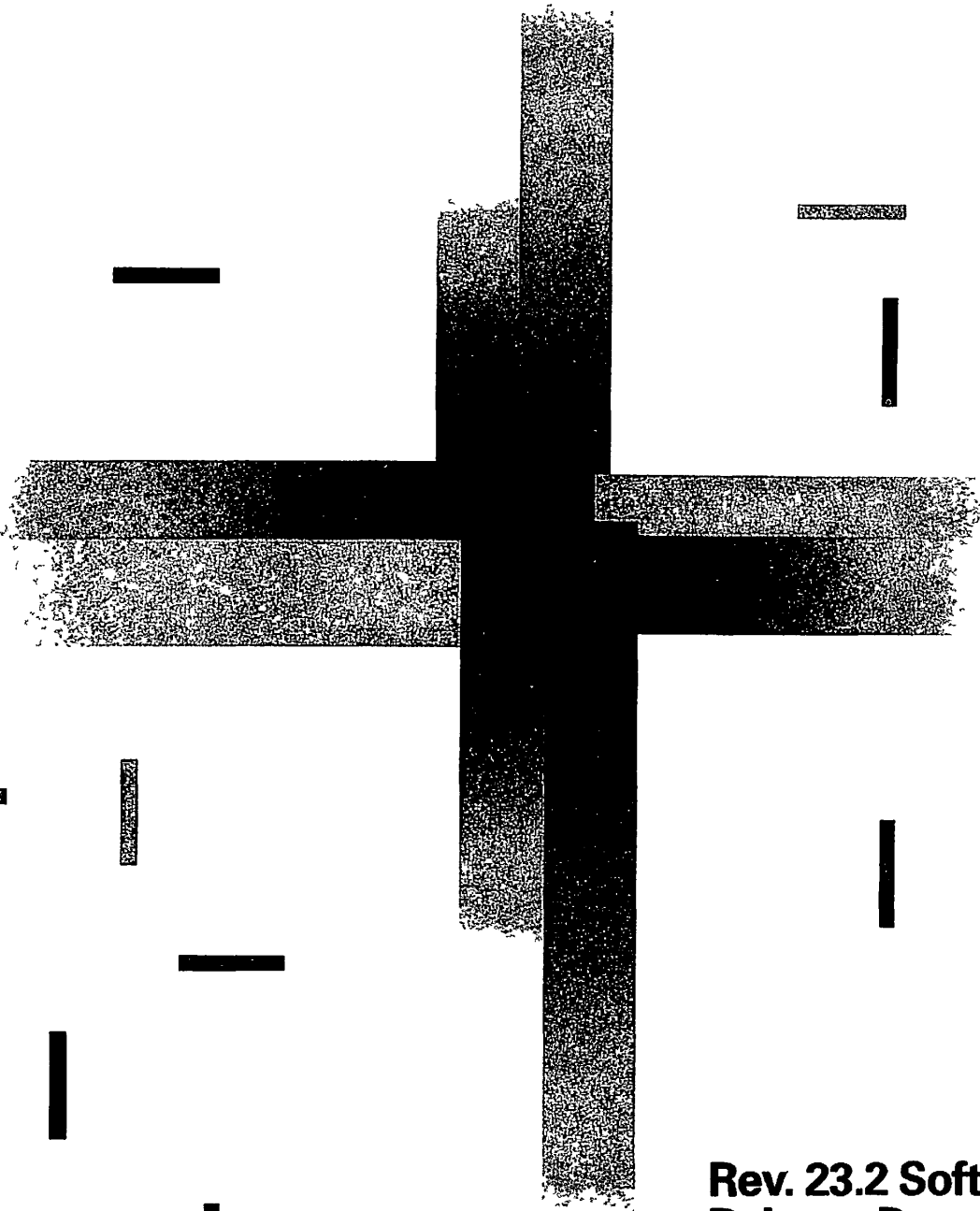




COMPUTERVISION



**Rev. 23.2 Software
Release Document**

Revision 23.2

DOC10001-9PA

Rev. 23.2 Software Release Document



Glenn Morrow

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 (Rev. 23.2).

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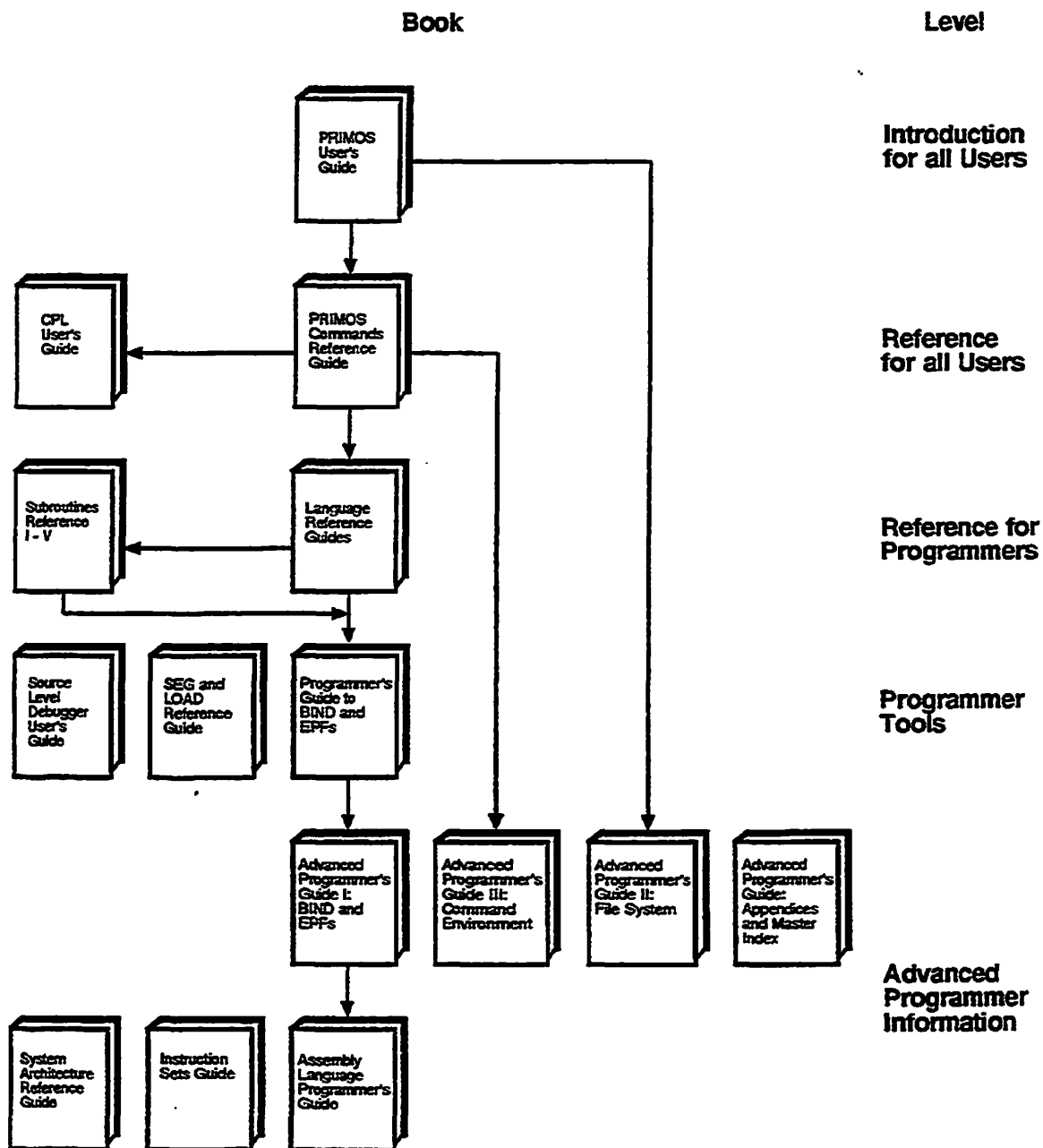
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About This Book



The *Rev. 23.2 Software Release Document* provides a summary of both new and enhanced functionality to Prime[®] user software at Rev. 23.2. Most changes to Prime user software at Rev. 23.2 are documented in this software release document. This publication consists of four chapters and five appendices:

- **Chapter 1, Introduction**, includes special considerations and installation requirements for Rev. 23.2 and lists product retirements and new features.
- **Chapter 2, New Features for the User and Programmer at Rev. 23.2**, describes the new and enhanced functionality at Rev. 23.2 for the user and programmer.
- **Chapter 3, New Features for the Operator and Administrator at Rev. 23.2**, describes the new and enhanced functionality at Rev. 23.2 for the operator and System Administrator.
- **Chapter 4, PRIMENET Performance Tuned Extensions (PNX)**, describes this method to enhance LAN remote file data access using PRIMENET[™]. This information is intended for the System Administrator or Network Administrator.
- **Chapter 5, Documentation Corrections**, provides a list of corrections and updates to existing PRIMOS documentation. No new PRIMOS functionality is introduced in this chapter.
- **Appendix A** provides operator instructions for performing a crash dump to tape. It contains new procedures available at Rev. 23.2.
- **Appendix B** provides operator instructions for performing a crash dump to disk. This is a new facility at Rev. 23.2, described in Chapter 3.
- **Appendixes C and D** document the error messages returned by PNX.
- **Appendix E, Rev. 23.2 Publications**, lists the most recent editions of all books integral to Master Disk Revision 23.2.
- **Master Index to the Rev. 23.0, Rev. 23.1, and Rev. 23.2 Software Release Documents**.

This book contains the only documentation for most of the changes to PRIMOS[®] at Rev. 23.2. A complete list of documentation for Rev. 23.2 is provided in Appendix E. This book should be used in conjunction with the most recent editions of PRIMOS user documentation and the online INFO and READ_BEFORE_USING files.

Prime Documentation Conventions

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

<i>Convention</i>	<i>Explanation</i>	<i>Example</i>
Uppercase	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 <i>user-id</i>
Abbreviations	If a command or option has an abbreviation, the abbreviation is placed immediately below the full form.	SET_QUOTA SQ
Brackets	Brackets enclose a list of one or more optional items. Choose none, one, or several of these items.	LD [-BRIEF -SIZE]
Braces	Braces enclose a list of items. Choose one and only one of these items.	CLOSE { <i>filename</i> -ALL }
Braces within brackets	Braces within brackets enclose a list of items. Choose either none or only one of these items; do not choose more than one.	BIND [{ <i>pathname</i> <i>options</i> }]
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, <u>RESUME MY_PROG</u>
Hyphen	Wherever a hyphen appears as the first character of an option, it is a required part of that option.	SPOOL -LIST
Subscript	A subscript after a number indicates that the number is not in base 10. For example, the subscript 8 is used for octal numbers.	200 ₈
Parentheses	Parentheses in command or statement formats are a required part of that format. Enter them as shown.	DIM <i>array</i> (<i>row</i> , <i>col</i>)

Introduction

1



This chapter summarizes the functionality changes to the PRIMOS operating system at Rev. 23.2. Specifically, it lists special considerations for Rev. 23.2, products being retired at this release, and new features at this revision of PRIMOS.

Special Considerations for Rev. 23.2

Installation

No new installation procedures are required for Rev. 23.2. To install Rev. 23.2, use the *Rev. 23.0 Software Installation Guide* (IDR10176-3XA). See the PRIMOS help file `HELP*>PRIMOS.TEXT>REV232.HELP` for the release numbers of independent products that are needed to support Rev. 23.2 functionality.

The following items should be considered when installing Rev. 23.2.

- The instructions for upgrading an existing system to a new revision of PRIMOS require two boot-from-disk operations. These instructions show how to successfully upgrade PRIMOS from 23.0 or 23.1 to 23.2, but it is possible to simplify the installation procedure for 23.2 by skipping the first boot from disk.
- When upgrading to Rev. 23.2 without reformatting disks, you may want to use ED or EMACS to modify the configuration file. You can modify the configuration file using the non-shared editor (NSED), but to use ED or EMACS, you may have to first re-share these products from the system console.
- Rev. 23.2 requires translator family Release T2.2, T2.3, or T3.0. (Release T3.0, which supports registered EPFs, is recommended.) Some systems may still be running an earlier T2 release. Therefore, you may also need to refer to the installation procedures contained in the *Translator Family Software Release Document* (DOC10217-3PA) for installing compilers, libraries, and environment products.

- To install the nonchargeable translator family runfiles and libraries on a new machine, you should follow the procedures described in the *Rev. 23.0 Software Installation Guide*, then execute the command

SSR -DEFAULT ENTRY\$

- While running **FIX_DISK** remains an optional part of a software upgrade, the reliable performance of the **RFS** and **FS_RECOVER** crash recovery facilities provided with Rev. 23.1 and subsequent revisions depends heavily on all disks being in an uncorrupted initial state. Therefore, it is *strongly* suggested that you run **FIX_DISK** on all disk partitions as part of the upgrade to Rev. 23.2.
- Update your version of **FS_RECOVER** to Version 3.0. Version 3.0 of **FS_RECOVER** is supplied on a separate magnetic tape with Rev. 23.2. The **FS_RECOVER** facility can be installed independently of the revision. The available versions of **FS_RECOVER** are as follows:
 - Version 3.0 is supplied with Rev. 23.2. This version supports **PRIMOS** Rev. 21.0 and subsequent revisions. Support for crash dump to disk is only provided at Rev. 23.2.
 - Version 2.0-21.0 is available as an Independent Product Release for **PRIMOS** revisions 21.0 or greater and is supplied with Rev. 23.1. This version provides only very limited functionality in the Rev. 23.2 environment.
 - Version 1.0-21.0 is available as an Independent Product Release for **PRIMOS** revisions 21.0 or greater. This version *does not work* in the Rev. 23.1 or Rev. 23.2 environments.

The installation procedures for **FS_RECOVER** are described in the *Crash Recovery Facilities* chapter of the *Rev. 23.1 Software Release Document* and in the *Using FS_RECOVER* document. Version 3.0 of **FS_RECOVER** is further described in a new edition of *Using FS_RECOVER* (DOC13062-3LA).

- The **PRIMENET Performance Tuned Extensions (PNX)** facility is supplied as part of the Master Disk at Rev. 23.2. It can be installed during the upgrade to Rev. 23.2 or separately at a later time. Installation instructions are provided in Chapter 4. **PRIMENET Performance Tuned Extensions (PNX)** are available as an independent product supported by Rev. 22.1.4 and all subsequent revisions. Therefore, it is possible that your system is already running **PNX**.
- **Quick Boot** is supplied as a microcode update on a separate diskette. Refer to the description of this feature in the document for further installation details.

- ICOP+ is supplied as a microcode update on a separate diskette. Refer to the description of this feature in the document for further installation details

Microcode Requirements

5310™, 5320™, 5330™, and 5340™ systems must be upgraded to at least CPU microcode Rev. J before attempting to boot Rev. 23.2. Attempting to boot Rev. 23.2 without performing this microcode upgrade may result in unpredictable halts and possible disk data corruption.

You can display your current microcode revision at the system console as follows:

```
<esc><esc>
DIR
MO ST
i
```

Pressing the escape key twice places the system console in maintenance processor mode (this does not affect executing processes). Type DIR to display the current microcode revision. Then type MO ST to return to PRIMOS mode. It may be necessary to type a semicolon (;) to get a prompt from the PRIMOS command processor.

Rev. 23.2 requires the following microcode levels:

CPU	Functional	Diskette	Diag A	Disk	Diag B	Disk	
	DSK7084	Mfg	Eng	DSK7084	Rev	DSK7084	Rev
2850	-950	D	6	-951	C	-952	B
2950	-953	D	7	-954	C	-955	B
4050	-935	E	23	-936	D	-937	C
4150	-928	J	27	-929	D	-930	C
5310	-958	J	35	-959	F		not applicable
5320	-960	J	35	-961	F		not applicable
5330	-962	K	35	-963	G		not applicable
5340	-956	K	35	-957	G		not applicable
5370	-964	C	31	-965	C		not applicable
6150	-940	J	16	-938	E	-939	E
6350	-924	S	44	-925	G	-926	G
6450	-941	E	17	-942	B	-949	B
6550	-927	L	40	-931	G	-932	F
6650	-943	E	17	-944	B	-945	B

The CPUs listed here all support SYSTEM_RECOVER (described in Chapter 3) at Rev. 23.2. CPUs that are not listed here do not require a microcode upgrade to support Rev. 23.2; systems not listed here do not support SYSTEM_RECOVER at Rev. 23.2.

If you need to update your microcode, please note that the microcode, decode net and the diagnostic processor code must all be upgraded. Simply installing the microcode is not sufficient. The simplest way to ensure all of these items are properly installed is to power down the system, then bring it up with the new diskette.

Product Retirements at 23.2

The configuration directive `TPDUMP` is obsolete and no longer used. If a system `CONFIG` file contains a `TPDUMP` directive, PRIMOS displays a message on the system console that `TPDUMP` is no longer supported and is being ignored. The presence of a `TPDUMP` directive in your `CONFIG` file does not otherwise affect system configuration.

R-mode is provided at Rev. 23.2, but is no longer supported, nor is compatibility with R-mode provided in new PRIMOS facilities.

`EDIT_PROFILE` continues to be provided, but the new `CONFIG_USERS` features described in this document are neither provided with nor compatible with `EDIT_PROFILE`. One of these new features, if used, renders your `SAD` incompatible with `EDIT_PROFILE`. If you chose to use this new `CONFIG_USERS` feature, you will not be able to subsequently access your `SAD` using `EDIT_PROFILE`.

Product Retirements After 23.2

Rev. 23.2 is the final PRIMOS revision that will be supported on non-IX mode machines. These systems include all three-digit computer room systems (e.g., the 400, 650, 750, 850) and the 2250.

The following products will be retired after Rev. 23.2; further use of these products is discouraged. These products will continue to be supplied as part of PRIMOS, but will not be supported.

- `AMLBUF` directive
- `AMLC` command
- `EDIT_PROFILE` utility

Rev. 23.2 New Features

The new features of PRIMOS Rev. 23.2 are listed below, grouped into two categories: those for the user and/or programmer and those for the system Operator and/or System Administrator. Chapter 2 discusses user and programmer features. Chapters 3 and 4 discuss operator and administrator features.

User and Programmer Features

The following enhancements are described in Chapter 2.

- **COMO –QUERY** to query the user before overwriting an existing como file.
- The ability to change your attached project without logging out. This feature is supported by four facilities:
 - **CHANGE_PROJECT** operator command to establish this functionality on your system.
 - **CHANGE_PROJECT** user command to change projects.
 - **CHPRJ\$** subroutine to change projects.
 - **PRJ\$CHD** subroutine to determine if a project change is in progress.
- **SIZE** command enhanced to return the name of a file that is currently open.
- **STATUS** command enhancement to reject invalid options.
- **SEMSUS** subroutine to determine the ID of a user waiting on a semaphore.
- **Spooler** enhancements for PostScript printers supporting landscape printing, a wide array of fonts, various page formatting options, and draft-stamped pages.

Operator and Administrator Features

The following enhancements are described in Chapters 3 and 4.

- **System boot options:**
 - **Quick Boot**, which speeds system boot by omitting most diagnostic processing.
 - **Parallel Shares**, which speed system boot by permitting the PRIMOS.COMI file to perform its system shares concurrently by using phantom processes.

- **CONFIG_USER security enhancements:**
 - Enhancing user password protection by preventing users from immediately reusing outdated passwords.
 - Forcing specific user to change his or her password upon next login.
 - Limiting the number of concurrent logins for a single user ID.
 - Disabling a user ID for a specified period of time.
 - Disabling a user ID after a specified number of failed login attempts.
- Regulating the number of login retries permitted for a remote user before dropping the line connection.
- **CHANGE_PROJECT** command to permit users to change their currently assigned login project.
- **Tape drive support enhancements:**
 - **RUN 774** tape dump command.
- **Disk drive support enhancements:**
 - Support for a larger number of assigned disks.
 - Support for two new disk drives, a 415MB SCSI drive and a 1.34GB SCSI drive.
 - Support for features of SCSI disk drives, including badspot checking and controller mode setting.
 - **SPIN_DOWN** command for stopping a SCSI disk drive.
 - **DISK_PAUSE** command for swapping disk drives without stopping the system.
- **ICOP+**, a highly efficient protocol for SCSI disk I/O.
- **Crash Dump to Disk (CDD)**, a facility for performing crash dumps to disk rather than to tape.
- **FS_RECOVER** Version 3, which supports crash dump analysis from a crash dump disk.
- **Automated system crash recovery**, a facility for automating the execution of crash recovery processing, including crash dump to disk.
- **PRIMENET Performance Tuned Extensions (PNX)**, for faster data transmission when using PRIMENET over a RINGNET local area network.

2

New Features for the User and Programmer at Rev. 23.2

■ ■ ■ ■ ■ ■ ■ ■

COMO Command Enhancement

At Rev. 23.2, the COMO command supports a new option, `-QUERY`. When you specify `COMO filename -QUERY`, the system asks you if you wish to continue if the COMO operation may alter or overwrite the specified file.

If you specify the `-QUERY` option and the COMO operation would normally overwrite the specified file, the system returns the following prompt:

```
"<DSKNAM>MYDIR>COMOFILE" already exists, do you wish to
overwrite it?
```

If you specify the `-QUERY` option and the COMO operation would normally modify the specified file (using the `COMO -PAUSE` or `-CONTINUE` options), the system returns the following prompt:

```
"<DSKNAM>MYDIR>COMOFILE" already exists, do you wish to
append to it?
```

Respond with either Y (proceed and overwrite file) or N (abort COMO command). The `-QUERY` option is ignored if one of the following conditions exists:

- The COMO command does not specify a filename
- The COMO command is ending a como file (`COMO -E`)
- The specified filename does not exist

If you do not specify the `-QUERY` option, COMO proceeds as it normally would to automatically overwrite or append to a specified file, if it already exists.

If you specify multiple `-QUERY` options in a COMO command, only the first instance of `-QUERY` on the command line is executed. All `-NTTY` and `-TTY` options are processed as they appear on the command line.

COMO -QUERY Examples

In the following examples, assume file <LABDSK>TEST>FOO exists.

```
OK, COMO FOO -QUERY -NTTY
"<LABDSK>TEST>FOO" already exists, do you wish to overwrite it? NO
OK,
```

In the above example, no como file was opened, but terminal output was turned off. The next example shows a more complex situation:

```
OK, COMO FOO -NTTY -QUERY -TTY
NO
OK,
```

In the above example, COMO first turned off terminal output (-NTTY), then waited for you to specify whether or not to overwrite the file. Because terminal output is off, the -QUERY prompt was not displayed. But, as shown in the above example, you must respond to this unseen prompt to proceed. After you respond to the unseen prompt, the como file is opened (if you specified YES) and the rest of the command line is processed, reactivating terminal output.

The next example shows a case where terminal output is not desired:

```
OK, COMO FOO -NTTY -QUERY -NTTY
MAYBE
"<LABDSK>TEST>FOO" already exists, do you wish to overwrite it? YES
OK,
```

In the above example, you are prompted if it is O.K. to overwrite the file, but the prompt isn't seen because terminal output is off, due to the first -NTTY option. If you don't supply a valid response to the query (here you responded MAYBE), terminal output is turned on, and you are reprompted. After a valid reply, COMO opens the como file (if you specified YES) and the rest of the command line is processed. The -NTTY option after the query ensures that terminal output will always be off after this command executes.

Changing Projects

Rev. 23.2 provides two ways to change from one project to another without logging out. You can use the CHANGE_PROJECT command or the CHPRJ\$ subroutine to change from one project to another. The PRJ\$CHD subroutine enables you to determine from an external login (or logout) program whether you are currently changing your project assignment.

The ability to change projects is an optional facility which must be activated on your system by your System Administrator. Activation of the change project facility is described in the Operator and Administrator chapter of this document.

At login, a user is assigned a project. A change of project assignment continues for the duration of the user's login session, or until the user changes it again. The system console (User 1) cannot change projects. Batch or other phantom processes cannot change projects.

CHANGE_PROJECT Command

The CHANGE_PROJECT command allows you to change your login project without logging out and logging back in again. Previously, projects were only assigned at login; now you can change your project assignment at any time. As previously, you can only access a project to which you belong and you can only access one project at a time. Changing your project changes the groups to which you currently belong, your command environment attributes, and your origin directory to those of the new project.

You can require a password before permitting a change of projects. This is a security feature designed to safeguard unattended terminals.

Note

When changing projects, specify the CHANGE_PROJECT command on its own command line or as the last command on a command line. PRIMOS cannot execute a command that follows a CHANGE_PROJECT command on the same command line.

The CHANGE_PROJECT command has the following syntax:

$$\text{CHANGE_PROJECT} \left\{ \begin{array}{l} \left[\begin{array}{l} \text{[project]} \left[\begin{array}{l} \{- \text{PASSWORD } \textit{password}\} \\ \{- \text{PROMPT} \} \end{array} \right] \\ \{- \text{ENABLE_PASSWORD}\} \\ \{- \text{DISABLE_PASSWORD} \left[\begin{array}{l} \{- \text{PASSWORD } \textit{password}\} \\ \{- \text{PROMPT} \} \end{array} \right] \\ \{- \text{HELP} \} \end{array} \right. \end{array} \right.$$

project

The name of the project that you wish to change to. You must be assigned to a project by the System Administrator in order to access it. You can list your current project by using the STAT PROJECTS command. If you do not specify a project, CHANGE_PROJECT changes you to the DEFAULT project ID, if one exists on your system.

-PASSWORD *password*

-PW

Specifies a password when changing projects. The password is the same as your user login password. You can specify a password using either the **-PASSWORD** option or the **-PROMPT** option (see below). The **-PASSWORD** option is only required if you have enabled password protection.

-PROMPT

Interactively specifies the password. If you specify the **-PROMPT** option, the system prompts you for the password. Respond with your user login password. The advantage of the prompt is that the password is not echoed on the screen, increasing your security. You cannot use this option with batch processes or phantoms.

-ENABLE_PASSWORD

-ENAPW

Specifies that your future uses of **CHANGE_PROJECT** will require you to specify a password when changing projects. The system default is no password required. This option remains in effect until you log out. One common use of this option is to specify it as part of your **LOGIN.CPL**.

-DISABLE_PASSWORD -PASSWORD *password* -PROMPT

-DISPW

Specifies that subsequent uses of **CHANGE_PROJECT** during this login will not require you to specify a password when changing projects. This option is only used if you have previously specified **-ENABLE_PASSWORD** during this login session; the system default is no password required. For security reasons, you must specify a password to disable the requiring of passwords. Specify your login password, either by specifying the **-PASSWORD** option and the password, or by specifying the **-PROMPT** option and being prompted for the password.

-HELP

Displays an online list of the **CHANGE_PROJECT** command options.

CHPRJ\$ Subroutine

The new subroutine **CHPRJ\$** permits you to change from one project to another during the execution of a program. **CHPRJ\$** permits you to either change your current project attachment or to specify whether a password will be required for subsequent project changes.

Usage

```
DCL CHPRJ$ ENTRY (FIXED BIN(15), CHAR(32) VAR,  
                 CHAR(16) VAR, FIXED BIN(15));
```

```
CALL CHPRJ$ (key, project_name, password, code);
```

Parameters

key

INPUT. The action to be performed. The following key values are available:

- | | |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| K\$CHPR | Change your project attachment to <i>project_name</i> . Because successful execution of CHPRJ\$ with this <i>key</i> value changes your project attachment, CHPRJ\$ cannot return to its calling program after successful execution of this <i>key</i> value. |
| K\$ENCP | Enable CHANGE_PROJECT command and use of the CHPRJ\$ subroutine (System Administrators only). |
| K\$DSCP | Disable CHANGE_PROJECT command and use of the CHPRJ\$ subroutine (System Administrators only). |
| K\$ENPW | Enable the requirement that you specify a password during subsequent invocations of the CHANGE_PROJECT command or the CHPRJ\$ subroutine. |
| K\$DSPW | Disable the requirement to specify a password during subsequent invocations of the CHANGE_PROJECT command or the CHPRJ\$ subroutine. |

project_name

INPUT. Used with the *key* value K\$CHPR to specify the name of the project that you wish to become attached to. For *key* values other than K\$CHPR, *project_name* is ignored. If you specify a *key* value of K\$CHPR and specify a null value for *project_name*, CHPRJ\$ changes your project to your default login project.

password

INPUT. Your user login password if a password is required for the operation. Otherwise, specify a null value. A password is required if *key* has the value K\$CHPR and you have previously enabled the password requirement (using either CHPRJ\$ with K\$ENPW or the CHANGE_PROJECT -ENABLE_PASSWORD command), or if *key* has the value K\$DSPW.

code

OUTPUT. Standard error code. Possible values are:

- E\$OK Successful completion.
- E\$NWRIT The K\$ENCP and K\$DSCP *key* values can only be specified by a System Administrator.
- E\$BPAS Invalid password.
- E\$BKEY Invalid *key* value.
- E\$BNAM The specified project name either does not exist, or the user does not belong to the project.
- E\$NVAL Undetermined validation error.
- E\$BPAR User 1 or the system console user called CHANGE_PROJECT with one of the following keys: K\$CHPR, K\$ENPW, or K\$DSPW.
- E\$NSUC The CHANGE_PROJECT command and the CHPRJ\$ subroutine have been disabled by the System Administrator.

PRJ\$CHD Subroutine

The new subroutine PRJ\$CHD permits you to determine if you are currently changing your project assignment. This is useful during the execution of external login and logout programs. You can only call this routine from within an external login or logout program. If called from outside an external login or logout program, PRJ\$CHD returns FALSE.

Usage

```
DCL PRJ$CHD ENTRY ( ) RETURNS (BIT(1) ALIGNED);
```

```
changing = PRJ$CHD ( );
```

Parameter

changing

RETURNED VALUE. Returns TRUE ('1'b) if you are currently changing projects; otherwise returns FALSE ('0'b).

SIZE Command Enhancement

The **SIZE** command cannot determine the size of a file that is currently open, but it now returns a message indicating the name of the open file. This is particularly useful when using **SIZE** with wildcards, as shown in the following example:

```
OK, SIZE @@
      1 record in dam file "SLEEPY" (51 halfwords)
      4 records in dam file "GRUMPY" (2200 halfwords)
      2 records in dam file "SNEEZY" (1098 halfwords)
File in use.    "HAPPY" (SIZE)
      1 record in dam file "BASHFUL" (777 halfwords)
      1 record in dam file "DOPEY" (12 halfwords)
      2 records in dam file "DOC" (253 halfwords)
ER!
```

Note that although this operation returns the error prompt because a file was in use, it does correctly list the sizes of all other files in the directory. Also note that the display now indicates clearly that all sizes are in halfwords.

STATUS Command Enhancement

The **STATUS** command has been enhanced to reject invalid options. Prior to Rev. 23.2, the **STATUS** command ignored invalid options and displayed the complete status information, just as when you specify **STATUS** with no options. At Rev. 23.2, when you specify an invalid option the **STATUS** command displays a message, as follows:

```
OK, STATUS FRED
Option "FRED" not recognized by this command. (STATUS)
OK,
```

SEM\$US Subroutine

This new subroutine returns the user number of the next user to be notified by a specified named semaphore. It does not notify the semaphore. This subroutine provides information about a semaphore at the moment that **SEM\$US** executed; by the time this routine returns, the user waiting on that semaphore may have changed.

Usage

```
DCL SEM$US ENTRY (FIXED BIN(15), FIXED BIN(15),  
                 FIXED BIN(15));  
  
CALL SEM$US (sem_num, user_num, code);
```

Parameters

sem_num

INPUT. The number of the named semaphore that you wish to check. Semaphore numbers are returned by the SEM\$OU and SEM\$OP subroutines.

user_num

OUTPUT. The user number of the next waiting process for the specified semaphore. A value of 0 is returned if there were no users waiting on the semaphore.

code

OUTPUT. Standard error code. Possible values are:

E\$OK Success.

E\$BPAR Invalid semaphore number.

E\$NRIT Calling process does not have access to the specified semaphore.

For further information on semaphores, refer to *Subroutines Reference III: Operating System*.

SPOOLER Enhancements

The print spooler has been enhanced to support the following new options for PostScript® printers.

- A larger selection of fonts
- A change to the default font size
- Landscape printing
- Thumbnail page printing: printing several pages of information on a single sheet
- Disabling PostScript page formatting
- A draft stamp superimposed on each page to identify rough drafts

The draft stamp option can be used with both PostScript and non-PostScript printers.

For further information on the print spooler, refer to the *Operator's Guide to the Spooler Subsystem*.

Font Options

Use the `-SET_FONT` option of the `SPOOL` command to specify the desired font and its point size. If you do not specify a font, PostScript printers default to Courier 11.5 pt.; this is a change: prior to Rev. 23.2, the default was Courier 10 pt. For PostScript printers, the following fonts are available (font names without point sizes are 11.5 pt.)

AvantGarde	San-serif, proportional spaced, 11.5 pt
Bookman	Serif, proportional spaced, 11.5 pt
Courier	Serif, monospaced, 11.5 pt
Courier-10	Serif, monospaced, 10 pt
Courier-12	Serif, monospaced, 12 pt
Courier-Bold	Serif, monospaced, 11.5 pt
Courier-Bold-10	Serif, monospaced, 10 pt
Courier-Bold-12	Serif, monospaced, 12 pt
Courier-BoldOblique	Serif, monospaced, 11.5 pt
Courier-Oblique	Serif, monospaced, 11.5 pt
Helvetica	San-serif, proportional spaced, 11.5 pt
Helvetica-Narrow	San-serif, proportional spaced, 11.5 pt

NewCentury	Serif, proportional spaced, 11.5 pt
Palatino	Serif, proportional spaced, 11.5 pt
Symbol	Symbols
Times	Serif, proportional spaced, 11.5 pt
Times-Bold	Serif, proportional spaced, 11.5 pt
ZapfChancery	Serif, proportional spaced, 11.5 pt
ZapfDingbats	Symbols

Landscape Printing

The SPOOL -SET_LANDSCAPE command causes a PostScript printer to print a document in landscape format. Landscape format permits longer lines per page (and more text per page) by turning the entire contents of the page 90 degrees, so that text runs parallel to the longer edge of the sheet of paper. (The more customary form of printing, in which text runs parallel to the shorter edge of the sheet of paper, is known as portrait format.) One common use of landscape format is to print tables that contain many columns. The following are the available options:

-SET_LANDSCAPE

Prints landscape format, 66 lines of 138 characters per line.

-SET_LANDSCAPE -AT NOSCALE

Prints landscape format, 50 lines of 105 characters per line. This is approximately the same number of characters per page as the standard portrait-format page.

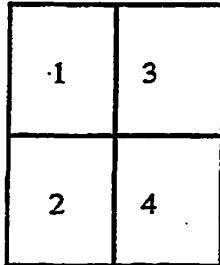
-SET_PORTRAIT

Prints portrait format, 66 lines of 80 characters per line. Portrait format is the standard page format (text running parallel to shorter edge of the sheet of paper) and the SPOOL command default.

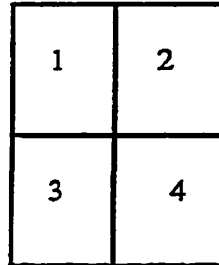
Thumbnail Page Printing ("n-up" Printing)

Thumbnail page printing enables you to print the images of multiple pages on a single sheet of paper. The sheet of paper is divided into from 2 to 16 equally-sized sectors, each of which receives the image of a single formatted page. For example, you could specify that a sheet of paper be divided into 4 quadrants, each of which contains the formatted contents of one page. This printing technique is also known as galley proof printing, or printing "2-up", "4-up", etc. Thumbnail page printing can be used with either portrait or landscape format pages.

You can specify 2, 4, 8, or 16 pages per sheet of paper. When printing 4, 8, or 16 pages per sheet you can also specify the reading sequence of the pages. For example, when reading a sheet divided into 4 pages ("4-up") you would always first read the top left page. You might next read either the bottom left page or the top right page. The following figure shows these reading sequence options:



Default page sequence



"X" page sequence

The default page sequence is appropriate for columnar information, such as computer programs. The "X" page sequence is more appropriate for most text information.

Specify thumbnail page printing as an **-AT** (**-ATTRIBUTE**) option to the **SPOOL -SET_PORTRAIT** or **SPOOL -SET_LANDSCAPE** command. The following tables show the available options for thumbnail page printing:

<i>1-1 Thumbnail Page Printing Options</i>				
-SET_PORTRAIT	<i>Sheet Size</i>		<i>Page Size</i>	
	<i>Orientation</i>	<i>Lines x chars per line</i>	<i>Font size</i>	<i>Page width x height</i>
<i>Default (1 page per sheet)</i>	Portrait	66 x 80	11.5 pts	8.0" x 10.5"
-AT 2-UP	Portrait	66 x 80	6.7 pts	4.7" x 6.1"
-AT 4-UP or 4X-UP	Portrait	66 x 80	5.1 pts	3.6" x 4.7"
-AT 8-UP or 8X-UP	Portrait	66 x 80	3.4 pts	2.3" x 3.1"
-AT 16-UP or 16X-UP	Portrait	66 x 80	2.6 pts	1.8" x 2.3"

<i>-SET LANDSCAPE</i>	<i>Sheet Size</i>		<i>Page Size</i>	
	<i>Orientation</i>	<i>Lines x chars per line</i>	<i>Font size</i>	<i>Page width x height</i>
<i>Default (1 page per sheet)</i>	Landscape	66 x 138	8.8 pts	10.5" x 8.0"
<i>-AT 2-UP</i>	Landscape	66 x 138	5.1 pts	6.1" x 4.7"
<i>-AT 4-UP or 4X-UP</i>	Landscape	66 x 138	3.9 pts	4.7" x 3.6"
<i>-AT 8-UP or 8X-UP</i>	Landscape	66 x 138	2.6 pts	3.1" x 2.3"
<i>-AT 16-UP or 16X-UP</i>	Landscape	66 x 138	1.9 pts	2.3" x 1.8"

<i>-SET LANDSCAPE -AT NOSCALE</i>	<i>Sheet Size</i>		<i>Page Size</i>	
	<i>Orientation</i>	<i>Lines x chars per line</i>	<i>Font size</i>	<i>Page width x height</i>
<i>default (1 page per sheet)</i>	Landscape	50 x 105	11.5 pts	10.5" x 8.0"
<i>-AT 2-UP</i>	Landscape	50 x 105	6.7 pts	6.1" x 4.7"
<i>-AT 4-UP or 4X-UP</i>	Landscape	50 x 105	5.1 pts	4.7" x 3.6"
<i>-AT 8-UP or 8X-UP</i>	Landscape	50 x 105	3.4 pts	3.1" x 2.3"
<i>-AT 16-UP or 16X-UP</i>	Landscape	50 x 105	2.6 pts	2.3" x 1.8"

Most of these options can also be specified using the SPOOL-PROC command to specify the procedure for a PostScript laser printer. (You cannot use the -PROC command to specify 8-up, 16-up, and NOSCALE pages.) Point sizes and other size characteristics may differ slightly from the corresponding -SET_PORTRAIT or -SET_LANDSCAPE command.

The available -PROC options are as follows:

<i>-PROC options</i>	<i>Sheet Size</i>		<i>Page Size</i>	
	<i>Orientation</i>	<i>Lines x chars per line</i>	<i>Font size</i>	<i>Page width x height</i>
<i>-PROC (LP)NORMAL</i>	Portrait	66 x 80	12.0 pts	8.2" x 10.8"
<i>-PROC (LP)PORT</i>	Portrait	66 x 90	10.0 pts	7.5" x 10.0"
<i>-PROC (LP)PORT2</i>	Portrait	66 x 90	6.5 pts	5.0" x 6.5"
<i>-PROC (LP)PORT4</i>	Portrait	66 x 90	4.7 pts	3.7" x 4.8"
<i>-PROC (LP)PORT4X</i>	Portrait	66 x 90	4.7 pts	3.7" x 4.8"
<i>-PROC (LP)LAND</i>	Landscape	66 x 140	8.5 pts	10.0" x 7.5"
<i>-PROC (LP)LAND2</i>	Landscape	66 x 140	5.5 pts	6.5" x 5.0"
<i>-PROC (LP)LAND4</i>	Landscape	66 x 138	4.1 pts	4.8" x 3.7"
<i>-PROC (LP)LAND4X</i>	Landscape	66 x 138	4.1 pts	4.8" x 3.7"

Disabling PostScript Page Formatting

SPOOL *-NO_FORMAT* causes a spooled file to be printed as a PostScript file in no-format mode. SPOOL *-NO_FORMAT -AT TEXT* causes a spooled file to be treated as a text file in no-format mode, *not* as a PostScript file. This allows you to disable the spooler's page formatter when not specifying a *-PROC* emulator.

Flagging Draft Copies

The *-AT DRAFT/* option to SPOOL *-SET_PORTRAIT* or SPOOL *-SET_LANDSCAPE* superimposes the word "DRAFT" onto each page of your document. The word "DRAFT" is superimposed in large outline letters diagonally across the entire page. (The slash character (/) in the command name indicates that the word "DRAFT" is printed diagonally across the page.) On landscape format pages, "DRAFT" is also printed in landscape mode. In thumbnail page printing format, each thumbnail page image has its own "DRAFT" notice.

You can use the *-AT DRAFT/* option for both PostScript and text files. It is not supported for files spooled with the *-PROC* option.

3

New Features for the Operator and Administrator at Rev. 23.2

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Quick Boot Option for Faster System Boot

The new Quick Boot option speeds system boot by bypassing most diagnostic processing. In Quick Boot mode, the time from power-up to the printing of the disk boot header is typically reduced from 8 to 12 minutes to 2 to 3 minutes. However, because Quick Boot does not perform diagnostic checking, it should only be used on a system that is fully functional. There are other limitations on Quick Boot, as described below.

Quick Boot is supplied on the system floppy disk DSK7084 used for loading boot microcode. This boot code is not dependent on the PRIMOS revision of your system; you can load Quick Boot on systems running Rev. 23.2 and on systems running earlier versions of PRIMOS. Refer to Chapter 1 for a list of the most recent microcode revisions.

Note Quick Boot is only available on 2850, 2950, 4050, 4150, and 6000-series systems. A similar process for quick booting is provided with 5000-series systems. Consult the *5300 Family Handbook* for details.

Invoking Quick Boot: When you power up a Prime system, the system automatically begins running its default boot process. Hitherto, this boot has defaulted to the standard boot process, which runs an extensive series of diagnostics. Now you can change the default boot process to Quick Boot, which boots the system without performing most diagnostic testing.

To change the boot default process during a power-up autoboot, press CONTROL-P at any point after the display of the Microdiagnostics and Control Program copyright header. This aborts the boot and displays the CP> prompt.

To enable Quick Boot mode, issue the BOOTQ command from the CP> prompt while the system is running. This sets the boot mode to Quick Boot, loads the microcode and DECODENET (if necessary), then executes the Quick Boot program QBOOT. Once the system is in Quick Boot mode, subsequent boots (power-on autoboots, BOOT, or BOOTQ) perform a Quick Boot.

To disable Quick Boot mode and return to standard boot mode, issue the **BOOTP** command from the **CP>** prompt. This resets the boot mode and runs CPU diagnostics, then executes the standard boot program **CPBOOT**. Subsequent boots (power-on autoboot, **BOOT**, or **BOOTP**) perform a standard boot.

When you first issue the **BOOTQ** command to establish Quick Boot mode and during every subsequent Quick Boot power-up, the following message is displayed on the system console:

```
WRN101: Quick Boot option enabled. Bypassing CPU  
integrity tests.
```

You can boot the system without changing the boot mode by specifying the boot file (**QBOOT** or **CPBOOT**) in the VCP commands **LOADTM** or **RUNTM**. This type of boot is useful for performing a boot from a device not supported by Quick Boot.

Setting Boot Switches: The **BOOTP** and **BOOTQ** commands have options that permit you to set the default power-up boot sense switch and data switch settings. These settings are expressed as five-digit octal numbers. For example:

```
CP> BOOTP 14114 12000
```

The first option is the sense switch settings, which sets the controller, disk drive, and file to be used for the boot. The second option is the data switch settings, which set the diagnostic routines to be performed during boot. For **BOOTQ**, the data switch settings should be set to all zeros, as follows:

```
CP> BOOTQ 14114 00000
```

BOOTQ and **BOOTP** commands without switch arguments perform the boot operation using the same switch setting used for the power-up boot. For this reason, it is a good habit to always reset the data switch settings to zeros when running **BOOTQ**.

The **BOOT** command defaults unspecified switch settings to zeros.

Resetting Boot Defaults Without Rebooting: You can issue either the **BOOTQ** or **BOOTP** command while the system is running to change the boot defaults. Press **<esc><esc>** to access the **CP>** prompt, then issue **BOOTQ** or **BOOTP**. This allows you to change the boot mode and default boot switch settings at any time. When you issue **BOOTQ** or **BOOTP** while the system is running, the command sets the boot mode and switch settings and then aborts the boot operation with an error message.

Quick Boot Restrictions: Quick Boot has some limitations, as follows:

- You can only boot from disk controllers with a device address of 26 or 27 (octal) and a unit number of 0, 1, 2, or 3.
- You can only boot from tape unit number 0.

Caution Quick Boot is not as user-friendly as standard boot. Quick booting from a non-existent or defective controller, or from a controller with invalid sense switch or data switch settings puts the system into a program hang without providing any error indications.

Parallel Shares During System Boot

The PRIMOS.COMI file used to boot your system contains numerous SHARE commands for sharing resources. PRIMOS now provides the ability to perform these time-consuming share operations in parallel with the other operations performed by PRIMOS.COMI. This can significantly reduce your boot time, especially if your PRIMOS.COMI performs a large number of share operations.

Parallel sharing is performed by removing the share operations from PRIMOS.COMI and placing them in a separate COMI file. At boot time, your PRIMOS.COMI file invokes a phantom process that executes this COMI file. In this way, the PRIMOS.COMI file and the shares COMI file execute concurrently.

Modifying Your PRIMOS.COMI File for Parallel Shares

To establish parallel sharing, perform the following operations prior to system reboot. These operations can all be performed without affecting programs running on the machine.

1. Determine if your PRIMOS.COMI shares PRISAM™, ROAM, DBMS, DISCOVER_DBMS, or SPOOL. These products cannot be shared using a called COMI file, and must continue to be shared as part of the PRIMOS.COMI file. Do not modify SHARE commands for these products in any way.
2. Remove all other SHARE.COMI commands from the PRIMOS.COMI file and copy these commands into a COMI file named SYSTEM>SHARES.COMI. You can include or omit embedded OPR commands, because PRIMOS ignores these commands when executing SHARES.COMI.

3. Add the command PHANTOM SYSTEM>SHARES.COMI to your PRIMOS.COMI file. This command invokes a phantom that executes the share operations. This phantom command should be located near the beginning of your PRIMOS.COMI file to maximize the time saved by parallel execution.

Note Although it is possible to issue a separate phantom request for each shared product, it is recommended that all the SHARE commands be included in one COMI program. This is because the SHARE code path is single-threaded. More than one phantom performing shares does not generate optimum performance. This is because of the overhead associated with multiple processes executing the same code path.

If you are using ORACLE Rev. 6.0.27 (or earlier), you may need to modify your ORACLE60.SHARE.COMI file for parallel sharing. If you continue to share ORACLE from PRIMOS.COMI, no modification is needed. If you share ORACLE from your SHARES.COMI file, the phantom executing SHARES.COMI may terminate abnormally unless you modify the COMI file for this version of ORACLE. Add the following two lines to the end of your ORACLE60.SHARE.COMI file:

```
CO CONTINUE 6  
CO -END
```

Timing Considerations for Parallel Shares

Because both the share operations and the PRIMOS.COMI file are executing concurrently during parallel sharing, some problems involving the timing of these two processes may develop. The following are things to watch for.

- If your system has many shared products and very little else in the PRIMOS.COMI file, it is possible that PRIMOS.COMI will finish before the shares, allowing users to log in before all the shared products have been installed. There are several ways to deal with this.
 - You can leave some of the shares in the PRIMOS.COMI file. (This solution is neither efficient nor robust, and should be considered only as a temporary fix.)
 - You could create a simple timing mechanism to prevent the PRIMOS.COMI file from enabling logins before the phantom has completed its job. For example, you could have the PRIMOS.COMI file delete a dummy file before calling the phantom that executes SHARES.COMI. Both COMI files would execute concurrently. SHARES.COMI would complete its execution by creating this dummy file. PRIMOS.COMI would wait until the dummy file existed before allowing logins. (You could have PRIMOS.COMI test for the

existence of the dummy file by running a CPL program that executes the EXISTS function.)

It is suggested that you include some type of timing mechanism, even if there is not currently a timing problem. This will prevent possible future problems from developing during routine system maintenance.

- It is possible that the SHARE commands were originally placed in specific locations in the PRIMOS.COMI file for timing reasons. That is, a SHARE provided a necessary delay separating two other activities in PRIMOS.COMI. If it is necessary to maintain a delay between two actions invoked from the PRIMOS.COMI file, then you can either leave those SHARE commands in the PRIMOS.COMI that are necessary for timing, or you can use another means to force the timing. It is recommended that you separate the PRIMOS.COMI commands with other activities, rather than leaving SHARE commands in the PRIMOS.COMI. The following are examples of situations where a delay between two activities is necessary:
 - Issuing the COMM_CONTROLLER command, then starting up TCP on a very fast processor. This can result in a race condition between the downline load operation and the TCP server. You can resolve this problem by separating these commands in the PRIMOS.COMI file.
 - Starting the DSM server, then starting up a product that logs messages to DSM. DSM must have time to stabilize before it can receive logged messages. You can resolve this problem by separating these commands in the PRIMOS.COMI file.
 - Starting the network, then initializing File Transfer Service (FTS). The network must be active before you can initialize FTS. You can resolve this problem by separating these commands in the PRIMOS.COMI file.

Parallel Sharing Example

The following examples show how to convert an old PRIMOS.COMI file into a new, smaller PRIMOS.COMI file that invokes a second COMI file to perform most SHARE operations. These examples do not contain any instructions for coordinating timing. The first example shows a PRIMOS.COMI file prior to being converted for parallel sharing.

```
/* PRIMOS.COMI, PRIRUN, DSW, 07/07/89
/* PRIMOS.COMI FILE FOR BRINGING UP PRIMOS
/* Copyright (C) 1986, Prime Computer, Inc., Natick, MA 01760
/* The (T) indicates that this product is part of the T Family
/*
CONFIG -DATA CONFIG /* specify CONFIG file after -DATA.
COPY SYSTEM>PRIMOS.COMO SYSTEM>PRIMOS.COMO.OLD -DL -NQ
COMO SYSTEM>PRIMOS.COMO -NTTY
DATE
START_DSM
SHARE SYSTEM>ED2000 2000
CO SYSTEM>EMACS.SHARE.COMI 7
CO SYSTEM>MIDASPLUS.SHARE.COMI 7
CO SYSTEM>CC.SHARE.COMI 7
CO SYSTEM>DBG.SHARE.COMI 7
CO SYSTEM>BASICV.SHARE.COMI 7
CO SYSTEM>SPICE.SHARE.COMI 7
CO SYSTEM>ORACLE60.SHARE.COMI 7
CO SYSTEM>INFORMATION.SHARE.COMI 7
DEFGV ORACLE60*>ORACLE.A.GLOBALS
R ORACLE60*>ENTER_ORACLE
SQLDBA STARTUP
RESUME SYSTEM>TRANSLATORS.REG.CPL /* Register system EPF's.
COMO -TTY
ADD 53061 2062 42062 2464 52064 2662
MIRROR_ON 2466 2562
MIRROR_ON 52466 52562
MIRROR_ON 52261 52263
DI 2660
CDD 2660 -AD -RD <C80U06>DUMPS /* Configure Crash Dump To Disk.
SYSTEM_RECOVER /* Maximum Recovery Steps Will Be
/* Configured.

CAB -REMBUF -IBS 2000 -OBS 2000
COMO -NTTY
SET_ASYNC -LINE 0 -TO 120 -PRO TTY -SPEED 9600
/* Set_Time_Info command: The following is an example for a time zone
/* of -5 hrs 0 min. (Natick, MA) with the default daylight savings
/* period (U.S. standard).
STI -TZ -0500 -DLST YES /* SET_TIME_INFO.
COMO -TTY
MAX ALL
COMO -NTTY
START_TALK_SERVER /* Start TALK.
START_NM
START_NET PRIMENET*>PRIMENET.CONFIG
START_NAMESERVER
COMM_CONTROLLER -LOAD -DEV LHC -DA 56 -NQ -PR TCP
START_TCP/IP
START_FTP_SERVER
START_MAILER
START_SMTF
```

```

START_NTS
CLOSE 7
DATE
CO SYSTEM>ROAM.SHARE.COMI 7          /* Share ROAM Before DBMS (T).
CO SYSTEM>PRISAM.SHARE.COMI 7       /* Share PRISAM (T).
COMO -NTTY
CO SYSTEM>DBMS.SHARE.COMI 7         /* Share DBMS (T).
CO SYSTEM>DISCOVER_DBMS.SHARE.COMI 7
CLOSE 7
COMO -TTY
MAX ALL                             /* Type Max To Permit User Log Ins.
TYPE PRIMOS.COMI IS FINISHED
DATE
COMO -E
CO -END

```

The following example show the same PRIMOS.COMI file after conversion for parallel shares. Note the removal of all SHARE and OPR commands, and most CO commands, with the exception of the special products: PRISAM, ROAM, DBMS and DISCOVER_DBMS.

```

/* PRIMOS.COMI, PRIRUN, DSW, 07/07/89
/* PRIMOS.COMI FILE FOR BRINGING UP PRIMOS USING PARALLEL SHARES
/* Copyright (C) 1986, Prime Computer, Inc., Natick, MA 01760
/* The (T) indicates that this product is part of the T Family.
/*
CONFIG -DATA CONFIG                  /* Specify CONFIG File After -DATA.
COPY SYSTEM>PRIMOS.COMO SYSTEM>PRIMOS.COMO.OLD -DL -NQ
COMO SYSTEM>PRIMOS.COMO -NTTY
DATE
START_DSM                            /* Start DSM.
PH SYSTEM>SHARES.COMI                /* Invoke Phantom for Parallel Shares.
RESUME SYSTEM>TRANSLATORS.REG.CPL    /* Register System EPF's.
COMO -TTY
ADD 53061 2062 42062 2464 52064 2662
MIRROR_ON 2466 2562
MIRROR_ON 52466 52562
MIRROR_ON 52261 52263
DI 2660
CDD 2660 -AD -RD <C80U06>DUMPS      /* Configure Crash Dump To Disk.
SYSTEM_RECOVER                       /* Maximum Recovery Steps Will Be
                                      /* Configured.

CAB -REMBUF -IBS 2000 -OBS 2000
COMO -NTTY
SET_ASYNC -LINE 0 -TO 120 -PRO TTY -SPEED 9600
/* Set_Time_Info command: The following is an example for a time zone
/* of -5 hrs 0 min. (Natick, MA) with the default daylight savings
/* period (U.S. standard).
STI -TZ -0500 -DLST YES              /* SET_TIME_INFO.
COMO -TTY

```

```
MAX ALL
COMO -NTTY
START_TALK_SERVER          /* Start TALK.
START_NM
START_NET PRIMENET*>PRIMENET.CONFIG
START_NAMESERVER
COMM_CONTROLLER -LOAD -DEV LHC -DA 56 -NQ -PR TCP
START_TCP/IP
START_FTP_SERVER
START_MAILER
START_SMTF
START_NTS
CLOSE 7
DATE
CO SYSTEM>ROAM.SHARE.COMI 7          /* Share ROAM Before DBMS (T).
CO SYSTEM>PRISAM.SHARE.COMI 7       /* Share PRISAM (T).
COMO -NTTY
CO SYSTEM>DBMS.SHARE.COMI 7         /* Share DBMS (T).
CO SYSTEM>DISCOVER_DBMS.SHARE.COMI 7
CLOSE 7
COMO -TTY
MAX ALL                          /* Type Max To Permit User Log Ins.
TYPE PRIMOS.COMI IS FINISHED
DATE
COMO -E
CO -END
```

This PRIMOS.COMI file invokes a phantom in the sixth line which executes SYSTEM>SHARES.COMI. The following is this user-written SHARES.COMI file. If any of these products or COMI files are not on the COMDEV, it would be wise to verify their presence before attempting to access them.

```
COMO SYSTEM>PRIMOS.SHARE.COMO
SHARE SYSTEM>ED2000 2000
CO SYSTEM>EMACS.SHARE.COMI 7
CO SYSTEM>MIDASPLUS.SHARE.COMI 7
CO SYSTEM>CC.SHARE.COMI 7
CO SYSTEM>DBG.SHARE.COMI 7
CO SYSTEM>BASICV.SHARE.COMI 7
CO SYSTEM>SPICE.SHARE.COMI 7
CO SYSTEM>ORACLE60.SHARE.COMI 7
CO SYSTEM>INFORMATION.SHARE.COMI 7
DEFGV ORACLE60*>ORACLE.A.GLOBALS
R ORACLE60*>ENTER_ORACLE
SQLDBA STARTUP
COMO -END
LOGOUT
CO -END
```

CONFIG_USERS Security Enhancements

At Rev. 23.2, the CONFIG_USERS screen interface and the CONFIG_USERS subroutines have been enhanced to support the following new security features:

- Preventing reuse of old login passwords
- Forcing individual users to change login passwords
- Controlling the number of concurrent logins
- Disabling a user ID for a specified period of time
- Disabling a user ID after a specified number of failed login attempts

Preventing Reuse of Old Login Passwords

Previously, when users were required to change passwords, the user could simply alternate between a couple of passwords. This CONFIG_USERS enhancement increases system security by enabling the System Administrator to exclude previously-used passwords.

Caution Enabling this CONFIG_USERS feature changes the version number of your SAD to a version that is incompatible with EDIT_PROFILE and incompatible with versions of FTP earlier than 2.4. After the first activation of this feature, subsequent access to your SAD using EDIT_PROFILE is no longer possible.

Access this facility from the List/Change Password Attributes option on the CONFIG_USERS System menu. This displays a screen containing the new Password History option. When you enable this option, PRIMOS begins maintaining lists of passwords for each user. PRIMOS records each user's 16 most recent passwords and prevents users from reusing any of these passwords.

When the System Administrator enables Password History, a Maximum password changes per hour field appears on the List/Change Password Attributes screen. This option allows the System Administrator to limit the number of password changes per user permitted in 1 hour. Specify a value from 0 (no limit on the number of password changes per hour) to 16 (each user can change passwords up to 16 times an hour). This maximum password changes per hour feature is only enabled if password history is also enabled. It prevents users from defeating the password history security feature by quickly cycling through a list of 16 different passwords.

Forcing Individual Users to Change Login Passwords

You can force an individual user to change password by setting the new Force Password Change field on the Change User ID screen. If set, the user is required to change login password at next log in.

Controlling the Number of Concurrent Logins

The System Administrator can now configure the number of concurrent logins permitted for each user. You can set a default maximum number of concurrent logins for all users and you can also specify greater or lesser maximums on a per-user basis.

Specify the default number of concurrent logins from the CONFIG_USERS System menu, via the List/Change Security Features option. Specify the number of concurrent logins per user from the CONFIG_USERS Add Single User or Add Multiple Users screens. A per-user value of zero defaults to the system default number of concurrent logins. A system default value of zero specifies an unlimited number of concurrent logins.

Disabling a User ID for a Period of Time

The System Administrator can disable or enable a user ID for a specified period of time. This is useful when assigning user IDs to short-term contract personnel, or when a user goes on an extended vacation or leave of absence. A disabled user ID still exists, but cannot be used until the specified time has expired or the System Administrator re-enables the user ID.

From the CONFIG_USERS Change User menu or the Add Single User or Add Multiple Users menus, you specify the Disable Account? option. This provides you with two options: either disable the user ID indefinitely, or until a specified date.

After you have set the Disable Account? option, you must confirm this change on the Change User, Add Single User, or Add Multiple Users menu. Only those changes that are confirmed at this user account level take effect.

Disabling a User ID After Multiple Failed Login Attempts

As a security precaution against attempts to "hack" into a system, the System Administrator can specify a maximum number of consecutive failed login attempts (due to invalid password). You specify this as the number of Allowable Failures on the CONFIG_USERS menu. If this maximum number is reached, the user ID is disabled for a specified period of time, then automatically reenabled. During this disabled time period all attempts to log in fail. If a user attempts to log in using an invalid password during this disabled

time period, the login fails and PRIMOS automatically extends the disabled period.

The System Administrator can specify from 0 through 15 failed attempts before disabling the user ID. A value of 0 permits unlimited failed attempts.

To access this security feature from the CONFIG_USERS System menu, select the new option: **List/Change Security Features**. This displays the **Allowable Failures** and **Account Failure Disposition** options.

The System Administrator can specify the disabled time period (the **Account Failure Disposition** option on the CONFIG_USERS menu) in quadseconds (1 quadsecond = 4 seconds; 900 quadseconds = 1 hour). Each attempt to log in during this account failure disposition time automatically increases the time by the established time period. By specifying -1, the System Administrator can specify that the user ID is to be disabled for an indefinite period of time, until re-enabled by the System Administrator.

For example, the System Administrator configures the system for three allowable failures and an account failure disposition of 900 quadseconds (1 hour). A user makes three consecutive failed attempts to log in. The user ID is automatically disabled for one hour. The user makes a fourth attempt to log in. The login fails (regardless of whether or not the password was correct). If the password was correct, the disabled period is not extended. If the password was not correct, the disabled time period is automatically extended for one hour from the time of the failed attempt.

Subroutine Interface for New CONFIG_USERS Features

The PRIMOS system attributes set by CONFIG_USERS are stored in the PRIMOS_System_Attributes data structure. This data structure can be read using CUS\$LIST_SYSTEM and modified using CUS\$CHANGE_SYSTEM. The descriptions of these subroutines in *Subroutines Reference IV: Libraries and I/O* provide further details on this data structure.

The PRIMOS attributes for individual users that are set by CONFIG_USERS are stored in the PRIMOS_Attributes data structure. This data structure can be created and modified using CUS\$USER, and read using CUS\$LIST_USER. The descriptions of these subroutines in *Subroutines Reference IV: Libraries and I/O* provide further details on this data structure.

To support the new CONFIG_USERS features provided at Rev. 23.2, these two data structures have been extended with additional fields.

System Attributes: The PRIMOS_System_Attributes data structure has been extended with the following additional fields:

```
2 Ver2,  
  3 Allowable_Failures  FIXED BIN(15),  
  3 Default_Concurrent_Logins  FIXED BIN(15),  
  3 Default_Account_Disposition  FIXED BIN(15),  
  3 Max_Password_Changes  FIXED BIN(15),  
  3 Password_History  BIT(1) ALIGNED,  
  3 reserved (2)BIT(1) ALIGNED; /* reserved for  
                                future use. */
```

Specify a *Version* number of 2 for this extended data structure at Rev. 23.2 and subsequent revisions.

Allowable_Failures

Sets the number of allowed login failures (invalid passwords) before the account disposition is applied (as described below). Valid values are 0 through 15. A value of 0 permits an unlimited number of failed logins; a value of 1 applies account disposition after the first failed login attempt.

Default_Concurrent_Logins

Sets the default number of concurrent logins permitted for all users. Concurrent logins do not include phantoms, batch processes or child processes. The System Administrator can specify different numbers of concurrent logins for individual users (as shown below). This field configures the default for all users not individually configured for concurrent logins. Valid values are 0 through 128. A value of 0 permits an unlimited number of concurrent logins.

Default_Account_Disposition

Sets the default action for the system to perform when a user reaches the allowable login failures limit. (You set this limit using the *Allowable_Failures* field.) If you set this field to -1, the user's account is disabled indefinitely when it reaches the allowable login failures limit. The System Administrator must re-enable the user account manually. If you set this field to 0 (the default), nothing happens when a user reaches the allowed login failures limit. If you set this field to a positive number, PRIMOS disables the user account for the number of quadseconds that you specified in this field. One quadsecond = 4 seconds.

For example, if you set this field to 900 and the *Allowable_Failures* field to 3, when a user fails to log in for the third consecutive time, due to invalid passwords, PRIMOS disables that user ID for 900 quadseconds (one hour). All login attempts fail during this hour. A login attempt during this hour that specifies an invalid password both fails and resets the clock to one hour from the time of that login attempt.

Max_Password_Changes

Sets the number of password changes that each user is allowed in one hour. Specify a value from 0 to 16 (inclusive). A value of 0 indicates that there is no limit for the maximum number of password changes per hour. A value of 16 indicates a maximum of 16 password changes per user per hour. This field is used with the *Password_History* field to prevent a user from quickly cycling through all 16 restricted passwords. If *Password_History* is not activated, this field has no significance.

Password_History

Specifies whether a history of the last 16 passwords is to be maintained for each user. If set to TRUE, then PRIMOS records the 16 most recent passwords for each user and disallows their use when users change their login passwords. If set to FALSE, all users are immediately free to change their passwords to any valid password.

Caution

Setting this field to TRUE changes the version number of your SAD to a version that is incompatible with EDIT_PROFILE and incompatible with versions of FTP earlier than 2.4. After the first activation of this feature, subsequent access to your SAD using EDIT_PROFILE is no longer possible.

User Attributes: The PRIMOS_Attributes data structure has been extended with the following additional fields:

```

2 Ver2,
  3 Force_Password_Change BIT(1) ALIGNED,
  3 Concurrent_Logins FIXED BIN(15),
  3 Disable_Until FIXED BIN(31);

```

Specify a *Version* number of 2 for this extended data structure at Rev. 23.2 and subsequent revisions.

Force_Password_Change

When set, this field requires a new user password the next time the user logs in. A value of 1 forces the user to change the password; a value of 0 accepts the existing password.

Concurrent_Logins

Sets the number of concurrent logins that are allowed for this user ID. Concurrent logins do not include phantoms, batch processes, or child processes. If you set this field to 0, its value defaults to the value specified in the *Default_Concurrent_Logins* field of the PRIMOS_System_Attributes data structure. You can set this field to a larger or smaller number than the system default. Valid values are 0 through 128. A value of 0 indicates that this field defaults to the system default value.

Disable_Until

Specifies the date and time that PRIMOS will re-enable a disabled user ID. This field defaults to the elapse time specified in the *Default_Account_Disposition* field of the PRIMOS_System_Attributes data structure. You can set this field to a larger or smaller number than the system default.

To specify a date, you must supply the date in QS (quadsecond) format. There are two routines in PRIMOS which convert to and from QS format: CV\$DQS (to convert from a binary date to a QS date) and CV\$QSD (to convert from a QS date to a binary date). A value of -1 indicates that the account is to be disabled indefinitely (until the System Administrator re-enables it). A value of 0 indicates that the account is enabled.

Status Codes: If a CONFIG_USERS subroutines fails, it returns a *status* value. The following additional *status* values are returned by CONFIG_USERS subroutines.

- CUS\$Invalid_Allowable_Failures The number specified in *Allowable_Failures* is < 0 or > 15. Returned by CUS\$CHANGE_SYSTEM.
- CUS\$Invalid_Max_Pw_Chg_Hr The number specified in *Max_Password_Changes* is < 0 or > 16. Returned by CUS\$CHANGE_SYSTEM.
- CUS\$Invalid_Default_Conc_Login The number specified in *Default_Concurrent_Logins* is < 0 or > 128. Returned by CUS\$CHANGE_SYSTEM.
- CUS\$Invalid_Default_Acct_Dis An invalid number for account disposition. Returned by CUS\$CHANGE_SYSTEM.
- CUS\$Pw_History_Not_Enabled Specified a value for *Max_Password_Changes* without enabling password history. Returned by CUS\$CHANGE_SYSTEM.
- CUS\$Cant_Open_Opf Routine could not open the OPF database for writing. Retry the subroutine call. Returned by CUS\$CHANGE_SYSTEM and CUS\$OPEN_SAD.

For further details on CONFIG_USERS, refer to the *System Administrator's Guide, Volume III: System Access and Security* and the *Subroutines Reference Guide IV: Libraries and I/O*.

Remote Login Retries

At Rev. 23.2, you can specify the number of login attempts that a remote user can make before the remote line connection is dropped. This new functionality is supported by the following commands:

- START_LSR operator command
- SET_LSR_DEFAULTS operator command
- CLOSE user command

START_LSR -RETRIES Enhancement

A new -RETRIES option has been added to the START_LSR command. The -RETRIES option allows the System Administrator to configure the number of login attempts that a remote (TELNET or NETLINK) user is to be granted before the connection is dropped.

Caution

Do not enable START_LSR -RETRIES if there are nodes on your network that are not running either PRIMOS Rev. 22.1.5 or Rev. 23.2 and subsequent revisions. Enabling retries on networks with nodes running earlier PRIMOS revisions could allow users access to nodes for which they did not previously have permission.

This problem is demonstrated by the following example: A site contains 3 systems: A, B, and C. For increased security, the System Administrator has configured the machines so that A can "see" B, B can "see" C, but A cannot "see" C. System A is running version 22.0 of PRIMOS, B is running 23.2 with the new LOGIN_SERVER and START_LSR -RETRIES set to 3. A user logging in from A to B (via LOGIN ME -ON B) specifies an incorrect password or user ID. System B's login server allows the user to try again (note that at this point, because System A is not running either 22.1.5 or 23.2 (it's running 22.0), the user is connected to System B and is using B's LOGIN_SERVER). The user may now issue LOGIN ME -ON C. The user has therefore been able to access System C from System A.

START_LSR has the following command syntax:

```
START_LSR {
  -PROMPT login_server_prompt
  -REDISPLAY_PROMPT
  -RETRIES m
  -HELP
}
```

-PROMPT login_server_prompt

Allows the System Administrator to specify the LOGIN_SERVER prompt when the LOGIN_SERVER is started up. For further details, refer to the Rev. 23.1 Software Release Document.

-REDISPLAY_PROMPT

Specifies whether or not the LOGIN_SERVER redisplays the LOGIN_SERVER prompt if a NULL command line is entered. For further details, refer to the *Rev. 23.1 Software Release Document*.

-RETRIES *nn*

Specifies the number of login retries to permit. You can specify 0 to 10 login retry attempts before the remote line is dropped. Note that this is the number of *retries*, and is thus one less than the total number of login attempts. The default is 0 retries (that is, only 1 login attempt).

If you are performing a log-through operation (LOGIN FOO -ON SYS2), START_LSR only permits one login attempt before dropping the remote line, regardless of the value you specified for this option.

-HELP

Displays the command-line syntax for the START_LSR command.

SET_LSR_DEFAULTS Setting Login Retries

The SYSTEM>SET_LSR_DEFAULTS tool has also been enhanced to allow the System Administrator to configure the number of retries when the system is cold started. The following is an example of a SET_LSR_DEFAULTS session that resets the number of retries. For further details, refer to the *Rev. 23.1 Software Release Document*.

OK, A SYSTEM
OK, R SET_LSR_DEFAULTS

Retrieving current LOGIN_SERVER defaults...

Prompt redisplay: enabled
Login prompt: "Login to %sn."
Retries: no retry attempts allowed before remote connection is dropped.

Do you wish to change the defaults (y/n)? Y

Prompt redisplay, when enabled, causes the LOGIN_SERVER to redisplay the LOGIN_SERVER prompt if a null or blank login command line is encountered.

Prompt redisplay is currently enabled. Would you like to disable it (y/n)? N

The current LOGIN_SERVER prompt is: "Login to %sn."
Would you like to change it (y/n)? N

Configuring the number of allowable retries allows the System Administrator to allow users between 1 and 10 attempts at logging in without closing the Virtual Circuit (if the user is logging from a remote system over PRIMENET) or NTS connection (if the user is logging through the Network Terminal Server). Not setting the number of retries (or setting the number of retries to 0) allows the user only 1 attempt at logging in.

The current number of allowable retries is currently: 0 (0 = none)
Would you like to change it (y/n)? Y
Number of retries (1-10 or 0 for none): 2

Prompt redisplay: enabled
Login prompt: "Login to %sn."
Retries: 2 retry attempts allowed before remote connection is dropped.

Ok to save new settings (y/n)? Y
The defaults for the LOGIN_SERVER have been updated. The changes will not take affect until the LOGIN_SERVER is restarted or the system is coldstarted.
OK,

CLOSE User Command for Remote Logins

The new retries option permits the user up to 10 login retries before dropping the remote line connection. However, the user may wish to drop the remote line without making multiple unsuccessful login attempts. The CLOSE command allows the user to have the login server close their remote connection immediately. For example, if you realize that you do not have a valid login on a remote system, you can issue the CLOSE command to drop the remote line without performing as many as 10 login attempts.

Consider the following example. You are the user, and the System Administrator has set START_LSR as follows:

```
START_LSR -PROMPT 'Login to %sn' -RETRIES 10  
-REDISPLAY_PROMPT
```

You might perform the following login session:

.....

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```
Login to PLATO
OK, LOGIN FOOBAR
Password?
Incorrect user id or password
```

```
Login to PLATO
OK, LOGIN FOOBAR
Password?
Incorrect user id or password
```

```
Login to PLATO
OK, LOGIN FOOBAR
Password?
Incorrect user id or password
```

At this point, you know that you cannot remember your password. You might attempt to use the TELNET escape sequence to break the connection (if coming over TELNET), or the NETLINK escape sequence (<cr>@<cr>) to break the connection (if coming over PRIMENET). However, if you have logged through (for example, LOGIN FOOBAR -ON PLATO), then neither of these escape sequences work. Instead, use the CLOSE command to drop the remote line.

```
Login to PLATO
OK, CLOSE
<disconnection message ...>
```

CHANGE_PROJECT Operator Command

The CHANGE_PROJECT user command allows users to change their login projects without logging out and logging back in again. (The CHANGE_PROJECT user command is described in the New Features for the User and Programmer chapter of this document.)

The CHANGE_PROJECT user command is an optional facility which must be activated on your system by the System Administrator. Use the CHANGE_PROJECT operator command to enable or disable project changing for all local users on the system.

The CHANGE_PROJECT operator command has the following syntax:

```
CHANGE_PROJECT { -ENABLE
                 -DISABLE
                 -HELP }
```

-ENABLE

-ENA

Enables project changing for all local users on the system. The option takes effect immediately for all users, and continues in effect until system cold start or you explicitly disable project changing by using the **-DISABLE** option. Specifying **-ENABLE** when project changing is already enabled has no effect.

-DISABLE

-DIS

Disables project changing for all local users on the system. The option takes effect immediately for all users. Project changing is disabled by default, so this option is only meaningful if you have previously enabled project changing. Specifying **-DISABLE** when project changing is already disabled has no effect.

-HELP

Displays the online list of options for the **CHANGE_PROJECT** command.

Tape Drive Support Enhancements

New Tape Dump Command

At Rev. 23.2, PRIMOS supports a new Maintenance Processor command for performing a crash dump to tape. You issue this new command as follows:

```
CP> SYSCLR  
CP> RUN 774
```

The **774** command provides greater flexibility in performing tape dumps than the previous tape dump commands. It can perform a backup to any tape unit. The **774** command prompts for full or partial tape dump and for the tape unit number. The following table shows the properties of the available tape dump commands:

<i>Tape Dump Command</i>	<i>Dump Type</i>	<i>Tape Unit</i>	<i>6250 bpi Support</i>
RUN 774	Prompt for full or partial dump	Prompt for tape unit (0 through 11)	6250 bpi supported
RUN 773	Prompt for full or partial dump	Tape unit 0	6250 bpi supported
RUN 775	Full dump only, no prompt	Tape unit 0	Not supported
RUN 776	Full dump only, no prompt	Tape unit 1	Not supported
RUN 777	Partial dump only, no prompt	Tape unit 0	Not supported

The 774 command is intended to replace all of these previous tape dump commands. The other tape dump commands are still supported, but their use is discouraged. For further details on using this command, refer to Appendix A.

New Tape Dump Messages

The display information and error messages returned during a tape dump have been modified for Rev. 23.2. Regardless of which tape dump command you specify, the information displayed during crash dump to tape processing is as shown in Appendix A.

Disk Drive Support Enhancements

Support for More Assigned Disks

Prior to Rev. 23.2, PRIMOS provided for a maximum of 10 assigned disks, 8 paging disks, and 238 added disks. At Rev. 23.2 the maximum number of assigned disks has been increased to 64. The maximum number of added disks and paging disks has not been affected.

The DISKS command has been modified to permit you to specify the pdevs for up to 64 assigned disks to the Assignable Disks Table.

MAKE and FIX_DISK operations can only be performed on assigned disks. Therefore, increasing the maximum number of assigned disks permits you to perform more than 10 concurrent FIX_DISK and/or MAKE operations. Running more concurrent FIX_DISK operations may improve mean time to recovery following a system crash, especially on systems supporting multiple robust partitions. FS_RECOVER (Version 3) provides support for 64 assigned disks.

Support for New Disk Drives

At Rev. 23.2, PRIMOS supports two new disk drives:

- Model 4731, a 421MB SCSI drive. Model 4731 has a capacity of 202,438 records distributed among 31 pseudoheads as follows:
 - Heads 0 – 21 have a capacity of 6604 records per head.
 - Heads 22 –30 have a capacity of 6350 records per head.
- Model 4732, a 1.34GB SCSI drive. Model 4732 has a capacity of 643,128 records distributed among 31 pseudoheads as follows:
 - Heads 0 – 20 have a capacity of 20828 records per head.
 - Heads 21 –30 have a capacity of 20574 records per head.

These new disk drives have been added to the available disk types for the MAKE command and the FIX_DISK command. The -DISK_TYPE options of the MAKE command and the FIX_DISK command now accept the following disk types:

<i>Disk type</i>	<i>Description</i>
CMD	Cartridge module device
SMD	80MB or 300MB removable SMD
68MB	68 megabyte fixed media
158MB	158 megabyte fixed media
160MB	160 megabyte fixed media
600MB	600 megabyte fixed media SMD
MODEL_4475	300 megabyte fixed media SMD
MODEL_4711	60 megabyte fixed media
MODEL_4714	84 megabyte fixed media
MODEL_4715	120 megabyte fixed media
MODEL_4719	258 megabyte fixed media
MODEL_4721	328 megabyte fixed media SCSI
MODEL_4729	673 megabyte fixed media SCSI
MODEL_4730	213 megabyte fixed media SCSI
MODEL_4731	421 megabyte fixed media SCSI
MODEL_4732	1.34 gigabyte fixed media SCSI
MODEL_4735	496 megabyte fixed media SMD
MODEL_4845	770 megabyte fixed media SMD
MODEL_4860	817 megabyte fixed media SMD

SCSI Disk Support

Rev. 23.2 supports several new SCSI disk drives (as listed above), and also supports the ICOP+ protocol (described below) for enhanced performance on SCSI disks. Users of SCSI disks should be aware of the following considerations. Except where noted, these statements apply to the Model 4721, 4729, 4730, 4731, and 4732 SCSI disk drives, regardless of whether ICOP+ is in use:

- SCSI disk drives do not have a write-protect button.
- SCSI disk drives perform automatic badspot checking and remapping within the disk drive itself. This considerably speeds and simplifies MAKE command execution. SCSI badspot handling is completely automatic and invisible to the user of the disk; no PRIMOS command options for badspot handling should be used with SCSI disk drives. During MAKE processing, the Model 4729, 4730, 4731, and 4732 default to a badspot level of 0; the Model 4721 defaults to a badspot level of 2. You can reset this option to a badspot level of 0.
- SCSI disk drives on a 7210 controller do not have a controller mode. The MAKE and FIX_DISK options -IC and -AC are ignored and should not be used. Commands that display the disk controller mode display a SCSI disk as -AC, regardless of the mode you originally specified.
- SCSI disk drives on a 7210 controller are automatically formatted with forward sectoring interleaving. The MAKE and FIX_DISK options -RDI and -ODI used to change interleaving are ignored and should not be used.
- SCSI disks may be partitioned, but, for performance reasons, it is strongly recommended that (wherever possible) you specify a SCSI disk as a single partition. (There is one exception, as described in the following section.)

No partition conversion has been required for any PRIMOS revision since Rev. 22.1. Therefore, when specifying the MAKE -DISK_REVISION, specify a *rev* of 22.1. When using FIX_DISK, you do not need to further convert partitions if they are already at Rev. 22.1.

Paging Partitions on SCSI Disks

SCSI disks may be split (using MAKE -SPLIT) to create either a paging partition or a crash dump disk. Splitting a disk creates two portions: a file system portion, and a non-file-system portion that can be later activated either for paging or for crash dump to disk. The requirements for a crash dump disk are presented later in this chapter. The following recommendations apply to the use of SCSI disks for paging partitions.

When using a SCSI disk for a paging partition, it is recommended, for performance reasons, that you do not use the disk for both paging and file system I/O. When you split the disk, allocate a minimal number of records for

the file system and the rest for paging. 10 records is the minimum file system size for SCSI disks. Do not use the file system portion of the disk. To prevent use of the file system portion, do not use ADDISK to add the disk.

Paging performance can be improved by establishing multiple paging partitions (up to 8). However, allocating several entire SCSI disks as paging partitions is likely to be more paging space than you need and more disk space than you can afford to lose. The following recommendations may help you to strike a balance between disk space and paging performance.

- If possible, use SMD (non-SCSI) disks for paging partitions. Create multiple small paging partitions on different SMD disks.
- If you use a SCSI disk for a paging partition, it is recommended for performance reasons that you do not partition the disk, but use the entire disk as a single paging partition.
- If you use SCSI disks for paging partitions, use several small SCSI disks rather than one large SCSI disk to maximize paging performance. However, to maximize disk space utilization, a single large SCSI paging disk may be preferable to several smaller SCSI paging disks.
- Splitting a SCSI disk results in the unavailability of some records due to alignment restrictions (in addition to the unused records on the file system portion of the split disk). Therefore, you may need to allocate more paging records on a SCSI disk than you would on a SMD disk. The number of unavailable records is different for each SCSI disk, as shown in the following table. This table assumes that the disk is being used as a single partition, split to allocate a minimal 10-record file system portion.

<i>SCSI Disk Model</i>	<i>Unavailable Records</i>
4721	56
4729	1050
4730	1122
4731	5718
4732	5448

- If a SCSI disk is larger than you need for paging, you can use part of the disk for paging and part for a crash dump disk. To do this, you MAKE the disk as two split partitions, allocating a minimal file system portion (10 records) to each partition. Use the non-file-system portion of one partition for paging, and the non-file-system portion of the other partition as a crash dump disk. Because these two partitions are not accessed concurrently, there should be no significant performance impact.
- If you must use a SCSI disk for both paging and file system I/O, you can minimize the performance impact by locating files on that disk that are rarely accessed.

- Try to avoid using disks in a 75500-6PK device module as paging partitions. Disk drives containing paging partitions cannot be swapped. The 75500-6PK is described later in this chapter.

For further details on disk support, refer to the *Operator's Guide to File System Maintenance*.

SPIN_DOWN Command

SPIN_DOWN is a new system console command that stops (spins down) a disk in a Model 75500-6PK device module. The principal use for this command is to take offline a malfunctioning disk until it can be repaired or replaced.

Issue the SPIN_DOWN command to stop a disk drive when you notice it malfunctioning; then issue the DISK_PAUSE command to suspend I/O operations when you are ready to replace the disk. SPIN_DOWN is only used with SCSI disk drives in a Model 75500-6PK device module that are controlled by a Model 7210 (SDTC) disk controller using ICOP+. If you are replacing a disk in a Model 75500-6PK device module immediately, you do not need to use the SPIN_DOWN command. The DISK_PAUSE command also performs a spin-down operation.

The SPIN_DOWN command has the following syntax:

SPIN_DOWN *pdev*

pdev is the physical device number (in octal) of the disk drive. You can only spin down a disk that is not in use; you cannot spin down a physical disk containing COMDEV (unless COMDEV is mirrored), a paging, added, or assigned partition, or a partition activated for crash dump to disk.

Following a successful spindown, an amber LED light is displayed on the specified disk drive in the Model 75500-6PK device module, indicating that the disk has spun down. After successfully issuing the SPIN_DOWN command, turn off the power switch located on the front of the disk drive.

If you attempt to spin down a disk that is either already spun down or nonexistent, SPIN_DOWN performs no operation but returns an OK prompt. If you attempt to spin down a disk for which spindown is not permitted, the system returns the following message:

Physical device number *pdev* conflicts with an active file system partition, assigned disk, or paging disk. Please verify the physical device number and check for conflicts.

Physical device number *pdev* is:

CONTROLLER ADDRESS: *nn*

UNIT NUMBER: *n*

The Controller address *nn* is either 22, 23, 24, 25, 26, 27, 45 or 46 (octal) and the unit number *n* is an octal number 0 through 7 (inclusive), as shown on the front of the disk drive itself.

This message is also displayed if the disk contains an activated partition for crash dump to disk. Refer to the description of crash dump to disk later in this chapter.

DISK_PAUSE Command for Swapping Disk Drives

At Rev. 23.2, PRIMOS supports swapping of SCSI disk drives in a Model 75500-6PK device module on a paused system. This permits you to replace a defective disk drive without powering down the system, suspending PRIMOS, or even halting applications or logging out users. All I/O operations on the system are simply suspended during the disk drive swap operation, then permitted to resume. During disk drive swapping, the system appears to be hung, except that activity on other (non-disk) controllers can proceed, thus preventing the timing out of remote logins and other network operations.

All disks in a Model 75500-6PK must be SCSI disks attached to a 7210 disk controller. The 7210 controller must be a disks-only controller using the ICOP+ controller protocol.

Disk drive swapping cannot be performed on a physical disk containing COMDEV (unless the COMDEV is mirrored), a paging, added, or assigned disk, or a partition activated for crash dump to disk.

You perform disk drive swapping by using a new system console command: **DISK_PAUSE**. Because of the risks associated with improper use of **DISK_PAUSE**, this command is available only to System Administrators who have undergone special training. Refer to the *Disk Replacement Procedure for the Model 75500-6PK Device Module (IDR13100-1XA)* for further details.

The System Administrator should be prepared to immediately swap the disk drive upon issuing the **DISK_PAUSE** command. If, however, the disk swap operation cannot be performed rapidly, the System Administrator should bear in mind the following timeout considerations:

- Because users are not able to perform I/O operations during a disk swap operation, they will probably treat the system as hung and will not enter any keystrokes. This may result in these users being logged out as inactive (timed out). You can either modify the timeout duration (using the LOUTQM configuration directive) before issuing DISK_PAUSE, or instruct your users to enter an occasional keystroke during the disk swap operation.
- Data base products that use timed semaphores (such as Prime INFORMATION) may return misleading timeout messages. If a disk is paused long enough for the timer to expire, a long series of messages may be displayed at the system console regarding the semaphore lock, such as:

```
Lock at address xxxxxx appears inactive. Referenced by
...
```

followed by a list of user names. Once the disk is unpaused, all semaphore activity is resumed without any problem, and no permanent damage has been done. To avoid the semaphore messages from being displayed, the System Administrator should set the notification frequency higher (such as to '5', as opposed to the default of '1') by using the INFORMATION Bootstrap Menu option 332 before pausing the disk. Refer to the *Prime INFORMATION Administrator's Reference Guide* for more information on this option.

Disk I/O Performance Enhancements

ICOP+ Protocol for SCSI Disk Controllers

ICOP+ is a new disk I/O interface protocol for the Model 7210 disk controller that significantly improves I/O performance with SCSI disk drives. ICOP+ is a refinement of ICOP (Intelligent Channel-Order Protocol), which is available on the Model 10019 SMD (non-SCSI) disk controller.

ICOP+ improves general I/O performance by using the intelligence of the disk controller to allow it to schedule multiple overlapping I/O requests in an optimal order. It also eliminates unnecessary "handshaking", thus speeding general I/O processing. ICOP+ also improves backup performance by using an internal cache that, in most cases, substantially improves tape streaming.

Note You must separately install the downline load file required for ICOP+. Only one ICOP+ downline load file is required per system, regardless of the number of ICOP+ controllers. This file is located in the DOWN_LINE_LOAD* directory. Model 7210 controllers purchased prior to Rev. 23.2 require a hardware upgrade to support ICOP+. Contact your PrimeService representative for further details.

If your system has a downline load file for ICOP+, PRIMOS automatically implements ICOP+ on all appropriate Model 7210 SCSI disk controllers. PRIMOS implements ICOP+ using downline-loaded microcode at system cold start. No reconfiguration or disk reformatting is required.

ICOP+ is supported on disk-only Model 7210 controllers. It is not supported on Model 7210 controllers used for both disk and tape I/O. These disk and tape controllers default to the generally less efficient 4005 mode protocol. Therefore, it is recommended that you configure your most heavily used SCSI disks on a disk-only Model 7210 controller. ICOP+ is not supported on other (non-SCSI) disk controllers.

Disk Mirroring: ICOP+ supports disk mirroring. This feature permits you to use disks in pairs so that each disk contains a copy of all data on the other disk. This mirroring of disk data doubles the storage requirements for mirrored data and decreases I/O performance, but if either disk fails, the other contains a complete, immediately accessible copy of the data.

Both disks in a mirrored pair must be ICOP+ SCSI disks. They must be the same type of disk drive, the same partition size, and the same type (revision and mode) of disk. The disks in a mirrored pair may reside on the same disk controller or on separate controllers.

Disk mirroring is described in detail in the *Operator's Guide to File System Maintenance*. The same requirements, commands, and messages are used for ICOP+ disk mirroring. However, one limitation does not apply to ICOP+: previously, all disks used for mirroring had to be formatted using MAKE -IC (-INTELLIGENT_CONTROLLER); ICOP+ SCSI disk used for mirroring can be formatted using either MAKE -IC or MAKE -AC (-ALL_CONTROLLER).

Dual Porting: ICOP+ supports dual-ported disks. Dual porting allows you to physically connect the same disk drive to two systems. Only one system can use the disk drive at a time. In the event of a halt on the primary system, you can switch the disk drive over to the secondary system.

You use the same commands for ICOP+ dual-ported SCSI disks that you use for dual-ported SMD disks. However, ICOP+ dual porting is more efficient than SMD dual porting because ICOP+ performs dual porting at the drive level, rather than at the daisy-chain (bus) level. This allows two systems to share the same SCSI bus concurrently, with each system using different disk drives on that bus. Each disk on the bus must have a unique unit number. Disks in a 75500-6PK device module display the unit number next to the disk drive.

It is strongly recommended that you *do not* dual port your command device (COMDEV).

Dual porting is usually performed using the `ADDISK -PRIORITY_SELECT` command (ICOP+ disks can also frequently perform dual porting using the `ADDISK` command with no option). The user interface for this command is as follows:

```
OK, ADDISK -PRIORITY_SELECT pdev
Please confirm the following information:
CONTROLLER ADDRESS: nn
UNIT NUMBER: n
Is this the disk you intend to priority select? YES
Issuing priority select.
OK,
```

The Controller address *nn* is either 26, 27, 45 or 46 (octal) and the unit number *n* is an octal number 0 through 7 (inclusive). Specify YES, NO, or QUIT at the prompt.

For further details on dual porting, refer to the *Operator's System Overview* and the `ADDISK`, `ASSIGN DISK`, and `MIRROR_ON` commands in the *Operator's Guide to System Commands*.

Downline Load of ICOP+

The downline load microcode files for all disk controllers reside in the directory `DOWN_LINE_LOAD*`. During system cold start, PRIMOS automatically downline loads the appropriate microcode for Model 7210 controllers. If the controller is a disk-only controller and ICOP+ is available, PRIMOS downline loads ICOP+. If the controller is a disk and tape controller or if ICOP+ is not available, PRIMOS downline loads 4005 mode protocol.

System Console Downline Load Messages: The following messages may be returned during downline load. These messages are displayed at the system console and logged to DSM (message IDs `DISKER11_ID`, `DISKER12_ID`, and `DISKOK3_ID`). DSM, in turn, displays these messages. Therefore, if DSM displays its messages on the system console, duplicate downline load messages display at the system console. If DSM displays its messages on another terminal, only one downline-load message is shown on the system console.

The following messages are displayed during downline load. The number *nn* shown in these messages is the controller address (in octal); possible values are 22, 23, 24, 25, 26, 27, 45, and 46.

DLL and init ICOP+ mode complete (nn) - (disk_init).

The DownLine Load (DLL) file was successfully found, read, and downline loaded, and the controller successfully entered ICOP+ mode. *nn* represents the controller device address (in octal).

DLL and init 7210 DLL complete (nn) - (disk_init).

The DownLine Load (DLL) file was successfully found, read, and downline loaded, and the controller successfully entered 4005 mode. 4005 mode was loaded either because ICOP+ is not available on your system or because this 7210 controller is a disk and tape controller. *nn* represents the controller device address (in octal).

Could not attach to DOWN_LINE_LOAD* - (disk_init).

PRIMOS could not locate the directory containing the DLL file for ICOP+.

Disk download file (SDIC_DISK.DL) not found - (disk_init).

PRIMOS could not locate the DLL file for ICOP+. In this case, PRIMOS reverts to downline loading the 4005 mode protocol. This protocol is generally less efficient than the ICOP+ protocol.

I/O errors while processing a disk DLL file (SDIC_DISK.DL - (disk_init)).

PRIMOS located the DLL file for ICOP+, but was either not able to read it or not able to downline load it into the Model 7210 controller.

Failure to enter ICOP+ mode (nn) - (disk_init).

PRIMOS successfully downline loaded ICOP+ into the disk controller, but an error occurred when the controller attempted to execute the ICOP+ microcode.

Failure to enter 7210 DLL mode (nn) - (disk_init).

PRIMOS successfully downline loaded 4005 mode microcode into the disk controller, but an error occurred when the controller attempted to execute the 4005 microcode.

DSM Downline Load Messages: The following messages can be logged by DSM during downline load of ICOP+ into Model 7210 disk controllers.

DISKOK1_ID: 4 bytes long
bytes 1,2: controller address
bytes 3,4: mode (1 = ICOP, 2 = 7210 DLL, 3 = ICOP+)

Successful downline load and entry into intelligent mode. This corresponds to the DLL and init ICOP+ mode complete (nn) console message.

DISKER2_ID: 6 bytes long
bytes 1,2: controller address
bytes 3,4: mode (1 = ICOP, 2 = 7210 DLL, 3 = ICOP+)
bytes 5,6: error (from dll_controller)

Downline load failed. This corresponds to the I/O Errors while processing a disk DLL file console message.

DISKER1_ID: 4 bytes long
bytes 1,2: controller address
bytes 3,4: mode (1 = ICOP, 2 = 7210 DLL, 3 = ICOP+)

Downline load successful, but controller failed to actually enter DLL mode. This corresponds to the Failure to enter ICOP+ mode console message.

Disk Error Messages for ICOP+

When the controller detects a disk error, it sends a message to the supervisor terminal and the DSM log file. Normally, this disk error message is returned and logged in DSM. If DSM is not running, PRIMOS returns this message to the system console. The following example shows an ICOP+ disk error message:

```
DISK ERROR IN ICOP+ MODE
OPCODE = opcode (OCT) cmd_name
DEVICE NUMBER = dev_no (OCT)
CRA = cra (OCT) RCRA = rcra (OCT)
LBA = lba (DECIMAL)
LSW = ls1 ls2 ls3 ls4 ls5 (OCT)
```

OPCODE

Returns an octal number and a command name. The following are the possible values:

000000	Response check for controller functionality (RESPONSE CHECK)
000001	Disk seek (SEEK)
000002	Controller selecting drive for next I/O operation (SELECT)
000003	Get information about ICOP controller (GET INFO)
000005	Open spindle; logically activate a disk for use (OPEN SPINDLE)
000006	Close spindle; logically deactivate a disk (CLOSE SPINDLE)
000007	Inquiry to obtain controller and drive configuration and revision information (INQUIRY)
000011	Abort request (ABORT)
000012	Return to track zero (RETURN TO TRACK ZERO)
000013	Read a record (READ)
000014	Write a record (WRITE)
000016	Write a record and verify the write (WRITE VERIFY)
000017	Format a disk track (FORMAT)
000021	Dump controller microcode (DUMP)
000022	SPIN UP
000023	SPIN DOWN
000024	ADD BADSPOT
000025	PAUSE CONTROLLER
000026	UNPAUSE CONTROLLER
000100	Asynchronously write a record (ASYNC WRITE)
000101	Enter intelligent mode (ICOP, 7210 DLL, or ICOP+) (ENTER INTELLIGENT MODE)

CRA

Note that the Current Record Address (CRA) is not divided into cylinder, head, and sector, because SCSI devices are logically addressed, not physically addressed. The Read Current Record Address (RCRA) is the CRA that was received on a read. If the RCRA differs from the CRA, this indicates disk corruption; run `FIX_DISK`.

LBA

The Logical Block Address (LBA) is the absolute block number (in decimal), viewing the entire disk as one big partition. The LBA includes non-user addressable blocks.

LSW

The ICOP+ Logical Status Word (LSW) consists of five logical status words, rather than ICOP's two logical and two physical status words. The values of these five LSWs for a Model 7210 controller in non-ICOP+ mode are shown

in the Disk Errors appendix to the *Operator's Guide to File System Maintenance*. The following changes to those LSW tables apply for the MODEL 7210 controller in ICOP+ mode:

- Logical Status Halfword 2 contains the following new or changed values:
 - 004000 Maximum control blocks exceeded (changed value)
 - 000200 Incomplete transfer during DMA
 - 000110 Drive not reserved
- Logical Status Halfword 3 contains the following new values:
 - 010000 Unrecoverable read error
 - 004000 Compare error (formerly LSW4 value 000400)
 - 002000 Parity error on SCSI bus (formerly LSW4 value 010000)
- Logical Status Halfword 4 contains the following new or changed values:
 - 010000 Undefined (now LSW3 value 002000)
 - 000400 Undefined (now LSW3 value 004000)
 - 000040 Reservation conflict
 - 000010 Duplicate drive response
 - 000002 SCSI bus hang
- Logical Status Halfword 5 contains the following new value:
 - 010000 Unsuccessful remap

Falling Out of Intelligent Mode: An internal error may cause the disk controller to fall out of intelligent mode, losing its downline loaded microcode and reverting to 4005 mode. If this occurs, PRIMOS logs a disk error message to DSM.

A Model 10019 controller may remain in ICOP mode, but fall out of Dynamic BadSpotting (DBS) mode. If this occurs, the disk error message displays the message Controller not in DBS mode after the normal error message. A disk error at this point would break a mirrored pair of disks.

Crash Recovery Facilities

Rev. 23.2 provides two new system crash recovery facilities

- Crash Dump to Disk (CDD)
- Automated System Recovery (SYSTEM_RECOVER)

The two facilities provide options for automatically performing crash recovery. Crash dump to disk can be run by itself, or run as an option of automated system recovery. By using these crash recovery facilities, you can configure the desired degree of automated crash recovery, from operator invocation of each operation to full automation of all crash recovery steps.

Two new operator commands were added at Rev. 23.2 to configure and manage these facilities: the CDD command and the SYSTEM_RECOVER command. Two new Maintenance Processor commands were also added to execute these operations following a system crash.

Crash Dump to Disk

Crash dump to disk provides an alternative to writing crash dumps to tape in the event of a system halt. Prior to Rev. 23.2, all crash dumps were performed to tape. Now you have the option of performing a crash dump to disk or to tape.

Crash dump to disk or to tape can be specified as an option of the automated system recovery facility, described later in this chapter.

There are two advantages of crash dump to disk over crash dump to tape:

- Crash dump to disk can be performed without operator intervention, because there is no need to mount reels of tape.
- Taking a crash dump to disk is, in many cases, significantly faster than taking a crash dump to tape.

Both of these advantages of crash dump to disk improve system availability by decreasing the time required for collecting crash dump data.

The FS_RECOVER facility can analyze either a crash dump to disk or a crash dump to tape. For further details on crash dump analysis, refer to the *Rev. 23.1 Software Release Document* and the Rev. 23.2 edition of *Using FS_RECOVER*.

Both the crash dump to disk and the crash dump to tape facilities have been enhanced to write map information as part of the crash dump. Previously, map information was written to the directory SYSTEM_DEBUG*>CRASH>MAPS and had to be separately recovered.

Activating a Crash Dump Disk: You must activate a crash dump disk before you can use it to perform a crash dump to disk. When you take a crash dump, CDD writes the system crash information into this activated partition. To activate a crash dump disk, perform the following steps:

1. Use the **MAKE** command to format the disk (only necessary the first time the disk is used).
2. Use the **DISKS** (or **DI**) command to add the disk to the Assignable Disks Table.
3. Use the **CDD -ACTIVATE_DISK** command to activate the crash dump disk. Only one crash dump disk can be activated at a time.

A crash dump disk must be the non-file-system portion of a split disk; it can be a paging partition that is not currently used for paging. The disk must be on a Model 10019 (IDC) or Model 7210 (SDTC) disk controller. A disk drive in a 75500-6PK device module that contains a crash dump disk cannot be swapped while it is activated. If you wish to perform a disk swap, you can deactivate the crash dump disk, activate a crash dump disk on another disk drive, then issue a **SPIN_DOWN** or **DISK_PAUSE** command.

If the crash dump disk is a non-SCSI disk, it must have been made with the **-IC** option of the **MAKE** command. A SCSI disk on a 7210 controller can be made with either the **-IC** or **-AC** option.

You cannot activate a partition as a crash dump disk (using **CDD -ACTIVATE_DISK**) if the partition is currently in use for paging (that is, if the **LIST_CONFIG** command shows it is a paging partition). Once you have activated a disk for **CDD**, you can not assign that disk (using **ASSIGN DISK**) because activating a disk for **CDD** writes initialization information to the disk. **CDD** activation of the non-file-system portion of a split disk does not restrict the use of the file system portion of that disk.

To create a crash dump disk on a SCSI disk, split the disk between the file system portion and the crash dump disk portion, following the minimum dump size requirements provided later in this chapter. Some disk space is lost to overhead when you split a SCSI disk, thus requiring you to allocate a larger crash dump disk on a SCSI disk than on a SMD disk. You can add the file system portion of the split disk (using **ADDISK**) and perform I/O on it without incurring a performance penalty, because file system I/O and crash dump processing do not occur concurrently.

Performing a Crash Dump to Disk: Once you have activated a crash dump disk, your system is ready to perform crash dumps to disk when needed. When a system halt occurs, you can perform the actual crash dump to disk in either of two ways:

- Automatically, by using System Recovery from the Maintenance Processor (as described later in this chapter)
- Manually, by using the Maintenance Processor command: **RUN 661**

In either case, this operation writes the crash dump information on the crash dump disk. This preserves the crash information so that you may perform a Resident Forced Shutdown (RFS) and a system reboot.

You can manually perform a crash dump to disk immediately following a system crash by issuing the following Maintenance Processor (VCP) commands from the system console:

```
CP> SYSCLR
Really? YES
DPM006:Central Processor system initialization completed.
      02 Aug 91 11:47:00 Fri
CP> RUN 661
Initializing dump disk 120762 .... OK
Beginning partial dump .....
CORE dump done 12591 records written, 20345 left on disk
MAPS dump done  47 records written, 20298 left on disk
PIOS dump done  65 records written, 20233 left on disk
Crash dump to disk 120762 completed.
DPM400: CPU halted at 000014/004707: 003776
      02 Aug 91 11:50:02 Fri
CP>
```

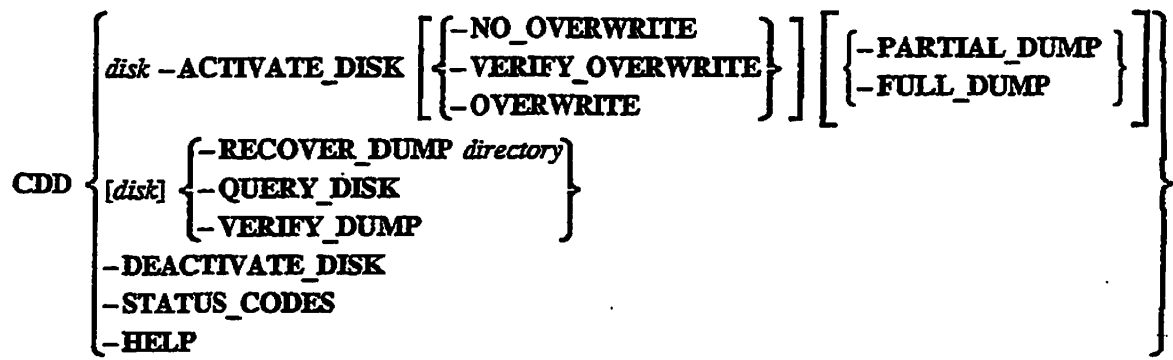
If the activated disk is too small to accommodate the crash dump or unrecoverable problems occur during the crash dump to disk, CDD prompts you to select crash dump to tape rather than crash dump to disk. For further details on manually performing a crash dump to disk, refer to Appendix B.

Analyzing a Crash Dump to Disk: You can use FS_RECOVER to analyze a crash dump to disk. Only Version 3.0 (or greater) of FS_RECOVER supports crash dump to disk. FS_RECOVER can analyze a crash dump on the crash dump disk itself, or a crash dump recovered to a file. Although FS_RECOVER can read a crash dump directly from the crash dump disk, it is usually preferable to recover the crash dump before performing FS_RECOVER analysis, for the following reasons.

- When you reactivate the crash partition, the existing dump is overwritten.
- In order to make a copy of the dump available for use by PrimeService, you must recover the crash dump to a file and then save it using MAGSAV.

Use the CDD -RECOVER_DUMP option to perform this operation. CDD -RECOVER_DUMP copies the crash information stored on the system's crash dump disk into a crash dump file stored in a user-specified file system directory.

CDD Command: The CDD command has the following syntax. The CDD command can only be issued by a System Administrator or at the system console.



disk

The pdev number or the name of the crash dump disk. A name can be used if the crash dump partition resides on a split disk and the file system portion of this disk has been added (using the ADDISK command). In this case, the crash dump partition shares the name of the added file system partition.

The *disk* option is required when you use the -ACTIVATE_DISK option to initially activate a crash dump disk. You can omit the *disk* option with -RECOVER_DUMP, -QUERY_DISK, or -VERIFY_DUMP if the desired crash dump disk for these operations is the currently activated disk.

-ACTIVATE_DISK *activation dumptype*

-AD

Activates a disk to serve as the crash dump disk. You must activate a crash dump disk before performing a crash dump to disk. This disk must be a local disk with enough free space to accommodate a crash dump. Only one disk can be activated at a time. Once activated, a crash dump disk remains activated until you explicitly deactivate the disk (using the -DEACTIVATE_DISK option) or until the next system cold start.

Because cold start deactivates the crash dump disk, it is suggested that you activate a crash dump disk as part of your PRIMOS.COMI file. However, you should specify this disk activation so that it does not overwrite an existing crash dump on the disk.

The disk that you activate must be on a Model 10019 (IDC) or Model 7210 (SDTC) disk controller. A disk on an IDC controller must have been made in -IC mode. If you specify a disk on an unsupported controller, CDD -ACTIVATE_DISK returns the following error message:

Disk *nnnn* cannot be used for crash dumps.
Its controller type is not supported by CDD.

-ACTIVATE_DISK has two optional suboptions: you may specify an *activation* suboption, which specifies what CDD should do when activating the crash dump disk, and you may specify a *dumptype* suboption, which specifies what type of dump to perform when a crash occurs. If you do not specify these suboptions, **-ACTIVATE_DISK** takes the defaults. You can change the *dumptype* suboption whenever you like by reissuing **-ACTIVATE_DISK**.

The **-ACTIVATE_DISK** option requires that you specify *disk* to identify the crash dump disk that you wish to activate. You may omit *disk* if the crash dump disk is already activated and you are using **-ACTIVATE_DISK** to change that disk's *dumptype* suboption.

When you activate a crash dump disk, any previous crash dump on that disk is lost. For this reason, **-ACTIVATE_DISK** provides *activation* suboptions that permit you to specify what to do if the disk you wish to activate already contains a crash dump.

-ACTIVATE_DISK takes the following *activation* suboptions:

-NO_OVERWRITE

-NO

Does not overwrite a pre-existing crash dump stored on the disk. If the pre-existing dump has not been recovered, CDD displays a message indicating that the dump exists and exits without activating the disk. If the dump has been recovered, CDD displays a message indicating that the dump exists, then queries for permission to activate the disk, overwriting the existing dump. You can answer YES (overwrite the pre-existing dump and activate the disk), or NO or QUIT (do not overwrite pre-existing dump and do not activate the disk).

-NO_OVERWRITE is the default activation suboption, unless the **-ACTIVATE_DISK** option and the **-RECOVER_DUMP** option appear on the same command line (as described below).

-VERIFY_OVERWRITE

-VO

Displays a message if a pre-existing dump exists and queries for permission to activate the disk, overwriting the existing dump. You can specify YES (overwrite the pre-existing dump and activate the disk), or NO or QUIT (do not overwrite pre-existing dump and do not activate the disk).

-OVERWRITE

-OV

Automatically overwrites any pre-existing crash dump stored on the disk and activates the disk.

-ACTIVATE_DISK takes the following *dump*type suboptions:

-PARTIAL_DUMP
-PD

Activates the crash dump disk to take a partial crash dump. If the disk size is estimated to be too small to contain a partial crash dump, CDD displays the following message on the system console:

Warning: Disk <pdev> is too small to safely accommodate a partial dump comprising one-quarter of physical memory.

CDD nevertheless still activates the disk. The size of a partial crash dump depends on many factors and cannot be known precisely until the dump is generated at crash time (see Appendix B). **-PARTIAL_DUMP** is the default suboption.

-FULL_DUMP
-FD

Activates the crash dump disk to take a full crash dump. If the disk size is calculated to be too small to contain a full crash dump, CDD activates the disk for a partial crash dump and reports this to your terminal. This process displays the following message:

Warning: Disk <pdev> is too small to safely accommodate a full dump. A partial dump will be activated instead.

If the disk size is estimated to be too small for even a partial crash dump, CDD also displays the following message:

Warning: Disk <pdev> is too small to safely accommodate a partial dump comprising one-quarter of physical memory.

CDD nevertheless still activates the disk.

-RECOVER_DUMP *directory*
-RD

Recovers a crash dump by copying it from the crash dump disk specified by *disk* into a crash dump file in the specified *directory*. **-RECOVER_DUMP** automatically generates a crash dump file named `DUMP.yymmdd.hhmmss`; this time stamp indicates the date and time that the system crash occurred. It is recommended that you recover a crash dump before analyzing the crash using `FS_RECOVER`.

You must specify the directory in which `-RECOVER_DUMP` is to create the crash dump file. You can use the *directory* suboption of `-RECOVER_DUMP` to specify the pathname of the directory on the command line. If you omit *directory* from the command line, `-RECOVER_DUMP` prompts you for the directory name. If you have recovered this dump before, the directory prompt defaults to the name of the directory used previously.

However specified, the directory must already exist. You can specify a complete directory pathname or just a directory name. An unqualified directory name (that is, one containing no > characters) is assumed to be a top-level directory on the currently attached file system partition. You can use an asterisk (*) to specify the currently attached directory. For performance reasons, it is recommended that the file system partition used for disk recovery be on a different disk drive than the crash dump partition.

If you specify both the `-ACTIVATE_DISK` and `-RECOVER_DUMP` options in the same command, CDD always performs the `-RECOVER_DUMP` operation before the `-ACTIVATE_DISK` operation, regardless of the order of the options in the command line. For example:

```
CDD disk1 -ACTIVATE_DISK -PARTIAL_DUMP -RECOVER_DUMP my_directory
```

In the example above, CDD first performs the `-RECOVER_DUMP` operation for the crash dump on `disk1`. CDD then performs the `-ACTIVATE_DISK` operation to activate `disk1` for a `-PARTIAL_DUMP`. `-ACTIVATE_DISK` requires no *activation* suboption when `-RECOVER_DUMP` is also specified; CDD assumes `-OVERWRITE` permission and deletes the old crash dump from the crash dump disk; this should not be a problem, as `-RECOVER_DUMP` has just recovered this crash dump to the file system.

`-QUERY_DISK`

`-QD`

Returns the current status of a crash dump disk. You can specify *disk* with this option, or omit it and receive the status of the currently activated disk (refer to the `-ACTIVATE_DISK` option). The status information includes the disk's partition name and/or its pdev number, whether the disk is currently activated, status of existing dump (no dump, recovered dump, or unrecovered dump), and, if a dump exists, the type (full or partial), size, and date of the crash dump, as shown in the following example:

```
OK, CDD 111161 -QD
```

```
[CDD Rev.23.2 Copyright (c) 1991, Prime Computer, Inc.]
```

```
Query Crash Disk
```

```
partition name : MYDISK
pdev           : 111161
activated      : yes
activated for  : partial dump
disk contains  : no dump
```

If the crash dump disk has been activated, but crash dump to disk is not enabled for system recovery, the `-QUERY_DISK` display includes the following line:

```
activated : yes (Note: CDD not enabled)
```

This message only concerns manual or automatic system recovery, described later in this chapter; it does not prevent manual invocation of crash dump to disk, as described in Appendix B.

If the specified disk is not activated and contains an unrecovered crash dump, `-QUERY_DISK` returns the following:

```
OK, CDD 111161 -QD
[CDD Rev.23.2 Copyright (c) 1991, Prime Computer, Inc.]
Query Crash Disk
partition name : ** not available **
pdev : 111161
activated : no
disk contains : unrecovered dump
date of dump : 02 Aug 91 12:12:28 Friday
size of dump : 13410 disk records
```

`-VERIFY_DUMP`

`-VD`

Determines whether an unrecovered dump exists on a crash dump disk. You can specify *disk* with this option, or omit it and receive the status of the currently activated crash dump disk. This option returns a subset of the information returned by `-QUERY_DISK`.

`-DEACTIVATE_DISK`

`-DD`

Deactivates the currently activated crash dump disk. If no disk is currently activated, this option does nothing. Refer to the `-ACTIVATE_DISK` option.

`-STATUS_CODES`

`-SC`

Lists the error and warning status codes returned in `SEVERITY$` when the `CDD` command is executed from within a CPL program. For further details on `SEVERITY$`, refer to the *CPL User's Guide*. The following `SEVERITY$` values may be returned:

- 0 Command completed without error.
- 1 General error (any error other than the specific errors listed below).

- 2 The partition name specified in *disk* has not been added (using ADDISK). Use the pdev number of the disk rather than the partition name, or add the disk.
- 3 The partition specified in *disk* could not be assigned. One common reason for this is that you failed to add the disk to the assignable disks table (using the DISKS command).
- 1 General warning (any warning other than the specific warnings listed below.)
- 2 You specified `-RECOVER_DUMP`, but there is no dump to be recovered.
- 3 You specified `-ACTIVATE_DISK`, but an unrecovered dump exists and cannot be overwritten, either because you specified `-NO_OVERWRITE` or you specified `-VERIFY_OVERWRITE` and responded NO to the overwrite prompt.
- 4 You specified `-ACTIVATE_DISK`, but the specified disk is too small for the dump type that you specified. If you specified `-FULL_DUMP` on a too-small disk, CDD returns this warning, then defaults to a partial dump. If you specified `-PARTIAL_DUMP` or CDD has defaulted to a partial dump, CDD returns this warning if the disk is too small for a partial dump.
- 5 You specified `-VERIFY_DUMP`, but no unrecovered dump exists.

`-HELP`
`-H`

Displays the list of command line options for the CDD command.

Disk Space Requirements for a Crash Dump Disk: The minimum size of the disk that you should allocate for crash dumps depends on many factors. One important factor is whether you intend to perform a full crash dump or a partial crash dump.

A full crash dump requires space equivalent to the number of pages of physical memory, plus the space required for a MAPS dump and a PIOS dump.

A partial crash dump requires substantially less disk space than a full crash dump, but the exact size depends on several factors (system configuration, number of active users) that are not easily predicted.

To create a crash dump disk, you use the `MAKE -SPLIT` command to split a disk, specifying the number of records that you wish to allocate. To calculate the number of records needed, do the following:

1. For a full crash dump, the number of records needed is the size of your system's physical memory (CORE), plus 47 records for the MAPS dump and (if it is a 6000-series system) 65 records for the PIOS dump. The size of the MAPS and PIOS dumps are the same for all crash dumps: tape or disk, full or partial. This is the number of records needed for a full crash dump to tape. You can calculate this number, or you can determine it by performing a full crash dump to tape. At Rev. 23.2, performing a crash dump to either disk or tape returns the size of the crash dump (refer to Appendices A and B for examples). Go to either Step 4 or Step 5 to determine the MAKE -SPLIT size to accommodate this full crash dump size.
2. For a partial crash dump, perform either of the following:
 - o If possible, compile a log of partial crash dumps to tape on your system. To determine the minimum CORE dump size, the results of more than one dump are required for a reliable estimate. For example, a partial dump after SHUTDOWN ALL may be smaller than a partial dump done after an actual crash. Use the CORE size of the largest of these partial crash dumps to tape as an initial estimate of the minimum CORE size of a partial crash dump to disk. A crash dump to tape contains the same information as a crash dump to disk, so their sizes can be directly compared.
 - o If you do not have a log of partial crash dumps to tape, you can initially estimate the CORE size for a partial crash dump as one-quarter the size of physical memory. Larger systems (more than 32MB of physical memory) usually require somewhat less than one-quarter the size of physical memory.
3. For a partial crash dump, add 47 records for the MAPS dump and 65 records for the PIOS dump to the estimated minimum CORE dump size from Step 3. Only 6000-series systems generate a PIOS dump.
4. If you are splitting a SMD (non-SCSI) disk for a full or partial crash dump disk, add 50 records to provide for disk errors. This is the minimum crash dump disk size for a SMD (non-SCSI) disk. Specify this number of records in the MAKE -SPLIT command for the SMD disk.
5. If you are splitting a SCSI disk for a full or partial crash dump disk, use the following table. Take the crash dump size that you estimated in Step 3 and round it up to the next larger *Crash Dump Size* value shown in this table. The corresponding value for your disk drive model is the number to specify as the MAKE -SPLIT value.

<i>Crash Dump Size (in records)</i>	<i>Model 4721</i>	<i>Model 4729</i>	<i>Model 4730</i>	<i>Model 4731</i>	<i>Model 4732</i>
7874	7874	8890	8890	13462	13208
15748	15748	16764	16764	21336	21082
23622	23622	24638	24638	29210	28956
31496	31496	32512	32512	37084	36830
39370	39370	40386	40386	44958	44704
47244	47244	48260	48260	52832	52578
55118	55118	56134	56134	60706	60452
62992	62992	64008	64008	68580	68326
70866	70866	71882	71882	76454	76200

If you need a *Crash Dump Size* larger than those shown in this table, you can continue the column for your disk model by increasing in increments of 7874 records. This chart provides optimal disk alignment when splitting a SCSI disk that has not been partitioned. If you have partitioned the SCSI disk, these numbers will not provide optimal disk alignment. This table should only be used for splitting the SCSI disks listed to create a crash dump disk; do not use it for creating paging disks or for splitting disks other than those listed.

For further details on estimating the size of a partial dump, refer to the Rev. 23.2 edition of *Using FS_RECOVER* (DOC13062-3LA).

Exceeding Available Disk Space During Crash Recovery: When you use the `-RECOVER_DUMP` option to copy a crash dump from the crash dump disk to the file system, the available space on the file system disk may be insufficient. This is usually because an old crash dump is still stored in the specified directory on the partition. You can free disk space by deleting files, then continue recovering the crash dump by using the `REENTER (REN)` command, as shown in the following example:

Automated System Recovery

When a system halt occurs, you should perform several operations to recover the system and to identify what caused the halt. Automated System Recovery allows you to configure the Maintenance Processor (MP) to automatically perform these system recovery operations.

This speeds and simplifies the steps required to recover a system following a system crash. The following operations can be automated using `SYSTEM_RECOVER`:

- Crash dump to tape or disk
- Resident Forced Shutdown (RFS)
- System hardware verification
- Cold start or warm start

Configure these operations prior to a system crash, and specify whether you want system recovery to be automated or to require operator invocation.

Note For automated system recovery, your system must have Maintenance Processor microcode that supports this facility. Refer to Chapter 1 for a complete list of MP microcode versions. All of the listed systems support automated system recovery.

Setting Automated System Recovery Options: When you first coldstart a system, it has no system recovery options configured. That is, you must manually invoke each recovery operation individually. Therefore, default system crash recovery is identical to pre-Rev. 23.2. You can re-establish this state without cold starting the system by issuing the `SYSTEM_RECOVER -NO` command.

To establish system recovery options, you issue the `SYSTEM_RECOVER` command. The `SYSTEM_RECOVER` command with no options sets all options to their most fully automated state.

There are, therefore, two basic system recovery states:

- No system recovery, at coldstart or following `SYSTEM_RECOVER -NO`.
- Fully automated system recovery, following `SYSTEM_RECOVER`.

From either of these states you can change individual options by specifying `SYSTEM_RECOVER` with the specific options. The following example shows how to set system recovery options. It shows several successive invocations of `SYSTEM_RECOVER` with different options. (The `SYSTEM_RECOVER -RC` option reports the current configuration of system recovery.)

```

<coldstart>
OK, SYSTEM_RECOVER -RC
SYSTEM_RECOVER Configuration /* No system recovery
    auto : no
    cd : no
    rfs : no
    sysv : no
    restart : no

OK, SYSTEM_RECOVER
OK, SYSTEM_RECOVER -RC
SYSTEM_RECOVER Configuration /* Fully automated system recovery
    auto : yes
    cd : disk
    rfs : yes
    sysv : no
    restart : cold

OK, SYSTEM_RECOVER -CDT -WARM
OK, SYSTEM_RECOVER -RC
SYSTEM_RECOVER Configuration /* Individual options reset
    auto : yes
    cd : tape
    rfs : yes
    sysv : no
    restart : warm

OK, SYSTEM_RECOVER -NO
OK, SYSTEM_RECOVER -RC
SYSTEM_RECOVER Configuration /* Reset to no system recovery
    auto : no
    cd : no
    rfs : no
    sysv : no
    restart : no

```

The simplest method of setting system recovery is to issue the **SYSTEM_RECOVER** command twice. The first command sets the system recovery state, the second command modifies that state:

```

OK, SYSTEM_RECOVER /* Sets options to fully automated.
OK, SYSTEM_RECOVER -CDT /* Reset individual option.

```

Note that system recovery frequently involves a coldstart. Therefore, each time you run system recovery, the coldstart voids the system recovery option settings. For this reason, it is recommended that you include the **SYSTEM_RECOVER** command (with the desired options) in your **PRIMOS.COMI** file, or have **PRIMOS.COMI** invoke a CPL program containing **SYSTEM_RECOVER**. In

this way, bringing the system up from a coldstart also re-establishes your system recovery options. Place the `SYSTEM_RECOVER` command(s) at the end of your `PRIMOS.COMI` file, so that crashes during execution of `PRIMOS.COMI` do not trigger automated system recovery.

Invoking Automated System Recovery: If you explicitly or implicitly configured automated system recovery (`auto : yes`), and your system's Maintenance Processor supports automated recovery, the specified recovery operations are automatically performed when a system halt occurs, without the need of any operator intervention. (Automated system recovery is *not* performed when you manually shut down or stop the system.)

If you did not configure automated system recovery or the Maintenance Processor (MP) does not support automated system recovery, you must restart the system manually. PRIMOS can still provide some recovery support, including configuring crash dump to disk (CDD) or crash dump to tape (CDT) and/or RFS prior to the system halt.

You can invoke system recovery by issuing a command from the Maintenance Processor. Use the `RUN 660` command to invoke the recovery tasks configured by the `SYSTEM_RECOVER` command, as follows:

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

You can use other `RUN` commands to individually invoke system recovery operations: `RUN 661` for crash dump to disk, `RUN 774` (or `773`, `775`, `777`, etc.) for crash dump to tape, `RUN 662` for Resident Forced Shutdown (RFS).

SYSTEM_RECOVER Command: You configure automated system recovery by using the `SYSTEM_RECOVER` command. The `SYSTEM_RECOVER` command can be issued from the system console or by a System Administrator from any terminal. The syntax for this command is as follows:

SYSTEM_RECOVER

SYSTEM_RECOVER -NO

SYSTEM_RECOVER $\left[\begin{array}{l} \{-\text{AUTO } [delay]\} \\ \{-\text{NO_AUTO}\} \end{array} \right] \left[\begin{array}{l} \{-\text{CDD}\} \\ \{-\text{CDT}\} \\ \{-\text{NO_CD}\} \end{array} \right] \left[\begin{array}{l} \{-\text{RFS}\} \\ \{-\text{NO_RFS}\} \end{array} \right]$

$\left[\begin{array}{l} \{-\text{SYSV}\} \\ \{-\text{NO_SYSV}\} \end{array} \right] \left[\begin{array}{l} \{-\text{COLD_RESTART}\} \\ \{-\text{WARM_RESTART}\} \\ \{-\text{NO_RESTART}\} \end{array} \right]$

SYSTEM_RECOVER $\left\{ \begin{array}{l} \{-\text{REPORT_CONFIGURATION}\} \\ \{-\text{STATUS_CODES}\} \\ \{-\text{HELP}\} \end{array} \right\}$

SYSTEM_RECOVER

The **SYSTEM_RECOVER** command with no options sets system recovery to its most fully automated state. It is exactly equivalent to specifying **SYSTEM_RECOVER -AUTO -CDD -RFS -NO_SYSV -COLD_RESTART**.

Note

If your system does not support automated system recovery, the **SYSTEM_RECOVER** command (or the **SYSTEM_RECOVER -AUTO** command) fails, returning a severity code of -1 and displaying the warning prompt.

SYSTEM_RECOVER -NO

Deconfigures all system recovery options. That is, system recovery is neither automatically invoked, nor can you invoke it manually (i.e., RUN 660 performs no operations); you must manually invoke each recovery operation individually. **SYSTEM_RECOVER -NO** is exactly equivalent to **SYSTEM_RECOVER -NO_AUTO -NO_CD -NO_RFS -NO_SYSV -NO_RESTART**. This is the condition of all systems immediately following coldstart, before a **SYSTEM_RECOVER** command is issued. It is identical to the condition of all PRIMOS systems prior to Rev. 23.2.

SYSTEM_RECOVER [*configuration_options*]

When the **SYSTEM_RECOVER** command is followed by one or more configuration options, PRIMOS resets the specified options to the values specified. Specify either none or one from each set of options. You can specify these configuration options in any sequence. If you do not set an option, it remains set to its previous value. Use the **SYSTEM_RECOVER -REPORT_CONFIGURATION** command to determine the current values of these configuration options.

- **-AUTO** [*delay*] configures the automatic execution of system crash recovery. Your system's Maintenance Processor (MP) must support the feature. You can specify an optional delay time in number of minutes for the system to wait between the time that you issue the **SYSTEM_RECOVER -AUTO** command and the time that automated crash recovery is available on the system. The range of possible values is 0 to 255; the default is zero minutes. (The **SYSTEM_RECOVER** command with no options sets automated crash recovery with a delay of zero minutes.) If a **SYSTEM_RECOVER -AUTO** command is pending due to a time delay and you issue a second **SYSTEM_RECOVER -AUTO** command (or a **SYSTEM_RECOVER** with no options), the first command is ignored; only the most recent **SYSTEM_RECOVER -AUTO** command is executed. The following example shows the use of *delay*.

```
OK,SYSTEM_RECOVER          /* Immediate activation of
                             /* automated recovery.
OK,SYSTEM_RECOVER -AUTO 10 /* Deactivates automated
                             /* recovery; reactivates
                             /* auto recovery in 10
                             /* minutes.
OK,SYSTEM_RECOVER -AUTO 5  /* Cancels pending 10
                             /* minute delay. Sets 5
                             /* minute delay for auto
                             /* recovery activation.
```

- **-NO_AUTO** configures non-automatic execution of system crash recovery. When a system crash occurs, you must manually invoke automated crash recovery by using a **RUN** command from the system console. Once invoked, the crash dump (CDD or CDT) and RFS configured features execute automatically, without further need of operator intervention (except to respond to CDT prompts). The **-SYSV** option is not meaningful when specified with the **-NO_AUTO** option.
- **-CDD** configures a crash dump to disk. Following a system halt, this option writes the crash dump on the currently-activated crash dump disk. If no disk is activated when you configure **CDD**, **SYSTEM_RECOVER** reports this to your terminal as a warning. Disk activation is performed by the **CDD -ACTIVATE_DISK** command. Establishing crash dump to disk

is further described earlier in this chapter; executing a crash dump to disk is further described in Appendix B.

- **-CDT** configures a crash dump to tape. During crash recovery, you must manually intervene to initiate the write to tape. The system prompts you to specify a full or partial crash dump and to specify the tape unit number. (These prompts are equivalent to those returned when using the RUN 774 maintenance processor command for crash dump to tape.) Crash dump to tape is further described in Appendix A.
- **-NO_CD** specifies that no crash dump should be performed.
- **-RFS** configures Resident Forced Shutdown, which attempts to shut down all local disks by flushing all file system buffers. It performs a normal shutdown on disks that had no file system changes in progress when the system crash occurred, and suggests FIX_DISK processing for those disks it could not successfully shut down. A warmstart cannot be performed following RFS. RFS is further described in the *Rev. 23.1 Software Release Document*.
- **-NO_RFS** specifies that no Resident Forced Shutdown should be performed.
- **-SYSV** configures system hardware verification to be performed before performing an *automated* cold restart. Execution of SYSV adds several minutes to the time required for cold start. This option is only meaningful when the **-AUTO** and **-COLD_RESTART** options are set; it performs no operation when you manually execute system recovery.
- **-NO_SYSV** specifies that no system hardware verification should be performed before an *automated* cold restart (other restarts are not affected). This speeds system reboot by bypassing most diagnostic processing (refer to Quick Boot, described earlier in this chapter). Because **-NO_SYSV** does not perform diagnostic checking, it should only be used on a system that is fully functional.
- **-COLD_RESTART** configures an automatic cold restart of the system after PRIMOS performs all of the other specified recovery operations. This option is only meaningful if the **-AUTO** option is also set. Only systems that support automated restart can use this option; on other systems this option is ignored.
- **-WARM_RESTART** configures an automatic warm restart of the system (if possible) after performing all of the other specified recovery operations. PRIMOS only performs a warm restart if a warm restart will successfully restart the system; otherwise, it ignores this option and automatically performs a cold restart. This option is only meaningful if the **-AUTO** and **-NO_RFS** options are set. Only systems that support automated warm restart can use this option; on other systems this option is ignored.

- **-NO_RESTART** specifies that no restart should be performed following the other specified recovery operations.

Note Automated restart can only be performed on machines that support this facility. Currently, the machines listed in the microcode table in Chapter 1 support automatic cold start. Currently no machines support automatic warm start. If your system does not support the specified automatic restart option, you must manually perform the boot operation from the system console.

SYSTEM_RECOVER -REPORT_CONFIGURATION **SYSTEM_RECOVER -RC**

Reports the current system recovery configuration settings, as shown in the following example:

```
SYSTEM_RECOVER Configuration
      auto : no
      cd   : disk
      rfs  : yes
      sysv : no
restart : cold
```

If crash dump to disk is configured (cd : disk) the display for this command includes a message if there is no activated crash dump disk. Configuring automated crash dump to disk and activating a crash dump disk are independent operations that can be performed in any sequence, but you must activate a crash dump disk before your system can perform a crash dump to disk.

SYSTEM_RECOVER -STATUS_CODES **SYSTEM_RECOVER -SC**

Lists the status codes returned in SEVERITY\$ when the SYSTEM_RECOVER command is executed from within a CPL program. For further details on SEVERITY\$, refer to the *CPL User's Guide*. The following SEVERITY\$ values may be returned:

- | | |
|----|------------------------------------------------------------------------------------------------------------------------------|
| 0 | Command completed without error. |
| 1 | General error (any error other than the specific errors listed below). |
| -1 | General warning (any warning other than the specific warning listed below). |
| -2 | You specified -CDD, but there is no activated crash dump disk. Use the CDD -ACTIVATE_DISK command described in this chapter. |

SYSTEM_RECOVER -HELP
SYSTEM_RECOVER -H

Displays the list of command line options for the **SYSTEM_RECOVER** command.

SYSTEM_RECOVER Example

Establishing Automated System Recovery: The following CPL program example configures automated system recovery with crash dump to disk. It preserves a como file record of the established status of the crash dump disk, the available space on the file system disk used for crash recovery, and the system recovery configuration. It then mails a copy of this information to the System Administrator. To establish system recovery, you would invoke a program such as this from PRIMOS.COMI.

```

&SEVERITY &ERROR &IGNORE
COMO CMDNC0>S35_RECOVERY.COMO
TYPE
TYPE *** S35 COLDSTART
TYPE
DATE
&DEBUG &ECHO
DI 111161          /* Add crash partition to Assignable Disks Table. */
AVAIL OSGRP7      /* Check available space on recovery disk */
                  /* before crash dump recovery. */
CDD 111161 -RD <OSGRP7>TEMP_DUMPS -AD
                  /* Recover any existing crash dump on the disk, */
                  /* then activate 111161 as a crash partition. */
AVAIL OSGRP7      /* Check available space on recovery disk */
                  /* after crash dump recovery. */
CDD -QD           /* Query the crash dump disk status to a COMO file. */
SYSTEM_RECOVER
                  /* Establish system recovery with default values: */
                  /* auto recovery, cdd, cold restart, no sysv, rfs. */
SYSTEM_RECOVER -RC
                  /* Report configuration to the COMO file.*/
&DEBUG &NO_ECHO
COMO -END
MAIL CMDNC0>S35_RECOVERY.COMO SYS_ADMIN@MYSYS
&RETURN

```

4

PRIMENET Performance Tuned Extensions (PNX)

.....

PNX Overview

Description of PRIMENET Performance Tuned Extensions

PRIMENET Performance Tuned Extensions (PNX) provides an expedited data path over RINGNET™ for interactive users and applications that perform remote file data manipulations.

PRIMENET Performance Tuned Extensions is an add-on to PRIMENET. It is available as an independent product release supported by PRIMOS Revision 22.1.4. (The document *PRIMENET Performance Tuned Extensions* (DOC13011-1LA) describes PNX on Rev. 22.1.4 systems.) PNX is supplied as a part of PRIMOS at Revision 23.2 (complete documentation is provided in this chapter; error messages for PNX are provided in Appendix C and Appendix D).

PRIMENET is a separately-priced product that is available in two versions:

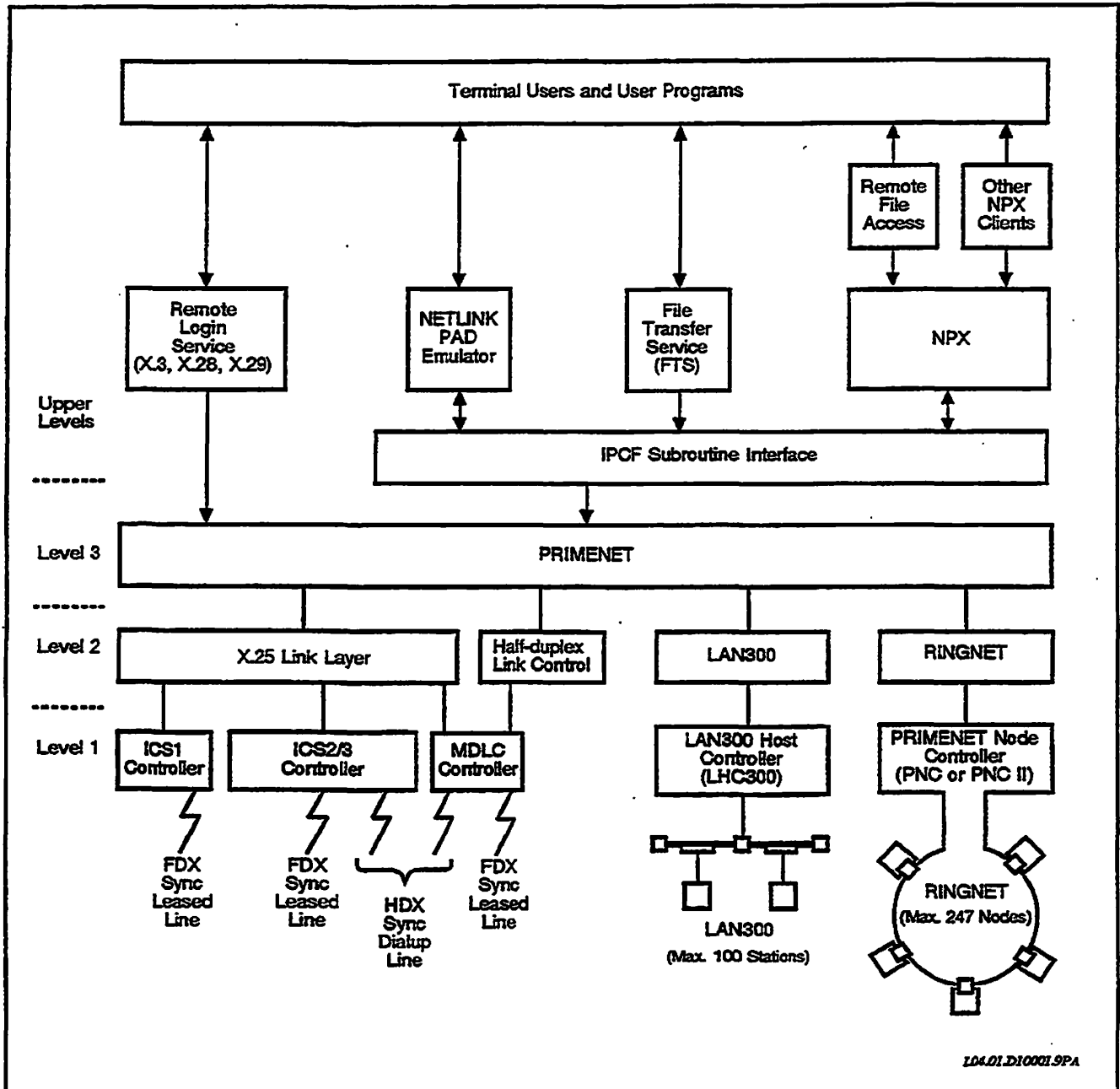
- PRIMENET
- PRIMENET with X.25 (that is, with a Wide Area Network facility providing full X.25 compliance)

Consequently, PRIMENET Performance Tuned Extensions also has two versions: the add-on for PRIMENET and the add-on for PRIMENET with X.25. The two versions are *not* interchangeable. Both versions are provided with Rev. 23.2.

Reliability Features of PRIMENET

PRIMENET provides an integrated Wide Area Network (WAN) and Local Area Network (LAN) environment for users who need to work on more than one system at the same time. PRIMENET software supports the X.25 standards, which provide extensive acknowledgements and error detection/correction facilities for messages sent across the network. X.25 establishes compliance standards for different computer manufacturers and Wide Area Network service providers. Compliance with X.25 standards provides for the secure delivery of data across a Wide Area Network.

For many years PRIMENET has been in compliance with the X.25 standard, whether data traffic was on a WAN or a LAN. A user can confidently access another system using X.25 or send a file to a co-worker on another system, whether the other system is on the other side of the hall or on the other side of the globe. Figure 4-1 shows the integrated networking environment provided by PRIMENET.



104.01.D10001.9PA

Figure 4-1. PRIMENET: An Integrated WAN and LAN Environment

Users whose networking needs can be satisfied by a collection of PRIMENET nodes on a Local Area Network may discover that X.25 provides more protection than is necessary. A Local Area Network is not so prone to errors as is a Wide Area Network, and if all the nodes on the LAN are PRIMOS systems, then the extensive use of X.25 acknowledgements may be unnecessary. Furthermore, if the LAN experiences heavy traffic, then the extra X.25 armor on a message frame may cause a bottleneck in response time.

Advantages of PRIMENET Performance Tuned Extensions

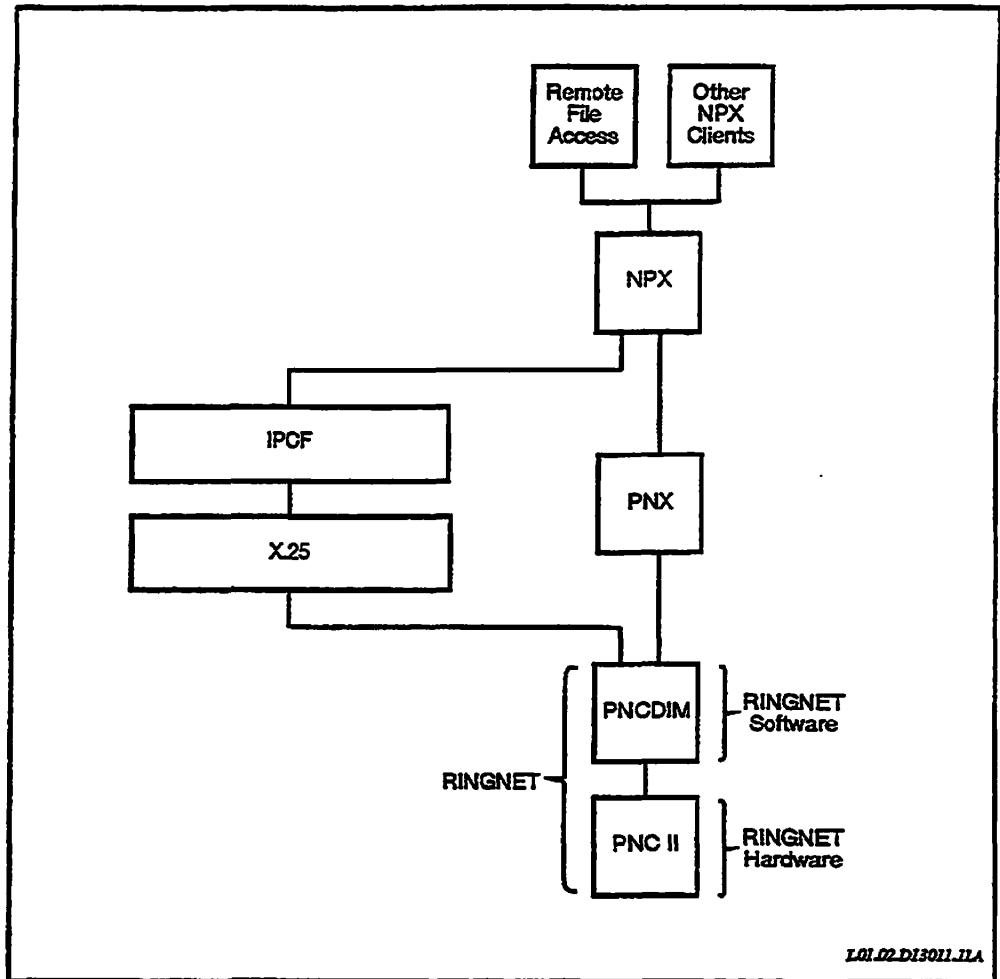
PRIMENET Performance Tuned Extensions provides a lightweight transport protocol across the secure corridor called RINGNET. RINGNET is a LAN that services only PRIMOS systems. The new software provides an alternate path for messages using the Prime software called NPX (Network Process eXtension). The two paths used by NPX may be categorized as either X.25 or PNX (Performance tuNed eXtensions).

Figures 4-1 and 4-2 show first an overview of PRIMENET and then a detailed focus on the environment within PRIMENET that allows the use of Performance Tuned Extensions.

Figure 4-1 on the previous page shows the overall topology and the general services provided by PRIMENET, without PNX. The top line of the figure indicates a user or process on the local system that needs to use any of the various PRIMENET facilities. Within the figure the facilities are labeled as on the Upper Levels (referring to the upper levels of the seven-layer OSI protocol stack).

The user or program has access to *all* these facilities. All facilities are funneled through PRIMENET on Level 3 to access *any* of the controllers on Level 1.

Figure 4-1 shows that users of NPX software have access to any Level 1 controller. Figure 4-2 shows the limits of PRIMENET Performance Tuned Extensions (PNX). Only RINGNET can be used, and only via a PNC-II as the Level 1 controller. When a call to NPX is made, the software verifies whether the sender and receiver can perform their interchange on RINGNET using PRIMENET Performance Tuned Extensions. If NPX verifies that the transaction can use PRIMENET Performance Tuned Extensions, then it uses the short-cut PNX data path. Otherwise, NPX uses the X.25 path, either via the RINGNET controller (as illustrated in Figure 4-2) or via any other Level 1 controller illustrated in Figure 4-1.



4-2 PRIMENET Performance Tuned Extensions: Functional and Topological Limits

With the installation of this new software, PRIMENET replaces an X.25 connection with a PNX connection. This PNX connection uses a protocol that is less encumbered by the overhead of X.25 checks and acknowledgements. PNX provides faster response time for traffic across RINGNET.

PNX provides improvements in the message traffic, both in frame size and packet size. Data packets have a fixed (default) size of 2048 bytes. Each data packet frame requires fewer checks and acknowledgements. Speed of delivery between the user applications is thereby improved.

Prerequisites for Use: To use PRIMENET Performance Tuned Extensions on a given RINGNET, each PRIMOS system must

- Use PRIMOS Rev. 22.1.4 or Rev. 23.2.

- Have sufficient physical memory to dedicate an additional 168KB for network buffers
- Have a separately-installed version of PRIMENET
- Be properly configured on the RINGNET (with CONFIG_NET)
- Use a PNC-II controller to access the RINGNET
- Run the PRIMENET Performance Tuned Extensions protocol

PNX Installation and Startup

Installing PNX

You must be a System Administrator to install PNX. You can perform the following installation steps during installation of Rev. 23.2 or subsequently. These steps can be performed on a fully functioning system without restricting logins or access to PRIMENET. (However, when you have completed these installation steps, you should perform a system cold start to activate PNX.) To install the PNX software to its system directories, do the following:

1. Attach to the directory PRINET:

```
OK, ATTACH PRINET  
OK,
```

2. Run the CPL file that installs PRIMENET.

- If this is either a new machine or a machine that did not previously support PRIMENET, run PRINET.INITINSTALL.

```
OK, R PRINET.INITINSTALL  
PRINET INSTALLATION SUCCESSFUL  
OK,
```

- If this machine previously supported PRIMENET, run PRINET.INSTALL

```
OK, R PRINET.INSTALL  
PRINET INSTALLATION SUCCESSFUL  
OK,
```

3. Attach to the directory PNX (if this software is an add-on to PRIMENET with X.25, attach to the directory named X.25PNX instead):

```
OK, ATTACH *->PNX
OK,
```

4. List the contents of the directory:

```
OK, LD
<0>PNX (ALL access)
4 records in this directory, 1000 records out of quota of 0.

2 Files.

PNX.INSTALL.CPL                PNX.REMOVE.CPL

4 Directories.

CMDNCO        HELP*        INFO        PRIMENET*

OK,
```

Note If you are adding to PRIMENET with X.25, then the above two files should be named X.25PNX.INSTALL.CPL and X.25PNX.REMOVE.CPL.

5. Execute the CPL file that performs the installation of PRIMENET Performance Tuned Extensions:

```
OK, R PNX.INSTALL
PNX Installation started at 90-12-14.11:48:14.Fri
OK,
```

The working software is installed into the CMDNCO and the PRIMENET* directories. (There is no PNX or PNX* directory.)

Adjusting the CONFIG File

In the directory CMDNCO on the command partition, you must make one change to the CONFIG file.

The NSLUSR directive within this file is to be assigned an additional value, a second octal argument to specify the number of slave processes allocated for PRIMENET Performance Tuned Extensions:

```
NSLUSR xx8 yy8
```

First Argument to NSLUSR: The CONFIG directive NSLUSR indicates the Number of SLave USERs that may be assigned as proxies for the same number of remote requests for NPX transactions within PRIMENET. Systems not using

PNX have a single octal argument for this directive. The value of that argument (xx_8) indicates the number of X.25-based slaves set aside for *local processes* to satisfy remote requests from non-PNX systems.

Although these slaves are local processes, they cannot be employed by local users. Consequently, they reduce the number of local processes available for local users and phantoms, whether or not they are being actively used by remote users.

Second Argument to NSLUSR: PNX requires a second octal argument to NSLUSR. This second argument (yy_8) indicates the number of specialized slaves set aside for PNX-based NPX transactions (the transactions provided by Performance Tuned Extensions). These specialized slaves also reduce the number of local processes available for local users and phantoms.

Setting NSLUSR Values: On systems providing PRIMENET Performance Tuned Extensions services to remote clients, the maximum total value for both arguments to NSLUSR may not exceed 800 (decimal). If the NSLUSR values exceed this total, an error message is issued at system initialization (see Appendix D) and the system automatically reduces the assignments.

An example of a conservative assignment of NSLUSR values for a system that is to be a server for PRIMENET Performance Tuned Extensions clients is

```
NSLUSR 144 144 /* Decimal values of 100 and 100
```

In some circumstances it may be desirable to configure NSLUSR with a zero value for the first argument, as follows:

```
NSLUSR 0 310 /* Decimal values of 0 and 200
```

In this case, this system can only take remote requests from systems supporting PNX.

It cannot be over-emphasized that the NSLUSR CONFIG directive allocates a group of slaves that reduces the number of processes available to local users. The total number of processes is machine-specific; your system may have either a total of 600 processes or a total of 960 processes. If, as above, your system allocates a total of 200 processes to NSLUSR, then local users and their related processes cannot exceed a total of 760 (or 400) processes, even if no slaves are currently active.

If all local processes for local requests are exhausted, then the system waits for a local process to complete a current assignment before it can assign the freed process to a new local request.

Conversely, if your system runs out of the NPX slaves you set aside with NSLUSR, either for X.25 or for PNX, then each additional request for a slave fails, producing the error message

```
No NPX slaves available.
```


Some system adjustments to be made for Performance Tuned Extensions are described later in this chapter. These adjustments provide for the efficient use of memory allocation, paging, and assignment of slave processes on your system.

Multiple Installations on RINGNET

Different systems on the RINGNET can run different PRIMOS revisions, and the RINGNET continues to provide all of them with NPX services across the X.25 path. However, RINGNET supports communications across the short-cut (PNX) path only for those systems on the LAN that

- Are running PRIMOS Revision 22.1.4 or Rev. 23.2.
- Have installed the PRIMENET Performance Tuned Extensions software. PNX is available as a separate software package on Revision 22.1.4; it is supplied as part of the master disk at Revision 23.2.

Only those systems that need slaves to run the new protocol require adjustments to the NSLUSR directive. Be sure to make adjustments to the NSLUSR directive on those systems providing services with the new protocol *before* you start the network. Otherwise, PRIMENET can be started and have PRIMENET Performance Tuned Extensions activated, but no slaves will be available to service the message traffic on the PNX path.

Note If your system has only client users of PRIMENET Performance Tuned Extensions, no slaves need to be allocated.

Setting the New Configuration

After setting the NSLUSR directive, you must configure the network.

```
OK, ATTACH PRIMENET*  
OK, CONFIG NET
```

Supply the node names and other CONFIG_NET parameters. No special settings are required for PNX.

Modifying PRIMOS.COMI

The PRIMOS.COMI file must contain the START_NET command. Edit the PRIMOS.COMI file in CMDNC0 and make sure that it contains these statements in the following order (other statements can appear within this list, but the order of these three statements is critical):

```
START_DSM
START_NM
START_NET PRIMENET*>PRIMENET.CONFIG
```

If your system uses an LHC controller for a LAN300 network, make sure that PRIMOS.COMI contains these four statements in the following order:

```
START_DSM
START_NM
COMM_CONTROLLER
START_NET PRIMENET*>PRIMENET.CONFIG
```

Rebooting the System

If PRIMENET has already been running on your system during the installation of PRIMENET Performance Tuned Extensions, the new protocol is not activated until the network is restarted. Therefore, if PRIMENET is currently running, first stop it by issuing the command STOP_NET.

It is recommended that you halt the system and perform a cold start to ensure that the latest versions of all files are loaded. If you are installing PNX as part of the Rev. 23.2 installation, you do not need to perform a separate boot for PNX.

Activate PRIMENET with the added PRIMENET Performance Tuned Extensions by issuing the command START_NET.

Other Visible Changes

After you have installed and started PRIMENET Performance Tuned Extensions, the following changes are visible:

- Two new files are in the PRIMENET* directory.
- The new server, PNX_SERVER, is visible.
- A new slave type, PNX_SLAVES, may at times be observed.

New Files: The new files in PRIMENET* are PNX_SERVER.COMI and START_PNX_SERVER.RUN. These executable files activate PNX_SERVER, the server for PRIMENET Performance Tuned Extensions. Additional ACLs are automatically assigned to PRIMENET* at the installation of PRIMENET Performance Tuned Extensions so that the new server and slaves can function.

New Server: Any user can see whether PNX_SERVER is active by issuing the STATUS USERS command. If PNX_SERVER is active, it is displayed among the other processes. It is assigned a process type of NSP (Network Server Process), and it is listed immediately after NETMAN, the other NSP process.

If DSM ACLs allow you use of the command, you can also issue LIST_USERS. If PNX_SERVER is active, it will be displayed under Servers.

New Slave Type: Slave types are not always visible to system users. They become visible during that period of time when a user on a remote system has made a call to your system in order to perform some remote file data manipulation. The calling user (the master) is assigned a slave on the remote system (your system) to perform the task. The slave first receives the assignment and then inherits the identity of the master that made the call. A few split seconds exist between the slave’s reception of the assignment and its inheritance of the master’s identity.

If you monitor the system during these interim moments, you may record a slave whose slave type is in transition: visible as a user ID that is not yet the user ID of the master. Three monitoring tools can record this: the USAGE command, the STATUS USERS command, and the LIST_USERS command.

The NSLUSR directive now has two slave types associated with it. Slaves reserved by its first parameter have the slave type SLAVE\$. Slaves reserved by its second parameter have the slave type PNX_SLAVE\$.

Adjustments for System Overhead

Overhead Costs

PRIMENET Performance Tuned Extensions carries with it some system overhead costs:

- Primary: an additional 168KB of physical memory for network buffers
- Secondary: for each slave added to support PRIMENET Performance Tuned Extensions (the second value assigned to NSLUSR)
 - Additional paging disk space
 - Additional wired memory

Your system must have sufficient physical memory available to provide the additional 168 KB for network buffers; no adjustment can be made to reduce this primary system requirement.

Secondary overhead costs are small. While you may recover some memory by reducing the number of slaves reserved for PNX, you thereby risk reducing the efficiency of the distributed environment.

Do not confuse this system overhead with network response overhead. The additional memory and paging requirements enable both your system and your network to run more efficiently in servicing network traffic on RINGNET.

The only overhead issue is whether the number of slaves assigned is so great that it affects the service provided to local user processes. If there are times when the total of active local processes and allocated slave processes reaches the maximum of number of user processes for your system (either 600 or 960), then you need to make one of the following adjustments:

Either

Reduce the number of allocated slaves on your system by making adjustments to the NSLUSR CONFIG directive

Or

Reduce the number of local processes by migrating local users to a different system

Monitoring Issues

If your system is approaching its maximum for total user processes, or if you simply want to have your system use PRIMENET Performance Tuned Extensions most efficiently, you should make one or both of the above adjustments.

A system monitoring tool you can use to evaluate loads on each system in the RINGNET is the USAGE command. Using this tool at regular intervals throughout a work day, you can identify the following for each system:

- The number and identity of users currently active and their individual loads on the system
- The percentage of CPU currently in use
- The percentage of available memory currently in use
- The percentage of time spent on I/O activities (as opposed to CPU processing activities)

After gathering this information from USAGE, you can adjust slave allocations and migrate users according to your findings. See the *Operator's Guide to System Monitoring* if you require additional information about the USAGE monitoring tool.

Note

No other network monitoring tools currently provide direct information about PRIMENET Performance Tuned Extensions. Neither the PRIMENET monitoring tool, MONITOR_NET, nor the Distributed Systems Management (DSM) Status Information and Metering (SIM) commands provide information about this protocol.

Documentation Corrections

5



The following are changes to existing PRIMOS documentation. These changes are either documentation corrections and clarifications for previously described PRIMOS features or updates to PRIMOS documentation for new Rev. 23.2 features described elsewhere in this Software Release Document.

The documents referenced here are the latest editions at Rev. 23.2, as listed in Appendix E. Please make the corresponding changes to your documentation.

Additional changes to PRIMOS documentation are listed in the *Rev. 23.1 Software Release Document*.

Subroutines Reference Document Set

E\$IVCM Standard Error Code

The E\$IVCM standard error code (99) returns the message

`Magtape command invalid`

This error code is also returned by subsystems that do not perform magnetic tape operations. These subsystems return this error code to indicate an invalid command of any type.

CPUID\$ Subroutine

Add the following value to the list of values for *cpu_model*:

42 P6150

For further details, refer to *Subroutines Reference III: Operating System*.

MOVEW\$ Subroutine

When using MOVEW\$, the block of memory that you wish to move cannot cross a segment boundary.

For further details, refer to *Subroutines Reference III: Operating System*.

PAR\$RV Subroutine

The returned value of PAR\$RV is *not* always 0, 1, or -1. The returned value, *par_rev*, is a positive number if a partition supports ACL protection and quotas. The actual positive number returned is the disk revision number. The descriptions for returned values of 0 and -1 are correct.

For further details, refer to *Subroutines Reference II: File System*.

RMSGD\$ Subroutine

If the message is a deferred broadcast from the system console (MESSAGE -ALL), RMSGD\$ returns a *from_number* value of 0 and a *time_sent* value of 0.

For further details, refer to *Subroutines Reference III: Operating System*.

SIZE\$ Subroutine

The SIZE\$ subroutine returns the size of the user directory itself (from 1 to 64 records), *not* the size of the user directory and its member files. If you want the size of a user directory and its member files, use the Q\$READ subroutine.

For further details, refer to *Subroutines Reference II: File System*.

SYN\$GRTR, SYN\$GTWT, SYN\$GWT, SYN\$MVTO Subroutines

These subroutines contain a *for_client_use* field. This field is a three-halfword pointer. It can therefore be declared as (3) FIXED BIN(15), as it is in the subroutine descriptions, or as PTR, as it is in the PL/I example in Appendix B of *Subroutines Reference V: Event Synchronization*.

For further details, refer to *Subroutines Reference V: Event Synchronization*.

ISC Program Example

The program example on pages B-8 through B-13 declares the MESSAGE_SIZE_IN_BYTES variable in bytes, but uses its value to control the filling of a buffer in halfwords. To correct this inconsistency of sizes, change the use of MESSAGE_SIZE_IN_BYTES on Page B-12 to the following:

```
do i = 1 to MESSAGE_SIZE_IN_BYTES + 1 / 2;
    bptr -> buffer (i) = i;
```

Instruction Sets Guide

PCL Instruction, Page 3-78

When arguments are to be transferred to the called procedure, the PCL instruction uses GR0, GR5, and GR7, destroying the previous contents of these registers. XB is updated if an AP has the S bit = 0. The contents of these general registers and of XB remain unchanged if no arguments are transferred.

PRIFORMA Programmer's Guide

DTOFIELD, Page 5-40

The correct description for DTOFIELD is:

Write double to specified field or array item.

The correct Non-C syntax for DTOFIELD is:

```
CALL FN_I_DTOFIELD (field_name, name_len, item,
                    double_value, format, format_len, status)
```

```
CALL FN_O_DTOFIELD (field_number, item,
                    double_value, format, format_len, status)
```

The correct C syntax for DTOFIELD is:

```
status = sm_i_dtofield (field_name, item, double_value,
                       format);
```

```
status = sm_o_dtofield (field_number, item, double_value,
                       format);
```

Parameter, Type and Meaning for DTOFIELD should include the following:

- format** CHAR
Format string for the double integer. The value can be either 0 (no format) or a standard format string. For example, a format string of %6.4f would specify a format of 6 digits to the left of the decimal point and 4 digits to the right of the decimal point.
- format_len** INT
Length of formatted integer string. For example, the format string %6.4f formats a 10-digit integer string, so *format_len* would take a value of 10.

LGET_FORM, Page 5-119

The correct data type for the *library_descriptor* parameter is INT.

WND_VIEW, Page 5-228 and 5-229

The correct description for WND_VIEW is:

Display pop-up information window and wait for user to press EXIT key.

The correct description for the returned value FE_TIMEOUT is:

A timeout limit can be set on the WND_VIEW using the SET_TIMEOUT_LIMIT routine. If the timeout period is reached without end-user interaction, *status* returns FE_TIMEOUT.

PRIFORMA Forms Manipulation Language Guide

Pages 2-8, 2-10, 2-11, 4-2, 4-4, 4-5, 4-6, 4-7, 5-7, 5-9, 5-11, 5-14, 5-49, 5-50, Index-2

All references to FN-FE-STATUS should be changed to refer to FN-FE_STATUS.

Page 4-4

The correct type definition for FN-FE_STATUS is PIC S9(9) COMP.
The correct type definition for FN-INVOCATION is PIC S9(9) COMP.

READ Statement, Page 5-27

A READ statement can contain only one AND *nnn* INTO *mmm* clause. Multiple AND operands cannot be used.

ADMIT KEYS, Page 5-43

The correct name of the preprocessor generated variable is FN-FKEY.

PRISAM User's Guide

Page 5-52 and 5-54

When you call the Z\$OPEN PRISAM subroutine, you specify the treename of a PRISAM file. Usually this file has a .PRISAM suffix. If the file you specify does not have a .PRISAM suffix, Z\$OPEN appends this suffix to the file before attempting to open the file. If the open fails because a file without a .PRISAM suffix is not a PRISAM file, Z\$OPEN returns ER\$FNF (file not found). If the open fails because a file with a .PRISAM suffix is not a PRISAM file, Z\$OPEN returns ER\$NPF (not a PRISAM file).

ORACLE Version 6.0 Installation and User's Guide

This manual has been issued in a new edition containing descriptions of new features and enhancements for ORACLE® Version 6.0.30. Make sure that the manual you are using is the most recent edition:

ORACLE® Version 6.0 Installation and User's Guide for 50 Series™ Systems (DOC10134-4LA).

MIDASPLUS User's Guide

Page 5-47 and 5-49

The ADD1\$ subroutine calls in this FORTRAN program on Page 5-49 do not work because the key SKEY1 is not aligned on a word boundary. The declaration of SKEY1 on Page 5-47 is misaligned due to the odd-number length of PKEY. You must copy SKEY1 to a word-aligned variable before passing it to ADD1\$.

Page G-3

The OPENM\$ subroutine call in this C program is incorrect C code and does not work. In C, you cannot use the plus sign (+) to add keys. Also, the data type short is unnecessary and misleading. The correct coding for this OPENM\$ call is as follows:

```
keys = krdwr | k$getu  
openm$ (keys, "bank", 4, funit, status)
```

DSM User's Guide

Page 2-9

In addition to the DSM functions listed in Table 2-1, the online display of DSM function names includes the SCREEN_HANDLER function and a group of functions with names ending in dollar signs (\$). These functions do not have corresponding DSM commands.

Page A-3

The DSM default configuration file, DSM_DEFAULT.CONFIG, has been modified by the following additions, which provide support for the Diagnostic Tool Box (DTB) used by PrimeService:

Function group .DTB\$ contains:

.SIM\$, CONFIG_UM, PRIVATE_LOGGER, SYSTEM_LOGGER

.
. .

User access definition DTB_USER\$ is:

User/ACL group .DTB\$ from location(s):

.ANY_NODE\$

Function/function group: .DTB\$ is allowed on node/node groups:

.ANY_NODE\$

The correct DSM administrator information in the DSM default configuration file is as follows:

User access definition DSM_ADMINISTRATOR\$ is:

User/ACL group SYSTEM from location(s):

.GROUP\$

The default configuration file for the DSM unsolicited message handler, DSM_UMH_DEFAULT.CONFIG, has been modified to support PNX. The NETWORKLOG portion of this default configuration now appears as follows:

Selection name: NETWORK.LOG

Configured on 17 Jul 91 08:43:36 Wednesday

Prime Product: NPX (database DSM*>SIT_TEXT_DBS>DSM_USA.TDIMG)

Prime Product: PRIMENET (database DSM*>SIT_TEXT_DBS>DSM_USA.TDIMG)

Prime Product: PNX (database DSM*>SIT_TEXT_DBS>DSM_USA.TDIMG)

Severity: -ALL

Destination: LOGGER DSM*>LOGS>NETWORKS>NETWORK.LOG -SYSTEM_LOG

Rev. 23.0 Software Release Document

Pages 2-30 and 2-31

All references to the DSM `-TTY` option are incorrect. The correct name of this DSM option is `-TTP`.

System Administrator's Guide Volume II: Communication Lines and Controllers

Pages 2-9

The correct command line for loading an LTS is as follows:

```
COMM_CONTROLLER -LOAD -DEV LTS -DNN PAYROL -PN DOWN_LINE_LOAD*>LTS.DL -NQ
```

Pages 3-9 and 4-7

A global `DISLOG YES` configuration directive enables dislog on all lines at boot time. Subsequent per-user `SET_ASYNC -NO_DISLOG` commands can disable dislog on individual lines.

Operator's Guide to Data Backup and Recovery

Page 1-4

The correct location of the DRB configuration file is `DRB*>CONFIG_FILE`.

Pages 2-1 and 2-5

To save an object using `MAGSAV` with the `-UPDT` option, you must also have protect (P) rights to the MFD of the partition. This right is normally provided by membership in the `.BACKUP$ ACL` group.

Operator's Guide to File System Maintenance

Page 2-2

There are two types of Fixed-Media Disks (FMDs); those that use the SMD data interchange protocol, and those that use the SCSI data interchange protocol.

The following is an updated version of Table 3-1 (Disk Size Data):

<i>Disk Type</i>	<i>Model Number</i>	<i>Number of Surfaces</i>	<i>Records per Surface</i>	<i>Total Number of Records</i>	<i>Usable MB</i>	<i>Removable</i>
80MB SMD		5	7407	37035	75.85	yes
300MB SMD		19	7407	140733	288.22	yes
60MB FMD	4711	4	7140	28560	58.49	no
68MB FMD		3	10071	30213	61.88	no
84MB FMD	4714	5	8120	40600	83.15	no
120MB FMD	4715	8	7140	57120	116.98	no
158MB FMD		7	10071	70497	144.38	no
160MB FMD		10	7389	73890	151.33	no
213MB FMD ³	4730	31	3335	103378	211.72	no
258MB FMD	4719	17	7320	124440	254.85	no
315MB FMD ¹	4475	19	7407	140733	288.22	no
328MB FMD	4721	12	13128	157536	322.63	no
328MB FMD ²	4721	31	5080	157480	322.52	no
421MB FMD ³	4731	31	6530	202438	414.59	no
496MB FMD	4735	24	9954	238896	489.26	no
673MB FMD ³	4729	31	10447	323850	663.25	no
675MB FMD ⁴		40	7569	302760	620.05	no
770MB FMD	4845	23	16112	370576	758.94	no
817MB FMD	4860	15	26201	393015	804.89	no
1.34GB FMD ³	4732	31	20746	643128	1317.13	no
32MB CMD		2	7407	14814	30.34	1 surface
64MB CMD		4	7407	29628	60.68	1 surface
96MB CMD		6	7407	44442	91.02	1 surface

Page 3-3

The following is an update to Note 3 for Table 3-1 (Disk Size Data):

³ The 213MB, 421MB, 673MB, and 1.34GB FMDs are SCSI disks with 31 logical surfaces. The number of records per surface shown in the table is the average number of records; these surfaces vary in number of records each, as follows:

213MB	surfaces 0-3: 3556 records; surfaces 4-30: 3302 records
421MB	surfaces 0-22: 6604 records; surfaces 23-30: 6350 records
678MB	surfaces 0-3: 10668 records; surfaces 4-30: 10414 records
1.34GB	surfaces 0-21: 20828 records; surfaces 22-30: 20574 records

This information is supplied for diagnostic purposes only; partitioning of these SCSI disks is *not* recommended.

Page 3-4

Disk drive unit numbers for FMDs depend upon the type of disk. SMD-format disks can range from 0 through 7, inclusive. SCSI-format disks on a Model 7210 controller with ICOP+ can range from 0 through 5. SCSI-format disks on a Model 7210 controller without ICOP+ can range from 0 through 6.

The Operator can set drive unit numbers for SCSI disks in a 75500-6PK device module. On the module next to each drive is a unit select switch, which displays the current drive unit number. Press the top button on this switch to decrease the drive unit number. Press the bottom button on this switch to increase the drive unit number. Refer to the *Disk Replacement Procedure for Model 75500-6PK Device Module* for further details.

Page 5-6

SCSI disks have forward sector interleaving. You cannot use the `-OVERRIDE_DEFAULT_INTERLEAVE` or `-RESTORE_DEFAULT_INTERLEAVE` options of MAKE to override this interleaving.

Page 5-8

The complete list of disk types is as follows:

SMD	80MB or 300MB removable
CMD	Cartridge module device
68MB	68 megabyte fixed media
158MB	158 megabyte fixed media
160MB	160 megabyte fixed media
600MB	600 megabyte fixed media
MODEL_4475	300 megabyte fixed media
MODEL_4714	84 megabyte fixed media
MODEL_4711	60 megabyte fixed media
MODEL_4715	120 megabyte fixed media
MODEL_4735	496 megabyte fixed media
MODEL_4719	258 megabyte fixed media
MODEL_4845	770 megabyte fixed media
MODEL_4721	328 megabyte fixed media
MODEL_4860	817 megabyte fixed media
MODEL_4729	673 MB SCSI fixed media
MODEL_4730	213 MB SCSI fixed media
MODEL_4731	421 MB SCSI fixed media
MODEL_4732	1.34 GB SCSI fixed media

Page 5-9

Add MODEL_4731 and MODEL_4732 to Table 5-2 (see note for Page 5-8, above).

Page 5-10

MAKE does not do badspot checking on Model 4729, Model 4730, Model 4731, or Model 4732 SCSI disks. These disks default to a `-BADSPOT_LEVEL (-BADLEV)` of 0. These disks default to no verification because badspot checking is already provided by the disk drive itself. The Model 4721 SCSI disk defaults to a `-BADSPOT_LEVEL` of 2. You can safely specify a `-BADSPOT_LEVEL` of 0 for a Model 4721 or any other SCSI disk drive.

Page 5-16

You should not use the `-MAP_UNCORR (-UNCORR)` option of MAKE with Model 4721, Model 4729, Model 4730, Model 4731, or Model 4732 SCSI disks. You cannot save records with correctable errors on these disks because badspot checking is performed by the disk drive itself.

Page 5-22

The `-SPLIT` option is used for creating partitions for either paging or crash dump to disk.

Page 5-37

When using a SCSI disk for a paging partition, it is recommended that you use the disk only for paging, rather than using it for both paging and file system I/O. Specify a minimal file system portion of 10 records which are not to be made available for I/O operations.

Page 6-15

Using the `FIX_DISK` option `-COMMAND_DEVICE (-COMDEV)` by itself (as shown in the following example) only reports the status of the command device

```
OK, FIX_DISK -DISK 1060 -COMMAND_DEVICE
```

To actually repair the command device, you must include the `-FIX` option on the command line, as shown in below:

```
OK, FIX_DISK -DISK 1060 -COMMAND_DEVICE -FIX
```

Page 6-19

Add `MODEL_4731` and `MODEL_4732` to `FIX_DISK` list of valid disks (see note for Page 5-8, above).

Page 6-34

Add `MODEL_4731` and `MODEL_4732` to `FIX_DISK` list of valid disks (see note for Page 5-8, above).

Page 9-2

Disk mirroring requirements should include

- Both the primary partition and the secondary partition must be in disk drives associated with either one of the following disk controllers: the IDC1 controller for SMD disks or the Model 7210 controller with ICOP+ for SCSI disks. Both disks must be on the same type of controller, though preferably not the same controller.
- The two partitions must be Rev. 21.0, Rev. 22.0, or Rev. 22.1 formatted partitions.
- If the partitions are SMD disks on an IDC1 controller, both partitions must be in Dynamic Badspot Handling (-IC) mode so that dynamic badspot handling can take place on them. This restriction does not apply to SCSI disks on a 7210 controller; the -IC or -AC mode, if specified, is ignored by MAKE for these disks.

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The COPY_DISK, PHYSAV, and PHYRST commands are obsolete and their further use is discouraged. Instead, use the PSR command with the -COPY option to make the two partitions physically identical. Refer to the *Operator's Guide to System Commands* for further details.

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Mirroring can be done only on disks connected to either intelligent disk controllers capable of dynamic badspot handling (IDC1) or Model 7210 controllers running ICOP+.

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In Table D-2, two of the octal OPCODE values are incorrect. Please correct 000144 to 000100 and 000145 to 000101.

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The complete list of disk types is as follows:

SMD	80MB or 300MB removable
CMD	Cartridge module device
68MB	68 megabyte fixed media
158MB	158 megabyte fixed media
160MB	160 megabyte fixed media
600MB	600 megabyte fixed media
MODEL_4475	300 megabyte fixed media
MODEL_4714	84 megabyte fixed media
MODEL_4711	60 megabyte fixed media
MODEL_4715	120 megabyte fixed media
MODEL_4735	496 megabyte fixed media
MODEL_4719	258 megabyte fixed media
MODEL_4845	770 megabyte fixed media
MODEL_4721	328 megabyte fixed media
MODEL_4860	817 megabyte fixed media
MODEL_4729	673 MB SCSI fixed media
MODEL_4730	213 MB SCSI fixed media
MODEL_4731	421 MB SCSI fixed media
MODEL_4732	1.34 GB SCSI fixed media

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FIX_DISK -COMMAND_DEVICE option (See note for Page 6-15, above.)

Appendices

■ ■ ■ ■ ■ ■ ■

A

Operator Instructions for Crash Dump to Tape

.....

At Rev. 23.2, new procedures are provided for performing a crash dump to tape or a crash dump to disk. This appendix provides instructions for crash dump to tape; this information supersedes the tape dump appendix of the *Rev. 23.1 Software Release Document*. Crash dump to disk is a new facility available at Rev. 23.2; procedures for crash dump to disk are described in Appendix B. Both crash dump to tape and crash dump to disk can be configured for automatic execution using the `SYSTEM_RECOVER` command. Refer to Chapter 3 for further details on automated system recovery. This Appendix provides instructions for manual invocation of a crash dump, and instructions for responding to errors during a tape dump operation. For further details, refer to the Handbook for your system.

Follow the directions below to generate a crash dump to tape. Before performing these steps, check the following items:

- Tape drive is powered up and online.
- Tape drive is loaded with a reel or cartridge of tape that is rewound to the beginning of tape. A tape reel must contain a write ring; a tape cartridge must not have its write-protect ("safe") switch set.
- If a 6250 bpi tape dump is desired, set the tape density switch located on the front panel of the tape drive to 6250 bpi with remote density enabled. The remote density light should light up. (Procedures for 6250 bpi tape dumps are described later in this appendix.) Not all tape drives support 6250 bpi.

After you perform a crash dump to tape, you should then run RFS in order to cleanly shut down the disks. Then you should coldstart the system.

Note A warm start is possible after a crash dump if the nature of the system crash would normally allow for a warm start. A warm start cannot be performed after running RFS. The use of RFS is encouraged in most circumstances. Follow your site's policies concerning the use of RFS and warm starts.

The following example illustrates the entire procedure for a crash dump to tape. You can also perform crash dump to tape by running system recovery, using `RUN 660` (as described in Chapter 3).

• • • • •

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```
CP1> SYSCLR
Really? YES
DPM006: Central Processor system initialization completed.
        01 Aug 91 11:47:00 Thursday
```

```
CP1> RUN 774
Enter F for full dump, P for partial: P
Ensure tape is mounted. Then enter unit [0-11]: 0
Initializing tape unit 0 .... OK
Beginning partial dump .....
CORE dump done      16392 records
MAPS dump done      47 records
PIOS dump done      65 records
Tape dump to unit 0 completed.
```

```
DPM400: CPU halted at 000014/004677: 003776      /* Standard successful
        01 Aug 91 11:50:17 Thursday              /* completion message.
```

```
CP1> SYSCLR
Really? YES
CP1> RUN 662      /* Running RFS (described in Rev. 23.1 documentation).
.
.
.      /* Output from RFS intentionally removed
.
.
*** From RFS: Shutdown completed, system halting...
```

```
DPM400: CPU halted at 000014/005016: 000050      /* Standard successful
        01 Aug 91 11:53:00 Thursday              /* completion message.
```

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

If you are using `SYSTEM_RECOVER`, some or all of these operations may be automated. Refer to Chapter 3 for details on `SYSTEM_RECOVER`.

`RUN 774` is the recommended command for crash dump to tape at Rev. 23.2, and the only one described in this appendix, but other crash dump to tape commands (`773`, `775`, `776`, and `777`) are still supported. These commands are more limited in which type of tape dump and which tape units are available. A table comparing these commands is provided in Chapter 3.

The display information and messages returned during a tape dump have been modified for Rev. 23.2. Regardless of which crash dump to tape command you specify, the information displayed during crash dump processing is as shown in the example above, and the error messages are those described in this appendix.

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.

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.

Caution Do not press the MASTER CLEAR button before performing a tape dump. Pressing this button destroys necessary tape dump information.

Initiating a Crash Dump to Tape

Now that the system is halted, you can initiate a crash dump to tape. Mount a 1600-bpi or 6250-bpi magnetic tape with a write ring, or insert a cartridge tape with writing enabled (cartridge switch not set to "safe"). You can use any tape unit 0 through 11 (with the exception noted below). Enter the following command sequence:

```
CP1> SYSCLR  
Really? YES /* Not all PRIME machines will ask you this.  
CP1> RUN 774
```

If you are planning to take a tape dump on an EXABYTE tape drive (for example, an EXB-8200), wait 60 seconds between issuing the SYSCLR and running the tape dump command. This should allow the tape drive enough time to become ready.

The RUN 774 command then prompts you to specify a full dump or a partial dump and the tape unit number:

Enter F for full dump, P for partial: P
Ensure tape is mounted. Then enter unit [0-11]: 0

Specify the letter P or F and press return. Specify the decimal number 0 through 11 that corresponds to your tape unit and press return. The system initializes the tape unit, then returns OK.

Note If the tape unit is a Model 4594 on a 7210 (SDTC) controller, the tape drive must be the first unit on the controller. Therefore the tape unit for a 4594 on a 7210 must be 0, 4, or 8. This restriction does not apply to Model 4594 tape drives on other controllers, or to other tape drives on a 7210 controller.

Tape Initialization Errors: If you do not issue a SYSCLR before running 774, the system usually halts immediately. If this happens, issue the SYSCLR, then reissue RUN 774.

If the tape unit is write-protected, tape initialization fails immediately and displays the following message:

```
Initializing tape unit 0 ....  
Tape unit 0 is write-protected (status: 000314)  
Enter R to retry, Q to quit: R
```

Insert a write ring in the tape reel or reset the tape cartridge write-protect safety switch. Remount the tape and type R to retry.

If the tape unit is offline, there is a 30-second delay, during which the system keeps trying to access the tape drive. If the tape drive is not put online within 30 seconds, the system returns an error message, rather than OK. The following example shows an example of a failed tape unit initialization:

```
CP1> RUN 774  
Enter F for full dump, P for partial: P  
Ensure tape is mounted. Then enter unit [0-11]: 0  
Initializing tape unit 0 .... /* 30 seconds elapse  
Tape unit 0 not responding (status 002010)  
Enter R to retry, Q to quit: R  
Ensure tape is mounted. Then enter unit [0-11]: 0  
Beginning partial dump .....
```

In the above example, the operator put tape drive unit 0 online, then typed R to retry the initialization. Initialization failure can also occur if the reel of tape (or tape cartridge) is defective. Mounting a different reel of tape may solve the problem.

If you type Q to quit the tape dump, the system exits the dump and returns you to VCP level. When you quit a tape dump, the system displays the DMP400 message: CPU halted at...

Tape Hardware Status Words: In certain cases when a tape dump fails, it returns an error message that includes a 6-digit (octal) hardware status word. This is important information that should be written down (along with the full text of the error message) for interpretation by your PrimeService representative.

Hardware status words for tape controllers are documented with the T\$MT subroutine in *Subroutines Reference IV: Libraries and I/O*. However, if the specified tape unit is not connected, or the controller is unable to return a valid status word, the number displayed is not a true status word, but instead an octal PIO instruction, as described in the *System Architecture Reference Guide*.

Tape Dump in Progress

After the initialization returns OK, the system performs the tape dump. It displays the following messages:

```
Initializing tape unit 0 .... OK
Beginning partial dump .....
CORE dump done      16392 records
MAPS dump done       47 records
PIOS dump done       65 records
Tape dump to unit 0 completed.
```

As the dump proceeds, it displays a dot (.) for every 1024 records (2Mb) of core memory written to tape. Certain cartridge tapes retension the entire tape when the first write operation begins. In these cases, the first dot takes much longer to appear; the distinctive sound made by the tape drive should make it clear what is happening.

The CORE dump done message is printed when the core dump has finished. If this message is not printed, the dump is not analyzable. In this case, note all messages printed during the dump and report them to your PrimeService representative.

The MAPS dump is always included in a tape or disk dump at Rev. 23.2. In previous revisions, MAPS information was not included in the dump, but had to be accessed separately. When this message is not printed, the core dump may still be valid and able to be analyzed if the correct separate map files (RING0.MAP and RING3.MAP) are provided along with the dump – for example, by using MAGSAV.

A PIOS dump is only included if you have a 6000-series machine.

Upon successful completion, the system should return the following completion message and halt message:

Tape dump to unit 0 completed.

DPM400: CPU halted at 000014/004677: 003776
01 Aug 91 11:50:17 Thursday

If you *don't* see these messages displayed, note all messages printed during the dump and report them to your PrimeService representative.

Aborting and Retrying a Tape Dump: If it appears that the console has hung or that the dump is not executing properly, you can abort and restart a tape dump by using the following commands:

```
<esc><esc> /* Press the escape key twice.  
CP> STOP  
CP> SYSCLR  
CP> RUN 774
```

Certain hardware or tape errors can make it impossible for a tape dump to complete. Before retrying a tape dump check to make sure that the disk drive is powered up and online, rewind the tape, make sure that the tape is not write-protected. You may have to replace the tape reel or cartridge if there is reason to believe the tape is defective.

6250-bpi Crash Dumps

If you have a 6250 bpi tape drive 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. Both the RUN 774 and RUN 773 commands automatically perform a 6250 bpi tape dump if this is possible on the specified tape unit.

If you are using a Model 4594 Kennedy quad-density tape drive, you should check to make sure that the tape drive is switched to 6250 bpi with remote density enabled. Set the remote density switch to 6250 bpi with RD enabled. (If you don't want 6250 bpi, set this switch to 1600 bpi with RD enabled.) Examine the control panel on the tape drive: the remote density light should be lit.

If a Model 4594 is *not* switched to 6250 bpi mode when you initiate a tape dump with RUN 773 or RUN 774, the action taken by the system depends on the controller to which the drive is attached. If it is attached to a 2382 controller, the tape dump initialization prints an error message asking you to enable remote density on the tape drive control panel. You can then enter R to retry the tape dump. If your Model 4594 is attached to a 7210 (SDTC) controller, the tape dump proceeds at whatever bpi mode was set on the tape drive. No error message is returned.

Multiple-reel Tape Dumps

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

- The amount of memory in the system
- The type of crash dump generated (full or partial)
- The number of users logged in at the time of the crash
- The tape density used (1600 or 6250 bpi)

A crash dump to tape may use as many reels as necessary. All reels must be written on the same tape unit. The tape unit is reinitialized at the start of every reel. The following example shows a multi-reel crash dump:

```
CP> RUN 774
Enter F for full dump, P for partial: P
Ensure tape is mounted. Then enter unit [0-11]: 0
Initializing tape unit 0 .... OK
Beginning partial dump .....
End of reel 1
Mount next reel on same tape unit. Then press <return> to continue: <return>
Initializing tape unit 0 .... OK
Beginning reel 2 .....
CORE dump done      16404 records
MAPS dump done      47 records
PIOS dump done      65 records
Tape dump to unit 0 completed.
```

```
DPM400: CPU halted at 000014/004677: 003776
        01 Aug 91 11:50:17 Thursday
```

CP>

Tape Label Information

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

- The name of the system
- The date and time of the crash
- The PRIMOS revision that the system was running
- The tape density used (1600 or 6250 bpi)
- The reel number (X of N reels)

B

Operator Instructions for Crash Dump to Disk



Crash dump to disk is a new facility available at Rev. 23.2. This appendix provides instructions for manual invocation of a crash dump to disk, and instructions for responding to errors during a disk dump operation. If crash dump to disk is not possible, you can perform a crash dump to tape; procedures for crash dump to tape are provided in Appendix A. Both crash dump to tape and crash dump to disk can be configured for automatic execution using the `SYSTEM_RECOVER` command. Refer to Chapter 3 for further details on automated system recovery. For further details on system crashes, refer to the Handbook for your system.

Before generating a crash dump to disk, check the following items:

- Disk drive is powered up and online.
- Disk drive is not write-protected. That is, the write-protect button must not be pressed.
- Disk must have been activated for crash dump to disk (as described in Chapter 3). If no disk is activated, perform a crash dump to tape.

After you perform a crash dump to disk, you should then run RFS in order to cleanly shut down the file system disks. Then you should coldstart the system.

Note A warm start is possible after a crash dump if the nature of the system crash would normally allow for a warm start. A warm start cannot be performed after running RFS. The use of RFS is encouraged in most circumstances. Follow your site's policies concerning the use of RFS and warm starts.

The following example illustrates the entire manual procedure for a crash dump to disk. You can also perform crash dump to disk by running system recovery, using `RUN 660` (as described in Chapter 3).

• • • • •

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```
CP1> SYSCLR
Really? YES
DPM006: Central Processor system initialization completed.
        01 Aug 91 11:47:00 Thursday
CP1> RUN 661
Initializing dump disk 120762 .... OK
Beginning partial dump .....
CORE dump done      12591 records written, 20345 left on disk
MAPS dump done      47 records written, 20298 left on disk
PIOS dump done      65 records written, 20233 left on disk
Crash dump to disk 120762 completed.

DPM400: CPU halted at 000014/004677: 003776          /* Standard successful
        01 Aug 91 11:50:17 Thursday                  /* completion message.

CP1> SYSCLR
Really? YES
CP1> RUN 662          /* Running RFS (described in Rev. 23.1 documentation)
.
.
.          /* Output from RFS intentionally removed
.
*** From RFS: Shutdown completed, system halting...

DPM400: CPU halted at 000014/005016: 000050          /* Standard successful
        01 Aug 91 11:53:00 Thursday                  /* completion message.

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

If you are using `SYSTEM_RECOVER`, some or all of these operations may be automated. Refer to Chapter 3 for details on `SYSTEM_RECOVER`.

How to Generate a Crash Dump to Disk

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 dumps.

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.

Caution Do not press the MASTER CLEAR button before performing a crash dump to disk or tape. Pressing this button destroys necessary crash dump information.

Initiating a Crash Dump to Disk

Now that the system is halted, you can initiate a crash dump to disk. Enter the following command sequence:

```
CP1> SYSCLR
Really? YES /* Not all PRIME machines will ask you this.
CP1> RUN 661
```

The RUN 661 command uses the crash dump disk previously activated using CDD-ACTIVATE_DISK (as described in Chapter 3). You specified at that time whether to perform a full dump or a partial dump.

The system initializes the dump disk, then returns OK.

Disk Initialization Errors: If you do not issue a SYSCLR before running 661, the system usually halts immediately. If this happens, issue the SYSCLR, then reissue RUN 661.

If no crash dump disk is activated, dump disk initialization fails immediately and displays the following message:

```
Dump disk setup failed: CDD not activated!
Do you wish to take a tape dump? [Y/N] Y
```

You cannot activate a crash dump disk at this point. Either type Y to perform a tape dump (described in Appendix A), or N to abort the crash dump.

Activated Disk Errors: If a crash dump disk is activated, but cannot be used, you may get one of the following errors:

```
Dump disk setup failed: CDD info is invalid!
Do you wish to take a tape dump? [Y/N] Y
```

A hardware problem has corrupted PRIMOS memory, making the activated disk inaccessible. Perform a crash dump to tape.

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Dump disk 120762 not responding (status: 100001)
Enter R to retry, T for tapedump, Q to quit:

The dump disk may not be powered up or may be offline. Correct the hardware problem and retry. If there is no obvious problem with the disk drive, take a crash dump to tape (described in Appendix A).

Dump disk 120762 is write protected (status: 120000)
Enter R to retry, T for tapedump, Q to quit:

The dump disk is write protected. Press the write-protect button on the disk drive and retry. If there is no obvious problem with the disk drive, take a crash dump to tape (described in Appendix A).

Dump disk setup failed: disk contains unrecovered dump
Enter O to overwrite disk, T for tapedump, Q to quit:

The dump disk already contains an unrecovered crash dump. Continuing with the crash dump to disk overwrites (deletes) this crash dump. This message is returned when you issue the SYSCLR and RUN 661 commands more than once following a system crash. In this case, you can type O to overwrite the previous aborted crash dump. If this message appears when you have not aborted a crash dump to disk, or if you suspect that valuable crash dump information is recorded on the crash disk, take a crash dump to tape (described in Appendix A).

Dump disk setup failed: wrong disk is mounted!

The disk currently mounted is not the one that was activated. Take a crash dump to tape (described in Appendix A).

Dump disk setup failed: read error on disk 120762 (status: 102000)

The disk header could not be read because of a disk hardware error. Take a crash dump to tape (described in Appendix A).

Dump disk setup failed: write error on disk 120762 (status: 102000)

The disk header or a test record could not be written because of a disk hardware error. Take a crash dump to tape (described in Appendix A).

Dump disk setup failed: bad header on disk!

Either the disk header record has been corrupted, or the disk is not a crash dump disk. Take a crash dump to tape (described in Appendix A).

Dump disk setup failed: bad disk address or size in header!

The disk header contains invalid information about which part of the disk to use for the crash dump. It is likely that the disk header record has been corrupted. Take a crash dump to tape (described in Appendix A).

Disk Dump in Progress: After the initialization returns OK, the system performs the crash dump to disk. It displays the following messages:

```
Initializing dump disk 120762 .... OK
Beginning partial dump .....
CORE dump done 12591 records written, 20345 left on disk
MAPS dump done 47 records written, 20298 left on disk
PIOS dump done 65 records written, 20233 left on disk
Crash dump to disk 120762 completed.
DPM400: CPU halted at 000014/004677: 003776
01 Aug 91 11:50:17 Thursday
```

As the dump proceeds, it displays a dot (.) for every 1024 records (2Mb) of core memory written to the dump disk.

The CORE dump done message is printed when the core dump has finished. If this message is not printed, the dump is not analyzable. Note all messages printed during the dump and report them to your PrimeService representative.

The MAPS dump is always included in a disk dump or tape dump at Rev. 23.2. In previous revisions, MAPS information was not included in the dump, but had to be accessed separately. When this message is not printed, the core dump may still be valid and able to be analyzed if the correct separate map files (RING0.MAP and RING3.MAP) are provided along with the dump – for example, by using MAGSAV.

A PIOS dump is only included if you have a 6000-series machine.

Upon successful completion, the system should return the following completion message and halt message:

```
Crash dump to disk 120762 completed.

DPM400: CPU halted at 000014/004677: 003776
01 Aug 91 11:50:17 Thursday
```

Errors While Disk Dump Is in Progress: After the initialization returns OK, the following errors can occur during crash dump to disk:

```
Not enough room for dump on disk 120762
5012 records available, need at least 5456
Do you wish to take a tape dump? [Y/N]:
```

When you activate a crash dump disk, CDD estimates the number of records that may be needed for a full or partial crash dump and returns a message if the number of records is insufficient (refer to Chapter 3). CDD activates the disk for a partial crash dump if there is not enough space for a full crash dump. At activation time, CDD cannot predict exactly how much space will be needed for a partial dump; it activates a disk for a partial dump if a certain minimum amount of space is available. The message above is returned when a crash dump is generated if the available space is insufficient for a particular crash dump. Take a crash dump to tape and restart system. Activate a larger crash disk for future crash dumps.

CORE dump aborted: write error on disk 120762 (status: 102001)
Crash dump to disk 120762 unsuccessful.

Crash dump was aborted by an unrecoverable disk error. This can occur during CORE dump, or in a later section of the dump (MAPS or PIOS). Abort and retry the crash dump (as described below). If the crash dump aborted during CORE dump and the retry also fails, take a crash dump to tape. If the crash dump aborted after the CORE dump completed, the crash dump is probably usable; however, it is recommended that you also take a crash dump to tape.

NNNN dump aborted: Not enough room for dump on disk 120762
Crash dump to disk 120762 unsuccessful.

Crash dump was aborted due to insufficient room on the disk, even though there was enough room to initiate the crash dump to disk. This is probably due to a large number of recovered disk errors. This can occur in any section of the dump, but is more likely in later sections (MAPS or PIOS). If the crash dump aborted during CORE dump, take a crash dump to tape. If the crash dump aborted after the CORE dump completed, the crash dump is probably usable; however, it is recommended that you also take a crash dump to tape.

Aborting and Retrying a Crash Dump to Disk: If it appears that the console has hung or that the dump is not executing properly, you can abort and retry a crash dump to disk by using the following commands:

```
<esc><esc> /* Press the escape key twice.  
CP> STOP  
CP> SYSCLR  
CP> RUN 661
```

If a crash dump has aborted, you can retry the crash dump by using the following commands:

```
CP> SYSCLR  
CP> RUN 661
```

As noted above, a retry of a crash dump to disk may result in a prompt asking whether or not to overwrite an unrecovered dump. Specify O to overwrite the aborted crash dump and proceed.

Analyzing a Crash Dump to Disk

After coldstarting the system, you should immediately analyze the crash dump to determine which disks require `FIX_DISK` processing. Issue the following commands:

1. `CDD -RECOVER_DISK` to copy the crash dump to a file system disk. This procedure is optional, but recommended; it is described in Chapter 3.
2. `FS_RECOVER` to analyze the crash dump. This procedure is described in the new edition of *Using FS_RECOVER*, which describes `FS_RECOVER` version 3, the only version that supports analysis of a crash dump from disk.

PNX Messages Logged by DSM

C



The PRIMOS system records the following status and error messages, storing them in the log files provided by the Distributed Systems Management (DSM) facility.

Messages related to activities for PRIMENET Performance Tuned Extensions are classified by the DSM facility as either PNX messages or NPX messages. This appendix describes the PNX messages and NPX messages in separate sections.

Each logged message has a degree of severity that is classified as either Information, Security Violation, Warning, or Alarm. The messages described in the following sections are listed under these classifications.

Note While DSM logs these messages, its SIM monitoring tools provide no further information on the activities of PRIMENET Performance Tuned Extensions. There is also no information provided by the PRIMENET utility, MONITOR_NET.

Every message is sent to the DSM log file by a PRIMENET routine that received notice of the error condition or status condition, and the name of the routine is provided in parentheses after each initial message (*routine-logging-msg*).

PNX Messages

PNX Messages Logged as Information

An incoming PNX packet has an invalid sequence number. Data may have been lost. PNX is initiating a channel reset. (*routine-logging-msg*)

Remote Node : *node-name*
Local User # : *user-num*
Local User Name : *user-name*
Remote User # : *user-num*
Local LCN : *logical-chan-num*
Remote LCN : *logical-chan-num*

As the message indicates, an invalid packet sequence number indicates that data may have been lost, so PRIMENET Performance Tuned Extensions initiates a channel reset. NPX will retransmit any data that may have gotten lost. This should be transparent to an application user.

A PNX incoming connection request has been rejected due to exhaustion of PNX slave process queue. (*routine-logging-msg*)

Remote Node : *node-name*
Remote User # : *user-num*
Remote LCN : *logical-chan-num*

There were no slaves available to accept a PRIMENET Performance Tuned Extensions incoming connection request. Application may pause and retry after a short delay.

PRIMENET node *node-name* down for PNX service. (*routine-logging-msg*)

The PRIMENET Performance Tuned Extensions protocol is no longer usable to the given destination node.

The PNX protocol has been initialized and process # *num* has been spawned as the PNX_SERVER Network Process. (*routine-logging-msg*)

The PRIMENET Performance Tuned Extensions protocol has been initialized on the local node. The particular process is running the PRIMENET Performance Tuned Extensions protocol.

The PNX protocol has been shut down.
(*routine-logging-msg*)

The PRIMENET Performance Tuned Extensions protocol has been terminated on the local node.

The PNX protocol has exhausted its supply of Channel Control Blocks. An incoming connection request has been rejected. (*routine-logging-msg*)

Remote Node : *node-name*
Remote User # : *user-num*
Remote LCN : *logical-chan-num*

The PRIMENET Performance Tuned Extensions protocol has exhausted its supply of Channel Control Blocks. This supply is not configurable but is determined at cold start of PRIMOS to be equal to the maximum number of configurable processes on that type of 50 Series machine. Application may pause and retry after a short delay.

The PNX protocol has exhausted its supply of Channel Control Blocks. An outgoing connection request has been denied. (*routine-logging-msg*)

Remote Node : *node-name*
Local User # : *user-num.*
Local User Name : *user-name*

The PRIMENET Performance Tuned Extensions protocol has exhausted its supply of Channel Control Blocks. This supply is not configurable but is determined at cold start of PRIMOS to be equal to the maximum number of configurable processes on that type of 50 Series machine. Application may pause and retry after a short delay.

PNX Messages Logged as Security Violations

Only the PNX_SERVER network process may call the routine PNX\$SERVER to execute the PNX network.
(routine-logging-msg)

User # : user-num
Local User Name : user-name

Only the PRIMENET Performance Tuned Extensions server process indicated by user type U\$PNX may call the gated routine PNX\$SERVER. Some other process has attempted to call PNX\$SERVER, possibly a malicious user.

Only the system console process running START_NET may attempt to initialize the PNX network.
(routine-logging-msg)

User # : user-num
Local User Name : user-name

Only the user-one process (connected with the supervisor terminal and running START_NET) may attempt to initialize the PRIMENET Performance Tuned Extensions network. Some other process has attempted to call PNX\$INIT, possibly a malicious user.

PNX Messages Logged as Warnings

A PNX Channel timer has expired in a free state.

Timer Type : *timer-type*

A timer has expired in a free state. This is not a serious error, and protocol processing continues. This is the shortest of three messages logging invalid timer expirations; its form is short because all the logging data was not accessible.

The PNX network has not been initialized, since the wired RINGNET buffers are not configured to be 1k half-words. (*routine-logging-msg*)

For this revision of PRIMOS, PRIMENET Performance Tuned Extensions only runs with 2048-byte RINGNET buffers, and this is the default size. Someone using CONFIG_NET has changed the ring buffer size to another value. Readjust the ring buffer size, either accepting the default or setting the size to 2048 bytes.

The PNX network has not been initialized, since there are no logical RINGNET links in the PRIMENET configuration. (*routine-logging-msg*)

For this revision of PRIMOS, PRIMENET Performance Tuned Extensions only runs over RINGNET.

The PNX network has not been initialized, since there is not a PNC-II controller configured on the node. (*routine-logging-msg*)

For this revision of PRIMOS, PRIMENET Performance Tuned Extensions only runs over PNC-II RINGNET controllers.

PNX Messages Logged as Alarms

An unknown packet type was sent to the PNX server from the PNCDIM. (*routine-logging-msg*)

An unknown packet type sent to PRIMENET Performance Tuned Extensions server from the PNCDIM. A re-boot is required for recovery. If the problem persists, contact PrimeService.

A PNX channel was found to be in an invalid state. (*routine-logging-msg*)

This is a short form of the next error message. The problem was so severe that the system could not access all of the data needed for the long form. Contact PrimeService and re-boot the system. (See the next message.)

A PNX channel was found to be in an invalid state. (*routine-logging-msg*)

Remote Node : *node-name*
Local LCN : *logical-chan-num*
Remote LCN : *logical-chan-num*

A PRIMENET Performance Tuned Extensions channel has been corrupted, due to a problem either with the PRIMENET Performance Tuned Extensions protocol or with the memory allocated for PRIMENET Performance Tuned Extensions channel data structures. Contact PrimeService and re-boot the system.

A PNX channel timer has been corrupted. (*routine-logging-msg*)

Remote Node : *node-name*
Local User # : *user-num*
Local User Name : *user-name*
Remote User # : *user-num*
Local LCN : *logical-chan-num*
Remote LCN : *logical-chan-num*
Local LCN State : *state-description*

The memory used by PRIMENET Performance Tuned Extensions either for channel data structures or for channel timer blocks has been corrupted. Contact PrimeService and re-boot the system.

This, the shorter of two error messages about invalid timer expirations, is logged when the system cannot access all of the data needed for the long form. (See the next message.)

A PNX channel timer has expired in an invalid state.
(*routine-logging-msg*)

Remote Node : *node-name*
Local User # : *user-num*
Local User Name : *user-name*
Remote User # : *user-num*
Local LCN : *logical-chan-num*
Remote LCN : *logical-chan-num*
Local LCN State : *state-description*
Timer Type : *timer-type-name*

The channel timer's expiration in an invalid state indicates a problem in the PRIMENET Performance Tuned Extensions protocol state machine. A re-boot is required for recovery. If the problem persists, contact PrimeService. This is the longer of two error messages about invalid timer expirations. (See the previous message.)

A PNX protocol error requires that a channel be aborted. (*routine-logging-msg*)

Remote Node : *node-name*
Local LCN : *logical-chan-num*
Remote LCN : *logical-chan-num*
Local LCN State : *state-description*
Packet Type : *type-code-num*

The PRIMENET Performance Tuned Extensions channel was in a state that invalidated the reception of a PRIMENET Performance Tuned Extensions packet. Both sides of the channel have been aborted. Re-boot the system and contact PrimeService about this problem in the PRIMENET Performance Tuned Extensions protocol state machine.

Error calling CRFP to allocate PNX transmit buffer free pool. (*routine-logging-msg*)
error-message.

PRIMENET Performance Tuned Extensions calls CRFP to allocate transmit buffers during initialization of PRIMENET Performance Tuned Extensions. A malfunctioning free pool area could cause unexpected errors. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling CRQ to allocate PNX aborted packet queue. (*routine-logging-msg*)
error-message.

PRIMENET Performance Tuned Extensions calls CRQ to allocate memory for entries on its aborted transmit packet queue for the PNCDIM to place aborted packets. A malfunctioning free pool area could cause unexpected errors. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling CRQ to allocate PNX receive packet queue. (*routine-logging-msg*)
error-message.

PRIMENET Performance Tuned Extensions calls CRQ to allocate memory for entries on its receive packet queue for events coming up from the PNCDIM. A malfunctioning free pool area could cause unexpected errors. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling CRQ to allocate PNX transmit packet queue. (*routine-logging-msg*)
error-message.

PRIMENET Performance Tuned Extensions calls CRQ to allocate memory for entries on its transmit packet queue for events going down to the PNCDIM. A malfunctioning free pool area could cause unexpected errors. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling FLSEFS to de-allocate PNX transmit buffer free pool. (*routine-logging-msg*)
error-message.

PRIMENET Performance Tuned Extensions calls FLSEFS to de-allocate transmit buffers during initialization of PRIMENET Performance Tuned Extensions. The free pool area has a malfunction. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling GETMUTEXLOCK to obtain PNX mutex lock.
(*routine-logging-msg*)

User # : *user-num*
User Name : *user-name*
Error Message : *error-message*

The memory reserved for PRIMENET Performance Tuned Extensions mutex locks may have been overwritten. A re-boot is required for recovery. If the problem persists, contact PrimeService.

There are two error messages to handle mutex lock errors. This is the short form, logged when the system cannot access all of the data needed for the long form. (See next message.)

Error calling GETMUTEXLOCK to obtain the PNX mutex lock. (*routine-logging-msg*)

Remote Node : *node-name*
Local User # : *user-num*
Local User Name : *user-name*
Remote User # : *user-num*
Local LCN : *logical-chan-num*
Remote LCN : *logical-chan-num*
Error Message : *error-message*

The memory reserved for PRIMENET Performance Tuned Extensions mutex locks may have been overwritten. A re-boot is required for recovery. If the problem persists, contact PrimeService.

There are two error messages to handle mutex lock errors. This is the full form. (See previous message.)

Error calling SAL_SYST to allocate dynamic memory for PNX network. (*routine-logging-msg*)
error-message.

Somewhere in ring0, a process or controller is overwriting memory. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling SFR_SYST to de-allocate dynamic memory for PNX network. (*routine-logging-msg*)
error-message

Somewhere in ring0, a process or controller is overwriting memory. Re-boot the system and contact PrimeService to eliminate future problems.

Error calling SW\$INT to initialize the PNX Network process. (*routine-logging-msg*)
error-message.

This is a symptom of problems with PRIMENET Performance Tuned Extensions or PRIMOS. A re-boot is required for recovery. If the problem persists, contact PrimeService.

Repeated attempts at transmitting a PNX Open Connection request have not been responded to by a PNX Open Accept response. The PNX channel has been aborted. (*routine-logging-msg*)

Remote Node : *node-name*
Local User # : *user-num*
Local User Name : *user-name*
Local LCN : *logical-chan-num*

A PRIMENET Performance Tuned Extensions open connection request timer is started whenever an open connection request is sent. Several consecutive timer expirations are handled by resending the open connection request. After the maximum number of open connection requests are sent, the local connection is aborted and this event is logged. Re-boot the system and contact PrimeService to eliminate future problems.

Size of PNX packet from PNCDIM is incorrect. Data may be lost. (*routine-logging-msg*)

The PNCDIM on the receiving node holds a frame ready for passing up to the host, but the frame size is different from that recorded in the packet header by the sender. Data may be lost. Re-boot the system and contact PrimeService to eliminate future problems.

NPX Messages

These messages are associated with NPX itself. They may be issued in response to either an X.25 connection or a PNX connection.

NPX issues these errors, indicating the service connection affected (X.25 or PNX). The reader of the logged message must interpret any ensuing codes (Status Code, Clearing Code, and Diagnostic Code) according to the service connection. Codes associated with both services are defined in the PRIMOS file SYSCOM>\$KEYS.INS.PL1.

NPX Messages Logged as Warnings

Connection cleared by slave; Unknown clearing code.
(*routine-logging-msg*)

```
Service           : service-name
Node              : node-name
Status Code      : status-code-num
Clearing Code    : clearing-code-num
Connection Id    : conn-id-num
```

An NPX connection was cleared by the remote slave with an unknown clearing code. The Service parameter lists the network service on which the event occurred. The Node parameter identifies the remote node from which the connection-clear was initiated. The Status and Clearing Codes are returned from the appropriate receive system call (the status should indicate that the connection has been cleared). These codes must be interpreted according to the Service (X.25 or PNX). The Connection Id identifies either the PRIMENET X.25 virtual circuit number or the PNX channel number on which the invalid clear occurred. The TRNRCV, XMTRCV, or LTMASXRC operation has been terminated unsuccessfully.

Connection establishment operation terminated because of resource allocation errors. (*routine-logging-msg*)

```
Service           : service-name
Node              : node-name
```

Buffer congestion in the local network is preventing the establishment of a PRIMENET X.25 virtual circuit. The connection cannot be established with the Node specified by *node-name*. The R\$ALOC operation has been terminated with no remote slave allocated.

Error while attempting to accept connection request.
(*routine-logging-msg*)

Service : *service-name*
Port Number : *port-num*
Connection Id : *chan-num*
Status Code : *status-code-num*

A local system error has prevented a PNX channel accept from being issued in response to an incoming channel request (slave allocation). The Port Number identifies the port on which the channel request was received, and the Connection Id provides its channel number. The Status code is returned from the system call. As a result of this system error, the incoming channel request is rejected and no local slave is allocated.

Error while attempting to open network connection.
(*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Status Code : *status-code-num*

A local system error was returned from a PNX_COPEN system call. The Node parameter identifies the remote node to which the connection was being established. The Status Code identifies the error returned from the system call. The R\$ALOC operation has been terminated with no remote slave allocated.

Error while attempting to post receive buffer.
(*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Status Code : *status-code-num*
Connection Id : *conn-id-num*

A local system error has prohibited a receive buffer from being posted to a PNX channel. The Node parameter identifies the remote node to which the associated channel is established. The Master/Slave Flag indicates the initiator of the local transmit/receive operation (0 = slave, > 0 = master). The Status Code is returned from the system call. The Connection Id identifies the PNX channel number. The TRNRCV or XMTRCV operation has been terminated unsuccessfully.

Error while attempting to post receive buffer.
(*routine-logging-msg*)

Service : *service-name*
Port Number : *port-num*
Connection Id : *conn-id-num*
Status Code : *status-code-num*

A local system error has prevented a receive buffer from being posted for a PNX channel in conjunction with an incoming channel request (slave allocation). The Port Number parameter identifies the port on which the channel request was received, and the Connection Id provides the channel number. The Status code is returned from the system call. As a result of this system error, the incoming channel request is rejected and no local slave is allocated.

Error while attempting to read receive event.
(*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Status Code : *status-code-num*
Connection Id : *conn-id-num*

A local network error has prohibited a PNX get channel event operation (PNX_CGEVT) from completing successfully. The Node parameter identifies the remote node to which the associated connection was established. The Master/Slave flag indicates the initiator of the local transmit/receive operation (0 = slave, > 0 = master). The Status code is returned from the system call. The Connection Id identifies the PNX channel number on which the get channel event operation was attempted. The TRNRCV, XMTRCV or LTMASTXRC operation has been terminated unsuccessfully.

Error while attempting to transmit.
(*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Status Code : *status-code-num*
Connection Id : *conn-id-num*

A local network error has prevented a PNX send message and post receive buffer operation from completing successfully. The Node parameter identifies the remote node to which the operation was targeted. The Status Code is returned from the system call. The Master/Slave Flag indicates the initiator of the local transmit/receive operation (0 = slave, > 0 = master). The Connection Id identifies the PRIMENET X.25 virtual circuit or the PNX channel number on which the send and post operation was attempted. The TRNRCV, XMTRCV, or LTMASTXRC operation has been terminated unsuccessfully.

Invalid message length. (*routine-logging-msg*)
Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Sent Length : *byte-count*
Received Length : *byte-count*
Connection Id : *conn-id-num*

A network error has truncated an NPX message received over a PNX channel. This should not be possible if PRIMENET Performance Tuned Extensions is functioning properly. The Node parameter identifies the remote node to which the associated connection was established. The Sent and Received lengths detail the invalid message. The Master/Slave Flag indicates the initiator of the local transmit/receive operation (0 = slave, > 0 = master). The Connection Id identifies the PNX channel number on which the truncated message was received. The TRNRCV, XMTRCV, or LTMASXRC operation has been terminated unsuccessfully.

Local buffer congestion problem on X\$RCV or X\$TRAN.
(*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Connection Id : *conn-id-num*

Buffer congestion in the local network is preventing the completion of a receive or transmit operation on a PRIMENET X.25 virtual circuit. The Node parameter identifies the remote node to which the operation was targeted. The Master/Slave Flag indicates the initiator of the operation with possible values (0 = slave, > 0 = master). The Connection Id provides the PRIMENET X.25 virtual circuit number. The operation is terminated unsuccessfully.

Message received out of sequence.

(routine-logging-msg)

Service : service-name
Node : node-name
Master/Slave Flag : flag-code-num
Expected Seq. No. : sequence-num
Received Seq. No. : sequence-num
Connection Id : conn-id-num

An incoming message on a PRIMENET X.25 virtual circuit or a PNX channel was received out of sequence. This should not be possible, as NPX operates on a single outstanding message basis. The Node parameter identifies the remote node which sent the out of sequence message. The Master/Slave Flag indicates the initiator of the local operation (0 = slave, > 0 = master). The Expected and Received sequence numbers detail the error condition. The Connection Id identifies the PRIMENET X.25 virtual circuit number or PNX channel number on which condition occurred. The TRNRCV, XMTRCV, or LTMASTXRC operation is terminated unsuccessfully.

Received message exceeded maximum buffer size.

(routine-logging-msg)

Service : service-name
Node : node-name
Master/Slave Flag : flag-code-num
Message Byte Count : count
Connection Id : conn-id-num

An incoming message overran the local NPX receive buffer on either a (PRIMENET X.25) X\$RCV operation or a (PNX) PNX_CREC operation. The Service parameter lists the network service on which the event occurred. The Node parameter identifies the remote node which sent the oversized message. The Master/Slave Flag indicates the initiator of the local operation (0 = slave, > 0 = master). The Message byte count identifies the size of the oversized message. The Connection Id identifies either the PRIMENET X.25 virtual circuit number or the PNX channel number on which the overrun occurred. The TRNRCV or XMTRCV operation is terminated unsuccessfully.

Unexpected clearing code received during connection establishment operation. (*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Status Code : *status-code-num*
Clearing Code : *clearing-code-num*

An unknown clearing code was received as a result of either an XLCONN operation (X.25) or a PNX_CHKAC operation (PNX). The Service parameter names the network service on which the event occurred. The Node parameter identifies the remote node to which the connection was being established. The Status and Clearing Codes are returned from the appropriate system call. Status and Clearing codes need to be interpreted according to the Service indicated (X.25 or PNX). The R\$ALOC operation has been terminated with no remote slave allocated.

Unexpected status code received during connection clear operation. (*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Status Code 1 : *status-code-num*
Status Code 2 : *status-code-num*

An unknown status was returned from either an (X.25) XLCLR operation or a (PNX) PNX_CCLS operation. The Service parameter identifies the network service on which the event occurred: X.25 or PNX. The Node parameter identifies the remote node to which the connection was established. The Status codes are returned from the appropriate system call. The Status codes need to be interpreted according to the Service indicated. The R\$RLS operation has been terminated with the state of connection unknown.

Unexpected status code received during connection establishment operation. (*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Status Code : *status-code-num*
Clearing Code : *clearing-code-num*

An unknown status code was received as a result of either an (X.25) XLCONN operation or a (PNX) PNX_CHKAC operation. The Service parameter lists the network service on which the event occurred: X.25 or PNX. The Node parameter identifies the remote node to which the connection was being established. The Status and Clearing Codes are returned from the appropriate system call. Status and Clearing codes need to be interpreted according to the Service indicated. The R\$ALOC operation has been terminated with the state of the remote slave unknown.

Unknown receive status. (*routine-logging-msg*)
Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Status Code : *status-code-num*
Connection Id : *conn-id-num*

An unknown receive status code was returned from either an (X.25) X\$RCV operation or a (PNX) PNX_CREC operation. The Service parameter lists the network service on which the event occurred: X.25 or PNX. The Node parameter identifies the remote node to which the operation was targeted. The Master/Slave flag indicates the initiator of the operation (0 – slave, > 0 – master). The Connection Id identifies either the PRIMENET X.25 virtual circuit number or the PNX channel number on which the unknown status was received. The Status Code is returned from the appropriate system call. The TRNRCV, XMTRCV, or LTMASTXRC operation has been terminated unsuccessfully.

NPX Messages Logged as Alarms

Error while attempting to assign network port.
(*routine-logging-msg*)

Service : *service-name*
Status Code : *status-code-num*

A local system failure has prevented the assignment of a network port for PRIMENET Performance Tuned Extensions (PNX_ASG). The Status code is returned from the system call. This is a fatal error, as the state of the slave is unknown.

Invalid transmit/receive operation detected.
(*routine-logging-msg*)

Service : *service-name*
Node : *node-name*
Master/Slave Flag : *flag-code-num*
Attempted Node Id : *node-id-num*
Incomplete Node Id : *node-id-num*

An invalid NPX transmit/receive operation has been detected. This condition occurs when NPX attempts to begin a transmit/receive operation and determines that the last transmit/receive operation never completed properly (for an unknown reason). The Node parameter identifies the remote node to which the operation was targeted. The Master/Slave flag indicates the initiator of the operation (0 = slave, > 0 = master). Attempted Node Id identifies the current operation, and Incomplete Node Id identifies the failed operation. This is a significant event because the state of NPX is questionable. The TRNRCV, XMTRCV, or LTMASTXRC operation is terminated with a network error.

Unable to assign network port due to resource allocation errors. (*routine-logging-msg*)

Service : *service-name*
Status Code : *status-code-num*

Local system failure has repeatedly prevented the assignment of a PRIMENET X.25 network port. The Status code is returned from the system call. This is a fatal error, as the slave is effectively lost and a re-boot is required for recovery.

Unexpected event retrieved by PNX_CHKOP.
(routine-logging-msg)

Service : service-name
User Number : user-num

An unexpected, illegal event was retrieved for a PNX channel by the slave side routine PNX_CHKOP. The User Number parameter identifies the process number of the NPX slave process which incurred the error. The R\$ALOC operation eventually will be either retried or aborted normally.

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PNX Messages Displayed at the Supervisor Terminal

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While most status and error messages concerning PNX are recorded in the DSM log file, some of them are directed to the supervisor terminal to enable the System Administrator or operator to be aware of the system status without needing to read the log. Some of the following messages have similar forms recorded in the DSM log. Refer to Appendix C for a list of messages logged for the PNX product itself (PRIMENET Performance Tuned Extensions) and for NPX itself as it provides support for the new protocol.

Messages at System Initialization

The combined number of PRIMENET X.25 and PRIMENET PNX slaves is too big. (NPXON)

Within the CONFIG file for PRIMOS the total of the two values assigned to the NSLUSR directive exceeds the maximum number of slave users. The system automatically calculates new values that do not exceed the maximum. After receiving the above error message, you will also receive either one or both of the following two messages, depending upon the extent of need for adjustments.

The number of PRIMENET X.25 slaves is decreased to *num*.

The first value assigned to the NSLUSR directive within the CONFIG file is reduced, because the maximum number of slave users was exceeded (see first message above). *num* is a decimal value.

The number of PRIMENET PNX slaves is decreased to *num*.

The second value assigned to the NSLUSR directive within the CONFIG file is reduced, because the maximum number of slave users was exceeded (see first message above). *num* is a decimal value.

error-text. Can't attach to PRIMENET*. (NPXON)

The problem indicated in *error-text* occurred while trying to attach to this directory to carry out the initialization of network slaves. Check that SYSTEM has ALL access rights.

error-text. Can't start slave.

The problem indicated in *error-text* occurred during the initialization of the designated number of network slaves. Your system has not exceeded its maximum number of slave users. Contact PrimeService.

error-text. SLAVE.COMI: Can't start slave.

The problem indicated in *error-text* occurred during the initialization of the designated number of network slaves. The file SLAVE.COMI does not exist in the PRIMENET* directory.

error-text. Can't allocate system memory for NPX internal structures.

The system could not allocate transmit/receive buffers or status vectors for a user that attempted to use NPX. Current network activity may leave no wired memory for the user. Contact PrimeService.

Messages at Initialization of PNX

These messages are displayed at the supervisor terminal, but a variation of each one is also recorded in the DSM log. Logged messages receive a severity classification (Information, Security Violation, Alarm, or Warning); see Appendix C for details.

The messages indicate an error condition discovered by a routine during operation, and this routine redirects the condition and associated message to the supervisor terminal. You may receive a clue on how to solve the problem by noting the name of (*routine-reporting-message*). If the error message is self-explanatory, no instructions for corrective measures are provided in the following list of error messages:

error-text. Can't start PNX_SERVER.
(*routine-reporting-message*)

The problem indicated in *error-text* has occurred during startup. Check that SYSTEM has ACL rights of PDALURWX for access to PRIMENET*. Check that the files PNX_SERVER.COMI and START_PNX_SERVER.RUN exist in PRIMENET*. Otherwise, call PrimeService for assistance.

Insufficient access rights. Only the system console user may start PNX_SERVER. (*routine-reporting-message*)

The PNX_SERVER cannot be started. PNX Database Initialization Error. (*routine-reporting-message*)

Check the network log for specific details about the error.

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PNX Messages Displayed at the Supervisor Terminal

The PNX_Server is not being started. No PNC-II Controller Installed. (*routine-reporting-message*)

The PNX_SERVER is not being started. No Ring Nodes are Configured. (*routine-reporting-message*)

The PNX_SERVER is not being started. The configured RINGNET buffer size is unacceptable for PNX.

PRIMENET Performance Tuned Extensions requires a ring buffer size of 2048 bytes. Readjust the ring buffer size accordingly.

Rev. 23.2 Publications

E

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This appendix lists all books that are integral to Master Disk Revision 23.2. For any books not related to a specific revision, see the *Guide to Prime User Documents* (DOC13079-1PA), or type HELP DOCUMENTS.

This appendix lists Prime publications in tables by function: PRIMOS administration and operation, PRIMOS architecture and assembly, PRIMOS use and programming, communications, data management, languages, and editors.

The column heads in each table organize the information about each book as follows:

- The *Book Title* column lists the book's title
- The *Most Recent* column contains information on the most recent revision at which the title has been published and the document number of that document.
- The *Also Required* column provides the document numbers for ordering any additional publications, such as release notes, updates, and full editions of the book, that work together with the document listed in the *Most Recent* column. Some of these additional publications may have titles that are different from the book title.

Note If the *Most Recent* publication is a release note (RLN*nnnnn-rrA*) or an update (UPD*nnnnn-rrA*), you must also have the last full edition of the title (DOC*nnnnn-rrA*) and any updates to that edition that were published prior to the publication in the *Most Recent* column. If the *Most Recent* publication is a full edition (DOC*nnnnn-rrLA*), you do not need to order any prior editions, updates, or release notes with it; a new edition contains all changes that have occurred since the last published full edition.

Table E-1. PRIMOS Administration and Operation				
Book Title	Most Recent		Also Required	
	Revision	Document Number	Revision	Document Number
Using FS_RECOVER	23.2	DOC13062-3LA		
Disk Replacement Procedure for the Model 75500-6PK Device Module	23.2	IDR13100-1XA		
DSM User's Guide	23.0	DOC10061-3LA		
MAGNET User's Guide	22.0	UPD10156-11A	21.0	DOC10156-1LA
Operator's Guide to Data Backup and Recovery	23.1	UPD10324-11A	23.0	DOC10324-1LA
Operator's Guide to File System Maintenance	23.0	UPD9300-51A	22.1	DOC9300-5LA
Operator's Guide to System Commands	23.0	DOC9304-5LA		
Operator's Guide to System Monitoring	21.0	DOC9299-3LA		
Operator's Guide to the Batch Subsystem	21.0	DOC9302-3LA		
Operator's Guide to the Spooler Subsystem	23.0	DOC9303-4LA		
Operator's System Overview	22.0	DOC9298-3LA		
Rev. 23.0 Software Installation Guide	23.0	IDR10176-3XA		
Rev 23.2 Software Release Document	23.2	DOC10001-9PA	23.1 23.0 22.1 22.0	DOC10001-8PA DOC10001-7PA DOC10001-6PA DOC10001-5PA
System Administrator's Guide, Volume I: System Configuration	23.0	DOC10131-3LA		
System Administrator's Guide, Volume II: Communication Lines and Controllers	22.1	RLN10132-21A	22.0	DOC10132-2LA

<i>Table E-1. PRIMOS Administration and Operation (continued)</i>				
<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
System Administrator's Guide, Volume III: System Access and Security.	23.0	DOC10133-3LA		
Prime 400 Handbook (Including the 350 and 500)	21.0	UPD8799-11A	20.0	DOC8799-1LA
Prime 850 Handbook (Including the 750)	22.0	UPD10063-12A	21.0 20.0	UPD10063-11A DOC10063-1LA
Prime 2250 Handbook	22.0	UPD10073-12A	21.0 20.0	UPD10073-11A DOC10073-1LA
2455 Handbook (Including 2350 and 2450)	22.0	UPD10086-21A	21.0	DOC10086-2LA
Prime 2550 Handbook	19.4.3	UPD8638-11A	19.2	DOC8638-192L
2755 Handbook (Includes 2550, 2655)	22.0	UPD8638-31A	21.0	DOC8638-3LA
4150 Handbook (Including the 4050, 2850, and 2950)	22.1	RLN10162-21A	22.0.2	DOC10162-2LA
4450 Handbook	22.0	DOC10227-1LA		
5300 Family Handbook	22.1.4	DOC10356-2LA		
6350 Handbook	21.0	UPD10161-11A	20.2.3	DOC10161-1LA
6550 Handbook (Including the 6350, 6150 6650, and 6450)	22.1.1	RLN10161-22A	22.0 21.0.2 21.0.3	UPD10161-21A RLN10161-21A DOC10161-2LA
Prime 9955 Handbook	22.0	UPD8887-23A	21.0 20.0.2 20.0	UPD8887-22A UPD8887-21A DOC8887-2LA
Using Your Prime 2250	21.0	UPD6516-11A	22.0 19.1	RLN10239-001 DOC6516-191L
Using Your Prime 2450 (Including the 2350)	20.0	DOC10085-1LA	22.0	RLN10239-001
Using Your 2455	21.0.1	UPD10085-21A	22.0 21.0	RLN10239-001 DOC10085-2LA

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	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
Using Your Prime 2550	19.4.3	UPD8552-11A	22.0 19.2	RLN10239-001 DOC8552-192L
Using Your Prime 2655	20.0	DOC8552-2LA	22.0	RLN10239-001
Using Your 2755	21.0	DOC8552-3LA	22.0	RLN10239-001
Using Your 4150	21.0.2	DOC10163-1LA	22.0	RLN10239-001
Release Note for 6250-bpi Tape Dump	22.1	RLN12005-1XA		

<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
Assembly Language Programmer's Guide	T2.0-22.1	DOC3059-3LA		
50 Series Technical Summary	21.0	DOC6904-2LA		
Instruction Sets Guide	21.0	DOC9474-2LA		
System Architecture Reference Guide	21.0	DOC9473-2LA		

<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
Introduction to PRIMOS	20.2	DOC10111-1XA		
PRIMOS User's Guide	22.0	DOC4130-5LA	23.0	DOC10316-1PA

Table E-3. PRIMOS Use and Programming (continued)

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PRIMOS User's Release Document	23.0	DOC10316-1PA		
PRIMOS Commands Reference Guide	22.1	RLN3108-71A	23.0 22.0	DOC10316-1PA DOC3108-7LA
New PRIMOS Help	23.0	DOC20012-1PA		
CPL Programmer's Companion	19.3	FDR7811-193		
CPL User's Guide	21.0	DOC4302-3LA		
Programmer's Guide to BIND and EPFs	23.0	UPD8691-12A	22.0 19.4	UPD8691-11A DOC8691-1LA
Security Features User's Guide	22.0	UPD10130-11A	21.0	DOC10130-1LA
SEG and LOAD Reference Guide	18.1 to 19.2	DOC3524-192L		
Source Level Debugger User's Guide	20.2	UPD4033-22A	19.4 19.2	UPD4033-21A DOC4033-193L
Subroutines Reference I: Using Subroutines	23.0	UPD10080-21A	22.1 21.0	RLN10247-1LA DOC10080-2LA
Subroutines Reference II: File System	23.0	DOC10081-2LA		
Subroutines Reference III: Operating System	23.0	DOC10082-2LA		
Subroutines Reference IV: Libraries and I/O	23.0	DOC10083-2LA		
Subroutines Reference V: Event Synchronization	23.0	UPD10213-11A	22.1 22.0	RLN10247-1LA DOC10213-1LA
Advanced Programmer's Guide I: BIND and EPFs	T3.0-23.0	DOC10055-2LA		
Advanced Programmer's Guide II: File System	23.0	DOC10056-3LA		

Table E-3. PRIMOS Use and Programming (continued)

<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
Advanced Programmer's Guide III: Command Environment	T3.0-23.0	DOC10057-2LA		
Advanced Programmer's Guide: Appendices and Master Index	T3.0-23.0	DOC10066-4LA		

Table E-4. Communications

<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
Distributed Processing Terminal Executive (DPTX) Guide	22.0	DOC4035-4LA		
ICS User's Guide	21.0	UPD10094-11A	20.1	DOC10094-1LA
LTS300 Installation Guide	21.0	DOC11034-2LA		
NTS Planning and Configuration Guide	23.1	DOC10159-2LA		
NTS Quick Reference Card	22.0	IDR10218-1XA		
NTS User's Guide	23.0	DOC10117-3LA		
PRIME/SNA Application Program Interface Programmer's Guide	21.0.6	DOC10100-2LA		
PRIME/SNA Concepts and Overview	21.0.5	DOC11095-1LA		
PRIME/SNA Installation and Configuration Guide	21.0.5	DOC11097-1LA		
PRIME/SNA Interactive Terminal User's Guide	21.0.5	DOC8910-2LA		
PRIME/SNA LU 6.2 API Programmer's Guide	21.0.5	DOC11101-1LA		

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<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
PRIME/SNA Operator's Guide	21.0.5	DOC8909-5LA		
PRIME/SNA Resource Planning Guide	21.0.5	UPD11096-11A	21.0.5	DOC11096-1LA
PT200 Keyboard PRIME/SNA Interactive Reference Card	21.0	IDR8910-2RA		
PRIMOS TCP/IP Guide	22.0	DOC10155-3LA		
Rev. 23.0 Prime Networks Release Notes	23.0	RLN10252-1LA		
Operator's Guide to Prime Networks	22.0	UPD10114-11A	21.0 23.0	DOC10114-1LA RLN10252-1LA
Programmer's Guide to Prime Networks	22.0	UPD10113-11A	21.0 23.0	DOC10113-1LA RLN10252-1LA
PRIMENET Planning and Configuration Guide	22.1	UPD7532-41A	22.0 23.0	DOC7532-4LA RLN10252-1LA
Remote Job Entry Phase II Guide	22.0	UPD6053-42A	21.0 21.0	UPD6053-41A DOC6053-4LA
User's Guide to Prime Network Services	22.1	UPD10115-11A	21.0 23.0	DOC10115-1LA RLN10252-1LA
WSI300 User's Guide	21.0	DOC10155-2LA		

<i>Table E-5. Data Management</i>				
<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
DBMS Administrator's Guide	22.0	DOC6292-2LA		
DBMS Data Description Language Reference Guide	19.4	UPD5717-11A	18.1	DOC5717-181L
DBMS Data Manipulation Language Reference Guide	21.0	UPD5308-12A	19.4 19.0	UPD5308-11A DOC5308-190L
DBMS Master Index	22.0	DOC10164-3PA		
DBMS Programmer's Companion	19.4	DOC8645-1XA		
DBMS User's Guide	20.2	UPD6291-11A	19.2	DOC6291-192P
DBMS/QUERY Report Generator Casebook	18.2	IDR5650-182P		
DISCOVER Reference Guide	22.0	DOC7798-2LA		
DISCOVER User's Guide	20.0	UPD7799-11A	19.4	DOC7799-1PA
MIDASPLUS Concepts	20.2	DOC9243-1PA		
MIDASPLUS Companion	19.4	DOC10045-1XA		
MIDASPLUS User's Guide	22.0	DOC9244-2LA		
PRIFORMA Forms Design and Administration Guide	22.0	DOC10240-1LA		
PRIFORMA Forms Manipulation Language Guide	22.0	DOC10241-1LA		
PRIFORMA Programmer's Guide	22.0	DOC10242-1LA		
Prime ORACLE 5.1 Administrator's Manuals	22.0	DCP10078		
ORACLE VERSION 6.0 Installation and User's Guide for 50 Series Systems	v6.0.30	DOC10134-4LA		
PRISAM Programmer's Companion	21.0	DOC10088-1XA		

<i>Table E-5. Data Management (continued)</i>				
<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
PRISAM User's Guide	22.0	DOC7999-4LA		
ROAM Administrator's Guide	22.0	UPD7345-31A	21.0	DOC7345-3LA

<i>Table E-6. Languages</i>				
<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
Translator Family Software Release Document	T3.0-23.0	DOC10217-3PA		
BASIC/VM Programmer's Guide	19.4	UPD3058-33A	19.0 18.1 17.2	COR3058-002 COR3058-001 FDR3058-101B
C User's Guide	T3.0-23.0	DOC7534-4LA		
C++ User's Guide	T2.2-22.1	DOC20004-1LA		
COBOL 74 Reference Guide	T1.0-21.0	UPD5039-23A	21.0 20.2 20.0	UPD5039-22A UPD5039-21A DOC5039-2LA
COBOL85 Reference Guide	1.1-22.0	RLN10166-11A	22.0	DOC10166-1LA
CBL to COBOL85 Conversion Program Guide	22.0	DOC10276-1PA		
FORTRAN Reference Guide	21.0	UPD3057-34A	19.4 19.0 18.1 17.2	UPD3057-33A COR3057-002 COR3057-001 FDR3057-101B
FORTRAN 77 Reference Guide	T2.0-22.1	UPD4029-51A	T1.0-21.0	DOC4029-5LA
Pascal Programmer's Companion	21.0	DOC7095-2XA		
Pascal Reference Guide	21.0	DOC4303-4LA		

Table E-6. Languages (continued)

<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
PL/I Conversion Guide: IBM PL/I to Prime PL/I	19.4	DOC5769-1LA		
PL/I Reference Guide	TL0-21.0	UPD5041-11A	19.4	DOC5041-1LA
PL/I Subset G Reference Guide	19.4	UPD4031-13A	19.0 18.1 17.2	PTU2600-084 PTU2600-075 IDR4031
PRIME Common LISP Environment Reference Manual	20.2	MAN10120-1LA		
PRIME Common LISP Language Reference Manual	20.2	MAN10119-1LA		
Prime RPG II Debugging Template	20.0	IDR11001-2XA		
RPG II V-mode Compiler Reference Guide	T1.0-21.0	UPD5040-22A	21.0 20.0	UPD5040-21A DOC5040-2LA

Table E-7. Editors

<i>Book Title</i>	<i>Most Recent</i>		<i>Also Required</i>	
	<i>Revision</i>	<i>Document Number</i>	<i>Revision</i>	<i>Document Number</i>
EMACS Extension Writing Guide	19.4	DOC5025-2LA		
EMACS Primer	18.3	IDR6107		
EMACS Quick Reference Card	21.0	IDR5026-1RA		
EMACS Reference Guide	21.0	DOC5026-2LA		
EMACS Standard User Interface Guide	19.4.5	DOC7446-2LA		
New User's Guide to EDITOR and RUNOFF	19.0	FDR3104-101B		

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