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Using
FS_RECOVER

Using FS_RECOVER

Fourth Edition

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This manual documents the software operation of the PRIMOS operating system on 50 Series computers and their supporting systems and utilities as implemented at Master Disk Revision Level 23.2, 23.3, and 23.4.

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About This Book

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This book documents Version 5.0 of the FS_RECOVER utility. System Administrators use this utility to reduce the time for file system recovery after a system crash. The object of FS_RECOVER is to reduce the time to recover by eliminating the need to run FIX_DISK on partitions that do not need to have FIX_DISK run on them. FS_RECOVER works in conjunction with AUTOPSY to analyze crash dumps and determine the integrity of the file system.

FS_RECOVER Version 5.0

This manual describes the operation of FS_RECOVER Version 5.0, for use under PRIMOS Revisions 23.2 and later. A major change at Version 5.0 is that FS_RECOVER now supports (and encourages the use of) Online FIX_DISK. Under PRIMOS revisions which support Online FIX_DISK, you may use FS_RECOVER to repair disk partitions online or offline, as circumstances dictate. Under earlier PRIMOS revisions, FS_RECOVER continues to function as it did in the past, running Offline FIX_DISK only. PRIMOS revisions which support Online FIX_DISK are:

- PRIMOS Revs. 23.4 and later

- In the United States, PRIMOS Revs. 23.3.0.R33 and later

- In Australia, PRIMOS Revs. 23.3.0vC and later

- In the United Kingdom, PRIMOS Revs. 23.3.0b and later

If you are running any of these PRIMOS revisions, FS_RECOVER automatically assumes Online FIX_DISK is available on your system. (This decision is based on analysis of the PRIMOS revision stamp; if your system is running a non–standard PRIMOS which supports Online FIX_DISK but has a revision stamp with a different style from any of those in the list above, you should always invoke FS_RECOVER with the –OLFD option.)

Throughout this book, the phrase "if Online FIX_DISK is available" should be understood as a brief way of referring to any revision of PRIMOS that supports Online FIX_DISK, as discussed in this section.

Other Useful Books

FS_RECOVER is one of a group of utilities and operating system features specifically designed to increase the Reliability, Availability, and Serviceability (RAS) of your 50–Series system. To use FS_RECOVER effectively, you should be familiar with the following books:

- *RAS Guide for 50 Series System Administrators* (DOC13156-1LA) describes the RAS design philosophy and how the RAS features and utilities fit together. It covers topics such as: halts and hangs, and how to recognize and deal with them; how to take crashdumps; how to plan for, configure and use the utilities RFS, CDD, SYSTEM_RECOVER, and FS_RECOVER.

- *Rev. 23.2 Software Release Document* (DOC10001-9PA) describes features added to PRIMOS at Rev. 23.2, including some features related to FS_RECOVER such as a new run vector for tape dumps, and system recovery features (SYSTEM_RECOVER and CDD).

- *Rev. 23.3 Software Release Document* (DOC13134-1PA) describes features added to PRIMOS at Rev. 23.3, including further documentation of CDD such as the –INFO option which is essential for the correct configuration of crash dump disks.

- *Rev. 23.4 Software Release Document* (DOC13134-002) describes features added to PRIMOS at Rev. 23.4. New features for the user and programmer include the LIST_DISKS command, Spooler enhancements that log operator requests, and the ability to suppress the first form feed of a print job. New features for the Operator and Administrator include new BATCH and CONFIG_USERS commands.

The following books may also be of help in using FS_RECOVER:

- The handbook for your CPU explains the operation of your system, including how to handle halts and hangs and how to perform crash tape dumps.

- *Operator's Guide to File System Maintenance* (DOC9300-3LA or later version) describes the PRIMOS® file system and explains how to format disk partitions, run the disk partition maintenance program (FIX_DISK), determine physical device numbers, and interpret disk error messages.

- *Operator's Guide to System Commands* (DOC9304-3LA or later version) serves as a reference guide for most of the operator commands that you will need.

- *DSM User's Guide* (DOC10061-1LA or later version) explains how to use the Distributed Systems Management software, including how to administer and display logs and how to manage a group of systems on a network.

Documentation Conventions

The following conventions are used throughout this document. The examples in the table illustrate the uses of these conventions.

Convention	Explanation	Example
Uppercase Bold	In command formats, words in uppercase bold indicate the names of commands, options, statements, and keywords. Enter them in either uppercase or lowercase.	**SLIST**
Italic	Variables in command formats, text, or messages are indicated by lowercase italic.	**LOGIN** *user-id*
Abbreviations	If a command or option has an abbreviation, the abbreviation is placed immediately below the full form.	**SET_QUOTA** **SQ**
Monospace	Identifies system output, prompts, messages, and examples.	`address connected`
Underscore	In examples, user input is underscored but system prompts and output are not.	`OK, RESUME MY_PROG`
Hyphen	Wherever a hyphen appears as the first character of an option, it is a required part of that option.	**SPOOL –LIST**
Ellipsis	An ellipsis indicates that you have the option of entering several items of the same kind on the command line.	*pdev-1* [... *pdev-n*]
Brackets	Brackets enclose a list of one or more optional items. Choose none, one, or several of these items.	**CDD –HELP [–INFO]**

What Is FS_RECOVER?

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This chapter describes

- The effect a crash can have on your file system

- What FS_RECOVER does

- What FS_RECOVER does with a crash dump

- Using FS_RECOVER without a crash dump

- Considerations when using FS_RECOVER

The Effects of a System Crash on Your Partitions

A system crash is an unexpected event. It can happen while PRIMOS is updating or changing the file system. If it does, it may be impossible to access some or all of the files on the partitions that were active at the time of the crash. The only way to to correct this problem is to run FIX_DISK on the affected partitions.

Note The term *file system*, as used here, refers to the data structures used by PRIMOS to find all the records for files on a partition.

What Does FS_RECOVER Do?

The main goal of FS_RECOVER is to reduce file system recovery time following a system crash. This allows you to make the file system available to users sooner. FS_RECOVER can assess the general state of your file system and provide an automated interface to FIX_DISK, even if your system has not crashed. If your system did crash and you took a crash dump, you can use FS_RECOVER to read and analyze the crash dump.

FS_RECOVER determines

- Which partitions need to be fixed *immediately*

- Which partitions need fixing that can be *deferred* to a more convenient time

- Which partitions were unaffected by the crash

FS_RECOVER also determines the correct FIX_DISK options for those partitions that must be fixed immediately and provides an automated facility for running FIX_DISK.

If your system has not crashed or if your system crashed but you did not take a crash dump, you can use FS_RECOVER to assess the general state of your partitions. FS_RECOVER determines which partitions are damaged and which partitions are *clean*. (The term *clean partition*, as used here, refers to a partition that does not cause PRIMOS to generate a warning message at the time it is mounted, or added. Refer to Appendix C for a listing of these warning messages.)

FS_RECOVER also determines the correct FIX_DISK options for the damaged partitions and provides an automated facility for running FIX_DISK.

What FS_RECOVER Does With a Crash Dump

If your system crashes you should always take a crash dump. Crash dump to disk (CDD) is preferable, because it is faster; but FS_RECOVER can also work with a tape dump.

You should use FS_RECOVER to analyze the dump as soon as possible after rebooting the system, *after* mounting all local partitions, but *before* starting any disk mirrors or allowing users to log in. It is recommended that you achieve this by invoking INIT_RECOVER.CPL from your PRIMOS.COMI as described in Chapter 2. The advantage of INIT_RECOVER is that it can automate the entire process of recognizing the existence of a CDD dump needing analysis, invoking FS_RECOVER to analyze the dump, and performing the necessary FIX_DISKs, all without any operator intervention.

If you took your crash dump on tape, you can still use INIT_RECOVER as a convenient way to analyze the dump and run automated FIX_DISK. The INIT_RECOVER command in your PRIMOS.COMI should include the –PAUSE option. This causes INIT_RECOVER to pause for a while to allow you to type Control–P to enter FS_RECOVER. On entering FS_RECOVER use Main Menu Option 1 to read the tape dump into a disk file, and then Main Menu Option 2 to analyze the dump and run automated FIX_DISK. The cold start continues automatically after FS_RECOVER has initiated the necessary FIX_DISKs.

If you do not use INIT_RECOVER at all, and you are cold starting after a crash, you should interrupt the cold start and invoke FS_RECOVER manually to analyze the crash dump. Pause the cold start with CO –PAUSE in PRIMOS.COMI, or by typing Control–P. Invoke FS_RECOVER, then proceed as described in the preceding paragraph. When FS_RECOVER has finished, continue the cold start manually.

Whichever of the above methods you use, when you have a crash dump you should always run FS_RECOVER to analyze the dump. You are recommended to use crash dump to disk and INIT_RECOVER whenever possible, because they reduce downtime and simplify the procedures.

FS_RECOVER uses the crash dump as part of its recovery analysis, the ultimate goal of which is to determine which partitions on the system need FIX_DISK before the cold start is allowed to continue. FS_RECOVER uses two main sources of information for this analysis:

- The crash dump itself, which contains detailed information about what was happening on your system at the time of the crash

- The *current* state of the disk partitions

The current state of the disk partitions is available only if each disk is mounted (this is why it is important to ensure that all local partitions are mounted before invoking FS_RECOVER). The current state information is merged with the crash dump information to form a recommendation for each partition that was mounted at the time of the crash; this is why it is important to ensure that all local partitions are mounted before you invoke FS_RECOVER.

When analyzing the crash dump, FS_RECOVER looks for three types of information, as follows:

Crash type	The type of crash, which affects the types of recommendations FS_RECOVER makes for running FIX_DISK, is determined from the machine state.
Activity	FS_RECOVER identifies file system activity at the time of the crash in order to indicate where damage to the integrity of the file system may be.
Prior corruption	FS_RECOVER looks for any information that might indicate that file system damage existed *prior* to the crash, such as flag bits set in the DSKRAT indicating that a disk was not cleanly shut down on some previous occasion. However, there is no guarantee that indications of prior damage can be detected in the crash dump; it is therefore essential to keep your partitions clean and healthy.

Generally, FS_RECOVER analyzes all this information in less than 10 minutes.

After the analysis is complete, FS_RECOVER prints a recommendation for each partition that was mounted at the time of the crash. Each recommendation includes three pieces of information:

- A list of pathnames for any files on the partition that were active at the time of the crash. The pathnames may or may not be complete, depending on the amount of file system information in the PRIMOS locate buffers at the time of the crash.

- A statement telling you

  o If FIX_DISK needs to be run on the partition

  o What FIX_DISK options should be used

  o Whether you should run FIX_DISK immediately or if you can defer running FIX_DISK to a more convenient time

  A facility is provided to change the FIX_DISK recommendation, should you decide to do so.

- If a partition was mirrored, the recommendation will tell you which half of the mirrored pair is to be used as the primary when you restart the mirror with the MIRROR_ON command.

When the recommendations are complete, FS_RECOVER begins a setup dialog in which it prepares to start phantoms to run the necessary FIX_DISK sessions. FS_RECOVER queries you for such optional services as stopping and restarting the Login Server. It creates CPL programs and control files for use by the phantoms, and determines how many phantoms are needed to execute all the CPL programs, taking into account the number of available phantoms, the number of FIX_DISK sessions required, the number of disk drives containing partitions requiring FIX_DISK, and the PRIMOS limit on the number of assignable disks.

FS_RECOVER then tells you how many phantoms are required, and asks you how many phantoms you wish to use. After you have made that decision, FS_RECOVER creates a phantom called the FIX_DISK Monitor that controls the phantoms which perform the FIX_DISK sessions. These phantoms keep separate, date stamped, como files for each FIX_DISK session so you can monitor their progress and results.

The FIX_DISK monitor phantom remains logged in until all FIX_DISKs are complete. However, if Online FIX_DISK is available (see page ix) and all FIX_DISKs are being performed online, FS_RECOVER terminates itself immediately. If being run from INIT_RECOVER.CPL, it allows the cold start to continue, while Online FIX_DISKs run simultaneously in the background.

If some or all FIX_DISKs are performed offline (either because Online FIX_DISK is not available, or offline FIX_DISK was specifically requested), FS_RECOVER does not terminate until all offline FIX_DISKs are complete. While the offline FIX_DISKs are proceeding, FS_RECOVER remains in a paused state. The DISK_MANAGER software is enabled at the system console

in order to execute commands such as ASSIGN and ADDISK for the FIX_DISK phantoms. When all offline FIX_DISKs are complete, the FIX_DISK monitor phantom automatically disables the DISK_MANAGER software. FS_RECOVER terminates, and the cold start then continues.

While the DISK_MANAGER is running, the system console is available for limited use by the operator (as discussed later in Chapter 3).

In summary, note that Online FIX_DISK can considerably reduce the time taken to recover your system to a fully operational state. Offline FIX_DISKs require the cold start to be paused while the DISK_MANAGER runs at the system console, and until the partitions being repaired offline can be mounted again. If all partitions needing repair are fixed using Online FIX_DISK, this delay is eliminated.

Using FS_RECOVER Without a Crash Dump

You can use FS_RECOVER at any time (not just at cold start), to assess the general health of your locally mounted partitions. If any of these partitions are damaged, FS_RECOVER asks if you want to run FIX_DISK on the damaged partitions. If you answer YES, FS_RECOVER sets up for automated FIX_DISK the same way it does for a crash dump recovery analysis.

This means you can use FS_RECOVER at cold start without a crash dump. For example, if you just had a system crash but were unable to get a crash dump, you can take advantage of the automated FIX_DISK facilities of FS_RECOVER. You can also identify and repair partitions that had a defer recommendation from a previous crash dump analysis.

Considerations When Using FS_RECOVER

The crash dump recovery analysis portion of FS_RECOVER works best if you use it immediately after each crash. FS_RECOVER may not work correctly if you attempt to analyze an old crash dump or a crash dump that was taken before other crashes.

The following are other considerations for using FS_RECOVER:

- FS_RECOVER cannot always display the full pathnames of every file affected by a crash. The pathnames are generated using the contents of the Locate buffers found in the crash dump. The more pathname information found in the Locate buffers, the more complete the pathnames FS_RECOVER can display. Pathnames cannot be generated for CAM files on robust partitions.

- The automated FIX_DISK facilities of FS_RECOVER cannot be used to repair the command device (COMDEV) for PRIMOS revisions prior to Online FIX_DISK. File system damage on the command device must be repaired by running FIX_DISK with the –COMDEV option at the system console.

- FS_RECOVER cannot be run by phantoms.

Installing FS_RECOVER

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This chapter discusses installation of FS_RECOVER on your system, including any changes you may have to make to the system.

The Installation Tape

Computervision® distributes FS_RECOVER on a standard 1600-bpi, MAGSAV-format tape. Mount the tape on any tape drive and restore the contents into any convenient partition. Restoring the tape contents creates a directory named FS_RECOVER, which contains about 1500 disk records. You install FS_RECOVER from that directory.

Using FS_RECOVER.INSTALL.CPL

To install FS_RECOVER, attach to the FS_RECOVER directory and execute the FS_RECOVER.INSTALL.CPL file. The installation file copies FS_RECOVER>SYSTEM_DEBUG* to a top-level directory named SYSTEM_DEBUG* on your command device (COMDEV). If you have several command devices, you may want to modify FS_RECOVER.INSTALL.CPL to install FS_RECOVER on all of them. The installation process also copies two new search rules files into SEARCH_RULES* and sets ACLs on SYSTEM_DEBUG*.

Note   If FS_RECOVER was previously installed on your system and you modified any of the CPL programs in SYSTEM_DEBUG* or SYSTEM_DEBUG*>CRASH, save copies of these before the installation so they won't be overwritten. However, since all FS_RECOVER CPL programs have been substantially revised for Version 5.0, do not use edited CPL programs from a previous revision. Any changes you wish to make should be reevaluated and recoded if still necessary.

If you are installing FS_RECOVER on a system where FS_RECOVER already resides, be sure to delete (or deactivate) all EPFs belonging to that previous version before using the new FS_RECOVER. To do this, issue these commands after executing FS_RECOVER.INSTALL.CPL:

```
OK, attach system_debug*
OK, delete @@.rp+
```

If the result is an error message similar to this:

```
EPF file not active for this user. Unable to remove file
"DISK_MANAGER RPO" (remepf$)
```

find the users for whom the EPFs in question are active, and have them use the REMEPF or ICE command. However, if the EPFs in question are DISK_MANAGER_LIBRARY or AUTOPSY (which are installed in the system's ENTRY$ search rules), this may not be possible. The best approach, then, is to type **ICE** at the system console, and at any other terminal where you want to run the new FS_RECOVER. Delete the RPO files after the next cold start.

Changes to Search Rules

FS_RECOVER uses four search rules files:

AUTOPSY.SR
MAPS.SR
COMMAND$.SR
ENTRY$.SR

The FS_RECOVER.INSTALL.CPL file automatically installs the first two files in SEARCH_RULES*. The last two search rules files are part of standard PRIMOS and already exist. The installation modifies these two files as follows:

- The COMMAND$.SR search rule defines where PRIMOS looks for external commands. The default is the directory CMDNC0 on the COMDEV. The installation adds SYSTEM_DEBUG* to the list so that, as a minimum, COMMAND$.SR contains CMDNC0 and SYSTEM_DEBUG*.

- The ENTRY$.SR search rule defines where PRIMOS looks when it attempts to resolve a dynamic link. The installation adds these rules:

    ```
    SYSTEM_DEBUG*>AUTOPSY.RUN
    ```

    ```
    SYSTEM_DEBUG*>DISK_MANAGER_LIBRARY.RUN
    ```

ACL Requirements

FS_RECOVER contains security checks to prevent unauthorized users from running it. The principal authorized users are the system console and the System Administrator.

FS_RECOVER may also be invoked by any user named SYSTEM or any user in the ACL group .RAS$. It is recommended that you do not allow these users to run FS_RECOVER often; if you do, you should preferably be using PRIMOS Rev. 23.3 or later. The reason for this recommendation is that the lesser privilege of these users makes for increased operational complexity in any FIX_DISK phantoms they create. In particular, CDD commands cannot be issued by these users or by phantoms which they create: in some circumstances a phantom started by FS_RECOVER to perform offline FIX_DISK on an activated crashdump disk may abort because it has insufficient privilege to recognize the disk as activated for CDD, and subsequently fails to take the correct steps to assign the disk. To avoid such problems you should upgrade to PRIMOS 23.3 or later, and preferably use Online FIX_DISK on any disk activated for CDD.

Note that Online FIX_DISK requires a user who lacks console or administrator privileges to belong to the .RAS$ group. If the System Administrator name is *not* SYSTEM but you want to allow a user called SYSTEM to use FS_RECOVER, you must ensure that the profile of user SYSTEM includes the .RAS$ group. Otherwise FS_RECOVER, when executed by user SYSTEM, would start phantoms which lacked the right to use Online FIX_DISK.

Note   On any system where FS_RECOVER is used, the user profile for SYSTEM must specify at least one ACL group (any group will do). This requirement is due to a peculiarity of the PRIMOS IPC (Inter–Process Communication) mechanism used by the DISK_MANAGER, and is necessary for successful communication between FIX_DISK phantoms and the DISK_MANAGER software that runs at the system console.

FS_RECOVER requires that the directory SYSTEM_DEBUG* and its subdirectories have ACLs granting ALL rights for the System Administrator, user SYSTEM, and the .RAS$ group. These ACLs are set automatically by FS_RECOVER.INSTALL.CPL when you install FS_RECOVER.

If you are using some directory other than SYSTEM_DEBUG*>CRASH for crashdumps (see the section below about the CDD_AUTO_CONFIG file), ensure that this directory has the same ACLs as SYSTEM_DEBUG*>CRASH. In doing this, remember that all parent directories of the dumps directory will require ACLs that allow users of the dumps directory to attach there (that is, Use rights as a minimum).

You should also ensure that the ACLs on the MFDs of all local partitions on your system give LUR rights to any user allowed to execute FS_RECOVER. This is because FS_RECOVER needs to be able to read the DSKRAT of each partition.

Segment Requirements

The user ID SYSTEM and the System Administrator's ID must be configured for at least 128 dynamic segments. Failure to provide this minimum limit may cause unpredictable results. When you invoke FS_RECOVER, it checks the number of dynamic segments configured and prints warning messages if the number is too small.

Changes to PRIMOS.COMI

To complete the installation of FS_RECOVER, you must change your PRIMOS.COMI file to include an INIT_RECOVER command of the form:

resume SYSTEM_DEBUG*>INIT_RECOVER.CPL *options*

The options to use are discussed in later sections of this chapter. You should place the INIT_RECOVER command in PRIMOS.COMI *after* all local disk partitions are mounted but *before* users are allowed to log in. For example:

```
STI -TZ 0500 -DLST YES                     /* Set up time-zone information.
R SYSTEM>ADD_DISKS.CPL                     /* Mount local disks.
R SYSTEM_DEBUG*>INIT_RECOVER -AA -AR -PAUSE  /* Invoke FS_RECOVER, if needed.
START_DSM                                  /* Start up DSM.
MAXUSR                                     /* Allow user logins.
```

Note   Using INIT_RECOVER.CPL makes it unnecessary to include CDD or SYSTEM_RECOVER commands in PRIMOS.COMI, as described in the next section.

The purpose of the INIT_RECOVER options used above is described in the next section.

It is best to add robust partitions using the –FORCE option with the ADDISK command. If a robust partition was not properly shut down, the ADDISK will not succeed if you omit –FORCE, and FS_RECOVER will not be able to analyze the state of the partition completely. Using –FORCE causes the robust partition to be added in read–only mode if it was not properly shut down; the read–only mode means FS_RECOVER cannot repair the partition online, but FS_RECOVER can analyze the state of the partition fully and then initiate offline repair.

Automated Recovery — Using INIT_RECOVER.CPL

If you use FS_RECOVER at all, it is recommended that you place the INIT_RECOVER command in your PRIMOS.COMI (as illustrated in the preceding section), using the –PAUSE option as an absolute minimum.

It is also recommended that you configure at least one CDD disk on your system to provide for crashdump to disk in the event of a crash, and create the CDD_AUTO_CONFIG file described below. Creation of this file causes INIT_RECOVER to perform actions that will reduce the time needed to restart your system, as well as simplifying and automating the management of your CDD disk(s). These actions include automatic recovery of any unrecovered dumps, and automatic activation of a CDD disk.

Note This section assumes knowledge of the CDD and SYSTEM_RECOVER commands, and their role in the RAS philosophy described in the *RAS Guide for 50 Series System Administrators* (DOC13156-1LA). For usage information, please refer to the *Rev 23.3 Software Release Document* (DOC13134-1PA), and the *Rev. 23.2 Software Release Document* (DOC10001-9PA).

Overview of INIT_RECOVER Actions

INIT_RECOVER supports three options which may be used in any combination:

–AUTO_RESTART or –AR

–AUTO_ANALYSIS or –AA

–PAUSE [*seconds*]

Certain features of INIT_RECOVER are triggered *not* by specifying one of these options but by creating the file SYSTEM_DEBUG*>CRASH> CDD_AUTO_CONFIG (hereafter referred to more briefly as CDD_AUTO_CONFIG).

Options and features if INIT_RECOVER are discussed individually in subsequent sections. Here is an overview of all actions performed by INIT_RECOVER, to which you will need to refer while reading these sections.

Note If your PRIMOS.COMI does not already contain a COMO command to capture a record of the cold start in a como file, it is recommended that you insert such a command. Place it so as to capture a record of all INIT_RECOVER actions, as a minimum. Particularly in the early stages of using INIT_RECOVER, a como file is an essential debugging aid if problems arise.

INIT_RECOVER performs the following actions:

1. Copies PRIMOS maps from the command device for later use during FS_RECOVER's recovery analysis. This is simply a housekeeping step.

2. This step is concerned with CDD and SYSTEM_RECOVERY, and executes only on systems running PRIMOS Rev. 23.2 or later:

   A. If –AUTO_RESTART was specified, INIT_RECOVER executes the SYSTEM_RECOVER command with default options. The default options define the actions to be executed if the system crashes as the following: RFS (Resident Forced Shutdown); a crashdump to disk; then an automatic cold start (if the CPU supports it).

   B. If the CDD_AUTO_CONFIG file exists INIT_RECOVER:

      i. Reads from this file the list of one or more disks available for crashdump to disk, and checks each disk for the presence of a fresh (i.e. unrecovered) dump.

      ii. Activates the first free disk for CDD.

      iii. This step executes only if the –AUTO_ANALYSIS option was specified. If an unrecovered dump was detected in step (i), INIT_RECOVER invokes FS_RECOVER to analyze the dump (the most recent dump, if there is more than one). FS_RECOVER automatically runs FIX_DISK on all disk partitions that need repair.

         As described in Chapter 1, the cold start pauses at this point until all offline FIX_DISKs are complete. Online FIX_DISKs are done in parallel with the rest of the cold start.

      iv. Recovers any unrecovered dumps on any of the CDD disks, using the recovery path optionally specified in line 1 of the file. This is done using one phantom per disk, and proceeds in parallel with the rest of the cold start.

   C. Optionally sends coldstart mail to interested users (this is described in more detail in a later section).

   D. Reports the system recovery configuration established in step 2A by issuing the command SYSTEM_RECOVER –RC.

3. This step may be executed under any PRIMOS revision.

   If the –PAUSE option was specified and FS_RECOVER was not executed in step 2B, INIT_RECOVER pauses for the specified period (the default is 15 seconds) to allow the operator to type Control-P to break into the coldstart and begin a FS_RECOVER session.

   If the system crashed and you took a tape dump, this step allows you to read the dump and then perform recovery analysis and automated FIX_DISK. Or, if you could not take a dump or this is a routine cold start after a normal shutdown, this step allows you to assess the health of all locally mounted disk partitions and run automated FIX_DISK on any that need it. As in step 2B(iii), FS_RECOVER pauses the cold start until any offline FIX_DISKs are complete.

The -AUTO_RESTART Option

The -AUTO_RESTART option causes INIT_RECOVER to issue the SYSTEM_RECOVER command with no options (see the *Rev. 23.2 Software Release Document* (DOC10001-9PA) for complete details). On all CPUs, this sets the automatic system recovery actions to RFS, CDD, and cold start.

These actions are carried out automatically if the system crashes, provided the system supports automatic recovery. For a full list of CPU models and microcode revisions which support automatic system recovery, refer to page 1-3 of the *Rev. 23.2 Software Release Document* (DOC10001-9PA). On systems which do not support automatic system recovery, the SYSTEM_RECOVER command issued by the -AUTO_RESTART option does *not* enable the system to restart automatically, although it does allow the operator to simulate automatic restart with the following commands (issued at the system console after the system crashes):

```
CP>   SYSCLR
CP>   RUN 660
```

These commands cause a dump to be taken and RFS to be run, after which the operator should cold start the system with the usual SYSCLR and BOOT commands.

Note

If your system *hangs* rather than halts (see the *RAS Guide for System Administrators* for a detailed discussion), you will not be able to perform recovery actions until you first stop the system by typing ESCAPE ESCAPE and then STOP at the system console. Even if your system supports automatic recovery, it will *not* perform automatic system recovery when manually stopped in this way. You must use the SYSCLR and RUN 660 commands as described above to initiate the recovery steps configured by the SYSTEM_RECOVER command.

Whenever possible, avoid using the Master Clear button when your system halts or hangs. A crashdump taken after Master Clear is practically useless to FS_RECOVER.

If you specify the -AUTO_RESTART option, INIT_RECOVER assumes a crashdump disk is available on your system. (The SYSTEM_RECOVER command will not fail if a crashdump disk is not available, but if the system crashes and CDD has not been configured a completely automatic restart will not be possible, because the restart procedure will prompt the operator for a tape dump.) Normally, you will have specified the crash disk(s) configured on your system in the CDD_AUTO_CONFIG file (as described in a later section).

The -AUTO_ANALYSIS Option

The -AUTO_ANALYSIS option is effective only if you have created a valid CDD_AUTO_CONFIG file specifying one or more crashdump disks for use by CDD. At each cold start, INIT_RECOVER checks all disks specified in the

CDD_AUTO_CONFIG file for the presence of an unrecovered dump. If
–AUTO_ANALYSIS was specified INIT_RECOVER compares the date stamps
of all unrecovered dumps (in practice there will rarely be more than one dump),
and passes the most recent dump to FS_RECOVER for analysis.

Note The –AUTO_ANALYSIS option causes FS_RECOVER to automatically repair any
partitions requiring immediate FIX_DISK. These actions are summarized in the Chapter
1 section, What FS_RECOVER does with a Crash Dump.

If the –AUTO_ANALYSIS option is specified, INIT_RECOVER assumes the
default FS_RECOVER working directory <0>SYSTEM_DEBUG*>CRASH.
(Refer to the discussion of the working directory later in Chapter 3.)

The –PAUSE Option

The –PAUSE option gives the operator the opportunity of pausing the cold start
to use FS_RECOVER to run any FIX_DISKs that may be necessary. This is
useful both during routine cold starts where no dump was taken because the
system did not crash, and on occasions where a crash dump was taken on tape
rather than disk. The only time –PAUSE does not give this opportunity is when
FS_RECOVER was not already executed by INIT_RECOVER because an
unrecovered dump was present and –AUTO_ANALYSIS authorized automatic
analysis of the dump.

The –PAUSE option causes INIT_RECOVER to print a message like this:

```
Task 5: Waiting 15 seconds.  Enter CONTROL-P to invoke FS_RECOVER.
        Otherwise PRIMOS.COMI will continue.
```

INIT_RECOVER pauses for the stated period. If you type Control-P
FS_RECOVER is invoked and the Main Menu is presented; otherwise the cold
start continues undisturbed. You can configure a different pause length by
specifying –PAUSE *seconds*.

It is recommended that you *always* specify –PAUSE. The advantage is that you
then always have a clean way to pause the cold start and run FS_RECOVER
when necessary. On occasions when you do not need to use FS_RECOVER the
only penalty is an insignificant 15 second delay.

It is recommended that you frequently use the Control-P facility to check the
health of your disk partitions during routine cold starts. The protection provided
by FS_RECOVER and other system recovery utilities works best if you
routinely ensure that your disk partitions are clean at cold start. After typing
Control-P, follow the procedure outlined in the Chapter 3 section, Using
FS_RECOVER Interactively at Cold Start. If all partitions are clean, the time
taken to use Main Menu Option 3 to verify this is minimal, and the cold start is
not delayed significantly. On the other hand, if repairs are needed, you are able
to detect the condition before users log in, and correct it immediately.

You should always type Control–P and use FS_RECOVER when you know that partitions are likely to be unclean; for example, after a system crash where for some reason a crash dump to disk could not be created.

The CDD_AUTO_CONFIG File

This file specifies your system's CDD configuration to INIT_RECOVER. INIT_RECOVER always looks for this file; if the file exists it triggers the actions summarized in the earlier overview of INIT_RECOVER, item 2B. The CDD_AUTO_CONFIG file is required if you use the –AUTO_ANALYSIS option, and recommended if you use the –AUTO_RESTART option.

The CDD_AUTO_CONFIG file is created in the directory SYSTEM_DEBUG*>CRASH by the system administrator or operator, using a text editor such as ED or EMACS, as part of the installation of INIT_RECOVER. The file should contain the following information:

```
CDD_recovery_path            /* The pathname for CDD -RD.
CDD_pdev_1 <disk_name_1>     /* First PDEV to use for CDD.
CDD_pdev_n <disk_name_n>     /* Last PDEV to use for CDD.
```

The <CDD_recover_path> line is optional but recommended. It specifies the directory into which CDD crash dumps are automatically recovered by INIT_RECOVER. If this line is not provided and INIT_RECOVER finds an unrecovered (i.e. fresh) dump on a CDD disk specified in CDD_AUTO_CONFIG, an error message is printed and the dump is not recovered. This is undesirable because, if not recovered immediately, the dump will be lost when the disk is reactivated. Dumps contain valuable information and should be kept until service personnel have the opportunity to inspect them.

At a minimum, the CDD_AUTO_CONFIG file must specify one local crash dump partition for use by CDD. One CDD partition is sufficient for most systems; you need to provide two or more partitions only if specifically recommended by Computervision service personnel.

Before a partition can be used for CDD:

- It must be a partition which PRIMOS has previously used as a paging partition but which is no longer in use for paging, or

- It must have been created by MAKE with the –SPLIT option. If it is not a SCSI disk, you should also have included the –DBS ON option.

For advice about creating a CDD partitions, see the CDD –INFO command in the *Rev. 23.3 Software Release Document.*

Because a CDD partition is split, it is possible to use its file system portion for normal file system purposes. Do this by adding it with the ADDISK command in the same way as any other local partition. In such a case, the <disk_name>

should be specified in the CDD_AUTO_CONFIG file after the <pdev>, as illustrated in the example below.

Note   This removes a restriction applied by earlier versions of FS_RECOVER. Version 5.0 of FS_RECOVER allows an activated crash dump disk to be added, and is able to run FIX_DISK on it in the same way as any other locally mounted partition. It is always recommended, however, that an activated crash dump disk be fixed online when FIX_DISK is necessary: refer to the Chapter 2 section on ACL Requirements, and the section at the end of Chapter 3 about Common Operational Problems.

The following is an example of a CDD_AUTO_CONFIG file:

```
SYSTEM_DEBUG*>CRASH
7671 USRCDD
100562          /* Back up Crash Dump Disk, file system
                   portion is not used.
```

In this example, two partitions are available for CDD, pdev 7671 and pdev 100562. Pdev 7671 is an added local partition with name USRCDD; pdev 100562 is not added because its file system portion is too small to be useful.

Examples of INIT_RECOVER Actions

The following example is an extract from a como file collected at typical cold start after a system crash. Task 2 is done as a result of the –AUTO_RESTART option, and Task 4 reports the configuration achieved by Task 2. Task 3 is triggered by the existence of a CDD_AUTO_CONFIG file which specifies two CDD pdevs, 120462 and 130063, neither an added partition. INIT_RECOVER has detected the crash dump taken just prior to the cold start as an unrecovered dump on pdev 120462; pdev 130063 is activated for CDD immediately, while the dump on 120462 is marked for recovery later on (by phantom, after FS_RECOVER has finished).

Because INIT_RECOVER was started with the –AUTO_ANALYSIS option, FS_RECOVER will analyze the dump on pdev 120462. The Main Menu shown here is that of FS_RECOVER, driven by input supplied automatically by INIT_RECOVER (without operator intervention). The como record of FS_RECOVER's execution is in a different file, not shown here; that file showed that FS_RECOVER automatically ran FIX_DISK on a number of partitions.

The cold start continued automatically at the point where the example ends.

OK, R SYSTEM_DEBUG*>INIT_RECOVER.CPL -PAUSE -AUTO_ANALYSIS -AUTO_RESTART

[INIT_RECOVER 5.0-23.2 Copyright (c) 1992, Prime Computer Inc.]

Task 1: Caching PRIMOS maps.

Task 2: Attempting to enable automated System Recovery.
        Automated system recovery enabled.

Task 3: Attempting automatic CDD activation.
        Reading <0>SYSTEM_DEBUG*>CRASH>CDD_AUTO_CONFIG file.
        Crashdump recovery path is: <SPARE>CRASH_DUMPS
        Caution: An unrecovered dump exists on PDEV 120462.
        1 immediately usable PDEV(s) in CDD auto config.
        Activated CDD on PDEV 130063.

        Attempting to invoke FS_RECOVER on PDEV 120462.
[FS_RECOVER a.21 Copyright (c) 1992, Prime Computer Inc.]

                          *** MAIN MENU ***

(1)   Read crash tapes
(2)   Perform crash recovery analysis
(3)   Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 2

                       *** RECOVERY ANALYSIS ***

Enter pathname of working directory [default= <0>SYSTEM_DEBUG*>CRASH]:

Crashdump pathname or PDEV: 120462

(Beginning crashdump load, please wait...)

Your session COMO file is <0>SYSTEM_DEBUG*>CRASH>RYDCAD.930217.201656.COMO

... como switched back from <0>SYSTEM_DEBUG*>CRASH>RYDCAD.930217.201656.COMO

        Found unrecovered dump(s) on 1 PDEV(s).
Phantom is user 102.
        Started phantom to recover crashdump on PDEV 120462.

Task 4: Reporting current System Recovery configuration:
[SYSTEM_RECOVER Rev. 23.2.0 Copyright (c) 1991, Prime Computer, Inc.]

                  -- SYSTEM_RECOVER Configuration --

                          auto : yes

```
              cd : disk
             rfs : yes
            sysv : no
         restart : cold
```

INIT_RECOVER successfully completed.

> The next example illustrates INIT_RECOVER executing during a cold start after a normal system shutdown where no dump was necessary. The CDD_AUTO_CONFIG file was the one used in the previous section, in which pdev 7671 is an added partition with the name USRCDD.

OK, R SYSTEM_DEBUG*>INIT_RECOVER.CPL -PAUSE -AUTO_ANALYSIS -AUTO_RESTART

[INIT_RECOVER 5.0-23.2 Copyright (c) 1992, Prime Computer Inc.]

Task 1: Caching PRIMOS maps.

Task 2: Attempting to enable automated System Recovery.
        Automated system recovery enabled.

Task 3: Attempting automatic CDD activation.
        Reading <0>SYSTEM_DEBUG*>CRASH>CDD_AUTO_CONFIG file.
        Crashdump recovery path is: <0>SYSTEM_DEBUG*>CRASH
        2 immediately usable PDEV(s) in CDD auto config.
        Activated CDD on Disk USRCDD (PDEV 7671).

Task 4: Reporting current System Recovery configuration:
[SYSTEM_RECOVER Rev. 23.2.0 Copyright (c) 1991, Prime Computer, Inc.]

              -- SYSTEM_RECOVER Configuration --

            auto : yes
              cd : disk
             rfs : yes
            sysv : no
         restart : cold

Task 5: Waiting 15 seconds. Enter CONTROL-P to invoke FS_RECOVER.
        Otherwise PRIMOS.COMI will continue.
        Wait completed, continuing with coldstart.

INIT_RECOVER successfully completed.

Mailing a Coldstart Message

If your system is running Rev. 23.2 or later, and you have some form of email software, you can use INIT_RECOVER.CPL to send a coldstart mail message to interested users/administrators. Many people in Computervision R&D find this feature very handy, especially if the system crashes or is restarted at night. The restart message contains the system name, the date/time of the restart, and any relevant CDD information. The following is an example of a restart message:

```
System P5370 coldstarted on 12 Mar 93 10:56:01 Friday
PRIMOS revision 23.4.0

Crashdump(s) existed on the following CDD partitions:
7671 USRCDD
Crashdumps are normally recovered to: SYSTEM_DEBUG*>CRASH
```

You can enable the mail feature by simply creating a program called SEND_RESTART_MAIL.CPL in SYSTEM_DEBUG*>CRASH. If INIT_RECOVER sees this file, it creates the cold start message in the same directory with the name RESTART_MAIL, and then starts a phantom to execute SEND_RESTART_MAIL.CPL. It is assumed that your system has some form of email software, and SEND_RESTART_MAIL.CPL is a program you have coded to mail the file RESTART_MAIL to interested users. Essentially, all the program has to do is execute a command such as:

```
mail <0>SYSTEM_DEBUG*>CRASH>RESTART_MAIL judith@ens
```

However, you should remember that INIT_RECOVER executes early in the cold start, probably before the mailer software is initialized. The SEND_RESTART_MAIL.CPL program will probably need to wait for the mailer to initialize before it can send the message. You can use the WAIT program supplied with FS_RECOVER:

```
r system_debug*>wait seconds_to_wait
```

The wait time varies from one system another, and may include time spent in FS_RECOVER if the operator uses the Control-P option. A more sophisticated approach is to wait for the mailer process to appear on the system. The following is an example:

```
/*  SYSTEM_DEBUG*>CRASH>SEND_RESTART_MAIL.CPL
/*  phantomed by init_recover.cpl at cold start

&severity &warning &ignore

/*  Como for debug.
/*
como system_debug*>crash>send_restart_mail.como

/*  Attach somewhere we have rights to create a &data
/*  file.
/*
a system_debug*>crash

/*  Attempt to wait for the mailer to be started up.  That
/*  is, use the MESSAGE command to tell when a process
/*  called MAILER_DAEMON comes into existence.  MESSAGE
/*  will not return severity 0 until the process exists.
/*
&do &until %severity$% = 0
  r system_debug*>wait 60
  &data message MAILER_DAEMON -now
    junk message: are you there?
  &end
&end

/*  Give the mailer time to start up fully.
/*
r system_debug*>wait 60

mail system_debug*>crash>restart_mail -to judith@ens ~
                                           jason@opera

&stop
```

Allocating Disk Records for Crash Dumps

To use FS_RECOVER you need to set aside some disk space for crash dumps.
Whether you use disk (CDD) or tape dumps, you need to provide for dumps to
be copied from the original medium into the PRIMOS file system. Ideally, this
space should be in the directory <0>SYSTEM_DEBUG*>CRASH, but this is
not a requirement; you can put crash files on any partition (see the earlier section
The CDD_AUTO_CONFIG File).

Note   You *must* ensure there is always space for at least one dump in the dumps directory you are using. If there is insufficient space, INIT_RECOVER will be unable to recover any fresh crash dump during cold start, and may consequently fail to activate CDD, leaving your system unprotected in the event of a later crash.

In addition, if the dumps directory resides on the command device and INIT_RECOVER's CDD recovery operations fill the disk, other parts of the coldstart will encounter serious failures.

Refer to the following section on Disk Space Housekeeping for recommended preventative and remedial actions when CDD recovery fails because of insufficient space.

The amount of disk space required for a crash dump file varies with the system configuration and the ciurcumstances of the crash. The easiest way to estimate the size of a dump for your system is to use the CDD –INFO command introduced at PRIMOS Rev. 23.3 (see the *Rev. 23.3 Software Release Document* for details). This command assists you in planning CDD configurations, and tells you the expected size of both partial and full dumps for your system. The dump sizes it quotes are measured in records and are correct for dumps copied to the file system as well as for raw dumps on a CDD partition or on tape (all media use records of the identical size).

Set aside space for at least two partial dumps. Full dumps are rarely needed, and take up considerably more space. There is no need to plan for full dumps unless specifically requested to by Computervision service personnel.

If you are using PRIMOS Rev. 23.2, under which the CDD –INFO command is not available, use the guidelines below for estimating dump sizes:

1. Use the STATUS SYSTEM command at the system console to determine the kilobytes (KB) of memory in your system.

```
OK, STATUS SYSTEM

System STAN is currently running PRIMOS Rev. 23.4
Copyright (c) 1993, Prime Computer, Inc.
32768K bytes memory in use

OK,
```

2. If you are generating *partial* crash dumps (as outlined in Appendix A) go to step 3.

   For *full* crash dumps, calculate the base number of disk records required, as follows, and go to step 4. The base number of records for a full tape dump is equal to the KB of memory divided by two.

$$\frac{\text{KB of memory in the system}}{2} = \text{base number of disk records}$$

3. For *partial* crash dumps, calculate the base number of disk records required by using one of the following formulas and then go to step 4.

   Use this formula if your system has 32768 KB *or less*:

   (KB of memory) * (0.35) = base number of disk records

   Use this formula if your system has *more than* 32768 KB:

   (KB of memory) / 4 = base number of disk records

4. If your system is a 6150™, 6350™, 6450™, 6550™, or a 6650™ (a 6000 Series machine), add 66 to the base number of disk records calculated in either step 2 or step 3. (This corresponds to the allowance for a PIOS dump made by CDD –INFO.)

5. If you are running PRIMOS Rev. 23.2 or later, add 64 for MAPS information.

Examples of Calculating Required Disk Records

If your system is a 6350 with 65536 KB of memory, you are running Rev. 23.2, and you use partial crash dumps, the number of disk records to set aside is as follows:

(65536 / 4) + 66 + 64 = 16514 disk records

If your system is a 2550™ with 8192 KB of memory and you use partial crash dumps, the number of disk records to set aside is as follows:

8192 * 0.35 = 2868 disk records

Disk Space Housekeeping

When you are using Crash Dump to Disk in conjunction with INIT_RECOVER (by creating the CDD_AUTO_CONFIG file), any fresh (i.e. unrecovered) CDD dumps are recovered automatically by INIT_RECOVER during cold start. For

reasons given in the preceding section, you must try to ensure there is always sufficient space in the dumps directory for recovery to succeed.

Recovery is the term used to describe copying a crash dump from the CDD disk into a file in the PRIMOS file system. Recovery is necessary because a CDD disk can only accommodate one dump at a time, and cannot be reactivated without destroying any dump already present. While FS_RECOVER is able to analyze a crash dump in situ on the CDD disk (and should be allowed to do so whenever possible to reduce system startup time), it is important to preserve crash dumps for a period in case they are needed by Computervision Customer Service.

INIT_RECOVER does not include any features for deleting old crash dumps. It is the System Administrator's responsibility to clear the dumps directory periodically, after ensuring that the dumps are no longer needed by Computervision Customer Service (or after archiving them to tape with MAGSAV, if they are still needed).

Deleting Como Files

The System Administrator or operator should also periodically review the como files and Fix Directories created by FS_RECOVER in SYSTEM_DEBUG*>CRASH. When these are no longer needed they should be deleted or archived. See Chapter 3 for more details.

Troubleshooting When Recovery Fails

CDD recovery is done by a phantom started by INIT_RECOVER during cold start. When this phantom strikes trouble, commonly because of insufficient disk space, it sends messages such as the following to the system console:

```
*** SYSTEM (user 124 on RYDCAD) at 10:09
CDD recovery problem on disk CRASH1. Failed to recover the dump...

*** SYSTEM (user 124 on RYDCAD) at 10:09
Follow directions in <0>SYSTEM_DEBUG*>CRASH>RD.CRASH1.930312.100904.COMO
```

If your CDD_AUTO_CONFIG file specifies only one CDD disk (which is usual), it is likely the problem above will also prevent the recovery phantom from reactivating CDD on your system. This is a serious problem, and the phantom will send further messages like the following at 15 minute intervals:

```
*** SYSTEM (user 124 on RYDCAD) at 10:24
Problem with CDD disk CRASH1. CDD could not be reactivated...

*** SYSTEM (user 124 on RYDCAD) at 10:24
Follow directions in <0>SYSTEM_DEBUG*>CRASH>RD.CRASH1.930312.100904.COMO
```

To correct the problem, follow the actions outlined in the como file specified in the messages. The como file may look like this:

```
[RECOVER_CDD_crashdump 5.0-23.2 Copyright (c) 1993, Prime Computer Inc.]


cdd 120462 -rd <ORANGE>DUMPS -AD
[*CDD Copyright (c) 1991, Prime Computer, Inc.]

Recovering dump from disk 120462 ...

Creating dump file "<ORANGE>DUMPS>DUMP.930307.113056" ...

>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>> Disk is full <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
File is "<ORANGE>DUMPS>DUMP.930307.113056".
Another 3269 records are needed.

Returning to Primos level.  After freeing up disk space, use the Primos
command "REN" to continue Recovery from this point.


*** CDD recovery aborted by lack of space.
Deleting aborted dump file...
"<ORANGE>DUMPS>DUMP.930307.113056" deleted.

*** ERROR REPORT AND ADVICE ***

CDD recovery has failed, for a reason that should be visible above.
There is still an unrecovered dump on disk 120462.
Use the command "CDD 120462 -RD" to recover the dump manually.

Disk 120462 could not be activated for CDD.
This is a problem which should be corrected urgently, by using the
command "CDD 120462 -AD" to activate the disk manually.
(Do this *after* recovering the dump as instructed above.)

If the recovery phantom (me) continues to send messages to the console,
you may log it out after reading this error report.

Now reporting the error to the console...
```

As the como file suggests, take the following steps to correct the problem:

1. Logout the recovery phantom. It has the CDD disk assigned, and you must log it out to be able to assign the disk to yourself (via the CDD command).

2. Use the command **CDD** *disk* **–QD** to find out how much disk space you need (i.e. the size of the dump to be recovered). Also check that this display confirms there is an unrecovered dump on the disk: do the next step only if an unrecovered dump is present.

3. Clear some space in the dumps directory, or find another directory. Use the command **CDD** *disk* **-RD** to do the recovery.

4. If the command CDD -QD indicates that no disk is currently activated for CDD, activate the disk in question using **CDD** *disk* **-AD**.

5. Take steps to ensure the problem does not recur, either by clearing the dumps directory, or specifying a bigger dumps directory in the CDD_AUTO_CONFIG file.

3

Using FS_RECOVER With a Crashdump

■ ■ ■ ■ ■ ■ ■

This chapter is concerned with recovery analysis: that is, with FS_RECOVER's Main Menu Options 1 and 2, which analyze a crashdump and run automated FIX_DISK. This procedure should be carried out during cold start, before users log in (using the INIT_RECOVER command described in the Chapter 2).

FS_RECOVER may also be used anytime as a simple way to assess the state of your disks and run FIX_DISK on them. This use of FS_RECOVER is discussed in Chapter 4.

Some general sections in Chapter 3 apply equally to all ways of using FS_RECOVER. These are:

- FIX_DISK Options

- FS_RECOVER's Main Menu

- The later sections of Chapter 3 describing the operation of FS_RECOVER's FIX_DISK phantoms

Recommended Strategies After a System Crash

It is recommended that you insert the INIT_RECOVER command in your PRIMOS.COMI as described in Chapter 2, in the section Automated Recovery — Using INIT_RECOVER.CPL. If you do this, the steps you then need to take on cold starting the system after a crash depend on the options you used with the INIT_RECOVER command:

1. If you used the –AUTO_ANALYSIS option to INIT_RECOVER and a crash dump to disk was successfully created, INIT_RECOVER automatically invokes FS_RECOVER to analyze the dump and perform all necessary FIX_DISKs. No operator intervention is necessary.

2. If you did not use the –AUTO_ANALYSIS option or a crash dump to disk was not taken, INIT_RECOVER allows you to pause the cold start and execute FS_RECOVER interactively. INIT_RECOVER prints the following message:

```
Waiting 15 seconds. Enter CONTROL-P to invoke FS_RECOVER.
```

After you type Control–P, FS_RECOVER will be invoked and you will enter the Main menu. Follow the instructions below in the section Using FS_RECOVER Interactively at Cold Start. The cold start continues when any offline FIX_DISKs are complete, or you quit from FS_RECOVER.

If your PRIMOS.COMI does not include the INIT_RECOVER command, follow these steps when your system crashes:

1. Generate a crash dump, either on disk if a CDD disk was activated before the system crashed, or by using a tape dump method described in Appendix A.

2. If you are running PRIMOS Rev. 23.1 or later, run RFS *after* generating the crash dump. (RFS accomplishes a forced shut down of PRIMOS and shuts down each partition in an orderly manner.)

3. Cold start your system.

4. Pause the cold start, either by typing Control–P, or preferably, by having inserted CO –PAUSE in PRIMOS.COMI *after* the point where all local partitions are mounted, and *before* any users can log in. Follow the instructions below in the section Using FS_RECOVER Interactively at Cold Start.

5. Finish off the cold start (by typing **CO –CONTINUE** if you used CO –PAUSE).

Using FS_RECOVER Interactively at Cold Start

After pausing the cold start and invoking FS_RECOVER, use the FS_RECOVER Main Menu options as follows:

1. Use Main Menu Option 3 of FS_RECOVER to assess the health of your disk partitions. If your system crashed because of a forced shut down or if you successfully ran RFS, all the partitions may be clean. If all the partitions are clean, exit FS_RECOVER.

2. If any of the partitions are damaged and a crash dump to tape was taken then do not initiate automated FIX_DISK while you are using option 3. Instead, go back to the Main Menu and select Option 1 to read the crash tape. (If you activated CDD, the crash dump is available on disk and you do not need to use Option 1.)

   Then select Main Menu Option 2 to analyze the crash dump file. Execute all recommended *immediate* FIX_DISK sessions.

3. If any of the partitions are damaged and a crash dump to tape was not taken, then initiate automated FIX_DISK while you are using Option 3.

4. If the crash dump analysis indicates you can defer some FIX_DISK sessions, you can reinvoke FS_RECOVER at a convenient time later and use Main Menu Option 3 to repair the damaged partitions.

FIX_DISK Options

When FS_RECOVER determines that a partition needs FIX_DISK, it displays the FIX_DISK options it recommends and, if running interactively, gives you the opportunity to change these options. The FIX_AUTO_CONFIG file, discussed below, provides a further way to influence the options used by FIX_DISK sessions started by FS_RECOVER.

Here is a brief description of the five main categories of the FIX_DISK option.

- **Online FIX_DISK vs. Offline FIX_DISK**
  Online FIX_DISK is the name given to a FIX_DISK session in which the –ONLINE option is specified. With this option FIX_DISK checks and repairs a disk partition while it is still available for use by other processes; the disk does not need to be shut down and assigned as it does for offline FIX_DISK. The –ONLINE option is supported under the PRIMOS revisions listed on page ix.

  Offline FIX_DISK is the name given to a FIX_DISK session in which the –ONLINE is *not* specified. This is the way FIX_DISK always operated before the –ONLINE option was introduced. The disk partition being repaired must be shut down and assigned.

  Online FIX_DISK cannot be used to repair a robust partition, but apart from that is generally preferred to offline FIX_DISK. FS_RECOVER version 5.0 incorporates defaults that favor the use of Online FIX_DISK: if the FIX_AUTO_CONFIG file exists FS_RECOVER by default uses Online FIX_DISK on all partitions; otherwise it uses Online FIX_DISK only for the command device.

  If your PRIMOS revision does not support Online FIX_DISK, FS_RECOVER cannot repair the command device, and repairs all other partitions with offline FIX_DISK.

- **Full FIX_DISK vs. Partial FIX_DISK**
  Full FIX_DISK traverses the complete file system tree. Partial FIX_DISK traverses the file system tree until it finds the specified file system object. It then checks and repairs that object (a file or directory subtree). A partial FIX_DISK can be significantly faster than a full FIX_DISK; however, a partial FIX_DISK does *not* mark the disk partition as properly shut down.

  If a dump analysis shows that only a partial FIX_DISK is required, FS_RECOVER will recommend the –PARTIAL option. In practice this happens infrequently.

- **Fast FIX_DISK vs. NoFast FIX_DISK**
  FIX_DISK without the –FAST option reads every record of DAM and CAM files. FIX_DISK with the –FAST option does not read every record of DAM or CAM files. Fast FIX_DISK cannot be run with the disk online, and is recommended for a robust partition when recovering from a system crash.

FS_RECOVER will recommend the –FAST option for robust partitions (only).

- **FIX_DISK with the –FIX option vs. FIX_DISK without the –FIX option**
  FIX_DISK with the –FIX option does the necessary repairs, while FIX_DISK without the –FIX option runs FIX_DISK in a read–only mode.

  FS_RECOVER will never recommend running FIX_DISK without the –FIX option. It makes little operational sense to run a FIX_DISK that does not repair the partition. You should avoid specifying NOFIX unless you have strong reasons to do so.

- **Skip**
  The SKIP option is used interactively or in the FIX_AUTO_CONFIG file when you want to tell FS_RECOVER to avoid running FIX_DISK on a specific partition. SKIP does not correspond to any FIX_DISK option.

Offline versus Online FIX_DISK, and the COMDEV

If you are using a PRIMOS revision which supports Online FIX_DISK (see page ix), FS_RECOVER automatically uses Online FIX_DISK to repair the command device. When Online FIX_DISK is available, the command device can be treated just like any other partition.

If you do not have Online FIX_DISK, FS_RECOVER cannot repair the command device. If your command device is damaged it must be fixed manually by running FIX_DISK independently of FS_RECOVER at the system console (with the –COMDEV option, as described in the *Operator's Guide to File System Maintenance*).

The FIX_AUTO_CONFIG File

You may optionally create a file called FIX_AUTO_CONFIG in the directory <0>SYSTEM_DEBUG*>CRASH, using an editor such as ED or EMACS. This file automates the FIX_DISK options you want FS_RECOVER to use on specific partitions. For example, you may specify that a certain partition should be repaired offline, or should never have FIX_DISK run on it.

FS_RECOVER reads the FIX_AUTO_CONFIG file during initialization of Main Menu Options 2 and 3. Its specifications are validated and incorporated by FS_RECOVER into the FIX_DISK recommendations. If the options specified in the file conflict seriously with what FS_RECOVER normally recommends, and FS_RECOVER is runnning interactively, it may query you for confirmation; if FS_RECOVER is not running interactively, the FIX_AUTO_CONFIG specifications are strictly followed.

The FIX_AUTO_CONFIG file is a simple text file in which each line contains some kind of specification for FIX_DISK options. Comments are supported. A comment is any text beginning with the characters /*; it may be all or part of a line. The significant part of the line is everything before the first /* (or, the whole line if /* is not present).

If the significant part of the line is blank it is ignored; otherwise it may contain:

- A default specification. There may be only one of these and it must precede any other specifications. Its syntax is:

    -DEFAULT [Token1] [Token2] ...

- A specification for a specific disk partition. The syntax is:

    pdev [Token1] [Token2] ...

The tokens in the above descriptions specify FIX_DISK actions. Some are similar to FIX_DISK options without the leading dash. The following lists all the valid tokens for FIX_AUTO_CONFIG:

ONLINE, ON	Online FIX_DISK
OFFLINE, OFF, OF	Offline FIX_DISK
FIX, FI	FIX_DISK –FIX
NOFIX, NFI, NF	FIX_DISK without the –FIX option
FULL, FU	FIX_DISK –FULL traverses the complete file system tree
NOFAST, NOFA, NFA	FIX_DISK without the –FAST option
FAST, FA	FIX_DISK –FAST
SKIP, SK	Do not run FIX_DISK on the disk partition

Note   The ONLINE token may not be used when Online FIX_DISK is not available.

For simplicity of operation, these tokens are the same as those you may enter interactively at prompts where FS_RECOVER allows you to respecify FIX_DISK actions. The additional token, PARTIAL (or PA), may be used interactively, but is forbidden in FIX_AUTO_CONFIG (because it is impossible to know at the time of creating the FIX_AUTO_CONFIG file whether a partial FIX_DISK is appropriate).

It is important to note how FS_RECOVER interprets the FIX_AUTO_CONFIG file:

- If the file does not exist, FS_RECOVER defaults to fixing all partitions except the command device offline, regardless of whether Online

FIX_DISK is available or not. If Online FIX_DISK is available, the command device is fixed online; otherwise FS_RECOVER does not attempt to fix the command device.

• If the file does exist, FS_RECOVER defaults to fixing all partitions online, if Online FIX_DISK is available. If Online FIX_DISK is not available, FS_RECOVER defaults to fixing all partitions, except the command device, offline.

• If a partition is robust, FS_RECOVER defaults to fixing it with the –FAST option, and this always requires FIX_DISK to be run offline.

Here is a simple example of a Rev. 23.4 FIX_AUTO_CONFIG file:

```
7660        OFFLINE
100265      SKIP
7663        FAST OFFLINE
```

In this example we are assuming a PRIMOS revision which supports Online FIX_DISK. The simple fact that the FIX_AUTO_CONFIG file exists causes FS_RECOVER to use Online FIX_DISK on all partitions not otherwise specified. This particular file specifies that the partitions 7660 and 7663 should to be fixed offline. All others, except 100265, will be fixed online. The specification OFFLINE for 7663 is redundant (but harmless), because a FAST FIX_DISK can only be done offline. The partition 100265 is not fixed at all: such a specification may be useful for a scratch partition which does not need regular repair.

Note that among the supported tokens you may use in FIX_AUTO_CONFIG, there are some which you will rarely need. FULL is never needed because PARTIAL is never legal in the FIX_AUTO_CONFIG file. FIX is rarely needed because NOFIX is not often a useful thing to do. In the above example, all partitions on the system are subject to full FIX_DISK with the –FIX option.

You can add a –DEFAULT specification to FIX_AUTO_CONFIG which overrides the defaults summarized above. This could be useful on a system where Online FIX_DISK is available but the System Administrator prefers FS_RECOVER to default to offline repairs. For example:

```
-DEFAULT OFFLINE
7661    ONLINE
7663    ONLINE
```

You might have a configuration like the above in a transition period after upgrading to a PRIMOS revision that supports Online FIX_DISK, while the advantages of Online FIX_DISK are being assessed. It would cause all partitions to default to Offline FIX_DISK, except for 7661 and 7663. If Online FIX_DISK is available, this is not a recommended permanent configuration.

The next example, again from a Rev 23.4 system, is similar:

```
-DEFAULT OFFLINE FAST
7661   ONLINE NOFAST
7663   ONLINE NOFAST
```

In this example the system has mainly robust partitions, making it reasonable to default to FAST (Offline) FIX_DISK. Partitions 7661 and 7663 are not robust, and therefore fixed online. There is a certain measure of redundancy in this example: even if this –DEFAULT specification was not provided, FS_RECOVER would normally detect each mounted robust partition automatically and default to a FAST FIX_DISK.

In summary, while the syntax of the FIX_AUTO_CONFIG file allows considerable flexibility, most FIX_AUTO_CONFIG files will only be a few lines long, specifying a small number of partitions needing special treatment.

The Main Menu

If the installation integrity checks pass when you invoke FS_RECOVER, FS_RECOVER displays its Main Menu and prompts you for a choice:

```
OK, FS_RECOVER
[FS_RECOVER Rev 5.0 Copyright (c) 1993, Prime Computer Inc.]


-------------------------------------------------------------------------
                        *** MAIN MENU ***

(1)   Read crash tapes
(2)   Perform crash recovery analysis
(3)   Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu:
```

You have several choices, as follows:

- Use Option 1 when you want to read a crash dump tape into a disk file.

- Use Option 2 to perform a file system recovery analysis on either a crash dump file that you created with Option 1 or on the CDD partition. You can then invoke automated FIX_DISK.

- Use Option 3 to assess the state of all currently mounted local disk partitions. You can then invoke automated FIX_DISK.

- Enter ! *PRIMOS_command_line* to execute a PRIMOS command without leaving FS_RECOVER.

- Enter M to cause FS_RECOVER to redisplay the menu.

- Enter Q to leave FS_RECOVER and exit to PRIMOS command level.

Breaking Out of FS_RECOVER

When you select a Main Menu option, you can stop execution of FS_RECOVER at any time by using Control-P. The *only* exception to this is when you are selecting a choice from the FIX_DISK menu. While you are in the FIX_DISK menu, Control-P, ECL support, and PRIMOS command-line support are disabled. If you do stop FS_RECOVER by pressing a Control-P, you see the following:

```
**** Break! ****
(A)bort, (C)ontinue, or (R)eturn to Main Menu? A
OK,
```

You can abort FS_RECOVER, continue with the interrupted selection, or go back to the Main Menu. You can also get back to the Main Menu by simply entering Q or QUIT in most cases. For example:

```
Enter a menu number, or (Q)uit or (M)enu: 1

Mount the first reel of the crash tape(s) and enter the magtape unit number.
You may also enter:
                     ! <Primos command>
                     Q or QUIT to return to the main menu.

Tape unit (9 track): q

MAIN MENU:
```

Executing PRIMOS Commands Within FS_RECOVER

In some places where FS_RECOVER prompts you for input, you can also enter PRIMOS commands. In many instances, as in the previous example, FS_RECOVER explicitly tells you that you may enter PRIMOS commands. To enter a PRIMOS command line from an FS_RECOVER prompt, precede the PRIMOS command line with an ! (exclamation point). Abbreviations, wildcarding, and iteration lists are fully supported. After the PRIMOS command completes, FS_RECOVER prompts for input.

Using ECL Within FS_RECOVER

The ECL environment within FS_RECOVER is totally separate from your PRIMOS ECL environment.

ECL is automatically enabled within FS_RECOVER except in the cases when

- ECL is not installed.

- You invoke FS_RECOVER from the system console on a system running a PRIMOS revision *prior* to Rev. 22.1.

Reading the Crash Dump From Tapes

FS_RECOVER cannot read the raw data on the crash dump tapes. You must use Main Menu Option 1 to read the data from tape into a disk file before FS_RECOVER can analyze the data. However, if you are running Rev. 23.2 and using CDD, you do not have to use Main Menu Option 1 because the crash dump is already on disk in a form that FS_RECOVER can read.

The tapes need to be successfully read only once, but individual reels with unrecovered tape errors may be reread as many times as necessary. If you stop reading tapes at the end of a reel, you can leave FS_RECOVER and then come back at some later time and continue reading the tapes, starting with the next reel.

To read crash dump tapes, select Option 1 from the Main Menu. Follow the prompts to mount the first reel of the crash dump tapes on a tape drive and enter the tape drive unit number:

```
[FS_RECOVER Rev 5.0 Copyright (c) 1993, Prime Computer, Inc.]

-----------------------------------------------------------------------------
                              *** MAIN MENU ***

(1) Read crash tapes
(2) Perform crash recovery analysis
(3) Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 1

Mount the first reel of the crash tape(s) and enter the magtape unit number.
You may also enter:
                    ! <Primos command>
                    Q or QUIT to return to the main menu.

Tape unit (9 track): q
```

Checking the Tape Drive

When you enter a magtape unit number, FS_RECOVER attempts to assign the tape drive. If the assign fails, you get an error message followed by another prompt for a magtape unit.

```
Tape unit (9 track): 0
PRIMOS error code 39 while assigning MT0. Device in use.

Mount the first reel of the crash tape(s) and enter the magtape unit number.
You may also enter:
                     ! <Primos command>
                     Q or QUIT to return to the main menu.

Tape unit (9 track): q
```

After assigning the tape drive, FS_RECOVER checks to ensure that a tape is mounted on the tape drive and that the drive is online and ready. If any of these checks fail, you get an error message followed by the magtape unit prompt.

```
Tape unit (9 track): q
Device offline or not ready.

Mount the first reel of the crash tape(s) and enter the magtape unit number.
You may also enter:
                     ! <Primos command>
                     Q or QUIT to return to the main menu.
Tape unit (9 track): q
```

The Crash Dump File

When the magtape drive is online and ready, FS_RECOVER prompts for the pathname of the output crashdump file. Ideally, this should be a file in SYSTEM_DEBUG*>CRASH, but this is not a requirement; you can put the crash dump data file on any partition. Use a unique name for each crash dump file so that the file is easy to identify. The recommended naming convention includes the system name, followed by a date/time stamp. For example, if your system is named MOLLY and the crash occurred on April 19, 1993 at 1:30 p.m., the recommended name for the crash dump data file is MOLLY.930419.1330 or *filename*.[DATE –FTAG].

Reading the Tape

After you enter the crash dump pathname, FS_RECOVER reads the tape. You should expect to see something like this:

```
Tape unit (9 track): 0
Crashdump pathname: SYSA.DUMP.930312.0930


TAPE LABEL:
   sequence# = 0     [CORE dump]         reel#       = 1
   version   = 2                         dump size   = 6067
   date      = 12 Mar 93 11:58:44 Fri    Primos rev = 23.3.0vC


Starting to read CORE dump on reel 1 (section 1)...

End of CORE dump on reel 1.
    6067 records read from tape      (excluding label)
    6067 records written to file     (in file rec# range 0 to 6066)
       0 records in this range were missing


TAPE LABEL:
   label id  = "MAPS"    [MAPS dump]      reel#       = 1
   version   = 2                          dump size   = 43
   date      = 12 Mar 93 11:58:44 Fri     Primos rev = 23.3.0vC

Starting to read MAPS dump on reel 1 (section 2)...

End of MAPS dump section on reel 1.
      43 records read from tape      (excluding label)
      43 records written to file     (in file rec# range 0 to 42)
       0 records in this range were missing
End of reel 1 (last reel of set).

FILE STATE:  File appears to be complete - Autopsy LOAD should succeed.
```

FS_RECOVER then returns you to the Main menu.

If the tapedump occupies more than one reel, you are prompted for the second and subsequent reels like this:

```
End of CORE dump section on reel 1  <more expected on next reel>
    2353 records read from tape      (excluding label, including errors)
    2350 records written to file     (in file rec# range 0 to 2349)
       0 records in this range were missing
End of reel 1.

FILE STATE:  File lacks a loadable CORE dump - Autopsy LOAD prohibited.

Enter command, tape unit for next reel, or <return> for main menu.
(Tape)>
```

At this point, mount the next reel and enter the tape unit number. After all reels
are read you will see a message like the following, after which FS_RECOVER
returns immediately to the Main menu:

```
End of reel 3 (last reel of set).

FILE STATE:  File appears to be complete - Autopsy LOAD should succeed.
```

From PRIMOS Rev 23.2 onwards every tapedump includes CORE and MAPS
sections, as illustrated in the first example above. If you have a 6000 Series
system there will also be a PIOS dump section.

It is fairly common to see warning and/or error messages such as these, as the
tape is read:

```
Starting to read CORE dump on reel 1 (section 1)...

Warning: [Reel 1, tape seq# 80+1, CORE file rec# 79]
         2 copies of record with tape seq# 80. Best of these (#2) has
         correct size; there should be no data lost.

Warning: [Reel 1, tape seq# 292+1, CORE file rec# 291]
         2 copies of record with tape seq# 292. Best of these (#2) has
         correct size; there should be no data lost.

TAPE ERROR  [Reel 1, tape seq# 2258+1, CORE file rec# 2257+1]
   RECOVERED after 1 retry.  Status '104304 (Vert Parity Bad Gap)

Warning: [Reel 1, tape seq# 2259+1, CORE file rec# 2258]
         2 copies of record with tape seq# 2259. Best of these (#2) has
         correct size; there should be no data lost.

End of CORE dump section on reel 1  <more expected on next reel>
   2353 records read from tape     (excluding label, including errors)
   2350 records written to file    (in file rec# range 0 to 2349)
      0 records in this range were missing
End of reel 1.
```

You can ignore error and warning messages provided the last reel is followed by
this message:

```
FILE STATE:  File appears to be complete - Autopsy LOAD should succeed.
```

and provided the summary that concludes every dump section finishes with 0
records in this range were missing. If these conditions are not both
met the dump may not be usable (although a small number of missing records
may not affect the dump analysis done by FS_RECOVER).

Reading the Crash Dump From Disk

If you are running PRIMOS Rev 23.3 or later, you are recommended to configure CDD and create crashdumps on disk rather than tape. This will reduce your system downtime as dump to disk is much faster. It will also reduce recovery analysis time as you do not have to do the tape–reading procedure described in the preceding section.

FS_RECOVER can analyze a disk dump in situ, without having to copy it anywhere. The CDD recovery procedure discussed at the end of Chapter 2, in which a dump is copied from the CDD disk into a regular PRIMOS disk file, is *not* necessary before FS_RECOVER can analyze the dump (although, FS_RECOVER can analyze the copied dump equally well, should you need to do this).

To analyze a disk dump in situ with FS_RECOVER, enter the pdev of the CDD partition at the pathname or pdev prompt in Main Menu Option 2.

To analyze a dump file, created either by reading tapes with Main Menu Option 1 or by recovering a dump from a CDD partition, enter the pathname of the file at the pathname or pdev prompt in Main Menu Option 2.

Performing the Recovery Analysis

After generating a CDD crash dump or using Main Menu Option 1 to read the crash tape, select Main Menu Option 2 (the crash recovery analysis choice) after being sure that you meet the following requirements:

- A crash dump file must exist, that is, at some point you must have used Main Menu Option 1 or be using CDD.

- When you select Main Menu Option 2, you must know the pathname of the working directory (the directory containing the FS_RECOVER CPL programs and the crash dump file) you want FS_RECOVER to use. Refer to the following section, about the FS_RECOVER Working Directory.

Automatic Recovery Analysis

When your PRIMOS.COMI file includes an INIT_RECOVER command which specifies the –AUTO_ANALYSIS option, FS_RECOVER is invoked automatically by INIT_RECOVER if an unrecovered (i.e. fresh) crash dump exists on a CDD disk. All the steps described in the rest of this chapter are performed automatically, without any operator intervention. FS_RECOVER analyzes the dump automatically, and if FS_RECOVER recommends FIX_DISKs as a result of the analysis, those FIX_DISKs will be automatically run.

When FIX_DISKs are run automatically in this way there is no opportunity for the operator to override FS_RECOVER's decisions. Use the CDD_AUTO_CONFIG file if you wish to control the FIX_DISK options used during automatic analysis.

The FS_RECOVER Working Directory

The FS_RECOVER working directory is where FS_RECOVER expects to find the CPL programs, RUN_FIX_DISK.CPL, and FIX_DISK_MONITOR.CPL. FS_RECOVER also uses the working directory to keep como files and to build CPL programs for automated FIX_DISK. Computervision recommends that you keep all your crash dump files in the working directory also, but this is not a requirement.

When you select Main Menu Option 2 or 3, FS_RECOVER prompts you to enter the pathname of the working directory and displays a default working directory pathname. To select the default working directory, simply press Return.

```
Enter pathname of working directory [default= <0>SYSTEM_DEBUG*>CRASH] : Return
```

The default working directory is SYSTEM_DEBUG*>CRASH. You can create and use a different working directory if desired, although this should rarely be necessary. To set up a new working directory, first create the directory in the desired location, then set its ACLs as described in the Chapter 2 section, ACL Requirements. Next copy the files RUN_FIX_DISK.CPL and FIX_DISK_MONITOR.CPL into the new directory, as illustrated here:

```
OK, COPY SYSTEM_DEBUG*>CRASH>RUN_FIX_DISK.CPL *>CRASH.NEW>==
OK, COPY SYSTEM_DEBUG*>CRASH>FIX_DISK_MONITOR.CPL *>CRASH.NEW>===
OK,
```

Finally, you must tell SYSTEM_DEBUG*>INIT_RECOVER.CPL to use the new directory when executing FS_RECOVER. Change the INIT_RECOVER command in your PRIMOS.COMI to include an option of the form –WORK *work_dir*, specifying the pathname of the new working directory.

Note   The change of working directory applies only to the operations of FS_RECOVER's automated FIX_DISK phantoms. The directory <0>SYSTEM_DEBUG*>CRASH must not be deleted, and remains the only valid location for the CDD_AUTO_CONFIG and FIX_AUTO_CONFIG files, and files used by the coldstart mail facility.

Pathname or pdev of the Crash Dump File

Next, FS_RECOVER prompts you to enter the pathname of the crashdump–to–tape file or the pdev of the CDD disk that you want to analyze. If

you are using CDD, simply enter the pdev of the CDD partition. If you just finished using Main Menu Option 1 to read crash dump tapes, FS_RECOVER uses the pathname of the file you read the tapes into as the default pathname. If you want to use the default pathname, simply press Return. Otherwise, enter the pathname of the crash dump file you want to analyze.

FS_RECOVER then attempts to load the crash dump, which takes about one minute.

Example of Doing the Analysis

Following is an example of the display when you select option 2:

```
----------------------------------------------------------------------
                           *** MAIN MENU ***

(1)   Read crash tapes
(2)   Perform crash recovery analysis
(3)   Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 2


----------------------------------------------------------------------
                        *** RECOVERY ANALYSIS ***

Enter pathname of working directory [default= <0>SYSTEM_DEBUG*>CRASH ]:

Crashdump pathname or PDEV: 120462

(Beginning crashdump load, please wait...)
```

The Session Como File

After FS_RECOVER successfully loads the crash dump, it starts a session como file in the working directory. The name of the como file is always unique and consists of the crashed system's name and a date/time stamp.

```
(Beginning crashdump load, please wait...)                              .

Your session COMO file is <0>SYSTEM_DEBUG*>CRASH>RES-C4.930405.100048.COMO
```

This como file contains a record of the dump analysis, a summary of the state of each disk partition, and the FIX_DISK options chosen for each disk requiring FIX_DISK. It is a useful summary to print out if you want an overview of the state of the system following a crash. It does not contain any record of FIX_DISK sessions (which are captured in separate como files,described later).

Messages Indicating the Machine State

After FS_RECOVER starts the session COMO file, FS_RECOVER determines the machine state at the time of the crash. *Record this information in your System Log Book.*

The following messages indicate possible machine states:

```
The machine was stopped by a MASTER CLEAR.

The machine did not halt; it was STOPPED by the Maintenance Processor.

The machine halted at x(0)/xxxxxx; xxxxxx+'0

PRIMOS executed a Slow Halt at x(0)/xxxxxx; xxxxxx+'0

PRIMOS stopped the machine using a Forced shut down.

The machine was stopped using the "SHUT ALL" command at the supervisor terminal.
```

Messages During Dump Analysis

After determining the machine state, FS_RECOVER begins analysis of the data. Depending on the size of the crash dump file, analysis can take up to 10 minutes but is typically less than this. During this time, you see several informational messages.

```
(Building Unit Info table, please wait...)
(Validating Disk Driver datastructures, please wait...)
(Validating state of the Locate subsystem, please wait...)
(Validating Unit Table Hash, please wait...)
(Building nllock LOCKLIST database, please wait...)
(Building nllock owners database, please wait...)
(Validating any resident DSKRATs, please wait...)
```

Occasionally you may see other warning or caution messages interspersed with the informational messages. Refer to the Runtime Warning Messages section of Appendix B for more information.

Recommendations for Running FIX_DISK

When FS_RECOVER completes the dump analysis, it has an initial picture of the state of each disk partition at the time the system crashed. FS_RECOVER then merges this initial picture with information from the running PRIMOS about the current state of all currently mounted local disk partitions, creating a

summary of the true current state of each partition and an appropriate FIX_DISK recommendation for each.

It is important to merge in the current state of each partition, because RFS (Resident Forced Shutdown) usually runs while the system is down, after the crash dump is created. It is not uncommon, therefore, for the crashdump alone to show damage that was actually repaired by RFS. For these reasons, it is important that you follow these operational rules:

- ADDISK on all local disk partitions in PRIMOS.COMI before the INIT_RECOVER command runs (or before running FS_RECOVER Main Menu Option 2 manually). You must do this for PRIMOS to be able to report the current state of each partition to FS_RECOVER.

- Do not change the SYSTEM_RECOVER parameters to omit RFS. RFS should run whenever the system crashes.

If you do not follow these guidelines, it is possible that FS_RECOVER will recommend unnecessary FIX_DISKs.

When the disk state analysis is complete, FS_RECOVER summarizes the state of each disk partition, and displays a FIX_DISK recommendation for each. This listing is preceded by the following help screen.

Note The options displayed vary according to your PRIMOS revision and whether Online FIX_DISK is available.

You will now be shown an individual summary of activity for each partition that was mounted at the time of the crash. After each summary there will be a FIX_DISK recommendation. To accept the recommendation simply answer YES, or press <RETURN>. To reject or modify the recommendation, enter one of the following options:

```
SKip          to do nothing to the partition
FAst          to run FIX_DISK with the FAST option
PArtial       to run a PARTIAL FIX_DISK
NoFix         to run FIX_DISK without the -FIX option
OFfline       to run FIX_DISK with the disk shut down
ONline        to run ONLINE FIX_DISK

        NOTE: Combinations for the above options are possible
              For example, you may enter: "FUll ONline NoFix"

HELP          to see this screen
QUIT          to return to the Main Menu
```

Press <RETURN> when you are ready to see the partition state summary:

The recommendation falls into one of four categories:

Immediate FIX_DISK

You should run FIX_DISK before using the partition, or the file system and data integrity may be compromised. FS_RECOVER may attempt to use the –FAST option and/or the –PARTIAL option to minimize FIX_DISK session time. By default, FS_RECOVER builds CPL files to run any immediate FIX_DISK.

Deferred FIX_DISK

You can add the partition but file system integrity may be compromised. If no database recovery is required for the files on the partition, you can make the partition available for use immediately. However, at some convenient time, you *must* run full FIX_DISK on the partition.

Not Required

The partition was clean before the crash and the crash did not damage the partition. You should find all your partitions in this state after a successful forced shut down or a successful invocation of RFS at Rev. 23.1. If no database recovery is required for the files on the partition, you can make the partition available for use immediately.

No Recommendation

If FS_RECOVER detects that a disk drive containing a partition that was mounted at the time of the crash has been repartitioned, no recommendation will be given.

Example of Immediate FIX_DISK

Here is an example of a partition requiring immediate FIX_DISK:

```
LDEV:  1  PDEV: 6062    NAME: <BAYGRP> (robust)
Warning: The crashdump indicates 2 serious problems with this partition:
     A file system transaction was in progress at the time of the crash.
     Portions of the DSKRAT were modified, but not written to the disk.

Activity File Type  Pathname
--------- ---------- --------
L       SAM file   <BAYGRP>UNIX01
L       ACL dir    <BAYGRP>ANDYG.RSRCH
LT      DAM file   <BAYGRP>ANDYG.RSRCH>TABLE

File Activity Codes:
L : file had modified unflushed records in Locate subsystem.
T : file may have had an in-progress transaction.

RECOMMENDATION: run FIX_DISK -FIX -ONLINE
Is the recommended action satisfactory: [YES]
```

Example of Deferred FIX_DISK

Here is an example of the summary for one partition requiring a deferred FIX_DISK:

```
------------------------------------------------------------------------
LDEV: 2 PDEV: 3462 NAME: <QUALF2>


No file system activity indicated; schedule a FIX_DISK at your convenience.
------------------------------------------------------------------------
```

In this example, there was no indication of file system activity or serious problems; an immediate FIX_DISK is not required. If no special database recovery is needed for the files on this partition, you can make it available to users. However, at some convenient time, you must run FIX_DISK to maintain the integrity of the partition's file system.

Changing a FIX_DISK Recommendation

After FS_RECOVER displays the summary and recommendation for a partition, it asks you if you agree with the recommendation. If you answer YES, FS_RECOVER continues with the next partition summary. If you answer NO, FS_RECOVER enters the FIX_DISK Menu, which then asks you what you want to do with the partition.

```
------------------------------------------------------------------------
LDEV: 2 PDEV: 3164 NAME: <DISK02>

RECOMMENDATION: run FIX_DISK -FIX -ONLINE
Is the recommended action satisfactory?
```

At this point, enter a valid choice from the summary menu shown previously in Recommendations for Running FIX_DISK or enter NO or HELP to see a list of valid choices:

```
Valid choices are:
    YEs             to run FIX_DISK -FIX -ONLINE
    AUto            to run FIX_DISK -FIX -ONLINE
    Full            to run FIX_DISK -FIX -ONLINE
    SKip            to do nothing to the partition
    FAst            to run FIX_DISK with the -FAST option
    PArtial         to run a PARTIAL FIX_DISK
    NoFix           to run FIX_DISK without the -FIX option
    OFfline         to run FIX_DISK with the disk shut down
    ONline          to run ONLINE FIX_DISK

                    NOTE: Combinations of the above options are possible.
                          For example, you may enter: FUll ONline NoFix

    HELP            to see this screen
    QUIT            to return to the Main Menu

    Is the recommended action satisfactory?
```

After you enter a valid choice, FS_RECOVER continues with the next partition. After you have answered the queries for all affected partitions, FS_RECOVER summarizes your choices.

The Summary Display

After all the partitions have been individually summarized, FS_RECOVER displays a general summary of all the FIX_DISK recommendations. FS_RECOVER then asks you if all the recommendations are satisfactory. If you answer NO, FS_RECOVER repeats the individual partition summaries so that you can change recommendations for running FIX_DISK.

CURRENT			CURRENTLY	TYPE OF	
LDEV	PDEV	NAME	MOUNTED?	FIX_DISK NEEDED	COMMENTS
0	6060	<DISK00>	yes	none	Comdev
1	6062	<DISK01>	yes	online, full	
2	3164	<DISK02>	yes	online, full	

```
3 partitions analyzed, 2 partitions require FIX_DISK.
2 immediate FIX_DISKs, 0 deferrable FIX_DISKs.

Are these FIX_DISK recommendations satisfactory? YES
```

Automated FIX_DISK

If there are no recommendations for running immediate or deferred FIX_DISK, FS_RECOVER returns to the Main Menu. If there are deferred or immediate FIX_DISK recommendations and you answer YES, indicating that you are satisfied with the FIX_DISK recommendations, FS_RECOVER asks if you want to initiate automated FIX_DISK on all partitions requiring immediate FIX_DISK (except the Command Device if you are running a PRIMOS revision that does not support Online FIX_DISK):

```
3 partitions analyzed, 2 partitions require FIX_DISK.
2 immediate FIX_DISKs, 0 deferrable FIX_DISKs.

Are these FIX_DISK recommendations satisfactory? YES
Do you want to initiate the immediate FIX_DISKs? YES
```

If all recommendations were for deferred FIX_DISK, FS_RECOVER returns to the Main Menu.

Setup for Automated FIX_DISK

If you answer YES indicating that you want to initiate the immediate FIX_DISK recommendations, FS_RECOVER displays a FIX_DISK Setup screen. In this screen the system is prepared for FIX_DISKs to run, using steps that vary according to whether any Offline FIX_DISKs are to run.

If you are executing FS_RECOVER at the system console, the FIX_DISK Setup screen typically looks like this:

```
-----------------------------------------------------------------------
                        *** FIX_DISK SETUP ***

OK to stop the LOGIN_SERVER before starting offline FIX_DISKs? y
LOGIN_SERVER has been stopped.
OK to restart the LOGIN_SERVER after offline FIX_DISKs complete? y
Forcing MAXUSR ALL for FIX_DISK sessions.
Attempting to startup the DISK_MANAGER.
DISK_MANAGER service has now been enabled.
```

Reminder If any of the partitions about to be repaired *offline* are currently mirrored you must break those mirrors with the MIRROR_OFF command before initiating automated FIX_DISK.

In the above example, note that you have the option of stopping and starting the Login Server before and after offline FIX_DISKs. These options are not applicable when no offline FIX_DISKs are being done.

If you are *not* running FS_RECOVER at the system console, FS_RECOVER tells you to go to the system console and enter any necessary setup commands, as in the following example:

```
-------------------------------------------------------------------------
                     *** FIX_DISK SETUP ***

DISK_MANAGER must be started up prior to initiating FIX_DISK phantoms.
Enter the following at the System Console:

    DISK_MANAGER -START

In order to allow FIX_DISK phantoms to log in, enter the following command
at the System Console:

    MAXUSR ALL

If you want to prohibit user logins while FIX_DISK is running, enter the
following command at the System Console:                    .

    STOP_LSR

                 '
Reminder: If any of the partitions which are about to be repaired
          are currently mirrored you must break those mirrors with
          the MIRROR_OFF command before initiating automated FIX_DISK.

Press <RETURN> after this is done and/or you are ready to proceed:
```

Automated FIX_DISK Phantoms

Immediately following either of the screen examples in the preceding section, FS_RECOVER continues as follows:

```
All programs which will control the FIX_DISK sessions are in the directory
    <0>SYSTEM_DEBUG*>CRASH>FIX.RYDCAD.930307.113056

The 4 partitions requiring FIX_DISK reside on 2 different disk drives.
Both of these disk drives can be worked on in parallel.  This requires one
phantom per disk drive (each phantom will do ALL the required FIX_DISKs for
a given disk drive), plus one phantom to drive the FIX_DISK_MONITOR program.
If 3 phantoms is too many, fewer (down to a minimum of 2) may be used.

Enter the number of phantoms to use (2-3) or (Q)uit: 3

FIX_DISK setup is now complete, and we're ready to begin.
Enter <RETURN> to begin, or QUIT, or "! <command>":
```

In the first two lines of this example, FS_RECOVER creates a subdirectory within the working directory, known as the **Fix Directory**, in which it builds the CPL programs that will run FIX_DISK. This directory is named FIX.<*system_name*>.<*date*>.<*time*>.

Next, FS_RECOVER determines how many phantoms are necessary to execute all the CPL programs. It takes into account the number of available phantoms, the number of FIX_DISK sessions required, the number of disk drives containing partitions requiring FIX_DISK, and the PRIMOS limit on the number of assignable disks.

FS_RECOVER then asks how many phantoms you would like to use. Unless you have a good reason to do otherwise, select the maximum number offered (it is most efficient).

Automated FIX_DISK CPL Programs and Como Files

The Fix Directory mentioned in the preceding section contains a CPL program and como file for each partition on which FIX_DISK is run.

The como files record the actual FIX_DISK session for each partition. Later, when all FIX_DISKs have completed, you may need to review the como files to check whether any partitions had file system objects deleted or truncated by FIX_DISK. If FIX_DISK makes repairs to a partition, the phantom executing the FIX_DISK sends a message like this to the system console:

```
*** FIX_C1D0 (user 120 on RYDCAD) at 15:01
FIX_DISK made repairs to partition ACCTNG (PDEV 7661).   Check COMO file.
```

If such a message is not sent, no repairs were made. But because it is easy to overlook messages sent to a busy system console, you should normally review all como files in the Fix Directory as a matter of routine.

Each como file in the Fix Directory is named in the format FIX.*diskname.date.time*.COMO. A typical como file is given below. In this example the FIX_DISK was done offline, and the como also shows requests sent by the phantom to the system console, asking the DISK_MANAGER software running there to perform privileged commands.

```
[RUN_FIX_DISK 5.0-23.2 Copyright (c) 1992, Prime Computer Inc.]

RUN_FIX_DISK starting at 23 Feb 93 20:22:56 Tuesday
-------------------------------------------------
FIX_DISK command line for partition HPS:
FIX_DISK -DISK 464 -FIX

*** Attempting to shutdown HPS (464).

[DISK_REQUEST a.21 Copyright (c) 1991, Prime Computer Inc.]
```

```
Sending  : "SH 464"
Received : "SH 464"
Executing: "SH 464"
Completed.

[DISK_REQUEST a.21 Copyright (c) 1991, Prime Computer Inc.]

Sending  : "DI 464"
Received : "DI 464"
Executing: "DI 464"
Completed.
[FIX_DISK Rev. 23.2.0 Copyright (c) 1991, Prime Computer, Inc.]
Date: 02/23/93. Time: 20:23.
Partition name is HPS

This is a revision 22.1 partition.
Disk is in -All_Controller mode with Reverse Allocation
The BADSPT file has 15 entries.

BEGIN MFD
  BEGIN CMDNC0
  END    CMDNC0  1
  BEGIN DOS
  END    DOS  1
  BEGIN DRBSRC.DAT
  END    DRBSRC.DAT  17739
  BEGIN VAUGHAN
  END    VAUGHAN  264
END    MFD  18185

32224 records in partition
18185 records used
    1 records lost
14038 records left
    0 records compressed
DSKRAT OK
FIX_DISK finished

[DISK_REQUEST a.21 Copyright (c) 1991, Prime Computer Inc.]

Sending  : "DI NOT 464"
Received : "DI NOT 464"
Executing: "DI NOT 464"
Completed.

[DISK_REQUEST a.21 Copyright (c) 1991, Prime Computer Inc.]

Sending  : "AD 464 -FORCE"
Received : "AD 464 -FORCE"
```

```
Executing: "AD 464 -FORCE"
Completed.

[DISK_REQUEST a.21 Copyright (c) 1991, Prime Computer Inc.]

Sending  : "END_OF_TASK"
Received  : "END_OF_TASK"
Completed.

RUN_FIX_DISK successfully completed.
```

Each CPL program in the Fix Directory is named in the format
FIX_*diskname*.CPL. Here is an example:

```
/* CPL to fix disk SDSNEW (pdev 50462)

&args no_como : -no_como, -nco

&severity &error &routine ERR
&s ERRORS := 0

r <0>SYSTEM_DEBUG*>CRASH>RUN_FIX_DISK.CPL %NO_COMO% ~
  -PDEV 50462 -DISK_NAME SDSNEW -FIX

&if %ERRORS% > 0 &then ~
  type Failed with %ERRORS%' error(s).'
&return

&routine ERR
&s ERRORS := %ERRORS% + 1
&return
```

Each FS_RECOVER phantom which runs FIX_DISK on a specific partition
executes a CPL program like this. You may occasionally need to re-execute one
of these programs manually: for example, if a FIX_DISK fails for some reason
outside FS_RECOVER's control, or because you want to add options like
-DUFE or -CMPR which FS_RECOVER never specifies. Once the
FS_RECOVER phantom which originally executed the program has logged out,
you may edit and re-execute the program freely.

Notice from the example that the FIX_*diskname*.CPL program is merely an
interlude to another (more complex) program called RUN_FIX_DISK.CPL.
RUN_FIX_DISK runs the actual FIX_DISK session and creates the como file
discussed above. Do not edit the RUN_FIX_DISK program; FS_RECOVER
may malfunction if you do.

Use the following guidelines if you want to rerun a FIX_*diskname*.CPL:

- Edit the CPL program if the RUN_FIX_DISK command it contains needs options removed or added. Any options you append to the RUN_FIX_DISK command will be added to the FIX_DISK command executed by RUN_FIX_DISK.

- If the FIX_DISK will run offline, check that the disk manager is running at the system console. If the disk manager is not running, use the command DISK_MANAGER –START at the console.

- Execute the CPL program. It is designed to run as a phantom, and you are recommended to execute it that way. It may be run at a terminal if desired, but must *not* be executed at the system console if the disk manager is running.

FS_RECOVER no longer needs the Fix Directory after all FIX_DISKs are complete. You should delete the directory when you no longer need the CPL or como files it contains.

The FIX_DISK Monitor Phantom

After you tell FS_RECOVER how many phantoms to use, you are prompted to begin automated FIX_DISK. You can also quit or execute PRIMOS commands prior to beginning automated FIX_DISK, as shown in the following example:

```
FIX_DISK setup is now complete, and we're ready to begin.
Enter <RETURN> to begin, "QUIT", or "! <command>":  ! m -all -now -force
The system will be available in about 10 minutes. Please standby...

Enter <RETURN> to begin, "QUIT", or "! <command>":  Return
```

When you press the Return key, FS_RECOVER starts up the FIX_DISK Monitor phantom. The Monitor then begins creating phantoms to run FIX_DISK sessions, according to the number of phantoms you specified earlier. If you specified only one phantom, or there are only a small number of FIX_DISKs to do, or it is not possible to start a phantom for some reason, the Monitor executes the necessary FIX_DISK itself.

When the Monitor has executed any FIX_DISKs it decides to execute directly, it sends a message like this to the system console:

```
*** SYSTEM at 17:42
Monitor: All directly invoked FIX_DISKs have been attempted.
```

The Monitor does not log out until all FIX_DISKs are complete. At this point, it
may still be waiting for FIX_DISK phantoms to complete. As each phantom
completes, the Monitor sends messages like this to the system console:

```
*** SYSTEM at 17:42
Monitor: Waiting for 2 FIX_DISK phantoms to complete.
```

When all FIX_DISKs are complete, the monitor sends the following message to
the system console and logs out:

```
*** SYSTEM at 17:42
Monitor: Work completed, logging out.
```

The Monitor always logs its activities in a como file created in the Working
Directory with a name like MONITOR.*<date>*.*<time>*.COMO . You do not
normally need to inspect this como file, unless there is some persistent
operational problem you need to diagnose. Here is a typical sample of a Monitor
como file:

```
[FIX_DISK_MONITOR 5.0-23.2 Copyright (c) 1992, Prime Computer Inc.]

A maximum of 2 phantom(s) will be used to do FIX_DISKs.
Control files in: <PR232>SYSTEM_DEBUG*>CRASH>FIX.SYDDV1.930223.202244

Reading contents of FIX_SPINDLE_LIST ...

FIX_SPINDLE_LIST contains 2 filename(s).
Attempting to spawn phantom FIX_C0D2 ...
Phantom is user 383.
Attempting to spawn phantom FIX_C1D0 ...
Phantom is user 384.

Monitor: Spawned 2 FIX_DISK phantoms.
Waiting for 2 FIX_DISK phantoms to complete.

Phantom logout notification received.  1 phantom(s) left.

Phantom logout notification received.  0 phantom(s) left.

Monitor: Work completed, logging out.
```

The Monitor como file is no longer needed after the Monitor logs out and you
are satisfied that all FIX_DISKs completed successfully. You should
periodically delete the Monitor como files as part of routine housekeeping.

The DISK_MANAGER

FS_RECOVER sets up phantom processes to do FIX_DISK. Depending on the kind of FIX_DISKs required and the state of the disk partitions when the FIX_DISKs are done, you need different privileged commands at specific times. FS_RECOVER uses a service called the DISK_MANAGER to perform these privileged commands for the FIX_DISK phantoms. The DISK_MANAGER causes the system console to perform these actions.

While the DISK_MANAGER is running, the system console is available for most commands. It is important, however, not to keep the system console busy. A busy system console cannot perform the commands which the FIX_DISK phantoms need.

The following commands cannot be run at the system console while the DISK_MANAGER is running:

> DELSEG
> ECL –ON
> ECL –OFF
> ICE
> RELEASE (RLS)

The DISK_MANAGER is rarely needed with Online FIX_DISK. If all FIX_DISKs are run online, FS_RECOVER will usually terminate immediately after starting the Monitor, and will not start the DISK_MANAGER.

The commands executed by the DISK_MANAGER (ASSIGN, UNASSIGN, ADDISK, SHUTDN, etc.) are normally needed only to service Offline FIX_DISK. Here is an example of the DISK_MANAGER in operation, in a situation where offline FIX_DISKs were started up by FS_RECOVER, run from the system console:

```
Enter the number of phantoms to use (2-3) or (Q)uit: 3

FIX_DISK setup is now complete, and we're ready to begin.
Enter <RETURN> to begin, or QUIT, or "! <command>":
FIX_DISK_MONITOR is user 103.
FIX_DISKs started.  Pausing FS_RECOVER to service System Console.
OK,
*** SYSTEM at 19:06
Monitor: Spawned 2 FIX_DISK phantoms.
*** Finished  "SH 41460" for FIX_COD0 (user 104).
*** Finished  "DI 41460" for FIX_COD0 (user 104).
*** Finished  "SH 2062" for FIX_COD1 (user 105).
*** Finished  "DI 2062" for FIX_COD1 (user 105).
stat us
```

	User No	Line No	
User	(In Decimal)		Devices (AL in Decimal)
SYSTEM	1	asr	<RYDCAD>
NM_SERVER	100	phant	<RYDCAD>
NETMAN	101	nsp	<RYDCAD>
FIX_DISK_MONITOR	103	phant	<RYDCAD>
FIX_COD0	104	phant	<RYDCAD> DK41460
FIX_COD1	105	phant	<RYDCAD> DK2062
TIMER_PROCESS	130	kernel	<RYDCAD>
BUFFER_SERVER	131	kernel	<RYDCAD>
LOGOUT_SERVER	132	kernel	<RYDCAD> (SYSTEM IDLE)
DSMSR	135	DSM	<RYDCAD>
DSM_LOGGER	136	DSM	<RYDCAD>
SYSTEM_MANAGER	137	SMSr	<RYDCAD>
NAME_SERVER	138	NameSr	<RYDCAD>
ISC_NETWORK_SERVER	139	ISCNsr	<RYDCAD>

```
OK, *** Finished  "DI NOT 41460" for FIX_COD0 (user 104).
Starting up revision 22.1 partition "POTATO".
*** Finished  "AD 41460 -FORCE" for FIX_COD0 (user 104).
*** Finished  "END_OF_TASK" for FIX_COD0 (user 104).
1 task left
*** Finished  "DI NOT 2062" for FIX_COD1 (user 105).
Starting up revision 22.1 partition "ORANGE".
*** Finished  "AD 2062 -FORCE" for FIX_COD1 (user 105).
*** Finished  "END_OF_TASK" for FIX_COD1 (user 105).
0 tasks left
DISK_MANAGER service has now been disabled.

FIX_DISKs finished.  Reentering FS_RECOVER to finish up.
LOGIN_SERVER has been restarted.
FS_RECOVER finished.
OK,
*** SYSTEM at 19:20
Monitor: Work completed, logging out.
```

In this example, you can observe the following sequence of events:

- FS_RECOVER starts the DISK_MANAGER as part of the FIX_DISK Setup, and then starts the FIX_DISK Monitor.

- FS_RECOVER then pauses until the Offline FIX_DISKs complete. It does this by calling a new command level which puts you at an OK, prompt.

- You remain in this command level until all Offline FIX_DISKs are complete. Periodically, the system console automatically executes commands on behalf of a FIX_DISK phantom, like this:

```
Starting up revision 22.1 partition "POTATO".
*** Finished  "AD 41460 -FORCE" for FIX_C0D0 (user 104).
```

During this time you may issue commands of your own (such as the stat us command in the example), provided they meet the requirements outlined above.

- When all offline FIX_DISKs are complete the DISK_MANAGER is no longer needed, and automatically switches itself off. Control returns to FS_RECOVER, which tidies up, and finishes.

If FS_RECOVER was invoked from INIT_RECOVER rather than interactively, following the last step INIT_RECOVER regains control, and the cold start continues.

If FS_RECOVER was invoked interactively, but not at the system console, you must start the DISK_MANAGER at the system console with the command DISK_MANAGER –START. After this, DISK_MANAGER and user commands execute at the console in the same way as illustrated above. The DISK_MANAGER stops itself automatically; the command DISK_MANAGER –STOP is not normally needed.

If you quit from FS_RECOVER after the DISK_MANAGER was enabled but before any FIX_DISKs were done, the DISK_MANAGER may remain enabled. If you execute FS_RECOVER again, you may then see this message:

```
*** USAGE ERROR ***
DISK_MANAGER services are already enabled.
```

Following this message it is possible that FIX_DISK phantoms will fail to communicate properly with the system console. You should immediately quit from FS_RECOVER, use the command DISK_MANAGER –STOP, and execute FS_RECOVER again.

Common Operational Problems

Occasionally FS_RECOVER's FIX_DISK phantoms will strike problems or special situations that they report in messages to the system console. This section explains how to deal with the commonest of these.

- If another user on the system inadvertently interferes with a disk which a FIX_DISK phantom needs to access, preventing the phantom from assigning the disk, one of the following messages is sent to the system console:

```
*** FIX_C0D0 (user 124 on RYDCAD) at 10:24
Cannot assign disk LOGINS.  Please "SHUT 41460; DI 41460".

*** FIX_C0D0 (user 124 on RYDCAD) at 10:24
Cannot assign PDEV 120462 (CDD2).  Please "CDD 120462 -DD".

*** FIX_C0D0 (user 124 on RYDCAD) at 10:24
Cannot assign PDEV 71462 (GILGIT).  Check como file.
```

These cases require operator intervention for the FIX_DISK phantom to proceed. You should act quickly because the phantom retries the failed command only a limited number of times before giving up (for a total of 1 hour). If the message recommends a specific command, issue this command at the system console. If the message is subsequently repeated at 15 second intervals (i.e. the phantom is still having difficulty) check the phantom's como file in the Fix Directory (described in the section Automated FIX_DISK CPL Programs and Como Files). The como file should contain error messages which enable you to diagnose and correct the problem.

- If your system has an activated CDD partition which is also locally mounted, there are some special considerations when FIX_DISK is run on this disk. Whenever possible, such a disk should be fixed online. If it must be fixed offline, you should be aware that it must be temporarily deactivated while the FIX_DISK is performed (in order to assign it). The FIX_DISK phantom attempts this automatically. You will see the following messages at the start and end of the period of deactivation:

```
*** FIX_C0D1 (user 129 on RYDCAD) at 10:24
Caution:  CDD PDEV 120462 temporarily deactivated for FIX_DISK.

*** FIX_C0D1 (user 129 on RYDCAD) at 10:24
End of caution:  CDD PDEV 120462 reactivated.
```

Because of these operational complexities, running offline FIX_DISK on an activated CDD partition is not recommended. Online FIX_DISK is recommended, because it does not require the disk to be deactivated.

4   Using FS_RECOVER for Automated FIX_DISK (anytime)

■ ■ ■ ■ ■ ■ ■

This chapter describes the use of FS_RECOVER's Main Menu Option 3. You should first be familiar with the general discussion of FIX_DISK options and FS_RECOVER's Main Menu at the start of Chapter 3, and the sections describing the operation of FS_RECOVER's FIX_DISK phantoms at the end of Chapter 3.

FS_RECOVER's Main Menu Option 3 is a convenient and intelligent interface with FIX_DISK which you can use to perform most routine FIX_DISKs on your system. This option first displays the state of all locally mounted disk partitions, and then gives you the option to run FIX_DISK on all partitions that need it, or on any individually specified partitions.

FIX_DISKs started by Option 3 are automated, just as they are during recovery analysis, described in Chapter 3. Automated FIX_DISKs relieve you of the need to issue commands like DISKS and ASSIGN, or to remember FIX_DISK options and syntax, or to code CPL programs to run FIX_DISK. CPL programs and como filesare created automatically and organized conveniently in the Fix Directory (described in Chapter 3).

Displaying the State of Currently Mounted Disks

Main Menu Option 3 is used to make a general assessment of the health of all currently mounted local partitions. During this assessment, FS_RECOVER recognizes only two states that a partition can be in, as follows:

Clean   A clean partition is one in which the file system structures on the partition are completely intact. This is indicated by bits set in the partition's DSKRAT that tell PRIMOS whether or not the partition had been cleanly shut down since its last full FIX_DISK session. If the bits are not set, PRIMOS displays a warning message when the partition is mounted. (Refer to Appendix C.) However, there are exceptional instances when a clean partition can become damaged *after* it is mounted. From Rev. 23.1, PRIMOS has specialized support to make information about these exceptions available to FS_RECOVER.

Damaged A damaged partition is one that was either not clean at the time it was mounted, or it was damaged after it was mounted. If the damage occurred after the partition was mounted and you are running PRIMOS Rev. 23.1 or later, FS_RECOVER will tell you the type of problem that damaged the partition.

Any disk partitions on which Online FIX_DISK is running appear in the State of Currently Mounted Disks display with IR for in-repair.

Following are four examples illustrating the use of the Main Menu Option 3.

Example 1

This first example shows the use of Main Menu Option 3 if you are running a revision of PRIMOS that does not support Online FIX_DISK (see page ix), and there is no FIX_AUTO_CONFIG file:

```
------------------------------------------------------------------------
                            *** MAIN MENU ***

(1) Read crash tapes
(2) Perform crash recovery analysis
(3) Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 3

------------------------------------------------------------------------
                         *** SHOW LOCAL DISKS ***

                                    FIX_DISK
            LDEV    PDEV     NAME    RECOMMEND    COMMENTS
            ----    ------   ----    ---------    --------
               0    6060     <DISK00> none        Comdev
               1    6062     <DISK01> full        NC
               2    3164     <DISK02> full        NC

Legend:
NC: Partition was not "clean" when it was mounted.

3 partitions displayed, 2 require full FIX_DISK.
```

FS_RECOVER now asks if you wish to run FIX_DISK on all partitions. If you answer NO, FS_RECOVER then asks if you want to run FIX_DISK on any partition. If you answer YES, FS_RECOVER sets up for automated FIX_DISK the same way it does after a crash dump analysis.

```
Initiate "FIX_DISK -FIX" on ALL disk partitions, except the Comdev? NO
Do you want to run FIX_DISK on any disk partitions, except the Comdev? YES

You will prompted once for each disk partition. To run
FIX_DISK -FIX on the partition simply answer YES or press <RETURN>.
To avoid running FIX_DISK on the partition, or to run FIX_DISK with other
options, enter one of the following:

    Full or YES      to run FIX_DISK -FIX
    SKip             to do nothing to the partition
    FAst             to run FIX_DISK with the -FAST option
    PArtial          to run a PARTIAL FIX_DISK
    NoFix            to run FIX_DISK without the -FIX option
```

```
      HELP              to see this screen
      QUIT              to return to the Main Menu

Run "FIX_DISK -FIX" on PDEV 6060 <DISK01>? YES
Run "FIX_DISK -FIX" on PDEV 6062 <DISK01>? SKIP
Run "FIX_DISK -FIX" on PDEV 3164 <DISK02>? FAST NOFIX

                              FIX_DISK
LDEV   PDEV      NAME    RECOMMEND    ACTUAL              COMMENTS
----   ------  --------  ---------  ------------------   --------

   0   6060    <DISK00>   none      full/fix             Comdev
   1   6062    <DISK01>   none      skip
   2   3164    <DISK02>   none      fast/nofix

Are these FIX_DISK recommendations satisfactory? YES
Enter pathname of working directory [default=<0>SYSTEM_DEBUG*>CRASH]:
```

At this point, the requested FIX_DISKs are set up and run exactly as described in Chapter 3 (see the section Setup for Automated FIX_DISK).

Example 2

In the next example, you are running a revision of PRIMOS that does not support Online FIX_DISK (see page ix) and using the FIX_AUTO_CONFIG file:

```
--------------------------------------------------------------------------------
                              *** MAIN MENU ***

(1) Read crash tapes
(2) Perform crash recovery analysis
(3) Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 3

--------------------------------------------------------------------------------
                           *** SHOW LOCAL DISKS ***

                              FIX_DISK
LDEV    PDEV    NAME        RECOMMEND  FIX_AUTO_CONFIG    COMMENTS
----    ----    --------    ---------  ---------------    --------
  0     6060    <DISK00>    none       not applicable     Comdev
  1     6062    <DISK01>    full       full/fast/fix      NC
  2     3164    <DISK02>    full       full/fast/nofix    NC

Legend:
NC: Partition was not "clean" when it was mounted.

3 partitions displayed, 2 require full FIX_DISK.
```

FS_RECOVER now asks if you wish to run FIX_DISK on partitions as specified in the FIX_AUTO_CONFIG file. If you answer NO, FS_RECOVER then asks if you want to run FIX_DISK on any partition. If you answer YES, FS_RECOVER sets up for automated FIX_DISK the same way it does after a crash dump analysis.

```
Using the FIX_AUTO_CONFIG options displayed above, is it OK to:
Initiate FIX_DISK on *ALL* disk partitions, except the Comdev? NO

Do you want to run FIX_DISK on any disk partitions, except the Comdev? YES

You will prompted once for each disk partition listed above. To run FIX_DISK
-FIX on the partition simply answer YES or press <RETURN>. To avoid running
FIX_DISK on the partition, or to run FIX_DISK with other options, enter one of
the following:

    FUll or YEs      to run FIX_DISK -FIX
    SKip             to do nothing to the partition
    FAst             to run FIX_DISK with the -FAST option
```

```
   PArtial          to run a PARTIAL FIX_DISK
   NoFix            to run FIX_DISK without the -FIX option

   HELP             to see this screen
   QUIT             to return to the Main Menu

Run "FIX_DISK -FIX" on PDEV 6062 <DISK01>? FAST FIX
Run "FIX_DISK -FIX" on PDEV 3164 <DISK02>? FAST NOFIX
```

```
                              FIX_DISK
LDEV    PDEV    NAME      RECOMMEND    ACTUAL              COMMENTS
----    ------  --------  ---------    ----------------    --------
   0    6060    <DISK00>  none         skip                Comdev
   1    6062    <DISK01>  none         full/fast/fix
   2    3164    <DISK02>  none         full/fast/nofix
```

```
Are these FIX_DISK recommendations satisfactory? YES
Enter pathname of working directory [default=<0>SYSTEM_DEBUG*>CRASH]:
```

Example 3

In the next example, you are running a revision of PRIMOS that supports Online FIX_DISK (see page ix) and not using the FIX_AUTO_CONFIG file:

```
-------------------------------------------------------------------------------
                            *** MAIN MENU ***

(1) Read crash tapes
(2) Perform crash recovery analysis
(3) Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 3


-------------------------------------------------------------------------------
                         *** SHOW LOCAL DISKS ***

                        FIX_DISK
LDEV   PDEV   NAME       RECOMMEND   COMMENTS
----   ----   --------   ---------   --------
   0   6060   <DISK00>   none        Comdev
   1   6062   <DISK01>   full        NC
   2   3164   <DISK02>   full        NC

Legend:
NC: Partition was not "clean" when it was mounted.

3 partitions displayed, 2 require full FIX_DISK.
```

FS_RECOVER now asks if you wish to run FIX_DISK on all partitions. If you answer NO, FS_RECOVER then asks if you want to run FIX_DISK on any partition. If you answer YES, FS_RECOVER sets up for automated FIX_DISK the same way it does after a crash dump analysis.

```
***Note: The Command Device will be fixed with ONLINE FIX_DISK.
Initiate "FIX_DISK -FIX" on *ALL* disk partitions? NO

Do you want to run FIX_DISK on any disk partitions? YES

You will prompted once for each disk partition listed above. To run FIX_DISK
-FIX -ONLINE on the partition simply answer YES or press <RETURN>. To avoid
running FIX_DISK on the partition, or to run FIX_DISK with other options, enter
one of the following:

    FUll or YES    to run FIX_DISK -FIX -ONLINE
    SKip           to do nothing to the partition
    FAst           to run FIX_DISK with the -FAST option
    PArtial        to run a PARTIAL FIX_DISK
    NoFix          to run FIX_DISK without the -FIX option
```

```
OFfline              to run FIX_DISK with the disk shut down
ONline               to run ONLINE FIX_DISK

                     NOTE: Combinations of the above options are possible.
                           For example, you may enter: "FUll ONline NoFix"

HELP                 to see this screen
QUIT                 to return to the Main Menu
```

```
>>> Note: PDEV 6060 is the Command Device, it must be fixed ONLINE.
Run "FIX_DISK -FIX -ONLINE" on PDEV 6060 <DISK00>? YES
Run "FIX_DISK -FIX -ONLINE" on PDEV 6062 <DISK01>? OFFLINE FAST FIX
Run "FIX_DISK -FIX -ONLINE" on PDEV 3164 <DISK02>? ONLINE PARTIAL NOFIX
Pathname: STM_AUTO>REV20.2>KS>LO_CLEAN_TEXT.SPL
```

```
                              FIX_DISK
LDEV    PDEV    NAME       RECOMMEND    ACTUAL                 COMMENTS
----    ------  --------   ---------    ------------------     --------

  0     6060    <DISK00>   none         online/full            Comdev
  1     6062    <DISK01>   full         offline/full/fast
  2     3164    <DISK02>   full         online/nofix/partial
                                        STM_AUTO>REV20.2>KS>LO_CLEAN_TEXT.SPL
```

```
Are the proposed FIX_DISK actions satisfactory? YES
Enter pathname of working directory [default=<0>SYSTEM_DEBUG*>CRASH]:
```

Example 4

In this last example, you are running PRIMOS Rev. 23.4 or later and using the
FIX_AUTO_CONFIG file:

```
------------------------------------------------------------------
                        *** MAIN MENU ***

(1) Read crash tapes
(2) Perform crash recovery analysis
(3) Display state of currently mounted disks

Enter a menu number, or (Q)uit or (M)enu: 3

------------------------------------------------------------------
                      *** SHOW LOCAL DISKS ***

               FIX_DISK
LDEV   PDEV    NAME      RECOMMEND   FIX_AUTO_CONFIG     COMMENTS
----   ----    --------  ---------   ------------------  --------
   0   6060    <DISK00>  none        online/fix          Comdev
   1   6062    <DISK01>  full        offline/fast/fix    NC
   2   3164    <DISK02>  full        offline/fast/nofix  NC

Legend:
NC: Partition was not "clean" when it was mounted.

3 partitions displayed, 2 require full FIX_DISK.
```

FS_RECOVER now asks if you wish to run FIX_DISK on partitions as specified
in the FIX_AUTO_CONFIG file. If you answer NO, FS_RECOVER then asks if
you want to run FIX_DISK on any partition. If you answer YES,
FS_RECOVER sets up for automated FIX_DISK the same way it does after a
crash dump analysis.

```
Using the FIX_AUTO_CONFIG options displayed above, is it OK to:
Initiate FIX_DISK on *ALL* disk partitions? NO

Do you want to run FIX_DISK on any disk partitions? YES

You will prompted once for each disk partition listed above. To run FIX_DISK
-FIX -ONLINE on the partition simply answer YES or press <RETURN>. To avoid
running FIX_DISK on the partition, or to run FIX_DISK with other options, enter
one of the following:

    FUll or YES    to run FIX_DISK -FIX -ONLINE
    SKip           to do nothing to the partition
    FAst           to run FIX_DISK with the -FAST option
    PArtial        to run a PARTIAL FIX_DISK
```

```
    NoFix              to run FIX_DISK without the -FIX option
    OFfline            to run FIX_DISK with the disk shut down
    ONline             to run ONLINE FIX_DISK

                       NOTE: Combinations of the above options are possible.
                             For example, you may enter: "FUll ONline NoFix"

    HELP               to see this screen
    QUIT               to return to the Main Menu

>>> Note: PDEV 6060 is the Command Device, it must be fixed ONLINE.
Run "FIX_DISK -FIX -ONLINE" on PDEV 6060 <DISK00>? YES
Run "FIX_DISK -FIX -ONLINE" on PDEV 6062 <DISK01>? OFFLINE FAST FIX
Run "FIX_DISK -FIX -ONLINE" on PDEV 3164 <DISK02>? ONLINE PARTIAL NOFIX
Pathname: STM_AUTO>REV20.2>KS>LO_CLEAN_TEST.SPL
```

```
                                    FIX_DISK
LDEV      PDEV    NAME      RECOMMEND    ACTUAL                 COMMENTS
----      ------  --------  ----------   --------------------   --------
   0      6060   <DISK00>   none         online/full            Comdev
   1      6062   <DISK01>   full         offline/full/fast      NC
   2      3164   <DISK02>   full         online/nofix/partial   NC
                                         STM_AUTO>REV20.2.>KS>LO_CLEAN_TEST.SPL
```

```
Are the proposed FIX_DISK actions satisfactory? YES
Enter pathname of working directory [default=<0>SYSTEM_DEBUG*>CRASH]:
```

Generating a Crash Dump Tape

A

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Follow the directions below to generate a crash dump tape. If you are running PRIMOS Revision 23.1 or later, you should then run RFS in order to cleanly shut down the disks. The last step is to cold start the system. The following example illustrates the entire procedure:

```
CP1> SYSCLR
Really? YES
CP1> RUN 773
Enter P for PARTIAL dump, Enter F for FULL dump: P

Dump completed.
CP1> SYSCLR          /* Note: Skip the following if you don't have Rev 23.1.
Really? YES
CP1> RUN 662
.        .        .
.        .        . /* Output from RFS intentionally removed
.        .        .
*** From RFS: Shutdown completed, system halting...

CP1> SYSCLR          /* Note: We're rebooting now.
Really? YES
CP1> BOOT 14114
```

How to Generate a Crash Dump Tape

You can initiate a crash dump only from the supervisor terminal and then only if the CPU is not running. Therefore, for hangs or other situations in which PRIMOS did not halt, you must stop the CPU before you initiate the crash dump.

See your CPU handbook for a complete discussion of halts, hangs, and crash tape dumps. See the *Rev. 23.2 Software Release Document* for information on a new run vector (774_8) for doing crash dumps to tape.

Halting the Machine

Use the following procedure to stop a 50 Series machine:

1. Turn the keyswitch on the Status Panel to the *enable* position.

2. Press the Escape key on the supervisor terminal twice. The maintenance processor should respond with the `CP>` or `CP1>` prompt.

3. Enter the STOP or the HALT command. The maintenance processor should respond with a `CPU halted at` message.

Initiating a Partial Crash Dump

Now that the system is halted, you can initiate a crash dump. Mount a 1600-bpi or 6250-bpi magnetic tape, with a write ring, on MT0 and enter the following command sequence:

```
CP1> SYSCLR
Really? YES        /* Not all machines will ask you this.
CP1> RUN 777       /* There may be a slight pause before the tape turns.
```

6250-bpi Crash Dumps

If you have a 6250 bpi tape drive on MT0 and if your system is running at PRIMOS Rev. 22.0.3 or later, you can write the crash dump tape at 6250 bpi. This takes less time and tape than a 1600 bpi crash tape dump. The argument to the RUN command is slightly different from the previous example:

```
CP1> SYSCLR
Really? YES        /* Not all machines will ask you this.
CP1> RUN 773       /* You only need a partial dump.
Enter P for PARTIAL dump, Enter F for FULL dump: P
```

Crash Dump Reels

The crash dump may use only part of a single reel or it may take several reels. The number of reels required depends upon the

- Amount of memory in the system

- Type of crash dump generated (full or partial)

- Number of users logged in at the time of the crash

- Tape density used (1600 or 6250 bpi)

Tape Label Information

Remember to put a label on each reel. The label should include the

- Name of the system

- Date and time of the crash

- PRIMOS revision that the system was running

- Tape density used (1600 or 6250 bpi)

- Reel number (X of N reels)

FS_RECOVER
Warning and Error Messages

B

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Warning Messages at Invocation

The following warning messages may display when you invoke FS_RECOVER.

```
Warning: The system is currently running PRIMOS Rev
"xx.xx.xx", which is a non-standard revision stamp that
FS_RECOVER does not understand. Enter the Prime compatible
revision stamp with a format like "21.0.3".
Compatible revision stamp:
```
>**Corrective action:** If you have customized PRIMOS, the next time you
>rebuild you should use a standard format revision stamp:
>*MajorRev.MinorRev.FixRev.YourRev.*

```
Warning: Can't open text file "xxxxxx>xxxxx>xxxxx".
```
>**Corrective action:** Fix AUTOPSY.SR search rules, which should contain
>three rules: SYSTEM_DEBUG*, SYSTEM_DEBUG*>HELP, and
>SYSTEM_DEBUG*>FRU. If that does not work, reinstall FS_RECOVER.

```
Warning: FS_RECOVER may not work because AUTOPSY is not the
same version.
```
>**Corrective action:** Reinstall FS_RECOVER if any problems occur.

```
Warning: Can't access DSKRAT for PDEV 'xxxxxx <xxxxxx>.
```
>**Corrective action:** Edit the ACLs on the DSKRAT for the specified
>partition to ensure that the System Administrator and SYSTEM have at least
>LUR access. This message will also appear if you are running PRIMOS
>Revision 23.0 or later, and have partitions that are not mounted at the root
>level.

Error Messages at Invocation

The following error messages may display when you invoke FS_RECOVER.

```
*** USAGE ERROR ***
FS_RECOVER cannot be invoked by phantoms.
```
Corrective action: Do not invoke FS_RECOVER from a phantom.

```
*** USAGE ERROR ***
FS_RECOVER can only be run by the System Console or System
Administrator.
```
Corrective action: Log in as SYSTEM or as the System Administrator and reinvoke FS_RECOVER.

```
*** FATAL ERROR ***
FS_RECOVER does not support PRIMOS revisions prior to Rev
21.0.
```
Corrective action: Upgrade PRIMOS to at least Rev. 21.0.

```
*** FATAL ERROR ***
This version of FS_RECOVER does not support Rev xx.xx.
Upgrade FS_RECOVER.
```
Corrective action: Upgrade to the latest version of FS_RECOVER.

```
*** FATAL ERROR ***
Error during link to AUTOPSY.  FS_RECOVER has not been
properly installed.
```
Corrective action: Reinstall FS_RECOVER.

```
*** FATAL ERROR ***
Error initializing AUTOPSY.  Configuration or installation
is incorrect.
```
Corrective action: Reinstall FS_RECOVER.

```
*** FATAL ERROR ***
FS_RECOVER and AUTOPSY versions do not match.  Installation
is incorrect.
```
Corrective action: This error indicates that your FS_RECOVER installation failed or that your ENTRY$.SR search rules are incorrect. Enter the PRIMOS ICE command first and then retry FS_RECOVER. If FS_RECOVER still fails, then reinstall FS_RECOVER. If the failure occurs again, use the LSR ENTRY$ command to examine your ENTRY$ search rules for more than one line containing a link to AUTOPSY.RUN. Problems have been seen with early versions of DTB and FS_RECOVER on the same system, because DTB sometimes inserts its copy of AUTOPSY into ENTRY$.SR.

```
**** FS_RECOVER default on-unit invoked for condition
"xxxxxx".
```
Corrective action: Open a COMO file and enter the PRIMOS DMSTK command. Open a service call with PrimeService to report the problem.

Runtime Warning Messages

The following warning messages may display at runtime.

```
Warning: This crashdump is from a different PRIMOS Rev:
XX.XX.XX.XX
```
Explanation: FS_RECOVER has detected that at the time of the crash, a different PRIMOS revision was running than is running now. This is important if the major revision is different, and can be important for some minor and fix revisions.

```
Warning: The crash dump is more than 24 hours old.
```
Explanation: FS_RECOVER has detected that you are attempting to analyze a crash dump that is more than 24 hours old. It is recommended that you use FS_RECOVER on a crash dump as soon as possible.

```
Warning: This crashdump is from system "xxxxxx".
```
Explanation: FS_RECOVER has detected that you are attempting to analyze a crash dump from another system. The analysis will continue, but automated FIX_DISK will not be done.

```
PRIMOS error code x while looking for xxx>xxx.CPL.   <PRIMOS
Message>
Either installation was incomplete, or wrong working
directory.
```
Explanation: FS_RECOVER was attempting to attach to and verify the working directory. If the PRIMOS error message was Not found, then the specified working directory either does not exist or does not contain one or both of the required CPL programs. (Refer to the subsection entitled FS_RECOVER Working Directory in Chapter 3.) If the PRIMOS error message is something other than Not found, then the error probably occurred while attempting to attach to the specified working directory. Verify that the specified working directory exists and then check ATTACH$.SR search rules and ACLs. If the specified working directory is the default working directory and the CPL programs are missing, then reinstall FS_RECOVER.

```
Warning: All the file system disks did not start in a
known/clean state. This means that disk corruption may have
existed BEFORE the crash occurred.
```
Explanation: FS_RECOVER has determined that at least one of the partitions that was mounted at the time of the crash was not clean. This means that there may be file system integrity problems on the partitions that will not show up during the crash analysis.

```
Warning: PDEV 'xxxxxx <xxxxx> has been repartitioned.
```
Explanation: While merging the state of the partitions at the time of the crash with the state of the currently mounted partitions, FS_RECOVER detected that a disk drive had been remade/repartitioned.

```
FIX_AUTO_CONFIG warning:  PDEV 4060 is not mounted.
```
Explanation: INIT_RECOVER.CPL might have been run before the disk partition was added, the Administrator may have incorrectly specified the pdev of an added disk in <0>SYSTEM_DEBUG*>CRASH> FIX_AUTO_CONFIG, or the ADDISK command for the disk partition may have failed.

```
FIX_AUTO_CONFIG error (at line 25).
    Source:   "7625 xxxxxx yyyyyyy"
    Cannot specify both "xxxxxx" and "yyyyyyy". This line
    ignored.
```
Explanation: The Administrator specified two different methods of running FIX_DISK in <0>SYSTEM_DEBUG*>CRASH> FIX_AUTO_CONFIG. Delete one of the method tokens.

```
FIX_AUTO_CONFIG error (at line 30).
    Source:  "3665      GARB"
    Option "GARB" not recognised. This line ignored.
```
Explanation: The Administrator specified an invalid token as a method of running FIX_DISK. Valid tokens are ONLINE, OFFLINE, OFLINE, FIX, NOFIX, NFI, FULL, NOFAST, NOFA, FASt, and SKIP. If your PRIMOS revision does not support Online FIX_DISK, then ONLINE and OFFLINE are not valid tokens.

```
FIX_AUTO_CONFIG error (at line 24).
    Source:  "5364 PARTIAL"
    Option "PARTIAL" illegal in FIX_AUTO_CONFIG. This line
    ignored.
```
Explanation: PARTIAL is not a valid token in FIX_AUTO_CONFIG. You cannot configure a file system object that needs repair.

```
FIX_AUTO_CONFIG error (at line 24).
     Source:  "5364 FAST ONLINE"
     Cannot specify "ONLINE" with "FAST". This line ignored.
```
Explanation: ONLINE FIX_DISK does not support FAST FIX_DISK. If you specify FAST, it implies OFFLINE FIX_DISK. Remove either FAST or ONLINE.

```
FIX_AUTO_CONFIG error (at line 11).
     Source:  "6060 OFFLINE"
     Cannot specify "OFFLINE" for the Command Device. This
     line ignored.
```
Explanation: You cannot specify OFFLINE FIX_DISK on the command device.

```
FIX_AUTO_CONFIG error (at line 13).
     Source:  "6164    SKIP FAST"
     Cannot specify "SKIP" with any other option. This line
     ignored.
```
Explanation: Remove either SKIP or any other option on the line.

```
FIX_AUTO_CONFIG is partially valid; the valid entries will
be used.
```
Explanation: An error occurred on at least one line in the file <0>SYSTEM_DEBUG*>CRASH>FIX_AUTO_CONFIG. FS_RECOVER will only use the valid entries.

```
FIX_AUTO_CONFIG error (at line 31).
     Source:  "6160 OFFLINE"
     Duplicate specification for PDEV 6160. This line
     ignored.
```
Explanation: The Administrator gave more than one specification for the disk partition. Check for the intended specification.

```
FIX_AUTO_CONFIG error (at line 11).
     Source:  "6060 FAST"
     Cannot specify "FAST" for the Command Device. This line
     ignored.
```
Explanation: You cannot use OFFLINE FIX_DISK on the command device. If you specify FAST, it implies OFFLINE.

```
FIX_AUTO_CONFIG error (at line 31).
     Source:  "4080"
     Found "4080" where octal PDEV number expected. This
     line ignored.
```
Explanation: You must specify the pdev number in octal.

```
FIX_AUTO_CONFIG error (at line 10).
    Cannot have more than one -DEFAULT specification. This
    line ignored.
```

Explanation: The Administrator gave more than one DEFAULT
specification. Check for the intended specification.

```
FIX_AUTO_CONFIG error (at line 12).
    The -DEFAULT specification must precede all PDEVs. This
    line ignored.
```

Explanation: Place the DEFAULT specification before any specification
for a disk partition.

```
FIX_AUTO_CONFIG error (at line 9).
    At least one option must follow "-DEFAULT". This line
    ignored.
```

Explanation: The Administrator did not provide any DEFAULT action.
Either delete the line or add the intended FIX_DISK methods.

```
FIX_AUTO_CONFIG error (at line 11).
    Source:  "DISK01 FAST"
    Found "DISK01" where PDEV number or -DEFAULT expected.
    This line ignored.
```

Explanation: Pdevs are specified for disk partition specifications. If the
Administrator used the disk name, change to the disk partition's pdev.

```
FIX_AUTO_CONFIG file contains no valid specifications; it
has been ignored.
```

Explanation: If there were other errors, then correct them. Otherwise,
delete the file.

```
FIX_AUTO_CONFIG warning: PDEV 7661 is the ComDev.
Specification ignored.
```

Explanation: Your revision of PRIMOS does not support ONLINE
FIX_DISK. FS_RECOVER cannot run FIX_DISK on the command device
with this revision of PRIMOS.

```
FIX_AUTO_CONFIG warning:
    Partition 7671 is write protected, ONLINE option
    ignored.
```

Explanation: To repair a disk partition, ONLINE FIX_DISK must write to
that partition. If you combine ONLINE with NOFIX, ONLINE FIX_DISK
will report disk partition problems. If the disk partition is a Robust Partition
and was not shut down properly, then the disk was added with the –FORCE
option and is, therefore, protected.

C PRIMOS Disk Mount Warning Messages

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The following messages may display when you add a partition to the system.

**** Disk *xxxxxx*: **Not ready.**

> The disk is not powered up or has not completed spin up. Ensure you are using the correct pdev.

*** Cannot read DSKRAT of disk *xxxxxx*

> The disk is accessible, but the DSKRAT header cannot be read. Ensure you are using the correct pdev. If your pdev is correct, call PrimeService.

*** Disk *xxxxxx*: **Old partitions not supported.**

> PRIMOS detects that you are attempting to mount a pre-Rev. 19 partition. If this is not so, ensure that you are using the correct pdev. If the pdev is correct, then ensure that the partition has been properly formatted.

*** Format of disk *xxxxxx* **not supported by this revision of PRIMOS.**

> PRIMOS detects that you are attempting to mount a partition whose version number is greater than the latest version supported by the version of PRIMOS you are running. This can happen if you upgrade PRIMOS, upgrade the partitions with either MAKE or FIX_DISK, and then attempt to install an earlier version of PRIMOS.

*** Proper shutdown of Robust Partition *xxxxxx* **did not take place.**
*** Partition will be write protected.

> PRIMOS prints this message when you force-mount a damaged robust partition. Run FIX_DISK –FAST and remount the partition.

*** Robust Partition *xxxxxx* **has not been properly shutdown.**
*** Fast Fix_disk has to be run before it can be added.

> PRIMOS displays this message when you attempt to mount a damaged robust partition. Run FIX_DISK –FAST and remount the partition.

*** Disk "*xxxxxx***" was not shutdown properly, Run FIX_DISK.**

> PRIMOS displays this message, as of Revision 22.1, when you mount a standard partition that is not clean. Run FIX_DISK.

(Quota system may be incorrect; run FIX_DISK.)

Pre-Rev. 22.1 PRIMOS displays this message when you mount a standard partition that is not clean. Run FIX_DISK.

Index

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Using FS_RECOVER
DOC13062-004

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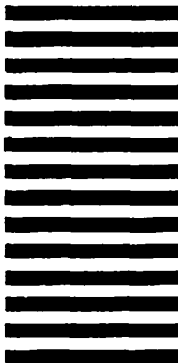   _____

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