

HT4001
486DX / DX2 / SX
SYSTEM BOARD

USER'S MANUAL

INTRODUCTIONS

The HT4001 486DX is a fully 486DX/ DX2/ SX PC / AT compatible system board implemented with the HEADLAND high performance 486 DX chipset with " VIRTUAL CACHE " architecture . This board is also able to work as an 486DX , 486DX2, 486SX system board. The HT4001 system board supports MS-DOS version 2.0 and above , XENIX 386DX , Novell Netware and all 386 application Programs.

KEY FEATURES

The normal HT4101 comes with the following features :

- . PGA 80486DX, 486DX2 & 486SX
- . Headland Chip Set : HT321 ISA Controller
HT342 Memory Controller
- . 8 Bit single ROM BIOS
- . Support 256K / 1M / 4M / 16M DRAMS mixed types for a maximum of 128MB memory on board
- . Seven 16-Bit I / O slots & one XT slots
- . Virtual cache architecture: Byte gathering write buffer
Out of order operation
Read and write hits on write buffer
- . Fast gate A20 / Fast Reset

PERFORMANCE TEST

<u>Item</u>	<u>486DX / 33MHz</u>	<u>486DX2 / 66MHz</u>
LandMark V2.0	111.5 MHz	223MHz
PowerMeter V1.7	14.8 MIPS	29.3MIPS
PowerMeter V1.7	19.0K DRY / S	37.6K DRY / S
CheckIt V2.01	16164 DHRYSTONES	33537 DHRYSTONES

GENERAL DESCRIPTION

Central Processor

The HT4101 system board is based on the 80486DX / DX2 / SX incorporates a 32-bit external data path and provides a 32-bit (4 Gige bytes) addressing space.

Headland HT340 Chip Set

- . 2 Chips solution
- . Local Bus interface
- . DX / SX 25 / 33 / 40 MHz , DX2 / 50 / 66 CPU Speeds
- . Fully static operation
- . Intel coprocessors built - in for DX / DX2 CPU
- . System and Video BIOS on single ROM
- . Use LSI Logic's 0.7 Micron HCMOS process

ISA Controller

- . AT Compatible
- . Sync 8MHz ISA Bus
- . Posted backplane memory writes
- . 10 or 16 bit I / O mapping
- . Integrated 8237s , 8259s and 8254 functionality
- . Fast gate A20 / Fast reset

Virtual Cache architecture

- . 4 double - word deep write buffer
- . Byte gathering write buffer
- . Out of order operation
- . Full or partial write buffer hits
- . AT - Compatible floating point error reporting

DRAM Controller

- . Mixed memory types (256K to 16MB)
- . EMS 4.0
- . Hidden refresh operation
- . 256MB Maximum system memory
- . Staggered refresh
- . Shadowing in 16KB increments between 640KB and 1MB
- . Remapping
- . 1, 2, 4 - way CAS interleave with fast paging
- . Data pipe relaxing DRAM timing

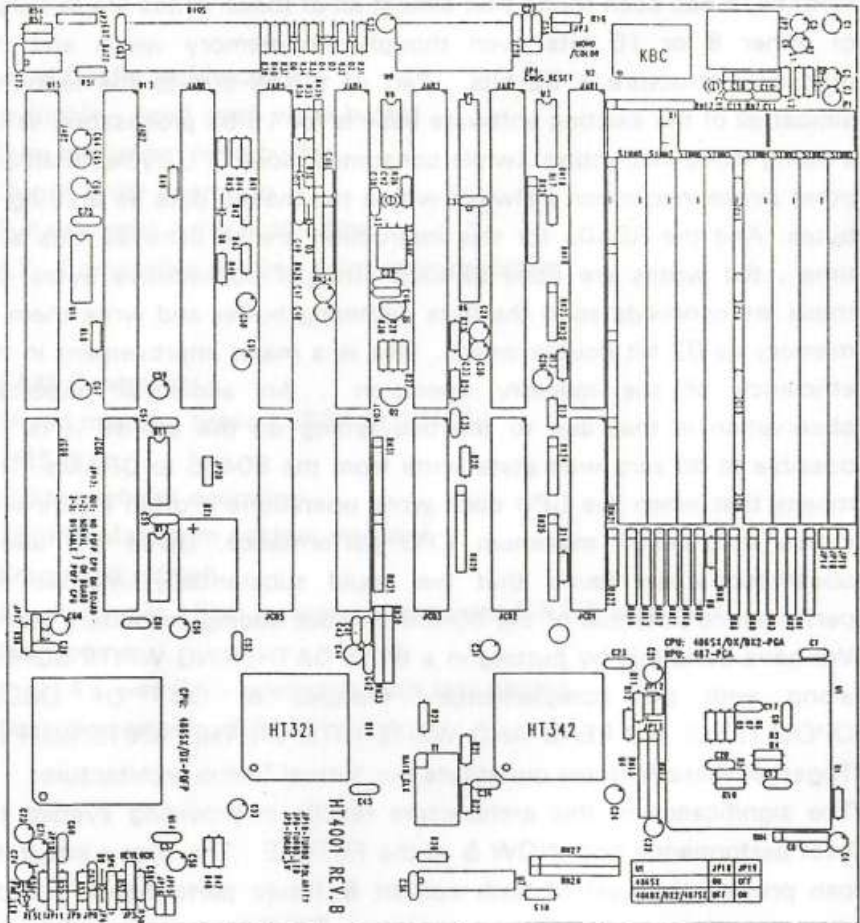
Virtual Cache architecture

Due to the very efficient internal cache on the 80486 (either SX or DX) almost all the memory activity on the 80486 bus consists of WRITE operations. This has been confirmed in the lab and indeed large volumes of trace data has been taken while the 80486 was running some popular benchmarks to examine the characteristics of this data . In addition to the fact that almost all of the activity is in WRITES, it has been found that almost all of these writes are in bursts of either 8 or 16 bits even though the memory width and the processor structure is 32 bits . Part of this is due to the fact that almost all of the existing software base is for 16 bit processors. While a string move instruction (while consumes more CPU cycles than any other single instruction) always writes the moved data as a string of bytes. And the READs for this instruction are all done 32 Bits at a time , the writes are done as long string if consecutive bytes. All these are consolidated in the byte gathering buffer and write them to memory as 32 bit double words. This is a major improvement in the efficiency of the memory operation . An additional important observation is that due to the bus timing on the 80486 it is not possible to do zero wait state write from the 80486 to DRAMs. This means that when the CPU does write operations it often incurs wait states that inhibit maximum CPU performance. Given the above observations we found that we could substantially improve the performance potential of the 80486 without adding secondary cache. We have done this by putting in a BYTE GATHERING WRITE BUFFER along with the complementary features or OUT OF ORDER OPERATIONS and READ AND WRITE HITS ON THE WRITE BUFFER. Together these features constitute our Virtual Cache architecture.

The significance of this architecture results in providing system the best performance both NOW & in the FUTURE . The user / integrator can provide the best of both current & future performance without the necessity of adding extra cache in EITHER case. Therefore the users / system integrators do not need to do anything to achieve superior performance other than adding the OVERDRIVE (DX2) to the socket

Chapter 2 Jumper Setting & Connectors

Jumper Location Diagram



HT4001 REV. B
Jumper Setting VER 1.1

JP2	: Keyboard connector
JP3	: CRT Switch
	Off (MONO)
	On (Color)
JP4	: CMOS reset switch
	Off (Default)
	On
JP5	: Keyboard Lock
	<u>PIN Definition</u>
	PIN 1 - LED Power
	2 - Key
	3 - Gnd
	4 - +KBD INH
	5 - Gnd
JP6	: Speaker
	<u>PIN Definition</u>
	PIN 1 - SPKR out
	2 - NC
	3 - Gnd
	4 - +5V VDC
JP7	: External Battery Connector
JP8	: Turbo LED
	<u>PIN Definition</u>
	PIN 1 - +5V DC
	2 - Data
JP9	: Turbo Switch
JP10	: Turbo Switch polarity
	PIN 1 & 2 - JP7 (On) is high speed (Default)
	PIN 2 & 3 - JP7 (Off) is high speed
JP11	: Reset
	<u>PIN Definition</u>
	PIN 1 - PWRGOOD
	2 - Gnd

- JP17 : Out 2 - No PQFP CPU on board
1 - 2 - Normal (On board PQFP CPU installed)
2 - 3 - Disable PQFP CPU (On board PQFP CPU installed)

JP18

JP19 : CPU Selector

JP18 (On) & JP19 (Off)

- U1 is installed with a 486SX CPU

JP18 (Off) & JP19 (On)

- U1 is installed with a 486DX /486DX2 CPU or 487SX NPU

JP20 : ResetDrv Selector

1 - 2 - From Powergood signal (Default)

2 - 3 - From Chipset

P1 : Power connector

PIN Definition

PIN 1	- PWRGOOD
9	- -5V VDC
2,10,11,12	- +5V VDC
3	- +12V VDC
4	- -12V VDC
5,6,7,8	- Gnd

System RAM Size Configuration

Location of memory chips		Memory Size (bytes)
<u>Bank 0</u> SIMM 5,6,7,8	<u>Bank 1</u> SIMM 1,2,3,4	
256Kx 9	None	1M
256Kx 9	256Kx 9	2M
1Mx 9	None	4M
256Kx 9	1Mx 9	5M
1Mx 9	256Kx 9	5M
1Mx 9	1Mx 9	8M
4Mx 9	None	16M
256Kx 9	4Mx 9	17M
4Mx 9	256Kx 9	17M
1Mx 9	4Mx 9	20M
4Mx 9	1Mx 9	20M
4Mx 9	4Mx 9	32M

Chapter 3 System Setup

After the board hardware is assembled and the keyboard, monitor, and peripherals are installed, power up the completed system and proceed with the SETUP procedure. Note that this may be done with or without the system being installed in the case. Any subsequent trouble shooting and problem identification can be done more easily if the system is not installed. SETUP can be performed by using the SETUP program built into the system BIOS.

The New AMI BIOS Features

CONFIGURE STANDARD SETUP DEFAULTS :

Configures the Standard CMOS Setup option defaults for the BIOS.

CONFIGURE ADVANCED SETUP DEFAULTS :

Configures the options to appear on the Advanced CMOS Setup screen and the default values of all the options in Advanced CMOS Setup.

CONFIGURE BIOS SETUP OPTIONS :

This option is used to modify the default setting for the BIOS Setup and Diagnostics, and can be used to remove certain options from the main screen of the BIOS Setup program.

CONFIGURE BIOS FEATURES :

Configures the String Information in the BIOS such as the Sign On Message, ROM Password, etc.

CONFIGURE ADVANCED BIOS FEATURES :

Allows for modifying the Clock switching, Cache Control, Turbo LED and the Reset Memory Controller mechanism for the BIOS.

FIXED DISK CONFIGURATION :

Enables the fixed disk parameter table stored in the ROM to be modified.

FLOPPY DISK CONFIGURATION :

Allows for modifications to the floppy parameter table in the ROM.

CONFIGURE MISCELLANEOUS OPTIONS :

Configures options such as the Serial and Parallel Ports, Software I/O delay, Refresh Rate, Power-On delay and the keys to switch from High CPU speed to Low CPU speed and vice-versa.

MODIFY SETUP DEFAULT COLORS :

Enables setup of the default colors for the BIOS.

GENERATE REPORTS :

This option is useful for developing a New BIOS. Reports on the BIOS which is currently loaded can be obtained from the screen.

MENU DRIVEN FUNCTIONALITY :

The New AMIGEN is totally Menu Driven to help simplify the BIOS configuration procedures.

OVERVIEW

The SETUP program is used to configure the system. These system options are stored in the CMOS. If the CMOS is good, the system is configured with the values stored in the CMOS. If the CMOS is bad, the system is configured with the default values stored in the ROM file. There are two (2) sets of BIOS values stored in the ROM file - the BIOS Setup default values and the Power-On default values. The BIOS Setup default values are the default values which are supposed to give the optimum performance for the system. They are the best case default values. The Power-On default values are the default values for the table values for the system. They are the worst case default values. The Booting Process of the New BIOS has been shown (Fig. 2).

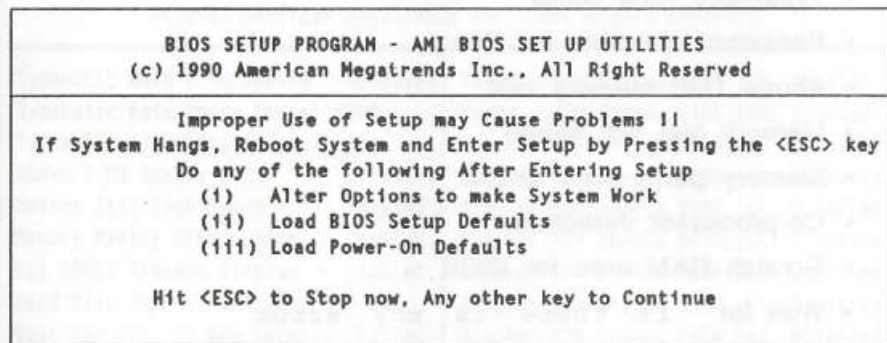
Figure 2. Setup Utility Menu of AMI BIOS

BIOS SETUP PROGRAM - AMI BIOS SET UP UTILITIES (c) 1990 American Megatrends Inc., all rights Reserved
STANDARD CMOS SETUP ADVANCED CMOS SETUP AUTO CONFIGURATION WITH BIOS DEFAULTS AUTO CONFIGURATION WITH POWER-ON DEFAULTS CHANGE PASSWORD HARD DISK UTILITY WRITE TO CMOS AND EXIT DO NOT WRITE TO CMOS AND EXIT
Standard CMOS Setup for Changing Time, Date, Hard Disk Type, etc. Select F2/F3:Color F10:Save & Exit

The New BIOS has a password feature in it. The user is asked for the password either in every boot or for entering into the Setup program or never. If the CMOS is good, the user is asked for the password stored in the CMOS, else he is asked for the ROM password. These options can be removed from the

AMIGEN program. The user is given a warning message before he is allowed to change any of the setup parameters. The warning message is shown in Figure 2.

Figure 3. Warning Message



STANDARD CMOS SETUP

This option is used to configure the following options :

- Date : Month, Date and Year
- Time : Hour, Minute and Second
- Daylight Saving : Disabled and Enabled
- Hard Disk C: and Hard Disk D: The user can choose any of the standard hard disk types from 1 to 46 or he can choose type 47 which is the user definable type. The user must enter the hard disk parameters if he wants to choose the user-definable hard disk type per drive, i.e., type 47 may be different for drive C: and for drive D:.
- Floppy drive A: and Floppy drive B: 360KB 5 1/4",, 1.2MB 5 1/4", 720KB 3 1/2", 1.44MB 3 1/2", Not Installed
- Primary Display : Monochrome, Color 40 x 25, VGA/PGA/EGA, Color 80 x 25, Not Installed.
- Keyboard : Installed or Not Installed

OVERVIEW

ADVANCED CMOS SETUP

The ADVANCED CMOS SETUP option is used to set the various system options for the user. The user can get various options, some of which are listed below :

- Typematic Rate Programming
- Typematic Rate Delay
- Password checking for Setup
- Above 1MB memory test
- Memory test tick sound
- Memory parity error check
- Co-processor detection
- Scratch RAM area for BIOS
- Wait for if there is any error
- Power-On num lock status
- CPU Speed at system boot
- Video ROM Shadow
- Adaptor ROM Shadow
- Main ROM Shadow

Please refer to Figure 4 on next page for the Advanced setting of CMOS.

Figure 4. Advanced Setup of CMOS

BIOS SETUP PROGRAM - ADVANCED CMOS SETUP	
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Typematic Rate Programming : Disabled	Video ROM Shadow C000,16K: Enabled
Typematic Rate Delay (msec): 500	Video ROM Shadow C400,16K: Enabled
Typematic Rate (Chars/Sec) : 15	Adaptor ROM Shadow C800,16K: Disabled
Above 1 MB Memory Test : Disabled	Adaptor ROM Shadow CC00,16K: Disabled
Memory Test Tick Sound : Enabled	Adaptor ROM Shadow D000,16K: Disabled
Memory Parity Error Check : Enabled	Adaptor ROM Shadow D400,16K: Disabled
Hit Message Display : Enabled	Adaptor ROM Shadow D800,16K: Disabled
Hard Disk Type 47 RAM Area : 0:300	Adaptor ROM Shadow DC00,16K: Disabled
Wait For <F1> If Any Error : Enabled	Adaptor ROM Shadow E000,16K: Disabled
System Boot Up Num Lock : On	Adaptor ROM Shadow E400,16K: Disabled
Numeric Processor Test : Disabled	Adaptor ROM Shadow E800,16K: Disabled
Weitek Processor : Absent	Adaptor ROM Shadow EC00,16K: Disabled
Floppy Drive Seek At Boot : Disabled	System ROM Shadow F000,64K: Enabled
System Boot Up Sequence : C:, A:	Memory Paging : Enabled
System Boot Up CPU Speed : High	Remap Memory : Enabled
Internal Cache Memory : Enabled	Middle BIOS (Below 16 MB) : Disabled
Fast Gate A20 Option : Enabled	Cache Shadow ROM : Enabled
Password Checking Option : Setup	Turbo Memory Settings : Auto

el (Ctrl)Pu/Pd:Modify F1:Help F2/F3:Color
 F5:Old Values F6:BIOS Setup Defaults F7:Power-On Defaults

AUTO CONFIGURATION WITH BIOS DEFAULTS

The New AMIGEN Utility also give you 2 alternative to load BIOS defaults from ROM table.

- Load BIOS Setup Defaults from ROM Table

Figure 5. Load BIOS Setup Defaults From ROM Table

BIOS SETUP PROGRAM - ADVANCED CHIPSET SET UP (c) 1990 American Megatrends Inc., All Right Reserved
STANDARD CMOS SETUP ADVANCED CMOS SETUP AUTO CONFIGURATION WITH BIOS DEFAULTS
LOAD BIOS Setup Defaults Value from ROM Table (Y/N) ? N
Load BIOS Setup Defaults Values for Advanced CMOS and CHIPSET Setup
Select F2/F3:COLOR F10:SAVE & EXIT

- Load Power-On Defaults values from ROM Table

Figure 6. Load Power-On Defaults From ROM Table

BIOS SETUP PROGRAM - ADVANCED CHIPSET SET UP (c) 1990 American Megatrends Inc., All Right Reserved
STANDARD CMOS SETUP ADVANCED CMOS SETUP AUTO CONFIGURATION WITH BIOS DEFAULTS
LOAD Power-On Defaults Value from ROM Table (Y/N) ? N
Load Power-On Defaults Values for Advanced CMOS and CHIPSET Setup
Select F2/F3:COLOR F10:SAVE & EXIT

CHANGE PASSWORD

This option can be used to change the password (of the user). The password can be at most 8 characters long. The password is stored in the CMOS. If the CMOS is bad, there is a default password which is stored in the ROM.

Figure 7. Change Password Setting

BIOS SETUP PROGRAM - CHANGE PASSWORD (c) 1990 American Megatrends Inc., All Right Reserved
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">Enter CURRENT Password:</div>
Use Maximum 6 ASCII Characters, ESC:Exit

HARD DISK DIAGNOSTICS

This option is used for formatting the hard disk. The disk drive information is taken from the Standard CMOS Setup Information. If the user wants to change the Disk Drive types, he must go to the standard CMOS Setup and change it. The user is asked for the Disk Drive (C/D) if 2 disks have been installed. The type for the hard disk is same as that shown in Standard CMOS Setup.

The various sub-options are :

- **Hard Disk Format** : For formatting the hard disk, the user is asked for the Interleave Factor. The user can also enter the Bad Track List.

Figure 8. HD Formatter

```

BIOS SETUP PROGRAM - HARD DISK UTILITY
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Hard Disk C: Type : 13          Cyln Head WPcom LZone Sect  Size (MB)
                               306  8   128  319  17   20
Hard Disk D: Type : Not Installed

Hard Disk Format
-----
Disk Drive (C/D)      ? C
Disk Drive Type      ? 13
Mark Bad Tracks (Y/N) ? N
Proceed (Y/N)        ?

Select  F2/F3:Color  F10:Save & Exit
    
```

- Auto Interleave : For automatically deleting the best Interleave factor and formatting the disk 1. The user can enter the Bad Track List.

Figure 9. Auto Interleave

```

BIOS SETUP PROGRAM - HARD DISK UTILITY
(c) 1990 American Megatrends Inc., All Right Reserved

Hard Disk C: Type : 13          Cyln Head WPcom LZone Sect  Size (MB)
                               306  8   128  319  17   20
Hard Disk D: Type : Not Installed

Auto Interleave
-----
Disk Drive (C/D)      ? C
Disk Drive Type      ? 13
Mark Bad Tracks (Y/N) ? N
Proceed (Y/N)        ?

Bad Track # 0
-----
No.   Cyln.  Head

Select  F2/F3:Color  F10:Save & Exit
    
```

- **Media Analysis** : The user is asked for the Interleave Factor. The Bad Tracks List will be generated for the hard disk. The user can update the Bad Track List if he wants.

Figure 10. Hard Disk Media Analysis

BIOS SETUP PROGRAM - HARD DISK UTILITY						
(c) 1990 American Megatrends Inc., All Right Reserved						
		Cyln	Head	WPcom	LZone	Sect
Hard Disk C: Type :	13	306	8	128	319	17
Hard Disk D: Type :	Not Installed					
Media Analysis						
Disk Drive (C/D)	? C					
Disk Drive Type	? 13					
Proceed (Y/N)	?					
Select F2/F3:Color F10:Save & Exit						

WRITE TO CMOS AND EXIT

The options set in the Standard Setup, Advanced Setup, Advanced Chipset Setup and the New Password (if it has been changed) are stored in the CMOS. The CMOS checksum is calculated and written into the CMOS. After that, control is passed back to the BIOS. Please refer to Figure 11 of next page.

Figure 11. Write Data to CMOS

BIOS SETUP PROGRAM - AMI BIOS SETUP UTILITIES (c) 1990 American Megatrends Inc., All Right Reserved
STANDARD CMOS SETUP ADVANCED CMOS SETUP AUTO CONFIGURATION WITH BIOS DEFAULTS
Write to CMOS and Exit (Y/N) ? N
Write the setting to the CMOS and Exit
Select F2/F3:COLOR F10:SAVE & EXIT

DO NOT WRITE TO CMOS AND EXIT

Control is passed back to the BIOS without writing to the CMOS.

Figure 12. Do Not Write Data to CMOS

BIOS SETUP PROGRAM - AMI BIOS SETUP UTILITIES (c) 1990 American Megatrends Inc., All Right Reserved
STANDARD CMOS SETUP ADVANCED CMOS SETUP AUTO CONFIGURATION WITH BIOS DEFAULTS
Want to Quit Without Saving (Y/N) ? N
Do Not Write the setting to the CMOS and Exit
Select F2/F3:COLOR F10:SAVE & EXIT