

z/VM



CMS User's Guide

Version 6 Release 3

Note:

Before using this information and the product it supports, read the information in "Notices" on page 323.

This edition applies to version 6, release 3, modification 0 of IBM z/VM (product number 5741-A07) and to all subsequent releases and modifications until otherwise indicated in new editions.

This edition replaces SC24-6173-01.

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About This Document

This document provides information about using the IBM® z/VM® Conversational Monitor System (CMS). It will show you how to:

- Use CMS to manage your files
- Create and update Help files managed by the z/VM HELP Facility
- Use windowing commands and full-screen CMS to customize your CMS session
- Create and run programs in the CMS environment

Intended Audience

This information is intended for users who want to use CMS functions and facilities. If you are not familiar with basic CMS functions, you might first want to read *z/VM: CMS Primer*. Those who will use this information for assistance in running programs should be familiar with the programming language they will use.

Where to Find More Information

For more information about CMS and the other parts of z/VM, see the documents listed in the “Bibliography” on page 329.

Links to Other Documents and Web Sites

The PDF version of this document contains links to other documents and web sites. A link from this document to another document works only when both documents are in the same directory or database, and a link to a web site works only if you have access to the Internet. A document link is to a specific edition. If a new edition of a linked document has been published since the publication of this document, the linked document might not be the latest edition.

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Summary of Changes

This document contains terminology, maintenance, and editorial changes. Technical changes are indicated by a vertical line to the left of the change. Some z/VM product changes might be provided through service by program temporary fixes (PTFs) for authorized program analysis reports (APARs), which also might be available for some prior releases.

SC24-6173-02, z/VM Version 6 Release 3

This edition includes changes to support the general availability of z/VM V6.3.

Removal of A220, CLAW, DHCP and LPD Support

The removal of unsupported TCP/IP device drivers and servers is part of an ongoing effort to provide only those TCP/IP services that are required by customers to support their enterprise.

SC24-6173-01, z/VM Version 6 Release 2

This edition includes changes to support the general availability of z/VM V6.2.

z/Architecture CMS

z/Architecture[®] CMS (z/CMS), previously shipped as a sample program, is now a fully supported part of z/VM. z/CMS runs in IBM z/Architecture 31-bit addressing mode in an ESA or XA virtual machine and enables CMS programs to use z/Architecture instructions, including those that operate on 64-bit registers, while permitting existing ESA/390 architecture CMS programs to continue to function without change. For more information about z/CMS, see *z/VM: CMS Planning and Administration*.

SC24-6173-00, z/VM Version 6 Release 1

This edition includes changes to support the general availability of z/VM V6.1.

Introduction to CMS

Learning how to use CMS is not an end in itself; you must learn how CMS interacts with the other environments of VM. The information contained in the following topic is organized to help you quickly familiarize yourself with CMS and the other environments of VM, so that you can learn how to take advantage of CMS to simplify your work.

Chapter 1, “Introduction to CMS and the z/VM Environment,” on page 3 introduces you to VM and its conversational component, CMS. It should help you to get a picture of how you, at a terminal, use and interact with the system. During a terminal session, commands and requests that you enter are processed by different parts of the system. This section describes how and when you can communicate with these different programs.

Chapter 1. Introduction to CMS and the z/VM Environment

The Conversation Monitor System (CMS) is a component of z/VM. To understand what CMS is, and how it works in z/VM, first you must understand the components (environments) of z/VM.

z/VM is an interactive, multiple-access operating system. Interactive means two-way communication between users and z/VM. Multiple-access means many people can use a z/VM system at the same time. Therefore, productivity is increased by sharing data more quickly and easily between you and other users.

With z/VM, you have a functional simulation of a real computer and its associated devices at your fingertips. This functional equivalent of a computing system is called a *virtual machine*.

Virtual machines are not real, but do work like a real system. Your entire organization can use z/VM to share the resources of a single processor, while at the same time every user accesses the system as if they were the only user.

The Control Program (CP) is a component that manages the resources of a single computer so that multiple computing systems appear to exist. When you are working in the CP environment, you are provided with processor functions, input and output devices, and processor storage.

This brings us to the CMS environment. CMS performs two roles: (1) as an end-user interface, it is the part of z/VM that is most often seen by your users, and (2) it is the part of the operating system that supports the running of your programs, thus, it is an application programming interface.

Using CP and CMS Commands

You can use CP and CMS commands, either alone or together, to accomplish a variety of tasks in z/VM. Following are some of the ways you can use CP and CMS commands.

CP Command Language

You use CP commands to communicate with the control program. CP commands control the devices attached to your virtual machine and their characteristics.

Allocating Space

For example, if you want to increase the virtual address space assigned to your virtual machine, use the CP DEFINE command. CP takes care of the space allocation for you and then lets your virtual machine use it.

Receiving Messages

If you are receiving printed output at your terminal and do not want to be interrupted by messages from other z/VM users, you can use the CP SET MSG OFF command to refuse messages, because it is CP that handles communication among virtual machines. The CP QUERY SET command displays the status of the CP SET MSG function and other CP SET command functions.

Sending Messages

CP commands let you send messages to the system operator and to other users.

You can also modify the configuration of devices in your virtual machine. CP commands are available to all virtual machines using z/VM. You can enter these commands when you are in the virtual machine environment using CMS (or some other operating system) in your virtual machine.

Not all CP commands are available to all users; some commands are only available to system administrators or other privileged users. Such commands are not discussed in this document.

Because many CP commands are used with CMS commands when performing a task, some of the CP commands you will most frequently use are discussed in this publication, in the context of their usefulness for a CMS application. These commands and other general CP commands are discussed in detail in *z/VM: CP Commands and Utilities Reference*.

CMS Command Language

The CMS command language lets you create, modify, and debug problems or application programs and, in general, manipulate data files. Many CMS commands are discussed and used as examples in this document. For more information on a command, see *z/VM: CMS Commands and Utilities Reference*.

Storing Files

You can take advantage of two methods for storing your files; you can store them on minidisks or in a file pool. *Minidisks* are areas of direct access storage device (DASD) space assigned to individual users. A *file pool* is a large amount of DASD space containing the files for many users. Within a file pool, you are assigned an individual file space in which you can organize your files. The part of CMS that manages file pools is called the *Shared File System* (SFS). Chapter 3, "Using the Shared File System," on page 41 discusses file pools and directories (individual files organized in hierarchical structures) in more detail.

When you store files in a file pool, you will be able to perform the same functions that you can by using minidisks. In addition, because of the way SFS handles file spaces, you will be able to better organize your files and easily share them with others.

Depending on your system configuration, you may have the option to use both methods of storing files. You could store those files that you may want to share in your SFS file space; other files could be stored on minidisks.

Using XEDIT, the Editor

When you want to create, modify, or manipulate CMS files, you call the editor, XEDIT. After XEDIT is started, you may process XEDIT subcommands and use the REXX/VM interpreter or EXEC 2 macro facility. The REXX/VM interpreter, CMS EXEC interpreter, and the EXEC 2 interpreter provide execution procedures consisting of CP and CMS commands; they also provide the conditional execution capability of a macrolanguage. A *macrolanguage* is a facility that lets you simplify your work by expanding the basic subcommand language, eliminating repetitive tasks, and much more.

Using Virtual Devices

Other CMS commands allow you to read cards from a virtual card reader, punch cards to a virtual card punch, and print records on a virtual printer.

Using HELP

You use the HELP command to display information on how to use CP commands and CMS commands, subcommands, execs, and explanations of CP and CMS messages. You can enter the HELP command when a brief explanation of syntax, a parameter, or function is sufficient, thereby avoiding interrupting your terminal session to refer to a manual.

Using Full-Screen CMS

CMS also lets you use windowing commands and full-screen CMS to help you manage the data on your physical screen. When you set full-screen on, you can type commands from almost anywhere on the physical screen. Full-screen CMS also lets you scroll forward and backward through your CMS session to see commands you entered previously and CMS responses to those commands.

Creating and Running Programs

z/VM supports many programming language environments, such as Ada, AD/Cycle, APL2[®], Assembler, C, C++, COBOL, FORTRAN, Pascal, PL/I, REXX, RPG, and VisualAge[®] Generator. You can find a comprehensive list of language processors that are run under CMS and relevant publications in *z/VM: CMS Application Development Guide*. CMS runs the assembler and the compilers when you load them with CMS commands.

Using Non-English Languages

If your z/VM system supports a language other than English, you can receive messages, view productivity aid panels (like the FILELIST screen), and enter various CMS commands in that language.

You can use the QUERY LANGLIST command to find out the languages that your virtual machine supports. You can also find out what language environment you are currently working in with two QUERY commands:

- The QUERY CPLANG command tells you the language environment for CP.
- The QUERY LANGUAGE command tells you the language environment for CMS.

z/VM lets you change the language you are working in without having to quit your session. The SET LANGUAGE command automatically gets all the information you need to interact with z/VM in another language. SET LANGUAGE also lets you add language information for applications.

For more information about the SET LANGUAGE, QUERY LANGLIST, and QUERY LANGUAGE commands, see *z/VM: CMS Commands and Utilities Reference*. For more information on the QUERY CPLANG command, see *z/VM: CP Commands and Utilities Reference*.

If you want to know more about the languages available on your z/VM system, contact your system administrator.

Using CP from CMS

You can also enter CP commands from within the CMS virtual machine environment.

Using CMS Pipelines

CMS Pipelines lets you solve a complex problem by breaking it up into a series of smaller, less complex programs called *stages*. A series of stages is called a *pipeline*.

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A pipeline operates on a set of data. The output resulting from one stage is the input to the next stage. Each stage manipulates or handles this data. Each stage consists of a stage subcommand and its operands.

You can call CMS Pipelines by issuing the CMS PIPE command interactively or by invoking it from an exec procedure.

z/VM Environments and Mode Switching

This document covers the tasks you can perform using CMS. Many of these tasks involve the interaction of CMS commands and commands or programs used in other environments of z/VM. Because you will be moving from one environment to another, or *mode switching*, you need to know how the environments of z/VM are related, and the paths you need to take to achieve your task.

Figure 1 and Table 1 summarize the paths between the z/VM environments, list the commands and actions you need to move between environments, and describe what to expect when entering commands from each. Additional information on entering commands will be given in “Entering Commands” on page 12.

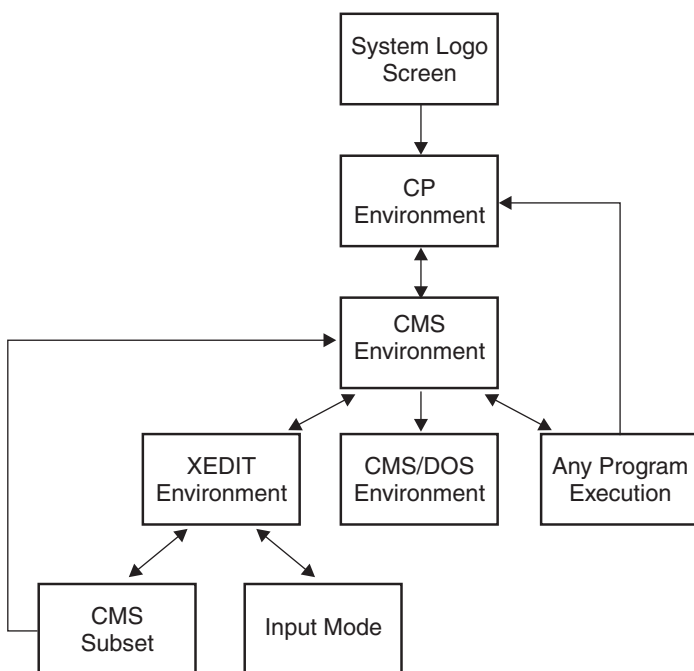


Figure 1. Paths From One Environment to Another

Table 1. Commands Used to Move from One Environment to Another

| To Go From... | To... | Enter This... |
|--------------------|---------------------|---|
| system logo screen | CP environment | LOGON |
| CP environment | CMS environment | IPL CMS or Begin |
| CMS environment | XEDIT environment | XEDIT <i>fn ft fm</i> or XEDIT <i>fn ft</i> |
| CMS environment | CMS/DOS environment | SET DOS ON |
| CMS environment | a program execution | run any OS or CMS program |

Table 1. Commands Used to Move from One Environment to Another (continued)

| To Go From... | To... | Enter This... |
|-----------------------|-------------------|--|
| XEDIT environment | CMS subset | CMS |
| XEDIT environment | input mode | INPUT |
| input mode | XEDIT environment | any input line carriage return, or null line |
| CMS/DOS environment | CMS environment | SET DOS OFF |
| CMS subset | XEDIT environment | RETURN |
| CMS subset | CMS environment | HX |
| XEDIT environment | CMS environment | FILE or QUIT |
| any program execution | CMS environment | HX (or abend) |

Notes:

1. The CP environment may be entered from any other environment using your terminal's Attention key (PA1 or equivalent), or by entering: #cp
2. A CP command can be entered at any time; if you are not in the CP environment, you must prefix your command with #CP. For more information, see Table 3 on page 8.
3. If you return to the environment you were in when you typed CP, you can do so using the BEGIN command. For example, if you were:
 - In the XEDIT environment or in input mode, the current line pointer remains unchanged.
 - Executing a program, execution resumes at the instruction address indicated in the Program Status Word (PSW).

With the exception of input mode in the XEDIT environment, you can always determine which environment your virtual machine is in by pressing the Return or Enter key (either once or twice) with a null line. Table 2 lists responses you receive and the environments they indicate:

Table 2. Determining your Environment from the System Response

| Response | Environment |
|------------|-------------|
| CP | CP |
| CMS | CMS |
| CMS DOS on | CMS/DOS |
| CMS subset | CMS Subset |

CP Environment

After you log on z/VM, your virtual machine is in the CP environment. In this environment, you can enter any CP command that is valid for your privilege class. This publication assumes that you are a general, or class G, user. Only CP commands are valid terminal input in the CP environment. You can find detailed information about each CP command in *z/VM: CP Commands and Utilities Reference*.

You can also enter CP commands from other z/VM environments. There may be times during your terminal session when you want to enter the CP environment to enter one or more CP commands. You can do this from any other environment by doing either of two things:

1. Enter the command:

```
#cp
```

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2. Use your terminal's Attention key (PA1 or equivalent). On a 2741 terminal, you usually press the Attention key twice, quickly, to enter the CP environment.

The CP READ status message (displayed in the lower right corner of your screen) indicates that your virtual machine is in the CP environment.

After entering whatever CP commands you need to use, you can return your virtual machine to the environment or mode that it came from by entering the CP command:

```
begin
```

which *begins* execution of your virtual machine.

Note: After you set full-screen CMS on, the PA1 key no longer serves as an Attention key but performs a windowing function. If you want to use an Attention key to enter the CP environment, you will need to set another key to the attention function. When you set full-screen CMS off, the CP TERMINAL BRKKEY remains as NONE. To reset it to PA1 (the initial setting), use the CP TERMINAL command. For more information, see the BRKKEY option of the CP TERMINAL command in *z/VM: CP Commands and Utilities Reference*.

CMS Environment

You enter the CMS environment from CP by entering the IPL command, which loads CMS into your virtual storage area. If you are planning to use CMS for your entire terminal session, you should not have to IPL again unless a program error forces you into the CP environment.

When you enter the IPL command, specify the name of the CMS named saved system at your installation. For example:

```
ipl cms
```

When your virtual machine is in the CMS environment, you can enter any CMS command and any of the CP commands that are valid for your user privilege class. You can also run many of your own OS or DOS programs. For more information on running OS or DOS programs, see *z/VM: CMS Application Development Guide for Assembler*.

Table 3 lists the ways that you can enter CP commands from the CMS environment.

Table 3. Using CP Commands in a CMS Environment

| Command | Description |
|--------------------------------------|--|
| Using the implied CP function of CMS | This function is controlled by the SET IMPCP command. If IMPCP=ON, command names unrecognizable to CMS are considered a CP command and are sent to CP. You can determine whether the implied CP function is in effect for your virtual machine by entering the command: <pre>query impcp</pre> If the response is IMPCP = OFF, you can change it by entering: <pre>set impcp on</pre> |
| Using a CP command | For example, you can enter the following: <pre>cp close punch</pre> |

Table 3. Using CP Commands in a CMS Environment (continued)

| Command | Description |
|------------------------|--|
| Using the #CP function | <p>This function lets you preface any CP command with the characters #CP, followed by one or more blanks, which passes the command to the control program <i>immediately</i>, bypassing any processing by the CMS virtual machine. For example:</p> <pre>#cp set msg off</pre> <p>The #CP function can be used in any z/VM environment, and you can enter it even when a program is executing.</p> |

Notes:

1. When the implied CP function is set off, you must use either the CP command or the #CP function to enter CP commands from the CMS environment. CP commands that you process in EXEC procedures should be prefaced by the CP command, regardless of the implied CP setting.
2. When you enter CP commands from the CMS environment either implicitly or with the CP command, you receive, in addition to the CP response (if any), the CMS ready message. If you use the #CP function, you do not receive the ready message.

CMS Virtual Machine Environments

z/VM provides two versions of CMS:

- ESA/390 CMS (generally referred to simply as CMS)

CMS runs in the following virtual machine architectures:

- ESA/390 (ESA or XA virtual machine)

An ESA virtual machine simulates IBM Enterprise Systems Architecture/390 (ESA/390). The XA virtual machine designation is supported for compatibility; an XA virtual machine is functionally equivalent to an ESA virtual machine.

- ESA/XC (XC virtual machine)

An XC virtual machine processes according to IBM Enterprise Systems Architecture/Extended Configuration (ESA/XC), which is an architecture unique to virtual machines. Although XC virtual machines run with dynamic address translation off, they can take advantage of a subset of dynamic address translation architectural features, and in particular, data spaces.

- z/Architecture CMS (z/CMS)

z/CMS runs in IBM z/Architecture 31-bit addressing mode in an ESA or XA virtual machine and enables CMS programs to use z/Architecture instructions, including those that operate on 64-bit registers, while permitting existing ESA/390 architecture CMS programs to continue to function without change.

To enter the z/CMS environment, issue the IPL command with the name of the z/CMS named saved system. For example:

```
ipl zcms
```

z/CMS switches your ESA/390 (ESA or XA) virtual machine to z/Architecture mode and thereafter executes in that mode.

Unless otherwise indicated, “CMS” means either version, and descriptions of CMS functions apply to both CMS and z/CMS. For information on the differences between z/CMS and CMS, see *z/VM: CMS Planning and Administration*.

The XEDIT Environment, Input Mode, and CMS Subset

XEDIT is a z/VM facility that lets you create and modify data files that reside on minidisks or SFS directories. The editor, or edit environment, is entered when you enter the CMS command XEDIT, specifying the identification of a data file you want to create or modify. Complete information about the editor is found in *z/VM: XEDIT Commands and Macros Reference* and *z/VM: XEDIT User's Guide*. For introductory tutorial information about editing, see *z/VM: CMS Primer*.

For example, to enter the edit environment to either create a file called PARTY SUPPLIES or to make changes to a file that already exists under that name, you would enter:

```
xedit party supplies
```

When you enter the edit environment, your virtual machine is automatically in edit mode, where you can enter XEDIT subcommands, CMS commands, or CP commands. After you enter the XEDIT subcommand:

```
input
```

data lines that you enter are considered input to the file. To return to edit mode, you must press Enter twice.

If you enter the XEDIT subcommand:

```
cms
```

the editor gives the following response to indicate you are in CMS subset mode:

```
CMS subset
```

At this point, you can enter any CMS command that is allowed in CMS subset mode. Commands that run in the user area are not allowed in the CMS subset environment. You can also enter CP commands. To return to edit mode, you use the special CMS subset command, RETURN. If you enter the HX (Halt Execution) command, your editing session abends and your virtual machine returns to the CMS environment.

For more information on CMS subset, see *z/VM: XEDIT Commands and Macros Reference*.

When you are finished with an edit session, you return to the CMS environment by issuing the FILE subcommand, which indicates that all modifications or data insertions that you have made should be written onto a minidisk or SFS directory. Otherwise, you can enter the subcommand QUIT, which tells the editor not to save any modifications or insertions made after the last time the file was written.

CMS/DOS

If you are a Virtual Storage Extended (VSE) user, the CMS/DOS environment provides you with all the CMS interactive functions and facilities, as well as special CMS/DOS commands that simulate VSE functions. The CMS/DOS environment becomes active when you enter the command:

```
set dos on
```

When your virtual machine is in the CMS/DOS environment you can enter any command that would be valid in the CMS environment, including the facilities of XEDIT, DEBUG, and EXEC. You cannot enter CMS commands or program modules that load programs, run programs, or both, using OS macros or functions.

The following commands are provided in CMS/DOS to test and develop DOS programs, and to provide access to VSE libraries:

| | | |
|----------|--------|--------|
| ASSGN | DOSPLI | LISTIO |
| CATCHECK | DSERV | OPTION |
| DLBL | ESERV | PSERV |
| DOSLIB | FETCH | RSERV |
| DOSLKED | FCOBOL | SSERV |

Your virtual machine leaves the CMS/DOS environment when you enter the command:

```
set dos off
```

If you reload CMS (with an IPL command) during a terminal session, you must also reenter the SET DOS ON command to return to the CMS/DOS environment.

Note: The CMS/DOS environment does not support System/370 (370 mode) applications. You will need to use the CP 370 Accommodation Facility to execute 370 applications in this environment. For information about the CP 370 Accommodation Facility, see *z/VM: CP Programming Services*.

For more information about the CMS/DOS environment, see *z/VM: CMS Application Development Guide for Assembler*.

Protected Application Environment

A protected application environment provides special enhancements to prevent users with no need to interact with CP from accidentally entering the CP environment.

When you are operating in a protected application environment:

- Pressing the Attention key will not cause you to enter CP mode.
- The terminal break key is set to NONE.
- CP attempts to start an automatic re-IPL upon encountering an error that causes CMS toabend.

A protected application environment is entered by using the CONCEAL option of the SET command or the directory OPTION control statement. Your system administrator sets the directory OPTION control statement to place you in a protected application at log on time. You can use the CONCEAL option of the SET command to enter a protected application at any time during your terminal session by entering:

```
set conceal on
```

Either way a protected application is entered, the terminal break key will always be set to NONE. SET CONCEAL OFF returns the break key to its default setting of PA1 for local, remote, and Virtual Telecommunications Access Method (VTAM[®]) 3270 graphics terminals.

For more information on the SET CONCEAL command, see *z/VM: CP Commands and Utilities Reference*.

Entering Commands

When you are running your virtual machine under z/VM, each command, or request for work, that you enter on your terminal is processed as it is entered. Usually, you enter one command at a time and commands are processed in the order that you enter them. You can enter CP commands from either the CP or CMS environment, but you cannot enter CMS commands while in the CP environment.

After you have typed in the line you wish to enter, you press the Return or Enter key on the keyboard. When you press this key, the line you have entered is passed to the command environment you want to have process it. If you press this key without entering any data, you have entered a *null line*. Null lines sometimes have special meanings in z/VM.

If you make a mistake entering a command, z/VM tells you what your mistake was, and you must enter the line again. The examples in this publication assume that the commands are correctly entered.

You can enter commands using any combination of uppercase and lowercase characters; z/VM translates your input to uppercase.

To enter a command from a display terminal when you use it as a virtual machine console under z/VM, type the command and press Enter. The keyboard is never locked during the execution of a command or program, so you can enter successive commands without waiting for the completion of the previous command. This *stacking function* can be combined with the other methods of stacking lines, such as using the logical line end symbol (#) to stack several commands. To stack commands with the logical line end symbol, type the commands on the command line, separate them with #'s, but do not press Enter until you have typed all the commands you want done at one time. For example, you might enter the following commands:

```
cp query time # cp query reader all # receive
```

First the system will display the time, then the contents of your virtual reader, and then will read in the first file in your virtual reader.

If, however, you enter more lines than your terminal can accommodate, you receive the status message NOT ACCEPTED, and you must wait until the buffer is cleared before you can enter the line.

If there are commands that you use frequently, you can set the *program function keys* (PF keys) on your terminal to process them. Although there is one set of function keys (1 through 24) on your terminal, these keys can have different settings in various environments.

For example, when you first LOGON, you might set your PF keys to perform certain functions. Then, when you enter different CMS environments, your PF keys may have entirely different settings. Chapter 10, "Introducing Full-Screen CMS," on page 253 provides details on PF keys in full-screen CMS and in the Window Manipulation (WM) environment. The remainder of this section will concentrate on setting PF keys for use when full-screen CMS is set off.

Some examples of commands you might wish to catalog on your CP and CMS PF keys are:

```
#CP QUERY READER ALL
#CP QUERY PRINTER ALL
QUERY ACCESSED
```

To set function keys 1, 2, and 3 to perform these command functions, enter:

```
cp set pf1 immed "#cp query reader all
cp set pf2 immed "#cp query printer all
cp set pf3 immed query accessed
```

Note: When you want to process a #CP function with a PF key, or you want a PF key to run a series of commands, you must use the logical escape symbol (") when you enter the SET command.

You can change a PF key setting any time during a terminal session, according to your needs. For example, you can change the setting of the PF5 key by entering:

```
cp set pf5 immed xedit test file"#bo"#input line"#file
```

sets the PF5 key as:

```
XEDIT TEST FILE#BO#INPUT LINE#FILE
```

Then, when you press PF5, z/VM will XEDIT a file called TEST FILE, input the word line, and write the file to file mode A.

Note: Throughout this document, you may see references to the term *file mode A*. This term refers to a minidisk or SFS directory that is accessed with a file mode of A. You may also see references to *A-disk*, which is another term sometimes used to refer to the directory or minidisk accessed with a file mode of A.

You can also set all of your PF keys in your PROFILE EXEC so they are set each time you load CMS. To change the setting of the PF5 key in your PROFILE EXEC, you could add to your PROFILE EXEC the line:

```
CP SET PF5 IMMED XEDIT TEST FILE #BO# INPUT LINE #FILE
```

Then, the next time you load CMS, the PF5 key will be set to perform this function. In this instance, you would not need to include the logical escape characters (") because the command was entered from a file.

The above examples use the IMMED operand of the CP SET command, which specifies that the function is performed as soon as you press the PF key. You can also set a key so that it is *delayed*, which results in the command or data line being placed in the user input area. Then, you must press Enter to process the command. For example:

```
cp set pf1 "#cp query rdr all
```

would place the following command in the user input area when PF1 was entered:

```
#cp query rdr all
```

The user would then press Enter for the command to be processed. The default setting is DELAY for PF keys.

With delay, it is possible to modify the line before you enter it. For example, you might set a key as:

```
QUERY ACCESSED X@
```

When you press this PF key, the command is placed in the user input area, with the cursor positioned following the "@" logical character delete symbol; you can

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enter the mode letter of the directory or minidisk you are querying before you press Enter to process the command. If you enter *A*, the *X* is deleted, and the resulting command as seen by CMS is `QUERY ACCESSED A`. For more information on using the logical character delete symbol, see the section on “Logical Line Editing Symbols” in *z/VM: CP Commands and Utilities Reference*.

How z/VM Responds to Your Commands

CP and CMS respond differently to different types of requests. All CMS command responses (and all responses to CP commands that are entered from the CMS environment) are followed by the CMS ready message. The form of the ready message can vary, because it can be changed using the SET command. The long form of the ready message is:

```
Ready; T=7.36/19.89 09:26:11
```

If you have entered the command:

```
set rdymsg smsg
```

to set the ready message to the short form, the ready message looks like:

```
Ready;
```

When you enter a command incorrectly, you receive a message describing the error. The ready message contains the return code from the command. By default, a return code of up to 10 digits in length displays as part of the ready message.

For example:

```
Ready(00028);
```

indicates that the return code from the command was 28.

```
Ready(200000);
```

indicates that the return code from the command was 200000.

Note that at least 5 digits are displayed. Leading zeros are added on the left as needed. A ready message from the command may contain a negative return code; for example:

```
Ready(-0001);
```

indicates that the return code from the command was -1. Note that at least 4 digits are displayed when the return code is negative.

The number of digits displayed for the return code depends on the SET RDYMSG command. For more information, see *z/VM: CMS Commands and Utilities Reference*.

Some Sample CP and CMS Command Responses

If you enter a CP or CMS command that requests information about your virtual machine, the response should be the information requested. For example, if you enter the command:

```
query reader * all
```

CP responds by showing you the contents of your reader. For example:


```

ORIGINID FILE CLASS RECORDS CPY HOLD DATE TIME NAME TYPE DIST
BROWNL 1725 A PUN 00000009 001 NONE 05/22 10:59:10 BROWNL NOTE G67/33
DEBBIEB 0711 A PUN 00000016 001 NONE 05/21 13:02:54 DEBBIEB NOTE G42/02

```

Similarly, if you enter the CMS command:

```
listfile * assemble c
```

you might receive the following information:

```

JUNK ASSEMBLE C1
MYPROG ASSEMBLE C1

```

If you enter a CP command to alter your virtual machine configuration or the status of your spool files, CP responds by telling you that the task is accomplished. For example, the response to:

```
purge reader all
```

might be:

```
0004 FILES PURGED
```

Some CP commands, those that alter some of the characteristics of your virtual machine, give you no response at all. For example, the following command will return no response from CP:

```
spool e class x hold
```

Certain CMS commands may issue prompting messages, to request you to enter more information. The following SORT command, which sorts CMS files, is an example.

```
sort in file al out file al
```

It prompts you with the message:

```
DMSRT604R Enter sort fields:
```

You then specify which fields you wish the input records to be sorted on.

Storing Your Files

You will be using CMS on a virtual machine. A virtual machine is similar to a real machine in that it has access to DASD storage. This storage is either on a minidisk or within an SFS file pool.

A minidisk is a location on a real DASD that has been allocated for storage of a user's files. Minidisks are defined using CP, and can also be formatted for use as an OS (Operating System) or DOS (Disk Operating System) disk.

A *storage group* is a subset of minidisks within an SFS file pool. Within a storage group, potential space is allocated for a user. This individual allocation of space is called a user's *file space*. In each user's file space, individual files are organized in hierarchical structures called *directories*. File spaces can contain CMS files or CMS simulations of OS (Operating System) data sets. There are two kinds of directories, those that have the *file control* (FILECONTROL) attribute, and those that have the *directory control* (DIRCONTROL) attribute. Later the differences between the two

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kinds of directories will be discussed. For now, just remember that there are two kinds of directories that let you do different kinds of work on the files within them.

For CMS applications, it does not matter whether your files are stored within a file space or on a minidisk. Regardless of the location of your data, CMS commands will generally function the same.

If you use SFS, your files will be stored in a file space allocated for you by your system administrator. For more information on the size of your SFS file space, you can use the QUERY LIMITS command. For more information on the QUERY LIMITS, see *z/VM: CMS Commands and Utilities Reference*.

To share SFS files, you grant other users authority to the files or directories of your choice. They do not need to link to your minidisks to share your files.

Console Output

When you use a 3270 terminal as your virtual machine console, you do not ordinarily retain a console log, as you do on a typewriter terminal. There are many circumstances in which you may want a printed record of your console output. It could be to obtain a copy of program-generated output, or to retain a record of CP and CMS commands that resulted in an error condition. There are two techniques you can use in z/VM to obtain hard copy representations of display terminal sessions: spooling console output and the 3270 copy function.

Spooling Console Output

The CP SPOOL command provides the CONSOLE operand, which lets you begin and end console spooling. Enter:

```
spool console start
```

when you want to begin recording your terminal session, and:

```
spool console stop
```

when you have finished. In between, you can periodically close the console file to release for printing whatever has been spooled thus far:

```
spool console close
```

Other operands that you can enter are the same as you might specify for any printer file, such as CLASS, COPY, CONT, and HOLD. For more information, see "Some Options Available on the CP SPOOL Command" on page 181.

An alternate technique is to spool your console to your own virtual reader:

```
spool console start * class a
```

Then, when you close the console file, instead of being released to the CP printer spool file queue, it is routed to your virtual reader and you can load it onto an accessed minidisk or SFS directory as a CMS file. You would do this by receiving the console file using the RDRLIST command. You can then use the editor to examine it (or to delete sections you do not need) and use the PRINT command to obtain a printed copy.

For full-screen CMS:

- You will need to use logfiles to spool information from your terminal. When you set full-screen on, by default, messages and warnings are logged for you. Messages are logged to a file with the file name and file type of MESSAGE LOGFILE; warnings are logged to WARNING LOGFILE.
- You can create a log of your CMS output or other output. To do this, after you are in full-screen CMS, enter the command SET LOGFILE CMS ON. Your output is then sent to a file with the file name and file type of CMS LOGFILE. Later, you could XEDIT or print this file to obtain a hard copy of the work you completed. For more information on the SET LOGFILE command, see *z/VM: CMS Commands and Utilities Reference*.

Copying Your Screen

If you are using a 3270 or 3290 display terminal, and you have a 3286, 3287, 3288, or 3289 printer, you can copy the entire screen display currently appearing on the screen. To copy the screen, you have to assign the copying function to a PF key with the CP SET PFnn COPY command.

Then, whenever you want to copy a screen display, you can press a key (whichever PF key you set). The display is printed on the printer you specified using the SET PFnn COPY command. If, when you press the PF key, the screen status area indicates NOT ACCEPTED, it means that the printer is either not ready or not available. When you press the PF key and receive no response, it means that the screen has been copied.

There is a print matrix available to the 3274 and 3276 user that allows control of the display to printer operations. In addition, a local print key is provided on the display terminal that is used for copy operations.

When you use the copy function to copy a screen, all 24 lines of the display screen are copied. For additional information, see *z/VM: CP Commands and Utilities Reference*.

Within the edit environment, you can copy your screen by assigning a PF key using the XEDIT subcommand, SET PFn with COPYKEY option. For example, you could enter the following subcommand:

```
set pf9 copykey
```

To print an edit screen, you could then press PF9. Figure 2 on page 18 is an example of a 3270 screen display that could be copied on the printer. The line:

```
X E D I T 1 File
```

is the screen status area for a remotely attached 3270; if locally attached, this area is blank. You can use the user input area of your screen to type in comments, or your name or user ID, if several users are spooling copy files.

```

ZOOKEEP FILELIST  A0  V 108  Trunc=108 Size=8 Line=1 Col=1 Alt=0
Directory = VMSYSU:ZOOKEEP.
Cmd Filename Filetype Fm Format Lrecl Records Blocks Date Time
ANIMAL DATA A1 V 95 34 1 8/04/00 21:12:04
BANANA DATA A1 V 95 29 1 8/04/00 20:58:07
BEAR NOTE A1 V 107 281 5 8/04/00 17:59:00
HONEY DATA A1 V 92 101 2 8/02/00 15:33:05
LION NOTE A2 V 75 28 1 7/25/00 12:10:03
ALL NOTEBOOK A0 V 120 277 4 7/24/00 9:14:02
TIGER NOTE A1 V 26 7 1 7/23/00 16:50:06
ZOOKEEP NETDATA A1 V 80 489 10 6/26/00 16:05:08

1= Help 2= Refresh 3= Quit 4= Cancel 5= Sort(dir) 6= Sort(size)
7= Backward 8= Forward 9= FL /n 10= Share 11= XEDIT/LIST 12= Cursor

====> John Doe - sample screen to be copied

X E D I T 1 File

```

Figure 2. 3270 Screen Display

For more information about copying screens in XEDIT, see the COPYKEY option of the SET PF command in *z/VM: XEDIT Commands and Macros Reference*.

If you are using full-screen CMS, you can copy your screen with the PSCREEN PUT command. This command sends a copy of your physical screen to a CMS file which you can later XEDIT or print. For more information, see *z/VM: CMS Commands and Utilities Reference*.

Interrupting Program Execution

When you are executing a program under CMS or executing a CMS command, your virtual machine is not available for you to enter commands. There are, however, ways that you can interrupt a program and halt its execution either temporarily (in which case you can resume its execution), or permanently (in which case your virtual machine returns to the CMS environment). In both cases, you interrupt execution by creating an *attention interruption*, which may take two forms, an attention interruption to:

- Your virtual machine operating system
- The control program.

Using the Attention Key

Attention interrupts result in what are known as VM or CP *reads* being presented to your virtual console. The two keys on your 3270 keyboard that signal interruptions are the PA1 key (REQ key on a 3278 Model 2A) and the Enter key. Throughout this publication, interruption signaling has been described in terms of the *Attention key*.

You can enter the CP environment by pressing the PA1 key. Whenever you press this key, your virtual machine is placed in a CP READ status, and you can enter any CP command. From the CP environment, you must enter the CP command BEGIN to resume execution of your virtual machine. On a typewriter terminal, the keyboard unlocks when a read occurs.

Whether you have to press the Attention key once or twice depends on the terminal mode setting in effect for your virtual machine. This setting is controlled by the CP TERMINAL command:

```
terminal mode vm
```

The setting VM is the default for virtual machines; you do not need to specify it. The VM setting indicates that one depression of the Enter key sends an interruption to your virtual machine, and one depression of the PA1 key results in an interruption to CP.

The CP setting for terminal mode, which is the default for the system operator, indicates that one depression of the Attention key, either PA1 or Enter, results in an interruption to CP. If you are using your virtual machine to run an operating system other than CMS, you might wish to use this setting. Enter the command:

```
terminal mode cp
```

Notes:

1. In any fullscreen environment, like Fullscreen CMS or XEDIT, all PF keys, all PA keys, the Enter key, and the Clear key cause virtual machine I/O interruptions.
2. After you set full-screen CMS on, the PA1 key no longer serves as an Attention key, but performs a windowing function. If you want to use a break key, you will need to set another key to the attention function. When you set full-screen CMS off, the CP TERMINAL BRKKEY remains as NONE. To reset it to PA1 (the initial setting), enter the CP TERMINAL command.

Interrupting Your Programs

HX (Halt Execution), HT (Halt Typing), and RT (Resume Typing) are three of the CMS *Immediate commands*. They are immediate because they are processed as soon as they are entered. Unlike other commands, they are not stacked in the console stack. On a display terminal, you can enter an Immediate command, such as HT or HX, whenever your virtual machine is in a running status, without having to signal an interruption before you enter the command. On a typewriter terminal, you must press the Attention key once to cause a virtual machine-check interruption (if the terminal mode is set to VM) before you can enter an Immediate command.

Sometimes, however, if your terminal is rapidly displaying output you must wait until the screen is full and the screen status area indicates a MORE... status before you attempt to enter the HT or HX command.

The Enter key can also be used as an interruption signaling key. If you press it once when your virtual machine is running, you will place your virtual machine in the VM READ status, so you can enter a command.

While in VM READ, you can pass null lines or Immediate commands to CMS. This procedure is particularly useful when you wish to stop execution of an exec that is issuing VM READs to the terminal. You can type HI or HX and have it passed to CMS without being read and interpreted as data by the exec. At the VM READ, use the cursor movement key to move the cursor back one space from its current position at the command line. (This results in the cursor being positioned in the lower right corner of the screen, three lines up from the bottom). Press Enter. If your cursor is not returned to the command line (for example, when using VTAM), use the cursor movement key to move the cursor back to the command line. Your

Introduction

terminal will remain in VM READ status. At this point, you enter HI, HX, or any Immediate command, or if you wish to resume execution of the exec, enter the next line of data.

If you are in either line mode or full-screen CMS and wish to interrupt execution of an exec issuing a read (indicated by a VM READ status in line mode, or Enter your response in vscreen CMS in full-screen CMS), type any Immediate command with prefix #. Instead of being passed to the exec, your command will be interpreted immediately. For instance, to halt interpretation of the exec, you would type #HI.

When you are entering an Immediate command with a prefix of #, nothing else may be entered along with the Immediate command. For example, if you type ABCD#HI (where ABCD is any data) then ABCD will be passed to the exec and HI will be placed in the console stack. The HI Immediate command will not be processed (not even when the exec issues another read). If you type HI#ABCD, then HI will be passed to the exec and ABCD will be placed on the console stack.

Note: The Immediate command HT is the only exception to this rule. You are permitted to follow a line of data with #HT. For example, if you enter ABCD#HT in response to a read by an exec, then the HT command will be processed first and ABCD will be passed to the exec.

Halting Screen Displays

When your terminal is displaying successive screens of output from a program or a CMS command, use the HT or HX Immediate commands to halt the display or the execution of the command, respectively. If your terminal is writing the information at a very rapid rate, you can have difficulty entering the HT or HX command. In these circumstances, press PA1 (or equivalent) to place your terminal into the CP environment (indicated by the CP READ in the screen status area). Then, you use either the CP REQUEST or ATTN command to signal a virtual machine read. When the screen status area indicates VM READ, you enter HX or HT. The program halts execution, your terminal accepts an input line, and you can:

- Terminate the execution of the program by issuing an Immediate command to halt execution:

```
hx
```

The HX command causes the program toabend.

Note: If you get no response after using the HX command, you should enter #CP, and then enter IPL CMS to reload CMS. After you receive the VM READ status in the lower-right corner of your screen, press the Enter key once more.

- Enter a CMS command. The command is stacked in a console stack and is processed by CMS when your program is finished executing and the next virtual machine read occurs. For example:

```
print abc listing
```

After you enter this line, the program resumes execution.

- If the program is directing output to your terminal and you wish only to halt the terminal display, use the Immediate command:

```
ht
```

The program resumes execution. Terminal output can also be immediately suppressed when you enter a command by placing #HT after the command. For example, to suppress output from the TAPE DUMP command, you would enter:

```
tape dump #ht
```

The logical line end character (#) lets the Immediate command HT be accepted; program execution proceeds without typing.

You can, if you want, cause another interruption and request that typing be resumed by entering the RT (resume typing) command:

```
rt
```

- Enter a null line; your program continues execution. The null line is stacked in the console stack and read by CMS as a stacked command.

Immediate commands that are entered while a command or program is running (the status is not VM READ or Enter your response in vscreen CMS) should not have a prefix of #. If they are, they will not be processed at the time they are entered. Instead, they will be processed when the next read is issued.

Control Program Interruptions

You can interrupt a program and directly enter the CP environment by pressing the PA1 key on a 3270 or by pressing the Attention key twice, quickly, on a 2741. Then, you can enter any CP command. To resume the execution of the program, enter the CP command:

```
begin
```

If your terminal is operating with the terminal mode set to CP, pressing the Attention key once places your virtual machine in the CP environment.

Note: Remember that in full-screen CMS mode, PA1 pops the WM window. If you wish to override this default setting, use the BRKKEY option of the CP TERMINAL command. When you set full-screen CMS off, the CP TERMINAL BRKKEY remains as NONE. To reset it to PA1 (the default setting), use the CP TERMINAL command. For more information, see *z/VM: CP Commands and Utilities Reference*.

The CP TRACE Command

You can use the CP TRACE command to monitor events that occur in your virtual machine. This lets you analyze the operation of your virtual machine and debug problems. z/VM lets you trace a number of events, including:

- Instruction execution
- Storage alteration
- Register alteration
- I/O activity.

Each traced event results in a trace entry, a command response that you can have sent to your virtual console, to a virtual printer, or to both. The trace entry contains a significant amount of information about the event. For a full explanation of how to use the trace facility, along with examples, see *z/VM: Virtual Machine Operation*.

Using the 3270 Text Feature

If you have a 3277 or 3278 display station equipped with the Data Analysis Text keyboard, you can type in, as well as display, all of the special text characters. For a description of these characters, see *z/VM: CMS Application Development Guide*. These characters are in addition to those available with standard EBCDIC 3270 terminals. To obtain a printed copy of your screen, see “Copying Your Screen” on page 17.

When you want to activate the text feature, and use the special characters, enter the command:

```
terminal text on
```

The `TERMINAL TEXT ON` command automatically forces the `TERMINAL APL OFF` command. Now, you can use any of the special characters when you enter, change, or locate text lines in a file.

You leave the special text environment by entering the command:

```
terminal text off
```

For more information on using the `SET TEXT` commands to select appropriate translation tables for special characters, see *z/VM: CMS Commands and Utilities Reference* and *z/VM: XEDIT Commands and Macros Reference*.

Error Situations

If you do not have the appropriate text hardware feature on your 3270, but attempt to display a file that contains the characters, the characters appear as blanks on a 3277, and as hyphens on a 3276 and a 3278.

If you inadvertently enter the `TERMINAL TEXT ON` command while using a terminal that does not have the text capability, you must do the following to return to regular operating procedures:

1. Press the PA1 key to enter the CP environment.
2. Enter, in uppercase letters only, the command:

```
TERMINAL TEXT OFF
```

Notes:

1. The 3270 text hardware feature is activated by a key, not a switch. Each time you press the `TEXT On/Off` key, you reverse its setting. If your terminal has a red light on the text keyboard, it will be illuminated when the text feature is on.
2. Compound characters, such as a character/-backspace/-character combination, are still entered and displayed as three characters. The screen position occupied by the backspace character appears as a blank because the character (X'16') is nondisplayable. For more information on displaying nondisplayable characters, see the description of the `SET NONDISP` commands in *z/VM: CMS Commands and Utilities Reference* and *z/VM: XEDIT Commands and Macros Reference*.

Syntax, Message, and Response Conventions

The following topics provide information on the conventions used in syntax diagrams and in examples of messages and responses.




How to Read Syntax Diagrams

Special diagrams (often called *railroad tracks*) are used to show the syntax of external interfaces.

To read a syntax diagram, follow the path of the line. Read from left to right and top to bottom.

- The \blacktriangleright — symbol indicates the beginning of the syntax diagram.
- The — \blacktriangleright symbol, at the end of a line, indicates that the syntax diagram is continued on the next line.
- The \blacktriangleright — symbol, at the beginning of a line, indicates that the syntax diagram is continued from the previous line.
- The — \blacktriangleleft symbol indicates the end of the syntax diagram.

Within the syntax diagram, items on the line are required, items below the line are optional, and items above the line are defaults. See the following examples.

| Syntax Diagram Convention | Example | | | | | | | | | | | | | | |
|---|---|---|----------|---|-------|---|-------|---|------------|---|--------|----|-------------|---|--------|
| <p>Keywords and Constants:</p> <p>A keyword or constant appears in uppercase letters. In this example, you must specify the item KEYWORD as shown.</p> <p>In most cases, you can specify a keyword or constant in uppercase letters, lowercase letters, or any combination. However, some applications may have additional conventions for using all-uppercase or all-lowercase.</p> |  | | | | | | | | | | | | | | |
| <p>Abbreviations:</p> <p>Uppercase letters denote the shortest acceptable abbreviation of an item, and lowercase letters denote the part that can be omitted. If an item appears entirely in uppercase letters, it cannot be abbreviated.</p> <p>In this example, you can specify KEYWO, KEYWOR, or KEYWORD.</p> |  | | | | | | | | | | | | | | |
| <p>Symbols:</p> <p>You must specify these symbols exactly as they appear in the syntax diagram.</p> | <table border="0"> <tr> <td>*</td> <td>Asterisk</td> </tr> <tr> <td>:</td> <td>Colon</td> </tr> <tr> <td>,</td> <td>Comma</td> </tr> <tr> <td>=</td> <td>Equal Sign</td> </tr> <tr> <td>-</td> <td>Hyphen</td> </tr> <tr> <td>()</td> <td>Parentheses</td> </tr> <tr> <td>.</td> <td>Period</td> </tr> </table> | * | Asterisk | : | Colon | , | Comma | = | Equal Sign | - | Hyphen | () | Parentheses | . | Period |
| * | Asterisk | | | | | | | | | | | | | | |
| : | Colon | | | | | | | | | | | | | | |
| , | Comma | | | | | | | | | | | | | | |
| = | Equal Sign | | | | | | | | | | | | | | |
| - | Hyphen | | | | | | | | | | | | | | |
| () | Parentheses | | | | | | | | | | | | | | |
| . | Period | | | | | | | | | | | | | | |
| <p>Variables:</p> <p>A variable appears in highlighted lowercase, usually italics.</p> <p>In this example, <i>var_name</i> represents a variable that you must specify following KEYWORD.</p> |  | | | | | | | | | | | | | | |

Syntax Diagram Convention

Example

Repetitions:

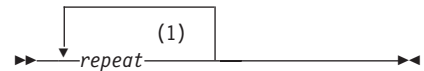
An arrow returning to the left means that the item can be repeated.



A character within the arrow means that you must separate each repetition of the item with that character.



A number (1) by the arrow references a syntax note at the bottom of the diagram. The syntax note tells you how many times the item can be repeated.



Syntax notes may also be used to explain other special aspects of the syntax.

Notes:

- 1 Specify *repeat* up to 5 times.

Required Item or Choice:

When an item is on the line, it is required. In this example, you must specify A.

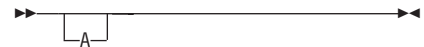


When two or more items are in a stack and one of them is on the line, you must specify one item. In this example, you must choose A, B, or C.



Optional Item or Choice:

When an item is below the line, it is optional. In this example, you can choose A or nothing at all.



When two or more items are in a stack below the line, all of them are optional. In this example, you can choose A, B, C, or nothing at all.



Defaults:

When an item is above the line, it is the default. The system will use the default unless you override it. You can override the default by specifying an option from the stack below the line.



In this example, A is the default. You can override A by choosing B or C.

Repeatable Choice:

A stack of items followed by an arrow returning to the left means that you can select more than one item or, in some cases, repeat a single item.

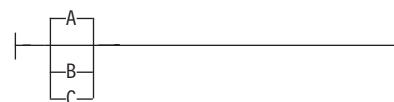


In this example, you can choose any combination of A, B, or C.

Syntax Diagram Convention**Example****Syntax Fragment:**

Some diagrams, because of their length, must fragment the syntax. The fragment name appears between vertical bars in the diagram. The expanded fragment appears in the diagram after a heading with the same fragment name.

In this example, the fragment is named "A Fragment."

**A Fragment:****Examples of Messages and Responses**

Although most examples of messages and responses are shown exactly as they would appear, some content might depend on the specific situation. The following notation is used to show variable, optional, or alternative content:

- xxx* Highlighted text (usually italics) indicates a variable that represents the data that will be displayed.
- [] Brackets enclose optional text that might be displayed.
- { } Braces enclose alternative versions of text, one of which will be displayed.
- | The vertical bar separates items within brackets or braces.
- ... The ellipsis indicates that the preceding item might be repeated. A vertical ellipsis indicates that the preceding line, or a variation of that line, might be repeated.

Message and Response Notation

This document might include examples of messages or responses. Although most examples are shown exactly as they would appear, some content may depend on the specific situation. The following notation is used to show variable, optional, or alternative content:

- xxx* Highlighted text (usually italics) indicates a variable that represents the data that will be displayed.
- [] Brackets enclose an optional item that might be displayed.
- { } Braces enclose alternative items, one of which will be displayed.
- | The vertical bar separates items within brackets or braces.
- ... The ellipsis indicates that the preceding item might be repeated. A vertical ellipsis indicates that the preceding line, or a variation of that line, might be repeated.

Introduction

Working with CMS Files

File management is one of the primary functions of CMS. You need to know how to name files, organize them, store and print them, and share them with other users. The following topics teach you these tasks and more.

Chapter 2, “CMS File System,” on page 29 discusses the data and programs that you create that are stored in *files*. These files are stored in Shared File System (SFS) directories or on minidisks. This section introduces you to the creation and handling of CMS files.

Chapter 3, “Using the Shared File System,” on page 41 provides details on the functions you can perform and the commands available to you when you store your files in a Shared File System (SFS) file pool.

Chapter 4, “Storing Your Files on Minidisks,” on page 113 provides details on how to manage files stored on minidisks.

Chapter 5, “More on the CMS File System,” on page 121 contains more detailed discussion on CMS files and CMS commands. Information on reserved file types, how file mode letters and numbers are used in SFS and minidisk environments, and CMS command search order and execution characteristics, are examples.

Chapter 6, “Using Real Printers, Punches, and Readers,” on page 181 discusses how to store and retrieve CMS files on punched cards, and how to use your virtual printer and punch to get real output.

Chapter 7, “Using Tapes,” on page 189 discusses how to store and retrieve CMS files on tape, using tape devices, and the use of tape commands.

Chapter 2. CMS File System

The file is the essential unit of data in CMS. Files in CMS are unique and cannot be read or written using other operating systems. When you create a file in CMS, you name it using a file identifier (file ID). The file ID consists of three fields:

- File Name (fn)
- File Type (ft)
- File Mode (fm) or Directory Name (dirname).

When you use CMS commands and programs to modify, update, or refer to files, you must identify the file by using these fields. Some CMS commands allow you to enter only the file name, or the file name and file type; others require you to enter the file mode or directory name as well.

Under z/VM, your files can be stored within a Shared File System (SFS) file space or on minidisks. Depending on your system configuration, you may have the option to use both methods of storing files. In this situation, you could store those files that you may want to share in your SFS file space; other files could be stored on minidisks.

This section provides general information on CMS files and how to display and manipulate your CMS files whether they reside in SFS directories, minidisks or both. In fact, the term *CMS file* refers to a file that can be stored in a directory or on a minidisk. For more information on managing your files in SFS, see Chapter 3, “Using the Shared File System,” on page 41 and for more information on using minidisks, see Chapter 4, “Storing Your Files on Minidisks,” on page 113.

z/VM OpenExtensions (POSIX support) includes another type of file called a byte file system (BFS) file. BFS files are organized in a hierarchy, as in a UNIX system. All files are members of a *directory*. Each directory is in turn a member of another directory at a higher level in the hierarchy. The highest level of the hierarchy is the *BFS file space*. Typically, a user has all or part of a BFS file space mounted as the *root directory*.

VM views an entire file hierarchy as a *Byte File System*. Each Byte File System is a mountable file system. The root file system is the first file system mounted. Subsequent file systems can be mounted on any directory within the root file system or on a directory within any mounted file system.

All files in the Byte File System are called BFS files. BFS files are byte-oriented, rather than record-oriented, like CMS record files on minidisks or in the Shared File System. You can copy BFS files into CMS record files, and you can copy CMS record files into the Byte File System.

For more information on BFS files, see “An Introduction to the Byte File System” in *z/VM: OpenExtensions User’s Guide*.

CMS File Formats

The CMS file management routines write CMS files in fixed physical blocks regardless of whether they have fixed- or variable-length records. For most of your CMS applications, you never need to specify either a logical record length and record format or block size when you create a CMS file.

If you need to, however, you can specify logical record length and record format when you create an SFS file with the CREATE FILE command, or, you can change the record format of an existing file as explained in “Changing the Record Format of a File” on page 179.

When you create a file using one of the CMS editors, the file has certain default characteristics based on its file type. The special file types recognized by the editor, and their applications, are discussed in “What Are Reserved File Types?” on page 121.

How CMS Files Get Their Names

When you create a CMS file, you can give it any file name and file type you wish. The rules for forming file names and file types are:

- The file name and file type can each be from one to eight characters.
- The valid characters are A-Z, a-z, 0-9, \$ (dollar sign), # (pound sign), @ (at sign), + (plus sign), - (hyphen), : (colon), and _ (underscore).

Note: Lowercase letters within a file ID are valid for use within the CMS file system. However, some CMS commands do not support file IDs that contain lowercase letters.

When you enter a command into the z/VM system, z/VM translates your input line by either the user-defined input table or by the uppercase table. For more information on the SET INPUT command, see *z/VM: CMS Commands and Utilities Reference*. If you do not have an input table, you can just enter the command in lowercase and z/VM translates your input line into uppercase characters.

Note: When defining input characters be sure that you will not end up with a file ID containing unsupported characters.

The @ and @ characters are line editing symbols in z/VM; when you use them to identify a file, you must precede them with the logical escape symbol ("). For more information on logical line editing symbols, see *z/VM: CP Commands and Utilities Reference*.

The third field in the file identifier is either the file mode (fm) or the directory name (dirname). The first character of a directory name can be an uppercase or lowercase letter (A-Z), a number (0-9), or one of several special characters, \$ (dollar sign), # (pound sign), @ (at sign), - (hyphen), or _ (underscore). The remaining characters can be A-Z and 0-9. Lowercase letters are allowed, as they are translated to uppercase. For more information about directory names, see Chapter 3, “Using the Shared File System,” on page 41 and *z/VM: CMS Commands and Utilities Reference*.

The file mode is made up of:

| File Mode | Description |
|-----------|--|
| Letter | <p>Specifies an alphabetic character (A-Z) currently assigned to the SFS directory or minidisk where you want the file to reside. When you use the editor to create a file, and you do not specify this field, the file you create is written to the directory or minidisk accessed with a file mode of A.</p> <p>The file mode letter, for any file, can change during a terminal session. Suppose when you log on, your top directory (or minidisk) is accessed with a file mode of A. (Your <i>top directory</i> is the directory assigned to you by the SFS administrator at the time you are enrolled in a file pool.) A file in that directory (or minidisk), named SPECIAL EVENTS, would have a file identifier of:</p> <pre>SPECIAL EVENTS A</pre> <p>If, however, you later access another directory (or minidisk) with a file mode of A, and access your top directory (or minidisk) with a file mode of B, then the SPECIAL EVENTS file will have a file identifier of:</p> <pre>SPECIAL EVENTS B</pre> |
| Number | <p>Specifies a number from 0 to 6. Each number has a particular meaning to CMS. For more information, see "File Mode Letters and Numbers" on page 129.</p> |

Duplicate File Names or File Types

On a given directory or minidisk, you can give the same file name to as many files as you want, providing you assign them different file types. Or, you can create many files with the same file type, but different file names. But you cannot have files with the same file name and file type on one minidisk or in one directory. That is, you could not have two files named COST ESTIMATE on file mode A.

For the most part, file names that you choose for your files have no special significance to CMS. If, however, you choose a name that is the same as the name of a CMS command, and the file that you assign this name to is an executable module or exec procedure, then you may encounter difficulty if you try to process the CMS command whose name you duplicated.

For more information on how CMS identifies a command name, see "CMS Command Search Order" on page 175.

For the most part, the file type field is used merely as an identifier. Some file types, though, have special uses in CMS; these are known as *reserved file types* and should be avoided, if possible. For more information on reserved file types, see "What Are Reserved File Types?" on page 121.

Working with CMS Files

In *z/VM: CMS Primer*, many examples were used to explain how to create, display, and manipulate your CMS files. This section is an overview or review of that material. It is not intended as a complete source of information on any of the commands discussed. It is merely a refresher to ready you for upcoming chapters. For more information on these commands see *z/VM: CMS Commands and Utilities Reference*.

Creating a New File

There are many ways to create a new file under CMS. The most common method is with the editor.

To create a new file called NEW FILE A and store it on your A disk, you would enter the following command either from the command line within the FILELIST display, or from the command line of CMS:

```
xedit new file a
```

A new, empty file called NEW FILE A would be displayed for your input. After your modifications were complete, you would file the new file for later retrieval.

Note: When a file is created using XEDIT, the editor assumes many default characteristics. These will be discussed in Chapter 5, “More on the CMS File System,” on page 121.

For more information on using XEDIT to create files, see *z/VM: XEDIT User's Guide*.

A few other methods of creating a new file are:

- Use the COPYFILE command to create a new file from an existing file.
- Modify an existing file and file or save it under a new name.
- For SFS users, the CREATE FILE command can be used which includes many formatting options. For more information, see “Creating New Files” on page 58.

Editing a File

To modify the contents of an existing file on one of your accessed disks or SFS subdirectories, you would use the editor.

For example, to edit a file called CHANGE CONTENTS A, the following command would be entered:

```
xedit change contents a
```

As a result, the current contents of the file would be displayed on your screen, ready for your modifications. When complete, you would enter, file, to save your alterations.

Displaying a List of Your CMS Files

Once you have created or gained access to CMS files, you can use CMS commands to display information about them. For this purpose, these two commands are available:

- LISTFILE
- FILELIST

Listing Your Files with the LISTFILE Command

You can use the LISTFILE command to list information about your CMS files. For example, entering:

```
listfile
```

displays the file name, file type, and file mode of all files on your A disk in the following format:

```

ALL      NOTEBOOK A0
ANIMAL   DATA      A1
BANANA   DATA      A1
BEAR     NOTE        A1
HONEY    DATA      A1
TIGER    NOTE        A1
ZOOKEEP  NETDATA     A1

```

For SFS, the LISTFILE command has various options that allow you to display different information about your files and directories. An example is the SHARE option. When you enter:

```
listfile (share)
```

Your output will be similar to this:

In addition to the file name, file type, and file mode, this display shows you the

```

FILENAME FILETYPE FM OWNER  TYPE  R W
ALL      NOTEBOOK A0 yourid BASE  X X
ANIMAL   DATA      A1 CROCKETT BASE  X X
BANANA   DATA      A1 BREEZY  ALIAS  X X
BEAR     NOTE        A1 BREEZY  ALIAS  X -
HONEY    DATA      A1 STONE   ALIAS  X -
TIGER    NOTE        A1 BREEZY  ALIAS  X -
ZOOKEEP  NETDATA     A1 yourid BASE  X X

```

owner of the file, whether your file is a base file or an alias, and what type of authority you have to the file (read or write). For more information on these terms, see Chapter 3, “Using the Shared File System,” on page 41.

For more information on the LISTFILE command, see *z/VM: CMS Commands and Utilities Reference*.

Using the FILELIST Command

Use the FILELIST command to display information about your CMS files. If your files are stored in an SFS file pool, you can use FILELIST for files in accessed directories.

Entering the FILELIST command will display a screen of information similar to the one shown in Figure 3 on page 34.

```

yourid FILELIST A0 V 108 Trunc=108 Size=7 Line=1 Col=1 Alt=0
Cmd Filename Filetype Fm Format Lrecl Records Blocks Date Time
ANIMAL DATA A1 V 95 34 1 8/04/00 21:12:04
BANANA DATA A1 V 95 29 1 8/04/00 20:58:07
BEAR NOTE A1 V 107 281 5 8/04/00 17:59:00
HONEY DATA A1 V 92 101 2 8/02/00 15:33:05
ALL NOTEBOOK A0 V 120 277 4 7/24/00 9:14:02
TIGER NOTE A1 V 26 7 1 7/23/00 16:50:06
ZOOKEEP NETDATA A1 V 80 489 10 6/26/00 16:05:08

1= Help 2= Refresh 3= Quit 4= Cancel 5= Sort(dir) 6= Sort(size)
7= Backward 8= Forward 9= FL /n 10= Share 11= XEDIT/LIST 12= Cursor

====> _

X E D I T 1 File

```

Figure 3. Sample FILELIST Screen

This FILELIST screen shows information about the files on file mode A.

- The first line has information about the FILELIST display itself. Your user ID appears instead of *yourid*. Size shows the number of files in the list. Line tells which file in the list is the first on this screen.
- There are several columns in the FILELIST display:
 - Cmd is where you would enter commands for a specific file or directory listed.
 - Filename, Filetype, and Fm indicate the file name, file type, and file mode of the file. For SFS, names of subdirectories are listed in the Filename column, but the Filetype column is blank.
 - Format shows the format of a file. An F is displayed for a fixed format file, V for a variable format file, and DIR for an SFS directory.
 - Lrecl, Records, and Blocks, carry information on the size of the file shown. Listings for SFS directories show a dash (—) in the columns for Lrecl, Records, and Blocks.
 - Date and Time show when a file was last updated. For SFS directories, these columns show when the directory was created.
- The bottom of the screen shows the current PF key settings.

FILELIST provides you with the same information as the LISTFILE command, but also lets you edit files and enter commands from the list. You can also enter XEDIT subcommands to manipulate the list itself.

For SFS, like LISTFILE, the FILELIST command has several options that allow you to display different information about your files and directories. The default option is FILELIST STATS. The FILELIST STATS screen is similar to one displayed for a non-SFS user except for the directory name identifier, appearing in the top left portion of the screen.

```
ZOOKEEP FILELIST A0 V 108 Trunc=108 Size=8 Line=1 Col=1 Alt=0
Directory = VMSYSU:ZOOKEEP.
Cmd Filename Filetype Fm Format Lrecl Records Blocks Date Time
ANIMAL DATA A1 V 95 34 1 8/04/00 21:12:04
BANANA DATA A1 V 95 29 1 8/04/00 20:58:07
BEAR NOTE A1 V 107 281 5 8/04/00 17:59:00
HONEY DATA A1 V 92 101 2 8/02/00 15:33:05
ALL NOTEBOOK A0 V 120 277 4 7/24/00 9:14:02
TIGER NOTE A1 V 26 7 1 7/23/00 16:50:06
ZOOKEEP NETDATA A1 V 80 489 10 6/26/00 16:05:08
```

Figure 4. Sample FILELIST STATS Screen

SFS also provides you with SHARE, SEARCH, and ALLDATES options of FILELIST to display other information about your files and directories. Chapter 3, “Using the Shared File System,” on page 41 shows example screens for the FILELIST options. For more information, see *z/VM: CMS Commands and Utilities Reference*.

Finding Files in Your FILELIST List: If you have many files in your list, the list may take up more than one screen. To find files in your FILELIST list, you can do any of the following:

1. Scroll through the list using the PF keys.
 - PF7** Scrolls backward one screen.
 - PF8** Scrolls forward one screen.
2. Use any of the appropriate PF keys to sort the displayed output.
3. Use the XEDIT subcommand LOCATE if you know the file name, file type, or both, of the file that you are looking for. You enter the LOCATE command at the bottom of the screen and then press the Enter key. For example:

```
====> locate /banana data/
```

If BANANA DATA is located, the line containing it becomes the first line on the screen.

4. Rearrange the list by entering one of the following synonyms on the command line:

SNAME

Sorts the list alphabetically by file name, file type, and file mode.

STYPE

Sorts the list alphabetically by file type, file name, and file mode.

SDIR

Sorts the list by directory name, file name, and file type.

SMODE

Sorts the list by file mode, file name, and file type.

SRECF

Sorts the list by record format, file name, file type, and file mode.

SLREC

Sorts the list by logical record length and then by size (greatest to least).

SSIZE

Sorts the list by number of blocks and number of records (greatest to least).

SDATE

Sorts the list by year, month, day, and time (most recent to oldest).

Using FILELIST or LISTFILE to List Some of Your Files

The LISTFILE and FILELIST commands let you obtain various lists of your files and subdirectories. You can ask for a list of files or subdirectories that have the same file name, or file type, or all of the ones that begin with a certain letter. Following are various ways that you might use the FILELIST and LISTFILE commands:

| Command | Description |
|------------------------------------|---|
| listfile filelist | Lists the files on file mode A. |
| listfile * * b filelist * * b | Lists the files on file mode B. |
| listfile bear * filelist bear * | Lists the files on file mode A with a file name of BEAR. |
| listfile * data filelist * data | Lists the files on file mode A with DATA as a file type. |
| listfile * * a1 filelist * * a1 | Lists the files with a file mode number 1 on file mode A. |

Erasing a File

Use the ERASE command to delete one or more of your CMS files or SFS directories. If a file is to be deleted, the file name, file type, and file mode (or directory identifier) are operands. If a directory is to be deleted, the directory identifier is the only operand needed.

For example, the following command will delete the file, DATA FILE A1:

```
erase data file a
```

Use the DISCARD command to erase a file or subdirectory that is displayed in a list (such as the FILELIST display). The DISCARD command is equivalent to the ERASE command. DISCARD can either be entered in the command area (Cmd) of the line that describes the file you want discarded, or it can be entered from the command line (at the bottom of the screen). DISCARD can only be used while in FILELIST, DIRLIST, RDRLIST, MACLIST, and PEEK command environments. For more information on the DISCARD or ERASE command, see *z/VM: CMS Commands and Utilities Reference*.

Copying Files

The COPYFILE command copies a file from one directory to another, from one minidisk to another, or between directories and minidisks.

For example:

```
copyfile linda assemble b pat assemble a
```

would create a copy of the LINDA ASSEMBLE file, name it PAT ASSEMBLE, and store it on file mode A.

You can copy a file over a file which already exists (overlying the contents of the file), using the REPLACE option. For more information on the COPYFILE command, see *z/VM: CMS Commands and Utilities Reference*.

Notes for SFS Users

To copy a file into a:

- File into a file that already exists in an SFS directory, and you want to use the REPLACE option, you need proper authority to the existing file. The authorization needed varies depending on the kind of directory the file resides in. If the file resides in a directory with the file control (FILECONTROL) attribute, you need write authority to the file. You also need read authority to the directory in which the file resides (so you can access it). If the file resides in a directory with the DIRCONTROL attribute, you need directory control write (DIRWRITE) authority to the directory.
- FILECONTROL directory by creating a new file, you need write authority to the directory in which you are creating the file. If you are copying into a DIRCONTROL directory, you need DIRWRITE authority on the directory.

Note: Types of directories and authority will be discussed in Chapter 10, “Introducing Full-Screen CMS,” on page 253.

Comparing Contents of Files

To compare the contents of two files to see if they are identical, use the COMPARE command from the CMS command line. The comparison is made on a record-for-record basis and dissimilar records are displayed to the terminal.

For example, suppose two files exist with the following contents:

| EMPLOYEE LIST A | EMPLOYEE LIST B |
|-----------------|-----------------|
| Kathy | Kathy |
| Diana | Diana |
| Kate | Kate |

To compare the contents of EMPLOYEE LIST A with EMPLOYEE LIST B, the following command would be entered:

```
compare employee list a employee list b
```

The following message would be returned indicating that contents of the files are identical:

```
DMSCMP179I Comparing EMPLOYEE LIST A with EMPLOYEE LIST B
Ready; T=0.30/0.03 08:06:21
```

If, in the second file, employee Kate was replaced by new employee Terri, the COMPARE command would return the following:

```
DMSCMP179I Comparing EMPLOYEE LIST A with EMPLOYEE LIST B
Kate
Terri
DMSCMP209W Files do not compare
Ready(00004); T=0.01/0.01 08:08:15
```

The line from each file which did not match is displayed.

Since the comparison is done a record-for-record basis, the insertion or deletion of a line may return misleading results. For example, if EMPLOYEE LIST2 A was an identical copy of EMPLOYEE LIST A, and the name of a new employee, Tom, was inserted in the file, so the contents of the files were:

| EMPLOYEE LIST A | EMPLOYEE LIST2 A |
|-----------------|------------------|
| Kathy | Tom |
| Diana | Kathy |
| Kate | Diana |
| | Kate |

The result of a compare on these files would be:

```
DMSCMP179I Comparing EMPLOYEE LIST A with EMPLOYEE LIST B
Kathy
Tom
Diana
Kathy
Kate
Diana
DMSCMP010E Premature EOF on file EMPLOYEE LIST A
Ready(00004); T=0.01/0.01 08:14:09
```

The COMPARE command did not recognize that the files were identical except for one line. It simply compared each line on a line-by-line or record-for-record basis and displayed each dissimilar record. It did, however, indicate that one file contained more records than the other.

For more information on the COMPARE command, see *z/VM: CMS Commands and Utilities Reference*.

Renaming Files

You can change the file identifier of a file with the RENAME command. For example, to change the name of TEST FILE A1 to GOOD FILE A1, the following command would be used:

```
rename test file a1 good file a1
```

You can use RENAME on a base file (not on an alias) to modify file mode numbers. For example:

```
rename news report a1 = = a2
```

This command changes the file mode number of the base file NEWS REPORT, along with the file mode numbers of all aliases to that file to 2. File mode numbers will be discussed in “File Mode Letters and Numbers” on page 129.

You cannot use the RENAME command to move a file from one minidisk or directory to another. (You can, however, use the COPYFILE command to copy a file from one directory or minidisk to another.)

If your files are stored in an SFS file pool, you can use the RELOCATE command to move a file from one directory to another. You can also rename a file in another user's FILECONTROL directory, if the user has granted you write authority to the file and to the directory. To rename a file in another user's DIRCONTROL directory, you need DIRWRITE authority. Types of directories and authority will be discussed in Chapter 3, “Using the Shared File System,” on page 41.

For more information on the RENAME, COPYFILE, or RELOCATE commands, see *z/VM: CMS Commands and Utilities Reference*.

Using Asterisks (*) and Percent Signs (%) in File IDs

As mentioned in the discussions on LISTFILE and FILELIST, some CMS commands that manipulate files allow you to enter the file name or file type fields or both as an asterisk (*), indicating that all files of the specified file name/file type are to be modified. Following is a list of some of these commands:

```
COPYFILE  RENAME      FILELIST
ERASE     TAPE DUMP  LISTFILE
```

For example, if you enter:

```
erase * test a
```

all files with a file type of TEST on file mode A are erased.

Several commands let you perform operations on a group of files that have a file name or file type that begin with the same character string. These commands are shown in the following list:

```
LISTFILE  CREATE LOCK  GRANT AUTHORITY  CREATE ALIAS
FILELIST  DELETE LOCK  REVOKE AUTHORITY
```

The same commands allow you to use the percent sign (%) as a place holder to mean any single character.

Some examples are given in Table 4.

Table 4. Examples of Using * and % in CMS commands.

| Command Entered | Result |
|--------------------------------------|---|
| listfile t* assemble | Produces a list of all files on file mode A with file names beginning with the letter T and having the file type of ASSEMBLE. |
| listfile tr* a* | Produces a list of all files on file mode A with file names beginning with the letters TR and having file types beginning with the letter A. |
| listfile %%% stock | You will see a list of all the files on file mode A whose file name is three characters in length and whose file type is STOCK. |
| listfile t% cat | Produces a list of all the files on file mode A with a three-character file name beginning with the letter T and having a file type of CAT, for example: top cat the cat tom cat |
| listfile %tr*s *ri% (See Note 1.) | This command would produce a list of files with: <ul style="list-style-type: none"> • File name starting with a character, followed by TR, and ending with an S. • File type starting with an RI or one or more characters preceding the RI, followed by two characters. • File mode A, since unspecified. |

Notes:

1. The LISTFILE command allows a great deal of flexibility in the use of percent (%) and asterisk (*). They may appear together, have multiple occurrences, or both, within a file type or file mode.
2. Because CMS checks for open files first, you may get unexpected results when specifying an asterisk for the file mode if there are open files matching the file name and file type specified.

For more information on the commands listed in this table see *z/VM: CMS Commands and Utilities Reference*.

Equal Signs in Output File IDs

The COMPARE, COPYFILE, RENAME, RECEIVE, and CREATE ALIAS commands let you enter output file identifiers as equal signs (=) to indicate that they are the same as the corresponding input file identifier. For example:

```
copyfile myprog assemble b = = a
```

copies the file MYPROG ASSEMBLE from file mode B to file mode A, and uses the same file name and file type as specified in the input file ID for those positions in the output file ID.

Similarly, if you enter the command:

```
rename temp * b perm = b
```

all files with a file name of TEMP on file mode B are renamed to have file names of PERM; the existing file types of the files remain unchanged.

Chapter 3. Using the Shared File System

You will be using CMS on a virtual machine. A virtual machine is similar to a real machine in that it has access to disk storage. This disk storage can be either a directory (within a Shared File System file space) or a minidisk. This section contains information specific to the Shared File System. For more information on how to manage your files if your files are stored on minidisks, see Chapter 4, “Storing Your Files on Minidisks,” on page 113.

What is the Shared File System?

The *Shared File System* (SFS) helps you manage and store your CMS files. Files you create reside in a *file pool*, a large amount of DASD space containing the files for many users. You will be enrolled in a file pool, and given a *file space* within it, where you can store your files.

There are two ways you can become enrolled in a file pool. You may be enrolled, along with other users, by an ENROLL PUBLIC command. In this case, you will have the authority to read from, write to, or lock the files and directories for which you are authorized. However, you will not have space to create files of your own. You may also be enrolled in a file pool by name. Here, you may have space allocated specifically for your use. Your system administrator is responsible for enrolling you in a file pool. This section assumes you are enrolled in a file pool by name.

Within your SFS file space you can organize your files into directories. A *directory* is a group of files. SFS directories can be arranged to form a hierarchy in which one directory can contain one or more subdirectories, as well as files. Within a directory you can store closely related files. For example, you could create a directory to store all the files for a particular project. You can then define subdirectories beneath that directory to contain files related to major parts of the project. SFS lets you define up to eight levels of subdirectories.

Suppose there is a file pool named BOOKPOOL, which was created for and is shared by a group of writers. You and other writers have a file space in the BOOKPOOL file pool. Your file space could contain chapters of your book and any other research you are working on. You could set up directories in the BOOKPOOL file pool that organize your book files.

Your *top* directory, the directory from which all files and subdirectories will branch, could contain files such as letters and memos, as well as a NOVEL directory. You might wish to create more subdirectories of the NOVEL directory to organize files dealing with the major parts of the project, such as the setting, the plot, or the ending. If you wanted, you could create additional subdirectories to organize individual chapters of the book.

Figure 5 on page 42 shows how this might look.

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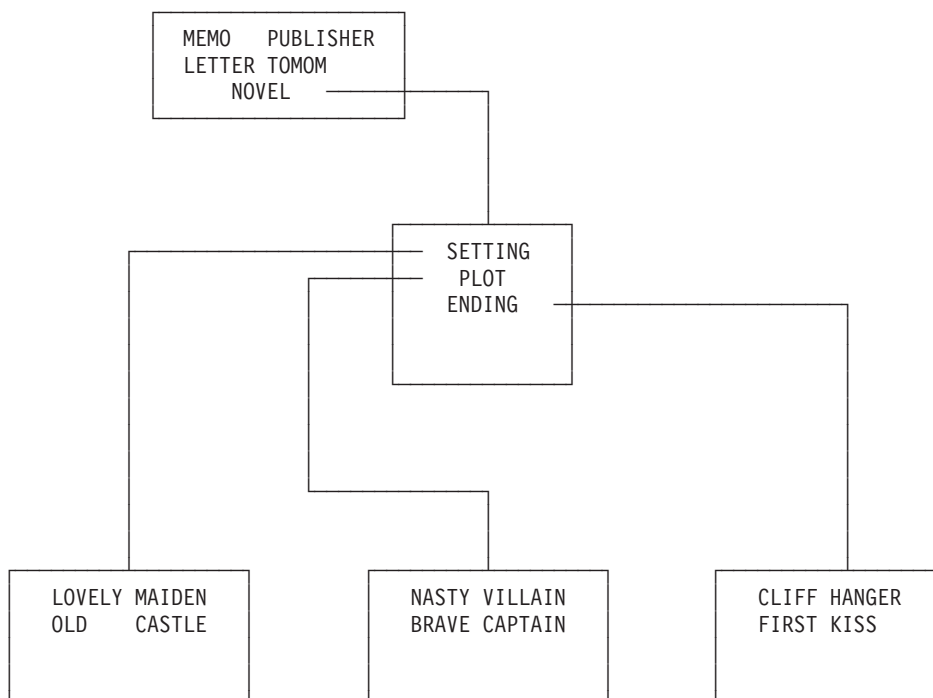


Figure 5. Sample Hierarchical Directory

Now that you understand how files and directories can be organized, you need to know how they are shared between users.

To share files or directories, you grant other users authority to them. The kinds of authorities you can grant depend on the kind of directory you wish to share.

There are two types of directories: directories having the file control attribute, called *FILECONTROL directories*, and directories having the directory control attribute, called *DIRCONTROL directories*.

For *FILECONTROL* directories, you can choose to grant authority for one or more individual files, or you can grant authority for all the files currently in a directory. You can even authorize users to read or write any files that will be added to the directory in the future. You can also grant users authority to a directory only, and not to the files it contains.

You have the option of letting other users write to these files or directories, or granting them read authority only. As the owner of the files and directories, you can also choose to revoke the authorities you have granted.

For *DIRCONTROL* directories, you grant authorizations at the directory level—you cannot grant authorities on individual files. You either grant *directory control read* (*DIRREAD*) authority or *directory control write* (*DIRWRITE*) authority for the directory. When you grant *DIRREAD* authority, others can read any file in the directory (even files that are added in the future). *DIRWRITE* authority lets others read or write any file in the directory (even future files). *DIRWRITE* authority also lets users create or erase files in the directory.

Detailed information will be given about types of authority in sections, “*FILECONTROL Directory Authority*” on page 83, and “*DIRCONTROL Directory Authority*” on page 86.

As you can see, FILECONTROL directories provide more flexibility. When you create a directory it is, by default, a file control directory. You need to specify an option to create a DIRCONTROL directory. In most cases, your directories will be FILECONTROL directories.

DIRCONTROL directories have a somewhat specialized use. They are intended primarily for data that is seldom updated or that is updated in a controlled manner. Although you may choose to not create DIRCONTROL directories, you should be aware of them, because it is likely that system data or applications you use will reside in those directories. Unless otherwise noted, all of the instructions in this section apply to both FILECONTROL and DIRCONTROL directories.

The rest of this section provides information on how to manage the files and directories you store within an SFS file pool.

With certain system configurations, you may have the option to store files both on minidisks and in SFS file pools. In this case, you can decide which files you want stored on minidisks, and which you want stored (and shared) in SFS file pools. If this is the case, you may want to read this section and Chapter 4, “Storing Your Files on Minidisks,” on page 113, for additional information on how to manage CMS files on minidisks.

Getting Started - Accessing Your Top Directory

To use directories and share files, you need to be enrolled in a file pool and be given a file space. Only a system administrator can do this. When the administrator assigns you a file space within a file pool, SFS automatically defines one directory within that file space. This directory is called your *top directory* because under it you can create a hierarchy of subdirectories in which to arrange your files. When first assigned to you, your top directory is always a FILECONTROL directory. You can change it to a DIRCONTROL directory, if you wish, by using the DIRATTR command.

The name of the top directory is always the same as your user ID. It cannot be changed. If, for example, your user ID is HENRY and you become enrolled in a file pool, *HENRY.* would be the name of your top directory. Notice the period after the top directory name. In SFS, the period indicates a directory; here the top directory belongs to the user ID HENRY. In the following examples, *yourid* is shown. When you enter each command, of course, your user ID will replace *yourid*.

Before you begin the exercises in this section, you will need to determine if you are enrolled in a file pool, and know your file pool identifier (*filepoolid*). If you do not know, see your system administrator now. You may be enrolled in the IBM-supplied VMSYSU file pool, or another file pool supplied by your system administrator. The file pool ID, VMSYSU, appears in the examples in this section. If this is not the file pool you are enrolled in, you will see your file pool ID in place of VMSYSU when comparing your screen to these examples. Regardless of which file pool you are enrolled in, you can use the examples in this section.

Once you are enrolled, you should determine if your top directory is accessed as A. To find out, enter the following command which will display the modes for all the directories and minidisks to which you have access.

```
query accessed
```

Note: You can alternatively use the MDISK option of the DIRLIST command to display not only your accessed minidisks, but also any minidisks that are linked.

Shared File System

These are listed, in a full screen environment, along with the directory structure that was specified (see “Listing the Structure of a Directory with DIRLIST” on page 51).

When you enter the QUERY ACCESSED command, you will see a display similar to one of the following two samples. If your top directory has been accessed with a file mode of A, you will see a display similar to this:

| Mode | Stat | Files | Vdev | Label/Directory |
|------|------|-------|------|-------------------------|
| A | R/W | 3 | DIR | VMSYSU: <i>yourid</i> . |
| S | R/O | 1321 | 190 | MNT190 |
| Y/S | R/O | 337 | 19E | MNT19E |

This information is organized as follows:

- Mode indicates the mode letter used to access the directory.
- Stat gives the status of the directory: R/W (read/write) or R/O (read/only). When you access an SFS directory without forcing the status to read-only or read/write, the status is determined by who owns it. If you:
 - Are the directory owner, then the directory is accessed as read/write. For DIRCONTROL directories, however, only one user may have the directory accessed in read/write status. If someone already has the directory accessed in read/write status, and you (the directory owner) attempt to get a read/write access, you will, instead, get a read-only access.
 - Are not the directory owner, then the directory is accessed as read-only.
 - Attempt to access a directory for which you are not authorized, the directory is not accessed.

Note: Most CMS commands that issue file mode letters will not allow you to write to files if the directory is accessed as read-only. However, COPYFILE and XEDIT will allow you to write to a file control directory accessed read-only, unless you use the SET RORESPECT ON command.

- Files displays the number of entries in the directory. This total can include subdirectories, revoked or erased aliases, and files.
- Vdev displays DIR for FILECONTROL directories, DIRC for DIRCONTROL directories. (These terms will be discussed in this section.)
- Label/Directory shows the complete name of the directory. In this example, your top directory is accessed with a file mode of A. The string VMSYSU:*yourid*. tells you the complete name of your top directory. It shows that your user ID is assigned to the VMSYSU file pool.

If you are a SFS user, and your top directory is *not* accessed as A, you will see a display similar to this:

| Mode | Stat | Files | Vdev | Label/Directory |
|------|------|-------|------|-----------------|
| A | R/W | 3 | 191 | AMC191 |
| S | R/O | 1321 | 190 | MNT190 |
| Y/S | R/O | 337 | 19E | MNT19E |

In this case, to complete the examples in this section, enter the following commands, substituting your file pool ID:

```
set filepool filepoolid:  
access . a
```

The SET FILEPOOL command establishes the name of your *default file pool*. The file pool may be VMSYSU, the file pool shipped with your system, or any other file pool to which you are assigned. In subsequent commands, you will not need to type the file pool ID. Unless you specify a different file pool, SFS will use your default file pool ID.

The ACCESS command accesses your top directory with a file mode of A. The . (period) is an abbreviation of your top directory, which is your user ID. Whenever you are referring to *yourid.*, you can substitute a . instead. Commands that default to file mode A, take input from, or send output to, your top directory. For example, if you send a file to another user and do not specifically state the file mode of the file, SENDFILE defaults to file mode A. If the file is not located in the directory you have accessed with a file mode of A, you get an error message telling you that the file was not found.

If you did not have your top directory accessed as A, you may want to add the two commands in the previous example to your PROFILE EXEC on your 191 minidisk. Otherwise, if you log off the system, and later log back on, you will have to reenter the commands, because they are not saved after a terminal session.

Depending on your installation, you are enrolled in a file pool, use minidisk storage, or have the capability to use both. If you have space in a file pool and no minidisk storage, your top directory is accessed with a file mode of A. If you have minidisk storage and no file pool space, your 191 minidisk is accessed with a file mode of A. If you have both space in a file pool and minidisk storage, one of the following statements is true, your:

- Top directory is accessed with a file mode of A. Your minidisk storage is not automatically accessed. This minidisk storage, which is at virtual address 191 or any other available virtual address, is accessed with the file mode of your choice when you want to use it.
- 191 minidisk is accessed with a file mode of A. If you want to use your file pool storage, you can enter the SET FILEPOOL and ACCESS commands to access it with the file mode letter of your choice.

If you want to change the default, see your system administrator.

For more information on accessing directories, see “Accessing Another User's Directory” on page 49.

Releasing Directories

When you no longer need a directory that you temporarily accessed, you can use the RELEASE command. For example, to release the directory accessed with file mode B, enter:

```
release b
```

When you want to assign a currently active mode letter to another directory, enter the ACCESS command to reassign that mode letter. It is not necessary to release an accessed directory before accessing another with the same mode.

When you log off, any directories that you temporarily accessed are automatically released.

Note: If you are experiencing poor response time and have many directories accessed that you do not need, you may want to release some of these directories.

Managing Your File Space

File spaces are not infinite, but contain a certain amount of space that your system administrator allocates to you. When your user ID was added to a file pool, the system administrator also allotted you a certain amount of space. If necessary, you can ask your system administrator to change your space allocation.

At any time, you can determine the amount of space you have used and how much more is available. To determine what proportion of your file space you have used, you would enter the QUERY LIMITS command (substituting the name of your file pool for the *filepoolid*):

```
query limits * filepoolid:
```

If you defined a default file pool, then just enter:

```
query limits
```

Your output will look like this:

| Userid | Storage Group | 4K Block Limit | 4K Blocks Committed | Threshold |
|---------------|---------------|----------------|---------------------|-----------|
| <i>yourid</i> | 3 | 1000 | 820-82% | 90% |

The first column shows your user ID (*yourid* in this example). The column labeled Storage Group shows the storage group within your file pool where your system administrator has assigned you.

The third and fourth columns contain information regarding the size of the file space. The third column shows that you have been allocated 1000 4K block units. The 4K Blocks Committed column shows that of the 1000 4K blocks you were allocated, you have used 820, which is 82% of the total.

The column labeled Threshold shows when you will receive a warning from the system informing you that your file space is almost full. The default threshold is 90%. When your file space is 90% full, you will receive a warning. If you wish to change the threshold, you can do so by issuing the SET THRESHOLD command. For more information on the SET THRESHOLD command, see *z/VM: CMS Commands and Utilities Reference*.

Note: This warning message will be seen only once for a file pool in between console reads. An example of a console read occurring is when you press the Enter key.

If, while using CMS, your file space becomes 100% full, you will receive an error message. At this point, you can use the FILELIST command to list the files in your file space, then use the DISCARD command to erase any unwanted files.

You can find out how much space you will free by erasing an SFS file by using the QUERY BLOCKS command. For example, if you enter:

```
query blocks myfile script a
```

for file myfile script in the VMSYSU:SMITH.ALL.FILES directory, accessed as A, you will see:

| Directory | Filename | Filetype | Fm | Type | Datablocks | Systemblocks |
|------------------------|----------|----------|----|---------|------------|--------------|
| VMSYSU:SMITH.ALL.FILES | MYFILE | SCRIPT | A | BASE 10 | | 2 |

The file is taking up 12 blocks of file space, so if you erase this file, you will free 12 blocks of space.

You may have files in your file space whose data has been moved into storage controlled by DFSMS/VM. They are referred to as being in *migrated status* (this will be discussed in more detail in “DFSMS/VM and SFS File Management” on page 70). You should be aware that although these files take up logical storage in your file space, they no longer occupy real storage as long as they are in migrated status. If they are recalled from migrated status, they will once again require physical space in your storage group. This recall happens automatically when you reference the file data if the SET RECALL command is set to ON. For more information about SET RECALL, see *z/VM: CMS Commands and Utilities Reference*.

If you cannot erase any of the files in your file space, there are several alternative recovery paths you can take:

1. If you are able to store any of your files on minidisks, you may be able to use the COPYFILE command to move files from your file space to a read/write minidisk. After copying the files, erase the original copy in your file space.
2. If you do not have any read/write minidisks in your virtual machine, you may be able to transfer some of your files to another user, using either the SENDFILE, PUNCH or DISK commands. When the files have been read into the other user's file space, you can erase them from your file space.
3. You can overlay the contents of a file with a *packed* version of the file, using the COPYFILE command with PACK option. To browse or modify the contents of a packed file, you must recopy the file to itself using the COPYFILE command with UNPACK option.
4. You may contact your file system administrator to request that more storage be added to your file space.

Organizing Your Files

SFS lets you keep your files organized because you can place groups of related files in their own directories. Your directories are arranged hierarchically. Your top directory is always the first level; subdirectories of your top directory branch out to a lower level. Both the top directory and subdirectories can contain CMS files. Subdirectories can either have the FILECONTROL or DIRCONTROL attribute.

For example, assume that Tony, a manager of a maintenance department, keeps employee records in a set of CMS files. The manager might create a directory for each employee. If his file space is in the POOLQ file pool, his directory structure might look like the example described in Figure 6 on page 48.

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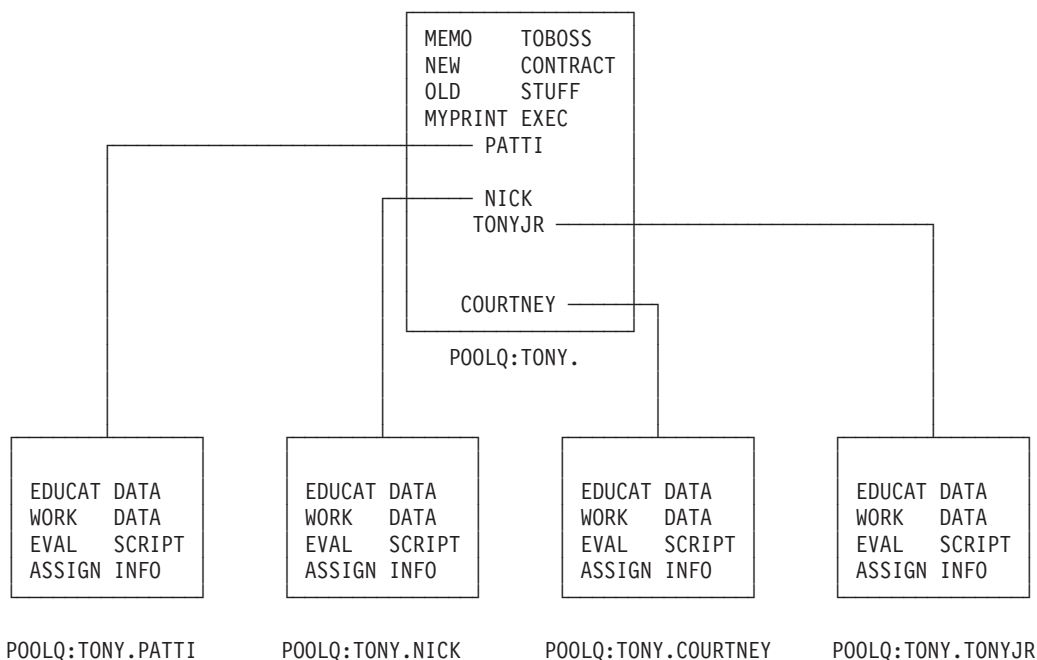


Figure 6. Another Sample Directory

The first four items in Tony's top directory are CMS files. His top directory also contains four subdirectories, one for each of his employees. The subdirectory for each employee contains four files.

Tony can use the same file identifier, such as EDUCAT DATA, for each of his employees because the files are in different subdirectories. The name:

EDUCAT DATA POOLQ:TONY.COURTNEY

is the complete name of the EDUCAT DATA file in Tony's .COURTNEY directory.

Likewise, the name:

EDUCAT DATA POOLQ:TONY.NICK

is the complete name of the EDUCAT DATA file in the .NICK directory.

Working with Directories

Before you begin working with SFS directories, you will need to understand how to specify the names of your directories within commands, and how to list the contents of your directories. This section explains these topics and includes exercises using the SFS directories and files provided with your system.

Using the Abbreviated Form of Your Top Directory

In the previous example, Tony could refer to any directory by using the file pool identifier (POOLQ:), followed by the name of his top directory (TONY.), followed by the name of the other directories. The file pool identifier must always be followed by a colon (:). Directory names must be separated by periods.

To refer to the .NICK directory in a command, Tony could specify the following directory name (*dirname* for short):

POOLQ:TONY.NICK

If POOLQ is Tony's default file pool, he can omit it from the directory name and refer to the directory as follows:

```
TONY.NICK
```

SFS will assume that the TONY.NICK directory is located within Tony's default file pool, POOLQ.

Tony can also omit his user ID from the directory name (if he has not issued a SET FILESPACE command) because it will default to his user ID. He must, however, be sure to retain the period to indicate his top directory. Therefore, Tony could refer to the .NICK directory in a command as follows:

```
.NICK
```

In executing a command, SFS would begin with Tony's top directory (designated by the period) and move down one level to the .NICK directory. Notice that there is not a space between the period and the word NICK.

Notice that you refer to FILECONTROL and DIRCONTROL directories in the same way. The .NICK directory could have either the FILECONTROL or DIRCONTROL attribute.

Accessing Another User's Directory

Note: If your system responds differently than indicated in this section, request assistance from the administrator that set up the SFS files and directories.

After your system administrator has set up the SFS files and directories that were shipped with your system, you will have automatic read authority to the files and directories that reside in the IBM-supplied VMSYSU file pool. Usually, other users will need to grant you authority for a directory or a file before you can access or use it.

Before you can work with the MAINT. top directory and its subdirectories, you must access it. You can access the MAINT. top directory as any available file mode letter. Your top directory is accessed with a file mode of A. Access the MAINT. top directory with a file mode of B.

A sample format of the ACCESS command follows:

```
►►—access—filepool:userid.—fm—————►►
```

The MAINT user ID is assigned to the VMSYSU file pool; if VMSYSU is also your default file pool, you do not need to specify the file pool ID. Because MAINT is the name of a top directory, be sure to follow it with a period. Leave a blank space before the file mode letter, B. To access the top directory owned by the MAINT user ID as B, enter:

```
access maint. b
```

In cases where you are not sure if a user is enrolled in your file pool, you can use the QUERY ENROLL command. For more information on QUERY ENROLL, see *z/VM: CMS Commands and Utilities Reference*.

Although you have now accessed another user's directory, your hierarchy of directories is not affected. That is, this directory becomes part of your CMS search

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order (discussed in “File Mode Letters and Numbers” on page 129), but is not part of your directory structure. Your directory structure will remain the same until you create new directories of your own.

To verify that the directory was accessed, you can enter the QUERY ACCESSED command, your screen will look something like this:

| Mode | Stat | Files | Vdev | Label/Directory |
|------|------|-------|------|-------------------------|
| A | R/W | 2 | DIR | VMSYSU: <i>yourid</i> . |
| B | R/O | 543 | DIR | VMSYSU:MAINT. |
| S | R/O | 1321 | 190 | MNT190 |
| Y/S | R/O | 337 | 19E | MNT19E |

You will notice the MAINT. directory is accessed with a file mode of B. Also notice that the MAINT. directory has the FILECONTROL attribute. If it had the DIRCONTROL attribute, you would see DIRC instead of DIR in the Vdev column. The MAINT. directory only remains accessed for the duration of your CMS session; a LOGOFF command will automatically release it.

Also notice that the MAINT. directory is accessed in read-only status. Most CMS commands that issue file mode letters will not allow you to write to files if the directory is accessed as read-only. However, COPYFILE and XEDIT will allow you to write to a file control directory accessed read-only, unless you use the SET RORESPECT ON command.

Another command that might be useful when you are accessing another user's directory is the SET FILESPACE command. This command is similar to the SET FILEPOOL command except it allows you to default the user ID portion of the *dirid* (rather than the file pool ID portion). In the above example, you could have entered:

```
set filespace maint
```

followed by:

```
access . b
```

and because you set the default user ID to MAINT, CMS would have accessed MAINT's top directory. There is a QUERY FILESPACE command you can use to find the default setting. For more information on SET FILESPACE and QUERY FILESPACE, see *z/VM: CMS Commands and Utilities Reference*.

Note: The examples that follow assume this has not been done.

Specifying a Directory Identifier

You need to refer to directories often when using CMS commands. When you use commands that accept a directory identifier, a *dirid*, you can refer to a directory several ways. A directory identifier can be a complete directory name, such as a file pool identifier followed by the name of a directory (for example, VMSYSU:MAINT.SAMPLES). It could be an abbreviated form of the directory name, as discussed in “Using the Abbreviated Form of Your Top Directory” on page 48. After you have accessed a directory, you can also use the file mode letter in commands which accept a directory name.

Because some directory names can be quite long, it could be tedious to have to type (or remember) the directory name each time you wanted to enter a command.

For this reason, there are shorter methods of identifying the directory or subdirectory. One such method is plus (+) and minus (-) file mode notation, and another is the use of file mode letters.

Rather than typing out the entire directory name, you can use the plus sign (+) to move down one level lower in the hierarchy and the minus sign (-) to move up one level. You will find this short-cut syntax particularly helpful in writing execs. To learn about plus and minus notation, see *z/VM: CMS Commands and Utilities Reference*.

You can use file mode letters to refer to accessed directories in commands that accept a directory identifier. This section provides examples of the use of the file mode letter as the directory identifier.

Listing the Structure of a Directory with DIRLIST

You can use the DIRLIST command to see what the MAINT. top directory contains. DIRLIST is a very useful command because it lets you easily see the *big picture* of what subdirectories are contained within a directory. A sample format of the DIRLIST command follows:

►►—dirlist—*dirid*—◄◄

If you do not specify a directory identifier when entering the DIRLIST command, your top directory is assumed.

Because you accessed MAINT. with a file mode of B, CMS finds the correct directory and performs the DIRLIST command when you just specify the file mode letter. Enter:

```
dirlist b
```

Your screen will look like the example shown in Figure 7.

```

yourid  DIRLIST  A0  V 319  l=1 Alt=0
Cmd    Fm Directory Name
-      B  VMSYSU:MAINT.
-      -  VMSYSU:MAINT.SAMPLES

1= Help      2= Refresh  3= Quit    4= Sort(fm)  5= Sort(dir)  6= Auth
7= Backward  8= Forward  9=         10=          11= Filelist  12= Cursor

====>
X E D I T  1 File

```

Figure 7. Entering the DIRLIST Command

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With DIRLIST, directories are listed in a full-screen display similar to the output you receive when you enter the FILELIST or RDRLIST commands.

The first column of the display, labeled *Cmd*, is where you can enter commands to be processed against any of the directories listed. The *Fm* column indicates the file mode letter you used to access the directory. The column labeled *Directory Name* lists the complete name of the directory.

The DIRLIST command lists the directory you specify plus all its subdirectories. DIRLIST can also display only a subset of directories, or minidisks linked to your virtual machine. Listed below are some of the options available for the DIRLIST command. For more information, see *z/VM: CMS Commands and Utilities Reference*.

ALL the default for DIRLIST; it lists all the directories in the specified directory structure for which you have some authority. Directories are listed regardless of their attributes, and even if they are not accessed.

ACCESSED

to list only directories that are accessed.

DIRCONTROL

to list only directory control directories

FILECONTROL

to list only file control directories

MDISK

to list the minidisks that you have linked. If this option is used with the ACCESSED option, only the minidisks you have accessed will be listed along with the directories that are listed. When the MDISK option is used with FILECONTROL, DIRCONTROL, or ALL, all of the minidisks you have linked will be listed along with all of the FILECONTROL, DIRCONTROL, or ALL directories that are listed. Examples of using this option will be given in the next section.

If you have authority to subdirectories under another user's top directory, but do not remember their names, you can use the DIRLIST command to display a list of all subdirectories to which you have authority. Use the same command format, except substitute the *userid* of the other user for the *dirid*.

Displaying Minidisks and Directories with DIRLIST

The MDISK option of DIRLIST command is an alternative to using QUERY ACCESSED command for both minidisk and SFS users. Because it shows all the minidisks that you have linked to your virtual machine in a full screen format, you can do automatic access and release of a disk. For example, the following is a sample DIRLIST (MDISK display):

```
yourid DIRLIST A0 V 319 Trunc=319 Size=4 Line=1 Co l=1 Alt=0
Cmd Fm Directory Name
- VMSYSU:yourid
C 0090
- 019A
- 019D
G 019F
A 0191
R 0399
```

You can tell whether a directory or minidisk is accessed by referring to the column labeled *Fm*. If the column displays a file mode letter, then the directory listed on that line is accessed with the file mode letter shown. If the line shows a dash (—)

in the Fm column, then that directory has not yet been accessed. For example, to access the minidisk at address 019A with file mode of B, you would enter the following ACCESS command:

```
yourid  DIRLIST A0 V 319 Truine=1 Col=1 Alt=0
Cmd     Fm Directory Name
      -  VMSYSU:      C 0090
acc / b 019A
      - 019D
      G 019F
      A 0191
      R 0399
```

Note: This command is also very useful when looking for free file modes.

Using the DIRLIST PF Keys

From the DIRLIST display, you can use your PF keys to obtain additional information for any of the directories listed.

Following is a list of the DIRLIST PF keys and their meanings. You can use these PF keys to find useful information about directories and files.

Table 5. DIRLIST PF Keys

| Key | Meaning | Usage |
|------|------------|--|
| PF1 | Help | Use PF1 to display the main HELP menu. |
| PF2 | Refresh | When you press PF2, the screen display is refreshed. The end results of any previously entered commands are shown. |
| PF3 | Quit | This key lets you quit from the DIRLIST environment and remove the displayed output from your screen. |
| PF4 | Sort (fm) | The PF4 key sorts the output currently displayed on your screen alphabetically by file mode. |
| PF5 | Sort (dir) | The PF5 key sorts the output currently displayed on your screen alphabetically by directory name. |
| PF6 | Auth | Pressing the PF6 key processes the AUTHLIST command. You will see your authority to the directory that is on the line where your cursor is placed, when you press PF6. Also, if you are the owner of the directory, you will see a list of users who have been granted authority. For more information, see "Using the AUTHLIST Command" on page 90. |
| PF7 | Backward | This key scrolls the DIRLIST display backward one screen. |
| PF8 | Forward | This key scrolls the DIRLIST display forward one screen. |
| PF9 | | Undefined |
| PF10 | | Undefined |
| PF11 | Filelist | Pressing the PF11 key brings you into a FILELIST display of the files or directories contained in the directory indicated (the directory on the line where your cursor is currently located). |
| PF12 | Cursor | This key causes the cursor to move from the file area to the command line. If the cursor is on the command line, it moves to its previous location in the file area. |

Using the LISTDIR Command

You can also list the structure of a directory by using the LISTDIR command. LISTDIR provides the same information as DIRLIST, but while DIRLIST provides a

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full-screen display, the output from LISTDIR appears in line-mode format. A sample format of the LISTDIR command follows:

```
▶▶—listdir—dirid—————▶▶
```

Like DIRLIST, you can use the options ACCESSED, DIRCONTROL, and FILECONTROL, to list a subset of directories. Also like DIRLIST, the easiest way to enter the LISTDIR command is to type the command followed by the file mode. For example, to list the structure of the MAINT. top directory, enter:

```
listdir b
```

Your screen will display this information:

```
Fm Directory Name  
B VMSYSU:MAINT.  
- VMSYSU:MAINT.SAMPLES  
Ready;
```

LISTDIR displays the same information as DIRLIST. The column labeled Fm shows the file mode letter where the directory is accessed, and the column labeled Directory Name shows the complete name of the directory.

If you are enrolled in VMSYSU you will be given read authority to the IBM-supplied files and directories owned by the MAINT user ID. You will be able to see a list of the directories using DIRLIST or LISTDIR. You can see a list of the files and directories using FILELIST or LISTFILE. You can see the actual contents of the files using XEDIT.

In the previous examples, we used DIRLIST and LISTDIR to list the structure of another user's top directory. Both DIRLIST and LISTDIR are also useful to see all of the directories below your own top directory. If you specify either command without a directory identifier, the command will default to your top directory and list all the subdirectories it contains.

Creating a Directory

Now that we have seen how to access and list the structure of existing directories, let us create a new directory. To create a directory of your own, use the CREATE DIRECTORY command. A sample format of the command follows:

```
▶▶—create—directory—dirid—————▶▶
```

Remember, you will always have a top directory whose name is the same as your user ID, followed by a period. Any new directories you create will be subdirectories of your top directory. You cannot change the name of your top directory, and you cannot create new directories that are the same level as your top directory.

For example, to create the directories shown in Figure 6 on page 48, Tony would have used the following series of commands:

```
create directory .patti  
create directory .tonyjr  
create directory .courtney  
create directory .nick
```


In these commands, the period specifies Tony's top directory. Therefore, the first command actually tells SFS to create a directory below Tony's top directory, with the name PATTI. The subsequent commands set up the .TONYJR, .COURTNEY, and .NICK directories.

To create a directory of your own, enter the following command:

```
create directory .party
```

This command will create a directory called .PARTY below your top directory. By default, your directory will have the FILECONTROL attribute. To create a directory with the directory control attribute, you must specify the DIRCONTROL option of the CREATE DIRECTORY command.

Figure 8 represents your directory structure after entering the CREATE DIRECTORY command.

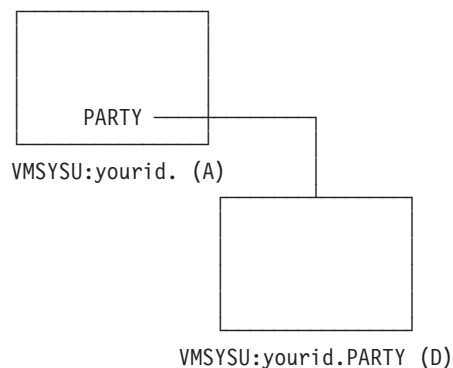


Figure 8. The .PARTY Directory

To create another directory called .PARTY.TREATS below the .PARTY directory, enter:

```
create directory .party.treats
```

Figure 9 on page 56 represents your directory structure.

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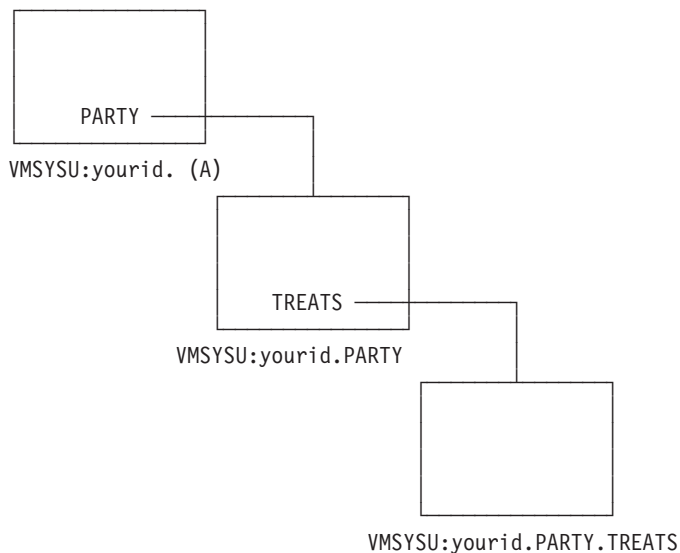


Figure 9. The .PARTY.TREATS Directory

The .PARTY directory is a subdirectory of your top directory; the .PARTY.TREATS directory is a subdirectory of the .PARTY directory.

To see a list of all of your directories, use the DIRLIST command with the name of your top directory or the file mode of your top directory.

```
yourid DIRLIST A0 V 319 1=1 Alt=0
Cmd Fm Directory Name
  A VMSYSU:yourid.
  - VMSYSU:yourid.PARTY
  - VMSYSU:yourid.PARTY.TREATS

1= Help      2= Refresh  3= Quit    4= Sort(fm)  5= Sort(dir)  6= Auth
7= Backward  8= Forward  9=         10=          11= Filelist 12= Cursor

====>

X E D I T 1 File
```

Figure 10. Using DIRLIST to List All Directories

The .PARTY and .PARTY.TREATS directories, and any other directories you create, will remain in your hierarchy until you explicitly erase them using the ERASE command. For more information on erasing directories, see *z/VM: CMS Commands and Utilities Reference*.

Putting Files into a Directory

Although you have just created the .PARTY and .PARTY.TREATS directories, they do not contain any files. You will now want to add files to your directories. You can do this by copying existing files into the directory and by creating new files.

Copying Files to a Directory

One of the ways you can put existing files into a directory is by copying existing files using the COPYFILE command. First, access the .PARTY directory you just created. To determine which file modes you have used, enter the QUERY ACCESSED command to display information similar to the following:

| Mode | Stat | Files | Vdev | Label/Directory |
|------|------|-------|------|-----------------|
| A | R/W | 2 | DIR | VMSYSU:yourid. |
| B | R/O | 543 | DIR | VMSYSU:MAINT. |
| S | R/O | 1321 | 190 | MNT190 |
| Y/S | R/O | 337 | 19E | MNT19E |

You used file mode A to access your top directory and file mode B to access the MAINT. top directory. File modes S and Y were assigned to access some of the disks that control your virtual machine. Choose file mode D to access the .PARTY directory.

Enter:

```
access .party d
```

This command will access the .PARTY directory, which is one level below your top directory, with a file mode of D.

Now, you are ready to use the COPYFILE command. A sample format of the command follows:

```
►►—copyfile—fn1—ft1—fm1—fn2—ft2—fm2—————►►
```

The first file name, file type, and file mode refer to the original file you are copying; the second file name, file type, and file mode refer to the copy you wish to create.

To work with the sample files provided, we'll need to release MAINT's top directory and access MAINT's .SAMPLE directory.

```
release b
access maint.samples b
```

The MAINT.SAMPLES directory (accessed with a file mode of B) contains the files INVITE SCRIPT and CAKE SCRIPT. You can copy the INVITE SCRIPT and CAKE SCRIPT files into your .PARTY directory. Keep the same file names and file types. Enter the following commands, pressing Enter after each one:

```
copyfile invite script b = = d
copyfile cake script b = = d
```

Figure 11 on page 58 represents your directory structure.

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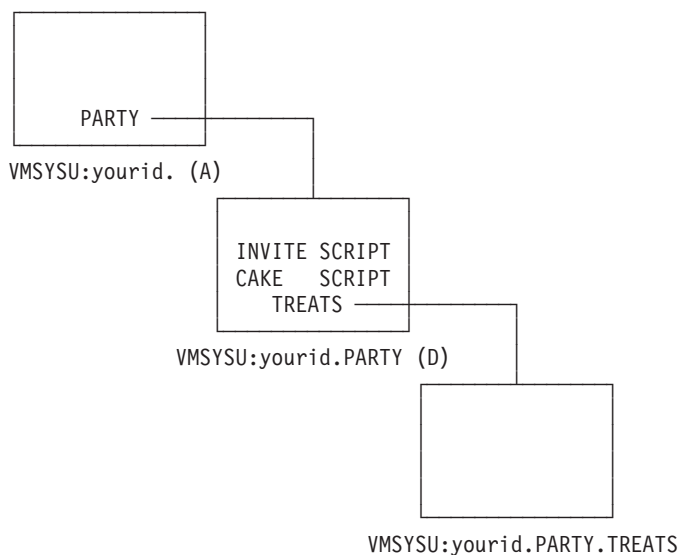


Figure 11. Files Within the .PARTY Directory

You can use the COPYFILE command to copy files from one directory to another, as we did in this example, or to copy files from a minidisk to a directory, or from a directory to minidisk. You just need to know the file mode of the directory, or minidisk, where the file is located and the file mode of the destination directory or minidisk.

Creating New Files

For more information on other ways to add files to your directories including creating new files using XEDIT or using the CREATE FILE command, see “Creating a New File” on page 32.

CREATE FILE creates new empty files in SFS directories only. Empty files are necessary as place holders for future input, and also for setting up authorizations and grants that will be used later. You cannot create new files on minidisks with CREATE FILE.

For example, you could create FUNTIMES SCRIPT by entering:
create file funtimes script d

CREATE FILE also lets you specify the record format, record length, and recoverability and overwrite attributes for the files you create. For additional information, see *z/VM: CMS Commands and Utilities Reference*.

Renaming Your Files and Directories

You can use the RENAME command to rename your own file, a file in another user's directory (if you are properly authorized), or a directory.

To rename your own file, use the RENAME command format as follows (for help with reading syntax diagrams, see “Syntax, Message, and Response Conventions” on page 22):

```
►►—rename—fn1—ft1—dirid—fn2—ft2—dirid—◄◄
```

The *dirid* is the same for both the old and new file IDs. You cannot use the RENAME command to move files to other directories. If you wish to move files between directories, you can do so with the RELOCATE command, which we will discuss in the section, “Relocating Your Files and Directories.”

If you are renaming a file in another user's directory, you must either use the directory name (not the file mode) in the RENAME command, or you must access the other user's directory in read/write mode. To access another user's directory in read/write mode, use the FORCERW option of the ACCESS command.

If you wish to rename a directory, use the following sample format (for help with reading syntax diagrams, see “Syntax, Message, and Response Conventions” on page 22):

```
►►—rename—dirid1—dirid2—►►
```

Specify the original directory identifier and the new directory identifier. You can use the RENAME command to rename directories; however you cannot:

- Use RENAME to move a directory to another parent directory
- Rename directories you do not own
- Use RENAME to move a directory or subdirectory from one level to another. For example, the following command is *not* allowed:

```
rename .party.treats.food
```

Relocating Your Files and Directories

You can use the RELOCATE command to:

- Relocate a file from one directory to another
- Relocate an entire directory and all the files it contains.

A sample format of the RELOCATE command follows (for help with reading syntax diagrams, see “Syntax, Message, and Response Conventions” on page 22):

```
►►—relocate—fn—ft—dirid1—TO—dirid2—►►
```

You specify the file ID (including the *dirid* where the file is currently located), and the destination *dirid*.

For example, you can relocate the CAKE SCRIPT file (currently in your .PARTY directory) to your .PARTY.TREATS directory with the command:

```
relocate cake script .party to .party.treats
```

Or, you can relocate files using file modes. You could access the .PARTY directory as D, and the .PARTY.TREATS directory as E, and enter the following command:

```
relocate cake script d to e
```

After you have entered this command, the CAKE SCRIPT file will be in the .PARTY.TREATS directory. CAKE SCRIPT .PARTY.TREATS is the long version of the new name of the file.

Note: All the directories in the following series of relocations are FILECONTROL directories. There are restrictions for DIRCONTROL directories:

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- Files cannot be relocated into or out of DIRCONTROL directories. However, DIRCONTROL directories can be relocated to other parts of the directory structure, and other directories can be relocated as subdirectories of DIRCONTROL directories.
- You cannot relocate a DIRCONTROL directory if anyone other than you has the directory accessed.

Figure 12 represents your directory structure.

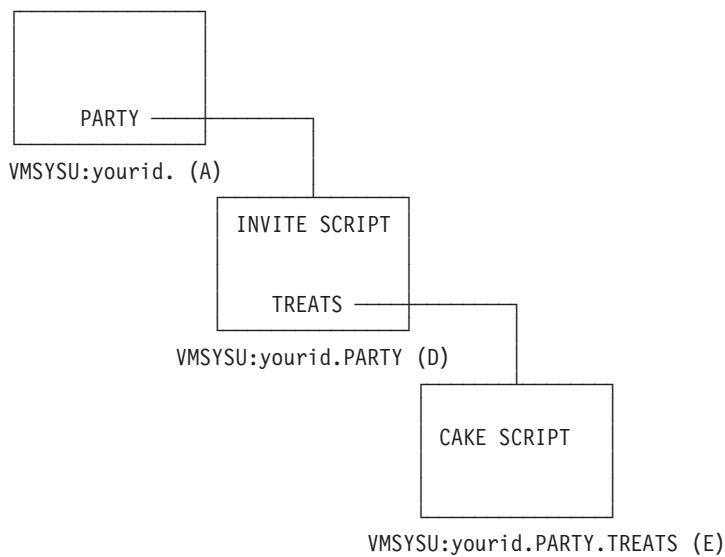


Figure 12. Moving a File to the .PARTY.TREATS Directory

To relocate an entire directory and all the files it contains, you would specify the following:

```
►►—relocate—dirid1—TO—dirid2—◄◄
```

For example, a new directory called .PARTY.FAVORS. will be created, then relocated. Enter:

```
create directory .party.favors
```

Figure 13 on page 61 represents your directory structure.

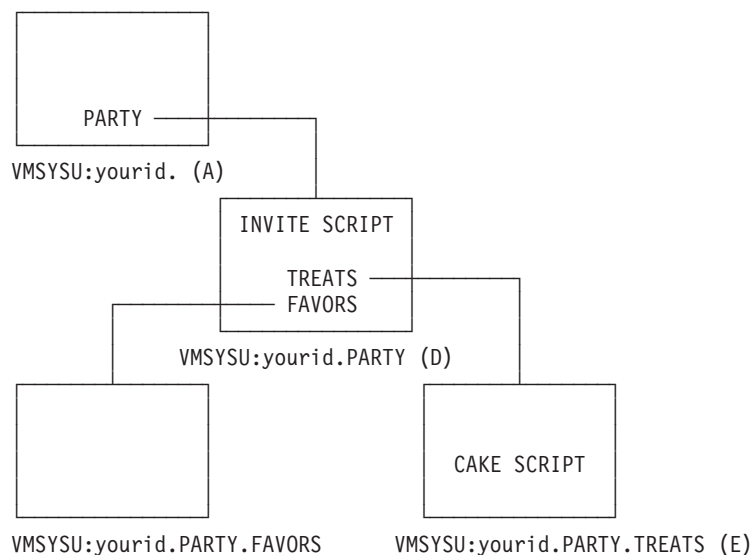


Figure 13. Creating the .PARTY.FAVORS Directory

Now relocate the directory with:
`relocate .party.favors to .party.treats`

Your directory structure now looks like Figure 14.

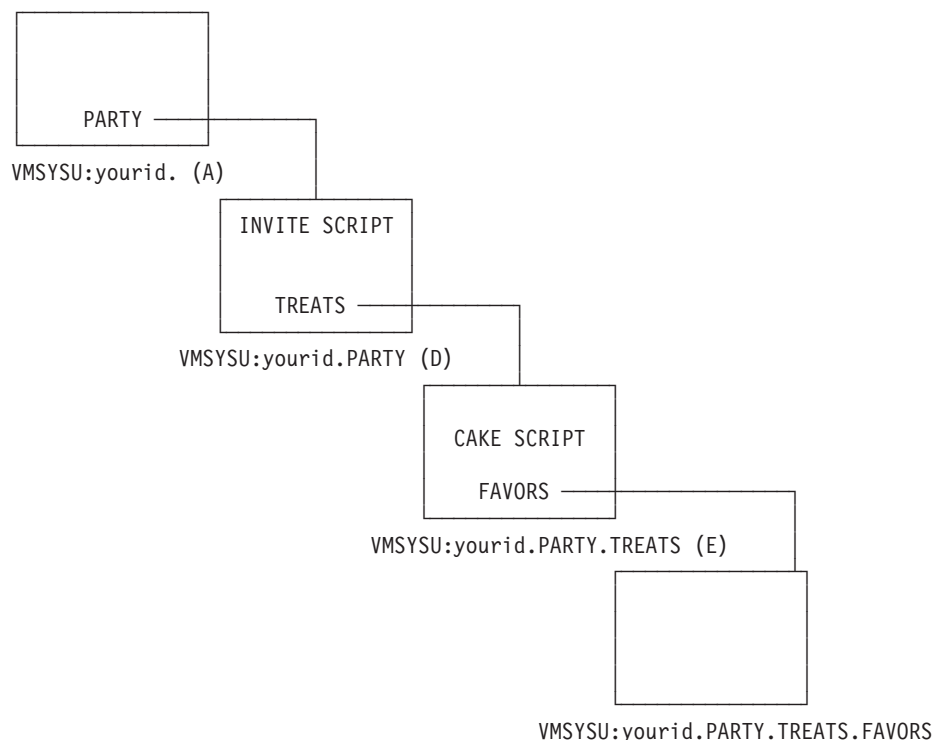


Figure 14. Relocating the .PARTY.FAVORS Directory

After you have entered this command, the .PARTY.FAVORS directory and any files it contains (currently none) would be relocated to below the .PARTY.TREATS directory. It would now be the .PARTY.TREATS.FAVORS directory because it is one level below the PARTY.TREATS directory.

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Create one more directory below the .PARTY.FAVORS directory:

```
create directory .party.treats.favors.games
```

To check whether the commands worked, you could check DIRLIST.

```
yourid  DIRLIST A) V 319 Trunc=319 Size=5 Line=1 Col=1 Alt=0
Cmd    Fm Directory Name
-      A  VMSYSU:yourid.
        D  VMSYSU:yourid.PARTY
        E  VMSYSU:yourid.PARTY.TREATS
        -  VMSYSU:yourid.PARTY.TREATS.FAVORS
        -  VMSYSU:yourid.PARTY.TREATS.FAVORS.

1= Help      2= Refresh  3= Quit    4= Sort(fm)  5= Sort(dir)  6= Auth
7= Backward  8= Forward  9=         10=          11= Filelist  12= Cursor

====>

X E D I T 1 File
```

Figure 15. Listing All Your Directories

Unlike COPYFILE, which creates a duplicate copy of the file in a new location, RELOCATE moves the file from one place to another. However, any aliases or authorities you may have created earlier are unchanged. (We will discuss aliases and authorities later in this section.)

When you are using the RELOCATE command, remember that you cannot relocate a file or directory to another user's file space or to another file pool. Also, to relocate a file or directory, you must be the owner.

Erasing a Directory

When you decide to erase a directory, you must first move any files or subdirectories you wish to keep. (Use the RELOCATE command to move files in FILECONTROL directories, and COPYFILE for files in DIRCONTROL directories.)

A sample format of the ERASE command follows:

```
►►—erase—dirid—(nofiles—►►
```

The NOFILES option of the ERASE command tells CMS that you have emptied the directory of all files and aliases before entering the command. NOFILES is the default for the ERASE command.

If you wish to erase not only the directory, but also the files it contains, specify the FILES option when using the ERASE command. If FILES is not specified and the directory contains one or more files or external objects, the erase is not performed. Additionally, if any subdirectories branch from the directory, the directory is not erased.

Navigating Through Your Directories

The options of the FILELIST command, and the FILELIST screen PF keys, can be used to navigate through your directories and see the files they contain.

For an example, we will copy some additional files from the MAINT.SAMPLES directory to the .PARTY and .PARTY.TREATS directories with the following commands:

```
copy theme script b = = d
copy music script b = = d
copy drink script b = = e
copy cookies script b = = e
```

Figure 16 represents your directory structure.

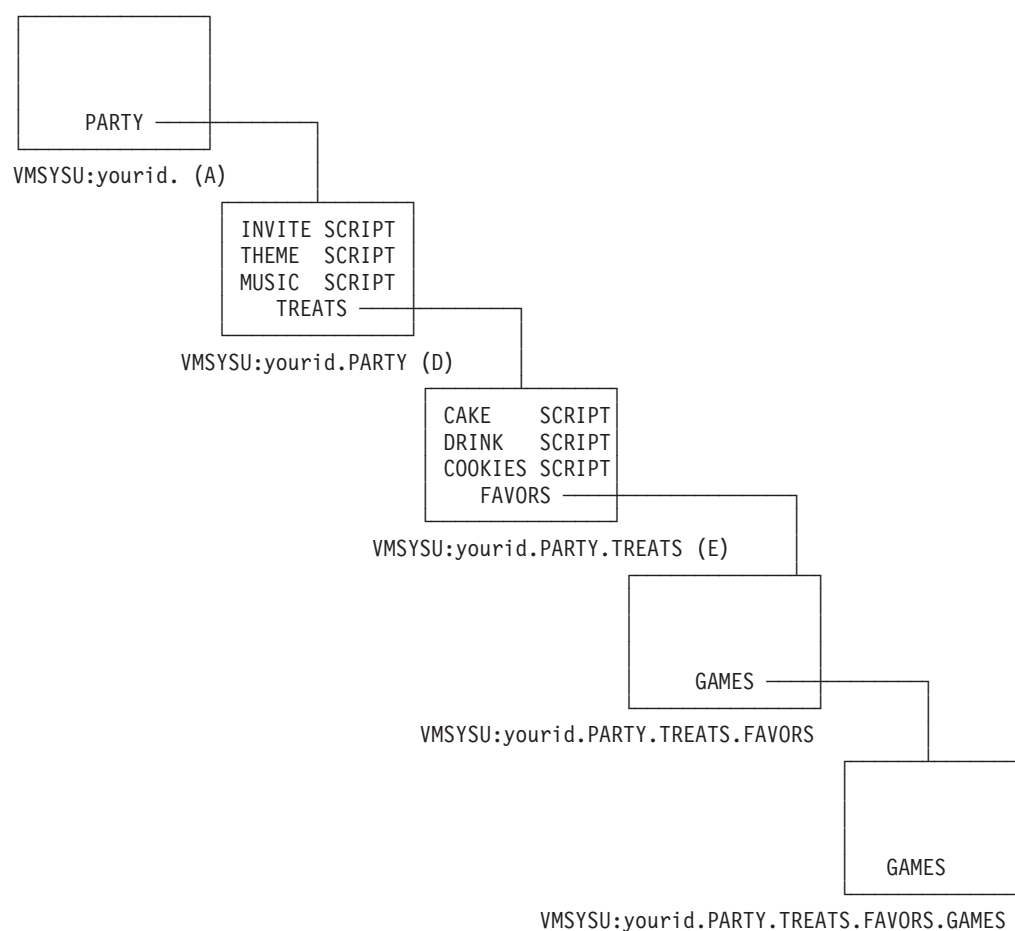


Figure 16. Copying More Files to .PARTY and PARTY.TREATS

For a FILELIST display of the .PARTY.TREATS directory, press PF11 from DIRLIST when your cursor is on the line for .PARTY.TREATS.

Your screen will look like the example shown in Figure 17 on page 64.

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```
yourid  FILELIST A0 V 1 08 Trunc=108 Size=4 Line=1 Col=1 A
Directory = VMSYSU:yourid.PARTY.TREATS
Cmd  Filename Filetype Fm Format Lrecl  Records  Blocks  Date    Time
-    COOKIES  SCRIPT  E1 V      37        6        1 1/06/00 16:03:52
     DRINK   SCRIPT  E1 V      13        8        1 1/06/00 16:03:42
     FAVORS  E DIR    -         -         - 1/06/00 15:59:38
     CAKE   SCRIPT  E1 V      55       13        1 1/06/00 15:56:16

1= Help      2= Refresh  3= Quit    4= Cancel  5= Sort(dir)  6= Sort(size)
7= Backward  8= Forward  9= FL /n 10= Share 11= XEDIT/LIST 12= Cursor

====>

X E D I T 1 File
```

Figure 17. Using PF11 from DIRLIST

This displays the FILELIST STATS screen. It shows a listing of all the files contained in the directory and a listing of all the subdirectories that are one level below the .PARTY.TREATS directory.

The .PARTY.TREATS.FAVORS directory is shown with file mode E, the file mode of the parent directory (.PARTY.TREATS). Notice that subdirectories do not have file mode numbers.

If you need information on the date and time the files were created, the date the files were last referenced, or the date and time the files were last updated, you can use the ALLDATES option of the FILELIST command. For example, to get these additional dates for the PARTY.TREATS directory, you would enter on the command line:

```
filelist * * e (alldates)
```

Your screen would look like the example shown in Figure 18 on page 65.

```

yourid  FILELIST A0  V 174  Size=4 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.PARTY.TREATS
Cmd  Filename Filetype Fm Create-Dt Create-Tm Lref-Dt Update-Dt Update-Tm
COOKIES SCRIPT E1 12/00/00 12:24:46 1/06/00 1/06/00 16:03:52
DRINK SCRIPT E1 12/00/00 12:35:26 1/06/00 1/06/00 16:03:42
FAVORS E 12/00/00 12:40:32 1/06/00 15:59:38
CAKE SCRIPT E1 12/03/00 11:15:23 1/06/00 1/06/00 15:56:16

1= Help      2= Refresh  3= Quit     4= Cancel   5= Sort(updt) 6= Sort(1rdt)
7= Backward  8= Forward  9= S(cdt) 10= Stats   11= XEDIT/LIST 12= Cursor

====>

X E D I T 1 File

```

Figure 18. Sample FILELIST Screen with ALLDATES Option

There are several PF key changes on this screen:

- PF5** Sorts by date of last update
- PF6** Sorts by date of last reference
- PF9** Sorts by creation date
- PF10** Toggles between the FILELIST STATS and FILELIST ALLDATES screen

For a complete description of ALLDATES and other FILELIST options, see *z/VM: CMS Commands and Utilities Reference*.

To display the contents of the .PARTY.TREATS.FAVORS directory, you can move your cursor to the line for the FAVORS directory and press PF11.

```

yourid FILELIST A0 V 108 Tre=1 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.PARTY.TREATS.
Cmd  Filename Filetype Fm Format Lrecl  Records  Blocks  Date  Time
-    GAMES      Z DIR      -      -      -    1/06/00 16:00:29

1= Help      2= Refresh  3= Quit    4= Cancel    5= Sort(dir)  6= Sort(size)
7= Backward  8= Forward  9= FL /n  10= Share    11= XEDIT/LIST 12= Cursor
Directory has been temporarily accessed as filemode Z
====>

X E D I T 1 File

```

Figure 19. Using PF11 from FILELIST

The .PARTY.TREATS.FAVORS directory contains the GAMES subdirectory. Note the message at the bottom of the screen. Because the directory was not accessed, FILELIST temporarily accessed the .PARTY.TREATS.FAVORS directory with the first available file mode letter, starting at the end of the alphabet.

The .PARTY.TREATS.FAVORS.GAMES directory is shown here with a file mode of Z (the file mode of its parent).

If you were to press PF11 from the Cmd area of the GAMES line, you would see the message:

Directory is empty

You can always tell where you are in the hierarchy by referring to the line of the FILELIST screen labeled Directory.

Table 6 lists several PF keys on the FILELIST STATS screen that provide you with information about the files and directories.

Table 6. FILELIST STATS PF Keys

| Key | Meaning | Usage |
|-----|------------|---|
| PF4 | Cancel | The PF4 key lets you exit all the way out of FILELIST, regardless of where you are within FILELIST and how many times you pressed PF11 to enter new displays. |
| PF5 | Sort(dir) | The PF5 key sorts the output currently displayed on your screen. Directories are listed alphabetically, followed by files, which are listed by date and time. |
| PF6 | Sort(size) | When you press PF6, the items shown in the FILELIST display will be sorted by block size, from largest to smallest. |
| PF9 | FL /n | When you place your cursor next to a file and press PF9, your screen displays a list of all files with that same file name and any other file type and file mode. |

Table 6. FILELIST STATS PF Keys (continued)

| Key | Meaning | Usage |
|------|------------|--|
| PF10 | Share | Pressing the PF10 key is the same as entering the FILELIST command with the SHARE option. A new FILELIST display is shown providing more data and another set of PF keys. You can press PF10 again to toggle back to the FILELIST STATS screen. |
| PF11 | XEDIT/LIST | When you press PF11, if your cursor is located on a file, PF11 will XEDIT the file. If your cursor is for a directory, PF11 will show a FILELIST display of the files within that directory. You can press PF3 to return to the FILELIST STATS screen. |

You can press PF10 to display the FILELIST SHARE screen. This screen shows more information about your files. PF10 is a toggle key. If you press it repeatedly, you will toggle between the FILELIST STATS screen (the default FILELIST screen) and the FILELIST SHARE screen.

Press PF10 now. Your screen will look like the example shown in Figure 20.

```

yourid  FILELIST A0  V 149 Size=6 Line=1 Col=1 Alt=18
Directory = VMSYSU:yourid.PARTY.TREATS
Cmd  Filename  Filetype  Fm  Owner   Type   R  W
-   COOKIES  SCRIPT    E1  yourid  BASE   X  X
    DRINK    SCRIPT    E1  yourid  BASE   X  X
    FAVORS           E   yourid  DIR    X  X
    CAKE     SCRIPT    E1  yourid  BASE   X  X
    ICECREAM SCRIPT    E1  yourid  ALIAS  X  -
    CANDLE   SCRIPT    E1  yourid  EXTRNL -  -

1= Help      2= Refresh  3= Quit    4= Cancel    5= Sort(dir)  6= Auth
7= Backward  8= Forward  9= Alias  10= Stats    11= XEDIT/LIST 12= Cursor

====>
X E D I T  1 File

```

Figure 20. The FILELIST SHARE Screen

The SHARE display differs from the FILELIST STATS screen with the columns labeled Owner and Type. The Owner column lists the owner of each file or directory displayed. The Type column shows the type of item displayed, such as:

- DIR** File control directory
- DIRC** Directory control directory
- MDISK**
 - Minidisk
- BASE** Base file

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ALIAS

Alias

ERASED

Erased Alias

REVOKED

Revoked alias

BASE*

Migrated base file

ALIAS*

Migrated alias

EXTRNL

External object

Note: External objects are only displayed if you have also specified the ALLfile option.

The terms: base files, aliases, migration, and erased and revoked files will be discussed in upcoming sections.

If you see an asterisk (*) next to BASE or ALIAS, this means that this file has been migrated and is now located in DFSMS/VM-owned storage. These files may take longer than usual to reference. For more information about file migration, see "DFSMS/VM and SFS File Management" on page 70.

External objects appear to be in the directory shown by FILELIST, but the data in these files is actually located outside of the directory, perhaps in another SFS file pool or in a database. These may be used by application programs.

For FILECONTROL directories, files contained in them, and external objects, the last two columns indicate whether you have read or write authority for each file or directory displayed. An X indicates that you have authority; a dash (-) means that you do not.

For DIRCONTROL directories, the last two columns indicate whether you have directory control read (DIRREAD) or directory control write (DIRWRITE) authority for the directory. For files and external objects within DIRCONTROL directories, the last two columns indicate whether you have DIRREAD or DIRWRITE authority for the parent directory. Regular read and write authorities cannot be granted on DIRCONTROL directories or the files within them.

A quick way to bring up the FILELIST SHARE screen is to enter the FILELIST command with the SHARE option. For more information, see *z/VM: CMS Commands and Utilities Reference*.

The FILELIST SHARE screen provides several PF key functions that differ from the FILELIST STATS display.

Table 7. FILELIST SHARE PF Keys

| Key | Meaning | Usage |
|------|---------|--|
| PF6 | Auth | This key processes the AUTHLIST command, displaying the authority you have on the file or directory where your cursor is located. If you are the owner, it also lists information on any authority you have granted to other users. For more information, see “Using the AUTHLIST Command” on page 90. |
| PF9 | Alias | This key processes the ALIALLIST command to see information regarding the file where the cursor is located. If the file is a base file that you own, you will see a list of users who have an alias to it. If the file is a base file that someone else owns, you will see a list of your aliases to it. If the file is an alias, you will see the owner of the base file. For more information, see “Using the ALIALLIST Command” on page 79. |
| PF10 | Stats | This is the toggle to the FILELIST STATS screen. |

Sharing Files

You can share your files with other users by:

- Accessing directories
- Creating aliases
- Granting authority.

We have already discussed accessing other users' directories to share files. This section will discuss sharing files by creating aliases and granting authority. Whenever you store your files in an SFS file pool, you have the option to share any of your files or directories with other users, or to share none at all.

To determine who is enrolled in your file pool, you can use the QUERY ENROLL command. A sample format of the command follows:

►►—query—enroll—user—for—*userid*—◄◄

Specify a user ID or nickname to determine if a specific user is enrolled. For example, to determine if Mary is connected to the VMSYSU file pool, you could specify:

```
query enroll user for mary
```

Your output might look like this:

| | |
|--------|----------|
| Userid | Enrolled |
| MARY | YES |

To see a list of all the users currently connected to your file pool, enter one of the following:

```
query enroll user for all
```

or

```
query enroll user
```

This section provides information on how to share files with users enrolled in your file pool. However, you can also use the QUERY ENROLL command to determine which users are enrolled in other file pools. For more information, see *z/VM: CMS Commands and Utilities Reference*.

DFSMS/VM and SFS File Management

You may want to ask your SFS administrator if *DFSMS/VM*, a storage management feature of *z/VM*, has been installed on your system, and is being used to manage SFS files, because this can affect the behavior of files in an SFS file pool.

DFSMS/VM provides the capability for the system to automatically manage SFS files and directories by assigning them to a management class. A *management class* is a set of attributes that define storage management criteria for the files. Files can be automatically deleted after a certain number of days, for example, or moved to DFSMS/VM-owned storage. This can simplify SFS administration and enable more efficient use of storage.

File Migration

Some SFS files controlled by DFSMS/VM may appear to reside in your file pool, but actually reside in a storage repository managed by DFSMS/VM. (Note that migrated files still are considered by SFS to consume their usual amount of room in your file space.) These files are said to be in *migrated status* in your file pool. (Files in DIRCONTROL directories are never migrated.) You can identify these files by issuing FILELIST (SHARE or LISTFILE. Migrated files are shown with an asterisk in the Type column.

These files act exactly like regular SFS files, but they must be *recalled* (either automatically or explicitly) into your actual file pool before you can access the data. This may cause a delay, depending on your system configuration and workload. Automatic recall is governed by the SET RECALL command, while explicit recall is performed with the DFSMS RECALL command. If SET RECALL is ON (the default), recall will happen automatically when the file data is referenced. (If you wish, you can add the SET RECALL setting to your PROFILE EXEC.) If SET RECALL is OFF, the file will not be recalled. You will get an error indicating that the file is migrated and will not be implicitly recalled. You can enter the DFSMS RECALL command to explicitly recall the file in this case. For more information about SET RECALL, see *z/VM: CMS Commands and Utilities Reference*, and for more information on the DFSMS RECALL, see *z/VM: DFSMS/VM Storage Administration*.

A file does not need to be recalled unless you need to access the file data itself (for example, with the XEDIT command.) You may query or change a file's attributes (LISTFILE, FILELIST FILEATTR, GRANT AUTHORITY, and so forth) without recalling the file. The file also does not need to be recalled to be erased, or to have its data replaced with COPYFILE (REPLACE).

Automatic File Migration and Expiration

As mentioned above, DFSMS/VM can automatically cause SFS files to be migrated or *expired* (erased) at certain predetermined times, in order to free up DASD in your storage group. The criteria for file migration and expiration are established by your installation's storage management policies. File expiration criteria are usually related to how long the file has existed, or how long since it has last been referenced. The entire file may be erased, or only the data in the file. (Files in DIRCONTROL directories *may* be expired.) For more information about DFSMS/VM, see *z/VM: DFSMS/VM Storage Administration*.

Creating Aliases to Files

When you create a file, this original file is known as a *base file*. Later, you can create an *alias* to the file and place it in another directory. The alias is a pointer to the base file; the base file does not move, and you are not creating a copy of it.

Aliases allow you to refer to a single file in more than one directory, or more than once in one directory. Aliases also let two different users refer to the same file using different names.

When entering most CMS commands, you do not need to be concerned with whether a file is a base file or an alias. All CMS commands will work on the file name you specify, regardless of whether it is a base file or an alias.

Aliases can be created only in FILECONTROL directories. They cannot exist in DIRCONTROL directories. You can, however, create an alias in a FILECONTROL directory that refers to a base file in a DIRCONTROL directory.

Aliases are useful for pointing to the same information from two directories, or from two different places within the same FILECONTROL directory. For example, assume that Jim is the owner of a file called PRICE LIST. PRICE LIST is within the directory Jim uses for the files for Project A1, called PROJA. When Jim is assigned a second project, he creates a separate FILECONTROL directory to contain files for the new project.

If Jim needs to use the same pricing information for both Project A1 and his new project, Project EZ, he may find it useful to create an alias for PRICE LIST in the new directory. He can name the file EZ PRICES in the new directory. EZ PRICES is then an alias to the base file, PRICE LIST. If he wanted to XEDIT the price information, he could specify either name. The advantage to making an alias to the base file, instead of a copy of the file, is that he could make changes to either file, and the change would be reflected in both files.

An alias does not have to be created from a base file; you can create an alias to an alias. Once Jim creates the alias EZ PRICES, he can create an alias to EZ PRICES if he needs the same information for a third project, Project NEW. Internally, CMS ensures that all aliases point directly to a base file, regardless of how they are created.

To illustrate this point, after Jim created aliases with the following commands, the pointers would be set as shown in Figure 21 on page 72.

```
create alias price list .proja ez prices .projez
create alias ez prices .projez new prices .projnew
```

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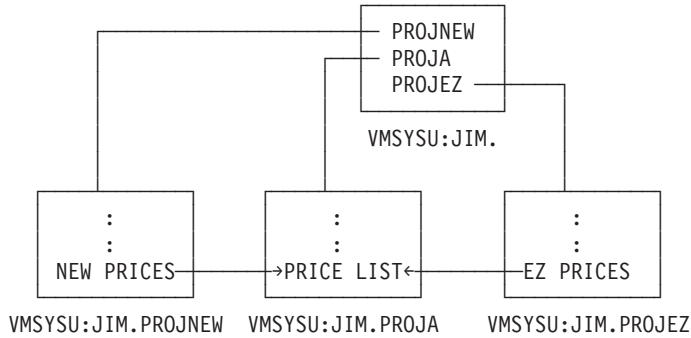


Figure 21. Example of Alias Pointers Between SFS Files

Aliases are most useful when sharing files. The other user can erase, rename, or relocate aliases to your file without affecting your base file. Also, if you change the name of your base file, a user who has an alias to it will still be able to share the file. CMS will automatically update the pointer so that the alias still refers to the same base file.

For example, Terry and Mike are working together on a project. Mike has created a file called LOTS TODO in one of his directories. The directory has the FILECONTROL attribute. Terry needs to share the file and would like to have her own pointer to it. There are two ways Terry and Mike can accomplish this:

- Mike can grant Terry read or write authority for the LOTS TODO file. Terry could then create an alias to the file in one of her own FILECONTROL directories. She could call it MIKE JOBS. Then every time she wanted to work with the file, she could XEDIT her alias MIKE JOBS. While Terry would have the alias called MIKE JOBS, the base file, LOTS TODO, is still owned by Mike.
- Terry could grant Mike write authority for one of her FILECONTROL directories, and Mike could create an alias for Terry within that directory. He could create for her an alias called TERRY JOBS as a pointer to the LOTS TODO file. When Terry wanted to work with the file, she would XEDIT her alias, TERRY JOBS.

Either way, once Terry has an alias to the file, she and Mike would be able to XEDIT the same information.

Creating an Alias to Your Own File

Previously, you used the COPYFILE command to copy the files INVITE SCRIPT, THEME SCRIPT, and MUSIC SCRIPT, from the MAINT.SAMPLES directory to the .PARTY directory that you created, and accessed, with a file mode of D.

Suppose you also wanted to group your INVITE SCRIPT file in the directory with the files for your party favors. All of your directories have the FILECONTROL attribute, so you know you can create aliases in any of them. You decide to create an alias for the INVITE SCRIPT file in the .PARTY.TREATS.FAVORS directory by using the CREATE ALIAS command.

A sample format of the CREATE ALIAS command follows (for help with reading syntax diagrams, see "Syntax, Message, and Response Conventions" on page 22):

```
►►—create—alias—fn1—ft1—dirid—fn2—ft2—dirid—◄◄
```

The first file name, file type, and directory identifier refer to the source file (the base file or the alias you would like to create an alias to); the second file name, file

type, and directory identifier refer to the alias you wish to create.

Note: When specifying the directory identifier for the alias you are creating, you cannot specify a different file mode number; the alias always has the same file mode number as the base file. Any change to the file mode number of the base file results in the same change to all the aliases to the file. For more information on file mode numbers, see “File Mode Letters and Numbers” on page 129.

As we discussed previously, a directory identifier can be a directory name, file mode, or any other way of referring to the specific directory. One of the easiest ways to use many commands is to access the directories and use file mode letters.

Previously, you accessed directories with the file mode letters A, B, D, and E. (If you were not sure which file modes you had used, you could enter the QUERY ACCESSED command to check). Access the .PARTY.TREATS.FAVORS directory with a file mode of F:

```
access .party.treats.favors f
```

Because your .PARTY directory is already accessed as D, you are ready to create the alias. You can choose whether to use the same file name and file type for the alias and base file. For this example, use the same name as your base file in your .PARTY directory for the alias you are creating in your .PARTY.TREATS.FAVORS directory:

```
create alias invite script d = = f
```

To check to see that the CREATE ALIAS command worked, do a FILELIST of all of your directories, beginning with your top directory, to look for occurrences of the INVITE SCRIPT file. You can do this by using the SEARCH option of the FILELIST command. Enter:

```
filelist invite script a (search
```

This command example tells SFS to display every occurrence of the INVITE SCRIPT file in any directory, beginning with your top directory (accessed with a file mode of A). You must give the command a starting point to search from. In this case, you start from your top directory, so that the search will begin at the top directory and search all of its subdirectories.

The FILELIST command will search only the files in your own directory structure. Any minidisk files you have will not be searched. It will also not find files you have in other users' directories.

Your screen will look like the example shown in Figure 22 on page 74.

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```
yourid  FILELIST A0  V 355  2 Line=1 Col=1 Alt=0
Cmd  Filename Filetype Fm Directory Name
-    INVITE  SCRIPT  D1 VMSYSU:yourid.PARTY
-    INVITE  SCRIPT  F1 VMSYSU:yourid.PARTY.FAVORS

1= Help      2= Refresh  3= Quit    4= Dirlist   5= Sort(name) 6= Auth
7= Backward  8= Forward  9= Alias  10= Filelist 11= XEDIT/LIST 12= Cursor

====>

X E D I T  1 File
```

Figure 22. The FILELIST SEARCH Screen

The FILELIST SEARCH screen contains a column labeled Directory Name which contains the entire directory name.

Note: If you see a dash (—) in the *Fm* column of any of the displayed files, the file contained on that line resides in a directory that is not accessed. You can still XEDIT the file from this screen by pressing the PF11 key; CMS temporarily accesses the directory containing the file for the duration of the XEDIT session.

INVITE SCRIPT appears in your .PARTY directory (currently accessed as D) and your .PARTY.TREATS.FAVORS directory (currently accessed as F).

In the previous example, you were searching for the occurrence of a specific file. To list all of your files in a specific directory, you would replace the file name and file type with asterisks and specify the file mode letter you used to access that directory.

Therefore, FILELIST * * A (SEARCH would list all of your files in the .PARTY directory (accessed as D) and will also list the names of any subdirectories of the .PARTY directory, such as the .PARTY.TREATS directory.

Your screen will look like the example shown in Figure 23 on page 75.

```

yourid  FILELIST A0 V 355 T7 Line=1 Col=1 Alt=0
Cmd  Filename Filetype Fm Directory Name
-    INVITE  SCRIPT  D1 VMSYSU:yourid.PARTY
    MUSIC  SCRIPT  D1 VMSYSU:yourid.PARTY
    THEME  SCRIPT  D1 VMSYSU:yourid.PARTY
    CAKE   SCRIPT  E1 VMSYSU:yourid.PARTY.TREATS
    COOKIES SCRIPT  E1 VMSYSU:yourid.PARTY.TREATS
    DRINK  SCRIPT  E1 VMSYSU:yourid.PARTY.TREATS
    INVITE  SCRIPT  F1 VMSYSU:yourid.PARTY.TREATS.FAVORS

1= Help      2= Refresh  3= Quit    4= Dirlist   5= Sort(name) 6= Auth
7= Backward  8= Forward  9= Alias  10= Filelist 11= XEDIT/LIST 12= Cursor

====>

X E D I T 1 File

```

Figure 23. Using FILELIST SEARCH to List All Your Files

To list all of your files, in all of your directories, enter the command FILELIST * * A (SEARCH). This will begin with your top directory (accessed as A) and list the files in the top directory and each directory below.

The FILELIST SEARCH screen contains several PF keys to determine information about the data on your screen. While some of these keys are the same as those on the FILELIST STATS or FILELIST SHARE screens, FILELIST SEARCH also provides you with the keys listed in Table 8:

Table 8. FILELIST SEARCH PF Keys

| Key | Meaning | Usage |
|------|------------|--|
| PF4 | Dirlist | Enters the DIRLIST command for the directory on the line where your cursor is located. |
| PF5 | Sort(name) | Sorts the output currently displayed on your screen alphabetically by file name and file type. |
| PF10 | Filelist | The directory where your cursor is located is temporarily accessed (if it is not already accessed), and you will see a FILELIST display of all the files in the directory. |
| PF11 | XEDIT/LIST | Lets you XEDIT the file on the line where your cursor is located. You can still XEDIT a file residing in a directory that is not accessed; CMS gives you temporary access for the duration of the XEDIT session. |

Creating an Alias to Another User's File

If you have authority to another user's file, there are several reasons you may find it useful to create an alias to the file. As we discussed earlier, an alias provides another way of referring to information in a file.

For example, the MAINT. top directory contains the MAINT.SAMPLES subdirectory. Within the MAINT.SAMPLES subdirectory is a file called GIFTS SCRIPT. If you have read authority to this file and to the MAINT.SAMPLES

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directory, you could access the directory to see what the GIFTS SCRIPT file contains. However, instead of accessing the entire directory, it may be easier and quicker to create an alias to the specific file you want to use.

Another reason to create an alias to another user's file is that it lets you place the alias wherever you like within your own directory structure. For example, because you already have a directory of party favors (your .PARTY.TREATS.FAVORS directory), you could create the alias in that directory. Otherwise, if you accessed the entire MAINT.SAMPLES directory, you would have to work with the directory structure the owner had organized.

An additional reason you may find it useful to create an alias to another user's file is in a situation where you have authority to a file, but not to the directory in which the file resides. In this case, you will not be able to access the directory and establish a file mode for it. Therefore, you would not be able to use any of the commands that require file modes, such as XEDIT, FILELIST, and COPYFILE. The CREATE ALIAS command would then provide you with the means to refer to the information in the file through one of your own FILECONTROL directories.

Note: Remember, you cannot share files across file pools.

If you want to create an alias to another user's file, that user must be in your file pool.

For example, enter the following command to create an alias to the GIFTS SCRIPT file in the MAINT.SAMPLES directory and put it in your .PARTY.TREATS.FAVORS directory, which you previously accessed with a file mode of F (giving your alias the name PRIZES SCRIPT):

```
create alias gifts script maint.samples prizes script f
```

After you enter the CREATE ALIAS command, you have a pointer to the data in the GIFTS SCRIPT file, but the actual data still resides in the MAINT.SAMPLES directory. After the owner of the GIFTS SCRIPT file updates and stores the file, you will be able to see the updated information through your alias, PRIZES SCRIPT.

To see that the CREATE ALIAS command worked, do a FILELIST on your .PARTY.TREATS.FAVORS directory.

```

yourid FILELIST A0 V 108 3 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.PARTY.TREATS.
Cmd  Filename Filetype Fm Format Lrecl  Records  Blocks  Date    Time
-    GAMES          F DIR      -        -        -    1/06/00 16:00:29
    INVITE  SCRIPT  F1 V      29        13        1 1/06/00 15:56:04
    PRIZES  SCRIPT  F1 V      16         6         1 1/06/00 14:12:36

1= Help      2= Refresh  3= Quit   4= Cancel    5= Sort(dir)  6= Sort(size)
7= Backward  8= Forward  9= FL /n 10= Share   11= XEDIT/LIST 12= Cursor

====>

                                X E D I T  1 File

```

Figure 24. Listing All the Files in a Directory

Move your cursor to the line for the PRIZES SCRIPT file, and press PF11 to XEDIT the file.

Your screen will look like the example shown in Figure 25.

```

PRIZES  SCRIPT  F1 V 132 Trunc=132 Size=6 Line=0 Col=1 Alt=0
Warning: Not authorized to lock file PRIZES SCRIPT F1

==== * * * Top of File * * *
|...+...1...+...2...+...3...+...4...+...5...+...6...+...7...
==== Gifts For Guests
====
==== Balloons
==== Candies
==== Party Hats
==== Noisemakers
==== * * * End of File * * *

====> _

                                X E D I T  1 File

```

Figure 25. Using PF11 to XEDIT a File

You can view the contents of the PRIZES SCRIPT file, but you cannot change them because you only have read authority to the base file. If you had write authority and were able to make changes to your alias, the owner of the file and other users who had authority to the base file would see your changes through their files.

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Notice the message at the top of the screen, warning you that you are not authorized to lock the file. For more information on file locking, see “Locking Files and Directories” on page 96.

From the FILELIST STATS screen, you can enter the FILELIST SHARE screen to find information about the GIFTS SCRIPT base file (PF10 from PRIZES SCRIPT line).

```
yourid  FILELIST A0  V 149  3 Line=1 Col=1 Alt=5
Directory = VMSYSU:yourid.PARTY.TREATS.
Cmd  Filename Filetype Fm Owner   Type   R W
-   GAMES      Filetype Fm Owner   Type   R W
-   INVITE     SCRIPT  F1 yourid  ALIAS  X X
-   PRIZES     SCRIPT  F1 MAINT  ALIAS  X -

1= Help      2= Refresh  3= Quit    4= Cancel    5= Sort(dir)  6= Auth
7= Backward  8= Forward  9= Alias  10= Stats    11= XEDIT/LIST 12= Cursor

====>

X E D I T  1 File
```

Figure 26. Using PF10 for Information on Aliases

You can see that the PRIZES SCRIPT file is an alias to which you have read authority. The user ID, MAINT, is listed in the column labeled Owner, because MAINT owns the base file.

Using the QUERY ALIAS Command

The QUERY ALIAS command is useful for determining who has created aliases to your file. If you are the owner of a base file, and you enter the QUERY ALIAS command on that base file, you will see a list of the users who have an alias to your file and the number of aliases they have. Also, if the aliases reside in one of your own directories or in another user's directory to which you have read authority, QUERY ALIAS will show you the file name and file type of each alias.

If you enter the QUERY ALIAS command on a base file that another user owns, you will see the names of any aliases you have to that base file.

If you enter the QUERY ALIAS command on an alias, you will see who owns the base file. If you own or have read, write, DIRREAD, or DIRWRITE authority to the directory where the base file resides, you will also be able to see the name of the base file.

You can enter the QUERY ALIAS command from the command line. A sample format of the command follows

```
►►—query—alias—fn—ft—dirid—◄◄
```


The file name, file type, and directory identifier, specify the file you wish to query. If you do not specify a directory identifier, the command will default to the directory accessed as A.

In the previous exercises, you created an alias, INVITE SCRIPT, in your .PARTY.TREATS.FAVORS directory. The base file, with the same name, is located in your .PARTY directory. Enter the QUERY ALIAS command on the base file:

```
query alias invite script .party
```

Your screen will look like this:

```
Directory = VMSYSU:yourid.PARTY
Filename Filetype Fm T Userid Num Filename Filetype Directory
INVITE SCRIPT D1 B yourid 1 INVITE SCRIPT .PARTY.TREATS.FAVORS
```

The QUERY ALIAS display shows you have an alias to the INVITE SCRIPT base file (the base file is indicated by a B in the fourth column), and that the alias is located in your .PARTY.TREATS.FAVORS directory.

Your user ID is shown in the Userid column because you are the owner of the alias. The Num column indicates the number of aliases to the file by the user. The file name and file type of your alias, INVITE SCRIPT, are shown to the right, as well as .PARTY.TREATS.FAVORS, the directory name of the directory where the alias resides.

You could also have entered the QUERY ALIAS command on your alias in the .PARTY.TREATS.FAVORS directory. To do so, you would enter:

```
query alias invite script .party.treats.favors
```

This command would show you that INVITE SCRIPT is an alias and that the base file by the same name resides in the .PARTY directory. You would be able to see the name of the directory where the base file resides because it is your own directory—you automatically have read and write authority to it.

If you entered a QUERY ALIAS command on an alias, and the base file resided in a directory to which you do not have any authority, you would not be able to see the file name, file type, or directory name of the base file.

Using the ALIALIST Command

There is also another way to determine who has an alias to a file using one of the PF keys that appears on both the FILELIST SHARE and SEARCH screens.

For example, to see if there are any aliases to the INVITE SCRIPT file in your .PARTY directory, enter:

```
filelist invite script d (share)
```

Your screen will look like the example shown in Figure 27 on page 80.

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```
yourid  FILELIST A0  V 149  1 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.PARTY
Cmd  Filename Filetype Fm Owner  Type  R W
-    INVITE   SCRIPT   D1 yourid  BASE  X X

1= Help      2= Refresh  3= Quit    4= Cancel  5= Sort(dir)  6= Auth
7= Backward  8= Forward  9= Alias  10= Stats  11= XEDIT/LIST 12= Cursor

====>

X E D I T  1 File
```

Figure 27. Using the PF Keys on the FILELIST SHARE Screen

Position your cursor on the line for the INVITE SCRIPT file and press PF9 to enter to the ALIALIST command. Your screen will look like the example shown in Figure 28.

```
yourid  ALIALIST A0  V 190  1 Line=1 Col=1 Alt=0
Base file = INVITE SCRIPT VMSYSU:yourid.PARTY
Userid  Num Filename Filetype Directory
yourid  1 INVITE   SCRIPT   .PARTY.TREATS.FAVORS

1= Help      2= Refresh  3= Return  4= Sort(type) 5= Sort(name) 6= Sort(dir)
7= Backward  8= Forward  9= S(user) 10=           11=           12=

====> _

X E D I T  1 File
```

Figure 28. Entering the ALIALIST Command

As you can see, the information you receive from ALIALIST is similar to the information you received from the QUERY ALIAS command. The first column, Userid, shows the user ID of anyone with an alias to the file. Here, it shows your user ID because you have an alias to INVITE SCRIPT.

The Num column shows how many aliases the user has—in this case 1. The next two columns show the file name and file type of the alias, INVITE SCRIPT. The final column shows the directory where the alias resides—your .PARTY.TREATS.FAVORS directory.

If another user has an alias to your file that resides in a directory to which you do not have authority, you would see only the user ID and the number of aliases; the directory name would not appear. For example, if Jay had two aliases to your INVITE SCRIPT in his PEOPLE directory (to which you do not have authority), you would only see one listing with his user ID, and the number 2.

Table 9 lists the following PF keys on the ALIALLIST screen to let you sort the entries displayed:

Table 9. ALIALLIST PF Keys

| Key | Meaning | Usage |
|-----|------------|--|
| PF4 | Sort(type) | Sorts the files displayed, first by file type, then by file name. |
| PF5 | Sort(name) | Sorts the files displayed, first by file name, then by file type. |
| PF6 | Sort(dir) | Sorts the display alphabetically, first by directory name, then by file name, then by file type. |
| PF9 | S(user) | Sorts the display alphabetically by user ID. |

Note: If you find the SHARE or SEARCH options of FILELIST to be more helpful for your work, you can set up either as the default FILELIST display. For more information on how to do this, see the DEFAULTS command in *z/VM: CMS Commands and Utilities Reference*.

Erasing Your Base Files

When you erase a base file, users with an alias to it will see that the status of the file is changed when they use such commands as FILELIST or QUERY ALIAS. The same is true, of course, if other users erase base files to which you have an alias.

Note: This is true unless the DATAONLY option was specified with ERASE. ERASE with DATAONLY erases only the data in a base file. All aliases and authorizations of the file remain intact, and its status is not shown as changed in FILELIST or QUERY ALIAS output.

For example, assume that you have an alias to CURTISJ's file, PALS SCRIPT. Your alias is called FRIENDS SCRIPT and is in a directory you have accessed as P. If CURTISJ erases the base file, when you enter the command:

```
filelist * * p (share
```

Figure 29 on page 82 displays what your screen should look like.

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```
yourid  FILELIST A0  V 149  T3 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.PARTY.PEOPLE.
Cmd  Filename Filetype Fm Owner  Type  R W
-    NEIGHBOR SCRIPT  P1 yourid  BASE  X X
    FAMILY  SCRIPT  P1 yourid  ALIAS X X
    FRIENDS  SCRIPT  P1 CURTISJ ERASED - -

1= Help      2= Refresh  3= Quit    4= Cancel   5= Sort(dir)  6= Auth
7= Backward  8= Forward  9= Alias   10= Stats   11= XEDIT/LIST 12= Cursor

====>

X E D I T  1 File
```

Figure 29. Erased Indicator on the FILELIST SHARE Screen

You would see ERASED in the column labeled Type. This tells you that the owner, CURTISJ, has erased the base file for your FRIENDS SCRIPT alias.

If, instead of entering the FILELIST command, you had entered the QUERY ALIAS command on your alias, FRIENDS SCRIPT, your screen would look like this:

```
Directory = VMSYSU:yourid.PARTY.PEO PTTEND
Filename Filetype Fm T Userid  Num Filename Filetype Directory
FRIENDS  SCRIPT  P1 E CURTISJ  1
```

There is an E in the Type column to indicate that the base file for the FRIENDS SCRIPT alias has been erased, and the file name, file type, and directory name for the base file are not shown, even if you have authority to the directory where the base file previously resided.

In either case, when you see that the PALS SCRIPT base file no longer exists, your alias to it is no longer valid. You can use the ERASE command to remove the reference to the erased file.

Authorizing Others to Access Your Files and Directories

Users can share your files or directories if you grant them authority to do so with the GRANT AUTHORITY command. The kinds of authorities you can grant differ for FILECONTROL directories and DIRCONTROL directories. You can grant another user READ or WRITE authority for any base file contained in a FILECONTROL directory. You can also grant READ or WRITE authority for the FILECONTROL directory itself. And, you can grant NEWREAD or NEWWRITE authority for FILECONTROL directories. NEWREAD authority means that the user is automatically granted READ authority to any file added to the directory in the future. NEWWRITE authority means that the user is automatically granted WRITE authority to any future file. For more information on the GRANT AUTHORITY command, see “Granting Authority” on page 87.

With DIRCONTROL directories, there are only two authorizations: directory control read (DIRREAD) authority and directory control write (DIRWRITE)

authority. DIRREAD authority means that the user can read the directory, any file in the directory, and any file added to the directory in the future. DIRWRITE authority lets you write to the directory, its files, and its future files. You cannot grant authority for individual files within a DIRCONTROL directory.

Naturally, other users can also share any of their files or directories with you by granting the above authorities to you.

When you create a file or subdirectory in one of your own directories, you are the owner of the new file or directory. As the owner, you automatically have certain irrevocable authorizations. The authorizations vary with the kinds of objects you create.

When you create a FILECONTROL directory or files within FILECONTROL directories, you automatically have WRITE authority to those objects. (WRITE authority always includes READ authority.) When you create a DIRCONTROL directory, you automatically have DIRWRITE authority for that directory. (DIRWRITE authority always includes DIRREAD authority.) Files in DIRCONTROL directories have no individual authorizations—your ability to read from or write to those files is derived from your DIRWRITE authority for the parent directory.

These authorities give you control over your files and directories. You can, for example, read from or write to the file or directory, rename it, or relocate it. (You cannot, however, relocate files into or out of DIRCONTROL directories—no user can.) You can erase any of your directories, and you can create or erase files within directories you own. You cannot erase, rename, or relocate your top directory.

If you grant a user authority to an alias of a base file you own, you are, in reality, granting authority to the base file.

Other users cannot read or modify your files or directories, unless you authorize them to do so. If you no longer want to share a file or directory, you can revoke the authority you have granted with the REVOKE AUTHORITY command. For more information, see “REVOKE AUTHORITY Command” on page 87.

It is important to remember that only the person who owns a file or directory can grant a user authority for it. (The only exception to this is that an SFS administrator can grant authority to another user. For more information, see “Administrator Authority” on page 86. If, for example, you grant authority for one of your files to a user named Bill, he cannot grant that authority to someone else.

FILECONTROL Directory Authority

In this section, READ and WRITE authority to a file and a directory will be discussed, in addition to dynamic authorization, NEWREAD and NEWWRITE.

READ Authority for a File

READ authority for a file means that the user can read, but not change, the contents of the file. If you give READ authority to another user, that user can make a copy of the file, print it, browse through it, define aliases for it, and create a SHARE lock for it. (We will discuss locking later in this section.) If that user tries to write to the file, however, SFS prevents the write and returns an error message.

READ Authority for a Directory

READ authority for a directory means that the user can read the names of objects within the directory (base files, aliases, subdirectories, and external objects). Users

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with READ authority can access the FILECONTROL directory in read-only status, or they can use Callable Services Library (CSL) routines in application programs to read files without accessing. This might lead you to believe that the person can read the contents of all the files within the directory, but this is not the case. For more information about CSL, see *z/VM: CMS Application Development Guide for Assembler*.

While it is convenient to think of directories as containing files, all they really contain are the *names* of files and subdirectories. When considering authorizations, think of directories and files as separate entities.

When you have only READ authority for a directory, you will not automatically have READ authority for the files (objects) in the directory.

Note: You do, however, have READ authority for any external objects in the directory. Since external objects do not have authorities of their own, they inherit their parent directory's authority. You can only see the names of its base files and aliases and the names of its subdirectories. (Only file names and directory names for that immediate level are shown—items at deeper levels of the hierarchy are not shown unless you also have authority to a lower-level directory.)

READ authority to a directory does not let you rename or relocate any base files or aliases within the directory. Only the owner of the directory is allowed these functions. Also, READ authority lets you lock the directory in SHARE mode only.

WRITE Authority for a File

WRITE authority for a file means you can modify the file or erase it. However, you cannot modify or erase any other files within the directory without authority for each individual file.

If you have WRITE authority for a file, you can lock the file in any mode (EXCLUSIVE, UPDATE, or SHARE).

WRITE authority always implies READ authority. You cannot have the ability to write to a file without having the ability to read it.

WRITE Authority for a Directory

WRITE authority for a directory gives the grantee a fair amount of authority over the contents of the directory. If you are granted WRITE authority for another user's directory, you can see the names of objects within the directory (which is implied with read authority). Also, you can create aliases or new files in that directory. However, you cannot read the contents of any files unless you have at least READ authority for the file, and you cannot change, erase or rename any file, unless you have WRITE authority for the file.

While you can create new files in the directory, the directory owner is considered the owner of any files you create in their directory. You automatically have WRITE authority to files you create, but you cannot grant authority to other users. Only the owner of the file can do so.

With WRITE authority for a directory, you can also create an alias in that directory to one of your own base files or to a base file of another user. Although you still own the base file, the other user would have the authority to use the alias and erase it at any time.

If you have WRITE authority to individual files within the directory, you can modify them. If you have WRITE authority for both the directory and an individual file, you can erase or rename the file.

You cannot delete another user's directory to which you have WRITE authority, nor can you rename or relocate it or create or delete subdirectories to the directory. However, you can lock the directory in any mode (SHARE, EXCLUSIVE, or UPDATE).

WRITE authority always implies read authority. You cannot have WRITE authority for a directory without implicitly having READ authority for that directory as well.

Dynamic Authorizations (NEWREAD and NEWWRITE)

SFS lets you grant authority for a FILECONTROL directory such that the grantee is automatically authorized for files added to the directory in the future. This ability, known as *dynamic authorization*, spares you from having to grant authority whenever you add a file to the directory.

There are two kinds of dynamic authorization: NEWREAD and NEWWRITE authority. When a base file is added to a directory, SFS determines whether any users have NEWREAD or NEWWRITE authority for the directory. The server then grants READ authority for the base file to any user having NEWREAD authority. Users with NEWWRITE authority are automatically granted WRITE authority for the base file.

The READ and WRITE authorizations that the server grants automatically are identical to those you grant yourself. It's as though the server issued a GRANT command for you. When you enter a QUERY AUTHORITY command, for example, authorizations that you granted are indistinguishable from those that the server granted for you.

All other rules regarding these READ and WRITE authorizations are the same. Suppose, for example, user Joe has read authority to TEST SCRIPT because you granted Joe NEWREAD authority for the directory prior to adding TEST SCRIPT to it. If you relocate TEST SCRIPT to another directory, Joe does not lose his READ authority for the file, even if the file is moved to a directory for which Joe has no authority. Remember that once SFS grants the authority, it is no different from you entering the command yourself.

When files are relocated into the directory from other directories, the server again automatically grants file authorities to those having NEWREAD or NEWWRITE authority for the directory. Moreover, the server retains the authorizations granted before the relocation (as it always does).

NEWREAD and NEWWRITE authority causes grants only on base files, not on aliases.

Both NEWREAD and NEWWRITE authority apply only to files that are added *after* the authority is granted. The authorities do not apply to any file that already exists in the directory. Consequently, when you are granting authority to a new user for the directory, you will probably want to enter at least two GRANT commands: one that grants authority for the existing files, and one that grants dynamic authorization for files added in the future. You might also want to grant READ or WRITE authority for the directory itself.

DIRCONTROL Directory Authority

In this section, DIRREAD and DIRWRITE authority to a file and a directory will be discussed, in addition to SFS administrator authority.

READ Authority for a File

You cannot grant READ authority to specific files in DIRCONTROL directories, only for files in FILECONTROL directories.

DIRREAD Authority for a Directory

You cannot grant READ authority for DIRCONTROL directories. Instead, you can grant DIRREAD authority.

DIRREAD authority applies only to DIRCONTROL directories. It lets the grantee read the directory and all files within the directory. It also lets the grantee read any file added in the future. Users with DIRREAD authority can access the DIRCONTROL directory in read-only status or they can use Callable Services Library (CSL) routines in application programs to read files without accessing. For more information about CSL, see *z/VM: CMS Application Development Guide for Assembler*.

WRITE Authority for a File

You cannot grant WRITE authority to files in DIRCONTROL directories, only for files in FILECONTROL directories.

DIRWRITE Authority for a Directory

DIRWRITE authority applies only to DIRCONTROL directories. It lets the grantee read from, and write to, the directory and all files within it. It also lets the grantee read from, and write to, any file added to the directory in the future. DIRREAD authority and DIRWRITE authority are mutually exclusive. Users with DIRWRITE authority can access the directory in read-only or read/write mode. Or, they can use CSL routines to read and write files without accessing. For more information about CSL, see *z/VM: CMS Application Development Guide for Assembler*.

Administrator Authority

The SFS administrator is the person responsible for generating file pools and managing their operation and use. An SFS administrator can do anything to a base file, alias, or directory that the owner can do, such as:

- Create files and directories
- Erase, rename, relocate, and copy files and directories
- Grant authority
- Revoke authority
- Create locks
- Delete locks.

The administrator can only do things that the owner can do, unless he performs additional tasks first. For example, the administrator cannot create an alias for a user if that user does not already have authority for the base file. However, the administrator can grant that authority and then create the alias.

To determine who has administrator authority in your file pool, you can enter the ADMINISTRATOR parameter of the QUERY ENROLL command. For more information, see *z/VM: CMS Commands and Utilities Reference*.

Granting Authority

To grant another user authority, use the GRANT AUTHORITY command. A sample format of the command follows (for help with reading syntax diagrams, see “Syntax, Message, and Response Conventions” on page 22):

```
►► grant authority [fn-ft] dirid TO [userid] _____►►
                                PUBLIC
```

Use PUBLIC to grant authority to everyone with access to your file pool.

To specify what type of authority you want to grant, you follow the GRANT AUTHORITY command with the options READ, WRITE, NEWREAD, NEWWRITE, DIRREAD, or DIRWRITE. READ authority is the default for FILECONTROL directories and the files that reside in them. DIRREAD is the default for DIRCONTROL directories.

For example, Craig is working on a project with Debbie. She needs to modify his file, SPECIAL PROJECT, which is in a FILECONTROL directory that Craig has accessed as Q. Because the file resides in a FILECONTROL directory, Craig can grant WRITE authority to that file as follows:

```
grant authority special project q to debbie (write
```

After Craig entered this command, Debbie would be able to read from and write to the SPECIAL PROJECT file.

If Debbie does not have authority to the directory on which the file resides, to access the file, she could create an alias to it, then XEDIT the alias.

As the owner of the file, Craig can revoke the authority he has granted at any time by using the REVOKE AUTHORITY command, discussed in the following section.

REVOKE AUTHORITY Command

If you no longer want another user to have authority to one of your files or directories, you can revoke the authority you granted previously with the REVOKE AUTHORITY command.

A sample format of the REVOKE AUTHORITY command follows (for help with reading syntax diagrams, see “Syntax, Message, and Response Conventions” on page 22):

```
►► revoke authority [fn-ft] dirid FROM userid _____►►
```

For example, if Craig later decided he no longer wanted to share the SPECIAL PROJECT file with Debbie, he could revoke her authority to the file by specifying the following command:

```
revoke authority special project q from debbie
```

If Craig wanted to revoke WRITE authority from Debbie, but let her continue to read the SPECIAL PROJECT file, he could use the KEEPREAD option of the REVOKE AUTHORITY command:

```
revoke authority special project q from debbie (keepread
```

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This command specifies that Debbie's authority should be changed from write (which Craig originally granted) to read. Other options include:

KEEPNEWREAD

Changes a user's authorization for a FILECONTROL directory from NEWWRITE to NEWREAD.

KEEPDIRREAD

Changes a user's authorization for a directory control directory from DIRWRITE to DIRREAD.

NEWAUTH

Removes NEWREAD or NEWWRITE authority from a file control directory while retaining any READ or WRITE authority to that directory.

RWAUTH

Removes READ and WRITE authority from a file control directory while retaining any NEWREAD or NEWWRITE authority to that directory.

Use the PUBLIC parameter of the REVOKE AUTHORITY command to revoke PUBLIC authority you granted earlier. You cannot revoke authority individually if you used PUBLIC to GRANT AUTHORITY. Similarly, the PUBLIC parameter will not revoke individual authority that you granted.

You can revoke authority individually if you grant authority individually. The ALL parameter revokes PUBLIC authority as well as individual authorities that you may have granted.

When you revoke another user's authority to one of your files, the user will see that the status of the file is changed when they enter the FILELIST or QUERY AUTHORITY commands. The same is true, of course, if other users revoke your authority for a file.

For example, assume that Mark granted you READ authority to his COOKING HINTS file. At that time, you created an alias to the file called CHEF TIPS, and placed the alias in your directory accessed with a file mode of M.

If Mark decides he no longer wants you to be able to read the file, and revokes your authority, when you enter FILELIST * * M (SHARE, you would see:

```
yourid  FILELIST A0  V 149  Trunc=149 Size=1 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.KITCHEN
Cmd  Filename Filetype Fm Owner  Type  R W
-    CHEF     TIPS      M1 MARKD  REVOKED - -
```

The word REVOKED in Type column tells you that the owner, MARKD, has revoked your authority to the base file for your CHEF TIPS alias.

If, instead of entering the FILELIST command, you had entered the QUERY AUTHORITY command on your alias, CHEF TIPS, your screen would look like this:

```
Directory = VMSYSU:yourid.ATTEND
Filename Filetype Fm Type  Grantee R W
CHEF     TIPS      M1 REVOKED yourid - -
```

The word REVOKED in the Type column indicates that your authority to the base file for the CHEF TIPS alias has been revoked. The file name, file type, and directory name for the base file are not shown, even if you still maintain authority to the directory where it resides.

In either case, when you see that you no longer have authority to the COOKING HINTS file, your alias to it is no longer valid. You can use the ERASE command to remove the reference to the revoked file.

Note: An *external security manager* (ESM) is a program that either augments or completely replaces the authorization checking done by file pool server processing. If there is an external security manager active on your system, the GRANT and REVOKE AUTHORITY commands you need to enter may be different from the commands discussed in the previous sections. You will need to refer to the external security manager documentation for the actual commands you would use to grant or revoke authority. Check with your system administrator to see if you have an external security manager active on your system.

Determining Who Has Authority for a File or Directory

To determine what authority has been granted on a file or directory, you can enter the QUERY AUTHORITY command. If you are the owner of a file or directory, QUERY AUTHORITY will show you a list of user IDs (including your own) for users who have authority to your file or directory, and will show what type of authority you have granted each user.

You can also enter the QUERY AUTHORITY command if you are not the owner of a file or directory. Here, the command output would show only the authority you have been granted to the specific file or directory.

A sample format of the command follows:

```
►► query—authority—fn—ft—dirid—►►
```

To determine who has authority for a specific file or files, specify the file name and file type, and the directory to be queried. To determine the authorities granted for a directory, specify only the directory identifier.

For example, to determine if any other user has authority to the CAKE SCRIPT file in your .PARTY.TREATS directory (currently accessed as E), enter:

```
query authority cake script e
```

Your screen will look like this:

```
Directory = VMSYSU:yourid.PARTY.TREATS
Filename Filetype Fm Type   Grantee R W
CAKE      SCRIPT    E1 BASE  yourid X X
```

Your user ID is listed under the Grantee column and both the R and W columns are marked with an X. Because you are the owner of the CAKE SCRIPT file, you automatically have READ and WRITE authority to it. You did not grant anyone else authority for the file, so no other user IDs are listed.

Although you originally used the COPYFILE command to copy the CAKE SCRIPT file from the MAINT.SAMPLES directory (to which you had read authority), the

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MAINT user ID does not maintain any authority for the new file. New files created using COPYFILE have none of the authorities or aliases associated with the original file. When you copied the CAKE SCRIPT file to your own directory, you became the owner of the new file.

When you enter the QUERY AUTHORITY command for a directory, additional columns are displayed. For FILECONTROL directories, the following is displayed:

```
Directory = VMSYSU:IRA:MCDS
Grantee  R  W  NR  NW
IRA      X  X  X  X
JACK     X  -  X  -
MIKE     X  X  X  X
SUE      X  X  -  -
.        .  .  .  .
.
```

The NR and NW columns indicate whether you have NEWREAD or NEWWRITE authority for the FILECONTROL directory.

If the directory has the DIRCONTROL attribute, the following is displayed:

```
Directory = VMSYSU:IRA:NEWS
Grantee  R  W  DR  DW
IRA      X  X  X  X
JESSICA  X  X  X  X
MARY     X  -  X  -
MIKE     X  X  X  X
MORGAN   X  X  X  X
.        .  .  .  .
.
```

The DR and DW columns indicate whether you have DIRREAD or DIRWRITE authority for the DIRCONTROL directory.

Using the AUTHLIST Command

Another way to find out information on authorizations for a file or directory is by using PF keys on the DIRLIST and FILELIST screen to enter the AUTHLIST command. As discussed in “Navigating Through Your Directories” on page 63, you can display the FILELIST STATS screen and then press PF10 to display the SHARE screen, or you can specify the SHARE option of FILELIST to display the SHARE screen directly.

For example, assume that you had previously granted authority for the COOKIES SCRIPT file in your .PARTY.TREATS directory (accessed as E) to MAINT and to RALPHW. To determine whether you gave each user READ or WRITE authority to the file, you could use the AUTHLIST command.

For example, enter the following command:

```
filelist cookies script e (share
```

Figure 30 on page 91 displays what your screen should look like.

```

yourid  FILELIST A0  V 149  1 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.PARTY.
Cmd  Filename Filetype Fm Owner  Type  R W
-    COOKIES  SCRIPT   E1 yourid  BASE  X X

1= Help      2= Refresh  3= Quit    4= Cancel  5= Sort(dir)  6= Auth
7= Backward  8= Forward  9= Alias  10= Stats  11= XEDIT/LIST 12= Cursor

====>
X E D I T  1 File

```

Figure 30. Using the PF Keys on the FILELIST SHARE Screen

Positioning your cursor on the line for the COOKIES SCRIPT file and pressing PF6, would result in:

```

yourid  AUTHLIST A0  V 165  3 Line=1 Col=1 Alt=0
File = COOKIES SCRIPT VMSYSU:yourid.PARTY.TREATS
Grantee R  W
yourid  X  X
MAINT   X  -
RALPHW  X  X

1= Help      2= Refresh  3= Return  4= S(Grantee)  5= Sort(W)    6=
7= Backward  8= Forward  9=         10=           11=          12=

====> _
X E D I T  1 File

```

Figure 31. Entering the AUTHLIST Command

The information you receive is similar to the information you received when entering the QUERY AUTHORITY command.

Note: Remember that the file pool administrator will also have authority to your files and directories. However, his or her user ID will not appear in the output of the QUERY AUTHORITY or AUTHLIST commands.

Table 10 on page 92 lists the following PF keys on the AUTHLIST screen that you can use to sort the information displayed on your screen:

Table 10. AUTHLIST PF Keys

| Key | Meaning | Usage |
|-----|------------|---|
| PF4 | S(Grantee) | Sorts the files displayed alphabetically by grantee. |
| PF5 | Sort(W) | Grantees with WRITE authority to the file are listed alphabetically, then other grantees are listed alphabetically. |

When you enter an AUTHLIST command for a directory, you will see additional columns on the AUTHLIST screen. For FILECONTROL directories, these columns indicate whether a user has NEWREAD or NEWWRITE authority. For DIRCONTROL directories, the columns indicate DIRREAD or DIRWRITE authority. For more information on the AUTHLIST command, see *z/VM: CMS Commands and Utilities Reference*.

Note: If the QUERY AUTHORITY or AUTHLIST command output shows XP or -P in the Read or Write column, the file shown is protected by an external security manager that is active on your system. Here, you will need to enter special ESM commands to determine who has authority to the file. Contact your system administrator to obtain these commands.

Determining Ownership of a File or Directory

The FILELIST SHARE screen is also quite useful for determining the owner of a file. When you enter the FILELIST command with the SHARE option, the FILELIST display shows a column labeled Owner. You can also use the SHARE option of the FILELIST command (or LISTFILE command) to determine the owners of any files or subdirectories contained within any directory.

For example, if you had a directory accessed with a file mode of T that contained several base files and aliases, you could determine the owner of any file by entering the command:

```
filelist * * t (share
```

The Owner column shows you the owner of each base file, alias, or directory.

```

yourid FILELIST A0 V 149 7 Line=1 Col=1 Alt=0
Directory = VMSYSU:yourid.GOODIES.EAT
Cmd  Filename Filetype Fm Owner  Type  R W
-    FRENCH  BREAD  T1 yourid  BASE  X X
    MEAT   CAKES  T1 SMITH  ALIAS  X X
    FRIED  RICE   T1 WILLIAMS ALIAS  X -
    CHILI  BEANS  T1 yourid  BASE  X X
    PIZZA  SAUCE  T1 SIMKULET ALIAS  X -
    RECIPES          T1 yourid  DIR   X X
    ICE    CREAM  T1 THOMPSON ERASED - -

1= Help      2= Refresh  3= Quit    4= Cancel    5= Sort(dir)  6= Auth
7= Backward  8= Forward  9= Alias  10= Stats   11= XEDIT/LIST 12= Cursor

====>

X E D I T 1 File

```

Figure 32. Determining the Owner of a File

Using Aliases to Share Files

Sometimes you may want to share a file with other users, but you may not want them to know the file by its original name. For example, Dave has a program entitled AUTO4 ASSEMBLE, but he would like others to know it as SAMPLE ASSEMBLE.

There are a few ways Dave could do this. One way is for him to create a subdirectory and grant read authority for it to others. This subdirectory could contain only the file Dave wants to share with other users. To do this, Dave might enter commands such as these:

```

create directory .programs
grant authority .programs to mydept (read

```

MYDEPT, in this example, could be a group identifier. Dave could put the nickname MYDEPT in his *userid* NAMES file to include the nicknames or user IDs of all those with whom he wishes to share the file. By using MYDEPT in the GRANT AUTHORITY command, Dave can grant READ authority to the entire group using a single command. (For more information on using a NAMES file, see *z/VM: CMS Primer*).

Next, he could grant all the people within the MYDEPT group READ authority for AUTO4 ASSEMBLE. (Assume that the file resides in a FILECONTROL directory called .ASSEMBLER.SOURCE.)

```

grant authority auto4 assemble .assembler.source to mydept (read

```

Finally, he could create an alias named SAMPLE ASSEMBLE in the shared .PROGRAMS subdirectory he created.

```

create alias auto4 assemble .assembler.source sample = .programs

```

Once Dave had completed these steps, all the users to whom he granted authority would know the file as SAMPLE ASSEMBLE. They would have access only to Dave's .PROGRAMS subdirectory, where he would have placed the SAMPLE

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ASSEMBLE alias. They would not know that the base file was AUTO4 ASSEMBLE, nor would they have any authority for anything in Dave's ASSEMBLER.SOURCE directory.

Dave could have reversed the order of the GRANT AUTHORITY and CREATE ALIAS commands and still have achieved the same result. He could have first created the alias, and then granted authority for it or the base file.

Granting authority for an alias is the same as granting authority for the base file. Therefore, if Dave erases the alias, none of the authorizations on the base file would disappear, even if he had used the alias name on the GRANT AUTHORITY command.

If another user listed the contents of the .PROGRAMS directory between the CREATE ALIAS and GRANT AUTHORITY commands, he or she would be able to see the alias name, but would not be able to access the base file.

Another way to share a file is to have the users grant you write authority for one of their FILECONTROL directories. This would let you create an alias for your file in their directories. You can also use the COPYFILE or XEDIT commands to create a base file in the other user's directory.

In this example, assume Dave already granted the users READ authority for the file. Now, he can enter a CREATE ALIAS command to create an alias in each of their directories. For example, he might enter commands similar to the following:

```
create alias auto4 assemble .assembler.source sample = jones.programs
create alias auto4 assemble .assembler.source sample = bill.shared
create alias auto4 assemble .assembler.source sample = mary.toolstuff.programs
create alias auto4 assemble .assembler.source sample = tim.languages.assemble
```

These commands would create the alias SAMPLE ASSEMBLE in each of their directories (in Jones' .PROGRAMS directory, in Bill's .SHARED directory, in Mary's .TOOLSTUFF.PROGRAMS directory, and in Tim's .LANGUAGES.ASEMBLE directory).

This technique for sharing files is useful when you are sharing with a few users. If you were sharing files with many users it would be impractical to have to enter a separate CREATE ALIAS command for each user. The following section, will explain ways to share a file with many users.

Creating a Bulletin Board or Shared Disk

If you want to create a *bulletin board* of files that are available to a group, you can do so by granting write authority for a FILECONTROL directory. For example, suppose a user named Eric was coordinating shared files in your department. Your department writes programs that are used by everyone enrolled in the file pool.

To let everyone easily use the files, Eric might create a FILECONTROL directory and grant write authority for that directory to every member of your department. Eric could also grant read authority for that directory to everyone else enrolled in the file pool so that everyone can view the programs your department writes.

Your department members could create aliases in Eric's directory whenever they created a new file or program they wished to share with the file pool users. At that time, they would also grant read authority for the base file to everyone in the file pool.

File pool users could periodically review the directory for new additions. To do this, they could add an ACCESS command for Eric's directory to their PROFILE EXECs. They could then occasionally enter a FILELIST for Eric's directory, and sort the listings by date to see what was new.

For example, suppose Eric wants to create a programming tools disk, called VMTOOLS, to contain short-cut programs and productivity aids for use by everyone in the file pool. First, he would create a directory (by default, the directory will have the FILECONTROL attribute):

```
create directory design:eric.vmtools
```

Next, Eric would enter the NAMES command:

```
names toolprog
```

For the nickname TOOLPROG, he would list those people who were authorized to write and distribute tools. To grant this group of people write authority for the VMTOOLS directory, Eric would enter the following command:

```
grant authority .vmtools to toolprog (write newwrite
```

Eric would then grant read authority for the directory to everyone in the file pool:

```
grant authority .vmtools to public (read newread
```

The GRANT AUTHORITY command with the PUBLIC parameter lets you grant authority to each user assigned to your file pool.

That is all Eric needs to do. His involvement in maintaining the VMTOOLS is over. Whenever a programmer develops a tool, the programmer would just create an alias in Eric's VMTOOLS directory.

Suppose Denny wants to make the new tool PROJTRAK MODULE (which is in his .GOODSTUFF directory) available to everyone. He would enter the command:

```
create alias projtrak module .goodstuff = = eric.vmtools
```

This would give all the users in the file pool read authority to the new tool, and would create an alias for PROJTRAK MODULE in Eric's .VMTOOLS directory.

To access the currently updated list of tools, users would add this ACCESS command to their PROFILE EXECs:

```
access design:eric.vmtools g
```

This command would let them access Eric's .VMTOOLS directory each time they log on. Whenever users want to review what's available, they would enter:

```
filelist * * g
```

This would show them a FILELIST display of the .VMTOOLS directory so that they would know if a new program was added.

To run the PROJTRAK program, a user would simply enter:

```
projtrak
```

There is another way to do this that would let Eric have more control over what the user community sees. In this variation, Eric could have his programmers create files instead of aliases in his directory. That would make Eric the owner of the base files. Once the programmers create a file in Eric's directory, they would be unable

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to grant any authority for that file. Eric would be the only one who could grant read authority for those files to the user community.

The techniques outlined previously work well for information that is updated frequently or at unpredictable times. If you have read-only data or infrequently updated data that you would like to share, consider using DIRCONTROL directories instead of FILECONTROL directories. DIRCONTROL directories provide better performance than FILECONTROL directories. For more information, see "Using Directory Level Control" on page 101.

For huge forum disks that contain several files on any given topic, you might consider creating a subdirectory on each topic. When a user enters a FILELIST on the higher level directory, all the user will see is a list of subdirectories, each containing files devoted to a particular topic. This technique protects users from being overwhelmed by hundreds of unrelated files.

Locking Files and Directories

To share files and directories between users, you need to understand how CMS handles the simultaneous use of shared files. Also, you will need to know how to ensure that you and another user do not simultaneously edit a file and accidentally overwrite changes.

Whenever you are actively reading or writing a file or directory, CMS acquires a lock for the file or directory. This particular lock is called an *implicit* lock. An implicit lock allows multiple readers and only one writer to use a file or directory. CMS acquires and frees implicit locks automatically. They are usually short-term locks. If a user tries to read or write to a file or directory, SFS first checks to see whether it is locked before allowing access.

While SFS automatically acquires and releases implicit locks, there are situations in which you may want to lock a file or directory with an *explicit* lock. (Except if it is an external object. These cannot be locked.) For example, you may want to perform a series of tasks on a file and not want anyone manipulating the file for a certain period of time. You can put an explicit lock on a file for the duration of your CMS session, or until you explicitly delete the lock.

Explicit locks are useful when you want to control the activity on your files or directories without revoking authority. For example, suppose Dr. Roman is performing various tasks (such as editing, renaming, and so on) on a file called MEDICAL HISTORY that many other doctors have access to, and he does not want them to see the file until he has completed his work. Dr. Roman can create a lock which will prevent other users from reading or modifying the file until he deletes the lock.

He would specify this type of explicit lock using the CREATE LOCK command with the appropriate options. A sample format of the CREATE LOCK command follows (for help with reading syntax diagrams, see "Syntax, Message, and Response Conventions" on page 22):

```
►► create—lock—[fn—ft]—dirid—[share—exclusive—update]—[session—lasting]—►►
```

You can create an EXCLUSIVE, SHARE, or UPDATE lock on a file in a FILECONTROL directory or on a FILECONTROL directory itself. You can create an

UPDATE lock on a file in a DIRCONTROL directory. EXCLUSIVE and SHARE locks do not apply to files in DIRCONTROL directories. When creating a lock, you must also specify its duration: SESSION or LASTING. Table 11 describes the meaning of each lock as it applies to a file or directory:

Table 11. Lock Functions on Files and Directories

| Lock Type | File | Directory |
|-----------|--|--|
| Exclusive | Other users cannot read or change the file. An EXCLUSIVE lock on a base file also prevents anyone from issuing any type of lock (SHARE, EXCLUSIVE, or UPDATE) on the file's parent directory. EXCLUSIVE locks cannot be created on files within DIRCONTROL directories. | Other users cannot read from or write to any of the base files or aliases in the directory. Also, they cannot create, delete, rename, or relocate any base files or aliases until the directory is unlocked. They can manipulate the contents of subdirectories, if they are authorized to do so. EXCLUSIVE locks cannot be created on DIRCONTROL directories. |
| Share | Other users can read the file while you are reading it. No one, including the person who issued the lock, can update the file until it is unlocked. Also, no one can rename, relocate, or erase the file. A SHARE lock on a base file also prevents other users from issuing an EXCLUSIVE lock on the file's parent directory. SHARE locks cannot be created on files within DIRCONTROL directories. | Other users and the person who locked the directory can read from files in the directory (if they are authorized for the files). No users, including the issuer of the lock, can update any files or subdirectories in the directory. Nor can they create, erase, rename, or relocate any base files, aliases, or subdirectories until the directory is unlocked. Also, a SHARE lock prevents anyone from issuing an EXCLUSIVE or UPDATE lock on any base file, alias, or subdirectory within the directory. SHARE locks cannot be created on DIRCONTROL directories. |
| Update | Other users can read the file while you are reading or updating it. They cannot rename, relocate, or erase the file. An UPDATE lock on a base file also prevents anyone from issuing any type of lock (SHARE, EXCLUSIVE, or UPDATE) on the file's parent directory. UPDATE locks can be created on files within both DIRCONTROL and FILECONTROL directories. If locked, only the holders of the locks can access the directory in read/write mode and change files. Users who do not hold locks on files can access the directory only in read-only mode. However, you can lock a file in a DIRCONTROL directory that you have accessed in read-only mode. | For FILECONTROL directories, the person who locked the directory can read from or write to any files for which he is authorized. Other users can only read files in the directory; they cannot write to the files (even if they have write authority to them). Nor can they create, delete, rename, or relocate any base file, alias, or subdirectory in the directory. Also, they cannot lock the directory in any mode; base files, aliases, and subdirectories can be locked only in SHARE mode. For DIRCONTROL directories, not even the person who holds the lock for the directory can access it in read/write mode. |

The lock that Dr. Roman would create for our previous example would be:
`create lock medical history a exclusive lasting`

Dr. Roman has just created an EXCLUSIVE lock to prevent others from reading or writing to the MEDICAL HISTORY file contained in directory A. Because he specified a LASTING lock, the lock will remain until he issues a command to delete it. A LASTING lock lasts across CMS sessions, and can be removed only with a DELETE LOCK command. The DELETE LOCK command is discussed in the section “Deleting Explicit Locks” on page 99.

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The alternative to the LASTING lock is the SESSION lock. A SESSION lock is removed when the DELETE LOCK command is entered, or when the CMS session is terminated, whichever comes first.

If you have read authority to a file or directory, you can create only a SHARE lock on that file or directory. If you have write authority, you can issue any type of lock (SHARE, EXCLUSIVE, or UPDATE) on the file or directory. If you have DIRWRITE authority to a directory, you can create UPDATE locks for the directory and on the files within it.

Note: If you create a lock on an alias, it is the same as locking the base file—the owner of the base file and other users with aliases to the file are affected by the lock. Thus, an alias that points to a file in a DIRCONTROL directory can have only an UPDATE lock put on it.

To allow others to read a file while you are updating it, you can create an UPDATE lock on the file or for the directory where the file resides.

For example, if Stan shared with other users a file, called BRUSHING TIPS, in his .DENTAL.HYGIENE directory, he could create an UPDATE lock on the file for the duration of his CMS session. To do so he would enter the following command:

```
create lock brushing tips .dental.hygiene update session
```

After he enters this command, Anne, who shares the file with Stan, would be able to read the file but not write to it. To read the file, she could use the TYPE command. She could also use the NOLOCK option of the XEDIT command to view the contents of the file. She could not, however, enter the XEDIT commands SAVE or FILE, to store an updated copy of the file.

When you use XEDIT with the default LOCK option, you do not need to create and delete a lock; XEDIT will take care of this for you. When you use XEDIT with the LOCK option, an UPDATE SESSION lock is automatically placed on your file. It is only when you specify the NOLOCK option of XEDIT that you need to be concerned with creating and deleting locks on files and directories. The NOLOCK option of XEDIT should only be used when you are not going to make any changes to the file, or if you are going to save your changes under a different name.

You do not need to be concerned with locking files in DIRCONTROL directories when using XEDIT. In fact, XEDIT ignores the LOCK and NOLOCK options for files in DIRCONTROL directories. Rather than use locks for protection from unwanted updates, XEDIT depends on the access status. If you have a DIRCONTROL directory accessed in read/write status, you are the only user who can write to files in that directory—an UPDATE lock is not necessary. If you have the directory accessed in read-only status you cannot write to any file in that directory.

Once Stan completes his work with the file, he can use the DELETE LOCK command to remove the lock. Because he specified a SESSION lock, if he does not delete the lock, it will automatically be removed when he ends his CMS session.

Another way to lock a file or directory is to create a SHARE lock. With a SHARE lock in effect, users with write authority can XEDIT the file with the NOLOCK option, but they cannot enter SAVE or FILE. Not even the person who creates the lock can update the file.

Deleting Explicit Locks

Use the DELETE LOCK command to delete explicit locks placed on files or directories with the CREATE LOCK command. A sample format for the DELETE LOCK command follows:

```

▶▶ delete lock fn-ft dirid

```

If Stan wanted to delete the UPDATE SESSION lock he placed on the BRUSHING TIPS file, he would enter the following command:

```
delete lock brushing tips a
```

To delete a lock for a directory, you specify the name of the directory to be unlocked, instead of the file name, file type and directory identifier.

Using the SET FILEWAIT Command

If you want your program to continue waiting for a file or directory that is implicitly locked, you can use the SET FILEWAIT command. A sample format of the command follows:

```

▶▶ set filewait on

```

If you use SET FILEWAIT ON, this means you do not want a request to fail because you cannot obtain immediate control of a file or directory. The request will wait until the required object becomes available or until you re-IPL or log off. For example, at the end of the day you could choose to start a program and disconnect your virtual machine.

If you do not wish to wait for an implicitly locked file or directory, use SET FILEWAIT OFF. This means that requests will fail immediately if a file or directory is not available.

If the file or directory is explicitly locked, you will not wait, regardless of the SET FILEWAIT setting.

Determining If a File or Directory is Locked

There will be times while using CMS commands when you may receive a message stating that the file or directory you want to work with is locked. You will need to find out who created the lock, so that you can get that person to delete or change the lock and allow you to read or write to the file. The next sections show you how to find explicit or implicit locks on files and directories.

Finding an Explicit Lock

The QUERY LOCK command displays the type of explicit lock and the user who created the lock on a file or directory. A sample format of the QUERY LOCK command follows:

```

▶▶ query lock fn-ft dirid

```

To query the lock for a file, you would specify the file name and file type, and the directory identifier. To query the lock for a directory, specify only the directory identifier.

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For example, suppose you are responsible for keeping track of system problems that affect your department. For this purpose, you have created a file called PROBLEM LOG in your .PROBLEMS directory, a FILECONTROL directory.

To let the other members of your department log a description of any system problems they experience, you have given each member write access to the PROBLEM LOG file. Before editing PROBLEM LOG to update the problems listed, you could enter the following command to determine if any other user has locked the file for editing:

```
query lock problem log .problems
```

Your screen might look like this:

```
Directory = VMSYSU.yourid.PROBLEMS
Filename Filetype Fm Type Userid Lock Duration
PROBLEM LOG N1 BASE ELLEN UPDATE SESSION
```

As you can see, ELLEN has entered an update lock for the file. Therefore, you should wait until Ellen completes her editing and unlocks the file before you try to edit it.

Finding an Implicit Lock

Because implicit locks are short term, the QUERY LOCK command does not display information about them. Even if it did so, the information might be incorrect by the time the output was displayed. To check for implicit locks:

1. Issue the command SET FILEWAIT ON.

This command tells CMS to wait for the file or directory to become free if a lock conflict occurs.

2. Reenter the command that was causing the lock problem.

If the command succeeds, the implicit lock was just freed. Enter SET FILEWAIT OFF and continue your work.

If the command fails and produces an error message, another user may have just acquired an explicit lock. Otherwise, the file or directory may have been erased, or your authority to it may have been revoked.

3. If the command execution time is lengthy, ask another user to enter the QUERY FILEPOOL CONFLICT command for you.

For example, if the user CROCKETD suspected there was an implicit lock on the file he wanted to access, he would ask another user to enter the following command:

```
query filepool conflict crocketd poolq:
```

The result would look like this:

```
Requester Holder Wait Lock Lock Type
BRISEED SMITH Lock File Share
MIKEB SMITH Lock File Share
CROCKETD SMITH Lock File Share
```

The first two columns show the most important information: who is requesting the lock, and who is holding the lock. CROCKETD, along with two other users, is waiting for SMITH. The other users are in the queue ahead of CROCKETD. When SMITH frees the lock, BRISEED will be the next user in line for the file.

The third column, *wait*, indicates the wait state of the *Holder*. In this example, each of the users is waiting for a lock to be freed. The *Lock column* indicates the type of resource for which the *Request* has requested a lock. The *Lock Type* column displays the type of lock that the *Request* wants placed on the resource.

Note: The QUERY FILEPOOL CONFLICT command does not show conflicts caused by explicit locks because CMS never waits for an explicit lock, even if FILEWAIT is on.

Once you find out who is holding the lock, you can call or send that user a message to see when the lock will be deleted. If you choose not to continue waiting, enter:

```
#cp ipl cms
```

When you IPL CMS, SFS realizes that you have ended your CMS session and stops waiting to process your command. During CMS initialization, FILEWAIT is automatically reset to OFF.

Using Directory Level Control

Regular SFS processing allows control at a file level. You can, for example, grant authority to individual files. You can lock individual files. And you can see file changes made by other users as soon as they are committed; you do not need to reaccess directories to see changes as you do with minidisks. This level of control is referred to as *file level control*.

While file level control provides the most flexibility and concurrency, some applications do not need that level of control. In fact some applications that were coded to use minidisks may not work properly with file level control. Such applications might not, for instance, be able to cope with a locked file in a directory that is accessed in read/write mode, as this cannot occur on a minidisk.

Directory level control provides a level of control that is better suited to these applications. Directory level control provides, essentially, minidisk-like control of files within directories.

You get directory level control when you create the directory, or by using the DIRATTR command on existing directories.

In addition to minidisk-like function, DIRCONTROL directories offer performance benefits for users with XC virtual machines, if the server uses data spaces (see "Performance Benefits of Directory Control Directories" on page 104). Depending on the use of the directory, you might find that the performance benefit of a DIRCONTROL directory outweighs its functional restrictions.

An important fact to remember is that DIRCONTROL directories are intended for use with *read-only* information, or information that is infrequently updated. When the directory is changed, write activity should be confined to brief periods of time, preferably when concurrent read access is low. Frequent writing to a DIRCONTROL directory can degrade performance for read-only users, and can impair overall server performance. For directories with frequent write activity, it is strongly recommended that you use file level control, *not* directory level control.

The following sections describe the characteristics of DIRCONTROL directories. These characteristics involve:

- Authorizations

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- Data consistency
- Concurrency
- Performance
- Other Functional Restrictions.

Authorizations for Directory Level Control

You cannot grant authority for individual files within a DIRCONTROL directory. Nor can you grant NEWREAD or NEWWRITE authority. Instead, *only* DIRREAD and DIRWRITE authority can be granted. As a directory owner, you have DIRWRITE authority for DIRCONTROL directories that you create.

DIRREAD authority lets the grantee read the directory and all files within the directory. It also lets the grantee read any file added in the future. Users with DIRREAD authority can access the directory in read-only mode, or they can use CSL routines to read files without accessing.

DIRWRITE authority lets the grantee read from and write to the directory and all files within it. It also lets the grantee read from and write to any file added to the directory in the future. Users with DIRWRITE authority can access the directory in read-only or read/write mode. Or, they can use CSL routines to read and write files without accessing.

This level of authorization control is similar to that of minidisks. If, for example, you allow another user to link to your minidisk in read/write mode, the effect is similar to granting DIRWRITE for a directory. That is, the user can read, write, and create files on the minidisk. Furthermore, the user can read from and write to any file that is created on the minidisk in the future. The authority lasts until the user is no longer allowed to link to your minidisk (perhaps you change the minidisk passwords).

Allowing a user to link to a minidisk in read mode is similar to granting DIRREAD authority for a directory. The user can read the entire minidisk and any files that are added to it.

The directory should contain read-only data or data that is rarely changed. If files in the directory are frequently updated, you should use file level control. With file level control, you still have the ability to grant authority for future files. (Use the NEWREAD or NEWWRITE options on the GRANT command.)

Data Consistency of Directory Control Directories

The data consistency of DIRCONTROL directories is also to that of minidisks. When you access a DIRCONTROL directory in read-only mode, you see a consistent view of the data until you reaccess the directory. If another user changes a file within the directory, you will not see the change until you reaccess. In FILECONTROL directories, on the other hand, you see file changes as soon as the other user commits the changes and you re-read the file.

When you access a DIRCONTROL directory in read/write mode, you see your own changes as you make them. This is identical with the way minidisks work.

It's important to remember that access-to-release consistency rules do not apply to aliases. Suppose you create an alias to a base file that resides in a DIRCONTROL directory. Then, you access the directory containing the alias and the

DIRCONTROL directory that contains the base file. If you use the alias to refer to the file, you will see the most current version of the file. Regular file control sharing rules apply.

If, however, you refer to the base file directly, you will see the version of the file that existed at the time the directory was accessed. That is, you will have access-to-release consistency. In fact, executing a FILELIST command for the base file and for the alias might show different sets of file statistics.

Another exception to access-to-release consistency is the *inplace* file. *Inplace* SFS files are files that have the INPLACE and NORECOVER attributes. For these files, SFS does not maintain access-to-release consistency. Nor does it try to immediately reflect all changes made to the file. While changed blocks may be seen, new blocks allocated to the file will not be seen until the user reaccesses the directory. So, while *inplace* files may reside in DIRCONTROL directories, they have little use outside of specialized applications.

Concurrency of Directory Control Directories

DIRCONTROL directories do not allow the same level of concurrency that FILECONTROL directories do. While read concurrency is the same, write activity is restricted. In particular, when a user has a DIRCONTROL directory accessed in read/write mode, no other user can write to the directory. If no one has the directory accessed in read/write mode, multiple users can concurrently write to different files within the directory by using CSL routines to directly refer to the files.

With FILECONTROL directories, on the other hand, any number of users can access the directory in read/write mode. Furthermore, these users can write to different files in the accessed directory at the same time. SFS ensures that no two users write to the same file at the same time.

Both DIRCONTROL and FILECONTROL directories let multiple users access the directory in read-only mode. Any number of users can be reading from a given file at the same time.

Another important concurrency difference between DIRCONTROL and FILECONTROL directories concerns updates of directories accessed in read-only mode. With FILECONTROL directories, some commands (such as XEDIT and COPYFILE) let you write to files even if the directory is accessed read-only. Applications that use CSL routines to directly reference files in FILECONTROL directories can write to files regardless of how the directory is accessed (so long as the user is authorized).

With DIRCONTROL directories, however, a read-only access prevents *all* writing activity. When you access a DIRCONTROL directory in read-only mode, there is no way for you to write to files in that directory. To write to files, you must access the directory in read/write mode. Or, if the command or application does not need the directory to be accessed, you can release the directory (that is, do not access it at all). When you do not have the directory accessed, you can write to files in it if no other user has the directory accessed read/write, or is currently writing to the files you need to write to.

The concurrency of DIRCONTROL directories is similar to that of minidisks. While it is possible to have several concurrent writers to a minidisk, the results are unpredictable. Minidisks, in effect, allow only one user to write to the minidisk at a time. Any number of users can access a minidisk in read-only mode.

Performance Benefits of Directory Control Directories

One compelling reason for using a DIRCONTROL directory is the potential performance benefit it provides. SFS delivers improved performance by using *data spaces*.

A *data space* is a separate area of virtual storage that can be directly addressed by your virtual machine. Your virtual machine does not need to communicate with the server to get file data. The use of data spaces can significantly improve performance of accessed DIRCONTROL directories.

Your file pool administrator controls which directories reside in data spaces. If you have a DIRCONTROL directory that you wish to have placed in a data space, you will need to ask your file pool administrator to do it. DIRCONTROL directories that are good candidates for data space residence meet these requirements:

- The directory should contain read-only data or data that is infrequently updated.
- If it is occasionally updated, write activity should be confined to brief periods of time, preferably when concurrent read access is low.
- Authorized users must access the directory *in read-only* mode to get the performance benefit.
- The directory must be *local* to the users accessing it for those users to get the performance benefit. (A data space cannot be referred to from another processor. CMS uses regular Advanced Program-to-Program Communication/Virtual Machine (APPC/VM) for remote file pools.)

Because your system has a limited number of available data spaces, your administrator will probably ensure that the directory meets all of the above requirements.

The read-only requirements are because of the data consistency SFS provides for DIRCONTROL directories.

For example, suppose users Cherie and Pam are accessing a directory in read-only mode. That directory happens to reside in a data space (refer to Figure 33 on page 105). If user Butch writes to a file in the directory, the data space is not changed (to provide data consistency to Cherie and Pam), but the data in the file pool *is* changed. SFS must now keep track of the version in the data space, and the data that Butch changed.

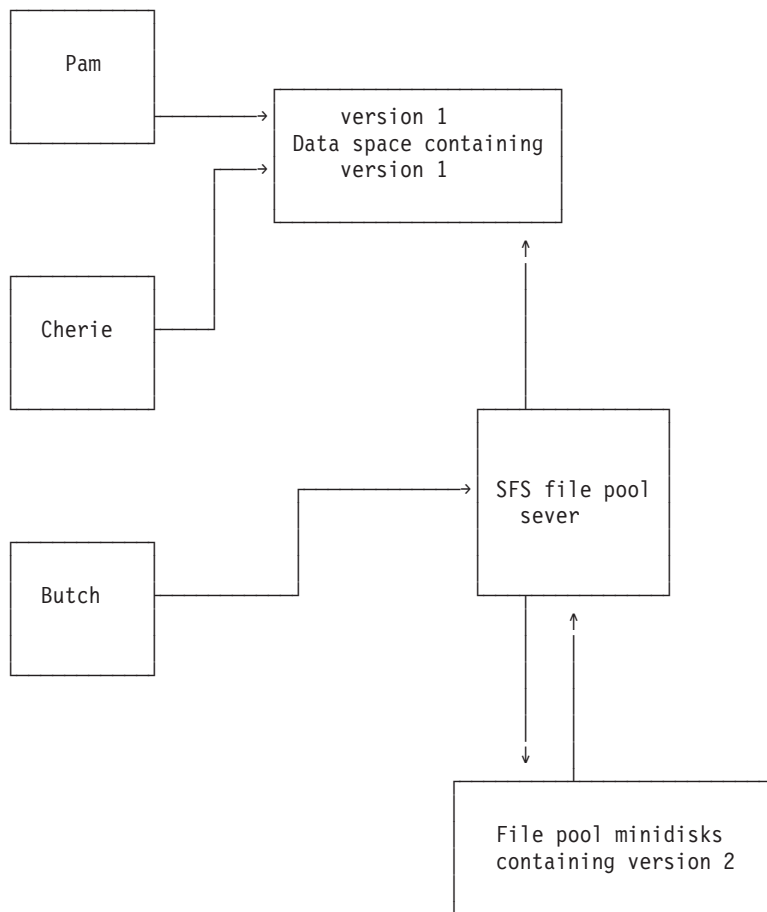


Figure 33. Using Directory Control Directories

Now suppose that Ed accesses the directory in read-only mode (refer to Figure 34 on page 106). If another data space is available, SFS loads the *changed* version of the directory into another data space and allows Ed to use it. SFS still maintains the original data space because Cherie and Pam still have it accessed. So, at this point, SFS is maintaining two data spaces for the directory. It also needs to keep track of the data that Butch changed.

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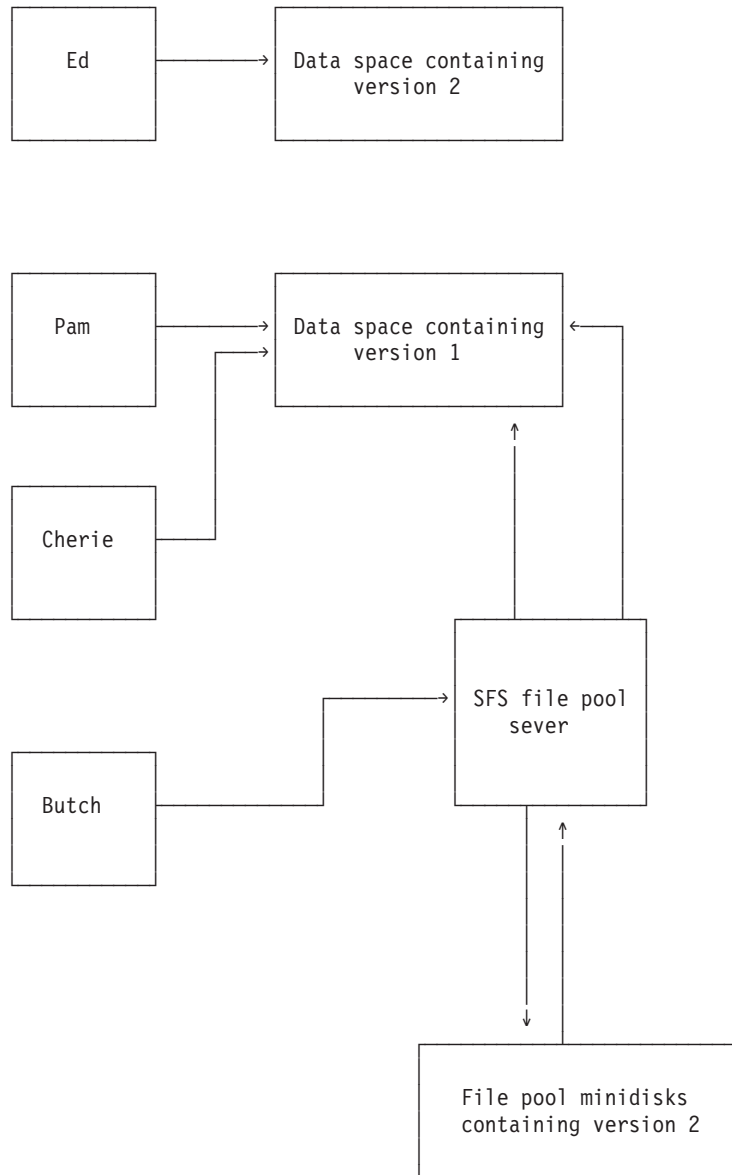


Figure 34. Using Directory Control Directories

Suppose Butch changes another file in the directory (refer to Figure 35 on page 107), creating a third version of the directory. If another user, Brad, accesses the directory, SFS loads yet another data space.

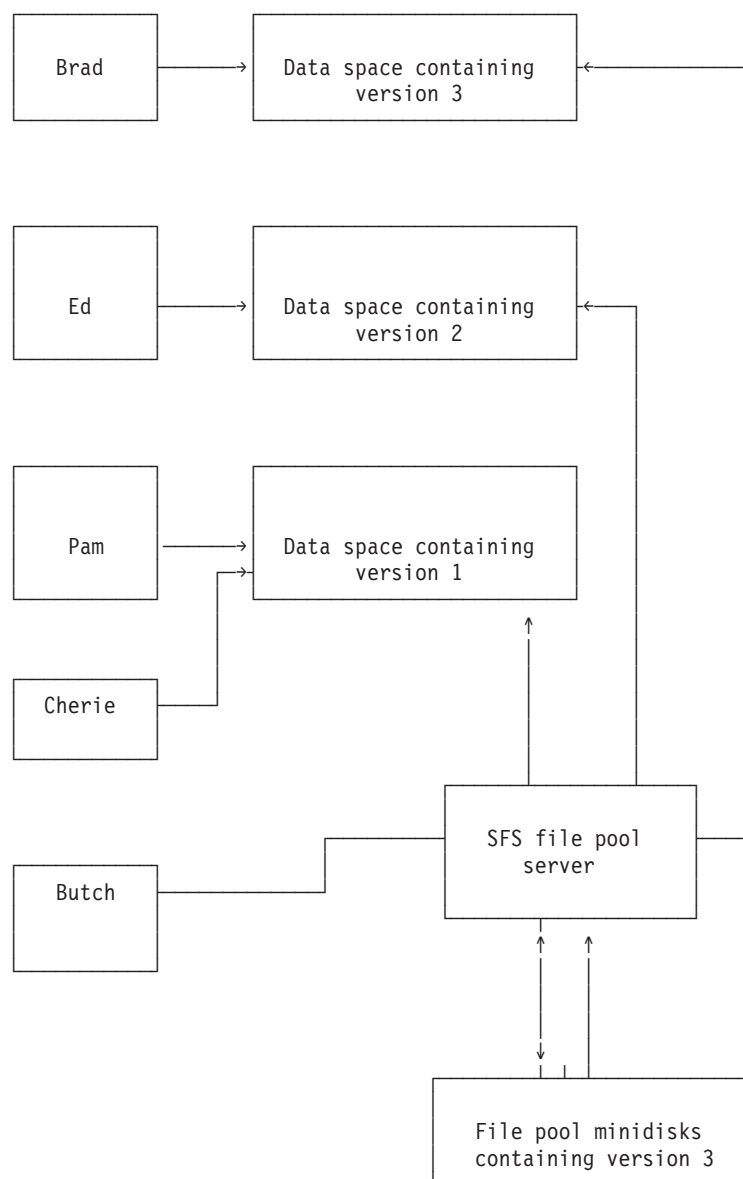


Figure 35. Using Directory Control Directories

SFS maintains each of the data spaces until all the users of a particular data space release or reaccess the directory. When all users of a back-level data space release any access of the directory, reaccess the directory it represents, or log off, SFS frees the data space for other uses. If, for instance, Cherie and Pam release the directory, the original data space would go away (assuming there were no other users of it). If Cherie happened to reaccess the directory, SFS would let her use the data space that had the most recent copy (the one Brad has accessed in our example).

It's also possible that Cherie and Pam neither reaccess the directory, nor release it all day. In this case, the server maintains the data space all day. The server does not force them to reaccess the directory, nor does it automatically *refresh* it. Remember that with DIRCONTROL directories, the server provides access-to-release consistency for read-only users at all times.

You can see how frequent writing activity on an often-used directory would create a lot of overhead in SFS processing. SFS would have to load data spaces and keep

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track of various levels of changed data. This processing overhead will reduce the performance gains, and the server could easily run out of data spaces. In this case, users who access the directory would use the SFS server processing—almost all performance benefits would be lost.

To get the most benefit from data space use, you should schedule all updates during periods of low directory use. You should make the updates in as brief a time as possible, and then *request all users of the directory to reaccess it*. You can determine who has your directory accessed by using the QUERY ACCESSORS command. While not all users will heed your advice, you can minimize the chance of the server running out of data spaces by sending the message.

File pool administrators can determine the number of versions of a directory that SFS is maintaining by using the QUERY ACCESSORS command.

Another requirement for DIRCONTROL directories in data spaces is that users must access the directory in read-only mode to get the benefit. Users who access in read/write mode do not use the data space. Nor do users who use CSL routines to refer to the directory without accessing it. Because CSL routines can refer to SFS files directly, some applications may not require the directory to be accessed. These applications will not use the data space and, consequently, will not get the performance benefit. The directory should be accessed before the application is started. Then, even though the application uses direct reference, the data space will be used (assuming the directory is local).

Another important point to remember is that aliases never use data spaces. Suppose, for example, you create an alias to a base file in a DIRCONTROL directory. The alias resides in one of your directories, and both directories are accessed. If you use the alias to refer to the base file, you will not use the data space. Instead, the server will process your request. If, however, you refer to the base file directly, you will use the data space. So, using the alias will give you the most current version of the file, which is the version the server maintains, but will not give you the benefits of the data space.

If your DIRCONTROL directory meets the requirements for use in a data space, you need to ask your file pool administrator to make the directory *data space eligible*. The administrator will probably verify that your directory does, indeed, meet the requirements for data space residence and enter a DATASPACE command for the directory. (Only users with file pool administration authority can use the DATASPACE command.)

Once the DATASPACE command is processed, your directory is said to be *data space eligible*. The next time a local user accesses your directory in read-only mode, the file pool server will load the directory into a data space if one is available. If a data space is not available, regular server processing is used.

So, even if your directory is data space eligible, there is no guarantee that it will be loaded into a data space. If your file pool administrator has correctly estimated the number of data spaces needed for the file pool, the odds are that one will be available. In any case, you might ask your administrator to enter a QUERY ACCESSORS command if you suspect that your directory is seldom placed in a data space (there is no noticeable performance improvement). The administrator can tell whether write activity on some other directory in a data space has caused all data spaces to be used.

Once a directory is made eligible for use in a data space, that eligibility persists (even across server shutdowns) until one of these things happens, the:

- Administrator explicitly removes eligibility by entering a DATASPACE RELEASE command.
- Directory is erased.
- Directory is changed from directory control to file control.

Other Functional Restrictions of Directory Control Directories

In addition to the characteristics described above, DIRCONTROL directories have these restrictions:

- UPDATE is the only type of explicit lock that the file is in.
- A file (or external object) cannot be the source or target of a RELOCATE command.
- The directory cannot contain aliases.

Example of a High-Performance Directory Control Directory

Suppose you work as a securities analyst in a brokerage firm. Your department analyzes businesses and creates a CMS file for each firm on which you have an opinion. Every day or two, your department completes a few new opinions. All the stockbrokers in your firm read the reports and advise their clients of your opinions. They typically read the files while discussing investment options on the telephone with clients, so they need good access performance.

These opinion files are good candidates for placement in a high-performance DIRCONTROL directory. Because opinions are generated every day or two, the directory would not have frequent write activity. Furthermore, you could schedule the updates to occur near the end of the business day when there is little read activity. Your department members might, for example, create CMS files in their own subdirectories while they are forming an opinion. When their analysis is complete, they would wait until the end of the business day and copy the file to the DIRCONTROL directory.

During the day, your company's numerous stockbrokers would keep the directory accessed in read-only mode. They would benefit from having the opinions in a high-speed directory because it would reduce delays when they are retrieving an opinion for a busy client.

While the example being used is for a brokerage firm, the same requirements for high-speed directories are satisfied by many situations: electronic bulletin boards, forum directories, document libraries, and so on. To illustrate how you would set up a high speed directory, we will continue with the brokerage example.

First, you need to create a DIRCONTROL directory. To do so, specify the DIRCONTROL option on a CREATE DIRECTORY command:

```
create directory vmsysu:yourid.opinions (dircontrol
```

If the directory already exists, you can convert it to a DIRCONTROL directory by doing the following:

1. Ensure that all explicit locks for the directory and its files are deleted.
2. Then enter: `dirattr vmsysu:yourid.opinions dircontrol (force`

The FORCE option revokes all individual authorizations you've granted for the directory and the files within it. Remember that individual authorizations are not allowed in DIRCONTROL directories. The FORCE option also erases all aliases from the directory. (Aliases cannot exist in a DIRCONTROL directory.)

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You can verify that the directory is directory control by entering:

```
query dirattr vmsysu:yourid.opinions
```

If it is a DIRCONTROL directory, you will see:

```
DIRCONTROL
```

Otherwise you will see:

```
FILECONTROL
```

Next, you would grant DIRWRITE authority to your department. Assuming you have created a nickname, SA, for the securities analysis department, you would enter:

```
grant authority vmsysu:yourid.opinions to sa (dirwrite
```

DIRWRITE authority allows your department members to create new files or update existing files in the directory. It also allows them to write to any file that is added to the directory in the future.

Next, grant DIRREAD authority to all the stockbrokers and anyone else who can use your computer system:

```
grant authority vmsysu:yourid.opinions to public
```

DIRREAD is the default for GRANT AUTHORITY, when a DIRCONTROL directory is specified.

Finally, call the file pool administrator and ask to have your directory made data space eligible. The administrator will enter a DATASPACE ASSIGN command for your directory, and your stockbrokers will enjoy high-speed opinions.

Application Considerations

The following considerations should be taken into account when using applications to operate in an SFS environment. For information on writing applications, see *z/VM: CMS Application Development Guide*.

- Many system facilities and applications, such as the DASD Dump Restore (DDR) Service Program, use CMS files. These files, like any other CMS files, can reside in an SFS directory or minidisk. However, before sharing these files with other users (or before using the files of others), you should be aware of the implications of doing so. For example, if you grant authority to another user, and that user locks the file, the facility may not be able to use the file. The same is true if another user grants you authority and later revokes it. In these cases, the facility may receive a nonzero return code and terminate, because it cannot use a file it needs.
- If you are running an application program without Coordinated Resource Recovery (CRR) and it fails, it could be a result of accessing directories in several file pools in read/write mode. Some applications try to write to more than one file mode. If those file modes are associated with directories in different file pools, the program may fail. For more information on CRR, see *z/VM: CMS File Pool Planning, Administration, and Operation*.

Using Several File Pools at One Time

It is possible for you to be enrolled in more than one file pool. If this is the case, you will have a top directory in each file pool. Your administrator might have set you up one of these file pools as your default file pool. Use the QUERY FILEPOOL PRIMARY command to find out your default file pool. Generally, the default file

pool is accessed with a file mode of A. You can access your file space in the other file pool by explicitly naming the file pool ID on any command that accepts a directory identifier.

For example, for user Alyson to create a directory named NEWDIR in the file pool DEVELOP, which is not her default file pool, she would enter:

```
create directory develop:alyson.newdir
```

If Alyson wanted to make the directory part of her CMS search order, she could do so by accessing the directory:

```
access develop:alyson.newdir w
```

Such ACCESS commands could be in her PROFILE EXEC, so that the directory in the DEVELOP file pool is automatically accessed each time Alyson logs on.

If file mode A is a minidisk rather than a directory, you should decide which file pool will be your default file pool. You would then use the SET FILEPOOL command in your PROFILE EXEC to make that file pool the default. Directories in your secondary file pools could also be accessed in your PROFILE EXEC.

Suppose that Sue is enrolled in three file pools: DEVEL1, PUBS, and CTEST. Her file mode A is a minidisk. She wants to make DEVEL1 her default file pool and have her top directory within DEVEL1 accessed as file mode B. The other two top directories she wants accessed as file modes O and P. In her PROFILE EXEC she would enter:

```
set filepool devel1:  
access . b  
access pubs:. o  
access ctest:. p
```

Sue can abbreviate the commands by omitting her user ID if she has not entered a SET FILESPACE command. CMS will assume she wants to access the top directories.

After these commands are processed, if Sue enters a command and omits the file pool ID, CMS will use DEVEL1 as the default.

To change the default file pool during a CMS session, enter the SET FILEPOOL command again. For example, to temporarily change her default to CTEST, Sue would enter the following command:

```
set filepool ctest:
```

To reset the default, Sue would enter SET FILEPOOL again:

```
set filepool devel1:
```

Note: Assuming your administrator has defined a default file pool for you, you can reset your current default to the one originally defined for you by entering:

```
set filepool primary
```

PRIMARY is a keyword. It means the default file pool in effect at the time of IPL.

Sharing Files with Users on Other Systems

If you need to communicate with someone on another processor, you can add to your names file a nickname for that user. In addition, you will need to find out the user's local ID, the logon ID for that local system. You will need to add this to the section of optional information at the bottom of the NAMES screen. (If the optional

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information tag section is full, you must XEDIT your names file and manually enter the information.) When you wish to issue a command, send information, or grant authority to this user, the optional information will enable your system to locate him, even though he is not at your location.

SFS lets you share your files with users on other systems. For example, you can share files with users in another building, another town, or state.

The Transparent Services Access Facility (TSAF) is a component of z/VM that handles communication between systems by letting APPC/VM paths span multiple VM systems. TSAF lets a source program connect to a target program by specifying a name that the target has made known, instead of specifying a user ID and node ID. A collection is a group of up to eight z/VM systems that can share resources.

Inter-System Facility for Communications (ISFC) is a component of z/VM that handles program-to-program communications between VM systems and LAN-based domain controller workstations. A Communication Services (CS) collection is a group of one or more of these domains.

To share files owned by another user in a different file pool, or on a different system in the same TSAF or CS collection, call the system administrator at the other location and ask to be enrolled in the other user's file pool. Then, the other user could grant you authority for the files you need to share. To access the files you own on your file pool, that user could, in turn, request enrollment in your file pool.

To enable you to share files with users on a different system, and not within the same TSAF or CS collection, your system administrator will need to use APPC/VM VTAM Support (AVS). For more information, see *z/VM: CMS File Pool Planning, Administration, and Operation*, and *z/VM: Connectivity*.

Chapter 4. Storing Your Files on Minidisks

z/VM uses disk storage, which can either be a directory (within the SFS file space) or a minidisk. This section contains information specific to minidisks. For more information on how to manage your files if your files are only stored in an SFS file space, see Chapter 3, “Using the Shared File System,” on page 41.

Minidisks and How They Are Defined

A minidisk is a location on a real DASD which has been allocated for storage of a user's files. A minidisk can also be formatted for use as an OS or DOS disk. Minidisks are also known as virtual disks.

For CMS applications, you never have to be concerned with the location of your data on minidisks; when you use minidisks, they are, for practical purposes, functionally the same as real disks.

You can have three types of minidisks: *permanent minidisks*, *temporary minidisks (T-disks)*, and *virtual disks in storage*.

Permanent minidisks

last across terminal sessions (logons); they are defined in the z/VM directory entry for your virtual machine.

Temporary minidisks

are automatically destroyed at logoff. You can define temporary minidisks for your own virtual machine by using the CP DEFINE command, or they can be attached to your virtual machine by the system operator.

Virtual disks in storage

are temporary simulations of minidisks in system storage; they are not allocated on a real DASD. Virtual disks in storage are defined in the z/VM directory entry for your virtual machine, or you can define them using the CP DEFINE command.

All three types of minidisks can be attached to your machine during a terminal session.

Defining Temporary Minidisks

If you use minidisks to store your files, from time to time you may find it necessary to define a temporary minidisk. Using the CP DEFINE command, you can attach a temporary minidisk to your virtual machine for the duration of a terminal session. You enter the CP DEFINE command with the device type of the storage you wish, the amount of cylinders or blocks you require, and the virtual device number you would like it assigned to.

Before entering the CP DEFINE command, you may wish to use the CP QUERY DASD command to see what virtual device numbers you are currently using.

Entering:
query dasd

will result in a display of information similar to the following:

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```
DASD 0191 3380 USG017 R/W    20 CYL  ON DASD  0954 SUBCHANNEL = 0003
DASD 0192 3390 USG01M R/O    120 CYL  ON DASD  0565 SUBCHANNEL = 0000
DASD 019E 3390 SYGEMC R/O    200 CYL  ON DASD  0541 SUBCHANNEL = 000A
```

The virtual device numbers currently being used are 191, 192 and 19E. In the CP DEFINE command example which follows, a virtual device number of 291 will be used.

The following command allocates a 10-cylinder temporary minidisk from a 3380 device and assigns it a virtual device number of 291:

```
define t3380 as 291 cyl 10
```

When complete, the system will return messages similar to the following:

```
DASD 291 DEFINED
Ready; T=0.15/1.39  11:21:07
```

You could check that your new temporary minidisk has been defined by reentering the CP QUERY DASD command:

```
DASD 0191 3380 USG017 R/W    20 CYL  ON DASD  0954 SUBCHANNEL = 0003
DASD 0192 3390 USG01M R/O    120 CYL  ON DASD  0565 SUBCHANNEL = 0000
DASD 019E 3390 SYGEMC R/O    200 CYL  ON DASD  0541 SUBCHANNEL = 000A
DASD 0291 3380 (TEMP) R/W    10 CYL  ON DASD  07D1 SUBCHANNEL = 0013
```

When you define a minidisk, you can choose any valid virtual device number that is not already assigned to a device in your virtual machine. Valid device numbers for minidisks are 0001 through FFFF.

For more information on the DEFINE or QUERY DASD command, see *z/VM: CP Commands and Utilities Reference*.

Defining Virtual Disks in Storage

A virtual disk in storage is another type of temporary minidisk that you can attach to your virtual machine for the duration of a terminal session. However, because a virtual disk in storage is allocated from system storage instead of on a real DASD, and so avoids the I/O overhead of writing to the DASD, it may be faster to use than a regular temporary minidisk.

Use the CP DEFINE command to create a virtual disk in storage. A virtual disk in storage is always defined as an FBA minidisk, which is allocated in 512-byte blocks. You do not need to have a real FBA DASD on your system. For example, the following command allocates a 160-block virtual disk in storage and assigns it a virtual device number of 333:

```
define vfb-512 as 333 blk 160
```

For more information, see *z/VM: CP Commands and Utilities Reference*.

Formatting Minidisks

Before you can use any new minidisk, you must format it. This applies to new minidisks that have been assigned to you, and to temporary minidisks and virtual disks in storage that you have defined with the CP DEFINE command. When you enter the FORMAT command, you must use the virtual device number you have defined for the minidisk and assign a file mode letter, for example:

```
format 291 c
```

CMS then prompts you with the following message:
 DMSFOR603R FORMAT will erase all files on disk C(291).
 Do you wish to continue? Enter 1 (YES) or 0 (NO).

You respond by typing either a number or a word (YES or NO):
 YES

CMS then asks you to assign a label for the minidisk, which you select. A valid label is considered to be any combination of one to six numeric (0-9) and alphabetic (A-Z) characters. However, be aware that the use of fewer than six characters will cause blanks to be filled in place of the missing rightmost characters. And, the use of more than six characters results in only the first six characters from the left being used. When the message:

```
DMSFOR605R Enter disk label:
```

is displayed, you respond by supplying a minidisk label. For example, if this is a temporary minidisk, you might enter:

```
scratch
```

CMS then erases all the files on that minidisk, if any existed, formats it for your use, and displays the following messages:

```
DMSFOR733I Formatting disk C
DMSFOR732I 10 cylinders formatted on C(291)
Ready; T=0.15/1.60 11:26:03
```

After the format of the disk is complete, entering the command:
 query disk

will return a display similar to the following, including the newly formatted disk:

| LABEL | VDEV | M | STAT | CYL | TYPE | BLKSIZE | FILES | BLKS | USED-(%) | BLKS | LEFT | BLK | TOTAL |
|--------|------|-----|------|-----|------|---------|-------|------|----------|------|------|-----|-------|
| DLO191 | 191 | A | R/W | 20 | 3380 | 2048 | 227 | | 4554-84 | | 846 | | 5400 |
| SCRATC | 291 | C | R/W | 10 | 3380 | 4096 | 0 | | 6-00 | | 1494 | | 1500 |
| IDTOOL | 192 | E/A | R/O | 120 | 3390 | 1024 | 1797 | | 55424-93 | | 3976 | | 59400 |
| YDISK | 19E | Y | R/O | 200 | 3390 | 4096 | 1443 | | 28661-80 | | 7339 | | 36000 |

The QUERY DISK command will be discussed further in section “Managing Your Minidisks” on page 119.

The FORMAT command should only be used to format CMS minidisks, that is, minidisks you are going to use to contain CMS files. In addition, this command gives you a choice of physical disk block size as an option.

For more information on the FORMAT or QUERY DISK commands, see *z/VM: CMS Commands and Utilities Reference*.

Linking and Sharing Minidisks

If your files are stored on minidisks, you will need to link to other users' minidisks in order to share files. This section contains the information you will need in order to create temporary or permanent links to other minidisks.

Storing Your Files on Minidisks

Since only one user can own a minidisk, and there are many occasions that require users to share data or programs, z/VM lets you share minidisks, on either a permanent or temporary basis, by *linking*.

Virtual disks in storage that are defined in the directory, although they are temporary, can be shared among users. A shareable virtual disk in storage exists from when the first user links to it until the last user detaches it or logs off. Because of its temporary nature, however, a shareable virtual disk in storage should not be used for permanent data.

Permanent links can be established for you in your z/VM directory entry. These minidisks are then a part of your virtual machine configuration every time you log on. You can also have another user's minidisk temporarily added to your configuration by using the CP LINK command.

Coding in the file of access For example, if you have a program that uses data that resides on a minidisk identified in the user ID INFO's configuration as 194, and you know that the password assigned to this minidisk is GO, you could enter the command:

```
link info 194 as 198 r pass= go
```

The *r* in the command indicates the access mode; in this case, it tells CP that you only want to read files from this minidisk and you will not write to it. If you try to enter this command when someone already has write access to that minidisk, you will not be able to establish the link. If you want to link to INFO in any event, you can reenter the LINK command using the access mode RR:

```
link info 194 198 rr go
```

Notes:

- Using the RR access lets one user read a minidisk while another is updating it at the same time. This can produce unpredictable results.
- The password cannot be entered on the command line if the password suppression facility is active.
- If RACF® or another external security manager is installed on your system and is in effect, the procedure for linking may be changed somewhat. For more information, see your system administrator.

Once successfully completed, INFO's 194 minidisk is then added to your virtual machine configuration at virtual device number 198.

To verify the command has been processed, you can enter the CP QUERY DASD command, which will result in a display similar to this:

```
DASD 191 3390 USG017 R/W    20 CYL  ON DASD  0541 SUBCHANNEL = 0003
DASD 198 3390 USG01M R/O    120 CYL  ON DASD  0565 SUBCHANNEL = 0001
```

You can also use the CP LINK command to link to your own minidisks. For example, if you log on and discover that another user has access to one of your minidisks, you will be given read-only access, even if it is a read/write minidisk. You can request the other user to detach your minidisk from his virtual machine, and after he has done so, you can establish the link:

```
link * 191 191
```

When you link to your own minidisks, you can specify the user ID as *, and you do not need to specify the access mode or a password.

For complete information and options available for the CP LINK command, see *z/VM: CP Commands and Utilities Reference*.

Accessing Minidisks

Once minidisks are linked, they can be accessed (assigned a file mode). In “Accessing Your Directories or Minidisks” on page 139, we discussed the reasons for accessing a minidisk or a directory. This section discusses how to display the minidisks you currently have access to, and how to assign a file mode to a minidisk virtual device number.

You may recall in “Formatting Minidisks” on page 114, an example was used where a new temporary disk was assigned a file mode as part of the formatting command. As part of the FORMAT, in addition to the assignment, the disk contents were erased. When linking to your own minidisks, or another user's minidisk, you would, generally, like to keep the information already on the minidisk. Therefore, the FORMAT command would not be applicable.

You can assign a file mode using the ACCESS command. A sample format of the ACCESS command follows:

```
▶▶—access—virtual device address—fm—▶▶
```

Before using the ACCESS command, you may want to use the QUERY ACCESSED command to determine the file modes (minidisks) you currently have access to, for example:

| Mode | Stat | Files | Vdev | Label/Directory |
|------|------|-------|------|-----------------|
| A | R/O | 765 | 191 | DL0191 |
| S | R/O | 1321 | 190 | CMS6.0 |
| Y/S | R/O | 337 | 19E | 19ESP6 |

The information displayed is organized as follows:

- Mode indicates the mode letter used to access the minidisk.
- Stat gives the status of the minidisk: R/W (read/write) or R/O (read-only).
- Files displays the number of files on the minidisk.
- Vdev displays the virtual device number of the minidisks.
- Label/Directory shows the label assigned to the minidisk when it was formatted.

If you had already linked to a minidisk whose virtual device number is 194, you could access it with a file mode of B by entering:

```
access 194 b
```

Releasing and Detaching Minidisks

When you no longer need a minidisk that you temporarily accessed, you can release it by entering the RELEASE command. For example:

```
release b
```


Storing Your Files on Minidisks

When you want to assign a currently active mode letter to another minidisk, enter the ACCESS command to reassign that mode letter. It is not necessary to release a minidisk before accessing another with the same mode.

When you log off, any minidisk that you temporarily accessed is automatically released.

You can also specify that the disk be detached from your virtual machine configuration by using the DETACH option of the RELEASE command. For example:

```
release b (detach or release 194 (detach
```

Note: If you are experiencing poor response time and have many minidisks accessed that you do not need, you may want to release some of these minidisks.

When you detach a virtual disk in storage or log off, if you are the last user of the virtual disk in storage, it is destroyed.

For more information on the RELEASE command, see *z/VM: CMS Commands and Utilities Reference*.

Minidisk File Directories

Each minidisk has a *master file directory* that contains entries for each of the CMS files on that minidisk. (The *directories* discussed in this section are not to be confused with those pertaining to the SFS.) When you access a minidisk, information from the master file directory is brought into virtual storage and written into a user file directory. The user file directory has an entry for each file that you can access. If you have accessed a minidisk specifying only particular files, then the user file directory contains entries only for those files.

If you have read/write access to a minidisk, then each time you save the file, the user file directory and master file directory are updated to reflect the current status of the minidisk. If you have read/write access to a minidisk and the FSCLOSE macro is issued, the user file directory is updated. When there are no open files on the minidisk, the master file directory is updated to reflect the current status of the files. If you have read-only access to a minidisk, then you cannot update the master file directory or user file directory. If you access a read-only minidisk while another user is writing files onto it, you may need to periodically reenter the ACCESS command for the minidisk to obtain a fresh copy of the master file directory.

Attention: You should never attempt to write on a minidisk at the same time as another user. CMS does not protect a user from loss of data on a minidisk when multiple users have write access to it.

You can use the CP QUERY LINKS command to determine if other users have links to any minidisks you want to access. For more information, see *z/VM: CP Commands and Utilities Reference*. If you are using the Shared File System, files can be locked and unlocked to prevent simultaneous updates. For more information, see “Locking Files and Directories” on page 96.

The user file directory remains in virtual storage until you enter the RELEASE command, specifying the mode letter or virtual address of the minidisk.

If you detach a minidisk (with the CP DETACH command) without releasing it, CMS implicitly releases the minidisk.

Attention: Any RELEASE attempted after a minidisk has been detached, whether it be implicit or explicit, cannot perform equivalent cleanup of open files as a RELEASE issued before the DETACH. Therefore, to ensure that all open files are cleaned up when detaching a CMS minidisk, issue the RELEASE command with the DETACH option, or issue the RELEASE command before issuing the CP DETACH command.

The entries in the master file directory are sorted alphanumerically by file name and file type, to facilitate the CMS search for particular files. When you are updating minidisks, the entries in the user file directory and master file directory tend to become unsorted as files are created, updated, and erased. When you use the RELEASE command to release a read/write minidisk, the entries are sorted and the master file directory is rewritten.

Managing Your Minidisks

The number of files you can write on a minidisk depends on both the size of the minidisk and the size of the files that it contains. You can find out how much space is being used on a minidisk by using the QUERY DISK command. For example, to see how much space is on a minidisk with a file mode of A, you would enter:

```
query disk a
```

The response may be something like this:

| LABEL | VDEV | M | STAT | CYL | TYPE | BLKSIZE | FILES | BLKS USED-(%) | BLKS LEFT | BLK TOTAL |
|--------|------|---|------|-----|------|---------|-------|---------------|-----------|-----------|
| MYDISK | 191 | A | R/W | 5 | 3390 | 1024 | 171 | 1221-92 | 107 | 1328 |

| Term | Description |
|-----------|---|
| LABEL | Identifies the label assigned to the disk when it was formatted. |
| VDEV | Identifies the virtual device number. |
| M | Identifies the access or file mode letter. |
| STAT | Identifies whether disk status is read/write or read/only. |
| CYL | Identifies the number of cylinders available on the disk. |
| TYPE | Identifies the device type of the disk. |
| BLKSIZE | Identifies the CMS disk block size when the minidisk was formatted. |
| FILES | Identifies the number of CMS files on the disk. |
| BLKS USED | Identifies the number of CMS disk blocks in use. The percentage of blocks in use is also displayed. |
| BLKS LEFT | Identifies the number of disk blocks left. |
| BLK TOTAL | Identifies the total number of disk blocks. |

When a minidisk is becoming full, you should erase whatever files you no longer need, pack inactive files using the COPYFILE command with PACK option, or dump to tape files that you need to keep (but do not need to keep active on the minidisk).

Storing Your Files on Minidisks

When you are executing a command or program that creates and stores a file, and the minidisk becomes full in the process, you will receive an error message. You must then try to clear some space on the minidisk before you can attempt to process the command or program again. To avoid the delays that such situations cause, you should try to maintain an awareness of the usage of your minidisks. If you cannot erase any more files from your minidisks, you should contact installation support personnel about obtaining additional read/write minidisk space.

Data Compression

You can save data in a compressed format to conserve DASD resources. The CSRCMPSC macro provides a pair of services that compress and expand data.

Compression takes an input string of data and, using a data area called a *dictionary*, produces an output string of compression symbols. Each symbol represents a string of one or more characters from the input.

Expansion takes an input string of compression symbols and, using a *dictionary*, produces an output string of the characters represented by those compression symbols.

To use the Data Compression Services for compression and expansion, the CSRCMPSC macro uses two dictionaries: the compression dictionary and the expansion dictionary. These dictionaries are logically and physically related. When you expand the data that has been compressed, you want the result to match the original data. Thus the dictionaries are complementary. When the compression is being done, the expansion dictionary must immediately follow the compression dictionary, because the compression algorithm examines entries in the expansion dictionary.

To help you use the compression services, the S-disk contains the following compiled REXX execs:

- CSRBDICV for building compression and expansion dictionaries
- CSRCMPEV to run a test, to compress and re-expand files using dictionaries created by the CSRBDICV EXEC. Reports are generated giving statistics on the efficiency of the compress and expand functions with the current dictionary set.

For more information on how to use these execs, see *z/VM: CMS Commands and Utilities Reference*. For more information about compression and using the execs, see *z/VM: CMS Application Development Guide* and *Enterprise Systems Architecture/390 Data Compression*.

Chapter 5. More on the CMS File System

This section is an extension of Chapter 2, “CMS File System,” on page 29. It contains more detailed information on CMS files and commands, such as:

- Additional considerations when naming and storing your CMS files.
 - What are Reserved File Types?
 - How are File Mode Letters and Numbers used? For SFS, for minidisks?
- What are Synonyms and Translations and how are they used?
- CMS command search order and execution characteristics.

Many CMS command names are listed in the section; many have not been discussed or even mentioned previously in this document. For a full description on any command, see *z/VM: CMS Commands and Utilities Reference*.

What Are Reserved File Types?

For the purposes of most CMS commands, the file type field is used merely as an identifier. Some file types, though, have special uses in CMS; these are known as *reserved file types*.

Nothing prevents you from assigning any of the reserved file types to your files, but caution should be used if they are not being used for the specific CMS function usually associated with that file type.

Some reserved file types also have special significance to XEDIT. When you use the XEDIT command to create a file with a reserved file type, the editor assumes various default characteristics for the file, such as record length and format, tab settings, translation to uppercase, truncation column, and so on.

File Types for CMS Commands

Reserved file types sometimes indicate how the file is used in CMS: the file type ASSEMBLE, for example, indicates that the file is to be used as input to the assembler; the file type TEXT indicates that the file is in relocatable object form, and so on.

Some CMS commands create files of particular file types, using the file name you enter on the command line. The language processors do this as well; if you are recompiling a source file, but wish to save previous output files, you should rename them before executing the command.

Table 12 lists the file types reserved for use by CMS commands, in addition to some special file types reserved for use by the language processors, which are IBM licensed programs.

Table 12. Reserved File Types

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|-----------|-------------------------|-------|------------|-------|-------|---|
| AMSERV | AMSERV | Input | <i>fit</i> | F | 80 | Input control statements for Access Method Services |

More on the CMS File System

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|-----------|-------------------------|---|-----------------------|-------|-------|--|
| ASM3705 | ASM3705 | Input | <i>fn</i> | F | 80 | 3705 assembler source statements |
| | GEN3705 | Output | <i>fn(nn)</i> | F | 80 | |
| ASSEMBLE | ASSEMBLE | Input | <i>fn</i> | F | 80 | Assembler language source statements |
| | VHFHASM | Input | <i>fn</i> | F | 80 | |
| | HASM | Input | <i>fn</i> | F | 80 | |
| AUTOSAVE | XEDIT | Input | <i>fn</i> | F | 80 | Copy of an edited file |
| AUXxxxx | UPDATE | Input | <i>fn</i> | F | 80 | List of file types used for update files |
| | XEDIT | Input | <i>fn</i> | F | 80 | |
| BASDATA | BASIC execution | Execu- tion time files | <i>fn</i> | V | 255 | |
| BASIC | BASIC | Input | <i>fn</i> | V | 156 | BASIC language source statements |
| C | CC | Input | <i>fn</i> | F | 80 | C source statements |
| CMSUT1 | AMSERV | Inter- medi- ate work files | <i>fn</i> | F | 121 | |
| | COPYFILE | | COPYFILE | V/F | ANY | |
| | DISK LOAD | | DISK | V/F | ANY | |
| | DOSLIB | | <i>fn</i> | V | 1024 | |
| | EDIT | | EDIT | | | |
| | ESERV | | <i>fn</i> | F | 80 | |
| | EXECUPDT | | X\$EUPD\$X | V/F | ANY | |
| | EXPAND | | CMSUT1 | | | |
| | GENCMD | | COMMANDS | | | |
| | HELP | | HELP | | | |
| | HELPCONV | | HELPCONV | | | |
| | INCLUDE | | DMSLDR | | | |
| | IUCV | | CMSCOMM | | | |
| | LANGMERG | | ' <i>Appl_ID</i> 'NLS | | | |
| | LOAD | | DMSLDR | | | |
| | MACLIB | | DMSLBM | | | |
| | READCARD | | READCARD | V/F | 80 | |
| | RECEIVE | | RECEIVE | V/F | ANY | |
| | SENDFILE | | SENDFILE | V/F | ANY | |
| | TAPE LOAD | | TAPE | V/F | ANY | |
| | TAPPDS | | TAPPDS | | | |
| | UPDATE | | <i>fn</i> | V/F | ANY | |
| | VMFPLC2 LOAD | | TAPE | V/F | ANY | |
| XEDIT | XEDIT | | | | | |
| ZAPTEXT | CMSUT1 | | | | | |
| CMSUT2 | ESERV | Work | ESERV | | | |
| | GENMOD | | COMMANDS | | | |
| | LANGMERG | | ' <i>Appl_ID</i> 'NLS | | | |
| CNTRL | UPDATE XEDIT | Input | <i>fn</i> | F | 80 | List of update files |
| COBOL | COBOL | Input | <i>fn</i> | F | 80 | COBOL source statements |
| | COBOL2 | Input | <i>fn</i> | F | 80 | |
| COPY | MACLIB | Input | <i>fn</i> | F | 80 | COPY control cards and macro definitions A book from a DOS/VS source library |
| | SSERV | Output | <i>fn</i> | F | 80 | |

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|----------------------|-------------------------|------------------|-----------------------------------|--------|----------------------------|--|
| CSLCNTRL | CSLGEN | Input | <i>fn</i> | V F | 65535 2 ³¹⁻¹ | Routine names, TEXT files, template files, and other CSL control files that are to be used in building the library |
| CSLLIB | CSLGEN | Output | <i>fn</i> | V | 65535 | Callable services library (CSL), generated by CSLGEN, for use on DASD |
| | CSLLIST | Input/ Output | <i>fn</i> | | | |
| | RTNLOAD | Input | <i>fn</i> | | | |
| CSLSEG | CSLGEN | Output | <i>fn</i> | V | 65535 | Callable services library (CSL), generated by CSLGEN, for use in a logical saved segment |
| | CSLLIST | Input/ Output | <i>fn</i> | | | |
| | RTNLOAD | Input | <i>fn</i> | | | |
| DCSSMAP | LANGGEN | Output | NLxy x-level id y-lang id | V | 100 | Output file from LANGGEN command |
| DIRECT | DIRECT | Input | <i>fn</i> | F | 80 | User directory entries |
| DLCS | GENCMD | Input | <i>fn</i> xxxSPAcc xxxUPAcc | F | 80 | Source statements for command syntax definition and synonym files |
| DOSLIB | DOSLIB | Input | <i>fn</i> | V | 1024 | CMS/DOS phase library |
| | DOSLKED | Input | <i>fn</i> | V | 1024 | |
| | FETCH | Output | <i>fn</i> | V | 1024 | |
| | GLOBAL | Input | <i>fn</i> | | | |
| DOSLNK | DOSLKED | Input | <i>fn</i> | F | 80 | Linkage editor control statements for input to CMS/DOS linkage editor |
| ESERV | ESERV | Input | <i>fn</i> | V/F | ANY | Input control statements for ESERV program |
| EXEC | EXEC | Input | <i>fn</i> | V | 130 | EXEC statements |
| | EXEC 2 | Input | <i>fn</i> | V | 256 | |
| | GEN3705 | Output | <i>fn</i> | F | 80 | |
| | LISTFILE | Output | CMS | F | 80, 88 | |
| | LISTIO | Output | \$LISTIO | F | 80 | |
| | REXX | Input | <i>fn</i> | V | 2 ³¹⁻¹ | |
| EXPAND | EXPAND | Input | <i>fn</i> | V/F | 2 ³¹⁻¹ | Control records that expand object files |
| FORTRAN | FORTGI | Input | <i>fn</i> | V | 80 | FORTRAN source statements |
| | FORTHX | | | | | |
| | FORTVS2 | Input | <i>fn</i> | V/F | 2 ³¹⁻¹ | |
| | GOFORT | | | | | |
| | TESTFORT | | | | | |
| FREEFORT | GOFORT | Input | <i>fn</i> | V | 81 | FREEFORM FORTRAN source statements |
| FT ^m F001 | FORTRAN execution | Input/ Output | <i>fn</i> | V/F | 2 ³¹⁻¹ | User input and output files |
| GCS | EXEC | Input | <i>fn</i> | V | 130 | EXEC statements |
| GLOBALV | GLOBALV | Input/ Output | Initial | F | 80 | Collection of named variables |
| | DEFAULTS | | Session Lasting | V V | =<520 =<520 | |

More on the CMS File System

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|-----------|--|--------|-------------------------------------|-------|-------------------|---|
| GROUP | GROUP | Output | <i>fn</i> | F | 80 | Group Control System (GCS) data block entries used to describe a GCS virtual machine group |
| HELPxxx | HELP | Input | <i>fn</i> | V | 79 | Input files for HELP Facility, Where: xxx specifies the name of the component to which the file belongs. For more information on file types reserved for HELP, see Chapter 9, "Tailoring the HELP Facility," on page 225. |
| \$HLPxxx | HELPCONV | Output | <i>fn</i> | V | 79 | Output files for HELPCONV command Where: xxx specifies the component to which the file belongs. |
| LANGGCTL | LANGGEN | Input | <i>fn</i> | V/F | 2 ³¹⁻¹ | Control file for LANGGEN command |
| LANGLIST | GENCMD GENMSG LANGMERG LANGGEN SET LANGUAGE VMFNLS | Input | VMFNLS | F | ANY | Contains CMS NLS country code and language ID mapping |
| LANGMAP | LANGMERG | Output | <i>ay</i> a-appl id y-lang id | V | 2 ³¹⁻¹ | |
| LANGMCTL | LANGMERG | Input | <i>fn</i> | V/F | 2 ³¹⁻¹ | Control file for LANGMERG command |
| LISTCPDS | PRINT | Input | <i>fn</i> | V/F | ANY | File used for printing an a page printer |

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|-----------|-------------------------|------------------|---------------------|-------|-------------------|---|
| LISTING | AMSERV | Output | <i>fn</i> | F | 121 | Processor output |
| | ASSEMBLE | Output | <i>fn</i> | F | 121 | Processor output |
| | ASM3705 | Output | <i>fn</i> | | | Processor output |
| | CC | Output | | | | Processor output |
| | COBOL | Output | <i>fn</i> | V | 121 | Processor output |
| | COBOL2 | Output | | | | Processor output |
| | ESERV | Output | <i>fn</i> | V | ANY | Processor output |
| | FORTGI | | | | | |
| | FORTHX | | | | | |
| | FORTVS2 | Output | | | | Processor output |
| | GENMSG | Output | <i>fn</i> | | | Processor output |
| | GOFORT | | | | | |
| | LOADLIB | Output | <i>fn</i> | | | Processor output |
| | PLIC | Output | | | | Processor output |
| | PLIOPT | Output | <i>fn</i> | | | Processor output |
| | TESTCOB | Input | <i>fn</i> | | | |
| VSPASCAL | Output | <i>fn</i> | | | Processor output | |
| LIST38PP | PRINT | Input | <i>fn</i> | V/F | ANY | File used for printing on 3800 model 3 page printer |
| LIST3800 | PRINT | Input | <i>fn</i> | V/F | ANY | File used for printing on 3800 printer |
| LIST3820 | PRINT | Input | <i>fn</i> | V/F | ANY | File used for printing on 3820 page printer |
| LKEDIT | LKED | Output | <i>fn</i> | F | 121 | Listing |
| LOGFILE | SET LOGFILE | Output | <i>fn</i> | V | 132 | |
| | | | <i>vscreen name</i> | V | 80 | |
| LOADLIB | LKED | Output | <i>fn</i> | F | ≤260 | 3705 control program load modules |
| | ZAP | Input | <i>fn</i> | | | |
| | GLOBAL | Library | | | | |
| LSEG | SEGEN | Input | <i>fn</i> | V/F | 2 ³¹⁻¹ | Logical segment definition file |
| LDTFD11 | AMSERV | Work | | | | |
| LDTFD12 | AMSERV | | | | | |
| LSEGMAP | SEGEN | Output | <i>fn</i> | F | 100 | Logical segment load map output from SEGEN command |
| MACLIB | GLOBAL | Library | <i>fn</i> | F | 80 | Macro definitions (dictionary and members) |
| | MACLIB | Input/ Output | <i>fn</i> | F | 80 | |
| | MACLIST | Input/ Output | <i>fn</i> | F | 80 | |
| MACRO | MACLIB | Input | <i>fn</i> | F | 80 | Macro definitions |
| | ESERV | Output | <i>fn</i> | F | 80 | |
| MAP | DOSLIB | Output | <i>libname</i> | F | 24 | Library map |
| | DOSLKED | Output | <i>fn</i> | F | 121 | VSE linkage editor map |
| | DSERV | Output | DSERV | F | 120 | Directory information from VSE libraries |
| | | | | | | Module map |
| | INCLUDE | Output | LOAD | F | 100 | Module map |
| | LOAD | Output | LOAD | | | Library map |
| | MACLIB | Output | <i>fn</i> | | | Library map |
| | TXTLIB | Output | <i>fn</i> | | | List of files dumped, loaded, scanned, or skipped |
| | TAPE | Output | <i>fn</i> | F | 80 | |

More on the CMS File System

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|------------------|-------------------------|------------------|-----------------------------------|--------|-------------------|--|
| MDMPxxxx | DUMPLD2 | Output | <i>fn</i> | F | 4096 | Segmented dump files |
| MEMO | XEDIT | Input/ Output | <i>fn</i> | V/F | ≤132 | For documenting program notes or writing reports |
| MODULE | DOSLKED | Input | <i>fn</i> | V | ANY | Nonrelocatable or relocatable Executable file |
| | GENMOD | Output | <i>fn</i> | F | 80 | |
| | LOADMOD MODMAP | Input Input | <i>fn</i> <i>fn</i> | V | 65535 | |
| NAMES | NAMEFIND NAMES | Input/ Output | <i>userid</i> | V | 255 | Information about users in communication |
| NETLOG | RECEIVE SENDFILE | Logging | <i>userid</i> | | 255 | Records logging transmission of files sent or received |
| | | | | V V | 255 | |
| NOTE | NOTE | Input/ Output | <i>userid</i> | V | 132 | Creates a note to be sent to others |
| NOTEBOOK | RECEIVE SENDFILE | Input | <i>userid</i> | V | 132 | Notes sent or received by you |
| | | | | V | 132 | |
| PASCAL | VSPASCAL | Input | <i>fn</i> | V | 72 | PASCAL source statements |
| PLI or PLIOPT | PLIOPT PLIC | Input | <i>fn</i> | F | 80 | PL/I source statements |
| | | Input | <i>fn</i> | | | |
| PROC | PSERV | Output | <i>fn</i> | F | 80 | A procedure from the DOS/VS procedure library |
| PSEG | SEGGEN | Input | <i>fn</i> | V/F | 2 ³¹⁻¹ | Physical segment definition file |
| PSEGMAP | SEGGEN | Output | <i>fn</i> | F | 100 | Physical segment load map output from SEGGEN routine |
| REPOS | GENMSG | Input | <i>xxxMEScc</i> <i>xxxUMEc</i> | F | 80 | Source statements for message repositories |
| REXX | PIPE | | <i>fn</i> | | | Contains stage commands and REXX statements |
| RPGII | RPGII | Input | <i>fn</i> | | | RPGII source statements |
| RTABLE | PROP | Input | <i>fn</i> | V | 72 | Routing table for Programmable Operating Facility |
| SCRIPT | SCRIPT | Input | <i>fn</i> | V | 132 | Input to SCRIPT processor |
| SYMDMP | FCOBOL | Output | <i>fn</i> | V | 512 | DOS/VS COBOL DEBUG file for SYMDMP option |
| SYNONYM | SYNONYM | Refer- ence | <i>fn</i> | F | 80 | |
| SYSUT1 | ASM3705 | Work | <i>fn</i> | F | 8000 | Created by the assembler and language processors for use as temporary workfiles. |
| | ASSEMBLE | Work | <i>fn</i> | | | |
| | DOSLKED | Work | <i>fn</i> | F | 248 | |
| SYSUT2 | ASSEMBLE | Work | <i>fn</i> | F | 13312 | Created by the assembler and language processors for use as temporary workfiles |
| | COBOL | Work | | | | |
| | DOSLKED | Work | <i>fn</i> | F | 1024 | |
| SYSUT3 | ASSEMBLE | Work | <i>fn</i> | F | 13312 | Created by the assembler and language processors for use as temporary workfiles |
| | COBOL | Work | <i>fn</i> | | | |
| | LKED | Work | <i>fn</i> | | | |
| | PLIOPT | Work | <i>fn</i> | | | |

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|-----------|---|----------------------|---------------|-----------|-------|--|
| SYSUT4 | COBOL LKED PLIC PLICR TESTCOB | Work | <i>fn</i> | F | 80 | Used as input to TESTCOB. Created by the assembler and language processors for use as temporary workfiles. |
| | | Input | | F | 512 | |
| SYSUT5 | COBOL | Output | <i>fn</i> | F | | Debug file |
| SYSUT6 | COBOL | Work | <i>fn</i> | F | | Work file |
| TEMPLATE | CSLGEN | Input | <i>fn</i> | F | 80 | Template information for parameters of CSL routines |
| TESTCOB | TESTCOB | Output | <i>fn</i> | | | COBOL workfile |
| TESTFORT | TESTFORT | Output | <i>fn</i> | VB | 125 | Processor printed output |
| TEXT | ASSEMBLE | Output | <i>fn</i> | F | 80 | Object code |
| | ASM3705 | Output | <i>fn</i> | | | 3705 source code and JCL statements |
| | CC | Output | <i>fn</i> | | | Object code |
| | COBOL | Output | <i>fn</i> | | | Object code |
| | COBOL2 | Output | <i>fn</i> | | | Object code |
| | DOSLKED | Input | <i>fn</i> | | | Object code |
| | FORTGI | Output | <i>fn</i> | F | 80 | Object code |
| | FORTHX | Output | <i>fn</i> | | | Object code |
| | FORTVS2 | Output | <i>fn</i> | | | Object code |
| | GEN3705 | Output | <i>fn(Ln)</i> | | | Linkage editor, control statements for 3705 control programs |
| | GOFORT | Output | <i>fn</i> | | | Object code |
| | INCLUDE | Input | <i>fn</i> | | | Object code |
| | LKED | Input | <i>fn</i> | | | Object code |
| | LOAD | Input | <i>fn</i> | | | Object code |
| | PLIC | Output | <i>fn</i> | | | Object code |
| | PLICR | Input | <i>fn</i> | | | Object code |
| | PLIOPT | Output | <i>fn</i> | | | Object code |
| | RSERV | Output | <i>fn</i> | | | Relocatable module file |
| | SET | | | | | |
| | | LANGUAGE | Work | SET\$TEMP | | |
| | TEXTFORT | Input | <i>fn</i> | F | 80 | Object code |
| | TXTLIB | Input | <i>fn</i> | | | Object code |
| | VSPASCAL | Output | <i>fn</i> | | | Object code |
| TXTlangid | GENCMD | Output | <i>fn</i> | F | 80 | Object code for language files |
| TXTLIB | GLOBAL | Library | <i>fn</i> | F | 80 | Object decks (dictionary and members) |
| | TXTLIB | Output | <i>fn</i> | F | 80 | |
| UPDATE | UPDATE | Input | <i>fn</i> | F | 255 | UPDATE control statements |
| | XEDIT | Output | | | | |
| UPDLOG | UPDATE | Output | <i>fn</i> | F | 271 | UPDATE log |
| UPDTxxx | UPDATE | Input | <i>fn</i> | F | 255 | UPDATE control statements |
| VS BASIC | VS BASIC | Input | <i>fn</i> | F | ≤256 | VS BASIC language source statements |
| VSBDATA | VSBDATA | Execution time files | <i>fn</i> | V | 140 | |
| XEDIT | XEDIT | Input | <i>fn</i> | V | 255 | Exec/XEDIT statements |

More on the CMS File System

Table 12. Reserved File Types (continued)

| File Type | Command/ Environment | Usage | File Name | RECFM | LRECL | Comments |
|-----------|-------------------------|-------|-----------|-------|-------|---|
| ZAP | ZAP ZAPTEXT | Input | <i>fn</i> | F | 80 | Control records that modify or dump files |

File Types for Output Files: TEXT and LISTING For Example

Output files from the assembler and the language processors are logically related to the source programs by their file names. Some of these files are permanent and some are temporary. For example, if you enter the command:

```
assemble myfile
```

CMS locates a file named MYFILE with a file type of ASSEMBLE and the system assembler assembles it. If the file is on file mode A, then, when the assembler completes execution, the permanent files you have are:

```
MYFILE ASSEMBLE A1  
MYFILE TEXT A1  
MYFILE LISTING A1
```

where the TEXT file contains the object code resulting from the assembly, and the LISTING file contains the program listing generated by the assembly. If any TEXT or LISTING file with the same name previously existed, it is erased. The source input file, MYFILE ASSEMBLE A1, is neither erased nor changed.

Because these files are CMS files, you can use the editor to examine or modify their contents. If you want a printed copy of a LISTING file, you can use the PRINT command to print it. If you want to examine a TEXT file, you can use the TYPE or PRINT command, specifying the HEX option.

Note: If a TEXT file contains control characters meaningful to the terminal, the lines in the file may not be displayed in their true form. Therefore, it is suggested you do not use the editor for TEXT files because the results are unpredictable. Instead, use the TYPE or PRINT commands with the HEX option to display TEXT decks. Use ZAPTEXT to modify the TEXT decks.

File Types for Temporary Work Files

Temporary work files are those files which are listed as *Work* in the *Usage* column of Table 12 on page 121 (CMSUT1 and SYSUT1 are examples). These files are created during the execution of a command, program, or function. Space is allocated for these files on an as-needed basis. They are erased when processing is complete. If a program, command, or function you are executing is terminated before completion, these *workfiles* can remain on your minidisk or SFS directory. These files are reserved for system usage, and use of these files may cause unpredictable results, and should not be shared. You can erase them.

File Types for Documentation

There are three CMS reserved file types for which XEDIT accepts (by default) uppercase and lowercase input data. These are:

| File Type | Description |
|-----------|---|
| MEMO | Specifies documenting program notes or writing reports. |
| NOTE | Specifies when sending notes to others. |

| File Type | Description |
|-----------|---|
| SCRIPT | Specifies the SCRIPT command. This command calls a text processor that is part of the IBM Document Composition Facility licensed program. |

File Mode Letters and Numbers

The file mode field of a CMS file identifier has these characters:

| File Mode | Description |
|-----------|---|
| Letter | Is established by the ACCESS command and specifies the directory or minidisk where a file resides: A through Z. |
| Number | Specifies a number from 0 to 6, which you can assign to the file when you create it or rename it; if you do not specify it, the value defaults to 1. File mode numbers have different meanings for SFS and minidisks; this will be discussed later in this section. |

How File Mode Letters Are Used

How you use file mode letters depends on how your files are stored, and how you want to use them. For most of the *reading* and *writing* you do of files, you use your directory or minidisk accessed with a file mode of A. File mode A typically has read/write status.

You may access other directories or minidisks in read-only or read/write status. Remember, to access an SFS directory, you must either be the owner of it, or be granted authority to it by the owner. To access a minidisk, you must first be linked to it.

You load CMS with the IPL command (short for Initial Program Load). At this point, if you are enrolled in an SFS file pool, your top directory is accessed with a file mode of A. If your files are stored on minidisks, you may instead have a minidisk at virtual address 191 accessed as your A-disk.

Note for SFS Users

It is possible that you could be enrolled in a file pool and also be able to use minidisk storage. The status of the file pool server determines what is accessed as file mode A. (The *file server* is a device or computer which accesses and retrieves files for all users.) In this case, if your top directory was accessed with a file mode of A, and the file pool server is down, access is dropped. CMS will try to access your 191 minidisk with a file mode of A. The directory cannot be accessed if the file server is down. If you do not have a 191 minidisk, you will need to wait for the file server to become available in order to continue your work.

Also, during CMS initialization, the minidisks that control your virtual machine are accessed. Your minidisk at address 190 (the system disk) is accessed with a file mode of S; the minidisk at 19E is accessed as an extension of file mode S, with a file mode letter of Y. File mode S and file mode Y are accessed for only S2 and Y2 files. This is because these are the only files on the file mode S and file mode Y that you, as a user, can see. (File mode numbers will be discussed later in this section.) Therefore, the access commands for these file modes are:

```
access 190 S/S * * S2
access 19E Y/S * * Y2
```

More on the CMS File System

In addition, at CMS IPL time the following special rules hold for the formatting and accessing of a minidisk defined as virtual device number 192. If 192 is:

- An unformatted temporary minidisk or virtual disk in storage, CMS formats it and accesses it as file mode D.
- A CP-formatted temporary minidisk or virtual disk in storage, CMS reformats it for CMS use and accesses it as file mode D.
- A CMS-formatted temporary minidisk, virtual disk in storage, or permanent minidisk that is accessed as a file mode other than D, CMS reaccesses it as file mode D.
- An unformatted or CP-formatted permanent minidisk, CMS does not automatically format, reformat, access, or reaccess it.

When CMS accesses a 192 minidisk as file mode D, any minidisk or SFS directory already accessed as D is released.

The actual letter you assign to any other minidisk or SFS directory (and you may reassign the letters A, D, and Y) is arbitrary; but it does determine the CMS search order, which is the order of file modes CMS searches when it is looking for a file. The order of search (when all file modes are being searched) is alphabetic: A through Z. If you have duplicate file identifiers on different file modes, you should check your search order before entering commands against that file name to be sure that you will get the file you want. You can find out the current search order by entering the QUERY SEARCH command.

How Extensions Are Used

You can also access file modes as logical extensions of other file modes; for example:

```
access 235 b/a
```

The B/A indicates that file mode B is to be a read-only extension of file mode A; file mode A is considered the *parent* of file mode B. A file mode may have many extensions, but only one level of extension is allowed.

If you have a minidisk accessed as an extension of a file mode, the extension is automatically read-only, and you cannot write on it. Therefore, you might access a minidisk as its own extension to protect the files on it from being accidentally overwritten. For example:

```
access 235 b/b
```

For SFS, accessing a directory as read-only restricts writing to files in that directory for all commands that use file modes, even if you are properly authorized to write to the files. The only exceptions to this are for directories with the file control (FILECONTROL) attribute. With FILECONTROL directories, you can create an alias to a file (with the CREATE ALIAS command), and write to the file using the COPYFILE and XEDIT commands, even if you have the directory accessed in read-only status. Of course, you must have the proper authorization to write to the file. To have XEDIT and COPYFILE respect the read-only access, use the SET RORESPECT ON command.

To protect a file in an SFS directory from being overwritten, you may want to create a lock. A SHARE lock will allow the owner, as well as other users, only the ability to read the file. To change the file, the owner must enter the DELETE LOCK command. For more information on locking files, see “Locking Files and Directories” on page 96.

Another use of file extensions is to extend the CMS search order. If you enter a command request to read a file, for example:

```
type alpha plan
```

CMS searches file mode A for the file named ALPHA PLAN and if it does not find it, searches any extensions to file mode A. If you have a file named ALPHA PLAN on file mode B, but have not accessed it as an extension of file mode A, CMS will not find the file, and you will have to re-enter the command:

```
type alpha plan b
```

Some commands, however, handle file mode extensions differently. The TYPE command defaults to a file mode of A. Therefore, in the example above, when you did not specify a file mode, CMS would search only file mode A and all extensions of file mode A. For more information on the search order for specific commands, see *z/VM: CMS Commands and Utilities Reference*.

Note that if you specify a file mode of asterisk (*), or if a particular command defaults to a file mode of asterisk, CMS uses the standard search order (A through Z, without regard to any extensions you have defined). For example, if a certain file was on your file mode W, which you had previously defined as an extension of file mode A (W/A), CMS would alphabetically search file mode A, followed by file mode B, and any remaining file modes until it reached file mode W, where the file would be found.

The same applies for commands that search for a file based on a default file type, such as the LOAD command, which defaults to a file type of TEXT. Because these commands usually have a default file mode of asterisk, CMS would use the standard search order.

Additionally, for some CMS commands that read and write a file, if you enter the command, and the file to be read is on an extension of a file mode having read/write status, the output file is written to the parent read/write file mode. The COPYFILE command is a good example of this type of command. If you have a file, named FINAL LIST, on file mode B extension of a read/write file mode A, and if you want to make a copy of the file with a different name, enter:

```
copyfile final list a final newlist a
```

After the command is completed, the duplicate exists on file mode A. The file on file mode B remains unchanged.

Accessing and Releasing Read-Only Extensions

When you access a file mode as a read-only extension, it remains an extension of the parent file mode as long as both file modes are still accessed. If either is released, the relationship is terminated.

If the parent file mode is released, the extension remains accessed and you may still read files on it. If you access another directory or minidisk at the file mode letter of the original parent file mode, the parent/extension relationship is reestablished. For example, if you enter:

```
access 191 a  
access 198 c/a  
release a
```

file mode C (virtual address 198) is still accessed. Note that if you enter:

```
query disk c
```

More on the CMS File System

virtual address 198 still appears accessed as C/A. Since file mode A is no longer accessed, files on the 198 minidisk can only be referred to by using file mode C, not A. The fact that it still appears accessed as C/A merely indicates that if you subsequently access another directory or minidisk as A, the parent/extension relationship is again in effect, and you can again refer to the files on the 198 minidisk using either file mode A or C.

If you release a read-only extension and access another directory or minidisk with the same file mode letter, it is not an extension of the original parent file mode unless you access it as such. For example, if you enter:

```
access 198 c/a
release c
access 199 c
```

file mode C (virtual address 199) is not an extension of file mode A.

When to Specify File Mode Letters: Reading Files

When you request that CMS access a file, you have to identify it so that CMS can locate it for you. The commands that expect files of particular file types (reserved file types) let you enter only the file name of the file when you enter the command. When you process any of these commands or process a module or exec file, CMS uses the standard search order to search all of your accessed file modes (directories and minidisks) to locate the file. Some CMS commands that perform this type of search are:

| | | |
|----------|---------|--------|
| AMSERV | GLOBAL | MODMAP |
| ASSEMBLE | LOAD | RUN |
| DOSLIB | LOADMOD | TXTLIB |
| EXEC | MACLIB | |

Some CMS commands require that you enter the file name and file type to identify a file. You may specify the file mode letter; if you do not specify the file mode, CMS searches only file mode A and its extensions when it looks for the file. If you do specify a file mode letter, the file mode you specify and its extensions are searched for the file. Some commands you can use this way are:

| | | |
|---------|---------|--------|
| FILEDEF | SYNONYM | UPDATE |
| PRINT | TAPE | |
| PUNCH | TYPE | |

For the STATE command, if you specify the file name, file type and file mode, CMS searches the specified disk and its extensions. If no file mode is specified, CMS searches all accessed disks in CMS search order.

There are some CMS commands that do not search extensions of file modes when looking for files. They include:

| | | |
|--------------|-----------------|------------------|
| CREATE ALIAS | GRANT AUTHORITY | RELOCATE |
| CREATE LOCK | LISTFILE | RENAME |
| DELETE LOCK | QUERY ALIAS | REVOKE AUTHORITY |
| ERASE | QUERY AUTHORITY | |
| FILELIST | QUERY LOCK | |

You must explicitly enter the file mode if you want to use these commands to process files that are on extensions.

Note: Note that ERASE and RENAME only operate on file modes accessed as read/write if a file mode letter is used.

These commands search every accessed file mode, regardless of whether they have read-only status or read/write status:

NAMES
NAMEFIND

Using Asterisks and Equal Signs

For some CMS commands, if you specify the file mode of a file as an asterisk, it indicates that you either do not know or do not care what file mode the file is on and you want CMS to locate it for you. For example, if you enter:

```
listfile myfile test *
```

the LISTFILE command responds by listing all files named MYFILE TEST on your accessed file modes. When you specify an asterisk for the file mode of the COPYFILE, ERASE, or RENAME commands, CMS locates all copies of the specified file.

For example:

```
rename temp sort * good sort =
```

renames all files named TEMP SORT to GOOD SORT on all of your accessed file modes having a read/write status. An equal sign (=) is valid in output file IDs for the RENAME and COPYFILE commands.

For some commands, when you specify an asterisk for the file mode of a file, CMS stops searching as soon as it finds the first copy of the file. For example:

```
type myfile assemble *
```

If there are files named MYFILE ASSEMBLE on file mode A and file mode C, then only the copy on file mode A is displayed. The commands that perform this type of search are:

| | | |
|-----------|-------|-----------|
| COMPARE | PUNCH | SYNONYM |
| DISK DUMP | RUN | TAPE DUMP |
| FILEDEF | SORT | TYPE |
| PRINT | STATE | XEDIT |

For the COMPARE, COPYFILE, RENAME, and SORT commands, you must always specify a file mode letter, even if it is specified as an asterisk.

The CREATE ALIAS and RELOCATE commands require an output file mode or a directory identifier. For more information on these commands, see Chapter 3, "Using the Shared File System," on page 41.

When to Specify File Mode Letters: Writing Files

When you enter a CMS command that writes a file, and you specify the output file mode, CMS writes the file onto the directory or minidisk accessed with that file mode. Some of the commands that require you to specify the output file mode are:

More on the CMS File System

COPYFILE
RENAME
SORT

Some of the commands that let you specify the output file mode, but do not require it, are:

| | |
|----------|-----------|
| FILEDEF | TAPE LOAD |
| GENMOD | TAPPDS |
| READCARD | UPDATE |

When you do not specify the file mode on these commands, CMS writes the output files onto file mode A.

Some CMS commands that create files always write them onto file mode A. The LOAD and INCLUDE commands write a file named LOAD MAP A5. The LISTFILE command creates a file named CMS EXEC on file mode A.

Other commands do not allow you to specify the file mode. They write output files to the file mode from which the input file was read, or to file mode A, if the file was read from a read-only file mode. These commands are:

AMSERV
MACLIB
TXTLIB
UPDATE

The SORT command also functions this way if you specify the output file mode as an asterisk (*).

In addition, many of the language processors, when creating work files and permanent files, write onto the first file mode in your search order having a read/write status, if they cannot write on the source file's file mode or its parent.

How File Mode Numbers Are Used

Every CMS file, regardless of whether it resides in a file space or on a minidisk, has a file mode number associated with it. The file mode number is established when the file is created. All CMS mechanisms that create files (such as the XEDIT command, the FSnnnn macros, or the COPYFILE command) let you specify a file mode number. If you do not specify a file mode number, CMS assigns a default file mode number of 1.

You can change a file mode number using any CMS command that changes or rewrites a file, such as the RENAME or COPYFILE commands. For a complete list, see "Commands Used to Assign File Mode Numbers" on page 138.

To change the file mode number using COPYFILE, the REPLACE option is used. For example:

```
copyfile temp script a1 = = a0 (replace
```

You can also change the file mode number of a file you are editing by entering the XEDIT subcommand:

```
====> ffile temp script a0
```


Other commands used to change file mode numbers are covered in the section, “Commands Used to Assign File Mode Numbers” on page 138.

Notes for SFS Users

- There are some rules to remember about the use of file mode numbers when specifying a file mode as a directory identifier. Generally, you do not want to use file mode numbers unless you are strictly specifying a file or set of files. You cannot specify file mode numbers on commands that operate on an entire minidisk or SFS directory, because file mode numbers are attributes of files, and not SFS directories or minidisks. For example, do not use file mode numbers on such commands as ACCESS, DIRLIST, RELEASE, and RELOCATE, which require a directory identifier, *dirid*, unless you are specifying a file or set of files.
- When using the RENAME command, the COPYFILE command with REPLACE option, or the XEDIT subcommand FFILE, these rules concerning file mode numbers apply. If you use:
 - RENAME on an alias, only the file name and file type of the alias are changed; you cannot change the file mode number of the alias.
 - RENAME on a base file, you can change the file mode number of the base file, which in turn will cause the file mode number of each alias to the file to be altered.
 - COPYFILE with the REPLACE option to change the file mode number of a base file, the file mode number of all aliases to that base file will also be changed.
 - COPYFILE with the REPLACE option on an alias, the file mode number of its base file and all other aliases to its base file (including the one specified in the command) are changed.
 - FFILE with any changes to the file mode number of a base file, or an alias, results in the same change to all related aliases and the base file.

File mode numbers can be used in CMS commands to identify or operate on subsets of files. For example, to list only those files in an accessed directory or minidisk that have a file mode of B2, you can enter:

```
filelist * * b2
```

Similarly, you can use file mode numbers to copy a subset of files:

```
copyfile * * b4 = = a4
```

In SFS, file mode numbers are not useful accessing subsets of directories. You can only use the ACCESS command to access entire directories. For example, the following command is valid:

```
access .payroll b/a
```

You cannot define a subset of files in a directory the same way you can with minidisks (using the ACCESS command). The proper way to access a subset of files is to create a subdirectory with those files in it, and then access the subdirectory.

File Mode Numbers in SFS

Following is a description of file mode numbers 0 through 6 for SFS directories. For more information on minidisks see, “File Mode Numbers for Minidisks” on page 137.

More on the CMS File System

File Mode Number 0

File mode number 0 has no special meaning for SFS. In a minidisk environment, file mode number 0 makes the files private. Because all SFS files are private unless you explicitly grant authority to someone, file mode number 0 is not meaningful for SFS files. If you do use file mode number 0, SFS treats the file as though it had a file mode number of 1. Users who can read from your SFS directories can see the names of the files within that directory, regardless of the file mode number.

File Mode Number 1

File mode number 1 is used for reading and writing files. It is the default file mode number.

File Mode Number 2

SFS treats file mode number 2 the same as file mode number 1.

File Mode Number 3

Files with a file mode number of 3 are erased after they are read. If you create a file with a file mode number of 3 and then request that it be printed, the file is printed, and then erased. You can use this file mode number when writing a program or exec procedure to create files which you do not want to retain in your file space. You can create the files, print them, and not have to worry about erasing them later.

The language processors and some CMS commands create work files and give these work files a file mode number of 3.

Note: A file mode number of 3 should not be used in the file ID when naming an exec; depending on what commands are processed within the exec, an exec with a file mode number of 3 may be erased before it completes execution.

File Mode Number 4

Files with a file mode number of 4 are stored in the SFS file pool in OS simulated data set format. These files are created by OS macros in programs running in CMS. You specify that a file created by a program is to have OS simulated data set format by specifying a file mode number of 4 when you enter the FILEDEF command for the output file. If you do not specify a file mode number of 4, the output file is created in CMS format.

For more information about OS simulated data sets, see *z/VM: CMS Application Development Guide for Assembler*.

Note: There are no file mode numbers reserved for DOS or VSAM data sets, because CMS does not simulate these file organizations.

File Mode Number 5

SFS treats this file mode number the same as file mode number 1.

File Mode Number 6

SFS treats this file mode number the same as file mode number 1.

Note: If you want your files to have the INPLACE attribute (*update-in-place*), which means that the existing records of a file are written back to their previous location on the file pool rather than in a new slot, you can create or change the extended file attributes for those files. For more information on manipulating extended file attributes, see *z/VM: CMS Application Development Guide*.

File Mode Numbers 7 Through 9

File mode numbers 7 through 9 are reserved for IBM use.

File Mode Numbers for Minidisks

If your files are stored on minidisks, file mode numbers 0 through 6 will have the following meanings:

File Mode Number 0

A file mode number of 0 assigned to a file makes that file private. No other user may access it unless they have read/write access to your minidisk. Under usual circumstances, if someone has a read-only link to your minidisk and requests a list of all the files on your minidisk, the files with a file mode number of 0 are not listed.

The DDR command lets you copy from one minidisk to another, and therefore, the file mode number 0 files. Use a read share password to protect minidisks with private files when using ACCESS.

File Mode Number 1

File mode number 1 is used for reading and writing files. It is the default file mode number.

File Mode Number 2

File mode number 2 is essentially the same, for the purposes of reading and writing files, as file mode number 1. Usually a file mode number of 2 is assigned to files that are shared by users who link to a common minidisk, like the system disk. Because you can access a minidisk and specify which files on that minidisk you want to access, files with a file mode number of 2 provide a convenient subset of all files on a minidisk. For example, if you enter the command:

```
access 489 e/a * * e2
```

you can only read files with a file mode number of 2 on the minidisk at virtual address 489.

File Mode Number 3

Files with a file mode number of 3 are erased after they are read. If you create a file with a file mode number of 3 and then request that it be printed, the file is printed, and then erased. You can use this file mode number if you write a program or exec procedure that creates files that you do not want to maintain copies of on your minidisks. You can create the file, print it, and not have to worry about erasing it later.

The language processors and some CMS commands create work files and give these work files a file mode number of 3.

Note: A file mode number of 3 should not be used for execs. Depending on what commands are entered within it, an exec with a file mode number of 3 may be erased before it completes execution.

File Mode Number 4

Files with a file mode number of 4 are in OS simulated data set format. These files are created by OS macros in programs running in CMS. You specify that a file created by a program is to have OS simulated data set format by specifying a file mode number of 4 when you enter the FILEDEF command for the output file. If you do not specify a file mode number of 4, the output file is created in CMS format.

More on the CMS File System

You can find more details about OS simulated data sets in *z/VM: CMS Application Development Guide for Assembler*.

Note: There are no file mode numbers reserved for DOS or VSAM data sets, because CMS does not simulate these file organizations.

File Mode Number 5

This file mode number is the same, for purposes of reading and writing, as file mode number 1. You can assign a file mode number of 5 to files that you want to maintain as logical groups, so that you can manipulate them in groups. For example, you can reserve the file mode number of 5 for all files that you are retaining for a certain period of time; then, when you want to erase them, you could enter the command:

```
erase * * a5
```

File Mode Number 6

The file mode number 6 indicates that the *update-in-place* attribute of a CMS file is in effect. This means that the existing records of a file are written back to their previous location on the minidisk rather than in a new slot. To take advantage of the *update-in-place* capability, the existing file must be modified, not replaced. Many CMS commands, such as XEDIT, COPYFILE, and RECEIVE, will usually replace the file.

Attention: When modifying an existing file mode number 6 file, it is possible to damage the file, or even the entire minidisk on which it resides. This damage occurs when the following conditions are met:

- Some of the updates made to the file or disk by an application are updated in place.
- CMS terminates (requiring a re-IPL of CMS) before it can write all of the data to disk.

For a variable format file, *update-in-place* applies only if a record is replaced by a record of the same length. For more information on the file mode 6 *update-in-place* attribute and data integrity, see *z/VM: CMS Application Development Guide for Assembler*.

File Mode Numbers 7 Through 9

File mode numbers 7 through 9 are reserved for IBM use.

Commands Used to Assign File Mode Numbers

Table 13 lists the commands you can use to assign file mode numbers:

Table 13. Commands Used to Assign File Mode Numbers

| Command | Usage |
|-----------------|--|
| COPYFILE | When you create a new file with the COPYFILE command, or change the file mode of an existing file or module with the COPYFILE command with REPLACE option. |
| DISK LOAD | When you load a file or files from the spooled card reader. |
| DLBL, FILEDEF | When you assign file definitions to files for programs or CMS command functions. |
| GENMOD | When a module file is created. |
| NETDATA RECEIVE | When you request that a current read spool file be processed, and that file is in NETDATA format. |

Table 13. Commands Used to Assign File Mode Numbers (continued)

| Command | Usage |
|----------|---|
| READCARD | When you specify a file identifier with the READCARD command or on a READ control card. |
| RECEIVE | When receiving a file from your virtual reader. |
| RENAME | When you use RENAME to change the file mode number. For SFS, see notes in section "How File Mode Numbers Are Used" on page 134. |
| SORT | When you use the SORT command and specify file mode in output file ID. |
| XEDIT | When you create a file with the editor or change the file mode number of an existing file using FILE, SAVE, or SET FMODE subcommands. For SFS note, see "How File Mode Numbers Are Used" on page 134. |

Accessing Your Directories or Minidisks

When you use the Shared File System, the directories within your file space are usually accessed so that you can manipulate them using CMS commands. If your files are stored on minidisks and are not *permanently linked* you must link to the minidisks before you can access them. *Permanent links* are those which have been established for you through your z/VM directory entry. These minidisks are then a part of your virtual machine configuration every time you log on.

Note: For more information on linking additional minidisks, for example, temporarily to another user's minidisk, see "Linking and Sharing Minidisks" on page 115.

By accessing directories and establishing a file mode letter for them, you can save time typing many commands. If a command accepts a file mode, you can simply specify the file mode, rather than the entire directory name, to process the command.

By accessing your directories or minidisks and establishing file mode letters for them, you can control:

- Which directories or minidisks are to contain the new files that you create.
- Whether you can write on a minidisk or whether you can only read from it (its read/write status).
- The command search order for programs executing in your virtual machine. (For more information, see "File Mode Letters and Numbers" on page 129.)

If you want to know which file modes (directories or minidisks) you currently have access to, enter:

```
query accessed
```

You will see a display like this:

| Mode | Stat | Files | Vdev | Label/Directory |
|------|------|-------|------|-----------------|
| A | R/W | 3 | DIR | VMSYSU:VMUSER. |
| C/A | R/O | 765 | 19C | 19CSP6 |
| S | R/O | 1321 | 190 | CMS6.0 |
| Y/S | R/O | 337 | 19E | 19ESP6 |

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Note: For a detailed *column-by-column* description, see “Getting Started - Accessing Your Top Directory” on page 43 for SFS, or see “Accessing Minidisks” on page 117 for minidisks.

The disk accessed as mode A, your *A-disk*, is your *default disk*. If you use a CMS command and do not specify a mode, your A disk will be assumed. It is in R/W (read/write) mode. For minidisks, you can only store files on disks you have accessed in R/W mode. For SFS, you need to have write authority to the directory to create a new file, and write authority to the file to update an existing file. Generally the owner of the directory has such authority, the exception being when the file pool is under the control of an external security manager (ESM), which is a program which either augments or completely replaces the authorization checking done by the file pool server. You can check with your system administrator to see if you have an ESM active on your system.

You can tell, from this display, whether your A disk is space in an SFS file pool or a minidisk. If, in row A, in the Vdev column, you see a DIR or DIRC, rather than a virtual device number, you are an SFS user. You may also be a minidisk user, but your main disk space is within an SFS file pool.

For more information on SFS linking and accessing, see “Getting Started - Accessing Your Top Directory” on page 43 and “Accessing Another User's Directory” on page 49. For minidisks, see “Linking and Sharing Minidisks” on page 115.

Note: As alternatives to using the QUERY ACCESSED command:

- List your accessed directories and minidisks in a full screen format, using the DIRLIST command with the MDISK and ACCESSED options. For more information, see “Listing the Structure of a Directory with DIRLIST” on page 51, or see the DIRLIST command in *z/VM: CMS Commands and Utilities Reference*.
- Access minidisks and directories with the VMLINK command, which finds free access modes (see “Linking and Accessing with VMLINK,” and *z/VM: CMS Commands and Utilities Reference*).

Linking and Accessing with VMLINK

For more information on how to use CMS and CP commands to access and release SFS directories, and to link, access, release, and detach minidisks, see “Getting Started - Accessing Your Top Directory” on page 43 and “Linking and Sharing Minidisks” on page 115. The VMLINK command makes it easier to use the functions of these commands.

For example, if you want to use files on the disk owned by user SYSTOOLS at address 233, you would have to:

1. Find out whether you have the disk linked, and where it is linked.
2. If it is not linked, find a free virtual device number at which to link it to your virtual machine.
3. Find a free access mode letter and access the disk.

With VMLINK, you could enter:

```
vm link systools 233 (nonames
```

VMLINK finds a free device number and access mode and performs the linking and accessing.

If you don't want to keep the SYSTOOLS 233 linked and accessed, you can release and detach the disk with:

```
vmlink systools 233 <detach> (nonames
```

You can also use VMLINK with SFS directories. To access the VMUSER's PARTY directory in file pool VMSYSU, enter:

```
vmlink .dir vmsysu:vmuser.party (nonames
```

The command examples included the NONAMES option. The NONAMES option causes VMLINK to avoid searching the NAMES files when using the VMLINK userid vdev or VMLINK .DIR dirid form of the command or the VMLINK .DIR dirid form of the command with SFS.

Notes:

1. Nicknames can be used instead of user IDs, device address, or directory names.
2. VMLINK without any options will display a menu of available nicknames.
3. A user can define his/her own nicknames, in addition to those provided by the system administrator.
4. VMLINK can be performed automatically when a user logs on, or re-IPLs, by using the AUTOLINK option.

NAMES Files for VMLINK

The system default search order is USERPROD NAMES * VMLINK *nodeid* * VMLINK NAMES *.

A nickname entry consists of a :NICK tag and a tag value. Other tags are optional, and if a tag is missing, its value is assumed to be null.

If minidisks or SFS directories are not specified on a :PRODUCT tag or nicknames are not specified on a :LIST tag, nothing is linked, but the contents of the tags in the entry can be retrieved by VMLINK. Attempting to do a FILELIST in this situation results in an error message. Exits are run when you use EXIT or PREEXIT.

You can use the NAMES command with the VMLINK option to create or modify the USERPROD NAMES file.

:category.name

associates this minidisk or SFS directory with other minidisks or SFS directories. If there is no :CATEGORY tag or if *name* begins with an at-sign (@) or a percent sign (%), the nickname entry is not displayed on the menu. VMLINK uses only the first eight characters of the category name.

You can display a menu of all nicknames associated with a category. Entering VMLINK SOMECA causes VMLINK to display a menu of all the nicknames with a :category.somecat tag, provided there is no SOMECA nickname.

There can be more than one :CATEGORY tag in a nickname entry. In this case the nickname would be listed in the VMLINK menu for either of the two categories.

:exit.execname parmlist

names an exit to be called after the minidisk or SFS directory is accessed. The content and behavior of the tag is the same as that of the EXIT option and

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*EXIT control statement. The NOEXIT option suppresses using this tag. The EXIT option overrides this tag. There is no way to suppress or override the *EXIT control statement.

:invoke.*envir cmd parmlist ;...*

names routines to be invoked after all products are processed. The content and behavior of the tag is the same as that of the INVOKE option. The INVOKE option overrides this tag and the NOINVOKE option suppresses the use of this tag.

Only the :INVOKE tag assigned to the first nickname specified on the command is processed; :INVOKE tags for nicknames on :LIST tags are not processed. The :INVOKE tag is not executed if a non-zero return code is encountered during the process of accessing the minidisks or SFS directories.

:list.*disk_operands*

names additional disk operands to be accessed. The disk operands are the same as for the VMLINK command, except it cannot be a category. Use the NOLIST option to suppress processing of the :LIST tag.

:nick.*nickname*

defines a nickname for a minidisk or SFS directory.

:node.*node_list*

lists the nodes for which the nickname is valid. If there is no :NODE tag, the nickname is valid on all nodes. The node list can contain node IDs, *symbols* defined on an *EQUATE record in the VMLINK CONTROL file, and node IDs qualified by an asterisk or a logical NOT sign:

- The asterisk matches any string at the beginning or end of a node ID. For example, :node.NAT* matches any node ID starting with "NAT", and :node.* matches any node ID. You cannot use an asterisk in the middle of a string; doing so causes a search for a node of that name. For example, NAT*12 would look explicitly for a node of NAT*12 only.
- The logical NOT sign (¬) or minus sign (-) before a node ID specifically excludes that node. For example :node. ¬NATVM12 will include all nodes except for NATVM12.
- An asterisk can be combined with the logical NOT sign or minus sign in one node ID. For example, ¬NAT* would exclude all nodes beginning with NAT.
- The logical NOT (¬) or minus sign (-) can be combined with a control file *EQUATE symbol to exclude the nodes represented by the symbol rather than include them. For example, with a *EQUATE symbol of MYNODES with nodes NATVM10 NATVM11 NATVM12, a :node.¬MYNODES in a names file would make the nickname not valid on nodes NATVM10, NATVM11, and NATVM12.

:preexit.*execname parmlist*

names an exit to be called before a minidisk is linked or an SFS directory is accessed. Its behavior is the same as that of the PREEXIT option and the *PEXIT control statement. The NOEXIT option suppresses using this tag. The PREEXIT option overrides this tag. There is no way to suppress or override the *PEXIT control statement.

:product.*disk_operands linking_details*

is the linking information for the minidisk or SFS directory. The disk operands and linking details are the same as for the VMLINK command, with these exceptions:

- The disk operands cannot be a nickname or a category.

- Nothing is linked when the disk operands consist of one or two asterisks: * or * *.
- When the disk operands are an asterisk and a virtual device number (* *vdev*), VMLINK accesses the user's *vdev* minidisk.

:title.description

describes the minidisk or SFS directory. The title is displayed on the terminal when the minidisk or SFS directory is accessed and as the description on the menu. When there is no :TITLE tag, the menu description is blank; in messages, VMLINK generates a title from the minidisk or SFS directory specification.

:tagname.tag_value

is a user tag. VMLINK takes no action based on the presence of a user tag, but the information it contains is available to exit execs, and invoked routines.

NAMES File Processing

VMLINK searches for nicknames first in any NAMES files specified on the command with the ADDFILE option; second in any files specified on the *ADDFILE record; and finally in any files specified on the *FILES record. Files are searched in the order specified, and where a mode letter is not specified, in A-to-Z file mode order. Alternatively, you can limit the search to files specified with the ONLY option.

The search for a nickname entry ends only when a nickname entry is found that is valid for the node or when all the NAMES files have been searched. If no match is found for a disk operand entered on the command, VMLINK looks for matching :CATEGORY tags. If there are multiple disk operands on the command, and one is determined to be a category, VMLINK displays a menu of nicknames in the category before it processes the next disk operand.

When a nickname is found in a NAMES file:

1. VMLINK verifies that the entry applies to the current node. If the current node is included in the node IDs listed on the :NODE tag, or if there is no :NODE tag, the entry applies to your system. If the nickname does not apply to your system, VMLINK continues the search.
2. The contents of the :LIST tag are appended to the list of minidisks and/or SFS directories to be accessed.
3. The file mode and vdev to be used are found if not specified.
4. The exec listed on the :PREEXIT tag is run for that nickname.
5. The minidisk or SFS directory on the :PRODUCT tag is linked and accessed.
6. The exec listed on the :EXIT tag is executed for that nickname.
7. VMLINK repeats the process to this point for the next nickname in the list.
8. When all nicknames have been processed, the INVOKE option or the :INVOKE tag on the first nickname in the command is processed.

VMLINK Control File

The VMLINK control file, VMLINK CONTROL, sets defaults for VMLINK, including:

- The search ranges for free file modes (the default for the *filemode*) (*MODES)
- The search range for free virtual device numbers (the default for *vdev*) (*VDEV)
- The NAMES files to be searched (*FILES)
- NAMES files to add to the beginning of the default search order (*ADDFILE)

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- VMLINK's behavior when it cannot access a minidisk or SFS directory (*ERROR)

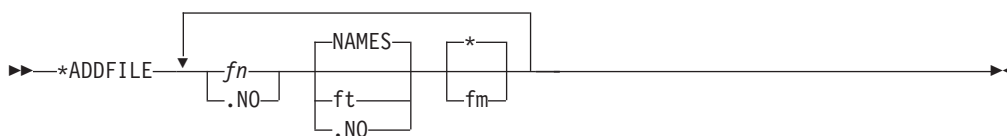
VMLINK scans all VMLINK CONTROL files in A-to-Z file mode order, but only the first acceptable instance of each type of control record, with the exception of the *EQUATE record, is used. Supported control records, and their acceptable values are described below. Thus you can have a VMLINK CONTROL file at file mode A containing only the records for which you want to override the system defaults. For the following control records, defaults set in the control files are overridden by values in a nickname entry, which in turn are overridden by operands specified with the command: *ADDFILE, *MODES and *VDEV.

Each control record name begins with an asterisk. Control records cannot be continued on the next line. VMLINK ignores blank lines and lines that do not begin with a valid record name.

These syntax diagrams show the defaults when the record is not in a control file.

*ADDFILE Record

Use *ADDFILE to list NAMES files to be searched before files listed on the *FILES record. The file type and mode of the last file name in the list can default to NAMES *.



As long as any value is entered this control record will be used and no further searching is done for this record.

If no control record value is specified the control record is ignored and the control file search will continue for this record.

*EQUATE Record

The *EQUATE record assigns a list of nodes to a symbol. When the symbol is used on the :NODE tag, the list of nodes is substituted for the symbol.



- All control files are scanned for *EQUATE records, and all *EQUATE records are used.
- *EQUATE records can be used to define more than one *symbol*, but VMLINK uses only the first instance of any particular value of *symbol*.
- A *symbol* defined on an *EQUATE record cannot be used as a *nodeid* on another *EQUATE record.
- An asterisk should not be used as a symbol. An asterisk in a names file node tag indicates that all nodes are valid. As a result, a symbol of asterisk will be ignored.

*ERROR Record

The *ERROR record determines whether VMLINK accesses any minidisks and/or SFS directories when it cannot access all the minidisks and/or SFS directories.

VMLINK can access multiple minidisks and SFS directories by either specifying more than one minidisk, SFS directory or nickname on the command or by specifying a nickname which defines a list.

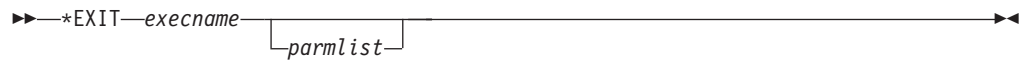


- **IGNORE**, the default, means to keep whatever was linked/accessed with this VMLINK.
- **RESTORE** specifies to get rid of whatever might have been linked/accessed by this VMLINK and restore any minidisks and/or SFS directories that were released.

If no control record value is specified the default **IGNORE** is used.

***EXIT Record**

The *EXIT record names an exec to be called after each minidisk or SFS directory has been accessed.



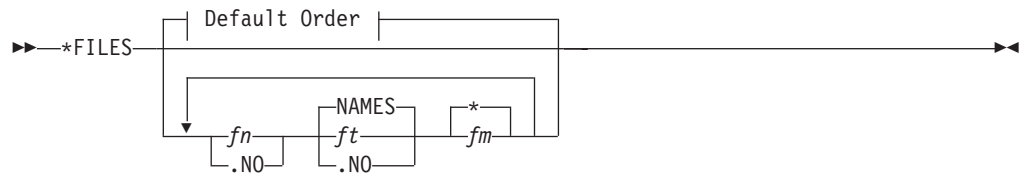
- This exit is called for each minidisk and SFS directory accessed before the exec named on an **EXIT** option or :exit tag.
- The *EXIT record is processed even if the **NOEXIT** option is specified.
- Just as with the **EXIT** option and :exit tag, the parameter list can include VMLINK variables.

As long as any value is entered this control record will be used and no further searching is done for this record.

If no control record value is specified the control record is ignored and the control file search will continue for this record.

***FILES Record**

The *FILES record specifies the file ID and search order for the NAMES files. The file type and mode of the last file name in the list can default to NAMES *.



Default Order:



VMLINK replaces the VMLINK variable, **.NO**, with the system node ID.

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As long as any value is entered this control record will be used and no further searching is done for this record.

If no control record value is specified the default order will be used.

*ID Record

The *ID record determines how VMLINK obtains the system node ID.

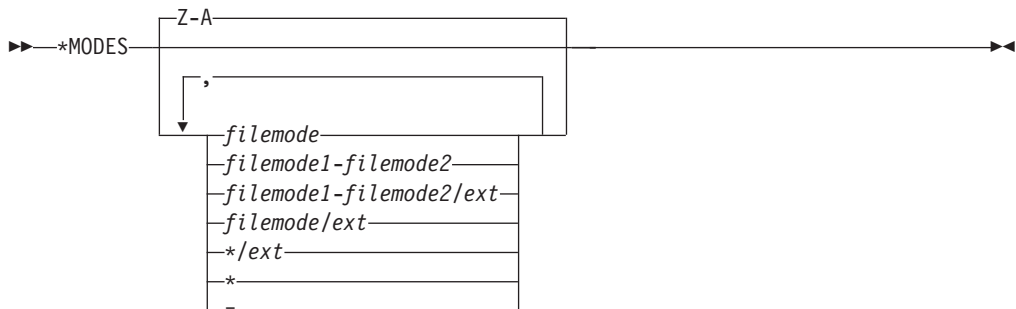


- IDENTIFY, the default, means to use the CMS IDENTIFY command to get the system node ID. See Usage Note 1 in the IDENTIFY command to see when this may not be the desired command.
- USERID means to use the CP QUERY USERID command to get the system node ID.

If no control record value is specified the default IDENTIFY is used.

*MODES Record

The *MODES record defines the default ranges and search orders for finding a free file mode letter. This defines the default search that is used when an asterisk is specified for the file mode in the linking details. A file mode "S" will not be used. If a file mode extension is specified, the extension is used unless overridden by the command line or by the :product tag in the NAMES file.

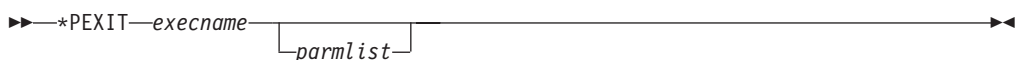


As long as any value is entered, this control record is used and no further searching is done for this record. If an asterisk (*) or equals sign (=) is specified in the control record, the default search order, Z-A, is substituted for the asterisk or equals sign.

If no control record value is specified, the default search order, Z-A, is used.

*PEXIT Record

The *PEXIT record names an exit exec to be called after VMLINK has located a free virtual device number and file mode letter and before the minidisk or SFS directory is accessed.



- This exit is called for each minidisk and SFS directory accessed before the exec named on the PREEXIT option or :preexit tag.
- The *PEXIT record is processed even if the NOEXIT option is specified.
- Just as with the PREEXIT option and :preexit tag, the parameter list can include VMLINK variables.

As long as any value is entered this control record will be used and no further searching is done for this record.

If no control record value is specified the control record is ignored and the control file search will continue for this record.

***VDEV Record**

The *VDEV record defines where to start a search for a free virtual device number. To search in ascending order, enter the virtual device address number, or a plus sign (+) followed by the virtual device number. To search in descending order, enter a minus sign (-) followed by the virtual device number. This value is used when an asterisk (*) is specified for the virtual device number in the linking details on the command line or in the names file. The virtual device number is a 1- to 4-character hexadecimal.



As long as any value is entered, this control record will be used, and no further searching is done for this record.

The default range is +120 if no control record value is specified, or if an asterisk (*) or equals sign (=) is specified as the control record value.

VMLINK Control File Example

```

*****
** Name      - VMLINK  CONTROL                      **
**                                                  **
** Function - The definitions in this file will define the **
**            system defaults. If this file does not exist **
**            or a record is not specified, a default value **
**            will be used.                          **
**                                                  **
** For performance reasons, it is recommended that only **
** values which are to be changed are included in this **
** file. Also, comment records can be removed.      **
**                                                  **
** Each record of this file is assumed to be a comment, **
** unless it starts with a valid keyword.           **
** Valid KEYWORDS are:                             **
**                                                  **
** ADDFILE - EQUATE - ERROR - EXIT - FILES - ID - MODES **
**            PEXIT - VDEV                          **
**                                                  **
** All of them preceded by an '*'                   **
*****
*EQUATE EAST      BOSTON NEWYORK ATLANTA
*EQUATE CENTRAL  STLOUIS DALLAS
*EQUATE WEST     FRISCO SEATTLE

*ERROR RESTORE

*EXIT EXITCTL
*PEXIT PEXITCTL

*ADDFILE NEWFILE
*FILES USERPROD NAMES * MYOWN NAMES * PRODUCT .NO * VMLINK NAMES Y

** For discussion purposes, we show a default value on *ID
** ID IDENTIFY

*MODES W-Z
*vDEV 900

```

Figure 36. VMLINK Control File Example

Some defaults were set in the example in Figure 36:

*EQUATE EAST BOSTON NEWYORK ATLANTA

EAST is a symbol that was defined, through the *EQUATE control record, to be a synonym of BOSTON and NEWYORK and ATLANTA nodes. In the same way, **CENTRAL** was defined for STLOUIS and DALLAS, and **WEST** for FRISCO and SEATTLE.

The list of nodes assigned to a *symbol* might have significance when systems can be grouped by some common characteristics (for example: geographical location, system level maintenance, system level release, products activated, and so on).

*ERROR RESTORE

RESTORE is an option on the *ERROR control record that tells VMLINK not to link as many minidisks as possible, but to restore any minidisk accessed if a nonzero return code is received.

*** EXIT EXITCTL**

EXITCTL is the filename of an EXEC defined on the *EXIT control record. It is executed after a minidisk is linked and accessed.

***PEXIT PEXITCTL**

PEXITCTL is the filename of an EXEC defined on the *PEXIT control record. It is processed before a minidisk is linked and accessed.

***ADDFILE NEWFILE**

if the file *NEWFILE NAMES* * is found when running VMLINK, it will be searched before the files listed on the *FILES control record.

***FILES USERPROD NAMES * MYOWN NAMES * PRODUCT .NO * VMLINK NAMES Y**

*FILES is a control record on which many VMLINK NAMES files were specified. However, the order in which they were specified determines the search order. In Figure 36 on page 148, the first NAMES file searched is the default, which is USERPROD NAMES, followed by MYOWN NAMES, and so on.

*** ID IDENTIFY**

IDENTIFY is an option of the *ID control record that causes VMLINK to use the CMS IDENTIFY command to obtain the system node ID.

***MODES W-Z**

is a control record that is defined so the first default file mode to be used to access a minidisk is **W**. But if W is unavailable, then the search for a free file mode continues incrementally towards **Z**. If you run out of access file modes, error message DMSVML1277E (no file mode is available) is issued.

***VDEV 900**

is a control record that defined so the first default virtual device address to be used to link a minidisk is **900**. But if 900 is unavailable, then the search for a free virtual device address continues incrementally towards **FFFF**. If you run out of virtual device addresses, error message DMSVML1277E (no virtual device address is available) is issued.

VMLINK Programming Interface

In addition to linking, accessing, and releasing minidisks or SFS directories for users transparently, VMLINK has a programming interface with REXX EXECs:

- Data about the nicknames or about the accessed minidisks or SFS directories can be returned on the stack or in a stem variable.
- Commands and routines can be run at different points in the accessing process. (PREEXIT, EXIT, FILELIST, and INVOKE options, :preexit, :exit, and :invoke tags, *PEXIT and *EXIT control statements or through use of VMLNICXT). The order in processing when these are run is described below.
 - VMLNICXT EXEC, if it exists, is called before any nickname file is searched.
 - *PEXIT control statement exec then the PREEXIT option or :preexit tag exec is called after VMLINK has located a free virtual device number and file mode letter but before the minidisk or SFS directory is accessed.
 - *EXIT control statement exec then the EXIT option or :exit tag exec is called after each minidisk or SFS directory has been accessed.
 - INVOKE option or :invoke tag routines are executed after all the minidisks and SFS directories have been accessed.
 - FILELIST option causes VMLINK to issue a FILELIST command for files on the first minidisk or SFS directory accessed. FILELIST overrides any commands on the :invoke tag, but is run after any INVOKE option commands specified on the VMLINK command. If INVOKE option is used

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with the FILELIST option, sure to specify the KEEP option also, otherwise, the FILELIST will fail because the minidisk or SFS directory it attempts to do the FILELIST on will have been released already because of the use of the INVOKE option.

- A call to VMLINK can specify parameters to be passed to commands and exit routines.
- A call to VMLINK can suppress tags in the nickname entry (for example: NOINVOKE, NOEXIT, and NOLIST options).
- Prior configuration of the virtual machine can be saved using the PUSH option.
- Prior configuration of the virtual machine can be restored using the POP option.
- VMLINK can search names files besides those listed in the VMLINK CONTROL file (*ADDFILE and *FILES control statements).

Since VMLINK is an EXEC, within REXX EXECs, VMLINK should be started under the CMS or command environments:

- Address command 'EXEC VMLINK ...'
- Address cms 'VMLINK ...'

There are three ways that VMLINK can pass data to a program:

- On the program stack
- In REXX stem variables
- As input parameters to a routine called during VMLINK processing.

Data can be identified by specifying VMLINK variables, such as .AR or the .MSG operand or the NAMES file tags in the options field. Variables can also be used in parameter lists.

The examples in this section use the following EXEC and the following entries for the nicknames PRODLIST, PRODA191 and PRODC193:

```
TESTER EXEC:
/*TESTER EXEC*/
parse arg in
say in
say 'Done'

:NICK.PRODLIST
:PRODUCT.
:TITLE.List of Disks
:LIST.PRODA191 PRODC193

:NICK.PRODA191
:PRODUCT..DIR VMSYSU:MAINT.ADISK
:TITLE.Directory for A-disk
:DOG.Fenris
:CAT.Snowball
:EXIT.TESTER .pa
:INVOKE.CP MSG * .TI1 accessed at .FM1

:NICK.PRODC193
:PRODUCT.PRODUCTC 193 <-900 Z-A RR>
:TITLE.Productc's disk
:DOG.Wolf
:CAT.Puff
:EXIT.TESTER .ta
```

Putting VMLINK Data on the Program Stack

To receive the messages generated by VMLINK in a REXX program, you can use the stack. Specifying the .MSG option will stack the messages in FIFO order by default, prefixed with *.MSG. An example of this is shown in Figure 37 on page 151

151:

```

type vmlstack exec

/* */
Address command
'EXEC VMLINK PRODLIST (.MSG'
do queued()
  parse pull a
  say a
end

Ready; T=0.01/0.01 11:46:33

vmlstack
*.MSG DMSVML2060I Directory for A-disk accessed as file mode K
*.MSG DMSVML2060I Productc's disk linked RR as 900 file mode L
Ready; T=0.10/0.12 11:46:39

```

Figure 37. VMLINK and the REXX Program Stack Example

In Figure 37, the first item was defined as an SFS directory. Therefore, it was only accessed.

Notes:

1. The form of the disk identifier is determined by the way the minidisk or SFS directory is specified in the command. See VMLINK usage note 4 in CMS Command Reference for details on this form.
2. In the stacked lines for each minidisk or SFS directory, variables and tags are listed in the order they are specified in the option field, paired with their values: *.vv vv_value* and *:tag tag_value*
3. By default, VMLINK saves and clears the stack before it calls a routine from PREEXIT, EXIT, or INVOKE, so routines do not have access to data stacked by the VMLINK command, nor do they have access to data stacked by a program that calls VMLINK. To pass data to an exit or a routine called by VMLINK, use the .PA and .TA variables in the routines parameter list.
You can preserve the stack for routines called with the INVOKE option by using the NOSAVE option.
4. Do not leave data on the stack when you call VMLINK in XEDIT. XEDIT tries to execute the stacked lines as subcommands. To keep the stack clear:
 - In a macro, use the STEM option to suppress the stacking.
 - In a macro, create a new stack buffer before calling VMLINK, and drop or empty the buffer before the macro exits.

Putting VMLINK Variables in REXX Stem Variables

By adding the stem option to the VMLINK command, it is possible to assign data passed from VMLINK to a REXX stemmed-variable. An example of this is shown in Figure 38 on page 152:

```
type vmlstem exec

/* */
Address command
'EXEC VMLINK PRODLIST (:PRODUCT .MSG STEM STEMVAR.)
do i = 1 to stemvar.0
  say stemvar.i
end

Ready; T=0.01/0.01 12:34:06
vmlstem
.MSG DMSVML2060I Directory for A-disk accessed as file mode X
.MSG DMSVML2060I Productc's disk linked RR as 122 file mode L
PRODLIST :PRODUCT
PRODA191 :PRODUCT .DIR VMSYSU:MAINT.ADISK
PRODC193 :PRODUCT PRODUCTC 193 -900 Z-A RR
Ready; T=0.08/0.09 12:34:10
```

Figure 38. VMLINK Variables and REXX Stem Variables Example

From Figure 38 we learn that even though PRODLIST is a list of products, VMLINK will still report a null :PRODUCT tag for it. Then it will resolve the two products that were part of the list. Asking for additional tag values on the VMLINK command results in an increase in the length of the stemmed-variable.

Passing VMLINK Variables as Parameters

VMLINK variables and tags (but not .MSG) can be passed as parameters on the INVOKE, PARMs, PREEXIT, and EXIT options, or on the corresponding NAMES file tags and control file records. VMLINK replaces variables with their values before it calls the routine.

The PRODA191 nickname entry includes this :INVOKE tag:

```
:invoke.CP MSG * .til accessed at .fm1
```

This call to VMLINK

```
address COMMAND 'EXEC VMLINK PRODA191 (NOTYPE'
```

produces this CP message with information about the first minidisk or SFS directory accessed:

```
10:14:36 * MSG FROM USER1 : DIRECTORY FOR A-DISK ACCESSED AT Q
```

The INVOKE option overrides the :INVOKE tag. This call to VMLINK

```
EXEC VMLINK PRODA191 (NOTYPE INVOKE CP MSG * .PR1 accessed at .FM1
```

substitutes the product and file mode for the minidisk or SFS directory into the CP message:

```
10:15:11 * MSG FROM USER1 : .DIR VMSYSU:MAINT.ADISK ACCESSED AT Q
```

The :EXIT tag for PRODA191 uses the .PA variable: :exit.tester .pa. Accessing the PRODA191 SFS directory with the PARMs option, like this,

```
address COMMAND 'EXEC VMLINK PRODA191 (NOTYPE PARMs X Y Z'
```

replaces the .PA variable on the :EXIT tag with the parameter string specified with the PARMs option. The parameter list starts with an identifier for the minidisk or SFS directory, in this case the nickname:

```
PRODA191 X Y Z
```

Notes:

1. VMLINK replaces variables in parameter lists with the values of the variables.
2. Tags cannot be specified in parameter lists, but the .TA variable can be specified; it is replaced by tag-value pairs for tags specified on the command invocation. For example, the :EXIT tag of the PRODC193 nickname is

```
:exit.testster .ta
```

This call to VMLINK, with the :DOG and :CAT tags specified as options, address COMMAND 'EXEC VMLINK PRODC193 (:DOG :CAT'

passes this parameter list of tag-value pairs to the TESTER EXEC:

```
PRODC193 :DOG Wolf :CAT Puff
```

3. VMLINK always passes a parameter list to an exit. The first token is the disk identifier, which is the same as the identifier for stacked lines, except that there is no leading asterisk. See VMLINK usage note 4 in the CMS Command Reference. The rest of the tokens are the values of variables specified on the EXIT and PREEXIT options and :EXIT and :PREEXIT tags.
4. VMLINK processes the :EXIT and :PREEXIT tags for all nicknames in the command and on :LIST tags. An exec on an EXIT or PREEXIT option or an exec on a *PEXIT or *EXIT control statement is called for each minidisk and SFS directory accessed. At each invocation, an exit exec has access to variable and tag data only for the particular minidisk or SFS directory.
5. Only the :INVOKE tag for the first nickname on the command is processed, and the INVOKE option is processed only once. A routine called with the INVOKE option or the :INVOKE tag has access to variables for all the minidisks and/or SFS directories accessed.
6. When VMLINK accesses an SFS directory, it replaces .CU with "DIR *dirname*". For example, this call to access MAINT's .SHIPS subdirectory specifies the TESTER EXEC as an exit:

```
vmlink .dir .ships (exit(testster .cu .fm)
```

VMLINK passes this string to the TESTER exec:

```
.DIR.SHIPS DIR SERVER:MAINT.SHIPS M
```

Where:

.DIR.SHIPS
specifies the disk identifier for the parameter list.

DIR SERVER:MAINT.SHIPS
specifies the value of .CU,

M specifies the value of .FM.

We have already shown how to pass VMLINK variables to exits. It is possible to use the .PA tag in your names file to accept parameters passed from the command line as well. Parameters may be passed to the :EXIT, :INVOKE, or :PREEXIT tags in the names file. In Figure 39 the data PARM_LIST would be substituted where a .PA exists in the VMLINK names file:

```
VMLINK PRODLIST ( PARM PARM_LIST
```

Figure 39. Specifying VMLINK Variables as Parameters Example

EXIT, PREEXIT and INVOKE Examples

The following are NAMES file entries to be used in the EXIT, PREEXIT and INVOKE examples:

```

====> NAMES (Vmlink panel)  File: MYOWN  NAMES  A1  <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODA  Description: Linking PRODUCT A with its
pre-req ...
Product Linking  :
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke:
                Preexit:
                Exit:
                Valid Nodes: NYVM1 BOSTVM3
                :
                List of Names: PRODA191 PRODC193
                :
                :
                :
Tag:              Value:
Tag:              Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete    10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====

```

Figure 40. VMLINK PRODUCT A NAMES File Entry

```

====> NAMES (Vmlink panel)  File: MYOWN  NAMES  A1  <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODA191  Description: Linkingproduct A Mdisk 191 ...
Product Linking  : PRODUCTA 191 <+800 G-A MR>
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke:
                Preexit:
                Exit:
                Valid Nodes: NYVM1 BOSTVM3
                :
                List of Names:
                :
                :
                :
Tag:              Value:
Tag:              Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete    10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====

```

Figure 41. VMLINK PRODUCT A Minidisk 191 NAMES File Entry

```

====> NAMES (Vmlink panel)   File: MYOWN   NAMES   A1           <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODB   Description: Linking PRODUCT B with no
pre-req ...
Product Linking   :
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke: EXEC INVOKEB .no1
                Preexit: PREXITB .CA1
                Exit:
                Valid Nodes: NYVM1 BOSTVM1
                :
                List of Names: PRODB191 PRODB193 PRODB195
                :
                :
                :
Tag:              Value:
Tag:              Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete   10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====

```

Figure 42. VMLINK PRODUCT B NAMES File Entry

```

====> NAMES (Vmlink panel)   File: MYOWN   NAMES   A1           <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODB191 Description: Linking Product B Mdisk 191 ...
Product Linking   : PRODUCTB 191 <+500 E-L RR>
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke:
                Preexit:
                Exit: EXITB .CU1 .FM1
                Valid Nodes: NYVM1 BOSTVM1
                :
                List of Names:
                :
                :
                :
Tag:              Value:
Tag:              Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete   10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====

```

Figure 43. VMLINK PRODUCT B Minidisk 191 NAMES File Entry

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```
====> NAMES (Vmlink panel)  File: MYOWN  NAMES  A1          <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODB193  Description: Linking Product B Mdisk 193 ...
Product Linking   : PRODUCTB 193 <+500 E-L RR>
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS

          Invoke:
          Preexit:
          Exit: EXITB .CU1 .FM1
          Valid Nodes: NYVM1 BOSTVM1
          :
List of Names:
          :
          :
          :
Tag:          Value:
Tag:          Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick  9= Delete    10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====
```

Figure 44. VMLINK PRODUCT B Minidisk 193 NAMES File Entry

```
====> NAMES (Vmlink panel)  File: MYOWN  NAMES  A1          <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODB195  Description: Linking Product B Mdisk 195 ...
Product Linking   : PRODUCTB 195 <+500 E-L RR>
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS

          Invoke:
          Preexit:
          Exit: EXITB .CU1 .FM1
          Valid Nodes: NYVM1 BOSTVM1
          :
List of Names:
          :
          :
          :
Tag:          Value:
Tag:          Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick  9= Delete    10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====
```

Figure 45. VMLINK PRODUCT B Minidisk 195 NAMES File Entry

```

====> NAMES (Vmlink panel)   File: MYOWN   NAMES   A1           <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODC   Description: Linking PRODUCT C with no
pre-req ...
Product Linking   :
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke:
                Preexit:
                Exit:
                Valid Nodes: NYVM1 BOSTVM3
                :
                List of Names: PRODC191 PRODC193
                :
                :
                :
Tag:              Value:
Tag:              Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete   10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====

```

Figure 46. VMLINK PRODUCT C NAMES File Entry

```

====> NAMES (Vmlink panel)   File: MYOWN   NAMES   A1           <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODC191 Description: Linking roduct C Mdisk 191 ...
Product Linking   : PRODUCTC 191 <-200 X-Z RR>
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke:
                Preexit:
                Exit:
                Valid Nodes: NYVM1 BOSTVM3
                :
                List of Names:
                :
                :
                :
Tag:              Value:
Tag:              Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete   10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====

```

Figure 47. VMLINK PRODUCT C Minidisk 191 NAMES File Entry

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```
====> NAMES (Vmlink panel)   File: MYOWN   NAMES   A1           <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: PRODC193  Description: Linking oduct C Mdisk 193 ...
Product Linking   : PRODUCTC 193 <-200 X-Z RR>
Information (USERID:
cuu/.DIR dirname) :
Category: PRODUCTS
                Invoke:
                Preexit:
                Exit:
                Valid Nodes: NYVM1 BOSTVM3
                :
List of Names:
                :
                :
                :
Tag:             Value:
Tag:             Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete   10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <=====
```

Figure 48. VMLINK PRODUCT C Minidisk 193 NAMES File Entry

Testing with the VMLNICXT EXEC

New product versions are usually introduced by making them available on a test basis, while keeping the old version available in case problems develop with the new version. VMLINK's VMLNICXT exit provides a way to introduce a new version while users and applications continue to use the same nickname. If there is a VMLNICXT EXEC, VMLINK calls it before it searches any NAMES files for the nickname. VMLINK passes the nickname to VMLNICXT. VMLNICXT either returns a nickname for a test minidisk or SFS directory or returns the input nickname. In either case, VMLINK uses the nickname returned by VMLNICXT.

A VMLNICXT SAMPEXEC is on the system tools minidisk. It can be customized to VMLNICXT EXEC, like this:

```
/* VMLNICXT EXEC--translate nicknames for beta test */
/* Input: nickname */
/* Output: substitute beta test nickname for */
/* input nickname */
/* The substitution list is a SELECT statement */
/* containing conditions in the form: */
/* when innick='PRODUCTION' */
/* then outnick='BETATEST' */
arg innick
select /*list of substitutions */
  when innick='REXXCOMP' /*Rexx Compiler*/
  then outnick='NEWREXXC';
  when innick='DMS' /*Display Management System*/
  then outnick='NEWDMS';
  otherwise outnick=innick;/*no substitution*/;
end
return(outnick) /*return substitute nickname*/
```

To use this VMLNICXT EXEC:

1. Install the new versions of REXXCOMP and DMS on new product minidisks or SFS directories.

2. Define the nicknames, NEWREXXC and NEWDMS, for the new product minidisks or SFS directory in a NAMES files accessed by the beta test users.
3. Make the VMLNICXT EXEC available to the beta test users. Now when the DMS or the REXXCOMP nickname, is used, the user or application gets the NEWDMS or NEWREXXC product minidisk or SFS directory.

When you are ready to put the test minidisks or SFS directories into production:

1. Update the NAMES files so the DMS and REXXCOMP nicknames refer to the new product minidisks or SFS directories.
2. Remove VMLNICXT EXEC.

NAMES File Exit Examples

To demonstrate how VMLINK handles the default overrides, simple PREEXITs, EXITs, and INVOKE EXECs are coded and run, and console output is displayed.

The code for VMLINK PREXITB exit example is shown in Figure 49:

```

/*                                     */
/*   This is the PREXITB EXEC example that is specified on the   */
/*   preexit tag in the VMLINK NAMES file for PRODUCTB          */
/*                                     */

Address command
parse arg nick_id cat
say
say "I am the PREXITB defined on the preexit tag of the NAMES file."
say "VMLINK passed me its category variable, .CA1. So I received: "
say "Nickname ID : " nick_id
say "Category    : " cat
say

```

Figure 49. PREXITB EXEC Example

The code for VMLINK EXITB exit example is shown in Figure 50:

```

/*                                     */
/*   This is the EXITB EXEC example that is specified on the    */
/*   exit tag in the VMLINK NAMES file for PRODUCTB            */
/*                                     */

Address command
parse upper arg nick_id vaddr filemode
say
say "I am the EXITB defined on the exit tag of the NAMES file."
say "VMLINK passed me its virtual address variable, .CU1, and its"
say "file mode variable, .FM1. So I received: "
say "Nickname ID      : " nick_id
say "Virtual Address  : " vaddr
say "File mode       : " filemode
say

```

Figure 50. EXITB EXEC Example

The code for VMLINK INVOKEB exit example is shown in Figure 51 on page 160:

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```
/*                                     */
/*   THIS IS THE INVOKEB EXEC EXAMPLE THAT IS SPECIFIED ON THE   */
/*   VMLINK NAMES File for PRODUCTB                               */
/*                                     */

Address command
parse arg nodes
say
say "I am the INVOKEB defined on the invoke tag of the NAMES file."
say "I am usually used to start up an application.  However, in this"
say "case, VMLINK passed me its node variable, .N01.  So I received: "
say "Nodes : " nodes
say
```

Figure 51. INVOKEB EXEC Example

VMLINK Control File Exit Examples

The code for the VMLINK PEXITCTL exit example is shown in Figure 52:

```
/*                                     */
/*   This is the PEXITCTL EXEC example that is used in the       */
/*   VMLINK CONTROL File                                         */
/*                                     */

say
say "I am the PEXITCTL defined on the VMLINK CONTROL control file."
say "But the preexit tag on the NAMES file will override me."
say
```

Figure 52. PEXITCTL EXEC Example

The code for the VMLINK EXITCTL exit example is shown in Figure 53:

```
/*                                     */
/*   This is the EXITCTL EXEC example that is used in the        */
/*   VMLINK CONTROL File                                         */
/*                                     */

say
say "I am the EXITCTL defined on the VMLINK CONTROL control file."
say "But the exit tag on the NAMES file will override me."
say
```

Figure 53. EXITCTL EXEC Example

VMLINK Command Examples

Before using the VMLINK command, you may require the VMLINK CONTROL and VMLINK NAMES files to be coded and activated by system support personnel. Advanced users can create their own. However, if you are using VMLINK with *userid* and *disk* or SFS options, you will not need NAMES or CONTROL files.

The examples in this section rely on the proper setup of the VMLINK CONTROL and VMLINK NAMES files. To show you VMLINK setup and usage, the examples in this section will use the VMLINK CONTROL file shown previously and the nicknames defined previously. While reading the these examples, please refer to the mentioned sections whenever needed.

Example 1

Figure 54 shows the execution of the following command:

VMLINK PRODB

The characteristics are:

- The entries declared for PRODB are in effect.
- The VMLINK CONTROL control file did not override any default values.

```

vmLink prodb
I am the PREXITB defined on the preexit tag of the NAMES file.
VMLINK passed me its category variable, .CA1. So I received:
Nickname ID : PRODB
Category    : PRODUCTS

DMSVML2060I Linking Product B Mdisk 191 ... linked RR as 500 file mode E

I am the EXITB defined on the exit tag of the NAMES file.
VMLINK passed me its virtual address variable, .CU1, and its
file mode variable, .FM1. So I received:
Nickname ID   : PRODB191
Virtual Address : 500
File mode     : E

DMSVML2060I Linking Product B Mdisk 193 ... linked RR as 902 file mode F

I am the EXITB defined on the exit tag of the NAMES file.
VMLINK passed me its virtual address variable, .CU1, and its
file mode variable, .FM1. So I received:
Nickname ID   : PRODB193
Virtual Address : 501
File mode     : F

DMSVML2060I Linking Product B Mdisk 195 ... linked RR as 903 file mode G

I am the EXITB defined on the exit tag of the NAMES file.
VMLINK passed me its virtual address variable, .CU1, and its
file mode variable, .FM1. So I received:
Nickname ID   : PRODB195
Virtual Address : 502
File mode     : G

I am the INVOKEB defined on the invoke tag of the NAMES file.
I am usually used to start up an application. However, in this
case, VMLINK passed me its node variable, .NO1. So I received:
Nodes : NYVM1 BOSTVM1

DMSVML2061I Linking Product B Mdisk 191 ... detached
DMSVML2061I Linking Product B Mdisk 193 ... detached
DMSVML2061I Linking Product B Mdisk 195 ... detached
Ready; T=0.15/0.19 15:05:27

```

Figure 54. VMLINK PRODB with NAMES, but Without VMLINK CONTROL Activated

The following occurred:

1. The **PREXITB**, which is the preexit EXEC defined on the preexit tag of the NAMES file, executed. It used the VMLINK variables passed to the EXEC as parameters with the category .CA1.
2. VMLINK linked and accessed the PRODB 191 minidisk with virtual address 500 and file mode E.
3. The **EXITB**, which is the exit EXEC defined on the exit tag of the NAMES file, executed for the preceding minidisk (191), showing the VMLINK variables passed to the EXEC as parameters with the virtual address .CU1 and the file mode .FM1.

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4. VMLINK linked and accessed the PRODB 193 minidisk with virtual address 501 and file mode F.
5. The **EXITB**, which is the exit EXEC defined on the exit tag of the NAMES file, was executed for the preceding minidisk (193).
6. VMLINK linked and accessed the PRODB 195 minidisk with virtual address 502 and file mode G.
7. The **EXITB**, which is the exit EXEC defined on the exit tag of the NAMES file, was executed for the preceding minidisk (195).
8. The **INVOKEB**, which is the invoke EXEC defined on the invoke tag of the NAMES file, was executed as the last step, showing the VMLINK variables passed to the EXEC as parameters with the valid nodes .NO1.
9. All minidisks were detached because of the NOKEEP option is used when the INVOKE tag is used. To keep the minidisks linked and accessed, use the KEEP option of the VMLINK command.

Example 2

Figure 55 and Figure 56 on page 163 show the execution of the following command:

VMLINK PRODB

The characteristics are:

- The entries declared for PRODB are in effect.
- The VMLINK CONTROL control file defined in Figure 36 on page 148 is active.

vmlink prodb

I am the **PEXITCTL** defined on the VMLINK CONTROL control file.
But the preexit tag on the NAMES file will override me.

I am the **PREXITB** defined on the preexit tag of the NAMES file.
VMLINK passed me its category variable, .CA1. So I received:
Nickname ID : PRODB
Category : PRODUCTS

I am the **EXITCTL** defined on the VMLINK CONTROL control file.
But the exit tag on the NAMES file will override me.

Figure 55. VMLINK PRODB with NAMES and VMLINK CONTROL Activated (Part 1 of 2)

```

I am the PEXITCTL defined on the VMLINK CONTROL control file.
But the preexit tag on the NAMES file will override me.

DMSVML2060I Linking Product B Mdisk 191 ... linked RR as 500 file mode E

I am the EXITCTL defined on the VMLINK CONTROL control file.
But the exit tag on the NAMES file will override me.

I am the EXITB defined on the exit tag of the NAMES file.
VMLINK passed me its virtual address variable, .CU1, and its
file mode variable, .FM1. So I received:
Nickname ID      : PRODB191
Virtual Address  : 500
File mode        : E

I am the PEXITCTL defined on the VMLINK CONTROL control file.
But the preexit tag on the NAMES file will override me.

DMSVML2060I Linking Product B Mdisk 193 ... linked RR as 900 file mode F

I am the EXITCTL defined on the VMLINK CONTROL control file.
But the exit tag on the NAMES file will override me.

I am the EXITB defined on the exit tag of the NAMES file.
VMLINK passed me its virtual address variable, .CU1, and its
file mode variable, .FM1. So I received:
Nickname ID      : PRODB193
Virtual Address  : 501
File mode        : F

I am the PEXITCTL defined on the VMLINK CONTROL control file.
But the preexit tag on the NAMES file will override me.

DMSVML2060I Linking Product B Mdisk 195 ... linked RR as 901 file mode G

I am the EXITCTL defined on the VMLINK CONTROL control file.
But the exit tag on the NAMES file will override me.

I am the EXITB defined on the exit tag of the NAMES file.
VMLINK passed me its virtual address variable, .CU1, and its
file mode variable, .FM1. So I received:
Nickname ID      : PRODB195
Virtual Address  : 502
File mode        : G

I am the INVOKEB defined on the invoke tag of the NAMES file.
I am usually used to start up an application. However, in this
case, VMLINK passed me its node variable, .NO1. So I received:
Nodes : NYVM1 BOSTVM1

DMSVML2061I Linking Product B Mdisk 191 ... detached
DMSVML2061I Linking Product B Mdisk 193 ... detached
DMSVML2061I Linking Product B Mdisk 195 ... detached
Ready; T=0.17/0.23 15:30:36

```

Figure 56. VMLINK PRODB with NAMES and VMLINK CONTROL Activated (Part 2 of 2)

The following occurred:

1. These steps are followed by the resolution of **PRODB** nickname entry in the NAMES file:
 - a. The **PEXITCTL**, which is the preexit EXEC defined on the VMLINK CONTROL control file, executed.
 - b. The **PREXITB**, which is the preexit EXEC defined on the preexit tag of the NAMES file, executed, overriding the PEXITCTL exit defined on the VMLINK CONTROL control file.
 - c. The **EXITCTL**, which is the exit EXEC defined on the VMLINK CONTROL control file, executed.

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2. These steps are followed by the resolution of **PRODB191** nickname entry in the NAMES file:
 - a. The **PEXITCTL**, which is the preexit EXEC defined on the VMLINK CONTROL control file, executed.
 - b. VMLINK linked and accessed the PRODB 191 minidisk with virtual address 500 and file mode E.
 - c. The **EXITCTL**, which is the exit EXEC defined on the VMLINK CONTROL control file, executed.
 - d. The **EXITB**, which is the exit EXEC defined on the exit tag of the NAMES file, executed, overriding the EXITCTL exit defined in the VMLINK CONTROL control file.
3. These steps are followed by the resolution of **PRODB193** nickname entry in the NAMES file:
 - a. The **PEXITCTL**, which is the preexit EXEC defined in the VMLINK CONTROL control file, executed.
 - b. VMLINK linked and accessed the PRODB 193 minidisk with virtual address 501 and file mode F.
 - c. The **EXITCTL**, which is the exit EXEC defined in the VMLINK CONTROL control file, executed.
 - d. The **EXITB**, which is the exit EXEC defined on the exit tag of the NAMES file, executed, overriding the EXITCTL exit defined in the VMLINK CONTROL control file.
4. These steps are followed by the resolution of **PRODB195** nickname entry in the NAMES file:
 - a. The **PEXITCTL**, which is the preexit EXEC defined in the VMLINK CONTROL control file, executed.
 - b. VMLINK linked and accessed the PRODB 195 minidisk with virtual address 502 and file mode G.
 - c. The **EXITCTL**, which is the exit EXEC defined in the VMLINK CONTROL control file, executed.
 - d. The **EXITB**, which is the exit EXEC defined in the exit tag of the NAMES file, executed, overriding the EXITCTL exit defined in the VMLINK CONTROL control file.
5. The **INVOKEB**, which is the invoke exit defined on the invoke tag of the NAMES file, executed for **PRODB** nickname entry resolution as the last step in the VMLINK cycle.
6. All minidisks were detached because of the INVOKE tag. To keep the minidisks linked and accessed, use the KEEP option of the VMLINK command.

Example 3

Figure 57 on page 165 shows the execution of the following command:

```
VMLINK PRODA ( KEEP INVOKE EXEC SAYHI
```

The characteristics are:

- The entries declared for PRODA are in effect, as are the entries for PRODC.
- This is an example of how the corequisite invocation EXEC defined in a NAMES entry is treated. No VMLINK CONTROL control file was activated in order to keep the output of the VMLINK command as clear as possible.
- The **SAYHI EXEC** is a simple EXEC intended just to demonstrate the activation of the VMLINK INVOKE exit through the VMLINK command.

```

vmlink proda ( keep invoke exec sayhi

DMSVML2060I Linking Product A Mdisk 191 ... linked MR as 800 file mode G
DMSVML2060I Linking Product C Mdisk 193 ... linked RR as 200 file mode X

Hi there... Everything ok?

Ready; T=0.09/0.11 12:59:25
    
```

Figure 57. VMLINK PRODA with Invoke EXEC

The following occurred:

1. VMLINK linked and accessed the PRODA 191 minidisk with virtual address 800 and file mode G, as declared in its NAMES entry.
2. VMLINK linked and accessed the PRODC 193 minidisk with virtual address 200 and file mode X, as declared in its NAMES entry.
3. No minidisks were detached because the option KEEP was used.
4. The SAYHI EXEC, which is shown in Figure 58, was executed as the last task of this VMLINK command.

```

/*                                     */
/*   A simple exec to be used with the INVOKE option on the   */
/*                                     VMLINK command.         */
/*                                     */
say
say "Hi there... Everything ok?"
say
    
```

Figure 58. SAYHI EXEC Example

VMLINK Linking Behaviors

These tables show how VMLINK will behave in linking and accessing minidisks depending on the status of the minidisk when the VMLINK command is issued.

Table 14. VMLINK Linking Behavior When No Link to the Disk

| No link to the disk | Action | Notes |
|--|---|-----------------------------|
| VMLINK with no options or linking details | Link in Read mode and access | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Link at <i>vdev</i> in Read mode and access | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Read mode and access disk | Same result with RR or READ |
| VMLINK with specified file mode range | Link in Read mode and access in range | Same result with RR or READ |
| VMLINK with specified single file mode | Link in Read mode and access at mode. This will release whatever was at that file mode | Same result with RR or READ |

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Table 14. VMLINK Linking Behavior When No Link to the Disk (continued)

| No link to the disk | Action | Notes |
|---|--|-----------------------------|
| VMLINK <DET> | No R/O to detach message | Same result with RR or READ |
| VMLINK <REL> | No action | Same result with RR or READ |
| VMLINK with (WRITE option) | Link in Write mode and access | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option) | Link at <i>vdev</i> in Write mode and access | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option) | Error message, no link done | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Write mode and access disk | Same result with M |
| VMLINK with specified file mode range and (WRITE option) | Link in Write mode and access in range | Same result with M |
| VMLINK with specified single file mode and (WRITE option) | Link in Write mode and access at mode. This will release whatever was at that file mode | Same result with M |
| VMLINK <DET> | No R/W to detach message | Same result with M |
| VMLINK <REL> | No action | Same result with M |

Table 15. VMLINK Linking Behavior When Already Linked in READ (Not Accessed)

| Already linked in READ (not accessed) | Action | Notes |
|--|--|-----------------------------|
| VMLINK with no options or linking details | Keep existing Link and access disk | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Detach existing link, link at requested <i>vdev</i> and access disk | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done, unless <i>vdev</i> requested is where it is already linked | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> and detach current link to disk. Link disk at requested <i>vdev</i> and access disk | Same result with RR or READ |
| VMLINK with specified file mode range | Keep existing link and access in range | Same result with RR or READ |
| VMLINK with specified single file mode | Keep existing link and access at mode. This will release whatever was at that file mode | Same result with RR or READ |
| VMLINK <DET> | Detach current disk | Same result with RR or READ |

Table 15. VMLINK Linking Behavior When Already Linked in READ (Not Accessed) (continued)

| Already linked in READ (not accessed) | Action | Notes |
|---|---|---|
| VMLINK <REL> | No action | Same result with RR or READ |
| VMLINK with (WRITE option) | Link in Write mode and access. Leaves Read link as is | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option) | Link at <i>vdev</i> in Write mode and access. Leaves Read link as is | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option) | Error message, no link done | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Write mode and access disk. Leaves Read link as is. | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK with specified file mode range and (WRITE option) | Link in Write mode and access in range. Leaves Read link as is | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK with specified single file mode and (WRITE option) | Link in Write mode and access at mode. This will release whatever was at that file mode. Leaves Read link as is. | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK <DET> | No R/W to detach message | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK <REL> | No action | Same result with M, unless <i>vdev</i> of Read link is the one forced |

Table 16. VMLINK Linking Behavior When Already Linked in READ (Accessed)

| Already linked in READ (accessed too) | Action | Notes |
|--|--|-----------------------------|
| VMLINK with no options or linking details | Keep existing Link and existing access | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Detach existing link, link at requested <i>vdev</i> and access disk | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done, unless <i>vdev</i> requested is where it is already linked | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> and detach current link to disk. Link disk at requested <i>vdev</i> and access disk | Same result with RR or READ |
| VMLINK with specified file mode range | Keep existing link and existing access if in range, otherwise reaccess disk in range | Same result with RR or READ |

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Table 16. VMLINK Linking Behavior When Already Linked in READ (Accessed) (continued)

| Already linked in READ (accessed too) | Action | Notes |
|---|--|---|
| VMLINK with specified single file mode | Keep existing link and access at mode. This will release whatever was at that file mode | Same result with RR or READ |
| VMLINK <DET> | Detach current disk | Same result with RR or READ |
| VMLINK <REL> | Release disk but keep link | Same result with RR or READ |
| VMLINK with (WRITE option) | Link in Write mode and access. Leaves Read link as is | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option) | Link at <i>vdev</i> in Write mode and access. Leaves Read link as is | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option) | Error message, no link done | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Write mode and access disk. Leaves Read link as is | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK with specified file mode range and (WRITE option) | Link in Write mode and access in range. Leaves Read link as is | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK with specified single file mode and (WRITE option) | Link in Write mode and access at mode. This will release whatever was at that file mode. Leaves Read link as is. | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK <DET> | No R/W to detach message | Same result with M, unless <i>vdev</i> of Read link is the one forced |
| VMLINK <REL> | No action | Same result with M, unless <i>vdev</i> of Read link is the one forced |

Table 17. VMLINK Linking Behavior When Already Linked in WRITE (Not Accessed)

| Already linked in WRITE (not accessed) | Action | Notes |
|--|--|-----------------------------|
| VMLINK with no options or linking details | Link in Read mode and access. Leaves Write link as is | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Link at <i>vdev</i> in Read mode and access. Leaves Write link as is | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done | Same result with RR or READ |

Table 17. VMLINK Linking Behavior When Already Linked in WRITE (Not Accessed) (continued)

| Already linked in WRITE (not accessed) | Action | Notes |
|---|--|---|
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Read mode and access disk. Leaves Write link as is. | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified file mode range | Link in Read mode and access in range. Leaves Write link as is | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified single file mode | Link in Read mode and access at mode. This will release whatever was at that file mode. Leaves Write link as is. | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <DET> | No R/O to detach message | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <REL> | No action | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with (WRITE option | Keep existing Write Link and access disk | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option | Detach existing link, link at requested <i>vdev</i> in Write mode and access disk | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option | Error message, no link done, unless <i>vdev</i> requested is where it is already linked | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and detach current link to disk. Link disk at requested <i>vdev</i> in Write mode and access disk | Same result with M |
| VMLINK with specified file mode range and (WRITE option | Keep existing link and access in range | Same result with M |
| VMLINK with specified single file mode and (WRITE option | Keep existing link and access at mode. This will release whatever was at that file mode | Same result with M |
| VMLINK <DET> | Detach current disk | Same result with M |
| VMLINK <REL> | No action | Same result with M |

Table 18. VMLINK Linking Behavior When Already Linked in WRITE (Accessed)

| Already linked in WRITE (accessed too) | Action | Notes |
|---|---|-----------------------------|
| VMLINK with no options or linking details | Link in Read mode and access. Leaves Write link as is | Same result with RR or READ |

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Table 18. VMLINK Linking Behavior When Already Linked in WRITE (Accessed) (continued)

| Already linked in WRITE (accessed too) | Action | Notes |
|---|--|---|
| VMLINK with <i>vdev</i> specified (a free one) | Link at <i>vdev</i> in Read mode and access. Leaves Write link as is | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Read mode and access disk. Leaves Write link as is. | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified file mode range | Link in Read mode and access in range. Leaves Write link as is | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified single file mode | Link in Read mode and access at mode. This will release whatever was at that file mode. Leaves Write link as is. | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <DET> | No R/O to detach message | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <REL> | No action | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with (WRITE option | Keep existing Write Link and existing access | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option | Detach existing link, link at requested <i>vdev</i> in Write mode and access disk | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option | Error message, no link done, unless <i>vdev</i> requested is where it is already linked | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and detach current link to disk. Link disk at requested <i>vdev</i> in Write mode and access disk | Same result with M |
| VMLINK with specified file mode range and (WRITE option | Keep existing link and existing access if in range, otherwise reaccess disk in range | Same result with M |
| VMLINK with specified single file mode and (WRITE option | Keep existing link and access at mode. This will release whatever was at that file mode | Same result with M |
| VMLINK <DET> | Detach current disk | Same result with M |
| VMLINK <REL> | Release disk but keep link | Same result with M |

Table 19. VMLINK Linking Behavior When Already Linked Multiple Times (READ and WRITE)

| Already linked multiple times (both Read and Write) | Action | Notes |
|--|---|---|
| VMLINK with no options or linking details | Use one of the already existing Read links and access. Detaches all other Read links. Leaves Write links as is. | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Link at <i>vdev</i> in Read mode and access. Detaches all other Read links. Leaves Write links as is | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done. Unless <i>vdev</i> requested is where a Read link already is. | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> . Link disk at requested <i>vdev</i> and access disk. Detach all other Read links. Leaves Write links as is. | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified file mode range | Use existing Read link and access in range. Detach all other Read links. Leaves Write links as is | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified single file mode | Use existing Read link and access at mode. This releases whatever was a that mode. Detach all other Read links. Leaves Write links as is | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <DET> | Detaches all Read links | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <REL> | Releases any access Read links | Same result with RR or READ, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with (WRITE option | Use existing Write Link and access the disk. Detach all other Write links. Leave Read links as is. | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option | Link is Write mode at <i>vdev</i> requested and access disk. Detach all other Write links. Leaves Read links as is. | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option | Error message, no link done, unless <i>vdev</i> requested is where it is already linked in either Read/Write mode. | Same result with M |

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Table 19. VMLINK Linking Behavior When Already Linked Multiple Times (READ and WRITE) (continued)

| Already linked multiple times (both Read and Write) | Action | Notes |
|---|--|--|
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and detach current link to disk. Link disk at requested <i>vdev</i> in Write mode and access disk. Detach all other Write links. Leaves Read links as is. | Same result with M, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified file mode range and (WRITE option) | Keep existing link and existing access if in range, otherwise reaccess disk in range. Detach all other Write links. Leaves Read links as is. | Same result with M, unless <i>vdev</i> of Write link is the one forced |
| VMLINK with specified single file mode and (WRITE option) | Keep existing link and access at mode. This will release whatever was at that file mode. Detach all other Write links. Leaves Read links as is. | Same result with M, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <DET> | Detaches all Write links | Same result with M, unless <i>vdev</i> of Write link is the one forced |
| VMLINK <REL> | Releases any accessed Write links | Same result with M, unless <i>vdev</i> of Write link is the one forced |

Table 20. VMLINK Linking Behavior When Already Linked But Directory Has Moved

| Already linked but directory has moved | Action | Notes |
|--|--|-----------------------------|
| VMLINK with no options or linking details | Link in Read mode and access | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Link at <i>vdev</i> in Read mode and access. | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done. | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> . Link disk at requested <i>vdev</i> Read mode and access disk. | Same result with RR or READ |
| VMLINK with specified file mode range | Link in Read mode access in range. | Same result with RR or READ |
| VMLINK with specified single file mode | Link in Read mode and access at mode. This releases whatever was at that mode. | Same result with RR or READ |
| VMLINK <DET> | No R/O link to detach | Same result with RR or READ |
| VMLINK <REL> | No action | Same result with RR or READ |

Table 20. VMLINK Linking Behavior When Already Linked But Directory Has Moved (continued)

| Already linked but directory has moved | Action | Notes |
|---|--|--------------------|
| VMLINK with (WRITE option | Link in Write mode and access | Same result with M |
| VMLINK with <i>vdev</i> specified (a free one) and (WRITE option | Link at <i>vdev</i> in Write mode and access | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) and (WRITE option | Error message, no link done | Same result with M |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE and WRITE options | Detach current disk at <i>vdev</i> and link this disk at that <i>vdev</i> Write mode and access disk | Same result with M |
| VMLINK with specified file mode range and (WRITE option | Link in Write mode and access in range | Same result with M |
| VMLINK with specified single file mode and (WRITE option | Link in Write mode and access at mode. This will release whatever was at that file mode | Same result with M |
| VMLINK <DET> | No R/W to detach message | Same result with M |
| VMLINK <REL> | No action | Same result with M |

Table 21. VMLINK Linking Behavior When Already Linked But No Longer Have Authority

| Already linked but no longer have authority to it | Action | Notes |
|--|--|-----------------------------|
| VMLINK with no options or linking details | Keep existing Link and access disk | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (a free one) | Detach existing link, link at requested <i>vdev</i> FAILS because no longer have authority. Old link is now gone. | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) | Error message, no link done, unless <i>vdev</i> requested is where it is already linked | Same result with RR or READ |
| VMLINK with <i>vdev</i> specified (one in use) with FORCE option | Detach current disk at <i>vdev</i> and detach current link to disk. Link disk at requested <i>vdev</i> FAILS because no longer have authority. | Same result with RR or READ |
| VMLINK with specified file mode range | Keep existing link and access in range | Same result with RR or READ |
| VMLINK with specified single file mode | Keep existing link and access at mode. This will release whatever was at that file mode | Same result with RR or READ |
| VMLINK <DET> | Detach current disk | Same result with RR or READ |

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Table 21. VMLINK Linking Behavior When Already Linked But No Longer Have Authority (continued)

| Already linked but no longer have authority to it | Action | Notes |
|---|--|-----------------------------|
| VMLINK <REL> | Release disk if accessed otherwise no action | Same result with RR or READ |

Using Synonyms

By using the SYNONYM and the SET ABBREV commands, you can control what command names, synonyms, or truncations are valid in CMS. For example, you could create a file named MYSYN SYNONYM that contains the following records:

```
PRINT  PRT  1
RELEASE LETGO 4
FILELIST FL  2
```

The first column specifies an existing CMS command, module, or exec name. The second column specifies the alternate name or synonym that you want to use. The third column is a count field that indicates the minimum number of characters of the synonym that can be used to truncate the name. You can use PRT, LETGO, and FL in place of the corresponding CMS command names after you enter the command:

```
synonym mysyn
```

The ABBREV function allows you to use the information in the third column of the record. The ABBREV function is in effect by default, but you may insure it is on by entering the SET ABBREV ON command. This function allows you to truncate any of your synonyms to the minimum number of characters specified in the third or last column. For example, you could enter P for PRINT or LETG for RELEASE. To load your synonym table at the beginning of every terminal session, enter the SYNONYM MYSYN command (or your own synonym table name) into your PROFILE EXEC.

Note:

1. An exec procedure having a synonym defined for it can be loaded by its synonym if implied EXEC (IMPEX) function is on. However, within an exec procedure, only the exec file name can be used. A synonym for an exec is not recognized within an exec, because the synonym tables are not searched during exec processing.
2. You cannot define translations or translation synonyms using the SYNONYM command. Translations must be defined in the Definition Language for Command Syntax (DLCS) file. You can truncate any translation, or translation synonym, to the minimum number of characters specified in the count field of the record if you entered SET ABBREV ON. For more information about DLCS, see *z/VM: CMS Commands and Utilities Reference* and *z/VM: CMS Application Development Guide*.
3. If either TAPE or VMFPLC2 is a synonym of the other, the synonym may not be used to call that function from within an exec. You may use any name other than TAPE or VMFPLC2 as a synonym of the other function. For example, from within an exec, TAPE is not a valid synonym for VMFPLC2; TAP, however, would be valid.

Using Translations

Once you have defined translations and translation synonyms for commands in your DLCS file, you can use the SET TRANSLAT command to control whether they are recognized by CMS. The SET ABBREV command controls whether the abbreviations of these translations will be recognized.

Note: The translation synonyms defined in a DLCS file are synonyms of command name translations. Do not confuse them with synonyms defined with the SYNONYM command. In the following paragraphs, the term *translation* means the command name translations and translation synonyms defined in DLCS. The term *synonym* refers to synonyms defined with the SYNONYM command and abbreviations of system language command names.

When you enter a command in CMS, the command name you use and all of the keywords in it must be in the same language. If you use a translation of the command name, all of the keywords you use with that command will be translated. If you specify a synonym for a command name, the keywords will not be translated. Therefore, you must specify them so that the command will recognize them.

It is possible for the translation of a command or keyword to be the same as the original command or keyword. If the command name you specify is the same as the original command, but you specify keywords for that command in a different language, CMS would determine which language to use upon encountering the first keyword that is different. The subsequent keywords must be in the same language as the first keyword to be successfully translated.

There are ways you can code programs and execs so that you can choose whether to allow translations. CMS only recognizes translations for commands entered from the command line or those called with the REXX/VM Interpreter command search function (ADDRESS CMS), or the equivalent search function in EXEC 2 (&PRESUME &SUBCOMMAND CMS).

CMS does not translate your command name or keywords if you SET TRANSLAT OFF. Also, a command will not be translated if it is issued from another program using the search hierarchy for SVC 202, or using the REXX/VM interpreter SVC 202 search hierarchy (ADDRESS COMMAND), or the equivalent search function in EXEC 2 (&PRESUME &COMMAND CMS). For more information on the CMS command search function for translations, see *z/VM: XEDIT Commands and Macros Reference*, and for more information on how CMS uses the translation and synonym tables to find commands, see *z/VM: CMS Commands and Utilities Reference*.

CMS Command Search Order

When you enter a command in the CMS environment, CMS uses the following search order to locate the command. When found, CMS stops the search and processes the command.

Note: If you have execs in storage or on an accessed file mode, or if you have module files in a saved segment or on any of your accessed file modes, CMS treats them as commands; they are known as *user-written* commands.

1. Search for an exec with the specified command name:

More on the CMS File System

- a. Search for an exec in storage. If an exec with this name is found, CMS determines whether the exec has a USER, SYSTEM, or SHARED attribute. If the exec has the USER or SYSTEM attribute, it is executed.
If the exec has the SHARED attribute, the INSTSEG setting of the SET command is checked. When INSTSEG is ON, all accessed directories and minidisks are searched for an exec with that name. (To find a file in a directory, read authority is required on both the file and the directory.) If an exec is found, the file mode is compared to the file mode of the CMS installation saved segment. If the file mode of the saved segment is equal to or higher (closer to A) than the file mode of the directory or minidisk, then the exec on the saved segment is executed. Otherwise, the exec in the directory or on the minidisk is executed. However, if the exec is in a directory and the file is locked, the execution will fail with an error message.
- b. Search the table of active (open) files for a file with the specified command name and a file type of EXEC. If more than one open file is found, the one opened first is used.
- c. Search for a file with the specified command name and a file type of EXEC on any currently accessed disk or directory, using the standard CMS search order (A through Z).
2. Search for a translation or synonym of the specified command name. If found, search for an exec with the valid translation or synonym by repeating Step 1.
3. Search for a module with the specified command name:
 - a. Search for a nucleus extension module.
 - b. Search for a module in the transient area.
 - c. Search for a nucleus-resident module.
 - d. Search the table of active (open) files for a file with the specified command name and a file type of MODULE. If more than one open file is found, the one opened first is used.
 - e. Search for a file with the specified command name and a file type of MODULE on any currently accessed disk or directory, using the standard CMS search order (A through Z).
4. Search for a translation or synonym of the specified command name. If found, search for a module with the valid translation or synonym by repeating Step 3.

If the command is not known to CMS (that is, all of the above fails), it is passed to CP.

For example, if you enter the command:

```
x sauces cookbook
```

CMS would complete the following search:

1. First, CMS searches for X EXEC. For this example, assume that an X EXEC would not be found.
2. CMS then searches the translation and synonym tables and finds that X is a synonym for XEDIT. Then, CMS repeats Step 1, searching for XEDIT EXEC. Again, assume that an XEDIT EXEC would not be found.
3. Next, CMS searches for a CMS command with the name X. It would not be found.
4. CMS again searches the translation and synonym tables and finds that X is a synonym for XEDIT. Then, CMS repeats Step 3, searching for XEDIT. The

XEDIT command would be found and processed. As a result, you would be able to XEDIT the file SAUCES COOKBOOK.

For more information on the CMS command search order, see *z/VM: CMS Commands and Utilities Reference*. For more information on searching for a translation or synonym, see the SET TRANSLATE or SYNONYM command in *z/VM: CMS Application Development Guide*.

CMS Command Execution Characteristics

Table 23 is an alphabetic list of the CMS commands that require special consideration when called from a user program. For example, a program running in free storage can cause part of its own code to be overwritten if it calls a nonrelocatable CMS command, which also runs in free storage. To avoid conflicts with nonrelocatable CMS commands, you should ensure that your user programs are relocatable.

Any commands that are listed in *z/VM: CMS Commands and Utilities Reference*, but are not in Table 23, are either disk--resident and relocatable (see "Relocatable CMS Commands" on page 179), or nucleus--resident. They will not interfere with the execution of a user program.

The *Code* column indicates the execution characteristics of the command.

Table 22. CMS Command Execution Characteristics

| Code | Meaning |
|------|--|
| E | Indicates that this command is an exec. It may process one or more CMS commands that run in free storage or the transient area. |
| N | Indicates that the first time this command is called, it processes in the transient area. On subsequent invocations, the command executes as a nucleus extension. Note: The transient area is the storage area used for temporary storage of programs or routines. |
| T | Indicates that this command executes in the transient area. |
| U | Indicates that this command executes in free storage. All OS free storage pointers are reset. |

Nonrelocatable CMS Commands

The nonrelocatable CMS commands are:

Table 23. Nonrelocatable CMS Commands

| Command | Code |
|----------|------|
| ALIALIST | E |
| AMSERV | U |
| ASSEMBLE | U |
| ASSGN | T |
| AUTHLIST | E |
| CATCHECK | U |
| CMSBATCH | U |
| COMPARE | T |

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Table 23. Nonrelocatable CMS Commands (continued)

| Command | Code |
|----------|------|
| CSLGEN | E |
| CSLLIST | E |
| DDR | U |
| DEFAULTS | E |
| DIRLIST | E |
| DISCARD | E |
| DOSLIB | U |
| DOSLKED | U |
| DOSPLI | E |
| DSERV | U |
| EDIT | E |
| ESERV | E |
| EXECDROP | T |
| EXECUPDT | E |
| FCOBOL | E |
| FILELIST | E |
| GENCMD | E |
| GENDIRT | T |
| GLOBAL | T |
| HELPCONV | T |
| IOCP | U |
| LABELDEF | T |
| LANGGEN | E |
| LANGMERG | E |
| LISTDS | U |
| LISTIO | T |
| LKED | U |
| MACLIST | E |
| MACLMIG | E |
| MODMAP | T |
| MOREHELP | E |
| NAMES | E |
| NOTE | E |
| NUCXDROP | T |
| NUCXMAP | T |
| OPTION | T |
| PEEK | E |
| PIPE | N |
| PSERV | U |
| PUNCH | T |

Table 23. Nonrelocatable CMS Commands (continued)

| Command | Code |
|----------|------|
| RDR | T |
| RDRLIST | E |
| READCARD | T |
| RECEIVE | E |
| RESERVE | T |
| RSERV | U |
| RUN | E |
| SENDFILE | E |
| SETPRT | T |
| SSERV | U |
| SVCTRACE | T |
| SYNONYM | T |
| TAPEMAC | U |
| TAPPDS | U |
| TELL | E |
| TYPE | T |
| VMFDOS | U |
| VMFMERG | E |

Relocatable CMS Commands

The relocatable CMS commands are:

- EXECMAP
- FORMAT
- GENMSG
- LOADLIB
- MACLIB
- MOVEFILE
- OSRUN
- SORT
- TXTLIB
- UPDATE

Note: These commands will not interfere with the execution of a user program.

Changing the Record Format of a File

Files can either have fixed- or variable-length record formats. You can change the record format of a file with the COPYFILE command and the RECFM option. For example, the following command would convert the file, DATA FILE A1, to fixed-length 130-character records:

```
copyfile data file a (recfm f lrecl 130
```

More on the CMS File System

If you want to keep the original file intact, you can specify an output file ID, for example:

```
copyfile data file a fixdata file a (recfm f lrecl 130
```

The file, FIXDATA FILE A, contains the converted records.

If the records in a file being copied are variable-length, each output record is padded with blanks to the specified record length. If any records are longer than the record length, they are truncated.

When you convert files from fixed-length records to variable-length records, you can specify the COPYFILE command with TRUNC option to ensure that all trailing blanks are truncated:

```
copyfile data file a (recfm v trunc
```

If you specify the COPYFILE command with LRECL option and RECFM V, the LRECL option is ignored and the output record length is taken from the longest record in the input file.

When you convert a file from variable-length to fixed-length records, you may also specify a fill character to be used for padding instead of a blank. For example, suppose SHORT RECS is a variable-length file with its longest existing record being of length, *L*. If you wish to pad each record in SHORT RECS with asterisks to make each record in the file of length *L*, you would enter the following command:

```
copyfile short recs a (recfm f fill *
```

Note: If SHORT RECS was already a fixed-length file, it would not be altered.

Similarly, when you are converting back to variable-length, a file that was padded with a character other than a blank, you must specify the FILL option to indicate the pad character, so that character is truncated.

Chapter 6. Using Real Printers, Punches, and Readers

CMS Unit Record Device Support

CMS supports one virtual reader at address 00C, one virtual punch at address 00D, and one virtual printer at address 00E. When you enter a CMS command or run a program that uses one of these unit record devices, the device must be attached at the virtual address indicated.

Using the CP Spooling System

Any output that you direct to your virtual printer or punch, or any input you receive from your reader, is controlled by the spooling facilities of the CP. Each output unit is known to CP as a *unit record spool file* or *spool file*, and is queued for processing with the spool files of other users on the system. Ultimately, a spooled printer file or a spooled punch file can be released to a real printer or card punch for printing or punching.

The final disposition of a unit record spool file depends on the spooling characteristics of your virtual unit record devices, which you can alter with the CP SPOOL command. To find out the current characteristics of your devices, enter the command:

```
query ur
```

Following is an example of the response you receive:

```
RDR 000C CL A NOCONT HOLD EOF READY
000C 2540 CLOSED NOKEEP NORESCAN
PUN 000D CL A NOCONT NOHOLD COPY 001 READY FORM STANDARD
000D TO CMSGDE DIST 2G47-706 DEST OFF
000D FLASH 000 CHAR MDFY 0 FCB
000D 2540 NOEOF CLOSED NOKEEP NOMSG NONAME
000D SUBCHANNEL = 0009
PRT 000E CL A NOCONT NOHOLD COPY 001 READY FORM STANDARD
000E TO CMSGDE DIST 2G47-706 FLASHC 000 DEST OFF
000E FLASH CHAR MDFY FCB
000E 1403 NOEOF CLOSED NOKEEP NOMSG NONAME
000E SUBCHANNEL = 000A
```

Note: Spool files are managed by CP, not CMS. Therefore they cannot reside in an SFS file pool.

Some Options Available on the CP SPOOL Command

As mentioned in the previous section, you can use the CP SPOOL command to:

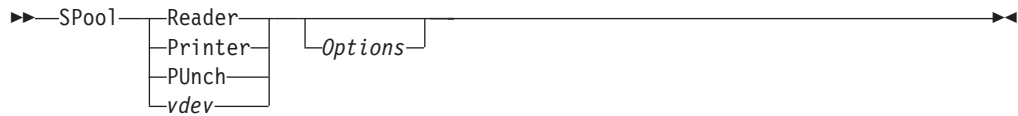
- Set control options for one or more of your virtual unit record devices.

Note: When you use the CP SPOOL command to do this, you do not change the status of spool files that already exist, but rather set the characteristics for subsequent output.

- Modify the disposition of a file after it has been processed. (Examples of using CP SPOOL for this purpose are given in “Altering Spool Files” on page 184.)

A simplified format for the CP SPOOL command is:

Real Printers, Punches, and Readers



When you enter a CP SPOOL command for a unit record device, you can refer to it by its virtual address, as well as by its generic device type (for example, CP SPOOL E HOLD). Listed below are descriptions of some commonly used options (the detailed command format and information on all options can be found in *z/VM: CP Commands and Utilities Reference*):

- **CLASS** *c*

Spool files, in the CP spool file queue, are grouped according to class, and all files of a particular class can be processed together, or directed to the same real output device. The default values for your virtual machine are set in your z/VM directory entry, and are probably the standard classes for your installation.

You may need, however, to change the class of a device if you want a particular type of output, or some special handling for a spool file. For example, if you are printing an output file that requires special forms, and your installation expects that output to be spooled class Y, enter the command:

```
spool printer class y
```

All subsequent printed output directed to your printer at virtual address 00E (all CMS output) is processed as class Y.

- **HOLD**

If you place a HOLD on your printer or punch, any files that you print or punch are not released to the control program's spooling queue, until you specifically alter the hold status. By placing your output spool files in a hold status, you can select which files you print or punch, and you can purge duplicate or unwanted files. To place printer and punch output files in a hold status, enter the commands:

```
spool printer hold
spool punch hold
```

When you have placed a hold status on printer or punch files, and you produce an output file for one of these devices, CP sends you a message to remind you that you have placed the file in a hold:

```
PRT FILE xxxx FOR userid COPY xx HOLD
```

If, however, you entered the CP SET MSG OFF command, you would not receive the message.

When you place a reader file in a hold status, then the file remains in the reader until you remove the hold status and read it, or you purge it.

- **COPY**

If you want multiple copies of a spool file, use the COPY operand of the SPOOL command:

```
spool printer copy 10
```

If you enter this command, then all subsequent printer files that you produce are each printed 10 times, until you change the COPY attribute of your printer.

- **FOR**

You can spool printed or punched output so that it will be distributed to another user ID by using the FOR operand of the SPOOL command. For example, if you enter:


```
spool printer for charlie
```

All subsequent printer files that you produce have, on the output separator page, the user ID CHARLIE and the distribution code for that user. The spool file is then under the control of that user, and you cannot alter it further.

- **CONT, NOCONT**

You can print or punch separate spool files with the NOCONT option of the CP SPOOL command. You can also combine them into one continuous spool file, if you use the CONT operand of the CP SPOOL command. For example, suppose you entered the following sequence of commands:

```
spool punch cont to brown
punch asm1 assemble
punch asm2 assemble
punch asm3 assemble
spool punch nocont
close punch
```

The three files ASM1 ASSEMBLE, ASM2 ASSEMBLE, and ASM3 ASSEMBLE, are punched to user BROWN as a single spool file. When user BROWN reads this file onto a minidisk or SFS directory, however, CMS creates separate files.

Note: Separate files are created in this case using the READCARD command. For more information, see *z/VM: CMS Commands and Utilities Reference*.

You can send multiple files by continuous spooling (using CP SPOOL PUNCH CONT) or by a series of DISK DUMP commands, but these methods are discouraged. As a sender, you are encouraged to do the following:

- Always use SENDFILE, which resets any continuous spooling options in effect.
- Do not spool the punch continuous.

Similarly, if the punch is spooled continuous and PUNCH is used to send multiple files, the file is read in as one file with “:READ” cards imbedded. In this case, although no files are overlaid, the recipient must divide the file into individual files. This problem can also be avoided by using SENDFILE, or by not spooling the punch continuous.

- **TO**

When you spool your printer or punch to another user ID, all output from that device is transferred to the virtual reader of the user ID you specify. When you are punching a CMS file, as in the example above, you should use the TO operand of the CP SPOOL command to specify the destination of the punch file.

The * operand places output in your own virtual reader:

```
spool printer to *
```

After you enter this command, subsequent printed output is placed in your virtual reader. You might use this technique as an alternative way of preventing a printer file from printing, or, if you choose to read the file onto your minidisk or SFS directory from your reader, of creating a file from printer output.

Similarly, if you are creating punched output in a program and you want to examine the output during testing, you could enter:

```
spool punch to *
```

so that you do not punch any real cards or transfer a virtual punch file to another user.

Altering Spool Files

After you have requested that z/VM print or punch a file, or after you have received a file in your virtual reader and before the file is actually printed, punched, or read, you can alter some of its characteristics, change its destination, or delete it altogether.

Every spool file in the z/VM system has a unique four-digit number from 1 to 9900 assigned to it, called a *spoolid*. You can use the spoolid of a file to identify it when you want to do something to it. You can also change a group of files, by specifying that all files of a particular class be altered in some way, or you can manipulate all of your spool files for a certain device at the same time.

The CP commands that let you manipulate spool files are CHANGE, ORDER, PURGE, and TRANSFER. In addition, use the CP QUERY command to list the status and characteristics of spool files associated with your user ID.

When you use any of these commands to refer to spool files of a particular device, you have the choice of referring to the files by class or by spoolid. You can also specify ALL. For example, if you enter the command:

```
query printer all
```

you might see the display:

Until any of these files are processed, or in the case of files in the hold status, until

| ORIGINID | FILE | CLASS | RECORDS | CPY | HOLD | DATE | TIME | NAME | TYPE | DIST |
|----------|------|-------|---------|-----|------|-------|----------|----------|--------|--------|
| CMSUG | 0142 | K PRT | 000178 | 002 | USER | 04/17 | 07:58:48 | SCHED | SCRIPT | BIN706 |
| CMSUG | 0180 | 1 PRT | 002021 | 001 | NONE | 04/17 | 08:02:26 | TESTFILE | SCRIPT | BIN706 |

they are released, you can change the following attributes using the CP CHANGE command:

- Spool file name and spool file type (this information appears on the first page or first card of output)
- Distribution code
- Number of copies
- Class
- Hold status.

For example, to change all printer files that are in a hold status to a nohold status, you could enter the following command:

```
change printer all nohold
```

If you decide that you would like to delete a particular spool file or files, you could delete a file or files with the CP PURGE command. For example, to purge printer file 0142 from previous printer display, you would enter:

```
purge printer 0142
```

For another example, you can purge the entire contents of your reader with the command:

```
purge reader all
```

After you have punched a file to some other user, or alternatively, sent a file using the SENDFILE command, you cannot change its characteristics or delete it, unless you restore it to your own virtual reader. You can accomplish this with the TRANSFER command. For example:

```
transfer all from usera
```

This command returns to your virtual reader all punch files that you spooled to and that still exist in USERA's virtual reader.

You can determine, for your reader or printer files, in what order they should be read or printed. If you decide you want printer file 0189 printed before 0142, you would enter:

```
order printer 0189 0142
```

The CP spooling system is very flexible, and can be a useful tool, if you understand and use it properly. *z/VM: CP Commands and Utilities Reference* contains complete format and operand descriptions for the CP commands used to modify spool files.

For SFS, there is an alternate way to send files to other users. Use the COPYFILE command to copy the file into one of the other user's directories (this assumes you have write authority to the directory). This way, the other user would not have to RECEIVE the file; it would already be in that user's directory. For more information, see Chapter 3, "Using the Shared File System," on page 41.

Using the RECEIVE Command to Receive a File

You can use the RDRLIST command to display information about the files in your virtual reader. From RDRLIST you can receive files from your reader to an accessed minidisk or SFS directory. To receive a file, you can enter the RECEIVE command directly from the command line, or from the RDRLIST environment.

For example, you could enter the following RECEIVE command from the RDRLIST environment to receive a file to your minidisk or directory accessed as file mode B:

| yourid | RDRLIST | A0 | V | 164 | Trunc=164 | Size=3 | Line=1 | Co | | | |
|-----------|----------|----------|-------|------|-----------|--------|--------|---------|-------|---------|--|
| Cmd | Filename | Filetype | Class | User | at | Node | Hold | Records | Date | Time | |
| | VACATION | NOTE | PUN | A | KATHY | DEPT | NONE | 5 | 07/07 | 10:3:11 | |
| | MEMO | SCRIPT | PUN | A | MGR | DEPT | NONE | 22 | 07/07 | 10:3:11 | |
| receive / | = | bSCRIPT | PUN | A | MGR | DEPT | NONE | 17 | 07/07 | 10:2:50 | |

For additional examples of using the RDRLIST or RECEIVE command, see *z/VM: CMS Primer*. For more information on command format and options, see *z/VM: CMS Commands and Utilities Reference*.

Sending Files or Notes

You can use the SENDFILE command to send a copy of a file to the virtual card reader of another user or to your own virtual reader. To use the SENDFILE command, you could specify the SENDFILE command from the CMS command line, including the name of the file and the user ID or nickname. For example:

```
sendfile prog6 assemble a jones
```

The file PROG6 ASSEMBLE A would be sent to user ID JONES. Or, you can enter the SENDFILE command with no parameters which would cause a data entry screen to appear. You would then indicate the file or files you wish to send and the user or users you wish to send to.

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You can also use the NOTE command to send a note to the virtual reader of one user or a group of users. Many options are available with the NOTE command. For examples of using SENDFILE and NOTE commands, see *z/VM: CMS Primer*. For command formats and options, see *z/VM: CMS Commands and Utilities Reference*.

Once you have sent the file, the RECEIVE command can be used to receive the contents of the file.

Using Your Card Punch and Card Reader in CMS

The following sections discuss the use of real cards and card punch under CMS.

Using Real Cards

To direct a real card deck to your own or another user's virtual machine reader, punch a CP ID card to precede the deck and read the cards into the system card reader. For additional information, see *z/VM: System Operation*.

Use the RECEIVE command to receive the file onto one of your accessed directories or minidisks.

Using Your Card Punch

Use the PUNCH command to create a punched copy of a CMS file. Once you use the PUNCH command to punch a file, a *READ control card* is punched to precede the deck, so that the card deck can be identified. If you do not wish to punch a READ control card (also referred to as a *header card*), you can use the NOHEADER option on the PUNCH command. An example of the PUNCH command is:

```
punch prog8 assemble * (noheader
```

Use the NOHEADER option whenever you punch a file that is not going to be read by the RECEIVE command.

The PUNCH command can only punch records of up to 80 characters in length. If you need to punch a file that has more than 80 characters, you can use the DISK DUMP command:

```
disk dump prog9 data
```

The RECEIVE command can also be used to read a file that has been punched using the DISK DUMP command. For example:

```
receive = prog6 assemble
```

For more information on using the PUNCH and DISK DUMP commands, see *z/VM: CMS Commands and Utilities Reference*.

Creating Files Using Your Punch

Apart from the preceding procedures that transfer whole files with one or two commands, there are other methods that create files using your virtual punch. From a program or an EXEC file, you can punch one line at a time to your virtual punch. Then, enter the CLOSE command to close the spool file:

```
close punch
```

Depending on how the punch was spooled (the TO setting), the virtual punch file is either punched or transferred to a virtual reader.

Punching Cards Using I/O Macros

If you write an OS, DOS, or CMS program that produces punched card output, you should make an appropriate file definition. If you are an OS user, you should use the FILEDEF command to define the punch as an output data device; if you are a DOS user, use the ASSGN command. If you are using the PUNCHC macro, the punch is assigned for you. The spooling characteristics of your virtual punch control the destination of the punched output.

Punching Cards from an Exec

In a REXX, EXEC 2, or CMS EXEC, use the following CMS commands to punch CMS files:

- EXECIO
- PUNCH
- DISK DUMP

Using the MOVEFILE Command

Use the MOVEFILE command, with the FILEDEF command, to place a file in your virtual reader, or to copy a file from your reader to another device. For example:

```
spool punch to *  
filedef output punch  
filedef input disk coffee exec a1  
movefile input output
```

The file, COFFEE EXEC A1, is punched to your virtual card punch (in card-image format) and spooled to your own virtual reader.

For more information on using the FILEDEF command, see *z/VM: CMS Commands and Utilities Reference*.

Chapter 7. Using Tapes

You can use CMS to read from or write to any tape that an attached tape device is capable of reading or writing. You can control tape devices at a variety of levels.

There are two main reasons for having data on tape:

- Data can be stored less expensively on tape than on DASD
- You can move data from one system to another using a tape volume.

You can use CMS to:

- Read tapes that were created by other operating systems
- Create tapes for other operating systems to read
- Read and create standard labeled tapes
- Read and create DDR tapes, which may be done by the DDR program running stand-alone (in a virtual machine or a real machine)
- Create tapes in a few formats that are intended to be read back only by CMS.

CMS provides 3 ways of using tapes:

- CMS native tape commands and execs
- A General Programming Interface for assembler language programs based on the *native tape macros*
- OS Simulation.

CMS works with 16 virtual tape devices, named TAP0, TAP1, TAP2, ...TAPF. Each tape device must be attached with a specific virtual device number, as given in this table:

| Device Name | Device Number |
|-------------|---------------|
| TAP0 | 180 |
| TAP1 | 181 |
| TAP2 | 182 |
| TAP3 | 183 |
| TAP4 | 184 |
| TAP5 | 185 |
| TAP6 | 186 |
| TAP7 | 187 |
| TAP8 | 288 |
| TAP9 | 289 |
| TAPA | 28A |
| TAPB | 28B |
| TAPC | 28C |
| TAPD | 28D |
| TAPE | 28E |
| TAPF | 28F |

Using Tapes

The most common device to use is TAP1, and CMS generally uses it by default.

Note: A noteworthy exception to this is the FILEDEF command, which uses TAP2 by default.

CMS uses virtual tape devices, because it runs in a virtual machine. A *virtual tape device* is a simulation of a tape device created by CP. CP always associates one of its real tape devices with each virtual tape device, allowing you to read and write real physical tapes. CP simulates the interpretation and recording of the virtual tape by reading and writing the real tape. To use a tape with CMS, you must create a virtual tape device. Real tapes have to be interchangeable on the real tape device. Procedures to do this vary from one installation to another. Sometimes they are partially automated, but you may just need to simply talk to an operator informally. The most basic means of creating a virtual tape device is to issue the CP system operator command, ATTACH.

CMS is not capable of sharing tape devices. When CMS is using a tape device, the virtual machine in which it is running must be the only host accessing the device. Therefore, the virtual tape device must *not* be created as a shareable device. A *shareable virtual device* is one that can be accessed by other hosts. Such a virtual tape device is created when the NOASSIGN option is used with the ATTACH command.

CP guarantees that a nonshareable device will be accessible by the CMS virtual machine only, no other host. A nonshareable device is created by the ATTACH command *without* the NOASSIGN option. Shareable virtual tape devices are mainly used with virtual machines running MVS™.

When a virtual tape device has been successfully created, which is often referred to as *attached*, you get a CP message similar to this:

```
TAPE 181 ATTACHED
```

Using the TAPE Command

The TAPE command is perhaps the most basic way to use tapes in CMS.

The TAPE command performs some basic tape functions:

- Dumps CMS files to tape
- Restores previously dumped CMS files
- Displays contents of previously dumped tape
- Positions tape
- Writes standard labels on a tape volume to initialize it
- Displays the VOL1 label from a tape
- Selects a recording format for future tape writes
- Displays characteristics of a virtual tape device
- Writes tapemarks
- Unloads a tape
- Erases a section of tape (the *erase gap* function).

When TAPE dumps CMS files, it dumps them in a special format designed to be read back only by the TAPE command.

Examples of the TAPE Command

The following examples show how to create a CMS tape with three tape files on it, each containing one or more CMS files, and then how you, or another user, might use the tape at a later time.

The examples are in the form of a terminal session and show, in the **Terminal Display** column, the commands and responses you might see. System messages and responses are in black type, and user-entered commands are in blue. The **Comments** column provides explanations of the commands and responses.

| Terminal Display | Comments |
|--|--|
| tell operator Please attach 500 to smith as 181 and mount a scratch tape | Send a TELL message to the system operator asking to have virtual tape device 181 created (attached) for you and associated with the real tape device 500. Ask the system administrator scratch tape on real device 500. |
| Tape 181 attached | Message indicates that the operator did it. Virtual device 181 (CMS device TAP1) exists now. |
| tape dump * assemble a | The TAPE command writes to the tape, all files on your A mode minidisk, and its extensions, that have the file type ASSEMBLE. Note: TAP1 is the default device for the TAPE command. |
| Dumping ... PRG1 ASSEMBLE A1 PRG2 ASSEMBLE A1 : : | The TAPE command responds by printing the file identification of each file written to tape. |
| PRG9 ASSEMBLE A1 Ready; | The last file, PRG9 ASSEMBLE, is dumped. |
| tape wtm Ready; | The TAPE WTM command writes a tape mark that will separate this group of files from subsequent files. |
| tape dump mylib maclib a Dumping ... MYLIB MACLIB A1 Ready; tape dump cmslib maclib * Dumping ... CMSLIB MACLIB S2 Ready; | Two macro libraries are dumped, by specifying the file identifiers. |
| tape wtm Ready; | Another tape mark is written. |
| tape dump mylib txtlib a Dumping ... MYLIB TXTLIB A1 Ready; | A text library is dumped. |
| tape rew Ready; | The tape is rewind. Note: Although there was no command to specifically write them, there are two tape marks after the text library on this tape, because of the TAPE command defaults. For more information, see "Tape Marks on TAPE DUMP tapes" on page 202. |

Using Tapes

| Terminal Display | Comments |
|--|--|
| tape scan (eof 4 eot Scanning ... PRG1 ASSEMBLE A1 PRG2 ASSEMBLE A1 PRG3 ASSEMBLE A1 PRG4 ASSEMBLE A1 PRG5 ASSEMBLE A1 PRG6 ASSEMBLE A1 PRG7 ASSEMBLE A1 PRG8 ASSEMBLE A1 PRG9 ASSEMBLE A1 | The tape is scanned to verify that all of the files are on it. The EOT option ensures that the scanning does not continue past the logical end of the tape. |
| End-of-file or end-of-tape MYLIB MACLIB A1 CMSLIB MACLIB S2 End-of-file or end-of-tape MYLIB TXTLIB A1 | Tape mark indication. |
| End-of-file or end-of-tape End-of-file or end-of-tape Ready; | Two tape marks indicate the end of the tape. See 6 in Figure 59 on page 193. |
| detach 181 Tape 181 Detached | The CP DETACH command deletes (<i>detaches</i>) the virtual tape device and thus frees up the associated real device, after unloading the tape. The real tape unloaded at this time contains the data written virtually with the preceding commands. |

The following table shows the commands to be entered after building a tape.

| Terminal Display | Comments |
|---|---|
| Tape 181 Attached | Message indicating a tape device has been attached. |
| tape load prg4 assemble | One file is to be read onto a minidisk. |
| Loading ... PRG4 ASSEMBLE A1 Ready; | The TAPE command displays the name of the file loaded. Any existing file with the same file name and file type is erased. See 1 in Figure 59 on page 193. |
| tape scan Scanning ... PRG5 ASSEMBLE A1 PRG6 ASSEMBLE A1 PRG7 ASSEMBLE A1 PRG8 ASSEMBLE A1 PRG9 ASSEMBLE A1 | The remainder of the first tape file is scanned. |
| End-of-file or end-of-tape Ready; | Indication of end of first tape file. See 3 in Figure 59 on page 193. |
| tape scan Scanning ... MYLIB MACLIB A1 CMSLIB MACLIB S2 End-of-file or end-of-tape Ready; | The second tape file is scanned. See 4 in Figure 59 on page 193. |
| tape bsf 2 Ready; | The tape is backed up and in front of the first tape file. See 2 in Figure 59 on page 193. |

| Terminal Display | Comments |
|---|---|
| tape fsf Ready; | The tape is forward spaced past the tape mark. See 3 in Figure 59. |
| tape load (eof 2 Loading ... MYLIB MACLIB A1 CMSLIB MACLIB A2 End-of-file or end-of-tape MYLIB TXTLIB A1 End-of-file or end-of-tape Ready; | The next two tape files (groups of CMS files separated by tape marks) are going to be read. See 5 in Figure 59. |
| detach 181 Tape 181 detached | The real tape is unloaded and the virtual device detached. |

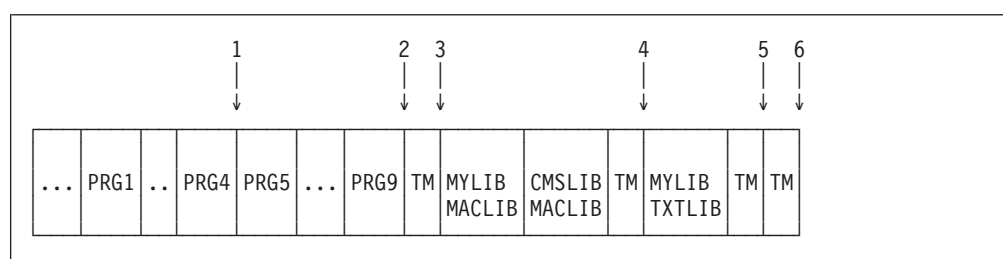


Figure 59. Basic Tape Layout for Tape 500

Using the VMFPLC2 Command

The VMFPLC2 command is almost identical to the TAPE command, but it dumps and restores CMS files in a slightly different format.

The VMFPLC2 format is superior to the TAPE format, because information about a file is recorded prior to the contents of the file instead of at the end. This lets you locate a particular file on the tape faster than with the TAPE format.

However, there are many existing tapes recorded in the TAPE format that cannot be loaded with VMFPLC2. Also, some earlier VM systems do not have the VMFPLC2 command. VMFPLC2 format tapes cannot be read on them. Finally, in previous levels of VM (before z/VM), VMFPLC2 was documented only as a system administration command. Therefore, many users are not aware of it.

Note: VM product and service distribution tapes are in VMFPLC2 format.

Using the VMFPLC2 Command

The following example shows you how to create a backup of your private minidisk or directory, and later restore a particular file from the backup. The VMFPLC2 command is used because it provides better performance than the TAPE command, when loading a single file or a small number of files from a large group of files.

Using Tapes

| Terminal Display | Comments |
|--|--|
| q tape TAPE 181 ON TAPE 0EAA Ready; | Check to see if a tape is attached. Ensure there are no file modes that are extensions of the file mode to be dumped. Extensions of the file mode to be dumped are always checked for files that match the selection criteria, and any file that matches is also dumped. |
| vmfplc2 dump * * a Dumping ... ALL NOTEBOOK A0 LASTING GLOBALV A1 PROFILE EXEC A1 : PRG9 ASSEMBLE A1 Ready; | The VMFPLC2 command is used because it provides better performance when specific files are loaded from tape. To use VMFPLC2 to read the tape, the tape must be written with VMFPLC2. All the files on the A file mode are written to tape. The tape can now be removed and stored for future use. If you later decide to restore your old copy of the XEDIT profile, you must first get your backup tape mounted and ready for use. Then, use the VMFPLC2 command. |
| vmfplc2 load profile xedit a Loading ... PROFILE XEDIT A1 Ready; | The PROFILE XEDIT file is located on the tape and written to file mode A. Because a number of files have to be examined to find the requested file, this may take a noticeable amount of time. The more files that were on your file mode A that were before (alphabetically) the file you requested, the longer it will take. The tape can now be removed and stored away again. |

For more information about the VMFPLC2 command, see *z/VM: CMS Commands and Utilities Reference*.

Using the TAPPDS Command

The TAPPDS command loads data from a tape created by the MVS IEHMOVE or IEBTPCH utility into CMS files. It also reads tapes formatted for input to the MVS IEBUPDTE utility into CMS files.

If the tape contains an unloaded Partitioned Data Set (PDS) created by the IEHMOVE utility, TAPPDS creates a single CMS file corresponding to each former PDS member.

For more information about the TAPPDS command, see *z/VM: CMS Commands and Utilities Reference*.

Using the TAPEMAC Command

The TAPEMAC command loads data from a tape that contains an unloaded PDS created by the MVS IEHMOVE utility. It loads it into one or more CMS maclibs, with maclib members corresponding to the former PDS members.

For more information about the TAPEMAC command, see *z/VM: CMS Commands and Utilities Reference*.

Using the MOVEFILE Command

In Chapter 6, “Using Real Printers, Punches, and Readers,” on page 181, the MOVEFILE command was used along with the FILEDEF command to place a file in your virtual reader. MOVEFILE is also the easiest CMS method for reading and writing labeled tapes. It reads and writes the most basic data formats. MOVEFILE copies data from one place to another using the OS simulation function. You use it with the FILEDEF and LABELDEF commands, and either the source, destination, or both can be a tape.

Because of the basic functions of OS simulation, MOVEFILE can transfer data to tape from various sources:

- Card reader
- CMS file
- Another tape
- OS-formatted minidisk.

Similarly, it can transfer data from tape to various destinations:

- Card punch
- Printer
- CMS file
- Another tape
- OS-formatted minidisk.

For more information about the MOVEFILE command, see *z/VM: CMS Commands and Utilities Reference*, and *z/VM: CMS Application Development Guide for Assembler*.

User Programs

You can run your own program under CMS to access tapes in the following ways.

CMS Native Tape Macros

CMS provides the following four macros for use as programming interfaces. They can be used in an assembler language program to access tape data:

RDTAPE

Reads a record from a tape

WRTAPE

Writes a record on a tape

TAPECTL

Performs a variety of tape control functions

TAPESL

Writes and processes tape labels.

There are also other general-use programming interfaces that apply to CMS devices in general that are applicable to tape. For example, the CMSDEV macro gets you information about a tape device.

OS Simulation

You can design a tape-processing program to run on both MVS and VM. The program would run on VM using CMS OS simulation. Such a program can process both tapes created by CMS, and standard label tapes created by an MVS system.

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Also, standard label tapes created by CMS OS simulation can be processed by applications running on an MVS system. CMS simulates MVS system calls, such as CLOSE, GET, OPEN, PUT, READ, and WRITE. OS simulation, like MVS, treats all data sets as generic regardless of what devices they are on. All the general rules of using OS simulation apply to tape data.

The FILEDEF and LABELDEF commands are critical parts of OS simulation.

Note: The MOVEFILE command is essentially a program which runs under CMS and uses the OS simulation services. For more information about the MOVEFILE command and CMS user programs used for accessing, see *z/VM: CMS Commands and Utilities Reference*, *z/VM: CMS Application Development Guide for Assembler*, and *z/VM: CMS Macros and Functions Reference*.

Also see “Using Tape Library Dataservers under OS Simulation” on page 204.

VSE Simulation

Using tapes with VSE simulation is similar to using tapes with OS simulation, except it is more restricted. CMS does not fully simulate some of the internal VSE control blocks that some programs (designed to run under VSE) access.

For more information about CMS user programs used for accessing tapes, see *z/VM: CMS Application Development Guide for Assembler* and *z/VM: CMS Macros and Functions Reference*.

VSE/VSAM (AMSERV Command)

You may use the IMPORT and EXPORT functions of VSE/VSAM to transfer data between a tape and VSAM data sets. Use the AMSERV command to do this. The tape format created by EXPORT to be received by IMPORT is a special format used just for them.

You may use the REPRO function of VSE/VSAM to transfer data between one tape and another, or between a tape and a VSE-formatted non-VSAM disk. Use the AMSERV command to do this. The tape format, written by REPRO and expected by REPRO, is a standard VSE format, which is almost identical with the standard MVS tape formats. Considering VSE simulation only reads and writes the VSE/AF Version 1 file system, and the VSE/AF Version 1 is obsolete, this function does not have much use.

For more information about the VSE/VSAM (AMSERV command), see *z/VM: CMS Application Development Guide for Assembler*.

Using the DDR Command (DASD Dump Restore)

The DDR command:

- Dumps data from a virtual disk to a tape
- Restores previously dumped data from a tape to a virtual disk
- Copies previously dumped tapes to other tapes.

The DDR tape data format is special to DDR. It includes raw images of disk tracks.

DDR has these advantages over other methods of getting data from disk to tape and back:

- It works with any virtual disk, regardless of the format of the data on it. All of the other methods of copying data from disk to tape require a certain disk format, for example, CMS file system format.
- Because it is dumping whole disk tracks, DDR is faster than the other methods.
- The DDR tape format can be created and read with the stand-alone DDR program.
- The DDR tape data format can use a compaction algorithm to fit more data on a tape than the other methods in some cases.

DDR also does other things that are not related to tape. For more information about the DDR command, see *z/VM: CP Commands and Utilities Reference*.

Tape Recording Formats

One of the choices you sometimes have to make when creating tapes is the recording format. A tape recording format is defined as the relationship between data which is sent to or received from a tape device and the physical representation of that data on the recording medium. The recording format consists of factors like:

- Recording density (Bits per inch, BPI)
- The number of tracks used
- Type of medium (3480 cartridge, open reel, and so on)
- Whether data is compacted or uncompactd by the device
- The way blocks are separated from one another on the medium
- Error correction information.

The following facts about recording formats will affect your choice of one:

- A specific tape device can only write certain recording formats.
- A specific recording format can only be read by certain tape devices.
- Some recording formats pack data into less space than others.
- Some recording formats allow you to move the data on and off the tape faster than others.
- Some recording formats have more integrity than others. That is, you have a smaller chance of not being able to read the data back or, worse, reading it back incorrectly.

The recording formats relevant to CMS are:

| Recording Format | Description |
|------------------|--|
| NRZI | The Non-Return to Zero Inverted (NRZI) recording format is recorded on a standard open reel in 9 tracks with an effective data density within a block of 800 bytes per inch. It is often called <i>800 BPI format</i> . |
| PE | The Phase Encoding (PE) recording format is recorded on a standard open reel in 9 tracks with an effective data density within a block of 1,600 bytes per inch. It is often called <i>1600 BPI format</i> . PE is an improvement over NRZI in tape capacity and also integrity. In the PE format, for example, preambles and postambles on the data blocks allow the device to distinguish between blocks of data and noise. PE format is probably the most standard interchange format. |

Using Tapes

| Recording Format | Description |
|------------------|---|
| GCR | The Group Coded Recording (GCR) format is recorded on a standard open reel in 9 tracks with an effective data density within a block of 6,250 bytes per inch. It is often called <i>6250 BPI format</i> . GCR is an improvement over PE in tape capacity and also integrity, since GCR has more error detection and correction capability built in than PE. GCR is almost as standard as PE for interchange. |
| 3480 Basic | The 3480 Basic format is recorded on a <i>3480 cartridge</i> . It fits considerably more data into a particular storage space than the open reel formats. It records on 18 tracks with an effective recording density of about 38,000 bits per inch. This format is often called <i>18 track format</i> or <i>38K BPI format</i> . The IBM 3480 was the first device that could read or write this format and while the format cannot be read by the traditional open reel devices, it is pretty common now and getting more so for installations to have 3480-type devices that can read it. 3480 Basic is a better interchange format than 3480 Compacted because all devices that can handle 3480 Compacted can handle 3480 Basic, but not all devices that can handle 3480 Basic can handle 3480 Compacted. |
| 3480 Compacted | The 3480 Compacted format is just like 3480 Basic, except that it is a compacted format. For more information, see "Compacted and Noncompacted Recording Format" on page 199. |
| 3490 Basic | The 3490 Basic format is recorded on a <i>3480 cartridge</i> . It fits twice as much data on a volume as 3480 Basic Format by recording 36 tracks. It can only be read by fairly new devices, so that limits its value for interchange. The format records data from the beginning of the tape to the end, and then back down the tape to be beginning. This means rewinding after processing a whole tape is faster than with 3480 Basic format. |
| 3490 Compacted | The 3490 Compacted format is just like 3490 Basic except that it is a compacted format. For more information, see "Compacted and Noncompacted Recording Format" on page 199. |
| 3590 Basic | The 3590 Basic format is recorded on a <i>3590 cartridge</i> . The basic recording data format is the same for all 3590 drives, but is offset by the tracking density factor or the drive model; such as, Model B has 64 tracks, Model E has 128 tracks, Model H has 256 tracks. The greater the number of tracks, the greater capacity the drive has to store data. |
| 3590 Compacted | The 3590 Compacted format is just like 3590 Basic except that the data is written to the tape in a compacted format, which saves space on the cartridge. For more information, see "Compacted and Noncompacted Recording Format" on page 199. |
| QIC | There are actually a variety of QIC tape recording formats, but VM doesn't have much of a need to distinguish between them. These formats are recorded on standard 1/4 inch cartridges. They are read and written by small, low performance tape devices which are usually attached to small personal systems. <i>There are no devices which read or write this format that can attach to z/VM systems.</i> We mention the format because older VM systems work with this format and you should know that it is not one that z/VM can use. |

Compacted and Noncompacted Recording Format

A compacted recording format uses a data compaction algorithm to store data in less space than traditional uncompact formats. For example, data which is EBCDIC coding of text has lots of blank characters in it and very few Q characters, but both blanks and Q's take up 8 bits' worth of space on the tape. In a compacted format, blanks can be stored in less than 8 bits' worth of space, while Q's are stored in more than 8 bits' worth of space, and the data takes up less space on the tape overall. This is just an example of the concept. The actual algorithm is quite complex.

Some data compacts better than other data, so with a compacted format it is difficult to predict how much space a particular set of data will take up on the tape. In fact, some data may take up more space on the tape in a compacted format than in the corresponding uncompact format. As a worst case, the 3480 Compacted, 3490 Compacted, and 3590 Compacted recording formats should take about 5% more space than 3480 Basic, 3490 Basic, or 3590 Basic.

Most data compacts quite well. Two examples of data that does not compact well and may actually expand, are:

- Data which is already the output of a compaction algorithm (for example, a DDR dump with the COMPACT option).
- Enciphered data.

In both of these cases, the data contains very little pattern and redundancy, which is what makes data compaction algorithms work.

EBCDIC and ASCII text compacts very well. Binary measurement data does not compact well.

The facility on IBM tape devices that allows them to read and write compacted recording formats is called Improved Data Recording Capability (IDRC). On some devices, it is a feature (separately orderable), while on others it is standard. On some devices, the facility is not available at all.

Do not confuse compacted recording formats with simply writing compacted data in a noncompact recording format. Anybody can compact some data and then send it to the tape device. DDR, for example, has an option for this. But the recording format is the relationship between the data sent to the device and how the device puts it on the tape. It is defined within the device.

Compacting data and then writing it in a noncompact recording format has essentially the same effect on storage capacity as writing uncompact data in a compacted recording format. But there are other differences:

- It takes time to compact data before sending it to the device, but when you use a compacted recording format, you can skip that step. The same applies to reading it back and decompacting it.
- The choice of recording format affects what devices you can use to write the data and to read it back. Whether you compact the data before sending it does not affect what devices you must use to read and write it.
- On the other hand, whether you compact the data beforehand affects what software you need to read and write the tape, whereas the choice of recording format has little effect on the software doing the reading and writing.

Device Recording Format Capabilities

This table shows all IBM devices which are capable of reading or writing any of the formats described in this section. Note that not all of them are supported for use by a z/VM system and are listed only because you may want to interchange tapes with non-z/VM systems.

| Device | Recording Formats |
|--|--|
| 2401, 2402, 2403, 2404, 2415, 2420 | NRZI PE |
| 2440 | PE GCR |
| 3410/11 | PE |
| 3410/11 with Dual Density Feature | NRZI PE |
| 3420 Models 3, 5, 7 | PE |
| 3420 Models 3, 5, 7 with Dual Density Feature | NRZI PE |
| 3420 Models 4, 6, 8 | PE |
| 3420 Models 4, 6, 8 with Dual Density Feature | PE GCR |
| 3422 | PE GCR |
| 3424 | PE GCR |
| 3430 | PE GCR |
| 3480 without IDRC facility (see note 1) | 3480 Basic |
| 3480 with IDRC facility (see note 1) | 3480 Basic 3480 Compacted |
| 3490E (see note 1) | 3480 Basic (see note 2) 3480 Compacted (see note 2) 3490 Basic 3490 Compacted |

| Device | Recording Formats |
|-------------------|--|
| 3590 (see note 3) | 3590 Basic (see note 3) 3590 Compacted (see note 3) |
| 8809 | PE |
| 9346 | QIC |
| 9347 | PE |
| 9348 | PE GCR |

Notes:

1. VM considers certain models of 3490 to be 3480 instead. For VM's purposes, these models are identical with 3480. All VM documentation, command syntax, and messages refer to these as 3480. All 3490s except the E models (called *3490E*) are in this category.
2. The 3490 can read the 3480 Basic and 3480 Compacted formats, but cannot write them.
3. 3590 tape drives are not compatible with prior tape cartridges, such as the 3480 or 3490 types. 3590 drives use a unique tape cartridge shared among the 3590 models. The 3590 tape drive models offer increasing capacity (number or tracks) throughout the model lines. It should also be noted that data which was written with a higher-capacity 3590 model cannot be read on a lower-capacity unit, because of tracking differences. However, a lower-capacity 3590 tape can always be read on a higher-capacity 3590 model unit. High-capacity 3590 models cannot write at a lower track capacity, and therefore cannot add data to a tape already written at lower capacity.

Selecting the Recording Format with CMS

You never have to select a recording format in order to *read* a tape. The device will sense the recording format and read the data properly (if the device is capable of reading that format at all).

When you *create* a tape, CMS will always select a recording format for you, if you do not want to select a specific one. But for all the reasons mentioned in the previous sections, you may want to select a specific one. If you select a recording format, and the device you are using cannot write in that format, CMS will not write anything and will give you an error message. Thus, even if the device can only write one recording format, it may be helpful to request that specifically. This protects you from various mistakes and misunderstandings in selecting a device.

Do not use a default recording format if for some reason you need a particular one. Defaults may change as the world of recording formats changes and as new devices are introduced.

To select a recording format, you use recording format options on the TAPE, VMFPLC2, FILEDEF, or ASSGN command, or on the native tape macros, or on DDR's OUTPUT control statement. For the exact syntax, see *z/VM: CMS Commands and Utilities Reference* and *z/VM: CMS Macros and Functions Reference*. Here are some examples:

```
TAPE DUMP * * A (3490B
```

```
TAPE DUMP * * A (DEN 6250
```

Using Tapes

```
FILEDEF OUTMOVE TAP1 (18TRACK
WRTAPE MYBUF,L'MYBUF,MODE=3490B
WRTAPE MYBUF,L'MYBUF,MODE=(,6250)
```

You specify a recording format differently with CMS than with CP tape commands for historical reasons. In CP, a command has a MODE option to select a recording format. Also for historical reasons, the DDR command uses the CP style of recording format selection (with a MODE option on the OUTPUT control statement).

You can select a recording format even with an operation which is not a write operation. For example:

```
TAPE LOAD * * A (18TRACK
FILEDEF INMOVE TAP1 (18TRACK
FILEDEF OUTMOVE DISK PROFILE EXEC A
MOVEFILE
```

This is for historical reasons having to do with old 7 track tape.

Unless you are writing, your selection of recording format has no effect. Nonetheless, if you select a recording format, it must be one the device is capable of *writing* or CMS will recognize an error and not perform the operation.

Even if you are writing, the recording format options may be accepted and yet have no effect. Here's why: You cannot generally change the recording format of a tape in the middle. For example, you cannot record one file on a tape in PE format and the next one in GCR format; the device doesn't allow this. So if the tape is not positioned to the beginning of the volume, your selection of a recording format may be ignored. Still, though, CMS validates it, making sure that the device is capable of writing that format in general.

The one way that it is allowed to change recording formats in the middle of a tape is to go from the compacted to the uncompact version of a format, or uncompact to compacted. Sometimes, in fact, all the labels on a tape are recorded in 3480 Basic format, while the data blocks are recorded in 3480 Compacted format. The reason for this is that more devices can read 3480 Basic format, so even though a device cannot read the data on a tape, it may be able at least to read the labels. MVS always creates labeled tapes this way (assuming operating system services write the labels). CMS never does (with the same assumption).

The VMFPLC2 command uses a superior format for the data on the tape. Unless there is some reason the VMFPLC2 command will not be available to read the data back, you should use VMFPLC2 instead of TAPE. For more information, see "Using the VMFPLC2 Command" on page 193.

Tape Marks on TAPE DUMP tapes

A tape should always have two or more tape marks at the end of the data, which is the conventional signal (to whatever tries to read the data) that this is the end. If a tape does not have these, a program may assume there is more data on the tape and keep reading past the end of the data. This causes unpredictable results and, with open reel tapes, may cause the device to run off the end of the tape and pull

the tape from the supply reel. (This is not disastrous, but is rather inconvenient, since the tape must be manually retreaded.)

Additionally, you may want a single tape mark in the middle of your data to separate groups of files.

Tape marks take up space on the tape, though, and on a buffered tape device (like most newer tape devices, including the IBM 3480), writing tape marks severely slows down tape operations.

You can place tape marks on the tape explicitly with commands like TAPE WTM, but the TAPE DUMP command itself helps you with them. By default, TAPE DUMP will dump all the files you tell it to without any intervening tape marks, but with two tape marks after the last (or only) file. It leaves the tape positioned before the two tape marks. This means the next time you write to the tape, you write over those two tape marks. This is useful if you are going to do multiple successive TAPE DUMP commands, because it means no matter when you stop doing TAPE DUMPs, your tape ends up with two tape marks at the end and none in the middle.

But you may wish to have tape marks between all CMS files on the tape. For this, there is the WTM option. WTM causes TAPE DUMP to place tape marks between all files it dumps. The command still places two tape marks at the end of the data, but it leaves the tape positioned *between* the two. This means that if you do successive TAPE DUMP (WTM) commands, you end up with a tape that has one tape mark between every two CMS files, and two tape marks to mark the end of the data.

The only problem with the above process is that it may waste dumping time and tape space, because it writes tape marks only to write over them later. Writing tape marks causes a severe performance degradation on a buffered tape device (because it causes a buffer synchronization) and physically writing a tape mark and then backing over it takes time on any device. Furthermore, the process that CMS and the device use to accomplish the writing over of tape marks leaves, with some devices, a large section of unused space on the tape. This obviously cuts into your tape capacity.

To solve that problem, there is the NOEODTM option. This tells CMS not to worry about placing two tape marks at the end of the data. With this, you can do multiple successive TAPE DUMP (NOEODTM) commands without any costly buffer synchronizations or empty spaces on the tape. But remember that you still want two tape marks at the very end of the data, so after your last TAPE DUMP (NOEODTM), always do a TAPE WTM 2.

One other thing to be aware of, while taking advantage of the high speed of TAPE DUMP (NOEODTM), is that the device's buffer does not get synchronized before the TAPE command completes. This means that the TAPE command may complete with no error indication, but a later error may prevent the data from actually getting onto the tape. This is not generally a problem, because you eventually have to get those end of data tape marks written anyway, and if the tape marks get written successfully, you know all previously dumped data also got written successfully.

If you use both NOEODTM and WTM, the command puts a single tape mark after your last (or only) CMS file, and leaves the tape positioned after it. In this case,

Using Tapes

NOEODTM only gets you a slight performance improvement, but you still have a capacity improvement. You still have to add one tape mark at the very end, too, to make the two end of data tape marks.

Attention: The NOEODTM option defeats CMS's usual guarantee of end of data tape marks and buffer synchronization. You are responsible for ensuring the tape marks and synchronization are taken care of.

Using Tape Library Dataservers under OS Simulation

Tape Library Dataserver machines (such as the 3494, 3495, and 3595) use a robotic tape operator to automatically select, mount, and demount tapes in a mechanically controlled tape library. This library and its attached tape cartridge drives (such as the 3480, 3490, and 3590) are under the control of the Removable Media Services (RMS) system. z/VM provides an interface to the RMS system through DFSMS/VM.

If tapes are to be used under OS simulation on a Tape Library Dataserver, z/VM requires that:

- DFSMS/VM and RMS must be installed.
- The RMS CSL library (FSMPSSI CSLLIB) must be accessed. In addition, the following command must be issued to make the RMS CSL routines available to CMS:

```
rtnload * (from fsmppi
```
- The RMS system administrator must select one of the 16 SCRATCHx (where x is 0-F) library categories as the default SCRATCH processing category pool.
- The user should make sure that the default SCRATCH pool of tapes has enough physical tapes currently assigned to it to meet any application program needs.
- If unique VOLIDs are specified on a LABELDEF or FILEDEF statement, these VOLIDs must reside within the tape library to enable the Dataserver to mount the tapes.
- If the user premounts a tape on a Dataserver device with the DFSMS/VM MOUNT command, and the tape is to be used for any type of output, the Target Category should be set to VOLspecific in the MOUNT command parameters. This corresponds to the automatic system Target Category setting for output tape mounts.

CMS provides the following interfaces:

- If the LIBSRV option is specified on the FILEDEF command to indicate that tape mounts should be done on a Tape Library Dataserver machine, OS simulation calls the RMS interface to mount the tapes automatically for the user. It is suggested that this option be used whenever a Tape Library Dataserver is being used, to allow the system to mount all the tapes automatically for the user.
- If the tape drive currently in use is found to be under the control of a Tape Library Dataserver, or the FILEDEF command has been issued with the LIBSRV option, OS Simulation attempts to get subsequent multivolume tapes mounted automatically for the user through the native DMSTVS mounting service and the CMS native rewind and unload tape processing functions by calling the RMS FSMRMDMT (Demount) and FSMRMMNT (Mount) CSL routines.
- 'RUN' (rewind and unload) function processing for the CMS TAPE or VMFPLC2 command or the TAPECTL macro calls the RMS FSMRMDMT (Demount) CSL routine if a Tape Library Dataserver is found to be controlling the tape drive that the 'RUN' was issued against.

- Input tapes remain in the same category on demount, but output tapes are moved to the VOLspecific category to prevent accidental tape overwrite on the next scratch tape mount from the default SCRATCH tape pool.

OS Utility Programs

The TAPPDS command can read OS partitioned and sequential data sets from tapes created by, or for, the IEBTPCH, IEBUPDTE, and IEHMOVE utility programs. When you use the TAPPDS command, the OS data set is copied into a CMS file, which can reside on a minidisk or in a SFS directory, or in the case of partitioned data sets, into multiple CMS files.

IEBTPCH

Sequential or partitioned data sets created by the IEBTPCH utility program must be deblocked for CMS to read them. If you have a tape created by this utility, each member (if the data set is partitioned) is preceded with a card that contains *MEMBER=membername*. If you read this tape with the command:

```
tappds *
```

CMS creates a minidisk file from each member, using the *membername* for the file name and assigning a file type of CMSUT1. If you want to assign a particular file type, for example TEST, you could enter the command as follows:

```
tappds * test
```

If the file you are reading is a sequential data set, you should use the NOPDS option of the TAPPDS command:

```
tappds test file (nopds
```

The preceding command reads a sequential data set and assigns it a file identifier of TEST FILE. If you do not specify a file name or file type, the default file identifier is TAPPDS CMSUT1.

IEBUPDTE

Tapes in control file format created for the IEBUPDTE utility program can be read by CMS. Data sets can be blocked or deblocked, and can be either sequential or partitioned. Because files created for IEBUPDTE contain ./ADD control cards to signal the addition of members to partitioned data sets, you must use the COL1 option of the TAPPDS command. Also, you must indicate to CMS that the tape is in IEBUPDTE format. For example, to read a partitioned data set, you would enter the command:

```
tappds * test (update col1
```

The CMS minidisk files created are always in fixed, 80-character format.

IEHMOVE

OS unloaded partitioned data sets on tapes created by the IEHMOVE utility program can be read either by the TAPPDS command or by the TAPEMAC command. The TAPPDS command creates an individual CMS file from each member of the PDS.

If the PDS is a macro library, you can use the TAPEMAC command to copy it into a CMS MACLIB. A MACLIB, a CMS macro library, has a special format and is usually only created by using the CMS MACLIB command. If you use the TAPPDS

Using Tapes

command, you have to use the MACLIB command to create the macro library from individual files containing macro definitions.

z/VM HELP Facility

In addition to z/VM reference manuals, there is an online z/VM HELP Facility that you can refer to while you are logged onto the system. The z/VM HELP Facility is part of CMS. The following topics teach you how to use the HELP Facility, and how to tailor the online documentation to suit your particular needs.

Chapter 8, “Using the HELP Facility,” on page 209 describes the z/VM HELP Facility, an online display of documentation and menus that guide you to the appropriate HELP file for the command or commands. This section describes the HELP Facility and shows you how to use HELP to assist you in performing z/VM tasks.

Chapter 9, “Tailoring the HELP Facility,” on page 225 describes ways in which you can tailor the HELP Facility to your needs and describes techniques provided by the HELP Facility for creating user HELP description files.

Chapter 8. Using the HELP Facility

The z/VM HELP Facility can assist you in your work by letting you conveniently display information about commands you may wish to use, or to display explanatory information on system messages.

This section gives you a general understanding of the structure and function of the HELP Facility. It will get you started using HELP and give you some examples to practice with. The HELP Facility is accessed with the CMS HELP command. If you need specific information on the format and syntax of HELP and related commands, see *z/VM: CMS Commands and Utilities Reference*.

The HELP Facility has the following components (some might not be installed on your system):

| <u>HELP Component</u> | <u>Description</u> |
|-----------------------|---|
| ADVHCMD | Directory Maintenance Facility commands |
| APPCVM | APPC/VM macro functions |
| AVS | APPC/VM VTAM Support commands |
| BORDER | CMS window border commands |
| CMS | CMS commands, utilities, and functions |
| CMSQUERY | CMS QUERY command operands |
| CMSSET | CMS SET command operands |
| CP | CP commands and utilities |
| CPQUERY | CP QUERY command operands |
| CPSET | CP SET command operands |
| CRR | Coordinated Resource Recovery commands (CRR command operands) |
| DEFINE | CP DEFINE command operands |
| DELETE | CP DELETE command operands |
| DETACH | CP DETACH command operands |
| DFSMS | DFSMS/VM commands |
| DISABLE | CP DISABLE command operands |

HELP Facility

- DISPLAY**
CP DISPLAY command operands
- DUMP**
CP DUMP command operands
- DUMPSCAN**
Dump Viewing Facility DUMPSCAN subcommands
- DUMPCVIEW**
Dump Viewing Facility commands
- EDIT** EDIT subcommands
- ENABLE**
CP ENABLE command operands
- EXEC** EXEC statements
- EXEC2**
EXEC 2 statements
- FCX** Performance Toolkit subcommands and field descriptions
- FILESERV**
File pool server commands (FILESERV command operands)
- FTP** TCP/IP FTP client (FTP command) subcommands
- GDDMXD**
TCP/IP GDDMXD/VM interface subcommands
- GLOSSARY**
z/VM Glossary
- GROUP**
Group Control System GROUP command and panels
- HELP** HELP Facility topics
- IMAPADM**
TCP/IP IMAP server administrative commands
- INCH** RSCS Data Interchange Manager commands
- INDICATE**
CP INDICATE command operands
- IUCV** IUCV macro functions
- LDAP** TCP/IP LDAP server subcommands
- LE** Language Environment[®] commands
- MACROS**
CMS assembler language macros
- MODIFY**
CP MODIFY command operands
- MONITOR**
CP MONITOR command operands
- MROUTE**
TCP/IP MROUTE server administrative commands
- MSOCKETS**
Systems management sockets

NFS TCP/IP NFS server administrative commands

NSINTER
TCP/IP NSLOOKUP interactive subcommands

NSLOOKUP
TCP/IP NSLOOKUP subcommands

OMACRO
OpenExtensions assembler language macros

OPENVM
CMS OPENVM command operands

OROUTINE
OpenExtensions callable services

OSHELL
OpenExtensions shell commands

PIPE CMS Pipelines stages and pipeline subcommands

PREFIX
XEDIT prefix subcommands and macros

PSCREEN
CMS physical screen commands

PURGE
CP PURGE command operands

PVM VM/Pass-Through Facility

PVMSET
VM/Pass-Through Facility SET subcommands

QUERY
XEDIT QUERY subcommand options

RDEVICE
CP SET RDEVICE command operands

RDVF Dump Viewing Facility DUMPSCAN subcommands for RSCS

REXX REXX/VM statements

ROUTINES
CMS routines and callable services

RQUERY
RSCS QUERY command operands

RSCS RSCS commands and link operational parameters

RSCSAUTH
RSCS dynamic authorization commands

RSKCMDS
Reusable Server Kernel commands

RXSOCKET
REXX Sockets functions

SET XEDIT SET subcommand options

SFSADMIN
SFS/CRR administrator and operator commands

HELP Facility

- SFSQUERY**
SFS/CRR administrator and operator QUERY commands
- SMTP** TCP/IP SMTP server administrative commands
- SNMP**
TCP/IP SNMP administrative commands
- SPXTAPE**
CP SPXTAPE command operands
- SQLDS**
DB2[®] Server for VM
- SSLADMIN**
TCP/IP SSL server administrative commands
- STORE**
CP STORE command operands
- TCPIP** TCP/IP commands and related functions
- TELNET**
TCP/IP Telnet protocol client subcommands
- TERMINAL**
CP TERMINAL command operands
- TRACE**
CP TRACE command operands
- TRSOURCE**
CP TRSOURCE command operands
- TSAF** Transparent Services Access Facility commands
- UFTD** TCP/IP UFT server administrative (UFTD command) subcommands
- VMDS**
VM data spaces CP macros
- VMDT**
VM Dump Tool toolkit macros and stages (unsupported samples and examples)
- VMDUMPTL**
VM Dump Tool subcommands and macros
- VMFINS**
VMSES/E VMFINS command operands
- VMFSIM**
VMSES/E VMFSIM command operands
- VMSESE**
VMSES/E commands
- VSCREEN**
CMS virtual screen commands
- WINDOW**
CMS window commands
- XEDIT**
XEDIT subcommands

XLINK

CP XLINK command operands

The HELP Facility is used on 3270-type terminals in display mode. It can also be used on line-oriented terminals. All the information about commands and messages is contained in files called HELP files. In display mode, HELP uses XEDIT to display these files. In line-mode, the HELP Facility types the HELP file to your screen one line at a time.

When you access the HELP Facility, HELP will EXECLOAD the HELPXED XEDIT macro, if it has not been loaded. Loading this file into storage improves the performance of the HELP command. If you occasionally use HELP, you may want to EXECDROP the HELPXED XEDIT macro to release the storage. For more information, see *z/VM: CMS Commands and Utilities Reference*.

HELP files usually appear on your screen in mixed case. However, in some installations, lowercase characters are reserved for displaying special alphabets. In this case, HELP files are displayed in uppercase.

As you work through the examples in this section and use HELP, you may need to refer to "DETAIL HELP" on page 236, to understand the syntax diagrams in the command HELP files.

You may notice when you perform certain tasks within the HELP Facility that your PF key listing at the bottom of the screen is covered by a message. If this occurs, simply press Enter to refresh the screen.

Getting HELP on Messages

Sometimes, when you perform a z/VM task, the system responds with a message. To find out why the message was produced and perform any necessary corrective action, you can use HELP for messages.

The HELP files for messages display the message text, an explanation of why the message was entered, the system action, and a user action.

You can display information about a message by entering one of these commands:

```
help msg msgid
help msgid
```

The module identifier (characters 4 - 6 of the message identifier) is ignored by HELP, so you do not need to enter it. For example, to display information about message DMSHLP002E, you can enter any of these commands:

```
help msg dmshlp002e
help msg dms002e
help dmshlp002e
help dms002e
```

If you receive a message without a message ID, it could be because you (or an application program running in your virtual machine) issued the CP SET EMSG TEXT command to display only message text. To get information about a message with no message ID:

- Search for a portion of the message text in the PDF version of the appropriate messages document.

HELP Facility

- If you do not know which z/VM function issued the message (and therefore do not know in which document to search), you can search across the entire z/VM library in the z/VM information center.

Hint: In your search string, do not include any text from substitution variables. Message documentation uses variables to represent fields in which the system returns event-specific data. If you use actual values, your search string will not match.

Getting HELP on Commands

To understand the HELP Facility, it is best to look first at its structure and second at how it functions.

There are two different types of HELP files: information files and selection files. Information files contain information about commands and messages. (In this context, a “command” can be any function that is invoked by specifying a name, such as a command, a subcommand, a macro, or a routine.) Selection files display menus that let you select the appropriate information file. This section explains the use of information files. See “Menus” on page 218 for an explanation of selection files.

The HELP Facility provides various ways of getting information for a command, depending on your level of expertise and the amount of detail you require for a particular task. Commands can contain three layers of information: BRIEF, DETAIL, and RELATED. Each layer displays a unique level of HELP.

You can display any of the three available layers by specifying the corresponding layering options: BRIEF, DETAIL, or RELATED. You may specify only one layering option at a time. However, once you have requested one layer of HELP on a specified command, you may toggle (switch) between the other layers available for that command. For more information on how to toggle between layers of HELP, see “Toggling” on page 220.

BRIEF is the default option, meaning that if you do not specify a layering option, the BRIEF layer of HELP is displayed if it exists. If BRIEF HELP is not available for a certain command, DETAIL HELP is displayed. The following sections provide more information on the three layers of command HELP.

Note: These examples include the HELP component name (CP, CMS, REXX, and so forth). However, if you are requesting HELP for a command in CP or CMS, you do not need to specify the component name. For example, to request HELP on the CMS command SENDFILE, you could simply specify `help sendfile`. For components other than CP or CMS (REXX, EXEC, TSAF, and so forth), you must specify the component name for HELP to locate the proper command information. For example, to get help on the REXX instruction, TRACE, you would need to specify `help rexx trace`.

BRIEF HELP

BRIEF is the first of three layers of HELP and is available for many commands. BRIEF HELP displays a short description of the requested command, its basic syntax (command without options), an example, and, if applicable, a message telling you that either more or related information is available.

If you are in full-screen CMS and request BRIEF HELP, your screen shows the HELP command you entered and just below it, displays the BRIEF HELP information in a window that is displayed on your screen. If you are not in full-screen CMS, your entire screen displays the BRIEF HELP information. For more information about full-screen CMS, see Chapter 10, “Introducing Full-Screen CMS,” on page 253.

The following example shows how your screen would look if you requested BRIEF HELP for the SENDFILE command and are not in full-screen CMS.

If you are currently in full-screen CMS, enter the command SET FULLSCREEN OFF. Then, enter:

```
help cms sendfile (brief
```

The screen shown in Figure 60 is then displayed.

```

CMS SENDFILE          BRIEF Help Information          line 1 of 12

The SENDFILE command lets you send files to other users. An
abbreviation for SENDFILE is SF.

FORMAT: SENDfile filename filetype userid (options

EXAMPLE: Greg needs a copy of your file SPEC SCRIPT A. His user ID is
        Greg. To send him a copy, enter:
            sf spec script greg

PF1= All      2= Top      3= Quit      4= Return      5= Clocate      6= ?
PF7= Backward 8= Forward  9= PFkeys 10=          11= Related    12= Cursor
Press PF11 to get related information.
====> -
                                          Macro-read 1 File

```

Figure 60. Sample of BRIEF HELP for the SENDFILE Command

DETAIL HELP

The DETAIL layer of HELP presents a complete description of the command, the command format, an explanation of its parameters and options, usage notes, and error information. DETAIL HELP provides information similar to the information you would find listed in *z/VM: CMS Commands and Utilities Reference*.

Subsetting Options

The DETAIL layer of HELP has seven subsetting options: DESCRIPT, FORMAT, PARMS, OPTIONS, NOTES, ERRORS, and ALL. By specifying subsetting options, you can display one or more particular sections of the DETAIL HELP. ALL is the default option, meaning that the entire DETAIL HELP is displayed. It is possible to change the default option, but if you do so, you will need to specify ALL as the subsetting option to display the entire DETAIL layer. For more information on the subsetting options and the DEFAULTS command, see *z/VM: CMS Commands and Utilities Reference*.

For example, to display the entire DETAIL layer of the SENDFILE command in the CMS environment, you would enter:

HELP Facility

```
help cms sendfile (detail)
```

Let's display just the usage notes in that same file. Enter:

```
help cms sendfile (notes)
```

The screen shown in Figure 61 is then displayed.

```
CMS SENDFILE      Detail Help Information      line 1 of 281
Usage Notes

1. Tailoring the SENDFILE Command Options

You can use the DEFAULTS command to set up options and override
command defaults for SENDFILE. However, the options you specify
in the command line when entering the SENDFILE command override
those specified in the DEFAULTS command. This allows you to
customize the defaults of the SENDFILE command, yet override them
when you desire. For more information, see the DEFAULTS command.

2. Using the SENDFILE Menu (Display Terminals Only)

Enter the SENDFILE command without operands to display a menu, on
which you "fill in the blanks" with the necessary information. A
sample SENDFILE menu is shown in the Examples, below.

PF1= All      2= Top      3= Quit      4= Return      5= Clocate      6= ?
PF7= Backward 8= Forward  9= PFkeys   10= Brief      11= Related     12= Cursor

====> _

Macro-read 1 File
```

Figure 61. Sample of *DETAIL HELP* for the *SENDFILE* Command

RELATED HELP

The **RELATED** layer of **HELP** is a multipurpose layer. **RELATED HELP** makes you aware of commands that are similar to the presently displayed **HELP** file, making it easier for you to decide which command to use. For example, if you want to remove a file from your **rdrlst** and, after reading **HELP ERASE**, you realize that **ERASE** is not the correct command, the **RELATED** layer of the **ERASE** command lets you easily access the **HELP** file for the correct command, **DISCARD**.

When you request **RELATED HELP** on the **SET** or **QUERY** commands, the screen lists and briefly describes all the **SET** and **QUERY** operands available for the system component. You could directly access **HELP** information on any of the displayed operands from these menu screens by positioning the cursor on a particular operand and pressing **Enter**.

For information on how to create your own **RELATED HELP** files, see Chapter 9, "Tailoring the **HELP** Facility," on page 225.

For example, to display the **RELATED** layer of the **ERASE** command in the **CMS** environment, enter:

```
help cms erase (related)
```

The screen shown in Figure 62 on page 217 is then displayed.

```

CMS ERASE          Related Help Information      line 1 of 20
Related Information

For RELATED information on removing files or parts of files from
your virtual machine, place the cursor under the topic of your choice
and press ENTER or the PF1 key.

DELETE   - Removes one or more lines from
          a file while using XEDIT.

ERASE    - Removes files from your minidisk
          or SFS directory.

PURGE    - Removes spool files from your
          reader, printer or punch.

DISCARD  - Removes files from "list-type" CMS command
          environments, such as FILELIST.

PF1= Help   2= Top     3= Quit    4= Return   5= Clocate  6= ?
PF7= Backward 8= Forward 9= PFkeys 10=         11= Brief   12= Cursor

====> _

Macro-read 1 File

```

Figure 62. Sample of RELATED HELP for the ERASE Command

Other Options

There are five other options that affect the display of HELP: SCREEN/ NOSCREEN, TYPE/NOTYPE, and EXTEND. Briefly, these other options control the display of files and error messages and the search order of commands. A complete description of these options can be found in *z/VM: CMS Commands and Utilities Reference*.

Getting HELP on SET and QUERY

The HELP Facility provides a special feature that lets you quickly access HELP on specific SET or QUERY options in CP, CMS, or XEDIT. If you know the component name (CP, CMS, or XEDIT) and the name of the option, you can immediately get to the specific HELP file you need.

Reserved file types in the HELP Facility let you access specific HELP files. To access HELP information for any CMS SET option, you would enter HELP, followed by the component name, CMSSET, and the option name. For example, to get HELP on the CMS command SET RDYMSG, you would enter the following:

```
help cmsset rdymsg
```

This command would immediately access the specific HELP file for the CMS SET RDYMSG command.

To request HELP for a CMS QUERY option, you would enter HELP, followed by the component name, CMSQUERY, and the option name.

The same is true for CP SET and QUERY options. To get HELP on a CP SET option, you would enter HELP, followed by CPSET, and the option name; for HELP on a CP QUERY option, you would enter HELP, CPQUERY, and the option name.

HELP Facility

To request HELP for XEDIT SET and QUERY options, you can simply enter HELP, followed by SET or QUERY, and the name of the option. For example, to get HELP on the XEDIT command SET APL, you would enter the following:

```
help set apl
```

Even though there is also a CMS command SET APL, the HELP Facility would correctly provide you with HELP information on the XEDIT SET APL command. You would need to enter:

```
help cmsset apl
```

to request information on the CMS SET APL command.

To display a HELP panel that directs you to the menus for the QUERY and SET options in CP, CMS, and XEDIT, enter:

```
help queryset tasks
```

For more information on HELP for SET and QUERY options, see *z/VM: CMS Commands and Utilities Reference*.

Facts About Command HELP

The following information helps you to more efficiently use command HELP:

- Command HELP lets you easily move between screens of HELP information. While viewing the command HELP for one command, you can get help for another command by specifying HELP followed by the name of the new command. For instance, if you were viewing the HELP file for the CMS PRINT command, and decided you wanted help on the CMS COPYFILE command, you could enter the following on the command line of your current screen:

```
help cms copyfile
```

This would bring you directly to the HELP information for the COPYFILE command.

- BRIEF, DETAIL, and RELATED are conflicting HELP options. You can specify only one of these options in the command string. If you specify more than one option at a time, the last option entered is effective. For example, RELATED HELP for the ERASE command is displayed if you entered the following on the command line:

```
help cms erase (brief related
```

If you entered on the command line:

```
help cms erase (descript notes brief
```

BRIEF HELP for the ERASE command is displayed. If you then entered MOREHELP on the command line or pressed PF10, you would see the DESC and NOTES sections for the ERASE command. For more information on how to use the PF keys to move between HELP screens, see "Using the PA2 and PF Keys" on page 220.

Menus

In HELP, menus serve as selection files; that is, HELP panels that assist you in reaching the HELP files you need. If you are uncertain of the name of a component or command you might like to use, you can simply choose from a list of likely possibilities.

You can select an entry from the menu by positioning the cursor in front of or under any part of the entry and then pressing Enter or the PF1 key. After the HELP file is displayed, you can return to the menu by pressing PF3.

To position the cursor at the entry you want, you can do any one of the following:

- Use the key marked --->|, which functions as a tab key, causing the cursor to move to the first character of the next entry.
- Use another cursor-movement key.
- Enter on the command line the desired entry or a string that appears in the task description and press PF5.

When the cursor is positioned at the desired entry, press Enter or the PF1 key to display the HELP file for that entry.

There are two types of menus, task menus and component menus. An asterisk (*) preceding an entry in a displayed menu indicates that the entry is the name of a component menu file. A colon (:) indicates that the entry is the name of a task menu.

TASK Menus in HELP

TASK menus are especially useful for users new to the VM system. This is because they describe an action that you may want to perform and then guide you to the appropriate HELP file.

You can see a list of tasks and components available to you by typing:

```
help task
```

Figure 63 displays the TASK menu.

```

HELP TASK                Task Help Information                line 1 of 40
(c) Copyright IBM Corporation 1990, 2003

z/VM Help, main panel

This panel lists other Help panels that provide information about
various z/VM functions, topics, and tasks.
To view a Help panel, move the cursor to any character of the name
and press the ENTER key or the PF1 key.

HELPIFNO - HELP Facility topics
MENUS    - z/VM Help menus
TASKS    - Basic z/VM tasks - good choice for beginners
COMMANDS - z/VM commands available to general users
CMS      - CMS commands
CP       - CP commands
QUERYSET - QUERY and SET commands and subcommands
TCP/IP   - TCP/IP commands
PF1= Help   2= Top   3= Quit   4= Return   5= Clocate   6= ?
PF7= Backward 8= Forward 9= PFkeys 10=      11=          12= Cursor

====>
Macro-read 1 File

```

Figure 63. Sample HELP TASK Menu

HELP Component Menus

Component MENUS list the names of all the command HELP files available for a specific HELP component.

HELP Facility

If you followed the example shown in the preceding section, your screen now displays the HELP TASK menu. To display all the command HELP files available for HELP component CMS, position your cursor anywhere under the word CMS, and press Enter. Figure 64 now displays the component MENU.

```
CMS MENU                      Menu Help Information          line 1 of 43
(c) Copyright IBM Corporation 1990, 2003

Help for CMS commands

To view a Help panel, move the cursor to any character of the name
and press the ENTER key or the PF1 key.
An asterisk (*) preceding the name indicates a MENU panel.
A colon (:) preceding the name indicates a TASK panel.

*BORDER  CMSBATCH  DROPBUF  GLobal  NAMES  RO  SVCTrace
*CMSQUERY CMSSERV  DSERV   GLOBALV  NETDATA  RSERV  SYNMSGs
*CMSSET   COMPare  Edit    GRAnt   NETLCNVT RT    SYNonym
*CMSUTIL  CONV2WD  ERASE   HB      NOTE    RTNDrop SYSWATCH
*EDIT    CONWAIT  ESERV   Help    NUCXDROP RTNLoad TAPE
*FILESERV COPYfile  ESTATE  HELPCONV NUCXLOAD RTNMap  TAPEMAC
*OPENVM  CP       ESTATEW HI      NUCXMAP  RTNState TAPPDS
*OSHELL  CREate  ETRACE  HO      OPNMSGs  RUN     TE
PF1= Help  2= Top    3= Quit   4= Return 5= Clocate 6= ?
PF7= Backward 8= Forward 9= PFkeys 10=      11=      12= Cursor

====>

Macro-read 1 File
```

Figure 64. Sample Component MENU for CMS

If you enter the command, help menus, your screen displays a listing of all the available menus.

Using the PA2 and PF Keys

The PA2 key (or its equivalent) and PF keys have special meanings when in the HELP Facility. This section provides details on the settings for each key.

As you use the PF keys, you will note that the last PF key you pressed is highlighted in the settings at the bottom of your HELP screen.

Toggling

A toggle key is a key that lets you move back and forth between various HELP displays. Toggle keys for HELP are PF1, PF10, and PF11. These keys let you toggle (switch) between the BRIEF, DETAIL, ALL, and RELATED HELP sections.

The type of information you get when you press each of these keys depends on the type of HELP information available for a particular command and also depends on what information is being displayed on your screen at the time when you press the PF key. The PF key settings shown at the bottom of your HELP screen change to reflect the kinds of HELP available to you and the options entered on the HELP command or by the DEFAULTS command. If a certain type of HELP is not available for a particular command, the corresponding PF key setting at the bottom of your HELP screen will be blank.

The PF1 key toggles between the ALL and BRIEF layers of HELP. PF10 toggles between the DETAIL and BRIEF layers of HELP. PF11 toggles between RELATED and BRIEF. For example, if you are viewing the BRIEF layer of HELP, your PF keys are set as follows:

```
PF1 = All
PF10 = Morehelp
PF11 = Related
```

This means that if you press PF10, you then receive MOREHELP, which provides you with the DETAIL layer of HELP information. Now, while you were viewing DETAIL HELP, your PF keys would have changed to the following settings:

```
PF1 = All
PF10 = Brief
PF11 = Related
```

If you pressed PF10, you would return to BRIEF HELP, and your PF key settings would be as they were in the first part of this example.

Note: If no subsetting options were specified, PF10 is not set to MOREHELP.

Table 24 lists the settings for PF1, PF10, and PF11 when all HELP layers are available for the displayed file.

Table 24. Toggling Between Layers of HELP

| Screen Display | PF Key Settings |
|----------------|--|
| BRIEF | PF1 = All PF10 = Morehelp PF11 = Related |
| DETAIL | PF1 = All PF10 = Brief PF11 = Related |
| ALL | PF1 = Brief PF10 = Morehelp PF11 = Related |
| RELATED | PF1 = Help PF10 = Morehelp PF11 = Brief |

Table 25 lists the values for PA2 and the PF keys. On a terminal equipped with 24 PF keys, PF keys 13 to 24 are assigned the same values as PF keys 1 to 12.

Table 25. PA and PF Keys in the HELP Facility

| Key | Meaning | Usage |
|-----|---------|--|
| PA2 | Print | Prints a hard copy of currently displayed HELP information. Remember that after quitting HELP, you must enter CP SP PRT CLOSE to print the file. |
| PF1 | Help | Accesses HELP files from a menu or a RELATED section after the cursor is positioned at the desired entry. |
| | All | Displays the HELP file as if the ALL option was specified. |

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Table 25. PA and PF Keys in the HELP Facility (continued)

| Key | Meaning | Usage |
|------|-----------------------|---|
| | Brief | Displays BRIEF information when viewing the ALL option of a specified HELP file. Note: If PF1 appears blank on a HELP screen, this means that either ALL or BRIEF HELP is not available for a particular command. |
| PF2 | Top | Moves the display to the beginning of the HELP file. |
| PF3 | Quit | Exits from the currently displayed HELP file. |
| PF4 | Return | Exits from the HELP Facility. PF4 quits all HELP files currently in storage. For example, if you call a menu, then call a HELP file from that menu, PF4 quits both the file and the menu and returns control to the originating environment. |
| PF5 | Clocate | Is the XEDIT subcommand CLOCATE. On the command line, enter the string you are looking for. Then press PF5 to tell HELP to locate the next occurrence of the string. Repeated pressing of the PF5 key locates additional occurrences of the string. HELP highlights the line located. |
| PF6 | ? | Displays the last user command entered from the command line. |
| PF7 | Backward | Scrolls the display backward one screen. |
| PF8 | Forward | Scrolls the display forward one screen. |
| PF9 | PF Key | Displays a file containing an explanation of PF key meanings for displayed files. |
| PF10 | Morehelp | Displays the HELP information from a command file as if the DETAIL optioN was specified. Note: If no subsetting options were specified, PF10 is not set to MOREHELP. |
| | Brief | Displays BRIEF information. Note: If PF10 appears blank, this means that either DETAIL HELP or BRIEF HELP is not available for a particular command. |
| PF11 | Related | Displays the HELP information from a command file as if the RELATED option was specified. |
| | Brief | Displays BRIEF information. Note: If PF11 appears blank, this means that either RELATED HELP or BRIEF HELP is not available for a particular command. |
| PF12 | Cursor on the screen. | |

Using the MOREHELP Command

If you are viewing HELP Facility files on a line-mode terminal, or if you cannot use a PF key to obtain DETAIL or RELATED information, you may find the MOREHELP command useful.

MOREHELP provides you with either additional or related information about the last valid HELP command you entered. For more information on the MOREHELP command, see *z/VM: CMS Commands and Utilities Reference*.

Displaying HELP Files Using XEDIT

If you are using HELP in display mode on a 3270-type terminal, the HELP Facility uses XEDIT to display HELP files. Many of the features of the XEDIT subcommands are used on the displayed files. Two of the available features are:

Clocate

Locates a specified character string in the file or uses PF5 to search the file. PF5 positions the cursor under the target string. CLOCATE remembers the string that was last used, even if you have performed other functions. You can press PF5 to use that last string again. To change the string being searched, enter a new string on the command line and press PF5 to search for the new string.

Scrolling

Moves the display up or down.

For more information on these features, see *z/VM: XEDIT Commands and Macros Reference*.

Not all XEDIT subcommands are used on the displayed HELP files. The excluded subcommands are listed below:

| | |
|-------|----------|
| ALL | READ |
| FILE | REPLACE |
| INPUT | SET |
| MACRO | POWERINP |

These subcommands are excluded to prevent unnecessary copying of HELP files or to avoid any inadvertent changes to the HELP files. If you use these subcommands while viewing a HELP file, they will be ignored, and you will receive an error message. While these subcommands will not work on files displayed by the HELP Facility, you can use them when you use the XEDIT subcommand to edit the files.

Note: When you enter a command from the command line, the system does not search for XEDIT subcommand synonyms and XEDIT macros such as the SPLTJOIN macro. This means that when a macro such as SPLTJOIN is invoked from within the HELP Facility, the message 'No such subcommand: SPLTJOIN' is displayed.

Printing HELP Screens

When you display HELP files, you can get a printed copy of the screen by pressing PA2 while the screen is displayed. To receive a hard copy:

1. Press the PA2 key.
2. Exit from HELP.
3. Enter the command:

```
CP SP PRT CLOSE
```

Note: If you want to print the entire HELP file for a certain command, you will need to access the HELP disk and print the file. See your system administrator for information on accessing and printing HELP files.

Working with Your HELP Files

Now that you are familiar with using HELP files, you may wish to learn how to customize your z/VM HELP files. For more information, see Chapter 9, “Tailoring the HELP Facility,” on page 225.

Chapter 9. Tailoring the HELP Facility

One of the most useful features of the z/VM HELP Facility is its versatility. You can tailor the displayed HELP to suit your needs by simply creating or changing CMS files.

You might want to generate new HELP files for any new commands, execs, or error messages you create. You may also want to make updates to the z/VM HELP files to fulfill your individual needs.

If you have your own set of HELP files, you can do as you wish with them. However, if you share a set of HELP files with other system users, you will have to get authority from the system administrator to alter the HELP Facility.

Creating HELP Files

Each existing HELP file has a distinct file name and file type. When you wish to write your own HELP files, there are naming conventions you must follow to ensure that your files are recognized by the HELP Facility.

Note: If your installation uses SFS, you can create your own HELP files on minidisks or in any accessed directory. However, the system HELP disk cannot be replaced by a directory in a file pool.

Therefore, you can create your own HELP files, store them in an SFS directory, and HELP will display the files if the directory is accessed. For HELP files sent with z/VM, installations will continue to use a minidisk.

The length of a record in a HELP file should not exceed 133 characters.

File Names for HELP Files

When you change the existing HELP files or write your own HELP files, you must follow these file name conventions:

- The file name for components, commands, subcommands, or execs is the exact full name of the component, command, subcommand, or exec.
- The file name for messages has the form *xxxnnn(n)t*,

Where:

xxx

specifies the component code prefix (for example, DMS for CMS messages). For a list of the component code prefixes, see *z/VM: CMS and REXX/VM Messages and Codes*.

nnn(n)

specifies the message number.

t specifies the message type code. For example, E specifies error messages in CMS.

For example, the HELP file name for the CMS message:

```
DMSABC001E No filename specified
```

would be DMS001E.

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- For commands or statement names containing special characters, HELP creates the file name by translating that special character.

If the name is a single special character, then the file name is the name of the special character. For example, & and ? have the file names of AMPRSAND and QUESMARK respectively. To display the HELP file XEDIT subcommand ?, you would enter HELP XEDIT ?. However, the actual file ID for that file would be QUESMARK HELPXEDI. The following table lists the special characters and their translations:

| Character | Translated To |
|-----------|---------------|
| ? | QUESMARK |
| = | EQUAL |
| / | SLASH |
| " | DBLQUOTE |
| & | AMPRSAND |
| * | ASTERISK |
| . | PERIOD |
| < | LESS THAN |
| > | GREATER THAN |

In command names or file names with more than one character, replace the special character with the first letter of its name. For example, & (AMPRSAND) would be replaced by an A. An exception is *, which is replaced by an R.

Thus, the EXEC 2 statements &STACK and &EXIT would have the file names ASTACK and AEXIT. Remember that these changes only apply to the file names of the statements; they do not affect the way you call for a HELP file display. To display the HELP files for &STACK and &EXIT, you would enter HELP EXEC2 &STACK and HELP EXEC2 &EXIT

File Types for HELP Files

You must also follow certain conventions for file types when you create your own HELP files. The file type:

- Of the HELP file is `HELPxxxx`,

Where:

`xxxx`

Specifies the name of the component to which the file belongs.

For example, the file type for a CMS command would be `HELPCMS`.

- For subcommands is `HELPMxxx`,

Where:

`xxx`

Specifies the command name associated with this subcommand.

For example, the file type for an XEDIT command subcommand would be `HELPIXEDI`.

- For messages is `HELPMMSG`.
- For a list of supported commands for a given function is `HELPMENU`.
- For a list of tasks supported for a given function is `HELPTASK`.
- For a list of abbreviations and synonyms for a given function is `HELPABBR`.

If the component name is shorter than four characters, the file type is shortened. For example, `HELPCP` is the file type for CP commands. If the component name is longer than four characters, only the first four characters are used. For example, `HELPQUER` is the file type for XEDIT QUERY subcommands.

The only exception to the above rule is for EXEC 2 HELP files. Because EXEC and EXEC 2 have the same first four characters, CMS examines the fifth character to determine if the request is for EXEC or EXEC 2. Because file types are limited to eight characters, CMS assigns the file type HELPEXEC to EXEC files and the file type HELPEXC2 to EXEC 2 files.

If you create a file with a file ID of HELP HELPMENU, the HELP Facility displays your HELP HELPMENU file instead of the HELP HELPTASK file when HELP is generated without any other parameters.

There are also certain file types that are reserved for the various components of the HELP Facility:

File Type

Reserved for

HELPABBR

Lists of abbreviations and synonyms for functions in a HELP component (which is identified by the file name)

HELPADVH

Directory Maintenance Facility commands

HELPAPPC

APPC/VM macro functions

HELPAVS

APPC/VM VTAM Support commands

HELPBORD

CMS window border commands

HELPCMS

CMS commands and utilities

HELPCMSQ

CMS QUERY command operands

HELPCMSS

CMS SET command operands

HELPCP

CP commands and utilities

HELPCPQU

CP QUERY command operands

HELPCPSE

CP SET command operands

HELPCRR

Coordinated Resource Recovery commands (CRR command operands)

HELPDEFI

CP DEFINE command operands

HELPDELE

CP DELETE command operands

HELPDETA

CP DETACH command operands

HELPDFSM

DFSMS/VM commands

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HELPDISA

CP DISABLE command operands

HELPDISP

CP DISPLAY command operands

HELPDUMP

CP DUMP command operands
DUMPSCAN subcommands
Dump Viewing Facility commands

HELPEEDIT

EDIT subcommands

HELPENAB

CP ENABLE command operands

HELPEXEC

EXEC statements

HELPEXC2

EXEC 2 statements

HELPEFCX

Performance Toolkit subcommands and field descriptions

HELPEFILE

File pool server commands (FILESERV command operands)

HELPEFTP

TCP/IP FTP client (FTP command) subcommands

HELPEGDDM

TCP/IP GDDMXD/VM interface subcommands

HELPEGLOS

z/VM Glossary

HELPEGROU

Group Control System GROUP command and panels

HELPEHELP

HELP Facility topics

HELPEIMAP

TCP/IP IMAP server administrative commands

HELPEINCH

RSCS Data Interchange Manager commands

HELPEINDI

CP INDICATE command operands

HELPEIPFO

TCP/IP IPFORMAT subcommands

HELPEIUCV

IUCV macro functions

HELPELDAP

TCP/IP LDAP server subcommands

HELPELE

Language Environment commands

HELPMACR
CMS assembler language macros

HELPMENU
HELP menu panels

HELPMODI
CP MODIFY command operands

HELPMONI
CP MONITOR command operands

HELMPRO
TCP/IP MPROUTE server administrative commands

HELPMMSG
z/VM messages

HELPMSOC
Systems management sockets

HELPNFS
TCP/IP NFS server administrative commands

HELPN SIN
TCP/IP NSLOOKUP interactive subcommands

HELPN SLO
TCP/IP NSLOOKUP set subcommands

HELPOMAC
OpenExtensions assembler language macros

HELPOPEN
CMS OPENVM commands

HELPOROU
OpenExtensions callable services

HELPO SHE
OpenExtensions shell commands

HELPPF
HELP Facility PF keys description

HELPP IPE
CMS Pipelines stages and pipeline subcommands

HELPPREF
XEDIT prefix subcommands and macros

HELPPSCR
CMS physical screen commands

HELPPURG
CP PURGE command operands

HELPPVM
VM/Pass-Through Facility

HELPPVMS
VM/Pass-Through Facility SET subcommands

HELPPQUER
XEDIT QUERY subcommand options

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- HELPRDEV**
CP SET RDEVICE command operands
- HELPRDVF**
Dump Viewing Facility DUMPSCAN subcommands for RSCS
- HELPREXX**
REXX/VM statements
- HELPROUT**
CMS routines and callable services
- HELPRQUE**
RSCS QUERY command operands
- HELPRSCS**
RSCS commands, RSCS dynamic authorization commands, and RSCS link operational parameters
- HELPRSKC**
Reusable Server Kernel commands
- HELPRXSO**
REXX Sockets functions
- HELPSECP**
VM/Remote Spooling Communications Subsystem Networking 3270
Secure Printing
- HELPSET**
XEDIT SET subcommand options
- HELPSFSA**
SFS/CRR administrator and operator commands
- HELPSFSQ**
SFS/CRR administrator and operator QUERY commands
- HELPSMTP**
TCP/IP SMTP server administrative commands
- HELPSNMP**
TCP/IP SNMP administrative commands
- HELPSPXT**
CP SPXTAPE command operands
- HELPSQLD**
DB2 Server for VM
- HELPSSLA**
TCP/IP SSL server administrative commands
- HELPSTOR**
CP STORE command operands
- HELPTASK**
HELP task panels
- HELPTCPI**
TCP/IP commands and related functions
- HELPTELN**
TCP/IP Telnet protocol client subcommands

| | |
|-----------------|---|
| HELPTERM | CP TERMINAL command operands |
| HELPTRAC | CP TRACE command operands |
| HELPTRSO | CP TRSOURCE command operands |
| HELPTSAF | Transparent Services Access Facility commands |
| HELPUFTD | TCP/IP UFT server administrative (UFTD command) subcommands |
| HELPVMDS | VM data spaces CP macros |
| HELPVMDT | VM Dump Tool toolkit macros and stages (unsupported samples and examples) |
| HELPVMDU | VM Dump Tool subcommands and macros |
| HELPVMFI | VMFINS command operands |
| HELPVMFS | VMFSIM command operands |
| HELPVMSE | VMSES/E commands |
| HELPVSCR | CMS virtual screen commands |
| HELPWIND | CMS window commands |
| HELPXEDI | XEDIT subcommands |
| HELPXLIN | CP XLINK command operands |

Examples of Naming Conventions

The following examples illustrate the naming conventions you would use to create specific files to work with the HELP command:

| File Name | File Type | Description |
|-----------|-----------|--|
| ACCESS | HELPCMS | A CMS command description |
| BEGIN | HELPCP | A CP command description |
| ADD | HELPXEDI | An XEDIT subcommand description |
| DMS186W | HELPMMSG | A CMS message description |
| CMS | HELPMENU | A list of the CMS command and exec names supported by the HELP Facility |
| HELP | HELPTASK | A list of HELP tasks supported by the HELP Facility. |
| CMS | HELPAABBR | A list of CMS abbreviations and synonyms supported by the HELP Facility. |

Creating Menus for HELP Files

The HELP Facility has two types of menus:

- Command component menus have a file type of HELPMENU
- Task menus have a file type of HELPTASK.

The file name of a HELPMENU file is the name of the component to which the commands in the menu belong. For example, EXEC2 HELPMENU is the file name and file type for the menu containing EXEC 2 statements. Menus with a file type of HELPMENU contain a list of the HELP files for that component.

The file name of a HELPTASK file can be any file name up to eight characters and should describe the list of tasks contained in the file. For example, DISK HELPTASK is the file name and file type for the task menu containing tasks that involve using minidisks. Menus with a file type of HELPTASK contain a list of tasks.

Creating HELPMENU Files

There are a few rules you must follow when creating HELPMENU files:

1. Precede the list of names with any amount of information for the user. This information should include instructions for selecting an entry from the menu.
2. Include two blank lines between the information for the user and the list of names. If two consecutive blank lines are not found, then the file is considered preformatted and is not sorted or formatted by HELP. Any two or more consecutive blank lines indicate the end of the user information section and the beginning of the list of names for the HELP files for that component. Therefore, you are limited to one blank line between lines in the user information area.
3. Following these two blank lines, enter the file names in any order. File names must have the following characteristics:
 - They must begin in column 1.
 - The file names must be one to a line and limited to eight characters.
The list of names is sorted in ascending alphabetic order (in columns 1 thru 9) and is formatted by the HELP Facility for display on the screen.
 - Names of submenus and subtasks should have a prefix of asterisk (*) or colon (:), allowing for a length of nine characters. If an entry on a menu is the name of another menu, the entry must be preceded by an * (asterisk). For example, on the CMS MENU, the REXX entry is preceded by an *. This means that if you select the *REXX entry, HELP displays a menu of REXX commands.

If an entry on a menu is the name of a task menu, the entry must be preceded by a : (colon). For example, on the COMMANDS MENU, the TASK entry is preceded by a colon. If you select the :TASK entry, HELP displays a TASK MENU of tasks you may wish to perform.

The file name of the menu file determines the component ID for items selected from a menu. Thus, the menu file REXX HELPMENU is a menu of REXX keywords and functions. For example, when the ABBREV entry is selected from the REXX HELPMENU display, HELP looks for the ABBREV HELPREXX file and displays it.

It is possible to break down a set of commands by function and to create a menu that is a subset of a command set. A menu that is a list of the REXX built-in functions might be called FUNCTION HELPMENU. When you select an entry such as ABBREV from the FUNCTION HELPMENU, the ABBREV HELPFUNC file is displayed if it exists. This means that to have the

ABBREV entry on both the REXX menu and the FUNCTION menu, you must have an ABBREV HELPFUNC file and an ABBREV HELPREXX file.

To simplify the creation of menus that are a subset of another component, an additional control word, .MT (Menu Type), is allowed in menu files. The .MT control word defines a component to override the component derived from the file name. Therefore, you could include the following in your FUNCTION HELPMENU file:

```
.MT REXX
```

This control word tells HELP to look for a HELPREXX file, instead of a HELPFUNC file, when you select an entry from the FUNCTION HELPMENU. The .MT control word is treated as a comment if it appears in other types of HELP files.

Example of HELPMENU File Creation

Assume you want to add HELP files concerning your internal system (System 5) procedures to the HELP Facility. You would follow the procedure outlined below.

1. Choose the component name of SYS5 (System 5).
2. Create the HELP files for these procedures.
3. Following the rules given in “File Names for HELP Files” on page 225, give each procedure file a file name and file type. Thus, the file containing the information about CLASS8 (a class identifying the type of printing desired) would be named CLASS8 HELPSYS5.
4. Create a new file and give it a file name of SYS5 and a file type of HELPMENU. This file will be your menu.
5. In the first few lines of the menu, type in any descriptive information you wish to appear when the menu is displayed. Skip two lines after this information and list the names of all the files you want to access from the menu.

Your menu should look similar to the following example in Figure 65.

A file may be selected for viewing by placing the cursor under any character of the file wanted and pressing the Enter key or the PF1 key.

```
CLASS8  
CLASS7  
CLASS0  
CLASSC  
MOUNT  
DEMOUNT  
:
```

Figure 65. Sample of HELPMENU File Creation

When you specify HELP SYS5 MENU, the HELP Facility will alphabetize and stack in columns the file names and display this file. You can then work with this menu as you would with any other HELP menu.

Creating HELPTASK Files

There are a few rules you must follow when creating HELPTASK files:

1. The file must start with a section of information for the user. This information should include instructions for selecting an entry from the task menu.
2. The file must include two blank lines between the information for the user and the list of names. Any two or more consecutive blank lines indicate the end of

Tailoring the HELP Facility

the user information section and the beginning of a list of tasks. Therefore, you are limited to one blank line between lines in the user information area.

3. Following the two blank lines is the task selection section. The lines in the selection section are vertically divided into two parts:
 - a. The first part, which starts in column 1 and ends in column 24, contains the operands and options of the HELP command to be entered when the item is selected.
 - b. The second part, starting in column 25, is the task description.

For example:

```
CMS PRINT (ALL          Print a file
|_____|_____
1                25
```

When you select the task “Print a file”, the HELP file for the CMS PRINT command is displayed just as if you had entered HELP CMS PRINT (ALL on the command line.

Example of HELPTASK File Creation

Assume you want to add HELP files for your internal system tasks to the HELP Facility. You would follow the procedure outlined in the following steps.

1. Choose the task name of INTERNAL (Internal Procedures).
2. Create the HELP files for these tasks.
3. Following the rules given in “File Names for HELP Files” on page 225, give each task file a file name and file type. Thus, the file containing the information about PRINT (printing a file on a local printer) would be named PRINT HELPINTE.
4. Create a new file and give it a file name of INTERNAL and a file type of HELPTASK. This file will be your task menu.
5. In the first few lines of the task menu, type in any descriptive information you wish to appear when the task menu is displayed. Skip two lines after this information and list in columns 1 through 24 the file names of the files created for Step 2. In the columns after 25, add a description of each task.

Your task menu should look similar to the following example in Figure 66.

Move the cursor to the task that you want, then press the Enter key or the PF1 key.

```
INTERNAL PRINT          Print a file on a local printer.
INTERNAL PHONE         Display a phone list for my department.
:
```

Figure 66. Sample of HELPTASK File Creation

When you specify HELP INTERNAL TASK, the HELP Facility will display the user information and task descriptions sections of this file. You may then work with this task menu as you would with any other HELP menu.

Creating Command HELP Files

When you request HELP for a specific command, there are several options available to display only a single subset of the information available for that command. These options are BRIEF, DESCRIPT, FORMAT, PARMS, OPTIONS, NOTES, ERRORS, and RELATED. In addition, the DETAIL option displays one or

more of the **DESCRIPT**, **FORMAT**, **PARMS**, **OPTIONS**, **NOTES**, or **ERRORS** sections. For more information on these options, see *z/VM: CMS Commands and Utilities Reference*.

In creating a HELP file, you must identify the parts of the information that correspond to each option. You would do this by using the **.CS** control word to identify the beginning and end of each section of HELP text. You would note the beginning of a section by specifying **.CS xxx ON**, where *xxx* is the corresponding keyword or number for that section. After the text for the section, you would specify **.CS xxx OFF**.

For example, before the text for a **BRIEF** section, you would specify **.CS BRIEF ON** or **.CS 0 ON**. At the end of the text, you would specify **.CS BRIEF OFF** or **.CS 0 OFF**. The text included in this section is displayed when you request **BRIEF HELP** for a command.

The following tables show the format of a HELP file. Remember, you can use the numbers shown in the table on the left or the keywords shown in the table on the right.

| | |
|--------------------------|--------------------------|
| .CS 0 on | .CS BRIEF on |
| Text for BRIEF option | Text for BRIEF option |
| .CS 0 off | .CS BRIEF off |
| .CS 1 on | .CS DESCRIPT on |
| Text for DESCRIPT option | Text for DESCRIPT option |
| .CS 1 off | .CS DESCRIPT off |
| .CS 2 on | .CS FORMAT on |
| Text for FORMAT option | Text for FORMAT option |
| .CS 2 off | .CS FORMAT off |
| .CS 3 on | .CS PARMS on |
| Text for PARMS option | Text for PARMS option |
| .CS 3 off | .CS PARMS off |
| .CS 4 on | .CS OPTIONS on |
| Text for OPTIONS option | Text for OPTIONS option |
| .CS 4 off | .CS OPTIONS off |
| .CS 5 on | .CS NOTES on |
| Text for NOTES option | Text for NOTES option |
| .CS 5 off | .CS NOTES off |
| .CS 6 on | .CS ERRORS on |
| Text for ERRORS option | Text for ERRORS option |
| .CS 6 off | .CS ERRORS off |
| .CS 7 on | .CS RELATED on |
| Text for RELATED option | Text for RELATED option |
| .CS 7 off | .CS RELATED off |

For HELP files other than **HELPMENU** and **HELPTASK**, two or more consecutive blank lines will be displayed as only one blank line so that the user will see as much useful information in as little space as possible. Therefore, when creating these HELP files, multiple blank lines may be added for ease of editing without concern for how their display might affect the user.

BRIEF HELP

BRIEF HELP provides a short description of a command, its basic syntax (without options), and an example. If you wish to follow the current *z/VM* conventions, any **BRIEF HELP** sections you create would contain this information in a maximum of 10 lines and 75 columns of text.

DETAIL HELP

DETAIL HELP presents a complete description of a command, the command format, an explanation of its parameters and options, usage notes, and error information. It consists of the following sections:

DESCRIPT

should contain a description of the command.

FORMAT

should include a syntax diagram. For a complete description of the notational conventions used in z/VM syntax diagrams, see "Syntax, Message, and Response Conventions" on page 22.

PARMS

should include descriptions of the parameters of the command.

OPTIONS

should include descriptions of the options available for the command.

NOTES

should include any usage notes and examples you wish to include in the HELP file.

ERRORS

should include any responses related to the command, and a sentence on how to use HELP to get information on a specific message. If you wish to provide additional information in your own HELP files, simply add the error text that you want displayed.

RELATED HELP

RELATED HELP provides information on commands that are similar to a command presently being displayed. It is especially useful if you are looking for similar functions or tasks, but are unsure of the specific command name.

The information in a RELATED section must be in task menu format. For more information, see "Creating HELPTASK Files" on page 233. The following screen sample shows the format of the RELATED section for the ERASE command:

```
.cs 6 off
.cs 7 on
.cm (c) Copyright IBM Corporation 1990, 1995

For RELATED information on removing files or parts of files from your
virtual machine, place the cursor under the topic of your choice and
press ENTER or the PF1 key.

XEDIT DELETE (BRIEF      DELETE¢% - Removes one or more lines from
XEDIT DELETE (BRIEF      ¢%      a file while using XEDIT.
XEDIT DELETE (BRIEF
CMS ERASE (BRIEF         ERASE¢% - Removes files from your minidisk
CMS ERASE (BRIEF         ¢%      or SFS directory.
CMS ERASE (BRIEF
CP PURGE (BRIEF          PURGE¢% - Removes spool files from your
CP PURGE (BRIEF          ¢%      reader, printer, or punch.
CP PURGE (BRIEF
CMS DISCARD (BRIEF       DISCARD¢% - Removes files from "list-type"
CMS DISCARD (BRIEF       ¢%      CMS command environments, such
CMS DISCARD (BRIEF       ¢%      as FILELIST.

.cs 7 off
```

Figure 67. Format of the RELATED Section of the ERASE Command

Note: The characters `␣%` are highlighting characters, discussed on “Highlighting Words within a File.”

Creating HELP Files for Messages

You may want to create your own HELP files for messages. The file names for your HELP files must conform to the file name conventions described in “File Names for HELP Files” on page 225. The file type for HELP files for messages is HELPMMSG.

The HELPMMSG files should display the message code and message, an explanation of why you received the message, the system action, and the user response. There is no need to use the .CS format word for HELP message files. The format for HELP message files is not as structured as that of command HELP files.

Following is the suggested format for the HELP message files:

Message Code and Message

This section lists the message code number and the format and possible variations of the message.

Explanation

The explanation should give a description of why the message was received. Depending on its complexity, you may want to list reasons separately, with a plan of corrective action for each one.

System Action

Again, depending on the complexity of the results of the message, you should give the return code, system status, and status of the command that was to be processed when the message appeared.

User Response

This section should describe what action(s) must be taken to correct the problem that caused the message.

You can use an existing HELP message file in *z/VM: CMS and REXX/VM Messages and Codes* as a guide when writing your HELP message files.

Highlighting Words within a File

When you create and format your own HELP files, you may also wish to highlight certain words for emphasis. The HELP Facility lets you highlight selected portions of a file when those portions are viewed in display mode. To highlight a portion of a line, enclose that part of the line with the pairs of characters `␣|` and `␣%`. The `␣|` control character turns the highlighting on (white on a color terminal); the `␣%` control character turns the highlighting off. Everything on the line appears highlighted until the `␣%` control characters are encountered. Care must be taken when inserting the highlight control characters within a HELP file because the control characters appear as a single blank when displayed on the screen (or typed on a line-oriented terminal). This can affect the formatting of a file. For example, if the screen width is 80 characters wide and a line is 90 characters long and contains 15 control character pairs, the line will take up two display lines (because the line length is greater than the display width). However, when formatted, the text will only appear on one display line, because 15 characters have been removed.

Note: With TASK menus or RELATED sections, the selection entries are automatically displayed by HELP as highlighted lines. If you desire to highlight

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only a portion of these lines, the control characters `␣%` should be used to turn highlighting off at the desired place in the file. You can use these characters as previously explained to turn highlighting on or off elsewhere in the line. The previous example of a RELATED section shows how `␣%` turns highlighting off after selection entries.

Using Command Abbreviations

To use the shortened version or a synonym of a command name in your HELP files, you must create an abbreviation file with the proper entry (similar to a synonym file discussed in “Using Synonyms” on page 174). This file has the name of the component to which the command belongs as a file name and the file type of HELPABBR. The abbreviation file contains the command, its synonym, or the proper abbreviation for the command name, and the number that represents the shortest possible character string that is acceptable. If the number is omitted, the default is the length of the second word. The command should be in uppercase. Here is an example of an entry in an abbreviation file:

```
ACCESS  ACcess  2
```

Any of the following will generate the CMS ACCESS command HELP file:

```
HELP AC
HELP ACC
HELP ACCE
HELP ACCES
HELP ACCESS
```

An abbreviation file can also be used to provide help for command synonyms and for command or subcommand names that contain special characters other than those supported by the HELP Facility.

You should create an abbreviation file whenever a component is added to the HELP Facility. The file should be given a file mode number of 2 (for example, CMS HELPABBR A2).

If no abbreviations are supported for the component, create an abbreviation file containing a comment line, indicated by an asterisk (*) in column 1. This lets HELP search more quickly for your HELP files.

Adding Your Own HELP Components

You can create your own HELP components for commands or applications you have added to your system. First, you must decide on the name for the component and create the HELP files you wish to be displayed for that component.

To display these HELP files, simply enter:

```
HELP component_name command_name
```

where *command_name* is the name of one of your commands. This will call the HELP Facility. The file with the file name, *command name*, and file type of HELPx`xxxx`, where `xxxx` is the first four characters of the component name, is displayed.

You can also create a menu of your commands. For more information, see “Creating HELP Files” on page 225.

If you have used the parsing facility and defined your command syntax using the Definition Language for Command Syntax (DLCS), you must also create or update

the APPLID HELPABBR file. HELP uses this file to resolve synonyms, translations, and abbreviations for commands with syntax defined by using DLCS. When a user requests HELP for a command in your component, HELP uses the APPLID HELPABBR file to locate the correct DLCS file application identifier.

For example, if you have created an application for generating monthly activity reports for your department and called it the Monthly Activity System, with a DLCS application identifier of MAS and a HELP component of MONTHLY, you should add the following line to the APPLID HELPABBR file:

```
MAS      MONTHLY
```

This tells HELP that when a user enters the command HELP MONTHLY PRI, HELP should search the MAS DLCS file and recognize that PRI is an abbreviation for the PRINT command in your application. HELP then displays your PRINT HELPMONT HELP file.

Note: The APPLID HELPABBR file follows the same HELPABBR file format. This means that you could specify an abbreviation for your component. The length of the abbreviation for a component in the APPLID file must always be at least four characters for HELP to find the component HELP files.

For more information on using the parsing facility and defining command syntax using DLCS, see *z/VM: CMS Application Development Guide*.

Using HELPCONV to Create HELP Files

HELPCONV is an additional text processing tool that helps you format your HELP files. HELPCONV control words can:

- Draw boxes to enclose tables, illustrations, or text
- Place comments within a file
- Separate the sections of a HELP file
- Cause concatenation of input lines and left- and right-justification of output
- Indent only the next input line the specified number of spaces
- Indent a series of input lines the specified number of spaces
- Indent the specified number of spaces for all but the first line in a series of input lines
- Override the derived component for a menu file
- Insert blank lines between output lines
- Change the final output representation of any input character.

The HELPCONV command converts an unformatted HELP file containing SCRIPT control words into a formatted HELP file.

Note: HELPCONV control words are not all recognized by the commonly used SCRIPT command structure. In addition, the format of the operands may differ between HELPCONV and SCRIPT. Care must be taken to use the correct control words and formats for the target processor.

These control words are summarized in Table 26 on page 240. The following format words remain in the file:

```
.CS
.CM
.MT
```

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The output file has the file type \$HLPxxxx.

Where:

xxxx

Identifies the last four characters of the file type of the input file.

Table 26. HELP and HELPCONV Control Word Summary

| Control Word | Operand Format | Function | Break | Default Value |
|---------------------------|-------------------------|--|-------|--------------------------|
| .BX (Box) | V1 V2...Vn OFF | Draws horizontal and vertical lines in the blank columns around subsequent output text. | Yes | Draws a horizontal line. |
| .CM (COMMENT) | Comments | Places comments in a file for future reference. | Yes | |
| .CS (CONDITIONAL SECTION) | n ON/OFF keyword ON/OFF | Separates sections of HELP files. | Yes | |
| .FO (FORMAT MODE) | ON/OFF | Causes concatenation of input lines, and left and right justification of output. | Yes | On |
| .IL (INDENT LINE) | n +n -n | Indents only the next line the specified number of spaces. | Yes | 0 |
| .IN (INDENT) | n +n -n | Specifies the number of spaces subsequent text is to be indented. | Yes | 0 |
| .MT (MENU TYPE) | component | Correlates a component to a menu file when the component is not to be derived from the file name. For files other than menu files, .MT is seen as a comment. | Yes | |
| .OF (OFFSET) | n +n -n | Provides a technique for indenting all but the first line of a section. | Yes | 0 |
| .SP (SPACE) | n | Specifies the number of blank lines to be inserted before the next output line. | Yes | 1 |
| .TR (TRANSLATE) | s t | Specifies the final output representation of any input character. | No | |

.BX (BOX)

The HELPCONV command inserts vertical and horizontal lines in the formatted output to enclose text, illustrations, or tables. The BOX control word defines and initializes a horizontal rule for output and defines vertical rules for subsequent output lines.

Now for some examples. The first time you enter the .BX control word, specify the columns in which you want the vertical lines to appear. The highest value that can be specified for a column is 239. Entering:

```
.bx 1 10 20 30
```

results in the following output:

```
+-----+-----+-----+
```

Subsequently, entering the .BX control word with no operands causes HELPCONV to create a horizontal line with vertical bars at the columns indicated.

As HELPCONV formats each line, vertical bars are placed in the columns that you specified on .BX, unless a column is already occupied by a data character. In this case, HELPCONV does not place a vertical bar in the column.

The next example shows how you can change the vertical structure several times in succession. Entering:

```
.bx 10 20
.sp
.bx 5 25
.sp
.bx 10 20
.sp
.bx 5 25
.sp
.bx 10 20
.sp
.bx off
```

results in:

```

      +-----+
      |         |
+-----+-----+-----+
|         |         |         |
+-----+-----+-----+
      |         |
+-----+-----+-----+
|         |         |         |
+-----+-----+-----+
      |         |
      +-----+
```

You can specify a .BX control word with different columns while a box is being drawn. When this happens, HELPCONV puts in vertical ascenders for all the old columns and vertical descenders for all the new columns. The vertical rules then appear in all subsequent output lines in the designated new columns.

The .BX control word causes a break in the text.

The column specification for the .BX control word uses a different rule than is used by others in HELPCONV. In some control words, the numbers in the control word do not represent columns, but displacements.

For example, the HELPCONV control word .IN 5 means that a blank character should be expanded to enough blanks to fill up *through* column 5; the next word starts in column 6. In the .BX control word, .BX 5 means to put vertical rules *in* column 5. Thus, you can use the same numbers for a .IN control word as for a .BX control word, and the vertical bar appears in the column immediately preceding the first word on that line.

For example, consider the file called MARYHADA that looks like this:

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```
.fo off
.bx 5 43
.in 5
Mary had a little lamb,
Whose fleece was white as snow,
And everywhere that Mary went,
The lamb was sure to go.
.bx off
```

This file, when processed by HELPCONV, creates this output:

```
Mary had a little lamb,
Whose fleece was white as snow,
And everywhere that Mary went,
The lamb was sure to go.
```

.CM (Comment)

The **.CM (Comment)** control word places comments within a HELP file. Comments are useful for:

- Tracking files

This is a useful way for you to keep track of your changes to HELP files. You can include a comment that gives your name, the date and reason you created a file, and a future date when the file can be erased. HELP does not display any lines in a HELP file beginning with **.CM**. Therefore, you can include information about any alterations you have made to your HELP files in the files themselves.

- Documenting formats

If you use a special format in a HELP file that can be accessed by other people, you may want to place notes within the file explaining how to update the file.

- Place-holders

If a file is incomplete, you may want to put comments in the file where information should be added later.

For example, you could add the following to your HELP file:

```
.CM Remember to change the date.
```

You would only see the line above when you were editing the HELP file.

You can also use comments to store unique identifications for locating a specific region of the file during editing.

Note that comments cause a format break. Comment lines are retained in the formatted file and do not appear when the HELP file is displayed. They are not removed by the HELPCONV command.

.CS (Conditional Section)

The **.CS (Conditional Section)** control word was explained in “Creating Command HELP Files” on page 234. As we discussed earlier, the **.CS** control word lets you identify the specific sections of the input file that are directly associated with the HELP Facility command *options*. These options are BRIEF, DESCRIPT, FORMAT, PARMs, OPTIONS, NOTES, ERRORS, and RELATED. (See *z/VM: CMS Commands and Utilities Reference* for more information on these options.)

For HELP command processing to display the appropriate information, the control word **.CS n ON** or **.CS keyword ON** is required before each section of the HELP text.

The control word `.CS n OFF` or `.CS keyword OFF` should follow each HELP section. This statement tells HELP that the end of the section has been reached.

The keyword designating each section exactly corresponds to the HELP option that specifies the section to be displayed. These keywords cannot be abbreviated in the HELP file.

The `.CS` (Conditional Section) control word acts as a break. If blank lines or portions of a file are between the conditional sections, these lines are displayed with the DETAIL information. These conditional section lines are not removed from formatted output by the HELPCONV command.

.FO (Format Mode)

The `.FO` (Format Mode) control word cancels or restores concatenation of input lines and right justification of output lines.

When format mode is in effect, lines are formed by shifting words to or from the next line (concatenation) and by padding with extra blanks to produce an aligned right margin (justification).

Use `.FO ON` to restore default HELP formatting, including both justification and concatenation of lines. Use `.FO OFF` to cancel concatenation of input lines and justification of output lines. Subsequent text is printed *as is*. If you use the `.FO` control word with no operands, `ON` is assumed.

The `.FO` control word acts as a break. When format mode is in effect, a line without any blanks that exceeds the current line length is extended into the right margin. If a line is processed so that only one word fits on the line, the word is left justified.

If no formatting is done by HELPCONV, HELP description files *must* contain a `.FO OFF` control word before the section of text you wish to leave unformatted. `.FO OFF` should be placed as the first line of MENUS and TASK menus and before the RELATED section of a file.

For example, when `.FO OFF` is found, justification and concatenation are completed for the preceding line or lines, but the following lines are typed exactly as they appear in the file.

When `.FO ON` is found, justification and formatting are resumed with the next input line. Output from this point on in the file is padded to produce an aligned right margin on the output page.

Note: You may not want this type of formatting in all cases; you may want certain output to appear exactly as it appears in your file or when presented on the prior releases of the HELP Facility. In this case, place `.FO OFF` in the file.

.IL (Indent Line)

Use the `.IL` (Indent Line) control word to set off paragraphs or portions of text by indenting them. This often improves the readability by emphasizing certain text. The `.IL` (Indent Line) control word indents *only the next line* a specified number of characters. The line is shifted to the right or left of the current margin (which includes any indent or offset values in effect).

When successive `.IL` control words are encountered without intervening text, or when you specify positive or negative increments without intervening text, the

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indent amount is modified to reflect all the .IL values encountered; that is, the increments are added together. For example, the following two lines result in the next line being indented 10 spaces:

```
.il 4  
.il +6
```

A negative value following .IL shifts the text to the left. If the resulting amount causes a shift to the left of character position one, an error message is generated.

The .IL control word acts as a break. Therefore, text accumulated before the .IL control word is processed and displayed before the next piece of text is processed.

Because the .IL control word causes a break in text, you may find it useful to indicate the beginning of a new paragraph. For example:

```
.il 3  
This line begins a new paragraph.  
.il 3  
This line begins another.
```

These lines result in:

```
    This line begins  
a new paragraph.  
    This line begins  
another.
```

.IN (Indent)

The .IN (Indent) control word changes the left margin displacement of HELP output.

For example:

```
This line is not indented.  
.in 5  
This line is indented.  
This line is indented.
```

results in:

```
This line is not indented.  
    This line is indented.  
    This line is indented.
```

The .IN control word resets the current left margin. For example, .IN 5 sets the left margin at 6, leaving five blank spaces at the left. This indentation remains in effect for all following lines until another .IN control word is encountered (unlike the .IL control word which indents only one line of text). .IN 0 cancels the indentation, and output continues at the original left margin setting.

.IN cancels any .OF (Offset) setting (discussed on “.OF (Offset)” on page 246). The .OF 0 request cancels the current offset, but leaves the left margin specified by the .IN control word unchanged.

Because .IN causes a break, text accumulated before the .IN control word is processed and displayed, then the next text is processed.

The .IN control word effectively sets a new left margin for output text so that when you want text indented you do not have to enter blanks in front of the input

lines (as you would for regular typing). HELPCONV continues to concatenate and justify input text lines that begin in column 1, but displays the output indented the number of spaces you specify.

Here is another example:

```
These few lines of text
are formatted
with enough words
.in 5
so that you can
see how HELP's formatting
process
.in +3
continues and may
.in -6
even be reversed, by using a
negative value.
```

These lines result in:

```
These few lines of
text are formatted
with enough words
    so that you can
    see how HELP's
    formatting
    process
        continues and
        may
    even be reversed,
    by using a negative
    value.
```

In this example, the first .IN control word (.in 5) shifts output to the right five spaces so that text begins in column 6. The second .IN control word (.in +3) requests that the current indentation increase by three spaces so the left margin is now in column 9. When you supply a negative value with the .IN control word (.in -6), the margin is shifted to the left.

.MT (Menu Type)

Use the .MT (Menu Type) control word to specify the component of a menu. The .MT control word overrides the default component of a menu file. When a menu file is used, the file name of the menu generates the name of the component. This component locates the appropriate HELP file when a selection is made. For example, if you select a command, *nnnnn*, from the XEDIT menu, it is equivalent to entering, HELP XEDIT *nnnnn*. If the line .MT *xxxxx* was included in the file, selecting a command from the menu would be equivalent to entering HELP *XXXXX nnnnn*.

The .MT control word assists in the creation of menus that are a subset of another menu. For example, a menu that contains a list of REXX functions might be called FUNCTION HELPMENU. In this case, the HELP files for the individual functions are only located if they are duplicated under the file type HELPFUNC. The .MT control word defines a component ID to override that derived from the file name. The FUNCTION menu could include:

```
.mt REXX
```

This specifies that the menu contains a list of REXX commands that can be found under the file type HELPREXX.

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The MENU TYPE control word acts as a break.

.OF (Offset)

The .OF (Offset) control word indents all but the first line of a block of text. An offset differs from an indentation. Offsets do not affect the first line immediately following the control word; the second and subsequent input lines are indented the specified number of characters. This is useful when formatting numbered lists where text is blocked to the right of the number.

The .OF control word does not take effect until after the next line is formatted. The indentation remains in effect until an .IN (Indent) control word or another .OF (Offset) control word is encountered.

You can use the .OF control word within a section that is also indented with the .IN control word. Note that .IN settings take precedence over .OF; however, any .IN request causes a previous offset to be cleared.

If you want to start a new section with the same offset as the previous section, you need only repeat the .OF n request.

This control word acts as a break; subsequent text is printed at the current left margin, that is, whatever the indentation is (0, if no .IN control word is in effect).

.OF shifts all but the first line of text. You can use the .IL (Indent Line) control word to shift only the next line to the left or right of the current margin.

For example, entering the following text with .OF control words at the beginning and end of material you want to offset:

```
.of 10
```

The line immediately following the .OF control word is printed at the current left margin. All lines thereafter (until the next indent or offset request) are indented 10 spaces from the current margin setting. These two examples were processed with offset control words in the positions shown.

results in:

```
The line immediately following the .OF control word is
printed at the current left margin. All lines
thereafter (until the next indent or offset
request) are indented 10 spaces from the
current margin setting. These two examples
were processed with offset control words in
the positions shown.
```

The effect of any previous .OF request is canceled, and all output after the next line continues at the current left margin setting.

.SP (Space Lines)

The .SP (Space Lines) control word leaves blank lines between text lines of output.

For example:

```
.sp 5
```

indicates that you want to leave five lines of space in the text output. You can use multiple spaces when you want a heading or a title to stand out.

For example the lines:


```
A Love Story
.sp 5
The quick brown fox
was eager
to meet the pretty poodle.
```

results in:

```
A Love Story
```

```
The quick brown fox
was eager to meet the
pretty poodle.
```

Note: For HELP files other than HELPMENU and HELPTASK, two or more consecutive blank lines will be displayed as only one blank line so that the user will see as much useful information in as little space as possible. Therefore, when creating these HELP files, multiple blank lines may be added for ease of editing without concern for how their display might affect the user.

.TR (Translate Character)

The .TR (Translate Character) control word lets you specify the output representation of each character in the source text. For example, you could specify that all blanks in the file appear as question marks (?) in the output.

After formatting of an input source line has been completed and immediately before actual output, each character of the output line may be translated to a different output code.

Translate character specifications remain in effect until explicitly changed. Because control words are only internally processed, they are never translated in the file.

A .TR control word with no operands causes the translation table to be reinitialized and all previously specified translations to be reset.

The .TR control word does not cause a break. If you have a section of text that has translation characters in effect, followed by a .TR to reset the translations, the last line of the text may not yet have been printed. In this case, that last line is not translated.

For example:

```
.tr 40 ?
```

This causes all blanks in the file to be typed as question marks (?) on output (X'40' is the EBCDIC representation of a blank).

Changing Existing HELP Files

Because all HELP files are CMS files, you can add or delete files or menus, or change any existing file or menu. However, there are a few restrictions you must follow when tailoring HELP files; they are discussed in the following sections.

Note: If you tailor your HELP files, you should retain documentation of the changes you have made by using the .CM control word to indicate that what

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follows is a comment. You can use this documentation later to help you update your files when IBM issues updates to the HELP Facility files.

Adding HELP Files

The HELP Facility lets you:

- Add HELP files to existing components or create a new component with its own HELP files.
- Modify the command and message description files IBM provides with additional description files of your choice.
- Produce a formatted HELP file by entering the HELPCONV command and the HELP control words when creating the HELP description file.

To create your own HELP file, follow the instructions in “Creating HELP Files” on page 225.

If you add HELP files to an existing component, you should follow the naming conventions for HELP files given in this section. If you update a component, you should also update its menu. For information on menus see “Creating Menus for HELP Files” on page 232.

A file that contains control words other than .CM, .CS, .FO, or .MT and has not been processed by the HELPCONV command is identified by HELP as being unformatted or containing extra control words.

Note for SFS Users: You can create your own HELP files on minidisks or in any accessed directory. However, the system HELP disk cannot be replaced by a directory in a file pool.

Deleting HELP Files

You delete HELP files just as you delete any CMS file, by specifying ERASE *filename filetype*. If you delete a file, you should delete the file name from the menu for that component and also from any task file.

Altering Existing HELP Files

To alter a HELP file:

1. Edit the file with a text processing editor (XEDIT).
2. Add or delete as you wish, making sure that you follow the instructions given in “Creating HELP Files” on page 225.
3. When using HELPCONV on a file that contains a RELATED section, formatting should be turned off for the entire RELATED section.

You must also change any .CS keyword ON/OFF lines to use the section number instead of the keyword. For example, .CS DESCRIPT ON would become .CS 1 ON. The .CS lines for the BRIEF and RELATED sections must also be changed to .CM, or the text for those sections must be included in a different section.

Note: When using HELPCONV on a HELPTASK or HELPMENU file, formatting should be turned off for the entire file.

Changing Menus

If you add, delete or change files, you must change the associated menu. Edit the menu file (the file name is the component name; the file type is HELPMENU) and make the necessary changes. Remember, there is an eight-character limit on file

names (a nine-character limit for submenus and subtasks). Only one file name goes on a line, and you can insert file names anywhere in the list. If you delete a HELP file, you should delete from all HELPMENU files any line on which the file name occurs.

Using Full-Screen CMS

You can alter the display of your CMS session by using windowing commands to display information in boxes on top of the information currently on your screen. The following topics show you how to use windowing commands and full-screen CMS to customize your CMS session.

Chapter 10, “Introducing Full-Screen CMS,” on page 253 describes how to call full-screen CMS and use windowing functions to view information in windows on your physical screen.

Chapter 11, “Customizing Full-Screen CMS,” on page 277 describes ways in which you can change the attributes of your windows and virtual screens.

Chapter 10. Introducing Full-Screen CMS

Windowing lets you manage several pieces of information on the physical screen at the same time. Through windows, you can manipulate information as you might rearrange pieces of paper on your desk top.

Windowing support primarily consists of:

- Windows
- Virtual Screens

You can use windowing for your own purposes by using the windowing commands provided with CMS. If you wish, you may also ask CMS to use windowing for command input and output, messages, and certain other types of output. This facility is called *full-screen CMS*. When you set full-screen CMS on, special windows are automatically defined for you, such as the MESSAGE window. If, for example, you receive a message while you are editing a file, you can look at it through the MESSAGE window without leaving the file you are editing. Or, you can hold the message until you have time to look at it later. Remember that you can always use windowing for your own purposes even if you choose not to use full-screen CMS.

This section explains windowing support. It is divided into two sections: “What Are Windows and Virtual Screens?” and “Using Full-Screen CMS” on page 255.

“What Are Windows and Virtual Screens?” defines windows and virtual screens. “Using Full-Screen CMS” on page 255 discusses how CMS can have functions similar to XEDIT, such as special PF keys and full-screen input for CMS commands.

What Are Windows and Virtual Screens?

A window is an area on the physical screen where virtual screen data can be displayed and manipulated. A window lets you see what is in a virtual screen.

A virtual screen can be thought of as a *presentation space* where data can be stored. A virtual screen (vscreen for short) simulates a physical screen, but is not confined to the size of the physical screen.

When you are looking at a window, you are actually viewing a virtual screen. Depending on the size of the window and the size of the virtual screen, you may be seeing a portion of the virtual screen or the entire virtual screen. For more information on virtual screens, see the VSCREEN DEFINE command in *z/VM: CMS Commands and Utilities Reference*.

Because a window shows you a portion of a virtual screen, you can perform several operations on the data in a virtual screen, and view the results in the window connected to the virtual screen. The characteristics of virtual screens that you can manipulate include:

- Reserved areas for information such as titles and PF key descriptions
- Color and highlighting
- Options to log data into a file.

Introducing Full-Screen CMS

The following diagram illustrates the relationship between the physical screen, a window, and a virtual screen.

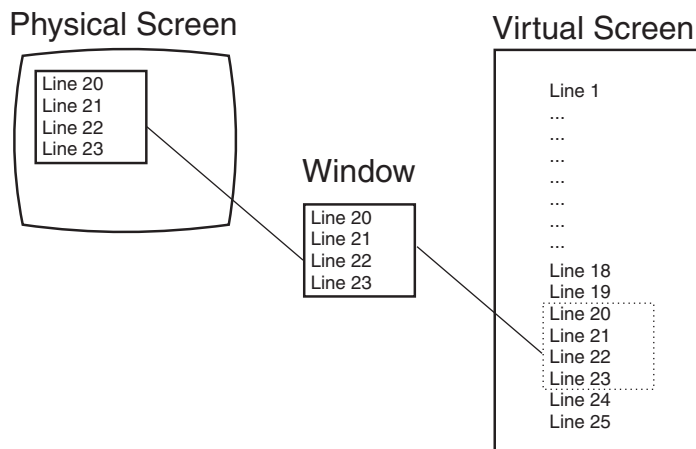


Figure 68. A Window into a Virtual Screen

When working with windows, you do not have to be concerned with the internal interactions between windows and virtual screens. However, as you become more familiar with how they work, you may find it useful to manipulate information by using the CMS commands for windows and virtual screens. Some of these commands will be discussed in this section. For more information on each command, see *z/VM: CMS Commands and Utilities Reference*.

What Can You Do with a Window?

Windows can be positioned anywhere on the screen as long as the entire window fits on the screen. The maximum size of any window is the size of the screen. You can have many windows on the screen at once. The windows can be displayed on top of each other and can overlap.

When you manipulate data in a window, you are actually manipulating the data in a virtual screen. Virtual screen data can be viewed by scrolling the window over the virtual screen.

Windows are maintained in an ordered list. You can shuffle the order by *popping* and *dropping* windows. The CMS commands to do this are WINDOW POP and WINDOW DROP.

Default windows are those that the system defines for you when you enter SET FULLSCREEN ON. Default windows can have reserved areas at the top and bottom, where system information is shown, and a data area between the reserved areas. In addition, location information may be displayed in the upper right corner of the windows.

The following section shows a sample full-screen CMS window and provides detailed information on the parts of the window.

Using Full-Screen CMS

There are many advantages to using full-screen CMS. When you set full-screen on, you can enter commands from almost anywhere on the physical screen. Your PF keys are referred to as CMSPF keys. Two of these can be used to scroll forward and backward through your CMS session to see commands you previously entered and CMS responses to these commands. To reenter any command, you do not need to retype the entire command. Instead, scroll back until the command is displayed on your screen, position your cursor on the command, type over any letter, and press Enter. The command will be re-run.

During your full-screen CMS session, messages and other output appear in windows on your physical screen and can be viewed without leaving your current work environment.

After you have logged on to the system, you can enter SET FULLSCREEN ON. Or, you can put this command in your PROFILE EXEC. Once you have entered this command, CMS is in a window and can take advantage of windowing support.

If you wish to leave full-screen CMS, just enter SET FULLSCREEN OFF. You can also enter SET FULLSCREEN SUSPEND or press the CMSPF 3 key to suspend full-screen CMS. The advantage to suspending full-screen CMS is that you can later enter SET FULLSCREEN RESUME and reenter your full-screen session where you left off. None of the default or user-defined settings for windows, virtual screens, or PF keys would be lost.

Now try some examples in full-screen CMS. Note that the examples and screens in this section are based on a physical screen size of 24 lines by 80 columns.

Enter SET FULLSCREEN ON from the command line. Your screen now looks like the example in Figure 69.

```

Fullscreen CMS 1
Columns 1 - 79 of 81 2

Ready;
-

3

PF1=Help      2=Pop_Msg   3=Quit      4=Clear_Top  5=Filelist   6=Retrieve 4
PF7=Backward  8=Forward   9=Rdrlist  10=Left     11=Right    12=Cmndline
====> 5
15:15:08 6
Enter a command or press a PF or PA key

```

Figure 69. Full-Screen CMS

Introducing Full-Screen CMS

Before you enter data, look at how your physical screen is organized.

1 Title Line

Identifies full-screen CMS. This is the CMS window. Other windows that have a title line are the MESSAGE, WARNING, and NETWORK windows.

2 Location Information

Shows the location of the window on the virtual screen. It appears in the upper right corner of the window when there may be additional virtual screen data to be displayed. For more information, see “Location Information” on page 257.

3 Data Area

Is the area of the window where CMS output is displayed. You can enter commands anywhere in this area, and you can scroll backward and forward through the displayed data.

4 PF Key Definition Area

Displays the CMSPF keys and their functions. Each function is described with a nine-character pseudonym that represents a command. You can change the function and pseudonym assigned to a key. For now, we will use the preassigned or *default* settings.

5 Command Line

Is the area of the window, in addition to the data area, where commands can be entered. This area is indicated by the large arrow.

6 Status Area

Reflects conditions or states that exist in your virtual machine. The next section gives a description of each section of the status area.

Status Area Information

The status area, located on the bottom line of the physical screen (line **6** in Figure Figure 69 on page 255), contains the following three indicators:

Clock Indicates the current time in hours, minutes, and seconds.

Message Class

Blank in the cited example, it indicates that a message was received by the virtual machine. Each time a message is received, its message class appears in this area. One of the following default message classes can be displayed:

- Message
- Warning
- Network.

Execution State

Reflects the status of the session. During a full-screen CMS session, one of the following execution state responses will appear in the status area.

Enter a command or press a PF or PA key

The system is waiting to process your next input.

Note: If you enter SET AUTOREAD ON,
Enter a command or press a PF or PA key

will be replaced by the status notice,
Enter your response in vscreen CMS

following each command.

Executing a command

The system is processing your command.

Enter your response in `vscreen vname`

The system is waiting for your reply to a request.

Note: In this message, *vname* will be replaced by the name of the virtual screen where you are to enter your response.

Scroll forward for more information in `vscreen vname`

The system is waiting for you to scroll forward to a window that is connected to the specified virtual screen.

Note: In this message, *vname* will be replaced by the name of a virtual screen.

When you receive this message, it means that new information is waiting to be added to the virtual screen. If you scroll a window connected to the virtual screen (or, in the instance when multiple windows on your screen are showing the virtual screen, if you scroll the window showing the virtual screen that is closest to the top of the ordered list of windows), the virtual screen will be updated with the new information. The virtual screen will also be updated if you enter one of the following commands: WINDOW CLEAR, VSCREEN CLEAR, WINDOW SHOW, or WINDOW HIDE. When a virtual screen is updated, this means that the oldest information in the virtual screen will be deleted from the top and the new information will be added to the bottom. This updating process will occur even if the window connected to the virtual screen is hidden or overlaid by other windows.

Whenever there is a conflict between status notices, the highest priority status notice will be displayed. In the previous list, the status notices are listed in order of priority, from highest to lowest.

Location Information

This information is specified in the following ways. You will see this data in the upper right corner of your window (see **2** in Figure Figure 69 on page 255), when there may be additional virtual screen data to be displayed.

Lines *x - y of z*

indicates the position of the window in relation to lines of virtual screen data. In other words, it shows which lines you are seeing in relation to how many more you can view.

Note: The CMS virtual screen is filled starting at the top. Lines are sequentially added until the virtual screen is full. Once the virtual screen is full, and you continue to work, older data that you have already scrolled begins to be deleted off the top of the virtual screen; new data is added to the bottom. Lines that you have not yet scrolled are not deleted.

Because old lines are deleted when new ones are added, the lines are renumbered. For this reason, the location information may appear to remain constant as you scroll forward. However, the data will change.

Columns *x - y of z*

indicates the position of the window in relation to columns of virtual screen data. Depending on the placement of the window, there can be more data to the right or left of your window.

Your Default Windows and Virtual Screens

When you are in full-screen CMS, several windows and virtual screens are automatically available to you. The windows and the virtual screens to which the windows are connected are listed in Table 27.

Table 27. Default Windows and Virtual Screens

| Window | Virtual Screen | Description |
|---------|----------------|---|
| CMS | CMS | Displays CMS and CP output |
| CMSOUT | CMS | Displays CMS and CP output while in XEDIT or the productivity aids that use XEDIT (FILELIST, RDRLIST, and so forth) |
| MESSAGE | MESSAGE | Displays user messages |
| NETWORK | NETWORK | Displays network messages |
| STATUS | STATUS | Displays status messages |
| WARNING | WARNING | Displays warnings |
| WM | WM | Provides the capability to enter windowing commands |

The examples throughout this section show only the default windows and virtual screens. You can find more information on the characteristics of these windows and virtual screens by referring to the tables at the end of Chapter 11, “Customizing Full-Screen CMS,” on page 277.

The WM Window

The WM window is a special window for window manipulation; that is, for dropping, moving, or changing the size of other windows. You can choose to display the window anytime a command or response is requested in the CMS virtual screen. There are also certain situations when the WM window is automatically displayed on your screen. Depending on how the WM window was obtained, one of the following three messages will appear in the window:

- Active window overlaid; enter a windowing command or press a PF key
- Output displayed; enter a windowing command or press a PF key
- Enter a windowing command or press a PF key

The WM window is automatically displayed on your screen in the following situations:

- When the window or windows showing the active virtual screen are not visible on the screen. (The active virtual screen is the one in which a command or response is requested.) For example, you may maximize a window that is not showing the active virtual screen so that it covers the window or windows showing the active virtual screen. Since you cannot enter commands in the active virtual screen, the WM environment is automatically entered; the WMPF keys and WM command line are available to manipulate all windows. You could then press WMPF 12 to restore the window and WMPF 3 to exit the WM environment.

When the WM window appears because the active window or windows are overlaid, the window displays the message: Active window overlaid; enter a windowing command or press a PF key.

- When you run an application that uses the CONSOLE macro to perform I/O and the following applies:
 - the CMS virtual screen is updated, or

- any virtual screen (other than CMS) is updated and a pop-type window is visible, showing the update,

you can simply drop the WM window to return to the application.

When the WM window appears while you are running an application using the CONSOLE macro and the previous two conditions are true, the window will contain the message,

Output displayed; enter a windowing command or press a PF key

If you wish, you can also pop the WM window anytime a command or response is requested in the CMS virtual screen. To do this, you would simply enter the command WINDOW POP WM or press the PA1 key (which in full-screen CMS defaults to the command WINDOW POP WM). When you pop the WM window, the window will display the message,

Enter a windowing command or press a PF key

The WM window provides you with a command line and a set of PF keys so that you can enter commands to manipulate the windows that are covering up your screen. You can enter commands with the WMPF keys, or you can enter windowing commands from the command line in the WM window.

The commands you can enter from the WM window are:

| | |
|-----------------|-----------------|
| CP | WINDOW DOWN |
| HELP | WINDOW DROP |
| PSCREEN PUT | WINDOW FORWARD |
| QUERY BORDER | WINDOW HIDE |
| QUERY HIDE | WINDOW LEFT |
| QUERY LOCATION | WINDOW MAXIMIZE |
| QUERY RESERVED | WINDOW MINIMIZE |
| QUERY SHOW | WINDOW NEXT |
| QUERY WINDOW | WINDOW POP |
| QUERY WMPF | WINDOW POSITION |
| SET BORDER | WINDOW RESTORE |
| SET LOCATION | WINDOW RIGHT |
| SET RESERVED | WINDOW SET |
| SET WMPF | WINDOW SHOW |
| WINDOW BACKWARD | WINDOW SIZE |
| WINDOW BOTTOM | WINDOW TOP |
| WINDOW CLEAR | WINDOW UP |

As you can see, the WM window is very useful because it provides you with a way to enter commands when you may not have access to the CMS command line or the CMS window.

To drop the WM window, you can press WMPF 3. This returns you to the CMS window.

As an alternative to pressing WMPF 3 to drop the WM window, you can also use the CLEAR key. The CLEAR key scrolls the topmost window forward. When there is no more data to scroll, you will exit from the WM environment.

For more information on the WM window and how to use it, see “Using the WM Window” on page 271.

Special Keys

When you are in full-screen CMS, you can access the CMSPF keys. As we discussed earlier, when the WM window is displayed on your screen, you can use the WMPF keys. The PA1 and PA2 keys also have special settings in full-screen CMS. The PA1 key pops the WM window, and the PA2 key scrolls the top window forward. In addition, the CLEAR key serves the same purpose as the PA2 key.

This section explains how to use the PA and PF keys and the CLEAR key to simplify your work and provides information on the default PF key settings.

The CMSPF Keys

Looking again at your physical screen with full-screen CMS on, let's work with the CMSPF keys.

Each key is given a pseudonym, which represents a command. These pseudonyms are listed in Table 28. In addition to pseudonyms, optional keywords indicating when the command is processed, in relation to other commands entered at the terminal, and what is displayed on the virtual screen are also listed. This optional keyword can be one of these:

ECHO The command is processed immediately when the function key is pressed. The key definition is echoed on the CMS virtual screen.

NOECHO The command is processed immediately when the function key is pressed. The key definition is not echoed on the CMS virtual screen.

DELAYED Delays the execution of the command string. When the key is pressed, the command is displayed in the input area and is not processed until you press Enter. If anything is currently in the input area, it is overlaid and no commands entered on the physical screen are processed. DELAYED is the default setting if no keyword is specified on the SET CMSPF command.

Table 28. CMSPF Key Settings

| CMSPF Key | Pseudonym | Optional Keyword | Command |
|-----------|-----------|------------------|---------------------------------------|
| CMSPF 1 | Help | ECHO | HELP |
| CMSPF 2 | Pop_Msg | NOECHO | WM WINDOW POP MESSAGE * |
| CMSPF 3 | Quit | NOECHO | SET FULLSCREEN SUSPEND |
| CMSPF 4 | Clear_Top | NOECHO | #WM WINDOW CLEAR = |
| CMSPF 5 | Filelist | ECHO | EXEC FILELIST |
| CMSPF 6 | Retrieve | | RETRIEVE |
| CMSPF 7 | Backward | NOECHO | #WM WINDOW BACKWARD CMS 1 |
| CMSPF 8 | Forward | NOECHO | #WM WINDOW FORWARD CMS 1 |
| CMSPF 9 | Rdrlist | ECHO | EXEC RDRLIST |
| CMSPF 10 | Left | NOECHO | #WM WINDOW LEFT CMS 10 |
| CMSPF 11 | Right | NOECHO | #WM WINDOW RIGHT CMS 10 |
| CMSPF 12 | Cmdline | NOECHO | VSCREEN CURSOR CMS -2 8 (RESERVED) |

For terminals equipped with 24 PF keys, PF keys 13 through 24 have the same values as PF keys 1 through 12, respectively. If you want to see the complete list of commands assigned to all the CMSPF keys, you can enter:

```
query cmspf *
```

You may have to scroll forward to see all the settings.

The CMS commands assigned to the PF keys appear as in the example in Figure 70.

```

                                Fullscreen CMS                Lines 1 - 17 of 27
                                                                Columns 1 - 79 of 81
Ready;
query cmspf *
CMSPF 01 Help      ECHO    HELP
CMSPF 02 Pop_Msg  NOECHO  #WM WINDOW POP MESSAGE *
CMSPF 03 Quit      NOECHO  SET FULLSCREEN SUSPEND
CMSPF 04 Clear_Top NOECHO  #WM WINDOW CLEAR =
CMSPF 05 Filelist  ECHO    EXEC FILELIST
CMSPF 06 Retrieve  NOECHO  RETRIEVE
CMSPF 07 Backward NOECHO  #WM WINDOW BACKWARD CMS 1
CMSPF 08 Forward  NOECHO  #WM WINDOW FORWARD CMS 1
CMSPF 09 Rdrlist  ECHO    EXEC RDRLIST
CMSPF 10 Left     NOECHO  #WM WINDOW LEFT CMS 10
CMSPF 11 Right    NOECHO  #WM WINDOW RIGHT CMS 10
CMSPF 12 Cmdline  NOECHO  VSCREEN CURSOR CMS -2 8 (RES
CMSPF 13 Help     ECHO    HELP
CMSPF 14 Pop_Msg  NOECHO  #WM WINDOW POP MESSAGE *
CMSPF 15 Quit     NOECHO  SET FULLSCREEN SUSPEND

PF1=Help      2=Pop_Msg  3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward  9=Rdrlist   10=Left     11=Right   12=Cmdline
====>
15:32:11                                Enter a command or press a PF or PA key

```

Figure 70. Displaying the CMSPF Key Settings

To scroll through your CMSPF key settings in full-screen CMS, you can use your CMSPF keys. CMSPF 7 scrolls backward one window display. CMSPF 8 scrolls forward one window display.

#WM Command

When you displayed the CMSPF key settings, you may have noticed that several of the CMSPF key settings contain the Immediate command, #WM. By using #WM in the PF key definition, you can set CMSPF keys to perform windowing commands that will be immediately processed in the CMS window. You can set your CMSPF keys without using #WM; however, your PF key commands can be processed after other commands that are pending at the time you press the PF key. You can use #WM to set PF keys to perform any of the windowing commands listed:

| | |
|----------------|-----------------|
| CP | WINDOW DOWN |
| PSCREEN PUT | WINDOW FORWARD |
| QUERY BORDER | WINDOW HIDE |
| QUERY HIDE | WINDOW LEFT |
| QUERY LOCATION | WINDOW MAXIMIZE |
| QUERY RESERVED | WINDOW MINIMIZE |
| QUERY SHOW | WINDOW NEXT |
| QUERY WINDOW | WINDOW POP |
| QUERY WMPF | WINDOW POSITION |
| SET BORDER | WINDOW RESTORE |

Introducing Full-Screen CMS

```
SET LOCATION          WINDOW RIGHT
SET RESERVED         WINDOW SET
SET WMPF             WINDOW SHOW
WINDOW BACKWARD     WINDOW SIZE
WINDOW BOTTOM       WINDOW TOP
WINDOW CLEAR        WINDOW UP
WINDOW DROP
```

You can also enter #WM commands from the command line or anywhere else in the CMS window.

Setting a CMSPF Key

You can change the setting of a CMSPF key by entering SET CMSPF followed by the PF key number, the pseudonym, optional keyword, and associated command.

For example, let's reset a PF key, PF9, to the TELL command, so whenever you want to send a message, you can press PF9, and then type a user ID or nickname and message. Enter the command:

```
set cmspf 9 Tell DELAYED TELL
```

Your CMSPF 9 key pseudonym at the bottom of the physical screen should show that it is assigned the pseudonym Tell. Now press PF9. TELL appears on the command line. Your screen should resemble the example shown in Figure 71.

```
Fullcreen CMS          Lines 17 - 29 of 29
                      Columns 1 - 79 of 81

CMSPF 15 Quit          NOECHO SET FULLSCREEN SUSPEND
CMSPF 16 Clear_Top    NOECHO #WM WINDOW CLEAR =
CMSPF 17 Filelist     ECHO   EXEC FILELIST
CMSPF 18 Retrieve     RETRIEVE
CMSPF 19 Backward     NOECHO #WM WINDOW BACKWARD CMS 1
CMSPF 20 Forward      NOECHO #WM WINDOW FORWARD CMS 1
CMSPF 21 Rdrlist     ECHO   EXEC RDRLIST
CMSPF 22 Left         NOECHO #WM WINDOW LEFT CMS 10
CMSPF 23 Right        NOECHO #WM WINDOW RIGHT CMS 10
CMSPF 24 Cmdline     NOECHO VSCREEN CURSOR CMS -2 8 (RES
Ready;
set cmspf 9 Tell DELAYED TELL
Ready;

PF1=Help      2=Pop_Msg  3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward  9=Tell     10=Left     11=Right   12=Cmdline
====> TELL_
15:34:05                      Enter a command or press a PF or PA key
```

Figure 71. Setting CMSPF 9 to TELL

For more information on the SET CMSPF command, see *z/VM: CMS Commands and Utilities Reference*.

PA1 Key

In addition to PF keys, you have a PA1 key on your keyboard that is assigned to WINDOW POP WM. The key can have different labels, depending on your terminal. If you do not have a key labeled PA1, ask your system administrator to show you the equivalent key.

When CMS is the active virtual screen, PA1 pops the WM window. As discussed in “The WM Window” on page 258, the WM window provides you with a command line and a set of PF keys for manipulating other windows.

PA2 Key

The PA2 key works in the CMS window to scroll the top window displayed on your screen forward. PA2 is very useful for controlling windows that are automatically displayed on your screen, such as the MESSAGE or WARNING window. When a MESSAGE or WARNING window appears on your screen, simply press PA2 to scroll the data forward. When there is no more data, the window disappears from your screen.

In the WM window, the PA2 key scrolls the data in the topmost window. Once you have scrolled all the data, pressing PA2 will cause you to exit from the WM environment.

Depending on your terminal type, you may not have a key labeled PA2. Again, your system administrator should be able to show you the equivalent key.

CLEAR Key

The CLEAR key performs the same function as the PA2 key. In the CMS window, the CLEAR key scrolls forward the topmost window displayed on your screen. In the WM window, the CLEAR key scrolls the topmost window, and exits the WM environment when you have scrolled all the data. In both cases, pressing the CLEAR key causes the entire screen to be rewritten.

Once again, depending on your terminal, you may not have a key labeled CLEAR. Your system administrator should be able to show you the equivalent key.

WMPF Keys

The PF keys in the WM environment are different from the CMSPF key settings. Table 29 lists the WM settings.

Table 29. WMPF Key Settings

| WMPF Key | Pseudonym | Optional Keyword | Command |
|----------|-----------|------------------|-------------------------|
| WMPF 1 | Help | NOECHO | HELP |
| WMPF 2 | Top | NOECHO | WINDOW TOP = |
| WMPF 3 | Quit | NOECHO | WINDOW DROP WM |
| WMPF 4 | Clear | NOECHO | WINDOW CLEAR = |
| WMPF 5 | Copy | NOECHO | PSCREEN PUT COPY SCREEN |
| WMPF 6 | Retrieve | | RETRIEVE |
| WMPF 7 | Backward | NOECHO | WINDOW BACKWARD = 1 |
| WMPF 8 | Forward | NOECHO | WINDOW FORWARD = 1 |
| WMPF 9 | Maximize | NOECHO | WINDOW MAXIMIZE = |
| WMPF 10 | Left | NOECHO | WINDOW LEFT = 10 |
| WMPF 11 | Right | NOECHO | WINDOW RIGHT = 10 |
| WMPF 12 | Restore | NOECHO | WINDOW RESTORE = |

Note: For terminals equipped with 24 PF keys, PF keys 13 through 24 have the same values as PF keys 1 through 12, respectively.

Messages in Full-Screen CMS

If you are already familiar with sending and receiving messages on the system, you will find the MESSAGE window helpful in full-screen CMS. Through this window, you can view messages without clearing the physical screen and your work will not be interrupted. (If you are not in full-screen CMS, the screen is cleared when you press Enter to see a message.)

Now, send a message to yourself. If you completed the previous exercise, you can press PF9 to display TELL at the command line. Complete a message to yourself, where *myuserid* is your user ID.

```
TELL myuserid This message is for myself.
```

When you receive your message, you will be notified as the:

- Terminal alarm sounds
- Status area message class indicator is updated to show that you have received a message, and the message window with the MESSAGE pops up.

Notes:

1. The MESSAGE window must contain at least one message before the window is displayed.
2. By using the CMS SET WINDOW command, you can choose whether or not you want the MESSAGE window to pop when you receive a message. The default setting is for the window to pop. For more information on the SET WINDOW command, see *z/VM: CMS Commands and Utilities Reference*.

Dropping and Popping a Window

There are many ways to manage your MESSAGE window. The easiest way is to use the PA2 key. When the MESSAGE window pops, you can press PA2 to scroll the window. When you have seen all the messages in the window, pressing PA2 again causes the window to disappear from your screen.

You can also use the WINDOW POP and WINDOW DROP commands to view the MESSAGE window or remove it from the physical screen.

The MESSAGE window is variable in size; that is, it expands as more messages are received. If you have not received any messages, the window is not displayed. Once you receive a message, the window displays and expands as you receive more messages.

Remove the previous message from your screen by entering:

```
window drop message
```

If you want to redisplay the MESSAGE window, press CMSPF 2 that is assigned to pop the MESSAGE window or enter WINDOW POP MESSAGE.

Using the Message Window

The MESSAGE window is very useful when you are editing a file and need to ask someone for information. To show you how this works, follow this example to add a new entry to your names file. First enter the command:

```
names
```

When the names panel appears on your screen, begin filling in the following information shown in Figure 72 on page 265.

```

====> NAMES (Mail panel)      File: VMUSER  NAMES  A0          <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: Rori                Notebook:
Userid:
Node: Sky

                Name: Aurora Borealis
                Phone:
                Address:
                :
                :
                :
                List of Names:
                :
                :
                :
                :
Tag:                Value:
Tag:                Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete  10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <====

====>
                                                    Macro-read 1 File

```

Figure 72. Adding an Entry to the Names File

Suppose that you suddenly realized you do not know the user ID. Move the cursor to the command line, and send a message to a friend:

```
tell babs What's Rori's user ID?
```

When your friend sends a reply to your message, the terminal alarm sounds, and the MESSAGE window appears on top of the names file. Your screen should resemble the example shown in Figure 73.

```

====> NAMES (Mail panel)      File: VMUSER  NAMES  A0          <====
Fill in the fields and press a PFkey to display and/or change your names file
Nickname: RORI                Notebook:
Userid:
Node: SKY

                Name: Aurora Borealis
                Phone:
                Address:
                :
                :
                :
+-----+
|                Messages                |
+-----+
| 15:35:16 MSG FROM VMUSER1 : Hi there!  |
| 15:48:19 MSG FROM VMUSER2 : Rori's user id is BOREAL. |
+-----+

Tag:                Value:
Tag:                Value:

1= Help      2= Add      3= Quit      4= Clear      5= Find      6= Change
7= PrevNick  8= NextNick 9= Delete  10= PrevScrn 11= NextScrn 12= Cursor
=====> Screen 1 of 1 <====

====> _
                                                    Macro-read 1 File

```

Figure 73. MESSAGE Window in the Names File

You may notice that other messages you received since you set full-screen on are shown in the MESSAGE window. This will occur if you have not cleared the window by scrolling it forward or by entering the command WINDOW CLEAR

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MESSAGE. If you have received several messages, you may need to enter the command WINDOW FORWARD to view your most recent message.

Now you can fill in the user ID. When you are finished, drop the MESSAGE window by entering the WINDOW DROP MESSAGE command. You can also use the WINDOW CLEAR MESSAGE command that scrolls the window forward past the current messages and removes the window from your screen. The WINDOW CLEAR MESSAGE command also positions the window so that when a new message is received, the message appears at the top of the window.

Once you have dropped the MESSAGE window, you can then add the entry to your names directory (with PF2) and exit the names file (with PF3).

Reentering Commands

Full-screen CMS provides you with several ways to easily reenter commands you previously entered. You press the CMSPF 6 key, which is set to RETRIEVE. You can also scroll back through your CMS session and edit and reenter commands you entered previously.

Using the RETRIEVE Key

When you first press CMSPF 6, the last command you entered is displayed on the command line. If you press it again, the next to the last line is displayed. If you continue to press CMSPF 6, the commands you previously entered display one at a time.

When the command you wish to reenter is displayed, simply press Enter to execute the command again.

Entering Commands from the Screen

You have probably noticed that while working in full-screen CMS, each time you enter a command on the command line, the command you entered remains on the physical screen. For example, if you completed the previous exercises, you have the following commands on your screen:

```
Ready;  
set cmspf 9 Tell DELAYED TELL  
Ready;  
TELL myuserid This message is for myself.  
Ready;  
window drop message  
Ready;  
names  
Ready;
```

With full-screen CMS, you can reenter any of these commands by moving your cursor to the place on the screen where the command is written, typing over at least one character, then pressing the Enter key. You can also change a word or words of a command that you previously entered, then reenter the new command.

For example, move your cursor under the command WINDOW DROP MESSAGE that currently appears on your screen. Type POP over DROP and press Enter to process the WINDOW POP MESSAGE command.

The MESSAGE window reappears on your screen as shown in Figure 74 on page 267.

```

Fullscreen CMS                               Lines 33 - 38 of 38
                                              Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;

+-----+
| 15:35:16 MSG FROM VMUSER1 : Hi there! |
| 15:48:19 MSG FROM VMUSER2 : Rori's user id is BOREAL. |
+-----+

PF1=Help    2=Pop_Msg  3=Quit    4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward 8=Forward  9=Tell    10=Left     11=Right   12=Cmdline
====>
15:45:02                               Enter a command or press a PF or PA key

```

Figure 74. Popping the MESSAGE Window

To drop the MESSAGE, move your cursor under the command WINDOW DROP MESSAGE. Re-type any letter and press Enter.

Logging Messages and Other Information

When you enter the command SET FULLSCREEN ON, by default, messages and warnings are logged for you. Messages are logged into a file with the file name and file type of MESSAGE LOGFILE; warnings are logged into WARNING LOGFILE.

To view all the messages you sent or received during your terminal session, you would simply need to XEDIT or print the file, MESSAGE LOGFILE. To view warnings you have received, you would XEDIT or print the file, WARNING LOGFILE.

If you wish, you can use the SET LOGFILE command to log your CMS output and other information into separate files that you can later XEDIT or print. If you don't want your messages or warnings to be logged, use the SET LOGFILE OFF command. For details on how to log information, see the SET LOGFILE command in *z/VM: CMS Commands and Utilities Reference*.

Working with Border Commands

You have already learned enough about full-screen CMS to work with windows. But there is another feature that makes working with windows even easier. Single character commands are typed in the corner of a window border. These commands are called *border commands*. You can scroll, move, drop or clear a window by entering a letter in the border corner.

For more information on the borders which are optional and are set on or off see the, WINDOW DEFINE and SET BORDER commands in *z/VM: CMS Commands and Utilities Reference*. Because borders frame a window, if the window is the same size as the physical screen, or if it is positioned in such a way that the borders do not fit on the physical screen, the borders are not shown. For the following examples, we will use windows with predefined borders that fit within the physical screen.

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To try some border commands, look at the MESSAGE window again. Because the MESSAGE window is variable in size, you will notice that the window size changes as we go through the examples.

First, clear the message virtual screen of all old messages by entering:

```
vscreen clear message
```

Next, send the following two messages to yourself. Type a # (the default line end character) between sentences.

```
tell * Let's see how border commands work.#tell * We'll try some!
```

Your messages now appear in the MESSAGE window. The corners of the window border are represented by a plus (+) sign.

```
Fullscreen CMS                               Lines 33 - 45 of 45
                                              Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                Messages                |
| 15:51:34 MSG FROM VMUSER : Let's see how border commands work. |
| 15:51:35 MSG FROM VMUSER : We'll try some!                       |
+-----+
-

PF1=Help    2=Pop_Msg  3=Quit    4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward 8=Forward  9=Tell    10=Left     11=Right    12=Cmndline
====>
15:51:35 Message                               Enter a command or press a PF or PA key
```

Figure 75. Looking at the Corners of a Window Border

Scrolling Forward and Backward

Now, to scroll the window forward, type the letter f in any corner and press the Enter key.

```

                                Fullscreen CMS                                Lines 33 - 45 of 45
                                                                Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                                     |
|                                                                              |
| 15:51:34 MSG FROM VMUSER : Let's see how border commands work.           |
| 15:51:35 MSG FROM VMUSER : We'll try some!                               |
|                                                                              |
+-----+

PF1=Help      2=Pop_Msg  3=Quit    4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward  9=Tell    10=Left    11=Right   12=Cmdline
====>
15:52:20 Message                               Enter a command or press a PF or PA key

```

Figure 76. Using a Border Command to Scroll Forward

Notice that the last line displayed becomes the first and only line displayed. The window size also changes because the MESSAGE window is variable in size. The window grows or shrinks depending on how much data there is to display.

Figure 77 shows the result of scrolling forward.

Now that you have viewed all the data in the MESSAGE window, if you scrolled

```

                                Fullscreen CMS                                Lines 33 - 45 of 45
                                                                Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                                     |
|                                                                              |
| 15:51:35 MSG FROM VMUSER : We'll try some.                               |
|                                                                              |
+-----+
Ready;

PF1=Help      2=Pop_Msg  3=Quit    4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward  9=Tell    10=Left    11=Right   12=Cmdline
====>
15:53:11                               Enter a command or press a PF or PA key

```

Figure 77. Result of Scrolling Forward

forward again, the window would disappear from your screen.

To scroll the same window backward, enter a b in any corner. Assuming you did not receive any new messages, the window now looks like the example in Figure 78 on page 270.

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```

                                     Fullscreen CMS                                     Lines 33 - 45 of 45
                                                                                               Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                                     |
|                                                                              |
| 15:51:34 MSG FROM VMUSER : Let's see how border commands work.           |
| 15:51:35 MSG FROM VMUSER : We'll try some!                               |
|                                                                              |
+-----+

PF1=Help      2=Pop_Msg   3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Tell     10=Left    11=Right   12=Cmdline
====>
15:53:54                               Enter a command or press a PF or PA key

```

Figure 78. Scrolling Backward through a Window Border

Scrolling Right and Left

Next, try scrolling the window to the right and left. Enter an `r` in a corner to move the window to the right. Notice the location information, Columns 48 - 70 of 70, that appears within the window. This indicates that the data you are viewing in the window represents the right-most portion of the data available for viewing.

The window now should look like the example shown in Figure 79.

```

                                     Fullscreen CMS                                     Lines 33 - 45 of 45
                                                                                               Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop wm
Ready;
window drop message
+-----+
|                                                                              |
|                                     Columns 48 - 70 of 70                     |
|                                                                              |
| der commands work.                                                         |
|                                                                              |
+-----+

PF1=Help      2=Pop_Msg   3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Tell     10=Left    11=Right   12=Cmdline
====>
15:54:28                               Enter a command or press a PF or PA key

```

Figure 79. Scrolling to the Right through a Window Border

Now, return the window to its previous position. Enter an `L` in a corner. The resulting window should now look like the example shown in Figure 80 on page 271

271.

```

                                Fullscreen CMS                Lines 33 - 45 of 45
                                                                Columns 1 - 79 of 81
window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                                     |
|                                                                              |
| 15:51:34 MSG FROM VMUSER : Let's see how border commands work.             |
| 15:51:35 MSG FROM VMUSER : We'll try some!                                |
|                                                                              |
+-----+

PF1=Help      2=Pop_Msg   3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Tell     10=Left     11=Right   12=Cmdline
====>
15:55:35                                Enter a command or press a PF or PA key

```

Figure 80. Scrolling to the Left through a Window Border

If you need to move a window somewhere else on your screen, use the *M* border command. Type an *m* in any corner of the window and then, before pressing Enter, move the cursor to the location on the screen where you want that corner. The entire window must fit on the screen or you will get an error message.

If you move a window and partially cover another window, you can use the *P* border command to pop the window on the bottom. Just enter a *p* in any corner of the bottom window, and it will put the partially-covered window on top.

For more information on using border commands, see *z/VM: CMS Commands and Utilities Reference*.

Using the WM Window

If you did not wish to use border commands to manipulate windows, you could, instead, press PA1 to pop the WM window and use the WMPF keys to perform these same functions. The WM window is useful for manipulating the topmost window showing on your screen.

If you have followed the previous exercises, the MESSAGE window is currently showing on your screen. Press PA1 to pop the WM window.

Note: If you receive a message regarding the SET FULLREAD command, disregard the message.

Your window should now look like the example shown in Figure 81 on page 272.

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```
Fullscren CMS                               Lines 33 - 45 of 45
                                           Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|               Messages               |
|                                     |
| 15:51:34 MSG FROM VMUSER : Let's see how border commands work. |
| 09:50:53 MSG FROM VMUSER : We'll try some!                    |
|                                     |
+-----+

-----
PF1=Help    2=Top      3=Quit    4=Clear    5=Copy    6=Retrieve
PF7=Backward 8=Forward  9=Maximize 10=Left   11=Right  12=Restore
Enter a windowing command or press a PF key
====> _
```

Figure 81. Popping the WM Window

If you wanted to scroll the MESSAGE window forward, one way to do so would be to use the *F* border command, as we did in the previous exercises. However, you could also use WMPF 8 to scroll the window forward.

Press WMPF 8 to scroll the MESSAGE window forward. Press it again to scroll to the bottom of the window and remove the window from your screen. Your window now should look like the example shown in Figure 82.

```
Fullscren CMS                               Lines 33 - 45 of 45
                                           Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
Ready;
vscreen clear message
Ready;
tell * Let's see how border commands work.#tell * We'll try some.
Ready;
Ready;

-----
PF1=Help    2=Top      3=Quit    4=Clear    5=Copy    6=Retrieve
PF7=Backward 8=Forward  9=Maximize 10=Left   11=Right  12=Restore

====> _
```

Figure 82. Dropping the MESSAGE Window

Now, only the WM window remains on your screen. Press WMPF 3 to drop the WM window.

You could also use other WMPF keys to manipulate windows. For example, WMPF 10 performs the same function as the *L* border command we previously used; WMPF 11 performs the same function as *R*.

Now, to show you another unique feature of the WM window, we will purposely create a situation where the window will automatically pop. First, press CMSPF 2 to pop the MESSAGE window. Your window should now look like the example shown in Figure 83.

You will see only the second message you received because in the previous

```

                                Fullscreen CMS                                Lines 33 - 46 of 46
                                                                Columns 1 - 79 of 81

window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                                     | Lines 2 - 2 of 2 |
+-----+
| 09:50:53 MSG FROM VMUSER : We'll try some! |
+-----+
Ready;
Ready;
-

PF1=Help      2=Pop_Msg   3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Tell     10=Left     11=Left     12=Cmdline
====>
16:05:32                                Enter a command or press a PF or PA key

```

Figure 83. Displaying the MESSAGE Window

exercise, WMPF 8 scrolled the window. Enter the following command on the command line:

```
set window message fixed
```

Your screen should now look like the example shown in Figure 84 on page 274.

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```

                                Fullscreen CMS                                Lines 33 - 48 of 48
                                                                Columns 1 - 79 of 81
window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                                     | Lines 2 - 2 of 2
|                                                                              |
| 15:51:35 MSG FROM VMUSER : We'll try some!                                |
|                                                                              |
+-----+

PF1=Help      2=Pop_Msg    3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Tell     10=Left    11=Right   12=Cmdline
====>
16:07:17                                           Enter a command or press a PF or PA key

```

Figure 84. Changing the MESSAGE Window

Now, enter the border command X from any corner of the MESSAGE window. The X command maximizes the window; that is, it enlarges the window to let you view more data.

Your screen should now look like the example shown in Figure 85. You will notice that the MESSAGE window is maximized, and the WM window

```

                                Messages                                Lines 2 - 2 of 2
15:51:35 MSG FROM VMUSER : We'll try some!

-----
PF1=Help      2=Top      3=Quit      4=Clear      5=Copy      6=Retrieve
PF7=Backward  8=Forward  9=Maximize 10=Left     11=Right    12=Restore
Active window overlaid; enter a windowing command or press a PF key
====>  _

```

Figure 85. WM Window

automatically popped. The WM window pops because the maximized MESSAGE window is so large that it covers up the entire CMS virtual screen. The WM window provides you with an area to enter commands to manipulate the window that is covering up your screen.

At this point, you could use the WMPF keys or enter windowing commands from the command line in the WM window to manipulate the maximized MESSAGE window. We will use one of the WMPF keys. Press WMPF 12 to restore the MESSAGE window.

The MESSAGE window should now look like the example shown in Figure 86. One way to exit from the WM environment is to press WMPF 3. This removes both

```

                                Fullscreen CMS                Lines 33 - 48 of 48
                                                                Columns 1 - 79 of 81
window drop message
Ready;
names
Ready;
window pop message
Ready;
window drop message
+-----+
|                                     Messages                    Lines 2 - 2 of 2 |
|                                                                              |
| 15:51:35 MSG FROM VMUSER : We'll try some!                               |
|                                                                              |
+-----+
PF1=Help   2=Top     3=Quit   4=Clear   5=Copy   6=Retrieve
PF7=Backward 8=Forward 9=Maximize 10=Left 11=Right 12=Restore

====> _

```

Figure 86. Restoring the MESSAGE Window

the WM and MESSAGE windows from your screen.

Even though you cannot see the MESSAGE window, you can reset it. Enter the following command to reset the MESSAGE window to its default status:

```
set window message variable
```

If you want to leave full-screen CMS, enter the command SET FULLSCREEN OFF. You can also suspend full-screen CMS by entering SET FULLSCREEN SUSPEND, or pressing CMSPF 3.

Now that you are familiar with using full-screen CMS and windows to display information, you may wish to read Chapter 11, "Customizing Full-Screen CMS," on page 277, for information on tailoring full-screen CMS and windowing support to your own particular needs.

Chapter 11. Customizing Full-Screen CMS

As you become more familiar with full-screen CMS, you may want to tailor windows and virtual screens to your special needs. First, it is necessary to understand what happens when you enter the command, SET FULLSCREEN ON.

During full-screen CMS initialization:

- All default virtual screens that you have not defined are defined, such as a virtual screen for CMS and CP output and virtual screens for messages, network messages, warnings from the operator, and status information.
- All default windows that you have not defined are defined, with the exception of the WM window. The WM window is defined when you enter the command WINDOW POP WM, when you press the PA1 key when CMS is the active virtual screen, or when the window is automatically displayed on your screen. (For more information on when the WM window is displayed, see Chapter 10, "Introducing Full-Screen CMS," on page 253.)
- All the reserved areas for the default virtual screens are written.
- Default windows are connected to the appropriate virtual screens.
- CMSPF key definitions are established.
- A connection to the IUCV Message All System Service is established and various message classes are routed to appropriate virtual screens.
- Logging is started for the MESSAGE and WARNING virtual screens. Messages are logged into the file MESSAGE LOGFILE, and warnings are logged into WARNING LOGFILE.
- The cursor is set in the CMS virtual screen.
- The CP TERMINAL BRKKEY NONE command is entered.

For more information on the SET FULLSCREEN and SET CMSPF commands, see *z/VM: CMS Commands and Utilities Reference*.

You may want to enter certain commands before entering full-screen CMS. Other commands may be entered after setting full-screen CMS on. For example, if you want to change the size of a default virtual screen or change the definition of a default window, you must enter the appropriate commands before setting full-screen CMS on. The following section teaches you how to easily change a default setting.

You should read this section at the terminal so you can try the exercises as you read the text. If you want to find out more about a command, see *z/VM: CMS Commands and Utilities Reference*.

Tailoring System Defaults

By defining windows and virtual screens before entering full-screen CMS, you can override full-screen CMS default definitions. Once in full-screen CMS, you can change features such as virtual screen reserved lines, border characters, and the CMSPF keys.

Now change the MESSAGE window and MESSAGE virtual screen to see how tailoring works. If you are in full-screen CMS, set full-screen CMS off by entering:

Customizing Full-Screen CMS

```
set fullscreen off
```

Suppose you define the MESSAGE virtual screen to be 35 lines by 70 columns, which means it will be larger than the default of 20 lines by 70 columns. We will put two reserved lines at the top (for a title) and no reserved lines at the bottom. We will also specify the default options for the MESSAGE virtual screen: SYSTEM, PROTECT, and WHITE. Enter the command as follows:

```
vscreen define message 35 70 2 0 (system protect white
```

Next, define the MESSAGE window to be 10 lines by 71 columns, which means it will be larger than the default of 8 lines by 71 columns. It will be located at line 10 and column 5 on your physical screen. (The default location is line 11 and column 3). Again, we will specify the default options: SYSTEM, VARIABLE, and POP. Enter the command as follows:

```
window define message 10 71 10 5 (system variable pop
```

Now, change the border character on the MESSAGE window to a \$ for all sides of the window border. By default, the top and bottom characters are - (dash) and the right and left sides are | (vertical bar). To do this, enter:

```
set border message on (all $
```

Here is where you set full-screen CMS on. Enter:

```
set fullscreen on
```

Next, define a field at reserved line 1 and column 1 of the MESSAGE virtual screen with a length of 70 (the number of columns in the virtual screen). This prepares the MESSAGE virtual screen for a new title by replacing the default title with blanks. Thus, you do not have to worry about trying to overlay existing data.

Enter the command:

```
vscreen write message 1 1 70 (reserved blank
```

Finally, change the title of the MESSAGE virtual screen. With the VSCREEN WRITE command, we will change the title from the default title *MESSAGES* to *My Personal Messages*. The new title begins in column 26 and is 20 characters long.

```
vscreen write message 1 26 20 (reserved data My Personal Messages
```

Now you have tailored the MESSAGE window and virtual screen to your own specifications. Another way to accomplish this would be to write an exec. Here is what the exec would look like:

```
/* EXEC to tailor the MESSAGE virtual screen and window */  
'vscreen define message 35 70 2 0 (system protect white'  
'window define message 10 71 10 5 (system variable pop'  
'set border message on (all $'  
'set fullscreen on'  
'vscreen write message 1 1 70 (reserved blank'  
'vscreen write message 1 26 20 (reserved data My Personal Messages'
```

To see your new MESSAGE window, send this message to yourself:

```
tell * Let's see what happened.
```

When the MESSAGE window is popped, you see the following:

Customizing Full-Screen CMS

```
Fullcreen CMS                               Lines 33 - 43 of 43
                                           Columns 1 - 79 of 81

Ready;
tell * This is message 9.
Ready;
tell * This is message 10.
Ready;
window maximize message
Ready;
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
                        My Personal Messages          Lines 1 - 6 of 11
                                           Columns 1 - 69 of 70

15:10:45 MSG FROM VMUSER : Let's see what happened.
15:32:43 MSG FROM VMUSER : This is message 1.
15:32:50 MSG FROM VMUSER : This is message 2.
15:32:56 MSG FROM VMUSER : This is message 3.
15:33:01 MSG FROM VMUSER : This is message 4.
15:33:08 MSG FROM VMUSER : This is message 5.

PF1=Help      2=Drop_Msg  3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Rdrlist 10=Left     11=Right   12=Cmdline
====>
16:05:47                                     Enter a command or press a PF or PA key
```

Figure 93. Changing Only the Top Border

To see just the bottom and left borders, enter:

```
set border message on (bottom = left *
```

Here is what happens to the window.

```
Fullcreen CMS                               Lines 33 - 45 of 45
                                           Columns 1 - 79 of 81

Ready;
tell * This is message 9.
Ready;
tell * This is message 10.
Ready;
window maximize message
Ready;
window restore message
*
*                               My Personal Messages          Lines 1 - 6 of 11
*                               Columns 1 - 69 of 70
* 15:10:45 MSG FROM VMUSER : Let's see what happened.
* 15:32:43 MSG FROM VMUSER : This is message 1.
* 15:32:50 MSG FROM VMUSER : This is message 2.
* 15:32:56 MSG FROM VMUSER : This is message 3.
* 15:33:01 MSG FROM VMUSER : This is message 4.
* 15:33:08 MSG FROM VMUSER : This is message 5.
+ =====

PF1=Help      2=Drop_Msg  3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward   9=Rdrlist 10=Left     11=Right   12=Cmdline
====>
16:09:49                                     Enter a command or press a PF or PA key
```

Figure 94. Changing the Bottom and Left Window Borders

SET RESERVED

Suppose you do not want to see a title in a window. With the SET RESERVED command, you can delete the title My Personal Messages from the MESSAGE window and reuse the area previously reserved for the title. Enter:

```
set reserved message 0 0
```

Here is what happens.

```

Fullcreen CMS                               Lines 33 - 47 of 47
                                           Columns 1 - 79 of 81

Ready;
tell * This is message 9.
Ready;
tell * This is message 10.
Ready;
window maximize message
Ready;
window restore message
* 15:10:45 MSG FROM VMUSER : Let's see what happ Lines 1 - 8 of 11
* 15:32:43 MSG FROM VMUSER : This is message 1 Columns 1 - 69 of 70
* 15:32:50 MSG FROM VMUSER : This is message 2.
* 15:32:56 MSG FROM VMUSER : This is message 3.
* 15:33:01 MSG FROM VMUSER : This is message 4.
* 15:33:08 MSG FROM VMUSER : This is message 5.
* 15:33:14 MSG FROM VMUSER : This is message 6.
* 15:33:20 MSG FROM VMUSER : This is message 7.
+ =====
PF1=Help    2=Drop_Msg 3=Quit    4=Clear_Top 5=Filelist 6=Retrieve
PF7=Backward 8=Forward 9=Rdrlist 10=Left    11=Right 12=Cmdline
====>
16:11:16                                     Enter a command or press a PF or PA key

```

Figure 95. Deleting a Window Title

Now, set the number of reserved lines at the top of the window to 1. Enter:
set reserved message 1 0

Your screen now looks like the example shown in Figure 96.

```

Fullcreen CMS                               Lines 33 - 49 of 49
                                           Columns 1 - 79 of 81

Ready;
tell * This is message 9.
Ready;
tell * This is message 10.
Ready;
window maximize message
Ready;
window restore message
*                               My Personal Messages    Lines 1 - 7 of 11
* 15:10:45 MSG FROM VMUSER : Let's see what h Columns 1 - 69 of 70
* 15:32:43 MSG FROM VMUSER : This is message 1.
* 15:32:50 MSG FROM VMUSER : This is message 2.
* 15:32:56 MSG FROM VMUSER : This is message 3.
* 15:33:01 MSG FROM VMUSER : This is message 4.
* 15:33:08 MSG FROM VMUSER : This is message 5.
* 15:33:14 MSG FROM VMUSER : This is message 6.
+ =====
PF1=Help    2=Drop_Msg 3=Quit    4=Clear_Top 5=Filelist 6=Retrieve
PF7=Backward 8=Forward 9=Rdrlist 10=Left    11=Right 12=Cmdline
====>
16:13:25                                     Enter a command or press a PF or PA key

```

Figure 96. Deleting a Blank Reserved Line

Now, drop the MESSAGE window by typing a D in any corner. Then, enter the following command to clear the MESSAGE virtual screen of all old messages:
vscreen clear message

SET WINDOW

By using the SET WINDOW command, you can choose whether or not you want the MESSAGE window to pop when you receive a message. The default setting is for the window to pop. In addition, the message class indicator will be updated, and the terminal alarm will sound. You can change this by setting the window to NOPOP.

To try it, enter:

```
set window message nopop
```

Now send yourself the following message:

```
tell * This window will not pop automatically.
```

After you press Enter, you will notice that your terminal alarm sounds and the message class indicator will be updated as shown in the following example. However, the window will not be automatically displayed on your screen. At this point, you would need to enter the command WINDOW POP MESSAGE to pop the window.

```
Fullscreen CMS                               Lines 49 - 55 of 55
                                              Columns 1 - 79 of 81
Ready;
vscreen clear message
Ready;
set window message nopop
Ready;
tell * This window won't pop automatically.
Ready;

PF1=Help    2=Drop_Msg  3=Quit    4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward 8=Forward  9=Rdrlist 10=Left    11=Right   12=Cmdline
====>
16:15:51 Message                               Enter a command or press a PF or PA key
```

Figure 97. Message Class Indicator

Now set the window to pop when you receive a message. Enter:

```
set window message pop
```

Send yourself the following message:

```
tell * I'll bet it pops this time!
```

Your screen displays the MESSAGE window as shown in Figure 98 on page 287.


```

Fullscreen CMS                               Lines 49 - 59 of 59
                                           Columns 1 - 79 of 81

Ready;
vscreen clear message
Ready;
set window message nopop
Ready;
tell * This window won't pop automatically.
Ready;
set window message pop
*                               My Personal Messages  Columns 1 - 69 of 70
* 16:15:51 MSG FROM VMUSER : This window won't pop automatically.
* 16:18:15 MSG FROM VMUSER : I'll bet it pops this time!
+ =====

PF1=Help      2=Drop_Msg  3=Quit      4=Clear_Top  5=Filelist  6=Retrieve
PF7=Backward  8=Forward  9=Rdrlist  10=Left     11=Right   12=Cmdline
====>
16:18:15 Message                               Enter a command or press a PF or PA key
    
```

Figure 98. MESSAGE Window

Now, clear the MESSAGE window with the C border command, or press PA2 to scroll and drop the MESSAGE window. This brings you back to the CMS window. If you want to leave full-screen CMS, enter the command: SET FULLSCREEN OFF. You can also enter SET FULLSCREEN SUSPEND, or press CMSPF 3 to suspend full-screen CMS. If you suspend full-screen CMS, you can later resume your CMS session where you left off. None of the default or user-defined settings for windows, virtual screens, or PF keys are lost.

Window and Virtual Screen Tables

If you are interested in tailoring windows or virtual screens, you may find it useful to refer to Table 30 for the full-screen CMS default characteristics for windows and Table 31 on page 289 for virtual screens.

Table 30. Default Windows

| Window | Lines | Cols | Psline | Pscol | Options |
|---------|----------|------|--------|-------|-------------------------------------|
| STATUS | 1 | Pscr | -1 | 1 | FIXED NOBORDER NOPOP NOTOP |
| CMS | Pscr | Pscr | 1 | 1 | FIXED BORDER NOPOP TOP |
| NETWORK | 8 (max.) | 71 | -12 | 7 | VARIABLE BORDER NOPOP TOP |

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Table 30. Default Windows (continued)

| Window | Lines | Cols | Psline | Pscol | Options |
|---------|----------|------|--------|-------|-----------------------------------|
| WARNING | 6 (max.) | 71 | 3 | 3 | VARIABLE BORDER POP TOP |
| MESSAGE | 8 (max.) | 71 | 11 | 3 | VARIABLE BORDER POP TOP |
| WM | 5 | Pscr | -1 | 1 | FIXED BORDER NOPOP NOTOP |
| CMSOUT | 8 | 75 | 9 | 3 | VARIABLE BORDER POP TOP |

BORDER

The window borders are displayed when possible.

In the case of the CMS window, even though the borders are on, you cannot see them because the window is the size of the physical screen.

FIXED

The number of lines in the window is always constant.

NOBORDER

The window borders are not displayed.

NOPOP

There is no effect on the window's position in the ordered list of windows when the virtual screen that the window is showing is updated.

NOTOP

The window cannot qualify as the topmost window.

POP The window is displayed on top of all other windows when the virtual screen that the window is showing is updated.

Pscol The column on the physical screen where the upper left corner of the window is placed.

Pscr Size of the physical screen.

Psline The line on the physical screen where the upper (when psline is positive) or lower (when psline is negative) corner of the window will be placed.

TOP The window may qualify as the topmost window.

VARIABLE

The number of lines in the window may vary from zero to the maximum, depending on the amount of scrollable data to be displayed.

Although the WM window is a default window, it is not defined when you enter full-screen CMS. The WM window is defined when you enter the command WINDOW POP WM, when you press the PA1 key when CMS is the active virtual screen, or when the window is automatically displayed on your screen. All default windows are SYSTEM windows; they are not lost when the system abends, or when the HX (halt execution) command is entered.

Table 31. Default Virtual Screens

| Virtual Screen | Lines | Cols | Rtop | Rbot | Dcolor | Options |
|----------------|-------|------|------|------|--------|-----------|
| WM | 1 | Pscr | 0 | 5 | White | NOPROTECT |
| STATUS | 1 | Pscr | 0 | 0 | White | PROTECT |
| NETWORK | 16 | 70 | 2 | 0 | Blue | PROTECT |
| WARNING | 4 | 70 | 2 | 0 | Red | PROTECT |
| MESSAGE | 20 | 70 | 2 | 0 | White | PROTECT |
| CMS | 120 | Pscr | 2 | 5 | Green | NOPROTECT |

Dcolor

Data color (if your terminal is equipped for color)

NOPROTECT

You can type into the window(s) connected to virtual screen; the data is not protected.

PROTECT

You cannot type into the window(s) connected to the virtual screen because the data is protected.

Pscr

Physical screen size. For terminals with a screen size of 80 columns or less, the CMS virtual screen contains 81 columns. For terminals with a screen size greater than 80 columns, the CMS virtual screen contains the same number of columns as the physical screen. The status and WM virtual screens always contain the same number of columns as the physical screen.

Rbot Bottom reserved lines

Rtop Top reserved lines

Although the WM virtual screen is a default virtual screen, it is not defined when you enter full-screen CMS. The WM virtual screen is defined when you enter the command WINDOW POP WM, when you press the PA1 key when CMS is the active virtual screen, or when the window is automatically displayed on your screen.

All default virtual screens are TYPE virtual screens. TYPE means data is moved to the virtual screen when the virtual screen is updated. In addition, all default virtual screens are SYSTEM virtual screens. SYSTEM means the virtual screen is retained when the system abends, or when the HX (halt execution) command is entered.

These CMS commands are unusable for the STATUS default virtual screen:

- SET LOGFILE
- SET VSCREEN
- VSCREEN CLEAR
- VSCREEN CURSOR
- VSCREEN GET

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- VSCREEN PUT
- VSCREEN ROUTE
- VSCREEN WAITT
- VSCREEN WAITREAD
- VSCREEN WRITE

However, the CMS commands VSCREEN DELETE and VSCREEN DEFINE may be used to replace the STATUS default virtual screen with a user version that will allow execution of these CMS commands.

Considerations When Disconnecting and Reconnecting

If you disconnect from your terminal, and later reconnect at a terminal that has a different physical screen size, you may notice certain changes.

Note: You must reconnect to a terminal with a physical screen size of at least 24 lines by 80 columns. If you reconnect to a terminal with a physical screen smaller than 24 by 80, full-screen CMS is suspended. You need to reconnect to a terminal with a larger physical screen to continue your full-screen CMS session.

Once you reconnect and resume your full-screen CMS session, certain windows and virtual screens that are the size of the physical screen are resized, relocated, or redefined to fit the dimensions of the new physical screen.

The windows and virtual screens that may be affected are those listed in the previous tables with **Pscr** under the headings Lines or Columns.

This list provides details on how these windows and virtual screens change:

- Default windows are resized to fit the new physical screen.
- Default windows you have moved are resized and relocated to the default size and location.
- User-defined windows with a size or location that cannot fit on the new physical screen are adjusted.
- Default virtual screens are redefined to fit the size of the new physical screen only if the width of the physical screen changes. Default reserved line data are rewritten in the new virtual screens. In the instance where the virtual screens must be redefined, you lose the data contained in those virtual screens.
- User-defined virtual screens are untouched.

You may also notice after you reconnect at another terminal that certain commands that depend upon the physical device characteristics temporarily reflect the characteristics of the previous terminal. For example, such commands as QUERY DISPLAY and QUERY WINDOW (in the case where the window is the size of the physical screen) do not automatically reflect the physical screen size of the new terminal.

Once you set full-screen on or enter XEDIT (or a productivity aid which uses XEDIT), the settings relating to terminal size are adjusted. Any subsequent commands you enter reflect the physical screen size of your current terminal.

Message Routing

You may also find it useful to refer to Table 32 which contains information regarding the default settings for message routing.

Table 32. Default Settings for Message Routing

| Message Class | Virtual Screen | Options |
|---------------|----------------|---------------------|
| CMS | CMS | NOALARM NONOTIFY |
| CP | CMS | NOALARM NONOTIFY |
| MESSAGE | MESSAGE | ALARM NOTIFY |
| WARNING | WARNING | ALARM NOTIFY |
| SCIF | MESSAGE | NOALARM NONOTIFY |
| NETWORK | NETWORK | NOALARM NOTIFY |

ALARM

The alarm sounds when a message is received.

NOALARM

The alarm does not sound when a message is received.

NOTIFY

The message class indicator is shown in the status area when you receive a message.

NONOTIFY

The virtual screen name is not displayed in the status area when you receive a message.

Migration Considerations

The following section provides specific information for users of CP, CMS, XEDIT, and applications, when using full-screen CMS. You should carefully review these items so that you will understand the benefits of full-screen CMS, as well as any adjustments you may need to make to fully use full-screen CMS capabilities.

CMS Considerations

- If the default CMS vscreen or the default WM vscreen are to be customized, be aware that the reserved lines cannot be altered until after the first time the vscreen is displayed. Any changes made through a VSCREEN WRITE command to the reserved area will have to be made after the screen has been displayed at least once. The reserved area includes the PF key definitions (CMSPF or WMPF) and the command line.
- CMS Immediate commands (including #WM and #CP in full-screen CMS), border commands, and windowing commands entered in the WM window do not support synonyms and cannot be translated to another language.
- When full-screen CMS is on, your PF keys are called CMSPF keys, and are set by default to perform windowing functions such as scrolling the CMS window, popping the MESSAGE window, and clearing the window on top. To override

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these settings or to make your CMSPF keys equivalent to your line-mode CP PF keys, set full-screen CMS on and then use the SET CMSPF command. Changing your CMSPF keys does not affect your CP PF keys.

- Fullscreen CMS sets CMSPF 6 to RETRIEVE. You do not have to define your own key to perform this function unless you want to override the default. Another way to retrieve commands that you previously entered is to scroll your CMS window back, so that the command you wish to reenter is visible. Then, position the cursor over the command, retype any character, and press Enter. The command is reentered. (The command echo and output are appended to the bottom of the CMS virtual screen by default).
- In full-screen CMS, virtual screen output may be logged to CMS files. Messages and warnings are logged by default. For more information, see the SET LOGFILE and SET FULLSCREEN ON commands in *z/VM: CMS Commands and Utilities Reference*. The CP SPOOL CONSOLE START command does not log full-screen CMS interactions.
- To copy a full-screen CMS screen image, use the PSCREEN PUT command. This command copies the image of your physical screen to a CMS file which you can then XEDIT or print.
- To tailor window and virtual screen attributes and extended attributes, use the VSCREEN DEFINE, SET VSCREEN, VSCREEN WRITE, and SET BORDER commands. The CP SCREEN command has no effect on the attributes of full-screen CMS output.
- To interrupt an exec that is reading data from your terminal, enter an Immediate command prefixed by # (or the current LINEND character). For example, you would enter #HT to halt entering or #HI to halt interpretation.
- In full-screen CMS, the CMS output (CMS or application messages) is not displayed immediately. When execution of the command is completed, the screen is refreshed and the CMS output that has been queued is displayed. When full-screen CMS is suspended, the CMS output displayed prior to the full-screen suspend remains in the CMS output virtual screen and is displayed when full-screen CMS is resumed.
- If you wish to enter ahead the next command (or commands) while a command is executing, do so on the full-screen CMS command line. Entering ahead in the I/O area in the CMS window is not recommended. When the currently-executing command completes, the screen is refreshed with new output written to the CMS window. This new output can overlay the command that you were in the process of entering.
- Enter the command SET VSCREEN CMS NOTYPE to suppress output to the CMS virtual screen. The CP SPOOL CONSOLE NOTERM command does not suppress full-screen CMS output.
- To enter long commands, type in the full-screen CMS I/O area. If you wish to enter long commands from the command line, drop or hide the STATUS window. For more information on the WINDOW DROP and WINDOW HIDE commands, see *z/VM: CMS Commands and Utilities Reference*. CMS command input is limited to 255 characters.
- When you press a PF or PA key, any input on the screen that has not been processed is discarded, except input that is entered on the command line. If the key that was pressed does not update the command line, then input on the command line remains unchanged.
- PF keys set to process Immediate commands (the key definition is preceded by #WM or #CP) are immediately processed. All other key definitions are stacked.
- On terminals with 80 columns, command output that is 80 characters wide cannot be completely viewed without scrolling the CMS window to the right.

This is because each line of CMS output is typically preceded by two Start Fields, one in the CMS vscreen and one that is placed at the start of each line when the physical screen is displayed. For more information on the VSCREEN WAITREAD command, see *z/VM: CMS Commands and Utilities Reference*. Therefore, the CMS window, in its default position at column one of the CMS vscreen, displays columns 1 through 79 of the output. The remaining output is viewed by scrolling to the right.

- If the virtual screen is wider than the window displaying it, then a field that wraps onto multiple lines in the virtual screen cannot be displayed as a single field on the screen. Certain keys on the terminal (ERASE EOF, DELETE, and INSERT MODE) will only work on fields on the screen, and not on the entire field in the virtual screen. In this case, the field is reconstructed using the changes on the screen and the parts of the field that are in the virtual screen (including parts that are not displayed on the screen). Note that the function of these keys will always work on fields on the screen; whenever a window vertically splits another window, these keys will not work on the entire field in the virtual screen.
- If you disconnect from full-screen CMS, when you reconnect, you may get a *MORE...* status. Press the CLEAR key to return to full-screen CMS.
- The screen is refreshed when there is a large amount of output waiting to be displayed. When a program or command issues a number of lines of output which is equal to the number of lines on the physical screen less one, the screen is refreshed.
- In full-screen CMS, there is no terminal escape character (ESCAPE), line delete character (LINEDEL), or character delete character (CHARDEL).
- CMS windowing only supports one active virtual screen on the physical screen. Other interactive virtual screens can be displayed on the physical screen, but are protected.
- The IUCV Message All System Service can stack up to 255 messages at any one time. If this limit is exceeded, any additional incoming messages are directly sent to the terminal.
- If the window, virtual screen, and physical screen do not have the same number of columns, it is recommended that you define the window with one column greater than the number of columns in the vscreen that it is displaying. This provides for the additional field definition character (Start Field) which is necessary for the proper display of the window on the screen and ensures that a maximum number of columns of virtual screen data are displayed.
- The detection of loaded programmed symbol sets occurs when full-screen CMS is initialized (SET FULLSCREEN ON), resumed (SET FULLSCREEN RESUME), or when XEDIT is called. Therefore, programmed symbol sets should be loaded prior to invoking these commands. They will then be available for use by full-screen CMS or XEDIT in displaying the screen. In line mode CMS, programmed symbol sets are detected the first time a window is displayed or when XEDIT is called. If XEDIT has not been called and the Session Services commands display a window, the check to determine if programmed symbol sets are loaded is only done the first time a window is displayed. If programmed symbol sets are loaded after the initial display of a window or after XEDIT has been called, you must call XEDIT to cause detection of the new programmed symbol sets.

CP Considerations

- To enter CP commands while in full-screen CMS, preface the commands with CP or #CP. The output from the CP commands will be displayed by full-screen

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CMS. If you wish to drop into CP during your full-screen CMS session, enter CP. This results in a cleared screen with a CP READ status. While you can then enter CP commands and receive output to your terminal, any CP commands you enter while in the CP READ status will not be displayed in full-screen CMS.

- #CP (the default LINEND character, followed by CP) is processed by full-screen CMS before it is processed by CP. In full-screen CMS, #CP is treated as a CMS Immediate command.
- If the CP SLEEP command is entered while full-screen CMS is on, it may appear that your terminal is hung. Any write to the terminal unlocks the keyboard. For more information on the CP SLEEP command, see *z/VM: CP Commands and Utilities Reference*.
- The CP SCREEN command has no effect on the attributes of full-screen CMS output. To tailor window and virtual screen attributes and extended attributes, use the VSCREEN DEFINE, SET VSCREEN, VSCREEN WRITE, and SET BORDER commands.
- The CP SPOOL CONSOLE NOTERM command does not suppress full-screen CMS output. Use the command SET VSCREEN CMS NOTYPE to suppress output to the CMS virtual screen.
- All messages classified as message class MESSAGE are displayed with headers. For more information on the ROUTE command, see *z/VM: CMS Commands and Utilities Reference*. This includes messages sent using the CP MESSAGE and the CP MSGNOH commands.
- CP does not edit lines entered in a full-screen environment. In full-screen CMS, there is no terminal escape character (ESCAPE), line delete character (LINEDEL), or character delete character (CHARDEL).

XEDIT Considerations

- XEDIT does not carry out its own I/O, but rather windowing functions are responsible for XEDIT I/O. As a result, certain CMS settings affect the XEDIT environment, especially these:
 - SET APL and SET TEXT
 - SET FULLREAD
 - SET NONDISP
 - SET REMOTE
 - SET LANGUAGE (affects Double-Byte Character Set (DBCS) display and the nondisplayable character set)
- If the BRKKEY is set to ON, and you enter full-screen CMS, the BRKKEY setting is changed to OFF. For more information, see the SET BRKKEY command in *z/VM: XEDIT Commands and Macros Reference* and the CP TERMINAL BRKKEY command in *z/VM: CP Commands and Utilities Reference*.
- In full-screen CMS, the default PA1 key for XEDIT (and the NAMES and SENDFILE commands) is COMMAND CMS WINDOW POP WM, if BRKKEY is not assigned to the PA1 key.
- Although you can define your own XEDIT virtual screen and assign to it any valid default attributes and extended attributes, XEDIT overrides these when it writes fields. You should continue to use the XEDIT SET COLOR subcommand to change the XEDIT screen attributes.

Considerations for Writing Applications

There are special considerations that apply if you are writing an application that will process when full-screen is active. For more information, see *z/VM: CMS Application Development Guide for Assembler*.

Using Execs and Programs in CMS

The CMS facilities known as the REXX/VM interpreter, EXEC 2, and CMS EXEC processors or interpreters let you create exec files. Using exec files, you can execute many commands and programs by entering a single command from your terminal; in effect, this is like writing your own CMS commands.

In the following topics, the exec facilities are described in general terms. You will be acquainted with the expressions used in exec files, and how execs function in CMS.

Also in these topics, you will learn how to create and run programs in the CMS environment.

Chapter 12, “Introduction to the Exec Processors,” on page 299 presents a survey of the basic characteristics and functions of exec facilities available to you.

Chapter 13, “Creating REXX Execs,” on page 303 describes how to create and use REXX execs. Sample execs are provided for you to try.

Chapter 14, “Creating a PROFILE EXEC,” on page 307 describes how you can create your own PROFILE EXEC.

Chapter 15, “Commands Used with REXX Execs,” on page 309 provides examples of using some CMS commands with REXX execs.

Chapter 16, “Developing Programs in CMS,” on page 319 shows you how to create, compile and run your programs in the CMS environment, using XEDIT as your tool.

Chapter 12. Introduction to the Exec Processors

The following EXEC processors and interpreters are available:

- The REXX/VM interpreter handles programs which are written in the REstructured eXtended eXecutor (REXX) language.
- The EXEC 2 processor handles EXEC 2 programs.
- The CMS EXEC processor handles CMS EXEC programs.

Note: EXEC 2 programs and processing are similar to those of the CMS EXEC. REXX programs are *not* similar to those of EXEC 2 or CMS EXEC.

REXX/VM Interpreter

The REXX/VM interpreter is an interpretive command and macro processor. It coexists with the CMS EXEC and EXEC 2 processors. REXX is functionally a superset of CMS EXEC and EXEC 2, but it uses a completely different language and syntax. There is no compatibility between REXX programs and those of CMS EXEC or EXEC 2.

z/VM differentiates REXX programs from CMS EXEC or EXEC 2 programs by their first statement. The first statement of every REXX program must be a comment. A comment begins with a `/*`, and ends with an `*/`, with anything you want in between. For example:

```
/* This is a comment. */
```

The REXX/VM interpreter functions are easy to learn and use. They use a general-purpose programming language, called REXX, much like that used by PL/I and other programming languages. REXX instructions use structured programming concepts like IF/THEN/ELSE, SELECT, DO WHILE, and so forth, which let you write programs while using words much like those you use to think and communicate.

Other features of the REXX/VM interpreter and the REXX language are:

- It has a number of useful built-in functions you can use in your programs.
- Programs can be written in mixed case with free form layout (which makes them easier to read and follow).
- It has extensive mathematical capabilities (you can even use it as a desk calculator if you wish).
- There is no limit (except the lesser of 16MB or the user's virtual storage size) to the length of manipulated data.
- It is easy to find syntax errors in a program. The REXX/VM interpreter processes programs line-by-line and word-by-word, without translating them to another form (no compiling). Thus, when there is a syntax error, the place where it occurred is clearly indicated.
- You can use the TRACE instruction to see how the REXX/VM interpreter is interpreting a particular instruction. This should help you in debugging.

These books tell you how to use the REXX/VM interpreter and the REXX language:

Exec Processors

- *z/VM: REXX/VM User's Guide* is a step-by-step, tutorial-like, guide to writing REXX programs. It is intended for new users.
- For more information on the REXX language and the REXX/VM interpreter, see *z/VM: REXX/VM Reference*. It is intended for all users.

As a CMS user, you should become familiar with the REXX/VM interpreter and use it often to tailor CMS commands to your own needs, as well as to create your own commands. The REXX/VM interpreter and the EXEC 2 interpreter can be used by the editor for XEDIT macro processing support.

EXEC 2 Processor

The EXEC 2 processor handles EXEC 2 programs. These EXEC 2 programs and processing are similar to CMS EXEC programs and processing.

EXEC 2 differs from CMS EXEC in these ways:

- EXEC 2 has extended string manipulation functions.
- EXEC 2 has arithmetic functions for multiplication and division.
- EXEC 2 has extended debugging facilities.
- EXEC 2 supports user defined functions and subroutines.
- EXEC 2 lets CMS user programs manipulate EXEC 2 variables.
- There is no 8-byte token restriction. Statements are composed of *words* of up to 255 characters each.
- Commands can be entered from EXEC 2 either to CMS or to specified *subcommand* environments (for example, XEDIT).

The exec control statements for EXEC 2 are part of the CMS General-Use programming interface. To obtain a list of all the control statements, enter:

```
help exec2 menu
```

To obtain information on a particular control statement, enter `help exec2` followed by the name of the statement. For example, to get information on the `&TRACE` control statement, enter:

```
help exec2 &trace
```

CMS EXEC Processor

A CMS EXEC procedure is a CMS file that contains executable statements. The statements can be CMS or CP commands or exec control statements. The execution can be conditionally controlled with additional exec statements, or it can contain no exec statements at all. In its simplest form, an exec file can contain only one record, have no variables, and expect no arguments to be passed to it. In its most complex form, it can contain thousands of records and can resemble a program written in a high-level programming language.

Two CMS commands create exec files. One is `LISTFILE`, which can be run with the `EXEC` option; it creates a file named `CMS EXEC`. The `CMS/DOS` command, `LISTIO`, creates an exec file named `$LISTIO EXEC`, which creates records for each of the system and programmer logical unit assignments. For more information on the `LISTIO` command and the `$LISTIO EXEC`, see *z/VM: CMS Commands and Utilities Reference*.

The exec control statements for EXEC are part of the CMS General-Use programming interface. To obtain a list of all the control statements, enter:

```
help exec menu
```

To obtain information on a particular control statement, enter `help exec` followed by the name of the statement. For example, to get information on the `&STACK` control statement, enter:

```
help exec &stack
```

Note: The module that contains the CMS EXEC processor (DMSEXT) is loaded as a nucleus extension with the PERMANENT attribute, so it cannot be inadvertently dropped by a CMS exec.

Relationship of the Exec Interpreters

The REXX/VM, EXEC 2, and CMS EXEC interpreters have their own distinct keywords and syntax. So for example, you cannot place EXEC 2 statements within a REXX program.

The three interpreters coexist, so exec programs will continue to correctly process with no user modifications, regardless of the language. To run CMS EXEC programs as EXEC 2 programs, you must convert the exec programs to EXEC 2 programs.

While you may not use, for example, EXEC 2 language statements in an exec to be interpreted by the REXX/VM interpreter, nor REXX language statements in an exec to be interpreted by the EXEC 2 interpreter, any exec can call another exec, regardless of the language. Thus an EXEC 2 procedure may be run from within a CMS EXEC procedure, and vice versa.

To allow greater user flexibility with EXEC 2 and the Procedures Language REXX/VM Interpreter, automatic cleanup of an active OS or VSAM environment is not performed at command completion, as it is in the CMS EXEC processor. It is your responsibility to ensure that OS and VSAM cleanup functions are performed when needed. You can accomplish this by using the EXECOS command. For more information on the EXECOS command, see *z/VM: CMS Commands and Utilities Reference*.

The CMS EXEC processor invokes OS and VSAM cleanup after the execution of any CMS command. Consequently, any CMS EXEC used resets the OS and VSAM environments if it contains a CMS command that is processed.

Running Execs

Exec programs may reside in exec files (with a file type of exec), on a minidisk or SFS directory, or in storage as storage resident execs, and can be used through the EXEC command.

When an exec file is used, CMS examines the first statement of the exec file to determine which of the following exec processors must be called to handle it:

- REXX/VM interpreter
- EXEC 2 processor
- Compiled REXX
- EXEC processor.

Exec Processors

For more information on how CMS handles running execs, see *z/VM: REXX/VM Reference*.

Attributes of Exec Files

Exec files can have any file name that is valid for a CMS file name. EXEC 2 and REXX files have file type `exec` for files that are run from the CMS environment, and the file type `XEDIT` for files used as XEDIT macros.

REXX or EXEC 2 files can be either F or V format. The maximum line length for lines read from the console is 130; for lines read from the stack it is 255.

Chapter 13. Creating REXX Execs

A REXX file, like a CMS EXEC or EXEC 2 file, has a file type of EXEC. You can create exec files with the CMS editors by using CMS commands or programs, or by punching cards. When you create a file (file type of exec) using XEDIT, records are, by default, variable-length with a logical record length (lrecl) of 130 characters and case is upper. The CMS EXEC Facility can process variable-length files of up to 130 characters. EXEC 2 can process variable-length files of up to 255 characters. The REXX/VM interpreter processes files of any logical record length. For example, to create an exec file, enter:

```
xedit new exec
```

If you have a fixed-length file that you want converted to a variable-length file, then you can edit the exec file and enter the XEDIT subcommand:

```
recfm v
```

Or, you can enter the COPYFILE command:

```
copyfile new exec a (recfm v
```

Whenever possible, you should use variable-length exec files.

If you use XEDIT to create a CMS EXEC or an EXEC 2 exec, you cannot enter the exec statements in mixed case. Enter the XEDIT subcommand:

```
set case uppercase
```

Running Your Exec Files

Exec procedures are run when you enter the file name of the exec file. You can precede the file name on the command line with the CMS command, EXEC. For example:

```
exec test
```

Where:

TEST

specifies the file name of the exec file.

For example, an exec named THANKYOU would be processed when you entered either:

```
exec thankyou or thankyou
```

You must precede the exec file name with the exec command when you:

- Run an exec from CMS EXEC and EXEC 2 execs.
- Run an exec from REXX with ADDRESS COMMAND. (The default is ADDRESS CMS, which means exec need not be specified.)
- Run an exec from a program.
- Call a REXX exec recursively.
- Have the implied exec (IMPEX) function set OFF for your virtual machine.

REXX Execs

The implied exec (IMPEX) function is controlled by the SET command. It lets you treat exec files as commands so that you only must enter the file name of the exec program. The default setting for IMPEX is ON; you almost never need to change it. To find out what the IMPEX setting is, enter:

```
query impex
```

If the response is:

```
IMPEX = OFF
```

this means that the exec command must precede the exec file name to run an exec procedure. To set IMPEX to ON, so that you only need to enter the exec file name, enter:

```
set impex on
```

An exec procedure having a synonym defined for it can be run by its synonym if the implied exec (IMPEX) function is on. You may use the synonym for an exec program within a REXX program.

One exec file that you never have to specifically process is a PROFILE EXEC. It automatically runs after you IPL CMS, when your directory or minidisk with a mode of A is accessed. PROFILE EXECs are discussed in Chapter 14, "Creating a PROFILE EXEC," on page 307.

Sample REXX Execs

Here are two sample REXX execs to give you some flavor of the language.

The sample exec in Figure 99 copies a file from any directory or minidisk to the directory or minidisk accessed as file mode A. Note that the exec uses the required first comment statement as a description of its function.

```
/* Copies a file from any accessed directory or minidisk to file mode A */
arg fn ft fm extra
if fn = '?' then signal tell
if extra ~= '' | ft = ''
then do
  parse source . . me .
  say 'Invalid command for 'me' exec.'
  exit
end
if fm = '' then fm = '*'
'COPYFILE' fn ft fm '= = A'
exit rc
tell:
parse source . . me .
say 'This exec,' me', copies the given file to'
say 'file mode A and passes back the return'
say 'code from copyfile'.
exit 100
```

Figure 99. Sample REXX Exec - Copy a File

The sample exec in Figure 100 on page 305 sends the file to the user ID that you specify. Note that in REXX execs you do not need to preface a CP command with CP.

```

/* This exec sends a file to a user */
parse source . . me .
arg user fn ft fm extra
if fn = ''
  then
  do
    say 'Command is:' me 'user fn ft <fm>'
    exit 100
  end
if ft = '' | extra ^= ''
  then
  do
    say 'Invalid' me 'message'
    exit 101
  end
'SPOOL PUNCH TO' user 'CLASS A'
if rc ^= 0
  then
  do
    say user 'is not a valid user ID'
    exit 102
  end
if fm = '' then fm = 'A'
'PUNCH' fn ft fm
retsave = rc
'SPOOL PUNCH TO * CLASS A'
if retsave ^= 0
  then
  do
    say 'Error' retsave 'from punch (while in' me)''
    exit 103
  end
'MSG' user 'I have punched you my file' fn ft fm
exit

```

Figure 100. Sample REXX Exec - Send a File

For more information on REXX language, see *z/VM: REXX/VM User's Guide* and *z/VM: REXX/VM Reference*. For more information on CMS functions that you can use from execs, see *z/VM: CMS Application Development Guide for Assembler*.

Chapter 14. Creating a PROFILE EXEC

A PROFILE EXEC is different from other execs. It has the special file name, PROFILE, and it is automatically processed whenever you enter *IPL CMS* (or if you have automatic IPL). Your PROFILE EXEC contains the CP and CMS commands that you enter at the start of every terminal session. You can write your PROFILE EXEC for any of the exec interpreters. It usually contains commands that:

- Access SFS directories or minidisks
- Describe your terminal and printer
- Set up your PF keys
- Describe macro and text libraries that you commonly use
- Set your screen colors (color terminals only)
- Run your synonym table
- Make frequently used execs storage resident.

A PROFILE EXEC written with REXX statements might look like this:

```
/* sample profile */
'ACCESS VMSYSU:JONES.TOOLS B'      /* Access a local tools directory */
'SET RDYMSG SMSG'                  /* Short form of ready msg */
'SYNONYM MYSYN'                    /* Run my synonym table */
'GLOBAL MACLIB OSMACRO PRIVMAC'    /* MACRO libraries */
'GLOBAL TXTLIB PRIVLIB'           /* TEXT libraries */
'SET PF1 IMMED RDRLIST'            /* PF1 key set to RDRLIST */
'SET PF6 RETRIEVE'                 /* PF6 key RETRIEVE function */
'SET PF11 IMMED FILELIST'          /* PF11 key set to FILELIST */
'EXECLOAD FILELIST EXEC (SYSTEM'   /* Make FILELIST, RECEIVE, */
'EXECLOAD RECEIVE EXEC (SYSTEM'    /* and EXECUTE storage */
'EXECLOAD EXECUTE XEDIT (SYSTEM'   /* resident execs. */
```

Figure 101. Sample PROFILE EXEC

Do not use the CP DEFINE STORAGE command in your PROFILE EXEC. It resets your virtual machine and you would have to IPL CMS again.

If you used the AUTOLOG or XAUTOLOG command to log on and IPL a CMS virtual machine, and variable AUTOLOG data was passed, the SYSPROF EXEC or the PROFILE EXEC (or any other exec or module called by it) may destroy the AUTOLOG data (for example, by using DESBUF). See *z/VM: CMS Planning and Administration* for more information about the SYSPROF EXEC and about AUTOLOG data being destroyed in this situation.

You can enter the following command at any time to run your PROFILE EXEC:

```
profile
```

If you make changes to your PROFILE EXEC during your terminal session, the changes will not be in effect until you run your profile again.

Should you want to suppress the processing of your PROFILE EXEC, the first command you enter after you enter the IPL command is the CMS ACCESS command with the NOPROF option specified. For example, if you enter:

```
ipl cms
```

PROFILE EXEC

The system response may be:

```
z/VM Vn.n.n   yyyy-mm-dd hh:mm
```

To suppress the processing of your PROFILE EXEC, you enter:

```
access (noprof
```

When the system responds with

```
Ready;
```

You have loaded CMS and accessed file mode A without running your PROFILE EXEC.

You can find more information about the CMS ACCESS command in *z/VM: CMS Commands and Utilities Reference*.

The EXECLOAD command makes a particular exec storage resident. The exec remains storage resident for the entire session and consequently, does not need to be reloaded each time it is invoked. For example, if you are a frequent user of the DIRLIST, FILELIST, MACLIST, NOTE, NAMES, RDRLIST, SENDFILE, and TELL commands, you might consider making the following execs storage resident:

| | | | | | |
|----------|-------|----------|-------|------------|-------|
| ALIALIST | EXEC | PROFDLST | XEDIT | RECEIVE | XEDIT |
| AUTHLIST | EXEC | PROFFDAT | XEDIT | SENDFILE | EXEC |
| DIRLIST | EXEC | PROFFLST | XEDIT | TELL | EXEC |
| DISCARD | EXEC | PROFFSEA | XEDIT | X\$DLST\$X | XEDIT |
| EXECUTE | XEDIT | PROFFSHR | XEDIT | X\$FLST\$X | XEDIT |
| FILELIST | EXEC | PROFMLST | XEDIT | X\$MLST\$X | XEDIT |
| MACLIST | EXEC | PROFNOTE | XEDIT | X\$NAME\$X | XEDIT |
| NAMES | EXEC | PROFPEEK | XEDIT | X\$NDIR\$X | XEDIT |
| NOTE | EXEC | PROFRLST | XEDIT | X\$PEEK\$X | XEDIT |
| PEEK | EXEC | PROFSEND | XEDIT | X\$SEND\$X | XEDIT |
| PROFALIA | XEDIT | RDRLIST | EXEC | | |
| PROFAUTH | XEDIT | RECEIVE | EXEC | | |

If your installation has a CMS installation saved segment containing any of these execs, you would not want to load them into storage. Frequently used execs are loaded into a saved segment so that users can share the same running copy of the exec. To use the execs in a CMS installation saved segment, you can load the saved segment when you IPL CMS, or you can issue SET INSTSEG ON.

To find more information about using the CMS installation saved segment, see the IPL command in *z/VM: CP Commands and Utilities Reference* and the SET INSTSEG, QUERY INSTSEG, and EXECMAP commands in *z/VM: CMS Commands and Utilities Reference*.

Chapter 15. Commands Used with REXX Execs

These are some of the commands used along with REXX execs. Command formats, descriptions, and usage notes for these commands can be found in *z/VM: CMS Commands and Utilities Reference*.

EXECDROP

Removes execs and macros from storage, or discontinues execs and macros in a saved segment.

EXECIO

Manages movement of lines between files or virtual devices, and the program stack or a variable. Also causes the processing of CP commands and recovers resulting output.

EXECLOAD

Loads an exec into storage.

EXECMAP

Lists execs and macros in storage and in active saved segments.

EXECOS

Resets the OS and VSAM environments under CMS without returning to the interactive environment.

EXECSTAT

Provides the status of a specified exec.

GLOBALV

Sets, maintains, and retrieves a collection of named variables.

IDENTIFY

Displays or stacks user ID, node ID, RSCS ID, date, time, time zone, and day of the week.

IMMCMD

Establishes or cancels Immediate commands from an exec.

LISTFILE

Lists information about CMS files in accessed SFS directories or on minidisks.

NAMEFIND

Displays or stacks information from a NAMES file (default *userid* NAMES).

PIPE

Invokes CMS Pipelines to process a series of programs or stages. A series of stages is called a pipeline. Each stage manipulates or handles data by:

- Using the stage commands and pipeline subcommands provided by CMS Pipelines. Several of the stage commands allow you to get and set REXX variables.
- Extending the set of CMS Pipelines stage commands and allowing you to write your own stage commands in the REXX language.

QUERY

Requests information about a CMS virtual machine.

RDR

Generates a return code and either displays or stacks a message that identifies the characteristics of the next file in your virtual reader.

Commands for REXX Execs

SET EXECTRACE

Sets tracing ON or OFF for your REXX exec or EXEC 2 exec.

SET INSTSEG

Sets the access to the CMS installation saved segment to ON or OFF and sets the file mode where it is searched.

VSCREEN WAITREAD

Updates the virtual screen with data in the virtual screen queue, refreshes the physical screen, and waits for the next attention interrupt. This is entered from an exec.

XEDIT

Initiates XEDIT to create or modify a file.

These Immediate commands can be used along with REXX execs:

- HI (Halt Interpretation)
- TS (Trace Start)
- TE (Trace End)

The following exec samples show you how you can use some of the CMS commands with your REXX execs. You can use CMS commands in your execs to operate on your SFS files. Callable Services Library (CSL) routines are also available for use with REXX execs to operate on SFS files and minidisk files. For more information, see *z/VM: CMS Application Development Guide for Assembler*.

Using EXECIO

The EXECIO command manages movement of lines between files or virtual devices and the program stack or a variable. It also causes the processing of CP commands and recovers resulting output.

Note: For manipulating CMS files, consider using Callable Services Library (CSL) routines instead of EXECIO. CMS file subsystem routines provide more functions than EXECIO. For more information on using CSL routines, see *z/VM: CMS Callable Services Reference* and *z/VM: CMS Application Development Guide*. You may also want to consider using the PIPE command instead of EXECIO. For more information on the PIPE command, see *z/VM: CMS Pipelines User's Guide*.

This explanation is not intended to teach you all you need to know to write REXX programs. For more information on REXX language, see *z/VM: REXX/VM User's Guide*.

The example in Figure 102 on page 311 illustrates how you might use EXECIO commands in a REXX program to read a CMS file from the program stack, then print that file, 60 lines per page, with the output indented 15 spaces.

If the CMS file in this example resides in a SFS file pool, it must either be not shared or shared read-only. Otherwise, this example may not work properly.

This is not the only, nor necessarily the best, way to accomplish the results. However, it does show some uses of the EXECIO command within a REXX program. The statement numbers in the left margin of the sample reference the explanations following the sample, and are not a part of the program.

Because the program reads, prints, and indents, you can name it RDPRIND EXEC (the file type must be EXEC).

```

1. /* This program reads, prints, and indents */
2. trace n
3. 'EXECIO 1 PRINT (CC 1 STRING'
4. arg filename filetype filemode .
5.   do until execiorc ^=0
6.     'EXECIO 100 DISKR' filename filetype filemode '(STEM' line.
7.     execiorc=rc
8.     do i=1 to line.0
9.       'EXECIO 1 PRINT (STRING           'line.i
10.      if i//60=0
11.        then 'EXECIO 1 PRINT (CC 1 STRING'
12.      end
13.    end
14. 'CLOSE PRT NAME' filename filetype
15. exit

```

Figure 102. The RDPRIND EXEC, an Example of the EXECIO Command Used in a REXX Exec

Following are numbered explanations of each statement in the RDPRIND EXEC:

1. The first statement in a REXX program must always be a comment (`/* comment */`).

Note how we use the comment to tell what the program does.

2. Trace all host commands that return a negative return code.
3. This is a CMS command to write a line to the printer (space to top of new page).
4. Read in the passed parameters, assigning values to file name, file type, and file mode. The `.` at the end of this line is a place holder, used here to ignore any passed data after the third parameter.
5. Starts a DO loop. This statement says that the instructions following the DO, up to the END statement that is paired with DO (line 13), should be repeated until the return code from EXECIO (saved in EXECIORC) is not 0.
6. This is a CMS command to read 100 lines from the file called *filename filetype filemode*. Those values are set by the ARG command in line 4. The number of lines actually read is assigned to variable `line.0` and the actual file lines are assigned to the variables `line.1`, `line.2`, and so on.
7. The return code from the previous host command (in this case from EXECIO on line 6) is saved in the special variable named RC. This statement saves the return code in a variable called EXECIORC so it can be checked later.
8. Another DO loop starts here, similar to the one started in line 5. In this loop, the set of instructions between the DO and its END (on line 12) will be repeated while I is incremented from 1 until it is equal to the number of lines returned from EXECIO.
9. This is a CMS command to write a line to the printer. The blanks will be preserved and the value of `line.i` will be placed on the end of the command before it is passed to CMS.

Commands for REXX Execs

10. This is a conditional check. It asks if the remainder of *i* divided by 60 is equal to 0. This will be true when *i* equals any multiple of 60.
11. If the previous condition checked (in line 10) is true, then this line is processed. If it is processed, it spaces the printer to the top of a new page (the same command was used in line 3).
12. This END ends the DO loop started in line 8.
13. This END ends the DO loop started in line 5.
14. This is a CP command to close the printer and name the file. Its file name and file type will be set based on the values set in line 4.
15. This statement ends the regular processing.

Now, to cause the exec to read and print a CMS file named TESTFILE DATA A, enter:

```
rdprind testfile data a
```

TESTFILE, DATA, and A are substituted into the program for file name, file type, and file mode respectively.

Using EXECDROP, EXECLOAD, EXECMAP, and EXECSTAT

The EXECLOAD command loads an exec into storage and prepares the exec for processing. The following command loads TPHONE EXEC into user free storage:

```
execload tphone exec a
```

When the exec is subsequently run, the storage resident exec is processed. This eliminates the need for CMS to reload the exec into storage each time the exec is run. The exec remains storage resident during the entire session or until specifically dropped by the EXECDROP command. Be aware that if you make any changes to the exec file on your minidisk or SFS directory, the storage resident copy of the exec remains unchanged. To have the new version processed, you will have to do one of these:

- Drop the exec from storage (using EXECDROP).
- Drop the exec from storage (using EXECDROP) and reload it (using EXECLOAD).
- Load the new version (EXECLOAD with the PUSH option).

Note: Before loading an exec into storage, you should determine whether you are using the CMS installation saved segment and if there is another exec with the same name already in storage. If so, you should do one of these:

- Specify the PUSH option on the EXECLOAD command.
- Use the EXECDROP command to drop your access to that exec and then enter the EXECLOAD command, or
 - If EXECMAP shows that the exec has the shared attribute, then use the SET INSTSEG OFF command to discontinue use of the CMS installation saved segment and then enter the EXECLOAD command, or
 - If the exec resides in a logical segment (that is, the SEGNAME field returned from EXECMAP for that exec name is non-blank), then enter a SEGMENT PURGE for the logical segment containing the exec(s).

To verify the existence of the TPHONE EXEC in storage and on your minidisk or SFS directory, you can use the EXECSTAT command. For example:

```
execstat tphone exec
```

gives a return code of 0 in register 15, verifying that the exec is storage-resident. The EXECMAP command lists the storage-resident execs.

Entering execmap returns the following if TPHONE EXEC is the only storage-resident exec:

| Name | Type | Usage | Records | Bytes | Attribute |
|--------|------|-------|---------|-------|-----------|
| TPHONE | EXEC | 0 | 15 | 512 | USER |

Should you decide that you no longer require an exec to be storage resident, you can delete it from storage with the EXECDROP command. For example, the following command deletes the TPHONE EXEC from storage:

```
execdrop tphone exec
```

Note: When an EXEC or XEDIT macro has been EXECLOADED into storage and the EXEC or XEDIT macro is invoked through a CMSCALL on which a FBLOCK is supplied, the high-order bit of the FBLOCK address must be set on in order for the usage count reported by the EXECMAP to be incremented. For more information on File Block, see *z/VM: REXX/VM Reference*.

Using IPL, SET INSTSEG, EXECMAP, and EXECDROP

The IPL command links the CMS installation saved segment for your CMS session. The command:

```
ipl cms parm instseg yes
```

links the default CMS installation saved segment, CMSINST. The saved segment contains the running copy of frequently used execs, eliminating the need to load your own copy of the execs into storage. The system accesses the saved segment at file mode S.

To change the file mode, use the SET INSTSEG command. For example, to access the saved segment at file mode B, enter:

```
set instseg on b
```

If you already have a file mode B, then the saved segment is immediately searched before it.

The EXECMAP command lists the execs in storage and the ones in saved segments. EXECMAP returns a list with the attribute specifying the location of the exec. For example, assume that you had loaded TPHONE EXEC into user storage and NAMES EXEC into system storage, that FILELIST EXEC and RECEIVE EXEC were in the CMS installation saved segment, and that NOTE EXEC was in a logical saved segment. In this case, the list would be:

| Name | Type | Usage | Records | Bytes | Attribute | Segname |
|----------|------|-------|---------|-------|-----------|----------|
| TPHONE | EXEC | 0 | 15 | 515 | USER | |
| NAMES | EXEC | 0 | 60 | 4616 | SYSTEM | |
| FILELIST | EXEC | 0 | 163 | 7488 | SHARED | |
| RECEIVE | EXEC | 0 | 625 | 27568 | SHARED | SEGMENT1 |
| NOTE | EXEC | 0 | 554 | 24952 | | SEGMENT1 |

If you no longer want to use an exec in the saved segment, you can discontinue your access to it with the EXECDROP command. For example, entering:

```
execdrop receive exec (shared
```

Commands for REXX Execs

deletes your access to the RECEIVE EXEC in the saved segment. If you decide you want to drop your access to the saved segment entirely, use the SET INSTSEG or SEGMENT PURGE command. SET INSTSEG OFF discontinues use of the CMS installation saved segment until you set it ON or until you re-IPL CMS.

Using EXECOS

The EXECOS command resets the OS and VSAM environments under CMS without returning to the interactive environment. If you request a reset of the OS or VSAM environment, after the processing of a CMS EXEC, the EXECOS command should *precede* the CMS EXEC command. For example:

```
/* example of using EXECOS within an EXEC */
'EXECOS EXEC VMFASM DMSSEB DMSSP'
exit
```

Using GLOBALV

The GLOBALV command sets, maintains, and retrieves a collection of named variables. You can pass these global variables between execs.

For example, we have two exec files named FIRST EXEC and SECOND EXEC, where the FIRST EXEC calls the SECOND EXEC. The variables are established as global variables in the SECOND EXEC by the statement *globalv put RUMORS*. The statement *globalv get RUMORS* in the FIRST EXEC assigns the global variables to the FIRST EXEC.

```
/* first exec */           /* second exec */
.                           .
.                           .
.                           .
second                       .
.                           globalv put 'RUMORS' /* assign variables */
globalv get 'RUMORS'        .
.                           .
.                           .
.                           exit
exit
```

Using IDENTIFY

You can use the information returned by the IDENTIFY command within your exec.

For example:

```
/* example of using identify within your exec */
.
.
'IDENTIFY (LIFO' /* get some useful information */
pull userid . node . rscsid .
.
.
exit
```

Using IMMCMD

The IMMCMD command establishes or cancels Immediate commands from an exec.

For the following example, we will assume that you have an exec that performs a repetitive process. Each time this exec is processed, one record is logged to a CMS file. Suppose you wanted to suppress logging of the records without terminating the exec. Because HX terminates the exec, you would not want to use it. Using Pull is not a good alternative because you want to decide at what point to terminate logging. You can create your own immediate command to stop logging using the CMS IMMCMD command within your exec. For example:

```

/* Sample exec using the CMS IMMCMD command      */
/* Set up stoplog Immediate command              */
'IMMCMD SET STOPLOG'
/* Set default logging                           */
arg log .
if log='' then log='YES'
if log~='YES' & log~='NO' then do
  say 'Invalid parameter :' log
  exit 24
end
do forever
  /* Check for STOPLOG */
  'IMMCMD STATUS STOPLOG'
  if rc~=0 then log='NO'
  /* Perform process ... */
  .
  .
  if log='YES' then 'EXECIO 1 DISKW LOG FILE A'
  .
  .
end
/* Clear STOPLOG Immediate command */
'IMMCMD CLEAR STOPLOG'
exit

```

Using LISTFILE

The LISTFILE command lists information about your CMS files on accessed SFS directories or minidisks. You can use this information within your exec.

```

/* Example using LISTFILE to find file ID of the first file */
/* that matches a given file name.                          */
address command
'MAKEBUF'
'LISTFILE' filename '* * (FIFO'
if rc~=0 then filetype='EXEC'
else pull filename filetype filemode .
address command 'DROPBUF'

```

Using NAMEFIND

The NAMEFIND command displays/stacks information from a NAMES file (default *userid* NAMES). Following is an example of how you can use the CMS NAMEFIND command in an exec:

Commands for REXX Execs

```
/* Program to retrieve phone numbers */
arg nick .
'NAMEFIND :NICK' nick ':PHONE :NAME (LIFO'
if rc=0 then do
  say 'Sorry, no phone listing for' nick
  exit
end
parse pull name
parse pull phone
if phone='' then do
  say 'Sorry, no phone listing for' name
  exit
end
say name"'s phone number is" phone'.'
exit
```

Using PIPE

The PIPE command can help you solve a complex problem by breaking it up into a series of smaller, less complex programs. If you did not use the PIPE command, you might need several CMS or CP commands, or a program to solve the problem.

For example, to display a list of all the users that are logged on and the real address of the line to which each is connected, you can issue the CP QUERY NAMES command. The following is an example of the results of a CP QUERY NAMES command:

```
FURMAN - 1F83, PUTTEST - DSC , SHERMAN - 01C3, BERT -L0258
BARB - 1FEB, SHERRI - 0D7D, GROVER - 0DD1, DEVPVM - DSC
BATCHIT - DSC , OSCAR - DSC , SERVER3 - DSC , STONE - 1F62
SMITH - DSC , PIPER - 01CE, LOGN03BE - 03BE, PVM - DSC
TAMMIE - DSC , MACK - DSC , ERNIE - 0168, PETE - DSC
```

Now suppose you wanted a list, in single column format, of only the users that are currently connected and the real address of the line to which each is connected. You could either write a program to do this or use the PIPE command. The following exec, called CONNECT EXEC, uses a single PIPE command to display a list of the connected users:

```
/* Displays a list of connected users */
'pipe',
'cp q n',
'| split ','',
'| strip',
'| nlocate /- DSC/',
'| console'
exit rc
```

CONNECT EXEC displays the following:

```
FURMAN - 1F83
SHERMAN - 01C3
BERT -L0258
BARB - 1FEB
SHERRI - 0D7D
GROVER - 0DD1
STONE - 1F62
PIPER - 01CE
LOGN03BE - 03BE
ERNIE - 0168
```

For more information on the PIPE command, see *z/VM: CMS Pipelines Reference*.

Using QUERY and RDR

The following example illustrates one way that you can use the information returned from the QUERY and RDR commands in an exec:

```
/* Sample exec to show QUERY and RDR command uses */

/* This section uses the CMS QUERY command to stack information on
the contents of the user's file mode A. Then, it reads in
the information (throwing away the header line stacked by
the QUERY command) and prints out a formatted message. Unused
variables set by the PULL command can be displayed if you desire */

'QUERY DISK A (LIFO' /* get disk information */
pull label cuu m stat cyl type, /* read from the stack, */
      blksize files used '-' percent, /* separate into all */
      left total. /* variables */
pull. /* read header line */
used = strip(used,l) /* strip leading blanks */
say 'Filemode A is' percent'% full ('used' used blocks out of' total,
      'available)'
```

```
/* This section invokes the CMS RDR command, which sets a
return code depending on the status of the reader and also on
the type of file in the reader, should one exist. The
REXX/VM interpreter sets the variable
RC to this returned value. Next, depending on the
returned value, this exec selectively runs one of
several commands. */

'RDR (NOTYPE' /* get info on rdr file */
/* RC set to return code from RDR command */

select
  when rc=0 then say 'Reader is empty'
  when rc=22 then 'disk load'
  when rc=13 then say 'Reader is not ready'
  otherwise
    say 'Return code other than expected'
end
```

Using SET EXECTRACE

You can trace your REXX exec or EXEC 2 exec by specifying SET EXECTRACE ON prior to exec invocation. To turn tracing off, specify SET EXECTRACE OFF.

Using Windows and Virtual Screens

VSCREEN WAITREAD is an important command for execs that read from and write to windows. A typical sequence for such an exec would be:

- Define a window and virtual screen (WINDOW DEFINE and VSCREEN DEFINE commands)
- Connect the window to the virtual screen (WINDOW SHOW command)
- Write data to the virtual screen (VSCREEN WRITE command)
- Enter the VSCREEN WAITREAD command.

When an attention interrupt is received, the exec can process the WAITREAD.*n* variables and update the virtual screen using the VSCREEN WRITE command. For more information on these commands, see *z/VM: CMS Commands and Utilities Reference*.

Using XEDIT

You can use the XEDIT command within an exec and stack XEDIT subcommands to manipulate a file.

Writing XEDIT macros

Writing an XEDIT macro is like creating a new XEDIT subcommand. An XEDIT macro is a REXX or EXEC 2 file invoked from the XEDIT environment.

For more information on writing XEDIT macros using the REXX language, see *z/VM: XEDIT User's Guide*. For more information about XEDIT macros written in EXEC 2 language, see the Help Facility by entering:
help exec2

Exchanging Data Between Programs Through the Stack

For more information on the REXX instructions that place data into the program stack, see *z/VM: REXX/VM User's Guide*.

Chapter 16. Developing Programs in CMS

Some of the programming languages used with the z/VM system are COBOL, C, FORTRAN, and PL/I. In this section, you will learn how to create and run programs, regardless of the programming language you use. You don't even have to know a programming language to complete this section. Just follow the examples. You do need to know how to use the XEDIT command to create a file.

For more information on the procedures and commands discussed in this section, see *z/VM: CMS Application Development Guide* and *z/VM: CMS Commands and Utilities Reference*. For information on how to write programs in the various languages, ask your administrator what IBM manuals to use.

Creating a Program

A program is a file that contains instructions for the computer. You create a program file with an XEDIT command, the same way you create any other file. A program file can have any file name that is no longer than eight characters, but its file type indicates the name of the programming language you are using. Some of the special programming language file types used in z/VM are:

- COBOL
- C
- FORTRAN
- PLI

Based on the file type, the editor gives values to various settings, like tabs. For example, suppose a programming language requires you to enter data in certain columns. The tabs are set according to that language, which makes it easy to line up the data using PF4 (the tab key). For more information on these settings, see *z/VM: XEDIT Commands and Macros Reference*.

Because many students, scientists, engineers, and other professionals use FORTRAN for problem solving, we have chosen a simple FORTRAN program to use for our example. Your system must have VS FORTRAN for the example to work. To find out if you have VS FORTRAN, either ask your system administrator, or enter:

```
filel fortvs2 * *
```

If the FILELIST display contains FORTVS2 MODULE, you can do the example. If not, you can still use the procedures explained in this section, but you have to use a programming language that is in your system. If you are in the FILELIST environment, press PF3 to leave it.

Our program converts a Fahrenheit temperature to Celsius. The program asks you to enter a Fahrenheit temperature with a decimal point (for example, 32.0). It then displays that temperature in Celsius.

Now enter:

```
x degrees fortran
```

Enter the following command to enter input mode:

Developing Programs in CMS

```
====> i
```

Now type these lines, exactly as shown.

```
00010 WRITE (6,15)
00015 FORMAT (' Enter FAHRENHEIT VALUE WITH DECIMAL POINT')
00020 READ (5,25)VALUE
00025 FORMAT (F4.1)
00030 OUTPUT = (VALUE - 32 ) / 1.8
00040 WRITE (6,45)OUTPUT
00045 FORMAT (F6.1,' DEGREES CELSIUS')
00050 END
```

You are finished entering your program instructions. Press the Enter key twice to enter edit mode. Then enter:

```
====> file
```

Now you have created a *source program*.

Compiling a Program

If you know FORTRAN, your source program is meaningful to you, but it means nothing to the computer. The computer only understands machine language. You must now *compile* your program. That means you ask a compiler to translate the program into machine language.

Before you compile your program, you must make sure you have enough virtual storage for the compiler. You probably have enough storage for all compilers except VS FORTRAN, which is used in our example. To find out how much virtual storage you have, enter:

```
query storage
```

You will see a message similar to the following (which indicates you have 1024K or 1 Megabyte of storage):

```
STORAGE = 1024K
```

If the number is less than 4096K (4MB) and you are using VS FORTRAN, you need to get more storage. Here's how:

1. Enter this command: `define storage 4m`

If you see the following message, you must ask your system administrator to increase your storage limit to 4MB:

```
Storage exceeds allowed maximum
```

After your system administrator grants your storage request, reenter the `DEFINE STORAGE 4M` command.

In addition to the message you get that verifies your new storage, you may get a message similar to the following:

```
DMKDSP450W CP entered; disabled wait PSW '00020000 00000000'
```

This means you must re-IPL CMS to load CMS again.

2. Enter `IPL CMS` to load CMS. When the status message, `VM READ` appears, press Enter again.
3. If you have not added the `SET FULLSCREEN ON` command to your `PROFILE EXEC`, type `SET FULLSCREEN ON` and press the Enter key.

Note: You need to follow the previous procedure to get more storage only one time during a terminal session. The next time you log on, you have to use it again (if you need more storage).

It is easy to compile a program with z/VM. You use a command that calls the compiler, followed by the file name of your program. The format is:

compiler filename
 | |
 └───> file name of your program
 └───> compiler command

To find what compiler command to use, see the IBM manual for the programming language you are using.

The FORTVS2 command calls the VS FORTRAN compiler, so enter:

fortvs2 degrees

A message from the compiler tells you if you made any errors while typing your program. To correct any errors, you:

- Edit the source program. For our example, you would enter:
 x degrees fortran
- Correct the errors and enter a FILE command.
- Compile the program again. For our example, you would enter:
 fortvs2 degrees

Before you try out the program, check the list of files that have the file name DEGREES. Enter:

filel degrees

Your list should contain these files:

```
DEGREES FORTRAN  
DEGREES LISTING  
DEGREES TEXT
```

DEGREES FORTRAN is the file you created. When your program is compiled, two new files are created. Both have the file name of your program. The file DEGREES LISTING contains your source program and a list of any errors that were found. You can look at this file by using an XEDIT command. You can also get a printed copy by using the PRINT command.

The file DEGREES TEXT contains the machine language version of your program. This file is loaded into storage when you run the program.

Both the LISTING and TEXT files are replaced if you change the program and compile it again.

Now you can press PF3 to leave the FILELIST environment.

Running a Program

Before you can run your program, you must tell z/VM the names of certain libraries that the system needs to run your program. You do that with the GLOBAL command. It has the following formats:

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```
Global MACLIB library-name...
Global TXTLIB library-name...
Global LOADLIB library-name...
```

The exact GLOBAL command you need depends on the language you are using and your installation. Ask your z/VM administrator to tell you which GLOBAL command(s) to use.

Enter the global commands necessary to identify your libraries, substituting your system's library names for those given in this example:

```
global txtlib vsf2fort cmslib
global loadlib vsf2load
```

When you find out which GLOBAL commands to use, it is a good idea to include them in your PROFILE EXEC, which is discussed in Chapter 14, "Creating a PROFILE EXEC," on page 307. That way, you do not have to enter GLOBAL commands in each terminal session.

To run your program, you use a command that loads your program into storage and runs it. It has this format:

```
LOAD filename (START
```

For example, to load and run your program, enter:

```
load degrees (start
```

You see:

```
EXECUTION BEGINS...
Enter FAHRENHEIT VALUE WITH DECIMAL POINT
```

Now enter a value with a decimal point. For example, enter:

```
32.0
```

You see:

```
 0.0 DEGREES CELSIUS
Ready; T=0.1/0.1 11:12:09
```

The ready message (Ready;) means that your program has completed.

Suppose you want to run the DEGREES program again. Do you have to compile it again? No, all you have to do is enter the LOAD command, because the machine language version of your program (the DEGREES TEXT file) is in permanent storage.

Note: Another way to run a program is to create a *module* using either the GENMOD (generate module) or the BIND command. You may choose this method when your program is free of errors, and you want to run it often or share it with other people. For information on creating a module, see *z/VM: CMS Application Development Guide* and *z/VM: Program Management Binder for CMS*.

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Glossary

For a list of z/VM terms and their definitions, see *z/VM: Glossary*.

The z/VM glossary is also available through the online z/VM HELP Facility, if HELP files are installed on your z/VM system. For example, to display the definition of the term “dedicated device”, issue the following HELP command:
`help glossary dedicated device`

While you are in the glossary help file, you can do additional searches:

- To display the definition of a new term, type a new HELP command on the command line:

```
help glossary newterm
```

This command opens a new help file inside the previous help file. You can repeat this process many times. The status area in the lower right corner of the screen shows how many help files you have open. To close the current file, press the Quit key (PF3/F3). To exit from the HELP Facility, press the Return key (PF4/F4).

- To search for a word, phrase, or character string, type it on the command line and press the Cloccate key (PF5/F5). To find other occurrences, press the key multiple times.

The Cloccate function searches from the current location to the end of the file. It does not wrap. To search the whole file, press the Top key (PF2/F2) to go to the top of the file before using Cloccate.

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See the following publications for additional information about z/VM. For abstracts of the z/VM publications, see *z/VM: General Information*, GC24-6193

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z/VM product information is available from the following sources:

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- IBM: z/VM Internet Library (www.ibm.com/vm/library/)
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z/VM Base Library

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