compares with Disc 1

If the discs are not the same, the STATUS line displays:

ERROR: Comparison of disc 0 with 1 failed: discs are NOT identical.

Chapter 5

System Generator

NOTE

Using the system generator locks the database. In a cluster environment, other stations are refused access while this utility is being used. A message to this effect will be displayed if another station attempts to access the system software database. The message will display the HP-IB address of the station currently accessing the database.

In the event of power failure while using the system generator, the database might remain locked. To release the database it must be accessed from the original station (HP-IB address will be displayed on all stations in the cluster). Using the show command (described in this chapter) will release the database.

If an attempt is made to write to a write protected disc, the following inverse video message will appear near the top of the display:

DISC IS WRITE PROTECTED

Introduction

The Model 64000 system software is composed of various modules. Each module is a collection of different interrelated system files that are necessary in a product; for example, the editor or an emulator. When a disc configuration must be changed or one or more modules must be replaced with new versions, use the system generator to change the software.

The system generator allows any of the system modules on the bus disc system or local disc system to be copied from bus disc to bus disc, local disc to local disc, bus disc to local disc, or local disc to bus disc. System modules can also be removed or just displayed (show). If the Model 64000 is used with a bus disc, access the system generator by pressing the monitor soft key **-backup--** followed by the **floppy** soft key. If the Model 64000 is a stand-alone station, just press the **floppy** soft key. At this point, **utilities** and **sys_gen** soft keys will be displayed. Press the **sys_gen** soft key and the command line will display:

floppy system_generator

After pressing RETURN, figure 5-1 shows the resulting display. The soft key template at the bottom offers a choice of **show**, **copy**, **remove**, or **help**. Pressing **end** and RETURN returns the Model 64000 to the monitor mode.

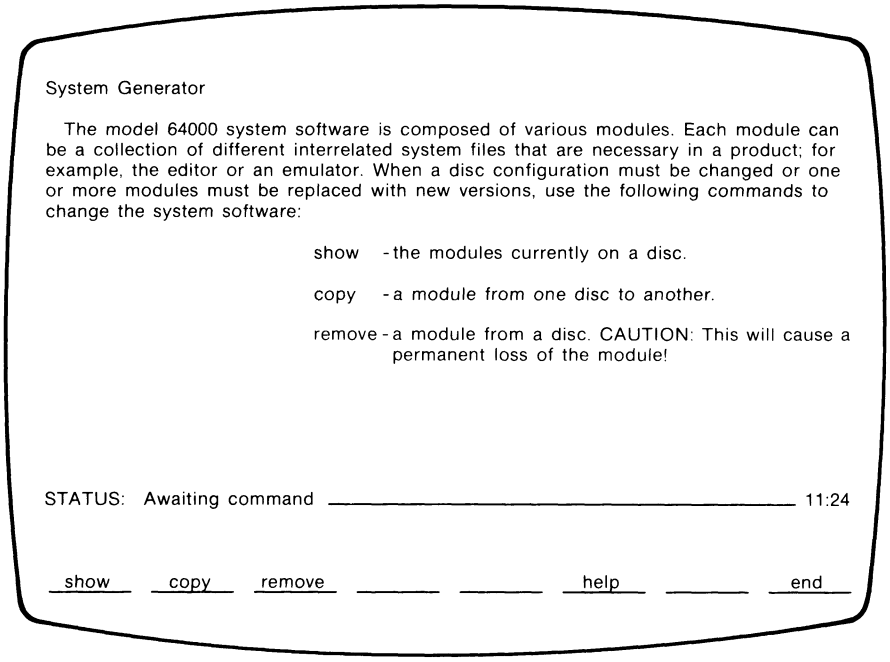


Figure 5-1. Soft Key Template for System Generator

Show Modules

The **show** soft key will display all the system modules that reside on either local discs or bus discs. Figure 5-2 shows the display after the **show** soft key is pressed. The soft key template is requesting the location of the modules: local disc or bus disc.

NOTE

Only the "local" soft key will appear on a stand-alone station.

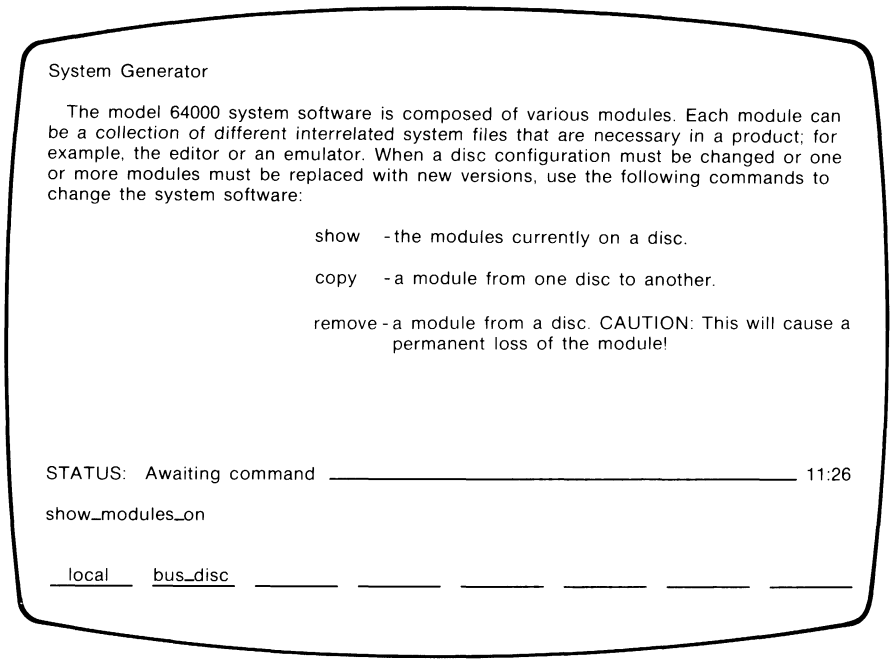


Figure 5-2. Show Modules (pressed show)

In this example, "local" is selected and the command line reads:

show_modules_on local_disc

The prompt <DISC#> requests the local disc number. Disc number "0" is entered. At this point the soft key template displays and . A second disc number can be entered by pressing and then local or bus_disc and the disc number. Or, ignore the soft key and and press RETURN. The module numbers and names with their creation date and number of pages stored (size) will be listed; first disc on the left of the screen and second disc (if any) on the right. The list of modules on local disc 0 is shown in figure 5-3.

After the modules are listed, the total pages left on the disc will be shown with the number of bytes stored per page. The number of bytes stored per page will vary with the device used for storage. For example, bus disc page size is 4K bytes and flexible disc page size is 2K bytes.

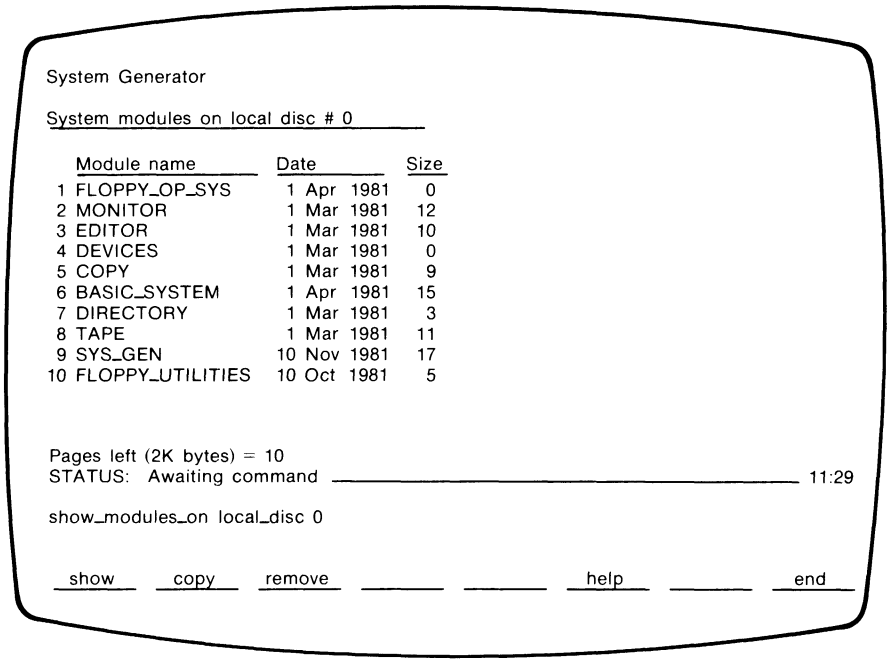


Figure 5-3. Modules on Local Disc 0

Copying Modules

With the copy soft key, one or all of the system modules can be copied from disc to disc. Figure 5-4 shows the display after the copy soft key is pressed. In the command line there is a choice of module name, module number, or all modules on a disc to be copied. The soft key <MODULE> replaces the STATUS line with:

ENTER: module name.

The soft key <NUMBER> replaces the STATUS line with:

ENTER: module number.

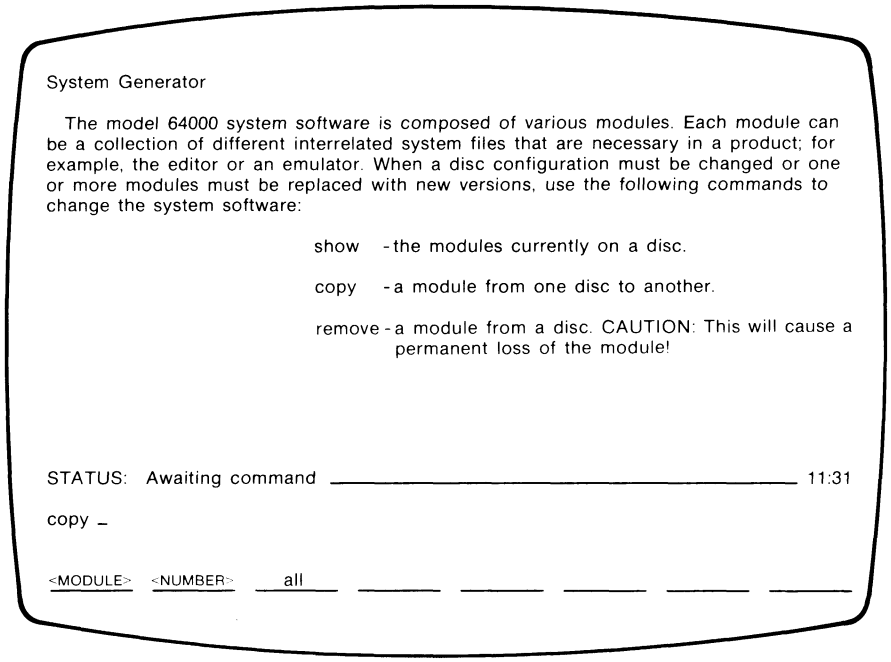


Figure 5-4. Copying Modules

If you are uncertain of module names and numbers, you can list all modules residing on a disc using the show soft key explained earlier.

When the soft key all is pressed, the display in figure 5-5 results.

The soft key template now shows [from] . The request is for the location of the module or modules. Pressing [from] changes the soft key template to:

[local] [bus_disc]

NOTE

Only the "local" soft key will appear on a stand-alone station.

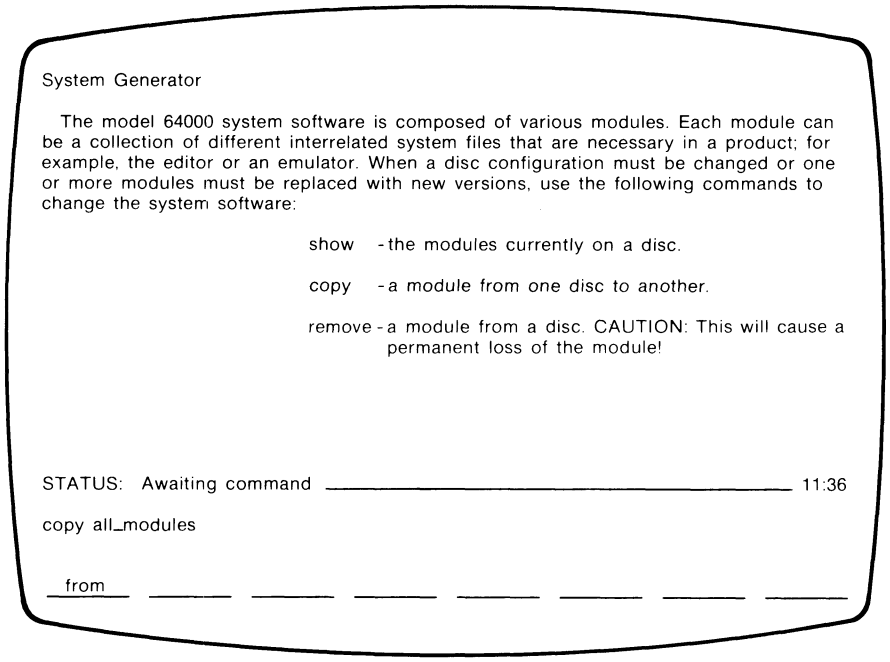


Figure 5-5. Copying All Modules

In this example, the modules of interest reside on a local disc. After pressing [local] the command line reads:

copy all_modules from local_disc_

and the soft key template changes to:

[<DISC#>] (prompts for the disc number)

In this example, the local disc is 0. After entering 0, a soft key prompt [to] requests the destination of the copied module or modules. This can be a local or bus disc. Pressing [to] changes the soft key template to:

[local] [bus_disc]

In this example, the modules are to be stored on local disc 1. After pressing [local] the [<DISC#>] prompt appears. After entering 1, the soft key template is blank and the command line reads:

copy all_modules from local_disc 0 to local_disc 1

After pressing [RETURN] the STATUS line displays in rapid succession:

STATUS: Locking database

Then,

STATUS: Removing module NAME

Next,

STATUS: Updating database

Since in this example all modules are being copied, the STATUS line shows the first module on disc 0:

STATUS: Copying module NAME OF FIRST MODULE

After this first module is copied, the STATUS line changes to:

STATUS: Updating database

The display now shows all the module names and numbers on the source disc at the left of the display and lists any modules already on the destination disc at the right. The first module copied is listed at the top of the right display or under any modules already on the destination disc (see figure 5-6). The process is repeated until all the modules are copied.

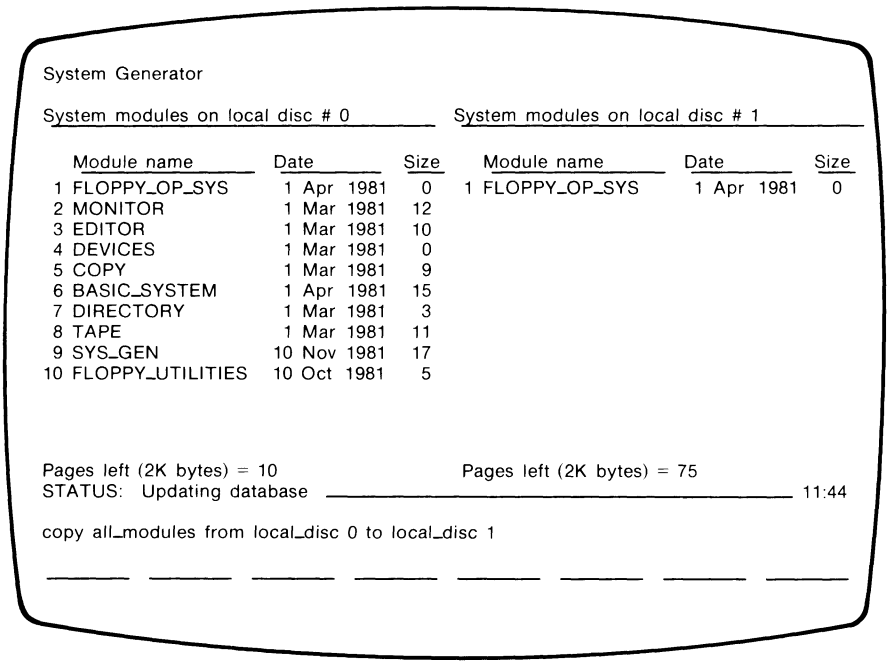


Figure 5-6. Copying All Modules (In Process)

If only one module is to be copied, the STATUS line messages are similar and the display lists this module at the end of the list on the right of the display.

Removing Modules

With the remove soft key, one or all of either the modules on the bus disc or local disc can be removed. Figure 5-7 shows the display after the remove soft key is pressed.

NOTE

Modules removed are permanently lost.

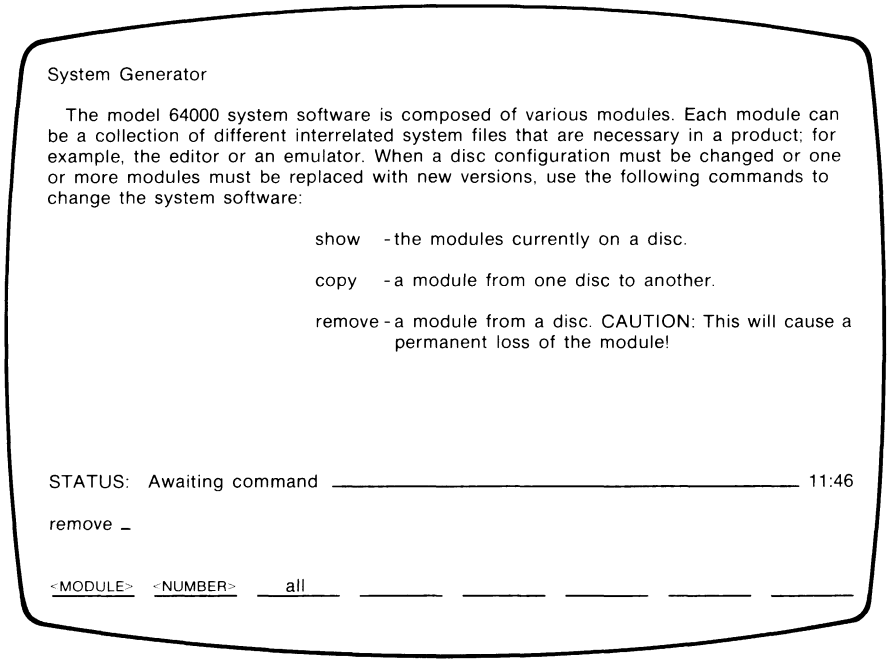


Figure 5-7. Removing Modules

In the command line there is a choice of module name, module number, or all modules on a disc to be removed. The soft key <MODULE> replaces the STATUS line with:

ENTER: module name.

The soft key <NUMBER> replaces the STATUS line with:

ENTER: module number.

As an example, local disc system module 3 will be removed from local disc 1. Number "3" is entered and the soft key template changes to:

from

The soft key prompt from requests the location of the module or modules. Pressing from changes the soft key template to:

local bus_disc

NOTE

Only the "local" soft key will appear on a stand-alone station.

Again, local is selected and the prompt <DISC#> requests the local disc number. In this example 1 is entered. After pressing RETURN, the STATUS line changes as follows:

STATUS: Locking database.

STATUS: Removing module NAME

STATUS: Updating database

STATUS: Unlocking database

STATUS: Remove complete

Then, the display lists the remaining system modules and returns the initial soft key template (see figure 5-8).

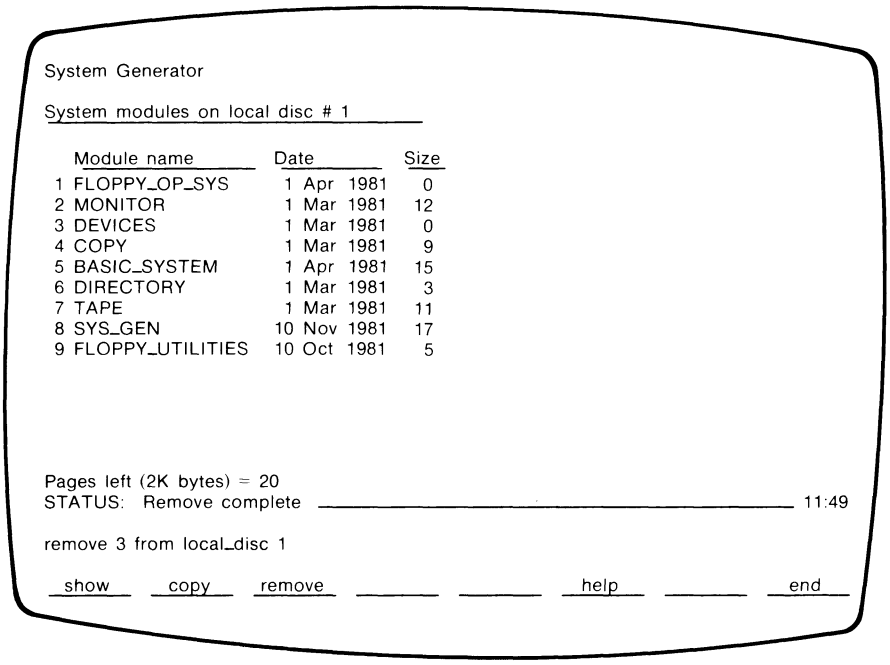


Figure 5-8. Removing Module 3 from Local Disc 1

Help Soft Key

The help soft key displays a summary of how the system generator can be used. A short description of each soft key is also included.

Chapter 6

Logical Interchange Format

What is LIF?

LIF stands for Logical Interchange Format. It is a method for organizing information on flexible discs and other removeable media. Hewlett-Packard has adopted LIF as a corporate standard for interchanging files via removeable media. LIF provides a means to transfer files among various HP products with a minimum of customer interaction.

LIF Volumes

A LIF volume is a disc that has been formatted to LIF specifications. A LIF volume has a volume label at a known location. The volume label contains information about the disc including the location and length of the directory. The volume label is created when medium is initialized or "formatted" using the "format_disc" command described later in this chapter.

Another piece of information in the volume label is the volume name. All LIF discs formatted on the Model 64000 have the volume name "HP64K".

LIF Directory

The directory on a LIF volume allows the files on the disc to be easily located. The length of the directory is variable. Volumes created on the Model 64000 have a directory that can contain a maximum of 112 files.

Each directory entry includes the following items: file name, type, location and length of the file, and the file creation date.

LIF File Names

LIF file names consist of 1 to 10 characters. The characters must be the uppercase alphabetic characters A through Z, the digits 0 through 9, or the underscore character. The first character must be an uppercase alphabetic character.

A file name must be unique on a LIF volume. There are no userids as with 64000 discs.

LIF File Types

Each file on a LIF volume has a file type. The types are explained below.

ASCII - A LIF ASCII file is an interchangeable file that contains operator-readable data. For example, source and listing files from the Model 64000 are put into ASCII files on LIF volumes.

BINARY - A LIF BINARY file is an interchangeable file that contains data that is not readable by the operator. For example, relocatable and absolute files from the Model 64000 are put into BINARY files on LIF volumes.

Reserved types -
Other file types appear in the directory as a signed integer. For example, a file might have a type -2001. These files are not interchangeable. The Model 64000 is unable to read data from or write data into these files because the structure of information in the file is unknown. These files can be used only on the system that created them.

Mapping 64000 File Names to LIF File Names

Whenever a file is transferred to a 64000 disc from an LIF disc or transferred to an LIF disc from a 64000 disc, the file name must be modified. This is because of the following differences in 64000 file names and LIF file names.

a. 64000 file names can contain lower-case characters while LIF file names cannot.

b. 64000 file names can be up to 9 characters long while LIF file names can be 10 characters long.

c. 64000 file names include a userid field while LIF file names do not.

d. There are about 12 standard file types on 64000 discs while there are only 2 interchangeable file types on LIF discs.

The 64000 LIF utilities provide two means of handling these differences. When dealing with individual files, the **store**, **restore**, **verify** commands allow both the 64000 file name and type and the LIF file name to be completely specified. The LIF utilities also provide a default file name mapping algorithm that is useful when dealing with groups of files. This mapping scheme is intended to reduce file name duplications and retain 64000 file type information when transferring files from 64000 discs to LIF discs. The default file name mapping scheme is explained in detail in Tables 6-1 and 6-2.

Table 6-1. Default 64000 File Name to LIF File Name Mapping

64000 Name	LIF Name	Comments
Filename	=> FILENAME	For :source and :listing files, the 64000 name is the same as the LIF file name except that any lower-case characters converted are to upper case.
Filename	=> FILENAMET	For file types other than :source or :listing, in addition to converting lower case to upper case, a character T is appended to the LIF file name. The value of T is chosen to reflect the 64000 file type as follows.
:USERID	=> :USERID is dropped	
:DISC	=> :DISC is dropped	
:source	=> ASCII	
:listing	=> ASCII	
:reloc	=> BINARY	
:absolute	=> BINARY	
:emul_com	=> BINARY	
:link_com	=> BINARY	
:trace	=> BINARY	
:prom	=> BINARY	
:data	=> BINARY	
:asmb_db	=> BINARY	
:asmb_sym	=> BINARY	
:link_sym	=> BINARY	
:comp_sym	=> BINARY	
:comp_db	=> BINARY	

64000 file type	T
:reloc	3
:absolute	4
:emul_com	6
:link_com	7
:trace	8
:prom	9
:data	A
:asmb_db	B
:asmb_sym	C
:link_sym	D
:comp_sym	E
:comp_db	F

Table 6-2. Default LIF File Name to 64000 File Name Mapping

LIF Name	64000 Name	Comments
FILENAME10	=> FILENAME1	For LIF ASCII files, the 64000 file name is the same except that the 10th character, if any, is truncated.
NAMET	=> NAME	For LIF BINARY files, if the LIF name is longer than one characters and last character (T) is 3, 4, 6, 7, 8, 9, A, B, C, D, E or F, then the last character of the LIF file name is truncated to form the 64000 file name. Otherwise, the 10th character of the LIF name, if present, is truncated.
	=> current USERID	
	=> first useable 64000 disc	
		The bus disc will be used first, if available. Next, flexible disc 0 if available; followed by flexible disc 1. In a stand-alone system, the hierarchy is disc 0 if available, followed by disc 1.
ASCII	=> :source	
BINARY	=> :data	The file type :data is chosen if the LIF fine name is 1 character long or if the last character of the LIF name is not 3, 4, 6, 7, 8, 9, A, B, C, D, E or F.
		Otherwise the file type is chosen by the last character of the LIF name as follows.
BINARY	=> :reloc	3 is last character of LIF name
BINARY	=> :absolute	4 is last character of LIF name
BINARY	=> :emul_com	6 is last character of LIF name
BINARY	=> :link_com	7 is last character of LIF name
BINARY	=> :trace	8 is last character of LIF name
BINARY	=> :prom	9 is last character of LIF name
BINARY	=> :data	A is last character of LIF name
BINARY	=> :asm_db	B is last character of LIF name
BINARY	=> :asm_sym	C is last character of LIF name
BINARY	=> :link_sym	D is last character of LIF name
BINARY	=> :comp_sym	E is last character of LIF name
BINARY	=> :comp_db	F is last character of LIF name

LIF on the Model 64000

If your 64000 development station is equipped with flexible discs, you will have a means of creating, reading, and writing LIF discs. The command to access the LIF utilities is:

floppy lif_utilities

When this command is issued, the LIF utilities module will be loaded and the display in Figure 6-1 results.

```
|                    LIF (Logical Interchange Format) Utilities                |
|    The Logical Interchange Format is a method of logically formatting floppy |
| discs.  LIF is used by the 64000 system and other HP products to exchange files. |
| On the 64000 system, LIF floppy discs are recognized only by the "lif_utilities" |
| subsystem which includes the functions listed below.                        |
|                                                                             |
|      format_disc       - formats the desired disc to LIF specifications.    |
|      duplicate_disc    - copies the desired disc to the other disc.  Both discs |
|                          must be formatted to LIF specifications.           |
|      compare_discs     - compares two LIF discs to see if they contain identical |
|                          information.                                       |
|      directory         - lists the files on any LIF discs.                  |
|      restore           - transfers a file from a LIF disc to a 64000 disc.  |
|      verify            - compares a LIF file with a 64000 file to see if they |
|                          contain identical information.                     |
|      store             - transfers a file from a 64000 disc to a LIF disc.  |
|      delete            - removes a file from a LIF disc.                    |
|                                                                             |

  The softkey line will be the following

  store    restore    verify    delete   directory     help       end     ---ETC----
--------- --------- ---------- --------- ---------- ---------- --------- ----------

  Pressing the ---ETC---- key displays the following

 format   duplicate  compare                         help       end     ---ETC----
--------- --------- ---------- --------- ---------- ---------- --------- ----------
```

Figure 6-1. LIF Utilities

Pressing the help key causes the display in Figure 6-1 to appear if you need to refer to it. Pressing the end key followed by "return" returns control to the Model 64000 monitor.

The remaining soft keys are explained in the following paragraphs.

Format

SYNTAX

format_disc <DISC #> [multiple_pass]

DESCRIPTION

The "format_disc" command causes the desired disc to be formatted to LIF specifications. All information on the specified disc is lost. A partially formatted disc should be reformatted before being used. A disc that fails the format operation should be discarded.

<DISC #> specifies the disc to be formatted, which must be 0 or 1.

The "multiple_pass" option causes each track to be written and checked four times during formatting. If the "multiple_pass" option is omitted, each track is written and checked once. The "multiple_pass" option increases the chances of detecting and marking a defective track during formatting.

Duplicate

SYNTAX

```
duplicate_disc <DISC #>
```

DESCRIPTION

The "duplicate_disc" command causes the specified flexible disc to be copied to the other flexible disc. Both discs must have been formatted to LIF specifications. A partially duplicated disc should either be formatted or completely copied before being used.

<DISC #> specifies the source disc to be copied and must be 0 or 1.

Compare

SYNTAX

```
compare_discs
```

DESCRIPTION

The "compare_discs" command compares the two flexible discs to see if they contain identical information. Both discs should be formatted to LIF specifications. The following messages are displayed after a successful and unsuccessful comparison, respectively.

STATUS: Comparison of disc 0 with 1 completed; discs are identical

ERROR: Comparison of disc 0 with 1 failed; discs are NOT identical

Store

SYNTAX

```
store [and_verify] [ <FILE NAME> [:<USERID>] [:<DISC #>] [:<FILE TYPE>]
                       [<DATE QUALIFIER>] [into <LIF_NAME> [:<LIF DISC>]]

                     all_files [:<USERID>] [:<DISC #>] [:<FILE TYPE>]
                       [<DATE QUALIFIER>] ]

                          [listfile <LIST DESTINATION>]
```

DESCRIPTION

The (store) soft key is used to copy one or more files from a 64000 disc or discs to a LIF disc or discs. The 64000 disc may be a bus disc or, in the case of a stand-alone system, a flexible disc. The bus disc will be used first, if available; next, flexible disc 0 if available, followed by flexible disc 1. The stand-alone station needs to be configured with the rear panel switches set to Local Mass Storage-Addressable.

The "and_verify" option causes each LIF file that is stored to be compared to the original 64000 source file. If the files are not identical, then the LIF file is automatically deleted and the store operation retried. If the verify operation fails a second time, an error message is written to the listing file and the store operation continues.

Default Values

<FILE NAME> all_files	Defaults to files with any name with the current userid on all 64000 discs.
<USERID>	Defaults to the current userid.
<DISC #>	Defaults to all 64000 discs.
<FILE TYPE>	Defaults to types: "source", "emul_com", "link_com", and "trace".
<DATE QUALIFIER>	If no date qualifier is specified, dates are ignored and do not affect the files stored to the LIF disc.
<LIF NAME>	If no LIF file name is specified, the LIF file name is formed from the 64000 file name (See Table 6-1).
<LIF DISC>	If no LIF disc is specified, the store operation begins with the first LIF disc, 0 followed by 1, that is not write protected. If that disc is full or becomes full during the store operation, the second disc is used if possible.
<LIST DESTINATION>	Defaults to the default listing file specified for the current userid.

Restore

SYNTAX

```
restore   [ <LIF NAME> [:<LIF DISC>] [<DATE QUALIFIER>]
            [into <FILE> [:<FILE TYPE>]]

            all_files      [:<LIF DISC>] [<DATE QUALIFIER>] ]

          [listfile <LIST DESTINATION>]
```

DESCRIPTION

The (restore) soft key copies one or more files from a LIF disc or discs to a 64000 disc or discs. The 64000 discs may be bus discs or, in the case of a stand-alone system, another flexible disc. The bus disc will be used first, if available; next, flexible disc 0 if available, followed by flexible disc 1. The stand-alone station needs to be configured with the rear panel switches set to Local Mass Storage-Addressable.

The restore command can only copy LIF file types ASCII or BINARY. If other file types are encountered, an appropriate message is written to the listing file.

Default Values

<LIF NAME> all_files	Defaults to all LIF files on all LIF discs.
<LIF DISC>	Defaults to all LIF discs.
<DATE QUALIFIER>	If no date qualifier is specified, LIF file dates are ignored and do not affect the files restored from the LIF discs.
<FILE>	If no 64000 file name is specified, the 64000 file name is formed from the LIF file name (See Table 6-2).
<FILE TYPE>	If no 64000 file type is specified, the 64000 file type defaults to "source" for LIF ASCII files and "data" for LIF BINARY files.
<LIST DESTINATION>	Defaults to the default listing file specified for the current userid.

IMPLEMENTATION RESTRICTION

The 64000 file system permits records to have a maximum length of 256 bytes. LIF files may have records up to 32767 bytes long. If, when restoring a LIF file, a LIF record longer than 256 bytes is encountered, then the LIF record is divided into several records and written to the 64000 file.

These divisions occur on 256-byte boundaries. If this should happen, the message "Warning: long LIF records divided" is written to the listing file.

Verify

SYNTAX

```
verify   [ <LIF NAME> [:<LIF DISC>] [<DATE QUALIFIER>]
             [with <FILE> [:<FILE TYPE>]]

           all_files      [:<LIF DISC>] [<DATE QUALIFIER>] ]

         [listfile <LIST DESTINATION>]
```

DESCRIPTION

The verify soft key compares the information in one or more files on a LIF disc or discs with files on a 64000 disc or discs. The results of the comparison are written to the listing file. The 64000 discs may be bus discs or, in the case of a stand-alone system, another flexible disc. The bus disc will be used first, if available; next, flexible disc 0 if available, followed by flexible disc 1. The stand-alone station needs to be configured with the rear panel switches set to Local Mass Storage-Addressable.

The verify soft key can only compare LIF file types ASCII or BINARY. If other file types are encountered, an appropriate message is written to the listing file.

Default Values

<LIF NAME> all_files	Defaults to all LIF files on all LIF discs.
<LIF DISC>	Defaults to all LIF discs.
<DATE QUALIFIER>	If no date qualifier is specified, LIF file dates are ignored and do not affect the files verified on the LIF discs.
<FILE>	If no 64000 file name is specified, the 64000 file name is formed from the LIF file name (See Table 6-2).
<FILE TYPE>	If no 64000 file type is specified, the 64000 file type defaults to "source" for LIF ASCII files and "data" for LIF BINARY files.
<LIST DESTINATION>	Defaults to the default listing file specified for the current userid.

IMPLEMENTATION RESTRICTION

The 64000 file system permits records to have a maximum length of 256 bytes. LIF files may have records up to 32767 bytes long. If, when verifying a LIF file, a LIF record longer than 256 bytes is encountered, then the LIF record is divided into several records and compared to the 64000 file.

These divisions occur on 256-byte boundaries. If this should happen, the message "Warning: long LIF records divided" is written to the listing file.

Delete

SYNTAX

```
delete <LIF FILE> [:<LIF DISC>]
```

DESCRIPTION

The (delete) soft key removes a file from the directory of a LIF disc or discs. Access to the file is permanently lost.

Default Value

<LIF DISC>	Defaults to all LIF discs.

Directory

SYNTAX

directory **[**listfile <LIST DESTINATION>**]**

DESCRIPTION

The **directory** soft key writes information on all LIF files on all LIF discs to the listing file.

Default Value

<LIST DESTINATION>

Defaults to the default listing file specified for the current userid.

Appendix A

LIF Implementation

Definitions

This section is included to help you understand some of the terms used in LIF.

Cylinder: A cylinder number denotes the position of an actuator when more than one detector is positioned by the same actuator mechanism.

Cylinder Mode Addressing: This is used where there are several surfaces on a particular medium. It would normally require three parameters to find a particular piece of data in this case; namely: cylinder number, surface (side) number, and sector number. Cylinder mode addressing sequentializes the medium so that any location can be defined by a single parameter. This mode is defined as follows: the absolute sector following the last sector on cylinder 0, surface 0, is taken to be the first sector on cylinder 0, surface 1, rather than the first sector on cylinder 1, surface 0.

Directory: A file that is found in a known location and contains a list of user files on the medium. The directory also contains the following information about each file: starting location of the file, length of the file, and type of data in the file.

Double Word Integer: A 32-bit signed binary integer. For this application, a double word integer is considered to be packed into two 16-bit words so that the most significant bits are in the first word, and the least significant bits are in the second word.

File: A user defined collection of logically contiguous records written onto the data portion of each sector and containing a set of user defined data.

Integer: A 16-bit signed binary number.

Interchangeability: The ability to read information from a medium on a host computer other than the one that originally wrote the information.

Sector: Used interchangeably with PHYSICAL RECORD. A grouping of contiguously recorded bits. This includes a header made up of a series of bits that recognizes and synchronizes the start of the sector and the body of the sector. The body contains the user information and certain device applications such as checksum and error correcting code (ECC). All references to sector location are in the linear list mode.

Track: The area of the medium that can be read by a single detector (head) without movement of that detector.

Unit of Addressing: This is a blocking factor that establishes valid start addresses. The LIF addressing unit is always 256 bytes.

Volume Label: Also referred to as "Directory Header", this is a file created on initialization of the medium at a known location (usually the first sector) that contains information about the medium. This information includes things such as type of media, and start and length of the directory.

Volume Number: In certain instances, a file may be placed on several different media. This usually happens because the size of the file is greater than the capacity of the medium. In this case, the volume number is an indication of which portion of a file is on this medium. Note: the Model 64000 does not support multivolume files.

Logical Media Layout

Figure A-1 shows the linear layout of all disc and preformatted tape media.

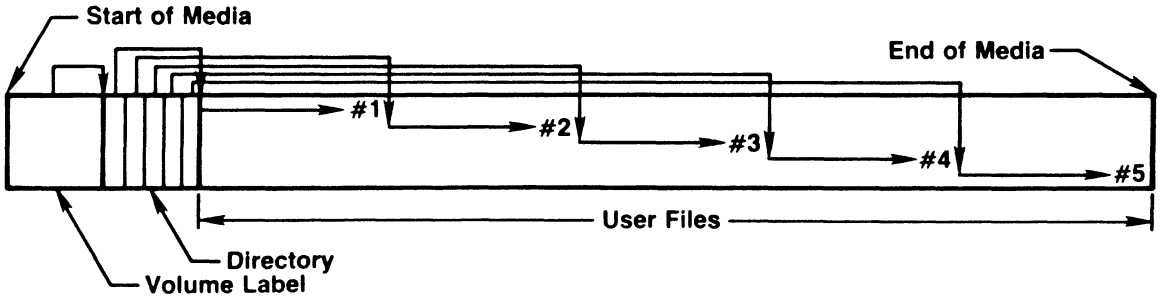


Figure A-1. Linear Layout For Disc and Preformatted Tape Media

Volume Label

The purpose of the volume label is to allow easy identification of the media type and to find file information (directory). The volume label is two sectors long and its format is as follows.

WORD (16 BITS)	CONTENTS
0	100000 OCTAL (LIF ID)
1 2 3	VOLUME LABEL (0-6 ASCII CHARACTERS)
4 5	DIRECTORY START ADDRESS
6	OCTAL 10000 NEEDED FOR SYSTEM 3000
7	DUMMY (SET TO 0)
8 9	LENGTH OF DIRECTORY (FIXED AT INITIALIZATION)
10	VERSION NUMBER (0 FOR MEDIA WITH NO EXTENSIONS)
11	SET TO 0
12-20	LEVEL 1 EXTENSIONS-SEE EXTENSIONS SECTION
21-126	RESERVED FOR EXTENSIONS AND FUTURE USE (SET TO 0)
127	RESERVED BY SYSTEM 250 FOR MEDIA MAINTENANCE WORD
128-255	SET TO 0

Location

The location of the volume label is defined to be the first unit of addressing available on the medium. All words in the second addressing block are to be initialized to 0 for compatibility with the System 3000.

LIF Id

This identifies media written in the logical interchange format specified by this standard.

Volume Label

Characters (0-6 ASCII) are packed with the first character of a pair in the high order byte. Trailing characters are spaces. To provide maximum interchange, characters are limited to upper case letters (A-Z), digits (0-9) and the underscore (_) character. The first character (if any) must be a letter. The purpose of this field is to identify the particular volume in a drive. Default volume label is six spaces.

Directory Start Address

This is a double word integer showing the address for the start of the directory in number of addressing units. The first word contains the high order bits and the second word contains the low order bits. The value of this field is two at the present time.

Word 6

This word is included to eliminate console messages on the System 3000. It must be written as shown.

Length of Directory

This double word integer entry is included to stop the directory from overwriting user storage space. This entry is decided on at disc initialization, thereby fixing directory size at that time. This entry contains the maximum allowable length of the directory in number of addressing units. Note, the length of the directory on discs produced by the Model 64000 is 14 sectors.

Version Number

This field is used to allow for implementation of extensions to the standard. It should be set to 0 for a base level implementation. For a list of capabilities added with each version, see the section on extensions that follows later. Note, the Model 64000 implements level 1 extensions. Discs formatted by the Model 64000 will have this field set to 1.

Words 21-126

These words are reserved for extension fields and for implementation dependent fields. See the later section on extensions for the currently implemented extensions.

Word 127

This word is reserved for the use of System 250 as a maintenance word. Tapes received from other machines must have this word set to 0.

Directory

The purpose of the directory is to allow data to be easily located. All information necessary for reading a file is contained in the directory, which is a linear list of directory entries each organized as follows.

WORD (16 BITS)	CONTENTS
0	
1	
2	FILE NAME (1-10 ASCII CHARS, TRAILING BLANKS)
3	
4	
5	FILE TYPE
6	STARTING ADDRESS
7	
8	LENGTH OF FILE
9	
10	
11	TIME OF CREATION (12 BCD DIGITS)
12	
13	L VOLUME NUMBER
14	IMPLEMENTATION
15	

Location

The directory is located starting on an addressing block boundary defined by the Directory Starting Location Field of the volume label. Directory location is further limited to the logical front of the medium. Therefore, user space cannot span the directory.

File Name

Characters (1-10 ASCII) are packed with the first byte of a pair in the most significant byte of the word. Characters are limited to digits (0-9), upper case letters (A-Z), and the underscore (_) character. The first character must be a letter. All nonpurged files must have at least one character in their file name and implementations must be capable of distinguishing all 10 characters. Padding is with trailing blanks.

File Type

This is a 16-bit signed integer. The presently defined file types follow.

0: Purged file - This standard makes no statement on directory names of purged files. However, the purged file name must be capable of being identical with a valid file. Implementation of this standard must not give duplicate file name errors for purged files.

1: ASCII data file - This is the interchange file type. The associated file consists of 8-bit ASCII characters. See the next section, File Structure, for a complete description.

−1: Logical end of directory - See Directory Organization.

−2: Binary data file - See File Structure, which follows later, for details.

Other negative file types are reserved for system dependent applications. It is not necessary for any implementation to be able to read these file types for conformance. They are merely for flexibility and convenience and to be used by the experienced user.

Starting Address

The starting unit-of-addressing number for a file is a double-word integer. The most significant bits are in word 6 and the least significant bits are in word 7.

Length of File

A double-word integer shows the allocated space for the file (not current length) on this volume. Again, the most significant word comes first. The length is given as the number of 256-byte blocks. Lengths less than 0 are not allowed. The usage of free space is implementation dependent. Therefore, the length and start address fields of a purged file are not guaranteed to be accurate. Free space is computed from the start address and length fields of the two nearest valid files that surround the free space.

Time of Creation

This field is 12 BCD digits of the form YYMMDDHHMMSS. These words will be packed with the first digit in the most significant bits of word 9 and the last digit in the least significant bits of word 11. This field can be used for a version number on systems not using a real-time clock. If the year and month fields are 0, the other fields will be a version number. However, all digits must be valid BCD numbers. Also, if a particular file spans several volumes, the directory entries for each volume of this file must have the same time stamp or version number.

Last Volume Flag

If the last volume flag (L) = 0, it is not the last volume of the file. If the last volume flag (L) = 1, it is the last volume of the file.

Volume Number

This is a 14-bit unsigned integer containing the volume number of this file on this medium. Volume number = 0 is not a valid condition. All files must be contained on at least one volume. Volumes start with number 1 and are incremented by one for each subsequent volume.

Implementation

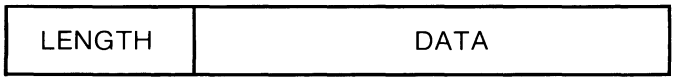
Words 14 and 15 are available for implementation dependent uses by file types −2000 to −77777. These fields must be set to 0 for all interchange file types and for file types −2 to −177.

Directory Organization

The directory is defined to be a linear list of directory entries. It has no fixed length, except as fixed at the time of initialization. A directory entry that has a file type of −1, is defined to be the end of logical directory. A logical end of directory mark is written unless the directory is filled. The physical end of directory is determined by adding the start of directory and length of directory fields. This address is considered an absolute end of directory indicator and thus precludes the need for a logical end of directory marker on full directories. Free space begins at Address # = (Starting Address # of last file entry + last file length). Implementations must also be aware of the absolute end of directory found in the volume label. Methods of packing and reallocating free space are not defined. However, entries must be stored so they are in order of strictly increasing starting addresses. Directory entries are undefined after the logical end of directory. Thus, when a file is appended, the next directory entry must be set to the logical end of the directory.

File Structure

A file is a list of records containing data. Defining the structure for file types 1 and −2 provides a mechanism for transferring files containing virtually any type of data. The file does not attempt to convey the meaning of the data as part of the file. This is best done by external means (naming conventions, attached hard-copy description etc.). A file consists of a linear list of records; explanations follow.



Location

A file location is determined by the value of the starting address field within the directory entry. A file always starts on an addressing block boundary. Further, a logical record will not traverse a volume. Thus, all volumes will start with a complete logical record making it possible to recover partial data.

Length

Length is a 16-bit integer showing the length of the record in bytes, but not including the length field in the count. A length of −1 will denote logical end of file. A file will have an end of file marker unless its length is at the maximum length defined in the directory. Also, the length field of the last record may exceed the physical space remaining; in this case, the file is terminated by physical length of file. If the last volume flag is set for the file, this is the end of file mark; otherwise, it is the end of the volume. A "0" length record is valid. In this case, the length field is followed by the length field for the next record. A record of length less than −1 is not allowed. Finally, if the length is odd, the record is rounded to the next word boundary and the extra byte is ignored.

The Model 64000 file system does not support 0 length records, records containing an odd number of bytes, or records longer than 256 characters. If one of these records is encountered, when reading an LIF file produced on another system, the Model 64000 reacts as follows.

A 0 length record is made into a record containing 2 space characters.

A record containing an odd number of characters is padded with a trailing space character to make an even number of characters.

LIF records longer than 256 bytes are divided into 2 or more records on the Model 64000. The division is made at 256 byte boundaries.

Data

File type 1: The record consists exclusively of 8-bit ASCII codes. All 8 bits are defined (i.e., foreign character sets) and no parity is checked or generated. Codes 0 through 127 have US ASCII meaning. Codes 128 to 255 are open. In addition, no FORTRAN carriage control, escape sequences, etc. are defined. Numeric data are formatted per ANSI standard X3.42, which is available from ANSI. Data records should be stored with one item per record. So an "n" element array would require n logical records for storage. Programs are stored with one source line per record. Records must not contain a trailing CR-LF unless it is a meaningful portion of the data item. Logical records are allowed to span physical record boundaries.

File type −2: The data format within the record is undefined and must be known to the user.

Extensions

An extension field is one that is defined to be of general interest to a large set of implementors, but is not required for implementation of the standard. No extension is allowed that would prohibit an implementation from reading, writing or creating a lower level implementation. Levels are hierarchical; that is, level N includes levels 0 to N−1.

Level 0 is defined to be the level with no extensions. This level must be supported for all implementations. The Model 64000 implements level 1 extensions when formatting LIF discs. The value of words 12-13 is 33, words 14-15 have a value of 2, and words 16-17 have a value of 16. Words 18-20 contain the date and time the volume was formatted. The following paragraphs explain the words in detail.

Words 12-17

These words contain physical attributes data. Words 12 and 13 contain the number of tracks per surface with the most significant word being word 12. Words 14 and 15 contain the number of surfaces per medium, with the most significant word being word 14. Words 16 and 17 contain the number of sectors per track with the most significant word being word 16.

Words 18-20

These words contain the volume stamp. This field is identical to the time stamp field of the directory listing, except this field reflects volume creation. All comments about valid BCD digits, version numbers, etc. still apply.

Flexible Disc Track Format

Table A-1 describes the physical track format for HP 5-1/4 inch minifloppies.

Table A-1. Minifloppy Physical Track Format

Item	Number of Bytes	Hex Value	Description
1	85	4E	Postindex gap
------ repeat items 2 - 17, 16 times per track ------			
2	16	4E	Sector preamble
3	12	00	ID address mark
4	3	A1	Note: missing clock transitions between bits 4 and 5.
5	1	FE	ID address mark
6	1	XX	Cylinder number (see note 1)
7	1	XX	Head number (see note 2)
8	1	XX	Sector number (see note 3)
9	1	01	Sector length (01 implies 256 bytes)
10	2	XX	CRC (see note 4)
11	22	4E	ID gap
12	12	00	Date address mark synchronization
13	3	A1	Note: missing clock transitions between bits 4 and 5.
14	1	FB	Data address mark
15	256	XX	Data
16	2	XX	CRC (see note 4)
17	28	4E	Sector postamble
18	approx. 600	4E	Preindex gap The number of characters in this gap is approximate. Bytes with value 4E should be written until the index pulse occurs.

Table A-1. Minifloppy Physical Track Format (Cont'd)

Note 1 -	Cylinder numbering begins at 00. Invisible (i.e., defective) tracks have a cylinder number equal to FF.
Note 2 -	Head 00 is the lower head, head 01 is the upper head. Invisible (i.e., defective) tracks have a head number equal to FF.
Note 3 -	Sector numbering begins at 00. Invisible (i.e., defective) tracks have a sector number equal to FF.
Note 4 -	16-bit cyclic redundancy check (CRC). The value of the CRC is calculated according to the following formula. $G(X) = X^{16} + X^{12} + X^{5} + 1$ The CRC register is initialized to 1's and includes all information starting with the address mark through the CRC characters.

Defective Track Marking

When formatting a disc, each track is written according to the physical format described above. After writing, each data sector is read. If an error occurs when reading any sector on the track, then the entire track is considered to be defective. If a defective track is detected, then the entire track is written again with the value of the cylinder number, side number, and sector number with bytes equal to FF for each sector. This marks the track as defective or "invisible."

After a defective track is found, the address field of the next good track is set to the value that would have been assigned to the defective track. Thus, a particular logical track is displaced inward on the disc for each defective track found.

Physical tracks are identified by their position on the medium, cylinder and side. Logical tracks are identified by the value of address bytes in the physical format. Figure A-2 depicts a hypothetical medium and designates physical tracks 02 and 05 as defective tracks.

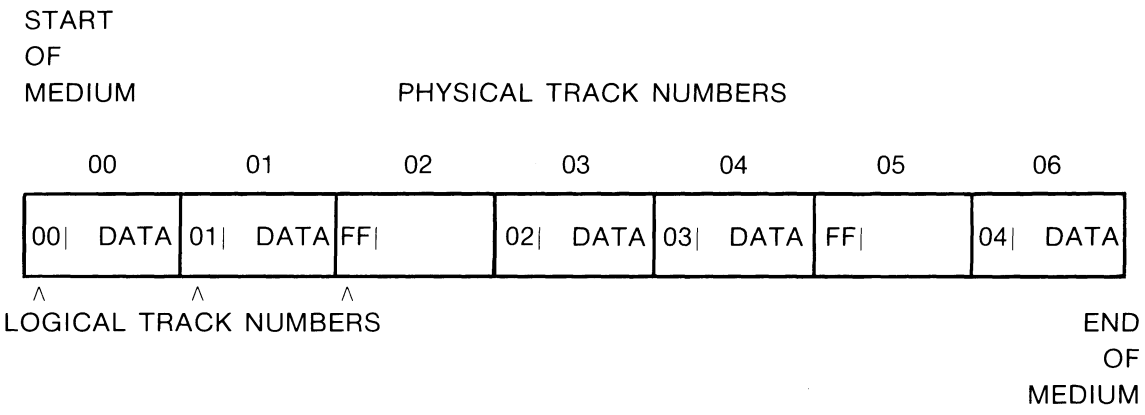


Figure A-2. Example Medium Showing Tracks 02 and 05 as Defective

There are 70 physical tracks on an HP 5-1/4 inch disc. There may be 0 to a maximum of 4 defective tracks marked invisible. Defective tracks are allowed in any physical position. Discs that have more than four defective tracks are rejected by the LIF formatting utility. Therefore, there are 70 – b logical tracks on a disc where b is the number of invisible tracks. Regardless of how many defective tracks are detected on a particular disc, at most only 66 logical tracks will be used to store data.

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