

**77314 DISK I/O BOARD SOFTWARE GUIDE**

supplementing

**MMS CP/M 2.23 USER'S MANUAL**

for the

**HEATH/ZENITH Z89 DIGITAL COMPUTER**

supporting

CORVUS 5, 10, and 20 MByte Winchester Drives

REMEX 8-inch Floppy Disk Subsystems (Z47)

Revised 6/12/81

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**SOFTWARE INSTALLATION  
MAGNOLIA MICROSYSTEMS DISK I/O BOARD FOR THE '89**

All Magnolia Microsystems' disk interface boards use a proprietary technique to expand the limited number of I/O port addresses available on the '89. This allows use of more than the five (3 serial ports, 5" disk, and 8" disk) devices allowed by Heath/Zenith.

Software is furnished on 5" 10-sector CP/M media. It can be made available on 5" or 8" Double Density media for use with the MMS Double Density controller upon request.

This document describes the installation of special BIOS software modules into a copy of MMS CP/M 2.2 running on a Heath or Zenith 89 computer. It is assumed that the computer is already ORG-0 CP/M compatible, that is, it is either:

1. Z89-FA or Z89-GA or newer model (check label on back of computer),
- or 2. Has had the Heath/Zenith 89-7 Upgrade Kit installed,  
(In both of these cases, the PROM at U517 will be marked "444-66")
- or 3. Has Magnolia Microsystems' CP/M Modification Kit installed.

Also, the '89 must be running the Magnolia implementation of CP/M 2.2, not the Heath/Zenith implementation.

If not, purchase either the MMS or Heath/Zenith ORG-0 hardware kit from your dealer and install it according to the instructions furnished with it. Then install MMS CP/M 2.2 according to the instructions in the MMS CP/M USERS GUIDE before proceeding with the installation of the MMS I/O board package and this software.

Following installation of this I/O board and associated drives, your '89 will have greatly increased disk storage capacity.

## DESIGN OF MAGNOLIA MICROSYSTEMS CP/M FOR THE H/Z89

Magnolia Microsystems' implementation of CP/M on the '89 has been specially designed to allow end users to easily add new types of disk storage to their machine. The BIOS portion of CP/M (see the Digital Research manuals) has been implemented in a modular fashion, with 3 types of modules used:

1. BASECPM.COM is a "MOVCPM" program which has NO disk I/O included at all.
2. biosname.HEX is a relocatable BIOS module which can be LINKed into a MOVCPM file to add a specific type of disk I/O.
3. bootname.HEX is a relocatable BOOT module which can be LINKed into a MOVCPM file to allow a specific type of disk drive to be booted.

A new utility LINK.COM is used to merge these modules together to form the MOVCPM file which is executed to create the desired system image used to sysgen a disk.

## OVERVIEW OF SOFTWARE INTEGRATION

The process of integrating additional types of drives into your Z89 system is divided between hardware and software installation procedures. The hardware installation is detailed in a separate document, CORVUS and REMEX software installation is detailed in this document. Install and test MMS CP/M on your '89 before adding the additional software described in this document.

The Zenith I/O Decode PROM and Monitor EPROM on the Z89 CPU Logic Board are replaced by the MMS Decoder and Monitor. These new items provide the necessary support for data transfer and booting a CP/M system from various types of system disks. The MMS Decoder and Monitor set does not support the Heathkit Cassette peripheral device.

After installing the disk drive hardware, it is necessary to get MMS CP/M software "up and running" on the new drive. To start, the new BIOS I/O module is merged into the current 5.25" mini-floppy CP/M system. This produces an augmented CP/M system that can recognize and communicate with the new drive type. Media can then be formatted on the new type of drive.

Next, the new BIOS cold-boot module is merged into the augmented system, producing a system that is "new-drive-bootable". This system is written onto the system tracks of the newly formatted drive. Other utility programs are also copied from distribution media onto the new drive, creating a new full-blown) CP/M system disk on the new type of drive.

Finally, MMS CP/M is booted from the new drive using the new system disk. The increased storage capacity of the new media will make disk-swapping much less frequent on the Z89 computer system.

The following sections in this document detail the installation of support software for CORVUS and REMEX drives as currently supported by Magnolia Microsystems.

### POWER-ON AND POWER-OFF PROCEDURE

The following power on/off sequence minimizes the probability of having a power transient cause destruction of data on the additional disk drive:

POWER-ON:

1. Turn-on the Z89 computer.
2. Turn-on the disk drive subsystem(s).
3. Follow the proper Boot procedure.

POWER-OFF:

1. Turn-off the disk drive subsystem(s).
2. Turn-off the Z89 computer.

## CORVUS SOFTWARE INSTALLATION PROCEDURE

**NOTICE:** Whenever installing a new revision of the Corvus modules, **BACK UP YOUR FILES BEFORE INSTALLING THE NEW MODULES.** The new modules may change one or more of the following WHICH MAY CAUSE LOSS OF DATA:

1. System track allocation on one or more logical drives
2. Directory space allocation on one or more logical drives

### 1. Boot a copy of MMS CP/M 2.23 from the 5.25" drive:

The new MMS EPROM Monitor allows system booting from several different disk drive systems. The built-in 5.25" mini-floppy drive is assigned the number 0; this number can be entered as an argument to the Boot command to specify the minifloppy as the boot drive. On resetting the Z89, the CRT screen command line appears as shown (operator inputs are underlined):

H: Boot 0(carriage return)

If the number is not entered, the Monitor will default to the drive device specified by dip switch SW501 on the CPU board. The boot will fail if that device is not present and bootable. Refer to documentation on the current Monitor EPROM set for available options.

### 2. Copy the new CORVUS software onto the 5.25" system diskette:

The CORVUS installation procedure requires that the 5.25" system diskette contain these files:

MOVCPM.COM	SETUP.COM	SYSGEN.COM
CORVGEN.COM	PIP.COM	LINK.COM
FILECOPY.COM	CLEAR.COM	CBOOT.HEX

and additionally, one of the following disk I/O modules:

CORV105.HEX	(1 5MB logical device on a 5MB drive)
CORV210.HEX	(2 4.7MB logical devices on a 10MB drive)
CORV910.HEX	(9 1.0MB logical devices on a 10MB drive)
CORV320.HEX	(3 6.4MB logical devices on a 20MB drive)
CORV920.HEX	(3 4.5MB, 5 0.75MB, and 1 1.8MB logical devices on a 20MB drive)

Other divisions can be made available on a custom basis.

Extraneous files can be erased to make room for the new CORVUS files; they can be recovered from your distribution copy of MMS CP/M 2.23 after the CORVUS disk is configured.

If multiple 5.25" drives are available, PIP.COM may be used to transfer the CORVUS software onto the 5.25" system work disk. If only one 5.25" drive is available, then the single drive utility FILECOPY.COM must be used.

### 3. Merge CORVnnn.HEX into MOVCPM.COM using LINK.COM:

The CORVUS BIOS I/O module CORVnnn.HEX provides the communication link to the CORVUS disk drive for CP/M. The command line syntax for the LINK utility is:

```
LINK d:source-filename d:destination-filename(cr)
```

To append the new module, at CP/M command level type:

```
A><u>LINK CORV210 MOVCPM(cr)</u>
```

```
LINK version 2.231  
Link completed
```

### 4. Determine CP/M logical drive letters and check CORVUS operating modes:

To determine the initial CP/M logical drive letters used to reference the CORVUS partitions, the utility program SETUP.COM is used to examine the system program MOVCPM.COM (now containing the CORVUS BIOS I/O module). SETUP is described in the MMS CP/M 2.23 User's Guide. At CP/M command level, type:

```
A><u>SETUP MOVCPM(cr)</u>
```

Select the SETUP function "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS". The display should look similar to the following fragment:

```
A: = (00) FIRST MINI-FLOPPY  
B: = (01) SECOND MINI-FLOPPY  
C: = (02) THIRD MINI-FLOPPY  
D: = (15) CONSTELLATION  
E: = (16) CONSTELLATION  
F: = (17) CONSTELLATION  
G: = (18) CONSTELLATION  
H: = (19) CONSTELLATION  
I: = (20) CONSTELLATION  
J: = (21) CONSTELLATION  
K: = (22) CONSTELLATION  
L: = (23) CONSTELLATION  
M: = (-- ) ...NOT ASSIGNED...  
N: = (-- ) ...NOT ASSIGNED...  
O: = (-- ) ...NOT ASSIGNED...  
P: = (-- ) ...NOT ASSIGNED...
```

At this time you should only have the CORVUS module and the module for your boot device linked to CP/M. Additional modules may not fit on a mini-floppy device. In this case, "D:" thru "L:" are the logical drive letters. All drives may not be present depending on the selected configuration module. The initial logical drive letters are not fixed, but are determined by the presence of other disk systems' BIOS I/O modules LINKed into MOVCPM.COM, and the chronological order of linkage. The number "15", however, IS FIXED to the first physical drive of the CORVUS, and can be used as an argument

to the Monitor's Boot command. DO NOT rearrange the logical/physical drive assignments at this time; press the command key to return to the SETUP menu.

**5. Write the CORVUS-augmented system onto the 5.25" system diskette:**

Changes or module additions to the system program MOVCPM.COM are not implemented on the Z89 until the program is executed and relocated, written onto the system diskette by SYSGEN.COM, and cold-booted back from the diskette into memory. At CP/M command level, type:

A><u>MOVCPM 48</u>(cr) (enter 32, 48, or 64 depending on system memory size)

CONSTRUCTING 48k Magnolia Microsystems CP/M on HEATH z89 : v2.23  
READY FOR "SYSGEN" OR  
"SAVE xx CPM48.COM"

A><u>SYSGEN</u>(cr)  
SYSGEN VERS 2.23  
SOURCE DRIVE NAME (OR RETURN TO SKIP)<u>(cr)</u> (system is in memory)  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)<u>A</u>  
DESTINATION ON A AND TYPE RETURN<u>(cr)</u>  
FUNCTION COMPLETE  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT) ...DO NOT HIT RETURN!

**6. Reset the Z89 and boot the new CORVUS-augmented system:**

The 5.25" system diskette now contains a system capable of communicating with the CORVUS disk drive after the CORVUS disk has been configured; RESET the Z89 and cold-boot:

H: <u>Boot 0</u>(cr)

### 7. Make a Copy of MOVCPM.COM and insert the CORVUS cold-boot routine:

The CP/M system that will eventually reside on the CORVUS must be "bootable" from the CORVUS drive. This means that it must contain the CORVUS cold-boot routine "CBOOT.HEX". The CORVUS-augmented MOVCPM.COM, containing the CORVUS BIOS I/O module and the normal 5.25" mini-floppy cold-boot routine should be preserved for generating 5.25" mini-floppy system disks. The expedient maneuver is to make a copy of MOVCPM.COM before overwriting the mini-floppy cold-boot routine. The utility PIP.COM is used to make the copy; at CP/M command level, type:

```
A>>PIP CMOVCPM.COM=MOVCPM.COM[V](cr)
```

```
A>>LINK CBOOT CMOVCPM(cr)
```

```
LINK version 2.231  
Link completed
```

### 8. Declare the CORVUS as the new cold-boot drive:

The logical/physical drive assignments table within CMOVCPM.COM must be straightened out so that logical drive "A:" references the first physical partition of the CORVUS and not the built-in 5.25" mini-floppy drive. The CP/M system that will boot from the CORVUS must reference the CORVUS as "A:"; the CP/M system that currently boots off the built-in 5.25" mini-floppy drive references the built-in 5.25" mini-floppy drive as "A:". At CP/M command level, type:

```
A>>SETUP CMOVCPM(cr)
```

Select the SETUP function "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS". Rearrange the logical/physical drive assignments table so that the first partition of the CORVUS is logical drive "A:". The resultant assignments table should look similar to the table reproduced here; compare it to the table shown in Step 4 preceding.

```
A: = (15) CONSTELLATION  
B: = (16) CONSTELLATION  
C: = (17) CONSTELLATION  
D: = (18) CONSTELLATION  
E: = (19) CONSTELLATION  
F: = (20) CONSTELLATION  
G: = (21) CONSTELLATION  
H: = (22) CONSTELLATION  
I: = (00) FIRST MINI-FLOPPY  
J: = (01) SECOND MINI-FLOPPY  
K: = (02) THIRD MINI-FLOPPY  
L: = (--) ...NOT ASSIGNED...  
M: = (--) ...NOT ASSIGNED...  
N: = (--) ...NOT ASSIGNED...
```



O: = (--) ...NOT ASSIGNED...  
P: = (23) CONSTELLATION

Start by setting drive A: to be the CORVUS drive by entering "15" within the parentheses. This will produce a "DUPLICATE ENTRY" message which can be ignored for the moment. Use the move-cursor and data keys of the Z89 to enter "16", "17" etc. for as many drives as were selected. These will correspond to drives B:, C:, etc. If a module dividing the CORVUS into 9 partitions was selected, it is recommended that the last drive (23) be entered as P:. This will allow it to be compatible with software which may be available in the future. Enter the mini-floppy numbers "00", "01", "02" in the first three unused locations. Finally, "HOME" the cursor and sweep each line entry again: the table should now be clear of any error messages.

Press the command keys to update CMOVCPM.COM to the new assignments table and to return to CP/M command level.

### 9. Write the new CORVUS-bootable system onto a CORVUS drive

The system program file CMOVCPM.COM now contains the CORVUS BIOS I/O module, CORVUS BIOS cold-boot module, and a logical/physical drive assignments table that refers to the CORVUS as "A:". (However, the system software in force is still using the original logical/physical drive assignments table observed in step 4.) To create a bootable CORVUS system type:

A>>CMOVCPM 48(cr) (enter 32, 48 or 64 depending on system memory size)

CONSTRUCTING 48k Magnolia Microsystems CP/M on HEATH z89 : v2.23  
READY FOR "SYSGEN" OR  
"SAVE xx CPM48.COM"

A>>CORVGEN(cr)

CORVGEN version 2.231  
Did you execute MOVCPM ? ( Y or N ) Y (system is in memory)  
Do you want to initialize the directories ? ( Y or N ) Y

Function complete

A>

## 10. Clearing the directories

As a new disk contains random data, it is necessary to initialize the directories for each CORVUS partition when executing CORVGEN for the first time. CORVGEN does this automatically if requested. If the 'initialize' option was not elected during CORVGEN, then the CLEAR utility is supplied to selectively initialize the directories. This program shouldn't be used on the first CORVUS partition (15), however, as it will erase any system files present. All directories must be initialized on a new drive. To use the CLEAR program type:

```
A><u>CLEAR B:</u>    ( B: could be any drive )
```

## 11. Copy the 5.25" files onto the CORVUS

The standard MMS CP/M system utilities, such as ED.COM, ASM.COM, STAT.COM, and PIP.COM can be moved from the 5.25" system mini-floppy to the CORVUS for user convenience. The utility PIP.COM can be used to facilitate this transfer; at CP/M command level, type:

```
A><u>PIP D:=A:*. *[V]</u>(cr)
```

If some extraneous system utilities were deleted from the 5.25" system mini-floppy to provide work space during the CORVUS software installation procedure, they can be copied from another 5.25" MMS CP/M 2.23 distribution diskette after the new CP/M system is booted from the CORVUS.

## 12. Boot MMS CP/M 2.23 from the CORVUS

The CORVUS should now contain a bootable, CP/M system. The MMS Monitor's Boot command will get the CP/M system from there if the correct physical drive number is given after the Z89 is RESET:

```
H:Boot <u>15</u>(cr)  
48K Magnolia Microsystems CP/M on HEATH z89 : v2.23  
A>
```

Alternately, the configuration port jumpers can be set as described in HARDWARE INSTALLATION PROCEDURE so that the system is booted from the CORVUS drive without entering the number:

```
H:Boot <u>(cr)</u>  
48K Magnolia Microsystems CP/M on HEATH z89 : v2.23  
A>
```

Since the system has been booted from the CORVUS drive, CP/M logical drives will be referenced as defined in your setup table. (See the logical/physical drive assignments table of step 8.)

### **13. Installing additional bootable systems**

Additional partitions (ie. 16-22) may also be bootable if a system is installed on the appropriate system tracks of the disk. As each partition appears to CP/M as a separate logical device, each partition may be SYSGENed. This is done using the SETUP utility and the normal MOVCPM and SYSGEN procedures. This means a uniquely named MOVCPM file should be created for each partition to be SYSGENed. The SETUP utility should then be used to specify the desired partition as the first drive in the logical/physical drive assignment table. Following this, the unique MOVCPM should be executed and the resulting system SYSGENed onto the appropriate partition.

### **14. Installing other BIOS modules**

After testing your CORVUS system operation, you may LINK other BIOS modules into your CMOVCPM.COM file to allow access to other types of drives.

This completes the software installation.

## REMEX 8" DRIVE SUBSYSTEM SOFTWARE INSTALLATION

**NOTICE:** This release of the Remex modules uses an Extended Double Density format with 1024-byte sector blocking/deblocking. This results in a storage capacity of 1210K bytes on a Double-Sided disk, compared to the 868K bytes allowed by early releases of the module. However, the new and old DD formats ARE NOT COMPATIBLE and files must be converted using the procedure described on page 18.

### 1. Boot a copy of MMS CP/M 2.23 from the 5.25" drive:

The new MMS EPROM Monitor allows system booting from several different disk drive systems. The built-in 5.25" mini-floppy drive is assigned the number 0; this number can be entered as an argument to the Boot command to specify the minifloppy as the boot drive. On resetting the Z89, the CRT screen command line appears as shown (operator inputs are underlined):

H: Boot 0(carriage return)

### 2. Copy the new REMEX software onto the 5.25" system diskette:

The REMEX installation procedure requires that the 5.25" system diskette contain these files:

```
MOVCPM.COM  SETUP.COM  SYSGEN.COM  PIP.COM  FILECOPY.COM
FIXBDOS.COM LINK.COM  FORMATX.COM EIGHTX.HEX EBOOTX.HEX
```

Extraneous files can be erased to make room for the new REMEX files; they can be recovered from your distribution copy of MMS CP/M 2.23 after the REMEX 8" system disk is created.

If multiple 5.25" drives are available, PIP.COM may be used to transfer the REMEX software onto the 5.25" system work disk. If only one 5.25" drive is available, then the single drive utility FILECOPY.COM must be used.

### 3. Fix MOVCPM.COM using FIXBDOS.COM:

For increased I/O speed and disk capacity, the REMEX BIOS module uses 1024-byte sectors and a read/write buffer that is larger than the normal CP/M sector size (128 bytes). A patch to the CP/M BDOS is required for sector blocking/deblocking; at CP/M command level, type:

A>FIXBDOS MOVCPM(cr)

FIXBDOS version 1.0  
FIX completed

#### 4. Merge EIGHTX.HEX into MOVCPM.COM using LINK.COM:

The REMEX BIOS I/O module EIGHTX.HEX provides the communication link to the REMEX disk drive for CP/M. To append the new module, at CP/M command level type:

```
A><u>LINK EIGHTX MOVCPM(cr)</u>
```

```
LINK VERSION 2.23  
LINK COMPLETED
```

#### 5. Determine CP/M logical drive letters and check REMEX operating modes:

To determine the initial CP/M logical drive letters used to reference the REMEX drives, the utility program SETUP.COM is used to examine the system program MOVCPM.COM (now containing the REMEX BIOS I/O module). SETUP is described in the MMS CP/M User's Guide. At CP/M command level, type:

```
A><u>SETUP MOVCPM(cr)</u>
```

Select the SETUP function "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS". The display should look similar to the following fragment:

```
A: = (00) FIRST MINI-FLOPPY  
B: = (01) SECOND MINI-FLOPPY  
C: = (02) THIRD MINI-FLOPPY  
D: = (05) FIRST EIGHT-INCH DRIVE  
E: = (06) SECOND EIGHT-INCH DRIVE  
F: = (07) THIRD EIGHT-INCH DRIVE  
G: = (08) FOURTH EIGHT-INCH DRIVE  
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...
```

In this case, "D:" and "E:" are the logical drive letters for the left and right drives of the Master REMEX. If a Slave REMEX is installed, "F:" and "G:" will be used to reference it. The initial logical drive letters are not fixed, but are determined by the presence of other disk systems' BIOS I/O modules LINKed into MOVCPM.COM, and the chronological order of linkage. The number "5", however, IS FIXED to the left drive of the first REMEX, and can be used as an argument to the Monitor's Boot command.

DO NOT REARRANGE the logical/physical drive assignments at this time; press the command key to return to the SETUP menu.

To check or change the REMEX default (boot-up) operating modes, select the SETUP function 'SET 8" FLOPPY DEFAULT DENSITY/SIDE CONTROLS'. The display should look similar to this fragment:

(0) = DD/DS	(Left drive of Master REMEX - system boot drive)
(1) = DD/DS	(Right drive of Master)
(2) = DD/DS	(Left drive of Slave REMEX - needn't be installed)
(3) = DD/DS	(Right drive of Slave - needn't be installed)

"DD" stands for double-density; "SD" stands for single-density.  
"DS" stands for double-sided; "SS" stands for single-sided.

The REMEX drive system is normally operated in the double-density, double-sided modes to take advantage of its large storage capacity. These are the default (boot-up) modes of the REMEX BIOS software as shipped from MMS.

The software modes internal to CP/M control the data format and I/O transfer to the REMEX drives. SD/DS mode is not allowed. Modes DD/SS or SD/SS may be specified for a REMEX drive at this time if DD/DS media is not available, or you do not wish to "risk" using non-certified DD/DS media in a DD/DS drive. However, REMEX 8" system (bootable CP/M) disks MUST be DD because of the amount of system track storage required. The Left drive of the Master REMEX (0) is used for CP/M system booting and should be set only to DD/DS or DD/SS modes.

The mode of a drive (not an inserted disk!) can be inspected at CP/M command level using the SET.COM utility, which is described in the MMS CP/M User's Guide. A drive can be temporarily SET to another mode for a particular task: e.g. SD/SS mode to read 8" SD/SS Standard Format CP/M transfer media. This SET utility allows the operator to quickly tailor the mode of a drive to the formatted mode of a disk, without having to SETUP, MOVCPM, and re-SYSGEN-ing the system disk. The drive should be SET back to it's normal mode after the task is complete.

#### **IMPORTANT:**

With MMS CP/M, the mode of the drive is the assumed format mode of the disk (NOT vice-versa as with the Zenith version of CP/M). Each 8" floppy-disk formatted on a REMEX drive should be marked "DD/DS", "DD/SS", or "SD/SS" to indicate the formatted state of the disk (which, again, reflects the mode of the drive).

DO NOT LOSE TRACK of the mode of the drives; they are determined by the CP/M system disk used to boot-up. DO NOT MIX the modes of drives and disks: before inserting a disk into a drive, tailor the mode of the drive to the mode of the disk using SET.COM, or by altering the default REMEX mode table of MOVCPM.COM using SETUP, and re-SYSGEN-ing.

Press the command keys to implement the drive mode changes (if any), and return to CP/M command level.

## 6. Write the REMEX-augmented system onto the 5.25" system diskette:

Changes or module additions to the system program MOVCPM.COM are not implemented on the Z89 until the program is executed and relocated, written onto the system diskette by SYSGEN.COM, and cold-booted back from the diskette into memory. At CP/M command level, type:

A><u>MOVCPM 48</u>(cr) (enter 32, 48, or 64 depending on system memory size)

CONSTRUCTING 48k Magnolia Microsystems CP/M on HEATH z89 : v2.23  
READY FOR "SYSGEN" OR  
"SAVE xx CPM48.COM"

A><u>SYSGEN</u>(cr)

SYSGEN VERS 2.23

SOURCE DRIVE NAME (OR RETURN TO SKIP)(cr) (system is in memory)

DESTINATION DRIVE NAME (OR RETURN TO REBOOT)A

DESTINATION ON A AND TYPE RETURN<u>(cr)</u>

FUNCTION COMPLETE

DESTINATION DRIVE NAME (OR RETURN TO REBOOT) ...DO NOT HIT RETURN!

## 7. Reset the Z89 and boot the new REMEX-augmented system:

The 5.25" system diskette now contains a system capable of communicating with the REMEX disk drive; RESET the Z89 and cold-boot:

H: <u>Boot 0</u>(cr)

## 8. Format 8" floppy-disks on the REMEX using FORMATX.COM:

Floppy-disks to be used with CP/M on the REMEX disk drive can now be formatted using the utility program FORMATX.COM. Obtain certified double-density, double-sided 8" floppy-disks for the REMEX if possible. The floppy-disks should be write-enabled (i.e. NOT write-protected).

The initial CP/M logical drive letters used to reference the REMEX drives were determined in step 5, and must be used to specify the REMEX drive used for formatting. At CP/M command level, type:

A><u>FORMATX</u>(cr)

MMS FORMAT VERS 2.23

ENTER DRIVE-NAME:, PUSH RETURN --<u>D:</u>(cr) (use appropriate letter)

INSERT BLANK DISK IN DRIVE D: AND PUSH RETURN ><u>(cr)</u>

. (format as many floppy-disks as desired)

INSERT BLANK DISK IN DRIVE D: AND PUSH RETURN ><u>C</u> (CTRL-C to terminate)

**9. Make a copy of MOVCPM.COM and insert the REMEX cold-boot routine:**

The CP/M system that will eventually reside on a REMEX 8" floppy-disk must be "bootable" from the REMEX drive. This means that it must contain the REMEX cold-boot routine "EBOOTX.HEX". The REMEX-augmented MOVCPM.COM, containing the REMEX BIOS I/O module and the normal 5.25" mini-floppy cold-boot routine should be preserved for generating 5.25" mini-floppy system disks capable of talking to the REMEX drives. The expedient maneuver is to make a copy of MOVCPM.COM before overwriting the mini-floppy cold-boot routine. The utility PIP.COM is used to make the copy; at CP/M command level, type:

```
A>>PIP MOVCPM8.COM=MOVCPM.COM[V](cr)
```

```
A>>LINK EBOOTX MOVCPM8(cr)
```

```
LINK VERSION 2.23  
LINK COMPLETED
```

**10. Declare the REMEX as the new cold-boot drive:**

The logical/physical drive assignments table within MOVCPM8.COM must be straightened out so that logical drive "A:" references the left drive of the REMEX and not the built-in 5.25" mini-floppy drive. The CP/M system that will boot off the left drive of the REMEX must reference the left drive of the REMEX as "A:"; the CP/M system that currently boots off the built-in 5.25" mini-floppy drive references the built-in 5.25" mini-floppy drive as "A:". At CP/M command level, type:

```
A>>SETUP MOVCPM8(cr)
```

Select the SETUP function "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS". Rearrange the logical/physical drive assignments table so that the left drive of the REMEX is logical drive "A:". The resulting assignments table should look similar to the table reproduced here; compare it to the table shown in Step 5 preceding.

```
A: = (05) FIRST EIGHT-INCH DRIVE  
B: = (06) SECOND EIGHT-INCH DRIVE  
C: = (07) THIRD EIGHT-INCH DRIVE  
D: = (08) FOURTH EIGHT-INCH DRIVE  
E: = (00) FIRST MINI-FLOPPY  
F: = (01) SECOND MINI-FLOPPY  
G: = (02) THIRD MINI-FLOPPY  
H: = (-- ) ...NOT ASSIGNED...  
I: = (-- ) ...NOT ASSIGNED...  
  
O: = (-- ) ...NOT ASSIGNED...  
P: = (-- ) ...NOT ASSIGNED...
```



## 10. (continued) Declare ... REMEX ...

Start by setting drive A: to be the first 8" drive by entering "05" within the parentheses. This will produce a "DUPLICATE ENTRY" message which can be ignored for the moment. Use the move-cursor and data keys of the Z89 to enter "06", "07", and "08" for drives B:, C:, and D:. Enter the mini-floppy numbers "00", "01", "02" for drives E:, F:, and G:. Finally, "HOME" the cursor and sweep each line entry again: the table should now be clear of any error messages.

Press the command keys to update MOVCPM8.COM to the new assignments table and to return to CP/M command level.

## 11. Write the new REMEX-bootable system onto a 8" floppy-disk:

The system program file MOVCPM8.COM now contains the REMEX BIOS I/O module, REMEX BIOS cold-boot module, and a logical/physical drive assignments table that refers to the left drive of the REMEX as "A:". (However, the system in control is still using the logical/physical drive assignments table observed in step 5.) To create a bootable REMEX 8" system floppy-disk, insert a formatted disk into the left drive of the REMEX, and at CP/M command level type:

```
A>>MOVCPM8 48(cr) (enter 32, 48 or 64 depending on system memory size)
```

```
CONSTRUCTING 48k Magnolia Microsystems CP/M on HEATH z89 : v2.23  
READY FOR "SYSGEN" OR  
"SAVE xx CPM48.COM"
```

```
A>>SYSGEN(cr)  
SYSGEN VERS 2.23  
SOURCE DRIVE NAME (OR RETURN TO SKIP)(cr) (system is in memory)  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)D (the REMEX's left drive)  
DESTINATION ON D THEN TYPE RETURN(cr)  
FUNCTION COMPLETE  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)(cr) (O.K. to reboot)  
A>
```

## 12. Copy the 5.25" files onto the REMEX 8" system floppy-disk:

The standard MMS CP/M system utilities, such as ED.COM, ASM.COM, STAT.COM, and PIP.COM can be copied from the 5.25" system mini-floppy to the REMEX 8" system floppy for user convenience. The utility PIP.COM can be used to facilitate the transfer; at CP/M command level, type:

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

If some extraneous system utilities were deleted from the 5.25" system mini-floppy to provide work space during the REMEX software installation procedure, they can be copied from your 5.25" MMS CP/M 2.23 distribution diskette after the new CP/M system is booted from the REMEX.

### 13. Boot MMS CP/M from the REMEX

The left drive of the REMEX should now contain a bootable, CP/M system floppy-disk. The MMS Monitor's Boot command will get the CP/M system from there if the correct physical drive number is given after the Z89 is RESET:

```
H:Boot 5(cr)
48k Magnolia Microsystems CP/M on HEATH z89 : v2.23
A>
```

Alternately, the configuration port jumpers can be set as described in HARDWARE INSTALLATION PROCEDURE so that the system is booted from the REMEX drive without entering the number:

```
H:Boot (cr)
48k Magnolia Microsystems CP/M on HEATH z89 : v2.23
A>
```

Since the system has been booted from the REMEX drive, CP/M logical drives "A:" and "B:" will refer to the left and right disk drives of the REMEX, and logical drive "E:" will refer to the built-in 5.25" mini-floppy used to install the REMEX software. (See the logical/physical drive assignments table of step 10.)

If the second and third REMEX Slave Drives are not installed, the logical/physical drive assignments table within the system program "MOVCPM8.COM" on the REMEX 8" system floppy-disk can be "compact". This would remove entries from the drive assignments table that do not actually exist. Using the SETUP utility, the unused physical drive numbers 07 and 08 can be deleted or moved "out of the way", and the built-in mini-floppy drive number 00 can be "tucked" into logical drive "C:". An additional cycle of executing MOVCPM8 and SYSGEN onto the REMEX 8" system floppy-disk will implement this housekeeping chore.

### 14. Installing other BIOS modules

After testing your REMEX system operation, you may LINK other BIOS modules into your MOVCPM8.COM file to allow access to other types of drives. This completes the software installation.

### CONVERSION TO EXTENDED DOUBLE-DENSITY FORMAT

Double-Density files generated using either the old release of MMS CP/M or Zenith CP/M can be converted to the extended Double-Density format. One way is to use formatted Single-Density/Single-Sided (SD/SS) media as intermediate storage for those files that you wish to convert: using the old CP/M system, copy the Double-Density files onto a SD/SS disk; using the new REMEX CP/M system, copy the files from the SD/SS disk onto an (extended) Double-Density disk.

Double-Density => Single-Density => (Extended) Double-Density

For discussion, assume that Double-Density file "SAVE.ME" exists on an OLD CP/M system disk. A NEW REMEX CP/M system disk has been created on an (extended) Double-Density disk. To get SAVE.ME into extended density format, you could:

1. Boot the OLD CP/M system from drive A:

2. Make a copy of SAVE.ME on a SD/SS disk in drive B:

```
A>SET B:SD(cr)           (this will set drive B: to SD/SS)
A>FORMAT B:(cr)         (insert and format a blank 8" SD/SS disk)
A>PIP B:=A:SAVE.ME(cr)  (make a Single-Density copy of the file)
```

3. Boot the NEW REMEX CP/M system from drive A:

4. Make a copy of SAVE.ME from the SD/SS disk in drive B:

```
A>SET B:SD(cr)           (this will set drive B: to SD/SS)
A>PIP A:=B:SAVE.ME(cr)  (A: is assumed to extended Double-Density)
```

The file SAVE.ME is now in extended Double-Density format on drive A:.

## APPENDIX A

### REMEX DRIVE JUMPER CONFIGURATION

REMEX Intelligent Drive Subsystems (RFS4810 and RFS4820) purchased from Magnolia Microsystems are shipped configured to operate with the 77314 I/O board and REMEX BIOS modules. The following data may be useful to service personnel or others who must configure drives for use with the MMS interface.

#### 1. Power-On Sense

Pin 17 (REMEX nomenclature) of connector J1 on the RFS4810 master drive must be jumpered to +5 volts so that the system software can determine if the subsystem is turned on or not. (pin 17 connects to conductor 34 in the ribbon cable to the '89.)

#### 2. Master Drive (RFS4810) Jumper Plugs

Underlined letters denote the insertion of a shorting plug between posts indicated:

AA	<u>BB</u>	CC	= -5 volt regulator disabled (depending on power supply used)			
H	J	Y	= default to double density			
<u>R</u>	<u>P</u>	<u>N</u>	M	L	K	= select as device "0" (CP/M drive A:, use device "1" in a Z47)
<u>U</u>	T	S	= door lock enabled			
<u>V</u>	<u>W</u>	X	= top head enabled (double-sided drives only)			
<u>Z</u>	<u>F</u>	G	= track 0 double density			

#### 3. Slave Drive (RFS4820) Jumper Plugs

Underlined letters denote the insertion of a shorting plug between posts indicated:

<u>A</u>	B	C	= door lock enabled			
<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	H	J	= select as device "1" (CP/M drive B:, use device "0" in a Z47)
<u>K</u>	L	M	= top head enabled (double sided drives only)			
<u>N</u>	<u>P</u>	R	= -5 volt regulator disabled (depending on power supply used)			

#### 4. Additional Slave Drives

Up to 2 (two) additional Slave drives may be added, jumpered as in #3 above, except select as devices "2" and "3".

#### 5. Z47 40-Conductor Cable

Only the first 34 wires in the 40 wire Z47 cable are used. If you have a Z47, simply plug it on (pin 1 to pin 1) to the 34 pin REMEX header.



## USER'S MANUAL

CP/M™ v2.23+ on Zenith/Heathkit Data Systems Z89

By

# MAGNOLIA MICROSYSTEMS

MAGNOLIA MICROSYSTEMS, INC.  
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Revised April 29, 1981

§2. 8/19/81

## USER'S MANUAL

CP/M™ v2.23+ on Zenith/Heathkit Data Systems Z89

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**INTRODUCTION  
TO  
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 disks. It consists of a collection of inter-related programs designed to accomplish specific tasks within the system. CP/M operates with 8080 and Z80 microprocessor 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. 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 all the information you need to get CP/M running on your computer and to help you understand the system. If you are intending to run existing applications packages you should also read the Digital Research manual entitled "An Introduction to CP/M Features and Facilities". It will probably not be necessary to concern yourself with the other CP/M manuals to run applications programs. However, if you intend to do your own programming you should spend time with all six of the of the manuals (Introduction, DDT, Interface, System Alteration, ED, ASM). This should be expected to take time and careful study, as well as experience in using all of the features available.

If you already are using CP/M 1.4 the "CP/M 2.0 User's Guide" will briefly describe the differences between the two versions.

Note: CP/M uses the symbols "A:", "B:", and "C:" (etc.) to designate disk drives, in place of the "SY0:", "SY1:", and "SY2:" used by HDOS.

CP/M™ is a registered trademark of Digital Research, Pacific Grove, CA.

3/18/81

**DISKETTE CARE AND HANDLING**

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

Always return the diskette to its protective envelope after use. **NEVER** touch the diskette through the window slot exposing 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.

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 remove the diskette from a disk drive compartment with the red 'BUSY' light on.

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.

## BOOT PROCEDURE

Use this procedure to boot up your CP/M. It assumes that your Z89 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. In this manual also, **all operator inputs are underlined**. Thus, in the example below, you would type a B followed by a RETURN.

Be sure there are **NO** diskettes in any drive before turning on the power switch. When the power is cycled the computer should display an "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.

Insert your CP/M™ diskette with the label facing the screen (make sure that the WRITE PROTECT notch on the disk is COVERED so that a system failure cannot destroy the data on the disk) and gently close the disk drive door.  
Type:

H: Boot(cr)

Type SPACES if HDOS

32K Magnolia Microsystems CP/M on Heath Z89 : v2.23

A>

Your CP/M™ system is now up and running. **If this is your first use of the system, back up the distribution diskette.** It is most important that you put your original disk away in a safe place as soon as possible. It should be left with the write-protect notch covered.

IF YOU MAKE A TYPING ERROR use either (1) CONTROL 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) (the character deleted will be erased from the screen).

## BACKUP PROCEDURE

This procedure must be used to make a copy of the original distribution diskette. First a blank 5 1/4" diskette will be formatted (with the FORMAT program) and then the distribution disk software will be copied onto it.

Boot up your CP/M™ diskette as previously explained. If you have one drive you FORMAT on drive A:, with two drives you format on drive B: (substituting B: for A:). At the "A>" prompt type:

```
A><u>FORMAT A:</u>(cr)
MMS FORMAT VERS 2.23
INSERT BLANK DISK IN DRIVE A: AND PUSH RETURN >
```

At this point remove the distribution CP/M disk from drive A: (the drive in the Z89), insert a new disk into it and push the RETURN key. The program will format the disk and read each sector to verify that it has been properly formatted. It then prompts to allow you to format another disk if desired. If any errors occurred the program will display "FORMAT ERROR: . . .". If this occurs try another disk.

```
INSERT BLANK DISK IN DRIVE A: AND PUSH RETURN>
```

When the format program has successfully completed, press the CONTROL and C keys simultaneously (hereafter shown as °C) to return to CP/M™.

Now re-insert your CP/M™ distribution disk in drive A: and copy it onto the disk you have just formatted. If you have two drives skip to the next page and use the COPY utility. Otherwise type:

```
A><u>ONECOPY</u>(cr)
MMS ONECOPY VERS 2.23
INSERT SOURCE DISK, PUSH RETURN >(insert distribution disk)<u>(cr)</u>
INSERT DESTINATION DISK, PUSH RETURN >(insert newly formatted disk)<u>(cr)</u>
.
. (REPEATS)
INSERT SOURCE DISK, PUSH RETURN >(insert distribution disk)<u>(cr)</u>
INSERT DESTINATION DISK, PUSH RETURN >(insert newly formatted disk)<u>(cr)</u>
INSERT SYSTEM DISK, PUSH RETURN >(leave new copy in drive)<u>(cr)</u>
```

```
A>
```

Now put the original distribution disk away in a safe place and use it only for backup purposes. **NEVER** remove the WRITE PROTECT tab from a distribution disk; never write to the disk. This will insure that you always have a working disk to fall back on if there is a system crash.

If you have two drives use the COPY utility:

A><u>COPY A: TO B:(cr)</u>

+COPY VERS 2.23

+SOURCE ON DRIVE A:

+BLANK ON DRIVE B:

+<RET> TO COPY, °C TO EXIT ><u>(cr)</u>

(after disk has been copied, this takes about 1.5 minutes  
for single-sided, single density disks)

+COPY A: TO B:

+SOURCE ON DRIVE A:

+BLANK ON DRIVE B:

+<RET> TO COPY, °C TO EXIT ><u>°C</u>

A>

Now put the original distribution disk away in a safe place and use it only for backup purposes. **NEVER** remove the WRITE PROTECT tab from a distribution disk; never write to the disk. This will insure that you always have a working disk to fall back on if there is a system crash.

Mark your new disk "32K MMS CP/M for Z89 v2.23+"

"S/N 2-175-xxxx"

"°Digital Research"

"°Magnolia Microsystems"

as required by your Software License Agreement.

## DEFINING SYSTEM PARAMETERS

NOTE:

If your printer operates at 9600 baud and your '89 contains the original single sided Siemens mini-disk drives (as delivered by HEATH or ZENITH) you may go on to the next section, INCREASING SYSTEM SIZE.

Use the SETUP utility to change the configuration of your MOVCPM.COM file in the following areas:

default baud rates (printer, modem, auxiliary)  
mini-floppy step rate  
mini-floppy default sided control

The program is menu-driven. Initiate the program by typing:

A><u>SETUP</u>(cr)

The screen will initialize to:

SETUP VERSION 2.23

- . DISPLAY CURRENT CONFIGURATION
- . SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS
- . SET BAUD RATES
- . SET MINI-FLOPPY STEP RATE
- . SET MINI-FLOPPY DEFAULT DOUBLE SIDED CONTROLS
- . SET 8" FLOPPY DEFAULT DENSITY/SIDED CONTROLS
- . 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 "\_".

To display the current configuration of the system, type (cr). The screen will show the following:

BOOT ROUTINE: MINI-FLOPPY

MODULES INSTALLED:

MINI-FLOPPY, STEP RATE: YY (0)=SS/ST (1)=SS/ST (2)=SS/ST

BAUD RATES:

AUXILIARY: 9600

PRINTER: 9600

MODEM: 300

"(n)=xx" PHYSICAL DRIVE'S DENSITY/SIDED  
DEFAULT STATUS

"SD" = SINGLE DENSITY

"DD" = DOUBLE DENSITY

"SS" or "DS" = Single or Double SIDED

"ST" or "DT" = Single or Double TRACK density

PUSH <RED> KEY FOR MENU

### SETTING PRINTER BAUD RATE

If your printer is running at 9600 baud then go on to "SETTING STEP RATE". Otherwise move the cursor to ". SET BAUD RATES", using the down-arrow on the numeric keypad, and push ENTER. The screen should now appear as below:

BAUD RATES:

AUXILIARY: 9600

PRINTER: 9600

MODEM: 300

A = 19200	F = 600
B = 9600	G = 300
C = 4800	H = 150
D = 2400	I = 110
E = 1200	

<RED> = QUIT (NO UPDATE)  
<BLUE> = END AND UPDATE FILE  
<WHITE> = RESTART WITH ORIGINAL DATA  
<UP> = MOVE UP A LINE  
<DOWN> = MOVE DOWN A LINE  
HOME = JUMP TO TOP LINE

Move the cursor to the PRINTER baud rate line (using the keypad down-arrow) and enter the letter (A-I) for the desired baud rate. The rate will change instantly. Push the blue key to set the baud rate and return to the menu.



### SETTING STEP RATE

If your '89 contains the original Siemens disk drives as delivered by HEATH/ZENITH proceed to "INCREASING SYSTEM SIZE". If you have MPI or other drives which step faster than 30mS, move the cursor down to the ". SET MINI-FLOPPY STEP RATE" line and push ENTER. The screen will appear as below:

STEP RATE: 30mS

<RED> = QUIT (NO UPDATE)  
<BLUE> = END AND UPDATE FILE  
<WHITE>= RESTART WITH ORIGINAL DATA

Enter the digits for the step rate (leading zero is required) and the digits will roll left. Only EVEN numbered step rates are allowed, even though the display number may be odd, it will be rounded up when you push the BLUE key. For example, to change the step rate to 6mS (for MPI drives) enter a "0" and then a "6" and the display should read "06mS". Push the <BLUE> key to update MOVCPM and return to the menu.

### SETTING MINI-FLOPPY DEFAULT DOUBLE SIDED CONTROLS

If you do not have MPI B52 or other double-sided drives proceed to the next section "INCREASING SYSTEM SIZE". Otherwise move the cursor down to ". SET MINI-FLOPPY DOUBLE SIDED CONTROLS" and push ENTER. The screen will be as shown below:

```
(0)=SS/ST  
(1)=SS/ST  
(2)=SS/ST
```

```
"SS" or "DS" = Single or Double SIDED  
"ST" or "DT" = Single or Double TRACK density  
<RED> = QUIT (NO UPDATE)  
<BLUE> = END AND UPDATE FILE  
<WHITE>= RESTART WITH ORIGINAL DATA  
<UP> = MOVE UP A LINE  
<DOWN> = MOVE DOWN A LINE  
HOME = JUMP TO TOP LINE
```

Drive (0) is the drive built-into the '89, drive (1) is the first add-on, and drive (2) is the second add-on. Move the cursor to each drive which is double-sided and/or double track density and enter the appropriate indication. Don't forget to push the <BLUE> key to apply these changes to MOVCPM.

### EXIT TO CP/M

Use the "Display Current Configuration" function to verify your entries, then select the "Return to CP/M" function. The MOVCPM.COM file on your disk will be updated to reflect your exact system configuration.

## INCREASING SYSTEM SIZE

Magnolia Microsystem's CP/M™ 2.23 is distributed in a 32K version. If you have 48K or 64K of RAM in your Z89, use MOVCPM.COM to increase the system size on your operating CP/M diskette. (See page 30, Section 6.9, in the "INTRODUCTION TO CP/M™ FEATURES AND FACILITIES" manual for additional information.) If you need to make any changes to the system these should be done before increasing the system size. Refer to the previous section on DEFINING SYSTEM PARAMETERS.

A><u>MOVCPM 48(cr)</u> (substitute "64" for "48" if you have 64K of ram)

CONSTRUCTING 48K Magnolia Microsystems CP/M on HEATH Z89 : v2.23  
READY FOR "SYSGEN" OR  
"SAVE xx CPM48.COM"

A><u>SYSGEN(cr)</u>  
SYSGEN VER 2.23  
SOURCE DRIVE NAME (OR RETURN TO SKIP)<u>(cr)</u> (system is in memory from MOVCPM)  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)<u>A</u>  
DESTINATION ON A THEN TYPE RETURN<u>(cr)</u> (48K CP/M system is written to disk)  
FUNCTION COMPLETE  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT) **DO NOT** press Return; instead wait for busy light to go out, press "SHIFT" and "RESET" together, then cold boot the new system:

H: <u>Boot(cr)</u>  
Type SPACES if HDOS  
48K Magnolia Microsystems CP/M on HEATH Z89 : v2.23  
A>

You now have a working copy of 48K CP/M. Mark your disk "48K", and make a back-up copy of your 48K system disk for safety.

### CREATING A WORKING COPY OF AN APPLICATION DISK

Use this procedure to create a "bootable", working copy of any additional distribution disks that you purchase. ALWAYS keep distribution disks WRITE PROTECTED, so that you have a good copy if your system crashes.

First, make a working copy of your new distribution disk using "ONECOPY" or "COPY A: TO B:" as shown above. Always place the required copyright notices on all copies that you make, and make copies only for your own use. Return the distribution copy to a safe storage place.

Then use SYSGEN to place a copy of your CP/M system on the working disk:

```
A>SYSGEN(cr)  
SYSGEN VER 2.23  
SOURCE DRIVE NAME (OR RETURN TO SKIP)A  
SOURCE ON A THEN PRESS RETURN>(insert working CP/M disk in A:)(cr)  
FUNCTION COMPLETE (CP/M system is read into memory from A:)  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)A  
DESTINATION ON A THEN TYPE RETURN>(insert new disk in A:)(cr)  
FUNCTION COMPLETE (CP/M system has been placed on new disk)  
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)(cr)
```

A>

Now use "FILECOPY" (or "PIP" if you have more than one drive) to place the CP/M utilities you need on your new disk. These usually will include:

```
STAT.COM  
FORMAT.COM  
FILECOPY.COM and/or PIP.COM  
ONECOPY.COM or COPY.COM
```

Instructions for using FILECOPY are given in the next section of this document. Instructions for using PIP are given in the "INTRODUCTION TO CP/M FEATURES AND FACILITIES" manual, Section 6.4, page 18.

Be sure to mark all disks containing CP/M with the copyright notices:

- Digital Research
- Magnolia Microsystems

## NOTES ON MAGNOLIA MICROSYSTEM'S CP/M™ ON THE Z89

This version of CP/M™ should run any "CP/M™ compatible" software without modification. However, the following should be kept in mind:

Interrupt mode 0 (8080 mode) must be selected if the floppy disk system is used.

In addition to the WARM and BDOS vectors at 0 and 5, there is a JMP at 8 (RST 1) used for disk timing. See Appendix B for a listing of PAGE 0 assignments.

The mini-floppy disk system uses a delayed-write method to speed disk access. A write-sector operation is delayed until either a READ sector, WRITE to a different (256 byte) sector, or the drive-select times-out. DO NOT REMOVE a disk until the DRIVE SELECT light is OFF.

The MODEM port (ALTERNATE TERMINAL) is initialized to 300 baud. The LP and AUX (DCE) ports are initialized to 9600 baud.

The Console Command Processor (CCP) is a file on the disk that is loaded during cold and warm boot. The file is stored under user #31 as "CCP.SYS".

The 1K "FLOPPY DISK RAM" (moved from 1400 to F400) is NOT used by the BIOS in v2.23 and may be accessed by the user in systems with 48K or less.

The BIOS RAM requirements vary depending on which disk I/O modules are LINKed to the main (6 page) BIOS. The mini-floppy module adds 8 pages.

The "AUTO-COMMAND" is only executed at a cold boot but this may be altered.

For faster boot and SYSGEN access the first 3 tracks (system tracks) are not recorded on the disk in physical order. This does not make the disks incompatible with HDOS but HDOS's access to these tracks will be slower.

The BDOS skews the sectors (tracks 3-75) on the mini-drive in the following order:

1,2,9,10,17,18,5,6,13,14,3,4,11,12,19,20;7,8,15,16

Whenever ordering software for use under this Standard CP/M™ Operating System make sure that your software vendor knows and understands that you want the STANDARD version of the software (i.e. ORG = 0100H) not Lifeboat's modified version (ORG = 4200H).

The Lifeboat Associates Media Format Ordering Code for this CP/M™ using 5" media is P7. Specify this when ordering from them.

## UTILITIES NOT DESCRIBED IN CP/M™ MANUALS

These utilities are restricted to use on floppy disk drives.

**FORMAT.COM** Formats (or erases) disk.

This utility formats a disk and then reads each sector to verify that it has been properly formatted. It **must** be used to format all new (blank) disks before they can be used with the system.

```
A>FORMAT B:(cr)
```

```
MMS FORMAT VERS 2.23
```

```
INSERT BLANK DISK IN DRIVE B: AND PUSH RETURN >
```

At this point, insert a new disk (or the disk to be erased) into drive B: and push the RETURN key. Any errors that are detected after formatting will be reported as follows:

```
FORMAT ERROR TRACK xx SECTOR yy STATUS zz
```

Where xx and yy are the track and sector numbers in HEX and zz is the status in HEX coded as follows:

BITS:

```
7 6 5 4 3 2 1 0  
- - - - fm t0 wp ry
```

Here "ry" indicates DRIVE READY if "1", "wp" means the disk is WRITE PROTECTED, "t0" means a RECALIBRATE (SEEK TRACK 0) failed and "fm" indicates that the READ/WRITE operation was unsuccessful (if "fm" is "1", "t0" and "wp" are "0", and "ry" is "1" then the error was in the format on the disk).

If any errors occurred the program reports "DISK DID NOT FORMAT!" before prompting for another disk. Push ©C to return to CP/M (without rebooting).

**FILECOPY.COM** Single drive file copier.

This utility copies a file using only 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 the block to the new file of the same name. Care must be taken to keep track of which disk is source and which is destination. When the file 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.

A>FILECOPY d:filename.type(cr)

MMS FILECOPY VERS 2.23

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

INSERT SYSTEM DISK, PUSH RETURN >(cr)  
A>

**ONECOPY.COM** Single drive whole-disk copier.

This utility copies the entire contents of a disk using one drive. Operates like FILECOPY except no filename.type is entered.

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

MMS ONECOPY VERS 2.23

INSERT SOURCE DISK, PUSH RETURN >  
  
(etc.)

**COPY.COM** Two-drive repeating disk 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 the entire disk (both sides if the drives are double sided).

A>COPY B: TO C:(cr)

+COPY VERS 2.23  
+SOURCE ON DRIVE B:  
+BLANK ON DRIVE C:  
+<RET> TO COPY, ©C TO EXIT >(cr)

+COPY B: TO C:  
+SOURCE ON DRIVE B:  
+BLANK ON DRIVE C:  
+<RET> TO COPY, ©C TO EXIT >©c

A>

The program will report any "SOURCE" or "DESTINATION" errors and compares each track after write and reports any "COMPARE" errors. An error will abort the copy and prompt for new disks (will not return to CP/M unless ©C is pushed instead of <RET>).



The following utilities are not restricted to use on floppy drives.

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

CP/M can save a command line on a disk which is executed when CP/M is booted. The utility "SETAUTO" is used to define the command line to be executed. For example, to cause the program S1200.COM to be executed automatically when CP/M™ boots:  
(assume disk to be altered is in B:)

A>SETAUTO B:(cr)

MMS SETAUTO VERS 2.23  
ENTER COMMAND LINE:  
\*S1200(cr)  
COMPLETED.

A>

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

A>SETAUTO B:

MMS SETAUTO VERS 2.23  
ENTER COMMAND LINE:  
\*(cr)  
COMPLETED.

A>

NOTE: The command line entered will **NOT** be converted to uppercase. If CP/M™ is to recognize the command in uppercase, it must be entered in uppercase in the SETAUTO command line.

**SET.COM** Declaring a drive to be Double (or Single) sided on a temporary basis.

Use SETUP for permanent changes.

This utility limits (or permits) CP/M's use of the second side of a drive which has been defined in the BIOS as double (or single) sided. This is useful if a double-sided drive is temporarily added to a system, or if it is desired to only use the "first" side of a double-sided drive when duplicating disks to be used on single-sided drives.

The status of a drive may be display by specifying only the drive name:

```
A>>SET B:(cr)
```

```
%DRIVE B: IS SINGLE SIDED.
```

```
A>
```

To set drive B: to double-sided, type:

```
A>>SET B:DS(cr)
```

```
%DRIVE B: SET TO DOUBLE SIDED.
```

```
A>
```

The drive may be set back to single sided by typing "SET B:SS".

The format utility (FORMAT.COM) will check to see if the drive it is formatting is double sided and if it is, will format both sides of the disk. Once you are running double sided, all new disks should be formatted on both sides even if they are only intended for use on a single sided drive. This way if the disk is mistakenly used in a double sided drive it will not produce "BAD SECTOR" errors if CP/M finds the first sidefull and writes to the second side.

If the second side is accessed and the disk or the drive is not double sided, a "BAD SECTOR" error will be reported. Type ©C to reboot, then set the drive to the proper configuration.

## SETUP.COM Defining system parameters

Use SETUP to change the configuration of your MOVCPM.COM file in the following areas:

- default baud rates (printer, modem, auxiliary)
- mini-floppy step rate
- mini-floppy default side and track density control

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

A>SETUP(cr)

The default filename is "MOVCPM" and the default type is "COM". The screen will clear and the program will examine the file for current configurations and validity of data. Then the screen will initialize to:

SETUP VERSION 2.23

- . DISPLAY CURRENT CONFIGURATION
- . SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS
- . SET BAUD RATES
- . SET MINI-FLOPPY STEP RATE
- . SET MINI-FLOPPY DEFAULT DOUBLE SIDED CONTROLS
- . SET 8" FLOPPY DEFAULT DENSITY/SIDED CONTROLS
- . 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

display:

BOOT ROUTINE: MINI-FLOPPY

MODULES INSTALLED:

MINI-FLOPPY, STEP RATE: 30 (0)=SS/ST (1)=SS/ST (2)=SS/ST

BAUD RATES:

AUXILIARY: 9600

PRINTER: 9600

MODEM: 300

"(n)=xx" PHYSICAL DRIVE'S DENSITY/SIDED  
DEFAULT STATUS

"SD" = SINGLE DENSITY

"DD" = DOUBLE DENSITY

"SS" or "DS" = Single or Double SIDED

"ST" or "DT" = Single or Double TRACK Density

PUSH <RED> KEY FOR MENU\_

The only valid key is RED which returns to the menu. Notice that all mini-floppy drives (0,1,2) are single-sided and the step rate is 30 mSec. Note, also, that the printer is initialized to 9600 baud.

## SET BAUD RATES

display:

BAUD RATES:

AUXILIARY: 9600

PRINTER: 9600

MODEM: 300

A = 19200      F = 600

B = 9600        G = 300

C = 4800        H = 150

D = 2400        I = 110

E = 1200

<RED> = QUIT (NO UPDATE)

<BLUE> = END AND UPDATE FILE

<WHITE> = RESTART WITH ORIGINAL DATA

<UP> = MOVE UP A LINE

<DOWN> = MOVE DOWN A LINE

HOME = JUMP TO TOP LINE

Enter the letter (A-I) for the desired baud rate. The displayed rate will change instantly. To change the printer to 1200 baud use the <DOWN> arrow key to move the cursor to the printer baud rate line and push an "E" which is the code for 1200 baud. The rate displayed will now be 1200. Push the <BLUE> key to update MOVCPM.

### MINI-FLOPPY STEP RATE

display:

STEP RATE: 30mS ..

<RED> = QUIT (NO UPDATE)  
<BLUE> = END AND UPDATE FILE  
<WHITE>= RESTART WITH ORIGINAL DATA

Enter the digits for the step rate (leading zero is required) and the digits will roll left. To change the step rate to 12mS enter a "1" and then a "2" and the display should read "12mS". Push the <BLUE> key to update MOVCPM.

### MINI-FLOPPY DEFAULT DOUBLE SIDED CONTROLS

display:

(0)=SS/ST  
(1)=SS/ST  
(2)=SS/ST

"SS" or "DS" = Single or Double SIDED.  
"ST" or "DT" = Single or Double TRACK density  
<RED> = QUIT (NO UPDATE)  
<BLUE> = END AND UPDATE FILE  
<WHITE>= RESTART WITH ORIGINAL DATA  
<UP> = MOVE UP A LINE  
<DOWN> = MOVE DOWN A LINE  
HOME = JUMP TO TOP LINE

Enter the appropriate indication to single or double sided and/or single or double track density. If you make any changes don't forget to push the <BLUE> key to apply these changes to MOVCPM.

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" your disk, and "COLD BOOT" to implement any changes made.

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

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: input=RDR:/output=LST:	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

The default assignments (indicated by \* above) may be changed using STAT.COM as described in "INTRODUCTION TO CP/M™ FEATURES AND FACILITIES" section 6.1, page 14. 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 has been installed on your '89.

See "SYSTEM ALTERATION" Section 6, page 15 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 that contains no disk I/O modules. It will not generate a usable system in its present form, and is furnished so that we may supply future updates to you more easily. Further instructions will be furnished with the updates as they are released.

## FIXMSOFT.COM

This utility patches Heath/Zenith copies of various Microsoft products (such as BASIC-80 and FORTRAN) so that they will operate on '89s that have the MMS ORG-0 CP/M Modification Board installed. Microsoft products used on '89s without the MMS Board do not have to be patched. To use the utility type:

A>FIXMSOFT(cr)

FIXMSOFT version 1.1

Insert Heath/Zenith MICROSOFT disk in drive A:  
push RETURN (or ©C to EXIT) [insert a copy of your  
Microsoft Distribution Disk](cr)

fixed: MBASIC [The utility will report what  
fixed: OBASIC programs are beint patched]

Insert Heath/Zenith MICROSOFT disk in drive A:  
push RETURN (or ©C to EXIT) [insert the disk you booted with]©C

A>\_

Write protect the patched copy, and consider it your "Master" from now on.

## READ.ME

This text file, if present on your distribution disk, will contain information newer than that included in these printed instructions. To view the file, type:

A>TYPE READ.ME(cr)

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



## MODIFYING SYSTEM CONFIGURATION

>>>> REMEMBER!

ANY CHANGES MADE IN "MOVCPM.COM" WILL NOT BE EFFECTIVE UNTIL A NEW SYSTEM IS CREATED AND SYSGEN'D. SEE "INTRODUCTION TO CP/M™ FEATURES AND FACILITIES" SECTION 6.9 OR PAGE 1.11 FOR THIS PROCEDURE.

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 0100 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 on page 2 of "DDT USERS GUIDE".

## 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 disk 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. 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:

```
A>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:

A>TYPE USER.PRN

.  
. .  
.

```
OA00=          ;-----  
                BIAS    EQU    2000-BIOS    ;OFFSET FOR DDT  
                ;-----
```

(strike any key to stop listing)

And now merge it into CPM48.COM:

A>DDT CPM48.COM

DDT VERS 2.2

NEXT PC

2B00 0100

-IUSER.HEX

-ROA00

NEXT PC

2B00 0000

-@C

A>

Now SYSGEN the new system:

A>SYSGEN

SYSGEN VER 2.23

SOURCE DRIVE NAME (OR RETURN TO SKIP)(cr) (skip, system is already in memory)

DESTINATION DRIVE NAME (OR RETURN TO REBOOT)A(cr)

DESTINATION ON A THEN TYPE RETURN(cr)

FUNCTION COMPLETE (new system has been placed on disk)

DESTINATION ON A: THEN TYPE RETURN (after LED is off press SHIFT/RESET)

Re-boot using the new system:

H: Boot(cr)

Type SPACES if HDOS

48K Magnolia Microsystems CP/M on Heath Z89 : v2.23

A>

Your re-configured system is now up and running.

Or the new image may be saved by typing "SAVE xx CPM48.COM".

### CHANGING BAUD RATES FROM A PROGRAM

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,80H
        OUT    A,PRINTER+3
        MOVA   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 ">" or it can be set into the "AUTO" field of the CCP so that the baud rate is set whenever CP/M™ is booted.

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:

```
A>DDT MOVCPM.COM(cr)  
DDT VERS 2.2  
NEXT PC  
zzzz 0100  
-D2160,216F(cr)  
2160 03 00 E5 2A FE 1A 36 C9 21 00 08 22 6E 16 0E 00 ...*..6.!.."n...  
-S2160(cr)  
2160 03 00  
2161 00 .  
-@C  
A>SAVE xx MOVCPM.COM(cr)
```

## BIOS DETECTION OF ESCAPE SEQUENCES

Provisions have been made in the 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.

### LOGICAL/PHYSICAL DRIVE ASSIGNMENTS

Before a drive is selected the drive number is converted in the SELDSK routine. SELDSK is called with a logical drive number in register C and returns the corresponding physical drive number in register C. The table used for this conversion can be altered using SETUP.COM. The physical mini-floppy drives are:

- 0 = First (built-in) Mini Floppy
- 1 = Second Mini Floppy (1st add-on)
- 2 = Third Mini Floppy (2nd add-on)

Other physical numbers will be assigned to disk types as they are released.

If you are booting from a drive other than the first mini-floppy the logical-physical drive table in the system being booted must put drive A: as the disk you are booting so that the CCP file can be loaded.

MINI-FLOPPY TRACK/SECTOR ALLOCATION TABLE

Track#	Sector#	Memory Address	CP/M™ module name
00	01	2280	Cold start loader
00	02	2300	''
00	03		BDOS
00	04		''
00	05		''
00	06		''
00	07		''
00	08		''
00	09		''
00	10		''
00	11		''
00	12		''
00	13		''
00	14		''
00	15		''
00	16		''
00	17		''
00	18		''
00	19		''
00	20		''
---01	01		BDOS-----
01	02		''
01	03		''
01	04		''
01	05		''
01	06		''
01	07		''
01	08		''
01	09		''
01	10		BDOS
01	11		BIOS
01	12		''
01	13		''
01	14		''
01	15		''
01	16		''
01	17		''
01	18		''
01	19		''
01	20		''
---02	01		EXTENDED BIOS AREA-----
02	02		''
02	03		''
02	04		''
02	05		''
02	06		BIOS

02	07	BIOS
02	08	''
02	09	''
02	10	''
02	11	''
02	12	''
02	13	''
02	14	''
02	15	''
02	16	''
02	17	''
02	18	''
02	19	''
02	20	BIOS
03	1-16	Directory*
03	17-20	Data*
04	1-20	''
''	''	''
39	''	''
----- double-sided only -----		
40	1-20	''
''	''	''
75	''	''

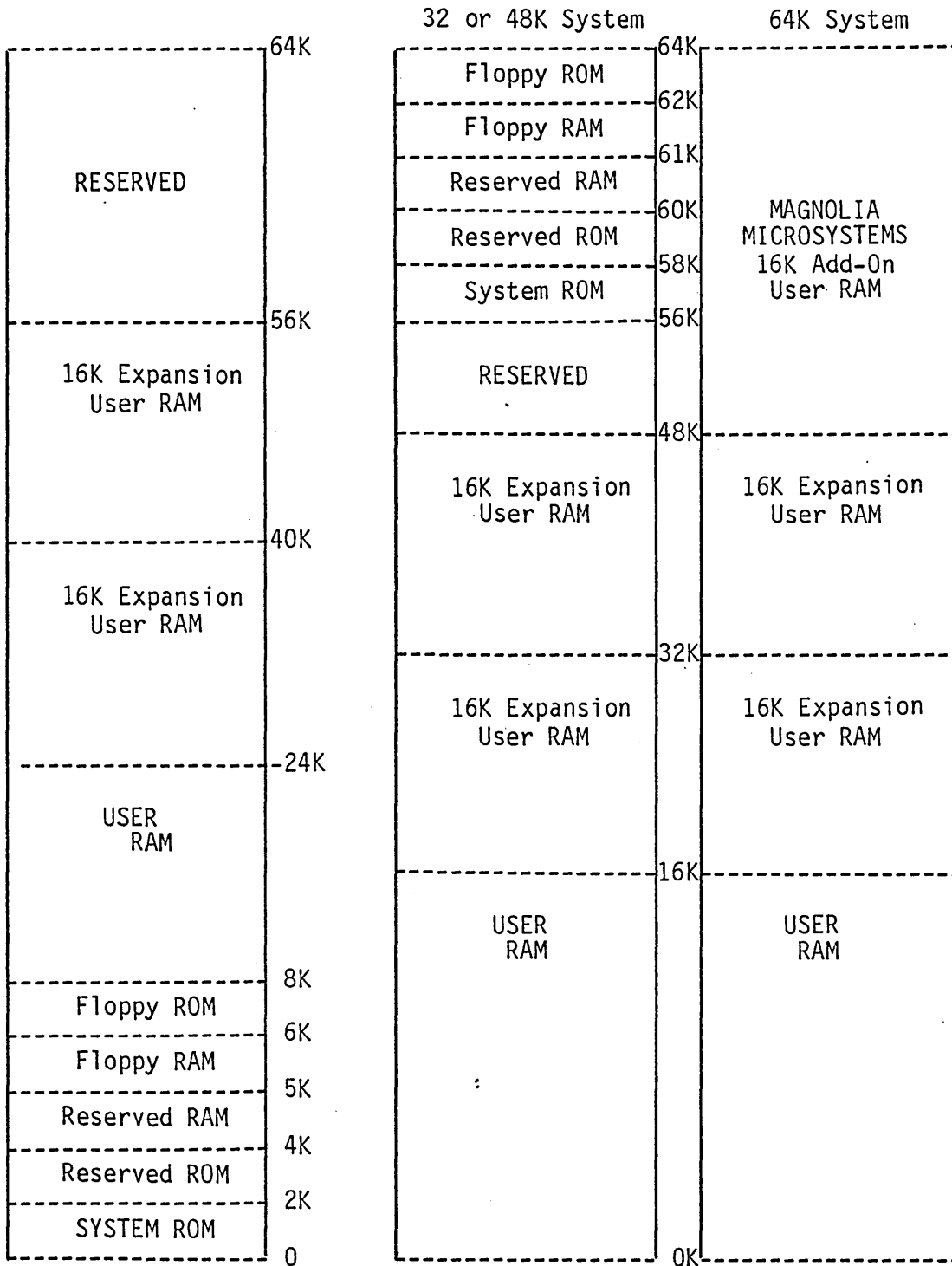
\* The system Console Command Processor (CCP) is contained on the disk in a file named CCP.SYS under user #31 and is loaded during a cold boot into RAM just in front of the BDOS.



**MEMORY MAP**

HDOS Mode (RESET)

Standard CP/M Mode (Org 0)



## INTERFACING PERIPHERALS TO THE Z89 AND 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 drivers.

The drivers 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 the printer is accessed, so connect unused inputs to a "High" level.

The following data will help you connect your printer to the Z89's LP port (P1) if you choose to use the standard device drivers furnished with your CP/M™.

If you prefer, you may change the standard device driver by following the procedure given on page 21. HOWEVER, Magnolia Microsystems can provide no technical assistance to help you with non-standard device drivers. If you are only making a minor change, you may wish to use DDT on MOVCPM.COM or on an image file of CPMxx.COM to "patch" the code, instead of re-assembling and overlaying it as described. Several customers have reported that changing the following two bytes has allowed them to use their standard HEATH (HDOS) cables, but this change HAS NOT BEEN VERIFIED and IS NOT SUPPORTED by MMS:

```
LPTSTO:      ;Z89 LP PORT OUTPUT STATUS;
             IN      PRINTER+6
             ANI     00110000B      ;CTS,DSR  --> ANI 00010000      ;CTS ONLY
             CPI     00110000B      ;BOTH    --> CPI 00010000      ;JUST ONE
             MVI     A,0
             .
             .
```

### DIABLO 630:

Install 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.

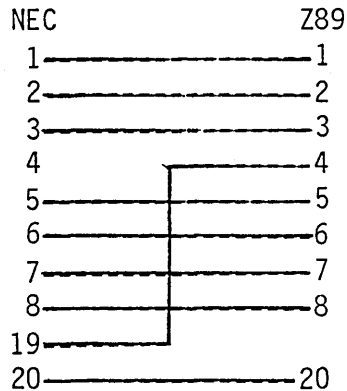
### DIABLO 1640/1650:

Install 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:

Build an RS-232 adapter as shown:

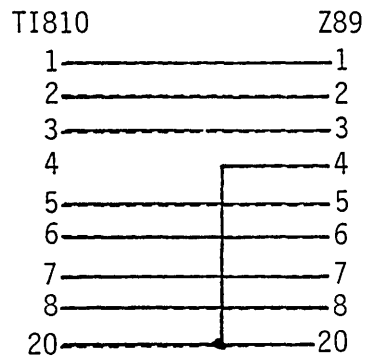


OR this change may be effected internally to the NEC. Remove the printer cover and trace the RS-232 cable back to the interface PC card. Disconnect the cable at the card and remove the hold-down clip on the connector housing to expose the hold-in tabs on the connector pins. Remove the pin from connector 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:**

Install the "DNB" option on the Printer's CPU board: Remove the printer's cover and the cover to the card-cage. The CPU board is tagged GREEN on its right ejector. Near the center of the right half of the CPU board is a set of jumpers labeled "E4", "E5", and "E6". To enable the "DNB" option E5 must be connected to E6. Carefully re-seat the CPU board and re-assemble the printer case. Use an RS-232 cable configured as shown:

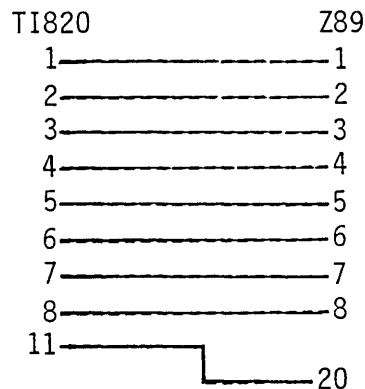


Alternately, this same strapping can be performed at XU1 on the motherboard of the 810:

Remove the resistor pak at XU1. Bend pin 8 up and over and solder to pin 7. Replace resistor pak at XU1.

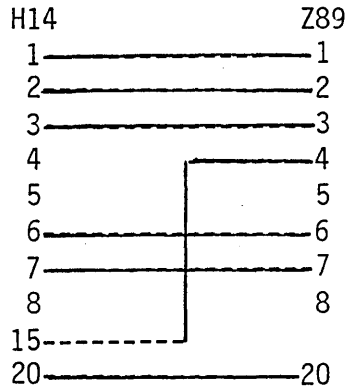
**TI 820:**

Select configuration code 14 (and 28 for 9600 baud) **AND** build an RS-232 cable as shown:



**H14:**

Strap the H14 internally to provide "NOT BUSY" on pin 15 (as described in HEATHKIT manual H14/ 595-2172), and build the following RS-232 adapter cable:



Note: **NO** connection on pins 5 or 8.

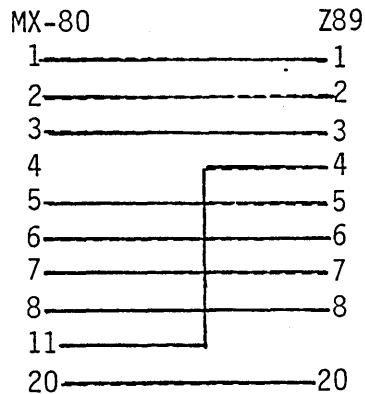
**EPSON MX-80:**

Epson is currently supplying two types of serial cards, Model 8140 and 8141. They are supported by selecting 9600 baud, 8-bit words, and **NO** parity checking, as follows:

8140: Cut option jumpers "J8/7", "JB1", "JB2", and "JPDS".

8141: Set dip switches 1-1 thru 1-8 all "OFF".

On **BOTH** cards, add a small jumper wire to the back of the female RS-232 onBector (for handshaking) connecting pin 4 (RTS) to pin 11 (Printer Ready), or, build the following cable for use between the MX-80 and '89:

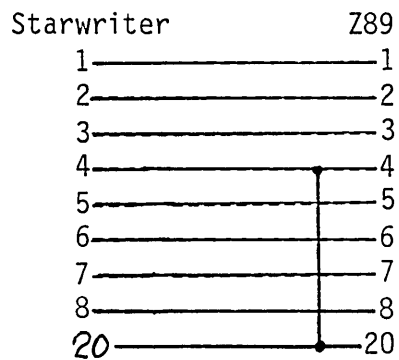


### QUME SPRINT 5:

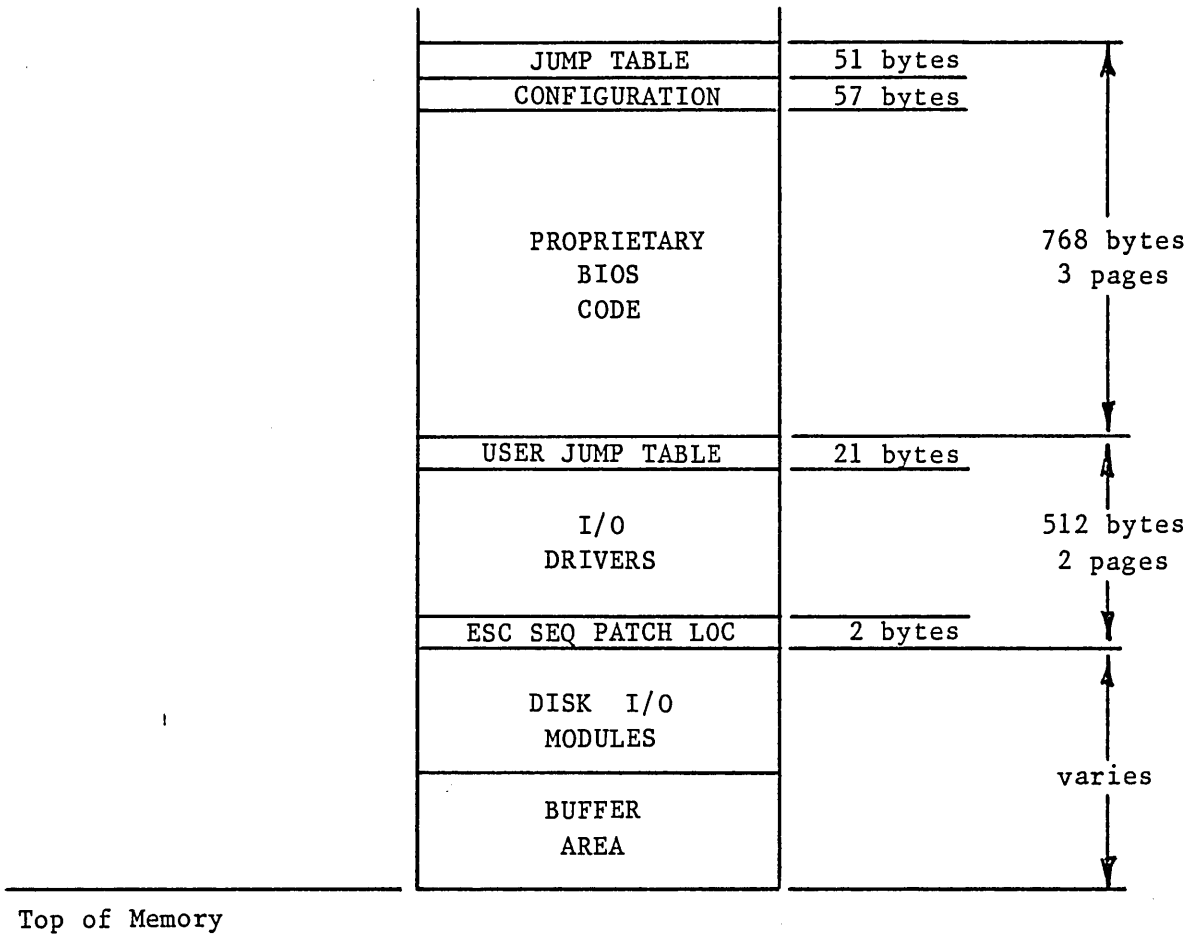
No Printer changes or Cable Adapters necessary -- just plug it in!

### STARWRITER

The CITOH "Starwriter" Daisy Wheel printer provides handshaking on pin 20 or 4 only. Add a wire between pins 4 and 20 inside the Starwriter and use a pin-to-pin cable, or, add the jumper between pins 4 and 20 inside the cable as follows:



**APPENDIX A  
BIOS MEMORY MAP**



**APPENDIX B  
RESERVED LOCATIONS IN PAGE ZERO**

With the following exceptions, PAGE ZERO is as defined in "CP/M 2.0 ALTERATION GUIDE" section 9, page 23.

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 mini-floppy disk system is in use.
000EH-000EH	Contains the 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.
0030H-0032H	Contains the interrupt service routine for the 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 only have to exist on USER 0 but can 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 corresponds to drive A: and the most significant bit to drive P:. A disk I/O module can access this value to further insure file protection. The following code in the WRITE-SECTOR routine will effect this:

```
INIT$RO EQU PATCH-2 ;address of default R/O vector (relocatable)

WRITE$SECTOR:
    LXI H,MIXER ;find out what logical drive we are
    LXI B,16 ;search 16 drives
    LDA NEWDSK ;drive we're looking for
    CCIR ;Z80 Compare, Increment, Repeat
    JNZ ERROR ;error if drive not found
    LHLD INIT$RO ;get R/O vector
    INR C ;(C) points to proper bit in vector
    ROTL DAD H ;rotate (HL) left
    DCR C ;count bits
    JNZ ROTL ;keep rotating until bit is in carry
    JC ERROR ;if bit is set we must not write to disk
    .
    .
    .
```

**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 Command 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 this byte is zero (as shipped) then the current disk is used, as normally expected. If this byte is 01 thru 10 (hex) then the indicated drive (01=A:, 10=P:) is assumed for loading commands. This allows all utilities to be on only one predetermined drive and not all working disks. This also enhances the system when used with a hard disk being accessed by many users (ie, CORVUS Winchester drive with CONSTELLATION multiplexer).

Disk Reset 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.