SQUARE ONE
INDUSTRIES INC.

CM-388L
386SX-40 PC/104 CPU Module

Reference Manual

Revised December 2004

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Contents

Introduction 1

1.1 Specifications

- CPU: ALI M6117D single chip with on-chip 386SX-40 CPU.

- MEMORY: 4MB soldered on board.

- CMOS Backup: CMOS Back up by Li battery.

- BIOS: AMI 128KB Flash BIOS EPROM.

- KEYBOARD/ MOUSE CONNECTORS: Supports 5-pin PS/2 and PC/AT Keyboard and PS/2 Mouse Connector.

- BUS TYPE: PC/104 Connector.

- WATCHDOG: Programmable 30.5 us ~ 512 sec.

- LCD/VGA: HMC HM 86508 LCD/VGA chip with 1MB Display memory, supports CRT and 24-bit TFT/DSTN/EL LCD flat panel

- IDE INTERFACE: One port supports up to 2 IDE devices.

- FLOPPY DISK DRIVE INTERFACE: Supports up to two Floppy Disk Drives, 3.5" or 5.25" FDD (360K/720K/1.2M/1.44M/2.88M) Drives A, B swappable.

- Serial Port x 2: 16-byte FIFO 16C550 serial port, jumper selectable RS- 232 x 1 + RS-232/422/485 x 1.

- Parallel Port: One bi-directional parallel port configurable as LPT1, 2, 3 supports IEEE1284 compliant high-speed EPP and ECP modes.

- Speaker: Buzzer on Board.

- System Power Requirement: Single +5V power by using 2-pin power connector.

- Operating Temperature: 0~60°C

- Board Dimensions: 96mm x 90mm

- Board Weight: 0.1Kg.

1.2   Safety Precautions

Follow the warnings below to protect your system from damage and yourself from injury:

1. Avoid exposing your system to static electricity at any time.

2. Protect yourself from electric shock. Do not touch any components of this board when the power is ON. Always disconnect power when the system is not in use.

3. Disconnect power when you change any hardware devices.

Hardware Configuration 2

2.1 Jumpers / Connectors Quick Reference

JSP 5-pin AT K/B Connector	K/B
5-Pin PS/2 Mouse Connector	MOUSE
Floppy Disk Drive Connector	FDC
RS-232 COM Port B Connector (10 pin)	COMB
RS-485 COM Port B Connector (2 pin)	CN1
COM Port A (RS-232)	COMA
Hard Disk Active LED	HDLED
Single +5V Input	POWER
IDE Hard Disk Driver Connector	IDE
VGA Connector	VGA
LCD Connector	LCD
System Reset Switch	RST
M-Systems DiskOnChip SSD Socket	DOC
Printer Connector	LPT
CMOS Battery Clear Jumper	JP1
LCD Panel Voltage Connector	JP2
RS-232/485 Selector	JP3
DOC Address Select	JP4
Power LED	PWRLED

2.2 Component Locations
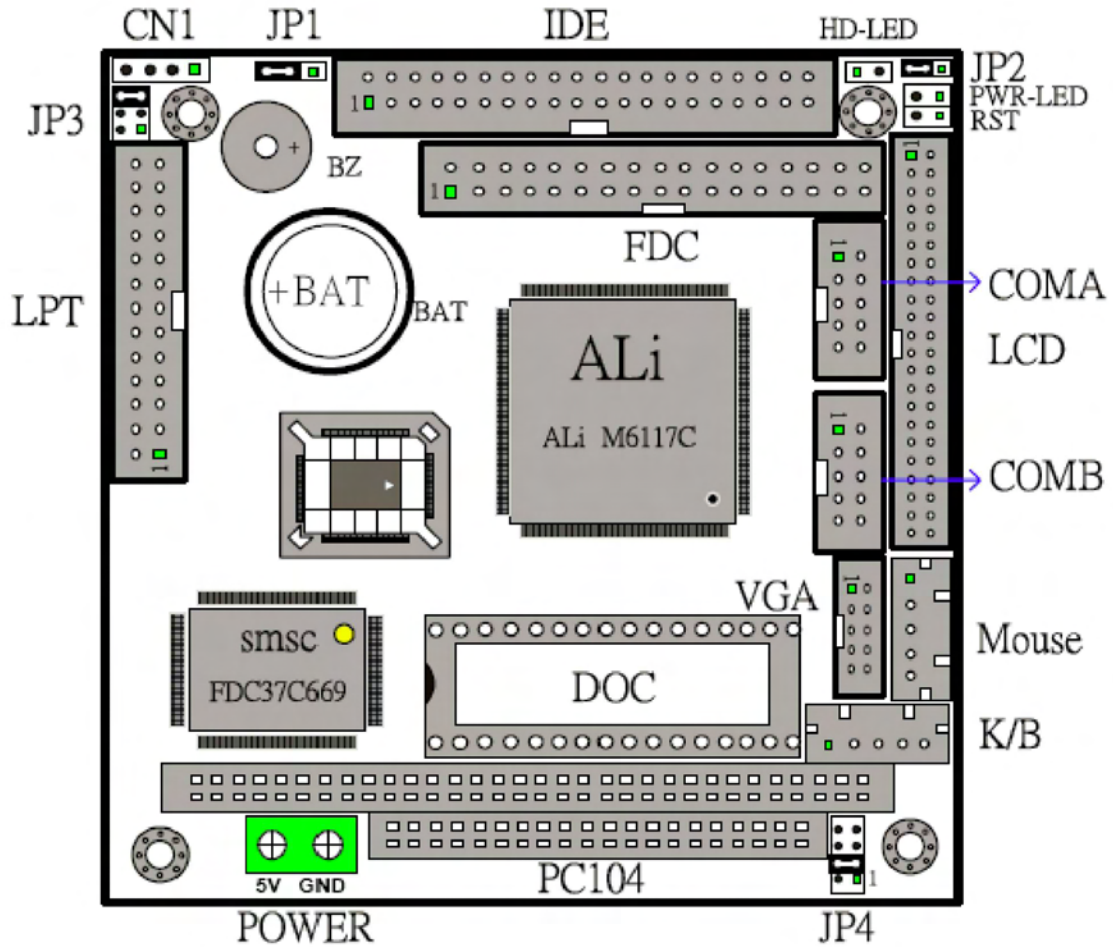
2.3 Keyboard Connector (K/B)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	CLK	2	DATA
3	NC	4	GND
5	VCC		

2.4 Mouse Connector (MOUSE)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	CLK	2	DATA
3	NC	4	GND
5	VCC		

2.5 Floppy Disk Drive Connector (FDC)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	GND	2	RPM
3	GND	4	NC
5	GND	6	NC
7	GND	8	INDEX
9	GND	10	MTR0
11	GND	12	DRV1
13	GND	14	DRV0
15	GND	16	MTR1
17	GND	18	DIR
19	GND	20	STEP
21	GND	22	WDATA
23	GND	24	WGATE
25	GND	26	TRK0
27	GND	28	WRTPRT
29	MID1	30	RDATA
31	GND	32	SEL
33	MID0	34	DSKCHG

2.6 COM Port B Connector (RS-232)   (COMB)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	2	RXD
3	TXD	4	DTR
5	GND	6	DSR
7	RTS	8	CTS
9	RI	10	NC

2.7 COM Port B Connector (RS-485)   (CN1)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	Data+	2	Data-

2.8 COM Port A Connector (RS-232)   (COMA)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	DCD	2	RXD
3	TXD	4	DTR
5	GND	6	DSR
7	RTS	8	CTS
9	RI	10	NC

2.9 Hard Disk Active LED (HDLED)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	VCC	2	GND

2.10 Single +5V Input (POWER)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	+5V	2	GND
3	+12V (Option)		

2.11 IDE Connector (IDE)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	RESET	2	GND
3	HD7	4	HD8
5	HD6	6	HD9
7	HD5	8	HD10
9	HD4	10	HD11
11	HD3	12	HD12
13	HD2	14	HD13
15	HD1	16	HD14
17	HD0	18	HD15
19	GND	20	NC
21	DREQ	22	GND
23	IOW	24	GND
25	IOR	26	GND
27	IOCHRDY	28	ALE
29	DACK	30	GND
31	IRQ	32	IO16
33	SA1	34	NC
35	SA0	36	SA2
37	HDCS0	38	HDCS1
39	DASP	40	GND

2.12 VGA Connector (VGA)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	RED	2	GND
3	GREEN	4	GND
5	BLUE	6	GND
7	H-SYNC	8	GND
9	V-SYNC	10	GND

2.13 LCD Connector (LCD)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	+12V	2	+12V
3	GND	4	GND
5	+5V	6	+5V
7	FPVEE	8	GND
9	P0	10	P1
11	P2	12	P3
13	P4	14	P5
15	P6	16	P7
17	P8	18	P9
19	P10	20	P11
21	P12	22	P13
23	P14	24	P15
25	P16	26	P17
27	P18	28	P19
29	P20	30	P21
31	P22	32	P23
33	GND	34	GND
35	SHFCLK	36	FLM
37	M	38	LP
39	GND	40	ENABLK
41	GND	42	NC
43	+5V	44	5V

2.14 System Reset Connector (RST)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	SIGNAL	2	GND

2.15 Printer Connector (LPT)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	STROB	2	AUTOFD
3	PD0	4	ERROR
5	PD1	6	INIT
7	PD2	8	SLCTIN
9	PD3	10	GND
11	PD4	12	GND
13	PD5	14	GND
15	PD6	16	GND
17	PD7	18	GND
19	ACK	20	GND
21	BUSY	22	GND
23	PE	24	GND
25	SLCT	26	GND

2.16 Buzzer (BZ)

PIN	ASSIGNMENT	PIN	ASSIGNMENT
1	VCC	2	SIGNAL

2.17 CMOS Battery Clear Jumper (JP1)

1-2 ON: Clear CMOS   2-3 ON: Default

2.18 LCD Panel Voltage Select (JP2)

1-2 ON: +5V   2-3 ON: +3.3V

2.19 COM B RS-232/422/485 Select (JP3)

1-2 ON: RS-232 Enabled.   2-3 ON: RS-422/485 Enabled.

2.20 M-Systems DiskOnChip SSD Socket (JP4)

ADDRESS SELECTION	JUMPER SETTING			
	PIN 1&2	PIN 3&4	PIN 5&6	PIN 7&8
C000	ON	OFF	OFF	OFF
C800	OFF	ON	OFF	OFF
D000	OFF	OFF	ON	OFF
D800	OFF	OFF	OFF	ON

DiskOnChip Flash Disk SSD 3

3.1 Preface

The CM-388 features a 32-pin socket to support the M-Systems DiskOnChip FlashDisk SSD. The DiskOnChip can be built on board by order. The DiskOnChip Flash Disk should be mapped into an 8K byte window in the BIOS expansion address space of the CM-388 PC/104 CPU Module which is usually located in the address range 0C8000H to 0DE000H. The CM-388 can contain the operating system in the DiskOnChip to allow systems to boot without a hard disk.

The DiskOnChip can run standard MS-DOS and the board can boot from the DiskOnChip, which is fully DOS Command compatible. Users can read and write DOS commands and data to DiskOnChip in the same manner as using a hard disk drive.

Users can set this DiskOnChip as a physical HDD and its priority is software selectable. For example, if a system has one HDD, either the HDD or the DiskOnChip could be assigned as C or D Drive.If the system has no HDD, the DiskOnChip will default as C drive. When it is set as C drive, it can boot the system as if using a hard disk drive. The data capacities of DiskOnChip are 2MB, 4MB, 8MB, 12MB, 24MB, 40MB, 72MB, and 144MB.The location of the M-Systems DiskOnChip socket is U10.

3.2 Quick Installation Guide

1. Make sure the CM-388/389 PC/104 Module has power OFF

2. Plug the DiskOnChip chip into socket U10. Verify the direction is correct (pin1 of the DiskOnChip is aligned with pin1 of the U10 socket).

3. Power ON the system.

4. Go to BIOS Setup "Advanced Chipset Setup"

5.   GPCS Function   Enable
     GPCS0 Command   MEMR/W 8bit
     GPCS0 Start Address   0C8000   HEX
     GPCS0 Size   8   KBYTE

  (1) GPCS0 Command   Always MEMR/W 8bit
  (2) GPCS0 Start Address   It's between C8000H …… DE000H
  (3) GPCS0 Size   Always 8 KBYTE

   Save the Settings and reboot the computer.

6. During POST, you should see a message displayed by the DiskOnChip SSD when its drivers are loaded into the system's memory.

7.If the DiskOnChip SSD is the only disk in the system, it will appear as the first disk (Drive C: in DOS)

8.The DiskOnChip can be used immediately via the "Format" procedure.

3.3 Utility Reference

For additional information regarding the M-Systems DiskOnChip, visit M-Systems at http://www.m-sys.com.

Watchdog Timer 4

4.1 Setting Watchdog Timer Function

INDEX 37H: Enable/Disable watchdog
Bit 7: counter read mode.

Bit	Value	Action
0-5	X	Do not modify of these bits!
6	0	Disable Watchdog Timer
	1	Enable Watchdog Timer
7	0	When read from index 3Bh,3Ah,39h;the return value is the setting counter value.
	1	When bit 7 set from 0 to 1, the counter present value will be latched to buffer. When read from 3Bh,3Ah,39h;the return value is the buffer value.

Bit	Value	Action
7-4	0000	Reserved
	0001	IRQ3
	0010	IRQ4
	0011	IRQ5
	0100	IRQ6
	0101	IRQ7
	0110	IRQ9
	0111	IRQ10
	1000	IRQ11
	1001	IRQ12
	1010	IRQ14
	1011	IRQ15
	1100	NMI
	1101	System Reset
	1110	Reserved
	1111	Reserved
3-0	X	Reserved

INDEX 39H, 3AH, 3BH: Watchdog timer

Index	3Bh	3Ah	39H
Bits	D7 ……. D0	D7 ……. D0	D7 ……. D0
Counter	[MSB …………………………………………….. LSB]		

Example:

Index	3Bh	3Ah	39H	Time Out
	00h	00h	01h	30.5 µsec
	00h	00h	02h	61 µsec
	00h	00h	03h	91.5 µsec
	00h	01h	00h	7.8 msec
	00h	02h	00h	15.6 msec
	00h	03h	00h	23.4 msec
	01h	00h	00h	2 sec
	02h	00h	00h	4 sec
	03h	00h	00h	6sec
	FFh	FFh	FFh	512 sec

INDEX 3CH: Time out status & Reset

Bit	Value	Action	Meaning
4~0	X	Do not modify these bits	
5	0	No meaning	
	1	Reset timer	
6	X	X	
7	0	Not (yet) occurred	Read only
	1	Has occurred	

4.2   Watchdog Program Example

The I/O port 22h is the index register and I/O port 23h is the data register. To read a configuration register, write the index value to I/O port 22h,then read data from I/O port 23h.

To write a configuration register, write the index value to I/O port 22h, then write data to I/O port 23h.

Example 1: If we want to read the data of a configuration register with an index of 10h, the steps are:

1) Write 10h (index) to I/O port 22h
2) Read data from I/O port 23h

Example 2: If we want to write data 55h to a configuration register with an index of 12h, the steps are:

1) Write 12h (index) to I/O port 22h
2) Write data 55h to I/O port 23h

Example 3: The steps of locking/unlocking the configuration registers:

```
    OUT 22h, 13h   (Enable 13h)
    OUT 23h, C5h   (Unlock)
    OUT 22h, XXh   (XX = Configuration Index)
    OUT 23h, YYh   (YY = Configuration data)
    OUT 22h, Xxh
    OUT 23h, YYh   (Configuration can be written repeatedly)
    OUT 22h, 13h   (Enable 13h)
    OUT 23h, 00h   (Lock)
```

Example 4: Enable WatchDog

```
; Please use TASM to compile the following program.
; Execute under DOS environment.
; .286
.model smart
.code
Start proc c
    mov ax,0c513h       ; Unlock config register
    call writechip
    mov ax,3737h        ; Disable watchdog timer
    call readchip
    and al,10111111b
    xchg ah,al
    call writechip
    mov ax,083bh         ; Set the expected counter value
    call writechip       ; to [080000h]
    mov ax,003ah         ; 30.5usc * 080000h = 16sec
    call writechip
    mov ax,0039h
    call writechip
```

```
        mov ax,3838h        ; Select "System reset " as timeout action
        call readchip
        and al,00001111b
        or al,11010000b
        xchg ah,al
        call writechip
        mov ax,3737h        ; Enabled watchdog timer
        or al,01000000b
        xchg ah,al
        call writechip
        mov ax,0013h        ; Lock config register
        mov writechip
        mov ax,4c00h
        int 21h
        endp

   readchip proc c
        out 22h,al
        nop
        nop
        in al,23h
        nop
        nop

   writechip proc c
        out 22h,al
        nop
        nop
        xchg ah,al
        out 23h,al
        nop
        nop
        xchg ah,al
        ret
        endp
   end
```

Example 5: Reset Watchdog

```
mov ax,0c513h           ; Unlock configuration register
call writechip
mov ax,3c3ch            ; Reset watchdog timer counter
call readchip
or al,00100000b         ; The counter is reset at out 23h,al
xchg ah,al
call writechip
mov ax,0013h            ; Lock configuration register
call writechip
```

AMI BIOS Setup 5

5.1 Starting Setup

The AMI BIOS is immediately activated when the computer starts to power on. The BIOS reads the system information contained in the CMOS and starts the process of checking out the system and configuring it. When it finishes, the BIOS will seek an operating system on one of the disks and then launch and turn control over to the operating system.

While the BIOS is in control, the Setup program can be activated in one of two ways:

1. Press the <Del> key immediately after switching the system on, or

2. Press the <Del> key when the following message appears briefly at the bottom of the screen during the POST (Power On Self Test).

Press DEL to enter SETUP.

If the message disappears before you respond and you still wish to enter Setup, restart the system to try again by turning it OFF then ON or pressing the "RESET" button on the system case. You may also restart by simultaneously pressing <Ctrl>, <Alt>, and <Delete> keys. If you do not press the keys at the correct time and the system does not boot, an error message will be displayed and you will again be asked to...
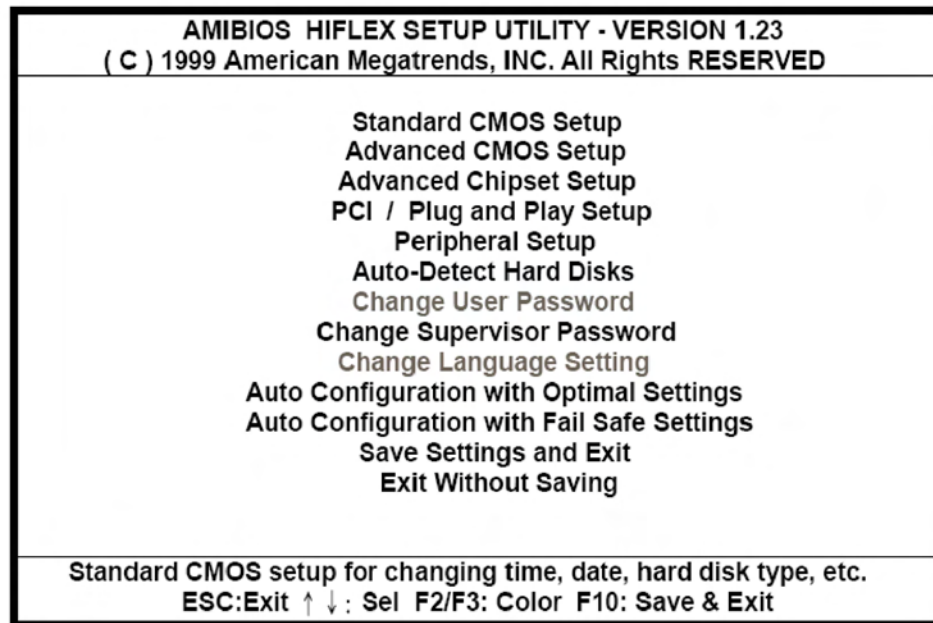
PRESS F1 TO CONTINUE, DEL TO ENTER SETUP

5.2   Main Menu

Once you enter the AMI BIOS CMOS Setup Utility, the Main Menu will appear on the screen. The Main Menu allows you to select from several setup functions and two exit choices. Use the arrow keys to select among the items and press <Enter> to accept and enter the sub-menu.

```
AMIBIOS  HIFLEX SETUP UTILITY - VERSION 1.23
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                Standard CMOS Setup
               Advanced CMOS Setup
              Advanced Chipset Setup
             PCI / Plug and Play Setup
                 Peripheral Setup
               Auto-Detect Hard Disks
               Change User Password
            Change Supervisor Password
              Change Language Setting
        Auto Configuration with Optimal Settings
       Auto Configuration with Fail Safe Settings
               Save Settings and Exit
                Exit Without Saving


Standard CMOS setup for changing time, date, hard disk type, etc.
    ESC:Exit  ↑↓: Sel  F2/F3: Color  F10: Save & Exit
```

Note that a brief description of each highlighted selection appears at the bottom of the screen.

Setup Items:

The main menu includes the following main setup categories. Please note that some systems may not include all entries.

- **Standard CMOS Setup**: This setup includes all the items in a standard AT-compatible BIOS.

- **Advanced CMOS Setup**: This setup includes all the items of AMI special enhanced features.

- **Advanced Chipset Setup** : Change Boot from (Floppy, IDE – 0…, , CDROM), Floppy Drive Swap, etc…,Password Check, or just to Setup.

- **PCI / Plug and Play Setup**: This item appears if the system supports PnP/ISA.

- **Peripheral Setup**: This setup specifies settings for integrated peripherals.

- **Auto-Detect Hard Disks**: Automatically detect and configure hard disk parameters. See also Section 5.3 "Standard CMOS Setup".

- **Change Supervisor Password**: Changes, sets, or disables password. It allows the user to limit access to the system and Setup.

- **Save Settings and Exit**: Saves CMOS value changes to CMOS and exit setup.

- **Exit Without Saving**: Abandon all CMOS value changes and exit setup.

5.3   Standard CMOS Setup

The items in the Standard CMOS Setup Menu are divided into 10 categories. Each category includes none, one or more than one setup items. Use the arrow keys to highlight the item and then use the <PgUp> or <PgDn> keys to select the desired value for each item.

```
          AMIBIOS  SETUP  - STANDARD CMOS SETUP
        ( C ) 1999 American Megatrends, INC. All Rights Reserved
Date (mm/dd/yyyy):Wed Jan 09 , 2002          Base Memory: 640KB
Time (hh/mm/ss):  10:56:28                    Extd  Memory: 3 MB

Floppy Drive A:      1.44 MB 3½
Floppy Drive B:      Not Installed
                                      LBA    Blk    PIO   32Bit
          Type    Size Cyln Head Wpcom Sec Mode  Mode   Mode   Mode
Pri Master : Auto                                              Off
Pri Slave  : Auto                                              Off
Sec.Master: Not Installed
Sec.Slave : Not Installed

Boot Sector Virus Protection      Disabled
Month: Jan   - Dec                       ESC:Exit      ↑ ↓ :Sel
Day  :  01   - 31                        PgUp/PgDn: Modify
Year  : 1901 - 2099                      F2/F3:Color
```

- **Date**: The date format is <day>, <date> <month> <year>. Press<F3> to show the calendar.. The input range for   the Month is 1-12. Range for Date is 1-31 or the maximum allowed for the specific month. Range for Year is 1900-2099. System BIOS will calculate the day of the week automatically.

- **Time**: The time format is <hour> <minute> <second>. The time is calculated based on the 24-hour military-time clock. For example, 1 p.m. is 13:00:00.

- **Daylight saving**: The category adds one hour to the clock when daylight-saving time begins. Italso subtracts one hour when standard time returns. Available settings are Enabled/Disabled.

- **Primary Master / Slave**: The categories identify the types of 1 channels that have been installed in the computer. There are 45 predefined types and 4 user definable types are for Enhanced IDE BIOS. Type "1" to Type "45" are predefined. Type "user" is user-definable.

  Press PgUp or PgDn to select a numbered hard disk type or type the number and press <Enter>. Note that the specifications of your drive must match with the drive table. The hard disk will not work properly if you enter improper information for this category.

If your hard disk drive type is not matched in the list, you can use Type"User" to define your own drive type manually.

If you select Type "User", you will need to know the information listed below. Enter the information directly from the keyboard and press <Enter>. This information should be included in the documentation from your hard disk vendor or the system manufacturer.

If the controller of HDD interface is ESDI, the selection should be "Type 1".If the controller of HDD interface is SCSI, the selection should be "None".If you select Type "Auto", BIOS will automatically detect the HDD & CD-ROM Drive at the POST stage and showing the IDE for HDD & CD-ROM Drive.

TYPE	Drive type
CYLS	Number of cylinders
HEADS	Number of heads
WPCOM	Write precom
SECTORS	Number of sectors
MODE	Mode type

If a hard disk has not been installed select NONE and press <ENTER>

- **Drive A Type / Drive B Type**: The category identifies the types of Floppy Disk Drive A or Drive B that have been installed in the computer.

None	No floppy drive installed.
360K, 5.25"	5¼" PC-type standard drive; 360K byte capacity.
1.2M, 5.25"	5¼" AT-type high-density drive; 1. 2M byte capacity.
720K, 3.5"	3½" double-sided drive; 720K byte capacity.
1.44M, 3.5"	3½" double-sided drive; 1.44M byte capacity.
2.88M, 3.5"	3½" double-sided drive; 2.88M byte capacity.

- **Virus Protection**: When this item is enabled, the AMI BIOS will monitor the boot sector and partition table of the hard disk drive for any attempt on modification. If an attempt is made, the BIOS will halt the system and the following error message will appear. If necessary, you will be able to run an anti-virus program to locate and remove the problem before any damage is done.

NOTE: Many disk diagnostic programs which attempt to access the boots ector table can cause the above warning message. If you will be running such a program, we recommend that it better for you to disable the Virus Protection beforehand.

- **Memory**: System memory is displayed as determined by POST.

- **Base Memory**: The POST will determine the amount of base (or conventional) memory installed in the system. The value of the base memory is typically 512K for systems with only 512K memory installed on the motherboard, or 640K for systems with 640K or more memory installed on the motherboard.

- **Extended Memory**: The BIOS determines how much extended memory is present during the POST. This is the amount of memory located above 1MB in the CPU's memory address map.

5.4   Advanced CMOS Setup

This section allows the user to configure the system for advanced operations. One can select the system's default speed, boot-up sequence, shadowing, keyboard operation and security.

```
          AMIBIOS SETUP – ADVANCED CMOS SETUP
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Quick Boot                 Enabled      Available Options
1st Boot Device            Floppy          Disabled
2nd Boot Device            IDE-0         ▶ Enabled
3rd Boot Device            SCSI
Try Other Boot Devices     Yes
BootUp Num-Lock            On
Floppy Drive Swap          Disabled
Floppy Drive Seek          Disabled
PS/2 Mouse Support         Enabled
System Keyboard            Absent
Primary Display            Absent
Password Check             Setup
Wait For 'F1' If Error     Enabled
C000, 32k Shadow           Disabled
C800, 32k Shadow           Disabled
D000, 32k Shadow           Disabled
D800, 32k Shadow           Disabled

                                        ESC:Exit  ↑ ↓ :Sel
                                        PgUp/PgDn :Modify
                                        F2/F3 : Color
```

- **1st (2nd , 3rd) Boot Device:** Selects Boot device and sequence.

- **Try Other Boot Devices**: If Yes, BIOS will try to boot from other Boot Devices if all Selected Boot Devices failed to boot. If NO, BIOS will try to Boot from only the Selected Boot Devices.

- **BootUp Num-Lock:** This allows you to determine the default status of the numeric keypad. By default, the system boots up with NumLock on.

- **Floppy Drive Swap**: When enabled, physical drive A will be assigned to logical drive B, and physical drive B will be assigned to logical drive A.

- **Boot Up Floppy Seek**: The system will detect and verify operation of the floppy drive type.

- **Mouse Support**: This item will set PS/2 Mouse as Enabled or Disabled.

- **System Keyboard**: This item can set System Keyboard as Absent or Present.

- **Primary Display**: The category selects the type of video adapter used for the primary system monitor. Although secondary monitors are supported, you do not

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have to select the type in Setup.

- **Password Check**: You can select whether the password is required every time the system boots or only when you enter the Setup. You can assign "Supervisor Password" and "User Password" in the main CMOS Setup Utility Screen.

- **Wait For "F1" if Error** : AMI BIOS POST error messages are followed by:

  Press <F1> to continue If this option is set to Disabled, AMI BIOS does not wait for you to press the <F1> key after an error message. The settings are Disabled or Enabled. The Optimal and Fail-Safe default settings are Enabled.

- **C000 – C800, 32K Shadow / D000 – D800, 32K Shadow / E000 – E800, 32K Shadow**: Optional firmware will be copied from ROM to RAM when this option is enabled.

5.5　　　　　Advanced Chipset Setup

```
         AMIBIOS SETUP – ADVANCED CMOS SETUP
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AT Bus Clock                    14.318/2      Available Options
Slow Refresh                    15 us          ▸ 14.318/2
Memory Hole At 15-16M           Disabled         PCLK2/3
RAS Precharge time              1.5T             PCLK2/4
RAS Active Time Insert Wait     Disable          PCLK2/5
CAS Precharge Time Insert Wait  Disable          PCLK2/6
Memory Write Insert Wait        Disable          PCLK2/8
Memory Miss Read  Insert Wait   Disable          PCLK2/10
ISA Write cycle end Insert Wait Enabled          PCLK2/12
I/O Recovery                    Enabled
I/O Recovery Period              0.75 us
On – Chip I/O Recovery          Disable
16Bit  ISA Insert Wait          Enabled
WatchDog Timer                  Disabled
WatchDog Timeout Select          1 Sec.
WatchDog Signal Select          System

                                           ESC:Exit  ↑ ↓ :Sel
                                           PgUp/PgDn :Modify
                                           F2/F3 : Color
```

- **AT BUS Clock**: ISA Bus Clock timing selection. When Auto Configuration is Disabled, then14.318/2, Pclk2/3, Pclk2/4, Pclk2/5, Pclk2/6, Pclk2/8, Pclk2/10, Pclk2/12 isavailable on ISA Bus.

- **Slow Refresh**: The chipset refresh settings deal with the timing of CPU access to dynamic random access memory (DRAM). The default timing has been carefully chosen and should only be altered if data is being lost. Such a scenario might occur if your system had mixed speed DRAM chips installed so that greater delays may be required to preserve the integrity of the data held in the slower memory chips. Available values: 120us, 60us, 15us.

- **Memory Hole At 15-16M**: Use this option to specify an area in memory that cannot be addressed on the ISA bus. The settings are Disabled, 512-640K, or 15-16MB. The default setting is Disabled.

- **RAS Precharge time**: DRAM must continually be refreshed otherwise it will lose its data. Normally, DRAM is refreshed entirely as the result of a single request. This option allows you to determine the number of CPU clocks allocated for the Row Address Strobe to accumulate its charge before the DRAM is refreshed. If insufficient time is allowed, refresh may be incomplete and data will be lost. Available values: 3.5T, 2.5T, 1.5T.

- **RAS Active Time Insert Wait**: When it is enabled, the system will insert a wait state for lower speed DRAM.

- **Memory Miss Read Insert Wait**: The above four items are disabled by default.

- **I/O Recovery**: This item allows you to determine the recovery time allowed for 8 bit I/O.Choices are 0u, 0.25u to 3.05 CPU clocks. Default is 1 clock.

- **I/O Recovery Period**: The recovery time is the length of time, measured in CPU clocks, which the system will delay after the completion of an input/output request. This delay takes place because the CPU is operating so much faster than the input/output bus that the CPU must be delay to allow of the completion of the I/O.

- **WatchDog Function**: Watchdog can be set through BIOS.

- **WatchDog Signal**: Set IRQ3, 4 ,5 ,6 ,7 ,9 ,10 ,11 ,12 ,14 ,15 ,NMI , Reset.

- **WatchDog Timer**: Set Timer 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 sec.

5.6　　　　Peripheral Setup

```
                AMIBIOS SETUP –  PERIPHERAL SETUP
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Onboard IDE                     Primary        Available Options
Onboard FDD                     Auto           ▶ Disable
Onboard Serial Port1            3F8h/COM1        Primary
Onboard Serial Port2            2F8h/COM2        Secondary
  Serial Port2 Mode             Normal
    Receiver Polarity           Non-Inverted
    Transmitter Polarity        Non-Inverted
Onboard Serial Port3            Disabled
  Serial Port3 IRQ              N/A
Onboard Serial Port4            N/A
  Serial Port4 Mode             N/A
  Serial Port4 IRQ              N/A
    Receiver Polarity           N/A
    Transmitter Polarity        N/A
Onboard Parallel Port           378
  Parallel Port Mode            ECP
  EPP Version                   N/A
  Parallel Port IRQ             5             ESC:Exit  ↑ ↓ :Sel
  Parallel Port DMA Channel     3             PgUp/PgDn :Modify
Onboard Parallel Port2          Disabled      F2/F3 : Color
```

- **Onboard IDE**: This item allows you to select the base address and IRQ for HDD active mode. Disabled and Primary are selectable. This setup item allows you to either enable or disable the primary controller.

- **Onboard FDC Controller:** This is to enable or disable the onboard Floppy controller.

- **Onboard Serial Port 1 / 2:** These items specify the base I/O port address and IRQ for the onboard Serial Port 1 (COM 1)/ Serial Port 2 (COM 2). Available addresses include 3F8h, 2F8h, 3E8h, 2E8h.

- **Onboard Parallel Port**: This specifies the base I/O port address and IRQ of the onboard Parallel Port. Settings are 378, 278, and 3BC.

5.7   Change Supervisor Password

User can set either supervisor or user password, or both of them. The differences between them are: 'supervisor password' can enter and change the options of the setup menus and 'user password' just can enter but does not have the right to change the options of the setup menus.

When one selects this function, the following message will appear at the center of the screen to assist in creating a password:

 ENTER PASSWORD :

Type the password, up to eight characters in length, and press <Enter>. The password typed now will clear any previously entered password from CMOS memory. User will be asked to confirm the password. Type the password again and press <Enter>. One may also press <Esc> to abort the selection and not enter a password.

To disable a password, just press <Enter> when user is prompted to enter the password. A message will confirm the password will be disabled. Once the password is disabled, the system will boot and Setup can be entered freely.

 PASSWORD DISABLED

When a password has been enabled, user will be prompted to enter it upon attempting to enter Setup. This prevents an unauthorized person from changing any part of the system configuration. Additionally, when a password is enabled, one can also require the BIOS to request a password every time the system is rebooted. This would help prevent unauthorized use of the computer. User can determine when the password is required within the BIOS Features Setup Menu and its Security option. If the Security option is set to "System", the password will be required both at boot and at entry to Setup. If set to "Setup", prompting only occurs when trying to enter Setup.

5.8 Drive Type Table

Type	Size (MB)	Cyln	Head	Sec	Wpcom	LBA	BLK	PIO	32BIT
1	10	306	4	17	128	Off	Off	Auto	Off
2	20	615	4	17	300	Off	Off	Auto	Off
3	30	615	6	17	300	Off	Off	Auto	Off
4	62	940	8	17	512	Off	Off	Auto	Off
5	46	940	6	17	512	Off	Off	Auto	Off
6	20	615	4	17	65535	Off	Off	Auto	Off
7	30	462	8	17	256	Off	Off	Auto	Off
8	30	733	5	17	65535	Off	Off	Auto	Off
9	112	900	15	17	65535	Off	Off	Auto	Off
10	20	820	3	17	65535	Off	Off	Auto	Off
11	35	855	5	17	65535	Off	Off	Auto	Off
12	49	855	7	17	65535	Off	Off	Auto	Off
13	20	306	8	17	128	Off	Off	Auto	Off
14	42	733	7	17	65535	Off	Off	Auto	Off
16	20	612	4	17	300	Off	Off	Auto	Off
17	40	977	5	17	300	Off	Off	Auto	Off
18	56	977	7	17	65535	Off	Off	Auto	Off
19	59	1024	7	17	512	Off	Off	Auto	Off
20	30	733	5	17	300	Off	Off	Auto	Off
21	42	733	7	17	300	Off	Off	Auto	Off
22	30	733	5	17		Off	Off	Auto	Off
23	10	306	4	17		Off	Off	Auto	Off
24	53	925	5	17	65535	Off	Off	Auto	Off
25	69	925	9	17	65535	Off	Off	Auto	Off
26	43	754	7	17	754	Off	Off	Auto	Off
27	68	754	11	17	65535	Off	Off	Auto	Off
28	40	699	7	17	256	Off	Off	Auto	Off
29	68	823	10	17	65535	Off	Off	Auto	Off
30	53	918	7	17	918	Off	Off	Auto	Off
31	93	1024	11	17	65535	Off	Off	Auto	Off
32	127	1024	15	17	65535	Off	Off	Auto	Off
33	42	1024	5	17	1024	Off	Off	Auto	Off
34	10	612	2	17	128	Off	Off	Auto	Off
35	76	1024	9	17	65535	Off	Off	Auto	Off
36	68	1024	8	17	512	Off	Off	Auto	Off

37	40	615	8	17	128	Off	Off	Auto	Off
38	24	987	3	17	987	Off	Off	Auto	Off
39	57	987	7	17	987	Off	Off	Auto	Off
40	40	820	6	17	820	Off	Off	Auto	Off
41	40	977	5	17	977	Off	Off	Auto	Off
42	40	981	5	17	981	Off	Off	Auto	Off
43	48	830	7	17	512	Off	Off	Auto	Off
44	68	830	10	17	65535	Off	Off	Auto	Off
45	144	917	15	17	65535	Off	Off	Auto	Off
46	152	1224	15	17	65535	Off	Off	Auto	Off
ARMD								Auto	Off
CDROM								Auto	Off
AUTO								Auto	Off
USER								Auto	Off

LCD/VGA Display 6

6-1 Features

The board uses an HM86508 chip which is an advanced single-chip flat panel and VGA controller. It's used for notebook or portable computer systems with simple operations and powerful features. It contains all functions and supports logic required to implement the IBM VGA display standards and enhanced display modes on LCD, PLASMA, EL panel at register and BIOS level compatible. Also a simultaneous display technology is implemented in HM86508 to be used for CRT and Flat panel.

HM86508 can support flat panel display, resolution up to 1024x768mono, 800x600 hi-color, 640x480 true-color. Unlike on CRT, the pixels on a flat panel display are real, discrete entities of a fixed size. This results in problems when different display modes are mapped onto one panel. The HM86508 provides approach to keep the vertical resolution of the display mode constant but center the active display area vertically on the panel.

The flat panel interface support Monochrome/ Color STN LCD panel, color TFT LCD panel, PLASMA panel and EL panel. Providing direct panel interface to (DD) Dual-panel, Dual-drive for color and monochrome and (SS) Single-panel, Single-drive (supports 8,9,12,15,18,24-bit data).For Single–panel/Single-drive panel which refresh data rate is not high, The HM86508 can set some of the video memory as the frame buffer for panel display to decrease video memory chip counts to one (a 256k x 16DRAM).

The HM86508 serves as a DRAM controller for the display memory, it handles DRAM refresh, display refresh, display memory access by CPU and supply the control signal of DRAM with dual write or dual-cas.

- **Dual-scan STN Frame Buffer:**
    Shadow Frame Buffer onto display memory for mono or color LCD panel.
    Pseudo Frame Buffer for color LCD panel (no additional DRAM required).
    External Frame Buffer for color LCD panel (external additional DRAM required)

- **Enhanced mode includes:**

    132 x 25 or 132 x 44 text mode
    640 x 480/256 colors(Windows accelerations mode support optional)
    640 x 480/65536 colors(Windows accelerations mode support optional)
    640 x 480/16.8M colors(Windows accelerations mode support optional)
    800 x 600/16   colors
    800 x 600/256   colors(Windows accelerations mode support optional)
    800 x 600/65536 colors(Windows accelerations mode support optional)
    800 x 600/16.8M colors
    1024 x 768/16   colors
    1024 x 768/256   colors(Windows accelerations mode support optional)
    1024 x 768/65536 colors(Windows accelerations mode support optional)
    1280 x 1024/16   colors(Windows accelerations mode support optional)
    1280 x 1024/256 colors(Windows accelerations mode support optional)
    1600 x 1280/16   colors interlace display mode

- **Integrated STN panel support:**

  Supports Dual/single scan mono STN LCD Panel, up to 64 simultaneous grays.
  Supports Dual/single scan color STN LCD Panel, up to 64k simultaneous colors,
  and 61 visual colors .
  Provides 8 and 16 bit panel interfaces

- **Integrated color TFT panel support:**

  Supports Normal or CRT-like TFT LCD panel
  Supports 9/12/15 or 18/24 bit panel interface, and up to 16.8M simultaneous
  colors.

Appendix A: Expansion Bus A

A-1 PC/104 Pin Assignments

Row D	Pin Name	Row C	Pin Name	Row A	Pin Name	Row B	Pin Name
				1	IOCHCHK	1	GND
				2	SD7	2	RESETDRV
				3	SD6	3	+5V
				4	SD5	4	IRQ9
				5	SD4	5	-5V
				6	SD3	6	DRQ2
				7	SD2	7	-12V
				8	SD0	8	ENDXFR
1	GND	1	GND	9	SD1	9	+12V
2	MEMCS16	2	SBHE	10	IOCHRDY	10	(KEY)
3	IOCS16	3	LA23	11	AEN	11	SMEMW
4	IRQ10	4	LA22	12	SA19	12	SMEMR
5	IRQ11	5	LA21	13	SA18	13	IOW
6	IRQ12	6	LA20	14	SA17	14	IOR
7	IRQ15	7	LA19	15	SA16	15	DACK3
8	IRQ14	8	LA18	16	SA15	16	DRQ3
9	DACK0	9	LA17	17	SA14	17	DACK1
10	DRQ0	10	MEMR	18	SA13	18	DRQ1
11	DACK5	11	MEMW	19	SA12	19	REFRESH
12	DRQ5	12	SD8	20	SA11	20	SYSCLK
13	DACK6	13	SD9	21	SA10	21	IRQ7
14	DRQ6	14	SD10	22	SA9	22	IRQ6
15	DACK7	15	SD11	23	SA8	23	IRQ5
16	DRQ7	16	SD12	24	SA7	24	IRQ4
17	+5V	17	SD13	25	SA6	25	IRQ3
18	MASTER	18	SD14	26	SA5	26	DACK2
19	GND	19	SD15	27	SA4	27	TC
20	GND	20	(KEY)	28	SA3	28	SALE
				29	SA2	29	+5V
				30	SA1	30	OSC
				31	SA0	31	GND
				32	GND	32	GND

Appendix B: Technical Summary B

B-1 Interrupt Map

IRQ	ASSIGNMENT
0	System TIMER interrupt from TIMER-0
1	Keyboard output buffer full
2	Cascade for IRQ 8-15
3	Serial port 2
4	Serial port 1
5	Parallel port 2
6	Floppy Disk adapter
7	Parallel port 1
8	RTC clock
9	Available
10	Available
11	Available
12	Available
13	Math coprocessor
14	Hard Disk adapter
15	Available

B-2 Timer & DMA Channel Maps

Timer Channel	Timer Channel
0	System timer interrupt
1	DRAM Refresh request
2	Speaker tone generator

DMA Channel	Assignment
0	Available
1	IBM SDLC
2	Floppy Disk adapter
3	Available
4	Cascade for DMA controller 1
5	Available
6	Available
7	Available

B-3   RTC & CMOS RAM Map

CODE	ASSIGNMENT
00	Seconds
01	Second alarm
02	Minutes
03	Minutes alarm
04	Hours
05	Hours alarm
06	Day of week
07	Day of month
08	Month
09	Year
0A	Status register A
0B	Status register B
0C	Status register C
0D	Status register D
0E	Diagnostic status byte
0F	Shutdown byte
10	Floppy Disk drive type byte
11	Reserved
12	Hard Disk type byte
13	Reserved
14	Equipment byte
15	Base memory low byte
16	Base memory high byte
17	Extension memory low byte
18	Extension memory high byte
30	Reserved for extension memory low byte
31	Reserved for extension memory high byte
32	Date Century byte
33	Information Flag
34-3F	Reserved
40-7F	Reserved for Chipset Setting Data

B-4   Memory & I/O Maps

MEMORY MAP	ASSIGNMENT
0000000-009FFFF	System memory used by DOS and applications
00A0000-00BFFFF	Display buffer memory for VGA/EGA/CGA/MONO adapters
00C0000-00DFFFF	Reserved for I/O device BIOS ROM or RAM buffer.
00E0000-00EFFFF	Reserved for PCI device ROM
00F0000-00FFFFF	System BIOS ROM
0100000-BFFFFFF	System extension memory

I/O MAP	ASSIGNMENT
000-01F	DMA controller (Master)
020-021	Interrupt controller (Master)
022-023	Chipset controller registers I/O ports
040-05F	Timer control registers
060-06F	Keyboard interface controller (8042)
070-07F	RTC ports & CMOS I/O ports
080-09F	DMA register
0A0-0BF	Interrupt controller (Slave)
0C0-0DF	DMA controller (Slave)
0F0-0FF	Math coprocessor
1F0-1F8	Hard Disk controller
278-27F	Parallel port-2
2B0-2DF	Graphics adapter controller
2F8-2FF	Serial port-2
360-36F	Network ports
378-37F	Parallel port-1
3B0-3BF	Monochrome & Printer adapter
3C0-3CF	EGA adapter
3D0-3DF	CGA adapter
3F0-3F7	Floppy disk controller
3F8-3FF	Serial port-1

Appendix C: Troubleshooting C

C-1 Troubleshooting POST Messages

During the Power On Self Test (POST), if the BIOS detects an error requiring user action, it will either sound a beep code or display a message. If a message is displayed, it will be accompanied by:

PRESS F1 TO CONTINUE, CTRL-ALT-ESC OR DEL TO ENTER SETUP

C-2 Troubleshooting POST Beep

Currently there are two kind of beep codes in BIOS. One code indicates that a video error has occurred and the BIOS cannot initialize the video screen to display any additional information. This beep code consists of a single long beep followed by three short beeps. The other code indicates that a DRAM error has occurred. This beep code consists of a single long repeated beep.

- Error Messages: One or more error messages may be displayed if the BIOS detects an error during the POST. This list includes messages for both the ISA and the EISA BIOS.

- CMOS BATTERY HAS FAILED: CMOS battery is no longer functional. It should be replaced.

- CMOS CHECKSUM ERROR: Checksum of CMOS is incorrect. This can indicate that CMOS has become corrupt. This error may have been caused by a weak battery. Check the battery and replace if necessary.

- DISK BOOT FAILURE, INSERT SYSTEM DISK AND PRESS ENTER: No boot device was found. This could mean that either a boot drive was not detected or the drive does not contain proper system boot files. Insert a system disk into Drive A: and press <Enter>. If the system was expected to boot from the hard drive, make sure the controller is inserted correctly and all cables are properly attached. Also be sure that the disk is formatted as a boot device. Then reboot the system.

- DISKETTE DRIVES OR TYPES MISMATCH ERROR - RUN SETUP: Type of diskette drive installed in the system is different from the CMOS definition. Run Setup to reconfigure the drive type correctly.

- DISPLAY SWITCH IS SET INCORRECTLY: Display switch on the motherboard can be set to either monochrome or color. This indicates the switch is set to a different setting than indicated in Setup. Determine which setting is correct, and then turn off the selection.

- DISPLAY TYPE HAS CHANGED SINCE LAST BOOT: Since last power off the system, the display adapter has been changed. User must configure the system for the new display type.

- ERROR ENCOUNTERED INITIALIZING HARD DRIVE: Hard drive cannot be initialized. Be sure the adapter is installed correctly and all cables are correctly and firmly attached. Also be sure the correct hard drive type is selected in Setup.

- ERROR INITIALIZING HARD DISK CONTROLLER: Cannot initialize controller. Make sure the card is correctly and firmly installed in the bus. Be sure the correct hard drive type is selected in Setup. Also check if any jumper needs to be set correctly on the hard drive.

- FLOPPY DISK CNTRLR ERROR OR NO CNTRLR PRESENT: Cannot find or initialize the floppy drive controller. Make sure the controller is installed correctly and firmly. If there are no floppy drives installed, be sure the Diskette Drive selection in Setup is set to NONE.

- Invalid EISA Configuration: RUN EISA CONFIGURATION UTILITY. The non-volatile memory containing EISA configuration information was programmed incorrectly or has become corrupt. Re-run EISA configuration utility to correctly program the memory.

  NOTE: When this error appears, the system will boot in ISA mode, which allows user to run the EISA Configuration Utility.

- KEYBOARD ERROR OR NO KEYBOARD PRESENT: Cannot initialize the keyboard. Make sure the keyboard is attached correctly and no keys are being pressed during the boot. If user is purposely configuring the system without a keyboard, set the error halt condition in Setup to HALT ON ALL, BUT KEYBOARD. This will cause the BIOS to ignore the missing keyboard and continue the boot.

- MEMORY ADDRESS ERROR AT ...: Indicates a memory address error at a specific location. One can use this location along with the memory map for the system to find and replace the bad memory chips.

- MEMORY PARITY ERROR AT ...: Indicates a memory parity error at a specific location. One can use this location along with the memory map for the system to find and replace the bad memory chips.

- MEMORY SIZE HAS CHANGED SINCE LAST BOOT: Memory has been added or removed since the last boot. In EISA mode, use Configuration Utility to reconfigure the memory configuration. In ISA mode, enter Setup and enter the new memory size in the memory fields.

- MEMORY VERIFY ERROR AT ...: Indicates an error verifying a value already written to memory. Use the location along with the system's memory map to locate the bad chip.

- OFFENDING ADDRESS NOT FOUND: This message is used in conjunction with the I/O CHANNEL CHECK and RAM PARITY ERROR messages when the segment that has caused the problem which cannot be isolated.

- OFFENDING SEGMENT: This message is used in conjunction with the I/O CHANNEL CHECK and RAM PARITY ERROR messages when the segment that has caused the problem which has been isolated.

- PRESS A KEY TO REBOOT: This will be displayed at the bottom screen when an error occurs that requires the user to reboot. Press any key and the system will reboot.

- PRESS F1 TO DISABLE NMI, F2 TO REBOOT: When BIOS detects a Non-maskable Interrupt condition during boot, this will allow the user to disable the NMI and continue to boot, or one can reboot the system with the NMI enabled.

- RAM PARITY ERROR - CHECKING FOR SEGMENT ...: Indicates a parity error in Random Access Memory.

- SYSTEM HALTED, (CTRL-ALT-DEL) TO REBOOT ...: Indicates the present boot attempt has been aborted and the system must be rebooted. Press and hold down the CTRL and ALT keys and press DEL.

C-3   Troubleshooting for POST Codes

NOTE: EISA POST codes are typically output to port address 300h.
ISA POST codes are output to port address 80h.

POST (hex)	Description
C2	NMI is Disabled. Power on delay starting.
C5	Power on delay complete. Going to disable cache if any.
C6	Calculating ROM BIOS checksum.
C7	ROM BIOS checksum passed. CMOS shutdown register test to be done next.
C8	CMOS shutdown register test done. CMOS checksum calculation to be done next.
CA	CMOS checksum calculation done, CMOS Diag byte written CMOS status register about to init for Date and Time.
CB	CMOS status register init done. Any initialization before keyboard BAT to be done next.
CD	BAT command to keyboard controller is to be issued.
CE	Keyboard controller BAT result verified. Any initialization after KB controller. BAT to be done next.
CF	Initialization after KB controller BAT done. Keyboard command byte to be written next.
D1	Keyboard controller command byte is written. Going to check pressing of <INS> key during power-on done.
D2	Checking for pressing of <INS> key during power-on done. Going to disable DMA and interrupt controller.
D3	DMA controller #1, #2, interrupt controller #1, #2 disable. Chipset init/ auto memory detection about to begin.
D4	Chipset initialization/ auto memory detection over. To uncompress the RUNTIME code.
D5	RUNTIME code is uncompressed.
D0	Transfer control to uncompressed code in shadow ram atF000: FFF0.

01	Processor register test about to start and NMI to beDisabled.
02	NMI is Disabled. Power–on delay starting.
03	Power on delay complete. To check soft reset /power-on.
05	Soft reset / power-on determined. Going to disable cache if any.
06	POST code to be uncompressed.
07	POST code is uncompressed. CPU init and CPU areainit to be done next
08	CPU and CPU date area init done. CMOS checksum calculation to be done next.
09	CMOS checksum calculation is done, CMOS Diag byte written. CMOS init to begin (if "init CMOS in every boot"is set).
0A	CMOS initialization done (if any).CMOS status register about to init for Date and Time.
0B	CMOS status register init done. Any initialization before keyboard BAT to be done next.
0C	KB controller I/B free. Going to issue the BAT command to keyboard controller.
0E	Keyboard controller BAT result verified. Any initialization after KB controller BAT to be done next.
0F	Initialization after KB controller BAT done. Keyboard command byte to be written next.
10	Keyboard controller command byte is written. Going to issue Pin 23, 24 blocking / unblocking command.
11	Pin 23, 24 of keyboard controller is blocked / unblocked. Going to check pressing of <INS> key during power-on.
12	Checking for pressing of <INS> key during power-on done. Going to disable DMA and interrupt controllers.
13	DMA controller #1, #2, interrupt controller #1, #2 disabled. Video display is disabled and port-B is initialized. Chipset init about to begin.
15	Chipset initialization over. 8254 timer test about to start.
19	8254 timer test over. About to start memory refresh test.
1A	Memory Refresh line is toggling. Going to check 15 micro second ON/OFF time.
20	Memory Refresh period 30 micro second test complete. Base 64K memory to be initialized.
23	Base 64K memory initialized. Going to set BIOS stack and to do any setup before interrupt vector init.
24	Setup required before interrupt vector initialization complete. Interrupt vector initialized about to begin.
25	Interrupt vector initialization done. Going to read input port of 8042 for turbo switch (if any) and to clear password if post diagnostic switch is on.
26	Input port of 8042 is read. Going to initialize global data for turbo switch.

27	Global data initialization for turbo switch is over. Any initialization before setting video mode to be done next.
28	Initialization before setting video mode is complete. Going for monochrome mode and color mode setting.
2A	Different BUSes init (system, static, output devices) to start if present. (Please see next section for details of different BUSes).
2B	About to give control for any setup required before optional video ROM check.
2C	Processing before video ROM control is done. About to look for optional video ROM and give control.
2D	Optional video ROM control is done. About to give control to do any processing after video ROM returns control.
2E	Return from processing after the video ROM control. If EGA/VGA not found then do display memory R/W test.
2F	EGA/VGA not found. Display memory R/W test about to begin.
30	Display memory R/W test passed. About to look for the retrace checking.
31	Display memory R/W test or retrace checking failed. About do alternate display memory R/W test.
32	Alternate Display memory R/W test passed. About to look for the alternate display retrace checking.
34	Video display checking over. Display mode to be set next.
37	Display mode set. Going to display the power ON message.
38	Different BUSes init (input, IPL, general devices) to start if present. (Please see next section for details about different BUSes).
39	Display different BUSes initialization error messages. (Please see next section for details of different BUSes).
3A	New cursor position read and saved. Going to display the hit <DEL> message.
3B	Hit <DEL> message displayed. Virtual mode memory test about to start .
40	Going to prepare the descriptor tables.
42	Descriptor tables prepared. Going to enter virtual mode for memory test.
43	Entered in the virtual mode. Going to enable interrupts for diagnostics mode.
44	Interrupt enabled (if diagnostics switch is on). Going to initialize data to check memory wrap around at 0: 0.
45	Data initialized. Going to check for memory wrap around at 0:0 and finding the total system memory size .
46	Memory wrap around test done. Memory size calculation over. About to go for writing patterns to test memory.
47	Pattern to be tested written in extended memory. Going to write patterns in base 640K memory.

48	Patterns written in base memory. Going to find out amount of memory below 1M memory.
49	Amount of memory below 1M found and verified. Going to find out amount of memory above 1M memory.
4B	Amount of memory above 1M found and verified. Check for soft reset and going to clear memory below 1M for soft reset. (If power on, go to check point #4Eh).
4C	Memory below 1M cleared. (SOFT RESET) Going to clear memory above 1M.
4D	Memory above 1M cleared. (SOFT RESET) Going to save the memory size. (Go to check point #52h).
4E	Memory test started. (NOT SOFT RESET) About to display the first 64k memory size
4F	Memory size display started. This will be updated during memory test. Going for sequential and random memory test.
50	Memory testing/initialization below 1M complete. Going to adjust displayed memory size for relocation/shadow.
51	Memory size display adjusted due to relocation/shadow. Memory test above 1M to follow.
52	Memory testing/initialization above 1M complete. Going to save memory size information.
53	Memory size information is saved. CPU registers are saved Going to enter in real mode.
54	Shutdown successful, CPU in real mode. Going to disable gate A20 line and disable parity/NMI.
57	A20 address line, parity / NMI disable successful. Going to adjust memory size depending on relocation/shadow.
58	Memory size adjusted for relocation / shadow. Going to clear Hit <DEL> message.
59	Hit <DEL> message cleared. <WAIT …> message displayed About to start DMA and interrupt controller test.
60	DMA page register test passed. To do DMA#1 base register test.
62	DMA#1 base register test passed. To do DMA#2 base Register test.
65	DMA#2 base register test passed. To program DMA units 1 and 2.
66	DMA unit 1 and 2 programming over. To initialize 8259 interrupt controller.
67	8259 initialization over.
7F	Extended NMI sources enabling is in progress.
80	Keyboard test started. clearing output buffer, checking for stuck key. About to issue keyboard reset command.
81	Keyboard reset error / stuck key found. About to issue keyboard controller interface test command.
82	Keyboard controller interface test over. About to write command byte and init circular buffer.

83	Command byte written, Global data init done. About to check for lock-key.
84	Lock-key checking over. About to check for memory size mismatch with CMOS.
85	Memory size check done. About to display soft error and check for password or bypass setup.
86	Password checked. About to do programming before setup.
87	Programming before setup complete. Going to uncompress SETUP code and execute CMOS setup.
88	Returned from CMOS setup program and screen is cleared. About to do programming after setup.
89	Programming after setup complete. Going to display power on screen message.
8B	First screen message display. <WAIT…> message displayed. About to do Video BIOS shadow.
8C	Video BIOS shadow successful. Setup options Programming after CMOS setup about to start.
8D	Setup option are programmed, mouse check and init to be done next.
8E	Mouse check and initialization complete. Going for hard disk controller reset.
8F	Hard disk controller reset done. Floppy setup to be done next.
91	Floppy setup complete. Hard disk setup to be done next.
94	Hard disk setup complete. To set base and extended memory size.
95	Memory size adjusted due to mouse support. Init. of different BUSes optional ROMs from C800to start. (Please see next section for details of different BUSes).
96	Going to do any init before C800 optional ROM control.
97	Any init before C800 optional ROM control is over. Optional ROM check and control will be done next.
98	Optional ROM control is done. About to give control to do any required processing after optional ROM returns control.
99	Any initialization required after optional ROM test over. Going to setup timer data area and printer base address.
9A	Return after setting timer and printer base address. Going to set the RS-232 base address.
9B	Returned after RS-232 base address. Going to do any initialization before Coprocessor test.
9C	Required initialization before Coprocessor is over. Going to initialize the Coprocessor next.
9D	Coprocessor initialized. Going to do any initialization after Coprocessor test.
9E	Initialization after Coprocessor test is complete. Going to check extd keyboard , keyboard ID and num-lock
9F	Extd keyboard check is done, ID flag set, num-lock on/off Keyboard ID command to be issued.

A0	Keyboard ID command issues. Keyboard ID flag to be reset
A1	Keyboard ID flag reset. Cache memory test to follow.
A2	Cache memory test over. Going to display any soft error.
A3	Soft error display complete. Going to set keyboard typematic rate.
A4	Keyboard typematic rate set. To program memory wait states.
A5	Memory wait states programming over. Going to clear the screen and enable parity / NMI.
A7	NMI and parity enabled. Going to do any initialization required before giving control to optional ROM at E000.
A8	Initialization before E000 ROM control over. E000 ROM to get control next.
A9	Returned from E000 ROM control. Going to do any initialization required after E000 optional ROM control.
AA	Initialization after E000 optional ROM control is over. Going to display the system configuration.
B0	System configuration is displayed.
B1	Going to copy any code to specific area.
00	Copying of code to specific area done. Going to give control To INT-19 boot loader.