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4.0 INTRODUCTION

In the previous unit, we have discussed the history of computer systems and methods to store data in computers. In this unit we shall discuss something about input/output devices and their functions. Input/output devices constitute a major part of a computer system. These are also called peripheral devices. Without I/O devices, a user cannot communicate with the computer. They are required to enter data and instructions in a computer so that the computer can process that data and provide the result to the user through output devices. In computer, inputs are the signals and data received by the system and outputs are the signals and data which are generated from the system.

First we will discuss briefly about input/output devices and then move on to the function and structure of input and output devices. And finally, we will discuss about recent trends in input devices such as digital camera, barcode reader, magnetic ink character recognition and magnetic stripe reader such as ATM machines and Electronic Point of Sale (EPOS).

4.1 OBJECTIVES

After studying this unit you should be able to understand:

- the basic concepts of input/output devices;
- functions of input/output devices;
- types of input/output devices;
- types of Ports;
- types of monitors, printers, scanners and graphics tablet; and
- newer technologies in computer hardware.

4.2 INPUT OUTPUT (I/O) DEVICES

Inputs are data or signals received by the computer system. An Input unit takes the input and converts it into binary form, so that it can be understood by the computer

The computer will be of no use if it is not communicating with the external world. Thus, a computer must have a system to receive information from the outside world and must be able to communicate results to the external world. Thus, a computer consists of input/output devices. Input and output devices can also be written as I/O devices.

Input and output devices of a computer system are the devices that connect you to computer. Input devices let you to transfer data and user command into the computer system. I/O devices are used to interact with the computer system. For example, you can type in data by using a keyboard, or you can input data in picture form by using a scanner in computer system.

On the other hand, output devices display the result of input data or signals after processing it. Examples of these could be your computer's monitor, which displays all the programs which are running on the computer, as well as the printer, which will print out a hard copy of the information which is saved in your computer.

Input and output devices allow the computer system to interact with the outside world by moving data into and out of the computer system.

Examples of some input devices are:

- Keyboard
- Mouse
- Joystick
- Microphone
- Bar code reader
- Graphics tablet
- Pen drive
- CD/DVD
- Digital Camera

An output device is used to send data out of the system. The user sees the result after processing of data by the computer through output devices. Examples of some output devices are:

- Monitor
- Printer
- Plotter
- Speaker

Input and output devices are also called I/O devices. They are directly connected to an electronic module called I/O module or device controller. For example, the speakers of a multimedia computer system are directly connected to a device controller called an audio card, which in turn is connected to the rest of the system.

Input and output devices are similar in operation but perform opposite functions. It is through the use of these devices that the computer is able to communicate with the outside world.

Input data for the computer system could be in any of the following forms :

- Manual inputs from a keyboard or console.
- Analog inputs from instruments or sensors.
- Inputs from a storage device, such as pen-drive, CD's and Floppy Drives.

The speed of a processor is far more than the input devices, such as the keyboard of computer system. Computer systems can process hundreds or thousands of computer words or characters per second. Thus, a study of the first method, i.e. manual input

reflects the inability of human-operated keyboards or keypunches to supply data at a speed that matches the speed of digital computers.

☞ Check Your Progress - 1

Part I: State True/False

- | | |
|---------------------------------------|--------------|
| 1) Keyboard is an input device. | True / False |
| 2) Monitor is an input device. | True / False |
| 3) Printer is an input device. | True / False |
| 4) Graphic Tablet is an input device. | True / False |
| 5) Joy-stick is an output device. | True / False |
| 6) Speaker is an output device. | True / False |
| 7) Microphone is an input device. | True / False |

Part II: Short answer type questions

- 1) What do you mean by input devices?

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.....
.....

- 2) What do you mean by output devices?

.....
.....
.....

- 3) Name some input and output devices.

.....
.....
.....

4.3 WHAT IS PORT ?

I/O ports are the interfaces through which computers communicate with external devices such as printers, modems, joysticks and terminals

Port is a connecting socket, outside the system into which different types of cables are plugged. It is a specific place from which other devices can be physically connected. I/O ports are the interfaces through which computers communicate with external devices such as printers, modems, joysticks and terminals. There are many types of ports used in computer system. Some of them are given as follows.

4.3.1 Parallel Port

Various peripherals can be connected through parallel port, which is a parallel communication physical interface. A parallel port transmits 8 bits of a byte of data in parallel. It is used for transmitting fast data over short distances. It is used to connect a printer to a computer. Since a parallel port transmits an entire byte at a time, it operates

I/O devices at a relatively high speed. A Parallel port is primarily used to connect printers to a computer and hence it is often called a printer port.



Figure 4.1: Parallel Port

4.3.2 Serial Port

Serial port transmits one bit of a byte, one at a time as a single stream of bits. It is meant for transmitting slow data over long distances. Communication over a phone is an example of serial communication. It is a serial communication physical interface which transmits one bit at a time. Dial-up modems and serial mice use serial ports.



Figure 4.2: Serial Port

4.3.3 Universal Serial Bus (USB)

A USB Port can connect up to 127 peripheral devices such as a digital camera, digital speakers, scanners, speakers etc. It permits *Plug and Play* – configuring of expansion cards and peripheral devices as and when they are installed.



Figure 4.3: USB

4.3.4 Small Computer System Interface (SCSI) Port

SCSI-Small Computer System Interface Port allows data to be transmitted in a daisy chain to up to 7 devices at a speed higher (32 bits at a time) than those possible with serial and parallel ports. It is a fast data transmitting device and is used to connect HDD, CD ROM drives and scanners with the computer system.

4.4 INPUT DEVICES

In this section we will discuss various types of input devices used for entering data into the computer system. These are:

4.4.1 Keyboard

It is the most common input device used for entering data and information into the computer system. This is the standard input device attached to all computers. The keyboard is a primary device for inputting text by pressing a set of keys. All the keys are neatly mounted in a keyboard connected to the computer system. Keyboard devices can be classified into two types **general purpose keyboards** and **special purpose keyboards**. General purpose keyboard are standard keyboards used with most computer system. They are called general purpose because that have enough keys to make them useful for any type of application. The layout of keyboard is just like the traditional typewriter of the type QWERTY. It also contains some extra command keys and function keys. It contains a total of 101 to 104 keys. You have to press a correct combination of keys to input data. The computer can recognize the electrical signals corresponding to the correct key combination and processing is done accordingly.

The User can enter data into the computer by pressing a set of keys on the keyboard. In a keyboard letters are printed on the keys. The first keyboard was developed in the 18th century and was named as a QWERTY keyboard. A Computer keyboard includes control circuitry which converts the key pressed by the user into key codes so that the computer can understand it. Now-a-days wireless keyboards are also being used which increase user freedom. The wireless feature is achieved by infrared signals or by radio frequency.

In general, a computer keyboard has following keys :

1. **Alphanumeric Keys:** It includes letters and numbers.
2. **Punctuation Keys:** These include comma, period, semicolon etc. and
3. **Special Keys:** These can be function keys, control keys, arrow keys and Caps lock keys etc.



Figure 4.4 : Keyboard

All the modern keyboards of computer are classified as:

- (a) Original PC keyboard having 84 keys;
- (b) Advance Technology (AT) Keyboard having 101-104 keys; and
- (c) Multimedia Keyboard having 120 – 140 keys.

4.4.2 Mouse

A Mouse is a handy device which can be moved on a smooth surface to cause the movement of a cursor on the screen. It is a pointing device which is used to input data and information into the computer system by pointing on it. Physically, a mouse contains a small case, held under one of the user's hands with one or more buttons. For GUI-based systems a mouse is an essential pointing-device. The cursor of the mouse moves in the same direction in which the mouse ball rolls.



Figure 4.5: Mouse

Its name is derived from its shape, which looks a bit like a mouse, with its connecting wire that one can imagine to be the mouse's tail. A Mouse rolls on a small ball and has two or three buttons on the top. When you roll the mouse across a flat surface on the screen, sensors sense the mouse in the direction of mouse movement. The cursor moves very fast with a mouse giving you more freedom to work in any direction. It is easier and faster to move through a mouse compared to movement using keys.

Types of Mouse

Mouse could be mechanical, optical or cordless types. Further information regarding these types are as follows :

Mechanical Mouse : Mechanical Mouse uses ball for the movement of cursor on the computer screen. When the ball is rolled in any direction, a sensor of the mouse detects it and also moves the mouse pointer in the same direction.

Optical Mouse : Optical Mouse uses Laser rays for the movement of cursor on the computer screen. It is an advanced pointing device. Movement is detected by sensing changes in the reflected light rather than the motion of a rolling sphere.

Cord-Less Mouse : Cord-Less Mouse is battery driven and does not need any wire for the physical connection with the motherboard. It transmits data through infrared or radio signal.

Computer mice are very useful in designing pictures and graphs and computer and video games by multimedia designers. A Mouse pad is required to move the mouse because it provides a smooth surface. However, an optical or laser mouse doesn't require a mouse pad.

4.4.3 Digitizing (Graphic) Tablet

Digitizing or Graphics' tablet is a computer input device that allows one to hand-draw images and graphics, similar to the way one draws images with a pencil and paper. These tablets may also be used to capture data of handwritten signatures. Some tablets are intended as a general replacement for a mouse as the primary pointing and navigation device for desktop computers. These are used by architects, engineers and designers in Computer Aided Design (CAD) for designing purposes, such as buildings, cars, mechanical parts, robots etc. These are also used in Geographical Information System (GIS) for digitizing of maps.

These are used by architects, engineers and designers in Computer Aided Design (CAD) for designing purposes, such as buildings, cars, mechanical parts, robots etc.



Figure 4.6: Graphics Tablet

Graphics tablet is most suited for artists and those who want the natural feel of a pen-like object to manipulate the cursor on their screen. Wacom is the most well known manufacturer of graphics tablets, and is incredibly well respected.

4.4.4 Trackball

Trackball is a moveable ball mounted on a stationary device, which can be rotated manually by using fingers. It is also a pointing device. In a trackball, the ball is placed on the top along with buttons which can be rolled with the fingers. These are used in playing video games.



Figure 4.7: Trackball

Mouse and mobile phones are equipped with trackballs to navigate addresses as well as play games.

4.4.5 Joystick

Joystick is a remote control device for a computer which is used for playing video games to indicate the position. It has a stick that pivots on a base and is used for controlling the action in video games. The User moves a spherical ball with the help of a stick in the joystick as opposed to the trackball where fingers are used for moving the ball.

Joysticks are also used for controlling machines such as cranes, trucks, underwater unmanned vehicles, flight simulators, industrial robots etc.



Figure 4.8: Joystick

The Joystick shown in Figure 4.8 has a base and a handle for controlling the movement of the cursor on the screen.

☞ Check Your Progress 2

Part I: True / False

- | | |
|--|--------------|
| 1) Cordless mice are directly connected with computer. | True / False |
| 2) Mechanical mice use laser rays for movement. | True / False |
| 3) Mouse is not a pointing device. | True / False |
| 4) Floppies are used to store data. | True / False |
| 5) Scanner is used to print documents. | True / False |
| 6) Printer is used to display pictures. | True / False |
| 7) Monitor is used to scan pictures. | True / False |

Part II: Short answer type questions

- What do you mean by keyboard?

- What do you mean by mouse and what are its types?

3) What do you mean by scanners and what are their functions?

4) What do you mean by joystick and trackballs in a computer system?

4.5 PICK DEVICES

Pick devices are used to select an object on the screen. The selected object can be text or graphics. Examples of pick devices are light pens and touch screens.

4.5.1 Light Pens

A Light pen is a pen like light-sensitive device. It is connected by a wire to the computer terminal to detect the CRT beam when pointed towards the screen and generate a narrow electrical pulse that can be fed to the computer as an input signal.

It is used to draw on the screen or to point to the displayed objects. It operates by detecting the light emitted by the screen phosphors.

A light pen can work with any CRT monitor but not with LCD monitors. It is used by architects and engineers for CAD applications and editing.

A light pen can work with any CRT monitor but not with LCD monitors



Figure 4.9: Light Pen

4.5.2 Touch Screens

Touch screens are monitors / electronic visual display screens which detect where they are being touched. The user makes selections by directly touching the screen, rather than moving a cursor to the point on the screen with a mouse or joystick

Now days touch screens are being used in ATM machines for making it user friendly and Kiosk machines are used for guiding the travelers about their travel plans. Touch screens are also used in many of the modern cell phones.



Figure 4.10: Touch Screen

4.6 SOURCE DATA ENTRY DEVICES

Entry of data into a computer system directly from the source, without transcription is called source data entry. Source data entry devices have a lower probability of error in input data than standard keyboard entry.

Some of the common source data entry devices are discussed below:

4.6.1 Digital Camera

A Digital camera is an electronic device which takes video or still photographs or both, digitally by recording images via an electronic image sensor. Digital cameras can do things which film cameras can't, for example displaying images on screen immediately after they are recorded.

Images recorded on a digital camera can be cropped for editing, deleted and various types of special effects can be created by using Photoshop software.

Digital cameras look like ordinary cameras but have sufficient memory in the form of chips to store thousands of images, rather than using photographic films.



Figure 4.11: Digital Camera

Most digital cameras allow users to choose the resolution needed for a picture. Most of those can connect directly to a computer to transfer data. A USB port is generally used for this purpose. A Wireless connection can also be used for connecting to a computer via Bluetooth.

These cameras use memory cards with flash memory to store images. The joint photographing expert's group standard (JPEG) is the most common file format used for storing data in a camera. Other formats include raw image format, DNG format etc.

4.6.2 Scanners

A Scanner is an input device and is used to input data into the computer system in the form of pictures. It optically scans images, printed text, handwriting, or an object, and converts it to a digital image. Examples of scanners are a desktop or flatbed scanner.

In scanners the document is placed on a glass window for scanning. Mechanically driven scanners that move the document are typically used for large-formatted volume of documents.

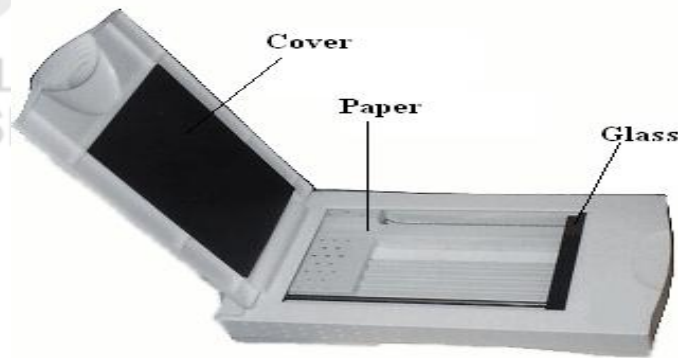


Figure 4.12: Optical Scanner

Another type of scanner is a planetary scanner. This scanner takes photographs of books and documents. Three dimensional scanners are used for producing three-dimensional models of objects.

4.6.3 Optical Mark Recognition (OMR)

OMR is the scanning of paper to detect the presence or absence of a mark in a predetermined position. Now days, it is used as an input device for source data entry purposes. Universities and colleges often use OMR for the evaluation of OMR sheets for competitive exams. OMR sheets consist of multiple choice question papers and students are required to make a mark to indicate their answers. OMR is used in the evaluation of questionnaires, surveys and university exam OMR sheets.

Universities and colleges often use OMR for the evaluation of OMR sheets for competitive exams



Figure 4.13: Optical Mark Recognition

4.6.4 Magnetic Ink Character Recognition (MICR)

Magnetic Ink Character Recognition is a character recognition system that uses special ink and characters. When a document that contains this ink needs to be read, it passes through a machine, which magnetizes the ink and then translates the magnetic information into characters.

MICR technology is used by banks for faster processing of large volumes of cheques. Numbers and characters found on the bottom of checks (usually containing the check number, sort number, and account number) are printed using Magnetic Ink. To print Magnetic Ink codes, we need a laser printer that accepts MICR toner.

MICR provides a secure, high-speed method of scanning and processing information. This technology is used for processing large volume of data. It speeds up data input for the bank because cheques can be directly fed into the input device as it also ensures accuracy of data entry. The most commonly used character set by MICR devices are known as E13B font which consists of the numerals 0 to 9, and four special characters.

MICR technology is used by banks for faster processing of large volumes of cheques

4.6.5 Bar Code Reader

A barcode reader is an electronic device which is used to read printed barcodes. Barcodes represent alphanumeric data which is a combination of vertical lines (bars) that vary in width and length. It is a fast and effective way to input data. A Barcode reader uses a laser beam to read the series of thick and thin lines which represent the bar code number.



Figure 4.14: Bar Codes



Figure 4.15: Bar Code Reader

The bar code is 13 digits long and it has four main divisions. The First two digits of a bar code represent the country, the second part represents the manufacturer's code (five digits) the third part represents the product code (five digits) and the last digit is a check digit.

4.6.6 Magnetic Stripe Reader

A magnetic reader is a hardware device which is used to read the information encoded in the magnetic stripe located at the back of a credit/debit card. A bank card holds data about the owner of the card, bank account number and code of the bank branch, where the account is held.



Figure 16: ATM Machine with Card



Figure 17: Magnetic Stripe Reader

Magnetic stripe readers are often used at supermarkets and in many different types of shops. In these machines data is read electronically and the point of sale is called Electronic Point of Sale (EPOS).

There are several other pick devices such as microphones and speakers. These have been discussed in length under the section Out Put Devices section of this unit.

4.7 OUTPUT DEVICES

One of the most important output devices in computer system is its screen commonly called monitor. It is an output device and displays all the programs and applications which are running on the computer system. A Monitor is the visual display unit of the computer system. It displays images generated from the video output. It displays images without keeping a permanent record.

A Graphic display is made up of a series of dots called 'pixels' (picture elements) whose pattern produces images in computer system. Each dot on the screen is defined as a separate unit which can be addressed separately. Since each dot on the screen can be controlled separately it gives greater flexibility in drawing pictures. The Number of dots per inch (dpi) is called the resolution of the screen and represents the quality of the computer system.

4.7.1 Cathode Ray Tube Monitors (CRT)

Monitors display what is going on in your computer. They can run at various resolutions. It is the part of computer which looks like a TV set. After typing the characters from the keyboard, we can see them on the monitor.

The main components of a CRT monitors are the electron gun, the electron beam controlled by an electromagnetic field and phosphor coated display screen. These older monitors are bulky and require a lot of space for installation.

A Graphic display is made up of a series of dots called 'pixels' (picture elements) whose pattern produces images in computer system

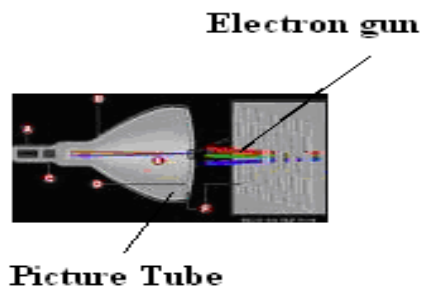
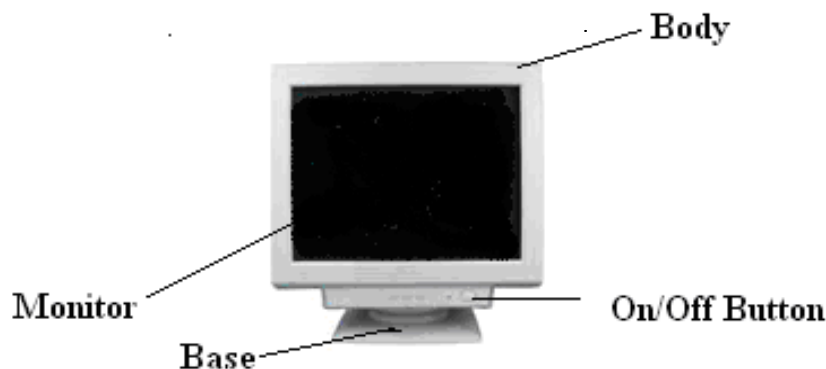


Figure 4.18: Normal CRT monitor and its internal working diagram

In CRT monitors, the image is projected on the screen by directing the electron beam onto the computer screen. To precisely direct the electron beams, copper steering coils are used to create a magnetic field inside the tube. By applying varying voltages to the copper coils a beam can be positioned at any point on the screen.

4.7.2 Liquid Crystal Displays (LCD)

First introduced in watches and clocks in the 1970's, LCDs are now used to display images in monitors. A newer technology in computer screens is TFT LCD monitors. These are light weight monitors and are used in laptop computers. Active matrix structure is used by most of the modern LCD monitors and television sets. In this technology, a matrix of thin-film transistors (TFT) is added to the polarizing and color filters. It enhances the display to make it look brighter and sharper. It can also produce much better images and have quicker response times.



Figure 4.19: LCD monitor

These monitors are portable, reliable and consume less electricity. Images produced by these monitors are of better quality than that of old CRT monitors. The LCD monitors have very high resolution and emit less radiation than CRT monitors. The screen is also flicker free.

4.7.3 Thin Film Transistor Liquid Crystal Display (TFT LCD)

It is type of monitor which used thin film transistor technology to enhance the image quality of LCD Monitors. These are used as monitor in television set, desktop computer, laptop computer and mobile phones etc.

4.7.4 Light Emitting Diodes Monitors (LED)

Light Emitting Diodes (LED) is the latest technology which is being used now a days for making high definition TV screens and monitors. It is a semi-conductor light source. In this technology diodes are used to light up the screen instead of liquid crystal Diodes.

LED is known as light emitting diode. It is an electronic device that lights up when electricity is passed through it. LEDs are usually red. They are good for displaying images because they can be relatively small, and they do not burn out. However, they require more power than LCD monitors. LED is light weight monitors and is used in laptop computers and in TV.

The Life of LED monitors is three times than that of LCD monitors and they have less warm up time than that of CRT or LCD monitors. These monitors require less space on the desk, less power consumption and have flicker free screen.

4.7.5 Projection Displays

These are normally used for large group presentations. These systems can be connected to a computer and whatever appears on the computer terminal gets enlarged and projected on a large screen. Video projector receives video signals and projects the corresponding image on a projection screen. It uses a lens system for this projection.

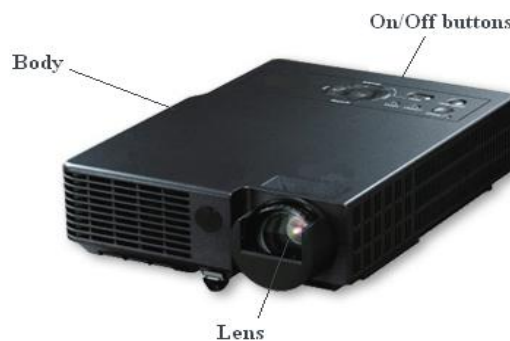


Figure 4.20 : LCD Overhead Projector

These are popularly used for seminars, class room lectures, marketing presentations and conference room presentations etc.

Classification of monitors on the basis of color

In terms of color capabilities, monitors can be divided into the following groups:

1. **Monochrome** : These monitors display the result in two colors, i.e., black/white, green/black, amber/black. One color is for the background of the screen and other for the foreground.
2. **Gray Scale**: It is a monochrome type of monitor. But it displays the output by using different shades of gray, made by a combination of black and white.
3. **Color Monitor**: It can display the output in many colors, ranging from 16 to over 1 million different colors. These are also called as RGB monitors, because they accept three separate signals, which are red, green, and blue.

Classification of monitors on the basis of size

After color classification, the most important aspect of a monitor is its screen size. The Size of computer screen is measured in diagonal inches and is given by measuring the distance from one corner to the opposite corner (diagonally). The smallest size for VGA monitors is 14 inches, which is also the entry level monitor for most computer systems. The Larger size landscape monitors can display two full pages side by side at a time. Other typical monitor sizes are 17 inches, 20 inches, 23 inches etc.

Classification of monitors on the basis of Resolution

The resolution of a monitor means the number of pixels per inch appearing on its surface. In general the greater the number of pixels the sharper is the images. Most modern monitors can display 1024 by 768 pixels. Some high-end models of computer monitors can display 1280 by 1024, or even 1600 by 1200 pixels. Even 3280 by 2048 resolution monitors are available for special purposes. While CRTs provide variability in resolution LCDs monitor have a fixed resolution.

The greater the number of pixels the sharper is the images

Classification of monitors on the basis of signal

Computer monitor can be divided into two categories on the basis of the type of signal which they accept. These are:

1. Analog Monitor
2. Digital Monitor

Analog Monitor

The Electronic signal that is sent by signals of varying frequency, amplitude or phase instead of being sent as an ON or OFF data transmission is called an analog signal. Analog signals allow equipment to handle information that continuously changes such as voltage, current, etc.

Analog signals can be represented by a wave sign and watches which changes their position continuously as shown in Figure 4.21



Figure 4.21: Examples of Analog Signal

These are the traditional type of color monitors and are based on CRT technology. These work like the television screen and accept analog signals.

Digital Monitor:

An electronic signal that is sent as binary digits of either ON or OFF is called a Digital signal. As shown in Figure 4.22 examples of digital signals and how they look like. In the first diagram signals are either 0 or 1 i.e. up or down for ON and OFF mode. In the right digital pictures are shown where a pixel is either ON or OFF helping to create an image on the display screen.

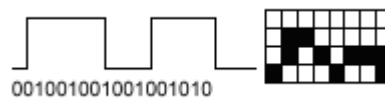


Figure 4.22: Examples of Digital Signal

The digital monitor receives digital signals and can use CRT technology. The data in these monitors is received from the video adapter. These are of different types such as CGA (Color Graphics Adapter), EGA (Enhanced Graphics Adapter), VGA (Video Graphics Array), and SVGA (Super Video Graphics Array). These are fast and produce clear images.

☞ Check Your Progress 3

Part I: True / False

- | | |
|--|--------------|
| 1) Pick devices are used to pick objects on the monitor | True / False |
| 2) CRT monitors consume more electricity than LCD monitors | True / False |
| 3) Light Emitting Display is the full form of LED monitors | True / False |
| 4) Bar Code Reader is an OUT PUT Device | True / False |
| 5) A Graphics tablet can be used as a mouse. | True / False |
| 6) Graphic tablets are used for designing purposes. | True / False |

Part II: Short answer type questions

- 1) What is the function of Graphic Tablet?

2) What do you mean by multimedia graphics tablet?

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.....

3) What do you mean by Computers Microphones ?

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4) What do you mean by barcode reader?

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.....

5) What do you mean by digital camera? Explain its various characteristics.

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.....
.....

4.7.6 Printers

Printers are used for producing output on paper. There are a large variety of printers and printing devices which can be classified according to the print quality and printing speed.

These varieties of printers are:

Printing Technology – impact printers vs. non impact printers

Impact printers use variations of the standard typewriter printing mechanism where a hammer strikes paper through an inked ribbon.

A non Impact printer uses chemical, heat or electrical signals to produce symbols on paper. Some of these require special coated or treated paper to print characters on them.

Classification of printers on the basis of speed :

On the basis of speed printers are of following types

1. **Character Printer** : These printers can print only one character at a time. They work similar to a typewriter. The examples are Daisy Wheel Printer, Dot Matrix Printer and Inkjet Printer.

(a) **Daisy-Wheel Printer** : This printer is similar to a ball-head typewriter. This type of printer has a plastic or metal wheel on which the shape of each character is embossed.



Figure 4.23: Daisy-Wheel Printer

A hammer presses the wheel against a ribbon, which in turn makes an ink stain in the shape of the character on the paper. Daisy-wheel printers produce letter-quality print but cannot print graphics. The print quality of this impact printer is very low as is the speed. These are practically obsolete now.

(b) **Dot-Matrix Printer** : This is one of the most popular printers used for personal computing systems. These printers are relatively cheaper compared to other technologies and use impact technology.

In the 1970s and 1980s, dot matrix impact printers were generally considered the best tradeoff between expense and versatility, and until the 1990s they were by far the most common form of printers used with personal computers. Characters in this printer are formed by the combination of dots.

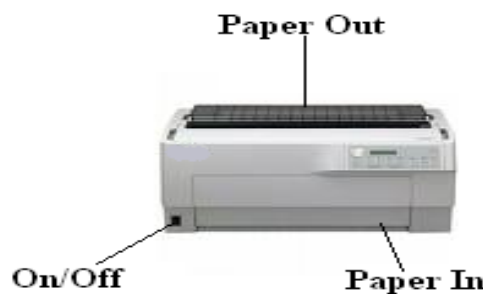


Figure 4.24: Dot Matrix Printer

A Dot-Matrix printer creates characters by striking pins against an ink soaked ribbon. Each pin makes a dot and combinations of dots form characters and illustrations. The moving portion of the printer is called the print head.

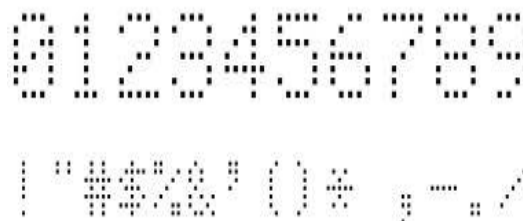


Figure 4.25: Characters as a pattern of dots

Advantages

- Dot matrix printers, like any impact printer, can print on multi-part stationery or make carbon copies.
- Impact printers have one of the lowest printing costs per page. As the ink is running out, the printout gradually fades rather than suddenly stopping part of the way through a job.
- They are able to use continuous paper rather than requiring individual sheets, making them useful for data logging. They are good, reliable and ideal for use in situations where printed content is more important than print quality.

Disadvantages

- Impact printers are usually noisy.
- They can only print low resolution graphics, with limited color performance, and limited quality.
- These printers are slow. Speed can be 225 cps to 250 cps. Speed may vary from one printer to another.

2. **Line Printer:** As the name suggests a line printer is a high speed printer which is used to print one entire line of text at a time. Line printers are used to print large amount of data, printing labels, accounting work and other large business printing applications in data centers. These are fast printers ranging in speed from 300 to 2500 lines per minute. Examples are Drum Printers and Chain Printers.

3. **Page Printer:** These are very high speed printers which produce high quality output. Their speed ranges from 10-25 pages per minute. These printers are commonly used today. They use modern Laser Printer technology and print a whole page at one go. There are many varieties of laser page printers and so their prices range from base level upwards.

Classification of printers on the basis of quality

The various types of printers based on print quality are as follows

1. **Ink-jet Printer:** The Inkjet printer works on inkjet technology and produces better quality printouts than dot matrix printers. These print by spraying a controlled stream of tiny ink droplets accurately on the paper forming either dot matrix or solid characters.

The printing quality of these printers is very good with a speed of 700 or more characters per second. These are non-impact and hence are relatively silent during the printing process. These printers are easy to use and can be used to print color pages.

Advantages

Compared to other printers, inkjet printers have a number of advantages. These are

- They are quieter in operation than impact printers.
- They can print finer, smoother details through higher print head resolution
- They can produce photographic-quality text and images.



Figure 4.26: Ink-Jet Printer

Disadvantages

The disadvantages of Inkjet printers are :

- The ink is often very expensive.
- Many intelligent ink cartridges contain a microchip that communicates the estimated ink level to the printer; this may cause the printer to display an error message, or incorrectly inform the user that the ink cartridge is empty.
- The very narrow inkjet nozzles are prone to clogging with dried ink.

2. **Laser Printer** : This is a high quality, high speed and high volume technology printer. In laser printers, a laser beam is used to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits it. The drum is then rolled through a reservoir of toner, which is picked up by the charged portions of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure. Laser printers produce very high quality text and graphics but are expensive. The technology used by them is the same as that of photocopying machines. The speed of laser printers varies from 10 pages per minute to 200 pages per minute. Laser printers are also called page printers; because they print a whole page at one go.

Standard laser printers can be classified into two categories in terms of color:

- Monochrome laser printer, and
- Color laser printer

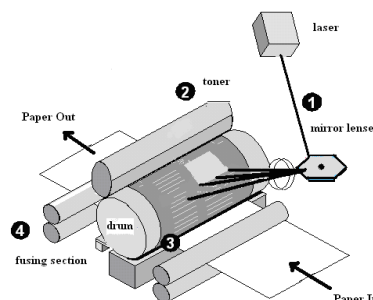


Figure 4.27: Laser Printer

Monochrome laser printers use a single toner. Color laser printers use four toners to print in full color. These printers are about five to ten times as expensive as their monochrome siblings. Color laser printers are popular and are being widely used, in spite of their cost. To print documents with graphics and photographs a color laser printer is a good option. Print speed, quality, printer resolution, reliability and the costs of toner are the major deciding factors for choosing a printer.

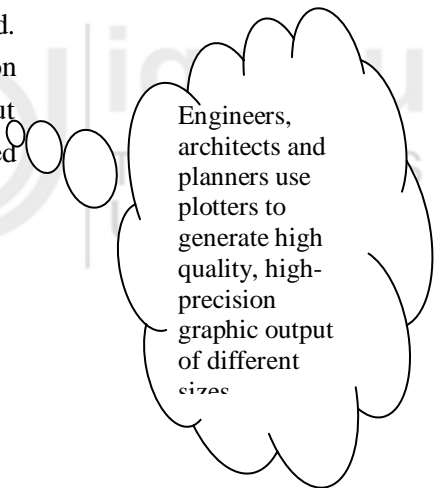
4.7.7 Plotters

A Plotter is a device that draws pictures on a page as output, after receiving a print command from the computer. It is also called a graph plotter. In plotters pens are used to draw lines on the paper, which is placed in the plotter.



Figure4. 28: Plotter

Plotters produce high quality diagrams on the paper and their output quality is good. Engineers, architects and planners use plotters to generate high quality, high-precision graphic output of different sizes. For several design applications such as design of layout of an aircraft, car, and architectural design of a building and in other computer-aided design applications plotter are very useful.



Plotter is of two types:

- Drum Plotter
- Flat-Bed Plotter

The drum plotters are generally smaller than flatbed plotters and they have lower resolutions than flatbed plotters. HP, Canon and Epson are the popular companies which manufacture good quality of platters.

4.7.8 Speakers and Microphones

Speaker

Computer speakers, or multimedia speakers, are external speakers, commonly equipped with a low-power internal amplifier which produces sound as output. External speakers are connected with a computer by using a plug and socket.



Figure 4.29: Multimedia Speakers

Computer speakers range widely in quality and in price. Laptop computers have inbuilt speakers.

Microphone

A Microphone is an acoustic-to-electric transducer or sensor and is used to convert sound signals into electrical signals. It was originally invented by Emile Berliner in 1877, and allows you to record voices or sounds and place them onto computers, generally as a wave file.



Figure 4.30: Voice Recording Microphone

To connect a microphone we insert the plug of it into the back of the computer system.

Integrated microphones can be found on laptops and some desktop monitors. These microphones are usually a small hole in front of the computer which when spoken into, will record your voice.

☞ **Check Your Progress 4**

Part I: State true or false.

- | | |
|---|------------|
| 1) Daisy-wheel printers prints high quality printing. | True/False |
| 2) A Dot-Matrix printer is a character printer. | True/False |
| 3) A Monochrome laser printer uses four toners. | True/False |
| 4) Color laser printers use a single toner to print. | True/False |
| 5) Laser printers are very cheap. | True/False |

Part II: Short answer type questions

- 1) What do you mean by speakers?
.....
.....
.....
- 2) What do you mean by printers? What are the various types of printers ?
.....
.....
.....
- 3) What do you mean by plotters? Explain their characteristics.
.....
.....
.....
- 4) What do you mean by a dot-matrix printer?
.....
.....
.....
- 5) What do you mean by Laser Printers?
.....
.....
.....

4.8 SUMMARY

Input/output devices are the devices that connect you to your computer. Input devices let you input data and other information into your computer and they also let you give your computer special instructions so that it will know what to do. For example, you can type in data by using a keyboard, or you can input data in picture form by using a scanner.

On the other hand, output devices display the results of your computer's computations. Examples of these would be your computer's monitor, which displays all of the programs you're running, as well as the printer, which will print out a hard copy of the information. Source data entry devices are those devices which automatically capture data and images at its source, record it in small chips and produces images immediately.

4.9 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

Part I:

- (1) True (2) False (3) False (4) True (5) False
(6) True (7) True

Part II: Short answer type questions

1. Input devices let you input data and other information into the computer. They are used to give special instructions to the computer so that it will know what to do. Input devices transfer data and user commands into the computer system. Input devices are used to interact with the computer system. Inputs are data or signals received by the computer system.

For example, you can type in data by using a keyboard, or you can input data in picture form by using a scanner.

2. Output devices display the result of your computer's computations. Examples of these are your computer's monitor. Output devices are those devices which display the result of input data or signals after processing it. When data is given to the computer to process then the processed data, in form of the desired result, comes out of the system through output devices.

3. Examples of Input devices are:
Keyboard, Mouse, Joystick, Microphone, Bar code reader and Graphics tablet.
Examples of output devices are:
Monitor, Printer, Plotter and Speaker

Check Your Progress 2

Part I:

- (1) False (2) False (3) False (4) True (5) False (6) False
(7) False

Part II: Short answer type questions

1. A Keyboard is one of the most important input devices and is used to input data into the computer system. Keyboards contain letters, numbers, function keys, arrow keys and some special keys on it. A User enters data into the computer by pressing a set of keys on the keyboard.
2. A Computer mouse is an input device. It is used to point on the instructions and commands are input by clicking on them by it. A mouse has two or three buttons

on it and is moved on a mouse pad which gives a smooth surface for its movement.

A Mouse is a very useful input pointing device in a GUI environment.

Different types of mice are: Optical mouse, mechanical mouse, wireless mouse

3. A Scanner is an input device which is used to input data in the form of pictures. It optically scans images, printed text, handwriting, or an object, and converts it to a digital image.
4. A Joystick is a remote control device for a computer which is used for playing video games to indicate position. It has a stick that pivots on a base and is used for controlling the action in video games. A Joystick is an input device of a computer. Joysticks are also used for controlling machines such as cranes, trucks, underwater unmanned vehicles, flight simulators, industrial robots etc.

A Trackball is a moveable ball mounted on a stationary device. It can be rotated manually by using the fingers. It is also used in playing video games. In Modern computers, a Mouse and in mobile phones trackballs are used to navigate addresses as well as play games. These are also used in playing video games.

Check Your Progress 3

Part I:

- (1) True (2) True (3) True (4) False (5) True (6) True

Part II: Short answer type questions

1. Digitizing or Graphics' tablet is a computer input device that allows one to hand-draw images and graphics, similar to the way one draws images with a pencil and paper. These tablets may also be used to capture data of handwritten signatures.
2. A graphics tablet is a computer input device that allows one to hand-draw images and graphics, similar to the way one draws images with a pencil and paper with the natural feel of a pen-like object to manipulate the cursor on their screen. These tablets are used to capture data of handwritten signatures. Architects, engineers and designers use it in Computer Aided Design (CAD) for designing purposes.
3. A microphone is an acoustic-to-electric transducer or sensor that converts sound signals into electrical signals. A microphone is an input device which converts the sound and voice into digital signal and then gives it to the computer for further processing.
4. A barcode reader is an electronic device which is used to read printed barcodes. It is a fast and effective way to input data. A Barcode reader uses a laser beam to read the series of thick and thin lines which represent the bar code number.

5. A Digital camera is an electronic device which takes video or still photographs or both, digitally by recording images via an electronic image sensor. Digital cameras have sufficient memory in form of chips. Most digital cameras allow users to choose the resolution. The digital cameras can connect directly to a computer to transfer data. A Wireless connection can also be used for connecting to a computer via Bluetooth. These cameras use memory cards with flash memory to store images.

Check Your Progress 4

Part I:

- (1) False (2) True (3) False (4) False (5) False

Part II: Short answer type questions

1. Computer speakers are output devices which produces **sound as output**. Computer speakers, or multimedia speakers, are external speakers, commonly equipped with a low-power internal amplifier. These are used to hear audio signals in a computer system.
2. A Printer is an output device and lets you take printouts of documents, pictures, and other files. It creates a hard copy of computer documents or files on a piece of paper. Whatever we see on the computer screen can be printed on a paper using a printer.

There are many different types of printers available in the market. Printers are mainly categorized into the following types:

Impact Printers

- a) Line Printers
 1. Drum Printers,
 2. Chain Printers
- b) Character Printers
 1. Dot Matrix Printer
 2. Daisy Wheel Printer
- c) Non impact Printer
 1. Thermal Printers
 2. Inkjet Printers
 3. Laser Printers

3. A Plotter is an output device which is used to produce high quality graphics on paper. Engineers, architects and planners use plotters to generate high quality, high-precision graphics output of different sizes. For several design applications such as design of layout of aircraft, car and architectural design of a building and in other computer-aided design applications plotters are very useful.
4. A Dot matrix printer or impact matrix printer refers to a type of printer with a print head that runs back and forth on the page and prints characters by impact, striking an ink-soaked cloth ribbon against the paper, much like a typewriter. Its speed is

50 cps (character per second) to 400 cps. It has one of the lowest printing costs per page.

5. Laser printers are one of the best printers available due to their high quality, high speed and high volume technology of printing. These printers produce very high quality text and graphics. Speeds of laser printers can range from **10 pages per minute to 200 pages per minute.**

4.10 FURTHER READINGS

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