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CP/M[™] 2.24 OPERATING SYSTEM USER GUIDE

for Heathkit and Zenith Data Systems

Z89 or Z90 DIGITAL COMPUTER

MAGNOLIA MICROSYSTEMS, INC.
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1. Most problems result from failure to follow instructions EXACTLY. Return to the manual and review the procedure. Start at the beginning and retrace each step, keeping written notes of any possible deviations from what should have happened. If the problem is still not resolved, make a written record of the FULL configuration prior to calling your dealer for assistance. As a minimum, note all hardware components, including make and model numbers (revision dates, serial numbers, etc. may be necessary to find a defective hardware element) and note all software in use by name and version number (version numbers usually appear in the sign-on string). Use SETUP and DRIVES to obtain a complete operating system description.
2. Call your dealer with the above information, preferably with the computer at hand. (Call Magnolia ONLY if you purchased direct; to assure the best quality support, we have found it vital to have the dealer involved from the beginning).
3. How things work together is the responsibility of the Systems Integrator. If you bought a system or subsystem from a single source, then that supplier is responsible for those pieces working together. If you bought components or subsystems from multiple suppliers, then YOU have assumed the role of Systems Integrator and must expect to perform that function, or pay someone to perform it for you. Magnolia products are designed, and priced, for non-experts putting together a few standard configurations, while allowing experts a great deal of flexibility in meeting special requirements. Magnolia's responsibility in the latter situation is limited to providing the features we document and meeting appropriate industry standards.

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INTRODUCTION

THE CP/Mtm 2.24 OPERATING SYSTEM FOR THE '89

NOTE: Throughout these instructions the terms "computer" and "'89" are intended to also include the Z90 and Heath/Zenith computers with model numbers containing "88" or "89" which include the Z17 Hard Sector Controller, the Z89-37 Double Density Controller, or the MMS 77316 Double Density Controller. Where differences exist, specific references will be made.

Your CP/M 2.24 Software Package contains the following items:

- CP/M License and Registration Cards (to Magnolia Microsystems and Digital Research)
- CP/M Operating System Diskette(s):
 - 5-inch marked "for Z17" for Z89 with Z17 Controller
 - OR
 - 5-inch marked "for Z90/Z89-37" for Z90 or Z89 with Z89-37 Controller
 - OR
 - both 5- and 8-inch marked "for MMS DD Controller"
- This Manual Set

After installing this software package, your computer will be able to support the additional variety of Floppy and Winchester Disk Drives allowed by the Magnolia Microsystems release of the CP/M operating system.

THE CP/M OPERATING SYSTEM

CP/M is a "Control Program for Microcomputers"; a software system designed to record and retrieve programs and data on floppy diskettes. It consists of a collection of inter-related programs designed to accomplish specific tasks within the system. CP/M operates with 8080 and Z80 microprocessors and is largely independent of the design of the computer and floppy disk system. As a result it has been adopted for use by the majority of computers using the 8080 and Z80 families of microprocessors and has become a "standard". Many high level languages and applications software packages have been designed to run under its control.

Magnolia Microsystems has implemented CP/M on your Z89 to make accessible the wide variety of existing CP/M based software, as well as the enhanced disk system capabilities available with the MMS release of CP/M.

Computer programs running under CP/M normally communicate only with the operating system and need no knowledge of the specific hardware in use. This is what makes programs written to run under CP/M so universal.

We have endeavored to supply you with the information you need to get CP/M running on your computer and to help you understand the system. If you intend to run existing applications packages you should also read the Digital Research manual chapter entitled "CP/M Features and Facilities". It will probably not be necessary to concern yourself with the other chapters to run applications programs. However, if you intend to do your own programming you should spend time with all six of the of the chapters. This should be expected to take time and careful study, as well as experience in using all of the features available.

DISKETTE CARE AND HANDLING

Insert diskettes into drives very carefully. DO NOT force the drive door closed, if you feel ANY resistance, open the door and try closing it gently again.

A mini-diskette can be WRITE-PROTECTED by placing an opaque sticker over the notch in the side edge of the jacket. A sheet of opaque stickers (for write-protecting) is usually furnished with each box of disks.

An 8" diskette can be WRITE-PROTECTED by uncovering (or making) a notch in the front edge of the jacket. 8" diskettes are distributed either with or without such write-protect notches.

All original media (distribution diskettes) should always be write-protected. NEVER remove the write-protection from diskettes you receive, and verify the write-protection of any distribution diskettes BEFORE PUTTING THEM IN YOUR DRIVE.

Always return the diskette to its protective envelope after use. NEVER touch the media through the window slot which exposes the magnetic surface.

Do not leave the diskette lying around. Dirt or dust on the diskette could cause the loss of data. Never leave the diskette lying on the video unit or near an electric motor since the presence of a magnetic field may cause loss or scrambling of data. Do not leave the diskette in direct sunlight because the black jacket can absorb enough heat to damage the media.

Use a felt-tip pen to make any notes on the label of the diskette. Using a ballpoint pen, pencil, or eraser could damage the media inside the envelope.

Never insert a diskette into the drive before powering the drive up; never power the drive down while a diskette is still inserted.

Preserve the diskettes by storing them at 10 to 52 degrees Centigrade or from 50 to 125 degrees Fahrenheit.

HARDWARE REQUIREMENTS

This release of CP/M 2.24 requires the following hardware configuration:

- o IF THE DISTRIBUTION DISK IS MARKED "for Z17":
 - o Z89 Computer System (which contains a Z17 controller as standard equipment)
 - *** OR:
 - o H88 or Z90 Computer System which has had a Z17 controller added
- o IF THE DISTRIBUTION DISK IS MARKED "for Z90/Z89-37":
 - o Z90 Computer System (which contains a Z89-37 controller as standard equipment)
 - *** OR:
 - o H88 or '89 Computer System which has been upgraded with Zenith's Z89-37 Double Density Controller package
- o IF THE DISTRIBUTION DISKS ARE MARKED "for MMS Double Density Controller":
 - o H88, Z89, or Z90 which has been upgraded with Magnolia's 77316 Double Density Controller package

At least one floppy disk drive on the disk controller card. If 96 track-per-inch (tpi) 5-inch drives are used (as in the Z37), a minimum of TWO drives will be required.

MEDIA SELECTION

It is extremely important to select high-quality media which is compatible with your drive and controller. Both the Z89-37 and MMS 77316 controllers require the use of SOFT SECTORED media, while the Heath Hard Sector controller uses only 10-sector diskettes.

If you are using 96 track-per-inch drives, such as the Tandon TM100-4 used in the Z37, use only media certified for 96 tracks per inch. While lower quality media may appear to work, it will not be made with the extra stable base material required for long term use at high track densities.

If you are using Double Sided drives, such as the Tandon TM100-2, use only media certified on both sides. While single sided media may appear to work properly, it may cause excessive wear-and-tear on the drive, causing early failure.

Double Sided and Single Sided 8-inch media can be distinguished from each other by the position of the small hole (the index window) in the disk jacket. Imagine a line across the disk jacket, such that the line goes along the center of the long oval opening (the head access window) and through the center hole, dividing the jacket evenly in half. For Single Sided media, the edge of the index window will be less than one eighth inch (0.3 centimeter) from this line. For Double Sided media, the edge of the index window will be about half an inch (1.3 centimeters) from the line. While a double-sided drive can read single-sided media, the reverse is not true.

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SOFTWARE INSTALLATION

PLEASE -- READ THROUGH ALL OF THESE INSTRUCTIONS BEFORE STARTING!!

If any questions arise, please contact the Dealer where you purchased this software package. Consultation with Magnolia Microsystems Staff Programmers is available at our standard consulting rates if you did not purchase this product directly from MMS.

INITIAL BOOT AND BACKUP PROCEDURE

This procedure **MUST** be used to bring up your CP/M and make a copy of the original distribution diskette. The distribution disk should be in the '89 an absolute **MINIMUM** amount of time to preserve its integrity as a backup device. It is assumed that your computer is functioning with at least 32K of RAM.

Note: Throughout this text, as in many programs, (cr) means to press the RETURN key. Most CP/M programs require a (cr) after characters are entered from the keyboard to inform the program that operator input is complete. Also, in this manual, all operator inputs are underlined. Thus, in the example below, you would press the "B" key, then the "RETURN" key. The computer will respond with the characters "oot" to complete the spelling of "BOOT".

Be sure there are **NO** diskettes in any drive before turning on the power switch(es). When the power is applied the computer should display an "MMS:" (or "H:") prompt accompanied by two short beeps. If the prompt does not appear after a reasonable warm up time press the right shift and reset keys simultaneously. The prompt should appear accompanied by a single beep. If not, see Section 8 ("Troubleshooting") in your Heathkit (Zenith) OPERATIONS/SERVICE MANUAL or contact your Dealer or Service Center for assistance.

1.0 Boot CP/M

Insert your CP/M distribution diskette in the first disk drive and gently close the disk drive door.

Type:

MMS: Boot(cr) NOTE: Some computers may require that a "drive designator" be typed after the "B", such as Boot 33(cr), Boot 29(cr), or Boot SD(cr). See your computer and/or Monitor EPROM documentation for details.

The drive select light should come on, and the operating system should load and sign on:

32K Z89/Z90 CP/M v2.242 (c) Magnolia Microsystems 1982
A0>

If present, the "A0>" indicates that your CP/M system is now up and running. If **this is your first use of this release, IMMEDIATELY go to step 2.** It is imperative that your original diskette be put in a safe place as soon as possible. Always leave it write-protected.

If your computer attempts to boot from the wrong drive (the red Drive Select light appears on a different drive), you have SW501 set wrong or you entered the wrong "drive designator". If the display shows:

Boot ?

you may not have SW501 on the CPU board set properly or you have a hardware error. If you have tried at least twice and are unsuccessful, refer to "In Case of Difficulty", page 1.18.

2.0 Examine the DIRectory of the distribution disk by entering:

A0>DIR(cr)

NOTE: IF YOU MAKE A TYPING ERROR while using CP/M you may either

- (1) hold the "CONTROL" key down while you press the "X" key (hereafter CONTROL X or ^X) to erase the line being entered and start over (the cursor is returned to the prompt) or
- (2) use the BACKSPACE key to remove the erroneous character(s).

Count the number of directory entries listed and make a note of the number for later use.

TYPE the file "READ.ME" to obtain information on any changes made since this document was last revised. You may press ^S (CONTROL S) to stop (and restart) the display to slow it down to reading speed.

A0>TYPE_READ.ME(cr)

The computer will display the file contents on the CRT.

3.0 Verify the system configuration

Use the "DRIVES" utility and determine if your hardware configuration matches that expected by the distribution disk. Type:

A0>DRIVES(cr)

If your distribution disk is marked "for Z17", your screen will display:

A: (0)	90K Z17 Hard Sector Controller v2.240	5"	SD/SS/ST
B: (1)	90K Z17 Hard Sector Controller v2.240	5"	SD/SS/ST
C: (2)	90K Z17 Hard Sector Controller v2.240	5"	SD/SS/ST

If you have a Z90 computer, or a Z89 with the Z89-37 Double Density Controller, your screen will show something similar to:

A: (46)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
B: (47)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
C: (48)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
D: (49)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST

If you booted a computer using Magnolia's 77316 Double Density Controller, your screen will show a display similar to:

A: (33)	162K MMS 77316 Double Density Controller v2.240	5"	DD/SS/ST
B: (34)	162K MMS 77316 Double Density Controller v2.240	5"	DD/SS/ST
C: (35)	162K MMS 77316 Double Density Controller v2.240	5"	DD/SS/ST
D: (36)	162K MMS 77316 Double Density Controller v2.240	5"	DD/SS/ST
E: (29)	594K MMS 77316 Double Density Controller v2.240	8"	DD/SS/ST
F: (30)	594K MMS 77316 Double Density Controller v2.240	8"	DD/SS/ST
G: (31)	594K MMS 77316 Double Density Controller v2.240	8"	DD/SS/ST
H: (32)	594K MMS 77316 Double Density Controller v2.240	8"	DD/SS/ST

NOTE: Drives 29 through 32 will be listed first if you booted from an 8-inch drive

If your drives are exactly as described in the right column, i.e, you have a Z89 with Single Sided, 40-track drives, or you have a Z90 with a set of Z87 Single Sided, 40-track drives, or you have single-sided 5- or 8-inch drives on your Magnolia controller, skip to Section 4.0.

If the display shows the "/HT" (half-track) indicator for drive A:, it indicates that drive A: is an 80 track drive which has been used to boot a 40-track diskette. You will need to specify the 80-track option for this drive when you use SETUP in step 6.1.1, but you should NOT use MODE to change the track setting of drive A: at this time.

If you have drives different than described (aside from the possible "/HT" option on drive A:), e.g., Z37 96 track-per-inch (tpi) drives, or Double-Sided 5- or 8-inch drives on your Magnolia controller, use the MODE utility to temporarily reconfigure your system.

Valid configuration arguments are:

- DS or SS = double or single sided
- DT, ST, or HT = double (96 tpi), single (48 tpi), or half track. The half track option allows a 96 tpi drive to READ (not write) 48 tpi media.
- DD or SD = double or single recording density
- S6, S30, etc. = track step rate in milliseconds. The number you enter will be rounded up to the nearest valid step rate.

For example, if you are using a Z37 Double-Sided, 96 tpi dual drive, type:

A0>MODE B:DS,DT(cr)

MODE v2.241 (c) Magnolia Microsystems 1982

NEW Configuration:

- Drive - B: (47) 5.25-inch floppy
- Controller - Zenith Z89-37
- Recording Density - Double
- Sides - 2
- Tracks per inch - 96
- Step Rate - 30 milliseconds
- Format type - MMS 77316 Double Density

NOTE: Many displays shown in this section will assume that you booted using the Z89-37 controller. If you booted from the Magnolia Double Density controller or the Z17 Hard Sector controller, these displays will appear slightly different, typically, all references to "Z89-37...." will be replaced with "MMS 77316 Double Density ..." or "Z17 Hard Sector...", with more or fewer drives listed in most tables. All features described, however, are still present and function as described.

You may simply type "MODE(cr)" for help, and/or see the detailed description of the MODE utility on page 2.4 if needed.

4.0 Format new SOFT-SECTORED media:

At the "A0>" prompt enter: NOTE: Substitute "A:" for "B:" if you have only one disk drive.

A0>FORMAT B:(cr)

The CRT will clear, and display:

MMS FORMAT v2.245 (c) Magnolia Microsystems 1982

Selected Configuration:

Drive - B: (47) 5.25-inch floppy
Controller - Zenith Z89-37
Recording Density - Double
Sides - 1
Tracks per inch - 48
Step Rate - 30 milliseconds
Format type - MMS 77316 Double Density

Is this the format you want? (Y/N) Y

Verify that the proper configuration is described, as it should be if you performed step 3 above. If so, just press (cr) to accept the default answer of "Yes" and skip to step 4.1 below.

OTHERWISE, press No(cr) and define the configuration needed.

The system will respond:

Enter (drive-name:) Parameters --

Valid values for arguments are as follows:

DS or SS = double or single sided
DT or ST = double (96 tpi) or single (48 tpi) track
DD or SD = double or single density
S6, S30, etc. = step rate in milliseconds
MMS, Z37, Z37X, etc.(media formats); the X implies extended format

Incorrect arguments may be changed before formatting begins.

Z37 drive owners (96 tpi, Double Sided) will respond with DT,DS(cr). Other users should refer to the detailed description of the MODE utility for assistance in choosing what to enter.

The screen will be updated with the new MODE data:

Selected Configuration:

Drive - B: (47) 5.25-inch floppy
Controller - Zenith Z89-37
Recording Density - Double
Sides - 2
Tracks per inch - 96
Step Rate - 30 milliseconds
Format type - MMS 77316 Double Density

Is this the format you want? (Y/N) Y

Verify that the information is now correct, and press (cr) to accept the default answer of "Yes".

OTHERWISE, press No(cr) and go back and try again.

4.1 Formatting diskettes

The program will display:

Insert BLANK disk in DRIVE B:.. Push RETURN to begin formatting, ^C to quit>(cr)

The following bar graph will appear on your CRT, where each "-" represents a track on the media to be formatted (track numbers are shown every 10 tracks). The "SIDE 1" message and data will not appear if you have single-sided drives.

SIDE 0

0-----1-----2-----3-----

SIDE 1

The program will report its progress by placing an "f" by each track as it is formatted:

SIDE 0

ffffffffffffff

0-----1-----2-----3-----

ffffffffffffff

SIDE 1

The program will then verify that each track can be read properly, indicating its progress by replacing the "f" with a "." as each track is read. A "v" will appear after satisfactory verification.

SIDE 0

ff

0-----1-----2-----3-----

vvvvvvvvvv.ffffffffffffffffffffffffffff

SIDE 1

[illegible]

AG:

Then move the distribution files to B: using the PIP utility:

```
A0>PIP B:=A:*. *[V](cr)
```

COPYING

..... ;PIP will list the files as it copies them

A0>

Now list the directories of both disks and verify that they are the same:

```
A0>DIR A:(cr)
```

```
A0>DIR B:(cr)
```

- 6.0 If you DID NOT use the MODE utility above, skip to step 6.3. OTHERWISE, configure the DISTRIBUTION BACKUP diskette you just created in drive B:.

Up to now we have been using the MODE utility to make temporary changes to the default drive types supported by CP/M. We will now use the SETUP utility to define the proper default drive configuration which matches your exact hardware. Then, each time CP/M is cold booted, it will know if, for example, you have 48 or 96 tpi drives.

- 6.1 Use the SETUP utility to configure the MOVCPM file on drive B:

```
A0>SETUP B:MOVCPM(cr)
```

The CRT screen will clear and display:

NOTE: If you booted from the Magnolia Double Density controller or the Heath Hard Sector controller instead of the Z89-37 controller, the display will appear slightly different, typically, all references to "Z89-37...." will be replaced with "MMS 77316..." or "Z89-17...", with more or fewer drives listed. All features described, however, are still present and function as described.

SETUP v2.240 (c) Magnolia Microsystems 1982

- . DISPLAY CURRENT CONFIGURATION OF "B:MOVCPM"
- . SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS
- . SET SERIAL PORT CONFIGURATION
- . Z89-37 Double Density Controller
- . EXIT TO CP/M

ENTER = EXECUTE A FUNCTION
<UP> = MOVE UP A LINE
<DOWN> = MOVE DOWN A LINE
HOME = JUMP TO TOP LINE

6.1.1 Set default disk drive configuration

Use the DOWN arrow key to move the cursor to the "Z89-37 Double Density..." (or "MMS 77316 Double Density ..." or "Z17 Hard Sector...") line, then press (cr) or "ENTER" to select that function. The CRT will clear and display:

Z89-37 Double Density Controller v2.240

LOGICAL NAME	PHYSICAL NUMBER	DISK SIZE	NO OF SIDES	TRACK DENSITY	RECORDING DENSITY	STEP RATE	MEDIA FORMAT	SECTOR SIZE
A	46	5.25"	1	48 tpi	Double	30ms	MMS	512
B	47	5.25"	1	48 tpi	Double	30ms	MMS	512
C	48	5.25"	1	48 tpi	Double	30ms	MMS	512
D	49	5.25"	1	48 tpi	Double	30ms	MMS	512

<RED> = QUIT (NO UPDATE)	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
<BLUE> = END AND UPDATE "B:MOVCPM"	XX
<WHITE>= RESTART WITH ORIGINAL DATA	XX display of allowable XX
ARROWS = MOVE TO NEXT FIELD	XX options (listed below) XX
<HOME> = JUMP TO START OF LINE	XX
AND THEN TO TOP LINE	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Allowable Entries include:

NO OF SIDES: 1 or 2 sides

TRACK DENSITY: 48 or 96 tpi (or 40 or 80 tracks; or Single or Double Track, both displayed as equivalent tpi)

RECORDING DENSITY: Single or Double

STEP RATE: NN (two-digit number, translated to next-higher allowable value)

MEDIA FORMAT: (code letter) from option table, invalid choices will be flagged

SECTOR SIZE: Displayed for informational purposes only

NOTE: Only NO OF SIDES and TRACK DENSITY MUST be changed at this time. You MAY make other changes now IF YOU UNDERSTAND THEIR SIGNIFICANCE. OTHERWISE, LEAVE THEM ALONE.

Position the Cursor to drive A: and change those items necessary to describe the first drive on your system.

Likewise, position the Cursor on the other drives and make the appropriate changes.

See the detailed description of the SETUP utility on page 2.5 for additional information if needed.

After verifying that your disk drives are correctly described, press the BLUE key to update the "MOVCPM" file on your DISTRIBUTION BACKUP diskette in drive B: and return to the Main Menu.

6.1.2 EXIT TO CP/M

Select the "Exit to CP/M" function and press "ENTER". The MOVCPM.COM file on your DISTRIBUTION BACKUP diskette has been updated to reflect your exact disk drive configuration.

6.2 Update the system image on the boot tracks of the DISTRIBUTION BACKUP diskette in drive B:

First, construct a copy (in memory) of the configured system by typing:

```
A0>B:MOVCPM_32(cr) ; don't forget either the "B:" or the "32"
```

```
CONSTRUCTING 32K Z89/Z90 CP/M v2.242 (c) Magnolia Microsystems 1982  
READY FOR "SYSGEN" OR  
"SAVE xx CPM32.COM"
```

Then, place it on the system tracks of the DISTRIBUTION BACKUP diskette in B: by typing:

```
A0>SYSGEN(cr)  
SYSGEN version 2.240 (c) Magnolia Microsystems 1982
```

NOTE: if you just ran MOVCPM (or a similar function) system is in memory

```
Get System from Memory (RETURN) or disk (Drive name)?(cr) ;in memory from  
MOVCPM  
Put System to what Drive (RETURN to quit)? B ;want it on B:  
Insert disk in Drive B: and push RETURN(^C aborts)(cr) ;written to diskette  
System successfully written to drive B:
```

```
Put system to what Drive (RETURN to quit)? (cr) ;back to CP/M
```

```
A0>
```

6.3 Label the copy of the distribution diskette as required by your Digital Research Software License:

```
Mark the disk: "DISTRIBUTION BACKUP"  
"32K MMS CP/M for Z89/90 v2.242"  
"S/N 2-175-xxxxx"  
"(c)Digital Research"  
"(c)Magnolia Microsystems"
```

If this is a 5" diskette, place a WRITE PROTECT sticker over the notch in the side of the diskette. If it is an 8" diskette, uncover (or create) the notch in the front edge of the jacket.

7.0 Test your DISTRIBUTION BACKUP Disk:

Press the right-hand SHIFT key together with the RESET key (hereinafter called "SHIFT/RESET") to return to the MONITOR PROM prompt (usually H: or MMS:).

Insert your new DISTRIBUTION BACKUP diskette in your first disk drive and enter:

MMS: Boot(cr) as on page 1.1.

It should boot just like the original distribution disk. Type:

A0>DIR(cr)

Verify that the number of files noted above in step 2.0 are listed on your CRT. Also, TYPE the READ.ME file as before to verify that it was copied properly.

FROM THIS TIME ON, IT SHOULD NEVER BE NECESSARY TO PUT THE DISTRIBUTION MASTER DISK IN THE COMPUTER, unless the DISTRIBUTION BACKUP diskette is destroyed.

Put the original distribution diskette away in a safe place and use it only if absolutely necessary. **NEVER** remove the WRITE PROTECT tab from a distribution diskette; never write to this diskette. This insures that you can always recreate your system if your DISTRIBUTION BACKUP diskette is damaged or destroyed.

Use the "DRIVES" utility to verify that the disk drive configuration is correct by typing:

A0>DRIVES(cr)

DRIVES v2.241

(c)Magnolia Microsystems

A: (46)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
B: (47)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
C: (48)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
D: (49)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST

- 8.0 Make another copy, this time of your DISTRIBUTION BACKUP (NOT distribution) diskette:

NOTE: If you have only one disk drive, you must use the ONECOPY utility described on page 2.15. Follow that procedure instead of the one described here if needed. If you have two disk drives of identical configuration, you may use the COPY utility described on page 2.16. If you use COPY, you will not need to use SYSGEN or PIP in this step.

Insert a second newly formatted piece of media into drive B: and move the operating system to it by typing:

A0>SYSGEN(cr)

SYSGEN version 2.240 (c) Magnolia Microsystems 1982

NOTE: if you just ran MOVCPM (or a similar function) system is in memory

Get System from Memory (RETURN) or disk (Drive name)? A ;from A:
Insert disk in Drive A: and push RETURN (^C aborts)(cr) ;into memory
System successfully read from drive A:

Put System to what Drive (RETURN to quit)? B ;want it on B:
Insert disk in Drive B: and push RETURN (^C aborts)(cr) ;written to diskette
System successfully written to drive B:

Put system to what Drive (RETURN to quit)? (cr) ;back to CP/M

A0>

Then move the distribution files to B: using the PIP utility:

A0>PIP B:=A:*. * [V](cr)

COPYING

..... ;PIP will list the files as it copies them

A0>

Now list the directories of both disks and verify that they are the same:

A0>DIR A:(cr)

A0>DIR B:(cr)

- 9.0 This diskette will become your CONFIGURED USER MASTER diskette. Begin configuring the CONFIGURED USER MASTER diskette you just created in drive B: as follows.
- 9.1 If you booted using a Z89-37 Controller or MMS 77316 Controller, and you have at least one drive on a Z17 Controller, LINK the Z17 module into the MOVCPM file on drive B:. Otherwise, skip to step 9.2.

```
A0>LINK B:Z17 B:MOVCPM(cr)
```

```
LINK v2.240
```

```
(c) 1982 Magnolia Microsystems
```

```
Linking "B:Z17 .HEX" module into "B:MOVCPM .COM"
```

```
Link completed
```

```
A0>
```

- 9.2 Use the SETUP utility to configure the MOVCPM file on drive B:

```
A0>SETUP B:MOVCPM(cr)
```

The CRT screen will clear and display:

NOTE: If you booted from the Magnolia Double Density controller or the Z17 Hard Sector controller instead of the Z89-37 Double Density Controller, the display will appear slightly different, typically, all references to "Z89-37...." will be replaced with "MMS 77316 Double Density ..." or "Z17 Hard Sector...", with more or fewer drives listed in most tables. All features described, however, are still present and function as described.

```
SETUP v2.241 (c) Magnolia Microsystems 1982
```

- . DISPLAY CURRENT CONFIGURATION OF "B:MOVCPM"
- . SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS
- . SET SERIAL PORT CONFIGURATION
- . Z89-37 Double Density Controller
- . EXIT TO CP/M

```
ENTER = EXECUTE A FUNCTION
```

```
<UP> = MOVE UP A LINE
```

```
<DOWN> = MOVE DOWN A LINE
```

```
HOME = JUMP TO TOP LINE
```

If you LINKed in the Z17 module, the line ". Z17 Hard Sector Controller" will appear in the main menu. If so, move the cursor to this line and set the default drive configuration for the Z17 as described in step 6.1.1.

9.2.1 Serial port configuration - optional

If you will be using a printer that does not operate at 9600 baud, or a modem that does not operate at 300 baud, you may wish to change the default baud rate for the device. This is not necessary at this time, but if you choose this option, the screen will display:

SERIAL PORT CONFIGURATION:

	INIT	RATE	- - - - -	Handshaking	- - - - -
DCE (320/D0) Aux Printer :	Y	9600	DTR[20] = 1	RTS[4] = 1	RLSD[-] = X
DCE (340/E0) Printer :	Y	9600	DTR[20] = 1	RTS[4] = 1	RLSD[-] = X
DTE (330/D8) Modem :	Y	300	DSR[6] = 1	CTS[5] = 1	RLSD[8] = X
Interrupt driven keyboard : Enabled					

<RED> = QUIT (NO UPDATE)	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
<BLUE> = END AND UPDATE "A:MOVCPM"	XX XX
<WHITE>= RESTART WITH ORIGINAL DATA	XX display of allowable XX
<UP> = MOVE UP A LINE	XX options XX
<DOWN> = MOVE DOWN A LINE	XX XX
HOME = JUMP TO TOP LINE	XXXXXXXXXXXXXXXXXXXXXXXXXXXX

To change baud rate for a port, move the cursor to the RATE for that port. The option display will list letters and corresponding baud rates. Enter the letter (A-I) for the desired baud rate. Push the BLUE key to update the "MOVCPM" file on your CONFIGURED USER MASTER diskette in drive B: and return to the Main Menu.

See "INTERFACING PERIPHERALS TO MMS CP/M" for additional details on connecting your printer to the '89.

DO NOT CHANGE the INIT option. This exists for programmers who write their own initialization routines for CP/M.

See the detailed description of the SETUP utility on page 2.5 for additional information if needed.

9.2.2 Condense the logical/physical drives table.

Select the "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS" function. This function allows you to eliminate unused drive designations to "condense" drives into a contiguous block. The display shown is typical of systems running the Zenith Z89-37 Double Density Controller and the Z17 Hard Sector Controller:

```
A = (46) Z89-37 Double Density Controller
B = (47) Z89-37 Double Density Controller
C = (48) Z89-37 Double Density Controller
D = (49) Z89-37 Double Density Controller
E = (00) Z17 Hard Sector Controller
F = (01) Z17 Hard Sector Controller
G = (02) Z17 Hard Sector Controller
H = (--) ...NOT ASSIGNED...
I = (--) ...NOT ASSIGNED...
J = (--) ...NOT ASSIGNED...
K = (--) ...NOT ASSIGNED...
L = (--) ...NOT ASSIGNED...
M = (--) ...NOT ASSIGNED...
N = (--) ...NOT ASSIGNED...
O = (--) ...NOT ASSIGNED...
P = (--) ...NOT ASSIGNED...
```

```
DELETE = SET DRIVE TO "NOT ASSIGNED"
<RED> = QUIT (NO UPDATE)
<BLUE> = END AND UPDATE "A:MOVCPM"
<WHITE> = RESTART WITH ORIGINAL DATA
<UP> = MOVE UP A LINE
<DOWN> = MOVE DOWN A LINE
HOME = JUMP TO TOP LINE
```

```
XXXX designates selected system drive
F1 = SELECT DEFAULT SYSTEM DRIVE
F2 = DESELECT DEFAULT SYSTEM DRIVE
F3 = DISPLAY REVISED TABLE
F4 = TOGGLE R/O VECTOR
```

The "XXXX" will actually be a block of four spaces in reverse video.

To eliminate a drive, position the cursor to that drive and press the "DELETE" key.

To specify a certain physical drive number (e.g. 00) as a logical drive (e.g. C), move the cursor to the chosen logical drive and enter the two-digit physical number. If that physical drive is already in the system as a different logical drive, the program will display the message "DUPLICATE ENTRY", which can be temporarily ignored.

Note that the drive you are going to boot from MUST be chosen as drive A:, or the CCP file cannot be loaded.

When you have finished deleting and entering drives, press the F3 key to display the revised table; each entry should now be free of error messages.

When the table has been configured the way you want it, press the BLUE key to update the MOVCPM file and return to the menu. Pressing the RED key will return you to the menu without changing the file.

See the detailed description of SETUP on page 2.5 if additional information is needed.

9.2.3 EXIT TO CP/M

Select the "Exit to CP/M" function and press "ENTER". The MOVCPM.COM file on your CONFIGURED USER MASTER diskette has been updated to reflect your exact disk drive and serial I/O configuration.

9.3 Update the system image on the boot tracks of the CONFIGURED USER MASTER disk in drive B:

First, construct a copy of the configured system by typing:

```
A0>B:MOVCPM(cr) ; don't forget the "B:".
```

```
CONSTRUCTING xxK Z89/Z90 CP/M v2.242 (c) Magnolia Microsystems 1982  
READY FOR "SYSGEN" OR  
"SAVE xx CPMxx.COM"
```

Then, place it on the system tracks of the CONFIGURED USER MASTER diskette in B: by typing:

```
A0>SYSGEN(cr)  
SYSGEN version 2.240 (c) Magnolia Microsystems 1982
```

NOTE: if you just ran MOVCPM (or a similar function) system is in memory

```
Get System from Memory (RETURN) or disk (Drive name)? (cr) ;in memory from  
MOVCPM  
Put System to what Drive (RETURN to quit)? B ;want it on B:  
Insert disk in Drive B: and push RETURN(^C aborts)(cr) ;written to diskette  
System successfully written to drive B:
```

```
Put system to what Drive (RETURN to quit)? (cr) ;back to CP/M
```

```
A0>
```

9.4 Label the diskette you just created as required by your Digital Research Software License:

```
Mark the disk: "CONFIGURED USER MASTER DISK"  
"xxK MMS CP/M for Z89/90 v2.242"  
"S/N 2-175-xxxxxx"  
"(c)Digital Research"  
"(c)Magnolia Microsystems"
```

Place a WRITE PROTECT sticker over the notch in the side of this diskette.

10.0 Test your CONFIGURED USER MASTER Disk:

Press SHIFT/RESET to return to the MONITOR PROM prompt.

Insert your new CONFIGURED USER MASTER diskette in your first disk drive and enter:

H:Boot(cr) just as above in step 1.

It should boot just like the original distribution disk, but sign on with the expanded memory capacity. Type:

A0:>DIR(cr)

Verify that the number of files noted above in step 2.0 are listed on your CRT. Also, TYPE the READ.ME file as before to verify that it was copied properly.

FROM THIS TIME ON, IT SHOULD **NEVER** BE NECESSARY TO PUT EITHER THE DISTRIBUTION BACKUP DISK OR THE DISTRIBUTION DISK IN THE COMPUTER, unless the CONFIGURED USER MASTER diskette is destroyed.

Put the distribution backup diskette away in a safe place (preferably separate from the distribution diskette) and use it only if absolutely necessary. **NEVER** remove the WRITE PROTECT tab from this diskette; never write to this diskette. This insures that you can always recreate your system if your CONFIGURED USER MASTER diskette is damaged or destroyed.

Use the "DRIVES" utility to verify that the disk drive configuration is correct by typing:

A0:>DRIVES(cr)

DRIVES v2.240

(c)Magnolia Microsystems

A: (46)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
B: (47)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST
C: (48)	162K Z89-37 Double Density Controller v2.240	5"	DD/SS/ST

CREATING A WORKING COPY OF AN APPLICATION DISKETTE

Use this outline to create a "bootable", working copy of ALL distribution diskettes you purchase. ALWAYS keep distribution diskettes WRITE PROTECTED so you will have a good copy if your working diskette is damaged or destroyed.

First, create a 'bootable' system disk on formatted media by copying the system from your CONFIGURED USER MASTER onto the new disk with SYSGEN as described above in 5.0.

Second, place copies of the CP/M utilities that you will need on the diskette by using PIP (or FILECOPY if you only have one drive). Instructions for using PIP are given in the "CP/M FEATURES AND FACILITIES" chapter of the Digital Research Manual, Section 1.6.4, page 17.

You will usually include:

- PIP.COM (or FILECOPY)
- MODE.COM
- STAT.COM

and perhaps

- FORMAT.COM
- SYSGEN.COM

You may find it convenient to make up a "minimum user master" with just these files, which you can "COPY" when needed.

Third, SHIFT/RESET your computer and boot the new disk.

Fourth, use PIP (or FILECOPY if you have only one drive) to move a copy of the programs from your new distribution disk in drive B: onto the 'bootable' disk in drive A:. Use the MODE utility, if necessary, to place your second drive in a mode which is compatible with the distribution disk (i.e., MODE B:Z37,SD(cr) to pip files from a single density Zenith 5-inch Soft Sector disk).

Be sure to mark all diskettes containing CP/M with your serial number and the copyright notices:

- (c) Digital Research
- (c) Magnolia Microsystems

as well as the copyright notice and serial number from the application program disk. You may also want to specify whether the "Type-ahead buffer" is enabled, since some applications programs cannot operate with the type-ahead function enabled.

IN CASE OF DIFFICULTY

If you are booting a 40 track disk in an 80 track drive such as the Z37, and are unsuccessful, open the disk drive door, but leave the disk in. Type the appropriate boot command and press RETURN. When the Drive Select light comes on, close the door. This helps center the disk in the drive. You may have to try this several times to get a successful boot. As soon as you are successful, continue with step 2 of the backup procedure, which will create an 80 track system disk.

IF YOU STILL HAVE PROBLEMS -----

1. Most problems result from failure to follow instructions EXACTLY. Return to the manual and review the procedure. Start at the beginning and retrace each step, keeping written notes of any possible deviations from what should have happened. If the problem is still not resolved, make a written record of the FULL configuration prior to calling your dealer for assistance. As a minimum, note all hardware components, including make and model numbers (revision dates, serial numbers, etc. may be necessary to find a defective hardware element) and note all software in use by name and version number (version numbers usually appear in the sign-on string). Use SETUP and DRIVES to obtain a complete operating system description.
2. Call your dealer with the above information, preferably with the computer at hand. (Call Magnolia ONLY if you purchased direct; to assure the best quality support, we have found it vital to have the dealer involved from the beginning).
3. How things work together is the responsibility of the Systems Integrator. If you bought a system or subsystem from a single source, then that supplier is responsible for those pieces working together. If you bought components or subsystems from multiple suppliers, then YOU have assumed the role of Systems Integrator and must expect to perform that function, or pay someone to perform it for you. Magnolia products are designed, and priced, for non-experts putting together a few standard configurations, while allowing experts a great deal of flexibility in meeting special requirements. Magnolia's responsibility in the latter situation is limited to providing the features we document and meeting appropriate industry standards.

UTILITIES FOR MAGNOLIA MICROSYSTEM'S CP/M

All programs on this distribution diskette **SUPERCEDE** and **REPLACE** programs of the same name on diskettes dated prior to this one. If you have earlier releases of MMS CP/M, always update all your diskettes to contain only programs from the most recently dated release. Do not become confused and use an obsolete version of a program, since incompatibility might exist and unpredictable results could occur.

REMEMBER: Even though the following programs have familiar names, new features have been added since previous releases. Be sure to use the current release of all programs. Users updating from previous MMS releases of CP/M should note that the functions of the following utilities have been combined:

SETUP and DDSETUP into SETUP (v2.241 or later)
MODE and SET into MODE (v2.241 or later)
FORMAT and DDFORMAT into FORMAT (v2.245 or later)

NOTE: Displays shown in this section use systems booted on the Z89-37 Double Density Controller as examples. If you booted from the Magnolia Double Density Controller or the Z17 Hard Sector Controller instead, the displays will appear slightly different, typically, all references to "Z89-37..." will be replaced with "MMS 77316 Double Density ..." or "Z17 Hard Sector ...", with more or fewer drives listed in some tables. All features described, however, are still present and function as described.

This diskette includes a special enhanced BDOS and CCP (See Appendix C for details) and replaces all previous CP/M releases.

FORMAT.COM

Version 2.244 (or later) of this utility formats (erases) media in drives on the MMS 77316 Double Density Controller, the Z17 Hard Sector Controller, and the Zenith Z89-37 Double Density Controller. The drive will be formatted according to the drive's current MODE, as described in that section, or the MODE may be temporarily changed from within FORMAT. See Appendix E for details on the various floppy disk formats supported by MMS CP/M.

A0>FORMAT B:(cr)

The CRT will clear, and display (for example):

FORMAT v2.245 (c) Magnolia Microsystems 1982

Selected Configuration:

Drive - B: (47) 5.25-inch floppy
Controller - Zenith Z89-37
Recording Density - Double
Sides - 1
Tracks per inch - 48
Step Rate - 30 milliseconds
Format type - MMS 77316 Double Density

Is this the format you want? (Y/N) Y

Verify that the proper configuration is described. If so, just press (cr) to accept the default answer of "Yes" and skip to "FORMATTING DISKETTES" below.

OTHERWISE, press No(cr) and define the configuration needed.

The system will respond:

Enter (drive-name:) Parameters --

Valid values for arguments are as follows:

DS or SS = double or single sided
DT or ST = double (96 tpi) or single (48 tpi) track
DD or SD = double or single density
S6, S30, etc. = step rate in milliseconds
MMS, Z37, Z37X, etc.(media formats); the X implies extended format

Incorrect arguments may be changed before formatting begins.

Z37 drive owners (96 tpi, Double Sided) will respond with DT,DS(cr) if the drive is not currently in that mode. Other users should refer to the detailed description of the MODE utility or to Appendix E for assistance in choosing what to enter.

The screen will be updated with the new MODE data:

Selected Configuration:

Drive - B: (47) 5.25-inch floppy
Controller - Zenith Z89-37
Recording Density - Double
Sides - 2
Tracks per inch - 96
Step Rate - 30 milliseconds
Format type - MMS 77316 Double Density

Is this the format you want? (Y/N) Y

Verify that the information is now correct, and press (cr) to accept the default answer of "Yes".

OTHERWISE, press No(cr) and go back and try again.

If incorrect parameters are specified, the screen will display:

Invalid parameters or syntax!
Enter (drive name:) Parameters --

A short help message will also be displayed. Enter new parameters, making sure that they are correctly entered and that they do not represent a non-existent format, such as a single density extended Z37 format or single density 5.25" MMS 77316 format.

FORMATTING DISKETTES

The program will display:

Insert BLANK disk in DRIVE B:. Push RETURN to begin formatting, ^C to quit> (cr)

The following bar graph will appear on your CRT, where each "-" represents a track on the media to be formatted (track numbers are shown every 10 tracks). The "SIDE 1" message and data will not appear if you have single-sided drives.

SIDE 1

SIDE 1

SIDE 1

SIDE 1

When through, answer N(cr) to exit to the CP/M command level. Verify that the media count displayed by the program matches the number of disks you successfully formatted, to insure that a defective diskette does not slip into usage.

MODE.COM Display or modify drive status

The MODE utility (version 2.241 or later) is used to display or modify the status of drives on the MMS 77316 Double Density, the Z17 Hard Sector, or the Zenith Z89-37 controllers. Typing

A0>MODE B:(cr)

displays the current status of drive B:, which might appear as follows:

```
PRESENT Configuration is:
      Drive - B: (47) 5.25-inch floppy
      Controller - Zenith Z89-37
Recording Density - Double
      Sides - 1
      Tracks per Inch - 48
      Step Rate - 6 milliseconds
      Format Type - MMS 77316 Double Density
```

To change a drive's configuration, type the parameters to be changed after the drive name. Using the same drive as an example, typing

A0>MODE B:DS,Z37,SD(cr)

would configure the drive to access double-sided disks with the Z37 single density format, and display the result:

```
NEW Configuration is:
      Drive - B: (47) 5.25-inch floppy
      Controller - Zenith Z89-37
Recording Density - Single
      Sides - 2
      Tracks per Inch - 48
      Step Rate - 6 milliseconds
      Format Type - Z37
```

Valid configuration arguments, which may be typed in any order, are:

DS or SS = double or single sided
DT, ST, or HT = double (96 tpi), single (48 tpi), or half track. The half track option allows a 96 tpi drive to READ (not write) 48 tpi media.
DD or SD = double or single recording density
S6, S30, etc. = track step rate in milliseconds. There are only a few valid step rates; the number you enter will be rounded up to the nearest allowed value.

Valid format type arguments are:

MMS	= MMS 77316 Double Density (5.25 or 8 inch)
M47	= MMS REMEX (8 inch)
Z37	= Zenith Z37 (5.25 inch)
Z37X	= Extended Zenith Z37 (5.25 inch)
Z47	= Zenith Z47 (8 inch)
Z47X	= Extended Zenith Z47 (8 inch)
Z67	= Zenith Z67 (8 inch)

The format type for drives on the Z17 Hard Sector controller cannot be changed. No configuration arguments need to be entered for the Z37 format type, because configuration information is encoded on the diskette.

SETUP.COM

SETUP (version 2.241 or later) is used to change the cold boot configuration of your CP/M. SETUP operates on a MOVCPM.COM file, which contains all the information needed to build a copy of CP/M tailored to your machine. Changes in system configuration are implemented by running MOVCPM and SYSGENing a disk, which must then be booted. SETUP can change the MOVCPM file in the following areas:

- o logical/physical drive assignments
- o read-only drives and default system drive
- o default baud rates (printer, modem, auxiliary)
- o initialization and handshaking on serial ports
- o enable/disable interrupt driven console, if installed
- o default step rate, side, track per inch, and recording density of drives on the MMS 77316 Double Density Controller, the Z17 Hard Sector Controller, and the Zenith Z89-37 Controller

The program is menu-driven and uses some H19 terminal features. Initiate the program by typing:

```
A0>SETUP(cr)
```

The default filename is "MOVCPM" and the default type is "COM", but other MOVCPM type files with unique names may be configured by entering the actual filename (i.e., "SETUP cpmfile(cr)", where "cpmfile.COM" is a copy or version of MOVCPM.COM). The screen will clear and the program will examine the file for current configurations and validity of data.

The screen will initialize to:

```
SETUP v2.241 (c) Magnolia Microsystems 1982
```

- . DISPLAY CURRENT CONFIGURATION OF "A:MOVCPM"
- . SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS
- . SET SERIAL PORT CONFIGURATION
- . Z89-37 Double Density Controller
- . EXIT TO CP/M

```
ENTER  = EXECUTE FUNCTION  
<UP>   = MOVE UP A LINE  
<DOWN> = MOVE DOWN A LINE  
HOME   = JUMP TO TOP LINE
```

With the cursor indicated by the "_". Move the cursor, using the right keypad (which is in the shifted mode), to the desired function and push the ENTER (or RETURN) key. The screen will re-initialize for the particular function.

In general, the RED key returns you to the menu without updating the file, the WHITE (or GRAY) key restarts the function with the previous data (nullifies current changes), and the BLUE key updates the file with the currently displayed information. Other keys are defined by the function selected and are displayed on the lower portion of the screen. Any errors that occur will be displayed on the top line, above the menu. The display and a brief description of each function follows.

DISPLAY CURRENT CONFIGURATION

Typical display for system booted from Zenith Z89-37 Controller:

CURRENT CONFIGURATION OF "A:MOVCPM"

BOOT ROUTINE: Z37 Double Density 5.25"

MODULES INSTALLED:

Z89-37 Double Density Controller
Console - with Type-Ahead v2.242

SERIAL PORT CONFIGURATION:

	INIT	RATE	- - - - -	Handshaking	- - - - -
DCE (320/D0) Aux Printer : Y	Y	9600	DTR[20] = 1	RTS[4] = 1	RLSD[-] = X
DCE (340/E0) Printer : Y	Y	9600	DTR[20] = 1	RTS[4] = 1	RLSD[-] = X
DTE (330/D8) Modem : Y	Y	300	DSR[6] = 1	CTS[5] = 1	RLSD[8] = X

Interrupt driven keyboard : Enabled

PUSH RED KEY FOR MENU_

The only valid key is RED which returns to the menu. Note, also, that the printer is initialized to 9600 baud.

The "BOOT ROUTINE" specifies the boot device; i.e. what kind of disk controller must be used to boot the system described by this MOVCPM file. For instance, a disk which had been SYSGEN'ed with the system shown above could only be booted using the Zenith Z89-37 Controller.

"MODULES INSTALLED" lists the disk controllers which the system can communicate with. Having a controller physically in your computer is not sufficient; the corresponding support software must be LINKed into the MOVCPM file. The system must at least include a module to communicate with the boot device to be able to load the CCP file during cold boot.

There is also a module which allows the keyboard to use interrupts. An interrupt system allows the system to keep track of commands typed while programs are running, so that the user can "type ahead" of the system. This feature is active when enabled; when disabled, you must wait for prompts before pressing any keys. The interrupt driven keyboard module is included in the system when shipped, but must be LINKed in (if desired) if you build a new system starting from BASECPM. The module name is ICON.HEX. The keyboard interrupt status line will not be in the display if the module is not in the MOVCPM file.

The "RATE" specified for each of the serial ports is the baud rate, which indicates the speed at which data can be transmitted. 'Baud' rate is often roughly equivalent to 'bits of data per second', though there are important differences between the two terms. Further details on the serial port configuration can be found in "SET SERIAL PORT CONFIGURATION", on page 2.9, and "INTERFACING PERIPHERALS TO MMS CP/M", page 3.1.

CHANGING THE LOGICAL/PHYSICAL ASSIGNMENT TABLE

The "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS" function allows you to eliminate unused drive designations to "condense" drives into a contiguous block, and to designate drives as read-only. It also allows selection of a default command drive. Select the function and press RETURN. The display shown is typical of systems running with the Zenith Z89-37 Controller:

A = (46) Z89-37 Double Density Controller
B = (47) Z89-37 Double Density Controller
C = (48) Z89-37 Double Density Controller
D = (49) Z89-37 Double Density Controller
E = (--) ...NOT ASSIGNED...
F = (--) ...NOT ASSIGNED...
G = (--) ...NOT ASSIGNED...
H = (--) ...NOT ASSIGNED...
I = (--) ...NOT ASSIGNED...
J = (--) ...NOT ASSIGNED...
K = (--) ...NOT ASSIGNED...
L = (--) ...NOT ASSIGNED...
M = (--) ...NOT ASSIGNED...
N = (--) ...NOT ASSIGNED...
O = (--) ...NOT ASSIGNED...
P = (--) ...NOT ASSIGNED...

DELETE = SET DRIVE TO "NOT ASSIGNED"
<RED> = QUIT (NO UPDATE)
<BLUE> = END AND UPDATE "A:MOVCPM"
<WHITE> = RESTART WITH ORIGINAL DATA
<UP> = MOVE UP A LINE
<DOWN> = MOVE DOWN A LINE
HOME = JUMP TO TOP LINE

XXXX designates selected system drive
F1 = SELECT DEFAULT SYSTEM DRIVE
F2 = DESELECT DEFAULT SYSTEM DRIVE
F3 = DISPLAY REVISED TABLE
F4 = TOGGLE R/O VECTOR

The "XXXX" will actually be a block of four spaces in reverse video.

To eliminate a drive, position the cursor to that drive and press the "DELETE" key.

To specify a certain physical drive number as a logical drive, move the cursor to the chosen logical drive and enter the two-digit physical number. If that physical drive is already in the system as a different logical drive, the program will display the message "DUPLICATE ENTRY", which can be temporarily ignored.

Note that the drive you are going to boot from MUST be chosen as drive A:, or the CCP file cannot be loaded.

When you have finished deleting and entering drives, press the F3 key to display the revised table: each entry should now be free of error messages.

In some special cases (usually when using a Winchester drive), you may want to boot on one drive but keep most of your programs on another drive, e.g., drive P:. To execute a program on that drive, you would usually have to specify the drive by typing "A0>P:filename". However, if you select that drive as the "default system drive", the system will automatically search there for "filename.COM" when no drive is specified and the program cannot be found on the logged-on drive (you can still access programs on any drive by specifying the drive, e.g., "A0>A:filename"). To designate a default system drive, position the cursor to the drive and press the F1 key. The drive will be displayed in reverse video, and the cursor will return to drive A:. See Appendix C for more details on this feature.

If no system drive is specified, the system searches for programs only on the currently logged-in drive (the drive whose name appears in the prompt, usually drive A:). If a system drive has been selected, you can de-select it by pressing F2.

In other special cases, you may wish to NEVER be able to WRITE to a particular drive. A drive on which no files may be created, erased, or changed is called a read-only drive. To designate a drive as read-only, move the cursor to the drive and press the F4 button. The label "R/O" will appear to the right of that drive. Pressing F4 again returns the drive to read-write status.

When the table has been configured the way you want it, press the BLUE key to update the MOVCPM file and return to the menu. Pressing the RED key will return you to the menu without updating the file. NO CHANGES WILL BE MADE unless you exit via the blue key.

SET SERIAL PORT CONFIGURATION

Display:

SERIAL PORT CONFIGURATION:

	INIT	RATE	- - - - -	Handshaking	- - - - -
DCE (320/D0) Aux Printer :	Y	9600	DTR[20] = 1	RTS[4] = 1	RLSD[-] = X
DCE (340/E0) Printer :	Y	9600	DTR[20] = 1	RTS[4] = 1	RLSD[-] = X
DTE (330/D8) Modem :	Y	300	DSR[6] = 1	CTS[5] = 1	RLSD[8] = X
Interrupt driven keyboard : Enabled					

<RED> = QUIT (NO UPDATE)	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
<BLUE> = END AND UPDATE "A:MOVCPM"	XX
<WHITE> = RESTART WITH ORIGINAL DATA	XX display of allowable
<UP> = MOVE UP A LINE	XX options (listed below)
<DOWN> = MOVE DOWN A LINE	XX
HOME = JUMP TO TOP LINE	XXXXXXXXXXXXXXXXXXXXXXXXXXXX

INIT: This parameter can be Yes or No. Unless you write your own serial port initialization routines, all ports should be set to "Y" so they will be properly initialized.

RATE: Move the cursor to the RATE column for the desired port. A list of possible baud rates with corresponding letters will appear in the option space. Enter the letter (A-I) for the desired baud rate.

Note that you may also have to change the switches on the device, e.g. the printer, connected to the port, and/or build a cable as described in "INTERFACING PERIPHERALS TO MMS CP/M".

Handshaking: For the specified RS-232 interface line, 1, 0, and X specify that a high, low, or no signal is required before data will be sent to the device attached to that port. See the section "INTERFACING PERIPHERALS TO MMS CP/M" for details on the proper handshaking configuration for your printer. Note that if you disable all hardware handshaking lines for a port (i.e., all X's), you must send more slowly than the device can receive, and you must receive more quickly than the device can send.

Interrupt driven keyboard: The keyboard interrupt status line will be present only if the appropriate module is in the MOVCPM file. If present, you may enable or disable the interrupt function by moving the cursor to that line and pressing the "E" or "D" keys.

After all changes have been made, press the BLUE key to update the file and return to the main menu.

SET DEFAULT DISK DRIVE CONFIGURATION

Use the DOWN arrow key to move the cursor to the "Z89-37 Double Density ..." (or "MMS 77316 Double Density ..." or "Z17 Hard Sector ...") line, then press (cr) or "ENTER" to select that function. The CRT will clear and display:

Z89-37 Double Density Controller v2.240

LOGICAL NAME	PHYSICAL NUMBER	DISK SIZE	NO OF SIDES	TRACK DENSITY	RECORDING DENSITY	STEP RATE	MEDIA FORMAT	SECTOR SIZE
A	46	5.25"	1	48 tpi	Double	30ms	MMS	512
B	47	5.25"	1	48 tpi	Double	30ms	MMS	512
C	48	5.25"	1	48 tpi	Double	30ms	MMS	512
D	49	5.25"	1	48 tpi	Double	30ms	MMS	512

<RED> = QUIT (NO UPDATE)
 <BLUE> = END AND UPDATE "B:MOVCPM"
 <WHITE>= RESTART WITH ORIGINAL DATA
 ARROWS = MOVE TO NEXT FIELD
 <HOME> = JUMP TO START OF LINE
 AND THEN TO TOP LINE

```

XXXXXXXXXXXXXXXXXXXXXXXXXXXX
XX                               XX
XX  display of allowable       XX
XX  options (listed below)    XX
XX                               XX
XXXXXXXXXXXXXXXXXXXXXXXXXXXX
  
```

Allowable Entries include:

NO OF SIDES: 1 or 2 sides

TRACK DENSITY: 48 or 96 tpi (or 40 or 80 tracks, or Single or Double Track, both displayed as equivalent tpi).

RECORDING DENSITY: Single or Double

STEP RATE: NN (two-digit number, translated to next-higher allowable value)

MEDIA FORMAT: (code letter) from option table, invalid choices will be flagged.
 See the section on MODE.COM for details.

CAUTION: If booting from the MMS 77316 Controller or the Zenith Z89-37 Controller, the media format of drive A: must be MMS 77316 Double Density, or you will be unable to boot.

SECTOR SIZE: Displayed for informational purposes only

Position the Cursor to each drive and make the appropriate changes.

After verifying that your disk drives are correctly described, press the BLUE key to update the "MOVCPM" file and return to the Main Menu.

EXIT TO CP/M

When you have configured the MOVCPM file as you want it, move the cursor to this position and press (cr) or "ENTER" to return to CP/M.

REMEMBER, as indicated by the sign-off message, that the system which is running has not been affected by this procedure. You must run "MOVCPM", "SYSGEN" a disk, and COLD BOOT that disk to implement **any** changes made.

MOVCPM.COM

This file has the Z89-37, the MMS 77316 Double Density, or the Z17 Hard Sector disk I/O and boot modules installed into it and is the system that is currently SYSGENed on your distribution diskette. This is a DIFFERENT file on 5 inch and 8 inch 77316 disks. Other modules (with their associated hardware) may be installed to allow other types of disk drives (such as Winchester hard disks) to be used with this CP/M system.

A "Boot" module must be included in each MOVCPM file. This module loads CP/M from a particular type of drive during cold boot. A drive of the same type must be selected as drive A: in the logical/physical assignment table (for details, see "CHANGING THE LOGICAL/PHYSICAL ASSIGNMENT TABLE", page 2.7).

WARNING: You should archive your old MOVCPM file before you change the boot device - e.g., before linking a Z17 Boot module into your MMS 8" MOVCPM:

```
PIP MOV8316.COM=MOVCPM.COM[V]      archive old system image
LINK BZ17 MOVCPM                   link in a new boot module
```

Execution of MOVCPM.COM causes construction of an image, in memory, of the system described by the MOVCPM file; however, this image is not executed. MOVCPM is invoked by typing:

```
A0>MOVCPM(cr)
```

which generates a system image suitable for the maximum contiguous memory size in your computer; or you may type:

```
A0>MOVCPM_xx(cr)
```

where 'xx' specifies the size in K-bytes of the generated system image.

The program will sign on:

```
CONSTRUCTING xxK Z89/Z90 CP/M v2.241 (c) Magnolia Microsystems 1982
READY FOR "SYSGEN" OR
"SAVE yy CPMxx.COM"
A0>
```

If you intend to immediately make a bootable disk using the system image you just created, you can run SYSGEN immediately. If you want to save the system image, but do not wish to make a bootable disk immediately, you should type SAVE yy CPMxx.COM, as specified by MOVCPM. This will save the system image in the file CPMxx.COM, which can be used later to SYSGEN a disk. Note that the "yy" parameter, which tells CP/M how many 256-byte pages of memory to SAVE, is not the same as the "xx" value, which describes the memory address of the top of the system **when it is executed**.

SYSGEN.COM

This utility is used to place a copy of CP/M (either from memory, another diskette, or a disk file) onto the system tracks of a diskette. It also places a 2K byte file containing CP/M's CCP on the diskette under USER 31, where it is invisible to the user.

CAUTION: You should not attempt to "Sysgen" a disk that has Z37 or Z37X media format. Disk format information is encoded on the first sector of such a disk. SYSGEN destroys this information, making the disk unusable until it is reformatted.

To use SYSGEN with a system image already in memory (i.e., from a preceeding MOVCPM operation), proceed as shown:

```
A0>SYSGEN(cr)
```

```
SYSGEN version 2.240 (c) 1982 Magnolia Microsystems
```

```
NOTE: if you just ran MOVCPM (or a similar function) system is in memory.
```

```
Get System from Memory (RETURN) or disk (Drive name) ?(cr)
```

```
Put System to what Drive (RETURN to quit) ?d ;name of drive to write
```

```
Insert disk in Drive d: and push RETURN (^C aborts) (cr)
```

```
System Successfully written to drive d:
```

```
Put system to what Drive (RETURN to quit) ?(cr)
```

```
A0>
```

To copy CP/M directly from a bootable disk (drive A: in this example), the procedure is as follows:

```
A0>SYSGEN(cr)
```

```
SYSGEN version 2.240 (c) 1982 Magnolia Microsystems
```

```
NOTE: if you just ran MOVCPM (or a similar function) system is in memory.
```

```
Get System from Memory (RETURN) or disk (Drive name) ?A
```

```
Insert disk in Drive A: and push RETURN (^C aborts) (cr)
```

```
System Successfully Read from drive A:
```

```
Put System to what Drive (RETURN to quit) ?d ;name of drive to write
```

```
Insert disk in Drive d: and push RETURN (^C aborts) (cr)
```

```
System Successfully written to drive d:
```

```
Put system to what Drive (RETURN to quit) ?(cr)
```

```
A0>
```

To create a bootable copy of a system image previously "SAVED" as a file (e.g. CPM64.COM), do the following:

```
A0>SYSGEN_CPM64.COM(cr)
```

```
SYSGEN version 2.240 (c) 1982 Magnolia Microsystems
```

```
Getting System from file "CPM64.COM"...
```

```
Put System to what Drive (RETURN to quit) ?d ;name of drive to write  
Insert disk in Drive d: and push RETURN (^C aborts) (cr)  
System Successfully written to drive d:
```

```
Put system to what Drive (RETURN to quit) ?(cr)
```

```
A0>
```

As the number and/or complexity of disk drive types supported increases, the size of the operating system increases. Attempting to SYSGEN a large CP/M system onto some disk types will produce the error message, "System is too Large for Destination". In such cases it is necessary to build a smaller system, i.e., one with fewer modules LINKed in. The chart in Appendix G shows the size of all current MMS modules. See the descriptions of BASECPM and LINK (both on page 2.19) for details on building a system.

SUBMIT.COM

The SUBMIT utility has become more versatile for MMS CP/M 2.24. In addition to the capabilities described at page 28 of "Introduction to CP/M Features and Facilities", the following enhancements have been made:

UNLIMITED CHAINING: SUBMITTED files may execute any number of other .SUB files at any time. Previous versions of SUBMIT allow only one additional .SUB file to be initiated at the end of the first file.

DIRECT COMMAND MODE: It is no longer necessary to create and edit a .SUB file. To enter program names directly, type:

```
A0>SUBMIT /program1;program2 arg1 arg2;program3. . .(cr)
```

The "/" indicates that commands, rather than a ".SUB" filename, follow. Command "lines" are separated by semicolons. To simulate an empty line, i.e., a line consisting of only a carriage return, simply type two adjacent semicolons (for instance, to exit PIP when using XSUB).

INTERACTIVE MODE: Similar to the direct command mode, the interactive mode allows you to enter a command series which might be too long to fit on a single line. Enter interactive mode by typing:

```
A0>SUBMIT /(cr)
```

An asterisk (*) prompt will appear, signaling you to enter command lines. As in the direct command mode, you may use semicolons to separate commands on a single line. Typing (cr) immediately after an asterisk ends the input and begins execution of the SUBMITTED commands.

DRIVE VERSATILITY: It is no longer necessary to be logged onto drive A: when running SUBMIT or XSUB.

XKILL.COM

XKILL deactivates XSUB, a process which formerly required a warm boot.

FILECOPY.COM Single drive file copier.

This utility copies a file between diskettes using only one drive (DIGITAL RESEARCH's "PIP" should be used if you have more than one drive). It will sequentially prompt the user to "INSERT SOURCE DISK" and fill memory with as much of the file as will fit, then prompt "INSERT DESTINATION DISK" and write and verify the block to the new file. Care must be taken to keep track of which diskette contains the source file and which is the destination diskette. When the file has been transferred the program will prompt "INSERT SYSTEM DISK" at which time the user puts the diskette with the CP/M system on it into the drive and re-boots the operating system.

A0>FILECOPY d:filename.type <d:newfilename.type>(cr)

MMS FILECOPY VERS 3.0

Insert SOURCE disk in d:, push RETURN >(cr)

Insert DESTINATION disk in d:, push RETURN >(cr)
(repeats)

Filecopy Completed.

Insert SYSTEM disk in d:, push RETURN >(cr)

A0>

ONECOPY.COM Single drive whole-disk copier.

This utility copies the entire contents of a disk using only one drive. After prompting the user to "INSERT SOURCE DISK", it fills memory with as much of the disk as will fit, then prompts "INSERT DESTINATION DISK" and writes the block to the new disk. Care must be taken to keep track of which disk is source and which is destination. When the entire disk has been transferred the program will prompt "INSERT SYSTEM DISK" at which time the user puts the disk with the CP/M system on it into the drive.

A0>ONECOPY (cr) (or ONECOPY d:)

MMS ONECOPY VERS 2.24

INSERT SOURCE DISK, PUSH RETURN >(cr)

INSERT DESTINATION DISK, PUSH RETURN >(cr)
(repeats)

INSERT SYSTEM DISK, PUSH RETURN >(cr)

A0>

Remember, copying entire disks with one drive is very inefficient - an 8" single sided, double density disk holds 594K. With a 32K system about 26K is available for a copy buffer, so the disks will need to be exchanged over 20 times!

COPY.COM Two-drive repeating diskette copier.

This utility is adapted from DIGITAL RESEARCH's "COPY". It uses the entry parameter "s: TO d:" where "s:" is the source drive name and "d:" is the destination drive name. This utility will copy and verify the entire diskette (both sides if the drives are double sided). Both drives must have the same MODE, i.e., same media format, number of sides, and number of tracks. If the drives have different MODEs, you can copy files using DIGITAL RESEARCH's "PIP".

A0>COPY B: TO C:(cr)

+MMS COPY VERS 4.1

+Insert SOURCE disk in B:

+Insert BLANK disk in C:

+Push RETURN to copy, ^C to Exit +(cr)

+COPY B: TO C:

+Insert SOURCE disk in B:

+Insert BLANK disk in C:

+Push RETURN to copy, ^C to Exit +^C

A0>

The program will report any "SOURCE" or "DESTINATION" errors and will compare each track after write, reporting any "COMPARE" errors. An error will abort the copy and prompt for new diskettes (will not return to CP/M unless ^C is pushed instead of RETURN).

Do not use copies for which an error message is reported as they are incomplete copies, even though a display of their directory will not reflect that any files are missing. Reformat the media and try again.

SETAUTO.COM Execute a CP/M command line (run a program) on boot.

CP/M can save a command line on a diskette which it will then execute whenever CP/M is booted. The utility "SETAUTO" is used to define the command line to be executed. For example, to cause the BASIC program APPLICATION.BAS to be executed automatically when CP/M boots:
(assume diskette to be altered is in B:)

```
A0>SETAUTO B:(cr)
```

```
MMS SETAUTO version 2.231  
ENTER COMMAND LINE:  
*MBASIC APPLICATION(cr)  
COMPLETED.
```

```
A0>
```

To disable the "AUTO" command, clear the "AUTO" field:

```
A0>SETAUTO B:
```

```
MMS SETAUTO VERS 2.231  
ENTER COMMAND LINE:  
*(cr)  
COMPLETED.
```

```
A0>
```

NOTE: The command line entered will NOT be converted to uppercase. If the command to be executed is an UPPERCASE filename, it must be entered in UPPERCASE.

STAT.COM Logical/Physical I/O Assignments (IOBYTE).

MMS CP/M contains device drivers for all four (console, printer, modem, and auxiliary printer) serial ports allowed on the '89.

The source files for these drivers are contained in the file USER.ASM on the distribution disk. Modifications may be necessary to support some special hardware configuration. For details, see "CHANGING DEVICE DRIVERS", page 4.1.

The default device assignments (indicated by * below) may be changed using STAT.COM as described in "CP/M FEATURES AND FACILITIES" section 1.6.1, page 10. For example:

```
A: STAT LST:=TTY:(cr)
```

will cause all subsequent output to the LST: device to be routed to the auxiliary serial port (alternate printer port) if it is present on your '89.

The current logical/physical I/O assignment options are:

CON:=TTY: aux serial port	LST:=TTY: aux serial port
CRT:* Z89 console	CRT: Z89 console
BAT: interrupt console	LPT:* LP port
UC1: modem port	UL1: modem port
RDR:=TTY: aux serial port	PUN:=TTY: aux serial port
PTR:* modem port	PTP:* modem port
UR1: Z89 console	UP1: Z89 console
UR2: LP port	UP2: LP port

If the "Interrupt Driven Console" module is installed in your system, you can use the STAT utility to enable/disable the interrupt feature. To enable the interrupt, type:

```
A0>STAT CON:=BAT:(cr)
```

To disable the interrupt, type:

```
A0>STAT CON:=CRT:(cr)
```

See "CP/M ALTERATION" Section 6, pages 138-9, for information on accessing the IOBYTE from other programs. Also, refer to USER.ASM on the distribution disk for details on how the IOBYTE is utilized.

BASECPM.COM

This is a renamed MOVCPM file which does not contain any disk I/O modules or a boot module (it can not generate an executable copy of CP/M in this form). It can be used to create systems which have only the disk I/O modules you need. It also contains the enhanced BDOS and CCP mentioned above.

The following modules are included on the distribution diskette (names may vary):

M316.HEX	MMS 77316 Double Density Controller Module
B8316.HEX	8" boot for MMS Controller
B5316.HEX	5.25" boot for MMS Controller
Z17.HEX	Module for HEATH hard-sectored mini-floppies (H/Z17)
BZ17.HEX	Boot for HEATH hard-sectored mini-floppies
Z37.HEX	Zenith Z89-37 Double Density Controller module
BZ37.HEX	Boot for Z89-37 Controller
ICON.HEX	Interrupt Driven Console module

LINK.COM

This program is used to install Disk I/O and Boot modules in a MOVCPM file. The syntax used to install a module is:

```
A0>LINK d:linkfile d:movcpmfile(cr)
```

Where:

- "d:" is a valid drive name
- "linkfile" is the module to be installed and must be type "HEX"
- "movcpmfile" is the MOVCPM-image file that the module will be installed into.
- If no movcpmfile is given then "MOVCPM.COM" is assumed.

The screen will display:

```
A0>LINK d:linkfile d:movcpmfile  
LINK v2.240  
(c) 1982 Magnolia Microsystems  
Linking "d:linkfile.HEX" module into "d:movcpmfile.COM"  
Link Completed
```

To create a new CP/M system, follow this outline:

REN OLDMOV.COM=MOVCPM.COM	archive old system image
PIP MOVCPM.COM=BASECPM.COM	get a fresh copy of CP/M
LINK diskmodule MOVCPM	link in the disk I/O module(s) desired
LINK anothermodule MOVCPM	
LINK diskbootmodule MOVCPM	link in the desired disk BOOT module
SETUP MOVCPM	set logical/physical table so that boot drive is logical device A:
MOVCPM	run the new MOVCPM program
SYSGEN	put the new system on the disk
SHIFT/RESET	we need a cold boot
BOOT	boot the new system and test it

DRIVES.COM

This utility displays the current drive configuration, including density/side/track information for floppy drives, logical/physical assignments, and total storage capacity for each drive. A typical display might show:

```
A0>DRIVES(cr)
DRIVES v2.240
(c) Magnolia Microsystems 1982

A: = (33) 162K MMS 77316 Double Density Controller      5" DD/SS/ST
B: = (29) 241K MMS 77316 Double Density Controller      8" SD/SS/ST
C: = (30) 1210K MMS 77316 Double Density Controller     8" DD/DS/ST
D: = (34) 700K MMS 77316 Double Density Controller      5" DD/DS/DT
```

LIST.COM

This is a directory program, offering much greater flexibility than the CCP's "DIR" or "DIR @" commands. It accepts several command line parameters as follows:

```
A0>LIST /o/o/o d:afn1 afn2 afn3/N . . .(cr)
```

/ is the option delimiter
o is a global option:

A sort alphabetically
Cn specifies the number of columns in the display (maximum of 5)
P list only \$SYS and \$R/O files
R list normal and \$R/O files
S list normal and \$SYS files
U list files from all USER numbers
Un list files from USER n (0-15)

d: specifies a logical drive
afn is an ambiguous file name, allowing "?" or "*" as wildcards
/N says DON'T list files matching this name

If no files are specified, then all files are listed.

COMPARE.COM

This program compares two files and lists any differences on the CRT. The command line is as follows:

```
A0>COMPARE d:ufn d:ufn(cr)
```

where 'd:' specifies the drive and 'ufn' specifies the filename.

NOTE: When analyzing the output from the COMPARE program, the first byte is labeled '0'. For a '.COM' file this byte is actually loaded into location 100H (hex) when the program is executed. This means that byte numbers output by the COMPARE program differ from the '.PRN' listing by 100H.

The program files for SUPERCALC v1.04 are in a special form which cannot be correctly copied using the PIP utility. Making copies of SUPERCALC v1.04 requires use of the SCMOVE utility, which copies SUPERCALC version 1.04 from one disk to another in response to the command:

If SCMOVE reports that it is unable to recognize SC.COM, your copy of SUPERCALC may be a later version which can be copied using PIP.COM (two files must be copied, SC.COM and SC.OVL).

Microsoft products used on '89s without this MMS Board do not have to be patched.

If FIXMSOFT has already been run on a Microsoft product on drive A:, it will report that the product has already been fixed. If the Microsoft product was not distributed by Heath/Zenith, FIXMSOFT will report that it is unable to recognize that product. This means that FIXMSOFT is not needed for this product.

Use "Control S" (^S) to stop and start the display of the file on your terminal.

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INTERFACING PERIPHERALS TO MMS CP/M

The standard CP/M physical I/O routines (see USER.ASM on the distribution disk) are designed to utilize hardware handshaking with peripherals, not the software protocol used by some HDOS and Zenith CP/M drivers.

MMS CP/M for the '89 includes support for the four (4) standard serial ports:

Common Name	Port Hex / Octal	Default Logical Device Name	CP/M's Physical Device Name
Console (Z19 Terminal)	E8-EF / 350-357	"CON:"	CRT:
DCE (Printer)	E0-E7 / 340-347	"LST:"	LPT:
DCE (Auxiliary)	D0-D7 / 320-327	not assigned	TTY:
DTE (Modem)	D8-DF / 330-337	"RDR:"/"PUN:"	PTR:,PTP:

As shipped, the drivers for both DCE (printer) ports expect to find **both** RTS (pin 4) and DTR (pin 20) "High" before sending data out to the external device. Either (or both) signal(s) may be used as a "Busy" signal to cause the Z89 to stop sending data to the peripheral device until it is not busy. An open circuit on either pin will be interpreted as "Busy", and CP/M will hang up whenever data is sent to the device unless you use the "SERIAL PORT CONFIGURATION" option of the SETUP utility to set each unused input to "X" so the DCE drivers will not care what level the input is at (OR you can connect unused inputs to a "High" level with a special cable). If your printer uses a "Low" level for "ready", use SETUP to set the appropriate lines to "0".

As shipped, the driver for the DTE (modem) port expects to find **both** CTS (pin 5) and DSR (pin 6) "High" before sending data out through that port. As with the DCE drivers, either or both signal(s) may be used as a "Busy" signal to the Z89. Most RS232 modems will connect pin-to-pin with this port. If you build an interface for this port, use procedures like those described above for the DCE ports, i.e., use SETUP to make unused inputs irrelevant, or connect them to a "high" level.

The following data will help you connect your printer to either of the Z89's DCE ports if you choose to use the standard device drivers furnished with your CP/M.

Remember to configure your printer for

- the same baud rate you pick in SETUP
- no parity checking
- 8-bit data
- one stop bit

if these options are available.

NOTE: Users updating from earlier releases of MMS CP/M can continue to use their present RS-232 cables IF they make no changes to the SERIAL PORT CONFIGURATION with SETUP. If they change the SERIAL PORT CONFIGURATION following the directions here, new cables may be necessary in some cases.

DIABLO 630

Enable hardware handshaking on DTR (pin 20) by installing a jumper between pins 5 and 6 at location A60 on the HYPRO Circuit Board. Other pins may already be jumpered. Do not move any of those.

Use the standard Pin-to-Pin cable furnished with the 630 to connect it to the Z89.

DIABLO 1640/1650:

Enable hardware handshaking on DTR (pin 20) by installing the optional "Printer Ready Signal" per section 3.9.2 in the XEROX-Diablo 1640-1650 Product Description (document 90412-01, October 1979):

"... move the black wire from pin 3 to pin 2 of the 12-pin connector on the HPRO4 end (...the end of the interface card inside the printer...) of the Serial I/O cable as follows. Lightly depress the hold-in tab thru the small hole at pin 3 of the connector, so the pin can be pulled out of the connector body. Being sure the tab is bent outward (...enough to secure the pin in the housing...), reinsert the pin into the connector body at pin 2..."

NEC 5510/5520 Spinwriter:

The Spinwriter's handshaking signal is available on pin 19. Build an RS-232 adapter as shown in Figure A; OR this change may be effected internally to the NEC, as follows:

Remove the printer cover and trace the RS-232 cable back to the interface PC card. Disconnect the cable at the card and remove the hold-down clip on the connector housing to expose the hold-in tabs on the connector pins. Remove the pin from connector position 3. Remove the pin from connector position 8 and insert it into position 3. Insert the pin originally in position 3 into position 8. Re-assemble the connector and re-connect it at the interface PC card. Replace the printer cover.

ALSO, set the DIP SWITCH just inside the front cover, on the left end:

OFF: 1,3,4,5,6 (S5 off --> Reverse Channel Active High)
ON: 2,7,8 (S7 and S8 on --> 1200 baud)

TI 810:

The TI-810's handshaking signal is available on pin 11. Build and use a cable configured as shown in Figure E, which is functionally equivalent to the cable furnished with the Heath version.

TI 820:

Select configuration code 14 (and 28 for 9600 baud) **AND** access the handshaking signal on pin 11 by building an RS-232 cable as shown in Figure C.

H14:

If you have been using your H14 successfully with a previous release of MMS CP/M, DO NOT change anything in SETUP. If you are interfacing the H14 to MMS CP/M for the first time, use SETUP to set RTS (pin 4) to "0", and DTR (pin 20) to "1". This will allow you to use the cable supplied with your printer.

EPSON MX-80:

Handshaking is available on pin 11 of EPSON serial adapter cards. Add a small jumper wire to the back of the female RS-232 connector connecting pin 4 (RTS) to pin 11 (Printer Ready), or, build an adaptor cable like that shown in Figure E.

H25/Z25:

Enable the hardware handshaking option by setting contact 5 (DC1/DC3) of SW202 on the rear panel to the "1", or "on", position. No other changes are necessary if you use the cable supplied with your printer.

QUME SPRINT 5:

No Printer changes or Cable Adapters necessary -- just plug it in!

STARWRITER

Some C ITOH "Starwriter" Daisy Wheel printers provide handshaking on pin 4 only, others on pin 20 only.

IF your printer has handshaking on pin 4, use SETUP to set DTR (pin 20) for the desired port to "X", or build a cable as shown in Figure F.

IF your printer has handshaking on pin 20, use SETUP to set RTS (pin 4) for the desired port to "X", or build a cable as shown in Figure B.

F10 / TRANSTAR 140

The C ITOH F10 (a similar unit is available as Transtar 140) Daisy Wheel printer uses handshaking on pin 20. Use SETUP to set the RTS line (pin 4) on the desired port to "X", or build a cable as shown in Figure B.

OKIDATA MICROLINE u82A and u83A

Access the handshaking signal on pin 11 by building a cable like that in Figure E. Set front panel switches 7 and 8 to "on", SPI to "on", and the rear DIP switches 2,4, and 1 to "on".

IDS

Use SETUP to set RTS (pin 4) for the desired port to "X", or build a cable as shown in Figure B.

DATASOUTH

Use SETUP to set RTS (pin 4) for the desired port to "X", or build a cable as shown in Figure B.

COMET, PROWRITER

The C ITOH "Comet" and "Prowriter" printers have similar handshaking, requiring that the RTS line (pin 4) be set to "X" with SETUP, or, build a cable as shown in Figure B.

Cable Diagrams:

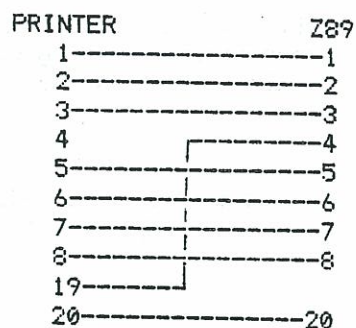


FIGURE A

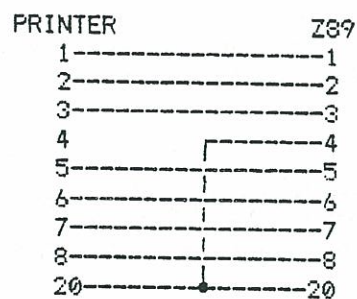


FIGURE B

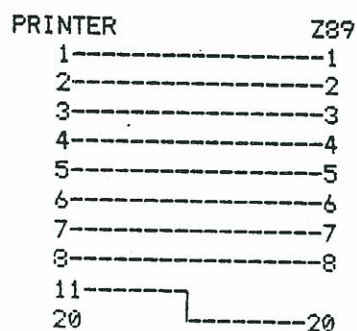


FIGURE C

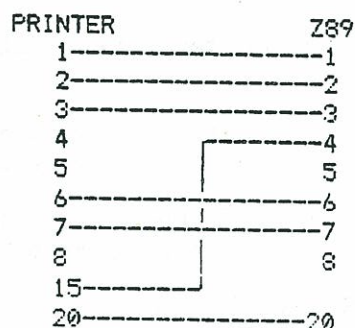


FIGURE D

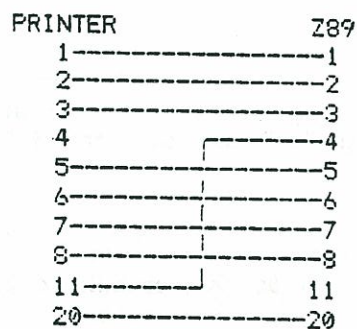


FIGURE E

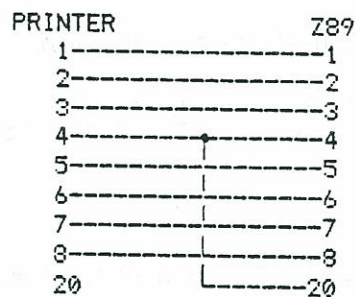


FIGURE F

PROGRAMMER'S GUIDE TO MMS CP/M 2.24

**** REMEMBER!

ANY CHANGES MADE IN "MOVCPM.COM" or "CPMxx.COM" WILL NOT BE EFFECTIVE UNTIL A NEW SYSTEM IS CREATED AND SYSGEN'D.

Because the system size will change as more disk I/O modules are added, the number of pages to save after altering MOVCPM.COM or CPMyy.COM must be determined by the user. Observe the "NEXT" address given when the file is loaded under DDT. This address determines the amount that must be saved. Subtract 0100H from this address and round up to the next 256-byte boundary. Convert the two most-significant digits to decimal and use this number in the "SAVE" command. This procedure is also covered in Chapter 4 of the Digital Research Manual (CP/M DDT).

CHANGING DEVICE DRIVERS

All device drivers (both Logical and Physical) are located in a 512 byte portion of the BIOS entered via a jump table. The source code for this "USER AREA" in the BIOS is on the distribution diskette as "USER.ASM". A memory map of the entire BIOS can be found in Appendix A.

Generate (using MOVCPM) an image of CP/M for the desired memory size and save it as CPMyy.COM (where yy is the memory size). Use DDT to find the starting address of the USER area (the "CONST" console status routine). Edit USER.ASM, making your desired changes and setting the starting address of the USER area, and ASMBle it (Note that some changes may be necessary in USER.ASM, depending on whether you use ASM or Digital Research's MAC assembler. The necessary changes are documented in the file.). Then load the CP/M image file under DDT and overlay your USER code using the BIAS given in the assembler listing. A sample follows for a 48K system:

```
A0>DDT CPM48.COM(cr)
```

```
DDT VERS 2.2
```

```
NEXT PC
```

```
2B00 0100
```

```
-L2000
```

```
2000 JMP 16D1
```

```
2003 JMP 175C
```

```
2006 JMP 1900 ————— this is the address we want
```

```
.
```

```
.
```

```
.
```

```
^C
```

Edit USER.ASM, including the address found above, then assemble it and get the BIAS address from the listing:

A0>TYPE USER.PRN

.

```
0A00=      ;-----  
           BIAS    EQU    2000-BIOS      ;OFFSET FOR DDT  
           ;-----
```

(strike any key to stop listing)

And now merge it into CPM48.COM:

A0>DDT CPM48.COM

DDT VERS 2.2

NEXT PC

2B00 0100 _____ Remember the number under NEXT for SAVE command

-IUSER.HEX

-R0A00 _____ Use the BIAS from .PRN listing

NEXT PC

2B00 0000

-JC

A0>SAVE xx NEWCPM48.COM _____ Save a copy of the new system. The number xx is calculated from the number under "NEXT", above, as described at the beginning of this section.

To SYSGEN the new system:

A0>NEWCPM48(cr)

CONSTRUCTION 48K Z89/Z90 CP/M v2.241 (c) Magnolia Microsystems 1982

READY FOR "SYSGEN" OR

"SAVE xx CPM48.COM"

A0>SYSGEN

SYSGEN version 2.240 (c) 1982 Magnolia Microsystems

NOTE: if you just ran MOVCPM (or a similar function) system is in memory

Get System from Memory (RETURN) or disk (Drive name)(cr) ("cr" ONLY, system is already in memory)

Put System to what Drive (RETURN to quit) ?A(cr)

Insert disk in Drive A: and push RETURN (^C aborts)(cr)

System Successfully writtem to drive A:

Put system to what Drive (RETURN to quit)

(press SHIFT/RESET)

Re-boot using the new system:

H: Boot(cr)

48K Z89/Z90 CP/M v2.241 (c) Magnolia Microsystems 1982

A0>

Your re-configured system is now up and running.

SAMPLE BAUD RATE PROGRAM IN ASSEMBLY LANGUAGE

A short example program follows which changes a port's baud rate to a pre-determined value:

```
NAME      S1200

PRINTER EQU    0E0H
MODEM    EQU    0D8H
AUX       EQU    0D0H

B19200 EQU    6      ;DIVISORS FOR INS8250
B9600 EQU    12
B4800 EQU    24
B2400 EQU    48
B1200 EQU    96
B600 EQU    192
B300 EQU    384
B150 EQU    768
B110 EQU    1047

ORG      0100H

LXI      H,B1200 ;EXAMPLE FOR 1200 BAUD PRINTER
MVI      A,30H
OUT      PRINTER+3
MOV      A,L
OUT      PRINTER
MOV      A,H
OUT      PRINTER+1
MVI      A,03H ;NO PARITY, 1 STOP, 8 DATA BITS
OUT      PRINTER+3
RET      ;RETURN TO CCP
```

This program can be called (after assembly and loading) by typing "S1200"(cr) at the CP/M prompt " ".

For more information on the INS8250 refer to section 14 in your Z89 "OPERATIONS/SERVICE MANUAL".

CHANGING THE "AUTO" IMPLEMENTATION

To allow the "AUTO" command line to be executed on WARM BOOT as well as cold, use DDT to patch MOVCPM.COM as follows:

```
A0>DDT MOVCPM.COM(cr)  
DDT VERS 2.2  
NEXT PC  
zzzz 0100  
-D216B,216F(cr)  
216B 03 00 E5 2A FE ...*.  
-S216B(cr)  
216B 03 00  
216C 00 _  
-^C  
A0>SAVE xx MOVCPM.COM(cr)
```

See "CHANGING DEVICE DRIVERS" for instructions on computing the value of "xx" for the SAVE command.

BIOS DETECTION OF ESCAPE SEQUENCES

Provisions have been made in the USER portion of BIOS which optionally allow the Escape Sequence codes generated by the terminal portion of the Z89 to be passed to an application program as a single character. This can greatly simplify application programs which use the function keys.

This patch must be applied dynamically by the application program and will be nullified by any WARM BOOT. When active, any special-function key that generates a two character escape code will be returned from the CONIN routine as the 7 bit ASCII code of the second character of the sequence, with the 8th bit set high to indicate that an escape character immediately preceded this character. For example, the f1 key generates ESC-S and would be returned as 0D3H (ASCII "S" (53H) + bit 7 = 0D3H). The ESCAPE key will still return 1BH. Sample code to enable the patch follows:

```
LHLD    1          ;GET ADDRESS OF BIOS JUMP TABLE
LXI     D,5
DAD     D          ;POINT (HL) TO HI-BYTE OF USER AREA ADDRESS
MOV     D,M
MVI     E,0        ;POINT (DE) TO START OF USER AREA
LXI     H,1FEH     ;ADDRESS WE WANT IS 510 BYTES PAST THAT
DAD     D          ;(HL) POINT TO ADDRESS
MOV     E,M
INX     H
MOV     D,M        ; (DE) CONTAINS THE ADDRESS OF THE BYTE TO PATCH
XRA     A          ; (NOP) CODE IS ZERO
STAX    D          ;REPLACE (RET) WITH (NOP)
```

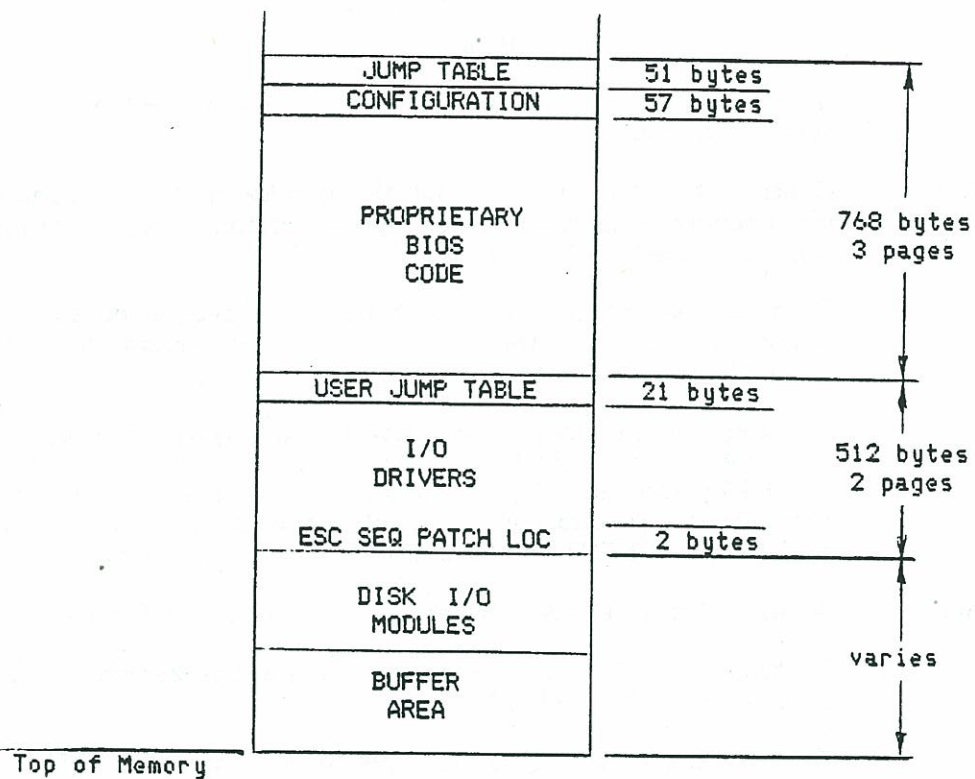
The patch is now active and CONIN will set the MSB on characters immediately preceded by an ESCAPE. To dynamically disable the patch:

```
LHLD    1          ;SAME AS BEFORE...
LXI     D,5
DAD     D
MOV     D,M
MVI     E,0
LXI     H,1FEH
DAD     D
MOV     E,M
INX     H
MOV     D,M        ; (DE) IS THE ADDRESS OF BYTE TO PATCH
MVI     A,0C9H     ; (RET) CODE
STAX    D          ;CAUSE ROUTINE TO END THERE
```

The CONIN routine will now pass ESC-sequences as individual (ESC) and (code) characters.

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APPENDIX A
BIOS MEMORY MAP



APPENDIX B RESERVED LOCATIONS IN PAGE ZERO

With the following exceptions, PAGE ZERO is as defined in Chapter 6 of Digital Research's Manual (CP/M ALTERATION), pages 144-5.

Locations from to	Contents
0008H-000AH	(interrupt location 1) Contains a jump to the system-clock interrupt service routine.
000BH-000CH	Contains the 2 byte (least significant byte first) tic counter which is incremented each time the system clock tics (every 2 milliseconds when the clock is turned on).
000DH-000DH	Contains the interrupt control byte. This byte is output to the General Purpose I/O port at 0F2H for each system tic or when the single density Z17 disk system is in use.
000EH-000EH	Contains the Z17 mini-floppy disk control byte. This byte is normally the image of the last byte output to port 7FH. Some bits may be altered by the mini-floppy system during a system-clock interrupt. The appropriate bits can be monitored to determine when the mini-floppy SELECT and/or MOTOR has been turned off.
0018H-001AH	Contains the interrupt service routine for the Z89 console 8250.
0020H-0022H	Contains the interrupt service routine for the Zenith Z89-37 Controller's 1797 "INTRQ" output.
0030H-0032H	Contains the interrupt service routine for the MMS 77316 Double Density Controller's 1797 "INTRQ" output.

APPENDIX C SPECIAL ENHANCEMENTS TO BDOS and CCP

Magnolia Microsystems has enhanced the BDOS and CCP provided with this copy of CP/M to add the following features: (Unsophisticated users shouldn't expect to understand this!)

BDOS Enhancements:

Default USER 0 search: If a file being OPENed is not found on the current USER number then USER 0 is searched for that file. This means that utilities need only exist on USER 0 to be accessed from all USER numbers.

Default R/O disk assignment: The last two bytes in the BDOS (addresses 1FFE,1FFF in MOVCPM) are the initial Drive R/O vector. This value is pre-loaded into the R/O vector whenever a system reset is initiated. This will force certain drives to be R/O. This value as shipped is 0000 so that no drives are assumed R/O. The least significant bit in the R/O vector corresponds to drive A: and the most significant bit to drive P:. Use SETUP to set the R/O bit for particular drives.

Deblocking codes: In addition to the deblock-code usually passed in register C on BIOS disk-write calls, the ACTUAL RECORD number is also passed in the DE register pair. This makes determining sequential writes much easier in that the next TRACK and SECTOR numbers do not have to be calculated before every write.

CCP Enhancements:

Default System Drive: The last byte in the CCP module (address 11FF in MOVCPM) is used to determine what drive a command will be loaded from if it cannot be found on the default (logged-in) drive. The SETUP utility can be used to specify the default system drive.

If a drive has not been specified when executing a command file, the following search sequence is executed:

- o Current user number, logged drive
- o User number 0, logged drive
- o Current user number, default system drive
- o User number 0, default system drive
- o If the program cannot be found, "No File" is printed.

The RES Command: A new intrinsic command has been included that will reset the disk system without re-booting. The command is "RES(cr)" and it has no parameters. It allows all drives to be reset to R/W and logged-off but it does not require a system disk in A: as "^C" does.

The CLS Command: This new intrinsic command clears the console CRT screen.

The PRNT command: The PRNT command, e.g. "PRNT C:FILE.PRN", pages its output, printing 62 lines of output to the LIST device, followed by a form-feed character (OCH). Tabs are expanded. Form-feeds in the file are passed to the LIST device, and reset the lines output count. In the case that form-feeds in the file correspond with form-feeds generated by hitting line 62, only one form-feed is output, so there will not be blank pages inserted. Entering Control-S stops the listing, another key starts it again, and any other key will abort the listing. Each byte of the file printed has the MSB masked (bit 7 set to 0) so that only ASCII is printed. If the file named is not present, "No File" is printed. As in CP/M, wildcards (*'s) in the filenames for PRNT and TYPE are not permitted.

The TYPE command: The TYPE command, e.g. "TYPE C:FILE.PRN", is identical to the PRNT command, except that the output is sent to the console instead of the LIST device. Control-S still works, and any other key still aborts the listing.

The prompt: The user number is now printed as part of the prompt, e.g. "A0>", "A15>", etc. The delay between the prompt and the system being ready to accept input (from the user or from a \$\$\$SUB file) has been removed.

The DIR command: The DIR command now has an additional form of "DIR @" which lists ALL files, including system and read-only files, while "DIR" lists only non-system and non-read-only files.

The directory display: The directory display no longer displays the drive name at the beginning of each line, and it now includes a '.' between the file name and file type. In addition, the display now contains five columns. The DIR command also has had the spaces between the filename and the .filetype removed ("FILE.HEX" instead of the previous "FILE HEX").

The ERA command: The ERA command now displays the name of each file it erases in the same format as the directory display.

The SUBMIT facility: The SUBMIT facility now expects the \$\$\$SUB file to be on the currently logged drive, instead of drive A: as was previously required. Therefore, you can submit a file while logged onto any drive. XSUB will also look for the \$\$\$SUB file on the default drive. Previous versions of SUBMIT and XSUB required logging onto drive A.

APPENDIX D CONFIGURING YOUR DISK DRIVES

See your appropriate hardware manual (Z89-37 or MMS 77316 Hardware Installation) for details on how to configure your disk drives for satisfactory operation.

APPENDIX E MEDIA FORMATS

The following floppy disk formats, with the corresponding file storage per disk, are supported by this release of MMS CP/M:

MODE format code	Common Name	Sectors: per track x Size	Single Sided, 48 tpi	Double Sided, 48 tpi	Single Sided, 96 tpi	Double Sided, 96 tpi
------------------------	----------------	---------------------------------	----------------------------	----------------------------	----------------------------	----------------------------

The H/Z Single Density Controller supports one format on 5" Hard Sector Media:

Z17	Z17 Single Density	10 x 256	90K	180K	180K	350K
-----	--------------------	----------	-----	------	------	------

The MMS 77316 Controller and the Zenith Z89-37 Controller support the following formats on 5" Soft Sector Media:

MMS,DD	MMS Double Density	9 x 512	162K	342K	340K	700K
Z37,SD	Z37 Single Density	10 x 256	90K	184K	190K	388K
Z37,DD	Z37 Double Density	16 x 256	148K	304K	308K	624K
Z37X,DD	Z37 Extended Density	5 x 1024	182K	382K	386K	782K

The MMS 77316 Controller also supports the following formats on 8" Media:

*,SD,SS	IBM Single Density	26 x 128	241K			
MMS,DD	MMS Double Density	16 x 512	594K	1210K		
M47,DD	MMS REMEX	8 x 1024	594K	1210K		
Z47,SD	Z47 Single Density	26 x 128	241K	490K		
Z47,DD	Z47 Double Density	26 x 256	482K	980K		
Z47X,DD	Z47 Extended Density	8 x 1024	596K	1208K		
Z67,DD	Z67 Double Density	26 x 256	482K	980K		

* 8" Single Density, Single Sided is the industry standard for data interchange. Specifying "SD,SS" with any of the 8" formats EXCEPT Z47X specifies this format.

DISK FORMATS LISTED IN DISK PARAMETER BLOCK FORM

Programmers may find the following table useful. If you do not understand disk parameter blocks, see your "Alteration Guide".

MODE												
Name	FORMAT	SEC SIZ	SPT	BSH	BSM	EXM	DSM	DRM	ALV0	CKS	OFF	SIZ
*(IBM)	ST SD SS	128	26	3	7	0	242	63	11000000	16	2	8
Z17	ST SD SS	256	20	3	7	0	91	63	11000000	16	3	5
	ST SD DS	256	20	3	7	0	181	63	11000000	16	3	5
	DT SD SS	256	20	4	15	1	95	127	11000000	32	3	5
	DT SD DS	256	20	4	15	1	185	127	11000000	32	3	5
* M47	ST SD SS	128	26	3	7	0	242	63	11000000	16	2	8
	ST DD SS	1024	64	4	15	0	299	191	11100000	48	2	8
	ST DD DS	1024	64	4	15	0	607	191	11100000	48	2	8
MMS	ST DD SS	512	36	4	15	1	82	95	11000000	24	3	5
	ST DD DS	512	36	4	15	1	172	95	11000000	24	3	5
	DT DD SS	512	36	5	31	3	85	127	10000000	32	3	5
	DT DD DS	512	36	5	31	3	175	127	10000000	32	3	5
*	ST SD SS	128	26	3	7	0	242	63	11000000	16	2	8
	ST DD SS	512	64	4	15	0	299	191	11100000	48	2	8
	ST DD DS	512	64	4	15	0	607	191	11100000	48	2	8
	ST DD DS	512	64	4	15	0	607	191	11100000	48	2	8
Z37	ST SD SS	256	20	3	7	0	91	63	11000000	16	3	5
	ST SD DS	256	20	3	7	0	187	127	11110000	32	3	5
	DT SD SS	256	20	3	7	0	191	63	11000000	16	3	5
	DT SD DS	256	20	4	15	1	195	127	11000000	32	3	5
	ST DD SS	256	32	3	7	0	151	127	11110000	32	2	5
	ST DD DS	256	32	4	15	0\$	155	255	11110000	64	2	5
	DT DD SS	256	32	4	15	1	155	127	11000000	32	2	5
	DT DD DS	256	32	4	15	0	315	255	11110000	64	2	5
Z37X	ST DD SS	1024	40	3	7	0	185	127	11110000	32	2	5
	ST DD DS	1024	40	4	15	0\$	194	255	11110000	64	2	5
	DT DD SS	1024	40	4	15	1	194	127	11000000	32	2	5
	DT DD DS	1024	40	4	15	0	394	255	11110000	64	2	5
* Z47/67	ST SD SS	128	26	3	7	0	242	63	11000000	16	2	8
	ST SD DS	128	26	4	15	1	246	127	11000000	32	2	8
	ST DD SS	256	52	4	15	0\$	242	127	11000000	32	2	8
	ST DD DS	256	52	4	15	0	493	255	11110000	64	2	8
Z47X	ST DD SS	1024	64	4	15	0	299	127	11000000	32	2	8
	ST DD DS	1024	64	4	15	0	607	255	11110000	64	2	8

\$ Errors in Heath's DPBs, should be "1". This error is not fatal but it wastes directory space on large files. Each directory entry will access only 16K when one entry is capable of accessing 32K.

Parameter Labels:

SPT	number of 128-byte Sectors Per Track.
BSH	Block Shift factor. LOG2(sectors per block)
BSM	Block Shift Mask. (sectors per block) - 1
EXM	Extent Mask. (extents per entry) - 1
DSM	Disk Storage Mask. (blocks per disk) - 1
DRM	Directory Mask. (num dir entrys) - 1
ALV0	Allocation Vector initial value (reserves direcorey area).
CKS	Check Size. Number of sectors to check in directory.
OFF	Offset of directory track. Number of tracks in system area.
SIZ	Physical disk size (8" or 5").
SEC SIZ	Physical Sector Size (bytes).
FORMAT:	
ST/DT	Single/Double Track density (48/96 TPI).
SD/DD	Single/Double recording Density (FM/MFM)
SS/DS	Single/Double Sided disk.

Note: MMS and Zenith handle double-sided disks differently. The difference is illustrated in the logical-physical head position table below (example is for 5.25" 48 tpi drive):

Logical Track	MMS Z17 Track	Physical Side	MMS 77316 Track	Physical Side	Zenith Track	Physical Side
0	0	0	0	0	0	0
1	1	0	1	0	0	1
2	2	0	2	0	1	0
3	3	0	3	0	1	1
37	37	0	37	0	18	1
38	38	0	38	0	19	0
39	39	0	39	0	19	1
40	35	***** 1	39	1	20	0
41	34	1	38	1	20	1
42	33	1	37	1	21	0
72	3	1	7	1	36	0
73	2	1	6	1	36	1
74	1	1	5	1	37	0
75	0	1	4	1	37	1
76			3	1	38	0
77			2	1	38	1
78			1	1	39	0
79			0	1	39	1

The "*****" marks some skipped tracks. These tracks were skipped because the heads on a 5.25" double-sided drive are offset, the second head being 4 tracks further in (towards the hub). These 4 tracks on side 1 were skipped to prevent possible problems with the Z17 controller, the more sensitive conditions near the hub, and the noise situation inside the "89" enclosure. On 96 tpi (Z17) drives 8 tracks were skipped making the physical track sequence 77, 78, 79, 71, 70, 69 . . . All other formats utilize all tracks on all sides. All MMS double sided diskettes can be partially used in single sided drives (the first half of the disk may be used). This is not possible with the Zenith formats.

APPENDIX F INTERRUPT DRIVEN KEYBOARD

There may be cases where you want to "type ahead" of the computer; that is, to enter the next few commands while another program is running. This "type ahead" capability has been added to MMS CP/M with an interrupt driven keyboard module in the distribution copy of MOVCPM.COM. To add this feature to a system lacking it, you must LINK the module ICON.HEX into the MOVCPM file, SYSGEN the new system, SHIFT/RESET, and re-boot.

The SETUP utility allows you to choose whether the system boots with the interrupt console enabled. See the "SET SERIAL PORT CONFIGURATION" function of SETUP for details.

If the system was booted with console interrupts disabled, you can enable them by typing:

```
A0>STAT_CON:=BAT:(cr)
```

The interrupts can be disabled by typing:

```
A0>STAT_CON:=CRT:(cr)
```

If LPT: or UC1: were being used as a console, then STAT_CON:=LPT: or STAT_CON:=UC1: would be used to disable the interrupt system.

NOTES and PRECAUTIONS

Some applications packages are difficult or impossible to run using the interrupt console routine, while the performance of others improves. If you find that a program is running incorrectly when the TYPE AHEAD feature is enabled, disable the TYPE AHEAD feature with the STAT utility and try again.

The interrupt routine uses a 256 byte console input buffer. This buffer may be cleared at any time by pushing the "BREAK" key.

When the interrupt routine is in use, the BDOS console input buffer is disabled by returning null status (no character ready) whenever BDOS calls the console status routine. The ^S/^Q pause feature is maintained by the interrupt module without conflicting with the TYPE AHEAD feature.

Some programs like DIR and PIP PRN:= monitor the keyboard and abort if there is any activity, which makes the TYPE AHEAD function unusable with them.

Characters will occasionally be lost if typed while the system is accessing some types of drives. If this becomes a problem, disable the TYPE AHEAD feature, or type more slowly during disk operations.

APPENDIX G MEMORY REQUIREMENTS OF I/O MODULES

The following chart describes the system storage requirements of the various I/O modules available for MMS CP/M (in 256-byte pages).

Module	Version	Pages	Comments
BOOT + BDOS + BIOS + USER	2.24	20	This is the "core" of CP/M, to which other modules are linked
ACT		3	A.C.T. Winchester Controller on MMS 77317 Interface
CORVxxx	1.0	3	CORVUS drives on MMS 77314 Interface
EIGHTX1		4	REMEX (Z47) drives on MMS 77314 Interface
HZ47X		4	REMEX (Z47) drives on Zenith Z89-47 Interface
ICON	2.242	2	Interrupt driven keyboard
INVDISK	2.23	2	Invisible disk module for MMS 77318 Expanded Memory
M316	2.242	9	5- and 8-inch drives on MMS 77316 Double Density Controller
SASI	2.240	5	SASI-compatible controllers on MMS 77320 SASI Bus Interface
XCOMP		3	XCOMP Controller with ST-506 on MMS 77317 Interface
XMS		4	XCOMP Controller with Mini-Scribe on MMS 77317 Interface
Z17	2.24	6	5-inch drive on Zenith Hard-sector Controller
Z37	2.24	7	5-inch drive on Zenith Z89-37 Double Density Controller

The number of pages available on the system tracks of selected disk formats is as follows:

Format	Density	Pages
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Z17	SD	30
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MMS 5"	DD	54
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MMS 8"	DD	64
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Z37	Do not SYSGEN a disk with the Z37 format - the disk will become unusable!	
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VALID DRIVE DESIGNATORS

Controller Code	Logical Unit No	Physical Comments Drive No
A -- Default Controller specified by SW501 and/or Configuration Port		
0	base+0	Default Controller, specified unit
1	base+1	Maximum unit depends on
etc	base+n	controller type
B -- Z17 Single-Density 10-Sector Controller		
0	0	
1	1	
2	2	
C -- Z89-37 5" Double Density Controller		
0	46	Remember, Zenith CP/M only
1	47	supports 3 drives
2	48	
3	49	
D -- Z89-47 Interface to Z47 (Remex) 8" Floppy Disk Subsystem		
0	(5)	Note: Bootable only with "D(cr)"
1	(6)	or "DD-0" through "DD-3"
2	(7)	not with "5" thru "8"
3	(8)	
E -- Z89-67 Interface to Z67 Winchester/Floppy Subsystem		
0	3	
1	4	
F -- Reserved for future Zenith disk I/O devices		
G -- MMS 77314 Interface to Remex (Z47) 8" Floppy Disk Subsystem		
0	5	
1	6	
2	7	
3	8	
H -- MMS 77314 Interface to Corvus (IMI) Winchester Subsystem		
0	15	
1	16	
2	17	
3	18	
4	19	
5	20	
6	21	
7	22	
8	23	Note: Usually not bootable

Controller Code	Logical Unit No	Physical Comments Drive No
I -- MMS 77316 Double Density Disk Controller - 8" Floppy Drives		
0	29	
1	30	
2	31	
3	32	
J -- MMS 77316 Double Density Disk Controller - 5" Floppy Drives		
0	33	
1	34	
2	35	
3	36	
K -- MMS 77317 Interface to XCOMP Winchester Controller		
0	37	
L -- Reserved		
M -- MMS 77318 128K RAM 'Invisible Disk'		
0	40	Must have been 'SYSGENed' since power-up
N -- MMS Network		
0 - 9	Network Server 0 through 9	
O -- MMS 77320 SASI-bus Interface -- Controller 0		
0 - 3	Use 'Command.String' to specify partition	
P -- MMS 77320 SASI-bus Interface -- Controller 1		
Q -- MMS 77320 SASI-bus Interface -- Controller 2		
R -- MMS 77320 SASI-bus Interface -- Controller 3		
S -- MMS 77320 SASI-bus Interface -- Controller 4		
T -- MMS 77320 SASI-bus Interface -- Controller 5		
U -- MMS 77320 SASI-bus Interface -- Controller 6		
V -- MMS 77320 SASI-bus Interface -- Controller 7		

Note: Each SASI controller supports 4 logical units

W-Z -- Reserved for future MMS Disk I/O products