

**STUDY MATERIALS ON HARDWARE INSTALLATION
AND MAINTENANCE**

(As per the curriculum of fifth semester BSc
Electronics of M. G. University)

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**MODULE II
M O T H E R B O A R D**

Motherboard – abbreviated as *mobo* – is the flat rectangular piece of circuit board to which every thing are connected directly or indirectly.

Form factor is the industry term for denoting the

- i) Size
- ii) Shape
- iii) Standard/layout of power supplies & add-in cards (and its numbers)

Important types :

1. AT (Advanced Technology)

2. ATX (Advanced Technology Extended) – consists of 7 Expansion slots

Other versions of ATX are

- i) Micro ATX – 4 Expansion slots
- ii) Flex ATX

3. BTX (Balanced Technology Extended) – Got better heat dissipation and airflow and they are optimized for the newest desktop technology including PCI Express and Serial ATA- consists of 7 Exp. Slots.

Other versions of BTX are

- i) Micro BTX - 4 Exp. Slots
- ii) Pico BTX – 1 Exp. Slot.

Parts and Layout of a typical Motherboard – Refer Hardware Lab Manual - 2008

Advantages of Upgrading

1. Increased speed – because of new improved processor and wider data path.
2. Expansion slots – such new motherboard will have expansion slots for new high speed, high data width expansion cards.
3. New BIOS chip – facility to use many new hardware / existing hardware more efficiently.

While upgrading the motherboard:-

- All the expansion, hard disk drives, display etc need to be changed – improves the speed / overall system performance.
- Even power supply of the computer may need to be upgraded to support the power requirement

- Increases the basic cost for upgrading – therefore step-by-step upgrading (firstly motherboard, then fast HDD system; next, fast display system and so on).

STEPS OF MOTHER BOARD UPGRADING

- A. Buying the new motherboard
- B. Preparing the new motherboard
- C. Removing the old motherboard
- D. Installing the new motherboard
- E. Setting up the system for the new motherboard

A. Buying New Motherboard

Keep in mind the requirements for the next couple of years.

Points to be considered while buying new Motherboard

1. **Size of Motherboard:-** Choose proper size MB which suits the cabinet
 - a. PC/XT Size: 8 1/2*13 1/2 inch
 - b. Std AT size: 12*13 inch
 - c. Baby AT size: 8 1/2*13 or 8 1/2*6 1/2 inch
2. **CPU option:-** Nowadays P IV is the min that one should buy. So MB should have facility for an upgrade to higher processor (without going for a new MB)
3. **Co-processor option:-** If the MB is for the 486 SX or 386 or lower processor, then it should have a socket to add a mathematical co processor. 486 and higher processors do not require this facility.
4. **BIOS type:-**Go for a well known BIOS maker- AMI, PHOENIX, AWARD etc.
5. **Number/size/type of expansion slots:-**Number of expansion slots denotes the number of equipments that can be connected. Size- 8 bit, 16 bit and 32 bit sizes. Type (according to the architecture) – ISA, EISA, PCI, Local Bus etc.

Consider the clock that operates the expansion card bus. This speed of the bus is called Bandwidth of the bus (Bandwidth is the number of data that can move through the bus in a given time)

6. **Devices embedded in the board:-**Motherboard manufacturers provide common interfaces such as the interfaces for display, floppy disk drive, serial/parallel I/O, sound, modem etc on the motherboard itself.
7. **Type and maximum size of memory.**
 - a. Size:- Initially 640 KB memory on the motherboard is OK. But now because of GUI e.g. Windows ME, XP etc the minimum requirement has reached 128 MB and even higher.
 - b. Type:- Go for motherboards that accept at least 168 pin DIMM (3.3 V) memory
8. **Cache memory type and size** (size and design is important)
Minimum size recommended: 64 KB and maximum benefit by using 128KB/256KB cache memory.
Caching algorithm - Write back cache (caches both the reading and writing processes) is preferred over the Write through cache (caches only the data being read)
9. **Position of keyboard connector:-**opening for the Keyboard connector – whether aligned or not.
10. **Warranty type and duration:-** Find out whether the warranty is covered for the new motherboard and its parts.

B. Preparing the New Motherboard

1. Installing CPU and CPU fan

Whether Slot 1 socket / ZIF socket 370

Align the CPU with the socket- slowly but firmly push into the socket or by using ZIF lever in the case of ZIF socket.

Plug the power wire of fan to one of the free power supply wire

2.Install memory:- Add new memory to the MB or remove the memory from the old MB and install it in the new MB. Make sure that the memory is of required speed and capacity.

3.Jumper setting:- Most motherboards have Auto Jumper setup option. These motherboards detect the CPU brand, core voltages, color/mono monitor type, cache memory type and size etc.. If the motherboard is of AT or lower system we have to set the motherboard set up switches (jumper settings)

Connection of different connectors such as speaker, turbo switch and indicator, reset switch etc. will be done after the motherboard is installed into the system.

C. Removing the Old Motherboard

- Switch off the system; Remove the power cable from the computer.
- Remove all the external connectors such as printer cable, monitor cable, keyboard etc.
- Remove the screws and lift the cover
- Remove the expansion cards
- Remove the connectors (to the speaker, power, turbo, reset etc.)
- To remove the MB, remove the plastic spacers or stand off (wing like springy construction on the top end; squeeze it using a nose plier to push the hole in the MB through it. Also remove the retaining screws (the base has some holes to fix the retaining screws to hold the motherboard in place)

D. Installing the New Motherboard

- Check the placement and orientation of CPU, BIOS and memory chips/ Co processor chips
- Check the SIMM or SIPP memory modules that they are firmly and correctly seated on the new motherboard.
- Check all jumper settings
- Attach the plastic standoffs
- Place the board into the case
- Fix the retaining screws
- Reconnect the power connector (black ground wire of both the power connector should be together)
- Reconnect all other connectors
- Reinstall the display card
- Reconnect the Keyboard, Power supply cable, display cable etc.
- Do not close the cover
- Switch ON the system – check for:- power supply fan spinning or not
- see the BIOS boot up message on the screen

- Memory test display should appear
- At the end of the test one beep sound should be produced by the system.
- Reinstall the remaining cards.
- If there is a new card, the card should be configured properly. The DMA, Interrupt and memory settings should be done properly to avoid conflict with the other existing expansion cards.
- Reconnect all the external cables.
- Run the setup to inform the computer about the devices such as display, floppy disk drive, Hard Disk Drive, Keyboard etc. Some setup program requires to tell about the total memory. But most of the new BIOS can auto configure.

F. Setting up the system for a new mother board.

(i) XT Motherboard

8 pin DIP socket with 8 DIP switches are used to configure various hardware in the PC and PC/XT computer

<u>Switch</u>	<u>Function</u>
Switch 1	Off : Boot from Floppy On : Do not boot from Floppy
Switch 2	Mathematical Co-Processor Off : Installed On : Not installed
Switch 3-4	Mother Board Memory Bank 3 Off - 4 Off : All 4 banks are filled 3 Off - 4 On : Bank 0 & 1 are filled 3 On - 4 Off : Bank 0, 1 & 2 are filled 3 On - 4 On : Only Bank 0 filled
Switch 5-6	Monitor type 5 Off - 6 Off : Monochrome monitor 5 Off - 6 On : CGA (40 * 25) 5 On - 6 Off : CGA (80 * 25) 5 On - 6 On : EGA, VGA or higher display
Switch 7-8	Number of Hard Disk Drives 7 On - 8 On : 1 Drive 7 Off - 8 On : 2 Drives 7 On - 8 Off : 3 Drives 7 Off - 8 Off : 4 Drives

(ii) Configuring AT and higher machines

IRQ No.	Device	Expansion Bus
0	Timer	No
1	Keyboard	No
2	Cascaded (To activate the 2 nd set of IRQ lines)	No
3	COM 2 (serial interface)	Yes
4	COM 1 (serial interface)	Yes
5	LPT 2	Yes
6	FDC	Yes
7	LPT 1 (parallel interface)	Yes
8	Real Time Clock	No
9	Redirected as IRQ 2	Yes
10	Available for use	Yes
11	Available for use	Yes
12	Motherboard mouse port	Yes
13	Math Coprocessor	No
14	HDC	Yes
15	Available	Yes

PC uses two interrupt controllers to manage the 16 interrupt request lines. But only 15 lines are available for actual use. IRQ 2 is used to activate the second set of IRQ lines (IRQ 8 – IRQ 15)

DMA Conflict

Direct Memory Access allows a special DMA Controller chip to move large volumes of data from memory to external device, external device to memory or memory to memory without CPU's assistance. For DMA operations, different channels are provided inside the computer (different devices use different channels). When a new DMA device is installed into the system, that device should be setup such that it should not interfere with the other existing DMA devices. Normally two DMA devices do not conflict unless they operate at the same time.

For example, we can have a Network card and a Disk drive using the same DMA Channel 3, they can work independently. But when we use them simultaneously, then a card conflict would occur.

On a PC or XT machine 4 DMA channels are provided

DMA Channel No.	Channel Function	Expansion Bus
0	DRAM Refresh	No
1	Available	Yes
2	FDC	Yes
3	HDC	Yes

For 286 or higher system there are 7 DMA channels

DMA Channel No.	Channel Function	Expansion Bus
0	8 bit Data Transfer	Yes
1	8 bit Data Transfer	Yes
2	Floppy Disk Transfer	Yes
3	8 bit Data Transfer	Yes
4	Cascaded for Channel:0 - 3	No
5	16 bit Data Transfer	Yes
6	16 bit Data Transfer	Yes
7	16 bit Data Transfer	Yes

Cards I/O Address: Refer Text Book

BIOS – Basic Input Output System

BIOS – or Basic Input Output System is a set of programs stored inside one or more PROM chip depending on the design of the computer and put on the mother board called as firm wire (i.e. soft ware stored in hardware). This collection of programs is the first thing loaded when we start the computer and make the operating systems and computer hardware to communicate with application programme and peripheral devices such as floppy disk, hard disk, printer, display, adapter etc.

Leading Manufacturers:- AWARD, AMI, Phoenix etc.

BIOS in most PCs have four main functions: –

- **POST (Power On Self Test):** - When we switch ON a computer, POST is the very first program which is executed from ROM i.e. it is the program executed before getting minimum display. The POST tests your computer’s processor, memory, chipset, video adapter, disk controllers, disk drives, keyboard and other crucial components and ensures that all of them are working properly. If this routine finds any error or fault, it is informed to the user as error beep or as some error message displayed on the screen. Some errors called nonfatal errors allow the user to continue where as fatal errors will not allow the POST to continue until the problem is rectified.
- **Setup:** - The system configuration and setup program is usually a menu driven program activated by pressing a special key (usually DEL key) during the POST .It enables us to configure the motherboard and chipset settings along with the date and time, passwords, disk drives and other basic system settings like power management, boot drive sequence, CPU timing, clock multiplier settings etc. This setup program in the BIOS is used to set and store the configuration settings in the CMOS RAM.

BIOS and CMOS RAM are in fact two totally separate components. The BIOS on the motherboard is stored in a fixed ROM chip. Also on the motherboard there is a chip called the RTC/NVRAM chip, which stands for Real Time Clock/Non Volatile memory. This is where the BIOS Setup information is stored and it is actually a digital clock chip with a few extra bytes to store other information. It is usually called the CMOS chip because it is made using CMOS (Complementary metal-oxide semiconductor) technology. Although it is called non-volatile, it is actually volatile, meaning that without power, all the settings and data in this RAM chip will be erased. A CMOS battery (Lithium coin cell type – 3V) in the system provides that power. (CMOS RAM chip run on as little as 1 microampere). Every time your system boots up, it reads the parameters stored in the CMOS RAM chip to determine how the system should be configured. Once the POST routine is executed successfully, BIOS goes to the boot process

- **BSL (Boot Strap Loader):** - The job of BSL is to load the operating system from secondary storage area into the computer's main memory (RAM). This is a routine that reads the first physical sector of various disk drives looking for a valid master boot record (MBR) and executes the code within it. The MBR program code then continues the booting process by reading the first physical sector of the bootable volume, which is the start of the volume boot record (VBR). The VBR then loads the first operating system start up file, which is usually IO.SYS (DOS/Windows 9X/Me) or NTLDR (Windows NT/2000/XP) from the floppy disk or the hard disk into the computer's main memory (RAM). A successful transfer of the OS into the RAM or the boot process is indicated by displaying the DOS prompt such as A:\> or C:\> on the monitor. If we have Windows 95 /98/ME etc. installed into our system, then instead of the DOS prompt we will directly go to the window's screen.
- **BIOS (Basic Input/output System):** - This refers to the collection of actual drivers used to act as a basic interface between the operating system and our hardware when the system is booted and running. Functions of BIOS are
 - i) to initialize the standard I/O drivers like keyboard, FDD, HDD, CDD, serial port, parallel port etc. and give the error message if any peripheral device is not responding to the BIOS. BIOS initialize these peripherals by using CMOS as the reference.
 - ii) to load the driver software for standard I/O devices to the memory (RAM)

BIOS/CMOS SET UP

The BIOS has a set up utility program for specifying the system configuration and settings. When we switch ON the PC, the BIOS gets control and it starts POST. Immediate pressing of the key gives

control to the setup utility. Once the setup utility gets control, it displays the Main Menu on the screen as shown.

BIOS Make and Model/Version No CMOS SETUP UTILITY	
STANDARD CMOS SET UP	INTEGRATED PERIPHERALS
ADVANCED BIOS FEATURES	SUPERVISOR PASSWORD
ADVANCED CHIPSET FEATURES	USER PASSWORD
POWER MANAGEMENT SET UP	IDE HDD AUTO DETECTION
PNP/PCI CONFIGURATIONS	HDD LOW LEVEL FORMAT
LOAD BIOS DEFAULTS	SAVE & EXIT SET UP
LOAD SET UP DEFAULTS	EXIT WITHOUT SAVING
ESC : QUIT	←↑→ ← Select Item
F10 : Save & Exit setup	

Some of the Important Menu screens frequently used are discussed

STANDARD CMOS SETUP:

Enables us to enter some basic hardware configurations and set the system clock and error handling. The screen looks as shown below

STANDARD CMOS SETUP	
Date (mm:dd:yy)	
Time (hh:mm:ss)	
Hard Disks	Type Size Cyls Head PreComp LandZ Sector Mode
Primary Master	Auto Auto
Primary Slave	None
Secondary Master	None
Secondary Slave	None
Floppy Drive A	: 1.44 M 3.5 in
Floppy Drive B	: None
Video	: EGA/VGA
Halt on	: All errors
ESC : Quit	←↓→← : Select items PU/PD/T/-; Modify
F1 : Help	(Shift) F2 : Change color

Note

- Cyls : No of Cylinders
- Head : No of read/ write heads
- PreComp : Write Precompensation Cylinder
- LandZ : Landing Zone Cylinder
- Sector : No. of sectors
- Size : Capacity
- Mode : Access mode: Auto
- Normal (HD<528 MB)
- Large (for MS-DOS only)

LBA (HD> 528 MB and supports Logical Block Addressing).

ADVANCED BIOS FEATURES SETUP

This section allows setup special enhanced features and improving the system performance. Figure shows a typical screen

ADVANCED BIOS FEATURES SETUP			
Virus Warning:	: Disabled	Video BIOS Shadow	:Enabled
CPU Internal Cache	: Enabled	C 800 – CBFFF Shadow	: Disabled
External Cache	: Enabled	OC000- CFFF Shadow	: Disabled
Quick Power on self Test	: Enabled	D000-D3FFF Shadow	: Disabled
Boot Sequence	: A, C, SCSI	D4000-D7FFF Shadow	: Disabled
Swap Floppy Drive	: Disable	D 8000-DBFFF Shadow	: Disabled
Bootup Floppy Drive	: Enabled	DC000 – DFFF Shadow	: Disabled
Boot up Numlock status	: On		
Boot up system speed	: High		
Gate A20 option	: Fast		
Typematic Rate Setting	: Disabled	ESC: Quit	
Typematic Rate (chars/Sec):	6	FL : Help	
Typematic Delay (msec)	: 500	FS : Old Values	
Security Option	: Setup	F6 : Load BIOS Defaults	
PCI/VGA Palette snoop	: Disabled	F7 : Load Setup Defaults	
OS select for DRAM>64 MB:	Non OS2		

Virus warning: This item protects the boot sector and partition table of the hard disk against overwriting. If any write attempt is made, the BIOS halts the system and displays a warning message so that you can either allow the operation to continue or run an antivirus program to locate and remove the virus.

CPU Internal Cache/External Catch: These options allow to enable (speed up memory access) or disable the internal cache inside microprocessor and external cache memory outside the processor.

Quick power on Self Test: This option speeds up the Post. If we select Enabled, BIOS skips some test in POST

Boot Sequence: Determines the drive sequence in which the BIOS try to boot the operating system

Swap Floppy Drive: This item allows us to enable swap Floppy Drive or not. When enabled the BIOS swaps floppy drive arrangements so that Drive A becomes Drive B and Drive B become Drive A.

Boot up Floppy Seek: When enabled, the BIOS will give a seek command to floppy drive A before booting the system.

Boot up Numlock Status: This allows us to enable or disable the Numlock function during boot up as per our personal taste. If set to 'ON' it turns on Num lock key when the system is powered ON.

Boot Up System Speed: This enables selection of normal (low) or High Speed

Typematic Rate Setting: When disabled, holding down a key continuously will not repeat the character. When enabled, the same key will be repeated as per the following controls.

Typematic Rate (Chars/Sec): The speed of repetition ranging from 6 to 30 characters/seconds.

Typematic Delay (msec): Initial time Interval before starting the repetition Typically 500 msec.

Security Option: This field chooses the type of password protection: ‘system’ and ‘setup’. When we select ‘setup’ the system asks for the supervisor password only when the setup utility is initiated. For the ‘system’ option, password is asked for every time the PC is powered on and also when the setup utility is run.

PCI/VGA Pallet Snoop: Some non-standard VGA display adapters may not show colours properly. This field allows you to set whether MPEG ISA/VESA VGA cards can work with PCI/VGA or not. When this field is enabled, a PCI/VGA can work with MPEG ISA/VESA VGA card.

OS Select for DRAM>64MB:- This option allows the system to access greater than 64MB of DRAM memory when used with OS/2, that depends on certain BIOS calls to access memory.

Video BIOS Shadow: This allows changing the video BIOS area from ROM to RAM after copying. Video BIOS shadowing increases the video speed; but may cause problems while running some operating systems or applications. Hence it is safer to disable this. Shadowing a ROM reduces the programme memory available between 640KB to 1024KB.

INTEGRATED PERIPHERALS: This option sets the hard disk configuration mode and port.

INTEGRATED PERIPHERALS	
IDE HDD BLOCK MODE : Enabled	Onboard FDC Controller : Enabled
IDE Primary Master PIO : Auto	Onboard Serial Port 1:3F8/IRQ4
IDE Primary Slave PIO : Auto	Onboard Serial Port 2 : 2F8/IRQ3
IDE Secondary Master PIO : Auto	UART Mode Select : Normal
IDE Secondary Slave PIO : Auto	
IDE Primary Master UDMA : Auto	On Board Parallel Port : 378/IRQ 7
IDE Primary Slave UDMA : Auto	Parallel Port Mode : SPP
IDE Secondary Master UDMA: Auto	
IDE Secondary Slave UDMA : Auto	ESC : Quit ↑↓← → Select item
Onchip Primary PCI IDE : Enabled	F1 : Help PU/PD/+/- : Modify
Onchip Secondary PCI IDE : Enabled	F5 : Old Values
USB Keyboard Support : Disabled	F6 - Load BIOS Defaults
	F7 - Load Setup Defaults

IDE HDD Block Mode: This field allows the hard disk controller to use the fast block mode to transfer data, by enabling transfer of multiple sectors per interrupt.

IDE Primary/Secondary Master/Slave PIO: These fields allow the system hard disk controller to work faster. PIO (Programmed Input/Output) allows the BIOS to communicate with the controller and CPU directly.

IDE Primary/Secondary Master /Slave UDMA: These fields improve disk I/O through put to 33 MB/Sec with the Ultra DMA/33 feature. The options are Auto and Disabled.

On-chip Primary/Secondary PCI IDE: The integrated peripheral controller contains an IDE interface with support for two IDE channels. Select 'Enabled' to activate each Channel separately.

USB Keyboard Support: Select 'Enabled' if your system contains USB controller and you have a USB Keyboard.

Onboard FDC Controller: - Select 'Enabled' to use the floppy disk controller (FDC) on the system board. If we install an FDC daughter board or if the system has no floppy drive, select 'Disabled' in this field.

Onboard Serial/Parallel Port: This field allows us to select the onboard serial and parallel ports and their address. The default values for these ports are

Serial port 1 : 3F8/IRQ4

Serial port 2 : 2F8/IRQ3

Parallel Port : 378/IRQ7

UART Mode Select: Determines the UART mode. The settings are normal,

IrDA & ASKIR

Parallel port Mode: Determines the parallel port mode function

SPP: Standard (Centronics) Printer Port

ECP: Extended Capabilities port

EPP: Enhanced Parallel Port

SUPERVISOR / USER PASSWORD: Supervisor Password sets a password that will be used to protect the system and Setup utility. User Password sets a password that will be used exclusively on the system. To specify a password, highlight the type you want and press <Enter>. The Enter Password: message prompts on the screen. Type the password, up to eight characters in length and press <Enter>. The system confirms your Password, by asking you to type it again. After setting a password, the screen automatically returns to the main screen.

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

IDE HDD AUTO DETECTION: This option detects the parameters of an IDE hard disk drive and automatically enters them into the standards CMOS setup screen. Up to 4 IDE drives can be detected with

parameters for each appearing in sequence inside a box. With the display of the first (primary master) drive's parameter, you are asked to accept them. To accept the displayed entries, press the "Y" key otherwise press the "N" Key. If we accept the values, the parameters will appear listed besides the drive letter on the screen. The process is continued for other drives.

MOTHERBOARD TROUBLESHOOTING

Errors detected by the BIOS during its post routine are conveyed to us either as error beep signals or as error message display.

Types of Errors:- 1) **Fatal Errors** – Computer cannot allow the system to continue the boot up procedure – communicated through a series of audible beeps.

2) **Non fatal Errors** – Allow the system to continue the boot up process – The error messages are normally displayed on the screen.

Mother Board Problems

1) When Switched ON, the system only beeps or shows POST error:

- Check POST message and correct the problem if possible
- Check for perfect sealing of socketed chips such as Memory chips, SIMM modules, BIOS and Keyboard Controller, CPU etc.
- Temporarily remove the NICs and other nonessential cards from the motherboard.
- If the problem is solved, replace cards one by one and each time check for correct operation – this will help to locate the actual faulty drive
- Remove and reseat all essential expansion cards and check the interconnecting cables

2) Intermittent crashing / stopping of the system:

- Determine the circumstances and check whether the crashing of the system occurs only when a specific software is executed
- Remove unnecessary memory resident programs and device drivers.
- Check for various card conflicts like IRQs, input/output ports, DMA channels and memory locations – Reconfigure in cases any such conflict is located
- Remove and reseat expansion cards and interconnecting cables
- Run diagnostic utilities for identifying any hardware problems
- Try reducing the speed of processor or the bus clock.

3) System fails displaying Parity Error

- Run any of the advanced diagnostic programs/software available and try to find out the fault
- Identify and replace the faulty chip(s) or memory module

BIOS ERROR BEEP CODES

The following error messages are conveyed through a number of short beeps; we can identify the error by counting the number of short beeps.

No. of Beeps	Error
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 64KB) of the system.
3	Base 64KB Memory Failure A memory failure occurred in the base memory (ie within the first 64K of memory)
4	Timer Not Operational Timer # 1 on the system board has failed to function properly
5	Processor Error: The CPU on the system board has generated an error
6	8042 – Gate A 20 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 Motherboard has generated an exception interrupt
8	Display Memory Read/Write Error The system video adapter is either missing or its memory is faulty [This is not a fatal error – All others are fatal errors]
9	ROM Checksum Error The BIOS 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

BIOS Non Fatal Error Messages

If a nonfatal error occurs during the POST routine 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

If the “Wait for <F1> if Any Error” option in the ‘Advanced CMOS Setup’ of the BIOS SET UP program has been set to “disabled”, then “Press <F1> to RESUME” prompt will not appear in the third line.

For most of the error messages generally there is no ERROR Message in the second line. Generally for those messages containing a line 2 ERROR message, the line 2 text will be “RUN SETUP UTILITY”.

Pressing the <F1> key will invoke the BIOS SEETUP program.

COMMON ERROR MESSAGES

CMOS Battery State Low: Battery power low – needs to be replaced.

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.

CMOS Display Type Mismatch: The type of video stored in CMOS does not match with the type detected by the BIOS- correct it through BIOS SETUP program.

Keyboard Error: The BIOS has encountered a timing problem with the keyboard

FDD Controller Failure: BIOS not able to communicate with the FDD controller. Check all appropriate connection after the system is powered OFF

HDD Controller Failure: BIOS not able to communicate with the HDD controller. Check all appropriate connection after the system is powered OFF. Also check the drive type in the CMOS Setup

Diskette Boot Failure: Boot Floppy is corrupted

POST MESSAGES

The POST has been designed to provide information about the hardware failures encountered or success achieved during various levels. The mode of information by POST varies and depends on the confidence levels achieved by the POST. There are 5 different modes used by POST.

1. *Hang or halt at specific stages*
2. *Checkpoint output on Port 80 (PPI – Port A in 8088 PC)*
3. *Speaker tones*
4. *Error code display on monitor*
5. *Detailed message on the monitor*

Some motherboards provide additional hardware support to help the engineer to interpret the POST messages. Some LEDs are used for this purpose

1. **Hang/Halt:-** This mode is followed by POST at the very initial stages when it does critical test on microprocessor, ROM etc. During these tests, if any failure occurs, the POST does not proceed further and it has no means of indicating the failure. Hence the POST hangs/halts the CPU.
2. **Checkpoint:-** The POST outputs a checkpoint number before commencing a particular test. If this checkpoint number remains unchanged, it is clear that the POST has not started the next test. This implies one of the following ;
 - i) POST has detected a fault and hangs
 - ii) POST has lost control after starting the test.

The checkpoint method of error indication is adopted only in the initial stages of POST, when few hardware units have been tested and the confidence level is limited.

3. **Speaker Tones:-** The POST programs the Timer 2 so as to generate a series of speaker tones- generates different tone sequence which identify the failing test

4. **Error Code display:-** POST displays a system error code which identifies the failing unit in the hardware. Certain POST versions display the name of the failing unit explicitly instead of error code
5. **Message display:-** When the confidence level of the POST has reached a sufficiently high level, the POST can execute message routines in order to output a detailed error message on the monitor. These messages are highly descriptive and explicitly identify the failing hardware. Sometimes the message gives encoded patterns identifying the type of failure in addition to the name of the failing unit.

POST Errors and Diagnosis: 8088 PC

Sl. No.	Error indication	Failing Sub-system	Fault clues
1	No display / beep sound after power ON	SMPS	Fuse blown / Check loose cables / SMPS input and output
		IPL hardware in Motherboard	Fault in IPL hardware – microprocessor, clock generator, bus controller, etc
2	Continuous beep	Power supply	Improper voltages
3	Repeating short beeps	Power supply	
4	1 long and 1 short beep	Motherboard	Motherboard RAM
5	1 long and 2 short beeps	Display adapter	Adapter loose or video RAM faulty
6	1 short beep and a blank display or incorrect display	Display	Internal problem in the CRT monitor
7	2 short beeps and no disk boot	Floppy disk	FDC, floppy cable, FDD, floppy diskette
		Hard Disk	HDC, hard disk cable, HDD
		Motherboard	DMA logic, DMA controller, DMA page register
8	101 error	Interrupt logic	PIC 8259 A
		Timer 0 logic	PIT 8253, clock divider
		DMA logic	DMA controller
9	301 error	Keyboard logic/interrupt	PIC 8259 A, Shift register 74LS322, keys stuck, AT-XT switch not set correctly on keyboard
10	601 error	Floppy disk	Diskette, floppy cable, FDC, FDD, motherboard connectors
11	201 error	Memory	RAM ICs
12	1801 error	Expansion unit	Expansion unit, Expansion unit cable
13	1701	Hard disk	HDC, HDD, hard disk cables/connectors
14	Check point 4; system hang	DRAM-first 16K	DRAM chips, RAM address decode logic, RAM address multipliers, Parity generator/checker

15	System halt at address FE15C and/or Checkpoint3	DRAM Refresh logic	Timer-PIT 8253, DMA Controller, DRQ0 flip-flop
16	System halt at FE0AD and/or checkpoint 2	Timer 1	PIT 8253 A
17	System halt at FE0AD and checkpoint 1	8K BIOS ROM	ROM chip, ROM address decode logic, IPL hardware
18	System halt at FE0AD	Processor	8088, ROM, IPL hardware
19	Missing Operating System	HDD	Check whether hard disk is identified in CMOS setup, Check whether partition containing OS is set active, Check whether OS is present in the active partition
20	Non System disk	HDD/FDD	There is no bootable OS in the disk
21	Memory test fails	Memory	Replace relevant DIMM and retry
22	CMOS Checksum error	CMOS RAM	CMOS RAM contents are corrupted or the battery is weak
23	Primary Master Hard disk fail	Primary Master IDE HDD	Check cables/connectors/jumper settings, ensure address clash does not exist
24	Floppy disk(s) fail	FDC/FDD	FDC or bus related problem in motherboard or FDD fault

ERROR CODES: The POST and BIOS follow a uniform pattern of error codes which are displayed on the CRT monitor. The last two digits, points the exact fault in the subsystem and the MSBs identify the failing subsystem. If the last two digits are zeros, it indicates that, the test for that subsystem is successful. A summary of error codes followed by IBM is as shown above. For certain error codes, error detail is also given immediately after the error codes.

Examples:-

601 error	Floppy disk	Diskette, floppy cable, FDC, FDD, motherboard connectors
201 error	Memory	RAM ICs
1801 error	Expansion unit	Expansion unit, Expansion unit cable

**UPGRADING / ADDING MEMORY – Refer: i) Text Book: All About Mother board
ii) Hardware Lab Manual – 2008**