CONTAQ-386 UPGRADABLE SYSTEM BOARD USER'S MANUAL

CONTAQ-386 UPGRADABLE SYSTEM BOARD USER'S MANUAL

MS-3124
Version 2

FCC-B RADIO FREQUENCY INTERFERENCE STATEMENT

Note: This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interence when the equipment is operated in a commercial enviroment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Notice 1:

The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Notice 2:

Shielded interface cables and A.C power cord, if any, must be used in order to comply with the emission limits.

Edition

January 1992

Copyright

Trademarks

CONTENTS

CHAPTER 1

Introduction

This manual is included all necessary information to operate this CONTAQ system board. It will assist you in the installation and the configuration of this system. It's also included how to upgrade 386 system as a 486 system with MS-4901 (486 CPU daughter board).

The CONTAQ system board is designed the CHIP with built-in cache controller. It can support 64K/128K/256K Direct Mapped cache and Write-back DRAM updated scheme.

This CONTAQ system board is supported 2 banks and upto 32 MB memory which will be able to support MS-DOS, PC-DOS, MS-OS/2, XENIX, UNIX, NOVELL NETWORK and IBM PC/AT compatible application programs.

1.1 System Board Specification

CPU :

INTEL 80386DX - 25/33
AMD Am386DX -25/33/40
C&T SUPER386 38600DX - 33/40
C&T SUPER386 38605DX - 33/40
MS-4901 486 CPU Daughter Board (optional)

* MS-4901 Supports :

INTEL 80486DX - 25/33/50
INTEL 80486SX - 16/20/25
INTEL 80487SX - 16/20/25

Coprocessor : Socket for WEITEK 3167 or INTEL 80387

Cache memory : 386 system supports 64K/128K/256K

Main memory :

256KB/1MB/4MB SIMM type RAM module
DRAM spec. - Fast Page mode/80ns
On board memory size up to 32 MB

Slots :

6 NO. 16-bit AT bus slots
2 NO. 8-bit AT bus slots

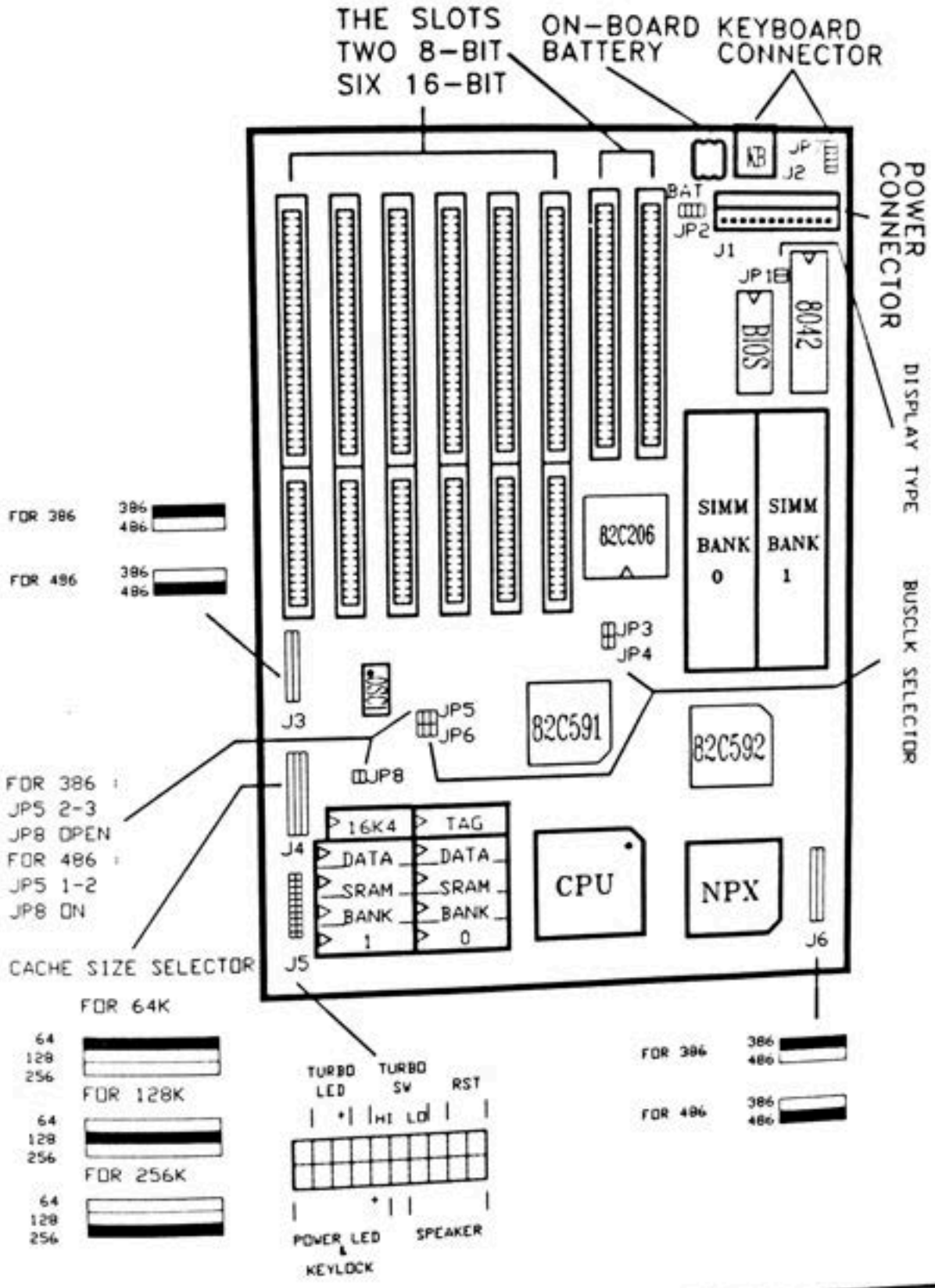
Battery :

3.6V/60mAh on board rechargeable battery
External battery connector

Dimensions : 28.0 cm x 22.5 cm x 4 layers

Mounting : Five mounting holds

1.2 Board Layout



CHAPTER 2

HARDWARE INSTALLATION

When you install your CONTAQ system board in a system case various jumper settings, connections and components must be made.

Jumper settings :

Cache size selector - J4
System selector - J3, J6, JP5, JP8
Bus clock selector - JP3, JP4, JP6
Display adaptor selector - JP1

Connectors :

Power connector - J1
Keyboard connector - J2 or JP7
Battery connector - JP2
Keyboard lock & Power LED - J5 (pin 1-5)
Speaker connector - J5 (pin 6-10)
Turbo LED connector - J5 (pin 12-13)
Turbo switch - J5 (pin 15-17)
Hardware reset - J5 (pin 19-20)

Component :

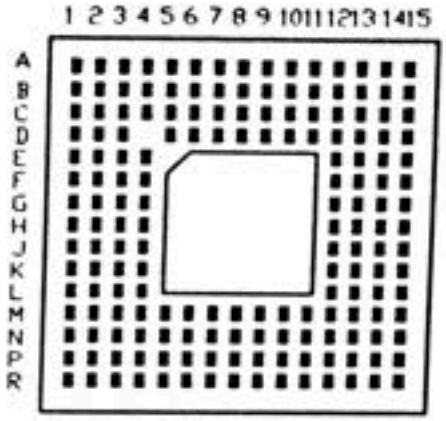
CPU
Coprocessor
Cache memory (SRAM)
Main memory (SIMM)

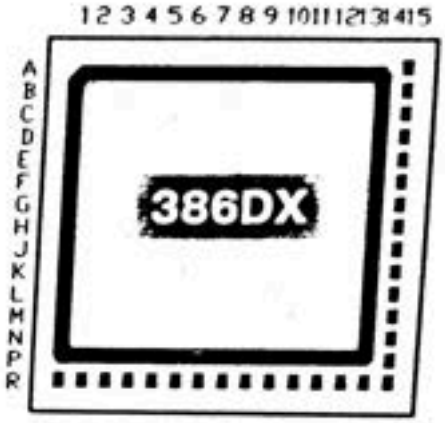
These are explained in detail as the following sections.

2.1.1 CPU Installation

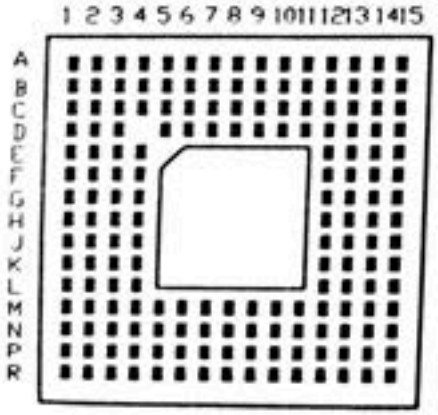
There is a 175 pin PGA socket on CONTAQ system board to support various 386DX CPUs and MS-4901 486 CPU daughter board. Users have to make sure the CPU chip is correctly rotated and aligned as follows:

A. For INTEL 80386DX, AMD Am386DX and C&T SUPER 386 38600DX





B. For C&T SUPER386 38605DX

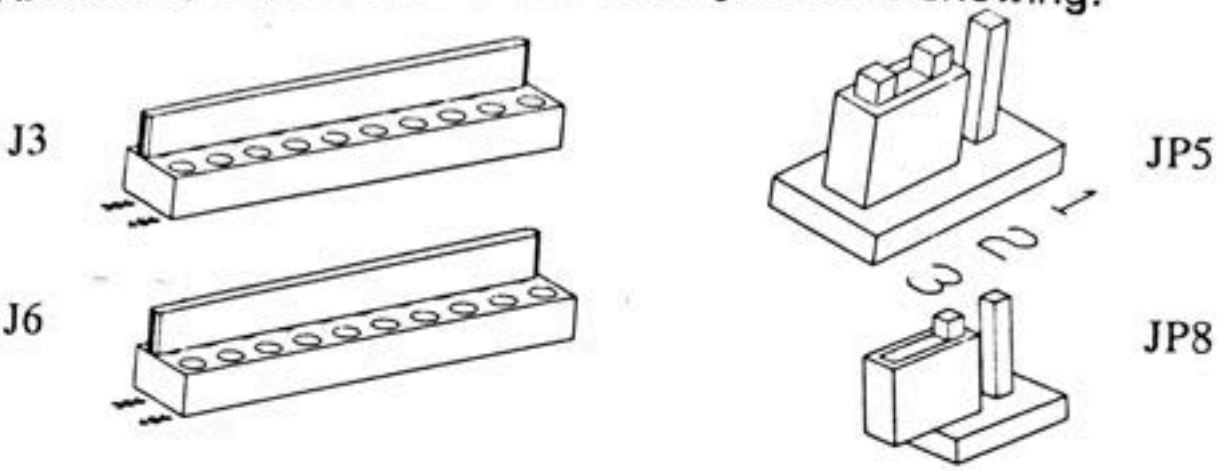


C. Concerning MS-4901 486 CPU daughter board information, please refer to MS-4901 Kit installation guide.

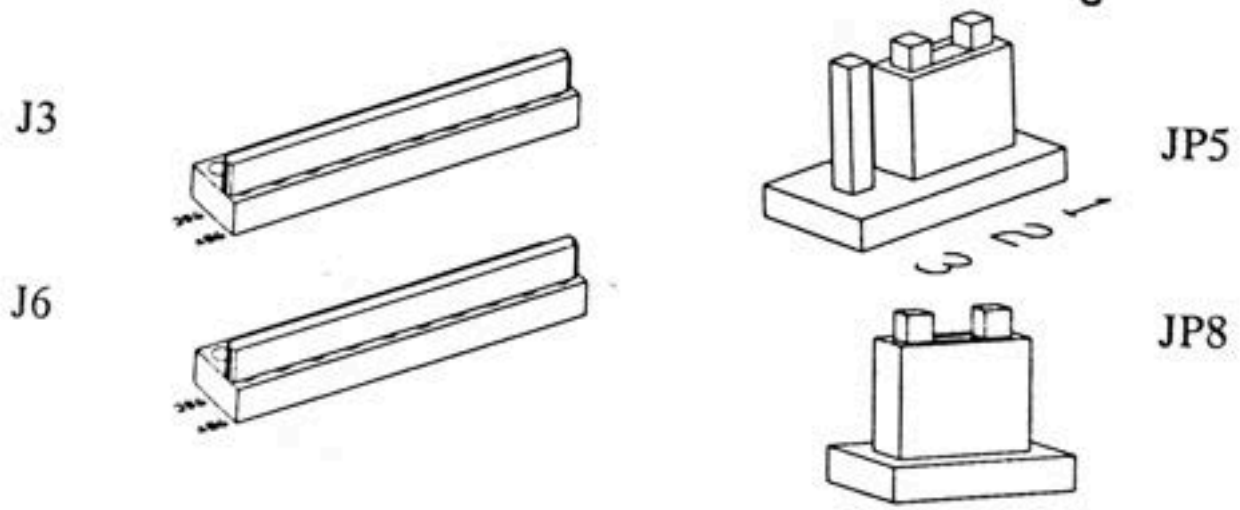
2.1.2 J3, J6, JP5, JP8 System Selection

The CONTAQ system is a 386 system board, but it can be upgraded as a 486 system.

A. Set J3, J6, JP5, JP8 for 386 system as showing:

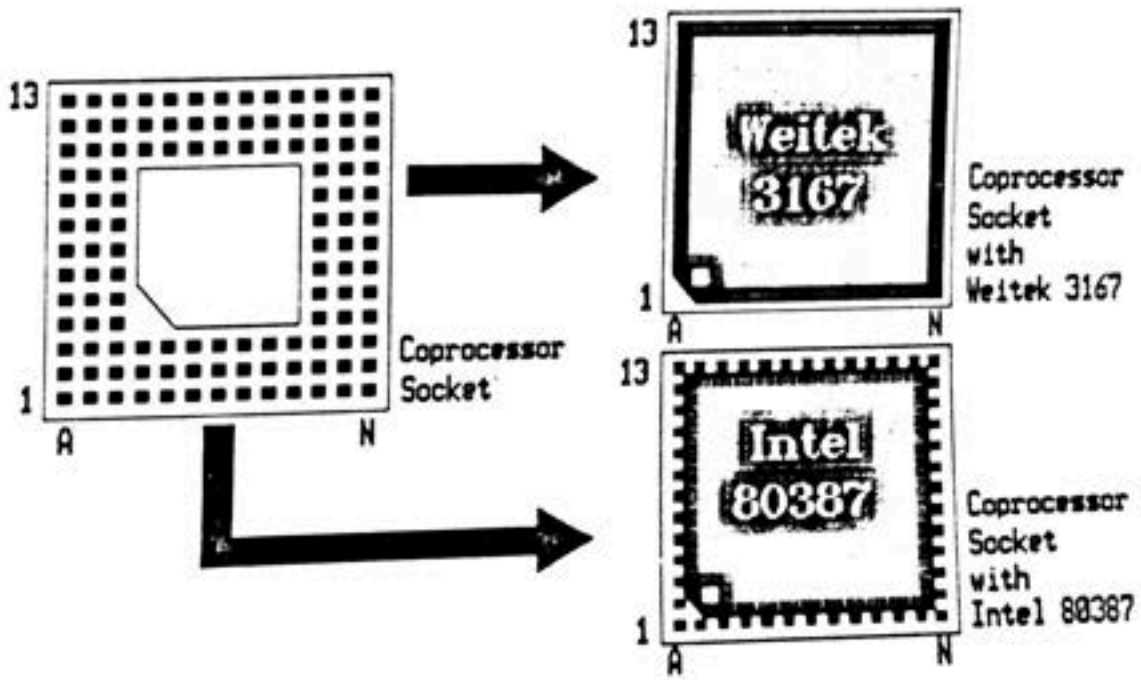


B. Set J3, J6, JP5, JP8 for 486 system as showing:



2.2 Numeric Coprocessor Installation

There is a 121 pin PGA socket on CONTAQ system board to support INTEL 80387 and WEITEK 3167. Users have to make sure the coprocessor is correctly rotated and aligned as following, but this socket should be empty if the MS-4901 486 CPU daughter board has installed.



2.3 Main Memory Installation

CONTAQ system board supports 2 banks. Thus users can choose the different ways to install the main memory as follows:

2.3.1 Main Memory Configuration.

BANK 0	BANK 1	Total
256 KB		1 MB
256 KB	256 KB	2 MB
1 MB		4 MB
1 MB	256 KB	5 MB
1 MB	1 MB	8 MB
4 MB		16 MB
4 MB	256 KB	17 MB
4 MB	1 MB	20 MB
4 MB	4 MB	32 MB

2.3.2 Installing SIMM Modules

The main memory used DRAM chips mounted in sets of nine chips on modules. These modules are called Single In-line Memory Modules (SIMM). Three sizes of modules can be used: 256KB, 1MB & 4MB. But each memory bank can only use one size of module.

On the board there are eight white plastic holders for these modules, labelled U9-U16.

Bank 0 is U9-12, Bank 1 is U13-16.

To install the SIMM modules, start from Bank 0 and completely fill the required bank with SIMM modules of the same size.

Removal is more difficult than installation and requires the gentle use of a suitable tool (e.g. a screwdriver).

2.4 Cache Memory Installation

CONTAQ system board supports 64K/128K/256K size of cache memory. Users have three choices to configurate the cache memory system as follows:

2.4.1 Cache Memory Configuration

cache size	TAG SRAM	location (Ux)	DATA SRAM	location (Ux)
64K	8K8	38	8K8	40,41,42,43,44,45,46,47
128K	8K8	38	32K8	40,41,42,43
256K	32K8	38	32K8	40,41,42,43,44,45,46,47

NOTE: 128K Cache is not available for 486 system.

2.4.2 SRAM Specification

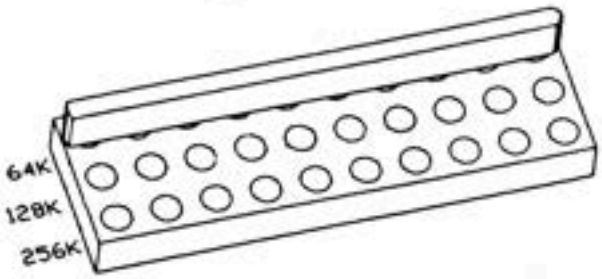
CPU SPEED	TAG SRAM	DATA SRAM
16/20/25 MHz	25 ns	35 ns
33 MHz	20 ns	25 ns
40 MHz	20 ns	20 ns
50 MHz	15 ns	20 ns

2.4.3 J4 Cache Size Selector Setting

There are three possible choices: 64KB, 128KB or 256KB depending on how much cache memory you install.

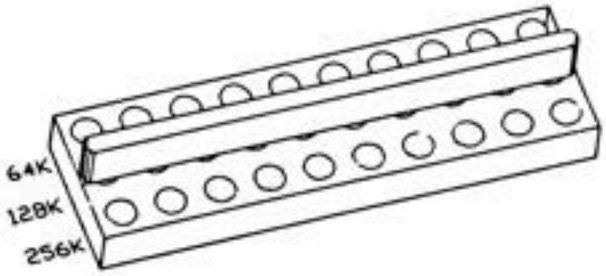
A. 64KB cache

Set J4 jumper block as showing:



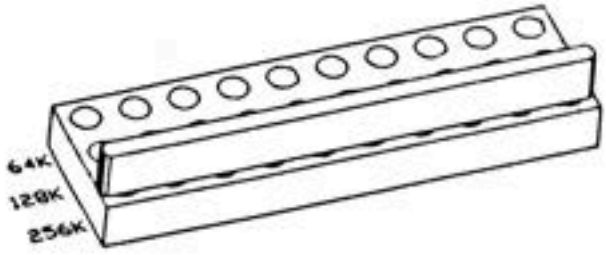
B. 128KB cache (for 386 system only)

Set J4 jumper block as showing



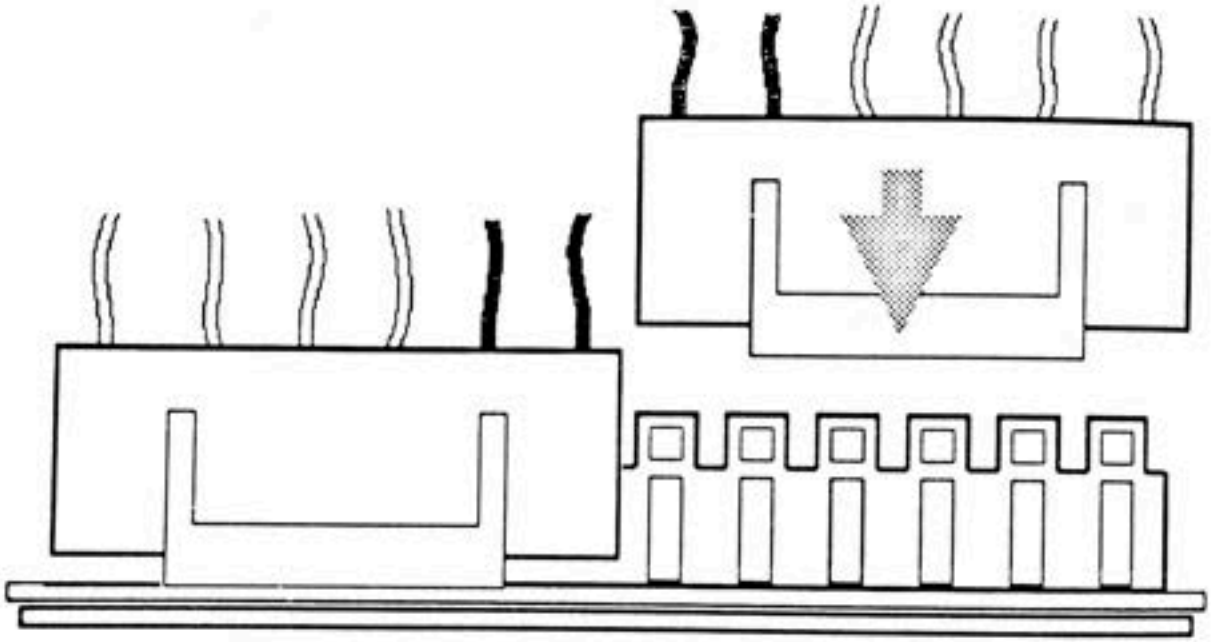
C. 256KB cache

Set J4 jumper block as showing:



2.5 J1 Power Connector

The power supply cables connect to the large white 12 pin connector. The two power supply connectors can only fit on in one orientation. Be sure to arrange the wires as showing, so that the black wires are at the center.



PIN#	Assignement	PIN#	Assignment
1	GND	1	Power Good
2	GND	2	+5V DC
3	-5V DC	3	+12V DC
4	+5V DC	4	-12V DC
5	+5V DC	5	GND
6	+5V DC	6	GND

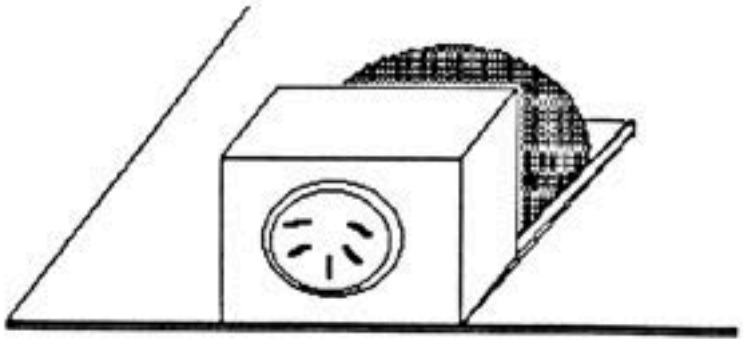
2.6 J2, JP7 Keyboard Connector

There are two possible choices for the keyboard connection. That depends on the case type.

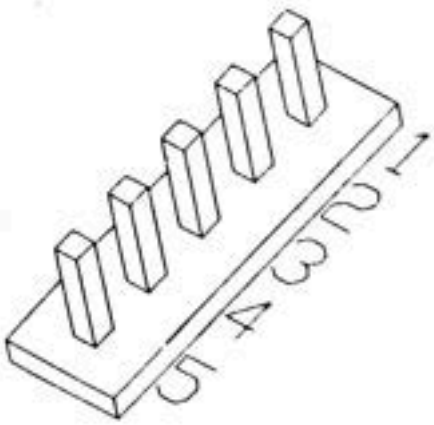
* J2 is a 5-pin DIN connector. It supports the general case to connect the keyboard cable jack.
* JP7 is a 5-pin PIN male connector. It could connect with a extend keyboard cable for PIN to DIN connection. It is fittable, the DIN connector is in the front of case to connect with the keyboard cable jack.

The pin assignments are:

1 = Keyboard Clock
2 = Keyboard Data
3 = Spare
4 = GND
5 = +5V DC



J2 DIN Connector



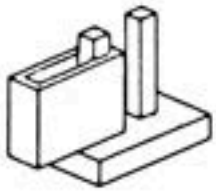
JP7 PIN Male Connector

2.7 JP1 Display Adaptor Selector

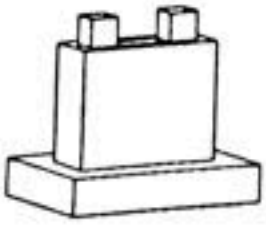
Set the JP1 jumper depending on whether you are using a monochrome (MGP) or color (CGA) display adaptor.

If using an EGA or VGA adaptor, the JP1 setting is irrelevant.

A. For Monochrome display adaptor as showing:



B. For color display adaptor as showing:

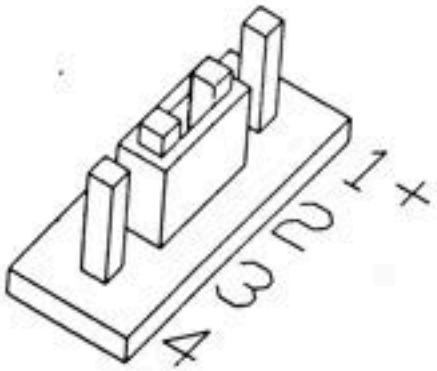


2.8 JP2 External Battery Connector

To retain the board's configuration in the CMOS RAM (reside in 82C206), so that must have a battery. There are two possible choices as follows:

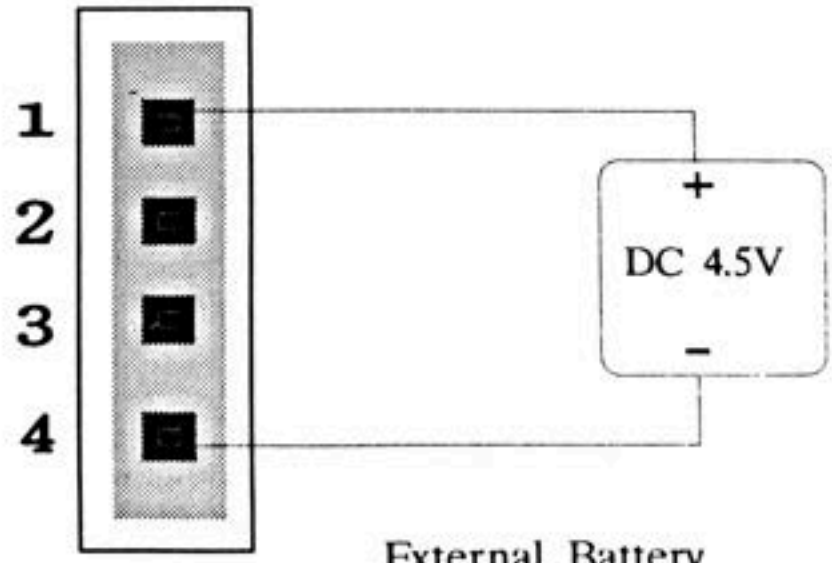
A. On board rechargeable battery

Set the JP2 as showing:



B. External Battery

Attached a 4.5V battery set to JP2 as showing:

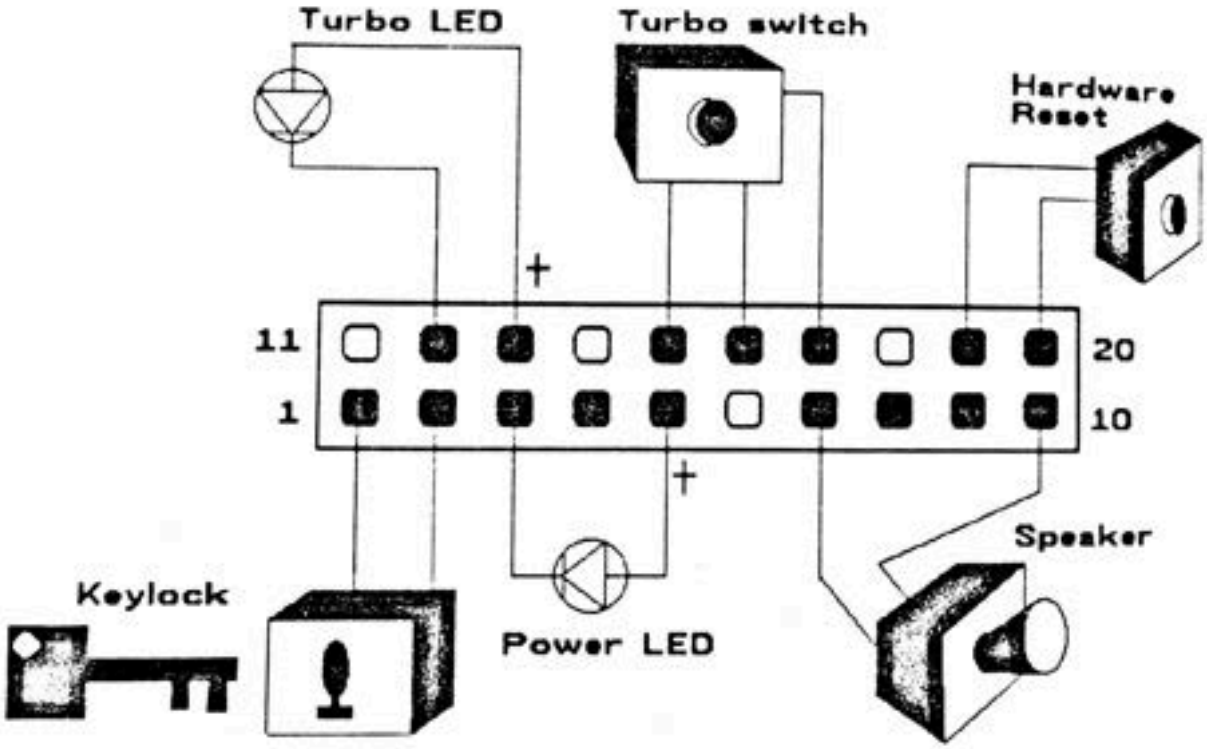


External Battery

2.9 J5 Connector Block

The turbo LED & switch, the hardware reset switch, the key-lock & power LED and speaker are all connected to the J5 connector block as showing.

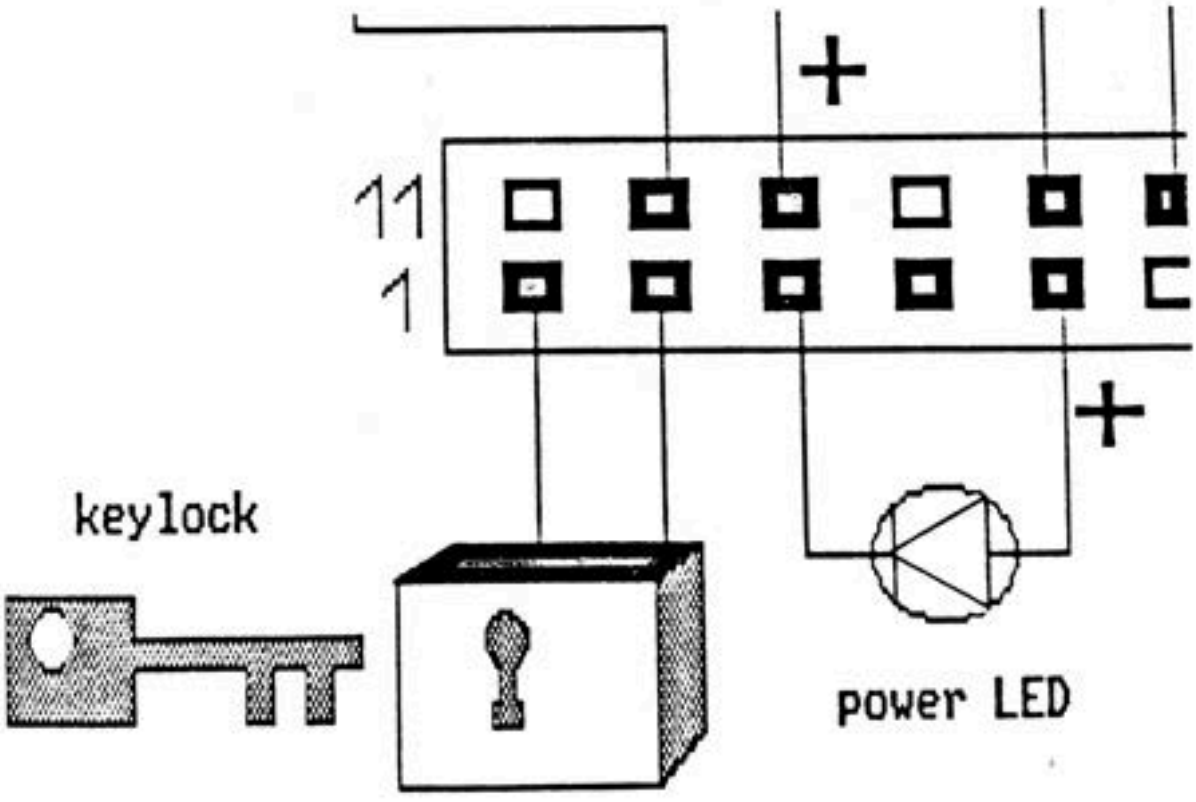
The detail information as the following sections.



2.9.1 Keylock & Power LED Connector

The J5 connector connects the power LED and the keylock. The keylock allows you to "lock" your keyboard, thus making it difficult for others to gain access to your PC. If security is a real concern, do not rely on this lock. The pin-out is as follows:

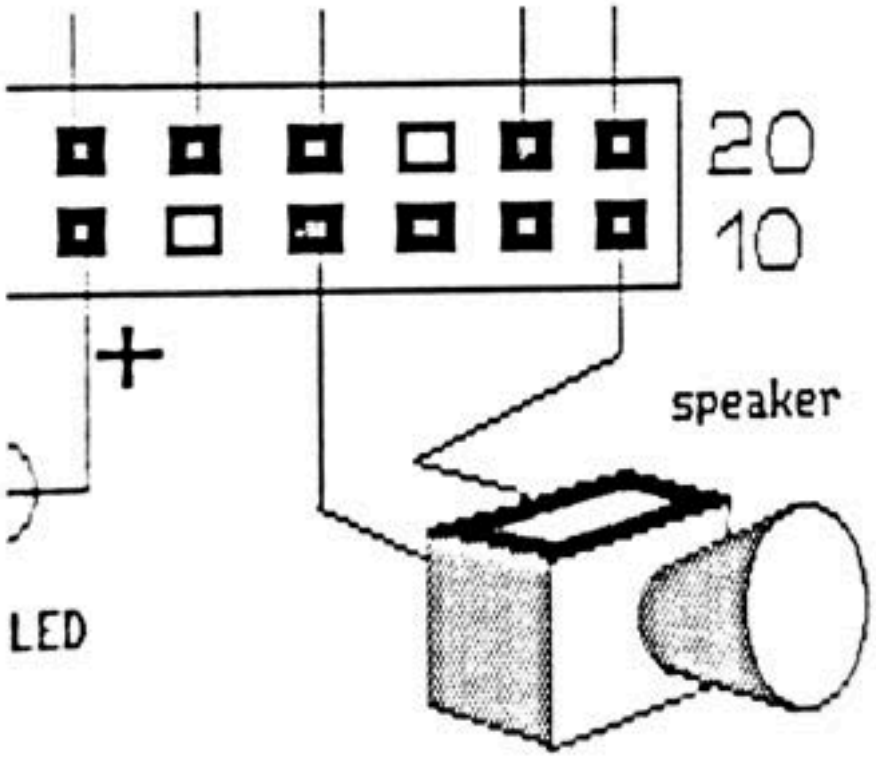
1 = GND
2 = Keylock
3 = GND
4 = NC
5 = Power LED (+)



2.9.2 Speaker Connector

The J5 connector is where you connect the cable from the case speaker. The pin-out is as follows:

7 = VCC
8 = GND
9 = NC
10 = Speaker Data

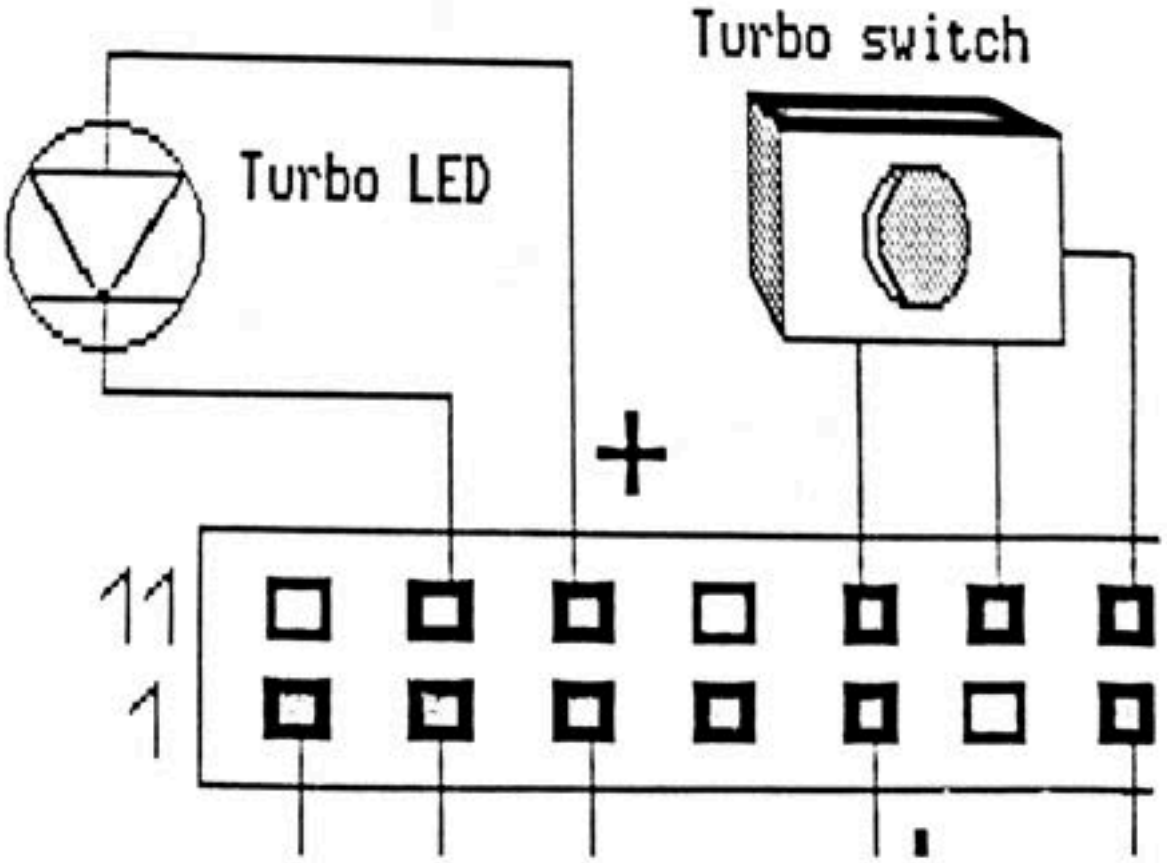


2.9.3 Turbo LED & Turbo Switch

The J5 connector is where you connect the cables from the Turbo switch and Turbo LED mounted on you system case. The Turbo switch allows you to toggle the processing speed from the normal high speed to the lower speed. Reducing the processing speed is sometimes necessary when running older software which is more timing critical. The Turbo LED lights to show high speed processing.

The pin-out is as follows:

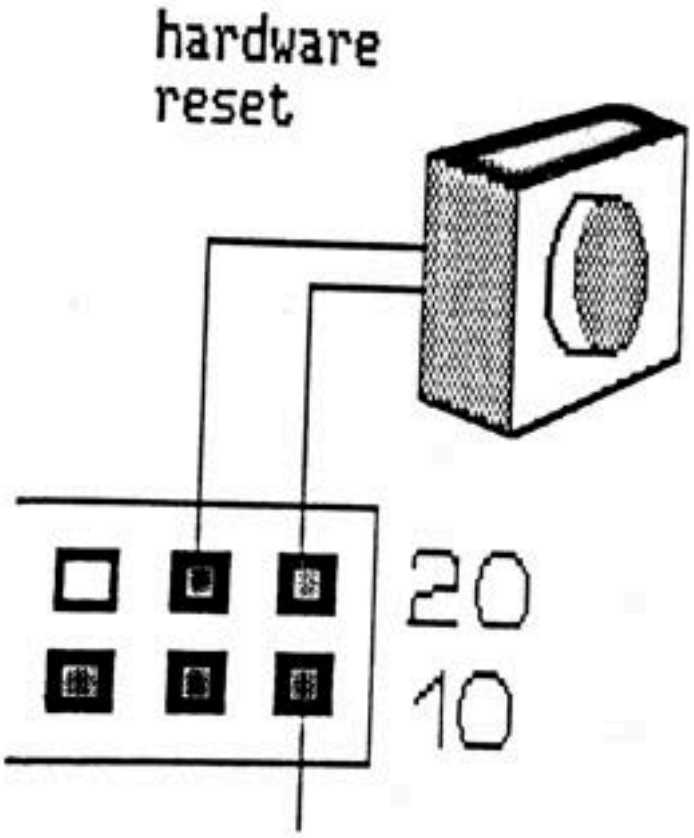
12 = GND
13 = Turbo LED (+)
15,16,17 = Turbo switch
Short pins 15 & 16 = High speed
Short pins 16 & 17 = Low speed



2.9.4 Hardware Reset

The J5 connector is where you connect the cable from the Reset button on your system case. This button allows you to reboot the computer without switching it off. The pin-out is as follows:

19 = Reset
20 = GND



2.10 JP3, JP4 and JP6 Bus Clock Selectors

There are two possible choices of bus clock mode: Synchronous or Asynchronous depending on the setting of JP6.

In synchronous mode, the bus clock must depend on the settings of JP3 and JP4. The all possible settings are as follows:

SYSTEM	JP6	JP3	JP4	BUS CLOCK	MODE
386	1-2	OPEN	OPEN	CLK2/10	SYN
386	1-2	ON	OPEN	CLK2/8	SYN
386	1-2	OPEN	ON	CLK2/6	SYN
386	1-2	ON	ON	CLK2/4	SYN
386	2-3	X	X	7.2 MHz	ASYN
486	1-2	OPEN	OPEN	Reserved	
486	1-2	ON	OPEN	CLK/4	SYN
486	1-2	OPEN	ON	CLK/3	SYN
486	1-2	ON	ON	CLK/6	SYN
486	2-3	X	X	7.2 MHz	ASYN

NOTES : 1. X means "Don't care"

2. CLK2 equals the OSC speed of mother board in the 386 system.

3. CLK equals the OSC speed of MS-4901 486 CPU daughter board in the 486 system.

CHAPTER 3

BOOTING THE SYSTEM & CMOS SETTING WITH AMI BIOS

The system contains user modifiable system configuration & chipset internal register configuration informations in CMOS RAM (resided in 82C206). The power conserving RAM is backed up by a battery, so that it retains the configuration information even if the power supply is turned off.

If the power is turned on, the configuration information is immediately available to the system board. The AMI BIOS supports a utility of setup which allows the user to change the configuration information stored in the CMOS RAM in order to match the configuration of the system board.

3.1 Booting the System & CMOS Setup

When the system is powered on, the BIOS will enter the Power-On Self Test (POST) routines. These routines are divided into two phases:

1. System Test and Initialization (test and initialize system board for normal opterations).

2. System Configuration Verification (compare defined configuration with hardware actually installed).

The AMI BIOS performs the various diagnostic checks at the time the system is powered on; if an error is encountered, the error will be reported in one of two different ways.

1. Speaker: If the error occurs before the display device is initialized, a series of beeps will be transmitted. Beep codes are found in Appendix A.

2. Display: If the error occurs after the display device is inti alized, the screen will display the error message. Error messages are found in Appendix B. In the case of a non-fatal error, a prompt to press the <F1> key may also appear on screen.

Normally, the only routine visible on the screen will be the memory test. Figure 3-1 displays the screen which appears when the system is powered on.

```
ROM-BIOS (C) 1989 American Megatrends Inc.
AC32 022892
XXXX KB OK



(C) American Megatrends Inc.,
30-0400-D31169-01111-121291-CTQ 386 &  486-F
```

Figure 3-1

After the POST routines are completed, the following message appears:

"Hit <DEL> if you want to run SETUP"

To access the AMI BIOS SETUP utility, press the <DEL> key. The BIOS setup menu as Figure 3-2 will be displayed at this time.

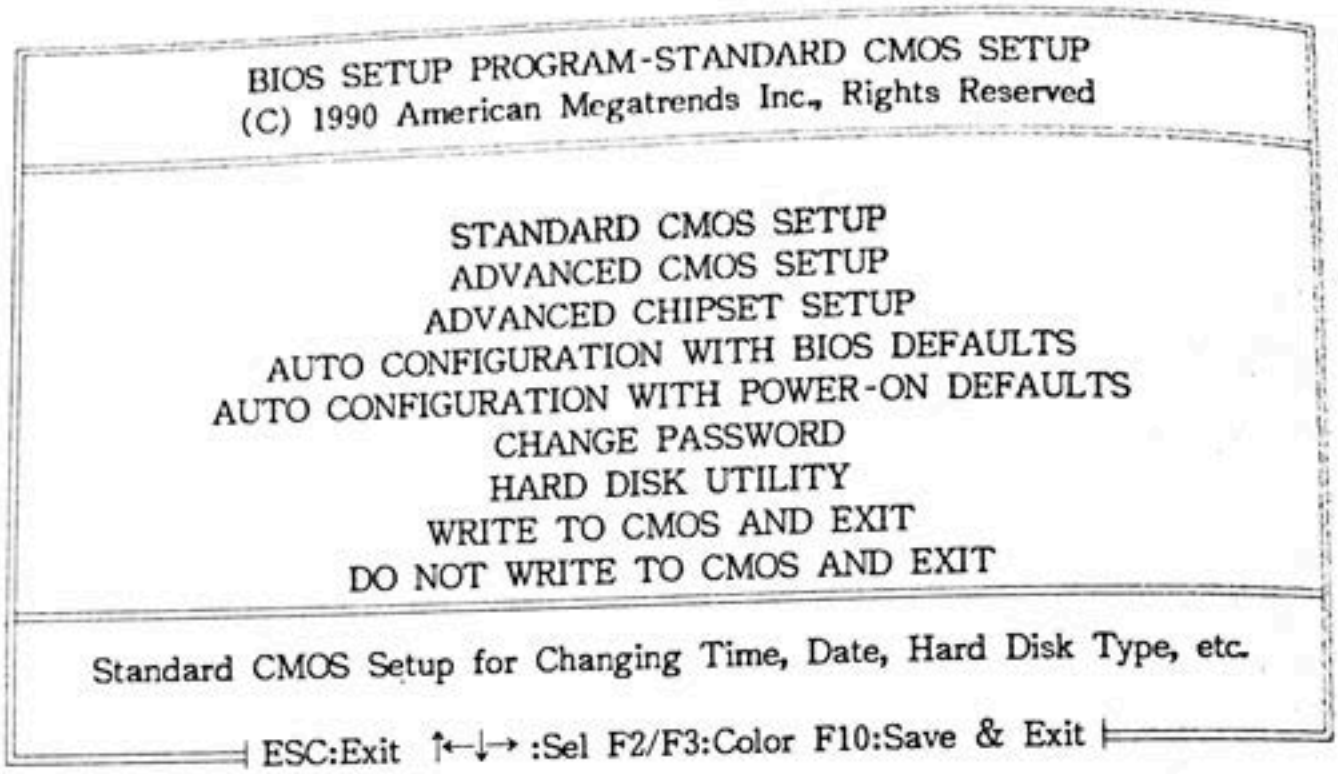


Figure 3-2

Listed below is an explanation of the keys displayed at the bottom of the screen accessed through the BIOS SETUP program:

1. <ESC> key: Exit to previous screen.
2. Arrow Keys: Use arrow keys to move cursor to desired selection.
3. <PgUp/PgDn> or <Ctrl-PgUp/Ctrl-PgDn> keys: Modify the default value of options for the highlighted feature. If there are less than 10 available options, the <Ctrl-PgUp/Ctrl-PgDn>keys functions the same as the <PgUp/PgDn> keys.
4. <F1> key: Displays help screen for selected feature.
5. <F2/F3> keys: Changes background and foreground colors.

6. <F5> key: Retrieves the values which were resident when current setup session was started. These values will be CMOS values if the CMOS was uncorrupted at the start of the session, or they will be the BIOS SETUP default values.
7. <F6> key: Loads all features in Advanced CMOS Setup/ Advanced Chipset Setup with the BIOS SETUP defaults.
8. <F7> key: Loads all features in Advanced CMOS Setup/ Advanced Chipset with the Power-On defaults.
9. <F10> key: Saves all changes made to Setup and exit program.

NOTE:

The default value for the prompt which occur when the <F5>, <F6> and <F7> keys are pressed is always <N> (No). Actually executing these options require changing the <N> to <Y> (Yes) and pressing <Enter>.

A warning message, shown in Figure 3-3 is displayed each time one of the first three options (Standard CMOS Setup, Advanced CMOS Setup and Advanced Chip Set Setup) is selected before any changes are allowed to any of the setup parameters.

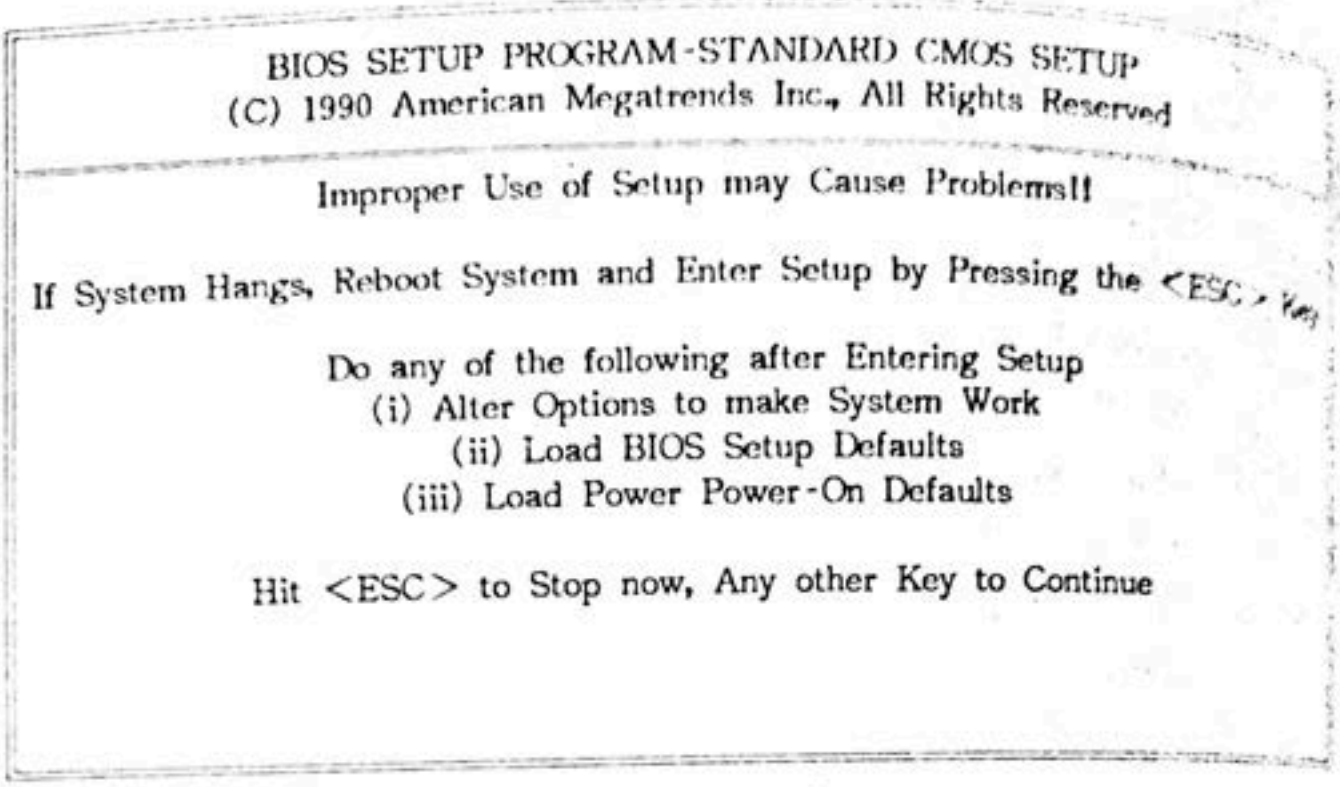

BIOS SETUP PROGRAM-STANDARD CMOS SETUP
(C) 1990 American Megatrends Inc, All Rights Reserved
Improper Use of Setup may Cause Problems!!
If System Hangs, Reboot System and Enter Setup by Pressing the <ESC> Key
Do any of the following after Entering Setup
(i) Alter Options to make System Work
(ii) Load BIOS Setup Defaults
(iii) Load Power Power-On Defaults
Hit <ESC> to Stop now, Any other Key to Continue

Figure 3-3

3.2 Standard CMOS Setup

Standard CMOS Setup is the first option on the main setup menu. Press <Enter> key at the highlighted selction to access the option. The screen as figure 3-4 will appear. The Standard CMOS Setup Function is used to configure the following features:

1. Date
2. Time
3. Daylight Saving
4. Hard Disk C: type
5. Hard Disk D: type
6. Floppy drive A:
7. Floppy drive B:
8. Primary display
9. Keyboard

NOTES:

1.Hard disk types from 1 to 46 are standard; the type 47 is user definable.

2.If keyboard is diabled, that BIOS will be bypass the keyboard test.

BIOS SETUP PROGRAM-STANDARD CMOS SETUP
(C) 1990 American Megatrends Inc., All Rights Reserved

Date (mn/date/year) : Thu, May 16 1991
Time (hour/min/sec) : 09:24:40
Daylight saving : Disabled
Hard Disk C: type : 46
Hard Disk D: type : Not Installed
Floppy Drive A: : 1.2MB, 5-1/4"
Floppy Drive B: : Not Installed
Primary Display : VGA/PGA/EGA
Keyboard : Not Installed

Base memory : 640 KB
Ext. memory : 7424 KB

Cyln	Head	WPcom	LZone	Sect	Size
751	8	65535	751	17	50MB

Sun	Mon	Tue	Wed	Thu	Fri	Sat
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

Month : Jan, Feb,....Dec
Date : 01,02,03,...31
Year : 1901, 1902,...2099

ESC:Exit ↑ ↓ → :Sel F2/F3:Color PU/PD:Modify

Figure 3-4

3.3 Advanced CMOS Setup

Advance CMOS Setup is the second optioon on the main set-up menu. Move the highlight-bar to this option, then press the <Enter> key to access this option. The screen will be as figure 3-5. The options for the following features of the Advanced CMOS Setup are either Disabled or Enabled.

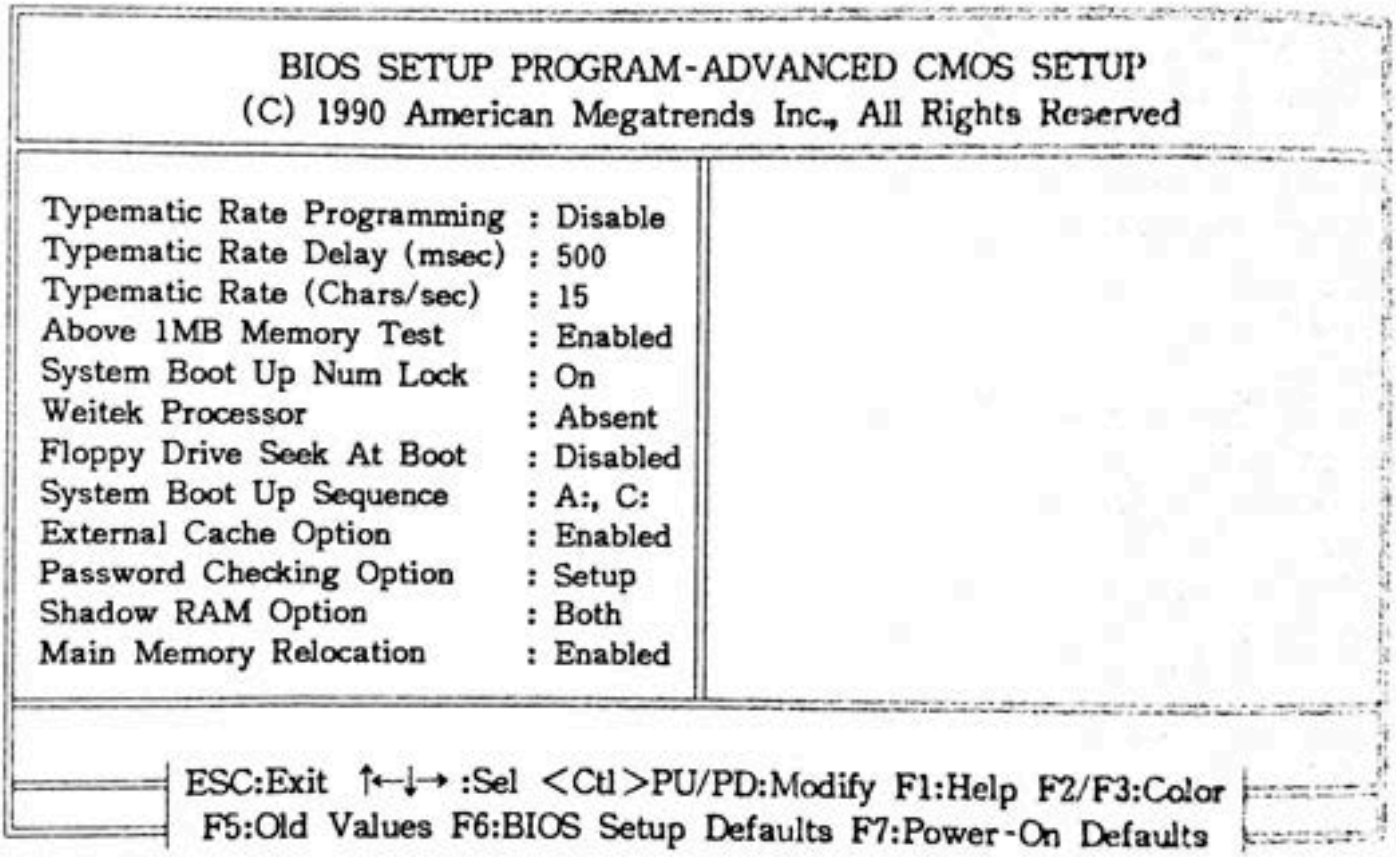


Figure 3-5

1. Typematic Rate Programming: By enabling this option, the user can adjust the rate at which a keystroke is repeated. When a key is pressed and held down, the character appears on the screen and after a delay set by "Typematic Rate delay", it keeps on repeating at rate set by the " Typematic Rate" value.

2. Above 1MB Memory Test: This features, when enabled, will invoke the POST memory routines on the RAM above 1 MB. If disabled, the BIOS will only check the first 1 MB of RAM.
3. Hard Disk Type 47 RAM Area: The AMI BIOS SETUP features two user definable hard disk types. Normally, the data for these disk types are stored at 0:300 in lower system RAM. If a problem occurs with other software, this data can be located at the upper limit of the DOS shell (640 KB). If the option is set to "DOS 1 KB", the DOS shell is shortend to 639 KB, and the top KB is used for the hard disk data storage.
4. System Boot Up Num Lock: The user may turn off the " Num Lock" option on his Enhance Keyboard when the system is powered on. This will allow him to use the arrow keys on the numeric keypad instead of using the other set of arrow keys on the Enhance Keyboard.
5. Weitek Processor: This option allows the user to make the Weitek numeric processor (Weitek 3167) as present or absent.
6. Floppy Drive Seek At Boot: The default for this option is "Disabled" to allow a fast boot and to decrease the possibility of damage to the heads.
7. System Boot Up Sequence: If this option is set to "C:, A:", the system will attempt to boot from the C:, and then A:. If this option is set to "A:, C:", the system will attempt to boot from drive A: and if unsuccessful, it will boot from C:.

8. External Cache Option: With this option, the user may specify whether the external cache system is present or absent.

9. Password Check Option: This option allows the user to enable the password check option every time the system boots or upon entering SETUP only. A third option is to disable the password entirely. Refer to Section 3.7 for a detailed description of password setup.

10. Shadow Option: This option allows the user to enable the system BIOS shadow RAM (main), or the VGA BIOS & System BIOS (both), or disable all shadow functions. The feature can increase the performance of BIOS.

11. Main Memory Relocation: The 256KB memory range in the 640KB through 1 MB will be relocated to top address range if this option is enabled. But you must disable this option in the following conditions:

    1. On board memory is 32 MB.
    2. Memory Block A,B,D and E, if any block of them get used.

3.4 Advance Chip Set Setup

Advance Chip Set Setup is the third option on the main set-up menu. Move the highlight-bar to this option, then press the <Enter> key to access this option. The screen will be as figure 3-6.

BIOS SETUP PROGRAM-ADVANCED CMOS SETUP
(C) 1990 American Megatrends Inc., All Rights Reserved

SRAM Wait States	: 1 W/S
Burst Mode (for 486 only)	: 3222 Slow
DRAM Write Wait States	: 1 W/S
DRAM Read Wait States	: 2 W/S
RAS Precharge Time	: 3 Sysclk
Non-Cacheable Block-0 Size	: 64 KB
Non-Cacheable Block-0 Base	: 640 KB
Non-Cacheable Block-1 Size	: 64 KB
Non-Cacheable Block-1 Base	: 640 KB
Non-Cacheable Block-0	: Disabled
Non-Cacheable Block-1	: Disabled
System BIOS is Cacheable	: Enabled
Video BIOS is Cacheable	: Enabled

ESC:Exit ↑←↓→ :Sel <Ctl>PU/PD:Modify F1:Help F2/F3:Color
F5:Old Values F6:BIOS Setup Defaults F7:Power-On Defaults

Figure 3-6

1. These SRAM Wait States, DRAM Read/Write Wait States and RAS Precharge must be adjusted to match the specifications of SRAM and DRAM (refers to section 3.9).

2. Non-Cacheable Range: The system board allows the user to set aside up to 2 block of variable size of main memory as non-cacheable. This non-cacheable areas are required by the system as some memory areas should not be cached.

A. Non-Cacheable Block - x Base: These options set the starting address of each block.

B. Non-Cacheable Block - x Size: These options set the non-cacheable memory size of each block.

C. Non-Cacheable Block - x: These options enable or disable the above non-cacheable range.

3. Burst Mode: This option is for 486 system only.

3.5 Auto Configuration With BIOS Defaults

The auto configuration with BIOS featrure uses the default system values before the user has changed any CMOS values. If the CMOS is corrupted, the BIOS defaults will automatically by loaded. If you wish to use the BIOS defaults, change the prompt to Y and press <Enter> key. The following message will appear on the screen:

"Default values loaded. Press any key to continue."

3.6 Auto Configuration With Power-On Defaults

This feature uses the default power-on values. You may wish to use this option as a diagnostic aid if your system is behaving erratically.

If you wish to use the Power-On defaults, change the prompt to Y and press <Enter> key. The following message will be appeared on screen:

"Default values loaded. Press any key to continue."

3.7 Change Password

The section of the manual deals with changing the user's password. The password check function is setup or always in "ADVANCE CMOS SETUP" (refer to section 3.3). The default password check function is disabled. But the password check function will be enabled when user sets the new password. The password, which will be stored in the CMOS, cann't exceed 6 characters in length.

To change the user password, select the "CHANGE PASSWORD" option from the main setup screen. In this option has three situations. The following has three example to describe to the steps of password setup.

Enable password check function & password setting

Example I. If user has not setted the password yet, but user likes to set the new password. The new password is "5319".

Step 1. Select the "CHANGE PASSWORD" option then press <Enter> key. The message will be as following:

"Enter NEW Password :"

Step 2. Keyin the new password (5319) then press <Enter> key, the message will be as following:

"Re-Enter NEW Password :"

Step 3. Re-keyin the new password (5319) and perss <Enter> key to confirm the new password. Then the screen will be as following:

"NEW Password Installed"

Press <ESC> key to return to the main setup menu.

Change Password

Example II. If user has installed the password. The current password is "ac32", but user likes to change the password. The new password is "steven".

Step 1. Select the "CHANGE PASSWORD" option then press <Enter> key. The message will be as following:

"Enter CURRENT Password :"

Step 2. Keyin the current password (ac32) then press <Enter > key. The message will be as following:

"Enter NEW Password :"

Step 3. Keyin the new password (steven) then perss <Enter> key. The message will be as following:

"Re-Enter NEW Password :"

Step 4. Re-keyin the new password (steven) then press <Enter> key to confirm the new password. Then the screen will be as following:

"NEW Password Installed"

Press <ESC> key to return to main setup menu.

Disable password function

Example III. If user has installed the password. The current password is "ms3124", but user likes to disable the password check function.

Step 1. Select the "CHANGE PASSWORD" option then press <Enter> key. The message will be as following:

"Enter CURRENT Password :"

Step 2. Keyin the current password (ms3124) then press <Enter> key. The message will be as following:

"Enter NEW Password :"

Step 3. Press the <Enter> key then the screen will return to the main setup menu.

Step 4. Press the <F10> key to save the data to CMOS & Exit.

3.8 Hard Disk Utility

!!WARNING!!

Performing the hard disk utility will destory any data on the hard disk being tested. BACK UP the hard disk(s) before performing any of these routines.

Hard Disk Utility is selected, the Screen will be shown as figure 3.7. This utility has the following features:

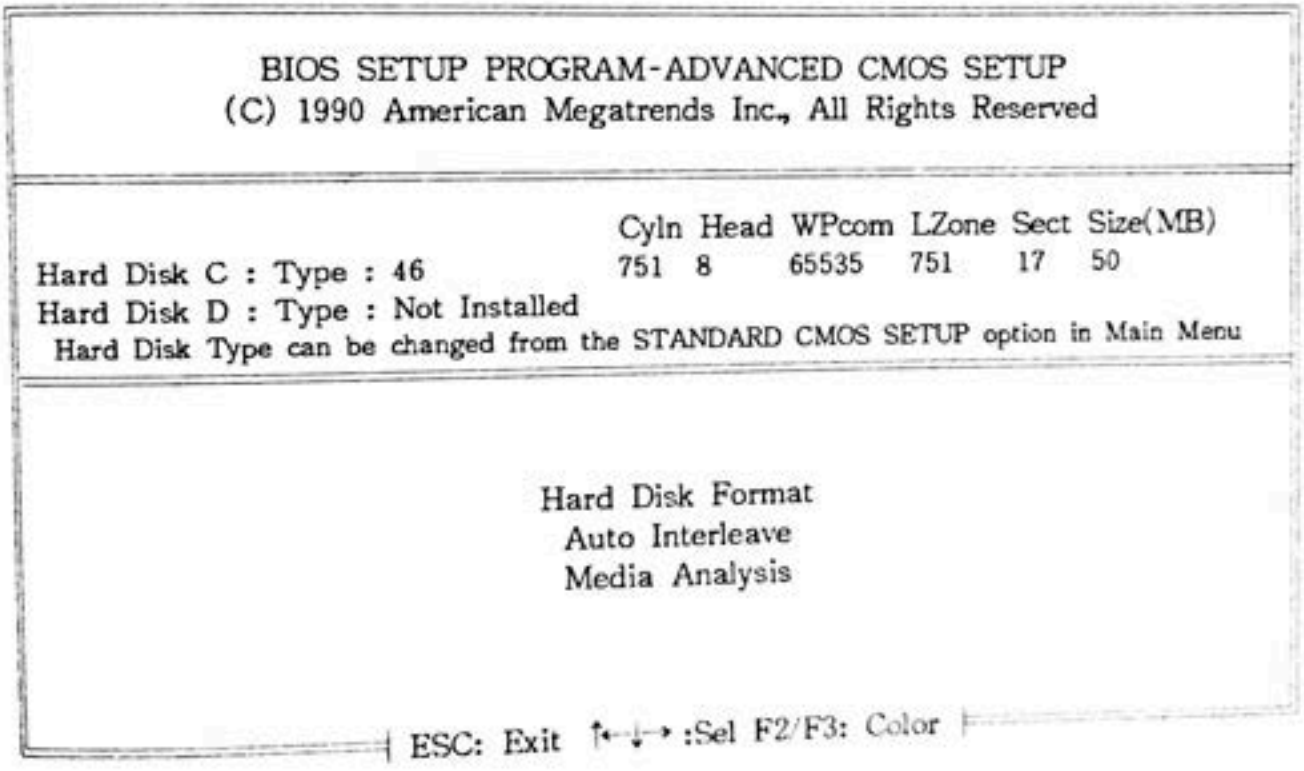


Figure 3-7

1. Hard Disk Format: This option performs a "low level" format of the hard disk drive(s). The user should check with the system or hard drive manufacturer to determine if this option should be taken.

2. Auto Interleave: This option determines the optimum interleave factor prior to the format of the hard disk drive(s).

3. Media Analysis: This option performs an analysis of each track of the hard disk drive to determine whether it is usable. If it is not usable, the track is marked as "bad" so that data cannot be stored there in the future.

3.9 Advnace Chip Set Defaults & Recommends

3.9.1 For 386 system:

Option Item	25/33 MHz	40 MHz	BIOS Default	Power-On Default
SRAM Wait States	0 W/S	1 W/S	1 W/S	1 W/S
Burst Mode	X	X	3222	3222
DRAM Write Wait States	1 W/S	1 W/S	1 W/S	1 W/S
DRAM Read Wait States	2 W/S	2 W/S	2 W/S	3 W/S
RAS Precharge Time	2 Sysclk	3 Sysclk	3 Sysclk	3 Sysclk
System BIOS Cacheable	Enabled	Enabled	Enabled	Disabled
Video BIOS Cacheable	Enabled	Enabled	Enabled	Disabled

3.9.2 For 486 system:

Option Item	20/25 MHz	33 MHz	50 MHz
SRAM Wait States	0 W/S	0 W/S	1 W/S
Burst Mode	2111	2111	3222
DRAM Write Wait States	0 W/S	0 W/S	1
DRAM Read Wait States	2 W/S	2 W/S	3
RAS Precharge Time	2 Sysclk	2 Sysclk	3
System BIOS Cacheable	Enabled	Enabled	Enabled
Video BIOS Cacheable	Enabled	Enabled	Enabled

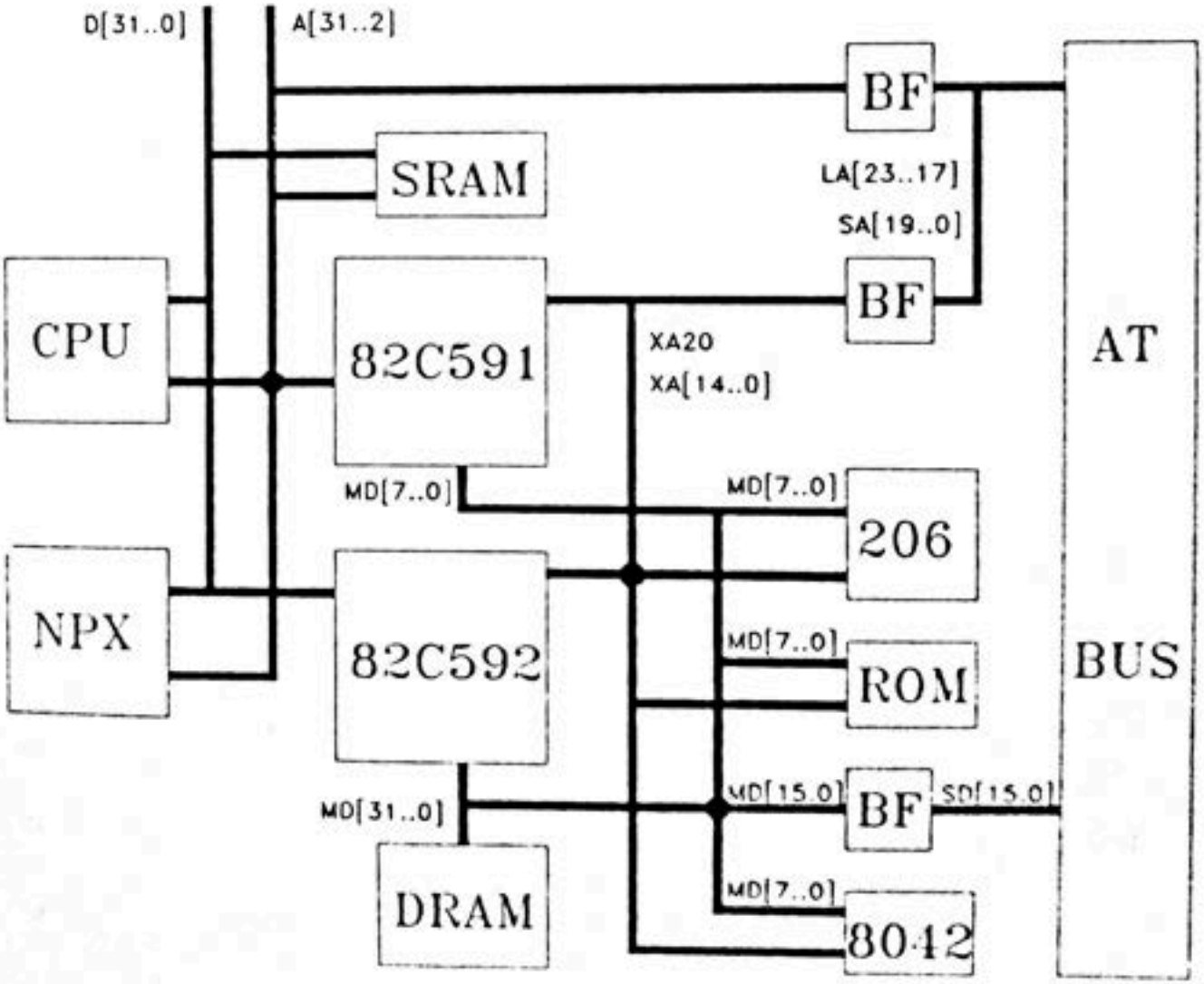
Note: 'X' means "Don't care".

CHAPTER 4

TECHNICAL REFERENCE

The information is included in this section goes beyond what is necessary if you merely wish to install and use the board.

4.1 System Block Diagram



4.2 Memory Mapping

The PC/AT architecture defines a 24-bit Byte oriented memory addressing scheme. The allocation of all of this 16 MByte memory address space to the various memory functions implicit in the PC/AT architecture is summarized here.

In accordance with the PC/AT architecture various areas of memory are reserved for specific functions external to the main memory DRAMS. Addresses are in hexadecimal code.

From	To	Description
000000	09FFFF	640 KBytes of system memory on the system board.
0A0000	0BFFFF	128KBytes of video RAM reserved for the graphics display buffer.
0C0000	0D7FFF	128KBytes of I/O expansion ROM space reserved for ROMs I/O adapters.
0D8000	0D9FFF	8KBytes of boot ROM on the system board reserved for Microcache initialization and control purposes.
0E0000	0EFFFF	64KBytes reserved on the system board. This address space is aliased FE0000 thru FEFFFF.
0F0000	0FFFFF	64KBytes of BIOS ROM on the system board. This address space is aliased at FF0000 thru FFFFFF.
100000	F5FFFF	Extended memory, maximum of (14MBytes plus 384 KBytes) of DRAM on the system board. The address space not used for system board memory is available for I/O channel expansion memory.
F60000	FDFFFF	512KBytes of address space unavailable on the system board. This address space may be used for expansion memory on the I/O channel.
FE0000	FEFFFF	64KBytes reserved on the system board. This address space is aliased at 0E0000 thru 0EFFFF.
FF0000	FFFFFF	64KBytes of BIOS ROM on the system board. This address space is aliased at 0F0000 thru 0FFFFF.

4.3 I/O Address Mapping

I/O Address (Hex)	Description
000-01F	DMA controller #1
022	Chip configuration register index port
023	Chip configuration register data port
024-03F	Interrupt controller #1
040-05F	Timer
060-06F	Keyboard controller
070-07F	Real time clock, NMI mask, Microcache program enable
080-09F	DMA page register
0A0-0BF	Interrupt controller #2
0C0-0DF	DMA controller #2
0F0	Clear math processor Busy
0F1	Not used
0F8-0FF	Math coprocesor
1F0-1F8	Fixed disk
200-207	Game I/O
278-27F	Parallel printer port #2
2F8-2FF	Serial port #2
300-31F	Prototype card
360-36F	Reserved
378-37F	Parallel printer port #1
380-38F	SDLC, bisynchronous #2
3A0-3AF	Bisynchronous #1
3B0-3BF	Monochrome display and printer adapter
3C0-3CF	Reserved
3D0-3DF	Color/Graphics monitor adapter
3F0-3F7	Diskette controller
3F8-3FF	Serial port #1

Note:

Address 000 thru 0FF are reserved for system board I/O.
Address 100 thru 3FF are available on the I/O channel.

4.4 I/O Channel Mapping

SIGNAL	PIN	PIN	SIGNAL
GND	B1	A1	-I/O CHCK
RESET DRV	B2	A2	SD7
+5V DC	B3	A3	SD6
IRQ2	B4	A4	SD5
-5V DC	B5	A5	SD4
DRQ2	B6	A6	SD3
-12V DC	B7	A7	SD2
0WS	B8	A8	SD1
+12V DC	B9	A9	SD0
GND	B10	A10	-I/O CH RDY
-SMEMW	B11	A11	AEN
-SMEMR	B12	A12	SA19
-IOW	B13	A13	SA18
-IOR	B14	A14	SA17
-DACK3	B15	A15	SA16
DRQ3	B16	A16	SA15
-DACK1	B17	A17	SA14
DRQ1	B18	A18	SA13
-REFRESH	B19	A19	SA12
CLK	B20	A20	SA11
IRQ7	B21	A21	SA10
IRQ6	B22	A22	SA9
IRQ5	B23	A23	SA8
IRQ4	B24	A24	SA7
IRQ3	B25	A25	SA6
-DACK2	B26	A26	SA5
T/C	B27	A27	SA4
BALE	B28	A28	SA3
+5V DC	B29	A29	SA2
OSC	B30	A30	SA1
GND	B31	A31	SA0

SIGNAL	PIN	PIN	SIGNAL
-MEM CS16	D1	C1	SBHE
-I/O CS16	D2	C2	LA23
IRQ10	D3	C3	LA22
IRQ11	D4	C4	LA21
IRQ12	D5	C5	LA20
IRQ15	D6	C6	LA19
IRQ14	D7	C7	LA18
-DACK0	D8	C8	LA17
DRQ0	D9	C9	-MEMR
-DACK5	D10	C10	-MEMW
DRQ5	D11	C11	SD8
-DACK6	D12	C12	SP9
DRQ6	D13	C13	SD10
-DACK7	D14	C14	SP11
DRQ7	D15	C15	SD12
+5V DC	D16	C16	SD13
-MASTER	D17	C17	SD14
GND	D18	C18	SD15

4.5 I/O Channel Pin Assignment

Signals	Pin	No.	Signals	
Ground	B1	A1	-I/O CHCK	(I)
Reset Drive (O)	B2	A2	SD7	(I/O)
+ 5V DC	B3	A3	SD6	(I/O)
IRQ9 (I)	B4	A4	SD5	(I/O)
-5V DC	B5	A5	SD4	(I/O)
DRQ2 (I)	B6	A6	SD3	(I/O)
-12V DC	B7	A7	SD2	(I/O)
0WS (I)	B8	A8	SD1	(I/O)
+ 12V DC	B9	A9	SD0	(I/O)
Ground	B10	A10	-I/O CH RDY	(I)
-SMEMW (O)	B11	A11	AEN	(O)
-SMEMR (O)	B12	A12	SA19	(I/O)
-IOW (I/O)	B13	A13	SA18	(I/O)
-IOR (I/O)	B14	A14	SA17	(I/O)
-DACK3 (O)	B15	A15	SA16	(I/O)
DRQ3 (I)	B16	A16	SA15	(I/O)
-DACK1 (O)	B17	A17	SA14	(I/O)
DRQ1 (I)	B18	A18	SA13	(I/O)
-Refresh (I/O)	B19	A19	SA12	(I/O)
CLK (O)	B20	A20	SA11	(I/O)
IRQ7 (I)	B21	A21	SA10	(I/O)
IRQ6 (I)	B22	A22	SA9	(I/O)
IRQ5 (I)	B23	A23	SA8	(I/O)
IRQ4 (I)	B24	A24	SA7	(I/O)
IRQ3 (I)	B25	A25	SA6	(I/O)
-DACK2 (O)	B26	A26	SA5	(I/O)
T/C (O)	B27	A27	SA4	(I/O)
BALE (O)	B28	A28	SA3	(I/O)
+ 5V DC	B29	A29	SA2	(I/O)
OSC (O)	B30	A30	SA1	(I/O)
Ground	B31	A31	SA0	(I/O)

Signals	Pin No.		Signals	
-MEM CS16 (I)	D1	C1	SBHE	(I/O)
-I/O CS16 (I)	D2	C2	LA23	(I/O)
IRQ10 (I)	D3	C3	LA22	(I/O)
IRQ11 (I)	D4	C4	LA21	(I/O)
IRQ12 (I)	D5	C5	LA20	(I/O)
IRQ15 (I)	D6	C6	LA19	(I/O)
IRQ14 (I)	D7	C7	LA18	(I/O)
-DACK0 (O)	D8	C8	LA17	(I/O)
DRQ0 (I)	D9	C9	-MEMR	(I/O)
-DACK5 (O)	D10	C10	-MEMW	(I/O)
DRQ5 (I)	D11	C11	SD8	(I/O)
-DACK6 (O)	D12	C12	SD9	(I/O)
DRQ6 (I)	D13	C13	SD10	(I/O)
-DACK7 (O)	D14	C14	SD11	(I/O)
DRQ7 (I)	D13	C13	SD12	(I/O)
+5V DC	D16	C16	SD13	(I/O)
-Master (I)	D17	C17	SD14	(I/O)
Ground	D18	C18	SD15	(I/O)

4.6 I/O Channel Signal Description

All I/O Channel signal lines are TTL-compatible with a maximum loading for two low-power (LS) devices.

CLK (Output)

This is the 8MHz AT system clock.

Reset DRV (Output)

This signal goes high to reset the system during power-on, low line-voltage, or when reset button is pressed.

LA17-23 (Input-Output)

These unlatched address signals give the system up to 16 MBytes of addressability. They are valid when BALE is high.

SD0-15 (Input-Output)

These 16 lines provide for data transfer between the processor, memory and I/O devices.

BALE (Output) - Buffered Address Latch Enable

BALE is used to latch SA0-19 on the falling edge. BALE is forced high during DMA cycles.

I/O CH CK (Input) - I/O Channel Check

I/O CH CK is an active-low signal that indicates that a parity error exists in a device on the I/O channel.

I/O CH RDY (Input) - I/O Channel Ready

This signal is pulled low by a memory or I/O device to lengthen Memory or I/O read/write cycles. It should only be held low for a maximum of 2.5 microseconds.

IRQ3-IRQ7, IRQ9-IRQ12, IRQ14-IRQ15 (Input) - Interrupt Request

These are interrupt request signals which indicate I/O service request attention. Their priority are as follows:

(highest) IRQ9,10,11,12,13,14,15,3,4,5,6,7 (lowest)

-IOR (Input/Ouput) - I/O Read

-IOR is an active-low signal which instructs the I/O device to drive its data onto the data bus SD0-DS15.

-IOW (Input/Output) - I/O Write

-IOW is an active-low signal which instructs the I/O device to read data from the data bus, SD0-SD15.

-SMEMR (Output) - System Memory Read

-SMEMR is an active-low signal which instructs memory devices to drive data onto the data bus, SD0-SD15. This signal is active only when the memory address is within the lowest 1 MB of memory address space.

-MEMR (Input/Output) - Memory Read

-MEMR is an active-low signal which instructs memory devices to drive data onto the data bus SD0-SD15. This signal is active on all memory read cycles.

-SMEMW (Output) - System Memory Write

-SMEMW is an active-low signal which instructs memory devices to store data present on the data bus SD0-SD15. This signal is active only when the memory address is within the lowest 1MB of memory address space.

-MEMW (Input/Output) - Memory Write

-MEMW is an active-low signal which instructs memory devices to store data present on the data bus SD0-SD15. This signal is active on all memory write cycles.

DRQ0-DRQ3, DRQ5-DRQ7 (Input) - DMA Request

These signals are asyhnchronous channel requests used by I/O channel devices to gain DMA service. DMA request channels 0-3 will perform 8-bit data transfers. DMA request channels 5-7 will perform 16-bit data transfers. DMA request channel 4 is used internally on the system board. DMA requests should be held high until the corresponding DACK line goes active. DMA requests are serviced in the following priority sequence:

(highest) DRQ0,1,2,3,5,6,7 (lowest).

-DACK0-DACK3, -DACK5-DACK7 (Output) -DMA Acknowledge

These active-low signals are the acknowledgement signals for DRQ0-DRQ3 and DRQ5-DRQ7.

AEN (Output) - DMA Address Enable

When AEN is active, the DMA Controller has control of the address bus and the memory and I/O read/write command lines.

-REFRESH (Input/Output)

This active-low signal is used to indicate that a memory refresh cycle is in progress.

T/C (Output) - Terminal Count

T/C provides a pulse when the terminal count for any DMA channel is reached.

SBHE (Input/Outpu) - System Bus High Enable

SBHE indicates high byte transfer is occurring on the data bus SD8-SD15.

-MASTER (Input)

This active-low signal is used in conjunction with a DRQ line by a processor on the I/O channel to gain control of the system. The I/O processor first issues a DRQ, and upon receiving the corresponding DACK, the I/O processor may assert -MASTER, which will allow it to control the system address, data and control lines. This signal should not be asserted for more than 15 microseconds, or system memory may be corrupted due to the lack of memory refresh activity.

-MEM CS16 (Input, Open collector) - Memory Chip Select 16

This active-low signal indicates that the current data transfer is a 1 wait state, 16 bit memory cycle.

-I/O CS16 (Input, Open collector) - I/O Chip Select

This active-low signal indicates that the current data transfer is a 1 wait state, 16-bit I/O cycle.

OSC (Output) - Oscillator

OSC is a 14.31818 MHz signal.

OWS (Input, Open collector) - Zero Wait State

OWS is used to indicate that the current bus cycle can be completed without inserting any additional wait cycles.

4.7 Timer & DMA Channel & Interrupt Level

A) Timer:

The system board has 3 programmable counter/timers controlled by the 82C206 chip.

Timer Channel 0 : System timer to interrupt controller
Timer Channel 1 : Dynamic RAM Refresh interrupt
Timer Channel 2 : Speaker tone generator

B) DMA Channel:

The system board has 8 DMA channels controlled by 82C206 chip.

DMA Channel 0 : Spare
DMA Channel 1 : SDLC
DMA Channel 2 : Diskette Adaptor
DMA Channel 3 : Spare
DMA Channel 4 : Cascade for DMA controller 1
DMA Channel 5 : Spare
DMA Channel 6 : Spare
DMA Channel 7 : Spare

C) Interrupt Level:

The 82C206 peripheral controller provides 16 level of system interrupts. Their priority is as follows:

Interrupt level	Description
NMI	Parity check error
IRQ0	System timer interrupt from timer 8254-2
IRQ1	Keyboard output buffer full
IRQ2	Interrupt rerouting from IRQ8 through IRQ15
IRQ3	Serial port 2
IRQ4	Serial port 1
IRQ5	Parallel printer port 2
IRQ6	Floppy disk adapter
IRQ7	Parallel printer port 1
IRQ8	Realtime clock
IRQ9	Rerouting to INT10 from hardware IRQ2
IRQ10	Spare
IRQ11	Spare
IRQ12	Spare
IRQ13	Math Coprocessor 80287
IRQ14	Hard disk adapter
IRQ15	Spare

4.8 Real-Time Clock & Nonvolatile RAM

The REAL TIME CLOCK and 64 bytes nonvolatile RAM are in the 82C206. The information is backed up by 3.6V rechargeable battery (or external battery). The following table lists the information that is already used in standard 386 system. Some of there served bytes in the table are used by chipset for the configuration information, be sure to check it before usig it.

4.9 Power Supply

As with all computer products a clean steady power source is necessary to get a reliable performance from the system. Make certain that your power supply provides a voltage range of 5.25V maximum to 4.95 minimum.

Routine is provided through connectors P8 and P9 to the I/O channel for +/- 5V, +/- 12V, and GND (see section 2.5 for connector pin assignment).

APPENDIX A

BIOS ERROR BEEP CODES

During the POST (Power On Self Test) routines, which are performed each time the system is powered on, errors may occur.

Non-fatal errors are those which, in most cases, allow the system to continue the boot up process. The error messages normally appear on the screen. See Appendix B for BIOS Error Messages.

Fatal errors are those which will not allow the system to continue the boot-up procedure. If a fatal error occurs, you should consult with your system manufacturer for possible repairs.

These fatal errors are usually communicated through a series of audible beeps. The numbers on the fatal error list below correspond to the number of beeps for the corresponding error. All erros listed, with the exception of #8, are fatal errors.

No. of Beeps	Error Message
1	Refresh Failure - The memory refresh circuitry of the motherboard is faulty.
2	Parity Error - A parity error was detected in the base memory (the first block of 64 KB) of the system.
3	Base 64 KB Memory Failure - A memory failure occurred within the first 64 KB of memory.

No. of Beeps	Error Message
4	Timer Not Operational - Timer #1 on the system board has failed to function properly.
5	Processor Error - The CPU (Central Processing Unit) on the system board has generated an error.
6	8042 Gate A20 Failure - The keyboard controller (8042) contains the Gate A20 switch which allows the CPU to operate in virtual mode. This error message means that the BIOS is not able to switch the CPU into protected mode.
7	Processor Exception Interrupt Error - The CPU on the motherboardhas generated an exception interrupt.
8	Display Memory Read/Write Error - The system video adaptor is either missing or its memory is faulty. PLEASE NOTE: This is not a fatal error.
9	ROM Checksum Error - The ROM checksum value does not match the value encoded in the BIOS.
10	CMOS Shutdown Register Read/Write Error - The shutdown register for the CMOS memory has failed.

APPENDIX B

BIOS NON-FATAL ERROR MESSAGES

If a non-fatal error occurs during the POST routines performed each time the system is powered on, the error message will appear on the screen in the following format:

```
ERROR Message Line 1
ERROR Message Line 2
Press < F1 > to RESUME
```

Note the error message and press the <F1> key to continue with the boot-up procedure.

For most of the error messages, there is no ERROR Message Line 2. Generally, for those messages containing a line 2 ERROR Message, the text will be "RUN SETUP UTILITY." Pressing the <F1> key will invoke the BIOS SETUP PROGRAM.

A description of the error messages appears below.

1. CH-2 Timer Error - Most AT standard system boards include two timers. An error with timer #1 is a fatal error, explained in Appendix A. If an error occurs with timer #2, this error message appears.
2. INTR #1 Error - The Interrupt channel #1 has failed the POST routine.
3. INTR #2 Error - The Interrupt channel #2 has failed the POST routine.

4. CMOS Battery State Low - There is a battery in your system which is used for storing the CMOS values. This battery appears to be low in power and needs to be replaced.

5. CMOS Checksum Failure - After the CMOS values are saved, a checksum value is generated to provide for error checking. If the previous value is different from the value currently read, this error message appears. To correct this error, you should run the BIOS SETUP Program.

6. CMOS System Options Not Set - The values stored in the CMOS are either corrupt or nonexistent. Run the BIOS SETUP Program to correct this error.

7. CMOS Display Type Mismatch - The type of video stored in CMOS does not match the type detected by the BIOS. Run the BIOS SETUP Program to correct this error.

8. Display Switch Not Proper - Some systems require that a video switch on the motherboard be set to either color or monochrome, depending upon the type of video you are using. To correct this situation, set the switch properly. (Remember to shut down the system first.)

9. Keyboard Is Locked ... Unlock It - The keyboard lock on the system is engaged. The system must be unlocked to continue the boot up procedure.

10. Keyboard Error - The BIOS has encountered a timing problem with the keyboard. Make sure you have an AMI keyboard BIOS installed in your system. You may also set the "Keyboard" option in the BIOS SETUP Program Standard CMOS Setup to "Not Installed", which will cause the BIOS to skip the keyboard POST routines.

11. KB/Interface Error - The BIOS has found an error with the keyboard connector on the system board.

12. CMOS Memory Size Mismatch - If the BIOS finds the amount of memory on your system board to be different from the amount stored in CMOS,this error message is generated. Run the BIOS SETUP Program to correct this error.

13. FDD Controller Failure - The BIOS is not able to communicate with the floppy disk drive controller. Check all appropriate connections after the system is powered off.

14. HDD Controller Failure - The BIOS is not able to communicate with the hard disk drive controller. Check all appropriate connections after the system is powered down.

15. C: Drive Error - The BIOS is not receiving any response from hard disk drive C:. It may be necessary to run the Hard Disk Utility to correct this problem. Also, check the type of hard disk selected in the Standard CMOS Setup of the BIOS SETUP Program to see if the correct harddisk drive has been selected.

16. D: Drive Error - The same error has occurred with hard drive D:.Follow the procedures in Error #15 to correct this situation.

17. C: Drive Failure - The BIOS cannot get any response from the hard disk drive C:. It may be necessary to replace the hard disk.

18. D: Drive Failure - The same error as #17 has occurred with hard drive D:.

19. CMOS Time & Date Not Set - Run the Standard CMOS Setup of the BIOS SETUP Program to set the date and time of the CMOS.

20. Cache Memory Bad, Do Not Enable Cache! - The BIOS has found the cache memory of the motherboard to be defective. Consult your system manufacturer to repair this problem.

21. 8042 Gate-A20 Error - The gate-A20 portion of the keyboard controller (8042) has failed to operate correctly. The 8042 chip should be replaced.

22. Address Line Short! - An error has occurred in the address decoding circuitry of the motherboard.

23. DMA #2 Error - An error has occurred with the second DMA channelon the motherboard.

24. DMA #1 Error - An error has occurred with the first DMA channel on the motherboard.

25. DMA Error - An error has occurred with the DMA controller on the motherboard.

26. No ROM BASIC - This error occurs when a proper bootable sector cannot be found on either the floppy diskette drive A: or the hard disk drive C:. The BIOS will try at this point to run ROM Basic, and the error message will be generated when the BIOS does not find it.

27. Diskette Boot Failure - The diskette used to boot-up in floppy drive A: is corrupt, which means you cannot use it to boot-up the system. Use another boot diskette and follow the instructions on the screen.

28. Invalid Boot Diskette - The BIOS can read the diskette in floppy drive A:, but it cannot boot-up the system with it. Use another boot diskette and follow the instructions on the screen.

29.* On Board Parity Error - The BIOS has encountered a parity error with some memory installed on the system board. The message will appear as follows:

ON BOARD PARITY ERROR
ADDR (HEX) = (XXXX)

where XXXX is the address (in hexadecimal) at which the error has occurred. "On Board" means that it is part of the memory attached directly to the system board, as opposed to memory installed via an expansion card in an I/O (BUS) slot.

30.* Off Board Parity Error - The BIOS has encountered a parity error with some memory installed in an I/O (BUS) slot. The message will appear as follows:

OFF BOARD PARITY ERROR
ADDR (HEX) = (XXXX)

where XXXX is the address (in hexadecimal) at which the error has occurred. "Off Board" means that it is part of the memory installed via an expansion card in an I/O (BUS) slot, as opposed to memory attached directly to the system board.

31.* Parity Error ???? - The BIOS encountered a parity error with some memory in the system, but it is not able to determine the address of the error.

* Memory diagnostic software, such as AMIDIAG, can be used to find and correct memory problems.

APPENDIX C

SYSTEM ASSEMBLY

CAUTION: Before beginning to install the CONTAQ system board make certain that every precaution against static electricity has been taken. Every chip on the system board is sensitive and can easily be damaged by static electricity.

1. Tools Required:

-- Small phillips and flat blade screw drivers
-- A small pair of scissors or diagonal cutters
-- Tweezer or small needle-nose pliers
-- A ballpoint pen
-- An ashtray to hold loose screws
-- A grounded power outlet (3-prong)

2. Components Required:

The following components are necessary to build an advanced system based on the CONTAQ system.

1) CONTAQ upgradable mother board.

2) 386DX CPU for 386 system, MS-4901 upgrading kit for 486 system.

3) INTEL 80387 Numeric Coprocessor (optional).

4) Standard PC/AT or an equivalent 220 W power supply capable of providing continuous power within a 4.95 V to 5.25 V range with suitable cables. A power line filter, if necessary.

5) Standard PC/AT or an equivalent hard disk with controller and cables.

6) Standard PC/AT or an equivalent floppy disk drive with controller and cables.

7) Standard PC/AT or an equivalent display adapter card (Monochrome, CGA, EGA or VGA).

8) 8 ohm speaker with cables, if required.

9) Keylock with cables, if required.

10) Power on LED with cables, if required.

11) Chassis with standard mounting hardware (any standard AT unit case or tower case).

12) Standard PC/AT or an equivalent keyboard (84 or 101 keys) with cables.

13) Serial/Parallel I/O card with cables (optional).

14) Monitor with cables.

3. System Assembly Procedures:

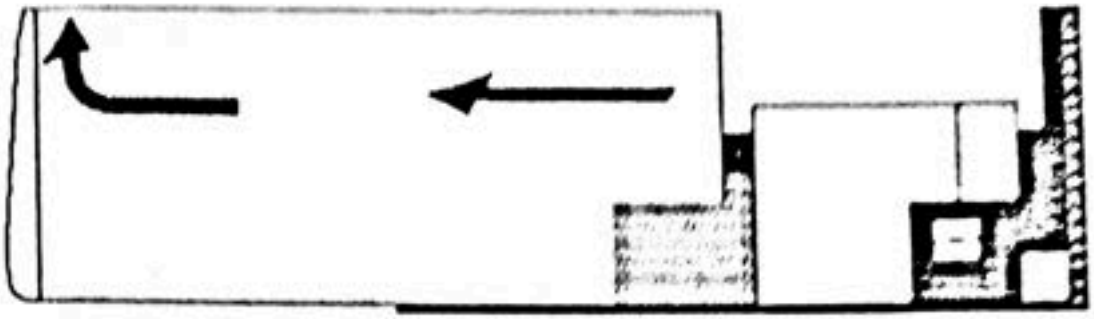
1) Install the CPU into the mother board. (see section 2.1 .1)

2) Optional : Install the Numeric Coprocessor (see section 2.2)

3) Install the memory into the memory bank 0 and bank 1. (For a more detailed description see section 2.3)

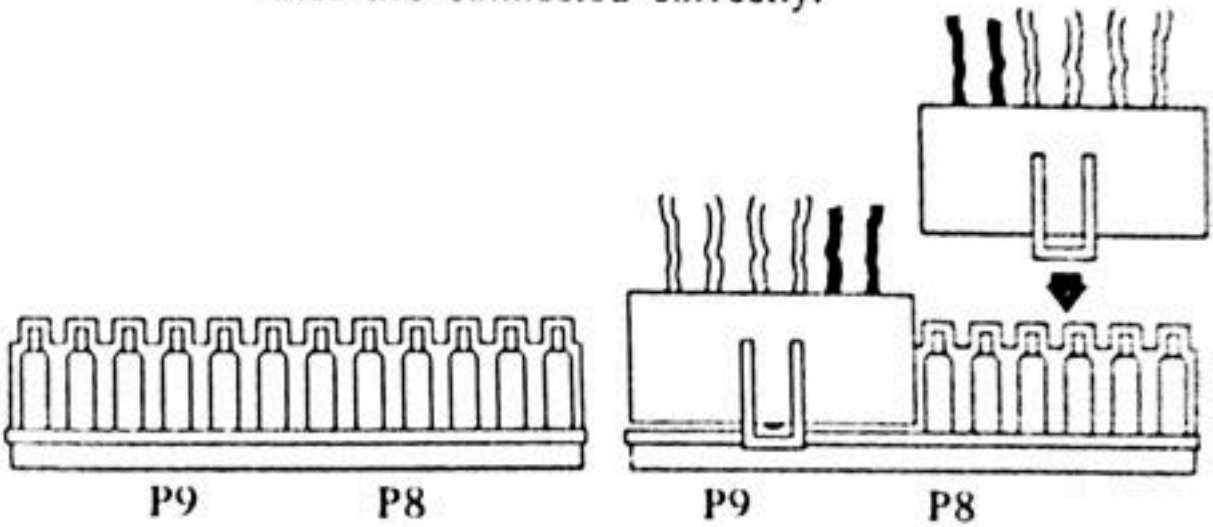
4) Verify the positions of all jumpers and make sure that all settings are correct. (see chapter 2)

5) Open the case by removing the mounting screws and sliding the cover forwards. Then, mount the system board into the case and make certain that it is electrically isolated from the case.



6) Connect power cables to connectors P8 and P8 as marked. The four black GND-cables should be in the middle. (see section 2.5)

CAUTION: Incorrect orientation or insertion of the power cables may cause substantial damage to the system. Therefore make sure that the power cables are connected correctly.



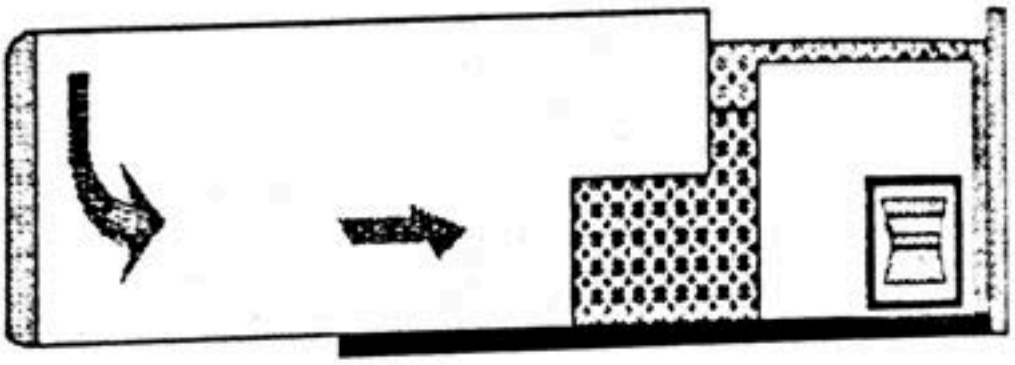
7) Make sure that all peripheral add-on cards have correct switch and jumper settings according to the manufacturers instructions.

8) Install the display adapter card into the appropriate slot.

9) Install the floppy disk drive, hard disk drive, and their proper controllers. Attach all necessary cables according to the manufacturers instructions.

10) Optional Connect the speaker, keylock, power-on LED, turbo LED, reset button and turbo switch (see section 2.9).

11) Close the case by sliding the cover backward and mounting the screws.



12) Attach the keyboard to the keyboard-connector at the rear of the system.

13) Attach the monitor to the display card connector.

14) Connect the power supply cables to the outlet.

15) Turn on the monitor power and the system power.

16) Run the BIOS setup utility to setup the system configuration. (For more detailed description see chapter 3).

17) As soon as the setup is completed reboot the system. If all selections were made correctly the system can start to operate.