

ANAPRO

H89 4MHz

CPU Speed Modification



H89 4MHz

INSTRUCTIONS

by

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ANAPRO

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TABLE OF CONTENTS

| | | |
|----|---------------------------------|----|
| 1. | INTRODUCTION | |
| | DESCRIPTION | 1 |
| | BOOT ROM | 1 |
| | SOFTWARE SUPPORT | 1 |
| 2. | OPERATION | |
| | RUNNING PROGRAMS | 2 |
| | RESTRICTIONS | 2 |
| | TERMINAL BAUD RATE | 2 |
| 3. | HARDWARE INSTALLATION | |
| | Procedure | 3 |
| | TESTING | 4 |
| 4. | SOFTWARE | |
| | THE MODIFIED BIOS | 5 |
| | Files on the disk | 5 |
| | SET.COM | 6 |
| 5. | HEATH BIOS | |
| | Description of utility programs | 7 |
| | BIOS MODULE SELECTION | 8 |
| | BIOS INSTALLATION PROCEDURE | 9 |
| | BIOS PATCHING | 11 |
| | BPATCH.COM | 11 |
| | LIVINGSTON BIOS-80 | 12 |
| 6. | CDR BIOS | |
| | CDR BIOS INSTALLATION | 13 |
| 7. | MAGNOLIA BIOS | |
| | Applicable programs | 15 |
| | MAGNOLIA BIOS INSTALLATION | 15 |
| 8. | TLB MODIFICATION | |
| | H89 | 17 |
| | H89A | 18 |
| | CHANGING BAUD RATE | 19 |
| | CLR.COM | 19 |

10

11

12

13

INTRODUCTION

DESCRIPTION. The ANAPRO 4MHz modification package consists of a plug-in speed module and appropriate software patches for the BIOS. Proper system operation is maintained by toggling between 2MHz and 4MHz as needed in the hardware. All toggling of speed is done automatically within the modified BIOS.

BOOT ROM. To avoid the need for a custom boot ROM, the boot is initiated at 2MHz and the speed is switched to 4MHz after the system is loaded. This switching is done automatically within the cold boot routine. Manual toggling of the speed can also be done by means of a short menu driven utility which is also supplied.

SOFTWARE SUPPORT. Included software supports Heath BIOS 2.2.03 and 04, CDR BIOS 2.91M, Magnolia BIOS 2.24 and Livingston BIOS-80. If you are using some other version of BIOS, you will need to make appropriate changes or restrict disk operations to the soft sector controller while at 4MHz. Only the H17 hard sector controller is sensitive to the speed change. Standard HDOS will run as usual but the system will remain at 2MHz. HDOS support software is available for a nominal extra charge.

OPERATION

RUNNING PROGRAMS. No special procedures need to be observed in using the H89 at 4MHz. You will find that most programs will run in half the time. The only exception are programs which make much use of disk access or I/O operations. Since the disk access and I/O is slow compared to the speed of the CPU, the gain from 4MHz operation will not be great under these circumstances.

RESTRICTIONS. There are some programs which make direct access to the hardware without using CP/M or BIOS calls. Such programs may need to be run at 2MHz for proper operation. Examples include FORMAT.COM and the Heath DUP.COM disk duplication program. Modified versions of several such programs are included. Use the ones appropriate to your system as described in the software section of these instructions.

TERMINAL BAUD RATE. With the higher clock speed, it is beneficial to increase the terminal baud rate to 19200. At the higher baud rate, you will find that the screen fills up much faster. Try the DIR command on a disk with many files to see the effect.

If you use WordStar with the cursor keys implemented, you will find the screen response much livelier. The cursor will usually keep up with the repeat key engaged. If you do not already have an automatic repeat conversion on your keyboard, you may do well to invest in one.

HARDWARE INSTALLATION

It will be necessary to remove your CPU board in order to install the 4MHz module. Refer to your H89 computer manual for help if needed.

- 1) Locate U502 and remove the IC (7492). This IC will no longer be needed.
- 2) Plug the 4MHz module into the U502 socket using care not to bend the pins. Orient the module with the wire toward the upper right.
- 3) Locate U552 and remove the IC (74LS273). Save this IC for reinsertion in step 5.
- 4) Plug the 20 pin socket which is attached to the module by a wire into the U552 socket. Note orientation of pin 1.
- 5) Now plug the 74LS273 IC from step 3 into the new socket at U552.
- 6) Remove the Z80 microprocessor at U504. This IC will no longer be needed.
- 7) Install the Z80A (supplied with the modification) into the U504 socket. A Z80B or Z80H may be provided instead of a Z80A. These are just higher speed (6MHz and 8MHz) versions of the Z80.
- 8) Reinstall your CPU board. Be sure to reconnect all of the wires. Refer to the Heath manuals for help if needed. Use special care with the connectors at the upper left part of the board since improper insertion may cause permanent damage to the TLB.

HARDWARE INSTALLATION

Operation at 4MHz requires the use of 150ns RAM ICs. However, ICs are often better than their marked rating and you may find that the present RAM will be satisfactory. Before spending money on new memory chips, make the conversion and run the memory test program. If the test shows no errors, chances are that you will be ok with the existing devices.

This completes the hardware modification. You should now follow the testing procedure to ensure proper operation of the hardware. Memory testing does not require a modified BIOS.

TESTING. After installing the modifications, perform a visual inspection to ensure that everything looks as it should. Turn the power on and check the system for normal operation. Everything should work as usual since the clock speed stays at 2MHz until software patches are installed. If you have problems at this point, go back through the installation procedure to make sure that everything was done right.

Now boot your system and run the MTEST memory test program. The program runs in a continuous loop till interrupted by user input. Test location and any detected errors are displayed on the screen. If there is a report of errors, you may need to replace the RAM ICs with 150 ns parts. Note that the memory test program is not foolproof and intermittent memory errors may not be detected.

As an extreme, the computer may completely lock up on start of the MTEST program. In such a situation, you may want to run MOVCPM to create a system of a smaller size (eg. 48K) and attempt the test again. Changing the system size places the BIOS into a different bank of RAM in the hope of finding some better ICs.

SOFTWARE

THE MODIFIED BIOS. The BIOS mods consist of changes in the disk driver dispatch routine. Any access to a disk driver is done at 2MHz. Speed is restored to 4MHz upon return from the driver. Speed switching is controlled by a bit in the general purpose control port (F2 hex).

The exact nature of the modifications depends on the particular software system being used. The included software supports Heath, CDR and Magnolia BIOS. Refer to the appropriate section of these instructions for your particular system.

The following files are on the software disk:

For Heath BIOS:

| | | | |
|-------------|-------------|-------------|-----------|
| B3M17.SYS | B4M17.SYS | FORMATM.COM | EH89.EMS |
| B3M37.SYS | B4M37.SYS | DUPM.COM | SMOD4.EMS |
| B3M1737.SYS | B4M1737.SYS | BPATCH.COM | M4.LIB |
| B3M1747.SYS | B4M1747.SYS | INSTAL.COM | |

For Livingston BIOS-80:

| | |
|-----------|------------|
| LMOD4.EMS | FORM80.EMS |
|-----------|------------|

For CDR BIOS:

| | | |
|-----------|-----------|------------|
| B48S4.IMG | B48P4.IMG | HSFORM.COM |
| B64S4.IMG | B64P4.IMG | BMOD.SUB |

For MAGNOLIA BIOS:

| | | |
|----------|--------------|--------------|
| MAG4.SUB | MAG4BIT.HEX | MAGNOLIA.DOC |
| MAG4.HEX | MAGFORM6.HEX | |

SOFTWARE

The following files are for general application

MTEST.COM - performs a test of system RAM
SPEED.ASM - source code for speed changing
SPEED.BAS - MBASIC source for speed changing
SPEED.PAS - Pascal source for speed changing
SET.COM - display/change CPU speed
SET.MAC - source code for SET.COM

There may be additional files on the disk as updates become available. Be sure to read any DOC files contained. In particular, look for the presence of an UPDATE.DOC file.

SET.COM. This utility is provided for those occasions where you may need to go back to 2MHz operation. This may be required when running game programs.

The program allows entry by means of menu selection or by command line. If you just run the program, a menu will display present speed and wait for an input. As an alternative, you may type the following:

```
A>SET 4          ;switches to 4mHz
```

```
A>SET 2          ;switches to 2MHz
```

HEATH BIOS

The following is a list of programs you will need to use and a short description of what they do.

- FORMAT.COM - takes a blank diskette and puts identifying marks on it for the system to use. A new disk cannot be used until it has been formatted.
- PIP.COM - transfers programs and files from one disk to another.
- SYSGEN.COM ✓ - makes a formatted diskette "BOOTABLE". Bootable means that the disk contains the CP/M system so that it can be used to get going when the computer is first turned on or after a reset.
- MOVCPM17.COM - adjusts the size of the CP/M system to
MOVCPM37.COM ✓ fit into the available RAM memory.
MOVCPM47.COM This needs to be run whenever the BIOS.SYS file has been changed since the new BIOS may be of a different size than the one previously used.
- CONFIGUR.COM - allows setting of the CP/M system and the BIOS for the physical equipment present. This is needed since the assortment of drives, printers and other options may differ.
- BIOS.SYS - this file contains the BIOS portion of the CP/M operating system. For the system to operate, every bootable disk must have a BIOS.SYS file.

HEATH BIOS

BIOS MODULE SELECTION. The 4MHz modification includes a selection of pre-assembled BIOS modules. Most users should find one of these suitable to their needs. If you have made any changes to the Heath BIOS, such as the Lindley MX driver, you will need to modify the BIOS source code and reinstall it with MAKEBIOS. This subject is covered in the BIOS PATCHING instructions.

The following BIOS modules are already preassembled:

(filename) - (drives supported)

H89 with CP/M 2.2.03

H89 with CP/M 2.2.04

B3M17.SYS - H17

B4M17.SYS - H17

B3M37.SYS - H37

B4M37.SYS - H37

B3M1737.SYS - H17/H37

B4M1737.SYS - H17/H37

B3M1747.SYS - H17/H47

B4M1747.SYS - H17/H47

Select the BIOS module applicable to your system, and follow the BIOS INSTALLATION PROCEDURE.

Because the FORMAT and DUP programs bypass the BIOS, you will need to use modified versions. For Heath BIOS, use FORMATM.COM and DUPM.COM which are included with the 4MHz software package. Use these modified utilities just as you would your standard Heath versions. The only changes are a speed toggle to allow proper access to hard sector diskettes.

HEATH BIOS

BIOS INSTALLATION PROCEDURE. In the following steps, use the version of MOVCPM appropriate to your system.

- 1) Create a bootable disk with the following files:

CONFIGUR.COM, MOVCPM37.COM, SYSGEN.COM

Also transfer the appropriate BIOS module and the INSTAL.COM program from the 4MHz disk.

- 2) Reset the system and boot the new disk.
- 3) Run INSTAL, specifying the desired module name in the command line. Proper input format:

```
A>INSTAL newbios
```

Note that newbios is actually the name of the BIOS module you have selected for your system. Entry of the ".SYS" is optional. For example, a valid command would be: A>INSTAL B3M37

Your old BIOS.SYS file is replaced by the new module. The INSTAL program is fairly forgiving and will detect many input errors.

- 4) Relocate the system to accommodate the new BIOS. This is done by typing:

```
A>MOVCPM37 * BIOS.SYS
```

Be sure to include the asterisk (*). This gives a system which makes full use of all available RAM. If you prefer to make a system of a particular size, the asterisk may be replaced by the number of Kilobytes for the system. For example, for a 63K system, type: A>MOVCPM37 63 BIOS.SYS

HEATH BIOS

- 5] Immediately following step 4, run SYSGEN. When asked for "source on", press <RETURN>. Press "A" for the destination.
- 6] Reset the system and boot the new disk again. If you get "garbage" display for the boot message, you are probably running at a console baud rate other than the standard 9600. In that case, press the "OFF LINE" key and use the ESCAPE sequence code to set the terminal to 9600 baud. This is done by pressing "<ESC> r L".
- 7] Run CONFIGUR to set your system parameters. In some installations, the CONFIGUR program may not run properly at 4MHz. It is safer to use SET.COM to set your system to 2MHz before running the CONFIGUR program.
- 8] This completes the installation. Your system should now boot and run at 4MHz. If you encounter problems, retrace your steps, make sure you selected the proper BIOS module for your system and check your CONFIGUR options.

HEATH BIOS

BIOS PATCHING. This section describes installation of 4MHz mods into BIOS source code. Modification is done automatically using the CP/M SUBMIT capability. Installation has been tested with standard Heath BIOS and with the Lindley MX80 driver. It may work with other changes in the BIOS but cannot be guaranteed to do so. If extensive changes have been made to your source, you may need to go back to the standard Heath BIOS and install the 4MHz patches first.

In addition to the 4MHz patches, included is provision to delete the H8 specific code from the BIOS. This saves space for H89 users.

Since this installation procedure is to be undertaken by the more experienced user, familiarity with the use of SUBMIT files is assumed and only general guidelines are include. The CP/M editor ED.COM is used for the editing of the BIOS source file.

BPATCH.COM is the Digital Research SUBMIT.COM program with several modifications included. It allows lower case ASCII characters to be processed without changing them to upper case. To differentiate it from SUBMIT, the program looks for filename.EMS rather than filename.SUB, otherwise operation is the same.

The file M4.LIB contains a larger code segment which is patched into the BIOS and must be present on the disk during the patching operation.

SMOD4.EMS is a SUBMIT file used by BPATCH to install the 4MHz mods. EH89.EMS is the SUBMIT file which deletes the H8 code from the BIOS.

A:

ED.COM

BIOS SO.ASM

X808.COM

M4.LIB

HEATH BIOS

To do the installation, have BIOS.ASM, ED.COM and M4.LIB on the disk and type "BPATCH SMOD4". This will install the 4MHz patches. If you want to delete H8 code, continue the patching by typing "BPATCH EH89". It takes a while to complete the patches. If you are patching an already modified BIOS, watch for any ED.COM error messages which may occur due to different placement of labels.

Due to disk space limitation, you may need to use two drives to do the patching on a standard H17 system. To do this, edit the SMOD4.EMS file to read the original BIOS.ASM file from from some other drive such as B:. Refer to the Heath CP/M manuals for more information on the use of SUBMIT.

LIVINGSTON BIOS-80. Modification to BIOS-80 is done in the same manner as patching of the Heath BIOS. Just use the LMOD4.EMS file in place of SMOD4.EMS.

The FORMATM program must be modified to include the BIOS-80 patches. To do this, transfer FORMATM.COM, FORM80.EMS and DDT.COM to a working disk. Also get FORMAT80.HEX from you BIOS80 disk. If you have version 5 of BIOS80, use FMT80V3.HEX but rename it to FORMAT80.HEX on the work disk.

Then type: A>BPATCH FORM80 <CR>

When all is done, you will have FORM80.COM on the disk. This is your modified format program.

CDR BIOS

CDR BIOS INSTALLATION. A set of modified CDR BIOS IMG files containing the 4MHz modifications is included. These BIOS images are installed into the PUTCPM files and provide support for serial and parallel printer configurations. Your BIOS must be version 2.91 for these modules to work.

***** IMPORTANT *****
To install the CDR BIOS image modules, you must have PUT48.COM and PUT64.COM files on the disk. If your copy of CDR BIOS came from ANALYTICAL PRODUCTS, then these files are part of the BIOS source package. For the standard CDR BIOS package, rename the original distribution copy of PUTCPM48.COM to PUT48.COM and PUTCPM64.COM to PUT64.COM.

Proceed as follows to install the modified CDR BIOS:

- 1) Create a new bootable disk following the normal CDR procedures. Transfer the following files from your CDR system to the new disk:

SUBMIT.COM, XSUB.COM, I/OMOD.COM, DRIVES.COM, CPMSIZE.COM
PUT48.COM, PUT64.COM (see IMPORTANT note above)

Transfer these files from the 4MHz disk:

B48P4.IMG, B64P4.IMG, B48S4.IMG, B64S4.IMG and BMOD.SUB

- 2) This step installs the modified 4MHz BIOS into your PUTCPM programs:

For a serial printer, type: SUBMIT BMOD S4

For a parallel printer, type: SUBMIT BMOD P4

CDR BIOS

- 3) When the submit procedure stops with the "DONE" message, run the CPMSIZE program to readjust the BIOS to the proper location. Run CPMSIZE twice to create a new 48K and a new 64K PUTCPM file.
- 4) Run I/OMOD to configure the new PUTCPM files to your system needs. Also run the DRIVES program to configure the drive parameters. Refer to the CDR manuals for proper use of these utilities.
- 5) Run the PUTCPM program to install the new 4MHz BIOS onto your disk.

This completes the CDR BIOS installation. Reset your computer and boot with the new system disk. If you have problems booting, review the installation procedure to ensure that all steps were done properly. Be sure to check that the DRIVES and I/OMOD configuration procedure reflects your system needs.

Because the HSFORMAT.COM program bypasses the BIOS, you will need to use HSFORM.COM which is included with the 4MHz software package. Use this modified format utility just as you would the standard CDR version. The only changes are a speed toggle to allow proper formatting of hard sector diskettes and a new signon message. The FORMAT9.COM program is not affected.

Due to disk space limitations, source code is not included on the disk. If you do not already have BIOS version 2.91, or if you want the modified source code, ANALYTICAL PRODUCTS will supply it for \$10 to cover handling costs. You must include your CP/M serial number to order the source since the package includes the BDOS portions as well.

MAGNOLIA BIOS

A modified FORMAT program is included as part of the package. Some other programs may not work properly at higher CPU speeds so watch for them. Examples include some disk copy programs which are dependent on CPU speed. Such programs will have to be run at 2MHz.

The following is a description of the pertinent files:

- MAG4.HEX - HEX image of the modified Magnolia BIOS version 2.24
- MAG4BIT.HEX - HEX image of the bit map for the BIOS
- MAG4.SUB - a submit file used in installing the patches
- MAGFORM6.COM - Magnolia format program modified for 4MHz/6MHz operation

MAGNOLIA BIOS INSTALLATION.

To install the patches, place the following files on a bootable disk in drive A:

Standard CP/M utilities:

DDT.COM SUBMIT.COM XSUB.COM

Magnolia files:

BASECPM.COM LINK.COM B5316.HEX B8316.HEX M316.HEX

Files from the 4MHz software disk:

MAG4.HEX MAG4BIT.HEX MAG4.SUB

Then type the following command: A>SUBMIT MAG4 <CR>

<CR> denotes the RETURN key. Execution will take a while so sit back and wait for the "DONE" message.

MAGNOLIA BIOS

When the action is completed, you will have on your disk two new files, MOVCPM5.COM and MOVCPM8.COM which are the modified version of MOVCPM. The MOVCPM5 is for 5 inch bootable and MOVCPM8 is for 8 inch bootable versions. You may wish to erase your old MOVCPM files and rename the new ones to conform to your normal system designation.

Proceed now to install the Z17 driver if needed as well as any other options per the instructions in your Magnolia documentation. You will also need to run the SETUP program to configure the new files.

TLB MODIFICATION

Operating speed of the terminal logic board can be increased to 3MHz, 4MHz or even 6MHz by making some simple modifications. Although increasing the TLB clock speed is recommended for improved performance, ANAPRO is not prepared to support the modifications beyond supplying these instructions.

H89. On the older H89, the speed is changed by moving a jumper at JP10 which is located at the lower left on the board. You may wish to dig out your Illustration Booklet and turn to page 19 for the layout of the TLB. Using an XACTO knife (or similar tool) carefully cut the trace connecting pins 2 and 5 of JP10 on the component side.

3MHz - solder a jumper between pins 1 and 5 of JP10.

4MHz - install a jumper from pin 9 of U413 (7492 at lower left corner) to pin 6 of JP10.

6MHz - solder a jumper from pin 14 of U412 (74LS161 at the top of the board) to pin 6 of JP10.

You may need to replace the Z80 CPU (U421) with a Z80A for 4MHz or Z80B for 6MHz operation. The standard Heath terminal ROM (U422) seems to work fine even at 6MHz, but some other vendors' parts such as the Super19 ROM may not work at the faster clock rates.

TLB MODIFICATION

H89A. There is no jumper on the H89A so you will need to do some soldering to IC pins. You may wish to dig out your Illustration Booklet and turn to page 15 for the layout of the TLB. Locate U426 (7404) near the center of the board and remove it. Carefully bend out pins 1 and 3 of this IC. Reinsert the IC at U426 so that pins 1 and 3 are not in the socket.

3MHz - locate U427 (74LS161 just above U426) and solder a jumper between pin 13 of U427 and pins 1 and 3 of U426. Do not remove pin 13 of U427 from the socket since that connection is still needed.

4MHz - locate U429 (7492 at lower center of board) and remove it. Carefully bend out pin 9 of this IC and reinsert the IC so that pin 9 is not in the socket. Solder a wire from pin 9 of U429 to pins 1 and 3 of U426.

6MHz - locate U427 (74LS161 just above U426) and remove it. Carefully bend out pin 14 of the IC and reinsert the IC so that pin 14 is not in the socket. Solder a wire from pin 14 of U427 to pins 1 and 3 of U426.

Replace U451 (74LS74 near center right) with a 74S74. You may need to replace the Z80 CPU (U430) with a Z80A for 4MHz or Z80B for 6MHz operation. The standard Heath terminal ROM (U437) seems to work fine even at 6MHz but some other vendors' parts such as the Super19 ROM may not work at the faster clock rates.

TLB MODIFICATION

CHANGING BAUD RATE.

19200 BAUD - To set this higher rate, the following changes need to be made:

First run CONFIGUR to make a bootable disk with the console baud rate set to 19200. When you exit configur, you will get garbage on the screen but ignore that and turn off the computer. Remove the CPU board and change the settings of the following switches on the CPU board and TLB.

CPU - set section 6 of switch SW501 to the 1 position.
TLB - set switch S401 sections 0 -3 to 1011.

Although it is possible to increase the BAUD to 38400, such a rate has not been found to be advantageous and it does produce errors.

CLR.COM. This program has been included to provide a means of changing the BAUD and presetting certain terminal configurations. As provided, the program will clear the screen and set the terminal and CPU to 19200 baud. With this program, you can keep the TLB and CPU set at 9600 baud and change it after booting. This procedure may be of benefit for those using HDOS in addition to CP/M.

Source code is included for easy customizing. This can be of particular benefit for users of the Super19, Ultra or similar replacement terminal ROMs.

