OUTPUT DEVICE

Output is a data that have been processed into useful information. It can be displayed / viewed on monitor, printed on paper, listened through speakers or head set

Output are of two forms:

1) **Hard Copy:** physical form of output is known as Hard Copy, like computer output copied on to paper, microfilm. Hard copy output is permanent and relatively stable form of output and highly portable

   Devices : Printers, platters and microfilms

2) **Soft Copy :** The electronic version of the output ,which is resides in computer memory and/or on disk is known as soft copy. Softcopy output is not permanent . It is transient and is usually displayed on screen. Softcopy output includes :audio and visual form of the output generated by computer

   Devices: Monitors, Voice Response systems, Projectors, Electronic White boards and head phones etc.

Output Devices
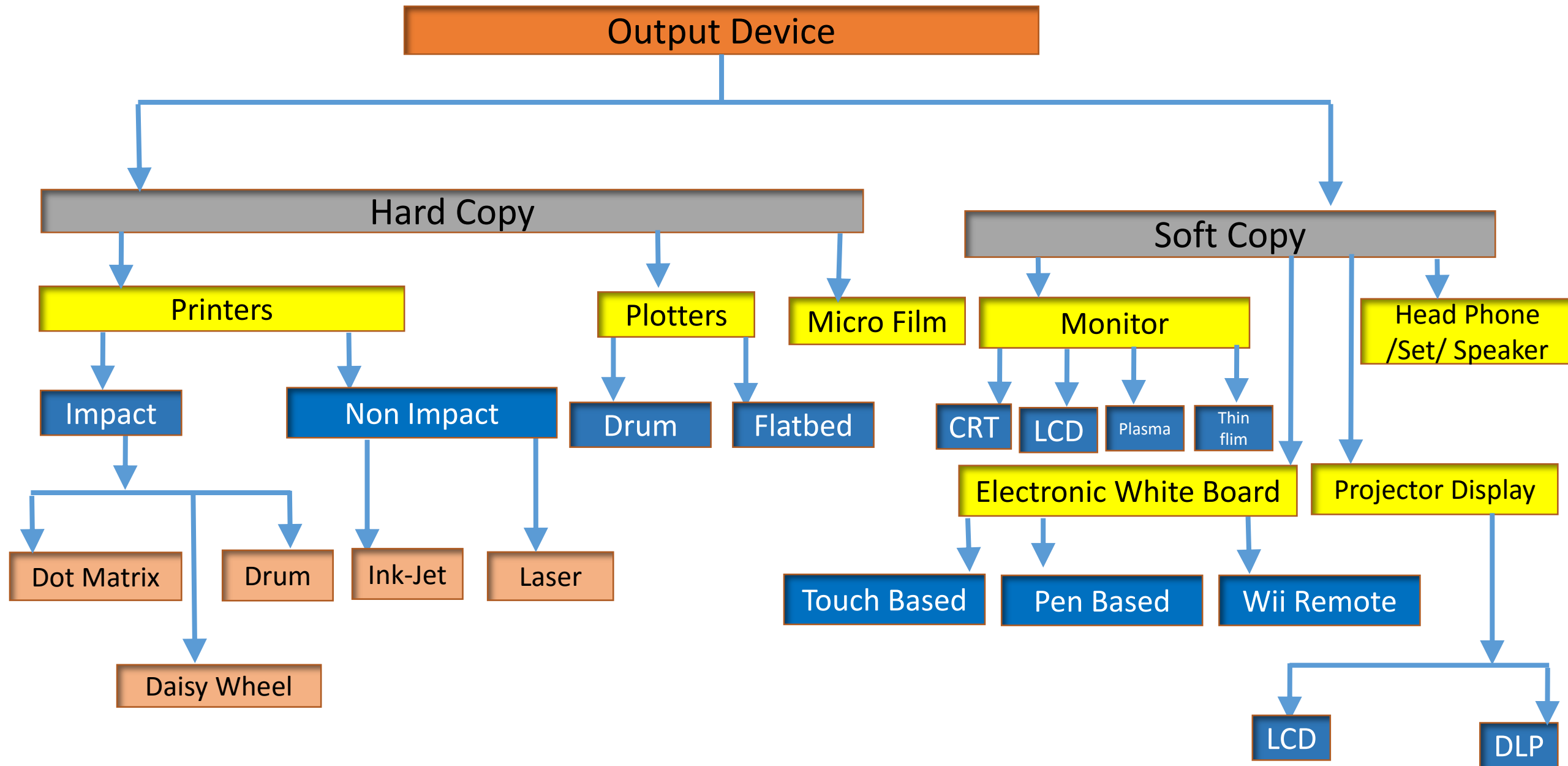
PRINTERS

- Printer prints 80 or 132 columns of characters in each line and prints either on single line sheets or on a continuous roll paper, depending upon the printer itself

- Quality of the print depends on the resolution. **The resolution is used to describe the sharpness and clarity of an image. The higher the resolution the better the image. Resolution is measured in dpi (dot per inch)**

- Printers divided into two categories : *Impact printers and Non-Impact printers*

- Impact printers work by physically striking a head or needle against an ink ribbon to make a mark on the paper. E.g Dot Matrix, Daisy Wheel and Drum printers

- Non-Impact printers use the technique other than physically striking the page to transfer ink on to the page. E.g : Ink-Jet, Laser Printers

Dot Matrix Printer

- Dot Matrix Printer / Wire Matrix Printer uses the oldest printing technology and it prints one character at a time. It prints characters and images as pattern of dots

- The speed of this printer is measured as character per second (cps). The speed can vary about 200 to 500 cps

- The print quality is determined by the number of pins (mechanism that print the dots) which can vary from 9 to 24. The more pins per inch , the higher the printer resolution. The result ion ranging from 72 to 360 dpi

- These printers are limited to the situation where carbon copies are needed and quality is not so important

Advantages
- In expensive and have low operating costs
- Can be used for different fonts, different line densities and different types of paper
- Bidirectional , i.e they can print the characters from either direction Left-Right or Right-Left
- Suitable for handling Accounting , Payroll, Billing applications - printouts
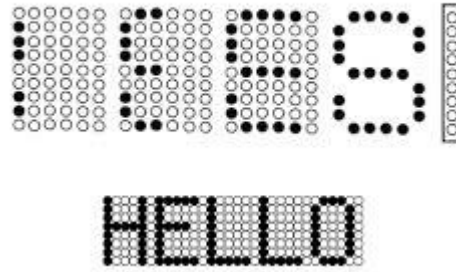
Disadvantages
- It prints only black and white, not suitable for colour print outs
- Produce low to medium quality printing
- Not suitable for image , graphics objects printouts
- The pattern of the dots that make up each character is visible on the print produced by it, and making it to look unprofessional

How Does a Dot Matrix Printer Work?
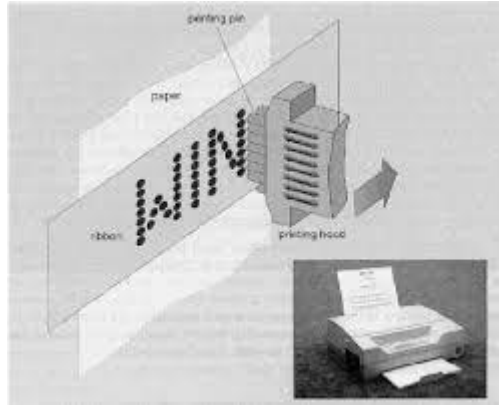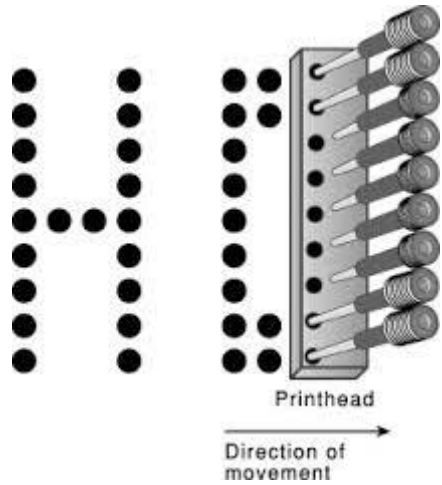
- The printer consists of an electro magnetically driven print head, which is made up of numerous print wires (pins)
- The paper is pressed against rubber coated cylinder / pins and is pulled forward as printing progress
- The characters are formed by moving electro magnetically driven print head across the paper, which strikes the printer ribbon situated between the paper and print head pin
- As the head stamps onto the paper through the inked ribbon, a character is produced that is made up of these dots
- These dots are very small for normal view and appear like solid human-readable characters

Daisy Wheel Printer

- **Daisy wheel** printer produces professional letter quality documents – printouts (Which is limitation in Dot Matrix printout). This printer also known as Letter Quality Printer

- Print head of this printer resembles daisy flower, hence the name

- They can have speed up to 60 cps

- **Advantages:**
  - ❖ Produces High Resolution output and reliable than dot matrix printer
  - ❖ Bi-directional printing and built-in microprocessor controls the features (Smart printer)

- **Disadvantages:**
  - ❖ Can print only alphanumeric outputs , not suitable for graphics
  - ❖ Can not change the fonts unless the print wheel is physically replaced
  - ❖ Very slow because of time required to rotate the print wheel for each character desired
 - ❖ More expensive than Dot matrix printer
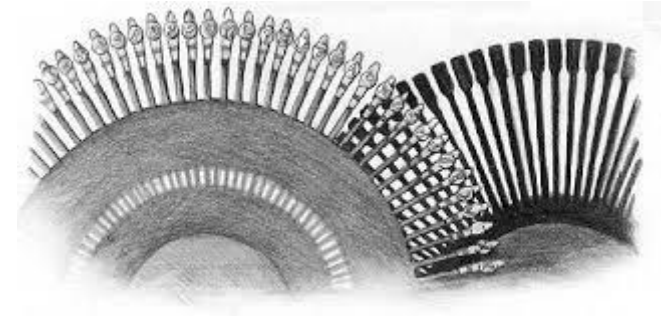
Drum Printer

- **Drum Printer** is a line printer , it can print a line in single operation (Dot Matrix and Daisy wheel printer prints one character per operation)
- It uses special tractor-fed paper with pre-punched holes along each side. This arrangement allows continuous high speed printing. Printing speed varies from 300 to 2000 lines per minute with 96-160 characters on each line

Advantages:
- ❖High Speed printers
- ❖Bi-directional printing and built-in microprocessor controls the features (Smart printer)
- ❖Suitable for heavy printing – business applications

Disadvantages:
- ❖Make sound
- ❖Have limited multi-font capabilities
- ❖Produces lower print quality
- ❖Very Expensive
- ❖Strike of the hammer should be should be precise . A single mistime strike of the hammer may lead to wavy and slightly blurred printing
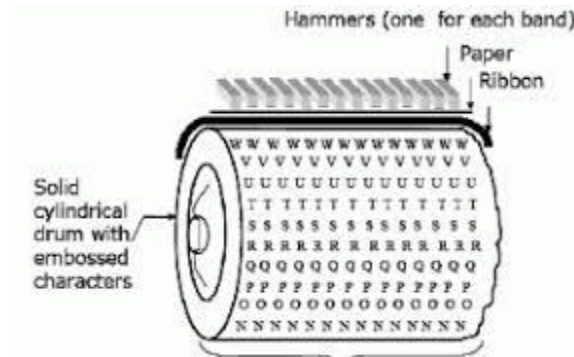
Ink – Jet Printer

- Ink-jet printer is a printer that places extremely small droplets of ink onto paper to create an image

- Being non-impact printer, it does not touch the paper while creating an image

- Instead it uses series of nozzles (spouts / jets) to spray drops of ink directly to the paper

- This printer originally manufactured to print in monochrome (black and white) only, but now it is extended to other colours. Nozzles increased to accommodate Cyan (C) , Magenta (M), Yellow (Y) and Black (K). This combination of colours are called CMYK

- This printer is costlier than dot matrix printers and quality is much better

- Can print any shape of the characters, special characters (Japanese , Chinese Characters) , chart, graphs etc.

- It typically print with a resolution of 600 dpi or more

- This printer can print about 6 pages per minute

- Suitable for small business and home offices

Laser Printer

- A **laser printer** provides the highest quality text and images , and is a very fast printer. This operates on the same principle as that of photocopy machine
- This is also known as page printers because they process and store the entire page before they actually print it
- It produces sharp, crisp images of both text and graphics, providing resolutions from 300 to 2400 dpi.
- It is able to print 4-32 text-only pages per minute for individual microcomputers and up to 200 pages per minute for mainframes
- It can print in different fonts, styles, size , colours
- This printer is more faster and expensive than Ink-Jet printer
- The cost of these printers depends on combination of costs of paper, toner replacement and drum replacement
- This printer is useful for volume printing because of their speed

How Does A Laser Printer Work?
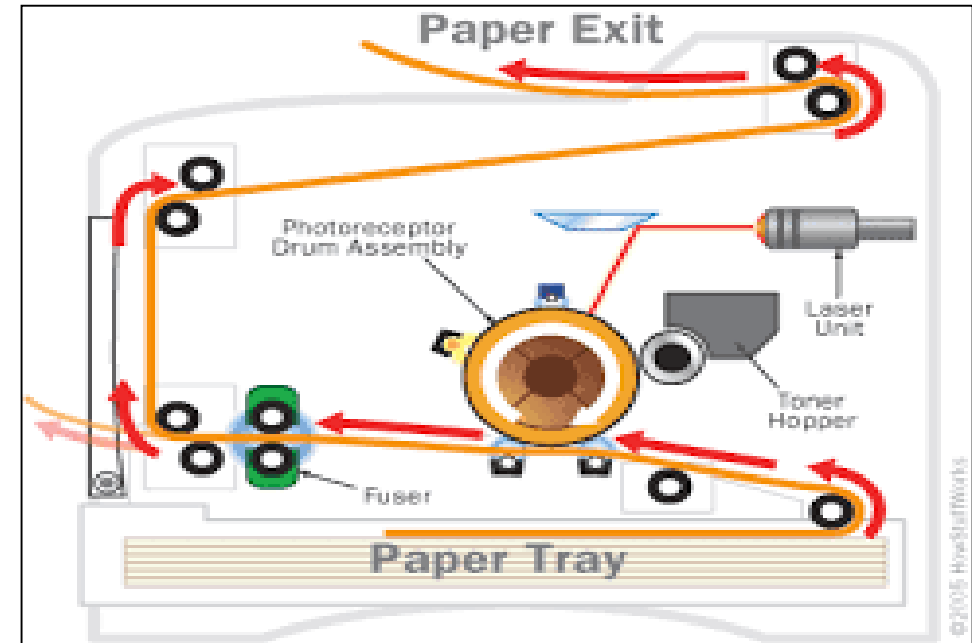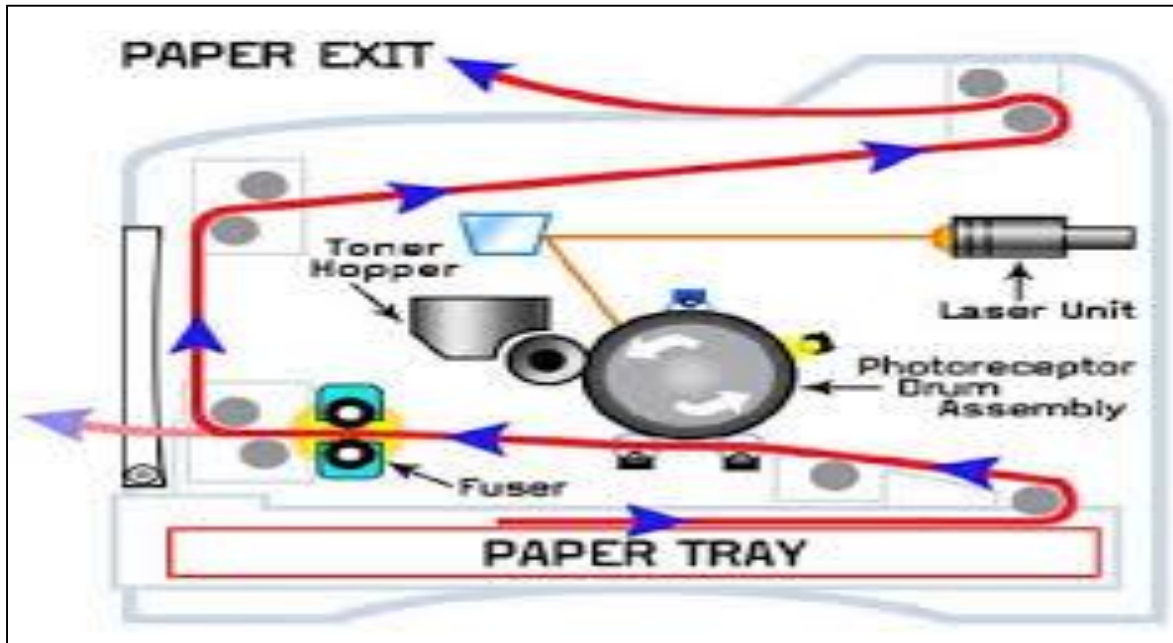
- The core component of laser printing system is the photoconductive drum. A rotating mirror inside the printer causes beam of laser to sweep across the photoconductive drum
- Initially, the beam of laser charges the photoconductive drum positively. When the charged photoconductor is exposed to an optical image through a beam of light to discharge, a latent or invisible image formed
- At the point where the laser strikes the surface of the drum, it creates a dot of positive charge
- These points are represented by black dots, which will be printed on the paper. After this, the printer coats the drum with a container, which contains a black powder called toner
- This toner is –vely charged, and so it clings to the +ve areas of the drum surface. When the powder pattern gets fixed, drum is rotated and paper is fed into the drum surface via a pressure roller
- This pressure roller transfers the black toner onto the paper. Since the paper is moving at the same speed as drum, the paper picks up the image pattern precisely
- Finally , the printer passes the paper through the fuser, a pair of heated rollers. As the paper passes through these rollers, the loose toner powder gets melted and fuses with the fibres in the paper. The paper is then brought out of the printer

HYDRA Printer

Plotters

- **A plotter** is a pen based output device that is attached to a computer for making vector graphics (i.e images created by a series of many straight lines)

- It is used to draw high-resolution charts, graphs, blueprints, maps, circuit diagrams and other line based diagrams

- It is similar to a printer, but it draws lines using a pen. As a result it can produce continuous lines, where as printer can only simulate lines by printing a closely spaced series of dots

- Multicolour plotter uses different coloured (cyan, magenta, yellow and black) pens to draw different colours

- Being vector based, a plotter tends to draw much crisper lines and graphics. The lines drawn by these devices are continuous and very accurate.

- But plotter is very slow output device because it requires excessive mechanical movement to plot. And it is unable to produce solid fills and shading

- Plotters are expensive than printers, but they produce large , more printouts than printers

- They are mainly used for CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) applications such as printing out plans for houses, car parts etc.

- It is also used with programs like AUTOCAD to give graphic outputs
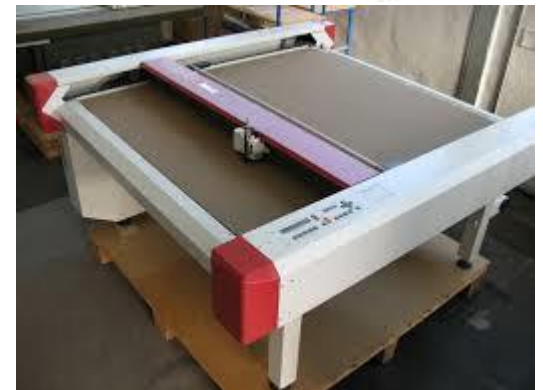
Types of Drum Plotter

Drum Plotter (where the paper moves)

- In drum plotter , the paper on which the design is to be printed is placed over a drum. These plotters consist of one or more pens that are mounted on carriage which is horizontally placed across the drum

- Drum can rotate in clockwise or anti-clockwise direction under the control of plotting instruction by computer

- In case a horizontal line is to be drawn, the horizontal movement of the pen is combined with the vertical movement of the page via drum

- The curves can also be drawn by creating a sequence of very short straight lines

- In these plotters, each pen can have different colour ink to produce multicolour designs

- Drum plotters are used to produce continuous output such as plotting earthquake activity or for long graphic output such as tall building structures

Flatted Plotter (where the paper is stationary)

- Flatted plotters consist of a stationary, horizontal plotting surface on which paper is fixed

- The pen is mounted on a carriage , which can move horizontally, vertically, leftwards or rightwards to draw lines

- In flatbed plotters, the paper does not move, the pen-holding mechanism provides all the motion

- These plotters are instructed by the computer on the movement of pens in the x-y coordinates on the page

- These plotters are capable of working on any standard , that is from A4 size paper to some very big beds

- Depending on size of the flatbed surface, these are used in designing of ships, aircrafts, building and so on

- The major disadvantage of this plotter is that it is a slow output device and can take hours to complete a complex drawing

Computer Output Microfilm (COM)

- COM is an extremely high-speed, low-cost process, which records computer generated information directly from the computer tape or cartridge to a miniaturized microfilm media

- Microfilm product is in fiche or roll format, can be duplicated rapidly and inexpensively

- This process can produce data in microfilm form at a highly significant speed from that of a paper printer. The image area of the copy is dramatically reduced upto 1/40 of its original size, yet it retains original clarity. Life expectancy of COM is more than 500 years

- Main disadvantage of using COM is that it cannot be read without the assistance of a special reader device

- COM is ideal for applications where there is a large amount of information to be retained like manuals, industrial catalogues, distribution of airline schedules, medical, X-rays etc.

Monitor

- The **monitor** is most commonly used output device for producing soft copy output. It is TV like display attached to the computer

- Monitor can either be monochrome display or colour display. Colour screens commonly display 256 colours at one time from selection of over 256,000 choices

- The monitors are available in various sizes like 14,15,17,19,21 inches

- Two parameters are used to describe the size of the monitor : *aspect ratio and screen size*

Aspect Ratio

3

4

Screen Size
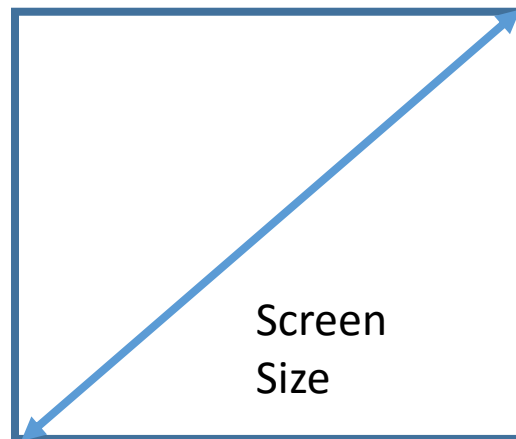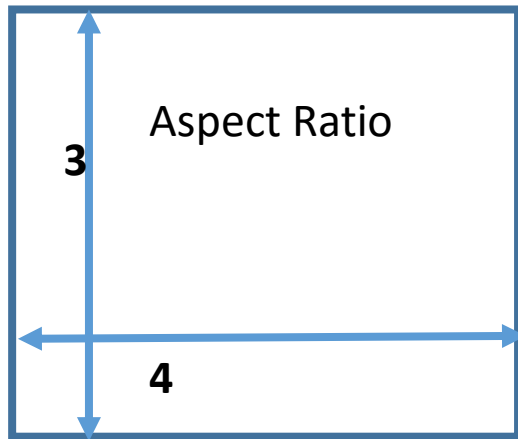
- **Aspect ratio is** the ratio of width of the display screen to height or ratio of vertical points to the horizontal points necessary to produce equal-length lines in both directions on the screen
- Generally aspect ratio of computer is 4:3
- **Screen size** are normally measured diagonally (in inches), the distance from one corner to the opposite corner

The screen clarity depends on three basic qualities: **Resolution , Dot pitch, Refresh rate**

❖ **Resolution:** It refers to the number of pixels in horizontal and vertical directions in the screen. In medium resolution graphics, pixels are large, in high resolution graphics pixels are small
   The average CRT display is comes with pixel screen of sizes 800X6000 or 1024X768 . A resolution of 1024X768 will produce sharper images than one of 800*6000

Monitor - Contd

❖ **Dot pitch :** It is measurement of the diagonal distance between two like coloured pixels on a display screen. It is measured in millimetres and common dot pictures are 0.51 mm, 0.31mm, 0.28 mm , 0.27 mm, 0.26mm and 0.25 mm. The smaller the dot pitch , the sharper the image

❖ **Refresh rate:** It is the number of times per second pixels are recharged so that their glow remains bright. The screen pixels are made from the phosphor. An electron beam strikes the phosphor and cause it to emit light, resulting in the display of the images
 However it needs to be refreshed periodically because phosphor hold their glow for just a fraction of a second. The refresh rate of the monitor varies from 60 to 75 Hz (Hertz). The refresh rate of 60 Hz means image is redrawn 60 times a second
 The higher the refresh rate , the more solid images on the screen

Colour Depth:

• Colour depth, also referred as *bit depth ,* is the number bits assigned to each pixel in the image and the number of colours can be created from those bits. In simple words it refers to the number of colours that a monitor can display

• Deferent colour depths depend on the amount of display memory dedicated to each pixel. One byte used to represent 256 colours for each pixel, 24-bit (or 3 bytes) colour can display 16.8 million different colours per pixel

Bits – Colour Depth	Known by name
8	Pseudo
16	High Colour
24	True Colour
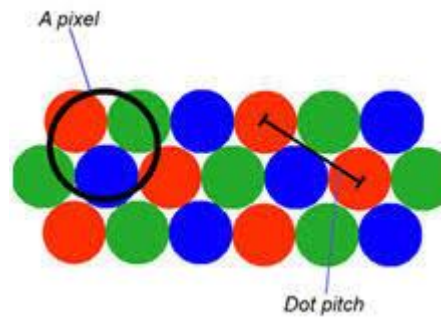
16
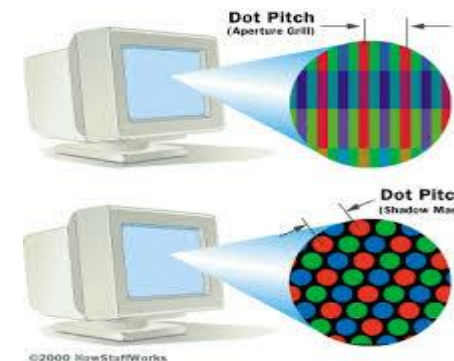
Briefing of LCD and CRT Monitors

Difference between LCD and CRT Monitors

Full form : LCD – Liquid Crystal Display , CRT – Cathode Ray Tube

Size : LCD is lightweight and compact , which saves desktop space compared to CRT

Resolution: LCD is designed to work in single resolution, while CRT is designed for many resolution

Pixel Density: LCD pixel is not as tight as the dot pitch in CRT

Brightness: The illuminated phosphor of a CRT is not nearly as bright as what the LCD can produce with its florescent backlight

Power Consumption: LCD consumes significantly less power than CRT (half of the CRT)

Flicker/Flash: With CRT monitors, the goal is to get a faster refresh rate of at least 85 Hz, but LCD run much slower refresh rate

Pixel Response Time: The time taken by a pixel to change its state is called *pixel response time*. CRT has extremely fast pixel response time but LCD can be quite slow. (hence some time we see ghost images in LCD)

Viewing Angle: CRT can be viewed in any angle but LCD is best viewed in "head on", other angles may result in inconsistent colour and brightness

Viewing Area: The viewing area of CRT is usually less than that of advertised. E.g of 19 inch monitors , viewing area is about 18 inches. The LCD monitors are measured exactly . E.g 19 inch monitor, viewing area is also 19 inches

Cost: Prices for LCD screens are quite high compare to CRT

Voice Response System

- **Voice Response System** has an audio response device which produces audio output. These sounds are pre-recorded in the computer. Each sound has a unique code

- Whenever enquiry sought from the system, the computer responds in digital form which is sent to the voice devices that unscramble the digital information and produces sound messages to the requesting computer

- There are two approaches to get computer to talk to the user
  - ❖ Synthesis by analysis – convert of the human voice
  - ❖ Synthesis by rule – applies a complex set of linguistic rules to create artificial speech

- Voice output has become common in many places like airlines, bus terminals, banks. It is used when an inquiry is followed by a short reply (such as bank balance, flight timings etc.)

- Other uses of voice outputs are : Automatic telephone voice takes the survey, inform customers on catalogue orders are ready to pick up, reminder on bills not paid

- Moreover, people with total or partial speech handicap are faced with the problem of communicating their wishes, need to others

Projectors

- The screen image projector is an output device , which is used to project information from a computer onto a large screen so that it can be simultaneously used viewed by large group of people

- Projector is commonly used for classroom training, conference room etc.

- Projectors are of two types : LCD (Liquid Crystal Display) and DLP (Digital Light processing)

ELECTRONIC WHITEBOARD

Head phone and Head Set

- Headphone is an audio device equipped with a pair of speakers attached to a head strap worn by the users

- Headphone are used with almost all electronic devices such as CD/DVD players, mp3 player, iPOD,etc. They are easily connected to a computer via a mini stereo plug

- A headset is combination of one or two speakers and a microphone with both the speakers and the microphone attached to a headstrap

COMPUTER TERMINALS

A computer terminal is a special unit that can perform both input and output. A terminal is an I/O device that uses a keyboard for input and a monitor for output. That is why terminal is called Video Display Terminal (VDT). Terminals can be categorized into following types:

Dumb Terminal: It refers to a terminal that has no processing or programming capabilities. It is designed to communicate exclusively with a host computer. It is used for simple data entry or retrieval tasks

Smart Terminal: Has built-in processing capability and memory , but does not have its own storage capacity. In comparison to the dumb terminal, a smart terminal can communicate, retrieve data and can perform a limited processing of its own, that is editing , verification of data. However this kind of terminal can not be used for programming. They are often found in local area networks in offices

Intelligent Terminal: An intelligent terminal has memory and inbuilt microprocessors , known as user-programmable terminal. This terminal can independently perform certain number of jobs without even interacting with server