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CHAPTER 1

INTRODUCTION

1.1 Introduction

PC Engineering is the branch of engineering which deals with the study of different hardware components/parts of a computer (their working and architecture), common faults associated with them and their rectification loading different software, assembling the computer etc. The different hardware parts, which will be dealt under PC engineering, are mouse, Keyboard, FDD, HDD, RAM, Microprocessor, Mother Board, SMPS, Monitor, CD Drive, Printers, modem etc.

1.2 Working of Computer

It deals with the study of working of a computer system, flow of data and information, processing of data, establishing communication between various software and hardware components.

1.3 Virus and Vaccines

Virus has been a great problem especially while accessing the Internet in the last few years, so the use of anti-virus packages has become of prime importance. So information regarding different viruses and their remedial action will be covered under this subject.

1.4. Installation of OS and Software

Installation of different operating systems like MSDOS, Windows 9.X, Windows 2000, Linux etc and software like MS Office, Page Maker ,JAVA , Visual Basic ,Oracle etc .

1.5. **Assembling of Computer**

After purchasing all the hardware parts of the computer, these are assembled / arranged to work as computer and various other tasks partitioning of hard disk , formatting of hard disk ,loading OS ,loading different applications as per users requirement ,making software and hardware configurations etc .form the part of the subject .

1.6. **Troubleshooting**

To diagnose the faults associated with the computer system and their rectification forms the part of the subject.

1.7. **Maintenance**

To optimize the performance of the computer system using different system tools available with the OS and the advanced utilities available in the market.

Exercise - 1

Q.1 Fill in the blanks

(i) Field Engineering deals with the _____. (study of different hardware parts, their working and architecture, trouble shooting etc.)

(ii) Hardware parts of a computer are _____. (key board, mouse, FDD, HDD, RAM, microprocessor etc.)

(iii) Different accessories of a computer are _____. (printer, scanner, modem etc.)

Q.2 Write short notes

(i) PC Engineering

(ii) Hardware parts of a computer

(iii) Accessories of a computer

Q.3 Explain PC Engineering in detail.

CHAPTER 2

MOTHER BOARD

2.1. Mother Board

Motherboard is the main board of the computer system. Motherboard contains CPU, RAM, ROM, extension slots, supporting logic circuits, connectors etc.

2.2. Types of Mother Board

(i) Bus Based Main Board – This type of main board contains a number of empty slots in which various expansion cards are inserted for interfacing various devices.

(ii) Single Board Based Main Board – All the necessary devices, which are, used in the system such as CPU, memory etc. are connected on this type of main board itself.

2.3. Bus

Bus is a connection between two components to transmit / receive signals between them. The buses are the thin lines on the motherboard, which take data, address, control signals and electric power from one place to another.

Depending on their use the buses are classified as follows:

- Data bus
- Address bus
- Control bus

a) Data Bus: Data bus is used to take data from one location to another. Data is stored in binary signals inside the computer, digit 0 is stored as 0 volt and digit 1 is stored as +5 volt electrical signal. 8-Bit processor requires 8 data lines on the motherboard to carry the data.

b) Address Bus: The signal on the address bus is used to select a particular memory location and to connect this location to the data bus so that the computer can read data from or write data to that particular location.

c) Control Bus: The control bus is used to send different control signals such as read/write signal to the memory & other peripherals.

2.4. **Different Components of Mother Board**

Following are the major components located on the motherboard:

a) Mother Board Connectors

b) I/O Slots

c) Memory Slots

d) Microprocessor Socket

e) HDD Interfaces

f) FDD Interface

g) I/O Ports

h) Supporting Chips

i) CMOS Battery

j) BIOS

Note: Now a day motherboards are available with the built in additional features like Display Adapter, Sound Card and Modem.

2.5. Mother Board Connectors

Following are the main connectors located on a motherboard:

(i) Keyboard Connector – These are either AT style connectors or PS/2 (Personal System)-type connectors. AT style connector is a 5-pin DIN type connector and PS/2-style connector is a 6-pin DIN type connector.

(ii) Speaker Connector: This is a 4-pin connector. Outermost pins of this connector are used for making the connections. Connection can be made in either directions. Its pin no. 1 is for +5 V supply and pin 2, 3 and 4 are for the ground supply connections.

(iii) Power LED and Key Lock Connector: This is a 5-pin connector. Its pin no. 1 & 3 are used for LED and pin no. 4 & 5 are used for key lock connector.

(iv) Reset Connector: This is a 2-pin connector. Pin no. 1 is for reset and pin-2 is for ground supply.

(v) Turbo LED: This is a 2-pin connector.

(vi) Power Connector: Two 6-pin connectors are used for making power connections to the motherboard. Keep the black wires of the two connectors side by side i.e. adjacent to each other. Two types of power supply connectors are available, one for the normal power supply and the other for ATX power supply, which requires a 20-pin connector.

2.6. I/O Slots (Expansion Slots)

Expansion slots are used to install expansion cards. Expansion cards enhance the performance of the system. For example, sound card is used to add the sound features in the system.

Expansion slots are categorised according to the number of bits that they can transfer at a time and the architecture used.

These are divided into the following categories:

(i) 8-Bit ISA

(ii) 16-Bit ISA

(iii) MCA

(iv) EISA

(v) VESA Local or VL Bus

(vi) PCI Local Bus

2.7. **Memory Slots**

Memory slots are used for installing different memory modules. Number and type of memory slots differ from one motherboard to another.

Motherboards contain DIP (Dual-In-Line Package) or SIMM (Single-In-Line Memory Module) 30-pin or 72- pin slots or DIMM (Dual-In-Line Memory Module) 168-pin slots that are used for installation of DRAM modules. Each memory module is a card on which many DRAM chips are cascaded together.

2.8. Supporting Chips

The motherboard has the following supporting chips:

a) Clock Generator (IC 8284)

b) Real time Clock (MC146818)

c) Key Board Controller (IC 8042/8742)

d) Bus Controller (IC 82288)

e) Programmable Interrupt Controller (IC 8259)

f) DMA Controller (IC 8237/8257)

2.9. HDD Interfaces

The different types of interfaces are available to connect a hard disk drive (HDD) to the computer, which are as follows:

(i) ST-506/412

(ii) ESDI

(iii) IDE

(iv) EIDE

(v) SCSI

Note: IDE interface is located on the motherboard itself. Old motherboards have HDD interfaces located on the HDFDC card, which is installed in the I/O slots.

2.10. I/O Ports (Input / Output Ports)

Computer has two ports to interface with the peripherals devices. These are Serial port and Parallel port.

Serial ports are COM1, COM2, COM3 and COM4 and Parallel ports are LPT1, LPT2 and LPT3. COM stands for communication and LPT stands for Local Parallel Terminal. COM ports are used for serial devices and LPT for parallel devices.

2.11. Microprocessor Sockets

Motherboard has slots / sockets to fit microprocessor on it. Different microprocessor sockets located on the motherboard are as follows:

- Socket 3: It is a 237-pin socket
- Socket 4: It is a 273-pin socket
- Socket 5: It is a 296-pin Zero Insertion Force socket.
- Socket 6: It is a 320-pin ZIF socket
- Socket 7: It is a 321-pin Zero Insertion Force socket.
- Socket PGA 370: 370-pin with Zero Insertion Force.

2.12. FDD Interface

Modern motherboards have an FDD interface located on them for interfacing FDD through a 34-Pin Data / Control cable.

Note: Old motherboards have FDD interface located on the HDFDC card, which is inserted into the I/O slot.

2.13. CMOS Battery

CMOS battery is used to preserve / save the BIOS settings ie. information regarding different peripherals connected, sequence of booting devices, system time etc.

2.14. **BIOS**

BIOS is a ROM chip which checks the different peripherals connected like FDD, HDD, CD Drive etc and also looks for the boot record when the system is switched ON.

2.15. **Jumper Setting**

Jumper setting is done on the motherboard to support different microprocessors or other features. It is done as per the specifications mentioned in the Mother Board manual.

Demonstration

a) Different components located on the motherboard.

b) Referring motherboard manual.

c) Jumper setting as per motherboard manual.

d) Connecting different devices to the motherboard.

e) Making connection with the motherboard connectors as per motherboard manual.

f) Fitting and removing CMOS battery.

Practical

a) Jumper setting as per motherboard manual.

b) Connecting different devices to the motherboard.

c) Making connection with the motherboard connectors as per motherboard manual.

d) Fitting and removing CMOS battery.

Exercise-2

Q.1 Fill in the blanks

(i) Type of motherboards are _____ & _____. (bus based, single board based)

(ii) Connection between two components is called _____. (bus)

(iii) Different types of buses available on the motherboard are _____, _____, and _____ buses. (data, address, control)

(iv) Types of keyboard connectors are _____, _____. (AT type, PS/2 type)

(v) SIMM slots are available in _____, _____ pins. (30, 72)

(vi) DIMM slots has _____ pins. (168)

(vii) ATX power supply connector has _____ pins. (20)

(viii) The HDD interface located on the motherboard is called _____. (IDE)

(ix) COM stands for _____. (Communication)

(x) LPT stands for _____. (Local Parallel Terminal)

Q.2 Write Short notes

(i) CMOS battery.

(ii) BIOS

(iii) Different microprocessor sockets

(iv) I/O ports

(v) Supporting chips

(vi) Memory slots

(vii) I/O motherboard

CHAPTER 3

I/O (EXPANSION) SLOTS

3.1. I/O Slots (Expansion Slots)

I/O slots are used for connecting different expansion cards, so that different peripherals can be interfaced with the mother board.

Expansion slots are categorised according to the number of bits that they can transfer at a time and the architecture used.

These are divided into the following categories:

a) 8-Bit ISA

b) 16-Bit ISA

c) MCA

d) EISA

e) VESA Local or VL Bus

f) PCI Local Bus

3.2. 8-Bit ISA (INDUSTRY STANDARD ARCHITECTURE)

- Total 62 contacts i.e. 31- pins on each side.
- Contains 8-Bit data line, 20-Bit address lines and rest for power and control signals.
- Available in all PC and PC-XT machines.
- Available in Black colour.

3.3. 16-Bit ISA

- Additional 36-contacts i.e. 18 on each side with existing 8-Bit ISA.
- 8-Bit ISA card can be connected.
- 16-Bit data lines are available.
- Available in AT machines.
- Available in Black colour.

3.4. MCA (Micro Channel Architecture)

- MCA is not compatible with ISA.
- MCA is a proprietary by IBM and is used in its PS/2 series of computers and mainframe computers.
- Available in 16 and 32-Bit architecture.

The concept introduced for MCA by IBM was:

- Auto configure – This feature allows the user to connect any device to the MCA slot without setup problem e.g. conflict of interrupts.
- Bus Mastering – This feature allows the peripheral device to take the control of the bus from the CPU for a short time to transmit or receive large amount of data.

3.5. EISA (EXTENDED INDUSTRY STANDARD ARCHITECTURE)

- Compatible with ISA
- 32-Bit architecture.
- Size of EISA is same as the size of 16-Bit ISA slot.

- Using 2 rows of connectors, the top connectors are same as that of 16 Bit-ISA and the bottom row has 55 new connections/contacts.

- Edge connector of the EISA card is longer than the ISA card. This makes it impossible for the user to force the ISA connector down into the EISA slot.

- This also allows bus mastering and auto configure.

- Available in Brown colour.

3.6. VESA (Video Electronics Standard Association) / VL Bus

- VESA is an association, which has set the international standards for the video products.

- These entire standards are referred as VESA standards.

- Additional Local Bus in the VESA I/O slots, is exclusively used for communicating with the CPU at its maximum speed.

- Maximum 3- Local buses are supported.

3.7. PCI (PERIPHERAL COMPONENT INTERFACE)

- Supports 64-Bit data path.

- Supports 130 megabits/second data transfer rate.

- Can communicate with 66/100 MHz speed.

- Supports 10 devices.

- Available in White colour.

Demonstration

a) Different I / O slots.

b) Fitting expansion cards in different I/O slots.

Practical

a) Fitting expansion cards in different I/O slots.

Exercise-3

Q.1 Fill in the blanks

(i) Expansion slots are categorized according to the _____. (number of bits that can be transferred at a time, architecture used)

(ii) 8-bit ISA slot has _____ contacts/pins. (62)

(iii) 16-bit ISA slot has _____ contacts/pins. (62+36)

(iv) ISA stands for _____. (Industry Standard Architecture)

(v) MCA is a proprietary of _____. (IBM)

(vi) VESA stands for _____. (Video Electronics Standard Association)

(vii) PCI stands for _____. (Peripheral Component Interconnect)

(viii) PCI supports _____ bits data path. (64)

(ix) Colour of PCI slots are _____. (white)

(x) Colour of ISA slots are _____. (black)

Q.2 Write short notes

(i) Different IO slots

(ii) Audio configure

(iii) Bus mastering

CHAPTER 4

SUPPORTING CHIPS USED ON AT MOTHER BOARD

4.1. Supporting Chips

Supporting chips are used on the motherboard to enable the proper functioning of the motherboard and to enhance its capability and features.

4.2. Classification of Supporting Chips

Supporting chips used on the motherboard may be classified in two groups:

(i) Programmable support IC – These chips contain memory to store the program. These are also called intelligent chips.

(ii) Non-programmable support IC – These chips do not have memory. These are also called dumb chips.

4.3. Different Supporting Chips

Different supporting chips used on the mother board are as follows:

a) Clock Generator

b) Real Time Clock (RTC)

c) Key Board Controller

d) Bus Controller

e) Programmable Interrupt Controller

f) DMA Controller

4.4. Clock Generator (IC 8284)

This is an 18-pin DIP IC, which operates on an input supply voltage of +5 volts. The IC 8284 is used in computer for generating clock pulses and also used for generating Ready signals & the Reset signals for the microprocessor.

4.5. Real Time Clock (MC 146818)

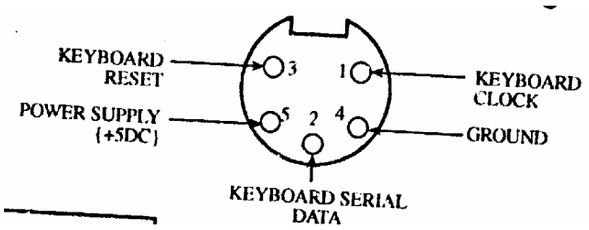
The Time of the Day (TOD) logic of XT motherboards has been replaced by the Real Time Clock (RTC) Logic on AT motherboards.

Whenever the power to the PC-XT is switched on, the Time Of the Day (TOD) logic on the XT motherboard generates a message asking you to enter the time and date. If no time and date is entered then it will automatically accepts the time and date as January 01, 1980. This problem has been solved on the AT motherboards using IC MC146818 with a battery backup. The RTC automatically maintains the time even when the power is switched off. This is a CMOS IC that contains an internal CMOS RAM. The RTC contains a 64 Byte RAM, which is used for holding the setup information. The default values are permanently stored in the ROM while changes stored in CMOS RAM.

4.6. Key Board Controller (IC 8042 / 8742)

This is an intelligent keyboard controller on the AT motherboards. IC 8042 is a 40-pin DIP IC containing an internal ROM and RAM. Keyboard controlling software instructions are stored in the ROM while the serial data input received by this IC from the keyboard are stored in its RAM.

Keyboard controller interfaces the keyboard on AT motherboard through a 5-pin DIN type connector.



When PC-AT is switched on the keyboard controller generates signals during the POST. As soon as these enable signals are received by the keyboard, the three LEDs on the keyboard flash momentarily. It indicates that the keyboard has been enabled.

4.7. **Bus Controller (IC 82288)**

This is a 20 pin IC, which receives the status S0, S1, and IO/M' signals from the microprocessor and generates the INTA, & ALE signals.

4.8. **Programmable Interrupt Controller (IC 8259)**

Two 8259 chips are cascaded together on the AT motherboards to provide a total fifteen interrupts. Interrupts assigned on the AT motherboard are as follows:

IRQ0	Assigned to Timer0
IRQ1	Assigned to the keyboard
IRQ2	Used for cascading
IRQ3	Assigned to serial port 2
IRQ4	Assigned to serial port 1
IRQ5	Assigned to parallel port 2
IRQ6	Assigned to floppy disk controller
IRQ7	Assigned to parallel port 1
IRQ8	Assigned to real time clock
IRQ9	Assigned for use by the software
IRQ10, 11, 12, 15	Reserved for future use

IRQ13	Used by the co-processor
IRQ14	Assigned to hard disk controller

IRQ = Interrupt Request Queue

4.9. **DMA Controller (IC 8257 / 8237)**

IC 8237 is a 40-Pin DIP IC, which operates on an input supply voltage of +5 Volts. DMA controller is used to transfer the data between the system and the peripherals.

4.10. **Logics**

a) Wait State Logic (WSL) Block: WSL generates the different wait state signals for the CPU and the DMA controller and keep them synchronized with the other devices.

b) Bus Arbitration Logic (BAL) Block: The BAL block manages the system bus, decides when the CPU should be give the control of the bus to the DMA controller.

c) Control Bus Logic (CBL) Block: It generates various control signals for interfacing the different devices installed at the I/O ports, memory devices and different supporting chips on the motherboard.

Demonstration

a) Different supporting chips of motherboard.

Exercise-4

Q.1 Fill in the blanks

(i) Chips, which do not have memory, are called _____. (dumb chips)

(ii) RTC stands for _____. (Real Time Clock)

(iii) TOD stands for (Time of the Day)

(iv) RTC chip gets power supply from _____. (CMOS battery)

(v) IRQ assigned to hard disk controller is _____. (14)

Q.2 Write short notes

(i) Supporting chips

(ii) RTC

(iii) Keyboard controller

(iv) DMA controller

CHAPTER 5

I/O PORTS

5.1. I/O (Input /Output) Ports

Computer has two types of ports to interface with the peripheral devices. These are Serial port and Parallel port.

Serial ports are COM1, COM2, COM3 and COM4 and Parallel ports are LPT1, LPT2 and LPT3. COM stands for communication and LPT stands for Local Parallel Terminal. COM ports are used for the serial devices and LPT ports for the parallel devices.

5.2. Types of Serial Communication

There are two types of serial communication, which are Asynchronous and Synchronous. Synchronous is used to communicate between the two computers whereas the asynchronous is used to connect the serial devices with the computers. The standard for asynchronous communication is RS-232C.

UART (Universal Asynchronous Receiver Transmitter) 8250 is used in the serial port RS-232C logic block of the motherboard.

5.3. I/O Port Addresses, Interrupts & Priorities

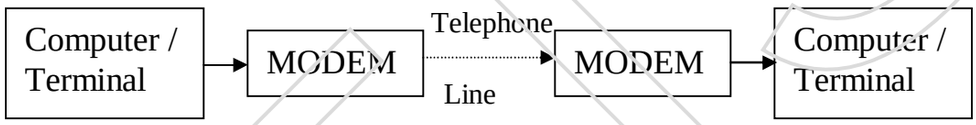
According to IBM standard, we can access 3 parallel & 4 serial ports, but because of unavailability of interrupts we can use only 3 (1+2) of them on XTs & 5 (2+3) of them on AT machines.

PARALLEL PORTS

PORT	I/O ADDRESS	IRQ	PRIORITY
LPT1	3BC	7 (On XT & AT)	Highest
LPT2	378	5 (On AT)	
LPT3	278	15 (On AT)	Lowest

SERIAL PORTS			
PORT	I/O ADDRESS	IRQ	PRIORITY
COM1	3F8	4	Highest
COM2	2F8	3	
COM3	3E8	4	
COM4	2E8	3	

5.4. **Serial Communication**



DTE DCE DCE DTE

Local end Distance end

DTE = Data Terminal Equipment

DCE =Data Communication Equipment

5.5. **Normal Communication**

When DTE wants to send the RTS (Request To Send) signal to the modem and if modem is ready, it sends the CTS (Clear To Send) signal to the DTE and then

DTE sends the DTR (Data Transmission Request) signal to the modem, asking modem to be ready to receive the signal and start transmitting on TXD (Transmit Data).

DSR (Data Set Ready) tells us that the modem is ON and is not in the test mode.

CD (Carrier Detect) indicates that modem has detected some incoming data and informs DTE that modem will soon be receiving the data.

When two DTE want to communicate, the sending DTE will send a dial tone, in response to this the called modem issues a RI (Ring Indicator) signal to its DTE and sends answer tone to calling modem. This modem sends a acknowledge tone and issues CD signal to its DTE.

For 25 Pin	For 9 Pin	COMMN Name	Signal Name	Direction	Notes
1			Protective ground	DTE to DCE	Mains and chesis ground
2	3	TXD	Transmit Data	DTE to DCE	Data transmitted from the terminal
3	2	RXD	Receive Data	DCE to DTE	Data Rxed at the terminal
4	7	RTS	Request to send	DTE to DCE	When the DTE wishes to send data it turn RTS on
5	8	CTS	Clear to send	DCE to DTE	The modem raises CTS to the DTE that it is OK to transmit
6	6	DSR	Data Set Ready	DCE to DTE	The modem raises this signal to say that it is powered up and

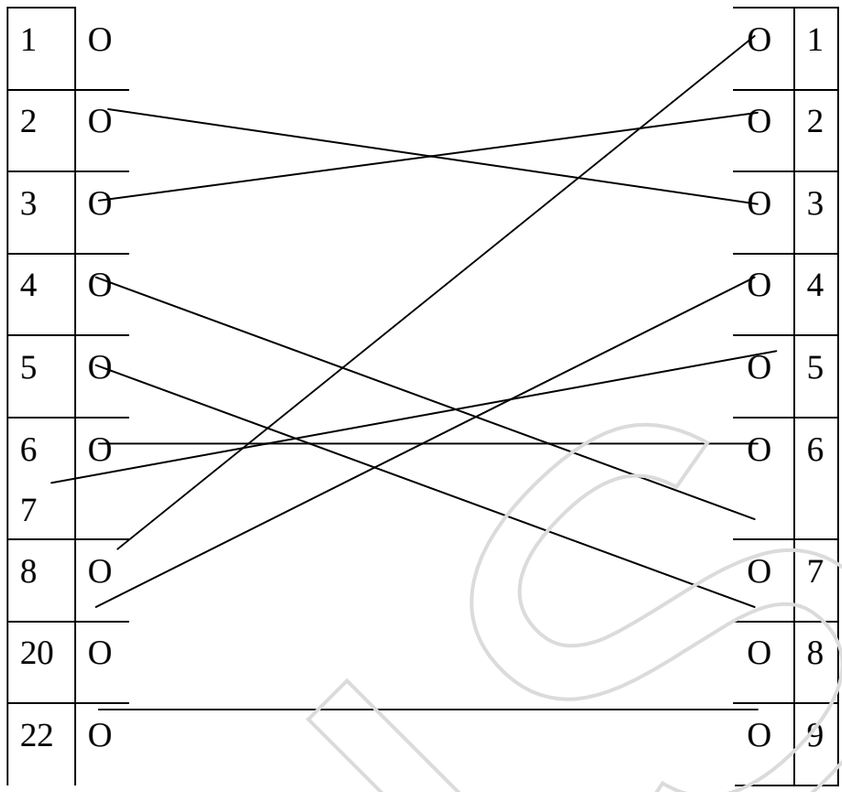
					connected to line
7	5	GND	Signal Ground	DTE to DCE	The reference zero volt.
8	1	CD	Carrier Detect	DCE to DCE	The modem received a signal from line.
20	4	DTR	Data Terminal Ready	DTE to DCE	Raised by terminal
22	9	RI	Ring indicator	DCE to DTE	Pulsed indicate an incoming call

5.6. **Serial Port Connectors**

(i) 9-Pin male connector

(ii) 25-Pin male connector

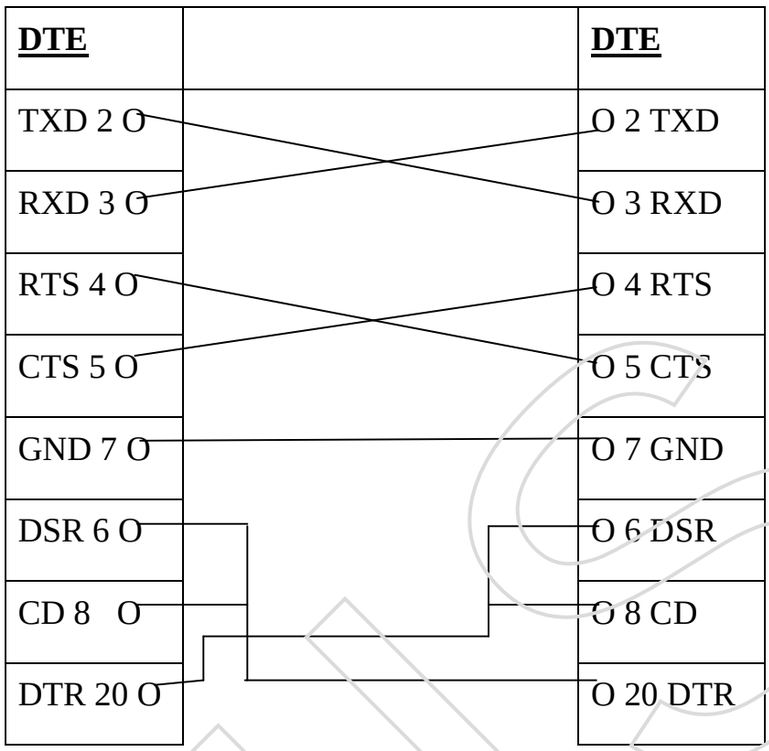
25-Pin to 9-Pin converter



In 25-Pin connector remaining pins are grounded.

5.7. DTE to DTE Interface Cable –

When interconnecting two DTE devices



5.8. Chips Used in Serial Port IBM PC

8250 – Serial port controller

16450 – Pin compatible with 8250 used for higher frequencies and found on AT I/O.

5.9. Parallel Port

Data transfer takes place byte by byte at the parallel port. The interface used is called CENTRONICS INTERFACE.

Centronics Interface has following standards:

- 25-Pin ‘D’ type female connector (PC side).

- 36 pin Amphonel connector (Printer side)
- Controller IC – 82C11 is used
- Handshaking signal is used.
- Data transfer rate 100 KBits/Sec.

5.10. Devices Connected to COM/Serial Port

- Mouse
- Modem
- Printer

5.11. Devices Connected to LPT/Parallel Port –

- Printer
- Scanner
- Camera

5.12. Fitting I/O Ports

Connect one end of the I/O port able to the motherboard and other end at the frame of the PC cabinet with the help of screws.

Demonstration

a) Different COM/Serial ports and LPT/Parallel ports.

b) Fitting I/O ports.

Practical

a) Fitting I/O ports.

Exercise-5

Q.1 Fill in the blanks

(i) Ports of computer are called _____ & _____. (COM & LPT)

(ii) Standard used for serial communication is _____. (RS232C)

(iii) Maximum number of I/O ports used on AT machines is _____. (5)

(iv) Serial ports are available in ____ & ____ pins. (9, 25)

(v) Standard used in parallel ports is _____. (Centronics)

(vi) UART stands for _____. (Universal Asynchronous Receiver Transmitter)

(vii) Connector connected to the printer side has _____ pins. (36)

Q.2 Write short notes

(i) I/O ports

(ii) Serial communication

(iii) Parallel ports

CHAPTER 6

PHYSICAL MEMORY ORGANISATION

6.1. Introduction

The main memory is divided into a number of sets or banks. The bank near the microprocessor socket is called bank 0 and at the distance is called bank 1. The memory is available in the form the of Dual In Line Package (DIP) ICs and memory modules.

6.2. Types of Memory Modules

The following types of memory packages / modules are available:

a) DIP
b) SIMM
c) SIPP
d) DIMM

6.3. DIP (Dual In Line Package)

DIP has two sides each side contains 8 pins. The chips used for AT machines can store 256 KB and are available in different configurations. These are 256 x 1, 256 x 2 or 256 x 4. For example, if chip is 256 x 4 bit then you will require only 2 chips to make complete 256 KB of memory.

If more than one bank is there then memory modules are used. The memory module is a set of number of RAM chips mounted / soldered on a single plug in circuit board.

6.4. SIMM (Single In Line Memory Module)

SIMM is a memory module i.e. number of chips is soldered on a small expansion board. The edge connector of this expansion board is plugged into a SIMM socket on the motherboard. *For a 32 bit computer you will have to add the 8 bit modules in a group of four modules to provide a complete 32 bit module or to fill a complete bank of memory. These modules are added or removed in a group of four modules (first module should be inserted in bank 0 then 1 and so on).*

SIMM modules are available in 256KB, 1 MB, 2 MB, 4 MB, 8 MB, 16 MB, 32 MB , 64 MB, 128 MB and 256MB. SIMM are available in 30 pins and 72 pins.

6.5. SIPP (Single In Line Pin Package)

SIPP is almost same as the SIMM except the SIPP contains pins at the bottom to connect them into the motherboard socket.

6.6. DIMM (Dual In Line Memory Module)

DIMM is same as SIMM. It is available in 168 pins.

6.7. Memory Speed

The speed of a memory chip is shown in nano seconds (ns). The lower the nano second value the faster the chip.

You should connect the same speed of memory chips , otherwise you will get parity error or computer may not start at all.

Speed of memory is displayed on the packing of a chip as a part of the chip part number. Only first two characters show the speed of a chip slower than 100 ns, for example 100ns will be shown as 10 or 140ns will be shown as 14 etc.

6.8. **Reading Chip Number**

Chip numbers are still not standardised. On most of the chips, speed is given separately. The capacity of the chip is in kilobytes and is given in the chip number.

For example a chip number is MB81464 – 70, tells us that it is a 64K x 4 bits chip and its speed is 70 ns. The chip number MB81256 – 60, tells us that it is 60 ns chip that provides 256K x 1 bit memory storage. Other than these values, contain the batch number or the date of manufacturing.

Demonstration

a) Different memory packages / modules

b) Fitting the memory modules in the memory slots located on the motherboard.

Practical

- Fitting the memory modules in the memory slots located on the motherboard.

Exercise-6

Q.1 Fill in the blanks

(i) DIP stands _____. (Dual In line Package)

(ii) Memory modules are _____, _____, _____. (SIMM, SIPP, DIMM)

Q.2 Write short notes

(i) SIMM

(ii) DIMM

(iii) SIPP

CHAPTER 7

LOGICAL MEMORY ORGANISATION

7.1. Logical Memory Organisation

The whole memory (RAM) is divided into the following logical regions:

(i) Conventional Memory

(ii) Upper Memory Block (UMB) / Shadow RAM

(iii) Extended Memory

(iv) Expanded Memory

7.2. Conventional Memory

Conventional Memory

Space for DOS programs and Data	640K
Memory resident program	
DOS	
Device Drivers	
BIOS & DOS interrupt	0K

First 640 KB of memory (RAM) is known as the conventional memory. The MSDOS is loaded in this memory. It is also known as base memory. All DOS based programs require conventional memory. You don't need an additional memory manager to use conventional memory because microprocessor can directly access it.

7.3. Upper Memory Block (UMB)/Shadow RAM

Next 384 K of memory above 640 K (1024 – 640) of conventional memory forms the UMB. This area is used to store ROM contents, therefore, it is also known as Shadow RAM. This area can be used by DOS, by using "DOS=UMB" statement in the Config.sys file, so you can free up the conventional memory.

Motherboard ROM BIOS	1024K
Unused address area	
EMS Window/page frame	Upper Memory Area
Adapter ROM	
Video memory	
Conventional Memory	640K 0K

7.4. Extended Memory (XMS)

The memory beyond 1 MB (1024 KB) on computer with processors 80286 and above is known as extended memory. Directly, microprocessor cannot access this memory, therefore extended memory manager "HIMEM.SYS" is required to access this memory. Make the following entry in the CONFIG.SYS file to access the extended memory:

DEVICE=HIMEM.SYS *(Here himem.sys is memory manager driver).*

Ex : Device =C:\Himem.Sys

7.5. High Memory Area (HMA)

HMA is the first 64 K of the extended memory. DOS can be loaded in this area, which leaves the conventional memory for the other programs. To load the MSDOS in this area, first load the extended memory manager "Himem.Sys" then make the entry "DOS=HIGH" in the CONFIG.SYS file.

7.6. Expanded Memory (EMS) (LIM)

When AT machines were introduced, DOS was not capable of addressing a memory beyond 640 KB of RAM.

To solve this problem Lotus and Intel has developed a method called expanded memory specification or EMS. This method was first introduced with DOS version 3.0 so it was called EMS 3.0 later on the Microsoft also joined with the group and this specification was also called LIM EMS version (Lotus, Intel, Microsoft, Expanded Memory Specification).

The EMS is completely different concept from the XMS memory; the XMS memory is the part of the main memory that continues beyond the 1024K or 1MB, whereas the EMS is not part of the main memory, it is separate memory installed into the system which can be accessed in a fixed sized pages using a method called "bank switching".

In this method a small window is used to view the contents of the EMS (Expanded Memory Specification). This window is located in the memory location between 640 KB and 1024 KB i.e. in the upper memory area.

The EMS memory is arranged in the blocks of 16KB each, to access this memory, 1 block of the EMS is copied into the window in the main memory and after the processing it is copied back to the EMS memory.

Note: MEM command is used to display the memory contents.

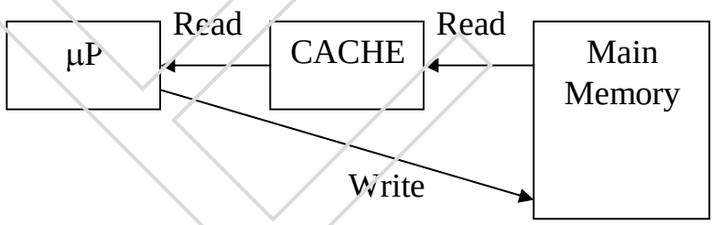
7.7. Cache Memory

Cache (pronounced as “cash”) memory is a high-speed memory used in between the main memory and the processor. The information frequently required by the processor are kept in the cache memory by the cache controller.

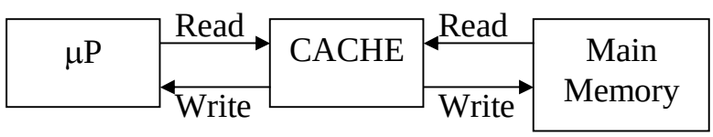
The cache controller always tries to make sure that the data required by the processor are available in the cache memory. This improves the speed of the system because data required by the processor are made available to the CPU without wait state. The cache memory when available inside the CPU is called Internal cache memory (L1 i.e. Level 1) and when available on the motherboard is called External cache memory (L2 i.e. Level 2).

7.8. Types of Cache

(i) Write Through Cache: In this type of cache memory, cache controller reads the data from the main memory and later microprocessor reads the contents from the cache memory and afterwards the data are directly written to the main memory by the microprocessor.



(ii) Posted-Write Through Cache : In this type of cache memory, the μP reads from and writes to the cache memory and the cache controller reads from and writes to the main memory. In this, cache controller gives clearance to the μP after completing the job.



(iii) Write-Back Technique: Such types of cache memory do the read and write operations. In this, cache controller accepts the data and gives clearance to the microprocessor. The cache controller writes the data to the main memory in its own time whenever free. This saves the time of μP.

7.9. Terminology

a) TAGRAM: It is a cache controller, which is used to maintain the record of the files.

b) Cache Hit: If the cache controller finds the data requested by the μP in the cache memory, then it is called cache hit.

c) Cache Miss: If the cache controller does not find the data requested by the μP in the cache memory, then it is called cache miss.

7.10. Virtual Memory

The space occupied in the hard disk being used as memory for processing the data is called virtual memory.

Demonstration

a) Loading memory managers.

b) Using UME, Extended Memory and HMA by DOS.

Practical

a) Loading memory managers.

b) Using UMB, Extended Memory and HMA by DOS.

Exercise-7

Q.1 Fill in the blanks

(i) MSDOS is loaded in _____ memory. (conventional)

(ii) First 640KB of memory is called _____ memory. (conventional)

(iii) UMB is called shadow RAM because _____. (it stores ROM contents)

(iv) Cache memory is used between _____ and _____. (RAM, Microprocessor)

(v) Memory manager required to access extended memory is _____. (HIMEM.SYS)

Q.2 Write short notes

(i) Conventional memory

(ii) Extended memory

(iii) Cache memory

(iv) HMA

(v) UMB

CHAPTER 8

MICROPROCESSOR

8.1. Microprocessor

CPU (Central Processing Unit) fabricated on a single chip is called microprocessor .It includes Control Unit (CU), ALU (Arithmetic and Logic Unit) and memory (RAM). But a few state that a microprocessor consists of CU and ALU only .It is the heart of the computer which controls all the activities of a computer.

8.2. Power of Microprocessor

Power of a microprocessor is its capacity to process the data. The power of the microprocessor is measured by:

(i) The length of microprocessors data word.

(ii) The number of memory words that the microprocessor can address.

(iii) Speed with which the microprocessor can execute an instruction.

The word lengths of 8-bit, 16-bit, 32-bit and 64-bit are the most common today. Now a day microprocessors are available up to 3 GHz speed.

A 8-Bit word has an address range of 256 (2 to the power 8) memory words and a 16-Bit word has an address range of 65,536 (2 to the power 16) memory words.

8.3. Manufacturers of Microprocessor

Intel, AMD and Cyrix are the leading manufacturers of the microprocessor.

	Intel	**AMD**	**Cyrix**
Name of μPs developed by companies	8085, 8086, 8088, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium MMX, P-II, Celeron, P-III, P-IV.	K-Series and Athelon	M-II Series and M-III Series

8.4. Microprocessor Input /Output

The primary function of the microprocessor (MPU) is to accept the data from the input devices such as keyboard, read instructions from the memory, process the data according to the instructions and send the results to the output devices such as LEDs, printers and video monitors. These input and output devices are called either peripherals or I/Os. Memory can be viewed as a special type of I/O. Designing the logic circuits (hardware) and writing the instructions (software) to enable the microprocessor to communicate with these peripherals is called interfacing and the logic circuits are called I/O ports or interfacing devices.

8.5. Formats of Communication/Data Transfer

a) Synchronous: Synchronous means at the same time, the transmitter and the receiver are synchronized with the same clock. The synchronous format is used

for the high-speed data transmission. Data transfer between the two computers is synchronous.

b) Asynchronous: Asynchronous means at irregular intervals. The asynchronous format is used for the low-speed data transmission. Data transfer between the μP and the peripherals is asynchronous.

8.6. **Modes of Data Transfer**

The microprocessor receives or transmits the binary data in either of the two modes i.e. parallel or serial.

In the parallel mode, the entire word (4-bit, 8-bit, 16-bit, 32-bit, 64-bit) is transferred simultaneously over the eight data lines. *The peripherals commonly used for parallel data transfer are keyboard and memory.*

In the serial mode, data are transferred bit by bit ie. one bit at a time over a single line between the microprocessor and the peripheral. *For data transmission from the microprocessor to a peripheral, a word is converted into streams of eight bits; this is called parallel to serial conversion. For reception, a stream of eight bits is converted into a parallel word; this is called serial to parallel conversion. The serial I/O mode is commonly used with peripherals are CRT terminals, printers, and cassette tapes*

8.7. **Microprocessor Controlled Data Transfer**

Most of the peripherals respond slow in comparison with the speed of the μP. Therefore it is necessary to set the conditions for the data transfer, so that the data are not lost during the transfer. The conditions are as follows:

(i) Unconditional Data Transfer – In this form of data transfer, the μP assumes that a peripheral is always available. For example, to display data at

the LED port, the μP simply enables the port, transfer data, and goes on to execute the next instruction.

(ii) Data Transfer with Polling – In this form of data transfer, the μP is kept in loop to check whether data are available. This is called polling.

(iii) Data Transfer with Interrupt: In this form of data transfer, when a peripheral is ready to transfer the data, it sends an interrupt signal to the μP. The μP stops the execution of the program, accept the data from the peripheral and then returns to the program.

(iv) Data Transfer with READY Signal: When the peripheral response time is slower than the execution time of μP, then READY signals are used. READY signal adds the T-states, thus extending the execution time. This process provides sufficient time for the peripherals to complete the data transfer.

(v) Data Transfer with Handshake Signals: In this form of data transfer, signals are exchanged between the microprocessor and the peripherals prior to the actual data transfer; these signals are called handshake signals. The function of handshake signals is to ensure the readiness of the peripherals and to synchronize the timing of the data transfer.

(vi) Peripheral Controlled Data Transfer: This type of data transfer is employed when the peripheral is much faster than the μP. For example, in case of DMA, DMA controller sends a HOLD signal to the μP.

8.8. Serial Communication

Serial communication occurs either in synchronous or asynchronous format. In the synchronous format, a receiver and a transmitter are synchronized and a block of characters is transmitted along with the synchronization information. This format is used for the high-speed transmission (more than 20K Bits/second).

In the asynchronous format, each character carries the information of the START and STOP bits. When no data are being transmitted, a receiver stays high at logic 1 called MARK and logic 0 is called SPACE. Transmission begins with one START bit (low) followed by a character and one or two STOP bits (high). This is known as framing.

The transmission of eleven bits for an ASCII character in the asynchronous format contains one START bit, eight character bits, and two STOP bits. The format is similar to the Morse code, but the dots and dashes are replaced by logic 0s and 1s. The asynchronous format is generally used in low speed transmissions (less than 20 K Bit/second).

8.9. Modes of Transmission

Communication can also be classified according to the direction of the data flow. On this basis, communication can be classified as Simplex and Duplex.

In Simplex transmission, data are transmitted only in one direction for example the transmission from a microcomputer to a printer.

In Duplex transmission, the data flow in both the directions at the same time. However, if the transmission goes one way at a time, then it is called half duplex and if it goes in both the ways simultaneously then it is called Full duplex. Generally, the transmission between the two computers or between a computer and a terminal is full duplex.

8.10. Parity Check

During transmission, data bits may change (e.g. because of noise) and a receiver may receive a wrong character. The MSB in the ASCII code can be used to check an error; this process is called parity check.

8.11. **Baud**

The rate at which the bits are transmitted (bits/second) is called a baud in serial I/O. Each piece of equipment has its own baud requirement. For example in most of the terminals and the printers, the baud is adjustable, in the range of 50 to 9600 baud.

8.12. **Different Controllers**

There are different controllers, which work in conjunction with the microprocessor. A few of them are as follows:

a) Programmable Peripheral Controller (8255): 8255 is widely used as a multipurpose programming I/O device for interfacing several types of peripherals to a computer.

b) Programmable Interrupt Controller (8259A): This controller is designed to work with 8080, 8085, 8086, 8088. It manages eight interrupts according to the instructions written into its control registers.

c) Programmable Interval Timer/Counter (8253): The function of 8253 is similar to the normal counters and timers. It generates accurate time delay and can be used for applications such as real-time clock (RTC).

d) DMA Controller (8237A)

Till now we have seen that the data is moved from the input port to the accumulator and then to a memory location and data transfer out of the memory, require the transfer of data from memory to the accumulator and then from

accumulator to the output register. This process is slow because each instruction needs to be fetched and executed. In DMA, the μP gives / releases the control of the buses to the DMA Controller 8237A. DMA controller manages the data transfer between the memory and the peripheral under its control, thus bypassing the μP.

8.13. **Fitting / Interfacing Microprocessor**

Microprocessor is fitted directly into the microprocessor socket / slot provided on the motherboard for this purpose.

Demonstration

a) Different microprocessors.
b) Fitting microprocessor on the motherboard.
c) Fitting heat sink and fan on the microprocessor.

Practical

a) Fitting microprocessor on the motherboard.
b) Fitting heat sink and fan on the microprocessor.

Exercise-8

Q.1 Fill in the blanks

(i) CPU fabricated on a single chip is called _____. (μP)

(ii) A 16-bit microprocessor has an address range of _____. (2^{16})

(iii) Leading manufacturers of microprocessors are _____. (Intel, AMD, Cyrix)

(iv) Modes of data transfers are _____, _____. (Serial & Parallel)

(v) Formats of data transfer are _____, _____. (synchronous, asynchronous)

Q.2 Write short notes

(i) Power of microprocessor.

(ii) Formats of data transfer

(iii) Modes of data transfer

(iv) Modes of data transmission

(v) DMA

CHAPTER 9

8085 MICROPROCESSOR

9.1. Introduction

8085 is an 8-bit general-purpose microprocessor capable of addressing 64K of memory. It has 40 pins, requires a +5V single power supply and can operate with a 3 MHz single-phase clock.

9.2. Classification of Signals

The signals of 8085 are classified into six groups, which are as follows:

(i) Address Bus
(ii) Data Bus
(iii) Control and Status Signals
(iv) Power Supply and Frequency Signals
(v) Interrupt and Peripheral Initiated Signals
(vi) Serial I/O ports.

9.3. Address Bus

Address bus is a group of 16 lines identified as A0 to A15. Address bus is unidirectional i.e. bits/data flow from the microprocessor to the peripheral devices. A8 to A15 lines are directly available known as High order address bus. A0 to A7 are multiplexed with data bus AD0 to AD7.

In a computer system each peripheral or memory location is identified with a binary number called an address and the address bus is used to carry a 16-bit address. 8085 microprocessor with its 16 address lines is capable of addressing $2^{16} = 65,536$ *(generally known as 64K)* memory location or peripheral devices.

9.4. Data Bus

Data bus is a group of eight lines used for data flow. These lines are bi-directional i.e. data flow in both the directions between μP and the peripheral devices. The eight data lines enable the μP to manipulate 8-bit data ranging from 00 to FF (0 to 255=256). The data bus determines the word length and the register size of a μP. Therefore 8085 μP is called an 8-bit μP.

The bi-directional signal lines AD0 to AD7 serve dual purpose. They are used as the Low order address bus as well as the data bus. *This saves the number of pins required for the IC.*

9.5. Control and Status Signals

This group of signals includes two Control signals (RD and WR), three Status signals (IO/M', S0 and S1) and ALE. These signals are as follows:

a) **ALE** (Address Latch Enable) – When the positive pulse is generated then, the 8085 indicates that the bits on AD7 to AD0 are address bits. *The signal is used primarily to latch (handle) the low order address from the multiplexed bus and generate a separate set of eight address lines, A7 to A0*

b) **Control Signals**.

RD'(Read) – This is read control signal (active low). This signal indicates that the selected I/O or memory device is to be read and data are available on the data bus.

WR' (Write) – This is a write control signal (active low). This signal indicates that the data on the data bus are to be written into a selected memory or I/O device.

c) **Status Signals**

IO/M' – This is a status used to differentiate between I/O and memory operations. When it is high, it indicates an I/O operation, and when it is low, it indicates a memory operation. This signal is combined with RD' and WR' to generate I/O and memory control signals.

S0 and S1 – These are status signals which are similar to the IO/M'.

9.6. Power Supply and Clock Frequency Signals

VCC - +5V Power supply.

VSS – Ground reference.

X1, X2 – A crystal or RC, LC network is connected at these two pins. Frequencies are internally divided by two, therefore to operate a system at 3 MHz, the crystal should generate a frequency of 6 MHz.

CLK (OUT) (Clock Output) – This signal can be used as the system clock for other devices.

9.7. Interrupt and Peripheral Initiated Signals

a) Interrupts

8085 has five interrupt signals that can be used to interrupt a program execution. They are as follows:

INTR (Interrupt Request) – This is used as a general purpose interrupt.

INTA (Interrupt Acknowledge) – This is used to acknowledge an interrupt.

TRAP – This is a non-maskable interrupt and has the highest priority.

RST 7.5, RST 6.5, RST 5.5 (Restart Interrupts) – These are used to transfer the program control to the specific memory locations. They have higher priorities than the INTR interrupts. Among these three, the priority order is 7.5, 6.5, 5.5.

Peripheral Initiated Signals

8085 has the following peripheral initiated signals:

HOLD – This signal indicates that a peripheral, such as DMA (Direct Memory Access) controller is requesting to use the address and the data buses.

HLDA (Hold Acknowledge) – This signal acknowledges the HOLD request.

READY – This signal is used to delay the μP Read or Write operations until a slow responding peripheral is ready to send or access the data.

RESET IN' – When the signal on this pin goes low, the program counter is set to zero and the μP is reset.

RESET OUT – This signal indicates that the μP is being reset. The signal can be used to reset the other devices.

9.8. Serial I/O Ports

SID (Serial Input Data) and **SOD** (Serial Output Data) are used for serial communication.

9.9. Internal Architecture of 8085

The μP is a programmable logic device designed with registers, flip-flops and timing circuits. The μP has a set of instructions designed internally, to manipulate the data and to communicate with the input and the output devices. It consists of the following:

a) **ALU**: Arithmetic and Logic Unit performs the computing functions. It includes accumulator, temporary register, arithmetic and logic circuits and five flags.

Accumulator**:** It is an 8-bit register. This register is used to store an 8-bit data to perform the arithmetic and the logical operations. The result of an operation is stored in the accumulator.

Flags: ALU includes five flip-flops that are set or reset according to the data conditions in the accumulator and the other registers. The flags are as follows:

S – Sign Flag: After the execution of an arithmetic and logic operation, if the sign flag is Set (1), then the number is negative and if it is Reset (0), then the number is considered as positive.

Z – Zero Flag: The zero flag is Set, when the ALU operation result is 0, otherwise, the flag is Reset.

AC – **Auxiliary Carry Flag**: In arithmetic operations, when a carry is generated, the AC flag is Set.

P – **Parity Flag**: After an arithmetic or logical operation, if the result has an even number of 1s, then the flag is Set. If it has an odd number of 1s, then the flag is Reset.

CY – Carry Flag: After an addition of two numbers, if the sum in the accumulator is larger than the eight bits, the flag is Set.

b) **Timing and Control Unit**: This unit synchronizes all the μP operations with the clock and generates the clock signals necessary for the communication between the microprocessor and the peripherals.

c) **Instruction Register and Decoder**: When an instruction is fetched from the memory, then it is loaded in the instruction register and the decoder decodes the instruction.

d) **Register Array**: It has six general-purpose registers. These registers are identified as B, C, D, E, H, and L. They can be combined as register pairs BC, DE and HL to perform the 16-Bit operations.

e) **Program Counter**: This is a 16-Bit register. This is a memory pointer. Memory locations have 16-Bit register.

f) **Stack Pointer**: This is also a 16-Bit register used as a memory pointer. It points to the memory locations in R/W memory, called the stack.

9.I0. Memory Map

For an 8-bit μP, memory is required to store eight bit of information as a group. Thus the memory word length should be eight bits. To communicate with the memory, the μP should be able to

- *Select the chip*
- *Identify the register*
- *Read from or write into the register.*

The registers are arranged sequentially and numbered 000_2 to 111_2. These numbers are called memory addresses, identifying each register as a memory location. To identify each register, the μP requires three address lines to place eight different addresses from 000_2 to 111_2. The 8085with its 16 address lines is capable of identifying or addressing 65,536 (64K) memory registers or locations.

Memory Map is defined as the assignment of the addresses to the memory registers in various memory chips in a system. The 8085 address can range from 0000H to FFFFH (2^{16} = 65, 536). *This memory map can be illustrated with an analogy of identical houses built in a sequence and their postal addresses or numbers. Let us assume that houses are given four-digital decimal numbers, 9999. Since it is cumbersome (burdensome) to direct someone to houses with large numbers, the numbering scheme can be divided with the concept of a row or block. Each block will have hundred houses to be numbered with the last two digits from 00 to 99. Similarly, the first two decimal digits identify the blocks. For example, a house with the number 0247 indicates that the house number is 47 and is located in block 2. With this scheme, all the houses in block 0 will be identified from 0000 to 0099 and in block 20 from 2000 to 2099 and in block 99 from 9900 to 9999. This numbering scheme with four decimal digits is capable of giving addresses to ten thousand houses from 0000 to 9999 (100 blocks of 100 houses each.). A number under development may have only two blocks completed-block 0 and block 20- the houses on these blocks can have addresses 0000 to 0099 and 2000to 2099, even if other blocks are still empty. Let us also assume that all houses are identical, and have eight rooms.*

The example of numbering the houses is directly applicable to the assigning of addresses to the memory registers.

In a memory system, memory registers are (*conceptually/ theoretically)* organized in groups (lines) to be numbered with Low-order (last) two hexadecimal digits (*similar to the last two digits of the house address)*. With two Hex digits, 256 registers can be numbered from 00H to FFH ie. 0 to 255 which is equal to 256. Similarly, the High-order (first) two Hex digits can be used to number the pages from 00H to FFH. For example, the memory address 020FH represents line 15 (register) on page 2, the, address 07FFH represents line 255 on page 7 and the address 1064H represents line 100 on page 16 ($64H = 100_{10}$ and $10H = 16_{10}$). The total memory addresses will range from 0000H to FFFFH –256 pages with 256 lines each 256 x 256 = 65,536, which is equal to 64 K. *To complete the analogy, a line (register) is equivalent to a house, a page is equivalent to a block, and eight flip-flops in a register are equivalent to eight rooms in a house.*

9.11. **Function of Memory**

The primary function of memory is to store instructions and data and to provide the information to the MPU whenever the MPU requests it. The MPU requests the information by sending the address of a specific memory register on the address bus and enables the data flow by sending the control signal**.**

Exercise-9

Q.1 Fill in the blanks

(i) 8085 is _____ bit microprocessor. (8)

(ii) 8085 is capable of addressing _____ memory. (64K)

(iii) 8085 has _____ pins. (40)

(iv) Number of address buses in 8085 is _____. (16)

(v) Number of data buses in 8085 is _____. (8)

Q.2 Write short notes

(i) Different signals of 8085.

(ii) Flags in 8085.

(iii) Memory chip.

CHAPTER 10

INTEL MICROPROCESSORS

10.1. Characteristics of Intel Microprocessors

Processor	Internal Data Line	External Data Line	Address Lines	Physical Mem.	Co-processor	Package	Cache (in KB)	No of Pins	Speed (in MHz)	PC
8088	16	8	20	1 MB	8087	DIP	NA	40	4.77	PC-XT
8086	16	16	20	--,,--	--,,--	DIP	NA	40	4.77	PC-XT
80286	16	16	24	16 MB	80287	CLCC PLCC, PGA	NA	68	6-40	PC-AT
80386 SX	32	16	32	4GB	80387	PGA	8	133	33-66	PC-AT
80386 DX	32	32	32	4GB	80387	PGA	8	133	33-66	PC-AT
80386 SL	32	16	32	4GB	80387	PGA		133	25	PC-AT
80386 SLC	32	16	32	4GB	80387	PGA	8KB	133	16, 20, 25	PC-AT
80486 SX	32	32	32	4GB	Inbuilt	PGA	8KB	237	50	PC-AT
80486 DX	32	32	32	4GB	--“--	PGA	8KB	237	60	PC-AT
80486DX2	32	32	32	4GB	--“--	PGA	8KB	237	66	
80486DX3	32	32	32	4GB	--“--	PGA	8KB	237	75	
80486DX4	32	32	32	4GB	--“--	PGA	8KB	237	100	

10.2. **Introduction**

PC-AT motherboard uses the microprocessor chips 80286 and above. The difference between PC-XT and PC-AT is in their I/O slots. XT motherboard uses 8-Bit (ISA) I/O slot, which is a 62- pin slot and the I/O slots of AT motherboards are combination of 62- pin and 36- pin ISA expansion slots.

Presently AT motherboards come with PCI slots also. Different Intel

Microprocessors are explained as follows:

10.3. **80286**

This CPU can work in the following modes:

(i) Real Mode – In real mode, 286 works like 8086.

(ii) Protected Mode – In protected mode, the CPU can take full advantage of its internal architecture. The CPU can address 1 GB of virtual memory (The space occupied in the hard disk for processing the data as a memory).

10.4. **80386**

This CPU can run windows 3.x. 386SL (SX Low Power) has sleep mode features which save the power. 386SLC (SX, Low Power with Cache) has 8 KB cache in the processor itself.

386SL specially made for the notebook and portable computers. The SL CPU has expanded memory support and cache controller built into the CPU itself. The cache controller can control upto 64KB external cache memory.

10.5. **80486**

The coprocessor of the 486 is similar to the external coprocessor of the 386 processor, but it gives almost twice the output because of the working at the increased speed of the 486 DX and the direct connection between the CPU and the coprocessor.

80486SX: In 486SX processor, Intel has switched off the math coprocessor but did not remove it from the chip.

80486 SL (SX Low Power): 486 SL is a low power version of 486SX CPU like 386 SL processor.

80486 DX2: DX2 is a special type of 486 processor. DX2 processor is called "clock doubled" processor because it works internally at the clock speed of 66 MHz, but communicates with the external devices at 33 MHz speed.

DX2-Overdrive: When DX2 processor was sold with the motherboard, it was called as a DX2 processor but the same chip when made available separately then it was called as an overdrive processor.

486 SLC 2: This is like SL, thus has power saving features. It has 16 KB cache memory on the processor itself and has double speed.

486 DX3: This is clock-tripled version of 486 chip. It works internally three times the speed at which it works externally. *A 25 MHz clock tripled 486DX3 will work at 75 MHz internally and a 33 MHz clock tripled 486DX3 will work at 99 MHz internally.*

486 DX4: DX4 processor works internally four times the speed at which it works externally. *A 25 MHz 486DX4 will work at 100MHz internally, whereas it will communicate with the external devices at the 25 MHz clock speed.*

Note: Upto 80486 DX4 all companies manufactured the chip by the same number as Intel.

10.6. **Pentium**

Pentium or 80586 is the next processor from the Intel and copyright / patented the name Pentium. The name Pentium comes from the Greek word pente, which means five. The new special technologies employed in this chip are as follows:

(i) Super scalar Architecture: The Pentium processor has twin data lines, which feeds two instructions together to the processor. This makes the processor to execute two instructions simultaneously is called Super scalar architecture.

(ii) Multithreading: The use of super scalar technology by the processor to execute more than one instruction at the same time is called multithreading. Multitasking OS executes more than one job at a time, but it does not execute all of them at the same time inside the CPU, instead processor allocates a fixed time piece for each process and executes each of them for a very short period of time one by one. *The change between different processes is so fast that this gives the impression as if the processor is executing all the programs at the same time. The multithreading is different from the multitasking in the sense that in the multithreading the processor actually performs two processes at the same time whereas in multitasking the processor makes us feel as it is performing two or more job at the same time.*

(iii) Two Internal Cache: It has two internal cache of 8 KB each, one for the data and the other for the program instructions.

(iv) Branch Predictions: Pentium predicts the future required data and gets these from the memory or hard disk and keeps them ready in the buffer.

PENTIUM 60 MHz AND 66 MHz:

It is installed in a ZIF (Zero Insertion Force) Socket-4. It has 273 pins out of which 173 pins are used for signals and 100 pins for ground/power.

Pentium has 64 Internal data lines, 32 External data lines and 32 Address lines. It is available in PGA package.

PENTIUM 75 MHz – 200 MHz:

These are available in 75 MHz, 90 MHz, 100 MHz, 133 MHz, 150 MHz, 166 MHz and 200 MHz speed. These can be inserted in ZIF Socket-5 containing 296 pins.

Package: CSPGA (Ceramic Staggered Pin Grid Array).

Or PSPGA (Plastic Staggered Pin Grid Array)

Power Supply: 3.3 Volts.

Comparison of internal and external bus frequencies for pentium processors

Internal Frequency in MHz	External Frequency In MHz
200	66
166	66
150	60
133	66
120	60
100	66
100	50
90	60
75	50

10.7. **Pentium MMX (Multi Media Extended)**

MMX is based on single instruction and multiple data, which enable parallel processing of various operations in a single cycle. Intel integrated 57 new

instructions to support graphics and animations. They are available in 166, 200 and 233 MHz. They are installed on a ZIF Socket-5 containing 296 pins.

- Power supply --2.9 V

10.8. P-II Processor

P-II microprocessors are available in 233, 266, 300 and 333 MHz frequencies. It has enhanced 3-D features.

- Package: SEC (Single Edge Contact) cartridge.
- Integrated Cache – 16 KB instruction cache and 16 KB data cache Level –1 cache and an integrated 512 KB Level-2 cache.
- Supports upto 64 GB of physical memory.
- Optimized for 32-Bit applications.

10.9. Intel Celeron

It is available in 266, 300, 333, 366, 400, 433, 466, 500, 533 and 667 MHz speed.

Package: Plastics Pin Grid Array (PPGA) compatible with PGA -370 sockets.

10.10. P-III 450-800 MHz Microprocessors

P-III are available in 800EB, 733, 667, 600, 600EB, 533B and 533EB MHz operating frequencies and supports 133 MHz bus frequencies.

Suffix ‘B’ indicates support for 133 MHz bus frequency and suffix ‘E’ indicates support for advanced transfer cache and advanced system buffering.

P-III are also available in 800, 750, 700, 650, 600, 500 and 450 MHz operating frequencies and supports 100 MHz bus frequencies.

- Package: SECC

10.11. P-IV Processor

It is available upto 3.06 GHz speed.

- Package: SECC

Demonstration

Different microprocessors.

Exercise-10

Q.1 Fill in the blanks

(i) PC-AT machines have _____ microprocessors. (80286 & above)

(ii) PII and PIII microprocessors are available in _____ package. (SEC)

Q.2 Write short notes

(i) New technologies employed in Pentium.

(ii) Multithreading

(iii) Multitasking

CHAPTER 11

FLOPPY DISK AND FDD

11.1. **Floppy Disk and Drive**

Computer's main memory RAM (Random Access Memory) is a "volatile memory". *By volatile memory we mean, whenever the power supply to this memory is switched off, everything stored inside it is completely washed off, and is lost forever.*

As we use the computer to keep many important records, it should have some facility to keep the data permanently, without any loss of data.

Magnetic storage devices are non-volatile means store data permanently.

Floppy disks are the main storage devices for the personal computers and are also the main source of transferring data between different computers. To use the floppy disk in your computer you require a floppy disk drive (FDD), and an interface to connect the computer with the disk drive. Floppy disk is a thin plastic disk used as a permanent/secondary storage device, which is coated with a magnetic material. *These storage devices are also called as "external storage devices", as they were not part of the main computer.*

Floppy disk is a thin plastic disk used as a permanent storage device, which is coated with a magnetic material.

VEIS

INFORMATION ABOUT FLOPPY DISK AND DRIVES

Storage Capacity	Number of storage sides	Density	No. of heads	Physical Size	Tracks Per Inch	No of Tracks Per Side	Sectors /Track	Bytes/ Sector	Rotation Speed (rpm)	Used with type of Machine
80K	Single	Single	1	5 ¼ inch	24	20	8	512	300	PC/PC XT
160 K	Single	Double	1	5 ¼ inch	48	40	8	512	300	PC-AT
360 KB	Double	Double	2	5 ¼ inch	48	40	9	512	300	PC-AT
1.2 MB	Double	High	2	5 ¼ inch	96	80	15	512	360	PC-AT
720 KB	Double	Double	2	3 ½ inch	135	80	9	512	300	PC-AT
1.44 MB	Double	High	2	3 ½ inch	135	80	18	512	300	PC-AT
2.88 MB	Double	Extra-high	2	3 ½ inch	135	80	36	512	300	

Capacity of Floppy = No of sides x tracks x Sectors/track x Bytes per sector

11.2. **Classification of Disks**

The disk can be classified based on the following factors:-

(i) Size - 5.25Inch Disk and 3.5Inch Disk

(ii) Number of Sides – Single Sided and Double Sided

(iii) Storage capacity – 360KB, 1.2 MB, 720KB, 1.44MB

(iv) Storage density – Single density and Double density.

Single Sided: These diskettes were used to record only on one side. The drives used to read/write these diskettes had r/w head only on the bottom side, the top side of these drives had a pad to keep the disk pressed to the bottom head.

Double sided: Both sides of the disk are used for recording of the information. The drives for these diskettes have r/w head both on top and bottom to read/write on both the sides of the disk. The bottom side is called head 0 and the topside is called head 1.

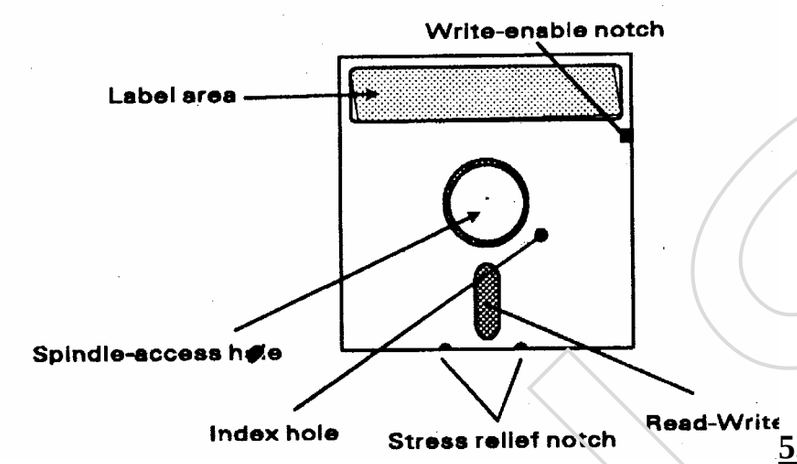
11.3. **Floppy Disk Construction**

Both 5.25" and 3.5" floppy disks use plastic base material *(usually Mylar)* coated with a magnetic compound.

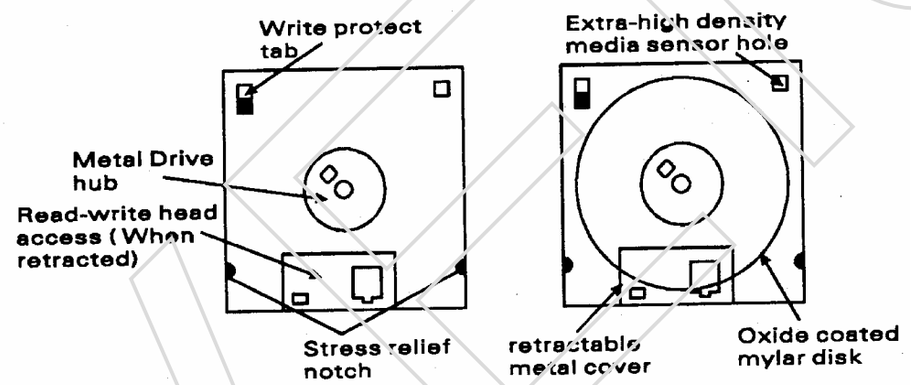
The compound is normally an iron oxide based compound for the single density and the double density floppy disks and for the high-density floppy disks normally a cobalt compound is used.

411.. **Parts of a Floppy Disk**

Jacket, Recording media, Label area, Drive hub hole, Index hole, Alignment hole, Read/Write window, Write enable notch, Write enable hole, Protection shutter, Spindle connector, High-density detection hole, Stress relief notch are the major parts of a floppy disk. All of these have been discussed below :-



5.25" Floppy



3.5" Floppy

a) Recording Media (3.5 & 5.25):

The recording medium consists of a flexible mylar film, coated on both sides with the magnetic oxide. Information is written onto it by magnetizing the oxide coating.

b) Label Area (3.5& 5.25):

The label is attached to the label area provided on the disk jacket.

This label should not in any way interfere with the insertion of the disk in the drive and the disk read/write operation.

When using a ball pen to write on the label of the 5.25-inch floppy disk, it should be written before sticking the label on the disk label area. Otherwise, writing on the label with a ball pen may mark the jacket and may mark the media inside. This may destroy the information on the disk.

As the jacket of the 3.5-inch disk is very rigid you do not have this problem with the 3.5-inch disk.

Whenever you insert a 5.25-inch disk into the drive, you should hold the disk by the label area and the label side should be facing up.

c) Hub Hole (5.25):

The round opening in the centre of a 5.25-inch floppy disk is called a hub hole, which is the centre of the disk. In this hole, the hub of the motor is inserted to rotate it.

The recording medium of the floppy disk remains clamped there, so that the motor can spin it inside the jacket.

A double- density 5.25-inch (360KB) floppy disks have something called "hub-ring reinforcements" on them. This is a thin plastic ring intended to help the floppy disks to withstand the mechanical force of the clamping mechanism.

The high-density floppy disks do not have this ring reinforcement facility because placing these rings on the floppy disk is difficult and they cause alignment problems.

d) Index Hole (5.25):

The small circular hole on the recording media and the disk jacket is called index hole. This index hole is used by the drive to find out the first sector n the floppy disk.

The starting point for all rest sectors is identified by pre-defined rules Or in other words it is used to locate the first sector i.e. sector 1 of a track. As the disk is rotated inside the jacket, when the index hole on the disk media and on the jacket come together, a sensor will sense this

and inform to the drive as start of as the sector. As floppy disk with a single index hole is called a soft sectored floppy disk. Hard sectored floppy disks have as many holes as there are sectors on them.

e) Alignment Hole (3.5):

It is same as an index hole to tell the drive about the first sector of the track. *This alignment hole is located on the centre metal hub of the disk. When the disk is inserted into the drive, the drive grasps the disk and this alignment hole is used to position the disk properly inside the drive.*

f) Read/Write Window (3.5&5.25);

On a 5.25-inch disk below the centre hole there is an opening, through which you can actually see the recording media.

This opening is also known as the media access hole. It is through this hole, the drive heads read and write the information on the disk surface.

On a 3.5-inch disk, this opening is protected by a sliding shutter, which opens only when the disk is inserted into the drive. *This shutter protects the recording media form accidental touch and other environmental contaminations, making the 3.5 inch diskettes more reliable.*

g) Write Protect Function (5.25 & 3.5):

A small rectangular opening on the topside of the 5.25-inch floppy is called "write enable notch" and a hole at one corner of the 3.5-inch floppy disk is called Write enable Hole.

5.25" = - Slot open – Write enabled

- Slot closed – Write protected.

3.5" = - Door open – Write protected

- Door closed – Write enabled

h) Protection shutter (3.5):

On a 3.5” disk the read/write opening is protected with a spring-loaded shutter. This shutter moves to expose the recording media, when the disk is inserted into the disk drive.

This shutter makes it much more difficult to touch the recording surface accidentally. Also, this protects the disk media from the dust and other environmental contaminations.

i) Spindle connector (3.5/5.25):

It is used to connect the disk to the spindle of the drive motor. This is a small opening on the hub of the 3.5-inch disk & round opening in 5 ¼ disk for this purpose which is called as Spindle access hole.

j) High Density Detection Hole (3.5):

A hole opposite to the write enable hole, which indicates that the floppy is 1.44MB is called high density detection hole.

A 5.25-inch drive does not have any facility to detect the type of the disk. *This makes it compulsory for the computer user to specify the disk type while formatting a new disk, when the disk and the drive type are not same. For example if you formatting a 360KB floppy disk in a 1.2MB drive it should be specified as “FORMAT A:/4” the /4 parameter after FORMAT command tells the DOS that a 360KB disk is to be formatted in a 1.2MB drive.*

k) Stress relief notch (3.5& 5.25):

There are two small half circular notches on the bottom center of the 5.25-inch disk and on the sides of the 3.25-inch disk. This notch helps in proper aligning of disk inside the drive.

11.5. **Floppy Disk Drive Components**:

Some of the major parts of a disk drive (FDD) are as given below:

1. R/W Head
2. Head actuator/Stepper motor
3. Spindle motor
4. Circuit Board
5. Cable connectors (for data cable and power cable)
6. Faceplate

a) R/W Head:

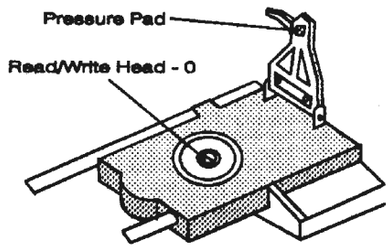
This is a magnetic read/write head, which reads from and writes to the disk.

The drives have two read/write heads; one on the top and one on the bottom are called double sided drives. The drives has only one head, at the bottom side of the head assembly is called single sided drives.

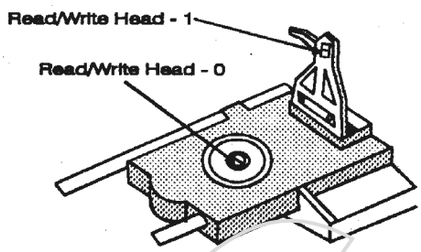
Head moves in and out over the disk surface to read from or to write to the disk. Both the heads are mounted on a single rack, so they always move together as a single assembly.

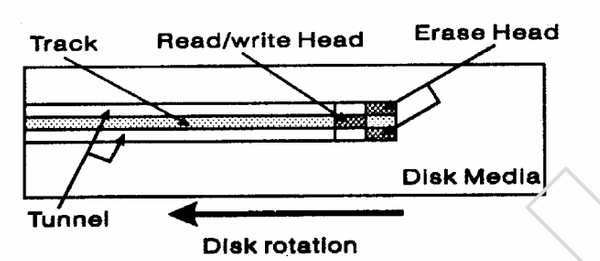
The head is made of soft iron compound with electromagnetic coil. Each head contains read/write head in the center and two erase heads on both sides.

SINGLE SIDED DRIVE



DOUBLE SIDED DRIVE



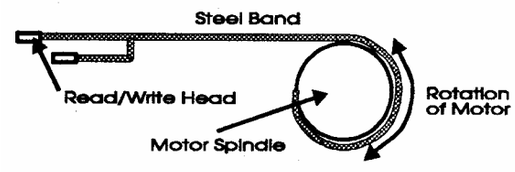


The recording of information on the disk surface using this read/write head is called "tunnel erasure recording", because as the read/write head writes information on the disk, erase head erases both sides of the written data. Using this method the head force the data to be within a narrow tunnel like shape. This prevents the adjoining data from being spilled into each other.

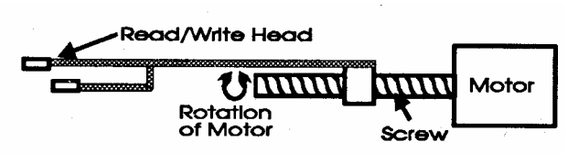
On a floppy drive, heads are always in contact with the disk surface. Because of this contact, slowly, oxide material forms the disk start to attach to the read/ write head.

This buildup should be cleaned periodically otherwise drive will start giving read or write error and sometime when the buildup is large, head starts scratching the disk surface making the disk permanently defective.

b) Head Actuator / Stepper Motor: Stepper motor moves read / write head over the disk surface. Stepper motor rotates in steps in any direction but with each step, it rotates a fixed angle of rotation. Each steps of this stepper motor defines a track on the disk. This motor is connected to the r/w head assembly using a steel band or a lead screw mechanism.

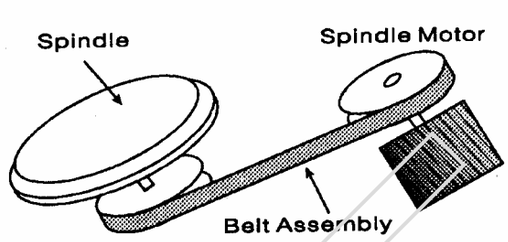


Steel Band Assembly

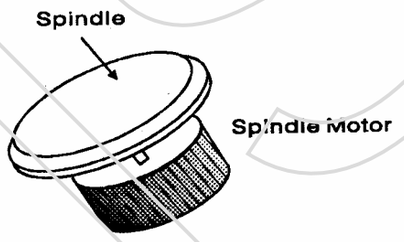


Lead Screw Mechanism

c) Spindle Motor: This motor rotates the disk by clamping the disk in the center. Old drives had a belt assembly to rotate the spindle but newer drives have "direct-drive" assembly. A direct-drive motor is directly connected to the spindle. Its *speed* is 300 RPM.



Spindle Motor's Belt Assy



Spindle Motor Direct Assy.

These drives always maintain a fixed rotation speed of 300 RPM (rotation per minute) or 360 RPM, depending on the drive type. There is no need to adjust the speed of rotation on these drives, older drives required to adjust the speed periodically for proper working of the drive.

d) Circuit Board: Circuit board is used to interface the outside signals with the disk drive and to control the stepper motor, spindle motor, read/write head, different sensors and other components on the drive.

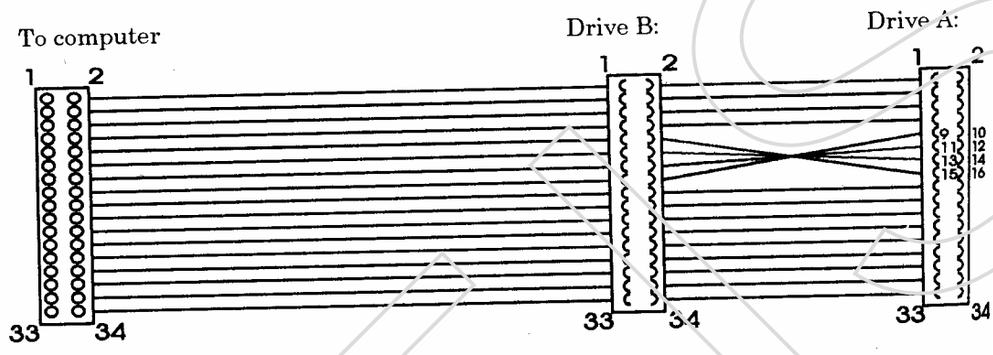
e) Cable Connectors: A disk drive is connected to the main computer system using two connectors, which are as follows:

(i) Data /Control connector

(ii) Power connector

Data/Control Connector: Data / Control connector is a 34 pin edge connector for a 5.25 inch drive and a 34 pin header connector for a 3.5 inch drive. This connector is used to carry the data and the control signals between the computer and the disk drive.

Data/Control Cable: A special twist on in the data / control cable identifies the drive A: and Drive B on a PC.

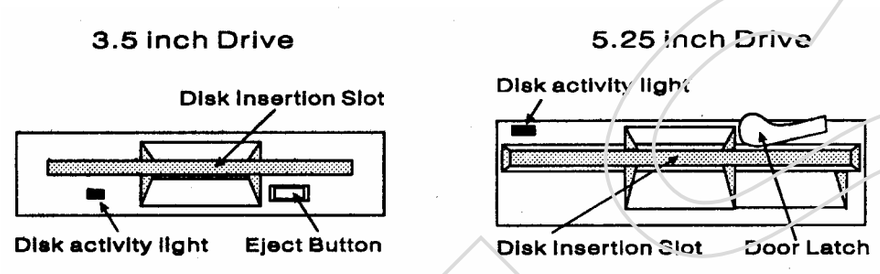


Power connector: This is a 4-pin connector used to connect power from the power supply (SMPS) of the computer. The 5.25-inch drives use a big size female connector, whereas the 3.5-inch drives use a smaller female connector.

In a 3.5 inch drive power connector, pin 1 is +5 volt DC and pin 4 is +12 volt DC and in a 5.25 inch drive power connector, pin 1 is + 12 volt DC and pin 4 is +5 volt DC.

As the 5.25inch drive and 3.5 inch drives use completely reverse power connection, one should be careful in connecting them, otherwise it could be very fatal for the drives.

f) Faceplate: Faceplate is also called "Bazel". It is the plastic front cover of a disk drive. Faceplate has a disk activity light. The 3 ½ FDD has eject button and 5 ¼ FDD has door latch. *These faceplates are mostly made slightly wider than the disk drive, so that the drive can be pushed into the drive bay from the front of the computer and the faceplte will fit firmly on the front cover of the computer's main system box.*



11.6. **Various Sensors and Their Functions**

There are various sensors located on a FDD, which are as follows:

(i) Index Sensor - It generates a pulse each time when the disk completes one rotation.

(ii) Track '00' Sensor – It senses that the head is at the outermost track.

(iii) Write Protect Sensor – It senses whether the floppy is write protected or not.

(iv) Capacity Sensor – Indicates 3 ½" floppy is 1.44MB.

(v) Media Sensor – It senses whether any floppy diskette is inserted or not.

11.7. **Interfacing/Connecting FDD**

FDD is connected to the motherboard through a 34-wire cable (Data/Control) having three 34-pin connectors of similar type. One connector is connected to the FDD interface located on the motherboard. Middle connector is connected to the FDD-B and after middle connector there is a twist in the cable. After twist in the cable third connector is located which is connected to the FDD-A.

Power supply to the FDD is given from the SMPS through a 4-pin connector.

11.8. **Configuring FDD**

Configuration options are stored in the CMOS RAM and are set by running the CMOS utility. BIOS setup requires adding the disk parameters manually.

Demonstration

a) Different parts of 3.5" and 5.25" floppy.

b) Different parts of 3.5" and 5.25" FDD.

c) Connecting FDD with the system.

d) Cleaning of R/W head and other parts of FDD.

Practical

a) Connecting FDD with the system.

b) Cleaning of R/W head and other parts of FDD.

Exercise-11

Q.1 Fill in the blanks

(i) Most commonly used floppy disk has a capacity of _____. (1.44MB)

(ii) Index hole is used by the floppy disk to _____. (find the first sector)

(iii) Read/write window in 3.5” floppy is protected against dirt by the _____. (protection shutter)

(iv) Write protect function in 3.5” floppy is enabled by _____. (opening the write protect notch)

(v) Speed of a spindle motor in FDD is _____. (300 RPM)

(vi) Connectors used in FDD are _____ and _____ (data/control, power)

(vii) Track ‘00’ sensor, senses whether the head is at the _____. (outer most track)

Q.2 Write short notes:

(i) Classification of disks.

(ii) Write protect function in disks.

(iii) FDD components

(iv) R/W head

(v) Connectors in FDD

CHAPTER 12

LOGICAL ORGANISATION OF A DISK

12.1. Logical Working of a Disk

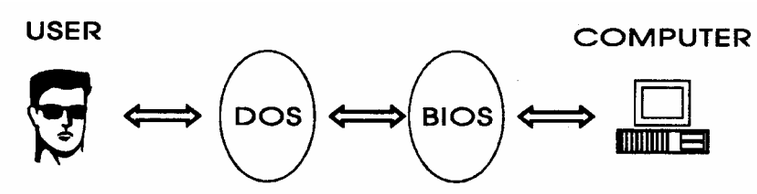
You have a good, working floppy drive, a disk, and a controller to connect that drive to your computer.

To use a particular disk drive, the BIOS and the OS in your system must support it.

If you have a BIOS that supports the drive but if the OS (operating system) in your system does not support the drive then you cannot use the drive & vice versa.

12.2. **BIOS (Basic Input Output Systems)**

BIOS is a program on a ROM chip on the motherboard of the computer. It provides an interface between the hardware and the Operating System.



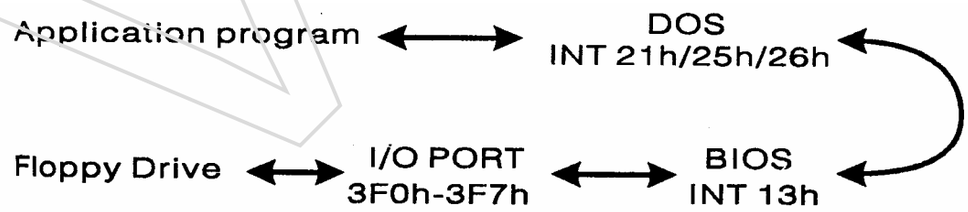
During booting press “Del” key to enter the setup, then enter the type of drive in the Standard Setup option.

12.3. **Interrupts**

Interrupts are used to communicate between OS, BIOS and the peripherals. Interrupts are software and hardware.

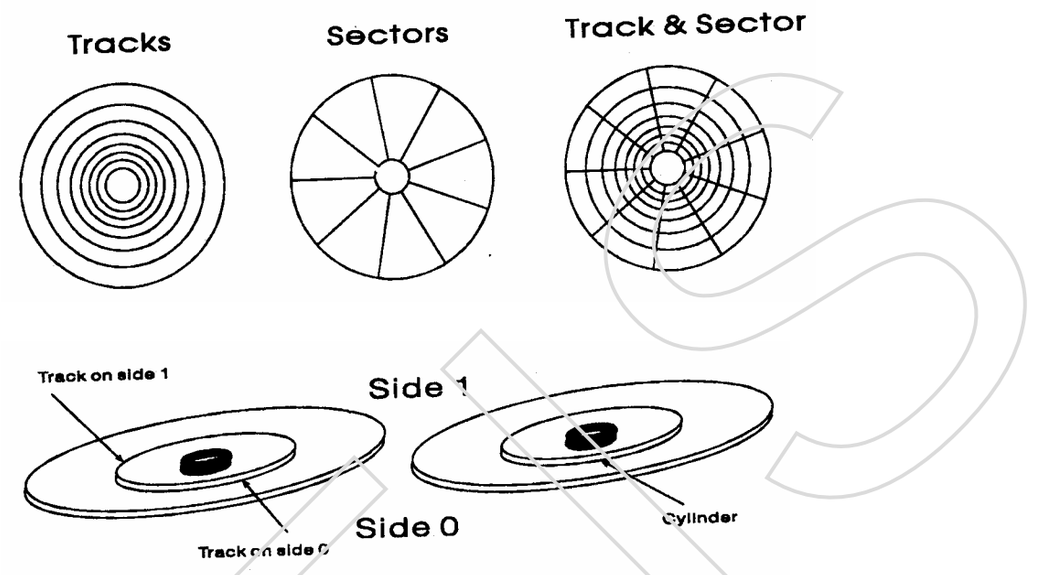
12.4. **Interface Between the Floppy Drive and Application Program**

The disk read/write operations required by the user program are sent to the DOS using the interrupt number 21h, 25h or 26h, then DOS sends the same to the BIOS using the BIOS interrupt number 13h. Next. BIOS converts these instructions to the drive controller control codes and sends to the disk drive by writing these codes into the i/o port 3F0 to 3F7.



12.5. **Tracks and Sectors**

To read/write any information on the disk, DOS uses a fixed disk format. The data in the floppy disk is arranged in tracks and sectors. Track number starts from 0 and sector number starts from 1.

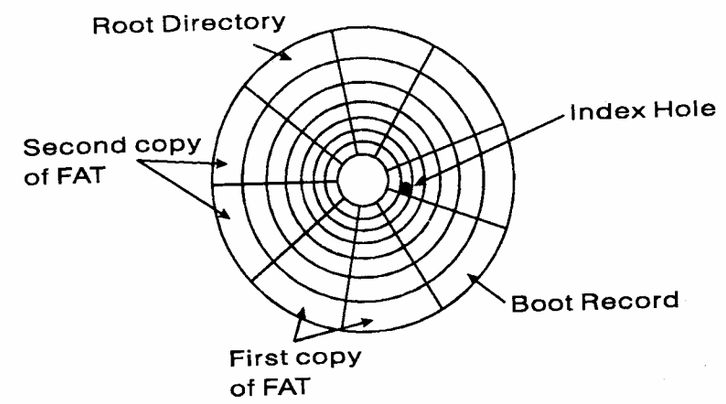


The size of a sector is 512 bytes.

Tracks are also called cylinder because the top and bottom tracks together form a cylinder like shape.

12.6. **Format of a Floppy Disk**

When a new floppy disk is brought, it is without tracks and sectors. By formatting the disk, operating system adds the tracks and sectors and their information. Formatting a new disk is like adding lines on a blank paper so that you will be able to write properly on it.



The storage capacity of a formatted disk is slightly less than the storage capacity of an unformatted disk. It is so because formatting of a disk consumes some storage space for writing the track, sector address and some other information.

Track 0, Sector 1 contains the Boot Record.

Next few sectors contain the FAT

& next few sectors contain the Root Directory.

12.7. **Boot Record**

Boot Record or MBR (Master Boot Record) keeps the complete information regarding the disk, for example number of bytes/sector, number of sectors/cluster, FAT type, Boot Sector, number of heads etc. It also contains a small program, which is used to look system files.

12.8. **FAT (File Allocation Table)**

FAT keeps the record of the space on the disk. DOS keeps two copies of FAT. DOS has FAT16.

12.9. **Root Directory**

The directory area keeps the information about the file name, date and time of file creation, file attribute, file size and the first cluster of the file. Each directory entry requires 32 bytes.

12.10. **Cluster**

Cluster is the minimum space allocated by the operating system when saving any information on the disk. A cluster can be made of one or more sectors, depending upon the disk size. Storage capacity of a sector is fix i.e. 512 Bytes. When computer writes some information onto the floppy disk, it allocates the space cluster wise and not the sector wise. If one cluster can store 512 bytes of information then to store 513 bytes you will require two clusters. If a file size is 2 bytes then also it will occupy a cluster.

Clusters are used to store the files to reduce the size of the FAT. First cluster number starts from 2.

Clusters are used to allocate the storage area for the data area only, FAT and directory area are not allocated according to the cluster size.

12.11. **Format**

During formatting the boot sector, FAT and root directory entries are written. After this the FORMAT command scans the complete disk to check for any defective area. It also divides the magnetic area into the system area and the data area. System area contains Boot sector, FAT, Root Directory structure and the data area

contains Index field, ID (identification) field & Data field. Different operating systems format the disk in different ways.

There are two types of formatting which are as follows:

(i) Low Level Formatting - Physically creating tracks and sectors.

(ii) High Level Formatting – Logically formats, which install the disk information, e.g. boot record, FAT etc.

Format command of DOS does the high level formatting. Low level formatting is done at the manufacturer level or if required can be done by using special software like Disk Manager (DM).

Formatting is done by **FORMAT** command. The use of format command is as follows:

Syntax: FORMAT Drive: [switches]

/S - Copies system files to the formatted disk

/Q – Performs a Quick Format. It removes the entries of root directory and FAT without checking the sector for reliability.

/U – This option delete all existing data on the disk and do not save any mirror information, which can be used to unformat the disk.

Example: FORMAT A:

Note: Be careful, at the time of formatting all files and directories in the disk will be deleted.

12.12. **Unformat**

This is used to unformat an accidentally formatted disk drive.

Syntax: UNFORMAT drive:

/TEST - When this switch is used UNFORMAT shows how it would recreate the information on the disk, but does not actually unformat the disk.

Exercise-12

Q.1 Fill in the blanks

(i) BIOS stands for _____. (Basic Input Output System)

(ii) BIOS provide an interface between _____ and _____. (hardware, OS)

(iii) Interrupts are used to communicate between _____, _____ and _____. (BIOS, OS, Peripherals)

(iv) Cylinder number starts from _____ and sector number starts from _____. (0, 1)

(v) The size of a sector is _____. (512 bytes)

(vi) System area contains _____. (boot record, FAT & root directory)

(vii) Format command does _____ of disk. (formatting)

(viii) Each directory entry requires _____. (32 bytes)

(ix) Size of the cluster is _____. (depends on the disk size)

(x) Tracks number starts at _____. (0)

Q.2 Write short notes

(i) BIOS

(ii) FAT

(iii) Root Directory

(iv) Format of a floppy disk

CHAPTER 13

COMMON FAULTS OF FDD

13.1. **Problem**

While trying to format a disk, message “Invalid media or Track 0 bad, disk unusable” or “write failure, disk unusable” or “Track 0 bad – media invalid” error is displayed.

Cause and Solution:

Track 0 of the disk is damaged. Replace the disk.

13.2. **Problem**: “Non-system disk or disk error” message is displayed.

Cause and Solution:

IO.SYS and MSDOS.SYS files are missing. Load IO.SYS and MSDOS.SYS files.

13.3. **Problem**: A floppy disk copied from one drive, is not readable in other drive.

Cause and Solution:

(i) You are trying to read a high-density disk in a low-density drive, if so read in high-density drive.

(ii) When a disk formatted in a low-density drive and written in a high density drive, if so format in a high density drive.

(iii) Disk is formatted by other type of operating system such as Unix, if so, format by the current operating system.

Take proper remedial action as per the cause.

13.4. **Problem**: Nothing is being read from or written to the disk from a drive.

Cause and Solution:

(i) Disk drive's door is not properly closed, if so close the door.

(ii) Disk is not formatted, if so format it.

(iii) Bad drive or bad cable connector, if so replace the drive or cable.

13.5. **Problem**: When formatting a disk, "Attempted write-protect violation" error message is displayed.

Cause and Solution:

(i) Trying to format a write-protected disk, if so unprotect it.

(ii) Write protect sensor in the drive is faulty or may be problem with the data/control cable, if so replace with the new one.

13.6. **Problem**: System displays "No such Drive" or "Boot Failure" during the booting.

Cause and Solutions: Drive parameters are not specified in the Setup, if so set the parameters.

13.7. **Problem**: System displays "Bad or missing command interpreter"

Cause and Solution:

Command.Com file in the boot floppy is missing, if so insert the disk with the Command.Com file.

13.8. **Problem**: System displays "Bad command or file name"

Cause and Solution: (i) Path is not set.

(ii) File is not available. Set the path.

13.9. **Problem**: System displays “Not ready reading drive A:”

Cause and Solution:

(i) Disk is not inserted properly.

(ii) Head is fully dirty.

Insert the disk properly.

Clean the head.

13.10. **Problem**: System displays “Insufficient disk space”

Cause and Solution:

There is not enough space available to write the information.

Replace the disk with the new disk.

13.11. **Problem**: System displays “General failure reading / writing drive A:”

Abort, Retry, Ignore, Failure

Cause and Solution:

(i) Floppy is not formatted or formatted by a different Operating System.

(ii) Floppy physically bad.

(iii) Read / Write Head dirty enough.

(iv) Head misaligned

(v) Data / Control cable bad

Perform the remedial action as per the cause.

13.12. **Problem**: When reading the disk “Data error reading drive A:” error message is displayed.

Abort, Retry, Ignore, Failure

Cause and Solution:

(i) Floppy has bad sectors, if so remove/fix the bad sectors by using the Scandisk utility.

(ii) Read / Write head is dirty, if so clean the head with the floppy cleaner.

(iii) When a disk is formatted in one drive and is used in another drive, which has a different head alignment.

Perform the remedial action as per cause.

13.13. **Problem**: When reading the disk “Sector not found. Error reading drive A:” error message is displayed.

Cause and Solution:

Same as explained in general failure (Problem-11).

13.14. **Problem**: Seek error.

Cause and Solution:

May be power supply problem. Check the power supply and take the proper remedial action.

Demonstration

Common faults and their rectification.

Practical

Common faults and their rectification.

Exercise-13

Q.1 Fill in the blanks

(i) “Non-system disk” indicates _____. (IO.SYS, MSDOS.SYS files are missing)

(ii) “Bad command or file name” indicates _____. (path is not set or file is not available)

(iii) “Seek error” indicates the problem associated with the _____. (power supply)

(iv) “Bad or missing command interpreter” indicates _____. (comman.com file is missing)

(v) “Attempted write protect violation” indicates _____. (trying to format/write protected disk)

Q.2 Write short notes

(i) “Track 0 bad” error message.

(ii) “Non-system disk or disk error” message.

(iii) “No such drive or boot failure” message.

(iv) “Not ready reading drive A” message.

(v) “Data error reading drive A” message.

CHAPTER 14
HARD DISK DRIVE (HDD)

14.1. Hard Disk

Hard disk is a secondary storage device with large storage capacity compared to the floppy disk. It is housed within the HDD. It has two or more R/W heads. Presently hard disks are available upto 120 GB capacity.

14.2. Hard Disk Drive (HDD)

Hard disk and HDD are inseparable. Hard disk is housed within the HDD in the form of disk platter, which forms a component of the HDD. HDD is a drive/device, which drives or makes a hard disk to work.

14.3. HDD Components

The major components of HDD are as follows:

- Disk Platter.
- Read/Write head
- Head Arm / Head Slider
- Spindle Motor
- Logic Board
- Cable Connectors

14.4. **Disk Platter**

These are circular shaped disks on which information is magnetically recorded. Each platter is divided into tracks and sectors.

14.5. **Read/Write Head**

It is used to write any information on the disk surface and to read the written data back, without any data loss. A hard disk contains one read/write head for each side of its platter. For example, if a drive contains 3 platters, then the total 6-read/write heads will be used to read the top and bottom sides of each platter. All the heads are connected together and moved in and out on the disk surface as a single unit.

Inside the hard disk, when the disk is at reset i.e. not spinning, then the head is in direct contact with the disk surface. As the disk starts to spin because of its rotation, air pressure develops under the head. This pressure lifts the head from the disk surface and the head starts to float on an air cushion, 3 to 10 μ inch (millionth of inch) above from the disk surface.

14.6. **Head Arm/Head Slider**

The arm on which the read/write heads of the disk drive are located is called the head slider.

14.7. **Spindle Motor**

It is the main motor, which rotates the platters of the hard disk drive, normally at the speed of 3600 or 7200 rpm. *It is called spindle motor because this motor is directly connected to the spindle on which the platters are connected.*

14.8. Logic Board

Logic board is used to control the different parts of the hard disk drive and to interface the hard disk drive with the computer.

14.9. Cable Connectors

These are used to connect the hard disk drive to the main computer system. There are two connectors located at the back of the HDD, which are data/control connector and power connector.

14.10. Head Actuator Mechanism

The read/write head of the disk drive is moved on the platter surface using stepper motor or voice coil actuator.

- Stepper Motor Actuator: Stepper motor rotates in steps and travels a fixed angle.
- Voice Coil Actuator: It moves in and out of the permanent magnetic poles, depending on the strength of the current. Therefore it jumps directly to a particular track.

14.11. Comparison Between Stepper Motor and Voice Coil

Characteristics	Stepper Motor	Voice Coil
Access Speed	Slow	Fast
Reliability	Poor	Very good

Automatic head parking	Usually not available	Yes
Movement of read/write head	A track at a time	For a single change in magnetic flux, the head flies to the desired track.

14.12. Interleave

If the sectors on the hard disk drive are numbered sequentially from 1 to the maximum number of sectors available, then the disk read operation will be slow because when the hard disk is given an instruction to read the complete sectors i.e. 1, 2, 3 …. up to last. After receiving this instruction the read/write head starts reading sector 1. After reading the sector 1 the drive sends this data to the controller. The controller checks the data. During this process the disk is continuously rotating and passes over to the second sector. Thus, to read the 2nd sector the disk will require one complete rotation.

So, if we put the sectors in serial order one after the other then during the read process we will always miss the subsequent sectors. For each subsequent sector the drive will require an unnecessary complete rotation.

We saw that by the time the data read from the 1st sector is read and processed the head reaches 3rd and 4th sector. So if we put the 2nd sector at 3rd or 4th position then the sector will be at the correct position. This will save unnecessary rotation after each sector read.

Numbering the sectors out of order will leave a gap of one or more sectors in the sector numbering is called interleaving.

14.13. Zone Bit Recording

Normally number of sectors in the outer cylinder as well as in the inner cylinder is same. Using the same number of sectors in the outer as well as inner track of the drive is waste of the storage capacity of the disk drive. The outer track of the drive can easily hold 50 percent more data compared to the inner track.

The method of having more number of sectors in the outer tracks compared to the number of sectors in the inner tracks is called zone bit recording.

14.14. Sector Translation

Zone bit recording has different number of sectors per track but the BIOS and DOS cannot work with a disk drive having different number of sectors per track. So, hard disk controller translates the different number of sectors into a constant number of sectors per track.

14.15. Logical Block Addressing (LBA)

Sector translation is also used when the storage capacity of the hard disk is very high. Most of the BIOS have a limitation of maximum 1024 cylinders, which means one cannot use a hard disk drive with more than 1024 cylinders, but most of the BIOS allows up to 256 heads per drive.

Now, if the value sent by the controller cannot be used by the BIOS because of higher number of tracks or any other reason, and then another translation is required, which is called Logical Block Addressing. The LBA arranges these values in such a way that BIOS can use them without any problem. These logical values can be translated into the physical values. In normal mode, DOS can access upto 540 MB of disk space .To access more than that, LBA mode is required to be selected.

Example: If a Hard disk has 2000 tracks, 16 heads, 63 sectors per track can be specified by 1000 tracks 32 heads, 63 sectors per track.

Note: Technical catalog of these drives do not contain sectors per track information.

14.16. Head Parking

The process of moving the read/write head to the safe area is called "Head Parking". The parking of the head is done with the help of some program e.g. PC TOOLS that move the head to the safe area. Head parking is required for the disks having stepper motor mechanism but now a days all the hard disks are having voice coil mechanism, which has auto parking facility, therefore there is no requirement of parking the head.

14.17 HDD INTERFACES

Interfacing means, making the communication between the two media. The different types of interfaces are available to connect a hard disk drive to the computer.

(i) ST-506/412 (Seagate Technology 506/412) Interface

- ST-506 interface was introduced for XT (Extended Technology) computers and ST-506/412 was introduced for AT (Advanced Technology) computers.
- Max. data transfer rate is 7.5 million bits / second.
- Requires separate 34-pin control cable and 20-pin data cable.

- Data separation is done on the controller card.
- Supports Max. 17 sectors/track.
- Supports two hard disks.
- Recording method is MFM (Modified Frequency Modulation) and RLL (Run Length Limit).
- 16 Read / Write heads supported.
- Example ST-124, ST-251, ST-225, ST-4096 etc.

Note: HDFDC (Hard Disk Floppy Disk Controller) cards are used to connect ST-506/412 type interface.

(ii) **ESDI (Enhanced Small Device Interface) -**

- Maximum data transfer rate is 24 million bits/sec.
- Requires separate 34-pin control cable and 20-pin data cable.
- Data separation is done on the drive and not on the controller.

(iii) **IDE (Integrated Drive Electronics)**

- Maximum data transfer rate is 24 million bits/sec.
- 40-pin cable includes both control signals and data signals.
- Supports two hard disks with single common cable in master and slave configuration.

- It can be directly connected to the IDE interface located on the motherboard.

There are basically three different IDE interfaces in use based on the type of system bus for which they are made. The interfaces are as follows:

(a) ATA IDE (Advanced Technology Attachment IDE) -- It works with 16-Bit and 32-Bit.

(b) XT IDE (8-Bit) – It works with 8-Bit XT class ISA bus.

(c) MCA IDE (Micro Channel Architecture IDE) –It works with MCA based systems.

Only the ATA IDE interface was standardized.

Depending on their capability, ATA IDE drives can be divided into following three categories:

- Non-intelligent Drive – Does not support sector translation.
- Intelligent Drive - Supports sector translation
- Intelligent Zone Bit Recorded Drive - Supports sector translation and use zone bit recording.

(iv) **EIDE (Extended or Enhanced IDE)**

This interface is also known as ATA-2 interface. It is same as IDE interface.

(v) **SCSI (Small Computer System Interface)**

- SCSI is pronounced as “SCUZZY”.

- 50-pin connector includes both data signals and the control signals.
- Can support upto 32 SCSI devices.
- SCSI is used for multitasking.
- SCSI can handle the data from one SCSI device to another SCSI device without CPU help.
- Requires separate SCSI controller card.
- Not yet standardised therefore there is no surety, that any given SCSI host adapter can control a SCSI device.

14.18. Jumper Setting

Jumper setting is done to make the drive Master or Slave. The way of jumper setting differs from one drive to another drive. Jumper setting is done at the back of the HDD as per the specifications given at the top of the HDD.

14.19. Configuring Hard Disk

Configuration options are stored in the CMOS RAM and are set by running the CMOS utility. Modern BIOS set up the hard disk parameters automatically but the old BIOS require adding the disk parameters manually. In the BIOS set up “Auto detect hard disks “.

14.20. Terminology

a) Seek Time: The time required to move the read / write head to the required cylinder is known as seek time.

b) Rotational Latency Period: The time required by the hard disk to rotate for locating the required data, when the read / write head has already reached on the required cylinder.

c) Access time: It is the total time required by a hard disk to read the requested data.

Demonstration

a) Different parts of a HDD.
b) Connecting HDD with the motherboard.
c) Jumper setting of the HDD for making it Master or Slave.
d) Different HDD interfaces.
e) Connecting HDD with the IDE interface.

Practical

a) Connecting HDD with the motherboard.
b) Jumper setting of the HDD for making it Master or Slave.
c) Connecting HDD with the IDE interface.

Exercise-14

Q.1. Fill in the blanks:

(i) The speed of spindle motor in HDD is usually _____. (3600 or 7200 rpm)

(ii) Head actuator mechanisms used in HDD are _____. (stepper motor and voice coil)

(iii) The process of numbering the sectors out of order is called _____. (interleaving)

(iv) The method of having uneven number of sectors per track is called _____. (zero bit recording)

(v) In normal mode, DOS can access _____ hard disk space. (540 MB)

(vi) Data/control connector of HDD has _____ pins. (40)

(vii) Jumper setting in hard disk is done to make _____. (master or slave)

(viii) Time required R/W head to move at the required cylinder is called _____. (seek time)

(ix) ST/506/412 interface requires _____ card for connecting HDD. (HDFDC)

(x) Number of IDE channels present on a motherboard is ____. (2)

(xi) Maximum number of IDE hard disk can be connected to a system is ____. (4)

Q.2 Write short notes

(i) Sector translation

(ii) Disk platter

(iii) Zone bit recording

(iv) LBA

(v) Head actuator mechanism

(vi) HDFDC

(vii) IDE

(viii) SCSI

CHAPTER 15

PARTITIONING OF HARD DISK

15.1. **Partitioning**

Partitioning is the method of dividing a physical hard disk into different logical disks. Each logical disk has its own relative sector numbers, where as the absolute sector number will exist only one for a physical hard disk including all the logical disks. Partitioning is done by using FDISK (FDISK.EXE) utility or Disk Manager (DM)

15.2. **Absolute Sector & Relative Sector**

Absolute sector number is the real physical sector number and the relative sector number is the sector number used by the DOS for different logical drives.

15.3. **Requirement of Partitioning**

The partitioning is done or required for the following reasons :-

a) The partitioning is required/done to load the different operating systems having different file formats on a single hard disk . For example, we can install DOS on one partition and UNIX on the other partition.

b) Partitioning is also useful for optimum utilization of the disk space. MSDOS 6.22 can support up to 8 physical hard disk drives, with total 24 partitions, of which each partition can have a maximum of 2 Giga Byte size. Therefore, if a 40 GB hard disk is required to be accessed by MSDOS, then the hard disk has to be partitioned in 20 logical disks of 2 GB each, otherwise 38 GB will go in waste.

c) Bigger partition size has bigger cluster size, so smaller files occupy unnecessary space because each file occupies a minimum of one cluster even if the file size is 1 byte.

CLUSTER SIZE FOR DIFFERENT SIZE OF LOGICAL HARD DISKS

Size of Logical Drive (in MB)	Cluster Size (in KB)
Up to 127	2
128 – 255	4
256 – 511	8
512 – 1023	16
1024 – 2047	32
2048 – 4095	64

15.4. **Creating Partition**

You can create the partition using FDISK.EXE program. When you create the partition following screen will appear.

Fdisk Options

Current fixed drive: 1

Choose one of the following:

1. Create DOS partition or Logical DOS Drive.
2. Set active partition – (To make the particular partition active. One partition must be active before you come out from the fdisk program).
3. Delete partition or Logical DOS Drive
4. Display partition information. (To display the status of partitions)

5. Enter Choice: [ ]

If Slave HDD is connected then the 5th option will appear as “Change current fixed drive”.

15.5. Create DOS Partition or Logical DOS Drive:

- Under this following options are displayed:
  - (i) Create Primary DOS Partition
  - (ii) Create Extended DOS Partition
  - (iii) Create Logical DOS Drive(s) in the Extended DOS Partition

First create the Primary DOS partition and allot/assign the space. After that, remaining space or part of that, specify for the Extended DOS partition. Afterwards create the Logical drives in the Extended DOS partition. The space, which you have not included in he Primary DOS and the extended DOS partition, is called NON-DOS Partition. It is used for NETWARE or UNIX operating systems. DOS cannot access NON-DOS partition.

15.6. Delete partition or logical DOS drive

Under this, following options are displayed:

(i) Delete Primary DOS Partition.

(ii) Delete Extended DOS partition

(iii) Delete Logical DOS Drive (s) in the Extended DOS Partition

(iv) Delete Non-DOS partition

To delete all the partitions, first delete NON-DOS partition, then delete Logical DOS drive (s), then delete Extended DOS partition and finally delete the Primary DOS partition. Before deleting a partition enter the volume label of the disk.

15.7. FDISK Switches

Following are the switches used with the FDISK:

a) /MBR: This option over writes the MBR program without disturbing the partition table information in the MBR. This option is useful in removing the MBR virus, which has infected Cylinder 0, Head 0, Sector 1 of a hard disk. To remove the virus, boot from a clean bootable floppy and type **A:\>FDISK /MBR** command.

This will replace the virus infected MBR code with a clean MBR code.

b) /STATUS – Displays the partition information of the hard disk drive without going into the FDISK menu.

c) /PRI – This option is used to create Primary DOS Partition from the command line itself.

d) /EXT - This option is used to create Extended DOS Partition from the command line itself.

e) /LOG - This option is used to create Logical DOS Drive (s) from the command line itself.

15.8. DOS Boot Record (DBR) / DOS Boot Sector

After the MBR, first logical sector of partition contains boot sector. The DBR loads the operating system from the hard disk drive into the main memory.

15.9. Starting with Partitioning

For creating partition, we require the following:

a) CD Drive / FDD

b) Bootable CD / Floppy Disk

First boot the system with the Bootable CD and then type FDISK on the DOS prompt. Proceed for further process of partitioning as mentioned in the beginning of the Chapter.

Demonstration

(i) Different FDISK menu options.

(ii) Partitioning of hard disk using FDISK.

Practical

⇒ Partitioning of hard disk using FDISK utility.

Exercise-15

(i) Partitioning is done by _____ and _____. (fdisk & DM)

(ii) DOS can access a maximum of _____ space. (2 GB)

(iii) FDISK/MBR is used to _____. (remove boot virus after replacing master boot record)

(iv) FDISK/STATUS is used to _____. (display the partition information)

Q.2 Write short notes

(i) Partition.

(ii) Requirement of partitioning.

(iii) FDISK/MBR.

Q.3 How partition is done using fdisk command?

CHAPTER 16

FORMATTING

16.1. Formatting a Hard Disk

The process of creating tracks and sectors is called formatting. Without formatting the hard disk as per the current operating system, the hard disk cannot be used. Newly purchased hard disk is required to be formatted before using in the system..

16.2. Types of Formatting

There are two types of formatting which are as follows:

a) Low Level Formatting

b) High Level Formatting

Low Level Formatting: The special software, for example Disk Manager (DM) or some BIOS have the facility for low level formatting. You should go for low level formatting when many bad sectors are there in the disk. It can remove the bad sectors and also has the capability to create interleave Low level formatting physically creates tracks and sectors on the hard disks.

High Level Formatting: The FORMAT (FORMAT.COM) command does the high level formatting. It can mark the bad sectors to avoid writing the information on that particular area .

16.3. High Level Formatting

Before formatting, partitioning is done by using FDISK utility. When FORMAT command is given, it performs the high level formatting. For this type the FORMAT on the DOS prompt and press Enter.

It will give a warning “All data on Non-Removable disk drive (Drive name) will be lost ”.

Proceed with FORMAT (Y/N)?

(Type `Y`). Following message will be displayed –

Checking existing disk format.

Verifying ----------space.

Format complete.

Volume Label (11 characters ,ENTER for None)

Syntax: FORMAT [Drive:]

16.4. Low Level Formatting

Low level formatting is done by using special software like Disk Manager (DM) .DM, first does the partitioning of the disk and later creates tracks and sectors.

16.5. Disk Manager (DM)

DM performs /does partitioning as well as low level formatting simultaneously. Procedure for using DM is type DM or DM/X on the DOS prompt.

(only for Understanding)

Following screen will appear:

Disk Manager Main Menu

Easy Disk Installation	*(Disk Manager will make all the necessary decisions to install your drive to full capacity)*
Advanced Options	*(*Advanced Disk Installation*
	**Maintenance Options*
	Create Ontrack Boot Diskette.
	Install/Remove support drivers.
	Run diagnostics.
	**Upgrade Disk Manager*
View/Print Online Manual	*(View/Print Online Manual-*
	**Drive jumper settings*
	**Registration*
	**Support*
	**installation*
	**Trouble Shooting*

Exit Disk Manager

b) Select Advanced Options

Following screen will appear:

Advanced Disk Installation *(Create partitions based on predefined sizes or custom sizes of your choice)*

Maintenance Options *(*Create On track Boot Diskette*

**Manually install, remove or upgrade any on track driver)*

Upgrade Disk Manager *(Automatically upgrade Disk Manager and any On track Support driver)*

Return to previous menu

c) Select Advanced Disk Installation

Following screen will appear:

Disk Manager found 2 drives.

Is the drive list correct?

YES

NO

Drive List

1) ST310212A

2) 528.4 MB

d) Select "YES"

Following screen will appear:

Highlight drive to install.

Press ENTER to begin

or press ESC to abort.

Drive List

1)ST 310212

2)528.4 MB

Return to previous menu

e) Press ENTER

Following screen will appear:

Would you like to make the first partition on this drive bootable ?

(Press F1 to see how this will affect your current drive letters)

YES

NO

f) Select "NO"

Following screen will appear:

Select a partition option

Option (A)

1 partition with 527.4 MB

Option (B)

2 partitions with 263.7 MB each

Option (C)

Define your own

Return to previous menu

g) Select Option (C)

Following screen will appear:

Enter size of volume in MB

(Maximum capacity of this volume =527.4 MB)

*528_*

(ESC to CANCEL)

h) Enter value and press ENTER

Following screen along with screen displayed for g) except value displayed at the bottom will be displayed:

Partition 1 *Logical Volume 1*

Type DOS-FAT 12/16 *MB------*

i) Keep on entering values for different drives and keep on pressing ENTER

A screen similar to the screen displayed for h) will be displayed.

ji) After completion of partitioning process ,following screen will appear :

Partition Type	*Cylinder Start end*	*Size MB*	*Logical volume type*	*Cylinder Start End*	*Size MB*
1 EXTENDED	*1 1022*	*527.4*	*1 DOS-FAT 12/16*	*1 440*	*227.0*
2			*2. DOS-FAT 12/16*	*441 634*	*100.0*
3			*3 DOS-FAT 12/16*	*635 828*	*100.0*
4			*4 DOS-FAT 12/16*	*829 1022*	*100.0*

Save and continue

k) Select Save and continue

Partition settings will be saved and DM will perform the formatting.

16.6. **Master Boot Record (MBR)**

MBR keeps the following information:

a) No. of partitions created.

b) Status of partition (Which partition is active)

c) Starting cylinder and ending cylinder of each partition.

d) Partition size.

16.7. **Starting with Formatting**

For formatting a disk, we require the following:

a) CD Drive / FDD

b) Bootable CD / Floppy Disk

First boot the system with the Bootable CD and then type

FORMAT on the DOS prompt. Proceed for further process of

formatting as mentioned in the beginning of this Chapter.

Demonstration

a) Formatting a disk-using FORMAT.

b) Using Disk Manager.

c) Partitioning and Formatting using DM.

Practical

a) Formatting a disk using FORMAT.

b) Formatting a disk using DM.

Exercise-16

Q.1 Fill in the blanks

(i) Process of creating tracks and sectors is called _____. (formatting)

(ii) Formatting is done by _____ and ____. (FORMAT command & DM)

(iii) Low level formatting is done by ____. (DM)

(iv) Low level formatting is recommended when _____. (many bad sectors are there)

(v) Disk manager does ____ and _____. (partitioning, formatting)

Q.2 Write short notes

(i) Formatting

(ii) MBR

(iii) DM

Q.3 Explain formatting procedure using DM.

CHAPTER 17
DISK UTILITIES

17.1. Disk Utilities

Disk utilities are used to improve the disk performance. Some of the disk utilities have been discussed in the subsequent paragraphs.

17.2. Scandisk

Scandisk is used to check the errors on the hard disk Scandisk performs two types of checks. These are Standard and Surface checks. Standard check checks only the directory structure and FAT whereas surface check, checks the magnetic surface of the disk and fixes the bad sectors.

Syntax: SCANDISK [DRIVE:] [SWITCHES]

/SURFACE: Checks the surface of the disk

/AUTO: Fixes the errors without prompting.

/ALL: Perform all checks.

17.3. Defrag

When a file is stored in different fragments in different clusters randomly across the disk is called fragmentation. In this case read/write head reads the file across the disk in scattered clusters, which slows down the system speed. De-fragmentation is used to bring the scattered file fragments together and to store the

fragmented file in nearby clusters on the disk surface so that read/write head can read the information much more efficiently and quickly.

De-fragment increases the life of hard disk because read/write head moves less to get the data.

Syntax: DEFRAG [drive:] [switches]

/F – Sort files by specified order

N	By Name (alphabetic)	E	By Extension
D	By Date (earlier first)	S	By Size (Smaller first)

17.4. **PKZIP**

This is used to compress the files .It is done to save the space on the drive.

Syntax: PKZIP [Options] Zip File [Files…]

Zip File – New zip file to be created .

Files …. – Files you wish to compress .

Use options -r & -rp to re-curse subdirectories.

17.5. **PKUNZIP**

It is to restore the compressed files. Compressed files are not readable, so they are required to be uncompressed / restored in their original form, so that they can be read.

Syntax: PKUNZIP [Options] Zip File

Use –d –e options to restore

17.6. **SMARTDRV**

It installs and configures the SMART Drive disk caching utility. Disk cache is a part of the system's main memory (RAM), which is used by the cache software to store the frequently accessed information from the disk drive into the RAM.

Syntax: SMARTDRV [Size]

Demonstration

- Using different disk utilities.

Practical

- Using different disk utilities.

Exercise-17

Q.1 Write short notes

(i) Scandisk

(ii) Defrag

(iii) PKZIP

CHAPTER 18

COMMON FAULTS OF HDD

18.1. **Problem -** Invalid disk media.

Cause – HDD is not formatted for the current operating system.

Solution – Format the disk with the current operating system.

18.2. **Problem** – Invalid partition table.

Cause – Partition or MBR is affected by the virus.

Solution –To correct, use FDISK/MBR .

18.3. **Problem** – No display on the monitor after connecting the HDD.

Cause – HDD data cable is connected in the opposite way.

Solution –Connect the HDD data cable in correct way .

Note: Problems covered under CHAPTER-6 (Common Faults of FDD) are also applicable for HDD.

Demonstration

a) Different faults of HDD.

b) Correcting different faults of HDD.

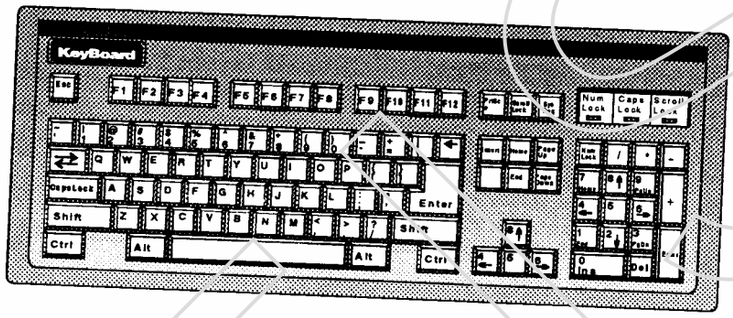
Practical

a) Correcting different faults of HDD.

CHAPTER 19
KEY BOARD

19.1. Key Board

Keyboard is one of the most popular input device used in the field of computer. It is based on the specification given by DIN *(Germany's Deutsche Industries Norm, a committee that sets German standards)*. The keyboards are available in 83, 84, 101, 102, 108 and 110 keys.



19.2. Keyboard Switches

The main component of any keyboard is the key switch. Different technologies are being used to make these switches. A few of them are as follows:

(i) Capacitive Switch

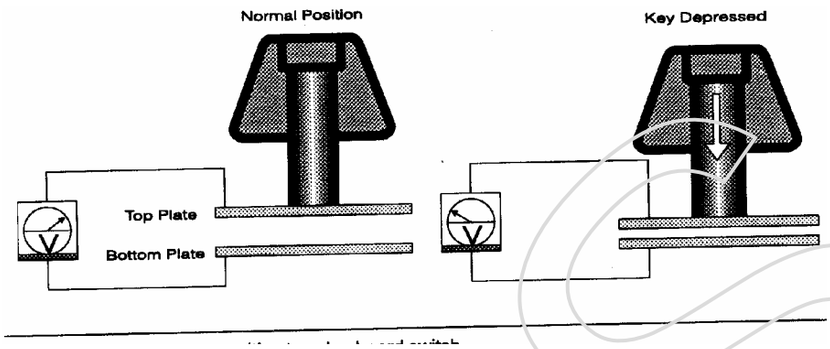
(ii) Hall Effect Switch

(iii) Opto-electronic Switch

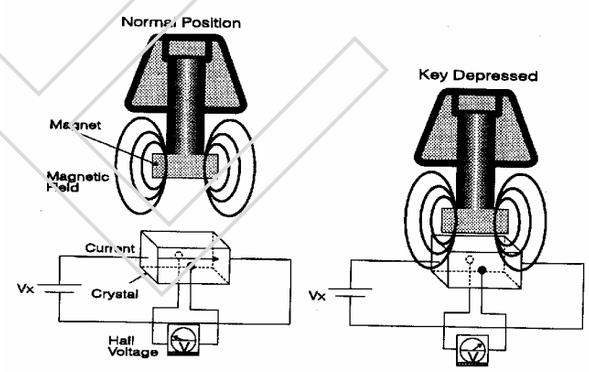
(iv) Membrane Switch

(v) Mechanical Switch

- Capacitive Key Switches: In this type of switches two plates of the capacitor are brought closer when the key is pressed. When the plates are brought closer or moved away the capacitance of the switch is changed and the sense amplifier detects this change. The change in voltage is converted into the proper logic signals.



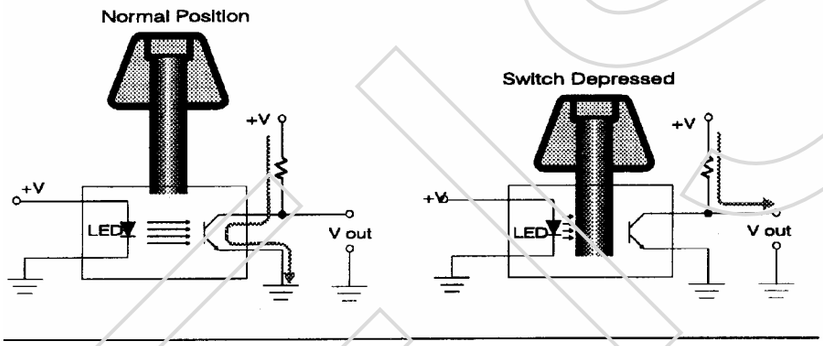
- Hall Effect Switches: In these switches when a magnetic field is applied to any device perpendicular to the direction of the current flow, the resistance of the device increases and when this magnetic field is removed, the resistance decreases. Hence the change in current flow takes place. Such switches have a normal life span of about 100 million strokes.



This effect can be used as a switch to turn on and off. Applying a very strong magnetic field to completely block the current flow through the device can turn off the current flow. As this type of switch does not contain any mechanical contacts, it is more reliable than the ordinary

mechanical switches and the switch will not deteriorate with the use, also the contamination of the contact will not have any effect on the working of the switch

- Opto-Electronic Switches: These are based on the optical and the electronic technology. This type of switches has a LED, which generates light when proper electric power is applied. Opposite to the LED, a phototransistor is used. The property of the phototransistor is such that it allows the current flow in the circuit, as long as light is applied to it. When the light falling on the phototransistor is removed, it will no longer allow the current to pass through it.



In this type of switch when the key is not pressed, the light from LED falls onto the phototransistor. This makes the current to flow through the phototransistor and produces a very low voltage at the output.

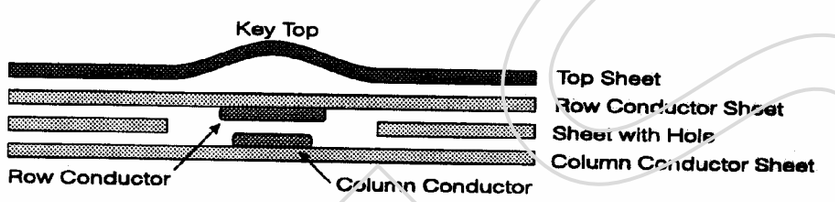
When the key is pressed, the light emitted from the LED is blocked, this will stop the current flow through the phototransistor and forces the phototransistor to cut-off condition. In this condition the current cannot flow through the phototransistor and a different value will be produced at the output.

The keyboard circuit interprets these two values as two different logical conditions, key being open and key being close.

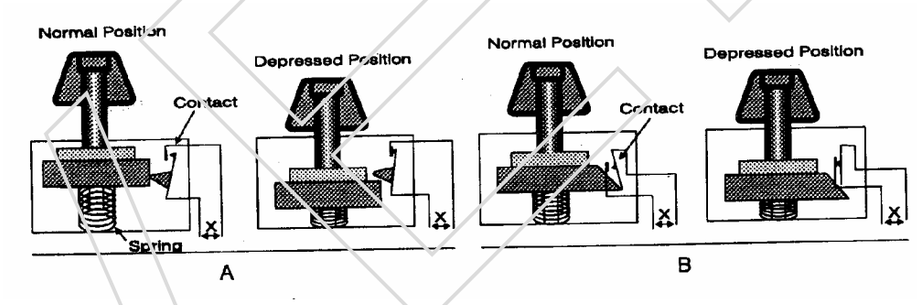
- Membrane Switch: A membrane keyboard is not a combination of separate switches.

In this keyboard, two rubber or plastic sheets are used as Row conductor sheet and Column conductor sheet. The row and column sheets are separated by another sheet with holes at the key positions. When the key is pressed, it forces the Row conductor sheet through the hole to touch the Column conductor sheet.

When the row conductor lines touches the column conductor lines, the key contact is made. The keyboard controller interprets this contact. These are most commonly used key switches.



- Mechanical Switches: In this type of switches, two metal plates are kept in open position and are moved closer when the switch is pressed. These switches are spring loaded. When key is pressed contact is made.



19.3. **Key Board Organisation and Working**

The key switches are arranged in a matrix of Rows and Columns. In this method, each key switch has a corresponding row and column number associated to it.

When the switch is closed, the row and column sensor senses the row and column value of the switch being pressed and interprets the information when a particular key is pressed.

a) Scanning

The process of finding out which key has been pressed after reading the row and column values is called “keyboard scanning”.

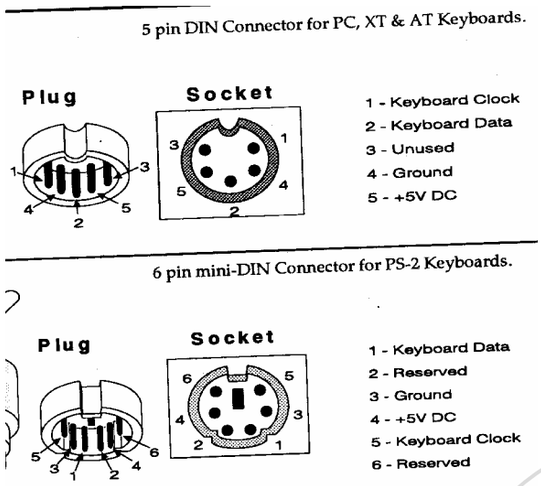
b) Encoding

When a key is pressed, the keyboard sends scan code of that particular key to the processor. The processor converts this scan code into the ASCII code. The keyboard sends about 88 scan codes from 1 to 88 for the 101/102 Enhanced AT keyboard. The keyboard sends different scan codes for pressing and depressing of the key.

19.4. **Interfacing**

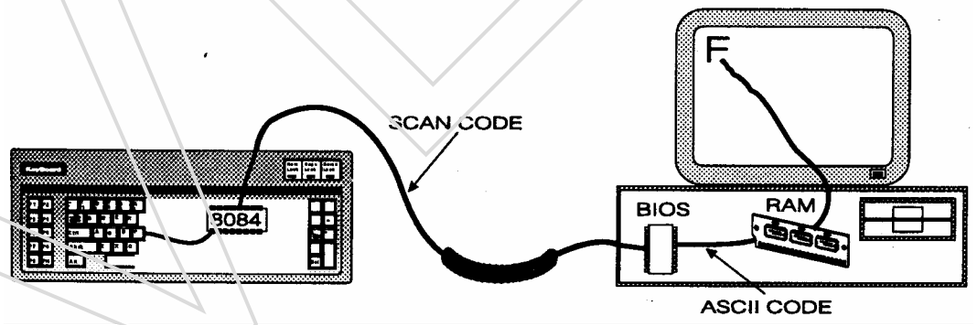
Keyboard interfacing is the method used to connect a keyboard to the main computer system. Interfacing is of two types--hardware and software interfacing.

(a) Hardware Interfacing: Keyboard is connected to the motherboard using a cable through a 5-pin DIN connector (PC, PC-XT and PC-AT key boards) or 6-pin DIN connector (PS/2 key boards) and SDL (Shielded Data Link) connector (IBM’s Advanced key board).



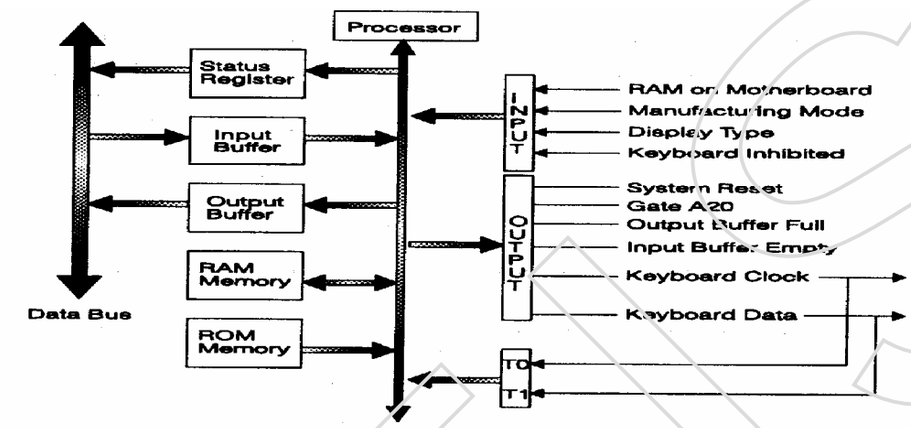
(b) Software Interfacing: When a key is pressed, the keyboard controller (microprocessor on keyboard) Intel 8048 generates the scan code for that particular key. The scan code is stored into the buffer memory available inside the keyboard and is made available at the keyboard port so that the BIOS can read it. After that these scan codes gets converted into proper ASCII format and stored into the computer's main memory (RAM), from where it can be displayed on the monitor with the help of CGROM (Character Generator ROM).

The scan code is sent in the serial format with one start bit, eight data bits, one odd parity bit and one stop bit, thus making a total 11 bit format.



19.5. **Key Board Controller**

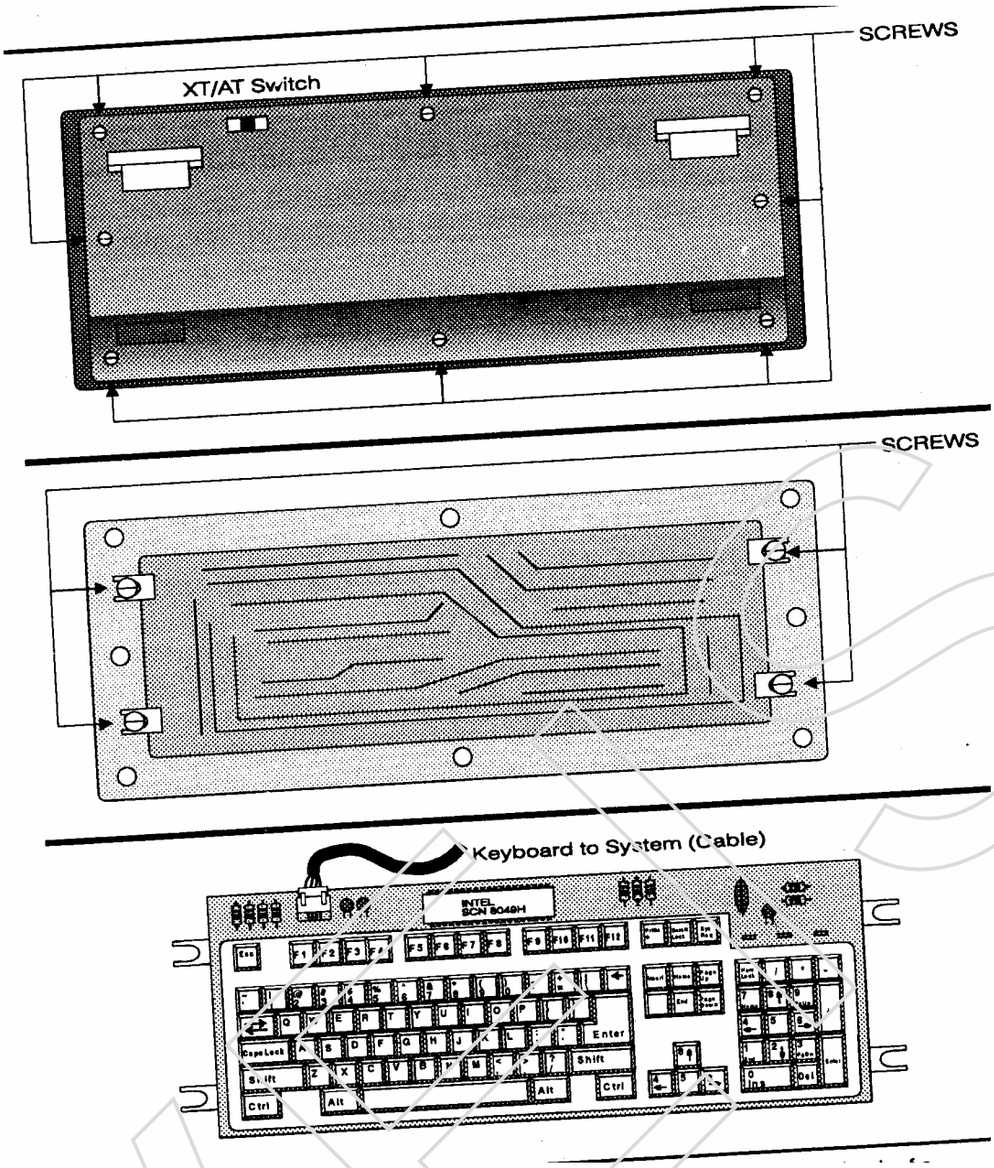
Keyboard controller is a single chip microprocessor such as Intel 8042, 8048 etc. These chips contain processor, RAM and ROM memory inside a single chip. The ROM of this chip is programmed to control different operations of the keyboard. The controller communicates with the main processor using a status register, an output buffer and an input buffer. These are connected to the main system through the system data bus.



19.6. **Trouble Shooting**

If keyboard is not working properly or inoperative then at first check the keyboard cable for continuity. Open the keyboard, remove the cable by de-soldering and using a multi-meter test each wire for continuity and cross connection. Normally, this problem happens due to continuous bending/turning of the cable near to the soldered points. You can cut the bended cable portion and then try for continuity test. If still continuity is not there, then replace the cable.

Opening of the keyboard has been shown in the figure-



19.7. **Common Faults**

(i) Non -operation of keyboard.

(ii) Wrong characters are displayed.

(iii) Some keys work and some do not work.

(iv) Each key pressed produces two or more letters.

(v) Intermittent problem or non-operation of some keys.

(vi) Broken or sticking keys.

19.8. **Fault Rectification**

i) Check keyboard cable, plugs and sockets. Remove and reinsert all the cables.

ii) Check the keyboard socket connection on the motherboard.

iii) Check the keyboard connector at the back of the computer to make sure that it is properly plugged in.

iv) Check for possible stuck keys on the keyboard.

v) Check keyboard itself by substituting it with a working keyboard. If the new keyboard works properly, it means the original keyboard is unserviceable.

vi) Try the original keyboard on a different computer, if it doesn't work properly, the keyboard is faulty and needs to be replaced .If it works, then there is some problem with the original computer system.

vii) Check system software, keyboard driver etc. and remove unnecessary TSRs (memory resident programs).

viii) Check if the problem is related to some particular software by using a different software

ix) Clean the keyboard.

x) Clean or replace key switches.

xi) Replace keyboard.

Demonstration

a) Opening of keyboard.

b) Setting of keyboard components.

c) Showing different parts of a keyboard.

d) Fault rectification.

Practical

a) Opening of keyboard.

b) Setting of keyboard components.

c) Fault rectification.

Exercise-19

Q.1 Fill in the blanks

(i) The most common type of keyboard switches being used now a day is _____. (Membrane switches)

(ii) Electronic components used by opto-electronic switches are _____ and _____ (LED, phototransistor)

(iii) The row and column conductor sheet are used in _____ switches. (membrane)

(iv) Keyboard interfacing is _____ a keyboard to the computer. (the method used to connect)

(v) Common types of connector used in keyboard are _____. (5-pin DIN connectors and 6-pin PS/2 connectors)

(vi) The scan code is generated by the _____. (keyboard controller)

(vii) 6-pin connector is used in _____ keyboards. (IBM's PS/2)

Q.2 Write short notes:

(i) Membrane switches.

(ii) Scanning and encoding.

(iii) Working of keyboard

CHAPTER 20

MOUSE

20.1. Mouse

Mouse is an input device, which has gained more popularity over the keyboard in the recent past. At first, Apple computers made the mouse as a standard feature in their Macintosh operating system.

20.2. Types of Mouse

Based on the technology used to detect the mouse movement, mouse can be divided into the following categories:

(i) Mechanical

(ii) Opto-mechanical

(iii) Optical

Based on the method used to interface or to connect the mouse to the main computer system, mouse can be divided into the following categories:

(i) Serial - Connected at COM port.

(ii) Bus – By adding separate Expansion card.

(iii) Proprietary / Mouse port – On PS/2 port.

Mouse can also be divided on the basis of number of buttons these are as follows:

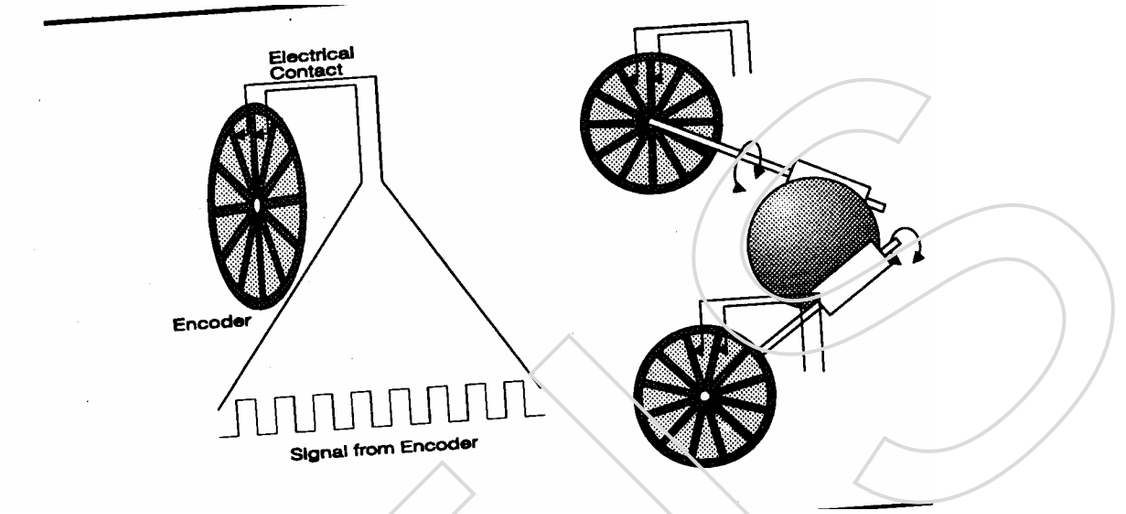
(i) Single button mouse

(ii) Double button mouse

(iii) Three button mouse

20.3. **Mechanical Mouse**

It works by the mechanical action of its different parts. When the mouse is rolled across a flat surface, different rollers inside the mouse move and generate electric signals. These signals are given to the computer & the computer converts them into the proper action on the screen.



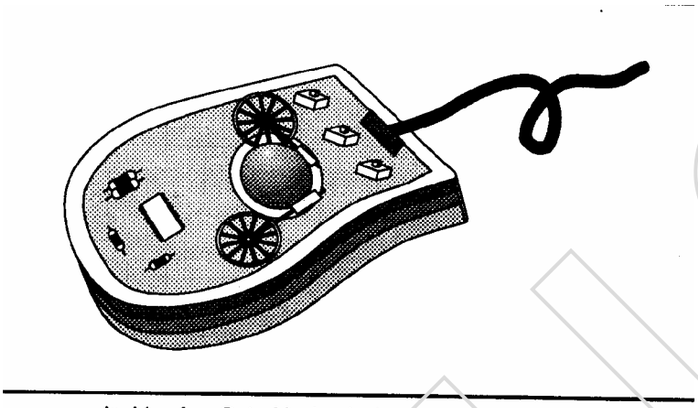
PROCESS

- *As the mechanical mouse is moved across a flat surface, a ball (made of rubber or rubber covering over a steel ball) touching the surface starts rotating in the direction of the movement.*
- *As the ball rotates, it touches and turns two rollers touching the ball inside the mouse. These rollers are mounted at a 90-degree angle to each other. One roller in used for the back and forth movement of the mouse & other for sideways movements.*
- *Each roller is attached to an encoder, which is a wheel like structure. As the rollers turns, these encoders rotate with them. Two pairs of contact bars touch the small contact points provided on the rims of each of these encoders.*
- *When a contact bar touches a point, an electrical signal is generated. The number of these signals indicates how many points the contact bars have touched. As the mouse in moved farther away, more signals are generated.*
- *The direction in which the mouse is moving can be found out by finding the number of signals from these two vertical and horizontal rollers.*
- *The signals generated by these rollers are sent serially to the PC. The mouse driver software converts these signals into the distance direction, and speed to move the screen cursor.*

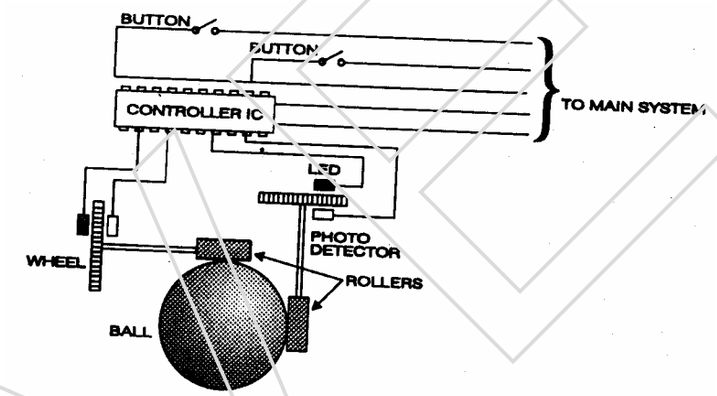
- *Also pressing of any of the mouse button sends a signal to the PC. Based on which button is pressed, how many times you have pressed and position of cursor at that time the mouse driver software performs the task, which you want to accomplish.*

20.4. **Opto-Mechanical Mouse**

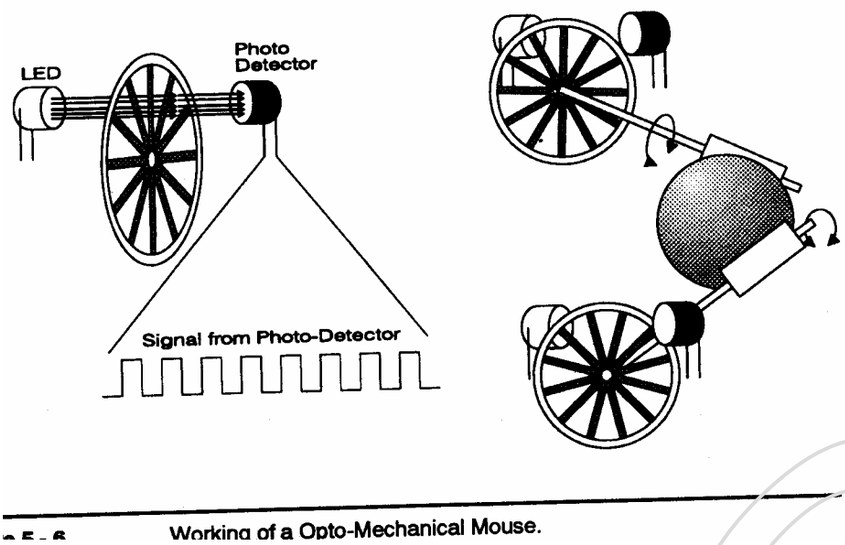
Basic construction of this mouse is same as mechanical mouse. In mechanical mouse, decoder is used whereas in this LED and photo detectors are used to sense the distance traveled by the mouse.



Inside of an Opto-Mechanical mouse.



Internal diagram of an Opto-Mechanical Mouse.



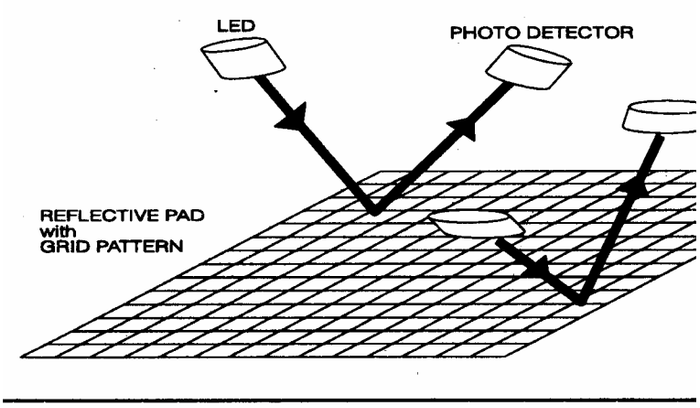
Working of a Opto-Mechanical Mouse.

PROCESS:

- *There are small opening on the rim of each wheel. As the wheel rotates, a pair of LED and photo detectors detects the number of openings passed between them. Each opening on the wheel allows the light from the LED to fall on the photo detector and generates an electrical signal.*
- *The number of signals generated indicates the number of openings in the rim of wheel passed. When more number of signals are passed, means mouse has traveled more distance.*

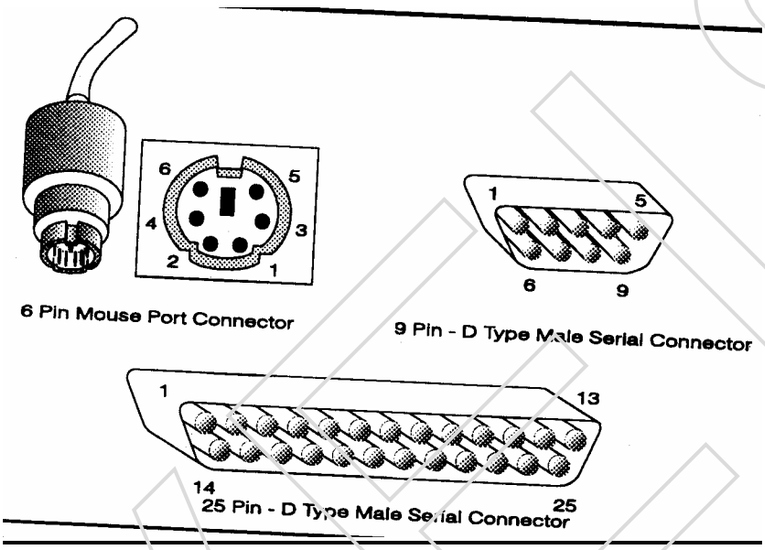
20.5. **Optical Mouse**

In this type of mouse, instead of ball and rollers, a light source and photo detectors are used with a special mouse pad. When the optical mouse is moved on the special pad, light from the light source gets reflected from the pad and special photo detectors inside the mouse detect the horizontal and vertical movement based on the reflected light received.



ure 5 - 7 Working of an Optical Mouse

20.6. **Different Types of Mouse Connectors**



20.7. **Connecting a Mouse**

A mouse can be connected to the system at any of the following:

(i) Serial –Port (COM1 and COM2)

(ii) A bus connection by adding adapter

(iii) Mouse Port (PS/2)

(iv) Wireless

A serial port is the most common method of connecting a mouse. One end of the mouse cord has a serial connector that can be simply plugged into an available port (COM1 or COM2).
In bus connection a special adapter(expansion card) is used to connect a mouse.
Computers equipped with special mouse port for connecting the mouse. This is similar to bus mouse except that the mouse control circuitry is directly built into the motherboard of PC

20.8. **Interfacing Mouse**.

To interface (Logical connection) a mouse with the computer, install a device driver. *(A driver is a program or software that helps the computer and device to communicate with each other.)* Device driver receives signals from the mouse and displays mouse pointer on the screen at a proper place and translates the pressing of mouse buttons into proper action.

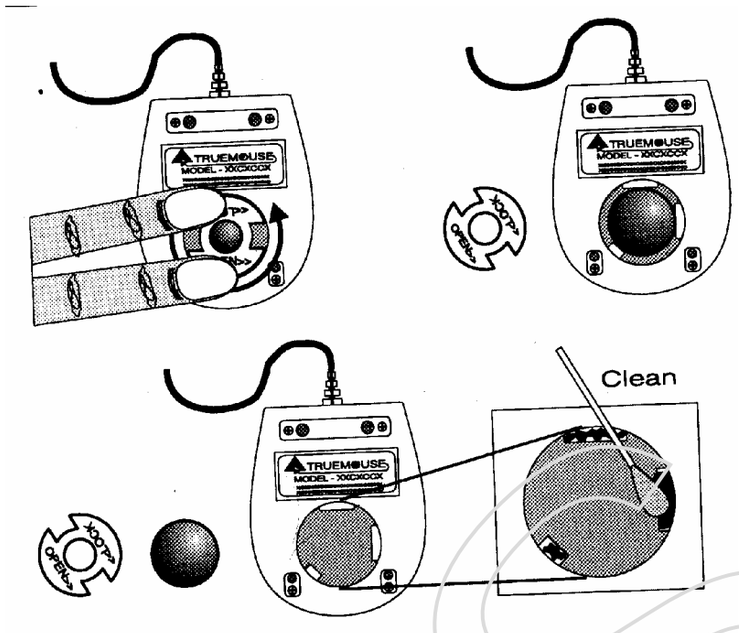
If MOUSE.SYS and MOUSE.COM files are provided with the mouse driver*(software)*, then add

DEVICE =C:\MOUSE \MOUSE.SYS line in the CONFIG.SYS file and add **C:\MOUSE\MOUSE.COM** line in the AUTOEXEC.BAT file, where mouse is the directory name.

20.9. **Cleaning the Mouse**

A mouse needs to be cleaned periodically to get a trouble free service. This is required because when the ball rolls over a mouse pad or some other surface, it picks up dirt from the desk. Slowly this dirt gets parked onto the ball and the rollers inside the mouse and thus jams them to some extent .As a result mouse starts behaving in an erratically manner or does not respond at all.

To clean the mouse, open the mouse in the way as shown in the figure-



Now take out the rubber ball and clean it with the lukewarm water and mild detergent and dry with a lint free cloth. Make sure that the surface is not scratched. Clean the rollers with the cotton bud using alcohol. Clean inside of the case for dust. After cleaning put the ball and the rollers in their position and close the mouse.

20.10. **Trouble Shooting**

If you experience problems with the mouse, the problem could be because of the mouse driver software, the application software you are using, cables or the main system itself. So use following trouble shooting techniques:

(i). Make sure that the mouse cable is correctly connected to its port .

(ii). Turn your PC's power off and switch it ON again and see if the error disappears.

(iii). If you have a second mouse of same type available, connect the new mouse. See that if the error disappears after switching ON the power to the PC.

(iv). Try the mouse on some other system where a mouse of the same type is working without any trouble.

(v). Some software programs do not support a mouse. Try mouse with a program, such as windows or mouse test (received with the mouse), that is known to support the mouse.

(vi). Make sure that the mouse device driver is in use and it is correct one and is setup correctly.

(vii). Try to update the mouse device driver.

(viii). Try to use second serial port.

20.11. **Common Faults and Remedy**

Most of the problems related with the mouse or any other input device are due to improper connections, incorrect or incorrectly installed device drivers or could also be due to bad hardware. Whenever you come across a problem with the mouse, first of all check all the cable connections. Some common faults and their remedial actions have been discussed below:

Problem 1: The mouse plugged in the system is not working.

Solution: Open the mouse and desolder the cable connections from the inside. Check for continuity/shorting of the cable. Chances are there that due to bending of cable inside the mouse, any of the wire might have broken.

Problem 2: On booting the system, a massage " Mouse not found" is given, even though the mouse is connected to the system.

Solution: This problem could be due to loose cable connection at the back of the PC. Check the connection, reboot the PC and see if the mouse works.

If not, then try plugging the mouse in another serial port.

If the mouse is not working on the second port also, try another mouse of the same type, which is working properly in the other system to see if it works.

Some times, this problem could also be due the malfunctioning of the motherboard. Check the motherboard and I/O ports.

Problem 3: The mouse has been functioning normally for quite some time but suddenly it has stopped working.

Solution: Remedial action for this is same as for the above problem.

Problem 4: The mouse works with some software but not with others.

Solution: Many software programs require that you configure then or reinstall them to take advantage of a mouse. Consult the documentation of the program to find the steps necessary to make the program work with your mouse.

Problem 5: The mouse works in only one direction, up -down or left –right.

Solution: This problem could be due to wrong setup or could be due to one set of rollers or sensors not working properly. If the problem is software related, then try the mouse with some other software or on some other machine .If the problem is hardware related then clean the mouse properly.

Problem 6: Mouse stopped responding to its buttons.

Solution: Replace the buttons with the new ones.

Problem 7: Mouse movement seems bumpy, irregular, and uneven.

Solution: This problem is most likely due to the accumulation of dust inside the mouse, on mouse ball and rollers. Clean the mouse properly as explained earlier.

This could also be due to the wrong setup of the mouse driver software. Check the mouse configuration and different settings such as vertical speed, horizontal speed, acceleration, mouse type etc. settings.

Demonstration

(i) Opening of mouse.

(ii) Demonstrating different parts of mouse.

(iii) Setting of rollers.

(iv) Cleaning of rollers, rubber ball and sensors.

(v) Fault Rectification.

Practical

a) Opening of a mouse.

b) Setting of rollers.

c) Cleaning of rollers, rubber ball & sensors.

d) Fault rectification.

Exercise-20

Q.1 Fill in the blanks

(i) Mouse was introduced in _____ type of computers.(Macintosh)

(ii) Special mouse pad is used for _____ mouse. (optical)

(iii) To load the driver for a mouse using DOS operating system the entries are made in _____ and _____ files. (autoexec.bat, config.sys)

(iv) Optical mouse uses _____ and _____. (LEDs, photo detectors)

Q.2 Write short notes

(i) Opto-mechanical mouse

(ii) Optical mouse

(iii) Methods of connecting mouse

CHAPTER 21

SMPS

21.1. SMPS (Switch Mode Power Supply)

Power supply unit provides necessary power to the computer system. This unit also provides protection to the other units by cutting off the power supply in case of an overloading.

21.2. Lay Out of SMPS

The external layout of power supply (SMPS) contains the following:

(i) Main power connector

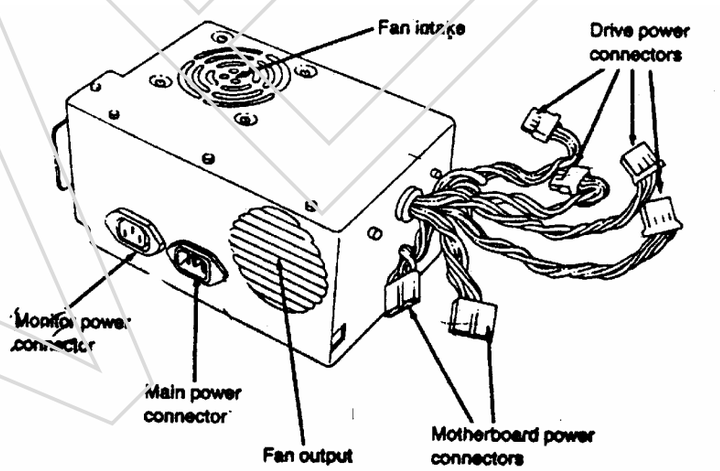
(ii) Monitor power connector

(iii) Fan intake

(iv) Fan outlet

(v) Drive power connectors

(vi) Motherboard power connectors



Drive Power Connectors: The power connectors for hard disk drive (HDD) and floppy disk drive (FDD) have 4 wires in each connector. The wires are used for +12Volt, +5 volt and ground supply.

Motherboard Power Connectors: There are two connectors of six wire each which are used for motherboard power supply having +12 volts, -5 volts, +5 volts, -12 volts, +5 volts Power Good and ground. While making connections of motherboard you should make sure that ground of 6-wire connector should be matched with the ground of the other 6-wire connector (should lie side by side).

21.3. Colours of Wires and Their Power Supply

+ 5 Volts - Red

- 5 Volts - White

+12 Volts - Yellow

-12 Volts - Blue

Ground - Black

Power Good (+5 Volts) -Orange

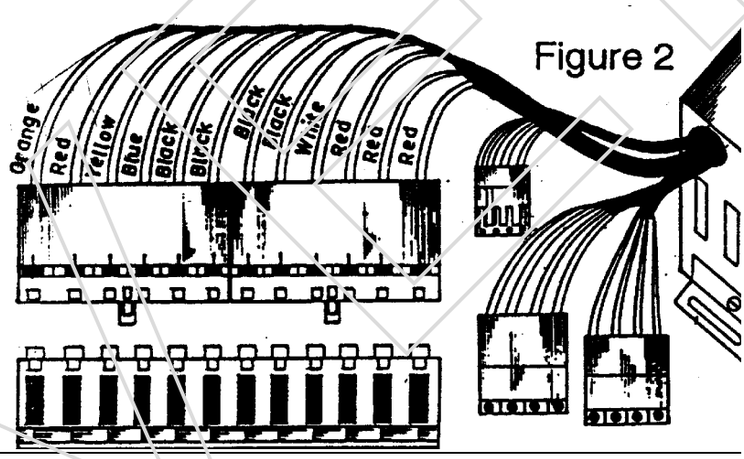


Figure 2

21.4. Computers and Their Power Supply

a) PC – 65 Watt

b) PC/XT - 120 watt

c)	PC/AT (286)	-	150 Watt
d)	PC 386	-	200 watt
e)	PC/AT 486 & above	-	250 watt

21.5. **Principle of SMPS**

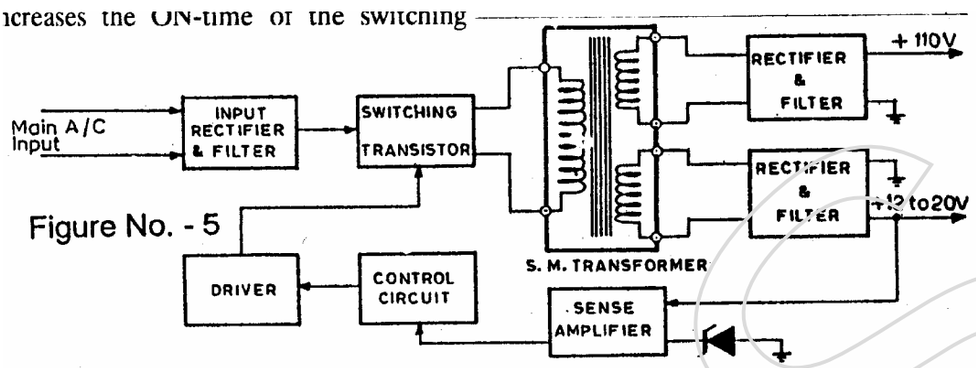


Figure No. - 5

The output of the power supply unit depends on the input. If this AC input is made constant, the output will also be constant. SMPS works exactly on this principle. First the AC is converted into DC, which is filtered by using capacitor to produce the smooth DC. This DC supply is fed to the switching transistor, which is made ON/OFF with the help of control circuit. This control circuit produces high frequency (15 to 20 KHz) square wave pulses. These pulses are given to the base of the transistor. By this the transistor is made ON/OFF and the given O/P DC is also made ON and OFF at the same frequency and gives output in the square wave pulses which are supplied to the primary winding of a small transformer and the output of its secondary winding is rectified and then filtered.

In this, in addition to the main DC supply, a low voltage DC is also obtained according to the requirement.

To regulate the output voltages, a part of power supply is supplied to the sense amplifier. This amplifier compares this voltage with the reference voltage, which produces an error voltage. This error voltage is supplied to the control circuit,

which controls the ON time of the switching transistor according to the error voltage. This way the output voltage is regulated.

If at any time the output voltage is increased, the produced error voltage reduces the ON time of the switching transistor and if the output voltage decreases the produced error voltage, increases the ON time of the switching transistor. In both these conditions the output supply is regulated.

Note: All the power supplies have a protection fuse.

21.6. **Trouble Shooting**

a) Problem: No power supply to the computer.

Solution: (i) Check AC line voltage.

(ii) Check the protection fuse of SMPS.

(iii) Check power supply to the connectors of SMPS.

b) Problem: System stops working after running for some time.

Solution: (i) Check working of SMPS fan.

(ii) Check wattage of SMPS.

c) Problem: System restarts automatically.

Solution: (i) Check SMPS wattage.

(ii) Constant Voltage Transformer (CVT) may not be controlling the ups and down of AC input.

Demonstration

a) Different parts of SMPS.

b) Different power connectors of SMPS.

c) Checking different O/P voltages.

d) Connecting different P/Ss from SMPS to the different devices.

e) Fitting and taking out SMPS from the cabinet.

f) Fault rectification.

Practical

a) Checking different O/P voltages.

b) Connecting different P/Ss from SMPS to the different devices.

c) Fitting and taking out SMPS from the cabinet.

d) Fault rectification.

Exercise-21

Q.1 Fill in the blanks

(i) SMPS stands for _____. (Switching Mode Power Supply)

(ii) Power good signal is carried by _____ wire. (orange)

(iii) Red wire carries _____. (+5V)

Q.2 Write short notes

(i) SMPS

(ii) Different connectors of SMPS

(iii) Colours of wires and their power supply

(iv) Principle of SMPS

CHAPTER 22
DISPLAY ADAPTERS

22.1. Display Adapter

Display adapter is an interface between the motherboard and the monitor. It is a display controller, which controls the quality of display on the screen i.e. colour and resolution. A display card has Character Generator ROM (CG-ROM) to store the dot pattern for all the characters. Display on the screen depends on the display adapter and the monitor used.

22.2. Resolution

Resolution is the number of pixels on the screen.

22.3. Pixel

It is defined as the smallest dot on a display screen.

22.4. Basic Principle of Display Adapter

The basic CRT controller principle is employed in all the display adapters. The CRT controller has video buffer memory, which is used to store the data from the CPU. The CRT controller reads the data from the video buffer and generates the appropriate address signals for the Character Generator ROM, which gives the dot patterns equivalent to the data stored in the ROM. These are processed by the video process logic and are sent to the CRT along with the synchronization signals.

22.5. Classification of Display Adapters

Display cards are classified according to the resolution and the number of colours they support.

TYPES OF DISPLAY CARDS AND THEIR RESOLUTION

SNo.	Card / Adapter	Resolution
1.	CGA	640 x 200
2.	MGA	720 x 348
3.	DFA	720 x 348
4.	EGA	640 x 350
5.	VGA	1024 x 768
6.	SVGA	1024 x 768

22.6. CGA (Colour Graphic Adapter)

- 9-Pin 'D' type female and one or two composite connectors. Composite connector has two pins, inner pin for 1.5 Volts composite video and outer for ground i.e. chassis.
- 6-pin berg connector (Single line connector) for light pen.
- No crystal present (Frequency takes from 8284 clock generator).
- IC-2300 4K CG-ROM present.

- 16K RAM in the form of eight 4116 or two 4416 ICs.
- IC 6845 as CRT controller.
- It is an 8-bit card.

22.7. **MGA (Monochrome Graphic Adapter)**

- 9-Pin ‘D’ type female connector only.
- 16.257 MHz crystal is present.
- IC 2301 4K CG-ROM present.
- 64K RAM in the form of eight 4164 or two 4464 ICs.
- 25-pin ‘D’ type female connector for printer.
- It is an 8-Bit card.

22.8. **DFA (Dual Frequency Adapter)**

- 9-Pin ‘D’ type female connector, 2-pin composite and 6-pin berg connectors.
- 16.257 MHz crystal.
- 8K internal CG-ROM and 28-pin socket for external CG-ROM is provided.
- 64K RAM in the form of two 4464 ICs.
- Jumpers are present for configuring display modes and printer port selection.
- It is an 8-Bit card.
- 25-pin ‘D’ type female connector for printer.

22.9. EGA (Enhanced Graphic Adapter)

- 9-Pin ‘D’ type female connector and composite connector.
- 24.872 MHz, 16.257 MHz or 27. 256 MHz crystals are present.
- 8K CG-ROM present.
- 256 K RAM in the form of 8-41256 or 8-4464 ICs.
- 26-pin ‘D’ type female connector (optional).
- It is an 8-Bit card.

22.10. VGA (Video Graphic Adapter)

- 15-Pin ‘D’ type female connector pins arranged in 3 columns.
- Crystals 14.318 MHz or 40 MHz is present.
- 16 K or 32K CG-ROM and separate controller ROM present.
- 512 K RAM in the form of 4-44256 ICs.
- Realtek, Trident, Prisma or any other makes SMD (Surface Mounted Device) is present.
- It is a 16-Bit card.

22.11. SVGA (Super Video Graphic Adapter)

- 15-Pin ‘D’ type female connector.
- 14.318 or 40 MHz crystal is present.
- 16 K or 32K CG-ROM and separate controller ROM.

- 1 MB RAM in the form of 8-44256 ICs.
- It is available in 16-bit and 32-bit.

Note: Now a day motherboards come with the built in Display Adapters.

Demonstration

a) Different types of display adapters.
b) Different components located on the display adapter.
c) Loading driver of the display adapter.
d) Installing display adapter in the I/O slot.
e) Making connection with the monitor.

Practical

a) Loading driver of the display adapter.
b) Installing display adapter in the I/O slot.
c) Making connection with the monitor.

Exercise-22

Q.1 Fill in the blanks

(i) Display adapter is an interface between the _____ and _____. (monitor, microprocessor)

(ii) VGA stands for _____. (Video Graphic Adapter)

(iii) Display adapters are classified according to the _____ and _____. (resolution, number of colours they support)

(iv) Number of pixels on the screen is called _____. (resolution)

CHAPTER 23

MONITOR

23.1. **Monitor**

Monitor is a popular output device. It displays the video information on the screen.

23.2. **Types of Monitors**

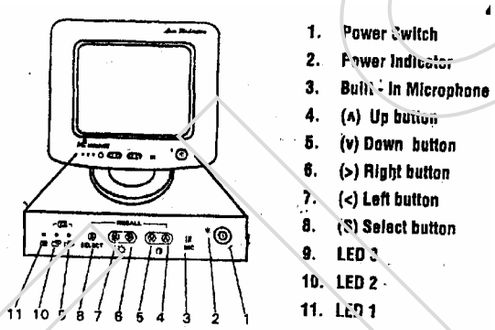
Monitors are classified on the basis of resolution and the number of colours they support.

TYPES OF MONITORS

Monitor Type	Resolution	Colours supported	Connector	Cards supported
RGB (Colour)	640 x 200	4	9-pin 'D' type	CGA, MGA, DFA, EGA
Monochrome TTL monitor	720 x 350	2	9-pin 'D' type	DFA, CGA, MDA
Composite	640 x 200	2	Composite	DFA, CGA
Dual frequency	640 x 200 720 x 350	2	9-pin 'D' type	MDA, CGA
EGA	640 x 350	16	9-pin 'D' type	EGA, CGA, MDA

VGA	640 x 480	256	15-pin 'D' type	VGA, SVGA
SVGA	1024 x 768	256	15-pin 'D' type	VGA & SVGA
Mono VGA	1024 x 768	2	15-pin 'D' type	--"--

23.3. **Front Panel Controls of Monitor**



1. Power Switch
2. Power Indicator
3. Built in Microphone
4. (^) UP Button
5. Down Button
6. (>) Right Button
7. (<) Left Button
8. (S) Select Button
9. LED 3
10. LED 2
11. LED 1

Following are the Front Panel Controls of a Monitor:

(i) Power Switch - This switch is used to switch ON/OFF power to the monitor. When it is pressed once, the monitor is switched on green LED lits up. When it is pressed again, the monitor is switched OFF and green LED is also switched OFF.

(ii) Power Indicator - This power indicator is switched ON when the power of the monitor is switched on.

(iii) Built in Microphone (MIC) - To connect built in microphone of the monitor, connect one end of the microphone cable at "Mike Output Jack" located at the back of the monitor and connect other end at the "Mike in Jack " on the sound card. (Note available at all the monitors)

(iv) UP, Down, Right, Left and Select Buttons -

- First press the select button to activate the select function.
- To change the function setting, press UP, Down, Left & Right button as per requirement.
- After adjusting one function, repeat the above procedure for the next function.
- After 5 second of making function adjustments, these settings are automatically saved.

23.4 **Adjustments and Programming of Different Controls**

Each LED represents different display adjustment. To adjust the settings of Brightness, Contrast, H- size, V-size, H-position, V-position, Pincushion, Trapezium and Rotation, Press the Select button and select the required control. The related LED of the selected control lits up.Now LED of Up, Down, Left and Right lits up. Using Up, Down, Left and Right buttons change the settings.

Different controls present on the monitor are as follows:

(i) Brightness - By this control brightness of full screen can be adjusted. After selecting Brightness control, by left and right buttons the brightness is adjusted.

(ii) Contrast - The difference between light and dark area is called contrast. By this control, picture contrast level can be adjusted. After selecting Contrast control, contrast is adjusted by Up & Down buttons.

Note: For Brightness & Contrast adjustments, all function LEDs should the switched OFF using Select button.

(iii) H-Size - By this horizontal size of display is adjusted.

(iv) V-Size - By this vertical size of display is adjusted.

Note: For making size adjustments, first switch ON the function LED-1 using Select button. After this using Left & Right buttons adjust the H-size (Display Width) and using Up & Down button the V-size (Display height).

(v) H-Position - By this horizontal position of the display is adjusted.

(vi) V-Position - By this vertical position of the display is adjusted.

Note: First switch ON the function LED-2 using Select button. After this adjust the H-Position (left/Right) using Left & Right buttons and adjust V-Position (Up / Down) using Up & Down buttons .

(vii) Pin Cushion - This control is used to adjust the internal rolling of the display in vertical direction.

(viii) Trapezoid - This control is used to correct the top and bottom trapezium distortion of the display. Note: First lit up the function LED-3 by using Select button, Then adjust the pincushion of display by left & right buttons and trapezium distortion by Up & Down Buttons.

(ix) Rotation (Tilt) - This control is used to correct the rotation of the display on the screen.

For this, first make the function LED-2 and 3 lit up by using Select button.

Note:

(a) LED-1, LED-2 and LED-3 are called function LEDs.

(b) Whenever any function button is pressed, the particular LED lits up to indicate the function selected.

(c) Whenever the adjustable range of a function button reaches to the minimum or the maximum limit, the function LED starts blinking.

(d) All settings / adjustments are saved automatically after 5 seconds.

(x) Recall (Pre-set) - This button is used to recall the factory settings of the controls instead of the present monitor settings being used.

For this, first switch off all the function LEDs by Select button. Then press Select and Up buttons together. By this, present display modes setting will change to the pre-set display modes setting. Pre-set modes are also known as Default modes.

By using Up, Down, Left, Right and Select buttons, different parameters of the display can be adjusted.

24.5 **Display Modes Memory**

It has a micro controller, which stores display settings and 17 display modes in its memory. This memory is divided into to areas one is for factory preset and other is for programmable settings. Factory preset area stores 10 display modes and the programmable setting area stores 07 display modes. Thus there are 17 display modes in all. This is an auto-scanning monitor, which can automatically synchronize the different video standards. It checks the display modes memory and adjust the suitable display mode.

24.6 **User Setting Area**

User setting area on the micro controller stores the user settings sequentially. When the number of settings exceeds the capacity of user area then on the basis of FIFO (First In First Out) principle. The last user setting will over lap first user setting. Whenever monitor is switched on the micro controller detects and displays the last mode stored in the user setting area.

23.7 **Sections of Digital Colour Monitor**

(i) Video Amplifier Section

(a) Contrast Control

(b) Video Mute

(c) Clamp Gate

(ii) Video Section

(a) Video Driver

(b) Video Output

(c) CRT

(iii) Blanking Section

(iv) Sync Amplifier Section

(a) Horizontal Sync

(b) Vertical Sync

(v) System Section

(a) Memory

(b) Standby

(c) Brightness

(d) Contrast

(e) Vertical Size

(f) Horizontal Size

(vi) Horizontal Section

(a) AFC (Automatic Frequency Controller)

(b) Horizontal Oscillator

(c) Horizontal Driver

(d) Horizontal Output

(e) EHT (Extra High Tension)

(f) Horizontal Yoke Coil

(vii) Vertical Section

(a) Vertical Amplifier

(b) Vertical Oscillator

(c) Vertical Driver

(d) Vertical Output

(e) Vertical Blanking Generator

(f) Vertical Yoke Coil

(viii) Power Supply Section

(a) Error Amplifier

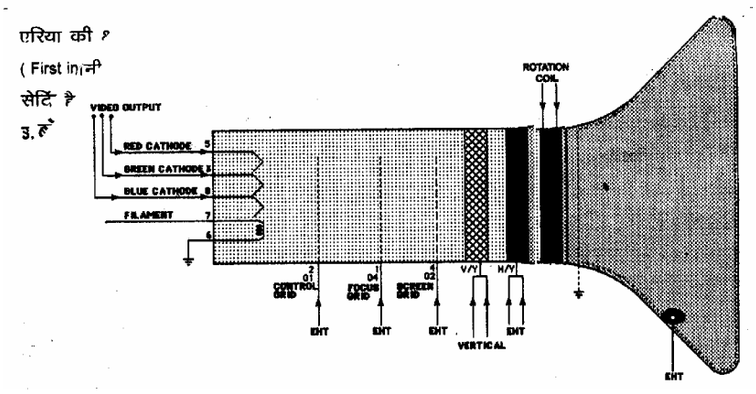
(b) Supply Oscillator

(c) Supply Driver

(d) Supply output

(e) SM (Switch Mode) Transformer

23.8 **CRT of Digital Colour Monitor**



This CRT has 09 pins, which have different signals on them, whose functions are as follows:

(i) Pin 1 – This pin has focus control grid signal. It controls the focus of the picture on the CRT. It is shown as G2. It is supplied with the boost voltage from the focus control of EHT.

(ii) Pin 2 – This pin contains the control grid signal, which is shown as G1. It is used to control the brilliance of the display for which both positive and negative supplies are applied through resistance and variable control (brightness control).

(iii) Pin 3 – This is the green cathode pin. which is shown as GK and supplied with a negative voltage through resistance or base green control. Green video signal is also applied to this pin by which picture in green colour is obtained on the screen.

(iv) Pin 4 – This pin contains screen focus control grid signal which is shown as G4. It controls the focus of the display screen for which boost voltage is supplied by the screen focus control of the EHT transformer.

(v) Pin 5 – This is the red cathode pin which is shown as RK and supplied with a negative voltage through resistance or base red control. Red video

signal is also applied to this pin to obtain the picture in red colour on the screen.

(vi) Pin 6 & 7 – These pins are for filament or heater, which are shown as F or H. These pins are supplied with a voltage of 6.5V to 18 V AC/DC, which is supplied from SMPS or EHT. In this monitor 6.5V is applied to the pin 7 from the SMPS and pin 6 is grounded.

(vii) Pin 8 – This is the blue cathode pin, which is shown as BK and is supplied with a negative voltage through resistance or blue base control. Blue video signal is also applied to this pin to obtain the picture in blue colour on the screen.

(viii) Pin 9 – This pin is not used and is grounded.

(ix) Final Anode – Final anode of CRT I supplied with an EHT of 18KV to 25KV DC. Some electronic material is filled within the CRT, which is charged and discharged with the application of high voltage. In this way CRT acts as a capacitor. For this reason only when the EHT plug is taken out from the final anode it is required to be discharged otherwise it is liable to give a severe electric shock.

23.9 Connectors at the Rear of Monitor

Following connectors are located at the back of the monitor:

(i) Power cable connector

(ii) 15 pins signal cable connector

(iii) Mike output Jack (not available on all monitors)

23.10 **Major Parts Inside the Monitor**

(i) CRT

(ii) Main PCB

(iii) Video output PCB – fitted at the back of CRT.

23.11 **Connecting the Monitor**

Monitor is connected to the system through a 15 pin connector located either on the display adapter or on the display adapter port (if the display adapter is built in within the motherboard). Power supply to the monitor is given from the SMPS through a 3 pin power connector.

Demonstration

(i) Different front panel controls of a digital colour monitor and their functions.

(ii) Different connectors located at the rear of the monitor.

(iii) Different major parts located inside the monitor

(iv) Connecting monitor with the system

Practical

(i) Different settings done by front panel controls.

(ii) Connecting monitor with the system

Exercise - 23

Q.1 Fill in the blanks

(i) Monitors are classified on the basis of _____ and _____. (resolution, colours they support)

(ii) Monitor connector has _____ pins. (15)

(iii) All settings/adjustments done by the front panel controls are saved automatically after _____ seconds. (5)

(iv) Total number of display modes is _____ in digital colour monitor. (17)

Q.2 Write short notes

(i) Different sections of digital colour monitor.

(ii) Display modes memory.

(iii) Front panel controls of monitor.

CHAPTER 24

CONFIG.SYS

24.1. Introduction

Config.Sys file is used to load the device drivers and the memory managers. Config.Sys and Autoexec.Bat files are called TSR (Transient and Stay Resident). There are various other entries also which are made in the Config.Sys file and they have been explained in the subsequent paragraphs.

24.2. Device

This is used to load the device drivers and the memory managers into the conventional memory.

Syntax: DEVICE=[Driver name]

Example: *DEVICE=C:\DOS\HIMEM.SYS*

24.3. Devicehigh

Loads a device driver into the upper memory block (UMB).

24.4. Files

It represents the maximum number of files that you expect to open at one time.

Syntax: FILE=[n] n = number e.g. 15

24.5. Buffers

When DOS reads the data from a disk; it stores the data in buffers. A buffer is a section of memory that is reserved for this purpose. Size of each buffer is equal to the size of the disk sector (512K). By default a system has 15 buffers. Buffers are placed in conventional memory but If DOS is loaded in the extended memory, then these can also be placed in the extended memory.

Syntax**:** BUFFERS=[n] n=number e.g. 40

24.6. **Set Comspec**

SET COMSPEC=C:\COMMAND.COM – When the transient portion is over written by some other program, then the resident portion of the Command.Com re-loads the transient portion afterwards. If the application program requires more memory, then the application program over writes the resident portion. In that case resident portion cannot re-load the transient portion. Thus computer display an error message “Insert system file or Insert bootable disk”. To avoid this error message include SET COMSPEC=C:\COMMAND.COM statement in the Config.Sys file.

24.7. ***Ansi.Sys***

It provides a set of functions for your monitor and keyboard. it is used to display colour and graphics.

Syntax: DEVICE=C:\DOS\ANSI.SYS

24.8. **Stacks**

The memory reserved to handle hardware functions is called a stack. STACKS command allocates stack memory.

Syntax: STACKS= number, size

e.g. stacks=12, 512 means 12 stacks of 512 bytes each.

Note: In DOS, the Config.Sys file plays an important role for loading device drivers and making other entries as stated above. But in Windows OSs, the Registry has replaced it.

Demonstration

a) Loading device drivers and memory managers.

b) Making different entries in Config.Sys.

Practical

a) Loading device drivers and memory managers.

b) Making different entries in Config.Sys.

Exercise-24

Q.1 Fill in the blanks

(i) Config.sys and Autoexec.bat files are called _____. (TSR)

(ii) TSR stands for _____. (Transient and Stay Resident)

(iii) Config.sys and Autoexec.bat files have been replaced by _____ in windows. (Registry)

(iv) Config.sys is used to load _____ and _____. (device drivers, memory managers)

(v) Devicehigh is used to load the _____. (drivers in UMB)

Q.2 Write short notes

(i) Config.sys

(ii) Device

CHAPTER 25
AUTOEXEC.BAT

25.1. Batch Files

Batch files are used for creating own programs. In a batch file, you can include sequence of MSDOS commands, so that they can be executed one by one without typing again and again. Any command that you can enter/type at the command prompt can be included in the batch file. Batch files are used to execute series of commands over and over. You can type the series of command in a file and save with extension BAT.

e.g. – Create a A.BAT file and type the following commands

DIR

TIME

In this example when you run A..BAT file, it will execute first DIR command and then the TIME command. You can stop the batch file by pressing ctrl+c or ctrl+break keys simultaneously.

25.2. Autoexec.Bat

Autoexec.Bat file is used to load the executable files of the device drivers being loaded in the Config.Sys, so that driver file can be made to run. It is also used to include DOS commands, so that they can be executed one by one without typing again and again. There are some batch commands also which can be included in this file. It also includes the commands required to be executed at the time of booting e.g. DOSKEY.

25.3. Batch Commands

CLS – Clears the screen and put the cursor in the top left corner.

REM – It is used for comments.

ECHO – ECHO command can turn ON and OFF.

PAUSE – Stops the process of the batch file until you press a key.

CALL – To start a batch program from another batch program e.g. CALL A.BAT

Note: In DOS, the Autoexec.Bat file plays an important role for loading device drivers and making other entries as stated above but in Windows 95 and above OS has been replaced by the Registry.

Demonstration

a) Making different entries in Autoexec.Bat.

Practical

a) Making different entries in Autoexec.Bat.

Exercise-25

Q.1 Fill in the blanks

(i) Autoexec.bat file includes _____ and _____. (commands required to be executed at the time of booting, executable files required for device drivers)

(ii) Path is permanently set by making entry in _____ file. (Autoexec.bat)

(iii) Entry of executable file required for the driver is made in the _____. (Autoexec.bat)

Q.2 Write short notes

(i) Batch file

(ii) Common batch commands

(iii) Autoexec.bat

CHAPTER 26

BOOT SEQUENCE

26.1. Bootimg

Switching on the system and loading the system files in RAM is called booting. It includes different steps as explained in the subsequent paragraphs.

26.2. Complete Boot Process

ON – Switching ON the Computer.

↓

POST (Power On Self Test) – After the machine is switched on, the power supply performs a self-check and once the output becomes stable, it sends a power good signal to the computer's motherboard and also checks the essential parts. Once POST is OK, it gives a beep.

↓

BIOS (Basic Input Output System) – As soon as the timer chip on the motherboard receives a power good signal, it stops sending the reset signal to the CPU. CPU starts executing the BIOS. BIOS checks the different peripherals connected to the computer like FDD, HDD, CD Drive etc. Then BIOS looks for the boot record at track 0, head 0, sector 1.

↓

Boot Sector Program – It checks for the IO.SYS and MSDOS.SYS system files. If these two files are not in the root directory then "Non-System disk or disk error, Replace and press any key when ready" error message is displayed. If these files are available then it checks IO.SYS first.

↓

IO.SYS – This is loaded into the main memory. It can communicate with the hardware.

↓

MSDOS.SYS – Next IO.SYS loads the MSDOS.SYS program into the main memory. MSDOS.SYS is a kernel (Supervisor) in between COMMAND.COM and IO.SYS.

↓

Config.sys – Then IO.SYS loads and reads the Config.Sys file and process it. If config.sys contains SHELL command then the command processor specified in the SHELL is loaded, otherwise COMMAND.COM is loaded. All the peripheral device drivers and memory managers are loaded in the Config.Sys file.

↓

COMMAND.COM – This is called shell. It contains internal commands and standard errors like Abort, Retry, Fails, Bad command or file name etc. Then it checks for AUTOEXEC.BAT. It is also known as Command Interpreter.

↓

Autoexec.Bat – This file includes any command or program required to be executed at the time of booting e.g. DOSKEY and executable files required for device drivers.

↓

C:\ or A:\- Finally prompt appears

Config.Sys and Autoexec.Bat are called TSR (Transient and Stay Resident).

26.3. **POST (Power On Self Test)**

POST is a software or set of programs inside the BIOS ROM chip on the computer's motherboard. This program tests all the main devices such as CPU, ROM, main memory (RAM), monitor, keyboard etc. at the of switching ON. During the testing, if POST encounters any problem, it stops the system and gives error message in the form of audio beeps and if there is no problem then it gives single beep and starts executing further.

26.4. **Command.Com**

The Command.Com file has three parts which are as follows:

(i) Resident portion (ii) Transient portion (iii) Initialization portion

Resident Portion: It contains all standard errors e.g. Abort, Retry, Fail etc. and also take care of re-loading the transient portion in case the transient portion is over written by some program.

Transient Portion: It contains all internal commands. It vacates the conventional memory in case a program requires more memory. It also knows how to interface with the external commands, that is why Command.Com is also known as Command Interpreter.

Initialisation Portion: This portion is used to initialize for getting the C:\> prompt. It also controls when and which program is to be loaded.

26.5. **Audio Error Code**

Sound Produced		Fault
1 Short beep	-	System OK

No beep	-	Power supply, motherboard.
Continuous beep	-	Power supply, motherboard.
Repeating short beeps	-	Power supply, motherboard.
2 short beeps	-	POST error code displayed.
1 long, 1 short beep	-	Mother board
1 long, 2 short beeps	-	Display adapter (MDA, CGA)
1 long, 3 short beeps	-	Display adapter (EGA)
3 long beeps	-	Keyboard

Demonstration

a) Steps of boot sequence.

Exercise-26

Q.1 Fill in the blanks

(i) POST stands for _____. (Power On Self Test)

(ii) BIOS stands for _____. (Basic Input Output System)

(iii) _____ file can communicate with the hardware. (IO.sys)

(iv) Device drivers and memory managers are loaded in _____. (Config.sys)

(v) _____ is known as command interpreter. (Command.com)

(vi) Resident portion contains _____. (all standard errors like Abort, Retry. Fail etc.)

(vii) Transient portion contains _____-. (internal commands)

(viii) Initialisation portion is used to _____-. (initialize to get C prpmpt)

Q.2 Write short notes

(i) POST

(ii) BIOS

(iii) Command.com

(iv) Parts of Command.com

(v) Resident portion

(vi) Command.com as command interpreter

Q.3 Explain complete boot sequence.

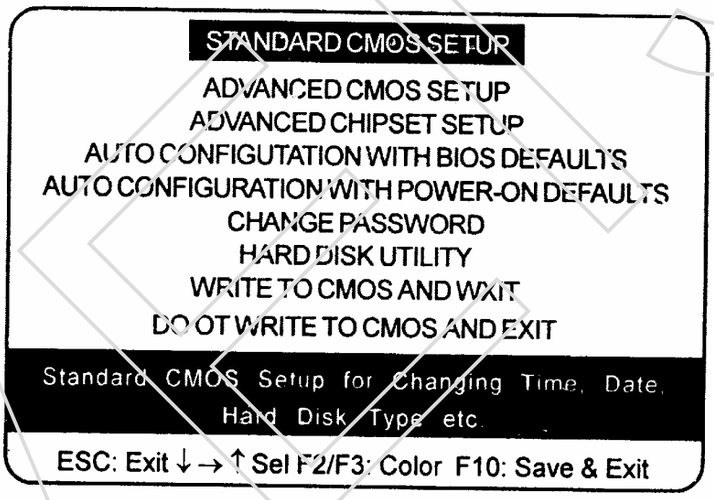
CHAPTER 27

CMOS SETUP

27.1. CMOS Setup

As the processor and the architecture of the system is changed, the BIOS programs are also changed by the manufacturers. Therefore, many types of BIOS are available, out of these some important points from all these BIOS will be discussing now.

As soon as the power to the PC-AT is switched on, the program stored in the ROM BIOS starts the system and a message appears on the monitor screen "Press DEL key to enter into CMOS SETUP". If the DEL key is pressed when prompted, the following screen will be displayed:



27.2. Standard CMOS Setup

This option may contain the following information:

1. Date and time

2. Type of hard disk
3. Type of floppy disk

Mode Settings for Hard Disk:

- Normal: For normal IDE disk drives with lower than 528MB storage capacity.
- Large: HDD above 528 MB capacity.
- LBA: HDD above 528 MB capacity and supporting zone bit recording.

27.3. **Advanced CMOS Setup**

It has the following options:

(i) Typematic Rate Programming: If this option is Disabled you can not make any changes in the default values stored for "Typematic Rate Delay" and "Typematic Rate"

(ii) Typematic Rate Delay (Microseconds): *The default value for this item is 250. This means that a delay period of 250 microseconds is necessary between pressing of two keys on the keyboard. You can choose any value between 250 to 1000 for this item.*

(iii) Typematic Rate (Characters/Sec): *The value stored for this item determines the number of times a character will be repeated on the screen when some key on the keyboard is pressed and hold down for a second. The default value for this item is 15. This means that the character represented by the key hold down on the keyboard will be repeated on the monitor screen at the rate of fifteen times every second. You can choose any value between 6 and 30 for this item.*

(iv) Above 1MB Memory Test: Every time when the system is switched on, the BIOS performs a memory test. The default setting of this item is Disabled.

In this way, only the initial 1MB locations are tested by the BIOS during the POST routine. But if this option is Enabled then the complete memory installed on the motherboard is tested.

(v) Memory Test Tick Sound: This option is used for generating ticking sound during the memory test. You can select the Disable value for this item to shut-off this sound during the memory test.

(vi) Memory Parity Error Check: When this option is Enabled then the BIOS routine will display the message RAM PARITY ERROR on the screen as soon as a parity error is detected during the memory test. If this option is Disabled then no message will be displayed.

(vii) Hit Del Message Display: If this option is Disabled then "Press Del" to enter setup will not be displayed on the screen during POST. *The message Hit Del to enter SETUP appears on the screen after the BIOS has performed the POST routine. If the Del Key is pressed during this time, the BIOS SETUP program is initiated and the values in the COMS SETUP may be altered.*

(viii) Wait for F1 if any error: BIOS Post runs system diagnostics tests that can generate an error message on the screen and display the message Press F1 to continue when this option is Enabled. If you do not want this option then Disable it.

(ix) System Boot Up Num Lock: This option determines whether the Num lock is turned on or off when the system is booted.

(x) System Boot Up Sequence: Keeps the sequence of booting. If you input value A:, C: then the BIOS will searches first A: drive for boot up files then C: drive, if boot up floppy is not available in A: drive.

(xi) System Boot Up CPU Speed: This option is used for selecting the CPU operating speed.

(xii) Password Checking Option: If it is Enabled then BIOS checks the password security.

27.4. Auto Configuration with BIOS Defaults

Loads BIOS setup default values from ROM.

27.5. Change Password

You can enter new password or change the password. Press Enter key to delete the password.

27.6. Additional Options

(i) Virus Warning: When this option is Enabled and when virus tries to modify the boot sector then “Boot sector is modified, Press Y or N” message is displayed.

(ii) External Cache: Enable or Disable the external cache memory.

(iii) Quick Power On Self Test: When enabled system boots up at a faster rate. This is because, POST skips some of the tests.

(iv) Swap Floppy Drive: When Disabled, the system identify the floppy drives as per the hardware installation i.e. as per the floppy drive interface cable. If we want that the drive paths for the floppy drives A and B should be interchanged to B to A then Enable the option.

(v) HDD Block Mode: Data is transferred between the hard disk and the DRAM memory either in block mode (as 8KB, 16KB, 32KB, 64KB etc.) or in normal mode (word by word). If the hard disk installed supports block mode then Enable it.

(vi) IDE Auto Detection: This automatically configures the hard disk parameters.

(vii) Power Management SETUP: If this feature is Enabled then you can make changes the in following:

(a) System Timeout: When the time period entered for this item runs out, the system will automatically slow down. This slow mode is referred as DOZE mode.

(b) Screen Sleep: When timer runs out; the display screen goes blank i.e. nothing is displayed on the screen.

Demonstration

a) Detecting different drives in the Standard CMOS Setup and making other settings.

b) Settings of Advanced CMOS Setup.

Practical

a) Detecting different drives in the Standard CMOS Setup and making other settings.

b) Settings of Advanced CMOS Setup.

Exercise-27

Q.1 Fill in the blanks

(i) Standard CMOS setup includes _____.

(ii) LBA stands for _____. (Logical Block Addressing)

(iii) Swap floppy drive is used to _____. (interchange FDDs A to B & B to A without changing physical connections)

Q.2 Write short notes

(i) CMOS setup

(ii) Mode settings for hard disk

(iii) ROM BIOS

(iv) Swap floppy drive

CHAPTER 28
CD ROM AND CD DRIVE

28.1. Optical Device

In an optical storage device, a LASER (Light Amplification by Stimulated Emission of Radiation) beam is used to read and write the data on the optical disk.

Advantages of LASER

(i) Laser emits light only on one frequency.

(ii) Light beam of laser can be focused with pinpoint accuracy onto microscopically small targets. This helps to store and read data in microscopic forms on an optical disk.

Data is stored on optical disk in the form of Lands (measuring 0.12 μm deep and about 0.6 μm wide) and Pits. Tracks are spiral and the density is 16,000 tracks per inch (tpi). The total length of the track on an optical disk is almost 5.8 kms and total number of pits is about two billion.

In a hard disk drive, the gap between the read/write head and the disk surface is about 35 to 100 micron (a micron is a millionth of a meter). Therefore a small dust particle can cause the head to crash. In optical recording, the laser beam does not come into contact with the disk surface, as only the light beam is focused on the recording surface, thus no chances of head crash.

28.2. CDROM (Compact Disk Read Only Memory)

CDROM is an optical device. It is WORM. WORM stands for Write Once and Read Many.

28.3. CD Drive

CD drive is the drive, which makes it possible to read the data from the CD. CD drives are available in the speeds of 1x, 2x, 4x, 6x, 8x, 12x, 16x, 24x, 32x, 36x, 48x, and 52x, where 1x is equal to 150 KBits/Sec.

28.4. **Connecting CD Drive**

Connect the CDROM drive at primary or secondary channel as Master or Slave. Change the jumper setting on the CDROM drive as per specifications given. CD drive is connected to the IDE interface through a 40-Pin data/control cable similar to the HDD. Power supply is given from the SMPS through a 4-Pin power connector. Jumper setting is done to make it Master or Slave at the back of the drive.

28.5. **CD Setup**

Peripheral comes with a software program, which is called a driver of the peripheral to interface with the hardware. The software has an EXE file for setup. Normally CDSETUP.EXE or SETUP.EXE or INSTALL.EXE comes with the CD driver.

When you run the setup file, setup will ask some questions. The questions are not standardized, they differ from CD make to CD make. It may ask to enter the interrupt and base address but normally it takes the default values. These depends upon the channel on which CD drive has been connected. These are as follows:

For Primary Channel: Base address is 1F0 and Interrupt is IRQ14

For Secondary Channel: Base address is 170 and interrupt is IRQ15

The setup will make changes in Config.Sys file as follows:

DEVICE = C:\PATH\SBIDE.SYS /V /D:MSCD001 /P:170, 15 /L:G

SBIDE.SYS is a driver file, which changes as per make of the drive.

/V is verbose, which displays the information.

/D: Device name and MSCD001 is a base address, same base address should be included in the Autoexec.Bat file.

/S sharing in networking

/L:G = By Force assigned G local drive letter.

Last drive = Z

The setup will include C:\PATH\MSCDEX.EXE /d:MSCD001 line in the Autoexec.Bat file. The driver /d:mscd001 should be same which is in the Config.Sys file.

CD drive will take the next drive letter automatically. If you want to mention then use option L e.g. /L:H, where H is the drive name, which is to be specified for the drive. In this case LASTDRIVE=Z should be mentioned in the Config.Sys, otherwise specified drive will not be accepted by the CD drive.

Then reboot the system to affect the changes.

28.6. **Accessing CD Drive in DOS Mode**

- Boot the system with bootable CD.
- A:/> prompt will appear.
- Copy CD driver file e.g. OAKCDROM.SYS and its executable file e.g. MSCDEX.EXE in C: drive.
- Add the following statement in the Config.Sys file

  Device = C:\OAKCDROM.SYS /D:MSCD001

  Last Drive = Z

- Add the following statement in the Autoexec.Bat file

  C:\MSCDEX.EXE /D:MSCD001

- Run the Autoexec.Bat file to affect the changes.
- CD drive will now automatically take the next available drive letter.

Demonstration

a) Different controls and connectors of CD drive.

b) CD ROM.

c) Connecting CD drive.

d) Jumper setting to make CD drive as Master or Slave.

e) Accessing CD drive in DOS mode.

Practical

a) Connecting CD drive.

b) Jumper setting to make CD drive as Master or Slave.

c) Accessing CD drive in DOS mode.

Exercise-28

Q.1 Fill in the blanks

(i) WORM stands for _____. (Write Once Read Many)
(ii) CD ROM is based on _____ technology. (optical)
(iii) Cd drive speed is given in multiples of X, where X is equal to _____. (150 kilo bits per second)
(iv) LASER stands for _____. (Light Amplification by Stimulated Emission of Radiations)
(v) CD drive is connected to the _____ interface on the motherboard. (IDE)
(vi) CD drive can be made master/slave by _____. (jumper setting)

Q.2 Write short notes

(i) CD ROM
(ii) Optical devices

Q.3 Explain how to access CD drive in DOS mode.

CHAPTER 29
MODEM

29.1. Modem

Each standard for transmission has a distance limitation e.g. RS232C has maximum distance limitation of 50 feet. The distance is relatively short or long for other standards, but there is a definite limit. To communicate between computers over greater distances the best mode is telephone lines. The telephone lines can only transmit analog signals whereas computer use digital signals, so a device called modem is used to communicate.

The term modem stands for modulator and demodulator. The modulator circuit in the modem converts binary data in to tones at the Tx end and at the Rx end of the transmission line, the demodulator circuit converts the tones back to the binary data. By this technique, a pair of modems can transfer digital information over long distances.

29.2. Working of Modem

The simple modem converts digital information into two tones. One common standard converts the RS232 signals into a high frequency tone (1270Hz) for logic 1 and a low frequency tone (1070Hz) for logic 0. These tones are then transmitted over the telephone line or any long serial line. Again, the demodulator portion of the modem converts received tones from the telephone line back to the RS232 signals.

A computer, which is connected to a modem, then the modem on the first system is connected to the modem on the second system by a telephone line. In this way, two computers can communicate even though they are separated by a long distance.

29.3. **Modulation and Demodulation**

Modulation is the process of converting digital signal into the analog signal.

Demodulation is the process of converting analog signal into the digital signal.

29.4. **Modulation Techniques used in Modem**

Modulation techniques used in Modem are as follows:

(i) Amplitude Modulation (AM)

(ii) Frequency Shift Keying (FSK),

(iii) Phase Shift Keying (PSK).

(i) Amplitude Modulation (AM)

Amplitude modulation changes the amplitude of the transmitted tone. In this turn the tone ON to represent a 1 and turn the tone OFF to represent a 0. *Amplitude modulation is used only for very low speed reverse channel transmission or in conjunction with some other type modulation such as phase modulation.*

(ii) Frequency Shift Keying (FSK)

FSK uses one tone to represent a 0 and another tone to represent a 1. In order to allow full duplex communication, four different frequencies are often used. For example, 250 Hz for a 0 and 2225 Hz for a 1 in one direction and 1070 Hz for a 0 and 1270Hz for a 1 in the other direction.

(iii) Phase Shift Keying (PSK)

The phase of a constant frequency is shifted by 180^0 to represent 1 and without phase shift represents 0.

29.5. **Standards in Modems**

There are a number of different standards for modem transmission so that one modem can communicate with another modem. Standards in use today come

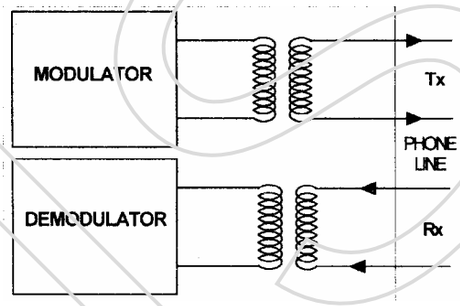
primarily from three sources. The modulation and coding standards are from CCITT (Committee Consultant International Telegraphing and Telephone) recommendations. The interface is either CCITT recommendation or EIA (Electric Industry Association) / TIA (Telecommunications Industry Association) standard.

29.6. **Types of Modems**

Modems have been classified into different categories based on the following:

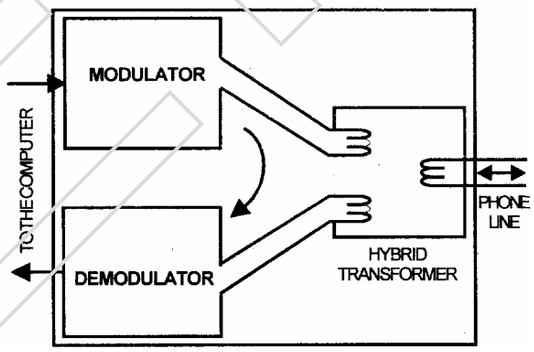
a) Number of Wires

(i) **4-Wire Modem**: It has two separate lines of two wires each, one line for transmission and other line for receiving the data. 4-wire modem supports full duplex transmission. 4-wire modem would be connected to the four telephone lines. It is used for dedicated or the leased lines only.



(ii) **2-Wire Modem**: In this two wires are used both for transmitting and receiving the data. 2-wire modems also support full duplex transmission.

In the 2-wire modem the output of the modulator is coupled to the telephone lines by the hybrid transformer, and the other end of the transformer is coupled to the input of the demodulator.



b) Modes of Transmission

Asynchronous Modem: These are low speed modems and operate in the asynchronous mode.

Synchronous Modem: In this transmitting and the receiving modems are synchronized.

c) Position of Connection

External Modem: These are connected with the computer externally through serial port.

Internal Modem: Internal modem comes as a peripheral card, which can be fitted into the I/O slot.

29.7. How Modem Communicates

To communicate, through modem, one modem dials a phone number and the other modem answers the phone. The modems then send signals to each other to establish a communication.

29.8. Connecting Modem

Modem is connected to the system through an interface cable which has a 25-Pin connector at one end and 9-Pin connector at the other end. 25-Pin connector is connected to the modem and the 9-Pin connector is connected towards the PC side to the serial port. Give the power supply of 7.5 V AC through an adaptor at connector AC-IN. Connect RJ-11 connector of the phone line at Phone connector of the modem.

29.9. Installing / Configuring Modem

- Click Start -→ Settings -→ Control Panel
- OR

- Click My Computer -→ Control Panel
- Click Modems icon.
- Install New Modem dialog box appears. Click Next.
- System will look for the modem if connected. Click Next.
- Select manufacturer and model of the modem. Click Next.
- OR
- Click Have Disk if your modem is not listed and you have an installation disk.
- Select the port to connect the modem (COM2). Click Next.
- Click Finish.

Demonstration

a) Different controls and connectors of modem.
b) Connecting modem with the system and the telephone line.
c) Installing / Configuring modem.

Practical

a) Connecting modem with the system and the telephone line.
b) Installing / Configuring modem.

Exercise-29

Q.1 Fill in the blanks

(i) MODEM stands for _____. (modulator and demodulator)
(ii) Different modulation techniques are _____. (AM, FSK, PSK)
(iii) Synchronous modems are _____ speed modems. (high)
(iv) Standard used for modem serial communication is _____. (RS232)
(v) Different frequencies are used for transmission in two different directions in _____ technique. (FSK)

Q.2 Write short notes

(i) Modem

(ii) Modulation techniques in modem

(iii) Working of modem

(iv) Modulation and demodulation

(v) Frequency shift keying

Q.3 Explain classification of modems.

CHAPTER 30
DIFFERENT CARDS

30.1. Printer Card

This card has a parallel port to connect a printer. But now a days motherboards come with the parallel port to connect the printer.

30.2. HDFDC (Hard Disk Floppy Disk Controller) Card

This card has a 40-Pin connector to connect the IDE devices and a 34-Pin connector to connect a floppy disk drive. But now a days motherboards come with the IDE and the FDD interfaces.

30.3. Multi I/O Card

This card contains

(i) RTC (Real Time Clock)
(ii) Serial Port
(iii) Parallel Port
(iv) Game Port *(To connect joystick)*
(v) FDC *(To connect Floppy Disk Drive)*

30.4. Display Card

It is to connect the monitor with the system. But now a days motherboards come with the built in display adapter. It has a 15-Pin connector for connecting the monitor.

30.5. Sound Card

It is used to connect mike and speakers. But now a days motherboards come with the built in sound card. It has connectors for connecting mike and speakers.

30.6. **TV Tuner Card**

It is used to convert a monitor into a TV.

30.7. **Modem Card**

It acts as an internal modem. It is used to connect to the Internet.

Exercise-30

Q.1 Fill in the blanks

(i) HDFDC stands for _____. (Hard Disk Floppy Disk Controller)

(ii) HDFDC card has a _____ pin and a _____ pin connector. (40, 34)

(iii) Multi I/O card contains _____. (serial port, parallel port, RTC, game port, FDC etc.)

(iv) RTC stands for _____. (Real Time Clock)

(v) TV tuner is used to _____. (convert monitor into TV)

(vi) Modem card is used to _____. (connect to internet)

Q.2 Write short notes

(i) Different cards

(ii) HDFDC card

(iii) Multi I/O card

(iv) TV tuner

CHAPTER 31
VIRUS AND VACCINES

31.1. Virus

Virus is a program inserted into another program, when the host program runs the virus gets activated. *(Another program is host program in which virus is residing).* Virus replicates (makes duplicate copy) itself and spreads to others through data transfer (by floppy or CD or Network). A virus infects data or program every time when the user runs the infected program.

31.2. Types of Viruses

There are two types of viruses, which are as follows:

i) Parasitic Virus ii) Boot Virus

i) Parasitic Virus: Parasitic virus attaches itself with the other programs and is activated when the host program is executed. Jerusalem and Datacrime are the popular parasitic viruses.

ii) Boot Virus: Boot viruses enter the boot sector of the disk and occupy the boot sector of the disk. C-brain is an example of boot virus.

31.3. Precautions to Avoid Virus Infection in Personal Computer

a) Ensure that the disk is free from virus before inserting into the disk drive.

b) Keep all-important files in a write-protected floppy. If important files are required to be copied without checking the disk for virus then copy from the write-protected floppy.

c) Always run anti virus program to keep check on viruses.

d) If virus is found on a PC, identify the type of virus and remove the virus.

31.4. **What the Viruses Do?**

Viruses do the work, for which they have been programmed. Viruses are also classified as per their job. These are as follows:

(i) File Infectors – File infector viruses insert themselves into the executable files. When the virus inserts itself in the targeted file, it starts modifying the startup of the executable files.

(ii) Boot Infectors – A boot-sector virus interferes with the boot procedure of the PC. All boot sector viruses infect disks, by transforming the system files. A boot sector virus can infect the hard disk when booted from the floppy disk, even though the floppy disk contains no system files and boot process is unsuccessful.

(iii) Partition Infectors – A partition infector is a virus that infects the partition record of the hard disks. The partition sector has a space of 512 bytes which is used by the partition program and the data. There is no space for virus to write its own code without overwriting the partition program. Partition infector copies partition program and overwrites it with its own virus code. After that when the computer is booted from the infected hard disk these codes will do something else and cause the system halt.

(iv) CMOS Virus – A CMOS virus infects the CMOS (Complementary Metal Oxide Semiconductor) RAM. *CMOS RAM is a area of memory which is used for storing the date and time, systems setup etc. CMOS is powered with the battery, therefore it contains the data even if power fails or switched off. CMOS virus destroys the CMOS contents.*

(v) Hardware Virus – This virus is able to do permanent damage to the hardware parts of the computer.

31.5. **Detection of Virus**

(i) By Appearance – You can detect a virus after the infection has taken place by looking the displayed messages or by seeing the change in file size.

(ii) By Behaviour – Most of the actions such as opening files, writing to the files are performed all the time by system itself. But when the system starts behaving in abnormal way, then we can say that the computer has been infected with the virus.

(iii) By Change – All viruses cause some change to the system in which they have infected. For example, changing the name of the file.

31.6. **Important Steps to Remove Virus**

Anti -virus programs are used to remove the virus from the disk. The following points should be remembered before starting removing the virus:

(i) Ensure that the anti virus program you are using is capable of removing the specific virus, which has infected your system.

(ii) You should boot the system from the clean (disinfected) bootable floppy or CDROM. After that you should run the anti- virus program.

(iii) If the partition of the disk has been infected then use **fdisk/mbr** command to rebuild the partition table.

(iv) If the boot sector has been infected and has destroyed the system files then boot the system from the clean bootable disk and make the disk bootable by the same disk.

31.7. **Popular Anti-Virus Packages**

Following are the popular anti-virus packages:

- Norton
- F-Prot
- FV86
- MCAFEE
- PC-Cillin
- Dr. Solomon's find virus

Demonstration

a) Installation of anti-virus packages.
b) Using anti-virus packages.

Practical

a) Installation of anti-virus packages.
b) Using anti-virus packages.

Exercise-31

Q.1 Fill in the blanks

(i) Virus is a _____. (program)
(ii) Examples of parasitic viruses are _____. (Jerusalem, Data crime)
(iii) C-Brain is an example of _____ virus. (boot)
(iv) CMOS RAM is the part of memory which is used to store _____. (date and time, system setup)
(v) Before running the anti-virus program, you should boot the system with _____. (clean bootable floppy/CD ROM)

Q.2 Write short notes

(i) Precautions to avoid virus infection in PC
(ii) Virus
(iii) Partition infectors
(iv) Boot infectors
(v) Detection of virus
(vi) Important steps to remove virus
(vii) Popular anti-virus packages

Q.3 Explain classification of viruses.

CHAPTER 32

DMP

32.1. DMP (Dot Matrix Printer)

In these printers, characters are formed by the dots arranged in the form of a matrix. Hence we call these printers as Dot Matrix Printer.

Following parameters can differentiate DMPs:

i) No of pins in print head.

ii) Characters Per Second (CPS)

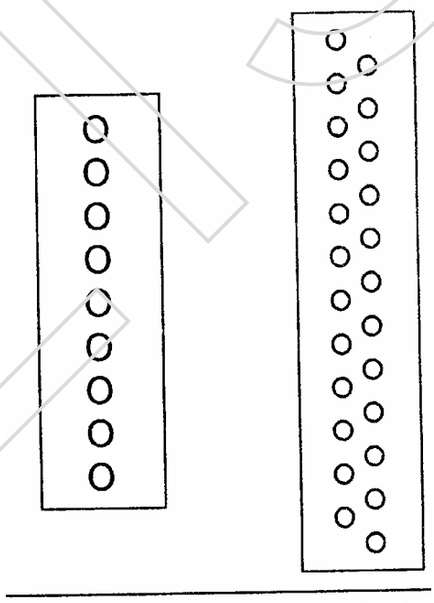
iii) Characters Per Inch (CPI)

iv) Width of printer (in columns)

v) Interface used [parallel/serial]

i) No of pins in print head:

Mostly printers have either 9 pins or 24 pins in their print head. In 9-pin head printers, all the pins are arranged vertically in one column only. For example, Epson FX 1000, TVSE LSP 100. In 24-pin head printers, the pins are arranged in two vertical columns, slightly displaced from each other. For example EPSON LQ 1070+.



9-pin & 24-pin head pins layout

Some odd pin printers are also available for example, the commonly used 'SEIKOSHA' has 8 pins & all the Philips models have 18 pins arranged in 2 columns.

ii) Characters Per Second (CPS):

CPS indicates how many characters can be printed in a second. CPS indicates the speed of the printer. The CPS for NLQ and draft mode are different.

For FX 1000

Draft – 240 CPS.

NLQ - 40 CPS

iii) Characters Per Inch (CPI):

This indicates how many characters can be printed in one inch length of a printable row. Commonly used CPIs are 10 cpi or 12 cpi or 15 cpi or 17 cpi or 20 cpi. Normally, above 15 CPI is called condensed mode.

iv) Width of the Printer:

This indicates the size of the printer. The two standard sizes are 80 columns & 132 columns. By 80 or 132 columns, we mean that the printer can print 80 or 132 different characters in a single line (row). *This parameter also indicates the size of stationery that will be used with the printer.*

v) Interface used:

There are two types of interfaces used to communicate with the computer, which are as follows:

a) Parallel
b) Serial

For parallel interface, we use a Centronics interface standard. This interface has a 25-pin D type female connector towards the computer side & 36-pin amphenol type connector towards the printer side.

32.2. **Modes of Printing**

There are two modes of printing, which are as follows:

(d) Draft – Print quality is poor.

(e) NLQ (Near Letter Quality) – Print quality is very good because two passes over same line.

In NLQ print out, in a 9 pin printer, 2 passes over the same line where as in a 24 pin printers, since the pins are arranged in 2 vertical columns. Slightly displaced from each other, 2 passes are not required.

32.3. **Major Parts of DMP**

In general, DMP can be divided into the 4 major parts which are as follows:

(i) Mechanical Assembly

(ii) Logic Card

(iii) Power Card

(iv) Front Panel

32.4. **Mechanical Assembly**

This is the most important part of a DMP from the troubleshooting point of view. This is because of 2 reasons:

1. *This part is always moving at a faster rate. Hence friction is high. Consequently wear & tear is high.*
2. *This part is normally open. Hence dust, dirt, paper particles, etc. may interrupt its normal operation.*

In general, the mechanical assembly can be divided into the following parts:

a) Print Head

b) Carriage & Carriage Assembly

c) Carriage Motor, Timing belt/ Carriage wire.

d) Sensors - Home position & Paper empty

e) Platen, Line feed Gear Assembly & Line Feed Motor.

f) Levers

g) Ribbon & Ribbon Gear Assembly

h) Tractor Assembly

a) Print Head

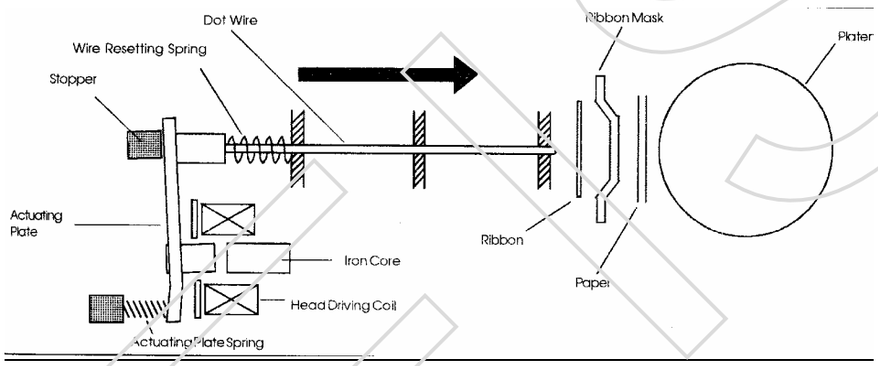
There are two types of print heads available, which are as follows:

(i) With cable

(ii) Without cable.

In head, with cable, the head cable is directly soldered to the print head. In case, the cable becomes faulty you have to throw the cable as well as the head. e.g. TVSE series except LSP 100.

In head, without cable, the cable is connected to head through a connector. If the cable goes faulty, then only cable can be easily replaced. Hence, it is preferred e.g. Epson series except FX 105 MX 80.



Print head Printing Operation

Internal structure of head & pins:

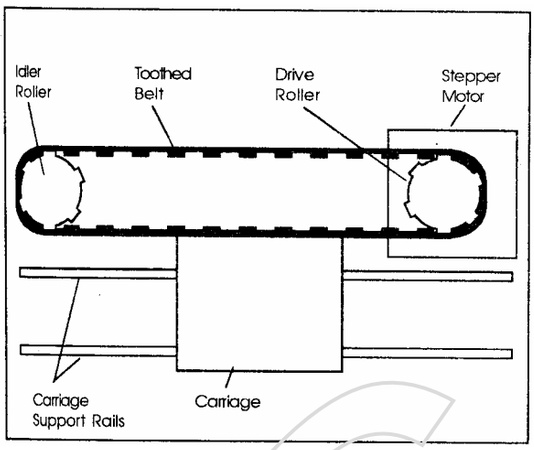
Here, the coil is wound on a ferrous rod. When current passes through this coil, the rod gets magnetized & the metallic base of the pins gets attracted towards it, moving the pin towards paper & thus ultimately striking ribbon & paper.

b) Carriage & Carriage Assembly

This provides the movement for the print head. It has a base for the head, which is called as carriage and is supported by the two rails. Over these rails, the base or 'carriage' moves horizontally from left to right & back.

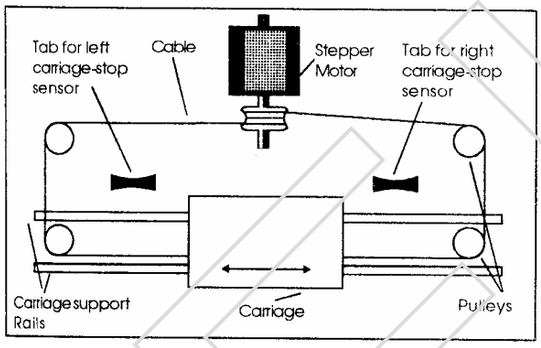
c) Carriage Motor, Timing Belt / Carriage Wire –

Carriage motor is basically a stepper motor. Carriage motor provides the force to move the carriage. This force is converted into the motion of the carriage by using the belt.



Top View of Printer Carriage Mechanism

The tension of the belt/wire is an important consideration while troubleshooting.



Top View of Printer Carriage Mechanism

d) Sensors

The sensors used are as follows:

(i) Home Position Sensor: *The print head is able to move freely but the controlling BIOS of printer must know its exact position. For this, there should be some reference position so that position onwards, BIOS can count the exact position of print head. In general, the left most position is taken as reference or home position. This must be detected for detecting it; the home position sensor is used. It is nothing but a normal photo detector circuit. The carriage has a vertical slit below it. Whenever, it reaches to leftmost position, the slit blocks the photoemission, thus giving a pulse.*

(ii) Paper Empty Sensor: *The printers should print only when there is paper in front of the print head. To detect the status of paper a simple mechanical micro switch is used.*

(iii) Left Carriage Stop Sensor

(iv) Right Carriage Stop Sensor

e) Platen, Line Feed Motor & Gears

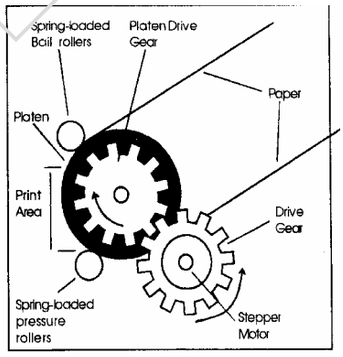
Whenever one line is printed, the paper should move some distance, so that the next line gets printed. This is performed by using platen, line feed motor & gear assembly. Platen is a hard-rubberized rod that provides striking surface for the print head pins. Line feed motor is a stepper motor. *Its motion is given through the line feed gear assembly.*

f) Levers

The levers are as follows:

(i) Paper thickness adjust lever. *This lever is used to adjust the gap between the platen & the print head. Hence, we can use variable thickness stationery. This lever virtually moves the head back & forth in horizontal plane very slightly.*

(ii) Friction lever: It is used to select cut sheet papers or continuous stationery. If you are not using continuous stationery i.e. if you are using cut-sheet papers, you must use some mechanism that will move the paper with the platen. This friction lever adjusts the friction rollers so that when in friction mode the pressure rollers are very tightly coupled to the platen. In between them the cut sheet paper is present. As a result, the paper will move with the platen movement.



Friction Feed Mechanism

g) Ribbon and Ribbon Gear Assembly

Ribbon provides the ink required for printing. Ribbon gear assembly makes the ribbon to roll from one end to the other end. *Suppose the same area if ribbon is used for printing, the print quality will go on fading. For this the ribbon is always moved in one direction only, i.e. from one side it goes in box and for other side it comes out. Inside the box it is re-inked. To move the ribbon in both directions the ribbon gear assembly is used.*

h) Tractor Assembly

This is used only with the continuous stationery, which has holes at the side.

32.5. **Trouble Shooting**

In printers, most of the problems occur because of the interface between computer and printer. The cable that runs between computer & printer must carry the right signals on the right lines. Normally, you should solve most of there interfacing & and configuration problems while setting the printer initially. For this you have to check DIP SWITCH settings on printers, particular configuration modes on your application etc.

In printers that have been setup correctly & have been operating for some time, the electromechanical parts cause majority of the problems. Dirt, dust & paper particles can jam these mechanisms. Metal parts may bend. Plastic parts may break or wear out. In electronic components the parts that are most likely to fail are those that handle the power.

Cleaning & Maintenance:

Since printers contain so many mechanical parts, periodic cleaning and maintenance are very important. In general you should follow the following steps:

a. Switch off the printer; remove the power cord from the mains.
b. Remove ribbon & cover.
c. Clean out dust, paper particles etc. from the mechanical assembly.
d. Check & clean paper feed path & platen. (For above two steps you may use special cleaning oils).

e. Clean print head & if required replace it.
f. Replace ribbon if worn out.
g. Test printer for satisfactory print quality. Adjust the paper thickness adjust lever.
h. Clean & re-place the covers.
i. Check that paper is placed properly & feeds smoothly.
j. Test printer for no line printing.

You should be always very careful while removing & again fitting any parts. Also after preventive maintenance, the printer must work smoothly. This never happen that your printer was working previously & after you have done the p.m. it is not working be careful.

32.6. **Diagnostic Aids**

i) Self-Test: *This test lets you check most of the electronic & mechanical parts in the printer very quickly.* During the self-test, printer is not connected to the computer. If self-test is carried out satisfactorily, it means the printer is serviceable.

ii) Alarm Indications: Some printers have an alarm to indicate the particular problem. The alarm may indicate printer status such as printer is out of paper. *The problem here is the significance of beeps which is different for different printers. So to come to any conclusion, you must refer the manual for that printer*.

iii) Diagnostic Tests: Some printers have built in diagnostic routines. These tests can be carried out using the front panel. To know particular button or key you must refer the manual.

iv) Third Party Diagnostic Software: Special softwares for diagnosing your printer problems are also available. For this printer must be connected to the computer & the interface must be OK.

Note: Use DIR > PRN command to print the list of files and directories available on drive or directory. If able to print, it means the printer, interface cable and the printer port are serviceable.

32.7. **Common Faults and Their Solution**

i) Problem:

Self-test does not print properly (Some dots are missing or entire character is missing.)

Solution:

(i) Clean the head by pure alcohol.

(ii) Check the head cable.

(iii) Check the power supply.

(iv) Replace the head.

(v) Logic card may be faulty.

ii) Problem:

When printer is connected to PC some characters are missing but the self test is OK.

Solution:

(i) Check the Interface cable.

(ii) Check the printer port

iii) Problem:

Prints junk characters.

Solution:

Interface cable is not connected properly.

iv) Problem:

Printer sounds as if it is printing but nothing is getting printed.

Solution:

Ribbon is not present or not installed properly.

v) Problem:

Printing is very faint and uneven.

Solution:

(i) Ribbon is old.

(ii) Ribbon gear assembly is not rotating or gears adjustment belt has loosened.

(iii) Head has become very hot.

(iv) Paper adjustment lever is not set properly.

vi) Problem:

Power is not supplied to the printer.

Solution:

(i) Check the fuse.

(ii) Check the power supply cable.

(iii) Check the power supply card.

vii) Problem:

All correct but there is no print out.

Solution:

(i) Install the printer software.

(ii) Set the printer as a default printer.

viii) Problem:

Head jamming frequently.

Solution:

(i) Carriage rod is not lubricated properly.

(ii) Carriage belt is loose.

(iii) Carriage motor is not getting proper power supply.

ix) Problem:

Skipping one line while printing:

Solution:

(i) Check DIP switches. Auto feed DIP switch should be always ON (Available in old printers).

(ii) Check Interface cable.

x) Problem:

Write fault error writing device PRN.

Solution:

(i) The job is fired but interface cable is not connected.

(ii) Printer is OFF line.

32.8. **Connecting Printer**

Printer is connected to the system through an interface cable having two connectors one each at both the ends. 25-Pin connector is connected towards the PC side to the parallel port and 36-Pin amphonel connector is connected to the printer. Power supply is given to the printer through 3-Pin power cable.

32.9. **Installing Printer**

- Click Start -→ Settings -→ Printers

  or
- Click My Computer -→ Printers
- Click Add Printer icon.
- Add Printer Wizard dialog box appears. Click Next.
- Select Local printer and click Next.
- Select Manufacturer and printer model and click Next.

  or
- Click Have Disk if the printer came with an installation disk and give path.
- Select the port you want to use for the printer connection (LPT1) and click Next.
- Type the printer name and click Next.
- Select Yes (recommended) to print a test page and click Finish.

Demonstration

a) Different parts of DMP.
b) General cleaning of DMP.
c) Lubrication of Carriage Assembly.
d) Loading of ribbon.
e) Installing of head.
f) Connecting and installing the printer.
g) Common fault rectification.

Practical

a) Lubrication of Carriage Assembly.
b) Loading of ribbon.
c) Installing of head.
d) Connecting and installing the printer.
e) Common fault rectification.

Exercise-32

Q.1 Fill in the blanks

(i) DMP stands for _____. (Dot Matrix Printer)
(ii) CPS standard for _____. (Character Per Second)
(iii) DMPs are available in _____ & _____ columns. (80, 132)
(iv) Home position sensors senses the presence of _____ (print head at the extreme left position)
(v) Tractor assembly is used with the _____ stationery. (continuous)

Q.2 Write short notes

(i) Parameters of DMPs.
(ii) Modes of printing
(iii) Major parts of DMPs
(iv) Parts of mechanical assembly
(v) Diagnostic aids

CHAPTER 33
LASER PRINTER

33.1. Introduction

Laser printers have become increasingly popular where high print quality is required. This is largely due to decreasing cost, which has now reached the level of a good quality dot matrix or inkjet printer.

LASER stands for Light Amplification by Simulated Emission of Radiation. The working principle of laser printers is similar to the normal photocopying machine. Various steps involved in the printing process are as follows:

(i) Forms an image of the page on a photosensitive drum.

(ii) Toner *(powdered ink)* is then applied to the image on the drum.

(iii) Next, the image is electro-statically transferred from the drum to a sheet of paper.

(iv) Finally, the inked image on the paper is fused with the heat by laser beam. *A rotating mirror sweeps a laser beam across the photosensitive drum as it rotates. The laser beam is turned on and off as it is sweeps back and forth across the drum to produce an image. After the image on the drum is inked and transferred to the paper the drum is cleaned and is ready for the next page.*

Laser printers provide a very high print quality. The resolution of these printers is 300, 600 or more dots per inch and the speed is 10 to 12 pages per minute.

33.2. Blocks of Printer

The printer blocks are as follows:

(i) Image Formation System

(ii) Paper Pick up/Feed System

(iii) Machine Control System

(iv) Interface System

33.3. **Image Formation System**

Printing on a laser printer requires the interaction of several different technologies (electronics, optics, electro-photographic etc.) to provide a page of printed out put. Each process functions independently and must be coordinated with all other printer processes.

All components of the image formation system are assembled into a replaceable EP *(electro-photographic)* cartridge. The EP cartridge contains the photosensitive drum, which allow the image to be formed on the drum surface and then it is transferred to the paper.

Photosensitive Drum: The Photosensitive drum is "heart" of the image formation system. The special properties of this drum allow the image to be formed on the drum surface and then transferred to paper. The drum is an extruded aluminum cylinder. The outside of the cylinder is coated with a layer of organic photoconductive material (OPC), which is a non-toxic material. The aluminum base of the drum is electrically connected to ground.

The OPC material has properties similar to a photodiode. It becomes electrically conductive (in one direction only) when exposed to light. Negative charges deposited on the surface of the drum conduct to the aluminum (zero potential) base of the drum when exposed to light. Areas of the drum not exposed to light remain nonconductive.

The image formation process consists of the following six stages.

(i) Cleaning
(ii) Conditioning
(iii) Writing
(iv) Developing
(v) Transferring
(vi) Fusing

i) Cleaning:

During the cleaning stage of the image formation process, the drum's surface is prepared to hold an image by physically and electro-statically cleaning the drum. During printing the drum is constantly rotating and makes several complete rotations per printed page. Before forming the image for a given section of print, leftover toner from the previous rotation of the drum must be

cleaned off. Rubber cleaning blades scrapes off the toner from the drum. *A sweeper blade in the debris cavity rotates sweeping toner away from the area near the drum.*

The erase lamps electro-statically clean the drum. *These five small lamps located in the hinged top cover illuminate the photosensitive material of the drum to neutralize any electrical charges, which may have previously been on the drum.*

ii) Conditioning:

After cleaning, the drum must be conditioned. This conditioning process involves the application of a uniform negative 600v charge on the surface of the drum, by the primary corona assembly. The primary corona is located in the EP cartridge. This charge is applied to the corona wire by a high voltage power supply.

This means the air surrounding the wire is ionized and no longer acts as an insulator and the negative charges from the wire migrate to the surface of the drum. The primary corona grid, positioned between the corona wire and the drum, regulates the voltage applied to the drum's surface, so that a uniform –600v charge is deposited. The corona grid is connected at a arrestor on the high voltage power supply, which acts to bleed off any extra current which would raise the surface voltage above the desired level.

iii) Writing:

After rotating past the conditioning station the drum has a uniform negative 600V potential on its surface. At the writing station, a laser beam is used to discharge the negative potential in selected areas by focusing laser light on the selected portions of the drum. This creates an electrostatic image, which is later developed into a visible image.

Laser light is produced by a small laser diode which is turned on and off by simply supplying or denying power. The laser diode is fixed in space, the beam created by the diode shines onto a six faced rotating "polygon" mirror. As the mirror rotates the beam reflected off the mirror sweeps in an arcing fashion. The swept beam is brought into focus on a horizontal line on the photosensitive drum by a set of mirrors and lenses. The beam reaches the drum through an opening in the top of the EP cartridge.

Because the beam is sweeping, in the entire length of the drum can be covered by the beam and because the drum is rotation the entire circumference can be covered. This sweeping of the drum and

*modulation of the beam in order to expose desired areas is very similar to how a television sweeps its electron beam to form a video image on its screen. Therefore many terms used are common. The speed of the scanner motor, which rotates the polygon mirror and the speed of the main motor, which rotates the drum are synchronized so that each successive sweep of the beam is offset on the surface of the drum by 1/300 of an inch. The beam can also be turned on and off at such a rate as to place dot of light every 1/300 of an inch in the horizontal direction. This is how the printer achieves its 300*300 dots per square inch resolution. At the beginning of each sweep before the beam reaches the drum, the beam, and the beam is reflected off a small mirror into an optical fiber. The momentary pulse of light is sent down the optical fiber to the dc controller where it is converted to and electrical signal used to synchronize the output of data for one sweep (scan line) with the rest of the data. This pulse called the beam detect pulse is also used to diagnose problems with the laser or scanner motor.*

After the writing station the drum has an invisible electrostatic image on which the portions of the drum that were not exposed to the laser are still at the 600V potential (placed there by the primary corona) but those portions exposed to light have been discharged to approximately -100V.

Although the infrared laser beam is invisible, eye damage will occur if direct or indirect (reflected) eye contact with the laser beam should occur. Pay attention to all caution and warnings when working with the laser unit.

iv) Developing

At the developing station, the invisible electrostatic image is developed into a visible image on the drum. *The developer consists of a metallic rotating cylinder, a fixed magnet that runs the length of the cylinder, a toner cavity and a toner brush height control blade. The toner in the toner cavity is a powdery substance made of black plastic resin bound to iron particles. The iron in the toner causes an attraction of the toner to the magnet inside the cylinder. The brush height control blade limits the amount of toner on the cylinder as it rotates around, close to the drum. The plastic toner particles obtain a negative surface charge by rubbing against the cylinder, which is connected to a negative DC supply. This electrostatic charge obtained by the toner is such that the toner particles are attracted to the areas of the drum, which have been exposed to laser light and repelled from the areas not exposed. An AC potential is also applied to the developer cylinder in order to further assist the toner particle to over come the attraction of the magnet and to pull toner back to the developer cylinder from the areas on the drum that were not exposed. This improves density and contrast.*

The DC bias of the developer cylinder can be adjusted. Doing this changes the attractive force between toner the drum, pulling more or less toner to the drum, allowing for print density adjustment.

v) Transferring:

At the transfer station, the toner on the drum is transferred to the paper. *A corona assembly is positioned behind the paper, so that the paper, which is traveling at the same speed that the surface of the drum is rotating, contacts the drum. This corona produces positive charges, which deposit on the back of the paper. The stronger positive charges on the paper pull the negatively charged toner particles off the drum. As the paper and drum continue to move the small radius of the drum and the stiffness of the paper cause the paper to naturally peel away from the drum. A high negative voltage being applied to a row of the static charge eliminator also assists separation. This static charge eliminator weakens the attractive force between the negatively charged drum surface and positively charged paper. Without this assistance, thin papers could possibly wrap around the drum. From the transfer station the paper moves to the fusing station and the drum rotates to the cleaning station to prepare it to receive the next section of print.*

vi) Fusing:

Until the paper reaches the fusing station, toner is held onto paper only because of gravity and weak electrostatic forces. At the fusing station, toner is melted and forced into paper by heat and pressure to produce a permanent image. *The fusing station consists of a non stick roller that is heated from the inside by a high intensity lamp and a soft roller that "give" when pressure is applied in order to allow for a large contact area between the paper and the upper fusing roller. At this point the toner is melted and squeezed into the paper fibers. To keep the toner or paper from sticking to the fusing roller, the roller is covered with a non-stick. "Teflon type" a cleaning pad, which is in contact with the fusing roller, applies a thin coat of silicone oil to the surface of the roller to also prevent sticking. The cleaner pad also serves to wipe off any toner or debris that becomes stuck to the roller.*

The fusing roller temperature is monitored by the machine control system via a thermistor sensing arrangement. The machine control system maintains a temperature of 165 degrees C during standby mode and 180 degrees C during the normal code of operation.

A thermo protector switch is also located in the fusing assembly, adjacent to the thermistor. The thermoprotector shuts down (opens the power circuit to the fuser bulb) when the temperature is in excess of 210 degrees C. if this occurs, power off the printer and allow the roller to cool seven minutes before returning power to the printer.

33.4. **Pick up/Feed System**

The pick-up and feed system is responsible for picking up the paper from the input paper tray, delivering it to the image formation system at the right time. *The cassette feed paper path begins when the machine control system, after receiving a print command, starts the main drive motor. Approximately two seconds later the paper pick up solenoid is enabled and the paper pick up roller makes one rotation and feeds paper to the registration rollers. The registration rollers are not turning at this time so the front edge of the paper bows.*

The registration rollers align the leading edge of the paper with the leading edge of the image on the photosensitive drum. When the alignment is correct the registration clutch solenoid is activated and the roller turns and advances the paper to ward the photosensitive drum. After the print image has been transferred to the paper at the transfer station, the paper is fed into the fuser assembly by the feed roller. The timing of manual paper feed is identical to the timing for cassette paper feed except for the following points.

1. *Different input paper sensors are used. These are cassette paper sensor and manual feed paper sensor.*
2. *The initial warm up time for manual feed is longer. It is assumed that manual feed will be used for envelopes and or heavier paper. Because these heavier paper warm up time allows all components to the fusing system to reach the 180 degree temperature, which is required for proper fusing of toner to these papers.*

The paper exit sensor indicates when paper reaches and clears the fusing station. Paper exit sensor detects a paper jam in any of the following conditions.

1. *Paper does not reach the delivery sensor within the required time (delivery delay jam).*
2. *Paper does not clear the delivery sensor within the required time (delivery jam)*
3. *Paper is present at the delivery sensor when power is switched on (*

<u>Main Drive</u>: The main drive and scanner motor provide the mechanical drives necessary for printing. The main motor is controlled via a driver by commands output from the DC controller. The main motor via gear trains, drives the following.

(i) Pick/up roller
(ii) Registration assembly
(iii) Drum (within ep cartridge)
(iv) Feed rollers
(v) Fusing assembly
(vi) Exit rollers
(vii) Developer

33.5. **Machine Control System**

The DC controller is the machine control system and is responsible for coordinating all the activities involved in the printing process. The machine control system drives the laser beam, coordinating dot pattern data from the interface with paper size, drum sensitivity and laser beam motion information. The machine control system controls and monitors paper motion, the high voltage system, fuser temperature, erase lamps and all motors. The control system shares machine status information with the interface so that proper diagnostic messages are displayed on the front panel. The following are controlled by the machine control system.

(i) Paper motion
(ii) Laser drive
(iii) Erase lamps
(iv) Timing
(v) Machine status
(vi) Paper size and availability
(vii) High voltage system
(viii) Fuser temperature
(ix) Motor drives

33.6. **Interface System**

The interface system is responsible for the following:

(i) Page formatting
(ii) Communicating with the CPU (Central Processing Unit)
(iii) Storing font information j
(iv) Storing configuration information
(v) Communicating with the machine control system.
(vi) Monitoring the control panel keys
(vii) Displaying information on the control panel

33.7. **Trouble Shooting**

Prior to troubleshooting, ensure that the printer meets the following operation conditions:

i) Ensure that the printer is installed on a solid level surface.

ii) Ensure that the line voltage providing power to the printer does not vary more than 10% from the rated value.

iii) Ensure that the printer is operated in a well-ventilated area.

iv) Ensure that the printer is not located in hot or humid area.

v) Ensure that the printer is never exposed to the ammonia gas.

vi) Ensure that the printer is not exposed to the direct sunlight.

33.8. **Common Faults and Their Rectification**

i) Problem:

Black page.

Possible Causes

1. No primary corona*: The purpose of the primary corona to apply a uniform negative charge to the surface of the drum. This charge repels the less negatively charged toner except in those areas exposed to the laser light. Without the primary corona charge the drum's surface is neutral because of the effect of the erase lamps. The neutrally charged surface would attract the less negatively charged toner and therefore create a total black image.*
2. Controller Problem: *If the laser was out of control and always ON. The surface of the drum would constantly discharge by the laser. The discharging of the entire surface would result in a black page.*
3. Beam detect problem

ii) Problem:

White page.

Possible Causes

1. Non-developing bias: *The purpose of the developing bias is to apply a charge to the developing cylinder, which then passes the charge to the toner. The charge of the toner is such that the toner is attracted to the neutralized surface areas of the drum discharged by the laser. If the toner charge is missing, the toner is not attracted to the drum resulting in a totally white page.*

2. No drum ground path: *if the drum ground is interrupted on discharge path would be available for the drum's surface charges. The discharging effect from the laser light would not occur and the highly negative charge placed on the drum by the primary corona would repel all toner leaving at white page.*
3. Drum not rotating: *If the drum does not rotate, the page will be white because the EP process functions will not occur.*
4. No toner in EP cartridge
5. Sealing tape not removed from EP cartridge
6. Beam to drum mirror blocked
7. Transfer corona wire broken so no high voltage.

iii) Problem:

Very faint print.

Possible Causes

1. Empty EP cartridge: *The EP cartridge is near the end of its life and is unable to supply an adequate amount of toner for the print image.*
2. Transfer corona: *The purpose of the transfer corona is to apply positive charge to the back of the paper to attract the negative charged toner image from the drum to the paper. Poor image transfer (e.g. faint print) will occur if transfer corona is not being enabled.*
3. Developer bias: *if no developer bias available the toner would not have a charge and nor be attracted to the discharged areas of the drum.*

iv) Problem:

Speckled print.

Possible Causes

No primary corona grid connection: The purpose of the primary corona grid is to ensure that the primary corona deposits a uniform negative charge pm the surface of the drum. If the grid is not function properly, uneven charges are deposited on the drum's surface. The random areas of uneven charges appear as dark marks. The marks result from no charge on the drum similar to the missing primary corona symptom described the "black page print sample".

v) Problem:

Vertical white streaks.

Possible Causes

1. Dirty beam-to-drum mirror: *The beam to drum mirror reflects the laser light from the scanner to the surface of the photoconductive drum. If the mirror is dirty, the laser light is blocked and no image may be written on the drum. The end result would be missing print is the printed output.*
2. Dirty transfer corona: *The purpose of the transfer corona is to apply positive charge to the back of the paper to attract the negative charged toner image from the drum to the paper. If portions of the corona were extremely contaminated or blocked, vertical streaks could occur in the printed output.*
3. EP cartridge: *If the EP cartridge was unable to provide sufficient toner for the printed image, white streaks could occur in the printed output.*

vi) Problem:

Right hand text missing or image distorted.

Possible Causes

Beam to drum mirror installed incorrectly: *The beam to drum mirror reflects the laser light from the scanner to the surface of the photoconductive drum. If the mirror is installed incorrectly or not resting full on the mirror supports, the scan plane of the laser beam would not be parallel. The resulting image written on the drum would be distorted, missing or out of parallel alignment.*

vii) Problem:

Horizontal black lines

Possible Causes

1. Laser/Scanner assembly: *Horizontal black lines could possible occur in event of a beam detect error. In this error condition (wherein the microprocessor is expecting beam detect but never received it) the processor turns on the laser continuously searching for the signal (i.e. resulting in a black line). If the processor cannot find the beam detect after two seconds a "51 service" beam detect malfunction occurs.*
2. Defective or improperly seated fiber optics cable
3. DC controller
4. Paper problem

Some paper surfaces are not receptive to dark density print refer to the paper specifications to determine if the correct paper is being used.

viii) Problem:

Slightly faint print.

Possible Causes

1. *Erase lamp assembly: Slightly faint print may result over long period of time if the erase lamps are not operations.*
2. *Drum sensitivity switches sense the drum's sensitivity to laser light. Three levels of drum sensitivity may be sensed. If these micro switches are malfunctioning the microprocessor may adjusting the laser power to the wrong level in respect to that required by the ep cartridge.*
3. *EP cartridge near end of life: Faint print indicates that the toner level of the ep cartridge is near the end of the life.*
4. *Low laser power*

ix) Problem:

Smeared (dirty) print.

Possible Causes

1. *Fusing assembly: If the fusing assembly is not heating the paper up to a temperature to sufficiently.*
2. *Bent static teeth: The purpose of the static teeth is to assist in separating the paper from the photoconductive drum by discharging the positive charges places on the paper by the transfer corona if the static teeth are defective, the print could possible be smeared on the paper prior to the paper entering the fusing station.*
3. *Dirty fuser cleaning pads*
4. *Paper: The paper may not be acceptable for the ep process and for laser printing. Verify the paper meets the paper specifications and storage reconnendations.*

x) Problem:

Distorted print.

Possible Causes

1. *If any component of the paper path is not allowing the paper to move at an uniform rate of speed, the print image would be affected (e.g. if main motor were rotating too fast or too slow, transport gear excessively worn, etc.*
2. *LASER/scanner assembly*

33.9. **Self Test**

Perform the Self Test by referring the manual with the help of control buttons. Press the ON/OFF switch available at the front panel to provide the power supply to the printer.

Demonstration

- Different parts of LASER Printer

Practical

- Fitting cartridge.
- Refilling cartridge.

Exercise-33

Q.1 Fill in the blanks

(i) LASER stands for _____. (Light Amplification by Stimulated Emission of Radiation)

(ii) LASER printers work on the _____ principle. (photocopying)

(iii) Black power used in LASER printouts is called _____. (Toner)

Q.2 Write short notes

(i) Printing process in LASER printer

(ii) Stages of Image formation system

(iii) Conditioning

CHAPTER 34

FEATURES OF DIFFERENT MOTHER BOARDS

34.1. PEAK / DM 386 MOTHERBOARD: PEAK / DM CHIP SET

It is designed for 80386DX 25 MHz, 33 MHz, and AMD Am 386 40MHz microprocessors. The prominent features are as follows:

(i) Coprocessor socket for Intel 80387 or WEITEK 3167.

(ii) 64KB AMI ROM BIOS.

(iii) Installable cache memory 32KB, 64KB, 128KB or 256KB.

(iv) Two 30-pin DRAM memory module slots.

(v) Shadow RAM support for system BIOS and Video BIOS.

(vi) CMOS RAM support with rechargeable battery backup.

(vii) Eight 16-bit ISA slot.

DRAM Memory Installation

Memory Size	Bank–0–SIMM Module	Bank--1–SIMM Module
1MB	4 x 256KB	EMPTY
2MB	4 x 256KB	4 x 256KB
4MB	4 x 1MB	EMPTY
5MB	4 x 256KB	4 x 1MB
5MB	4 x 1MB	4 x 256KB

8MB	4 x 1MB	4 x 1MB
16MB	4 x 4MB	EMPTY
17MB	4 x 4MB	4 x 256KB
20MB	4 x 1MB	4 x 4MB
20MB	4 x 4MB	4 x 1MB
32MB	4 x 4MB	4 x 4MB

34.2. **486 V.L. GREEN MOTHERBOARD: OPTI 895 CHIPSET**

This motherboard uses 82C895 and 82C602 OPTI chipset. This motherboard supports microprocessors ranging from 25 MHz to 100 MHz. These are 486SX / DX / DX2 /DX3/ DX4 (3V / 4V / 5V), manufactured by INTEL, AMD, CYRIX, UMC, IBM, TI and ST.

Prominent Features

- CPU operating speed selection through hardware setting or software selection.
- Supports AMI WINBIOS (Windows based BIOS).
- Installable cache memory upto 256 KB
- Three DRAM memory 72-pin SIMM slots and four 30-pin SIMM slots.
- Three VESA expansion slots and eight 16-Bit ISA expansion slots.

34.3. **PCI MOTHERBOARD FOR 486 CPU: INTEL 82420 CHIPSET**

This motherboard uses PCI buses. The chips used in this are as follows:

(i) 82423TX Data Path Units (DPU) – It contains Bus Buffer Control Interface circuitry, memory data interface logic etc. This chip transfers 32-Bit data between the microprocessor and the DRAM memory. This VLSI chip is available in 160 pins Quad Flat Pack Package.

(ii) 823781B (System I/O controller) – This chip interface the PCI bus with the ISA bus.

Other than explained these chips also include other logics.

The microprocessors supported by this motherboard are same as supported by 486 V.L. GREEN MOTHERBOARD.

34.4. HOT – 433 486 PCI/ISA MAIN BOARD: UMC CHIPSET

UMC motherboard uses following chipsets

- UMC UM881
- UMC UM886
- UMC UM 8669, 8663, 8667

HOT – 433 motherboards support various microprocessors operating at a clock speed of 25, 33, 40, 50, 66, 80, 100, 120, and 133 MHz. The microprocessors that can be installed on this motherboard are as follows

- 486 SX/DX/DX2/DX4 from Intel
- Am486DX/DX/DX2/DX4/ Am 5X86-P75 from AMD.
- 486S/DX/DX2/DX4/5X86 from cyrix.

Prominent Features

- Supports four 32-Bit PCI bus expansion slots and four 16-Bit ISA expansion slots.
- PS/2 mouse / keyboard connector.
- Supports 4 SIMM memory banks (72-pin)

34.5. **PREMIERE PCI BABY-AT BOARD: INTEL MEMORY CHIP SET 82430**: This motherboard is designed for Pentium 60/66 MHz and also supports Pentium 120 MHz/133 MHz processors.

It contains - One 82434 LX (PCI / Memory cache controller).

- Two 82433 LX (Local bus extension device)
- One 823781B (System I/O Bridger).

34.6. **INTEL 430VX MMX PENTIUM MAIN BOARD 82430 VX CHIPSET**

This motherboard has one floppy disk controller, two 16550 UART serial port, high-speed EPP/ECP parallel port and one infrared port for video/digital cameras.

It consist of

- Intel 82437 VX PCI (Memory controller chip).
- Intel 82371 SB PCI/ISA IDE accelerator.
- Intel 82438VX data bus accelerator.

Supports the following microprocessors:

INTEL – Pentium 90 MHz to 233 MHz.

Cyrix/IBM – 6X86 PR 133, P150, P166

AMD – K5:PR90, PR100, PR133, PR150, PR166.

K6: PR166, PR200, PR233

Prominent Features

(ii) Four 72-pin SIMM socket and one 168-pin DIMM socket. *These sockets are used for installing RAM upto 256MB on the board.*

(iii) Supports plug and play BIOS for power management.

(iv) Supports three 32-bit PCI bus expansion slot and three 16-bit ISA expansion slots.

Connectors

- Universal Serial Bus (USB) Header: The serial universal bus interface connector is used for interfacing external peripheral devices. This USB supports real plug and play features. It is able to transfer data at the rate of 12 MBits per second. The USB uses simple 4 pin rectangular connector.
- Parallel Port Connector (for Printer): This port is used for interfacing the printer. Supports SPP, EPP and ECP capabilities.
- Infrared Connector: This is 5-pin connector for Hewlett Packard HSDL-1000 compatible infrared transmitter/receiver module – IrDA. Once this is installed the COM1 port address can be redirected at this port. This allows wireless interface between portable device supporting IrDA standard and software installed on main computer such as LapLink. IrDA specifies a data transfer rate of 115 Kbits per second (kbps) within the distance of 1 meter.

All equipments such as the laptop, printer etc. comes with the necessary software and installation instructions.

- AT Power Supply Connector: This is a 12-pin power supply connector, which has +5V, +12V and software controlled soft-power signals. The motherboard can turn off the system power through software control, such as the shut down feature in Windows 95 or 98. The system BIOS automatically turns off the system.

34.7. INTEL 430 TX PCISET

Motherboard based on Intel 430 TX chipset is compact because data path unit is integrated within the 82439TX system controller chip.

Prominent Features

- *Support bus frequencies 60/66 MHz for 3.3 V and 2.5 V Pentium processors.*
- *Integrated DRAM controller, which supports DRAM memory ranging from 4 MB to 256 MB. SDRAM and EDO RAM can be installed.*
- *Integrated Level – 2 cache controller.*
- *Supports PCI bus interface at 30/33 MHz with upto five PCI bus masters.*
- *Inbuilt power management features.*

34.8. INTEL 440LX AGPSET

PCI AGP Controller Intel 82443LX is the first Intel product that introduced the Accelerated Graphics Port (AGP). The accelerated graphics port interface is designed to take full advantage of the PII processors and 3-D graphics applications.

34.9. INTEL 440LX CHIPSET BASED PII MOTHERBOARDS

- Intel chipset 82443LX is used.
- Supports Pentium II 166, 200, 233, 266, 300, 333 MHz processors.
- CPU voltage selection auto.
- Two 168-pin DIMM sockets supporting EDODRAM (Extended Data Out DRAM) and SDRAM (Synchrounous DRAM).

34.10. INTEL 440ZX AGPSET FOR PII

Intel has introduced a new technology called FSB (Front Side Bus) in 440ZX AGP (Accelerated Graphics Port) SET. This 100 MHz FSB technique enables the chipset 440ZX to handle 100 MHz system clock frequency. This supports PC 100 SDRAM (Memory module has a speed of 100 MHz).

Chips used: Intel 82443ZX and 82371EB.

34.11. INTEL 810 CHIPSET

- 370-Pin socket connector (PGA 370).
- Two SIMM and two DIMM slots.

Chips Used: Intel 82810 (GMCH0) and Intel 82810-DC-100(GMCH).

GMCH – Graphics and Memory Controller Hub.

34.12. SOME OTHER POPULAR INTEL CHIPSETS

- KOB 810DST CHIPSET CELERON / PII / PIII MAINBOARD
- INTEL 440BX AGPSET
- INTEL 440EX AGPSET
- INTEL 440GX AGPSET
- INTEL 440MX AGPSET
- INTEL 450NX PCISET
- INTEL 801E CHIPSET
- INTEL 820 CHIPSET
- INTEL 840 CHIPSET

Demonstration

a) Different motherboards.

Practical

(i) Fitting motherboard in the cabinet.
(ii) Removing & fitting CMOS battery.
(iii) Removing & Fitting Memory and other cards
(iv) Rectification of common faults.

CHAPTER 35

ASSEMBLING OF COMPUTER

35.1. Assembling of Computer

Assembling of Computer involves the installation of different hardware parts and making these interconnections. It also includes the partitioning and formatting of hard disk. It involves installation of operating system and other application software as per the user's requirement

35.2. Different Hardware Parts of Computer

(i) PC Cabinet (AT/ATX) – Comes with SMPS, FDD & HDD cables and screws.
(ii) Motherboard
(iii) Microprocessor
(iv) RAM (Memory)
(v) Floppy Disk Drive (FDD)
(vi) Hard Disk Drive (HDD)
(vii) Keyboard
(viii) Mouse
(ix) Monitor
(x) I/O Cards (Optional)

35.3. Optional Peripherals of Computer

(i) Printer
(ii) Modem
(iii) CD Rom Drive
(iv) Speakers
(v) Scanner

35.4 **Accessories of Computer**

(i) CVT (Constant Voltage Transformer)

(ii) UPS (Uninterrupted Power Supply)

35.5 **PC Cabinet (AT/ATX)**

It is a rectangular box, which hoses all the major hardware parts of the computer except keyboard, mouse and monitor. This cabinet after installation of different hardware parts is often known as CPU (Central Processing Unit). This cabinet comes with the SMPS fitted inside it. Along with this FDD & HDD cables and various screws are also supplied for fitting peripherals. Motherboard, FDD, HDD, I/O Ports etc. are installed directly in the cabinet with the help of different screws.

35.6. **Motherboard**

Motherboard is the main board of the computer through which all the hardware parts are connected .It comes with the I/O ports, connectors and cables, motherboard manual, CD (containing drivers) for interfacing different peripherals. It is fitted directly in the cabinet with the help of special nuts / screws. Power supply to the motherboard is supplied from the SMPS through two 6-pin connectors or a single 20-pin connector (ATX).

35.7. **RAM**

It is installed in the memory slots located on the motherboard for this purpose.

35.8 **Microprocessor**

It is installed in the microprocessor socket / slot located on motherboard for this purpose. Power supply to the fan of microprocessor is given either from the SMPS or from the motherboard.

35.9 **Floppy Disk Drive (FDD)**

It is fitted in the cabinet in a special compartment made for this purpose with the help of screws. It is interfaced with the motherboard through a 34-pin data / control cable and the power supply is given from the SMPS through a 4-pin connector.

35.10. **Hard Disk Drive (HDD)**

It is fitted in the cabinet in a special compartment made for this purpose with the help of screws. It is interfaced with the motherboard through a 40-pin Data / Control cable and the power supply is given from the SMPS through a 4-pin connector.

35.11. **Keyboard**

It is connected outside the cabinet and is connected to the motherboard either through a 5-pin connector or through a 6-pin connector located on the motherboard.

35.12. **Mouse**

It is connected outside the cabinet and is connected to the motherboard either through a 9-pin connector or through a 6-pin connector.

35.13. **Monitor**

It is connected out side the cabinet through a 15-pin connector either on the Display Adapter (fitted in I/O slot on the motherboard) or on the display adapter port (if display adapter is built-in within the mother board). Power supply to the monitor is given through a 3-pin power connector from the SMPS.

35.14 **Expansion (I/O) Card (optional)**

I/O cards may be used if display adapter is not built in within the motherboard or for adding different features e.g. sound card, T.V. tuner card etc. I/O card are installed in the I/O slots located on the motherboard.

35.15 **Assembling Procedure**

(i) Fit the motherboard in the cabinet as explained and demonstrated in CHAPTER 2 (motherboard).

(ii) Connect power supply to the motherboard from the SMPS through two 6-pin connectors or a single 20-pin connector (ATx) as explained and demonstrated in CHAPTE 2 (motherboard).

(iii) Connect the I/O port cable connectors with the motherboard and fit them in the cabinet as explained demonstrated in I/O ports chapter 5.

(iv) Install RAM Modules in the memory slot as explained and demonstrated in CHAPTER 6 (Physical Organizing of Memory).

(v) Install microprocessor in the microprocessor socket / slot as explained and demonstrated in CHAPTER 8 (microprocessor).

(vi) Connect the Monitor with the CPU through a 15-pin connector and give the power supply to the monitor from the SMPS through a 3-pin power (230VAC).

(vii) Switch on the system and perform the " Display Test". If it is OK proceed further.

(viii) Fit the FDD in the cabinet as explained and demonstrated in CHAPTER 11 (FDD).

(ix) Inter face the FDD with the motherboard through a 34-pin Data / Control cable and give the power as explained in CHAPTER 11 (FDD).

(x) Fit the HDD in the cabinet as explained and demonstrated in CHAPTER 14 (HDD).

(xi) Interface the HDD with the motherboard through a 40-pin Data / Control cable (if IDE interface) and give the power supply from the SMPS through a 4-pin connector as explained in CHAPTER 14 (HDD).

(xii) Connect the Keyboard with the motherboard through a 5-pin connector as explained and demonstrated in CHAPTER 19 (Keyboard).

(xiii) Connect the mouse with the motherboard through 9-pin serial port as explained and demonstrated in CHAPTER 20 (Mouse).

(xiv) Install I/O card if required in the I/O slots as explained and demonstrated in CHAPTER 3 (I/O Slot).

(xv) Connect the other optional peripherals in the similar manner.

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35.16 Software Process Involved in Assembling

(i) Connect the CD Drive with the motherboard using 40-pin Data / Control Cable (if IDE interface) and give the Power supply from the SMPS through a 4-pin Connector as explained and demonstrated in Chapter-28 (CD ROM And CD Drive).

(ii) Switch on the System.

(iii) Auto detect different peripherals on the BIOS Setup and make CD Rom as 1st Boot Device and ----- as 2nd Boot Device in the Advanced CMOS Setup as explained and demonstrated in CHAPTER 27 (CMOS Setup) Insert the Bootable CD in the CD Drive and boot from CD ROM (Boot with CD Rom support). A:\> Prompt will appear.

(iv) Partition the hard disk using FDISK utility as explained and demonstrated in CHAPTER 16 (Partitioning of Hard Disk).

(v) Format the hard disk drives using FORMAT utility as explained and demonstrated in CHAPTER 16 (Formatting of Hard Disk).

(vi) Now insert the Motherboard CD into the CD Drive to load different motherboard drivers in the hard disk.

(vii) Install required operating system.

(viii) Install different application software as per user requirement.

(ix) Now the system is complete and ready for operation.

Demonstration

(i) Fitting and connecting different hardware parts.
(ii) Loading OS
(iii) Loading different application software.

Practical

Assembling of computer.

Exercise - 35

Q. 1 Short Notes:

(i) Assembling of Computer.

(ii) Different hardware part of computer.

(iii) Optional peripherals of computer.