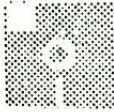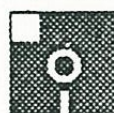MAGNOLIA
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77318 128K RAM BOARD

HARDWARE INSTALLATION

and

CP/M^{tm} v2.2 SOFTWARE INSTALLATION

for the

HEATH/ZENITH Z89 and Z90

DIGITAL COMPUTER

MAGNOLIA MICROSYSTEMS, INC.
2264 - 15th Ave. W. • Seattle, WA 98119

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INTRODUCTION

MAGNOLIA MICROSYSTEMS 128K RAM BOARD FOR THE '89

NOTE: Throughout these instructions the nomenclature "'89" will include ALL Heath/Zenith computers with model numbers containing "88", "89", or "90". Differences between these models will be discussed where they affect the installation of the MMS product.

Your 128K RAM board package contains the following items:
- 128K RAM extension board, part number 10-77318-2
- Memory map control board, part number 10-77318-1
- 3.5-inch 3-conductor jumper cable
- 4-inch 16-conductor ribbon cable
- 74S132 integrated circuit (not needed for some installations)
- 4-inch cable tie
- Mounting Bracket, card guide, and screws
- Floppy Disk containing RAM Test and CP/M v2.2 support software

HDOS support software for the 128K RAM board is available from:
QUIKDATA COMPUTER SERVICES, INC.
2613 Penn Circle
Sheboygan, WI 53031

After installing this package, your '89 will contain a total of 176K of RAM which can be used in several different memory maps under program control. The '89 retains full compatibility with existing operating systems:

- 56K HDOS, with BK of system ROM/RAM in low memory
- 64K CP/M, with phantoming of 8K system ROM/RAM compatible with both the Zenith and Magnolia releases of CP/M
- CP/M-Plus (CF/M v3), with improved disk system performance

A detailed description of the various maps available is given in the section entitled "ACCESSING ALTERNATE BANKS OF MEMORY".

CP/M v2.2 support software (for both the Magnolia and Zenith releases of CP/M) which treats the additional 112K of RAM as a disk drive is furnished with the board. This software package creates an "invisible disk" with 98K (or 110K) of usable space, 64 directory entries, and an average access time of only 3mSec. (Compared to the 700mSec access time of the standard 5-inch floppy!)

Information about additional software support for this board may be included in a "READ.ME" file on the "CP/M v2.2 Support Software" diskette.

HARDWARE INSTALLATION
PLEASE -- READ ALL OF THESE INSTRUCTIONS BEFORE STARTING!!

Refer to the illustrations on the next page as required

1. Remove the cover from your '89:

- Unplug the '895 line card from the AC outlet
- Release the latch plates on both sides of the computer
- Tilt the top cover back and unplug the fan (do not allow the shell to hang unsupported)
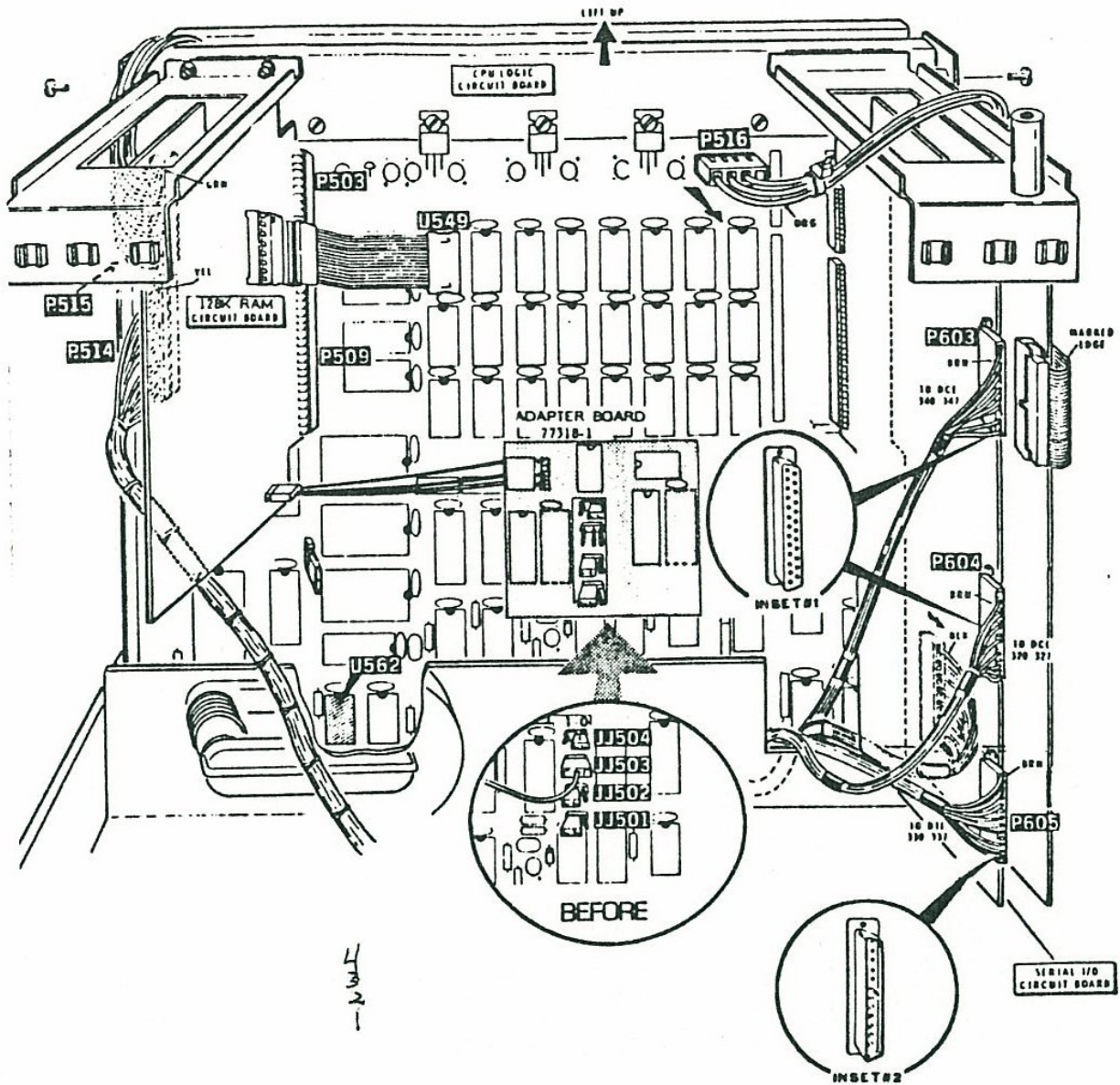- Set the cover aside.

2. Verify that U562 on the CPU board is a 7A<u>S</u>132.

- Temporarily raise the CPU board (remove the two screws at the top of the CPU board and three cables at P510, P515 and P516) and check the type number of IC U562. If it is marked "70§132" or "443-792" SKIP TO STEP 3.
- IF NOT, remove U562 and replace it with the 716132 furnished with the new 128K RAM board.
- Temporarily replace the CPU board, reconnect PSIA (yellow wire up), P515 (green wire up), and P516 (orange wire to the left); plug the '89 in and verify that an H: prompt still appears. IF NOT, see the section "IN CASE OF DIFFICULTY"
- Unplug the '89 after testing; remove P514, P515, and P516; and raise the CPU board again.

3 Prepare P503. P509, and U5b9 socket

- If the computer presently contains a 16K add-on RAM board (either Zenith or MMS) remove it and store in anti-static packaging for protection. Also remove the 16-conductor DIP cable to U509 on the CPU board.
- OTHERWISE, verify that the CPU board is populated with a full ABK of RAM - if not, install 10116 RAM chips (available separately) to bring it to 148K.
- If necessary, remove the 16K RAM chip from U549 and save it in black foam

ILLUSTRATIONS

ILLUSTRATIONS

WARNING: Boxed-in areas show hazardous voltage locations.

CABINET SHELL

TILT BACK

LATCH PLATE

SLIDE FORWARD TO UNLATCH

INSET

OR

LATCH PLATE

SLIDE BACK TO UNLATCH

INSET

SMALL CABLE TIE

ANODE SOCKET
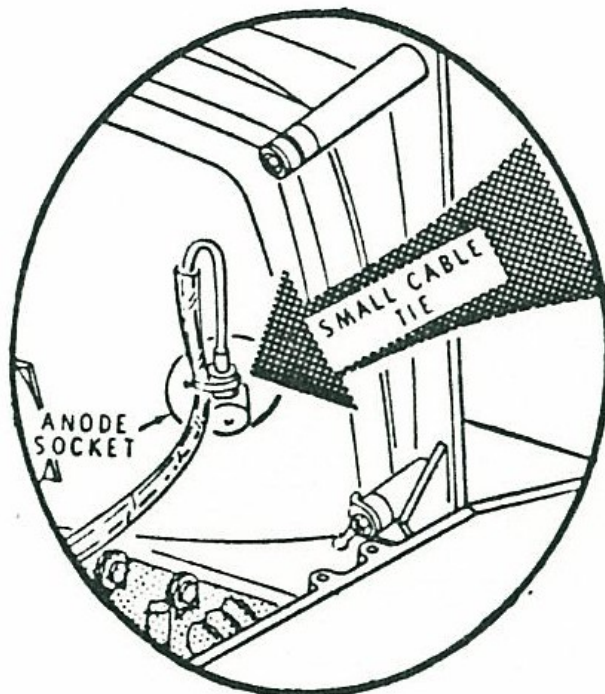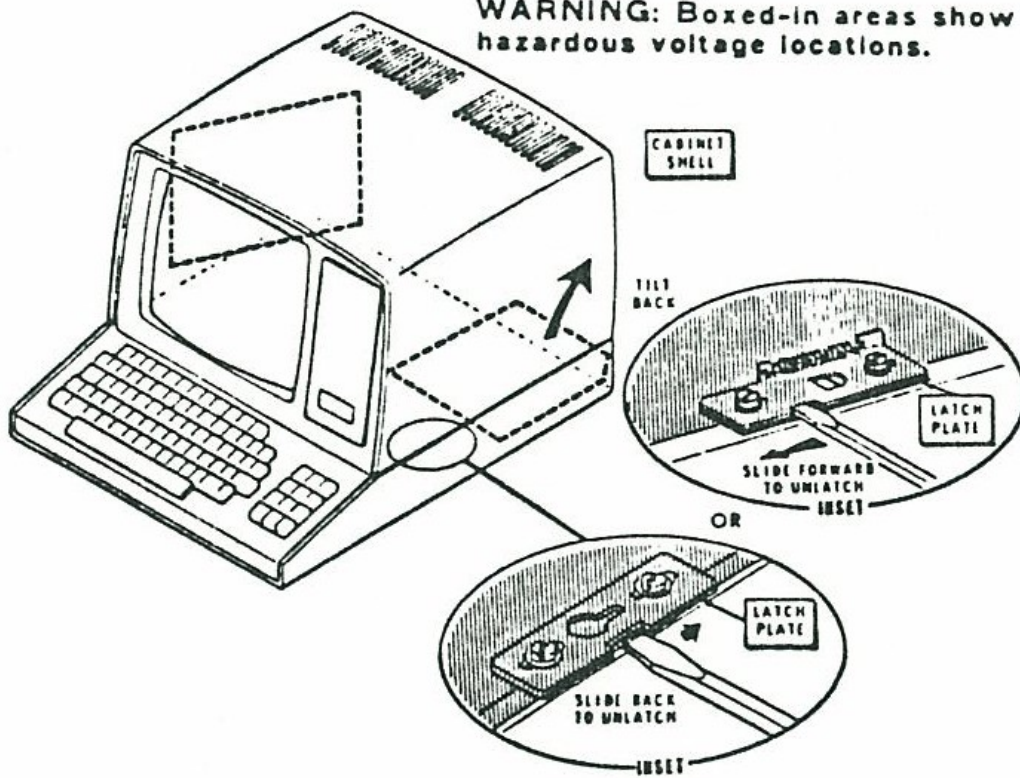
4. Install the new memory map control board, P/N 10-77318-1:

- If your '89 contains a MMS ORG-0 CP/M modification board (P/N 10-77312) remove it from sockets U517 and U552 and save it in a piece of foam
- OTHERWISE, simply remove 10; U517 and U552 from the CPU board and save them in a piece of foam
- If your '89 contains the Zenith 88-7 CP/M PROM upgrade, remove the jumper wire between JJ503 and P509 pin 17 and save it (it is replaced by a trace on the new memory map control board)
- Place the bottom programming jumper (3.1501) on the CPU board in the "1" (left) position. The top jumper (JJ503 on RFI machines, JJ504 on old machines) should be left in the "0" (right) position. JJ502 (and JJ503 on old machines) are no longer used and may be left in either position.
- Carefully plug the new control board into the empty sockets U517 and U552 as shown

5. install the new 128K RAM board, P/N 10-77318-2:

- Plug the new 128K RAM board on P503 and P509
- Install the 16-conductor DIP cable between the new board and U549 on the CPU board. The striped edge of the cable should be "up" on both ends.
- Install the 3-conductor jumper cable between the male connectors on the two new cards, observing that the missing pin matches the missing wire on the cable.

6. Exercise care when working near the neck of the CRT. If your '89 was built from a new "RFI" kit, there will be minimal clearance between the control board and the CRT socket.

- Carefully lower the CPU board back down. Replace the two screws removed in step 2.
- Reinstall the power connectors P514 (yellow wire up), P515 (green wire up), and P516 (orange wire to the left).
- Check that all I/O cables (disk drive and serial port) are properly connected. Replace any that have pulled loose.
- If necessary, use the small cable tie furnished to create a loop at the CRT end of the heavily plastic-encased high voltage lead (to remove the excess length and hold it away from possible contact with the 128K RAM board). If your machine was built from a kit this may have already been done. This will prevent the damage which could occur from high voltage coming into contact with the board.

7. Install the Mounting Bracket using two 6-32 screws, making sure that the 128K RAM board is in the slot in the plastic card guide.

8. Reinstall the cover, reversing the steps shown in step 1 on page 4.

9. Connect the computer to an AC outlet and turn it on. It should beep twice, just as before. If not, see the section "IN CASE OF DIFFICULTY".

10. Use the monitor memory test function, either Go 7375(cr) in Zenith PROMS or M(cr) in Magnolia PROMS. The LWA value displayed should be 377377 (octal) or FFFF (hex), representing the full 64K of RAM available. Let the test complete at least one full cycle without error. If any errors occur, see the section "IN CASE OF DIFFICULTY".

11. This completes the hardware installation and preliminary checkout. Unit: which were equipped with 64K of RAM prior to installation of the new card should operate just as before, running 64K CP/M (either Zenith or Magnolia releases) and/or 56K HDOS. Users newly upgrading from 48K must use MOVCPM to generate a 64K copy of CP/M and SYSGEN the disks to be used in the 64K machine. HDOS will automatically use the extra memory, and should sign on as "56K" (the maximum usable because of the ROM, etc., in the bottom 8K of the address space).

12. Extended Memory Test:

- Boot a copy of your CP/M system disk.
- Execute the utility "TEST128K" (found on the "CP/M v2.2 Support Software" distribution disk). If you only have HDOS, you must purchase the HDOS support software.
- Follow the instructions provided on the CRT.

SOFTWARE INSTALLATION

Software installation procedures depend completely upon which operating system is to be used with the 128K RAM board. Support software for four (4) different operating system releases are available:

- CP/M Plus (CP/M v3) -- see the "Supplemental User's Guide" included with your CP/M Plus documentation set.
- CP/M v2.2 (Magnolia Microsystems Release) -- see the installation instructions in the following section.
- CP/M v2.2 (Heath/Zenith Release) -- see the instructions in the "RAMDISKDOC" file on the "CP/M v2.2 Support Software disk.
- HDOS -- refer to the installation instructions included with the separately purchased support package.

"INVISIBLE DISK" SOFTWARE INSTALLATION

NOTICE: These instructions apply ONLY to users of the Magnolia Microsystems release of CP/M v2.2 for the '89. Users of the Heath/Zenith release of CP/M '89 must follow the instructions included in the file "RAMDISK.DOC" on the CP/M v2.2 Support Software disk.

The Magnolia release of CP/M for the '89 uses a proprietary method to "LINK" special CBIOS modules together to create the exact disk subsystem support needed by each user. If your Magnolia CP/M distribution disk contains the file BASECPM.COM you have a release which supports the "INVISIBLE DISK" software furnished with the 128K RAM board. If your disk does not contain this file, it must be updated before you can use the new software. Contact your Dealer for this update. Your disk(s) will be updated to the current release, and returned with a copy of the current MMS CP/M User's Guide.

NOTE: Refer to the appropriate section in your MMS CP/M User's Guide for additional information on the utilities used in the following instructions.

1. Boot up a copy of your CP/M distribution disk, and move copies of the following files to your system disk from the new distribution disk:

        M318A.HEX   WARMBOOT.COM   DEFAULT.COM
        M318B.HEX   BOOTINV.COM   LINK.COM
        B318.HEX

2. Choose one of the "Invisible Disk" modules, M318A or M318B, to include in your system. M318A has 110K-bytes of file space but has no system space. M318B ("B" for "Bootable") has only 98K-bytes of file space, but has system space, thus allowing use of the WARMBOOT and BOOTINV utilities. See the description of each of these utilities for more details.

3. LINK the selected "invisible disk" module into your MOVCPM file (M318B is used here as an example):

```
A0>LINK M318B MOVCPM(cr)

...
Link Completed
A0>
```

4. Use SETUP to assign the "invisible disk" (physical drive an) to the desired logical drive name:

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

    select "SET LOGICAL/PHYSICAL DRIVE ASSIGNMENTS" and place the "INVISIBLE DISK" at the desired logical device. (We will assume "I:" for the balance of this discussion.) Some older versions of SETUP will use the name "Unknown Disk Module" instead of the correct name, however, everything will still work correctly.

    EXIT back to CP/M.

5. Execute MOVCPM, and SYSGEN a disk to test the new system.

6. Shift/Reset the '89, and COLD BOOT the new system.

7. The "invisible disk" can now be used just like any other drive. See the section "USING THE INVISIBLE DISK" for possible applications.

NOTE: The directory of the Invisible Disk will be cleared the first time the disk is accessed (for example, by asking for a directory of it). This will happen only once after turning on the '89 (unless you change operating system configurations or versions, which will destroy the data on the 'disk'). A simple Shift-Reset DOES NOT destroy any valid data on the disk. Simply re-boot the same operating system, and continue using the disk.

ERROR MESSAGES

When using an MMS CP/M 2 system with many disk I/O modules, you may encounter the message:

INVISIBLE DISK MODULE BELOW 56K BOUNDARY!

which appears in reverse video on the 25th line of the screen. The message denotes that the Invisible Disk module is so low in memory that performing a bank-switch would disable the module (sea "ACCESSING ALTERNATE BANKS OF MEMORY" for details). This condition can be corrected by building a new CP/M system with the Invisible Disk module LINKed after you have LINKed most of the other modules.

If you boot a system with the Invisible Disk module on an '89 with no 77318 board installed, you may see the error:

MEMORY MAP ERROR!

If the message appears when the board is installed, than review the installation procedure to find the cause of the error.

USING "INVISIBLE DISK" UTILITIES

NOTICE: These utilities can be used ONLY with the Magnolia Microsystems release of CP/M 2 for the '89.

DEFAULT.COM

This utility changes the default command drive byte in the CCP file. The default command byte is discussed in "DEFAULT SYSTEM FILE STORAGE". DEFAULT allows you to specify a different default system drive without having to re-SYSGEN your system. Typing:

```
A0>DEFAULT d:(cr)
```

changes the default command drive from whatever it presently is to drive d:.

WARMBOOT.COM

If you use the M318B module, you can make your system warm-boot faster by typing:

```
A0>WARMBOOT d:(cr)
```

where d: is the name of the Invisible Disk. The WARMBOOT utility writes the current BDOS and CCP to d:. and makes CP/M think of drive d: as A: during each warm boot. WARMBOOT may be applied more than once; i.e., you can switch back to booting from A: by specifying A: as the WARMBOOT drive. NOTE: If drive d: has been SYSGENed, the system image there will be DESTROYED unless: 1) d: is A:, or 2) the system on d: is identical to the system on A:.

BOOTINV.COM and B318.HEX

The BOOTINV utility allows you to do a "virtual boot" from the Invisible Disk. After you have built and SYSGENed a system to communicate with the Invisible Disk (using M318B.HEX) as described in "INVISIBLE DISK" SOFTWARE INSTALLATION, use the following procedure to make a system that can be booted from it:

```
PIP ICPM.COM=MOVCPM.COM[V]     ; make a copy of OVCPM
LINK M318B ICPM                ; LINK in the M318B.HEX module
LINK B318 ICPM                 ; LINK the Invisible Disk boot module
SETUP ICPM                     ; select "Set Logical/Physical Drive Assignments",
                                 and set the Invisible Disk (drive #0) as A:
ICPM                           ; create an image of the new system
SYSGEN                         ; write the system from memory to the Invisible
                                 Disk
BOOTINV                        ; "boot" the Invisible Disk
```

A system booted from the Invisible Disk can be used just as you would use any other system, but is much faster. If you have a monitor EPROM which supports 'booting' from the Invisible Disk, your can even 'cold-buot' your computer once you have 'sysgened' it.

USING THE "INVISIBLE DISK"

We expect many unique uses for the "invisble disk" concept to be developed. Some that have been used successfully by Magnolia Microsyeteme, Inc., include: '

DEFAULT SYSTEM FILE STORAGE

The CCP in the Magnolia release of CP/M for the '89 supports a "default system drive" feature. The logical device to be used as the "default system drive" is defined by the last byte in the CCP. An option in the SETUP utility (v2.24 or later) is to define this "default system drive"; users with earlier versions of SETUP (or DDSETUP) can use the DEFAULT utility to 'patch' this byte in the CCP file instead.

The enhanced CCP, when looking for a .COM, file:
  • looks on the logged-on drive, first under the current user number, then under USER 0 if not found
  • if still not found, looks on the "default system drive", again under both the current user number and USER 0.

For an example using a combination of the "invisible disk" together with the "default system drive" feature, consider an '89 being used as a single-drive Word Processing work station:

Configure a bootable CP/M disk that has the "invisible disk" as B:. and also define B: as the "default system drive". Put copies of all commonly used programs on this disk. Using Magic Wand(tm) as an example:

        EDIT.COM
        PRINT.COM
        STAT.COM
        FORMAT.COM
        PIP.COM
        SYSGEN.COM

Execute the following command lines upon boot (you may want to use the SETAUTO utility to run a SUBMIT file that does this):

        PlP B:=A:*.COM[V]
        WARMBOOT B:

This will copy the programs and part of CP/M to the "invisible disk", where they will remain until the power is interrupted to the '89. Drive A: can then be used for text disks. The system will get EDlT and PRINT, etc., from B: (the "invisible disk"). so these files are not needed on each text disk. in addition, the system will load the BDOS and CCP from the "invisible disk" when the machine "warm boats" at the end of each .COM file, so the text disks do not have to be SYSGENed.

WORKING and TEMPORARY FILE STORAGE

Many application programs (communication packages, compilers, sorting packages, etc.) require temporary disk storage while they are running. Or, a data lookup file might require frequent disk access. Using the "invisible disk", with its 3ms latency, will significantly enhance the speed at which disk I/O bound programs can operate. The responsible programmer must remember, however, that the storage is volatile, and he must recover any needed files before the operator powers the machine down.

We use this feature in-house as follows to update Assembly Language programs:

1. Move the source file from diskette into the "invisible disk"
2. Edit and Assemble using the "invisible disk" for all intermediate files (such as .BAK, .PRN and .SYM).
3. Save the revised source on diskette before debug is started
4. Debug as required
5. Go back to step 2 as needed. Remember, even Shift-Reset doesn't destroy the data. if a crashed program corrupts the "invisible disk", reload the file from diskette.

This technique speeds the software production cycle significantly.

Other new uses for the 128K RAM board may be described in a "READ.ME" file on your distribution software disk.
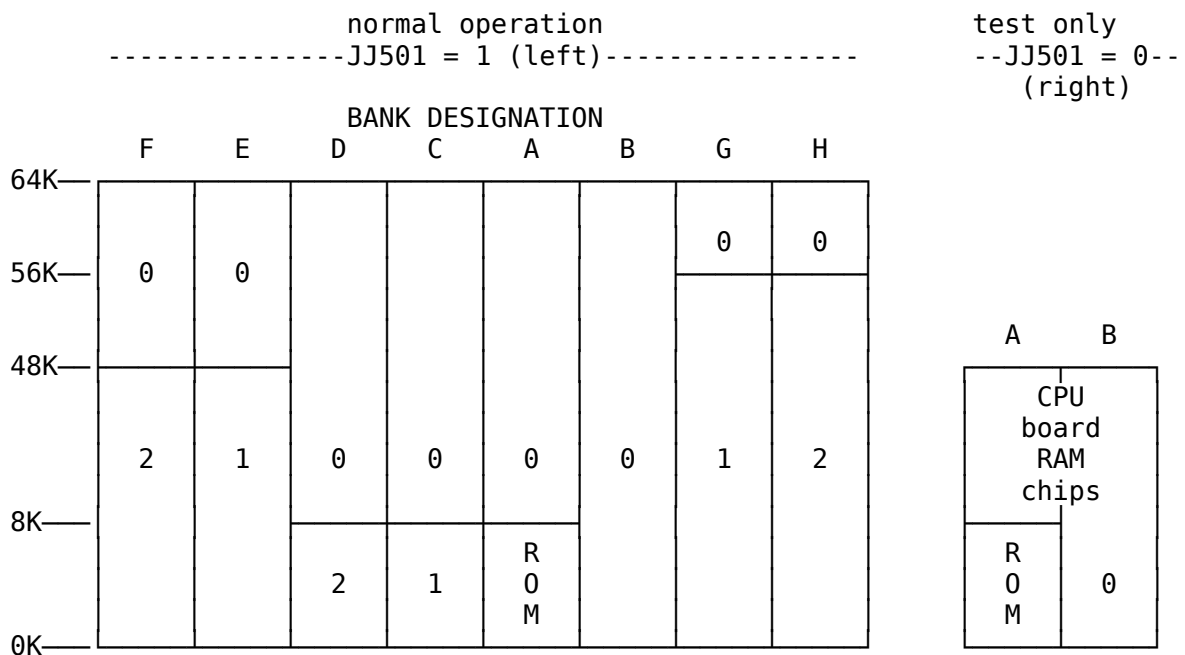
ACCESSING ALTERNATE BANKS OF MEMORY

NOTICE: Magnolia Microsystems can provide additional assistance in using the extra RAM provided by this card at our standard Consulting Rates. Contact our Customer Service Department if you need to arrange for this service.

The BANKSW.ASM file contains all the routines necessary to control the board set from the assembly language level. Be sure to note the cautions given in the file -- learning to work in a bank-switched environment is complex and may require that you learn new programming techniques.

The INVDISK.ASM source file is a good example of how to control the Bank Switching capabilities of the 128K RAM board package, using the foundation given in BANKSW.ASM.

The following chart graphically depicts the various memory maps available. Use it in conjunction with the source files to understand the software required.

```
                        normal operation                        test only
           ---------------JJ501 = 1 (left)----------------      --JJ501 = 0--
                                                                   (right)

                          BANK DESIGNATION
          F       E       D       C       A       B       G       H
   64K─┐ ┌───────┬───────┬───────┬───────┬───────┬───────┬───────┬───────┐
       │ │       │       │       │       │       │       │   0   │   0   │
   56K─┤ │   0   │   0   │       │       │       │       ├───────┤       │                 A       B
       │ │       │       │       │       │       │       │       │       │           ┌───────┬───────┐
   48K─┤ ├───────┼───────┤       │       │       │       │       │       │           │       CPU     │
       │ │       │       │       │       │       │       │       │       │           │      board    │
       │ │   2   │   1   │   0   │   0   │   0   │   0   │   1   │   2   │           │       RAM     │
       │ │       │       │       │       │       │       │       │       │           │      chips    │
    8K─┤ │       │       ├───────┼───────┼───────┤       │       │       │           ├───────┼───────┤
       │ │       │       │       │       │   R   │       │       │       │           │   R   │       │
       │ │       │       │   2   │   1   │   O   │       │       │       │           │   O   │   0   │
       │ │       │       │       │       │   M   │       │       │       │           │   M   │       │
    0K─┘ └───────┴───────┴───────┴───────┴───────┴───────┴───────┴───────┘           └───────┴───────┘
```

The '89 is in bank A upon power up. with system ROM/RAM in the bottom 8K of its memory space, with up to 56K of RAM above that.

Normal CP/M operation uses Bank B, in an all-RAM configuration. The switch between A and B is controlled by D5 on the GP output port, as defined by Zenith CP/M.

In order to access any of the other 6 banks (C thru H), bits D2 and D3 on the GP output port must be taken thru the "unlock" sequence defined in the .ASM file on the disk.

Once this "unlock" sequence has been output, bits D2, D4, and D5 control which of the eight memory mep options is in use, as shown in the .ASM file on the distribution dink.

Maps C and D allow the users' program (which obviously must be above the 8K boundary) to initalize the bottom BK of memory pages 1 and 2. This feature is especially useful to HDOS users.
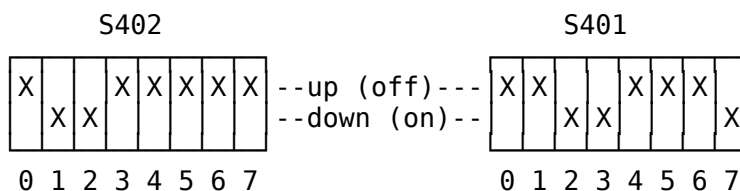
Maps G and H allow for a 8K common page in high memory, allowing programs in this top 8K to access 56K banks 0, 1 and 2. These two maps are used by the "INVlSIBLE DISK" software on the distribution disk.

Maps E and F provide the 16K common page required by MP/M II, with access to three 48K banks (0, 1, and 2) by programs running in the top 16K of RAM.

IN CASE OF DIFFICULTY

If the H: or MMS: prompt appears but the machine does not beep when turned on, you may have inadvertently disconnected the speaker wire from P402 on the Terminal Logic Board when moving the CPU board. Reconnect the wire and re-test.

If the usual H: or MMS: prompt does not appear and the machine does not beep when turned on, you may have inadvertently moved a DIP switch on the Terminal Logic Board when moving the CPU card. Re-set the switches to the proper position, usually:

```
           S402                                     S401
 ┌─┬─┬─┬─┬─┬─┬─┬─┐                      ┌─┬─┬─┬─┬─┬─┬─┬─┐
 │X│ │ │X│X│X│X│X│ --up (off)---        │X│X│ │ │X│X│X│ │
 │ │X│X│ │ │ │ │ │ --down (on)--        │ │ │X│X│ │ │ │X│
 └─┴─┴─┴─┴─┴─┴─┴─┘                      └─┴─┴─┴─┴─┴─┴─┴─┘
  0 1 2 3 4 5 6 7                         0 1 2 3 4 5 6 7
```

See your computer documentation to verify that this is correct for your application.

If the H: prompt still fails to appear, move JJ501 from position 1 to 0 (left to right). This trims the available memory space to 48K, all of which is on the CPU board. if the H: still does not appear, remove the 128K RAM board (replacing the 4116 at U549), leaving the control board installed. If the machine now works, either:

- The RAM board was not plugged on correctly (a one-pin offset is possible)
- The interconnect cable was not installed correctly (check the keying)
- If the '89 has not been running with 64K installed, it is possible that the trace between J509.19 and U517.12 or J509.20 and U517.13 is broken.
- The RAM board, Cable, or Control Board has been damaged.

The standard ROM memory test verifies the 48K of RAM on the CPU board, and only 8K of the 128K card. (Plus, of course, the 4116 from U549 moved to the new card). If errors occur in the ROM memory test, see your standard documentation to determine where the error exists.

LIMITED 90-DAY WARRANTY

Magnolia Microsystems, lnc. warrants to its Dealer (End User only if purchased directly from MMS, inc.) that this hardware product is free from defects in materials and workmanship for a period of 90 days following purchase. Defective products will be repaired or replaced at our discretion when examination discloses that a defect exists. End Users must return the product to the Dealer from whom it was purchased for warranty claims.

Software furnished with the hardware is supplied "AS-IS", with no warranty as to its merchantability or fitness for any specific use.