RESEARCH MACHINES

CP/M Operating System

Version 2.2D

USERS GUIDE

PN 11901, Revision 1

CP/M Operating System (Version 2.2D) Users Guide

PN 11901 Revision 1

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Published by Research Machines Limited. Written using Research Machines 380Z-D microcomputer; photo-typeset on a Compugraphic Editwriter, and printed by Hazell Press, Abbey Trading Estate, Wembley, Middlesex HA0 1YT.

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Preface

This guide describes the CP/M operating system and how to use it to manage your disc system. General principles, examples, and precautions, are included where appropriate.

Complete beginners should first look at the accompanying Disc System Users Guide, which describes the equipment and introduces the CP/M Operating System. Before using this CP/M Users Guide you should be confident in setting up the system properly and in getting it running.

Chapter 1 is a general introduction to the guide itself and to the CP/M operating system. Chapter 2 describes how CP/M is structured. The organization of disc storage and the conventions used are described in chapter 3. CP/M commands are introduced in chapter 4 and the built-in commands are described.

In chapters 5, 6, and 7 you will find descriptions of the activities that the system can perform on discs and on disc files using CP/M utility programs.

Under certain circumstances CP/M will display messages on your screen, and chapter 8 lists these messages, together with their likely causes and suggested actions for you to take.

Appendices in this manual contain material that you may need only rarely, or applies only in certain cases. For example, appendix B is of use only if you wish to exchange data on discs between your computer and another one that reads or writes only in a different density.

Other Manuals For Your System

Both the 480Z and the 380Z-D disc systems have their own Disc System Users Guides, which are delivered with all new systems and upgrade kits. The appropriate Disc System Users Guide should be consulted together with this CP/M Users Guide.

Another manual provided with disc systems is the Extended BASIC Versions 5 and 6 for Disc and Network Systems Reference Manual.

Each 480Z comes with the LINK 480Z Cassette System Users Guide. Apart from a detailed introduction to the use of the 480Z as a cassette based system, the LINK 480Z Cassette System Users Guide gives additional information about the 480Z, including its ROS monitor, its character set, its graphics characters, BASIC in ROM, and ROMPACKs. Also delivered with the 480Z is the "BASIC in ROM Reference Manual" which contains all the necessary information for running the BASIC in ROM facility and ROMPACKs on a cassette-based 480Z.

Some other manuals are supplied only if you have chosen certain options when ordering your new machine or an upgrade. These include:

- Silicon Disc & Network Access Reference Manual PN 13466
- Network Users Guide PN 13819
- LINK 480Z Shared-disc System — General Information Manual PN 12914
- 380Z-D Winchester Disc User Guide PN 13453

The above manuals cover their specialized topics in detail, so this manual devotes little, if any, space to those subjects.

Additional copies of this publication may be ordered in writing from our sales department. Please give the title in full.

If you want detailed information about the hardware, firmware, or operating system of either the 480Z or the 380Z-D, or, if you want to program in machine-language, there are other manuals which may be purchased on request from Research Machines. These are detailed below.

System Manuals Available For Purchase From Research Machines

- Link 480Z Information File, PN 10939
  — Contains detailed information about the LINK 480Z hardware, especially the physical characteristics of the input/output ports, the high resolution graphics and TTL/RGB option, and the printed circuit boards.

- 380Z and 480Z Firmware Reference Manual, PN 10971
  — Written for machine-code programmers who wish to bypass CP/M. Describes the Front Panel and EMT firmware facilities contained in the COS (380Z) and ROS (480Z) monitors.
- CP/M and CP/NET Programmers Guide, PN 12084
  — For machine code and assembly language programmers, describes the program interfaces available in CP/M and CP/NET for users wishing to use the BIOS and BDOS facilities.
- Machine Language Programming Guide for 380Z and 480Z, PN 11068
  — Describes machine language programming for the Z80 microprocessor and includes a detailed explanation of the use of the Front Panel debugging aid.
- ZASM for Disc and Network Systems, PN 11066
  — Describes the ZASM assembler on 380Z-D and 480Z disc systems.

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Text representing screen messages, and text you type in is printed in OCR-B typeface, as:

  ```
  Press any key to continue
  ```

- In keyboard entries, all specified characters are to be keyed in individually except when contained between "<" and ">".
- Keyboard entries contained between "<" and ">" refer to either a single key, as in <RETURN>, or to two keys, one held down while the second one is pressed, as in <CTRL/C>.
- Where a keyboard entry is introduced by the term "enter", this implies that the entry must be concluded with <RETURN>.

Comments

Customers' comments are of great value to us in improving the quality of our microcomputer systems, publications, and services. If you would like to make any comments, please use the reply-paid form provided at the back of this manual.

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Chapter 1

Introduction

This Manual

In this manual we aim to give you a working knowledge of CP/M 2.2 as it has been adapted by Research Machines for use on the 380Z-D and the 480Z microcomputers — Version 2.2D. As far as possible each particular aspect of CP/M is discussed under a single heading, and the whole manual is based on the facilities available in CP/M rather than on the facilities available on your Research Machines microcomputer.

Before referring to this guide, it is a good idea to read the system Users Guide for your particular microcomputer. The 480Z and 380Z-D Disc System Users Guides have been written to accommodate both the complete novice and the experienced user who is new to Research Machines microcomputers. They describe the functions of your system in some detail and also give a general introduction to CP/M 2.2D without going into the detail given in this CP/M Guide. If this is the first time that you have come across CP/M, read the 480Z or 380Z-D Disc System Users Guide before going any further.

What is CP/M 2.2D?

CP/M is a monitor control program providing a disc and file handling operating system for stand-alone microcomputers. It controls the computer input and output functions. It organizes the files held on disc and reports on the data storage. Finally, it enables you to load and execute programs from disc.

CP/M was designed in 1976 for use on a floppy disc based microcomputer using an 8080 microprocessor. Today it will run on the 8080, 8085 and Z80 microprocessors, and it has become one of the world's most popular operating systems.

All Research Machines microcomputers to date have incorporated a Z80 microprocessor and the 380Z and 480Z disc systems are supplied with one of several versions of the CP/M operating system. Version 2.2D is a Research Machines adaptation of CP/M 2.2 designed for use in systems offering double density storage. It is used in all 480Z disc systems, all 380Z-D systems and any earlier 380Z systems that have been upgraded to give double-density storage.

Compatibility

Many of the component parts of Research Machines microcomputer systems are designed to be compatible with one another and it is intended to maintain this compatibility as far as possible.

However, program compatibility can be achieved at several levels, as follows:

- High level language source codes have a high degree of compatibility with a wide range of machines from both Research Machines and other manufacturers.

- Compiled or assembled programs using CP/M BDOS functions exhibit a fair degree of compatibility with other CP/M based machines.

- Compiled or assembled programs using CP/M BIOS calls are largely compatible with other CP/M based machines.

- Compiled or assembled programs using 380Z, 380Z-D, and 480Z EMTs have some compatibility across this range of machines but are incompatible with computers from other manufacturers.

- Compiled or assembled programs making direct access to the hardware are incompatible with other machines.

Chapter 2

Operating System Structure

The Disc System Users Guide for your particular system gives an overview of how CP/M operations are carried out. You should be familiar with this before going further into this manual.

In this chapter we will go into greater detail, describing the main parts of CP/M, how they relate to each other, and how they communicate with the rest of the microcomputer system.

The Layers in the System

At the heart of your system is the hardware, which is under the control of a monitor held in firmware.

In the 480Z the monitor is called ROS, the Resident Operating System; in the 380Z-D the monitor is called COS, the Central Operating System. These have been designed by Research Machines and reside permanently in read-only memory.

Although ROS and COS are very different internally, they present interfaces that look almost identical to any part of the system outside them. In this way, the same version of CP/M can be used to control disc operations on the two different Research Machines systems. This in turn allows software (providing that it uses only CP/M interfaces) to run on either of the two systems without alteration as well as on another manufacturer's system that uses a compatible version of CP/M.

CP/M communicates with either ROS or COS on one hand and with the user or the user's programs on the other. CP/M performs the common or repetitive parts of the operations you want to perform, thereby relieving you of the need provide the instructions for them. This saves both programming and keyboard time. However, to use the system effectively means knowing what commands to give to CP/M and what responses you will get to those commands.

The layered nature of CP/M is shown in figure 2.1.

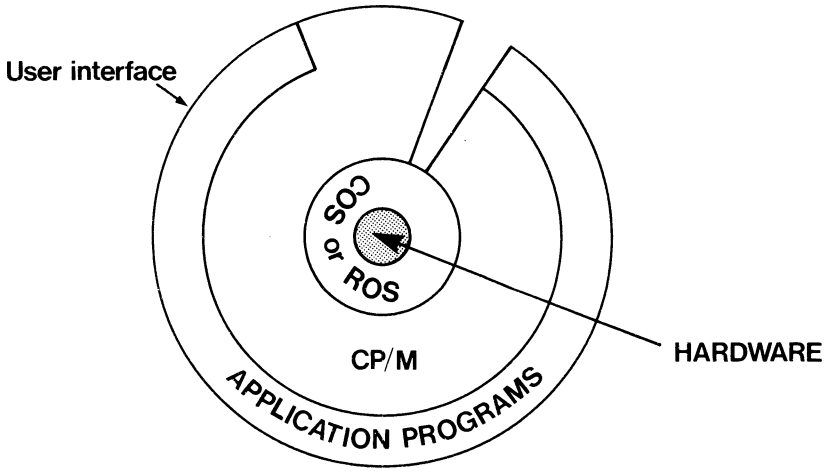

Figure 2.1 The Layers in the Structure

If you intend to use your system for writing and running high level language programs only, BASIC, PASCAL, or FORTRAN for instance, you will not need to know much about ROS or COS. If you intend to program in machine code, you may need to know a great deal about ROS and COS and should refer to the Firmware Reference Manual, and the CP/M and CP/NET Programmers Guide.

When you switch on your system, the CPU (Central Processing Unit) will be executing the firmware monitor program — ROS or COS. That is, the whole system is under the command of the monitor program and it is said to be at monitor command level. It will wait for a monitor command and indicates this by displaying a prompt. The ROS prompt is "}" (480Z) and the COS prompt is "→" (380Z).

At this point, your system will not accept any command other than a monitor command. Your Disc System Users Guide will list the most useful commands and a more complete description is given in the Firmware Reference Manual. They are intended mainly for use by machine code programmers. Here we are only concerned with the command used to load CP/M.

Loading CP/M

To load the CP/M disc operating system into the memory of a stand-alone computer that is at monitor command level, put a system disc in the left-hand drive and type B or b. (Alternatively, put a disc into the right-hand drive and type X or x). Note that ROS and COS treat both capital and lower case commands in the same way.

Either of the commands B (for Boot) or X (for Exchange) calls up the bootstrap loader.

The bootstrap loader is a short (firmware) program stored in read-only memory (ROM) which reads the first sector of the first track on the disc into a defined place in memory. That sector holds another short program, the bootstrap, which loads all the rest of CP/M into memory.

This whole operation is analogous to lifting oneself up by the bootstraps and this has given it the name "bootstrapping", now shortened to "booting".

When anyone uses the word "boot" they mean "load the disc operating system".

As you can see booting is just a clever way of loading a special sort of program: the disc operating system. There is no mystique about it and we try to avoid the jargon "booting" wherever possible. However, the brevity of the term "boot" is undoubtedly attractive and we take advantage of this by using it in some screen messages.

Slightly different procedures must be followed in order to load the CP/M disc operating system into the memory of a 480Z computer that is connected up as a station either on a network (type N) or on a shared-disc system (run START on the host). Network and Shared-Disc System manuals contain full details.

Once the disc operating system is loaded it becomes part of the whole system and when we use the term "system" we generally mean your microcomputer system complete with CP/M loaded.

When CP/M is loaded, the monitor prompt disappears and is replaced by the CP/M prompt and the initial CP/M version message. The message appears at the top of the screen and is very similar to:

```
Research Machines
Release 1/20B
56k CP/M vers 2.2 D
For 480Z & 380Z-D.
```

The prompt appears at the bottom left of the screen as:

```
A>
```

Whenever the CP/M prompt is displayed the system is waiting for you to type in something that it will recognize: a CP/M command. It will not accept a ROS/COS command or a BASIC command or any other kind of command; it will accept only a CP/M command.

On the display screen the CP/M prompt is a "greater than" sign and it is always preceded by a letter indicating the current drive.

Current Drive

The side of the disc from which you first load CP/M is assigned to logical disc drive A. (For an explanation of logical disc drives see your system Users Guide.) This remains the current (or default) drive until it is switched to another drive (See chapter 4). This is indicated at the end of the initial CP/M sign-on message as:

```
A>
```

However, when you are accessing other logical drives in the system, the drive currently being accessed will be indicated on the display immediately before the CP/M prompt. For example:

```
C>
```

CP/M Command Line

The next character typed in will appear immediately to the right of the prompt. Subsequent characters appear to the right of the previous character in a continuous line until the RETURN key is pressed. This line of characters is called a "command line". For example:

```
A>VERIFY<RETURN>
```

This will call up the utility called VERIFY from the disc in drive A, and this utility will respond with a sign-on message introducing itself. However, some command lines are obeyed immediately and allow for no further communication with the user. The most common CP/M command lines are described in full under individual headings later in this manual.

CP/M Structure

Just as Research Machines have designed the 480Z and 380Z-D systems in conceptual layers, so Digital Research have designed CP/M in layers. Between each layer and its adjacent layers are well defined interfaces.

The outer layer is the portion of CP/M you will be most aware of: the CCP.

CCP — The Console Command Processor

The console command processor interprets and executes the commands that you type in at the keyboard. Usually these commands are not actually executed by the CCP, but rather the CCP loads a program of that name (the command) to do the job. The program is in control of the system while it is running, and, on completion of the program, control is usually returned to the CCP. Control may be returned either to the monitor or directly to another program.

In executing CP/M commands the CCP handles all its input and output operations through the next layer of CP/M: the BDOS.

BDOS — The Basic Disc Operating System

The basic disc operating system is at the very heart of CP/M. It handles all of the basic disc file operations such as reading files, writing files, allocating and reallocating disc space, and general disc-oriented tasks.

User programs that use BDOS functions for all input and output operations in the same way that CCP does, will remain compatible with other CP/M-based microcomputers. This is because BDOS is the same for all such microcomputers and thus provides a well defined interface with the third and final CP/M layer: the BIOS.

BIOS — The Basic Input/Output System

The basic input/output system is the machine-dependent part of CP/M. It is written by Research Machines to provide the BDOS with a set of basic input/output operations directly related to those provided by the monitors ROS and COS, and hence to the hardware used in the 380Z and 480Z microcomputers.

Figure 2.2 shows how the layers of CP/M fit into the operating system shown earlier in figure 2.1.

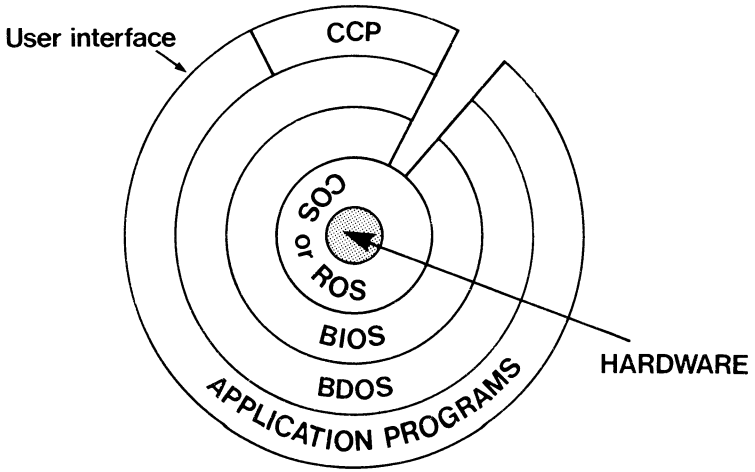

Figure 2.2
Where CCP, BDOS, and BIOS fit into the Layered System

Transportability

The figure above shows both how the layering of the system with accurately defined interfaces between the layers allows CP/M and CP/M-based software to be transported from one type of system to another type of system, and that the system can be divided at the junction between any two layers. Either of the two resulting portions can be replaced provided that the new piece exactly matches the remaining portion at the junction (or interface) between the layers where the division took place. If the interfaces are well defined, the software outside any interface can be transported to a system offering the same external interface.

The Research Machines version of CP/M 2.2D presents the inner interface of BIOS to either ROS or COS. The interface between ROS and BIOS is identical to the interface between COS and BIOS, so CP/M 2.2D is compatible with both systems.

Similarly, if each microcomputer manufacturer using CP/M provides an identical interface between their BIOS and the BDOS, then CP/M (BDOS and CCP) can be transported between systems. Although small differences and licensing agreements may prevent this actually happening, these parts of CP/M, as defined by Digital Research Inc., are used on many different microcomputer systems.

Finally, users' programs need to have the same view of CP/M regardless of what machine they are running on. The outer edge of CP/M provides this view.

Chapter 3

Disc Storage

Your disc storage system uses either 5.25-inch or 8-inch floppy discs.

Each disc is divided into concentric tracks; not physical tracks such as on a gramophone record, but magnetic tracks, such as on cassette tape. There are 40 tracks per side on a 5.25-inch disc, and there are 77 tracks per side on an 8-inch disc.

Each track is divided up into sectors. In double-density mode there are 36 logical sectors per track on 5.25-inch drives and 52 on 8-inch drives. In single-density mode there are 16 logical sectors per track on 5.25-inch discs and 26 on 8-inch discs. For more information about discs and disc formats, have a look at the 380Z and 480Z Firmware Reference Manual.

Each sector can be located independently and information may be transferred to or from it by part of your system called the disc controller.

As its name implies, the disc controller controls all disc storage operations. It is a hardware item and is controlled by the firmware. In the 480Z it is incorporated in the disc unit and in the 380Z-D it is built into the main processing unit.

A 480Z can be fitted with a much larger random-access memory than the usual maximum size of 64K bytes. The additional memory cannot be addressed directly, but CP/M can make it available for use by giving it the appearance of a disc, hence the name of "Silicon Disc" for the additional memory.

One particularly important difference between a magnetic disc and a silicon disc is that a silicon disc provides only temporary storage. Any files stored on a silicon disc must have been written there since switching the machine on, and will be lost when the machine is switched off.

Disc Format

Before any disc can be used to store information, its magnetic surface(s) must be prepared to receive that information. The disc must first be cleared of any data that is already stored on it. Then its tracks must be divided up into addressable sectors which enable any particular data to be located and retrieved. This is called formatting (or initialization) and is performed by a utility called FORMAT.

A corresponding formatting operation is also required on a silicon disc (if present), and is performed automatically each time the 480Z is switched on.

FORMAT is a utility that initializes discs for either single or double-density storage. If you initialize a disc with FORMAT, all the information held on the disc will be erased.

Changing Discs

Your system is provided with an auto-sensing facility which will accept discs in either single or double density. When you are operating at CP/M command level, that is, when the > prompt is showing, this facility must be initiated by pressing <CTRL/C> each time you change discs between CP/M commands. If you do not press <CTRL/C>, you will run the risk of generating errors in otherwise good files.

It is important to remember this and make it a habit.

For the same reason, whenever a disc change is required during the execution of an application program, either the BDOS Reset Disc function or the Reset Drive function must be called by the program.

If you have a single drive system, you must be very careful when using utilities that require the disc to be changed. *Change the disc every time the utility requests you to do so,* otherwise the system may access a part of a disc that you intended to leave undisturbed. This may either spoil the file held there or make it completely unreadable.

The Current Drive

In CP/M the BDOS can access information through only one logical disc drive at a time. The BDOS has the concept of a default logical disc drive which it will use for all disc operations unless it is specifically told to use another drive. The default drive may also be called the current drive (or sometimes the logged-in drive). CP/M allocates logical drive A to the drive containing the disc from which you loaded the operating system and this remains the current drive until another drive is selected either by a keyboard command or by a program.

Another allocation made by CP/M is of logical drive M to the silicon disc (if present).

Some commands and utilities can address a disc in a drive other than the current drive. Have a look at DIR, STAT, or FASTCOPY, for instance.

If you are unsure about what logical disc drives are or how to use them, have a look at the explanation given in the Disc System Users Guide for your system.

Files

A file is any single set of data (or information) records that a user gathers and stores on any permanent storage medium.

All the work that you do on your microcomputer system is based on disc files. And the efficiency with which you work depends on your ability to handle files. It takes a lot of practice to create appropriate files and to use them effectively.

Some basic rules for you to start with follow:

- Every different file must have a unique name or reference
- File names that bear some relationship with the contents of the file are much more useful than those that don't
- Keep a duplicate (backup) copy of every important file on a separate disc
- Periodically delete any files that you no longer use, particularly temporary or work files
- A file can be any size up to the capacity of one disc surface. However, very large files can take a long time to edit and a lot of very short ones can involve you in a great deal of file activity.

If you want to know more about disc files, have a look at the Disc System Users Guide for your system.

File References

You must give every file in your collection a unique file reference. If you use the same file reference for files with different contents, sooner or later you will become confused. In fact CP/M will not allow you to store two files with the same file reference on the same side of a disc. If you try to do this, the existing file will be overwritten by the new one. However, some utilities will indicate that there already exists a file with the name of the one that you want to store.

The file reference is made up of three parts, always given in the following order:

- Logical drive name
- Filename
- Filetype

For example a typical file reference is:

B:ADDRESS.DAT

Logical Drive Name

The logical drive name is optional in a file reference. If the file you want to refer to is on the disc in the current or default drive, then the logical drive name is not needed. However, it must be in the file reference if you want to refer to a file on a disc other than one in the current drive. Some utilities, PIP for instance, must usually be supplied with logical drive names in the file references.

The logical drive name is always presented as:

d:

where d: is the name of any valid logical drive; usually any one of A,B,C, or D (and M if you have a silicon disc). If your system has a single drive, keep an eye on the logical drive name when a disc change is called for; this should help you to avoid letting the system try to access the wrong disc.

The colon ":" is mandatory each time you refer to a logical drive and in CP/M commands. Apart from its use in identifying some special input/output characters, this is the only situation where it may be used.

The Filename

The filename is the only mandatory part of the file reference.

It consists of eight characters or less. Any alphanumeric characters (A-Z and 0-9) can be used in a filename or the following special characters: !"#$&'—+()[]. The remaining characters are not allowed in a filename. However, we recommend that only alphanumeric characters be used because some software cannot handle filenames that include symbols; for instance, the only symbol allowed in BASIC filenames is the $ symbol.

In the commands and utilities described in this manual (.COM files) the filename is presented as:

FILENAME

It needs no particular identification but will be recognized as a filename by the CCP purely by its position in the command line.

The Filetype

As its name suggests, the filetype indicates the type of a file. In many cases it is optional. However, when it is used, it is presented as:

.TYP

where "typ" consists of three alphanumeric characters. (The same characters are valid for the filetype as are valid for the filename.) You will also find the filetype referred to as the extension filename.

If a filetype is used, the full-stop "." is mandatory.

The following filetypes have become established and are assumed by various programs, although their use is somewhat arbitrary:

- ZSM Assembler source
- PRN Printer listing
- BAK Back-up file
- OVR Overlay
- SUB Submit files
- PAS PASCAL source
- REL Assembler/compiler output relocatable files
- BAS BASIC source file
- COM Command file
- TXT Text file
- COB COBOL source file
- HEX Assembler object file
- $$$ Temporary files

You may invent others of your own.

In presenting a file reference to the CCP, alphabetic characters may be either upper or lower case. However, after processing by the CCP, they will be returned as upper case only. File references must not contain any spaces.

NOTE If your program gets its characters from the keyboard and puts them into a file control block (FCB), you must ensure that the characters are in upper case, otherwise you will create a file with a lower case filename that most of the system is unable to access.

Typical file references might be:

A:STAT.COM — A CP/M command file called STAT on drive A
C:PART9.TXT — A text file called PART9 on drive C
INV — A file called INV on the disc in the current logical drive

The discussion above refers only to those applications requiring a unique file reference. Such a reference is called an unambiguous file reference. However, on many occasions you will want to refer to more than one file at a time and this may be done using an ambiguous file reference.

Ambiguous File References

Ambiguous file references contain either or both of the characters "?" and "*". These two characters are sometimes called "wild cards" because they are used in a manner very similar to wild cards in a card game.

The character "?" may be used in place of any other single character in a filename or filetype. It will be accepted by the CCP, and by some, but not by all CP/M commands, as matching any of the allowable characters occupying the same position in the reference. For example, the ambiguous file reference:

AB?.X?Z

will be matched by any of the following file references:

ABC.XYZ ABZ.XCZ AB4.XYZ ABQ.XQZ ABB.X9Z

The character "*" may be used in place of an unspecific number of characters in either a filename or a filetype. The "*" is often used to replace a complete filename or filetype, but it may be used for just some of the characters within a filename or filetype providing that no other characters follow the "*".

For example, the ambiguous file reference:

*.ABC

will be matched by any of the following file references:

XYZ.ABC PROG5.ABC FILETWO.ABC OMEGA.ABC

Also

B:*.*

will be matched by all the files on logical disc drive B.

The file reference:

AB*.B*

will be matched by such files on the disc in the current drive as:

AB.BAS ABLE.BAS ABCDEFGH.BAK AB43.BAK

However, the ambiguous file reference

*XYZ.ABC

will be read as

*.ABC.

Note that the logical drive part of the file reference cannot be replaced by either of these ambiguous characters.

With careful construction of your filenames, you should be able to group your files in any way you want by using the two characters "?" or "*" when using CP/M.

In the examples given above, you will see that files may be grouped by having certain characters in particular positions in the file reference. These key characters are recognized while the others are ignored by the use of wild cards. You can change the way that your files are grouped by altering either the key characters or their positions with the REN command. However, REN itself will not accept wild cards. You can only rename one file at a time.

NOTE: Not all CP/M utilities will accept ambiguous file references and, in general, your own programs will not cope with them unless you write them specifically to do so.

File Allocation

Provided that there is adequate free space on the disc in question, you can forget about the amount of disc space that a file will need. Once you have created a unique file reference it will be entered in the directory and, until you erase it, CP/M will keep a record of where that file is stored and how big it is. This is done automatically.

You can use STAT to tell you the size of any particular file or the amount of free space available on any particular disc.

There is a limit to the number of files that can be held on one side of a disc. The directory (see DIR) on any disc in single-density format, and on 5.25-inch discs in double-density format, will hold only 64 filenames. Double density 8-inch discs and quad density 5.25-inch discs hold 128 filenames. So if your files are very small, it may be the directory capacity rather than the amount of space available that will determine the amount of data that can be stored on a disc.

Chapter 4

Resident Commands

This chapter introduces CP/M commands and explains the use of resident (or built-in) commands.

CP/M Command Level

Once you have loaded CP/M, and before you enter a command or run a program, the CP/M prompt will be displayed:

```
A>
```

In this state your system is said to be at the "CP/M command level". It is waiting for a CP/M command.

When using a CP/M command or when running a program of any sort, your system will not respond to further CP/M commands. You must first leave (exit or quit) the utility or program and return to the CP/M command level.

Some commands, such as DIR, automatically return the system to the CP/M command level. Others, such as PIP, may require a solitary <RETURN>. Utilities written by Research Machines require a <Q> and application programs use various methods to finish and return to CP/M. Have a look at the instructions for using the particular program concerned. If you are in doubt, <CTRL/C> should return your system to the CP/M command level.

Types of Command

There are two types of command available to you:

- Resident or Built-in Commands; described in this chapter.
- Transient Commands; described in chapters 5, 6, and 7.

The resident commands are present in CP/M itself and are loaded when CP/M is loaded. They may be used at any time regardless of what discs are in the drives or of which drive is the current logical drive.

On the other hand, transient commands are complete programs stored indiviuallly on disc. They are not loaded with CP/M but they must be called up each time that you want to use them. They are supplied on the system disc and are often known as system utilities. However, they are not part of the operating system itself. Whenever you want to use a transient command you must ensure that it is included on one of the discs in the drives. If the transient command to be used is on a disc other than the disc in the current drive, then the drive name must be specified in the file reference. However, the filetype (.COM) should not be given.

For example, if the current drive is B, and you want to run the utility program TURNKEY, which happens, on this occasion, to be stored on the disc in drive A, enter:

```
A:TURNKEY<RETURN>
```

Resident Commands

The resident commands are:

- d: — To switch the current drive
- TYPE — To inspect an ASCII text file
- ERA — To erase files
- SAVE — To store a file
- REN — To rename a file
- DIR — To inspect the contents of a disc

Finally, although it is not strictly a CP/M command, there is:

- XXX — To run the program "XXX.COM"

The three chapters following this one are devoted to descriptions of the various transient commands available to you while this chapter describes the resident commands.

d: To Switch The Current Drive

When you load the CP/M operating system, it treats the disc drive from which it was read as logical disc drive A. (A discussion on logical drives is given in the Disc System Users Guide for your system.) After loading CP/M, therefore, the current disc drive (default drive) is always logical drive A and this is displayed on the screen immediately before the CP/M prompt, as follows:

```
A>
```

The current logical drive is maintained until it is changed by the command:

```
d: <RETURN>
```

where d: is any one of the other logical drives (A, B, C, or D) available in the system

To change the current logical drive to B, for example, simply type:

```
B:<RETURN>
```

and the prompt will change to:

```
B>
```

You can now access the files on logical drive B. Switching to any other logical drive or back to A again is carried out in the same way by typing the new logical drive name followed by a colon and <RETURN>.

Drive Selection Errors

CP/M will only switch to a new drive if it can actually access a disc in that drive. So before you switch drives make sure that:

- The logical drive you select does exist in your system
- There is a disc in that drive
- The disc has been correctly inserted in the drive and <CTRLC> was pressed immediately after you inserted it (See "Changing Discs" in chapter 3).

If CP/M fails to select the new drive, an error message will be displayed. The message tells you what to do and indicates which drive it failed to select.

For example, if you try to select an illegal or non-existent drive, such as Q, the following error message will be displayed:

```
Press <CTRLC> to abort.
Disc Err On Q: Select
```

Pressing <CTRLC> will switch the system back to logical drive A. Make the three checks listed above and try again. In this case logical drive Q does not exist so you should try B,C, or D (or M if you have a silicon disc).

DIR To Inspect the Contents of a Disc

You can use the DIR (directory) command to find what files are on any particular disc. You can check for the presence of any particular file or group of files. You will also find it useful to check that creation, renaming, copying, or deletion operations have been carried out successfully.

To display the contents of a particular disc, enter:

```
DIR d:
```

where d: is the logical drive accessing the disc in question. If the disc is in the current logical drive, then d: may be omitted.

For example, the command:

```
DIR A:<RETURN>
```

might produce the directory listing:

```
A: FORMAT   COM        A: FASTCOPY   COM
A: VERIFY   COM        A: TURNKEY    COM
A: BASICS   COM        A: MYPROG1    BAS
A: MYPROG2  BAS
```

To find a particular file or group of files on a disc there is no need to display the whole directory; simply enter:

```
DIR file-reference
```

If you have used an unambiguous file reference, CP/M will search for the file on the specified drive and display its full file reference. If you have used an ambiguous file reference, CP/M will list all the files on the specified drive whose file references match the file reference given.

If CP/M cannot find any file reference that matches the one you have specified, it will display the message:

```
NO FILE
```

NOTE: DIR will not find any file with its display attribute set to $SYS: such files may be found using the command STAT, described in chapter 7.

TYPE To Inspect the Contents of a File

You can display the contents of any disc file by using the TYPE command. The file that you specify should be a text file; either a data file or a program source listing. Object code files (such as COM files), apart from being meaningless to you because they are written to be machine readable, can contain characters that will interfere with the normal display and may even lock up your system.

To inspect the contents of a file, enter:

```
TYPE file-reference
```

For example, if you key in the command line:

```
TYPE ACCOUNT.BAS<RETURN>
```

this will display contents of the file ACCOUNT.BAS if it is present on the current disc.

You can also select a file on another logical drive in the TYPE command line.

For example, the command:

```
TYPE B:INFO2.TXT<RETURN>
```

searches the disc in logical drive B for a file named INFO2.TXT and, if it finds it, displays its contents.

If the file you wish to examine, for example INFO.TXT, is not present on the disc in drive B, the message:

```
B:INFO.TXT?
```

is displayed.

NOTE The TYPE command will only accept a single unambiguous file reference.

If you try to use the TYPE command to display an object code file (.COM) and your system locks up, (that is, it will not respond to any keyed command) try using <CTRL/D> <RETURN> to return to the CP/M prompt.

ERA To Erase Files

You can use ERA to erase (delete) any single file from a disc in any logical disc drive. You can also erase any group of files from a single disc provided that they can be identified collectively by an ambiguous file reference. This can make it devastatingly destructive if used carelessly.

To avoid erasing files by accident, before using ERA make sure that you are completely familiar with:

- The three constituent parts of file references (described in chapter 3)
- Grouping files using an ambiguous file reference

If you have any doubts, practice on a disc containing files that can *safely* be deleted. Take a copy of any disc for practice if you do not have a disc of unwanted files.

To erase a single file, type:

```
ERA file-reference<RETURN>
```

For example, if you key in the command line:

```
ERA B:LEDGER3.DAT<RETURN>
```

the system looks for a file named LEDGER3.DAT on the disc in logical drive B. If it is successful, it erases the file and makes the space it occupied available for new files.

To erase a group of files, type:

```
ERA ambiguous-file-reference<RETURN>
```

For example, the command line:

```
ERA C:*.BAS<RETURN>
```

erases all filetype BAS files from the disc in logical drive C.

To delete all the files on a disc, type:

```
ERA *.*<RETURN>
```

CP/M does not carry out this command immediately, but gives you a chance to change your mind by displaying the message:

```
ALL FILES (Y/N)?
```

If you still want to delete all of your files, type <Y><RETURN>, otherwise type <N><RETURN> which will cancel the ERA command.

After using ERA, you can check that the contents of the disc are as you had intended them to be, by using the DIR command. You can also use DIR to check an ambiguous file reference before using ERA.

Note that you cannot erase a file with its access attribute set to Read-Only (R/O) (See STAT in chapter 7). If you try this, the following screen message will be displayed:

```
Disc error on d: File RO
```

and the ERA command is cancelled. Now you should press any key to return to the CP/M prompt.

Note also that, if you are using a shared-disc system, then you cannot erase a file unless you have previously requested and been allocated write access to the required logical drive.

REN To Rename a File

The REN command is used to change a file reference (that is, to rename it) without altering its contents.

To use the REN command, enter a command line of the form:

```
REN new-file-reference=old-file-reference
```

For example, the command:

```
REN B:JIM.FIL=B:FRED.FIL<RETURN>
```

instructs CP/M to look for a file named FRED.FIL on the disc in logical drive B, and to rename it JIM.FIL.

If the file to be renamed is on the current drive, there is no need to give the drive name. However, if it is on another logical drive, only the new file reference needs to include the drive name. The REN command cannot move a file that it is renaming to another logical drive.

If a file with the name given as 'old-file-reference' does not exist the following message is displayed:

```
NO FILE
```

If you try to rename a file with a name that already exists for another file, the message:

```
FILE EXISTS
```

is displayed and the REN command is aborted.

On a shared-disc system, you must have been allocated write access to the required logical drive before using REN.

After using REN, you can check that the contents of the disc are as you intended them to be by using the DIR command.

SAVE To Save a Memory Area

The SAVE command is used for storing an area of user memory (TPA) as a file on disc. To use SAVE, type a command line of the form:

```
SAVE p file-reference
```

where "p" is the number of pages (256-byte blocks) to be stored from memory, starting at 0100H, as a new file with the file reference given.

For example:

```
SAVE 4 ZAP.COM<RETURN>
```

will store the contents of memory locations 0100H to 04FFH inclusive as a new file called ZAP.COM on the disc in the current drive.

The SAVE command is usually used for storing areas of memory that contain new or modified machine-code programs. The manuals you would need to refer to in order to find out more about this subject are listed in the preface to this manual.

On a shared-disc system, you must have been allocated write access to the required logical drive before using SAVE.

XXX To Run the Program "XXX.COM"

This command provides the link between resident commands and transient commands. The transient commands supplied with this version of CP/M are described in the following three chapters.

When you enter the name of a command, the CCP will look for it among the built-in commands. If the CCP does not find it there, it will then look for a .COM file of that name on the disc in the current drive. If the CCP finds the file on this disc, it loads the file into memory as a program and runs it as if it were a resident command. Your own machine-code programs are executed in the same way.

Remember that this facility only exists for .COM files on the disc in the current drive. To execute a program held on a disc in another drive the logical disc drive must be specified in the file reference.

Chapter 5

Transient Commands for Information Transfer

CP/M offers you three ways to transfer the information that is stored in disc files:

- You can copy one or more files by using the PIP program.
- You can copy one or both sides of a disc to another disc, using the FASTCOPY program. (This also copies the operating system, if any.)
- You can use the COPYFILE utility to copy single files from one disc to another. This is more convenient than PIP if your 480Z system has only one disc drive.

These programs (PIP, FASTCOPY, and COPYFILE) are available to help you to control your disc files, so that you can:

- Place information where you want it,
- Create backup security copies of all your important files.

NOTE Both PIP and COPYFILE will copy files stored on a disc in one density to another disc formatted in a different density (provided that the disc drive units are capable of operating at the required densities). FASTCOPY, however, can only copy all the files held on one disc side to another disc side formatted in the same density. A step-by-step guide to transferring files from a disc in one density to one in another density is given in Appendix B.

Take care when copying files, that there is sufficient room on the disc onto which you are copying the files to receive them. This can be checked by using the resident command STAT for both the discs concerned.

PIP To Copy Files

You will often need to copy files: PIP (Peripheral Interchange Program) provides a wide variety of ways to do this.

If you want to make a copy of a disc file on another disc, and your system has only one disc drive, then COPYFILE will usually be quicker and more convenient to use than PIP. If, however, your single-drive system is fitted with a silicon disc, then you can use PIP to copy the file first to the silicon disc then to the destination disc.

The PIP command allows you to:

- Copy information sequentially from one device to another.
- Copy a file from one disc to another.
- Copy a group of files from one disc to another.
- Make a differently-named copy of a file on the same disc.
- Combine the contents of two or more files to create a single file.
- Transfer files between magnetic discs and a silicon disc.
- Copy a file to or from an external device:

Disc file to screen
Disc file to printer
Disc file to external device
External device to disc file
External device to screen
External device to external device
Keyboard to disc file
Keyboard to screen
Keyboard to printer
Keyboard to external device
External device to printer

On a shared-disc system, you must have been allocated write access to any logical drive on which you intend to write a file.

Errors During Copying: Note that if, after copying a file or files, the disc directory contains a file reference with the filetype .$$$, then that file has been incompletely copied due to an input/output error during copying and the copy operation should be run again. You can use the ERA command to delete the incorrectly copied file.

Initiate PIP by entering one of the following forms of command:

```
PIP command-line

PIP
```

The first form executes the single command line when you press <RETURN>, then returns the system to CP/M command level.

On the other hand, the second form starts the PIP program and then displays the PIP prompt "*". This allows you to enter a command line that it can obey. You can now copy a batch of files, one at a time, without leaving PIP. Any number of command lines may be entered. Each command will be executed when you press <RETURN> and, on completion, the PIP prompt will be displayed for the next command line. When you have carried out all the copying operations and wish to return to the CP/M command level, simply press <RETURN>.

Single Drive Systems: If your system has only one disc drive and you wish to copy a batch of files from one disc to another, you will benefit greatly from using a silicon disc if you have one (copy the files to the silicon disc, change magnetic discs, and copy the files from the silicon disc). Otherwise you must be careful to change discs when requested after each read or write operation. The message is of the form:

```
Insert disk A/C and press <space>
```

The alternative disc is B/D. During disc changes, pay attention to which disc you are using as the source (input file) and which disc you are using as the destination (output file).

The General Form of PIP

To copy a file, the command is of the form:

```
PIP dest-file-ref=source-file-ref<RETURN>
```

where:

dest-file-ref is the file reference of the destination file

source-file-ref is the file reference of the source file

For example, the command:

```
PIP C:JAMES.BAS=B:FRED.FIL<RETURN>
```

will copy the contents of the file FRED.FIL from drive B to a file named JAMES.BAS on drive C.

You can also make a copy of a file on the same disc, in which case you must give the copy a different filename (or filetype), for example:

```
PIP B:GOLD=B:USBANK<RETURN>
```

will copy the contents of the file USBANK on the disc B into a new file called GOLD on the same disc.

If B is the disc in the current logical drive (with PIP on it), the logical drive can be left out of the file references, for example:

```
PIP GOLD=USBANK<RETURN>
```

Copying Groups of Files

To copy a group of files from one disc to another, the command is of the form:

```
PIP dest-disc-drive:=source-ambiguous-file-ref
```

where:

dest-disc-drive holds the destination disc

source-ambiguous-file-ref is the ambiguous file reference that identifies the group of files to be copied

For example, the command:

```
PIP B:=A:*.COM<RETURN>
```

would copy all the files with the filetype COM on the disc in drive A onto the disc in drive B, giving them the same names.

Joining Together Two or More Files

To join together (concatenate) copies of two or more files into a single file, the command is of the form:

```
PIP dest-file-ref=source-file-ref-1,
source-file-ref-2,source-file-ref-3,....
```

where:

dest-file-ref is the reference of the new file

source-file-ref-1, -2, -3,... are the references of all the existing files that you want to join together to form the new file

The original files remain unchanged.

Copying To and From External device

PIP allows you to refer to physical devices through the use of logical device names.

CON — console
RDR — reader
PUN — punch (a null device)
LST — list

NOTE Files transferred to external devices must be files of ASCII characters. Files containing control characters, such as document files created under the WordStar word-processing program, cannot be copied in this way.

Input from SIO4 If you want to create a new disc file containing text (ASCII) characters from a serial input device with the logical device name RDR connected to the SIO4 serial interface socket, follow this procedure:

1. Initialize the SIO4 interface by selecting the printer option with the SIO4 interface and the appropriate baud rate for the input device.

2. Connect the input device to the SIO4 socket. (On the rear panel of the 380Z-D or on the back of the 480Z disc unit.)

3. Start the PIP program as follows:

```
PIP file-reference=RDR:<RETURN>
```

4. Start the input device.

   Note that the last character in the input file must be the <CTRL/Z> character (ASCII 26) to indicate to PIP that the end of file has been reached.

Output to printer If you want to send a disc file containing text (ASCII) characters to an output device, such as a printer, with the logical device name LST:

1. Select the appropriate printer option (serial or parallel)

2. Start the PIP program as follows:

```
PIP LST:=file-reference<RETURN>
```

Linking two machines You can transfer text files between two Research Machines computers along a cable connecting their SIO4 ports by using PIP on each machine, as follows:

- Initialize PRINTER on the source machine as SIO4 by running CONFIG.

- Initialize PRINTER on the destination machine as SIO4 at the same baud rate as on the source machine also by running CONFIG.

- Connect the machines by a serial cable.

- On the destination machine enter:

```
PIP dest-file-ref=RDR:<RETURN>
```

- On the source machine send the text file to the SIO4 interface by entering:

```
PIP LST:=source-file-ref,<CTRL/Z><RETURN>
```

The text file may be up to about 8K bytes long for this method.

You can use this method to transfer text files to and from another CP/M based machine providing that it has a serial interface.

Creating a Disc File from the Keyboard

To create a disc file containing ASCII characters transmitted from the keyboard (logical device name CON:), the command is of the form:

```
PIP file-reference=CON:<RETURN>
```

This starts the PIP program and you can now type the text into the file.

During keyboard entry, characters on the current line of the display can be deleted using <DELT> and re-entered. But this is inadvisable because both the visibly deleted characters and the delete codes are stored in the file.

Deletion is not possible after <RETURN> has been pressed or after the end of the line has been reached, when the cursor is automatically moved to the start of the next line.

Explicit use of the <RETURN> key is included as a character in the text file. Automatic cursor return/line advance does not cause a character to be included in the text file.

When you have finished entering text, the PIP program is terminated by entering the character <CTRL/Z> (ASCII 26).

To transfer a text file from one device (RDR:) to another device (LST: or CON:) use a combination of the input and output methods in the last three uses of PIP described above.

NOTE: On a 380Z-D the baud rate on RDR may be set up using the EMT (Emulator Trap) SETLST and then the printer selected, as, for example, Centronics (user port, type 3). In this way data may be transferred, say from the SIO4 port to the printer:

```
Select SIO4
Set baud rate
Select user port
PIP LST:=RDR:
```

However, the 480Z is not capable of having simultaneous printer channels open. Reselection of a print device closes down the RDR channel.

COPYFILE To copy single files on a single drive system

The COPYFILE utility has been designed to allow users of single drive 480Z disc systems (without a silicon disc) to copy files efficiently. It is not designed to work on other systems.

COPYFILE copies files, one at a time, from any disc surface to any other disc surface. Any number of files can be copied successively without leaving COPYFILE.

Example of Dialogue When Copying with COPYFILE

When you want to run COPYFILE, make sure that you have a disc containing the COPYFILE utility in the drive (and, if on a shared-disc system, that you have write access to the logical drive on which you intend to write). Then enter:

```
COPYFILE
```

The first message from COPYFILE appears on the screen as:

```
COPYFILE                              version 2.3A

COPYFILE copies a file from either side
of a disc to either side of another disc
on a single drive 480Z disc system. e.g.
from drive A or C to B or D & vice-versa

                      WARNING

To avoid corrupting your source disc,
please follow the disc changing messages
exactly. For extra protection cover the
write protect notch on the source disc.

In response to any prompt you may press
<ESC> to re-select the options, or
<Q> to quit and return to CP/M.

Press <RETURN> to continue:-
```

The second message from COPYFILE utility is then displayed:

```
COPYFILE                          version 2.3A

In response to any prompt you may press
  <ESC> to re-select the options, or
   <Q> to quit and return to CPM.

When asked to specify source and
destination files, give the file
reference as: d:filename.filetype
followed by <RETURN>.

Where:-
  drive d may be A,B,C,D or blank,
  filename may be 0 to 8 characters
  filetype may be 0 to 3 characters.

  Source file ?
```

- When specifying the source file, either the filename or the file type must consist of at least one character.
- Key in the file reference of the source, followed by <RETURN>, for example

```
A:MYPROG.BAS<RETURN>
```

- COPYFILE will display:

```
Destination file?
```

- The destination file reference must consist of at least a logical drive name other than the source drive.
- Key in the file reference of the destination, followed by <RETURN>,

```
B:PROG3.BAS <RETURN>
```

Notice that you can copy to a file with a different name in COPYFILE. However, where you do not give a destination filename or filetype, COPYFILE will use those of the source file.

- COPYFILE will display:

```
To copy from file
A:MYPROG.BAS to file B:PROG3.BAS
insert disc then press <RETURN>.
(or press <Q> to quit)
```

- Insert the *source* disc then press <RETURN>. After this point and throughout the file copying operation <ESC> and <Q> are inoperative.

  COPYFILE will now display:

```
Accessing source.....
```

  and, when it has read the file (or just part of it, if it is a long file) into memory , it will display the message:

```
Accessing destination.....
Insert disk B/D and press <space>
```

- Remembering that your destination disc is B/D, remove the source disc from the drive and replace it with the destination disc.

- Press <space> to start COPYFILE writing the file from memory onto the destination disc.

- At the end of the copying operation COPYFILE displays:

```
File copy completed
```

Use of COPYFILE without Sign-on Messages

Once you have have become familiar with COPYFILE, you will find it quicker to leave out the first two messages in the COPYFILE dialogue by starting the program with a full command line. You can specify the file you want to copy in the same way as you do for PIP but you cannot use ambiguous file references.

The general form of the command line for this method of using COPYFILE is:

```
COPYFILE dest-file-ref=source-file-ref<RETURN>
```

where:

dest-file-ref is the destination file reference

source-file-ref is the source file reference

For instance, if you want to copy the file FORMAT.COM from one disc to another, enter the command line:

```
COPYFILE B:=A:FORMAT.COM
```

Then, as its first message, COPYFILE will display:

```
To copy from file
A:FORMAT.COM to file B:FORMAT.COM
insert disc then press..<RETURN>.
     (or press <Q> to quit)
```

from which it will proceed with the requested copying operation as soon as you press <RETURN>.

FASTCOPY To Copy Discs

The FASTCOPY utility is a disc image copying utility that copies the entire contents of one disc surface (the source) onto another disc surface (the destination). It will work on both single drive and dual drive systems.

The source is the disc or surface from which the copy is being made. It supplies the input to the processor and may be known as the input disc. The destination is the disc or surface onto which the copy is to be written. It receives the output from the processor and may be known as the output disc.

The main functions of FASTCOPY are:

- Single surface to surface copying on the same (double-sided) disc
- Single or double surface copying on separate discs

The main features of FASTCOPY are:

- Processing of a batch of discs successively (although you can stop at any point and return to CP/M by pressing <Q>)
- Copying in either single or double density but not from one density to the other
- Runs on either single or dual drive systems
- The disc from which FASTCOPY is loaded can be removed to allow copying of another disc
- Automatic formatting of unformatted destination disc surface(s)
- Optional reformatting of the destination disc surface (or both surfaces if two surfaces are to be copied) on previously formatted discs
- Prompts for the information required at each stage of the operation

When you want to run FASTCOPY, make sure that you have a disc containing the FASTCOPY program inserted. This may be removed once FASTCOPY is loaded.

The FASTCOPY dialogue is shown in the example below. This is followed by a table of the error messages that you may encounter when using FASTCOPY.

Example of Using FASTCOPY

The use of FASTCOPY to copy both surfaces of a disc onto another disc is shown as a series of steps. It is only one of several ways of using FASTCOPY but it shows all the essential features.

- With a disc containing a copy of the FASTCOPY utility in the current drive, load FASTCOPY by entering the command line:

```
FASTCOPY<RETURN>
```

FASTCOPY displays a message similar to:

```
FASTCOPY                          version 2.30

FASTCOPY is a fast disc to disc image
copier. It enables you to copy either
one or both surfaces of a disc, but will
not copy from one density to another. It
automatically formats unformatted discs.

If you wish you may now remove the
system disc, or any other disc(s).

                    WARNING

All files on the destination disc will
be overwritten. The source disc is the
location of the Master Copy.

In response to any prompt you may press
   <ESC> to re-select the options, or
   <Q> to quit and return to CP/M.

Press <RETURN> to continue:
```

Note that the version number, in this case V2.3O, may be different on your system.

The destination disc should be a blank disc, that is, the output disc surface (or surfaces) should not contain any files that you wish to keep, as these will be overwritten during the copying operation.

Pressing <RETURN> will display the next FASTCOPY message:

```
FASTCOPY                          version 2.30

                        WARNING

All files on the destination disc will
be overwritten. The source disc is the
location of the Master Copy.

In response to any prompt you may press
<ESC> to re-select the options, or
   <Q> to quit and return to CP/M.

Source disc..............(A,B,C,D) ?
```

Setting the FASTCOPY Options

- Remove the disc containing FASTCOPY, unless it is also either the source or the destination.

- Enter the name of the logical drive that will contain the source disc.

  For single-surface copying, the source may be in any one of the four drives. Double-surface copying will always involve either copying the disc in logical drives A and C (response A) onto the disc in logical drives B and D or vice versa (response B). FASTCOPY will repeat its prompt if you give any other response than these.

  If you have a single-drive system, remember that the system will automatically switch the current logical drive between A/C and B/D each time that you are prompted to change discs during the copying operation.

  In this example we will enter <A> as our response.

  FASTCOPY then displays the message:

```
Destination disc......(B,C,D) ?
```

- Enter the name of the logical drive where the destination disc is, or, for single-drive systems when performing disc to disc copying, will be, located.

  In this example we will enter <B>.
  FASTCOPY then displays:

```
Copy both sides ..............(Y/N) ?
```

  If you want to copy both sides give the response <Y>, otherwise type <N>.

  In this example we will copy both sides — <Y>.

  FASTCOPY displays:

```
To copy A,C to B,D,
Insert disc(s), then press .....<RETURN>
(or press <Q> to quit)
```

- Insert the source disc into the drive that you have selected — in this case, drive A.

- If you have a dual-drive system, you can also insert the destination disc in the other drive — in this case, drive B. However, in a single drive system you must wait until you are prompted to change discs by the system.

- Check all your responses. The copying operation can be abandoned at any point during the dialogue up to now.

Starting the Copying Operation

- If you want to change any of the instructions that you have entered, type:

```
<ESC>
```

  and return to "Setting the FASTCOPY Options" above. However, if you are sure that all your responses are as you want them to be, then press:

```
<RETURN>
```

and you will start the FASTCOPY process.
Wait while FASTCOPY displays the message:

```
Checking discs, please wait...
```

- If there are any disc errors, a message will be displayed.

- If the destination disc is formatted, a message similar to the following will be displayed:

```
Source disc is ..........DOUBLE density
Destination disc is .......SINGLE density
Reformat destination.................(Y/N) ?
```

Press <Y> to reformat the destination disc to double density and continue with FASTCOPY, or <N> to allow you to change discs.

During the copying operation the tracks are counted as they are transferred through the disc controller and the number is displayed on the screen. This allows you to see how far the operation has progressed. The screen message reads:

```
Copying A,C to B,D, reading track nn
```

followed by the message:

```
Copying A,C to B,D, writing track nn
```

where nn is the number of the track being read from or written to.

nn goes up to 39 for 5.25-inch disc systems
nn goes up to 76 for 8-inch disc systems

On completion, FASTCOPY displays:

```
Disc copy completed.
```

and after a pause, the cursor returns to the message:

```
To copy A to B
Insert disc(s), then press....<RETURN>
     (or press <Q> to quit)
```

- You can now change discs in order to continue copying a batch of discs, or if you have finished with FASTCOPY, press <Q> to return to CP/M.

- If you want to copy another disc with a different selection of options, remove the discs used in the previous copying operation, press <ESC>, and return to "Setting the FASTCOPY Options" above.

- When you terminate FASTCOPY by typing <Q>, the system displays the CP/M prompt:

```
A>
```

Error Recovery

FASTCOPY can recognize a number of error conditions and produce relevant screen messages. These messages, their meaning, and any corrective action necessary, are listed in Table 5.1. The remainder may be found in chapter 8.

Table 5.1 FASTCOPY Error Messages and Responses

Message	Response
`Disc not ready, drive B`	You have tried to copy to or from a drive where there is no disc, or whose door is open. i) Ensure a disc is present ii) Close the drive door iii) Press <RETURN>

Either:
 	
`Write protected, cover notch, drive d:`
 	
for 8-inch discs, or:
 	
`Write protected, uncover notch, drive B:`
 	
for 5.25-inch discs.
	The physical write protect notch on the destination disc is stopping write operations.
	
	i) Remove the covering from the write protect notch on a 5.25-inch disc (or cover it on an 8-inch disc)
	ii) FASTCOPY will wait
	iii) Press <RETURN> to rerun FASTCOPY

Chapter 6

Transient Commands for System Management

This chapter describes utilities which enable the operating system to be copied or modified.

The following operations are possible:

- Copying the operating system unchanged onto another disc, so that that disc can be used for loading CP/M into memory.
  - — Use SYSGEN (disc to disc option)
- Modifying the operating system on a disc so that when the system is loaded from that disc, a particular command will be obeyed automatically.
  - — Use TURNKEY
- Modifying the operating system on a disc so that when the system is loaded from that disc various system parameters (for example, printer selection, screen width) will be set automatically.
  - — Use CONFIG (disc option)
- Altering various system parameters in the system currently running in memory.
  - — Use CONFIG (S option)
- Making a version of the operating system that uses less memory, leaving space for information that will not be overwritten by CP/M or by the loading of programs.
  - — Use MOVCPM and SYSGEN (S option)
- For experts only:—

  If it is desired to modify the operating system, this can

be done by using MOVCPM to create a copy of the system in memory, modifying this system (for example, by using the front panel) and then, by using SYSGEN, to copy this system to another disc.

The functions of the above-named utilities are:

- MOVCPM — To prepare a copy of CP/M in memory with a changed top memory location (56K is the highest permitted memory location for CP/M). A lower top memory location may be needed if your programs access locations outside the transient program area (TPA).

- SYSGEN — This utility has two uses:

  1. To make copies of CP/M directly from one system disc onto one or more new system discs.

  2. To store the output of the MOVCPM utility (held in memory) onto a new system disc.

- CONFIG — To set the printer interface, screen width, and read after write check for immediate use or for automatic use with a particular system disc

- TURNKEY — To start an application program automatically after loading CP/M.

MOVCPM
To Prepare a New Version of CP/M for Copying

It is common practice to keep a copy of the CP/M operating system on all of your discs (but refer to your CP/M Licence Agreement). You can then start or restart the operating system using any of your discs. If you need to create a system disc with a copy of CP/M that uses a smaller memory size for its transient program area than the standard maximum 56K permitted, two CP/M utility programs must be used consecutively (MOVCPM and SYSGEN). This is necessary, for example, when using BASIC with certain machine-code add-ons. The BASIC Reference Manual for your system will indicate when this is necessary and how the system's memory is organized in this case.

If you have as the output (destination) disc, an old disc that contains an earlier version of CP/M, or a version that has been configured for a different memory size, MOVCPM and SYSGEN will overwrite the old system files without destroying any of the other files on that disc.

To use MOVCPM, turn on the system, insert a system disc into drive A, and load CP/M. Then enter:

```
MOVCPM nn *<RETURN>
```

where 'nn' is the top memory location to be used by CP/M. If omitted, the highest available memory location (56K) is assumed.

The system then displays the message:

```
CONSTRUCTING nnk CP/M vers 2.2
READY FOR "SYSGEN" OR
"SAVE 39 CPMnn.COM"
A>
```

where nn is the new memory size you require for CP/M to use.

You should now use the SYSGEN utility to copy this CP/M onto a disc.

NOTE The copy of CP/M produced by MOVCPM will have the standard default CONFIG options and will not have a built in TURNKEY command. If you want this copy of CP/M to have some other CONFIG options or to have a TURNKEY command line, you will have to run these utilities after you have used SYSGEN.

SYSGEN To Copy CP/M onto a Disc

You can copy the CP/M operating system either from a system disc or from a new copy prepared previously by the MOVCPM utility and currently being held in memory onto a formatted disc by using the SYSGEN utility. To use SYSGEN type:

```
SYSGEN<RETURN>
```

The system will display the message:

```
SYSGEN                          version 2.5G

Copies the CP/M Operating System from
a system disc or the output of MOVCPM.

The destination disc must be formatted.
SYSGEN overwrites the existing system
on the destination disc.

In response to any prompt you may press
   <ESC> to reselect the options, or
    <Q> to quit and return to CP/M.

Press <RETURN> to continue:-
```

Press <RETURN> and SYSGEN will then display:

```
SYSGEN                    version  2.5G

In response to any prompt you may press
   <ESC> to reselect the options, or
    <Q> to quit and return to CP/M.

Load system from drive.........(A,B) ?
(or press <S> for system from MOVCPM)
```

1. To copy CP/M from a system disc, enter the name of the logical containing the disc holding the system that you want to copy. For example:

   ```
   <A>
   ```

   SYSGEN will then display:

   ```
   To load system from drive A
   Insert disc, then press.......<RETURN>
   ```

After pressing <RETURN>, SYSGEN displays:

```
Loading system from drive A
```

followed by:

```
CP/M has been loaded from drive A

Destination drive.............(A,B) ?
```

2. To copy CP/M previously left in memory by MOVCPM, enter:

```
<S>
```

SYSGEN then displays

```
Destination drive.............(A,B)?
```

You can now specify the destination drive, for example:

```
<B>
```

then SYSGEN displays:

```
To copy CP/M to drive B
Insert disc, then press ......<RETURN>
   (or press <Q> to quit)
```

During copying, SYSGEN displays the message:

```
Saving system to drive
```

After copying the system to the destination disc, SYSGEN displays:

```
System copy completed
```

The destination disc now contains a new copy of CP/M. If you now want to copy the CP/M utilities, use the PIP utility or, for single drive systems, use the COPYFILE utility.

Before leaving SYSGEN you can use it to copy the system onto further discs. Select the new destination drive, put a new disc into that drive, and proceed as before. A whole batch of discs may be processed in this way.

Replace the system disc in its original drive (if you removed it), and return control to that copy of CP/M by pressing <Q>. This terminates SYSGEN.

If you do not replace the original system disc, CP/M will be reloaded from the disc in the current drive, automatically switching the system to the new version of CP/M.

NOTE The copy of CP/M transferred from one disc to another by using SYSGEN alone will maintain both the CONFIG options and the TURNKEY command line set in the source CP/M. However, it will not copy any program files referred to in the TURNKEY command line.

Error Recovery

Use MOVCPM and SYSGEN with care. Failure to enter the correct arguments for MOVCPM may not produce an error message, but will probably cause either an invalid copy of CP/M, or no copy at all, to be sent to the new disc.

If there is absolutely no doubt that the CP/M version on the source disc is exactly the same as the version required for the destination disc, you may omit MOVCPM and copy the system with SYSGEN alone.

If the system displays either:

```
CONSTRUCTING nnK CP/M vers 2.2
```

or:

```
INVALID MEMORY SIZE
```

or the standard CP/M error message, then you have made a typing error in either the program name or the arguments. Enter:

```
MOVCPM *<RETURN>
```

If there is no copy of MOVCPM on your current disc, the system will display the standard CP/M error message. Use the DIR command to check the presence of the MOVCPM.COM file.

If the message:

```
SYNCHRONIZATION ERROR
```

appears, you are probably using an incorrect version of the MOVCPM program for your machine (possibly intended for a different machine; you may be in contravention of your licence agreement). You must use the copy of MOVCPM available on the distribution disc supplied by Research Machines Limited for your particular machine.

If you enter a valid drive name (either A or B), SYSGEN will ignore the copy of CP/M prepared by MOVCPM and will take a copy from the specified drive. If there is no CP/M, but the disc has been formatted, the system will display the error message:

```
Incorrect CP/M Version
```

If the following message is displayed:

```
Seek error on drive d:
```

where d: is the drive containing that disc, the hardware cannot access that part of the disc. It is most likely that you have inserted a disc formatted in a different density from the previously accessed disc. Replace it with a disc of the correct density.

CONFIG
To Set Printer Interface, Screen Width, and Write Check

CONFIG allows you to set these three system features (attributes) by the following dialogue. The settings can either take effect immediately on the system currently in memory or be assigned to the system disc, in which case the settings do not take effect until that system is next loaded.

To run CONFIG, enter:

```
CONFIG<RETURN>
```

Your system responds with the start-up message:

```
CONFIG                          version 5.1J

CONFIG enables you to set three system
features, either on the system currently
in memory or on the system stored on the
system disc. The features which may be
set are:

     1. Printer interface
     2. Screen width
     3. Read after write check

Features set by CONFIG on the system in
memory take effect when you press the
<I> (Insert) key, but those set on the
system on disc, take effect only after
that system has been loaded.

In response to any prompt, you may press:

  <ESC>   to reselect the options, or
   <Q>     to quit and return to CP/M.

       Press <RETURN> to continue.
```

The above message from CONFIG is restricted by the size of the display and the following additional comments are worth noting:

- If you use CONFIG to change features on the system in memory, those features will not be saved on disc. When the system is switched off and/or reloaded the changes will be lost. Similarly, changes to a system on disc do not affect the system in memory but require the modified system to be loaded from that disc.

- If you make a mistake in any setting, you can go back and correct it without leaving CONFIG.

- Any changes made using CONFIG are implemented by pressing <I> when it appears in the prompt on the main menu in the third screen message to appear; this is described below.

- The system in memory (system selection <S>) refers to the system under which your programs are currently running. This is not the same system as MOVCPM provides, which is held in a special buffer area in memory.

Press <RETURN> and the second screen message will be displayed:

```
CONFIG                              version 5.1J

In response to any prompt, you may press
  <ESC>    to reselect the options, or
   <Q>     to quit and return to CP/M.


Set features on drive.............(A,B)?
  (or press <S> for system in memory)
```

The first four lines of this message, the title, the version number, and the response reminder for repeating or leaving (quitting) CONFIG, are repeated from the start-up screen message and continue to be repeated throughout CONFIG. They are not repeated again in this manual.

The remainder of the message asks you to indicate the location of the system that you wish to change. It can be on a disc in either logical drive A or B, or it may be the current system in memory. If you select a disc drive, for example, B, you will receive a message such as:

```
Setting features on system in drive B.

<P> Printer.........device is SERIAL 6
                    ....speed is 9600 Baud
<S> Screen............width is 80 chars.
<R> Read after write check is OFF
<I> Insert the above features.

Select feature (P,S,R) or insert (I)?
```

(From the previous message the alternative responses A or S will change only the end of the first line to:

```
                    ..........in drive A.
```

or

```
                    ..........in memory.
```

respectively. This variation, in the first line only, continues throughout CONFIG and is not repeated in this manual.)

This is the main menu in CONFIG. The first time that it is displayed it shows the settings on the specified system, subsequently it will include each change as it is made. They are given in capitals for both the printer and the read after write check settings, and in numerals for the screen width.

If the settings are as you want them to be, press <I> and they will be inserted into the system you have specified. If you want to change a setting, press the appropriate key: <P> for printer, <S> for screen width, or <R> for read after write check.

Pressing <P> at this point will now cause the system to display the PRINTER message:

```
    Setting PRINTER on system in drive B.

Device <0> CONSOLE        <4> SERIAL 4
       <1> SERIAL 1       <5> SERIAL 5
       <2> SERIAL 2       <6> SERIAL 6
       <3> USER PORT

              Select device (0 to 6)?
```

Select the device to suit your printer. (Refer to your printer manual if you do not know what to specify here.) The display will return to the main menu and will include the new settings. If you select any of the devices, SERIAL 2,4,5, or 6 then this additional display will appear:

```
    Speed  <0>  110 Baud      <4> 2400 Baud
           <1>  300 Baud      <5> 4800 Baud
           <2>  600 Baud      <6> 9600 Baud
           <3> 1200 Baud

                  Select speed (0 to 6)?
```

will appear on the screen.

Now select the speed to suit your printer (1 to 6). CONFIG will then return to the main menu.

If you select any of the devices, CONSOLE, SERIAL 1, or USER PORT, the speed cannot be set and the speed prompt shown above is not displayed in the main menu.

Pressing <S> will display the SCREEN message:

```
Setting SCREEN on system in drive B.

Screen width when system is loaded:

<0> 40 characters
<1> 80 characters

<L> NO-CHANGE-Leave in pre-boot width

          Select width (0,1,L)?
```

If you select either of the screen width options, 40 or 80 characters, the display will be forced into the specified width each time CP/M is loaded. If you press <L> the sysstem will maintain the screen width that exists before CP/M is loaded. Select the option you want. The display will then return to the main memory and will include the new setting.

Pressing <R> will display the WRITECHECK message:

```
Setting WRITECHECK on system in drive B.

Read after write check

<0> Switch OFF
<1> Switch ON

Select switch setting (0,1)?
```

The read after write check affects the performance of many operations. With the read after write check OFF, writing speed is increased but reliability might suffer. Select either ON or OFF. The display will then return to the main menu and will include the new setting.

When all the settings shown in the main menu are as you want them to be, press <I> to insert them into the system that you selected.

When you have finished with CONFIG, press <Q> to return to CP/M command level.

REMEMBER If you have used MOVCPM to change the memory size to be used by CP/M, you will also have to run CONFIG subsequently to set up these options as you require them.

TURNKEY To start a program automatically

TURNKEY allows you to write a CP/M command line that will be obeyed automatically each time the operating system is loaded from monitor (ROS/COS) level. For instance you can use TURNKEY to cause CP/M to display the disc directory (by using DIR) or perhaps set it to call up TXED each time you start up your system and load CP/M.

Only one command line (equivalent to requesting *one* program to be loaded) may be held in TURNKEY.

To set TURNKEY, type:

```
TURNKEY<RETURN>
```

TURNKEY displays the message:

```
TURNKEY                          version 2.1J

TURNKEY writes a single command line of
up to 80 characters onto a valid CP/M
system disc.

The command line will be obeyed every
time the system is loaded (COLD BOOT).

                  WARNING
Make sure that the command line that
you are about to enter will execute
correctly on your system.

In response to any prompt you may press
<ESC> to reselect the options, or
<Q> to quit and return to CP/M.

Press <RETURN> to continue:-
```

Now TURNKEY asks for the name of the drive containing the disc on which you wish to place the TURNKEY command line:

```
TURNKEY disc in .............(A,B) ?
```

Press either <A> or <B> according to which logical drive is accessing the disc in question. TURNKEY will now tell you what the current TURNKEY command line is (if any) and ask you if you wish to change it:

```
Modify.......................(Y,N) ?
```

If you want to change the current command line press <Y> and TURNKEY will ask you to enter the new command line. Complete it with a <RETURN> and TURNKEY will indicate:

```
Function completed.
```

For example, you may wish to display the directory on one of your discs so change the TURNKEY command line to:

```
DIR<RETURN>
```

Reload the operating system from the disc holding TURNKEY to check that it does work.

REMEMBER If you have used MOVCPM to change the memory size of your CP/M, you will also have to rerun TURNKEY to set the automatic command line again. SYSGEN, used on its own, or FASTCOPY, will make an exact copy of the system on the source disc including any TURNKEY command line.

Chapter 7

Transient Commands For Disc Maintenance

All disc filing systems require some maintenance or, as it is commonly called, housekeeping. This chapter tells you how to prepare discs for storage, how to inspect the space available, and how to reduce errors.

Old discs and old files are more liable to error than new ones but regeneration of disc files helps to avoid disc errors. Discs do, in fact, wear out. So keep your most important information on your newest discs and periodically throw away your oldest ones after copying any wanted files they contain onto new discs.

It is also a good idea to reformat any old discs that can be cleared of files before copying new files onto them. For example, when using FASTCOPY always use the reformatting option.

This chapter explains how to use the FORMAT, VERIFY, and STAT programs supplied as components of this version of CP/M. All discs must be formatted before use and the FORMAT program is supplied to do this. VERIFY ensures that all sector headers on a formatted or used disc are valid. The program STAT allows you to find out the essential characteristics of discs and files.

FORMAT To Format a Disc

FORMAT is used:

- To prepare a new disc for use
- To reformat a used disc
- To ensure that a disc is blank

FORMAT lays down a pattern on the disc, dividing it into storage areas which can be found by the hardware. In this version of CP/M, discs can be formatted in either single or double density.

It is important that the FORMAT program be used with great care. If it is run on a used disc, it will completely erase all files that are present on the disc including the CP/M operating system. Make sure that you understand the disc drive labelling conventions for your machine before you use FORMAT.

All discs used with Research Machines disc systems must be correctly formatted. New discs should be formatted before use by running either the CP/M utility program FORMAT (below) or the Research Machines utility program FASTCOPY.

Any silicon disc must also be formatted before use, and this is done automatically each time a 480Z so equipped is switched on.

Checking if a Disc is Already Formatted

If you wish to check whether or not a disc has already been formatted, first place a system disc in drive A and load CP/M. Place the disc you wish to check in any drive (d), and type:

```
DIR d:<RETURN>
```

If the system displays either the disc directory or the message:

```
No file
```

then the disc has already been formatted.

If the response is the message:

```
Press <CTRL/C> to abort
Disc Err on d: Select
```

then the disc (in d) has not been formatted. In this case, in order to restart CP/M, replace the system disc and type:

```
<CTRL/C>
```

Using the FORMAT Program

To use FORMAT, type:

```
FORMAT<RETURN>
```

The FORMAT program displays a message similar to:

```
FORMAT                          version 2.30

FORMAT writes a pattern onto the disc,
dividing it into storage areas which can
be located by the hardware.

Without this pattern, discs can not
normally be used, that is, they must be
formatted before use.

                    WARNING

Any files on the disc to be formatted
will be destroyed. Please remove the
system disc.

In response to any prompt you may press
   <ESC> to restart the program, or
    <Q> to quit and return to CP/M.

Press <RETURN>  to continue:-
```

Note that the version number, in this case 2.3O, may be different on your system.

If you now press:

```
<RETURN>
```

the introductory message will be replaced with:

```
FORMAT                          version 2.30
                    WARNING

Any file on the disc to be formatted
will be destroyed. Please remove the
system disc.

In response to any prompt, you may press
   <ESC> to restart the program, or
    <Q> to quit and return to CP/M.

Format which disc.........(A,B,C,D)?
```

You can now remove the CP/M system disc from whichever drive contains it to ensure that you do not format it again and destroy all its files by mistake. Then enter the drive name (d) containing the disc surface to be formatted. FORMAT displays the message:

```
Format both sides.....(Y/N)?
```

Press <Y> if you want both sides to be formatted. Note that you can only format both sides if your answer to the previous question was either A or B.

Press <N> if you only want to format the side selected above. FORMAT displays the message:

```
Double density.............(Y/N)?
```

Press <Y> for double density or <N> for single density. FORMAT displays the message:

```
To format disc in drive d,
Insert disc, then press <RETURN>
  (or press <Q> to quit)
```

Insert the disc to be formatted in the named drive (if it is not already present) and type:

```
<RETURN>
```

After you press <RETURN> there will be a pause while the program checks the disc to see if it is already formatted. The display will show:

```
Checking disc, please wait........
```

If it is not formatted, the formatting operation will be started. If the disc is formatted, one of the following messages will be displayed:

```
Single density disc, reformat (Y/N)
```

or

```
Double density disc, reformat (Y/N)
```

or

```
Mixed density disc, reformat (Y/N)
```

A formatted disc may contain files. If there is any possibility that the disc that you are about to format holds files that you want to retain, press <N>, and check its contents. If you are happy that anything on the disc can be removed, press <Y> to start the formatting operation.

While the formatting operation is taking place the following message is displayed:

```
Formatting disc d, track nn
```

where d is the logical drive holding the disc and nn is the number of the track(s) being formatted.

At the end of the operation, the disc will have been formatted and the FORMAT program displays the message:

```
Format completed.
```

and the cursor then returns to the prompt:

```
Insert disc, and press <RETURN>
```

You can now put another disc in the same drive and format it. Press <RETURN>, or alternatively, press <ESC> or <Q> either to respecify the FORMAT operation or to return to the CP/M command level, respectively.

Pressing <ESC> returns the cursor to the prompt:

```
Format which disc (A,B,C,D):
```

which allows you to reselect the format parameters for another format operation.

Pressing <Q> returns control to CP/M and, if you have removed the system disc, the following message will be displayed:

```
Please re-insert System Disc into A:
and press <RETURN>
```

Replace the system disc if you had previously removed it.

The error messages produced by FORMAT, their explanations, and the appropriate responses, are summarized in Table 7.1. A complete list is given in chapter 8.

Table 7.1 FORMAT Program Error Messages

Message	Explanation	Response
`Disc not ready, drive d`	You tried to format an empty disc drive.	i) Insert a disc ii) Close drive door iii) Try again
`Write protected, uncover notch, drive d`	You tried to format a write-protected 5.25-inch disc.	Remove notch cover and try again.
`Write protected, cover notch, drive d`	You tried to format a write-protected 8-inch disc.	Cover the notch and try again.

VERIFY To Test that a Disc is Readable

The VERIFY utility tests every sector on a disc to ensure that it can be read without error. If any errors are found, these will be reported. Running VERIFY does not change the contents of the disc in any way.

To run the program, enter:

```
VERIFY<RETURN>
```

The program displays the version number followed by an introductory message, as follows:

```
VERIFY                          version 2.3J


VERIFY ensures that the format of the
disc is valid by checking that the
hardware can read all areas of the disc.

It does not examine or overwrite the
contents of existing files.
In response to any prompt you may press
   <ESC> to re-select the options, or
    <Q> to quit and return to CP/M.


Press <RETURN> to continue:-
```

Pressing <RETURN> displays:

```
VERIFY                          version 2.3J

In response to any prompt you may press
   <ESC> to re-select the options, or
    <Q> to quit and return to CP/M.

Verify which disc.............(A,B,C,D) ?
```

Enter the name (d) of the logical drive that contains (or will contain) the disc you want to verify, and the program will then display the message:

```
Verify both sides.................(Y/N)?
```

Respond with <Y> or <N> according to whether you want to verify both sides or not. VERIFY displays:

```
To verify disc in drive d,
Insert disc, then press <RETURN>
   (or press <Q> to quit)
```

Place the disc that you want to verify in the drive that you selected above. Pressing <RETURN> starts the verifying process and displays the message:.

```
Checking disc, please wait......
```

In single-drive systems, when you have not yet inserted the disc to be verified in the specified drive, the system displays:

```
Insert disk in drive d, and press <space>
```

The verification operation now starts and its progress is indicated by one of the messages:

```
Verifying double density disc, track nn.
```

or

```
Verifying single density disc, track nn.
```

according to whether the disc to be verified is single or double density and where nn is the number of the track(s) being verified.

At the end of the verification process and if no errors have been found, the following message is displayed:

```
Disc successfully verified.
```

The cursor returns to the question:

```
Insert disc in d, and press <RETURN>
```

If errors are found, their presence is displayed when they are detected and the system retries to read the bad sector. At the end of the verification process a summary of the errors is given.

Errors may be soft or hard. Soft errors appear during only one data transfer process and will be overcome by the retry procedure or by copying the file. On the other hand hard errors exist permanently in the magnetized surface and cannot be overcome by the retry procedure. Discs with such errors must be reformatted but if the error persists, the disc must be discarded.

STAT To Display System Information

The STAT (status) command is very useful. It will display the status of discs or the files held on discs. You can use it to:

- Display the amount of blank space available on a disc
- Display the status of a file or of a group of files

- Modify the access and disclosure attributes of a file

To display the space available on a disc, enter:

```
STAT d:<RETURN>
```

where d: identifies the logical disc drive containing the disc that you want to inspect.

For example, the command:

```
STAT C:<RETURN>
```

displays the space available on the disc in drive C, as follows:

```
Bytes remaining on   C:     41k.
```

To display the status of an individual file enter:

```
STAT filename<RETURN>
```

For example, the command:

```
STAT B:PIP.COM<RETURN>
```

will display:

```
Recs      Bytes      Ext        Acc

58         8k         1         R/W    B:(PIP.COM)
Bytes Remaining on    B:    73k
```

A file name displayed in parentheses (brackets), such as B:(PIP.COM), means that the file has its disclosure attribute set to SYS. This indicates that the file name is not shown in the directory display produced by the DIR command.

However, if the named file is not on the disc, the message:

```
File Not Found
```

is displayed.

To display the status of a group of files, type:

```
STAT ambiguous-file-reference <RETURN>
```

For example, the command:

```
STAT B:*.TEX<RETURN>
```

will display the status of all files with the extension filename TEX on the disc currently in logical disc drive B.

The display will be in the form:

```
 Rec     Bytes    Ext      Acc
  8       1K       1       RO   B:MYFILE1.TEX
  4       1K       1       RW   B:DRIVE.TEX
 16       2K       1       RO   B:(QUESTION.TEX)
Bytes Remaining on  B: 237K
```

This display shows the following information:

Rec — The number of 128-byte records allocated to the file

Bytes — The number of bytes on the disc allocated to the file in units of 1K (1024 bytes)

Ext — The number of physical extents on the disc allocated to the file; this is equal to the number of FCB (file control block) entries in the directory that are allocated to the file.

Acc — The setting of the access attribute for each file, either R/O (read-only) or R/W (read-write).

D:FILENAME.TYP — The logical disc drive name, the filename, and the filetype of each file. If this file reference is enclosed in parentheses, the file has its disclosure attribute set to SYS; otherwise this attribute is set to DIR.

To alter the access and disclosure attributes of a file, you may use one of the following:

- `STAT file-reference $R/O<RETURN>`

  — to set the access attribute to the read-only state.

- `STAT file-reference $R/W<RETURN>`

  — to restore the access attribute to the default read$write state.

- `STAT file-reference $SYS<RETURN`

  — to set the disclosure attribute to SYS so that the file is not listed by the DIR function.

- `STAT file-reference $DIR<RETURN>`

  — to set file disclosure attribute to DIR so that the file is listed by the DIR function. This is the default setting.

Ambiguous file references may be used, for example:

```
STAT *.* $DIR<RETURN>
```

will change the disclosure attribute to DIR on every file.

After each of these changes has been successfully carried out, STAT will display a message of the form:

```
filename.typ set to R/O (R/W,SYS,or DIR)
```

The display given by:

```
STAT *.*<RETURN>
```

shows the access and disclosure attributes of each file. Files that have the disclosure attribute SYS appear with their names in brackets.

Disc Characteristics

STAT can be used to display the characteristics of current discs; that is all the discs that have been accessed since the last <CTRL/C> or BDOS Disc Reset or Reset Drive function.

The command line is:

```
STAT DSK:<RETURN>
```

For an 8-inch disc in drive C formatted in double-density, for example, this will result in the following display:

```
  C: Drive Characteristics
3888: 128 Byte Record Capacity
 486: Kilobyte Drive Capacity
 128: 32 Byte Directory Entries
 128: Checked Directory Entries
 256: Records/Extent
  16: Records/Block
  52: Sectors/Track
   2: Reserved Tracks
```

Chapter 8

Messages

Your system will often display messages on the screen. These messages are displayed for different reasons and from different sources. CP/M generates some of the messages that you will receive, but they may also come from ROS, COS, language interpreters, or any program that you may be running.

Many messages, such as start-up and instructional messages, are self-explanatory. Other messages are not so clear. In particular, error messages do not always explain what has gone wrong, because to do so would take up too much system space. For this reason it is not always easy to tell where they come from.

The rest of this chapter is directed to explaining the messages which may appear on your display. There are others, but we have omitted those that are self explanatory.

For messages generated during the running of programs other then the CP/M utilities distributed with your disc system, you should consult the manuals or instructions for those programs.

The messages are listed in alphabetical order with an explanation of the meaning of each one and details of its source. Where appropriate, the action to be taken when this message occurs is given.

Message — *Explanation* — *Source*

`ABORTED` — PIP

You stopped a PIP operation by pressing a key.

`Ambiguous file specification` — COPYFILE

The file specification given is ambiguous.
Give an unambiguous (specific) file specification.

`Attend to printer` COS/ROS

The printer that you have requested cannot be accessed. Check the connections.

`BAD DELIMITER` STAT

Check command line for typing errors.

`Bad load` CP/M

There is insufficient memory to load a CP/M program. If you are not using a 56k system, use MOVCPM to build a bigger CP/M, otherwise the program is too big.

`Bad parameter(s), drive d:` Utilities

Utility mode-of-operation failure. Report it to Research Machines.

`Boot? or Boot Error` ROS/COS

There is a physical error on the system disc. Retry or remove the disc and load CP/M from another disc.

`BREAK` Front Panel

This message will appear right at the bottom of the Front Panel display. It is most likely that there is a program or hardware fault. Repeat the current operation, check the program, and if the fault persists, contact Research Machines Technical Support Department.

`CANNOT CLOSE DESTINATION FILE - (filespec)` PIP

An output file cannot be closed. You should take appropriate action after checking to see if the correct disc is in the drive and that the disc is not write-protected.

`CANNOT READ` PIP

PIP cannot read the specified source (input file).

`CANNOT WRITE` PIP

The destination (output file) specified in the PIP command is illegal. You probably specified an input device as a destination.

`Checksum error` PIP

A hex record checksum error was encountered. The hex record that produced the error must be corrected, probably by recreating the hex file.

`Copying to a different density disc is not allowed without reformatting.` FASTCOPY

FASTCOPY cannot copy to a disc formatted in a different density from the source. Reformat the destination disc.

`CORRECT ERROR, TYPE RETURN OR CTL-Z` PIP

A hex record checksum was encountered during the transfer of a hex file. The hex file with the checksum error should be corrected, probably by recreating the hex file.

`CRC error, drive d:` Utilities

There is a fault on the disc, reformat it.

`CRC error on download, drive d:` Utilities

Utility mode-of-operation failure. Report it to Research Machines.

`DESTINATION IS R/O, DELETE (Y/N)?` PIP

The destination file specified in a PIP command already exists and it is Read Only. If you type <Y>, the destination file is deleted before the file copy is done.

`Disc directory full!` COPYFILE

There is no room for another entry in the directory. Return to CP/M command level, erase a file, and rerun COPYFILE.

`Disc Err on d:` CP/M

Basic Disc Operating System Error on the designated drive: CP/M replaces d: with the drive specification of the drive where the error occurred. This message is followed by one of the four phrases in the situations described below.

```
Press <CTRL-C> to abort
Disc Err on d: Bad Sector
```
CP/M

This message appears when:

— CP/M finds no disc in the drive
— the disc is improperly formatted
— the drive latch is open
— power to the drive is off.
— you are trying to access a disc in the wrong density without either pressing <CTRL/C> or performing a BDOS Disc Reset or Reset Disc function

Check for one of these situations and try again. This could also indicate a hardware problem or a worn disc. Press <CTRL/C> to terminate the program and return to CP/M.

```
Disc Err on d: File R/O
```
CP/M

You tried to erase or rename a read-only file. The file should first be set to read-write (R/W) with the command: "STAT filespec $R/W."

```
Disc Err on d: R/O
```
CP/M

The named disc drive has been assigned read only status with a STAT command, or the disc in the drive has been changed without being initialized with a <CTRL/C>. CP/M terminates the current program as soon as you press any key.

```
Press <CTRL-C> to abort
Disc Err on d: Select
```
CP/M

CP/M has received a request to access or to select a non-existent drive or one without a formatted disc correctly inserted. CP/M terminates the current program as soon as you press any key. Press <CTRL/C> to abort.

`Disc Error` — ROS, COS

There is a fault in the disc drive unit. Check that the red light on the front of the unit is lit. If it is off, check the connections and the fuses. If it is on, there is probably a fault on the intelligent disc controller board.

`Disc is single sided, drive d:` — Utilities

You have called for a double-sided operation on a single-sided disc. Reselect the options or change the disc.

`Disc not formatted, drive d:` — Utilities

The utility requires a formatted disc. Insert a formatted disc or run the FORMAT utility.

`Disc not ready` — COS

There is a fault in the disc drive, it is not switched on, or it is not connected.

`Disc not ready, drive d:` — CP/M, Utilities

Disc not properly inserted, drive door not closed or drive unit now switched on. Reinsert disc and press <RETURN>

`DISC READ ERROR - (filespec)` — PIP

The input disc file specified in a PIP command cannot be read properly. This is usually the result of an unexpected end-of-file. Correct the problem in your file.

`DISC WRITE ERROR - (filespec)` PIP

A disc write operation cannot be successfully performed during a PIP command, probably due to a full disc. You should either erase some unnecessary files or get another disc with more space and execute PIP again.

SUBMIT

The SUBMIT program cannot write the $$$.SUB file to the disc. Erase some files, or select a new disc and try again.

`ERROR: BAD PARAMETER` PIP

You entered an illegal parameter in a PIP command. Retype the entry correctly.

`Failed to write - disc may be full!` COPYFILE

There is no room on the disc. Return to CP/M command level, erase a file, and rerun COPYFILE.

`FILE EXISTS` CP/M

You have asked CP/M to create or rename a file using a file specification that is already assigned to another file. Either delete the existing file or use another file specification.

REN

The new name specified is the name of a file that already exists. You cannot rename a file with the name of an existing file. If you want to replace an existing file with a newer version of the same file, either rename or erase the existing file, or use the PIP utility.

`File Not Found` — CP/M

CP/M cannot find the specified file. Check that you have entered the correct drive specification or that you have the correct disc in the drive.

`File not found, drive d:` — Utilities

The file specified is not on the disc specified. Either respecify the file or insert the correct disc and press <RETURN>.

STAT

STAT cannot find the specified file. The message might appear if you omit the drive specification. Check to see if the correct disc is in the drive.

`FILE NOT FOUND - (filespec)` — PIP, STAT

An input file that you have specified does not exist.

`File x:xxxxxxxx.xxx does not exist!` — CP/M

Respecify the file.

`Illegal source to destination drives.` — COPYFILE

The drive names selected are illegal. Respecify the drives.

`Incorrect CPM version (drive d:)` — Utilities

The utility requires a different version of CP/M; in most cases. It is needed in memory, but also possibly on disc, such as when using SYSGEN or TURNKEY.

`Incorrect firmware version` — Utilities

The utility requires a different version of the firmware.

`Insufficient free memory in system` — Utilities

The operation you are attempting requires more free memory.

`INVALID DIGIT - (filespec)` — PIP

An invalid hex digit has been encountered while reading a hex file. The hex file with the invalid hex digit should be corrected, probably by recreating the hex file.

`Invalid Disc Assignment` — STAT

Might appear if you follow the drive specification with anything except =R/O.

`Invalid File Indicator` — STAT

Appears if you do not specify R/O, R/W, DIR, or SYS.

`Invalid file specification` — COPYFILE

The file specification given is invalid. Respecify the file.

`INVALID FORMAT` — PIP

The format of your PIP command is illegal. See the description of the PIP command.

`INVALID SEPARATOR` — PIP

You have placed an invalid character for a separator between two input filenames.

`NO DIRECTORY SPACE - (filespec)` — PIP

There is not enough directory space for the output file. You should either erase some unnecessary files or get another disc with more directory space and execute PIP again.

`No current TURNKEY command line.` — TURNKEY

There is no TURNKEY command line in the system specified.

`NO FILE - (filespec)` — CP/M; DIR, ERA, REN, PIP

CP/M cannot find the specified file, or no files exist.

`No room` — CP/M

There is insufficient memory to load the operating system.

```
No operating system on this disc
Please use SYSGEN.
```
— Formatted disc

or

```
No operating system
on this disc
Please use COPYSYS.
```
— Disc formatted under CP/M 2.2C

The system tracks on this disc do not contain an operating system. Either use SYSGEN to place a system on the disc or load CP/M from another disc.

NO SPACE — SAVE

Too many files are already on the disc, or no room is left on the disc to save the information.

NOT A CHARACTER SOURCE — PIP

The source specified in your PIP command is illegal. You have probably specified an output device as a source.

** NOT DELETED ** — PIP

PIP did not delete the file, which may have had the R/O attribute.

Not double density disc, drive d: — SYSGEN

The destination disc must be formatted in double density. Format the disc or insert a correctly formatted disc.

NOT FOUND — PIP

PIP cannot find the specified file.

Please give a valid command or type H for help. — ROS

The system is waiting for a valid ROS command. The help menu, obtained by typing <H>, lists the available commands.

QUIT NOT FOUND — PIP

The string argument to a Q parameter was not found in your input file.

`Read error` TYPE

An error occurred when reading the file specified in the type command. Check the disc and try again. The STAT filespec command can diagnose trouble.

`READER STOPPING` PIP

Reader operation interrupted.

`Record Too Long` PIP

PIP cannot process a record longer than 128 bytes.

`Requires CP/M 2.0 or newer for operation` PIP

This version of PIP requires the facilities of CP/M 2.0 or a later version.

`START NOT FOUND` PIP

The string argument to an S parameter cannot be found in the source file.

`Seek error, drive d:` Utilities

There is a fault on the disc or it is not formatted: try to reformat it.

`Sides have differing densities, drive d:` Utilities

You have called for a double sided operation on a disc with mixed densities. If the disc is the source, reselect the single sided option. If the disc is the destination either change it or reformat it.

`SYNCHRONIZATION ERROR` MOVCPM

The MOVCPM utility is being used with the wrong CP/M system.

`** TOO MANY FILES **` STAT

There is not enough memory for STAT to sort the files specified, or more than 512 files were specified.

`UNEXPECTED END OF HEX FILE - (filespec)` PIP

An end-of-file was encountered prior to a termination hex record. The hex file without a termination record should be corrected, probably by recreating the hex file.

`Unknown command, drive d:` Utilities

Utility mode-of-operation failure. Report it to Research Machines.

`Unknown disc error, drive d:` Utilities

Utility mode-of-operation failure. Report it to Research Machines.

`Unknown IDC response, drive d:` Utilities

Utility mode-of-operation failure. Report it to Research Machines.

`Unrecognized Destination` PIP

Check command line for valid destination.

`VERIFY ERROR:-(filespec)` PIP

When copying with the V option, PIP found a difference when rereading the data just written and comparing it to the data in its memory buffer. Usually this indicates a failure of either the destination disc or drive.

`Write check failure, drive d:` Utilities

Probably a destination fault. Repeat the copying operations.

`Write protected, cover notch, drive d:` Utilities

The disc is write protected. Cover the notch to write enable it. Reinsert the disc and press <RETURN>.

`Write protected disc` Utilities

Write enable the disc or change to another disc. Reinsert and press <RETURN>

`Write protected, uncover notch, drive d:` Utilities

The disc is write protected. Uncover the notch to write enable it. Reinsert the disc and press <RETURN>.

`WRONG CP/M VERSION` Utilities

You tried to run a CP/M 2.2D utility under an earlier CP/M. Load CP/M 2.2D.

`(Your input)?` CP/M

If CP/M cannot find the command you specified, it returns the command name you entered followed by a question mark. Check that you have typed the command line correctly, or that the command you requested exists as a .COM file on the default or specified disc.

Appendix A

Contents of the CP/M 2.2D Distribution Disc

The CP/M distribution disc supplied with your disc system contains some or all of the following files:

File reference	*Purpose*
COPYFILE.COM	To copy individual files on a single-drive disc system
CONFIG.COM	To set three system features; screen width, printer, and read after write check.
* DDT.COM	To debug an assembly-level program
FASTCOPY.COM	To copy the entire contents of a disc's surface(s)
* FILEX.COM	To transfer ASCII files between disc and cassette storage (LINK 480Z only)
FORMAT.COM	To format discs
* LOAD.COM	To create an executable (.COM) assembly-level program file
MOVCPM.COM	To create a version of CP/M to match a given memory size
PIP.COM	To copy disc files
STAT.COM	To display the status of files and modify file attributes
SYSGEN.COM	To tailor and copy CP/M onto a system disc
* SUBMIT.COM	To submit a file of CP/M-level commands for batch processing

File reference	*Purpose*
TURNKEY.COM	To start a program automatically after loading the operating system
VERIFY.COM	To check that all the files on a disc are readable
* XSUB.COM	To allow parameter passing from a command file to the programs it launches. Used with SUBMIT.COM
RELEASE.TXT	Release note for this version of CP/M

The programs marked with an asterisk (*) are not described in this manual. Descriptions of these programs can be found in the CP/M Operating System Manual available from Digital Research.

Appendix B

Quad Density and Other Storage Densities

Contents of this Appendix

Introduction

The main body of this manual was written to cover the use of a 380Z-D or 480Z with one or two disc units and the CP/M 2.2D disc operating system. The disc storage was generally assumed to be "double density"; a term referring to the amount of information which could be stored on any one disc. The products referred to in this appendix can store twice as much information again on each disc; a format known as "Quad Density".

The operations described in this appendix deal particularly with the transfer of data to or from quad density, but the same principles apply to any other combination of different densities.

Quad Density

Quad density gives twice as much disc storage space per disc as double density, or four times as much as single density. You can therefore work with far fewer discs and far fewer disc changes.

Quad density is supported by the latest version of the CP/M disc operating system: CP/M 2.2F. This version of CP/M will run on any 480Z and will also support shared discs and a silicon disc. The version of CP/M that you have loaded is indicated in the sign-on message, for example:

```
Research Machines
56K CP/M vers 2.2F 1/30A
For 480Z Disc Systems
Quad and Double Density

Silicon Disc on drive M:
```

To obtain quad density, you will need either an MQ1 (single drive) or an MQ2 (dual drive) disc unit. These drives are clearly labelled on the front panel. CP/M 2.2F can be used with MD1 or MD2 disc units but with disc storage limited to double density. It is not possible to equip a dual drive disc unit with one double density drive and one quad density drive.

If you can work entirely at quad density, do so. The only parts of this document of particular interest to you then will be those headed Storage Characteristics, Utilities and Error Messages. Most of this document is concerned with the use of a quad density system when you already have discs recorded at lower densities, or if you wish to write disc files that can be read on machines limited to lower densities.

Compatibility

Early Research Machines products used single density storage. Many later products, including all 480Z disc systems supplied before September 1984, use double density storage, but can still handle discs in single density. Quad density products will also handle double or single density discs, but there are two good reasons for not running lower density discs on any system designed for higher densities: firstly it is a waste of your disc storage capacity, secondly there is a loss of reliability.

Whenever possible you should use discs formatted in the highest density available on your system.

Use the ability to handle lower density discs solely for the purpose of copying files to or from other computers if they are restricted to a lower density.

When you insert or exchange a disc in a drive unit, you should make it a habit always to press <CTRL/C> to reset the operating system before using the disc. It is particularly important to do this when replacing a disc of one density with a disc of a different density.

Storage Characteristics

On each side of a 5.25-inch disc formatted in quad density you will have 342K bytes of available disc space. In comparison, the storage capacity available to you on the same disc side in other densities is as follows:

In single density	72K
In double density	164K

A silicon disc holds up to 174K

Although the space available at quad density is slightly more than twice that available at double density, you may not be able to store quite twice as many files, particularly if you have a lot of small files. This is due to data being stored in blocks of 2 kilobytes at quad density, compared with 1 kilobyte at lower densities. The result of this is to "round up" the apparent size of any file that occupies an odd number of kilobytes to a size 1 kilobyte larger when it is copied to a quad density disc.

You may store up to 128 files on each side of a quad density disc. This compares with a maximum of 64 at lower densities.

Version 2.2F of CP/M provides a TPA of the same size as version 2.2D, namely 50.5K on a 56K stand-alone system, or 48.5K on a shared-disc system.

Copying Between Different Densities

Your Research Machines 480Z Disc System has been designed to store information on discs in quad density. However, it will also handle discs formatted in single density or in double density such as those which you might have acquired from an earlier Research Machines computer. Discs formatted in quad density will store about twice the amount of information that can be stored in double density and four times the amount of information that can be stored in single density. So you will probably want to convert your earlier software to quad density in order to make best use of the disc space you have available.

If you are unsure of which density any particular disc has been recorded in, you can find out by running the VERIFY utility.

It is not permissible to have one side of a disc formatted in quad density and the other side formatted in a different density. The utilities supplied with quad density CP/M will not allow the creation of any mixed density disc. You are still able, however, to read any existing (single/double) mixed density disc.

The only way to change the density in which files are stored is to copy them to a disc that has been formatted in the required density. This involves the use of the utilities FORMAT, SYSGEN, and PIP (or COPYFILE if you have only a single disc drive). The use of these utilities is described elsewhere in the Users Guide.

However, if you are a completely new user, you may wish to transfer programs from a single-density or a double-density disc to a quad-density working disc without learning the facilities your system offers. To do this, follow the method given below, step by step. If in doubt, you will find full details in the Users Guide. General information about the system and about handling discs is given earlier in that Guide, and you should have read the first four chapters.

Copying Single or Double Density Data to Quad Density

You will need three discs, which are:

- A *system* disc containing at least version 2.2F of CP/M and the utilities FORMAT, SYSGEN and PIP (or COPYFILE for a single drive system). Any complete copy (using FASTCOPY) of your CP/M 2.2F master system disc will do. (Utilities must be the quad-density versions — see page 12).

- A *software* disc containing the programs and files that you want to copy.

- A *blank* disc, or a disc containing no wanted files, to store the software in quad-density.

The disc names underlined above are used throughout to identify which disc is being referred to at each point.

Make sure that both your CP/M system disc and the software discs you intend to copy *from* are write protected: that is, the notch should be covered. On the other hand, the blank disc(s) that you wish to copy *to* must be write-enabled: that is, the notch should be uncovered.

The following instructions are intended to guide you through the steps you need to take but they do not replace the screen messages which must also be followed. The instructions are split into separate sets of instructions for systems with two drives and for systems with only one drive.

Any text printed in OCR-B typeface, for example:

```
Press any key to continue
```

represents a message from the system or a command to the system, and the symbols < > indicate a key that you must press to respond to the system. All responses are given in a column on the right-hand side of the page.

If you have only one drive, go straight to the section headed Systems With Only One Drive, on page 8.

Systems With Two Drives

1. Connect up your system and switch on all components.

2. Put the quad-density CP/M system disc containing FORMAT, SYSGEN and PIP into drive A/C — label towards the lever and read/write slots leading. Then load the operating system from this disc by pressing: <B>

3. Put the blank disc into drive B/D, type FORMAT<RETURN>, and use this program to format (or reformat) the disc.

```
Format which disc......(A,B,C,D) ?        <B>
Format both sides..........(Y/N) ?        <Y>
Quad density...............(Y/N) ?        <Y>
                                        <RETURN>
```

   If the disc is already formatted, respond as follows:

```
   Single density disc, reformat.(Y/N) ?    <Y>
or
   Double density disc, reformat.(Y/N) ?    <Y>
or
   Quad density disc, reformat...(Y/N) ?    <Y>
or
   Density mismatch, reformat....(Y/N) ?    <Y>
```

   Wait until the following message is displayed:

```
   Format completed
```

   Then, to leave FORMAT utility, press: <Q>

4. Type SYSGEN<RETURN> and use that program to copy CP/M from the system disc to the formatted disc in B/D.

```
Load SYSTEM from drive.....(A,B) ?        <A>
Destination drive..........(A,B) ?        <B>
                                        <RETURN>
```

   Wait until the following message is displayed,

```
   SYSTEM COPY COMPLETED
```

   Then, to leave SYSGEN, press: <Q>

5. Use PIP to make a copy of itself onto the newly formatted disc, (NOTE: PIP gives no screen messages), as follows:

   Type: `PIP B:=A:PIP.COM<RETURN>`

6. Now remove the system disc from drive A/C and put it to one side. Take the blank disc, onto which you have just copied both the CP/M system and PIP, out of drive B/D and insert it in drive A/C.

7. Put the software disc that you want to copy to a quad-density disc into drive B/D. Press: `<CTRL/C>`

8. Use PIP to copy all the files from your lower-density disc, as follows:

   Type: `PIP A:=B:*.*<RETURN>`

   Then, if there are files on both sides of your software source disc, when the `A>` prompt returns, type:

   ```
   PIP C:=D:*.*<RETURN>
   ```

   Alternatively, files from the second side of the source disc can be copied to the first side of the new disc by:

   ```
   PIP A:=D:*.*<RETURN>
   ```

   If you want to copy only specific files or delete some of the copied files, consult the CP/M Users Guide for further details of PIP and ERA.

9. If you make a mistake in your typing at any stage, press `<DELT>` to delete it, then retype the entry correctly. If you do not correct a mistake before pressing `<RETURN>`, press the RESET button on the rear panel of your 480Z and go back to step 2.

10. By this point you will have a disc containing the required software in quad-density, in drive A/C. To make sure that all the programs are there, type `DIR A:<RETURN>`, then `DIR C:<RETURN>`, to display the contents of the directory for each side of the disc. There will be plenty of room for further files on this disc.

You should also make a back-up copy of this disc. Use the FASTCOPY program, described in chapter 5. Note that FASTCOPY copies the whole of one disc surface to another, and it can write only in the same density as it reads.

Systems With Only One Drive

Single-drive disc systems are ideal for running existing programs and for writing new programs, for which the additional disc storage space provided by a second drive is not needed.

Single-drive systems are not ideal for performing disc-to-disc file copying operations. You can, however, perform exactly the same operation as you can with two drives but there is a marked drop in performance, largely because of the number of disc changes you are required to make. In addition, there is a likelihood of error due to incorrect disc changes.

If you have access to a dual-drive system, use it rather than your single-drive system for your disc-to-disc file copying. On the other hand it you only have access to a single-drive unit, the software has been designed to enable you to perform all your disc-to-disc file copying with the minimum of inconvenience.

The most complex operation will be the copying of files on a single-density or double-density disc to a quad-density disc. The following instructions, tell you how to perform this operation step by step.

1. Connect up your system and switch on all components.

2. Put the system disc into the drive — label towards the lever and read/write slots leading. The load the operating system by pressing: <B>

3. As soon as the prompt A> shows at the bottom left corner of the screen, type FORMAT<RETURN> and use the program to format (or reformat) the blank disc.

```
Press <RETURN> to continue:-          <RETURN>
Format which disc.....(A,B,C,D) ?     <B>
Both sides.............(Y/N)      ?     <Y>
Quad density...........(Y/N)      ?     <Y>
                                        <RETURN>
```

Remove the system disc, insert the blank disc and then press: <space>

If the disc is already formatted, respond as follows:

```
Single-density disc, reformat.(Y/N) ?    <Y>
```
or
```
Double-density disc, reformat.(Y/N) ?    <Y>
```
or
```
Quad-density disc, reformat...(Y/N) ?    <Y>
```
or
```
Density mismatch, reformat....(Y/N) ?    <Y>
```

Wait until the following message is displayed:

```
Format completed.
```

Then, to leave FORMAT, press: <Q>

4. Remove the now formatted blank disc, insert the system disc, and press: <space>

5. After the A> prompt, type SYSGEN<RETURN> and use the program to copy CP/M to the formatted blank disc.

```
Press <RETURN> to continue:-          <RETURN>
Load SYSTEM from drive....(A,B) ?          <A>
                                      <RETURN>
```

Do not change the disc — it is the one you want to read.

```
Insert disc, then press...<RETURN>  <RETURN>
Destination drive.........(A,B) ?          <B>
```

Replace the system disc with the formatted blank disc.

```
Insert disc, then press...<RETURN>  <RETURN>
```

Then you must also press: <space>

Wait until the message:

```
SYSTEM copy completed
```

is displayed, then, to leave SYSGEN, press: <Q>

6. Remove the blank disc and replace it with the system disc. Then you must also press: <space>

7. Type COPYFILE<RETURN> and use this program to make a copy of itself onto the formatted blank disc, as follows:

   Press: <RETURN>
   ```
   Source file..... ? COPYFILE.COM<RETURN>
   Destination file.... ? B:<RETURN>
   ```
   Press: <RETURN>

   Remove the system disc, insert the blank disc and then press: <space>

8. When the file has been copied you will see:

   ```
   File copy completed
   ```

   and you can now use COPYFILE to copy the files from the software disc onto the blank disc.

   During this part of the operation, follow all the screen messages, treating the software disc as disc B/D and the originally blank disc as disc A/C.

   ```
   Source file..... ? FILENAME.TYP<RETURN>
   ```
   (Where FILENAME is the name of a file on your software disc and TYP is its filetype.)

   ```
   Destination file... ? B:<RETURN>
   ```

   Remove the "blank" disc, insert the software disc containing the file you have named and press: <space>

When the message:

```
Accessing source..........
```

changes to

```
Accessing destination.....
```

the following message will appear:

```
Insert disc B/D and press <space>
```

Take the software disc out of the drive, reinsert the originally blank disc and press: <space>

9. Instruction (8) can now be used repeatedly to copy any remaining files from the software disc to the originally blank disc.

10. If you make a mistake in your typing at any stage, press <DELT> to delete it and then retype the entry correctly. If you do not correct a mistake and press <RETURN>, press the RESET button on the 480Z rear panel and go back to step 2. If you enter a mistake during repetitions of step (8), press <ESC>, or <Q> if <ESC> fails to get you to a point from which you can restart.

11. By this point you will have a disc containing the required software recorded in double-density, on a disc in drive A/C. To make sure that all the files are there, type DIR A:<RETURN>, followed by DIR C:<RETURN>, to display the contents of the directory for each side of the disc. This disc will have plenty of room for further files.

    You should also make a back-up copy of this disc. This can be done by using COPYFILE repeatedly, as above, or by using FASTCOPY or PIP, as decribed in the CP/M users guide. Note that FASTCOPY copies the whole of one disc surface to another, and can write only in the same density as it reads.

Copying Quad Density Data to Other Densities

The sections above describe how to copy files to quad density. If you want to copy from quad density to another density the procedures are almost exactly the same. The most important difference is in the choice of density when formatting the new, or spare, disc that you are going to use to receive the copies of your files. This must be formatted in a suitable density for use on the machine that will later read that disc.

As mentioned elsewhere, a disc formatted and written on a quad density drive, but at a lower density, will not be as reliable as one formatted and written on a lower density drive. You should, therefore, use the disc solely for the transfer. Copy the required files on the lower density machine onto a disc formatted on that machine, and do not rely on the disc formatted at the "wrong" density for long-term storage.

Utilities

The utilities available under CP/M 2.2F are almost identical to those available under CP/M 2.2D but they have been tailored to handle quad density. Earlier utilities bearing the same names will not work under CP/M 2.2F.

Although the latest utilities will run under earlier versions of the operating system, you are recommended to replace all your existing working copies of any operating system utility programs with copies of the latest versions, as well as replacing the operating system stored on any existing working system disc. This will avoid any incompatibility problems.

Some notes follow on the utilities most affected by the introduction of quad density disc storage:

FORMAT (Version 4.0D and later)

> You can format discs in quad, double or single density and the density options are given in that order. However, the utility is optimized for quad density and the other two formats should rarely be used. FORMAT will not allow you to select different densities for the two sides of a disc.

FASTCOPY (Version 4.0D and later)

You can use FASTCOPY to copy one or both complete disc sides to another disc in any one of the three available densities. The source and destination discs must be in the same density. If their densities differ, there is a reformatting option available.

You are reminded on the first screen of this utility that you cannot use FASTCOPY to copy from one density to another. For this purpose you should use PIP.

PIP

PIP does not announce itself, so you may not be sure which version you are using. See the notes under Utilities, above.

PIP is the usual utility to use for copying files, either individually or in groups, with or without renaming, regardless of densities. Its use on a single-drive unit, however, may involve more disc changes than necessary, and COPYFILE should be used instead.

COPYFILE (Version 4.0B and later)

This utility is particularly useful for copying files from one disc to another when only a single-drive unit is available. It makes the maximum use of available memory in order to minimize the number of disc changes needed.

Other utilities modified for use with quad density systems are:

CONFIG	(Version 6.0B and later)
SYSGEN	(Version 4.0C and later)
TURNKEY	(Version 4.0B and later)
VERIFY	(Version 4.0C and later)

The usage of the above four utilities has not changed and remains as described in this Users Guide.

Error Messages

Version 2.2F of CP/M and associated utility programs will display error messages if and when necessary. Because of the new features introduced in this version of the operating system, certain messages from earlier versions have been slightly altered and a few new messages have been added.

A list follows of modified or new messages, with explanations:

```
The creation of discs with different
densities on either side is not allowed.
```

Displayed by FORMAT or FASTCOPY if an attempt is made to create a mixed density disc.

```
Sides have differing track densities.
Please verify separately.
```

Displayed by VERIFY if an attempt is made to verify both sides of a mixed density disc at once.

```
Firmware/Hardware error
```

This replaces the earlier "Bad Parameter Error" message, which appeared only in the event of a firmware or hardware error.

```
Write-protected disc
```

References to (un)covering the notch have been dropped, for compatibility with the use of this message in shared-disc systems.

`Drive not quad density`

Displayed by FORMAT, or the FORMAT option in FASTCOPY, if an attempt is made to format a disc in quad density while using a double density drive unit.

`Error - quad density disc`

Displayed if an attempt is made to use a quad density disc on a double density drive unit.

`Quad density disc`

Displayed by CP/M if an attempt is made to access a quad density disc on a double density drive unit.

`Quad density disc`
`Boot error`

Displayed by CP/M if an attempt is made to boot the system form a quad density disc on a double density drive unit.

Technical Support

If you require further details of any of the topics mentioned in this appendix, try referring to the LINK 480Z Disc System Users Guide or other parts of this Users Guide. If your query is still unresolved, please contact our Technical Support Department, on Oxford 249866.

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