



RTE-A

**Utilities Manual
SCSI Update**

**Measurement and Control Systems Division
11000 Wolfe Road
Cupertino, CA 95014**

Manual Part No. 12016-90003
SCSI U0991

Printed in U.S.A. September, 1991
SCSI Update

NOTICE

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THE MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard.

This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced, or translated to another language without the prior written consent of Hewlett-Packard Company.

RESTRICTED RIGHTS LEGEND

Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subparagraph (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARs 252.227.7013

Printing History

The Printing History below identifies the edition of this manual and any updates that are included. Periodically, update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this printing history page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past updates; however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all updates.

To determine what manual edition and update is compatible with your current software revision code, refer to the Manual Numbering File or the Computer User's Documentation Index. (The Manual Numbering File is included with your software. It consists of an "M" followed by a five digit product number.)

Second Edition	Jul 1983	.....
Update 1	Dec 1983	..... Update TF, File System Utilities
Update 2	Jun 1984	..... Update and Add utilities
Reprint	Jun 1984	..... Update 1 & 2 Incorporated
Update 3	Jan 1985	.....
Reprint	Jan 1985	..... Update 3 Incorporated
Update 4	Jul 1985	..... Add FORMA and ERTISH
Reprint	Jul 1985	..... Update 4 Incorporated
Update 5	Jan 1986	.....
Reprint	Jan 1986	.....
Update 6	Oct 1986	..... Add FST
Reprint	Oct 1986	..... Update 6 Incorporated
Third Edition	Aug 1987	..... Rev. 5000 (Software Update 5.0)
Fourth Edition	Jan, 1989	..... Rev. 5010
Update 1	July, 1990	..... Rev. 5020
SCSI Update 1	July, 1990	..... Rev. 5020
SCSI Update 2	Sep, 1991	..... Rev. 5025

Backup and File Interchange Utilities

RTE-A provides several utilities for file and disc backup and for file interchange with other Hewlett-Packard and non-Hewlett-Packard systems. This chapter discusses these utilities and their relationships to each other and suggests their most effective use.

Backup Utilities

You may use several utilities to back up and verify data from a disc drive to a tape drive (either magnetic tape or CS/80 cartridge tape). Backup utilities include FST, TF, FC, ASAVE/ARSTR, COPYL, and PBV.

RTE-A supports two modes of backup, file backup and physical disc image backup. Table 2-1 shows the utilities used for each mode.

Table 2-1. Disc Backup Utilities

	File Backup from Disc	Physical Image Backup from Disc
to Cartridge Tape	FST, TF, FC	ASAVE/ARSTR
to Magnetic Tape	FST, TF, FC	ASAVE/ARSTR
to Disc	CI, FST	COPYL

File backup allows on-line backup and restoration to and from discs. It allows selective file backup and selective file restore from a larger backup. Selective file backup can be relatively fast, since you need not back up the entire disc LU. However, you may find that total file backup of a full disc is slower than physical image backup, due to the file system overhead. In addition, off-line restoration is not possible, since file backup requires a functioning, disc-based operating system.

Physical backup allows off-line restoration and, in the case of a total disc backup, is faster than file backup. However, you cannot restore files selectively using physical backup but must restore the entire disc, which wipes out any previous contents.

FST and TF are used to back up files from disc to tape and restore files from tape to disc (some restrictions apply to FMGR files). These utilities support incremental backups of just those files that were modified, and they allow you to append new backups to old backups. FST is faster than TF and supports streaming on streaming tape drives. FST can also be used to back up and restore files to and from archive files. Refer to the individual sections in this chapter on FST and TF for a complete description of each utility.

FC is used to back up files from disc to tape and restore files from tape to disc. Refer to the section in this chapter on FC for a complete description of this utility.

ASAVE and ARSTR can be used to copy an RTE-A disc LU to magnetic tape or CS/80 cartridge tape, regardless of file structure. ASAVE lets you save to tape; ARSTR does the restoration. ASAVE and ARSTR let you append new disc LU backups to previous backups and can be used in a memory image system for off-line restores and saves. See Chapter 3 for a complete description of the ASAVE and ARSTR utilities.

COPYL can be used to copy the data on one disc LU to another disc LU of similar type, regardless of file structure. See Chapter 3 for a complete description of the COPYL utility.

All of the above utilities support a Verify option that lets you check that data was properly saved.

LIF is used primarily to interchange files between Hewlett-Packard systems but can also provide file backup. Refer to the section in this chapter on LIF for a complete description of this utility.

PBV is used to verify a “pushbutton” save or restore. Many CS/80 discs include an integrated cartridge tape drive that provides a front panel save and restore function (called a “pushbutton” save and restore), which you can use to save or restore an entire disc unit to/from a CS/80 cartridge tape. Although these CS/80 hardware functions do not have media-to-media verify, you can use PBV, which can be loaded from CS/80 cartridge tape or magnetic tape, to verify the pushbutton save or restore.

CI is the RTE-A command interpreter and can be used to copy files on disc. See the *RTE-A User's Manual* (part number 92077-90002) for a complete description of CI.

File Interchange on RTE-A

You can use the FST, TF, FC, and LIF utilities to interchange files between RTE systems (RTE-A, RTE-6/VM, RTE-XL and RTE-IVB), other Hewlett-Packard systems, and UNIX-based systems. These utilities support a Verify option to ensure the validity of data copied. Table 2-2 shows which utilities to use to move data between systems. The table indicates which utilities are recommended for copying and restoring files from/to a system. For example, "FC/TF" means that FC is recommended for copying files from one system (the source), and TF is recommended for restoring files to the other system (the destination).

Table 2-2. File Interchange Utilities

From System \ To System	RTE-A or RTE-6/VM (5) CI files	RTE-A or RTE-6/VM (5) FMGR files	RTE-XL RTE-IVB (4)	UNIX
RTE-A or RTE-6/VM(5) CI Files	FST/FST	FST/FST	N/A	FST/TAR (3)
RTE-A or RTE-6/VM(5) FMGR files	FST/FST	FST/FST	FC/FC	(2)(3) FST/TAR
RTE-XL RTE-IVB(4)	N/A	FC/TF	FC/FC	N/A
UNIX	(3) TAR/FST	(1)(3) TAR/FST	N/A	-
Notes: (1) Filenames truncated to 6 characters, time stamps lost (2) Restrictions on use with FMGR files (see TF/FST) (3) UNIX compatibility restrictions (see TF/FST) (4) No CS/80 CTD support (5) Revision 2540 or later				

File Storage to Tape (FST)

FST is a high performance, logical (file-by-file) backup utility. It copies files faster than TF and FC because of its streaming capability. It also performs faster than TF and FC on tape units that do not support streaming. FST supports backups and restores to and from magnetic tape, CS/80 cartridge tape drives, and archive files on disc.

FST reads files from and writes files to both CI volumes and FMGR cartridges. FST does not, however, back up type 0 files. This utility saves files with all the needed extent information so that you can restore them to their original layout, if desired. FST replaces reserved characters in FMGR filenames (for example, “.”, “/”, or “@”) with non-reserved characters, and sends a message to the terminal or log device/file when it renames a file.

A virtual memory scheme, using a scratch file, lets you save or restore a virtually unlimited number of files. The only restriction is imposed by the amount of available disc space where the scratch file exists. Any overflow of the scratch file is reported before the files are saved. You may decide where to locate the scratch file.

FST uses a two-pass approach to its backup and restore process. First, you select the files to back up or restore. The selected filenames and some other file information are kept in a directory file on the disc. During this first pass, you can add files, remove files, and list filenames in the directory file. You may also perform other functions, such as setting the log device/file or changing the selected tape LU.

The second pass begins after you select all the desired files and set all the other backup/restore parameters. During this pass, the files you selected and the directory file itself are transferred between tape and disc. Filenames and file masks for FST commands conform to FMP standards.

You can use multiple reels for large backups that require more than a single tape. Since a file can cross tape boundaries, files that are larger than an entire tape and multiple files that require more than one tape can be handled.

Each archive created by FST contains a header, an optional comment file, and a directory file, followed by the files saved from disc. A file header immediately precedes each saved file.

You may run FST interactively or programmatically. Parameters in the command string determine the mode. Interactive and programmatic mode are discussed in the following sections.

Calling FST

You may run FST programmatically by entering all the desired commands in the runstring. When FST executes all the commands, or an unrecoverable error occurs, FST exits. The maximum length of the runstring is the limit imposed by CI, 256 characters.

Separate commands in the runstring by a vertical bar (|). You must rename files used in the runstring if their names contain a vertical bar.

FST aborts if an error occurs in programmatic mode. If FST ends abnormally, the error is indicated by a “-1” in the first return parameter kept by CI and FMGR.

In the following example, all the files in the working directory are backed up to LU 8 with the Verify option selected:

```
CI> fst ba @|verify|mt 8|go
```

If you do not enter any commands in the FST runstring, FST assumes you are using interactive mode. Commands are entered at the FST > prompt. FST executes each command before prompting for the next one, and continues to prompt for commands until you enter the EXIT command, as follows:

```
CI> fst
FST> <command>
FST> <command>
.
.
.
FST> ex
CI>
```

You may enter just the first two characters of a command, or up to the whole name; for example, EX, EXI, and EXIT all cause FST to exit.

To specify more than one command on a line, separate the commands by a vertical bar (|) as follows:

```
CI> fst
FST> <command> | <command> | ... | <command>
FST>
```

When FST exits normally, the \$RETURN parameters are set as follows:

```
$RETURN1 = Number of errors encountered during the last save/restore pass.
$RETURN2 = Number of verify errors during the last verify pass.
$RETURN3 = Number of warnings generated during the last pass.
$RETURN4 = Number of files saved.
$RETURN5 = Number of files restored.
```

FST Commands

Table 2-3 summarizes the FST executable commands.

Table 2-3. FST Commands Summary

Commands	Description
Information Commands	
HElp (or ?) SHow	Provide a summary of commands and syntaxes. Display the DF, MT, TI, SC, LL, and option settings.
Backup/Restore and Related Commands	
BACKup mask DF Directory Files file_desc GO Begin Backup/Restore REstore mask SC Select Comment File filename TA UNIX TAR Format Title title UNselect mask	Select files to back up. Specify a non-default directory file. Begin executing backup/restore. Select files to restore. Select the tape's comment file (backup only). Select UNIX TAR archive format. Specify a title for the archive (backup only). Unselect files.
Listing Commands	
DL Directory List mask LC List Comment File LH List Header List Selected Files mask LL Select Log Device/Files device/file LN List Non-Selected Files mask	Display the archive's directory file. List the archive's comment file. List the archive's header. List the files selected for backup/restore. Set log device or file for FST activities. List the non-selected files (restore only).
Tape LU Control Commands	
MT Specify Tape LU or archive file tape_LU/ file name NExt append_# POsition append_# PREvious append_# SD Set Tape Density density_# SEcure	Set the magnetic tape LU or archive file. Advance the tape to another append. Position the tape to a specific append. Rewind the tape to a previous append. Set the tape density (HP 7974/7978 only). Lock the tape LU and check the tape status or open archive and check the file's status.
Transfer and Exit Commands	
EXit RUn program TR Transfer to filename Command File / Command Stack	Exit FST. Run an external program. Begin executing a transfer file. Display the command stack.

Command Stack (/)

Purpose: Displays the FST command stack.

Syntax: / [n]

n The optional command line count that specifies the number of command lines from the last command entered to be displayed.

Description:

FST uses the RTE standard command stack, which supports finds, page movement, line marking, and various other operations. For a full description, refer to the online help by typing “? stack” from CI.

Backup (BA)

Purpose: Selects a file or group of files to back up from disc.

Syntax: BA mask [dest_mask] [sec_code]

mask The file or group of files to be backed up from disc. (This can be a disc LU number.)

dest_mask The optional mask that changes the characteristics of the files (for example, the pathname and file type extension) as they are saved on the archive.

sec_code The system master security code.

Description:

To save FMGR files with security codes, specify each file with its individual security code, or enter the system master security code with the mask.

You may execute BA as many times as desired before you start the data transfer to tape. Note that you may not use both the BA and RE (Restore) commands when you select files to transfer.

Directory File (DF)

Purpose: Specifies the name and location of the directory file.

Syntax: DF file_desc

file_desc The partial file descriptor that can include a pathname, filename, and block size.

Description:

The file descriptor can specify any directory or FMGR cartridge that is not write-protected. FST uses the default pathname, filename, or size of the directory file if you do not enter them. The default location of the directory file is the /SCRATCH global directory. If /SCRATCH does not exist, FST creates a directory file on the first available FMGR cartridge. The default filename is a unique filename created by the FmpOpenScratch call. The default size is 500 blocks.

Each selected file requires a minimum of two blocks in the directory file. For large backups that require more than 500 blocks for the directory file, extents are needed for the directory file, and directory file access is slower. To avoid extents, specify the size of the directory file.

Although FST creates a directory file if you do not, DF lets you create directory files for a particular location, name or size. Note that DF can be used only when no files have yet been selected using BA or RE. The following example specifies location, name and size:

```
FST> DF /BigLU/FSTdirFile::::10000
```

The next example just specifies the location:

```
FST> DF /LonelyDisc/
```

List Directory (DL)

Purpose: Lists the directory of files on the archive.

Syntax: DL [mask]

mask The optional mask that specifies a file or group of files in the archive directory. (This can be a disc LU number).

Description:

The directory of the archive is displayed and logged to the user log device/file. If you do not specify a mask, the entire directory on the archive is displayed; otherwise, only those files in the archive directory that match the mask are displayed. DL does not modify the list of selected files already obtained by the BA or RE commands.

Exit (EX)

Purpose: Exits FST.

Syntax: EX

Description:

This command returns you to the environment from which FST was run. (See the section on “The Keep (K) Option” later in this chapter for information on exiting without waiting for the tape to rewind.)

Begin Backup/Restore (GO)

Purpose: Begins the data transfers to or from the archive.

Syntax: GO

Description:

After you select all the files for the backup/restore, use GO to start the actual transfer of the files.

Help (HE)

Purpose: Displays the command help information.

Syntax: HE [command]

or

? [command]

command Any FST command or option.

Description:

If you do not specify the optional command, general help information is displayed; otherwise, information for the specified command or option is shown.

List Comment File (LC)

Purpose: Lists the comment file of the archive.

Syntax: LC

Description:

The comment file from the archive is displayed and logged to the log device/file.

List Header (LH)

Purpose: Lists the archive header.

Syntax: LH

Description:

The archive header (format, title, and creation date) is displayed and logged to the log device/file.

List Selected Files (LI)

Purpose: Displays all the files that were selected for backup/restore.

Syntax: LI [mask]

mask The optional mask that specifies a file or group of files in the directory file to be displayed. (This can be a disc LU number.)

Description:

If you do not specify a mask, all selected files in the directory file are displayed and logged to the log device/file. Otherwise, just those files that match the specified mask are displayed and logged. Refer to the “Disc Directory File” section later in this chapter for a description of the directory file.

Select Log Device/File (LL)

Purpose: Changes or selects the log device/file.

Syntax: LL <device/file> [a] [o]

device/file The device or file to which the output from the listing commands and FST messages is routed.

a The option to append to the specified log file, if one exists.

o The option to overwrite the specified log file, if it exists.

Description:

Using a log file lets you check the file listings and FST messages following a backup/restore. Specifying LL 1 routes the output to your terminal.

List Non-Selected Files (LN) (Restore Only)

Purpose: Displays the non-selected files; that is, the files that are on the archive but are not being restored to disc.

Syntax: LN [mask]

mask The optional mask that specifies a file or group of files on the tape. (This can be a disc LU number.)

Description:

If you do not specify a mask, all non-selected files in the directory file are displayed and logged to the log device/file. Otherwise, only those that match the mask are displayed and logged. This command should be used only during a restore operation.

Specify Tape LU/Archive File (MT)

Purpose: Selects the tape Logical Unit (LU) number or an archive file name.

Syntax: MT [tape_LU | filename]

tape_LU The selected tape LU number.
filename The file descriptor of the archive file.

Description:

If you do not specify a tape LU, the current tape LU is set to 0. If you specify an LU other than a tape LU, an error is reported, and the LU value is set to 0. If you specify an LU other than the current tape LU and the current tape LU is locked by FST, FST unlocks the current tape LU and may take it off-line before it selects the new LU. Refer to the section on the Keep option later in this chapter for information on when the tape LU is taken off-line.

If you specify an illegal tape LU or LU 0, you must use MT to set a legal tape LU before you can execute a backup or restore operation.

If an archive file is specified instead of a tape LU, FST uses this archive file for backups or restores. Archive files are type 1 files and the data can be in either FST format or TAR format. Using an archive file with FST is essentially the same as using a tape. The main difference is that the tape control commands NE, PO, PR and SD are not supported with archive files and the append feature is not supported.

Archive files in TAR format are written with a TAR blocking factor of 20.

Next (NE)

Purpose: Advances the tape to another append of data.

Syntax: NE [append_#]

append_# The number of appends to move the tape forward.

Description:

If you do not enter an append number, the tape moves forward to the next append of data. This lets you move the tape and examine various backups that were appended to the tape. If the append number is larger than the number of remaining appends, the tape is positioned at the last append.

Position (PO)

Purpose: Positions the tape at a specific append.

Syntax: PO [append_#]

append_# The specific append number to which the tape is moved.

Description:

If you do not specify an append number, the current position is reported. The main backup of the tape is position zero (0). The first append is position one (1), and so on. If you specify an append number larger than the number of appends on the tape, the tape is positioned at the last append.

Previous (PR)

Purpose: Rewinds the tape to a previous append of data.

Syntax: PR [append_#]

append_# The number of appends to move the tape backward.

Description:

If you do not specify an append number, the tape is rewound to the previous append of data. This lets you move the tape and examine various backups that were appended to the tape. If you specify an append number that is larger than the number of previous appends on the tape, the tape is positioned at the beginning of the tape.

Restore (RE)

Purpose: Selects a file or group of files from the mounted FST archive to restore to the disc.

Syntax: RE [mask] [dest_mask] [gr|eg|ag]

mask The optional mask that specifies the file or group of files to be restored to disc. If you do not use a mask, all the files on the archive are restored. (This can be a disc LU number.)

dest_mask The optional mask that renames the characteristics of the files (for example, the pathname and file type extension) as they are restored to disc. (This can be a disc LU number.)

gr Begin group restore.

eg End group restore.

ag Abort group restore.

Description:

You may execute RE as many times as desired before you start the data transfer from the archive. Note, however, that RE cannot be used with BA.

A mask is used to select a specific file or group of files. If you do not use a mask, all the files on the archive are restored, with the same path and, if possible, on the original disc LU.

If you are trying to selectively restore many files from a backup tape with a large directory file, the selection process can take quite a long time before the data transfer even begins. This is because when each RE command is executed, a pass is made through the entire directory file. Note that the files are not actually restored until you issue the GO command. Note that with TAR and TF format the GR option is not allowed. RE is handled differently in these cases. See the section TAR or TF Compatibility for more information.

You may use Group commands to speed up large restores. When FST encounters a GR command, it keeps track of all subsequent RE commands, but does not execute them immediately. Instead, they are all executed at once, as a single operation, when the EG (End Group) command is encountered. Thus FST can make a single pass through the directory file, matching all the masks within the group.

Streaming may not occur when you use RE, depending upon the type of tape drive, the size of the SHEMA (shareable EMA) buffer, and the size of the files being restored. However, restore operations imply extraordinary circumstances, such as a corrupt disc or a system that is down, and thus occur much less frequently than backup operations.

Run (RU)

Purpose: Runs a program external to FST.

Syntax: RU prog_name

prog_name The name of the program to run.

Description:

RU provides more flexibility when you run FST, as it lets you execute non-FST commands without exiting FST and losing the current FST settings and selections.

For example, you can obtain a directory listing from disc by using the CI DL command with the following command string:

```
FST> ru dl /progs/@.ftn
```

Or, you can create a comment file to save to the tape from within FST by running EDIT/1000 with the following command string:

```
FST> ru edit /my files/fst/comments
```

Select Comment File (SC) (Backup Only)

Purpose: Selects the comment file for the archive.

Syntax: SC [filename]

filename The filename of the comment file for the archive you are backing up.

Description:

If you do not specify a filename, the current comment file is no longer selected. Comment files are useful for detailed archive identification or restoration instructions.

Set Tape Density (SD) (Backup Only)

Purpose: Sets the tape density for the HP mag tape streaming tape drives.

Syntax: SD [density]

density The desired density in bpi for writing to the tape.

Description:

If you do not specify a density number, the current tape drive density setting is displayed. Setting the tape density does not apply to appends; all data on one tape must be at the same density. Refer to your tape drive manual for the proper tape drive density setting.

Secure (SE)

Purpose: Secures (locks) the tape LU and checks the tape status or secures (opens) the archive file and checks the file's status.

Syntax: SE

Description:

SE locks the tape LU specified in the MT command and makes sure the tape is on-line. SE lets you immediately protect an on-line tape from other users if it is not write-protected. Using MT to specify a different tape LU unlocks the current tape LU.

Show (SH)

Purpose: Shows the user-selected states of the FST program.

Syntax: SH

Description:

SH displays the states of the option commands, the tape LU or archive file selected, the file count with the number of 128-word blocks and kilobytes represented by the file count, your title and comment file (backups only), the name of the directory file, the log file, and the amount of tape footage needed for the tape access.

TAR (TA)

Purpose: Specifies the UNIX TAR format for the archive.

Syntax: TA, [ON/OFF/A/B] [,C]

- ON Turns ON the TA option. For backups, only type 4 files are converted to a UNIX file format. For restores, all selected files are restored as converted ASCII files. ON is the default.
- OFF Turns OFF the TA option.
- A (ASCII) Turns ON the TA option and, for backups, converts type 3 and above files to UNIX file format. Restores are handled the same as with TAR ON.
- B (Binary) Turns ON the TA option for binary file formats. For backups, files are not converted to UNIX file format and are saved as blocks of data. For restores, all selected files are restored as blocks of data from the archive.
- C Allows the selection of case sensitive file names from a TAR archive.

Description:

Although TA resembles an option, it is a command and thus cannot be entered in a string of options.

When you back up files, you must select all files under the same format. In other words, you may not back up some files in TAR format and other files in FST format on the same archive.

When you restore a TAR archive, FST sets the TA option to ON automatically upon recognizing the archive format. On restores, the default setting restores and converts all files as ASCII files. If a binary restore is required, you must specify the B parameter.

When the 'C' option is enabled, the FST 'RE' command is case sensitive. Also, the FST 'DL' command preserves the case of the filenames on the TAR archive when the directory of files on the archive is displayed. Since UNIX files are case sensitive, it is possible to have multiple files on the same archive which, when shifted to uppercase, result in the same name.

For example, to restore both of the "readme" files from a TAR archive which contains 'README' and 'readme':

```
FST > ta,,c
FST > re,README,uppercase
FST > re,readme,lowercase
FST > go
```

Tape format: TAR

Copying README ::: 4 : 1 to UPPERCASE ::: 4 : 1
Copying readme ::: 4 : 1 to LOWERCASE ::: 4 : 1

Title (TI) (Backup Only)

Purpose: Specifies a title for the archive header.

Syntax: TI title

title The text, up to 72 characters long, that describes the contents of the backup.

Description:

You can use the LH command later to examine the title for the current backup in order to help identify the archive. If you do not specify a title, the last BA command mask entered is used as the default.

Transfer to Command File (TR)

Purpose: Transfers control to a command file.

Syntax: TR filename

filename The name of the command file.

Description:

FST executes commands from the file you specify. This is advantageous when you use the same sequence of commands frequently. A command file is quicker to reference, removes the possibility of typing errors, and does not require operator intervention to execute a series of commands.

To use other commands along with TR in a runstring, specify them before the TR command. FST does not execute any commands in a command string that occur after TR.

Command lines that begin with an asterisk (*) are ignored by FST and can be used to include comments in a command file.

Command files cannot be nested.

Unselect (UN)

Purpose: Removes a file or a group of files from selection in the directory file.

Syntax: UN [mask]

mask The optional mask that specifies the file or group of files to unselect from the directory file. (This can be a disc LU number.)

Description:

If you do not specify a mask, UN unselects all the files and purges the directory file from the disc. This command only modifies the directory file and does not affect the files on tape or disc. You can use UN as many times as needed before you actually begin the data transfer to/from the archive.

FST Options

Options enhance the usability of backing up and restoring files. Table 2-4 provides a summary of the FST options. Note that all options do not apply to all commands. You may specify the options, in any order, by entering the first character of the option or up to the entire option name. For example, B, BR, BRI, BRIE, and BRIEF all specify the Brief option.

The SH command displays the current state of the options. All options are initially OFF. Currently selected options are ON.

Set options by entering one or more options on a line and specifying ON or OFF. ON is the default. You may specify an option on the same line as an FST command; to do so, separate the option from the command by a vertical bar (|). You need not set all the options to be used for one backup or restore operation on the same line. The syntax for setting options in interactive mode is as follows:

```
FST> option [option]...[option] [ON/OFF] [option]...[option] [ON/OFF]
```

This allows multiple options to be set ON or OFF in one line.

You may also specify options in the FST runstring as follows:

```
CI> fst option [option]...[option] [ON/OFF] [option]...[option] [ON/OFF]
```

The examples that follow show how to set options ON or OFF (the examples are entered in interactive mode, but options can also be entered in the FST runstring from the CI> prompt, as shown above):

Example 1: Set Verify option ON.

```
FST> verify on
```

Example 2: Set Append and Clear options ON.

```
FST> a c
```

Example 3: Set Brief, Keep, and Yes options ON; set Lock, Original, and Purge options OFF.

```
FST> b on lock off keep y on orig pu off
```

Table 2-4. FST Command Options Summary

Options	Description
Append	Append this backup to the data already on the tape.
Brief	Only show errors and status messages.
Clear	Clear the disc file's backup bits.
Duplicate	Replace duplicate files.
Faulty	Restores files from a partially overwritten tape.
Keep	Keep tape on-line when backup/restore is complete.
Lock	Lock any disc LUs used.
Original	Restore files to their original main size.
Purge	Purge the disc files after backing up the files.
Quiet	Report messages only to the log device/file.
SrchApp	Search through appends during RESTORE.
Update	Replace duplicate file if file has been updated.
Verify	Verify the files during the backup/restore.
Whole	Back up all the blocks reserved for the file.
Yes	Write over the tape without asking.

Append (A) (Backup Only)

Append adds the backed-up files at the end of the tape contents, rather than replacing the previous files. You can only append to tapes that you previously backed up using FST. The Append option is used only with the BA command.

If the mounted tape is not an FST tape, but the Yes option is ON, the tape is overwritten.

Brief (B)

Whenever you do a backup or restore, a “Copying” message is displayed and logged to the log device/file for each file copied. If you specify the Brief option, these messages are not displayed, and only the start and stop of the backup/restore, along with any errors that occur during the process, are shown.

Clear (C)

This option clears the backup bit of copied files that were backed up or restored. In the hierarchical (CI) files system, each file has a backup bit, which indicates whether the file was backed up. When you specify Clear, Verify is automatically ON.

Duplicate (D) (Restore Only)

The Duplicate option lets you replace any file on the disc that has the same name as a file being restored from the tape. If you do not specify the Duplicate option, files with duplicate names are not restored.

Note that when Duplicate is ON, Update is turned OFF, and vice versa.

Faulty (F) (Restore Only)

The Faulty option lets you restore FST files from a partially overwritten tape, in which the original directory file and probably some actual file data were partly or completely destroyed. Simply position just beyond the overwritten portion of the tape, then build a directory file from the remaining, uncorrupted data. For more detailed information, see the section “Rescuing Files from an Overwritten Tape.”

Keep (K)

The Keep option causes the tape to remain on-line/loaded after you exit FST or select another tape LU. On-line refers to 1/2 inch magnetic tapes; loaded refers to CTD (cartridge tape drive) tapes. Note that if the tape is left on-line/loaded, another user can write over the tape if it is not write-protected. Leaving the tape on-line also lets FST exit without waiting for the current rewind to complete (except for 797X streaming mag tapes).

FST uses the following rules for leaving the tape on-line/loaded:

- If the tape is write-protected, it is left on-line/loaded, independent of the Keep option setting.
- If the tape is not write-protected and the Keep option is not set, the tape is taken off-line/unloaded.
- If the tape is not write-protected and the Keep option is set, the tape is left on-line/loaded.

Note that the Keep option assists when using the 35401A AUTOCHANGER. Refer to the “Multiple Reels” section in this chapter for more information.

Lock (L) (Backup Only)

Setting the Lock option ON locks the disc LUs that are accessed during the backup selection. Setting this option OFF unlocks all locked disc LUs. The Lock option is useful because of the two-phase process that FST uses for its backup operation.

There is a time lapse between the first pass (when all the file information is collected for each file) and the second pass (when the files are transferred). If any file changes during this interval, incorrect or incomplete data may be saved to the tape. The Lock option prevents this by locking the disc LUs needed for collecting data.

This option must be used carefully. When a disc LU is locked, all other users are prevented from accessing that LU. Commonly used disc LUs should only be locked for a short period of time.

Original (O) (Restore Only)

The Original option lets you restore files to the disc with their original main block size. Usually, files of type 3 and above are restored to disc at a block size that contains all the data in the file without creating extents. Sometimes, however, a file must be restored with the same main block size as when it was backed up. You can specify the Original option to accomplish this. This option has no effect on type 1 or type 2 files; they are always restored in their original format.

Note that the Original and Whole (described below) options are not identical. Original determines the main size of a file being restored, while Whole determines how much of a file is backed up.

Purge (P) (Backup Only)

Purge lets you purge the source disc files after they are backed up and verified by FST. When you select Purge, Verify is automatically set (files cannot be purged without verification). The Purge option does not apply to the RE command.

Quiet (Q)

The Quiet option prevents FST output from being displayed on a terminal. Any errors, warnings, or messages are placed in the log device/file. You should specify a log device/file when you use this option; otherwise, it is almost impossible to determine the output of the backup or restore operation. This option is most useful when used programmatically or from a transfer file, but is allowed interactively.

SrchApp (S) (Restore Only)

The SrchApp option causes FST to search automatically through all of the appends on an FST tape when restoring files. Because this option would typically be used on an FST tape which contains incremental appends, selecting this option will automatically enable the UPDATE option. Selecting SrchApp will also initialize a group restore (see Restore command). The file names and/or masks from each RE command are stored and used later to search each append's directory file. Restarting grouping, for example,

```
RE [mask] [dest_mask] GR
```

will have the effect of reinitializing grouping, and the previous RE commands will be invalidated. After the GO command is issued, the directory file for the current append will be searched for selected files. After restoring any selected files, the tape will be positioned to the next append and the process repeated until the last append has been searched. The SrchApp option can only be used with tapes in FST format.

Update (U)

Update causes FST to restore any duplicate files whose update times on the archive are later than the update times on the disc. This option does not apply to FMGR cartridge restoration, since FMGR files do not have update times.

Update and Duplicate cannot be used at the same time. When the Update option is turned ON, the Duplicate option is turned OFF, and vice versa.

Verify (V)

When you specify the Verify option, FST goes through another pass of the archive after the files are backed up or restored, and compares the data on the tape with the data on the disc to verify that the data was transferred correctly. Streaming may not occur during the verify pass, depending upon the tape drive, the size of the SHEMA buffer, and the size of the files.

Whole (W) (Backup Only)

Normally, FST uses the end-of-file position, specified in the disc directory for the file, to determine how many blocks of data to save to tape. When Whole is ON, FST ignores the end-of-file position and copies all the blocks reserved for the file.

When you back up files to the tape, there is usually no need to save any data beyond the end-of-file position specified in the disc directory entry of each file. When the Whole option is OFF, the end-of-file position in the disc directory is used to calculate how many blocks of data are actually saved to tape. However, sometimes the end-of-file position is corrupt, or does not accurately represent the data to be saved. In that case, the Whole option should be ON.

This option only applies to the BA command. Specify Whole as follows:

1. Set Whole ON.
2. Enter the BA command or commands for the files to be copied with Whole.
3. Set Whole OFF.
4. Enter the BA command for the files to be copied without the Whole option.

Yes (Y)

When you write to an archive that already has data on it, FST asks if you want to write over the archive. You may use the Yes option to suppress this question and have FST copy over the archive automatically.

File Masking and Renaming

Although FST masking is designed to be consistent with CI masking, there are some differences, depending upon which command is being executed. Any differences, however, should not affect situations where data could be lost (“unsaved”).

The BA and RE commands refer to copying files, so a D qualifier (described below) is forced into the mask. The DL (List Directory), LI (List Selected Files), LN (List Non-Selected Files), and UN (Unselect) commands simply display file information, so no qualifiers are added by FST. The D, K, N, and S qualifiers are described in the next section.

D, K, N, and S Qualifiers

The D, K, N, and S qualifiers are used when you select files to copy or display. All the qualifiers can be used together; however, the K qualifier overrides the D.

The D qualifier is forced for the BA and RE commands. It has two functions:

- If any directory matches the mask, everything within the directory also matches.
- It preserves the subdirectory path structure of files being copied. (See Example 1 under Backing Up or Example 1 under Restoring in the next sections.)

The N qualifier is almost the reverse of D. N prevents directories from matching and causes subdirectory structures to be “unpreserved” when used with the D qualifier. Since D is sometimes forced, you can use N to help nullify its effects. (See Example 3 under Backing Up or Example 3 under Restoring in the next sections.)

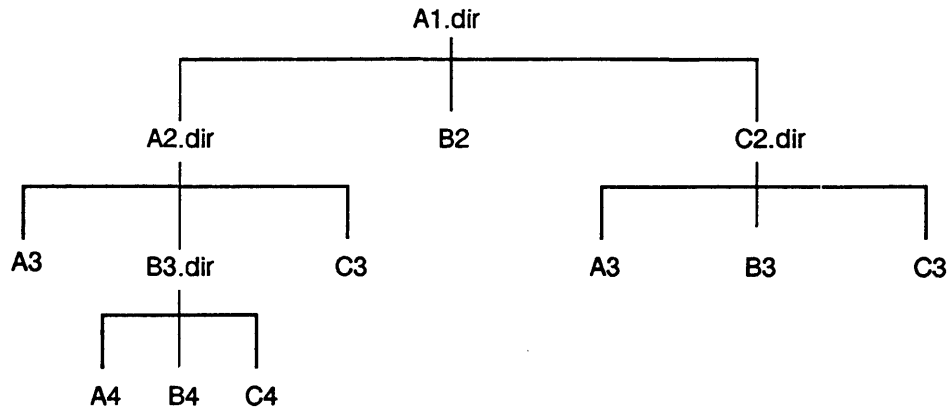
The S qualifier searches down through the entire directory structure. (See Example 3 under Backing Up in the next section.)

The K qualifier searches down through the entire directory structure and preserves the subdirectory path. (See Example 2 under Backing Up or Example 2 under Restoring in the next sections.)

Backing Up

When you select files to save, use the same rules as CI's CO (Copy) command. Files are matched by name, type extension, or any other characteristic given in the mask, and the D qualifier is forced into the mask. Filenames and paths can be modified by entering a destination mask with the BA command. Qualifiers on the destination mask are ignored.

Following is a directory tree structure and three examples of file selections for backup. The LI command shows each selected file and how it was renamed. Assume the working directory is A1.dir.



Example 1: Back up the files that match the C@ mask.

Note that the files in subdirectory C2.dir are selected even though they do not match C@, because the mask gets expanded to C@.@.D and subdirectory structure is preserved under /Z/.

```

FST> ba c@ /z/
4 files selected; 4 total
FST> li

C2.DIR:::2:64:32 to /Z/C2.DIR:::2:64:32
C2/A3:::3:24 to /Z/C2/A3:::3:24
C2/B3:::3:24 to /Z/C2/B3:::3:24
C2/C3:::3:24 to /Z/C2/C3:::3:24

FST>
  
```

Example 2: Back up the files that match the A@.@.k mask.

Note that the path structure is preserved, every lower path is searched, and the effect of the D qualifier is overridden. That is, files do not match just because their directories do.

```

FST> ba a@.@.k /z/
4 files selected, 4 total
FST> li

A2.DIR:::2:64:32 to /Z/A2.DIR:::2:64:32
A2/A3:::3:24 to /Z/A2/A3:::3:24
A2/B3/A4:::3:24 to /Z/A2/B3/A4:::3:24
C2/A3:::3:24 to /Z/C2/A3:::3:24

FST>
  
```

Example 3: Back up all the non-directory B files using the masks B@.@.ns.

Note that N causes no directories to match nor subdirectory structures to be preserved, and S causes the search to examine every path.

```
FST> ba b@.@.ns /z/
3 files selected; 3 total
FST> li

B2:::3:24 to B2::Z:3:24
A2/B3/B4:::3:24 to B4::Z:3:24
C2/B3:::3:24 to B3::Z:3:24

FST>
```

Restoring

When you select files to restore, you follow most of the same rules that apply to CI's CO command. Files are matched by name, type extension, or any other characteristic given in the mask, and the D qualifier is forced into the mask. You can match filenames and paths by entering a destination mask with the RE command. Qualifiers on the destination mask are ignored.

The mask can also be a disc LU number, which selects the files that were backed up from that disc. In this case, FST tries to restore the file to that disc.

The differences between restore masking and standard CI masking are as follows:

- Only the D, K, N, and S qualifiers are usable; all other qualifiers are ignored.
- A mask of @, or equivalent, matches every file on the archive, regardless of its path. If you do not enter a mask, the default is @.
- If you do not enter a directory structure with the mask, all paths match and only the filenames, type extensions, and other file characteristics are checked for a match (see Example 1 below).
- Global directories, like subdirectories, are preserved as subdirectories if you enter a destination mask (see Example 1 below).

Examples 2, 3, and 4 below provide explanations for the most commonly asked questions about masking, including restoring files to the working directory with path preservation, without path preservation, and with partial path preservation.

Below is a listing of a directory tree structure, backed up to the tape, followed by several examples of file selections for restoring. The LI command displays each file selected and shows how it was renamed. Note that this tree and its files are identical to those shown in the previous section.

```

/A.DIR:::2:64:32
/A1/A2.DIR:::2:64:32
B2:::A1:3:24
/A1/C2.DIR:::2:64:32
/A1/A2/A3:::3:24
/A1/A2/B3.DIR:::2:64:32
/A1/A2/C3:::3:24
/A1/A2/B3/A4:::3:24
/A1/A2/B3/B4:::3:24
/A1/A2/B3/C4:::3:24
/A1/C2/A3:::3:24
/A1/C2/B3:::3:24
/A1/C2/C3:::3:24

```

Example 1: Restore the files that match the C@ mask.

Note that the files in subdirectory C2.dir are selected even though they do not match C@, because the mask expands to C@.@.D, and the directory structure is preserved under /Z/.

```

FST> re c@ /z/
6 files selected; 6 total
FST> li

/A1/C2.DIR:::2:64:32 to /Z/A1/C2.DIR:::2:64:32
/A1/A2/C3:::3:24 to /Z/A1/A2/C3:::3:24
/A1/A2/B3/C4:::3:24 to /Z/A1/A2/B3/C4:::3:24
/A1/C2/A3:::3:24 to /Z/A1/C2/A3:::3:24
/A1/C2/B3:::3:24 to /Z/A1/C2/B3:::3:24
/A1/C2/C3:::3:24 to /Z/A1/C2/C3:3:24

FST>

```

Example 2: Restore the files matching the A@.@.k mask, and place them in your working directory.

Note that the path structure is preserved, and the effect of the D qualifier is overridden (That is, files do not match just because their directories do.).

```

FST> re a@.@.k @
5 files selected; 5 total
FST> li

/A1.DIR:::2:64:32 to A1.DIR:::2:64:32
/A1/A2.DIR:::2:64:32 to A1/A2.DIR:::2:64:32
/A1/A2/A3:::3:24 to A1/A2/A3:::3:24
/A1/A2/B3/A4:::3:24 to A1/A2/B3/A4:::3:24
/A1/C2/A3:::3:24 to A1/C2/A3:::3:24

FST>

```


Example 3: Restore all the non-directory B files using the mask B@.@.ns, and place them into the working directory, flattening the directory structure.

```
FST> re b@.@.ns @
3 files selected; 3 total
FST> li

B2::A1:3:24 to B2:::3:24
/A1/A2/B3/B4:::3:24 to B4:::3:24
/A1/C2/B3:::3:24 to B3:::3:24

FST>
```

Example 4: Restore the files and directory structure under the /A1/A2.dir directory to the working directory.

Note that the A1/A2 directory path is not preserved in the destination.

```
FST> re /a1/a2/@ @
6 files selected; 6 total
FST> li

/A1/A2/A3:::3:24 to A3:::3:24
/A1/A2/B3.DIR:::2:64:32 to B3.DIR:::2:64:32
/A1/A2/C3:::3:24 to C3:::3:24
/A1/A2/B3/A4:::3:24 to B3/A4:::3:24
/A1/A2/B3/B4:::3:24 to B3/B4:::3:24
/A1/A2/B3/C4:::3:24 to B3/C4:::3:24

FST>
```

Incremental Backup

Incremental backup is a procedure that involves periodically backing up all the files and doing frequent backups only of files that were changed since the previous backup. The backup bits in a file's directory entry are used for this, as explained later, so FMGR files do not apply. The initial backup is called a "full backup," and subsequent, selective backups are called "delta backups."

For example, on Friday night, do a full backup of a particular directory. On Monday, Tuesday, Wednesday, and Thursday nights, take delta backups (and append to the same tape that contains the full backup).

Delta backups are done through the use of the backup bit in all hierarchical file directory entries. If the backup bit is set, the file was not backed up; if it is clear, the file was backed up. Whenever a file is created or modified, the backup bit for that file is set. The B qualifier can be used in a mask to select just those files in the working directory whose backup bits are set.

Backup is performed as follows:

1. Use FST to back up all the files, specifying the Clear option to clear all the backup bits of the files that get saved. This is the full backup.
2. Select only those files that have their backup bits set (This is specified by the B qualifier in the file mask.), again using the Clear option to clear the backup bits. This is the delta backup.

For example:

Friday: FST> ba /important data/@
 1000 files selected; 1000 total
 FST> ti IMPORTANT DATA - FULL BACKUP
 FST> c
 Clear ON
 Verify ON
 FST> go

Monday: FST> ba /important data/@.@.b
 90 files selected; 90 total
 FST> ti IMPORTANT DATA - MONDAY DELTA
 FST> c a (the 'a' is optional)
 Append ON
 Clear ON
 Verify ON
 FST> go

Tuesday: FST> ba /important data/@/@.b
 120 files selected; 120 total
 FST> ti IMPORTANT DATA - TUESDAY DELTA
 FST> c a (the 'a' is optional)
 Append ON
 Clear ON
 Verify ON
 FST> go

Wednesday: etc.

Thursday: etc.

Restoring from Incremental Backups

The SrchApp option can be used to restore selected files from an incremental backup. The SrchApp option will automatically move through each append and search for files to restore.

Using the previous incremental backup example:

```
FST> s
SrchApp ON
Initialize Group restore
Update ON
FST> y
Verify ON
FST> re @.golf
FST> re four@
FST> re @.day
FST> gQ
1 files selected; 1 total

      Tape format:      FST
      Title           :      IMPORTANT DATA - FULL BACKUP
      Created          :      Sat Jun 24, 1989   1:42:14 pm

Copying / IMPORTANT_DATA / NO_GOLF_2.DAY : : : 4 : 2 : 36

Verifying archive

      1 files selected
      1 files restored
      1 files successfully verified.

Positioned at append #1
2 files selected; 2 total

      Tape format:      FST
      Title           :      IMPORTANT DATA - MONDAY DELTA
      Created          :      Mon Jun 26, 1989   12:57:14 pm

Copying / IMPORTANT_DATA / TROYS_SCORES.GOLF : : : 4 : 4 : 36
Copying / IMPORTANT_DATA / FOUR_EYES.ONLY : : : 4 : 1 : 8

Verifying archive

      2 files selected
      2 files restored
      2 files successfully verified.

Positioned at append #2
1 files selected; 1 total
```

```
Tape format:      FST
Title           :   IMPORTANT DATA - TUESDAY DELTA
Created        :   TUE Jun 27, 1989   1:01:03 pm
Copying / IMPORTANT_DATA / TROYS_SCORES.GOLF : : : 4 : 8 : 36
```

Verifying archive

```
1 files selected
1 files restored
1 files successfully verified.
```

```
Positioned at append #0
FST>
```

As an alternative to the `SrchApp` option, you may also choose to use the positioning commands within FST to select the desired append. The FST commands, `NE` (Next), `PR` (Previous), and `PO` (Position), allow the tape movement from one append to another.

The `Update` option only restores a file on the tape if it is newer than the file on the disc. You can use a command file and the `Update` option to devise a general method for restoring just the latest copy of a file.

Using the incremental backup example shown in the previous section, the following general command file example restores a particular file from an incremental backup tape:

```
* Position to the last append (Thursday's)
*
po 4
* Turn on the update and verify options.
Update
Verify
* restore the file (if it's there)
re /important_data/vacation
go
*
* Position to Wednesday's append
*
po 3
re /important_data/vacation
go
*
* Position to Tuesday's append
*
po 2
re /important_data/vacation
go
.
.
.
```

You may also locate the file manually or with a command file, and then position to the correct append and restore the file. The following example shows a command file that is used to find the location of the desired file:

```
d1 /important_data/vacation
ne
d1 /important_data/vacation
ne
d1 /important_data/vacation
ne
d1 /important_data/vacation
ne
d1 /important_data/vacation
```

When you run this command file, you can see which append has the latest copy of the file, position to that append, and restore the file.

Appending Data

Tape appends are individual backups on the same tape. Each append is separated by tape marks on the tape and has its own tape header, comment file, and directory listing. Each append is independent of the others. You may use the Append option to specify a backup as an append to a tape. The NE, PR, and PO commands are used to examine the individual appends on a tape. The maximum number of appends allowed on a single tape is 1023. Appends are not supported when backing up to an archive file. ■

Consecutive Backups

The BA command simply appends to the list of already selected files, regardless of the GO command. GO does not clear the selection of files for BA. If you do not want previously selected files for a backup, you must use the UN command to unselect the files. A common mistake is to select a first set of files and copy them to tape using GO, then select a second set, without exiting FST, and copy them to the tape using GO. Thus, the first files are included with the second files on the second copy, because the first files were never unselected.

Multiple Reels

FST supports multiple reels, but handles them differently than other logical backup utilities. When FST backs up files, it splits them across tape boundaries when it reaches the end of a tape. This lets FST back up single files that are too large for one reel.

To restore a single file from multiple reels requires only the reel or reels on which the file is contained. You need not start with the first reel. For example, if you know a file exists on reel 9 of a backup, you can mount the ninth reel and restore the file without having to mount tapes 1 through 8.

The tape format and DL command help determine where a file exists among multiple tapes. The comment file and directory file are at the front of each reel in a multiple reel backup. When the directory file is written to the second reel, the directory is updated, specifying each file that was written to the first reel. Directory updating is also done on all succeeding tapes. This lets you do a DL command on the last tape of a backup to locate a file on any tape in the multiple reel backup.

The Keep option determines the state of the mounted tape when its end is reached during a multiple reel backup. If Keep is ON, the tape remains on-line/loaded after it is filled. You'll see a message telling you to "Enter 'GO' when a new tape is on-line/loaded." (On-line refers to 1/2 inch magnetic tapes. Loaded refers to CTD tapes.)

If Keep is OFF, the tape is taken off-line/unloaded after being filled. You'll see a message telling you that "FST will continue when the tape is ready (on-line/loaded)."

You can use the Keep option in several ways. Use Keep OFF when loading and unloading on the 35401A AUTOCHANGER. Tapes are unloaded when full, and FST continues when the next tape is loaded. If your terminal is not near the tape drives, you can issue GO from the terminal before the tape is on-line/loaded. If you have set the Yes option ON, you can then walk to the tape drive, ready the tape, and the backup will begin. You need not return to your terminal to issue another command.

Tape Loading

If FST is ready to begin the backup or restore operation but the tape unit is not (for example, if the tape unit is off-line or the tape is not loaded), FST displays one of two messages, depending upon the state of the Keep option, as follows:

- When the Keep option is OFF, the message "Will continue when tape becomes ready" is displayed. FST begins the backup or restore operation when the tape is loaded correctly.
- When the Keep option is ON, a message that gives the state of the tape unit and tells you to "Type 'GO' when ready or 'BR' to terminate" is displayed. FST begins the backup or restore operation when you enter one of the commands.

TF Compatibility

FST can restore from TF formatted tapes with FST command functionality; however, FST has less information about TF formatted tapes than about FST tapes. When FST restores files from an FST tape, it uses the directory file on the tape to restore the files. Since a TF formatted tape does not have a directory file, FST cannot determine the files on the tape as easily. Therefore, when FST restores from a TF formatted tape, it stores the filenames or masks entered with each RE command into a directory file, which it then uses to search the tape and restore the selected files to disc.

Because FST uses a larger buffer and a faster process than TF, it restores from TF formatted tapes faster than TF, even though FST does not stream when it restores from TF tapes. FST creates a partial directory file of the TF tape during the restore pass, so that tape positioning during the verify pass (on a selective restore) is also faster.

The following example illustrates an FST restore operation from a TF formatted tape:

```
CI> fst
FST> re @.ftn
FST> re makefile

FST> go

      Tape format: TF
      Title: TapeTitle
      Created : Mon Feb 28, 1986 9:40:00 am

      Copying file1.ftn
      Copying file2.ftn
      Copying makefile

FST>
```

TAR Compatibility

FST can read and write archives in TAR format; however, due to the differences between the TAR and FST formats, FST functions in a slightly different manner. Like the TF format, the TAR format does not include a directory file and FST cannot immediately determine the files in an archive. For this reason, when FST restores from a TAR archive, the results of the RE command are not reported after each command. Instead, the file names or masks entered with the RE command are saved and used when the tape is searched for the selected files to be restored.

UNIX Compatibility

Generic RTE/UNIX file system differences are discussed in the UNIX compatibility section in the TF section of this manual.

FST cannot restore ASCII files with record lengths greater than 1024 words from TAR archives. Records longer than 1024 words will be split into multiple records with a warning issued for each file containing the long records. When creating TAR archives with FST, there is no restriction on the record lengths for type 4 files; however, when a record longer than 1024 words is encountered, a warning is issued stating that the record will be split upon restoration by FST. Note that the record structure of the file is still intact and TAR will be able to restore the file without splitting the record.

Files on TAR archives whose names would be illegal RTE file names are renamed by FST. The output of a DL command of a tar archive displays the original file name and the new name created by FST. File names containing reserved characters will have the reserved characters replaced according to the following table.

Reserved Character	Replaced by
' ,	_
.	_
,	_
@	*
-	?
:	
>	^
[(

Note that not all periods will be replaced. If the last period in a name will result in a legal RTE type extension, it will be preserved. File names which begin with numbers will be prepended with the underscore character ('_').

To select a renamed file with the RE command, the new file name should be used as the basis for the mask in the RE command. The FST 'DL' command will display the original and new names for any file which will be renamed upon restoration.

Rescuing Files from an Overwritten Tape

It is not uncommon to accidentally overwrite a tape. If the overwritten area is smaller than the original backup, you may use the Faulty option, described earlier in this chapter, to restore the data beyond the overwritten area.

Since overwriting a tape destroys the directory file, FST must try to build a new one from the file headers that can still be found. Once a new directory file is built, the operations associated with a normal restore can proceed.

FST assumes that the overwrite ended with at least one EOF mark. After you set the Faulty option ON, position the tape just past the EOF mark that immediately precedes the point where you want FST to start looking for the data that was not overwritten. Then issue the RE command, with a mask if desired. FST builds the new directory file, displays messages about the status of the process, and provides needed information in case the process fails.

The following example shows how to restore whatever files still remain from an FST backup that was partially overwritten by a TF backup, on a magnetic tape.


```
FST> mt 8
FST> f v
Faulty ON
Verify ON
FST> ne 2
Positioned at append #2
FST> re
FAULTY option ON: Assuming tape being restored is partially corrupted.
Searching for a legal tape record
(sometimes some tape errors are seen here because of parity)
Searching for a valid file header
Scanning tape and building directory file
3 files selected; 3 total
FST> li

f:::4:29:36
g:::3:24:59
h:::4:3:10

FST> go
Copying f:::4:29:36
Copying g:::3:24:59
Copying h:::4:3:10

Verifying tape

FST>
```

It may take a few attempts for you to find the correct file position on the tape, depending upon how many EOF marks actually precede the data you want to restore. If FST reports finding an EOF mark but the process stops, either you did not position the tape to the proper place, or FST did not find any file headers before reaching the next EOF mark.

NOTE

This process involves unusual tape positioning. Do not try to use the DL command when you restore from overwritten tapes. DL tries to read the directory file from the tape, which may disturb the current positioning.

If the original backup required multiple tapes, the file that crossed the tape boundary cannot be fully restored.

Disc Directory File

When FST backs up to or restores from an archive, it creates a directory file, which contains the names of the files specified in the BA or RE commands along with information about each file that FST needs to perform the backup or restore. Although you cannot display the directory file itself, you may use the LI command to display a list of the files in it.

The size of the directory file on the disc LU limits the size of the backup/restore. You may use the DF command to specify the name and size of the directory file and place the directory file on an LU that is large enough for the current operation. If you do not use DF, FST creates its own directory file when it becomes necessary.

Each time you use the BA command, the contents of the directory file increase. In a restore, because FST uses the directory file on the archive, the entire directory file is copied to disc; therefore, you must specify all the disc space needed for the restore with the first RE command. The directory file on disc is purged when you exit FST.

You cannot move a directory file after it is created. Therefore, use DF before you use BA or RE if the default file descriptor is not adequate. Refer to the earlier discussion of the DF command for directory file default information.

Shareable EMA

FST uses shareable EMA (SHEMA) for its tape buffering. Internally, FST uses between two and five 25-page buffers. The more pages supplied, the faster the speed at which FST backs up files and maintains streaming. However, FST does not use more than five 25-page buffers (125 pages of SHEMA) for tape buffering during streaming.

SHEMA is also used to buffer FMGR file information temporarily when BA is used. If the current SHEMA is not large enough for an FMGR backup selection, more SHEMA is required. Because FST uses SHEMA, you cannot run two identical copies of FST at the same time. You must specify another SHEMA partition for each copy of FST. Refer to the section "Installing FST" later in this chapter.

FST Format

Each archive that FST creates contains an archive header, followed by the comment file (if one was selected), and a complete directory of the backup. The individually saved files follow, each one preceded by its header.

Each tape of a multiple tape backup has the comment file and the entire directory file at its head. Each directory maintains the tape number for each file saved on previous tapes. This lets you look at the last tape to determine which tape contains which file.

The format for FST contains all the needed extent information for files. This lets you restore files to the exact needed size, leaving no wasted blocks on the disc, or restore files to their original layout with all the extents or extra space present.

Type 1 and type 2 files are always restored to their original disc format. FMP cannot detect wasted blocks for these types of files or manipulate their extents. For the hierarchical (CI) file system, information such as time stamps and access rights are restored as required.

Replacing Reserved Characters

FST replaces reserved characters in FMGR filenames with non-reserved characters, and sends a message to the terminal or log device/file that the file was renamed. The reserved characters and their replacements are as follows:

Reserved Character	Replaced By
.	*
/	!
@	?
[(
>	^

The following exceptions apply when FST replaces reserved characters:

- A period (.) in the middle of a filename is not replaced.
- If there are multiple periods (...) in the middle of a filename, all but the first period in the group are replaced by asterisks.
- If “[” or “>” is the first character in a filename, it is not replaced.

Recommended System Usage

FST uses a directory file to handle the list of all files to back up or restore. Although this speeds up operations (such as doing a DL of the tape or selectively restoring files), the directory file does take up space on the disc and on the tape. Also, the larger the size of the directory file, the longer some operations take to complete.

To avoid slowing down operations and running out of space on the disc LU on which the directory file is located (or to which it is being restored), follow these guidelines when you plan your backup strategy:

- To back up multiple disc LUs that require multiple tapes, divide the operation into saves that fit on a single tape.
- If one disc LU has thousands of files to be saved, save the LU by itself (That is, do not try to back up other LUs with it.). Note that the saves can be individual appends on the same tape; therefore, the tape is not being wasted, and you do not need to switch tapes.

Streaming

Streaming is supported on the HP 9144 Tape Drive and the HP 7974/7978 and 7979/7980 Magnetic Tape Drives. Streaming is supported only during backups, not during restores. Restore operations, however, imply extraordinary circumstances, such as a corrupt disc or a system that is down, and occur much less frequently than backup operations.

FST is supported on non-streaming tape drives, but its speed is limited to the transfer rate of the tape drive. However, FST performs backups and restores on non-streaming tape drives faster than other backup utilities.

Multiple buffers in SHEMA help provide the streaming capabilities during FST backups. Note that files that were written to the buffer may not be copied to the tape before the end of the tape is reached (even if the “Copying ...” message for such a file is displayed or written to the log/device file). In this case, the files are copied to the next tape and the “Copying ...” message for those files is displayed again. Thus, occasionally a file may appear to have been copied to the end of the first tape and to the beginning of the second tape, when actually it was copied only to the second tape.

Streaming is affected by your disc organization. During a backup, if FST accesses many small, scattered files, or files with many scattered extents, continuous streaming is less likely. The larger the files and the fewer extents, the better streaming is maintained.

Streaming is not supported when you back up files in TAR format. Since the process for obtaining the data to be stored to tape is much slower, streaming should not be expected.

FST Format

The FST format and header basics are shown below.

FST Format:

Tape Header	Comment Header (opt)	Comment File (opt)	Dir. Header	Dir. File
-------------	----------------------	--------------------	-------------	-----------

Header	data	Header	data	...	FileMark	FileMark
--------	------	--------	------	-----	----------	----------

FST Header Basics (in bytes):

001-100	File descriptor
125-136	Size in bytes (Octal ASCII)
137-148	Update time (Octal ASCII)
295-296	Source disc LU
299-302	Size in blocks
303-304	Newfile flag
305-368	Disc directory entry
369-370	Extent number
371-372	More extents flag
418-423	Header type ('FST' for file data)
468-500	Owner's name

Installing FST

Two programs, FST and FSTP, are used to facilitate file backup and restore. FST has primary control of all the commands; FSTP handles I/O to and from the archive. For example, when doing a tape backup, FST fills the tape buffers from the disc, while FSTP copies the buffers to tape. In tape backups, FST and FSTP have just enough priority to maintain streaming without preventing other processes from functioning.

To install FST, first link FST and FSTP using the LINK command files #FST and #FSTP. The SHEMA label in #FST must be a legal SHEMA partition label, and the SHEMA size should be set as large as possible to enhance streaming. Up to a maximum of 125 pages of SHEMA is used for streaming.

Use the EM command in the LINK program to specify the SHEMA size. Only #FST must be changed to specify the proper SHEMA labels and size. Place both run files on directory /PROGRAMS or on an FMGR cartridge.

The file >FS000 must be located on the global directory /CATALOGS. If /CATALOGS does not exist, >FS000 can be placed on an FMGR system cartridge.

Because FST uses SHEMA, only one unique FST program can use a particular SHEMA partition at a time. All other FST programs that attempt to access the same SHEMA partition abort with a value of -2 in the CI variable \$RETURN1, and the following message is displayed:

```
My SHEMA partition is already in use.
```

For additional copies of FST, relink each new copy of FST.RUN, specifying a different SHEMA label for each copy. You can set up a transfer file to use the -2 value in \$RETURN1 to select an unused copy of FST automatically.

FST Error Handling

Tape and disc accesses are monitored so that errors can be captured without aborting FST. When you run FST interactively, most errors cause a return to the FST prompt.

The directory file and all specified options remain intact if an error occurs. When you run FST programmatically, errors return a value of -1 in the CI variable \$RETURN1. If the necessary SHEMA partition is already in use, FST aborts with a value of -2 in \$RETURN1.

If an error causes FST to abort a backup or restore operation and return to the FST > prompt, directory information is not lost. You can reenter the GO command to restart the operation without reselecting the files. We recommend that you use log files for all backups and restores. Errors may occur even when all the specified files are copied.

FST Error Messages and Warnings

The following error messages and warnings may be displayed when you perform a backup or restore using FST:

Aborting FST

FST is being terminated because of a previously reported error.

Appending is not allowed when creating UNIX TAR tapes

The append option was specified for creating a TAR tape, but appends can be done only to FST tapes.

Appends are only allowed on FST tapes

The tape must be in FST format in order to append to it.

Appends are not allowed with archive files

Appends can only be made to FST backups on tape.

Archive file is corrupt: < filename >

While reading the archive file, FSTP encountered a FMP -12 error and could not continue.

Archive file is not type 1: < filename >

Archive files must be type 1 files. TAR archive files transferred from UNIX machines via FTP must be transferred as binary files.

Break command: process aborted

The current process was aborted because the break flag was set.

Cannot access the log file/device: < filename or LU >

The selected log file/device is not available for use.

Cannot append to the log file: < filename >

The append positioning for the log file was unsuccessful.

Cannot backup: < filename >

A selected file could not be saved to tape successfully.

Cannot backup sparse files across DS: < filename >

You cannot back up sparse files (files with missing extents) across a DS link.

Cannot call a transfer file from a transfer file

The current transfer file contains the FST command to access another transfer file. Transfer files cannot be nested.

Cannot clear backup bit: < filename >

FST could not clear the backup bit of the file backed up or restored.

Cannot create group scratch file. Unable to set SrchApp option

The SrchApp option enables a group restore and 'RE' selections are stored in a scratch file for use during the append search.

Cannot determine the density

The current tape density cannot be determined with the SD command.

Cannot find the directory file on the tape

The directory file could not be located on the tape during tape backup verification.

Cannot find this tape header: < filename >

Incorrect positioning of the tape occurred while searching for a file header. Note that if this error occurs, there is a potential problem with FST.

Cannot lock the tape LU

FST was not able to lock the tape LU.

Cannot create the directory file

The directory file used for file selection could not be created.

Cannot open the archive file: < filename >

The archive file specified in the MT command could not be opened.

Cannot open the selected comment file

FST is not able to open and use the selected comment file.

Cannot open transfer file

FST could not open the specified transfer file.

Cannot position to beginning of data

A rewind to the beginning of an append on a magnetic tape failed. FST did not return to the beginning of the tape append.

Cannot purge: < filename >

FST could not purge the file that was backed up.

Cannot purge the old < filename > in order to rename its replacement

When FST restores a duplicate file to disc, it first copies the file from tape to a scratch file on disc, and gives it a temporary name. If that copy operation is successful, FST purges the original file on disc, and renames the scratch file with the original filename. If FST cannot purge the original file, it cannot rename the scratch file with that filename. In other words, the original file on disc cannot be updated until the old contents can be purged.

Cannot restore: <filename >

FST could not restore a selected file from tape successfully.

Cannot restore <filename > from this tape. It is on tape <tape # > (tape <tape # > is mounted)

The mounted tape belongs to a multi-tape backup, and the selected file exists on a previous tape.

Cannot restore linked files: <filename > linked to <filename >

FST does not restore UNIX hard links or symbolic links from TAR archives.

Cannot restore UNIX device files: <filename >

FST does not restore UNIX device files from TAR archives.

Cannot select file for backup: <filename >

The specified file could not be selected for backup.

Cannot set TAR format: the most recent file selection is from a non-TAR archive. Unselect all files and load a TAR archive for TAR file restoring.

The TAR option cannot be turned on when the currently selected files are from a non-TAR archive.

Cannot successfully rename the restored file <scratch file > to <filename >

When FST restores a duplicate file to disc, it copies the file from tape to a scratch file on disc and gives it a temporary name. If the copy from tape to the scratch file is successful, FST purges the original file on disc, and renames the scratch file with the original filename.

Cannot turn OFF TAR format: the most recent file selection is from a TAR archive. Unselect all masks and load the correct archive for non-TAR use.

The TAR option cannot be turned OFF when the currently selected files are from a TAR archive.

Class I/O between FST and FSTP confused. Current instruction aborted

There is miscommunication between the father program, FST, and the son program, FSTP, during Class I/O. The current instruction is aborted. If this error occurs, there is a potential problem with FST.

Corrupt comment file on disc

FST cannot obtain the necessary disc information to copy the comment file to the tape.

Corrupt comment file on tape

Corrupt records in the comment file were detected during a listing of the comment file.

Corrupt file. Cannot select: <filename >

The file selected for backup is corrupt.

CTD tape is not initialized

The loaded cartridge tape must be formatted before it can be used.

Directory file failed verify

The directory file failed the verify pass of the backup. This could mean that the directory file became corrupt during the backup operation.

Directory file is corrupt. File selection lost and directory file being purged

The directory file is assumed to be corrupt because the positioning within the directory file failed. The directory file is purged and all previous file selection is lost.

Disc error: Unable to load FST segment

FST was not able to load the needed segment of code.

EMA full. Need to process REstore commands with a GO before continuing.

The number of TF or TAR Restore commands exceeded the EMA limit. Execute the current Restore commands by issuing a GO command; then enter the additional RE commands.

Encountered EOF. Search quitting.

An EOF mark was encountered before any legal file header during an attempt to build a new directory file with the Faulty option.

Erasing the current backup from the tape

The backup in progress is corrupt. A filemark is placed on the tape where the backup began to show that the data following is not valid. The next backup to that tape will begin at that filemark, and the corrupt data will be overwritten.

ERROR: Grouping was never begun.

GR was not entered to begin grouping a set of RE commands, but another grouping command (for example, EG or AG) was entered. You must enter GR before entering other group commands.

Error reading transfer file

FST could not read the next command from the command file successfully.

Error scheduling FSTP:

An FMP error occurred while trying to RP FSTP.

Error scheduling < FSTP rp'd name >: ID segment gone

FSTP was terminated during initialization.

Error scheduling < FSTP rp'd name >: <xxxx> violation

FSTP could not be scheduled successfully.

Error using group scratch file. Cannot process SrchApp option.

The SrchApp option enables a group restore and 'RE' selections are stored in a scratch file for use during the append search.

Extent header missing from archive

FST was expecting the next header on the archive to be for a particular extent, but it was not.

FC tape format: unhandled by FST

The mounted tape is in FC format, which FST does not handle.

File cannot be selected for TAR text conversion: <filename >

The specified file is either inaccessible or corrupt for a TAR ASCII backup.

File failed verify: <filename >

The file on the tape failed to verify (compare identically) with the same file on the disc.

File restored, but not with proper TEXT data: <filename >

The restored TAR file was found to be corrupt on the tape. It was probably a binary file and should not have been restored in ASCII format.

FMP ERROR: <error message >

A report of an error returned from FMP.

FMP ERROR: <error message > - <filename >

A report of an error returned from FMP with the related filename.

Grouping not allowed for non-FST archives

You entered GR to group a set of RE commands when restoring a non-FST archive. Grouping is allowed only for FST archives.

Illegal density

An invalid density was specified with the SD command.

Incorrect usage of command

Incorrect parameters were supplied for an FST command.

Insufficient free space available, size up FST

Free space in the program used for internal buffering is not large enough.

LU <#> is already locked

A mask, with the lock option ON, specified a disc LU that is already locked.

Multiple failures. Search quitting.

While attempting to recover data from an overwritten tape, a good record could not be found.

Need at least 50 pages of EMA to run

Not enough shareable EMA space was linked with FST for proper execution.

No comment file exists on this archive

No comment file exists; therefore, none can be listed with the LC command.

No files selected yet

No files can be backed up, restored, or listed because no successful file selection was completed.

No RNs available: Cannot lock LU <#>

No resource numbers are available to lock the disc LU.

No such archive file: <filename >

The archive file specified in the MT command could not be found.

No tape LU has been selected

A command requiring a specified tape LU was entered, but a legal tape LU was not selected.

Non-FST append found on tape: appending cannot continue

An append to a tape with non-FST data was attempted. FST appends are only allowed on tapes that have all their appends in FST format.

Not a legal tape unit

The MT command was used to specify an illegal tape LU.

Not enough disc space for the archive file: <filename >

The archive file specified in the MT command could not be created in the specified directory. Locate the archive file on a disc with more free space.

Not enough room on this tape to hold the backup. Try another tape.

The mounted tape is too short to hold the current backup directory file and/or comment file.

Not updating: <filename >

The specified file is not being restored because it is older than the disc copy and the Update option is ON.

Option or ON/OFF expected: <unrecognized command >

An illegal word was supplied in an option setting command string.

Owner not set for <directory name >

The original ownership could not be successfully restored to the specified directory.

Protection not set for <filename >

The original read/write protection could not be successfully restored for the specified file.

Setting tape density unsuccessful

The density of the tape unit could not successfully be set to the specified value.

SrchApp mode is available only for FST tapes

The SrchApp mode can be used only when restoring FST tapes.

Tape channel error

The CTD returned a channel error.

TAPE ERROR: < error code >

A tape instruction returned on the no-abort/no-suspend path with the error code in the A- and B-registers.

Tape FAULT error

The CTD returned a fault error.

Tape headers do not match

The wrong tape is mounted for a multiple tape restore.

Tape is not on-line

The mounted tape is off-line.

Tape LU is down

The tape LU is down.

Tape not ready

The cartridge tape drive unit is not ready for tape access. (For example, the tape may be unloaded or positioned to the load point.)

Tape sequence wrong: Tape <#> loaded, tape <#> expected

The sequence of tapes mounted during a multiple tape restore operation is incorrect. The mounted tape belongs to the current multiple tape backup, but is out of sequence.

Tape status error

The error bit was set in the A-register when returning from a tape request call.

Tape write-protected

Files cannot be copied to a write-protected tape.

TAR and non-TAR formats cannot be mixed for backup. Current files must be unselected before TAR format can be used.

The TAR option was turned ON for backup after files were already selected without the TAR option. The formats cannot be mixed.

TAR and non-TAR formats cannot be mixed for backup. Current TAR files selected must be unselected before TAR format can be turned OFF.

An attempt was made to turn the TAR option OFF after files were already selected with the TAR option. The formats cannot be mixed.

TAR selection was used, but the archive is not in TAR format.

The TAR option was turned ON, but the archive is not in TAR format.

The current append is not an FST backup

The tape has been positioned to an append that is not in FST format.

The directory file is already open: cannot assign a new one.

The DF command cannot be used once the directory file has been opened. Note that the UN command can be used to purge the current directory file, but all selected file information must be reselected.

This is not the original tape on which the restore was initiated

A different tape was mounted since the restore operation began. For a restore, FST reads the directory file on the tape during the file selection process. When the GO command is entered, the original tape must still be mounted for a successful restore.

Too many appends specified, tape positioned at last one

There are no more appends on the tape. The tape is still positioned at the last append.

Too many files on this cartridge; size up your EMA

The Extended Memory Area (EMA) is too small for the current file selection for backup from an FMGR cartridge. The EMA must be increased in order to execute it.

Unknown command

The command you entered was not recognized by the program.

Unknown tape format

The mounted tape has a tape format that FST does not recognize (That is, it is not in FST, TF, or TAR format.).

Unrecoverable data tape error

The CTD returned an unrecoverable data error.

Unsuccessful path creation

The path of a selected file did not exist and FST could not successfully create the path during a restore operation. The file was not restored.

**Warning: <filename> contains record lengths > 1024 words.
File saved in TAR mode. (FST will split records during restore.)**

A file was saved in TAR format archive which has records with lengths greater than 1024 words. The file was successfully saved in TAR mode; however, a warning is issued because if FST restores this file, the long records will need to be split. (If TAR is used to restore this file, the records will still be intact.)

**Warning: <filename> contains record lengths > 1024 words.
FST had to split records during restore of TAR text file.**

While trying to restore a file from a TAR format archive, FST encountered a text file with records greater than 1024 words in length. FST will split records after every 1024 words in a record.

**Warning: Illegal FMP name: <illegal filename>
Renamed to : <new filename>**

While reading a TAR format archive, FST encountered a filename which would be an illegal filename. FST will rename the file to a legal filename.

Warning: remainder of command line discarded

Only the commands that precede a TR command, and TR itself, are executed.

Warning: Restore selections cleared

The current append position was changed, so all selected files from there are unselected.

***** Warning *** TAR setting is still on from the restoring. Selected files will be backed up with TAR mode.**

The TAR option is still ON after selecting a TAR archive. Backed up files will be in TAR format.

<xxx> violation when locking LU <#>

An error occurred when trying to lock a disc LU.

Manual Part No. 12016-90003
Printed in U.S.A. September, 1991
U0991

