Ithaca   InterSystems
Standard BIOS User's Manual

Version 4c
Manual Revision 8/17/81

ITHACA INTERSYSTEMS
STANDARD BIOS
USER'S MANUAL

Copyright   Notice

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Service   Information

When your CP/M diskette arrives, inspect both the diskette and the shipping carton immediately for evidence of damage during shipping. If the shipping carton is damaged or water-stained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is not present when the carton is opened and the contents of the carton are damaged, save the carton and packing material for the agent's inspection. Shipping damages should be reported immediately to the carrier. We advise you to save the shipping container for use in returning the diskette to InterSystems, should it ever be necessary to do so.

If it is necessary to return the diskette to InterSystems for any reason, you must obtain a Return Authorization Number from our Customer Service Department. You can do this by calling, sending a TWX message, or writing to us. After the return has been authorized, proceed as follows:

1) Include an explanatory letter. This should include, if possible, a list of the commands that were given before the malfunction, and a detailed description of the effects of the malfunction.

2) Include the Return Authorization Number.

3) Pack the above information and the diskette in a container suitable to the method of shipment.

4) Ship prepaid to InterSystems. You may reach us for both correspondence and service at:

                Ithaca InterSystems, Inc.
                Customer Service Dept.
                1650 Hanshaw Rd.
                P.O. Box 91
                Ithaca, New York 14850   U.S.A.

                Telephone: (607) 257-0190
                TWX: 510   255-4346

        In Europe:
                Ithaca InterSystems (U.K.) Ltd.
                Coleridge Lane, Coleridge Road
                London N8 8HG   U.K.

                Telephone: 01-341-2447
                Telex: 299568

Chapter I

Introduction

     This is the manual for the "simple BIOS" that is part of the
InterSystems CP/M package. "BIOS" stands for Basic Input/Output
System; the BIOS handles all the I/O devices in your system
(e.g., terminal, printer, disk drives) for CP/M. We call this
BIOS the "simple BIOS" to distinguish it from the InterSystems
high-performance BIOS, which is called the "cache BIOS." These
notes pertain only to the BIOS, and do not explain the operation
of CP/M. CP/M is documented separately by Digital Research.

     CP/M is a single-user operating system. Accordingly, the
BIOS is equipped to handle a single video terminal. The BIOS is
shipped with an "autobaud" routine turned on; this routine will
automatically determine the baud rate (data rate) of the video
terminal. The BIOS will also support a _serial_ printer.   ←

     The disk portion of the BIOS will handle up to four 8-inch,
soft-sectored floppy disk drives, and disks of three types:
single sided, single density; single sided, double density; and
double sided, double density. Note, however, that not all disk
drives are equipped to handle double sided disks. The BIOS
determines the type of a diskette automatically when it accesses ←
it; no special input is required when a diskette is ejected and a
diskette of a different type is inserted.

     The BIOS is accompanied by two InterSystems utility
programs: SET.COM and IFORMAT.COM. SET.COM allows you to "set
up" the BIOS for your equipment and application: you can set
baud rates for the terminal and printer, choose whether to run in
polled or interrupt mode, set the disk step time for optimal disk
performance, and enable several features that can be triggered by
typing a control character at the terminal keyboard. The use of
SET.COM is fully discussed in chapter 4, _Using SET.COM._

     IFORMAT.COM is used primarily to initialize a blank
diskette. It can format a diskette to either single or double
density, and copy CP/M from the system track(s) of one disk to ←
the system track(s) of another. Detailed instructions on the use
of IFORMAT.COM are found in chapter 5, _Using IFORMAT.COM._

Hardware Requirements.

     The following boards are required to bring up CP/M with the
InterSystems simple BIOS:

          1.   InterSystems FDC-II disk controller board
          2.   InterSystems VIO-0, VIO-1, or 6SIO board
          3.   MPU-80 CPU board
          4.   64K random access memory (as shipped)

     In addition, you need an asynchronous video terminal, and
two 8-inch, soft-sectored floppy disk drives. You could
theoretically bring up CP/M with a single disk drive, but it

would be impossible to make backup copies without a second drive.

Chapter II

How To Boot Up Your System

Starting your computer and the CP/M operating system is called "booting up your system." This chapter describes what happens when you boot up your system, the difference between a cold boot and a warm boot, and how to boot up your system.

Disks used with CP/M have either one or two reserved tracks called the system tracks. Single density disks have two system tracks. Double density disks, which store twice as much information per track, have one. The system tracks are reserved for CP/M and a BIOS; even if there were nothing on them, the user could not store files on them.

When the system is booted up, the disk controller board reads CP/M from the system track(s) of the disk in drive A into memory, and transfers control to it. Thus, in order to boot up, there must be a disk with CP/M on its system tracks in drive A.

There is a little room on the system track(s) for a BIOS; but there is not enough room for a BIOS with the kind of features offered by the InterSystems BIOS. We resolved this difficulty by putting our BIOS in a regular disk file called ISTARTUP.COM. We then wrote an extremely rudimentary BIOS, called the "tiny BIOS," that resides on the system track(s) with CP/M. The tiny BIOS's only job is to load and run ISTARTUP.COM. ISTARTUP.COM then supplants the tiny BIOS, which is not used in any way until the next time the system is booted up. Because of this arrangement, a disk from which you wish to boot up must have the file ISTARTUP.COM on it, as well as having CP/M on its system track(s).

note

The actual process of booting up is quite simple:

1) Make sure that your computer, your disk drives, and your terminal are all plugged in and turned on.

2) Press the "reset" button on your computer.

3) Insert a diskette with CP/M on its system track(s) and ISTARTUP.COM in its directory in drive A.

4) Press the "run" button on your computer.

5) Type several carriage returns, until your system responds:

CP/M 2.2 Ithaca InterSystems, Inc. BIOS version 4.c (standard)

A>

At this point, the CP/M operating system is running.

Chapter III

Copying The Distribution Diskette

Now that you have successfully booted up, the first thing you should do is to make two copies of the distribution diskette. Then put the distribution diskette in a safe place, and never use it.

The reason for copying the distribution diskette twice is that diskettes wear out with use, and are even occasionally destroyed by a hardware failure. In general, it is wise to keep two copies of everything that is stored on diskettes, and three copies of anything that would be difficult or expensive to replace. Your InterSystems CP/M diskette falls into the latter category.

To copy a diskette, you need to use the InterSystems diskette formatting and system copying utility IFORMAT.COM, and Digital Research's file copying utility PIP.COM. Detailed instructions on how to use IFORMAT.COM are found in chapter 5 of this manual, Using IFORMAT.COM. PIP.COM is explained in Digital Research's CP/M manuals. However, you can copy a diskette without being familiar with PIP.COM and IFORMAT.COM if you follow the step-by-step instructions below.

1) Turn on your system and boot up with your InterSystems CP/M diskette.

2) Insert a blank diskette in drive B. Depending on your diskette and disk drives, you may need to put a write-protect tab on your blank diskette. A write-protect tab is a little piece of gummed paper or foil that will cover a notch about 1/4 inch deep on the side of your diskette. Not all diskettes have this notch. The notch is found on the edge opposite the label. If your diskette has such a notch, you should cover it with a write-protect tab. Write-protect tabs usually come with your diskettes. Disk drives that are equipped to sense an uncovered write-protect notch will not let you write data on such a diskette.

3) Run the program IFORMAT.COM by typing "IFORMAT", followed by a carriage return. IFORMAT.COM will sign on and prompt you as follows:

Ithaca InterSystems System Installation and Formatter Program
Version 2.2   Revised 5/19/81

F)ormat   C)opy   V)erify   H)elp   Q)uit -->

IFORMAT.COM is now waiting for a response from you. Type "F" for "Format, followed by a carriage return. IFORMAT.COM will respond with:

Drive letter: A..D or H)elp or Q)uit -->

Type "B" and a carriage return. If the diskette you inserted in

drive B was double sided, IFORMAT.COM will say:

The drive you selected contains a double-sided diskette;
therefore, double density format will be used.

If the diskette you inserted was single sided, IFORMAT.COM will
ask:

S)ingle or D)ouble density -->

Type "S" and a carriage return. The next prompt will be:

Format S)ystem or A)ll tracks Q)uit -->

Type "A" and a carriage return. You will hear your disk drive
formatting the diskette in drive B. When IFORMAT.COM has
completed this task, it will say:

M)ore or Q)uit -->

Type "M" and a carriage return. IFORMAT.COM will now print its
initial prompt again:

F)ormat C)opy V)erify H)elp Q)uit -->

This time, type "C" and a carriage return. IFORMAT.COM will ask:

Source drive letter: A..D or Q)uit -->

Type "A" and a carriage return. IFORMAT.COM will now ask:

Destination drive letter: A..D or Q)uit -->

Type "B" and a carriage return. IFORMAT.COM will copy the system
track(s) from drive A to drive B. It will say:

M)ore or Q)uit -->

This time, type "Q" and a carriage return to quit. IFORMAT.COM
will return to CP/M.

    Now copy all the disk files from drive A to drive B by
typing exactly this: "PIP B:=*.*[V]", followed by a carriage
return. PIP.COM will respond by listing all the files it is
copying, and then return to CP/M.

    The disk in drive B is now a copy of the one in drive A. To
make sure, insert it in drive A and try booting up with it. It
should work as well as the original diskette did. Now repeat
this procedure to make another copy of the source disk.

Chapter IV

Using   SET.COM

The BIOS is accompanied by a program called SET.COM, which lets you modify the BIOS to suit your own system and application. SET.COM modifies the copy of ISTARTUP.COM on your currently logged-in disk. The next time you boot up with that disk, the revised version of ISTARTUP.COM will be loaded into memory, and the changes you made will take effect.

The purpose of this chapter is to show you how to use SET.COM, as well as to explain the meaning of each parameter that you can change, and to help you choose the correct settings for your application.

The changes you can make with SET.COM fall into two categories. The first consists of various operating parameters that govern how the BIOS communicates with your disk drives, terminal, and printer. The second has to do with the BIOS features that can be triggered by control characters.

A control character is a special, non-printing character that you can type by holding down the "ctrl" button on your console, and simultaneously typing a letter. For example, if you hold down the "ctrl" key and type "A", you have typed a control-A, not an "A". Control characters are usually special signals to an operating system or a program.

The BIOS offers six functions that are triggered by control characters. SET.COM lets you choose which of these functions you want to enable, and which control character to use for each enabled function. Once a control character has been chosen to trigger a BIOS feature, the BIOS will absorb that control character whenever it is typed; it becomes unavailable for other use. For example, if you specify in SET.COM that control-P should cause anything sent to the console to be sent to the printer, as well, then typing control-P will have only this effect, and no other. If control-P is a command in a program you are running, it will never get there; the BIOS will intercept it. Thus, when you are enabling control-character triggered features in the BIOS, you should choose control characters that are not used in other programs you want to run.

This is SET.COM's general format: it prints a line stating the current value of the parameter being changed, and waits for you to type in a response. If you just type a carriage return, it leaves that parameter unchanged, and goes on to the next one. If you type in a valid new value, it will change ISTARTUP.COM accordingly, and go on to the next line. If you type a caret (^), it will leave the current parameter unchanged, and back up to the preceding one. Finally, if you type a control-C, it will return to CP/M.

For the control character triggered features, it will name the feature and print either a capital letter or an asterisk. A capital letter means that that control character currently

activates the feature; an asterisk means that the feature is
currently disabled. If you type in a letter, that control
character will now activate the feature; typing an asterisk
disables the feature. As with the operating parameters, just
typing a return leaves the feature as it is, and typing a caret
will make SET.COM back up to the preceding line. For example, if
SET.COM prints:

Control character to send console output to the printer P-->

that means that control-P currently causes console output to be
sent to the printer. If you now type "X", in the future it will
be a control-X that has this effect.

        To run SET.COM, boot up your system and type "SET", followed
by a carriage return. The entire operation will appear on your
screen as illustrated below, except that the prompt lines (the
lines ending with "-->") will appear one at a time.

A>set
This program modifies ISTARTUP.COM

        1) To leave a feature in its present state,
           just hit the return key.
        2) To return to the preceding feature, type a "^".
        3) For a list of valid responses, type a "?"
        4) To return to the operating system, type a control-C.
        5) For the control character features, just type the
           letter, not the actual control character. You can
           shut the feature off by typing a *.
           Ctrl-Z is not allowed.

        ****
        ** Remember that you must reboot your system **
        ** for the changes you make to take effect. **
        ****

The current disk step time is 10 milliseconds -->
The console mode is: Polled
     New mode(I = Interrupt, P = Polled) -->
The baud setting of the console is autobaud -->
The baud setting of the printer is 300   -->
Control character to reboot the system   *-->
Control character to display the type-ahead buffer   *-->
Control character to stop the system   *-->
Control character to send console output to the printer *-->
Control character to clear the type-ahead buffer   *-->
Control character to toggle the disk operation display *-->

The illustration shows all settings as they are when the BIOS is
shipped to you. As you can see, all control character features
are disabled. We ship the BIOS this way so that it will not "use
up" any control characters that might be needed for programs you
want to run. However, we have found the control character
features quite useful, and encourage you to enable at least some
of them.

Here is a more detailed description of each of the above parameters and features, with some possible reasons for enabling, disabling, or changing each:

1) Milliseconds per disk step. This is the rate at which your disk drives can move the read/write head from track to track. If you are trying to step your disks too fast, you will get disk errors. Stepping your disks more slowly than they are rated for works, but makes your drives both slower and noisier than they need to be. The manual for your disk drives should tell you how fast your drives can be stepped.

We have set the disk step time to 10 milliseconds, which is slow enough for almost all drives. Most drives will run faster.

2) Polled or interrupt mode. This refers to the way the BIOS processes characters typed at the console. In polled mode, whenever the system is not doing anything else, it repeatedly checks ("polls") the console to see if a character has been typed. This means that characters typed when the system is busy will be lost (since the system can not poll the console when it is doing something else). If you type a BIOS control character, it will not take effect until the computer finishes its present task.

In interrupt mode, when a character is typed at the console, whatever the computer is doing is interrupted long enough for the character to be processed. Instead of having to poll the console when it is not otherwise busy, the system just stops and waits for an interrupt. Control characters that activate BIOS features will always take effect immediately. Other characters typed when the computer is busy will be put into a special type-ahead buffer for storage until your program or the operating system is ready to accept them. This means that you can type ahead responses to anticipated prompts before they actually occur. When your program is ready, your typed responses will be taken from the type-ahead buffer.

The BIOS was designed with interrupt mode in mind, and we recommend that you use interrupt mode for most applications. However, there are a few programs that do not tolerate interrupts. (TDL's DEBUG-II is the only one of which we are aware, but there may be more.) Polled mode is available for those special applications when an interrupt-driven system is not desirable. Also, if you have one of the old Ithaca Audio Z-80 boards, rather than the newer MPU-80, you cannot run in interrupt mode.

3) The console baud setting. The baud setting is the rate at which your console can receive and transmit information. In order for your console to be able to send and receive characters, it and the BIOS must be set to the same baud rate. The BIOS can be set to any of 16 standard baud rates, ranging from 50 to 19,200 baud.

The BIOS also offers an autobaud routine that will automatically determine the console's baud rate. To turn on the autobaud routine, simply type "autobaud" instead of a baud setting. If the autobaud routine is turned on, you must type a number of carriage returns every time you boot up your system. The BIOS sets itself to different baud rates until it receives two carriage returns in a row; then it "knows" it has found the correct setting. Setting a standard baud rate instead of the autobaud routine means that you do not have to type carriage returns every time you boot up.

To set a standard baud rate, check the manual for your console to find the correct baud setting. If your console will run at more than one baud setting, set it to the highest. Then use SET.COM to set the BIOS to that setting.

If your system is equipped with a front panel, you can also specify "switches" instead of a baud setting. In that case, when you boot up, the BIOS will read the right four "programmed input" switches on your front panel and set the console baud rate according to the code given below, where a 0 represents a switch that is down, and a 1 represents a switch that is up. The BIOS will only read the switches once, in the process of doing a cold boot; changing the switches after that will have no effect. The following code is used:

0000	=	50	baud
0001	=	75	baud
0010	=	110	baud
0011	=	134.5	baud
0100	=	150	baud
0101	=	300	baud
0110	=	600	baud
0111	=	1200	baud
1000	=	1800	baud
1001	=	2000	baud
1010	=	2400	baud
1011	=	3600	baud
1100	=	4800	baud
1101	=	7200	baud
1110	=	9600	baud
1111	=	19,200	baud

Never specify "switches" as a baud setting if you do not have a front panel!

4) The printer baud setting. Everything that applies to the console baud setting also applies to the printer baud setting, except that there is no autobaud routine, and if you specify "switches," it is the left four "programmed input" switches, not the right four, that will be read. If your printer will run at more than one baud setting, you will probably want to set it to the highest; then set the BIOS to match.

All the remaining features are triggered by control characters. As explained above, if you assign a control character to one of these features, it becomes unavailable for other use; thus, you should choose control characters that are not used by other programs you want to run. However, InterSystems does have standard control characters for each feature; they are given in parentheses at the end of the first sentence of each section. For consistency's sake, you may want to use the standard control characters, provided they do not interfere with your applications.

5) Control character to reboot the system (N). This permits you to do a cold boot from the console, without having to hit the "reset" and "run" buttons on your front panel.

6) Control character to display the type-ahead buffer (D). When you hit this control character, the contents of the type-ahead buffer at the instant the control character was typed will be displayed on the screen. Since characters that are typed ahead do not appear on the sreen until they are taken out of the buffer, you can use this control character to check what you have typed ahead for misspellings or mistakes. Remember that the type-ahead buffer exists only if you are running in interrupt mode (see the descriptions of polled and interrupt modes, above).

7) Control character to stop the system (S). This character will freeze the system until any other character is typed. This is useful when information is being displayed on the console faster than you can read it, for example. But this control character does not just stop the terminal display; it stops the entire system, just as if you had hit the "stop" button on the computer. Once the system is stopped, typing any character will restart it.

8) Control character to send console output to the printer (P). This control character will cause a printer copy to be made of whatever is being sent to the terminal. Typing the control character again turns the option off.

9) Control character to clear the type-ahead buffer (A). If you change your mind about what you have typed ahead, hit this control character to clear the buffer.

10) Control character to toggle the disk operation display (Y). This is primarily for diagnostic purposes. Every time the BIOS reads or writes a disk sector, a line will be printed on the terminal giving some information about the transaction. The line

looks like this:

Drv A   Sur 0   Cyl 14   Sec 16   Op 46   DMA A400   DD

The letter after "Drv" is the drive letter. "Sur" gives the
surface of the disk; it is always 0, unless you are using a
double-sided disk, in which case, it is either 0 or 1.   "Cyl"
identifies the cylinder, "Sec" is the sector number; both numbers
are hexadecimal (base 16). "Op" is the operation code of the
disk controller chip, and is deciphered as follows: if the disk
is double density, the first digit will be 4; if it is single
density, the first digit will be 0. The second digit is 6 for a
disk read, and 5 for a disk write.   "DMA" is the address in
memory to or from which the sector was copied. "DD" stands for
double density; "SD" would mean single density.

        If you have enabled this feature and you accidentally strike
this control character, you may be baffled by all the diagnostic
output appearing on your screen. Typing the same control
character again shuts this feature back off.

Chapter V

Initializing A Blank Diskette: Using IFORMAT.COM

The InterSystems utility program IFORMAT.COM performs several disk-related tasks. It can format a disk to either single or double density, and it can copy the system track(s) from one diskette to another. It can also verify a disk (that is, check the entire disk to make sure that the formatting is correct and that there are no disk defects). Finally, it can put a memory image of a relocated operating system on the system track(s) of a disk. This last application, however, is quite specialized, and will be covered in chapter 7, Relocating CP/M And The BIOS. Formatting, verifying, and copying the system track(s) are explained in this chapter.

To run IFORMAT.COM, boot up your system and type "IFORMAT", followed by a carriage return. IFORMAT.COM will sign on as follows:

Ithaca InterSystems System Installation and Formatter Program
Version 2.2   Revised 5/19/81

F)ormat   C)opy   V)erify   H)elp   Q)uit -->

The last line is a prompt: IFORMAT.COM is waiting for you to type in one of the listed options, followed by a carriage return. Whenever IFORMAT prompts you, it will list your response options as shown above. You can type out the entire word, but you only have to type as far as the right parenthesis. Do not type the right parenthesis itself; it is there only to indicate how far the word must be spelled out. IFORMAT also disregards the case of your response: upper case letters and lower case ones are considered identical.

For example, if you wanted to choose "Copy" as a response to the prompt above, you could type "C", "CO", "COP", or "COPY", in any combination of upper and lower case. "COPPER" or "COPYPOO" would not be accepted.

In the prompt above, "Quit" simply returns you to CP/M , without further action. "Help" will cause an explanatory message (a condensed version of this chapter) to be displayed on the screen. Format, Copy, and Verify are IFORMAT's three principal operations, and are explained individually below.

Format.

Formatting a diskette means putting magnetic address information at the beginning of each sector. These are called sector headers. The disk controller board finds its way around your diskettes by reading the sector headers.

Some blank diskettes are pre-formatted; but there are several formatting standards, and the diskette may not be correctly formatted for the InterSystems disk controller board

and the cache BIOS. In any case, it can never hurt to reformat a blank diskette. But CAUTION: NEVER REFORMAT a diskette that has files on it that you want to save! Reformatting a diskette is starting from scratch; any files that are already on the disk are destroyed.

     Your InterSystems equipment can read, write, and format diskettes in two densities: single density and double density. Double density diskettes provide over twice the storage of single density diskettes, as well as faster data access. Single density diskettes, however, are more standard in the industry. If you want a diskette that is transportable to most other 8-inch floppy disk systems, you should choose single density; otherwise, double density is probably the better choice.

     The way a disk is formatted determines its density. IFORMAT.COM permits you to choose the density to which you want your diskettes formatted. Double-sided disks are the exception: a double-sided disk is always double density. Also, if you are formatting your disks to double density, make sure that they are rated for double density use. Though you could easily format and use a single density rated disk at double density, disk reliability could suffer.

     When IFORMAT.COM formats a disk, it also verifies the formatting. That is, after it has formatted each track, it reads the track to check for disk errors. A defective disk will most likely be detected at this point.

     Having selected "Format", you will be prompted with:

Drive letter: A..D or H)elp or Q)uit --->

Once again, selecting "Help" will cause a help message to be printed on the screen, and typing "Quit" will return you to CP/M. If you do not type either of these options, type the letter of the drive that contains the disk you want to format. MAKE SURE YOU TYPE THE RIGHT DRIVE LETTER! Remember that formatting a disk wipes out everything on it.

     If the drive you selected contains a double-sided disk, IFORMAT.COM will now print this message:

The drive you selected contains a double-sided diskette; therefore, double density format will be used.

Otherwise, IFORMAT.COM will prompt you with:

S)ingle or D)ouble density -->

Type "Single" (or abbreviate) for single density, or "double" for double density. Now that the density has been determined, IFORMAT will ask:

Format S)ystem or A)ll Tracks Q)uit -->

This is your last chance to type "quit", if you realize that you

typed the wrong drive letter, or selected the wrong density. If
you type "System", IFORMAT.COM will format only the system
track(s) of the drive you selected: the outermost track if you
chose double density, the outer two tracks otherwise. If you
type "All", IFORMAT.COM will format the entire diskette.

    When IFORMAT.COM has finished its task, it will print:

M)ore or Q)uit -->

Type "Quit" if you are done. Type "More" to return to the
initial prompt (Copy, Format, Help, Quit). You might type "More"
if you were formatting more than one disk, or if you now wanted
to copy CP/M onto the system track(s) of the diskette you just
formatted.

Copy.

    The outer two tracks of a single density diskette, and the
outermost track of a double density diskette, are called the
system track(s). They are reserved for the operating system
(CP/M) and the tiny BIOS. When you boot up your system, the disk
controller board reads CP/M and the tiny BIOS into memory from
the system track(s). The tiny BIOS in turn loads and runs
ISTARTUP.COM, which is the main BIOS. (See chapter 3, BOOTING
UP YOUR SYSTEM.)

    If the disk in drive A does not have CP/M and the tiny BIOS
on its system track(s), you cannot boot up with it. Also, since
the contents of the system track(s) are not stored as a file that
appears in your directory, they cannot be copied with the CP/M
file copying utility PIP.COM. The copy facility in IFORMAT.COM
lets you copy the system track(s) from one disk to another.
(Digital Research also provides a system track copying utility
called SYSGEN.COM, but it is restricted to single density disks.
We recommend that you use IFORMAT.COM, instead.)

    IFORMAT.COM's "Copy" facility automatically determines the
densities of the disks being used, and copies the correct number
of system tracks. You can copy the two system tracks of a single
density disk onto the system track of a double density disk, and
vice versa, with no difficulty.

    Having selected "Copy", you will be prompted as follows:

Source drive letter: A..D or Q)uit -->

Typing "Quit" will return you to CP/M without further action. To
copy, type the letter of a drive that has a copy of CP/M and the
tiny BIOS on its system track(s). Normally, this will be drive
A, since you booted up with the disk in drive A. If you typed a
valid drive letter (a letter between A and D, naming a drive that
contains a diskette), you will hear that disk drive reading the

system track(s). IFORMAT.COM will then ask:

Destination drive letter: A..D or Q)uit -->

Again, typing "Quit" will abort the copy and return you to CP/M.
To complete the copy, type the letter of the drive that contains
the disk onto which you want the system track(s) copied. You
should hear that drive writing the track(s). As soon as it is
done, IFORMAT.COM will print:

M)ore or Q)uit -->

Type "Quit" to return to CP/M. Type "More" to return to the
initial prompt, if you want to format or copy onto another disk.

Verify.

     The "verify" operation checks an entire disk for errors. If
the disk is defective, or incorrectly formatted, "verify" will
print an error message. When IFORMAT formats a disk, it
automatically verifies, too. But you can verify a disk without
formatting it by selecting "verify."

     If you selected "Verify" in response to IFORMAT's initial
prompt, IFORMAT will ask:

Drive letter: A..D or Q)uit -->

Type the letter of the drive that has the disk you want to
verify. IFORMAT will print:

Checking disk X: xxxxx density

where "X" is the drive letter of the disk being checked, and
"xxxxx" is either "single" or "double." If a disk error is
found, an error message will be displayed. If not, the message:

Disk X is OK.

is printed, followed by the prompt:

M)ore or Q)uit -->

Typing "More" brings back IFORMAT's initial prompt; typing "Quit"
returns you to CP/M.

Error messages.

     If you respond to a prompt in a way that IFORMAT cannot
understand, it will print a message like this one:

I do not know what "POUGHKEEPSIE" means. Your options are:

and repeat the prompt. This could occur if you misspelled a
response, responded with a word not on the list, or included the

right parenthesis in your response. Remember, the right
parenthesis is there only to indicate how far the word must be
typed out.

        The only other error messages are disk error messages. In
this case, IFORMAT is advising you of a disk error condition. It
will first name the individual error, and the drive letter and
track number. (The individual disk errors are listed and
described on pages 26-29.) After naming the error, it will give
you the following options:

ERROR: I)gnore   S)tart over   H)elp   Q)uit -->

"Ignore" continues as if the error had not occurred. "Start
over" brings back the initial prompt. "Help" prints an
explanatory message. "Quit" returns you to CP/M.

Chapter VI

Relocating CP/M And The BIOS

This chapter explains how to reconfigure CP/M and the BIOS so that they are located at a different address in memory. It requires a fairly detailed understanding of CP/M. You may find it helpful to re-read Digital Research's CP/M 2.2 Alteration Guide. Before examining how to relocate the operating system, we will discuss where it is normally located, and why one might want to move it.

A standard CP/M system is arranged as follows: a 1/4K area called the "boot" area starts at address 0 and extends to 100H. The boot area stores miscellaneous CP/M variables and buffers. User programs are loaded and run starting at 100H, in an area called the Transient Program Area, or TPA. The bulk of the CP/M operating system -- all but the boot area -- is located at the top of available memory. It consists of the Console Command Processor (CCP), the Basic Disk Operating System (BDOS), and the Basic Input/Output System (BIOS). The TPA extends upward from 100H until it runs into the CCP. User programs can extend past the TPA and overwrite the CCP, provided they conclude with a warm boot. (In a warm boot, the CCP is read back in from the system track(s) of the disk.)
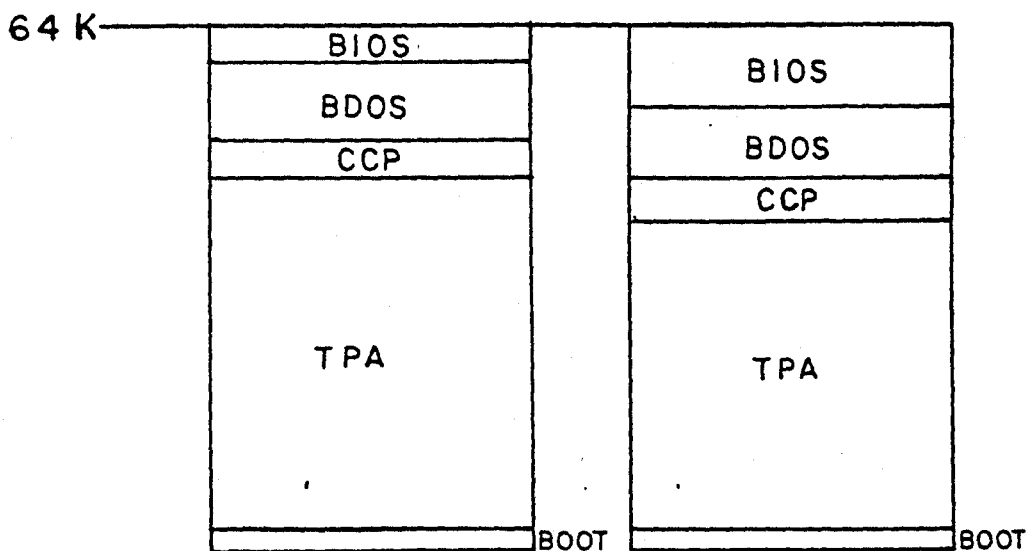

Fig. 1
A standard
64K CP/M system

Fig. 2
The InterSystems
simple BIOS

The exact location of the CCP, BDOS, and BIOS depends on the amount of memory avaiable, up to a maximum of 64K. (The Z80 central processing unit cannot directly address more than 64K.) Figure 1, above, shows a standard CP/M system in 64K of memory. This is also called a "64K system."

The InterSystems BIOS differs from the CP/M standard in one respect: it is 2K larger than the room allotted for it by CP/M, so the CCP and BDOS are located 2K lower than they otherwise would be. Thus, the configuration shown in figure 2, on the preceding page, is what CP/M would call a "62K system", though it actually requires 64K of memory. We will adopt this nomenclature in order to be consistent with CP/M. Remember, though, that the InterSystems BIOS will always require 2K more memory than the nominal system size. For example, with 48K of memory, you could have a 46K system.

The object of relocating the operating system is to move it to the top of available memory, and thereby maximize the size of the user program area. The BIOS is shipped to you as a 30K system, so it requires 32K of memory to run. (Users of the cache BIOS, however, are shipped a 62K simple BIOS system.) If you have more than 32K of memory, space is being wasted at the top of memory, and you will not be able to run programs that do not fit into your user program area. Thus, you need to create a system nominally 2K smaller than the amount of memory you have.

To relocate the operating system, you need to use the program MOVCPM.COM provided by Digital Research to create a new operating system configured to run where you are planning to locate it. This new operating system must then be saved in a disk file. Then you must use IFORMAT.COM to put the contents of that disk file on the system track(s) of your target diskette. Finally, you will have to reassemble the BIOS source to create a new ISTARTUP.COM designed to communicate with the relocated BDOS and CCP.

We have provided step-by-step instructions for relocating CP/M and the BIOS below. Before you can use them effectively, however, you must determine which of the following two groups you belong to, as the instructions will vary slightly between the two groups:

A. You have just bought the InterSystems CP/M package, including both CP/M and the simple BIOS.

B. You bought CP/M from someone else, and got this BIOS to go with your InterSystems hardware.

1) Boot up your system with a copy of the distribution diskette. NEVER USE THE ACTUAL DISTRIBUTION DISKETTE! You may even want to create a special copy just for this operation. The diskette you use for this operation should have CP/M on its system track(s), and the following files in its directory:

      -- ISTARTUP.COM
      -- SBIOS.SRC, the BIOS source file

-- ASMBIOS.SRC, the BIOS assembler
-- IFORMAT.COM
-- MOVCPM.COM, CP/M's system relocator program
-- LOAD.COM, CP/M's hex file loading utility
-- A text editor of your choice.

The first four files are part of the InterSystems BIOS package; the next two are part of CP/M. A text editor also comes with CP/M, if you have no other one.

2) Create a new version of SBIOS.SRC, the assembly language source file for ISTARTUP.COM. Use a text editor to edit SBIOS.SRC. The first line of SBIOS.SRC is a title line. The second is an EQUate statement setting the system size for which SBIOS will be assembled. It will say "msize   equ   62", meaning that SBIOS is configured as a 62K system (which requires 64K of memory). Using your editor, change the number 62 to reflect the new location of the CCP, BDOS, and BIOS. For example, if you have 48K of memory and thus want to create a 46K system, set msize to 46. Do not set msize to a number greater than 62.

3) Rename ISTARTUP.COM to ISTARTUP.62.

4) Assemble your new version of SBIOS.SRC into a .HEX file by typing the command "ASMBIOS SBIOS.AA/HEX". The two-letter extension after "SBIOS" has the following meaning: the first letter is the name of the disk drive on which the assembler should find the source file (SBIOS.SRC); the second letter is the drive to which the .HEX file should be sent. If you also want an assembler listing, type a third letter naming the disk drive to which the .LST file should be sent. Since you used this diskette to boot up, the source file should be on drive A, and you will want the output (.HEX) file sent to the same drive. The assembler will take about five minutes to assemble the BIOS (more if you chose to generate a listing).

> Note: The assembler that you get from us is a restricted version of our ASMBLE Z-80 macro assembler; it will assemble only the InterSystems cache BIOS, the InterSystems simple BIOS (this one), and the tiny BIOS. Do not try to assemble any other files with this assembler. The unrestricted version of ASMBLE is available for sale from InterSystems.

5) Load SBIOS.HEX and create a file called SBIOS.COM by typing the command "LOAD SBIOS". The loader will let you know it is finished by telling you the first and last address of SBIOS.COM, and the number of bytes of machine code it created.

6) Erase SBIOS.HEX.

7) Rename SBIOS.COM to ISTARTUP.COM.

8) Group A should skip this step and go directly to step 9. Create a new tiny BIOS configured for the desired system size. To do this, you need to alter the tiny BIOS source file,

TBIOS.SRC, and reassemble it. The procedure is the same as for SBIOS. Here it is again, in outline form:

> a.   Edit   TBIOS.SRC.   Change   the   second   line, "msize   equ   62", to set msize equal to the desired system size.
> b.   Assemble the new TBIOS.SRC into a .HEX file.
> c.   Use the LOAD command to create a .COM file.
> d.   Erase the .HEX file.

9) Run MOVCPM.COM by typing "MOVCPM xx *", where the "xx" is replaced by the size in K of the system you want (the same number to which you set msize in the BIOS source). If you are in group B, however, add 2 to this number before running MOVCPM.COM. For example, if you set msize equal to 46, type "MOVCPM 48 *". MOVCPM will generate a memory image of a CP/M system of the size you selected, and load it into memory starting at 900H (regardless of where it is configured to run). MOVCPM should print, approximately:

CREATING xxK CP/M
READY FOR "SYSGEN" OR "SAVE 35 CPMxx.COM"

where "xx" is the system size you selected. The exact text may vary slightly with the version of MOVCPM. In particular, the two-digit number after "SAVE" may be different. For the next step, use the number that MOVCPM printed after "SAVE".

10) Save the system image created by MOVCPM by typing "SAVE 35 CPMxx.COM", replacing the xx with the size of the system you are creating, and using the number that MOVCPM specified after "SAVE". You now have a file named CPMxx.COM on your disk.

11) Put CPMxx.COM onto the system tracks of your disk by typing "IFORMAT CPMxx.COM". If you are in group B, type "IFORMAT CPMxx.COM TBIOS.COM" instead. IFORMAT will respond,

Ready to put file CPMxx.COM on the system track(s)
     [and, if you are in group B]
Ready to patch file TBIOS.COM
onto the system track's BIOS location
Destination drive name (S)tarts over) -->

Now, specify the drive onto which you want to put the new system. Usually, this will be drive A. IFORMAT.COM will put the reconfigured operating system on the system track(s), and will automatically patch in the tiny BIOS if you are in group B.

12) With the new operating system on the system track(s), and ISTARTUP.COM modified as described above, you should be ready to run. Do a cold boot with the diskette on which you have been working. The system should boot up normally. Remember, though, that your re-assembled BIOS has the autobaud routine turned on, so you will have to type several carriage returns for the system to come up. You are now using the relocated operating system and BIOS.

13) You can copy the relocated operating system onto other diskettes simply by using IFORMAT (without filenames as arguments) and the Copy command, and by using PIP to copy your modified version of ISTARTUP.COM. However, remember that you modified both the system track(s) and ISTARTUP.COM. If you copy your new version of ISTARTUP.COM onto another disk without copying the new system track(s), as well, you will be unable to boot up with that disk. In other words, the system track(s) and ISTARTUP.COM must always be modified together.

Chapter VII

Error   Messages

This chapter explains the error messages that can occur in
the tiny BIOS and the main BIOS. Almost all the errors are disk
errors: that is, they are messages printed in response to an
error condition detected by the disk controller board while it
was trying to read or write a disk.

The tiny BIOS.

The tiny BIOS is the extremely rudimentary BIOS that resides
on the system track(s) with CP/M. Its only purpose is to load
and run ISTARTUP.COM, meaning that it only runs for a few seconds
at a time (until ISTARTUP.COM takes over). Nevertheless, the
tiny BIOS can generate a few error messages, principally if it
encounters a disk error while trying to read ISTARTUP.COM. These
messages are given as 2-letter codes to conserve space, and can
be quite cryptic if you are not expecting them. In general, any
time you are unable to boot up, and a few strange letters appear
on your screen, check them against the following list:

BE: system attempted to perform an operation beyond the scope of
the tiny BIOS.
CE: CRC error found while reading diskette.
MS: disk controller cannot find correct sector.
WC: disk controller is on the wrong cylinder.

Any of these messages is usually the result of a faulty disk
drive or a faulty diskette. If you get one of these messages
while trying to boot up with your backup diskette, make another
backup diskette. If you get one of these messages while trying
to boot up with the distribution diskette, contact InterSystems
or your dealer for assistance.

ISTARTUP.COM.

Every time the BIOS reads or writes to a disk, it also
checks whether the disk controller reported an error condition.
If it finds an error, it tries the operation up to ten times
before giving up. After each unsuccessful try, it will print a
message of this form:

[Disk Error]
Drv x   Sur x   Cyl xx   Sec xx   Op xx   DMA xxxx

"[Disk Error]" will be the actual error found. (The individual
disk errors are listed and explained below.) The x's will be
replaced by the correct letters and numbers for this particular
error. Note that the second line is identical to the line
generated by a normal disk access when the disk operation display
is turned on. For a full explanation of this line, see page 14.

If an error message of this form is displayed a few times in a row, and then stops, it means that the disk controller was able to recover from the error condition on one of its retries. This is called a "soft error." However, a soft error is usually a sign of bigger trouble to come; usually, it means that the disk is beginning to wear out. When you start getting soft errors on a disk, it is prudent to copy all files onto another disk while you still can.

After ten unsuccessful retries, the BIOS will give up, and pass an error code back to CP/M. CP/M will then print this message:

BDOS Err on x: Bad Sector

where "x" is replaced by the drive letter. This means that either the disk drive or the diskette is faulty. The data on that sector of the disk is effectively lost. You have two response options to the above message: you can type a carriage return to ignore the error, or type control-C to do a warm boot. Ignoring the error may permit you to continue, but you risk having faulty data (or executing a faulty program, with unpredictable results). Control-C aborts what you were doing.

A description of each individual disk error follows.

Drv Flt

Some disk drives activate the 'drive fault' line that goes from the drives to the controller when they detect some internal mechanical or electrical failure. This message usually means that your disk drive is faulty.

CRC err

A Cyclic Redundancy Check (CRC) is like a parity check. When data is recorded on the diskette, a number called the 'CRC' is calculated as a function of the data. This number is stored with the data on the diskette. Whenever data is read from the diskette, its associated CRC is also read. The disk controller calculates a new CRC from the data read. If the new CRC doesn't exactly match the CRC stored on the disk, an error has occurred. The 'CRC error' message is printed on the console if the CRC for a certain sector or sector header does not match the new CRC.

Ovr rn

The disk controller transfers data directly from memory to the disk, and vice versa. To do this, it must request an S-100 memory cycle from the central processing unit (in effect, it must ask for permission to transfer data). If it requests a memory cycle and does not get one within about 27 microseconds, an over run error will result. Unless you have more than one DMA device in your system (a device requesting memory cycles), this error should not occur. If it does, either your FDC-2 disk controller board or your MPU-80 central processing unit is probably faulty, and should be serviced.

Ms sctr

     Each track is divided into a number of sectors (26 for
single density, 15 for double and quad density). Before the
controller can read the contents of a sector into memory, it must
first read a sector header to make sure that it is reading data
from the proper track, surface, and sector. (See the description
of formatting, page 21.) If the controller is looking for a
sector whose sector header is faulty, it will report a missing
sector.

Wrt prtct

     Many of the higher quality disk drives check the diskette
for a write protect tab on the diskette. If there is no tab, the
diskette can only be read, not written. If there is a tab (as is
normally the case), the diskette is not write-protected. The tab
is just a piece of tape that covers a notch on an edge of a
diskette. If such a disk drive senses the uncovered notch on a
diskette, and the BIOS tries to write on the diskette, this error
will be generated.

Ms add mrk

     See 'Missing sector' for an explanation of what a sector
is. The address mark is a special code (one byte) that appears
before each sector header (which in turn precedes the sector
itself). It tells the controller that a sector follows. If this
error occurs, it usually means that the wrong kind of diskette is
being used (e.g., hard sector instead of soft sector) or that
there is something wrong with the drive or the drive-controller
connection.

Data fld CRC

     See "CRC error" for an explanation of what a CRC is. There
are two CRC's calculated for each sector: one is calculated just
for the data field of the sector, the other is calculated for the
data field and the sector header combined. If the data field CRC
is incorrect, this error occurs. Since a data error will also
make the full-sector CRC incorrect, this error usually occurs in
conjunction with a "CRC error." Thus, a "CRC error" alone means
that the error is in the sector header; a "CRC error" combined
with a "Data field CRC" means that the error is in the data field
(though there may also be an error in the header).

Wng cyl

     If the disk controller discovers by reading sector headers
that it is on the wrong disk track, this error occurs. It is
usually accompanied by a "Missing sector" error, since the
correct sector will not be found on the wrong track. One cause
for this error is a drive that is being stepped too quickly (see
the explanation of disk step time, page 12). If this is the
case, the error can be quickly eliminated by setting a longer
step time with SET.COM.

Ms data mrk

    See 'Missing address mark'. The data mark is like the
address mark, except that it precedes the data field. Thus, it
is between the header and the data.

Den flt

    This message means that the BIOS was unable to determine the
density of a disk. This error can occur if you try to read a
disk that does not have one of the three standard InterSystems
formats. Reformatting the disk should eliminate the error, but
will also erase whatever is on the disk.

Appendix A

Jumper Configurations For InterSystems Series II Boards

These are the jumper configurations required to run the InterSystems standard BIOS. Depending upon your particular application, some jumpers may be different. This list is intended only as a quick reference guide; for details on the significance of each jumper, consult the manuals for the individual boards.

MPU-80:

JA: 1 is B-C, 2 is B-C
JB: 1 is A-B, 2 is A-B, 3 is A-B, 4 is A-B, 5 is B-C, 6 is B-C
JC: 1 is A-B, 2 is B-C, 3 is A-B, 4 is B-C, 5 is B-C, 6 is A-B
JD: 1 is A-B, 2 is A-B, 3 is A-B, 4 is B-C, 5 is B-C, 6 is B-C
JE: 1-A and 2-A
JF: B-C
JG: A-B
JH: 1 is A-B 2 is A-B, 3 is B-C, 4 is B-C, 5 is A-B
JI: B-C
JJ: 1 is B-C, 2 is A-B, 3 is B-C, 4 is A-B
JK: A-B
JL: A-B
JM: A-B
JN: A-B
JO: A-B for the front panelless system, B-C with a front panel

FDC-II:

J1: 1 is A-B, 2 is A-B
J2: B-C
J3: pin 1 connected to pin 15
    pin 4 connected to pin 14
    pin 5 connected to pin 12
    pin 8 connected to pin 11
(pins numbered as shown at right)
The header is supplied connected as described.

```
 1     17
 2     16
 3     15
 4     14
       13
 5     12
 6     11
 7     10
 8      9
```

J4: 1 is A-B, 2 is A-B, 3 is B-C, 4 is A-B
J5: A-B
J6: B-C
J7: B-C
J8: B-C
J9: B-C
J10: A-B
J11: A-B
J12: A-B
J13: B-C
J14: A-B
J15: all rows are B-C
J16: shunt the third pair of pins from the bottom

J17: B-C
J18: A-B
J19: all rows are B-C
J20: A-B
J21: all rows are B-C

VIO-0 and VIO-1:

CLA header (at J1) is 1-2, 3-4, 5-6, 9-10, 11-12, 13-14.
The header is supplied connected as described.

CLB header (at J2) is 1-2, 3-4, 5-6, 9-10, 11-12, 13-14.
The header is supplied connected as described.

J3 (VIO-1 only): all rows are B-C
J4: 1 is open, 2 is B-C, 3 is A-B, 4 is B-C, 5 is open, 6 is A-B
J5: 1 is open, 2 is B-C, 3 is A-B, 4 is B-C, 5 is open, 6 is A-B
J6 (VIO-1 only): 1 is B-C, 2 is B-C, 3 is B-C, 4 is A-B
J7 (VIO-1 only): 2 is center to B; all others are open.
J8: both are center to RS.
J9 (VIO-1 only): shunt F-F.
J10: center to + and 1 to W
J11: all center to -
J12: not used.
J13 (VIO-1 only): A-B.
DIP switch SW1: all switches open.

6SIO:

Header H1 is 1-2, 3-4, 5-6, 9-10, 11-12, 13-14.
Header H2 is 1-2, 3-4, 5-6, 9-10, 11-12, 13-14.
Both headers are supplied connected as described.
Header H3 is 3 to 15, 14 to 38, 13 to 39.

J1: All are A-B.
J2: A-B.
J3: A-B.
J4: shunt A-B third pair of pins from the top.
J5: shunt A-B sixth pair of pins from the top.
J6: B-C.
J7: A-B.
J8: B-C.
DIP switches SW1 and SW2 are all closed.

InterSystems BIOS Comment and Bug Report Sheet

Please use this sheet (and any additional sheets if necessary) when sending your comments and bug reports to InterSystems.

NAME: _____

ADDRESS: _____

PHONE: _____

VERSION: _____ SERIAL NUMBER: _____

BUGS (description of problem): _____

_____

_____

_____

_____

SUGGESTIONS FOR IMPROVEMENTS TO THE BIOS: _____

_____

_____

_____

_____

_____

_____

_____

SUGGESTIONS FOR IMPROVEMENTS TO THE MANUAL: _____

_____

_____

_____

_____