System 300

CP/M SUPPLEMENTARY MANUAL

California Computer Systems

The information contained in this manual is believed to be correct at the time of publication. However, CCS assumes no liability resulting from the use of this manual.

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SYSTEM 300

CP/M SUPPLEMENTARY MANUAL

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TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

This manual describes California Computer Systems' System 3ØØ version of CP/M 2.2. It is intended as a supplement to, not a substitute for, the basic CP/M documentation and covers only CCS's additions and modications to the standard CP/M package as received from Digital Research. It assumes a basic knowledge of CP/M terms and organization on the part of the reader and is oriented to the systems programmer, although the system operator may have reason to consult the description of the utility programs in Chapter 3.

The standard distribution version of CP/M is designed to work with an Intel Microprocessor Development System. CCS has made the necessary modifications to the operating system for it to work with CCS's System 3ØØ and has expanded its drive handling capabilities. As distributed, the System 3ØØ CP/M supports the following:

* Single-sided and double-sided 8" floppy disk drives
* Single-sided 5.25" floppy disk drives
* Single- and double-density diskettes conforming to the IBM 374Ø and System 34 formats and containing either 128, 256, 512, or 1Ø24 bytes per sector
* A console device
* A serial printer
* A Centronics-type parallel printer

Simple modifications to the software will enable the System 3ØØ CP/M to support double-sided, instead of single-sided, 5.25" floppy disk drives.

The extensively modified or unique portions of the software include the system loader, the BIOS, and, to support the new capabilities of the BIOS, several utility programs.

The BIOS and the system loaders are described in the next chapter; Chapter 3 describes the utility programs. To aid the customizing of the software, the appendices describe how to tailor the software for different applications.

CHAPTER 2

SYSTEM 300 CP/M DESCRIPTION

2.1 SYSTEM MEMORY CONFIGURATION

The system load in memory is organized as shown in the Digital Research Manual "CP/M 2.2 Interface Guide." However, the base of the system load, CBASE, is negatively offset 2K compared to the normal CP/M load to allow for the enlarged BIOS. Thus while CBASE in a 64K version of Digital Research's standard CP/M 2.2 is at E4ØØh, it is at DCØØH in CCS's 64K version. For each size memory configuration, then, the space available for the TPA in CCS's version is 2K less than in a normal CP/M load. This is true even when a transient program overlays the CCP; the beginning address of the system load in this case, FBASE, is also negatively offset 2K from the standard CP/M load. Please note that the entry points into the BIOS will also be offset by 2K, or 8ØØh.

2.2 RESERVED PAGE Ø RAM

Page Ø (ØØH-ØFFH) in a CP/M system is reserved for system parameters. The System 3ØØ CP/M uses some unique parameters in addition to the standard CP/M parameters. Table 2-1 on the following page lists the page Ø locations used by the System 3ØØ CP/M.

Address	Contents
ØØØØH-ØØØ2H	These locations contain a jump instruction to the warm-start entry point, 42Ø3H + bias (the bias is equal to the difference, converted into hex, between the system memory size in Kbytes and 2ØK.
ØØØ3H	The Intel Standard IOBYTE is stored in this location. It is set to its default value by the BIOS during cold-starts and is preserved during warm-starts.
ØØØ4H	The current default drive number is stored in this location.
ØØØ5H-ØØØ7H	These locations contain a jump instruction to the BDOS. The address contained in ØØØ6-ØØØ7H is the beginning address of the BDOS and hence the lowest address in memory used by CP/M if the CCP is overlaid.
ØØØ8H-ØØØAH ØØ1ØH-ØØ12H ØØ18H-ØØ1AH ØØ2ØH-ØØ22H ØØ28H-ØØ2AH ØØ3ØH-ØØ32H ØØ38H-ØØ3AH	The first five of the seven Z-8Ø restart locations are not used by CP/M. The sixth restart location (ØØ3ØH-ØØ32H) is held reserved for future use. The seventh restart location ØØ38H-ØØ3AH) contains a jump instruction into the DDT or SID when programmed breakpoints are used in the debug mode.
ØØ4ØH-ØØ53H	These locations contain disk parameters used by CC3ØBOOT. Locations ØØ4Ø-ØØ4FH are defined by CP/M as user scratch pad locations; ØØ5ØH-ØØ53H are held reserved, but are not used by present versions of CP/M.
ØØ5CH-ØØ7CH	The CCP uses these locations as a default file control block for the transient program.
ØØ7DH-ØØ7FH	These locations are the optional default random record position.
ØØ8ØH-ØØFFH	Locations Ø8ØH-ØFFH are a temporary buffer for CC3ØBOOT when it is loaded into memory from sector Ø1 of Track ØØ of the system disk.

Table 2-1 Page Ø Parameters

2.3 CC3ØBOOT

The system loader CC3ØBOOT is designed to read the system into memory from floppy disk. During a cold-start entry into CP/M, CC3ØBOOT, contained in Sector Ø1, Track ØØ of the system diskette, is loaded into system memory at locations Ø8ØH-ØFFH by the ROM-resident bootstrap loader on the disk controller board. Once loaded, CC3ØBOOT begins execution and loads into memory the system tracks (Tracks ØØ and Ø1 on 8" system diskette and Tracks ØØ, Ø1, Ø2 on a 5.25" diskette.) It then transfers control to the cold-start routine in the BIOS.

2.4 CC3ØBIOS

CC3ØBIOS is California Computer Systems' customized, expanded BIOS designed for CCS's System 3ØØ. It contains the hardware-dependent console, printer, and disk drivers. To support both maxi and mini floppy diskettes of varying formats, it uses a modified version of CP/M's sector deblocking algorithms. CC3ØBIOS also implements the Intel MDS IOBYTE as described in Section 2.4.6 below and in Digital Research's "CP/M 2.2 Alteration Guide."

2.4.1 Diskette Compatibility

CC3ØBIOS is designed to be compatible with 8" and 5.25" soft-sectored unrecorded diskettes that conform to the IBM 374Ø and System 34 standards for diskette format and that have 77 and 35 tracks per diskette, respectively. It supports double-sided 8" diskettes as well. Table 2-2 on the following page shows the compatible diskette formats. Regardless of the general diskette format, Track ØØ of any diskette must be formatted in 128-byte, single-density sectors, as specified by the IBM standards. CCS's floppy disk initialization routine, CC3ØINIT, automatically formats Track ØØ in 128-byte, single-density sectors and should be used to initialize any blank diskettes to ensure their compatibility with CC3ØBIOS.

DENSITY	BYTES PER SECTOR	DISKETTE SIZE	SECTORS PER TRACK	USER CAPACITY (BYTES)*
Single	128	5.25"	18	73,728
		8"	26	249,600
Single	256	5.25"	10	81,920
		8"	15	288,000
Single	512	5.25"	5	81,920
		8"	8	307,200
Single	1024	5.25"	2	65,536
		8"	4	307,200
Double	128	5.25"	29	118,784
		8"	48	460,800
Double	256	5.25"	18	147,456
		8"	26	499,200
Double	512	5.25"	10	163,840
		8"	15	576,000
Double	1024	5.25"	5	163,840
		8"	8	614,400

* User capacity figures based on single-sided drives and on 5.25" drives with 35 tracks.

Table 2-2. Compatible Diskette Formats

CC30BIOS has been designed to read recorded diskettes of the standard 128-byte sector, single-density, single-sided format that have been formatted by a disk controller chip of the 179x family. It cannot, however, read diskettes formatted by a 1771 disk controller chip, nor is it guaranteed that CC30BIOS can read diskettes in non-standard formats recorded on other systems.

2.4.2 Drive Compatibility

The software is designed to control single-sided or double-sided 8" floppy disk drives of the Shugart SA800/850 type or single-sided 5.25" drives of the Shugart SA400 type. If the drives have been purchased from CCS, they are configured for software compatibility. If they have been obtained from another source, they need to configured as described in the Floppy Disk Controller Reference Manual. Should an application call for double-sided mini drives, different step rates, or mini drives containing more than 35 tracks, see the appropriate appendix in this manual.

2.4.3 Software Compatibility

The deblocking capabilities of CC3ØBIOS add considerable flexibility to the System 3ØØ. However, when the deblocking mode is used with certain CP/M programs, the last write to disk may be lost. These programs complete their action by writing to the disk and then "warm-booting" the system to return control to CP/M. Normally this causes no problem, since in the non-deblock mode data is transferred directly to the disk. But in the deblocking mode, data is transferred first to a memory buffer which holds the data until an event such as a subsequent read or write or directory update operation forces the contents of the buffer to be written out to disk. An occasional result of this holding operation is that a reboot operation can be initiated without the memory buffer being emptied first. Thus the final writes of data never get transferred from memory to disk and are lost. To ensure your software is compatible with the deblocking mode, you can do one of the following:

1. For new software, ensure that the final disk write operations are directory updates. CP/M is set up to immediately update the directory on the disk every time 128 bytes of directory information (one CP/M logical sector) are transferred. This effectively empties the buffer before a warm boot is initiated.

2. Or, after the final disk write in a routine, read any other physical sector. This will purge the buffer and ensure that the written data is transferred to the disk.

It is not a good idea to try to solve the problem by modifying the warm-start routine so that it clears the buffer before actually doing the warm start. Because a warm start is the usual technique for error recovery, you could aggravate the error condition further by attempting to write potentially bad data onto the diskette.

2.4.4 Peripheral Compatibility

CC3ØBIOS contains drivers routines for the two serial ports (SIOA and SIOB) and the parallel port (PIOA) on the 282Ø System Processor. SIOA is defined as the default console port, SIOB as a serial printer port, and PIOA as a Centronics printer (or equivalent) parallel port. Both serial port drivers program the ports for asynchronous serial communication at 96ØØ baud with a serial word format of 8-bits, one stop bit, and no parity.

CC3ØBIOS supports the MDS IOBYTE function, which allows selection of peripherals through the STAT command. The STAT command divides common peripherals into four logical categories according to basic function: Console (primary channel of communication between user and system), List (output list devices such as printers), Reader (paper taper reader), and Punch (paper tape punch). It allows one of four physical devices to be assigned to a logical device category at any one time. As shipped, CC3ØBIOS supports the following physical-to-logical device assignments:

Logical Category	Physical Device Label	Actual Peripheral Selected
CONSOLE:	TTY	Console
LIST:	TTY	Serial Printer
	CRT	Console
	LPT	Parallel Printer
READER:	TTY	Console
PUNCH:	TTY	Console

Table 2-3. Logical-to-Physical STAT Assignments

The teletype is the default physical device in each of the logical categories. See the STAT command in Digital Research's manual "An Introduction to CP/M Features and Facilities" and Section 2.4.6 below for more information.

2.4.5 The Primitive Disk Routines

The primitive floppy disk routines transfer a sector of data at a time. If the drive has not been previously accessed, the routines determine the drive size (8" or 5.25") and disk format (bytes per sector, density). The primitive disk routines will attempt up to ten times to successfully transfer a sector of data. To ensure that control is returned to the BDOS in case the DMA transfer "hangs," a watchdog timer is set at the begin of the attempted disk access. If the sector transfer is successful, ØØH is returned in the A register; if it is unsuccessful, a non-zero value is returned. During a sequential read or write to a double-sided disk, overflow from the last sector of a track on side Ø continues on sector Ø1 of the same track on side 1.

2.4.6 The Basic I/O Routines

As mentioned in Section 2.4.4 above, the basic I/O routines in CC3ØBIOS drive ports SIOA, SIOB, and PIOA. The following corrolation is made between the BDOS jump targets and the BIOS basic I/O routines:

BDOS Jump Targets	Basic I/O Routines	Routine Function
CONST	CSTS	Console Status
CONIN	CI	Console Input
CONOUT	CO	Console Output
LIST	LO	List Output
PUNCH	PO	Punch Output
READER	RI	Reader Input
LISTST	LSTAT	List Status

Table 2-4. BDOS Jump Targets--BIOS Basic I/O Routines

The basic I/O routines support the MDS IOBYTE function. The IOBYTE, stored in location ØØØ3H, contains the current physical-to-logical device assignments. When the system is first initialized, the assignments for each logical device are set to their default value, the teletype. The STAT command can be used to modify the contents of the IOBYTE, changing the current physical-to-logical assignments. When an I/O routine is called involving one of the logical devices (for example, the routine CONIN), it jumps to one of the basic I/O routines (listed in the first column in Table 2-5 below). Each basic I/O routine contains a table associating peripheral driver routines with the physical device assignments in its logical device category. The I/O routine reads the IOBYTE and then transfers control to the driver routine indicated by the physical device assignment. It is important to keep in mind that the physical device names are merely convenient labels; they are not necessarily descriptive of the actual peripheral they select for I/O. In most systems, for example, the actual peripheral selected for Console I/O by the Teletype assignment will be a CRT.

CC30BIOS does not support every physical device assignment in every logical category. The peripheral drivers for those assignments it does not support are equated to the IOER routine (see Table 2-5 below). The IOER routine outputs the IO ASGT ERROR message and sets the physical-to-logical assignments to the Teletype in all categories (see Section 2.4.7 below). See Appendix A for instructions on adding peripheral drivers.

The following table lists the basic I/O routines for each logical device, the peripheral drivers selected by the physical device assignment, and the contents of the drivers.

BASIC I/O ROUTINES	PERIPHERAL DRIVERS	CONTENTS
LOGICAL CONSOLE DEVICE		
	TTY Assignment:	
CI (input)	TTYIN (input driver)	SIOA input driver
CO (output)	TTYOUT (output driver)	SIOA output driver
CSTS (input status)	TTST (input status)	SIOA input status
	TTOST (output status)	SIOA output status
	CRT Assignment:	
	CRTIN (input driver)	IOER Equate
	CRTOUT (output driver)	IOER Equate
	CRTST (input status)	IOER Equate
	UC1 Assignment:	
	CUSI1 (input driver)	IOER Equate
	CUSO1 (output driver)	IOER Equate
	CUST1 (input status)	IOER Equate

LOGICAL LIST DEVICE

	TTY Assignment:	
LO (output)	LSER (output driver)	SIOB output driver
LSTAT (output status)	LSERT (output status)	SIOB output status
	CRT Assignment:	
	TTYOUT (output driver)	SIOA output driver
	TTOST (output status)	SIOA output status
	LPT Assignment:	
	LPRT (output driver)	PIOA output driver
	LPRTST (output status)	PIOA output status
	UL1 Assignment:	
	LUSE1 (output driver)	IOER Equate
	LUSE1S (output status)	IOER Equate

LOGICAL READER DEVICE

	TTY ASSIGNMENT:	
RI (input)	TTYRDR (input driver)	TTYIN Equate
	PTR Assignment:	
	PTRIN (input driver)	IOER Equate
	PTRST (status)	IOER Equate
	UR1 Assignment:	
	RUSI1 (input driver)	IOER Equate
	RUST1 (status)	IOER Equate
	UR2 Assignment:	
	RUSI2 (input driver)	IOER Equate
	RUST2 (status)	IOER Equate

LOGICAL PUNCH DEVICE

	TTY Assignment:	
PO (output)	TTYPNCH (output)	TTYOUT Equate
	PUN Assignment:	
	HSP (output driver)	IOER Equate
	HSPST (status)	IOER Equate
	UP1 Assignment:	
	PUSO1 (output driver)	IOER Equate
	PUST1 (status)	IOER Equate

UP2 Assignment:	
PUSO2 (output driver)	IOER Equate
PUST2 (status)	IOER Equate

Table 2-5. IOBYTE Handlers and Peripheral Drivers

2.4.7 Error Messages

CC3ØBIOS incorporates error messages for the following four conditions: Drive Not Ready, I/O Assignment Error, Disk Time Out, and Warm Boot Error.

DRIVE NOT READY: If you try an operation with a drive which is not ready (i.e., the door is open) or nonexistent you will receive the error message

DRIVE N NOT READY

where N is the drive unit. To get out of the error condition, ready the drive (insert a diskette, shut the door) and hit any key on your console device. Whatever program you were running at the time will then continue. If the problem is a nonexistent drive, you will have to reboot your system.

I/O ASSIGNMENT ERROR: You can use the CP/M STAT command as described in the Digital Research manual "An Introduction to CP/M Features and Facilities" to alter the contents of IOBYTE and thus change the physical-to-logical I/O device assignments. CC3ØBIOS contains driver routines only for the teletype (TTY) device in each logical device categories and for the CRT and Line Printer (LPT) in the List category. Assigning any other physical device to a logical category forces a jump to the I/O Assignment Error routine when an I/O operation is performed involving that logical category. The message

I/O ASGT ERR

is output, the I/O assignments default to the teletype for each logical category, and control returns to CP/M.

DISK TIMEOUT: CC3ØBIOS incorporates a watchdog timer which allows control to be returned to CP/M should a drive "hang" during a disk operation, such as a read, write, seek, or restore. At the beginning of each disk operation, the watchdog timer is set for a specific time interval; if it times out before the disk controller signals end-of-job, the Disk Timeout error message

DISK TIMEOUT

is displayed and control is returned to the BDOS.

BOOT ERROR: During a warm boot of CP/M, the warm-boot routine outputs the message

BAD BOOT

and rings the console bell if it cannot read the system after ten tries. If you hit the carriage return key, the routine will try ten more times to read in the system.

CHAPTER 3

SYSTEM 300 UTILITY PROGRAMS

Most of the utility programs (also called transient programs) described in Section 6 of the CP/M manual "An Introduction to CP/M Features and Facilities" work with the System 3ØØ CP/M and thus have not been altered in any way. However, to fully support the capabilities of the System 3ØØ CP/M, CCS has added utility programs and modified others. This chapter describes these utility programs.

Please note that when either CC3ØINIT, CC3ØGEN, or CC3ØCOPY is executing, it does not access the the printer driver routines in the the BIOS. This means that the console displays cannot be routed to the printer. Also note that the above programs work directly with CCS's disk controller boards and thus cannot work in systems using other manufacturer's boards.

3.1 DOCUMENTATION CONVENTIONS

The following documentation conventions are in effect in this chapter:

<cr> represents a carriage return

^C represents a Control-C

N> represents the default (currently selected) drive prompt, where N can be a letter between A and P, inclusive.

Underlined characters in sample console displays are user inputs.

3.2 CC3ØINIT

CC3ØINIT performs two basic functions: 1) it formats diskettes; 2) it verifies data integrity on already recorded diskettes.

3.2.1 CC3ØINIT Description

In the format mode, CC3ØINIT formats 5.25" and 8" single-sided or double-sided diskettes so that they

a. are compatible with CC3ØBIOS;
b. conform to the IBM 374Ø and System 34 format standards;
c. can be read and written to by the 179x family of disk controllers and the 1771 disk controller.

After if finishes formatting the entire diskette, CC3ØINIT automatically reformats Track ØØ in 128-byte, single-density sectors so that it conforms to the IBM format standards. It then verifies the diskette.

In addition to formatting an entire diskette, CC3ØINIT can format a single track only, allowing the data on a diskette with one bad track to be saved. This facility can also be used to reformat Track ØØ in any format supported by CC3ØINIT. However, CC3ØBOOT and the ROM bootstrap loader will then be unable to read the diskette. After formatting a track, CC3ØINIT automatically verifies the track. For the details of the formats used by CC3ØINIT, refer to the Programming Information Appendix of your Floppy Disk Controller Reference Manual.

In the verification mode, CC3ØINIT verifies the data integrity of an entire diskette, indicating which records are in error. Note that the verification mode does not support the single-track option.

3.2.2 CC3ØINIT Requirements/Restrictions

In the format mode, CC3ØINIT does not support 128-byte, double-density sectors or 1Ø24-byte, single-density sectors.

CC3ØINIT can not verify diskettes written by 1771 disk controller chip.

CC3ØINIT requires a CCS Floppy Disk Controller.

3.2.3 CC3ØINIT Operation

CAUTION: CC3ØINIT destroys any existing data as it formats the diskette. If you wish to reformat a diskette for CC3ØBIOS compatibility, yet preserve its contents, see CC3ØCOPY.

CC3ØINIT relies on console interaction to receive the parameters it needs to format or verify a diskette. It accepts only a limited number of responses to the questions it asks and prompts for the acceptable responses. If it receives an unacceptable response, it repeats the question. Except as noted, entering a carriage return in response to any of the questions returns you to CP/M. The console dialog is as follows:

WHICH DRIVE (A-D)?

Enter the drive letter of the diskette to be formatted and/or verified. When CC3ØINIT is finished, it repeats this question, allowing additional diskettes to be formatted or verified. A <cr> returns you to CP/M.

SINGLE OR DOUBLE SIDED (Ø OR 1)?

Ø specifies single-sided; 1 specifies double-sided. If you respond with a 1, CC3ØINIT formats/verifies both sides of the disk.

SINGLE OR DOUBLE DENSITY (S/D)?

In the format mode, your response must agree with the sector size selected below. If it doesn't, CC3ØINIT will return to this question when it tries to format the disk.

TRACK NUMBER (Ø-8Ø OR *)?

To format or verify the entire disk, enter *. To format one track only, enter the track number, followed by a space. If you choose to format a single track, make sure the format you specify matches the rest of the disk--otherwise, CC3ØBIOS will not be able to read the disk.

SECTOR SIZE (Ø-3)?

Enter the code that selects the bytes-per-sector formatting you desire:

Code	Bytes/Sector	Density
Ø	128	S
1	256	S/D
2	512	S/D
3	1Ø24	D

Single-density, 1Ø24-byte sectors and double-density, 128-byte sectors are supported in the verification mode.

SELECT INIT WITH VERIFY OR VERIFY ONLY, (Ø OR 1)

This line appears only if you have specified the entire disk for formatting or verification. Enter Ø to format and verify the disk; enter 1 to verify the disk only. A <cr> causes CC3ØINIT to restart at the first question. If you specify init with verify, CC3ØINIT responds with:

WARNING--CONTENTS OF DISK WILL BE DESTROYED. CONTINUE (Y/N)?

Enter Y if you wish the disk to be formatted. Any other response causes a repeat of the previous question.

NUMBER OF TRACKS (35, 4Ø, 8Ø)?

This question appears if the selected drive is a mini. Enter the number of tracks per side your mini supports, followed by a space. CC3ØINIT prompts for and accepts only those numbers supported by mini drives currently on the market. Unless altered, CC3ØBIOS supports 35-track minis only.

VERIFYING

CC3ØINIT displays this message as it verifies the diskette or reformatted track.

EXAMPLE: In the following console dialog example, a single-sided 8" diskette in Drive B is initialized for 1Ø24-byte, double-density sectors.

```
N>CC3ØINIT

CCS SYSTEM 3ØØ FORMAT PROGRAM V1.1
PLEASE USE CAUTION WHEN USING THIS PROGRAM
AS IT IS POSSIBLE TO DESTROY EXISTING DATA
WITH NO CHANCE OF RECOVERY
WHICH DRIVE (A-D)? B
SINGLE OR DOUBLE SIDED (Ø OR 1)? Ø
SINGLE OR DOUBLE DENSITY (S/D)? D
TRACK NUMBER (Ø-8Ø OR *) *
SECTOR SIZE (Ø-3)? 3
SELECT INIT WITH VERIFY OR VERIFY ONLY, (Ø OR 1) Ø
WARNING--CONTENTS OF DISK WILL BE
DESTROYED.  CONTINUE (Y/N)? Y
VERIFYING
WHICH DRIVE (A-D)? <cr>
```

3.2.4 CC3ØINIT Error Messages

CC3ØINIT contains general error messages that are displayed whenever an error occurs during a disk operation. They identify the nature of the operation in which the error occurred, specify the physical location of the error (drive unit, diskette side, track number, sector number), and display the contents of the disk controller's status register. Numerical values are in hex. For a definition of the status register, see the 1793 Data Sheet in the 2422 Floppy Disk Controller manual.

HOME ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

After CC3ØINIT issues a Restore Command (return to Track ØØ), it checks status and will display the above message if the drive is not ready (i.e., door open), the disk is write protected, or the disk controller does not report the head over Track ØØ.

SEEK ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

CC3ØINIT displays the Seek Error Message if it detects one of the following errors after it issues a Seek Command: drive not ready, drive write-protected, or head on Track ØØ.

INIT ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

CC3ØINIT writes an entire track at one time. After it has finished writing a track, it checks for error conditions. It displays the above message if it detects one of the following errors: drive not ready, drive write-protected, or lost data.

READ ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

During verification of a diskette, CC3ØINIT displays the above message if it encounters one of the following error conditions: drive not ready, record not found, CRC error, or lost data.

CC3ØINIT also contains error messages which flag specific error conditions. Some of these messages will appear in conjunction with the operation error messages.

DRIVE NOT READY, PLEASE FIX AND RETRY

If the selected drive is not ready, this message is displayed and CC3ØINIT restarts at the question WHICH DRIVE (A-D)? Check that the diskette is properly inserted and the drive door closed.

SEEK ERROR

After the drive has been specified, CC3ØINIT does a preliminary restore of the drive (seek to Track ØØ) and reads status. If the Track ØØ flag is not set, it displays this error message and restarts with the WHICH DRIVE (A-D)? question.

DISKETTE IS WRITE PROTECTED PLEASE FIX

If CC3ØINIT enounters a write-protected diskette, which of course it cannot initialize, it displays this error message and restarts at the question WHICH DRIVE (A-D)? Replace the tab on the write-protect notch (8" diskette) or remove the tab (5.25" diskette) before responding.

DRIVE TYPE CONFLICT PLEASE RETRY

This message appears for 8" drives only. If you have indicated that the diskette is single-sided when it is actually double-sided, or vice versa, CC3ØINIT displays this error message. CC3ØINIT then restarts with the question WHICH DRIVE (A-D)? Mini drives do not have an output indicating whether or not a diskette is double-sided; hence CC3ØINIT can do no error checking in the case of mini drives.

BAD TRACK OR SECTOR SIZE/DENSITY SELECTION

Before CC30INIT begins formatting the diskette, it ensures that 128-byte double-density or 1024-byte single-density sectors have not been selected and that the number of the track to be formatted does not equal or exceed the number of tracks on the diskette (77 for an 8"; user-specified for a mini). If either the sector/density or the track selection is unacceptable, the above error message is displayed and CC30INIT returns to the console dialog, starting with SINGLE OR DOUBLE DENSITY (S/D)?

DID NOT DETECT TRACK00 ON RESTORE, ABORT

If the disk controller signals that it has finished a restore command but Track 00 is not flagged, CC30INIT displays this error message in conjunction with the Home Error Message and returns control to CP/M. This error condition usually indicates hardware malfunction.

TRACK ZERO FLAGGED WHEN HEADS OFF ZERO, ABORT

This error message may occur in conjunction with the Seek Error Message. If after a seek or step command Track 00 is flagged, this message is displayed and control is returned to CP/M. It usually indicates a hardware malfunction.

STATUS IS LOST DATA, PROGRAM IS ABORTED

This message is displayed in conjunction with the Init Error Message whenever the DRQ flag or the Lost Data flag is set in the status register after a track read or write. This error message usually indicates problems with the data transfer rate. If it occurs during data verification of an already recorded diskette, it is possible that the number of bytes per sector may be greater than specified in the console dialog. Control is returned to CP/M.

STATUS IS RECORD NOT FOUND, Y TO CONTINUE

This error message occurs only during verification of a diskette. CC30INIT will attempt four times to successfully read in a sector. If it is unsuccessful after the fourth attempt because it cannot find the sector, it will display the above message and query. If you enter Y, CC30INIT proceeds to the next sector, continuing its verification attempt. Any other response causes CC30INIT to restart with the first question in the console dialog. This error message usually indicates a hard error on the floppy disk. It might also occur during data verification of an already recorded diskette if the number of bytes per sector or data density is less than specified in the console dialog.

STATUS IS CRC ERROR, TYPE Y TO CONTINUE

CC3ØINIT displays this error message after it has attempted unsuccessfully to read the disk four times because of a CRC error. Entering Y causes CC3ØINIT to proceed to the next sector and continue its verification attempt. Any other response causes CC3ØINIT to restart with the first question in the console dialog. This error message usually indicates a hard error on the diskette.

TIMEOUT ON DISK OPERATION, DO YOU WISH TO RETRY OR
RETURN TO CPM? PLEASE REPLY Y(ES)/N(O)

CC3ØINIT sets the watchdog timer for each disk operation. If the watchdog timer times out before the disk controller signals end-of-job (INTRQ bit set), CC3ØINIT displays this message. A response of Y causes CC3ØINIT to restart with the source drive request. A response of N (or any other entry) causes control to be returned to CP/M. This error condition usually is caused by hardware malfuction.

PREMATURE DMA TERMINATION, PROGRAM ABORTED

The disk controller should signal end-of-job before the DMA transfer is terminated. If the DMA terminates before the disk controller reaches end of job, CC3ØINIT displays this message and returns control to CP/M. This error condition is usually caused by hardware malfunction.

3.3 MOVCPM

MOVCPM allows the System 3ØØ CP/M to be reconfigured for different memory sizes.

3.3.1 MOVCPM Description

The System 3ØØ MOVCPM works essentially the same as Digital Research's program described in Section 6.9 of "An Introduction to CP/M Features and Facilities." It places an image of the System 3ØØ CP/M into user memory at 9ØØH, reconstructed for the memory size specified by the operator. To allow for the increased size of CC3ØBIOS, the System 3ØØ MOVCPM automatically offsets the system load 2K from the standard CP/M load. Note that the image it places into memory is the System 3ØØ CP/M as distributed by CCS. If you have altered CC3ØBIOS, you need to patch the altered BIOS onto the system image as described in Appendix A.

3.3.2 MOVCPM Operation

The System 3ØØ MOVCPM supports the following two commands:

N>MOVCPM * *<cr>

Causes an image of the current memory configuration of the System 3ØØ CP/M to be constructed in memory in preparation for a CC3ØGEN operation.

N>MOVCPM n *<cr>

Causes an image of the System 3ØØ CP/M configured for n kilobytes to be constructed in memory in preparation for a CC3ØGEN operation.

Upon completion, MOVCPM displays

```
READY FOR "SYSGEN" OR
"SAVE 4Ø CPMxx.COM"
```

3.4 CC3ØGEN

CC3ØGEN generates the system, either from an image residing in user memory or from a system diskette, onto the system tracks of a user-specified diskette.

3.4.1 CC3ØGEN Description

The SYSGEN routine supplied with Digital Research's distribution version of CP/M works only with "standard" diskettes--that is, 8" diskettes formatted in 128-byte, single-density sectors. Since CCS's System 3ØØ CP/M is distributed on diskettes formatted in 1Ø24-byte, double-density sectors, CCS rewrote the SYSGEN program to support non-standard diskettes. CC3ØGEN allows the system to be generated on 5.25" diskettes and supports the same diskette formats as CC3ØBIOS. Digital Research's standard SYSGEN program has also been included on the distribution diskette.

3.4.2 CC3ØGEN Requirements/Restrictions

CC3ØGEN requires 24K of user memory; to meet this requirement, the System 3ØØ CP/M must be configured for a memory size of 32K or greater.

If the size and format of the destination diskette results in system tracks having a smaller capacity than the system tracks of the source diskette, data may be lost. An unaltered version of the System 3ØØ CP/M requires a system diskette formatted in 512-byte or 1Ø24-byte double-density sectors.

CC3ØGEN will work only in systems with CCS's disk controller.

3.4.3 CC3ØGEN Operation

CC3ØGEN prompts the user for its operating parameters. If it does not receive an acceptable response, it will repeat the question. The console dialog is as described below:

SOURCE DRIVE: Enter either a drive unit letter or <cr>. A carriage return indicates to CC3ØGEN that an image of CP/M already exists in memory from a previous CC3ØGEN or MOVCPM operation and can be written to the drive specified below. If instead of a <cr>, a source drive is specified, CC3ØGEN examines the drive for readiness and then asks for confirmation of the source drive:

SOURCE ON n, THEN TYPE RETURN If n is the correct source drive, enter <cr>. CC3ØGEN will then read the system tracks of the source drive into memory. Any response other than <cr> aborts the program.

DESTINATION DRIVE: Enter either the destination drive unit letter or <cr>. A <cr> causes control to be returned to CP/M, leaving the system image in memory. If you specify a drive, CC3ØGEN examines the drive for readiness. It then asks for confirmation of the destination drive:

DESTINATION ON n, THEN TYPE RETURN If n is the correct destination drive, hit <cr>; CC3ØGEN will then begin writing the system image out to disk, verifying what is written. Hitting any other key returns control to CP/M.

SYSTEM COPY AND VERIFICATION ENDED NO ERRORS
CC3ØGEN displays this message after it has written and verified the system tracks on the destination diskette. CC3ØGEN returns to the destination drive request, allowing additional system diskettes to be generated.

EXAMPLE: The following console dialog causes the image of CP/M already in memory to be written on the diskette in Drive B. User inputs are underlined.

```
N>CC3ØGEN

CCS SYSTEM GENERATION PROGRAM VERSION 1.1
COPYRIGHT 198Ø CALIFORNIA COMPUTER SYSTEMS

SOURCE DRIVE: <cr>

DESTINATION DRIVE: B
DESTINATION ON DRIVE B, THEN TYPE RETURN <cr>

SYSTEM COPY AND VERIFICATION ENDED NO ERRORS

DESTINATION DRIVE: <cr>
```

3.4.4 CC3ØGEN Error Messages

When CC3ØGEN detects a disk operation error, it displays an error message indicating the nature of the operation when the error occured, the physical location (drive, side, track, sector), and the contents of the disk controller's status register. Numerical values are in hex. The contents of the status register are defined in the 1793 Data Sheet in the Floppy Disk Controller Reference Manual.

HOME ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

After a restore command has been issued, CC3ØGEN checks the disk controller's status. It will output the above error message and restart with the source drive request if the selected drive is not ready, if a seek or CRC error is detected (source drive only), or if the destination drive is write-protected.

READ ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

After the disk controller has finished reading a sector, CC3ØGEN checks status. It displays the above error message and restarts at the source drive request if it detects any of the following errors: drive not ready, record not found, CRC error.

WRITE ERROR: DRIVE n; SIDE n; TRACK n; SECTOR n; STATUS-n

After the disk controller has finished writing a sector, CC3ØGEN checks status. It displays the above error message and restarts at the source drive request if it detects any of the following errors: drive not ready, drive write-protected, record not found, CRC error, data lost.

The following error messages are designed to report specific error conditions. They may occur in conjunction with the operation error messages above.

INSUFFICIENT MEMORY SPACE--NEED 24K

CC3ØGEN needs 24K of user memory to operate. It will display this message and return control to CP/M if CP/M is configured for less than 32K.

DRIVE NOT READY PLEASE CORRECT

If the selected drive is not ready--i.e, diskette not inserted, door not closed--CC3ØGEN displays this message and restarts at the source drive request.

DISK IS WRITE PROTECTED PLEASE FIX

If the diskette in the destination drive is write-protected, CC3ØGEN displays this message and restarts at the source drive request. To enable writing to the disk, fold the write protect tab over the notch on an 8" diskette or remove the write protect tab on a mini diskette.

WARNING:POSSIBLE LOST DATA

After CC3ØGEN has completed writing the system to the destination disk, it issues this warning message if the capacity of the system tracks on the destination disk is less than required by the System 4ØØ CP/M. CC3ØGEN then returns to the source drive request instead of the destination drive request as it normally does. Type two carriage returns if you wish to return to CP/M. Note that if you reduce the size of CC4ØBIOS, this message may still appear, even though the destination diskette has sufficient capacity for the altered system.

RECORD NOT FOUND, ABORT

If the disk controller reports it cannot locate the sector it is attempting to read or write, CC3ØGEN outputs the above error message and restarts with the source drive request.

DATA COMPARISON ERROR PLEASE RETRY OR
TYPE A CARRIAGE RETURN TWICE TO EXIT TO CPM

After CC3ØGEN writes a sector to the destination diskette, it reads back the data and compares it to the data read in from the source diskette. If the data is not in agreement, CC3ØGEN displays this error message and returns to the source drive request.

3.5 CC3ØCOPY

CC3ØCOPY makes exact copies of recorded diskettes for the purpose of backup. It also reinitializes recorded diskettes for CC3ØBIOS compatibility or error recovery.

3.5.1 CC3ØCOPY Description

CC3ØCOPY copies the contents of a diskette recorded by a disk controller chip of the 179x family onto another diskette in a format compatible with CC3ØBIOS. It reads and copies one track at a time, reading the track on the source diskette, formating the corresponding track on the destination diskette, and then writing the data to the formatted track. It examines the first three tracks (Tracks ØØ, Ø1, and Ø2) on the source diskette for data density and bytes per sector, duplicating their formats on the corresponding tracks of the destination diskettes. It then assumes that the rest of the tracks have the same format as Track Ø2.

If you specify the same diskette as the source and the destination, CC3ØCOPY reformats the diskette, preserving the data. This facility can be useful for recovering data on diskettes with soft errors. However, to ensure against data loss, make a backup copy of the diskette before you attempt to reformat it with CC3ØCOPY.

```
**********************************************************
*                                                        *
*   NOTE:  CCS assumes no liability for any data loss    *
*   resulting from the use of CC3ØCOPY.                  *
*                                                        *
**********************************************************
```

CC3ØCOPY allows the option of verifying that the data on the destination diskette matches the data on the source diskette.

3.5.2 CC3ØCOPY Requirements/Restrictions

The source and destination diskettes must be the same size and both single- or double-sided.

CC3ØCOPY requires 24K of user memory to copy a diskette; to acheive this, the System 3ØØ CP/M must be configured for a memory size of 32K or greater. If you select the verify option, CC3ØCOPY requires 32K of user memory to operate, or a version of System 3ØØ CP/M configured for 4ØK or greater.

CC3ØCOPY cannot read diskettes recorded by a 1771 disk controller chip and requires a CCS Floppy Disk Controller to operate.

3.5.3 Operation

CC3ØCOPY uses console interaction to obtain some of its operating parameters. It accepts only a limited number of responses to its questions and prompts for the acceptable responses. The console dialog is as follows:

SOURCE DRIVE (OR CONTROL C TO ABORT)
DESTINATION DRIVE (OR CONTROL C TO ABORT)

CC3ØCOPY accepts a drive unit letter in response to either of these questions. A ^C returns control to CP/M. CC3ØCOPY examines the specified drives for compatibility; if they are compatible it then asks:

DO YOU WISH TO VERIFY DATA?

If you do, enter Y; any other entry is taken as negative. If both drives are minis, CC3ØCOPY asks:

IS IT DOUBLE-SIDED?

Enter Y if both minis are double-sided. Any other entry is negative.

MINI DRIVES WILL DEFAULT TO 35 TRACKS.
IF THIS IS O.K., TYPE A CARRIAGE RETURN. OTHERWISE,
ENTER THE NUMBER OF TRACKS:

Enter <cr> if your mini drives support 35 tracks. Otherwise, enter the number of tracks in decimal, followed by <cr>. If you make a mistake entering the number, hit any character other than a number or <cr> and you will be given a chance to try again.

WARNING - CONTENTS OF DESTINATION DISKETTE WILL BE LOST.
DO YOU WISH TO CONTINUE?

This warning appears for both both mini and 8" drives. If you wish to continue with the copy, enter Y. Any other entry is taken as negative.

COPYING TRACK nn
VERIFYING TRACK nn

As it copies, CC3ØCOPY displays the track it is on in decimal. During verification of the track, the word VERIFYING overwrites the word COPYING.

CC3ØCOPY returns to the source drive request after it has completed copying the disk, allowing additional copies of the disk to be made. A ^C returns you to CP/M.

EXAMPLE:

The following console dialog copies the contents of the 8" diskette in Drive B onto the 8" diskette in Drive C and verifies that the data is correct. User entries are underlined.

```
N>CC3ØCOPY

CCS DISK COPY PROGRAM VERS 1.1

SOURCE DRIVE (OR CONTROL C TO ABORT) B
DESTINATION DRIVE (OR CONTROL C TO ABORT) C

DO YOU WISH TO VERIFIY DATA? Y
WARNING - CONTENTS OF DESTINATION DISKETTE WILL BE LOST
 DO YOU WISH TO CONTINUE? Y

VERIFYING TRACK 77

SOURCE DRIVE (OR CONTROL C TO ABORT) ^C
```

3.5.4 CC3ØCOPY Error Messages

INVALID DRIVE DRIVE (OR CONTROL C TO ABORT)

If you enter anything other than A, B, C, D or ^C to the source or destination drive request, CC3ØCOPY displays this message and waits until you enter a valid drive unit or a ^C.

INVALID DRIVE COMBINATION

If you choose a destination drive of a different size than the source drive, CC3ØCOPY displays this error message and prompts again for the source drive.

SOURCE AND DESTINATION DRIVES ARE NOT COMPATIBLE, PLEASE RETRY

This message is displayed if your 8" source and destination diskettes are not both single-sided or both double-sided. CC3ØCOPY restarts at the source drive request.

BAD NUMBER - TRY AGAIN

CC3ØCOPY displays this message if you respond to the number-of-tracks query with any character other than a number or a carriage return. It then waits for you to enter either a carriage return (indicating 35 tracks per side) or a number followed by a carriage return.

DRIVE NOT READY

If the source or destination drive is not ready (e.g., the drive door is open), this message is displayed and, if your terminal supports this feature, the terminal bell will ring. To allow CC3ØCOPY to continue, ready the drive and then hit any key on the keyboard except ^C. ^C returns you to CP/M.

DRIVE IS WRITE PROTECTED - TYPE CR TO CONTINUE

This message is displayed if the destination drive is write-protected. If you wish CC3ØCOPY to continue, unprotect the diskette, return it to the drive, and hit the carriage return key. Any other response returns you to the first question in the dialog.

CANNOT READ SOURCE

If for some reason CC3ØCOPY cannot read the source diskette, it displays this error message and returns to the first question in the dialog. Possible causes for this error message include an unformatted diskette or one formatted by a 1771 disk controller chip.

BAD SOURCE SECTOR nn - IGNORE?

If CC3ØCOPY cannot read a sector on the source diskette after ten tries, it displays this error message and query, in which nn is the sector number. If you wish CC3ØCOPY to continue copying the diskette enter Y. CC3ØCOPY will transfer whatever it got from the sector and continue to the next sector. Data integrity in this case cannot be assured. If the error was a soft error, the data is probably good. If it was a hard error, the resulting data is unpredictable. If you enter any character other than a Y, CC3ØCOPY ceases its copy attempts and restarts at the beginning of the console dialog. Since CC3ØCOPY attempts to read a sector ten times before it displays the error message, it is unlikely that in subsequent attempts it will be any more successful in reading the sector. If you discover that the same sector is in error on several discover that the same sector is in error on several contiguous tracks, the diskette probably has been scratched or otherwise damaged.

DATA VERIFICATION ERROR ON THIS TRACK, DO
YOU WISH TO CONTINUE?

If the verification check finds that the data read from the destination disk does not match the data read from the source disk, CC3ØCOPY displays this error message and query. Type Y to continue. Any other response causes CC3ØCOPY to restart with the first question of the console dialog.

TIMEOUT ON DISK OPERATION, ABORT

CC3ØCOPY sets the watchdog timer for each disk operation. If the timer times out before the disk controller signals end-of-job, CC3ØCOPY displays this message and returns control to CP/M. This error condition usually results from a hardware malfunction.

APPENDIX A

CUSTOMIZING THE SYSTEM 300 CP/M

PURPOSE:

Appendix A describes the procedure for modifying CC3ØBIOS to support additional or different peripheral devices, different drive step or serial baud rates, and for patching the modified CC3ØBIOS onto CP/M. Other possible modifications of CC3ØBIOS are identified in Appendices B through D; the steps involved in making the modifications are too lengthy to be included this appendix. However, the method of patching the modified CC3ØBIOS onto CP/M is the same as described below.

METHOD:

1. Load CC3ØBIOS.ASM using ED.

2. Add or alter peripheral drivers. Section 2.5.1 on the IOBYTE contains the background information you need to do so. When writing your driver routines, please keep the following points in mind:

   a. Modification of existing driver routines generally involves changing the contents of the peripheral driver only, leaving the IOBYTE handling routines and the driver routine name unmodified. For example, to bring up a default printer on any port other than SIOB, you need to rewrite routines LSER and LSERT, leaving their names the same. The only exception to this general rule occurs when changing the peripheral driven by the CRT List assignment. Currently the List IOBYTE handlers, LO and LSTAT, map the CRT physical assignment to the TTYOUT and TTOST routines; the TTYOUT and TTOST labels in the

LO and LSTAT tables need to be replaced with the names of the user-written printer output and status routines (see Table 2-3).

b. Adding a peripheral involves selecting a currently unsupported physical device and replacing the associated IOER equates with driver routines of the same name. For example, an additional console could be selected by the CRT physical device assignment. To support such a console, the following IOER equates should be replaced with driver routines CRTIN, CRTOUT, and CRTST:

```
CRTIN:  EQU      IOER
CRTOUT: EQU      IOER
CRTST:  EQU      IOER
```

If you plan to vector a list output routine to the console device, you must also write an output status routine (named, for example, CRTOST).

c. Driver routines must conform to the CP/M calling conventions. See Section 6 of your CP/M Alteration Guide, "The BIOS Entry Points," for a description of the responsibilities of each entry point subroutine. Your drivers must fulfill these responsibilities. Generally speaking, output drivers find the character in register C, while input drivers pass it to register A.

d. Console input, List output, Punch output, and Reader input routines require corresponding status routines. For example, if you are adding a peripheral for the User Line Printer 1 assignment, the IOER equates for both LUSE1 (output) and LUSE1S (status) must be eliminated and replaced with output and status routines of the same name. In some cases, there are no IOBYTE handlers for the status routines (e.g., the only IOBYTE handler for the Reader logical device is the reader input routine, RI). In such cases, the input or output driver must call the status routine.

e. Initialization routines must be added to the one-time code (at the end of the source listing) for those newly-supported I/O ports which require initialization.

3. Review the following equates and conditional assembly directives at the beginning of the source code and modify them as needed:

MSIZE EQU 64--If you plan to reconfigure the System 3ØØ CP/M for a memory size other than 64K, modify this line to reflect the desired memory size in Kilobytes.

CBAUD EQU 13--The console baud rate is set for 96ØØ baud. If a baud rate other than 96ØØ baud is desired, this equate should be modified according to the values given in the table above it.

PBAUD EQU 13--This equate sets the serial printer's baud rate to 96ØØ baud. It too can be set to any of the values indicated in the baud rate table.

MINI EQU TRUE; MAXI EQU TRUE -- If the system will be using only one size drive, you can save space in the assembled code by eliminating code pertaining to the unused drive size. To do so, change the TRUE statement to FALSE for the unused drive type.

STEP5 EQU 3; STEP8 EQU 1--The optimal step rate for a drive's read/write head differs from drive to drive. Shugart drives require an 8 ms, 3 ms, and 25 ms step rate for the SA8ØØ, SA85Ø, and SA45Ø, respectively; MPI 51/52s require a 5 ms step rate; Memorex 55Ø requires a 6 ms step rate. The STEP equates set the step rates to 6 ms for single-sided 8" drives and 3Ø ms for 5.25" drives (see Table A-1 below). These step rates will work with almost all drives; however, some SA8ØØ drives might require a slower step rate, while drives which can support a faster step rate may operate noisily. You may wish to implement one of the alternative step rates shown in Table A-1 below.

STEP5 EQU N		STEP8 EQU N	
N	STEP RATE	N	STEP RATE
Ø	6 ms	Ø	3 ms
1	12 ms	1	6 ms
2	2Ø ms	2	1Ø ms
3	3Ø ms	3	15 ms

Table A-1. Step Rate Values

Note the step rate for double-sided 8" drives is fixed at 3 ms and cannot be easily altered. All double-sided 8" drives should operate well at that step rate.

4. Finally, make any necessary changes to the source code regarding double-sided drives, sector skew, extended-track mini drives, etc. See the appropriate appendices.

5. Assemble CC30BIOS.ASM, using Digital Research's MACro Assembler. YOUR ASSEMBLED CC30BIOS SHOULD NOT EXCEED 3.5K BYTES IN TOTAL LENGTH.

6. Place a blank diskette into drive B and initialize it for double-density, 1024-byte sectors using CC30INIT.

7. Using MOVCPM, read the system into memory. To read in a 64K version of the system (present configuration), use the command

   ```
   A>MOVCPM * *<cr>
   ```

   To read in a version of the system reconfigured for another memory size, use the command

   ```
   A>MOVCPM n *<cr>
   ```

   where n equals the memory size desired in kilobytes.

8. Save the system image on the new diskette:

   ```
   A>SAVE 40 B:CPMn.COM   (n is the system memory size
                            in Kbytes)
   ```

   The MOVCPM program displays the actual command you should use.

9. Now, in preparation for patching your new BIOS onto the system, load in CPMn.COM using DDT:

   ```
   A>DDT B:CPMn.COM
   DDT VERS 2.2
   NEXT PC
   nnnn 0100
   ```

   An image of CP/M now resides in memory, beginning at 900h. A memory map is as follows:

900H	CC30BOOT
980H	CCP
1180H	BDOS
1F80H	BIOS (the original CC30BIOS)

10. Read CC30BIOS.HEX into place at 1F80H. Since DDT loads hex files at their origin, it will be necessary to specify an offset to get your version of CC30BIOS to load in at 1F80H. The offset will vary according the size memory

CC3ØBIOS.HEX is configured for, since the origin will vary. Table A-2 gives offsets for common memory sizes. If your memory size is not listed, you will have to calculate it as described in steps a and b below.

MEMORY SIZE	BIOS ORIGIN	OFFSET
2ØK	42ØØH	DD8ØH
24K	52ØØH	CD8ØH
32K	72ØØH	AD8ØH
4ØK	92ØØH	8D8ØH
48K	B2ØØH	6D8ØH
56K	D2ØØH	4D8ØH
62K	EAØØH	358ØH
64K	F2ØØH	2D8ØH

Table A-2. CC3ØBIOS Offsets

a. To calculate the offset, first determine the origin of your BIOS. The formula is 42ØØh + b, where b is the hex value of the difference in Kbytes between your CP/M system size and 2ØK.

b. Now use the hex command (undocumented in the DDT manual) to subtract the BIOS origin from 1F8ØH:

```
-H1F8Ø nnnn (nnnn = BIOS origin)
ssss dddd (ssss and dddd are the sum and difference)
```

The difference is the offset.

11. Read CC3ØBIOS into place, specifying the offset and exit DDT:

```
-ICC3ØBIOS.HEX
-Rdddd        (dddd=offset)
nnnn pppp
-GØ
```

Note the value of nnnn; it is the top load address for your modified CC3ØBIOS and will be needed in the next step.

12. Save the system image on the new diskette for future reference. To calculate the number of pages to save, subtract 1ØØh from the top load address of CC3ØBIOS (nnnn above) and then round up to even 1ØØh bytes. Translate

the result into 256-byte pages in decimal (1ØØH bytes equal 1 page).

```
A>SAVE XX B:CPMn.COM
```

13. Write the patched system onto the new system diskette using CC3ØGEN:

```
A>CC3ØGEN

CCS SYSTEM GENERATION PROGRAM 1.1
COPYRIGHT 198Ø CALIFORNIA COMPUTER SYSTEMS

SOURCE DRIVE: <cr>

DESTINATION DRIVE: B
DESTINATION DRIVE ON B, THEN TYPE RETURN <cr>

SYSTEM COPY AND VERIFICATION ENDED NO ERRORS
```

14. You now have a customized system on the diskette. Insert the diskette into Drive A, reset the system, and you are now up and running on your customized version of CP/M.

APPENDIX B

DOUBLE-SIDED MINI DRIVES

PURPOSE:

The CCS Floppy Disk Controller supports double-sided mini and maxi drives. However, the current System 3ØØ version of CP/M 2.2 does not support double-sided mini drives, since they do not provide a status signal to identify when a double-sided diskette is mounted. Thus any general software developed by CCS would have to implement either single- or double-sided mini diskette operations, but not both. Since single-sided drives are more common, CCS decided to implement single-sided operation.

There are two basic methods of implementing double-sided drive capabilities:

A. The reverse side of each diskette can be treated as an extension of the obverse side. In its easiest form, this method treats each track on side 1 as an extension of the corresponding track on side Ø; these associated tracks are often called cylinders. For example, a track on a 128-byte per sector, single-density 8" diskette would logically consist of sectors 1-26 on side Ø and sectors 27-52 on side 1;

B. Each side of the diskette can be treated as a separate logical unit of assignment; that is, each physical drive is treated as two logical drives.

CC3ØBIOS uses method A to support 8" double-sided drives. Most of the code for implementing double-sided mini drives under method A already exists; this appendix identifies the few changes that need to be made the code.

METHOD

To implement double-sided mini drives, only the 5.25" disk parameter tables (DP5xx) need to be changed to accomodate the increased capacity of double-sided drives. The new values for these tables can be defined by using the CP/M DISKDEF macro to suit your individual desires or you can use the following suggested values:

	TABLES DP5xx					
Parameters	SØ	S1	S3	DØ	D1	D2
Sectors Per Track	36	4Ø	32	58	72	8Ø
Block Shift Factor	3	3	3	3	4	4
Block Mask	7	7	7	7	15	15
Extent Mask	Ø	Ø	Ø	Ø	1	1
Blocks Per Disk	143	159	127	231	143	159
No. Dir Entries	63	63	63	63	63	63
ALLOC Ø	192	192	192	192	128	128
ALLOC 1	Ø	Ø	Ø	Ø	Ø	Ø
Dir Check Vector Size	16	16	16	16	16	16
System Track Offset	3	3	3	3	3	3

Note: For disks formatted in 512-byte, single-density sectors and in 1Ø24-byte, double-density sectors, the software uses Tables DP5S1 and DP5S2, respectively.

Table B-1. Double-sided Mini Parameters

We arrived at these values by using the DISKDEF Macro and judgement. For instance, we chose the block size (CP/M's logical allocation data size increment) so that every block on the diskette could be defined by an 8-bit value. Similarly, we selected a number for directory entries sufficient for the diskette capacity.

APPENDIX C

EXTENDED-TRACK MINI DRIVES

PURPOSE:

The distribution version of CC3ØBIOS supports 8" drives with 77 tracks and 5.25" diskettes with 35 tracks. However, some mini drives have more than 35 tracks available: the MPI B-51/52, Tandon TM 1ØØ, and QUME Data Track 5 have 4Ø tracks, while the MPI B-91/92 have 8Ø tracks. This appendix identifies the CC3ØBIOS changes necessary to take advantage of the these drives' added capacity.

METHOD:

In the case of single-sided drives, only the disk parameter tables in CC3ØBIOS need to be changed. The necessary changes to the tables are shown below. In the case of the double-sided drives, the changes identified in Appendix B for installing double-sided drives also need to be made. In addition, some of the drives can support a faster step rate; see Appendix A.

	Drives:	SINGLE-SIDED		DOUBLE-SIDED	
	Tracks:	4Ø	8Ø	4Ø	8Ø
DP5SØ:	DW	18	18	36	36
	DB	3	3	3	4
	DB	7	7	7	15
	DB	Ø	Ø	Ø	1
	DW	82	172	165	172
	DW	63	63	63	63
	DB	192	192	192	128
	DB	Ø	Ø	Ø	Ø
	DW	16	16	16	16
	DW	3	3	3	3

```
DP5S1:     DW      2Ø      2Ø      4Ø      4Ø
           DB       3       3       3       4
           DB       7       7       7      15
           DB       Ø       Ø       Ø       1
           DW      91     192     184     192
           DW      63      63      63      63
           DB     192     192     192     128
           DB       Ø       Ø       Ø       Ø
           DW      16      16      16      16
           DW       3       3       3       3
DP5S3:     DW      16      16      32      32
           DB       3       3       3       4
           DB       7       7       7      15
           DB       Ø       Ø       Ø       1
           DW      73     153     147     153
           DW      63      63      63      63
           DB     192     192     192     128
           DB       Ø       Ø       Ø       Ø
           DW      16      16      16      16
           DW       3       3       3       3
DP5DØ:     DW      29      29      58      58
           DB       3       4       4       5
           DB       7      15      15      31
           DB       Ø       1       1       3
           DW     133     138     133     138
           DW      63      63      63     127
           DB     192     128     128     128
           DB       Ø       Ø       Ø       Ø
           DW      16      16      16      32
           DW       3       3       3       3
DP5D1:     DW      36      36      72      72
           DB       3       4       4       5
           DB       7      15      15      31
           DB       Ø       1       1       3
           DW     165     172     165     172
           DW      63      63      63     127
           DB     192     128     128     128
           DB       Ø       Ø       Ø       Ø
           DW      16      16      16      32
           DW       3       3       3       3
DP5D2:     DW      4Ø      4Ø      8Ø      8Ø
           DB       3       4       4       5
           DB       7      15      15      31
           DB       Ø       1       1       3
           DW     184     192     184     192
           DW      63      63      63     127
           DB     192     128     128     128
           DB       Ø       Ø       Ø       Ø
           DW      16      16      16      32
           DW       3       3       3       3
```

Note: The disk parameter tables DP5S1 and DP5D2 are also used for 512-byte, single-density and 1Ø24-byte double-density diskettes, respectively.

APPENDIX D

SECTOR SKEW

PURPOSE:

CC3ØBIOS uses sector skew to increase disk access speed. Between each sector read or write, most programs need to perform a certain amount of processing. Since the next physical sector will have already rotated past the head, it would be inefficient for CC3ØBIOS to wait until that sector came around again for the next sector read or write. Instead, CC3ØBIOS chooses the physical location for the next logical sector based on the sector skew factor. The sector skew factor is selected so that most programs have adequate processing time before the physical sector selected for the next read or write operation is detected. The skew factor CC3ØBIOS uses is dependent on diskette size and format. For example, an 8", single-density diskette with 128-byte sectors is given a skew factor of six, so that the next logical sector is the sixth subsequent physical sector, while a 5.25", single-density diskette with 256-byte sectors is given a skew factor of 3.

Since programs differ in the amount of processing time they require, changing the sector skew factors may increase disk access speed. For example, a program requiring extensive processing between sector reads or writes may not be given sufficient processing time by the sector skew factor and thus miss the next logical sector. It would then have to wait one full revolution of the disk. If the sector skew factor is gradually increased, a sector skew factor will be arrived at where the program is given enough processing time to pick up the next sector on the same revolution of the disk, resulting in a sharp decrease in disk access time. This would be the optimal sector skew factor. In the current version of CC3ØBIOS, the sector skew tables are generated by using an algorithm which may not be immediately obvious to a user wishing to modify the tables. This appendix describes how to modify the tables.

METHOD

To change the sector skew values, you need to change two values in the skew table for a diskette of a particular size and format. The current sector skew tables are as follows:

```
T848    DB    48,48,1
T826    DB    26,13,6
T815    DB    15,15,4
T88     DB    8,8,3
T84     DB    4,2,2

T529    DB    29,29,7
T518    DB    18,9,4
T51Ø    DB    1Ø,1Ø,3
T55     DB    5,5,2
T52     DB    2,2,1
```

Table D-1. Sector Skew Tables

The first value in each sector skew table is the number of sectors per track (one side only) and remains constant. The third value is the sector skew factor and can be modified to any number between 1 and the first value. The second number is the result of the first value divided by the greatest common denominator (GCD) of the first and third values. It must be changed if the new skew factor results in a different GCD. For example, if you wanted to change the skew factor in table T51Ø to 5, the second value must change to 2 (GCD=5; 1Ø/5=2). Of course, CC3ØBIOS must be reassembled and installed (see Application Note 1 for procedure). NOTE THAT THE SKEW FACTOR IN TABLE T826 IS AN INDUSTRY STANDARD AND SHOULD NOT BE CHANGED.