

Unit 4: Input and Output Devices (4 Hrs.)

Introduction

A computer interacts with the external environment via the input-output (I/O) devices attached to it.

Input devices is used for providing data and instructions to the computer. After processing the input data, computer provides output to the user via the **output device**.

I/O devices that are attached externally, to the computer machine are also called **peripheral devices**.

Different kinds of input and output devices are used for different kinds of input and output requirements.

Input-Output Unit

Composed of two parts: **Input Unit** and **Output Unit**

- The input unit gets the data and programs from various input devices
Such as- keyboard, mouse, trackball and joystick
- Irrespective of the kind of input data provided to a computer, all input devices must translate the input data into a machine-readable form. The transformation of the input data to machine readable form is done by the **input interface** of input device.
- The output unit gets the processed data from the computer and presents the information or results to the user via output devices like display screen, printer, plotter and speaker.
- The processed data sent to the output device is in machine understandable form. This processed data is converted to human readable form by the **output interface** of output device.

Data Flow:

- Input: Data is entered through input devices.
- Processing: The CPU processes the input data according to instructions.
- Output: The processed data is sent to output devices for presentation.

Role of I/O Unit:

- Bridges the gap between humans and computers, enabling interaction and communication.
- Essential for data entry, output presentation, and interaction with external devices.
- Its efficiency significantly affects overall system performance.

Input Devices

Input devices are the essential tools that allow you to **interact with your computer** and provide it with instructions or data. They act as bridges between your physical world and the digital realm, enabling you to **control, communicate, and create** within the computer system.

Human Data Entry Devices

Keyboard

Pointing devices – mouse, trackball, joystick, digitizing tablet

Pick devices – light pen, touch screen

Source Data Entry devices

Audio input – speech recognition

Video input – digital camera

Scanner – hand-held scanner, flat-bed scanner

Optical scanner – OCR, OMR, MICR, barcode reader

Human Data Entry Devices

Input devices that require data to be entered manually to the computer are identified as human data entry devices. The data may be entered by typing or keying in, or by pointing a device to a particular location.

Keyboard:

- One of the first peripherals to be used and is still the primary input device.
- Contains various keys that enable you to enter alphanumeric and numeric data into a computer.
- Effective device for inputting non-graphical data (i.e., text data)
- Standard keyboard is in QWERTY format and contains 101 keys.

A standard keyboard contains six types of keys:

- (i) Alphanumeric keys
- (ii) The modifier keys
- (iii) Numeric keys
- (iv) The function keys
- (v) The cursor movement keys
- (vi) Special purpose keys

Some keyboards have 110 keys, where the extra keys (multimedia keys) are designed to work with the GUI operating system.

Working:

When a key is pressed, keyboard interacts with a keyboard controller and keyboard buffer. The keyboard controller stores the code of pressed key in keyboard buffer and informs the computer software that an action has happened on the keyboard. The computer software checks and reads the keyboard buffer and passes the code of pressed character to the system software. Due to a time gap between pressing of a key on keyboard and reading by the system software, keyboard are designed to store many strokes together.

Pointing devices

Mouse

Mouse is a small, portable device with a sensor that detects movement on a flat surface. The movement is translated into cursor movement on the screen. The mouse provides an easy way to select and choose commands from menus, dialog boxes, icons etc. Mouse is used extensively, while working with graphics elements such as line, curve, shapes etc. Using mouse we can perform following operations:

- **Pointing:** Mice excel at pointing and selecting specific elements on the screen. This is crucial for tasks like highlighting text, clicking buttons, and choosing options in menus, all of which are essential for data entry workflows.
- **Click:** Often clicking is initiated to do some action, such as to move the cursor in a word processor or to select links on the webpage.
- **Drag and Drop:** Many data entry tasks involve moving and arranging data, and mice provide an intuitive way to drag and drop items efficiently.

Working:

In a mechanical mouse, rollers and sensors are used to sense the direction and rate of movement of mouse. When the ball of mouse moves, the rollers sense the horizontal and vertical movement and sensors sense the speed of movement. This information is passed to computer via the mouse chord. When an optical mouse is moved, a beam of light is reflected from its underside. These pulses of light determine the direction and rate of movement. The information is sent to computer via the mouse chord.

Trackball

Trackball is a stationary device with a ball that the user rotates with their fingers or thumb. The ball's rotation translates into cursor movement. The advantage of trackball over mouse is that it is stationary so it does not require much space to use it. Trackball is a device that is a variant of the mouse but has the functionality of mouse. Trackball is generally built in laptops since there is no space for the mouse to move on the lap.

Joystick

- **Function:** Controls cursor movement on screen, primarily used in gaming.
- **Design:**
 - Vertical lever ("stick") pivots on a plastic base.
 - Base houses circuit board and potentiometers.
 - Springs return stick to center position.
- **Functionality:**
 - Potentiometers measure stick movement.
 - Circuit board sends movement data for processing.
- **Applications:**
 - Popular in video games, especially for speed and direction control.
 - Also used in some accessibility tools and specialized software.

digitizing tablet

Digitizing tablet is a flat, pressure-sensitive surface where users draw or write with a stylus. The position and pressure of the stylus translate into cursor movement and digital ink creation. It is used primarily to input drawings, sketches, etc.

- **Applications:** Graphic design, digital art, handwriting recognition, photo editing.

Pick devices

light pen

Light pen sometimes called a mouse pen is a hand-held electro-optical pencil shaped pointing device used to select screen positions or select objects on the display screen by directly pointing to the objects with the pen. It is used for making drawing, graphics and for menu selection.

Here's how a light pen worked as a pick device:

The tip of the light pen housed a photocell, a light-sensitive element. When the pen is moved on the screen, light from the screen at the location of pen causes the photocell to respond. The electric response is transmitted to the computer that can identify the position on screen at which the light pen is pointing. With the position known, the computer could then perform actions based on the user's selection, such as clicking on an icon or drawing on the screen.

Although largely replaced by touchscreens and mice, light pens played a significant role in the early development of interactive computing.

touch screen

Source Data Entry devices

Source data entry devices are a special category of computer input devices that capture data directly from its original source, eliminating the need for manual typing or re-keying. This saves time, reduces errors, and improves overall data accuracy.

Audio input – speech recognition

Video input – digital camera

Scanner – hand-held scanner, flat-bed scanner

Optical scanner – OCR, OMR, MICR, barcode reader

Output Devices: Monitors, Printers, Modems, Soundboards.

Output devices are the hardware components of a computer system that present information to the user in a human-readable format. They take the processed data from the computer and convert it into various forms like visual, audio, or physical.

Monitors, Printers, Speakers and headphones,

Plotters: It is a printer that interprets commands from a computer to make line drawings on paper with one or more automated pens.

Types: Drum plotters, Flatbed plotters, Electrostatic plotters, Inkjet plotters.

VDU: video display unit (or Visual display unit).

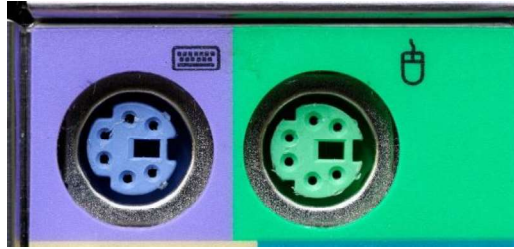
I/O Port

I/O ports, short for Input/Output ports, are the physical connectors on your computer that allow you to connect various devices and peripherals. They act as gateways for both **input** (data entering your computer) and **output** (data exiting your computer). Think of them as handshake points for information to flow between your digital world and the physical world.

16 Types of Computer Ports and Their Functions

1. PS/2

Developed by IBM for connecting mouse and Keyboard.



2. Serial Port

=> DB - 25

=> DE-9, RS-232, COM Port

Even though the communication is PS/2 and USB is serial technically, the term serial port is used to refer to the interface that is compliant with the RS-232 standard.



Fig: DB9 Female / DB25 Male Serial Port Cable RS232

3. Parallel Port or Centronics 36-Pin Port



The interface between computer and peripheral devices like printers with parallel communication.

4. Audio Port

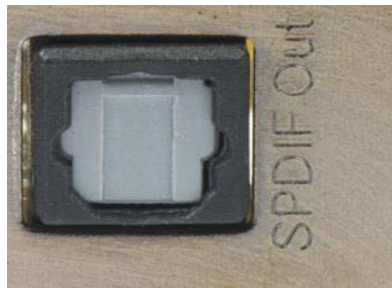


Port	2-Channel	4-Channel	6-Channel	8-Channel
Blue	Line In	Line In	Line In	Line In
Lime	Line Out	Front Speakers	Front Speakers	Front Speakers
Pink	Mic In	Mic In	Mic In	Mic In
Orange			Center/Subwoofer	Center/Subwoofer
Black		Rear Speakers	Rear Speakers	Rear Speakers
Grey				Side Speakers

Used to connect speakers or other audio output device with the computer.

5. S/PDIF/TOSLINK

(Sony/Philips Digital Interface Format) and (Toshiba Link)



Is an audio interconnect used in home media.

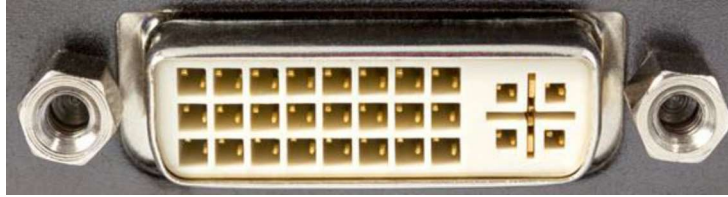
6. Video Port



Found in many computers, projectors, video cards and HD TVs.

It is a D-sub connector consisting of 15 pins in 3 rows.

7. Digital Video Interface (DVI)



DVI is a high speed digital interface between a display controller like a computer and a display device.

It was developed to transport lossless digital video signals and replace the analogue VGA technology.

=> Mini - DVI and

=> Micro - DVI, transmitting only digital signals

8. Display Port



Display port aims to replace VGA and DVI ports

9. RCA Connector



Carries composite video and stereo audio signals over three cables.

Yellow-colored RCA connector transmits analog video signals.

Red and white RCA connectors are used for stereo audio signal

10. Component Video



Uses 3 connectors color coded as Green, Blue, and Red.

Here, video signals are split into more than two channels and the quality of video signal is better.

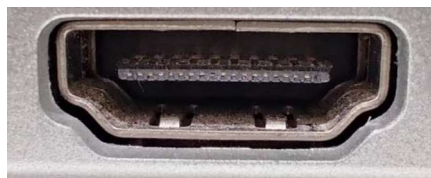
11. S-Video (Separate Video Connector)



Used to transmit only video signals.

Picture quality is better than that of Composite Video but lesser resolution than component video.

12. HDMI (High Definition Media Interface)



Digital interface to connect HD and UHD devices like computer monitors, HDTV, BlueRay players, gaming consoles, HD cameras etc

13. USB (Universal Serial Bus)



USB port can be used to transfer data, act as an interface for peripherals and even act as power supply for devices connected to it.

There are three kinds of USB ports:

=> Type A

=> Type B or mini USB

=> Type C or micro USB

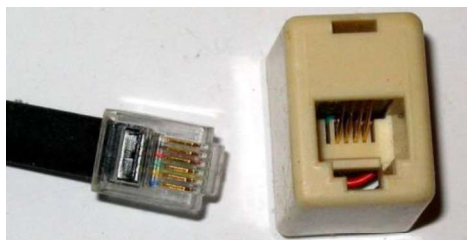
14. RJ - 45



The interface that is used for computer networking and telecommunications is known as Registered Jack (RJ)

RJ-45 in particular is used for Ethernet over cable.

15. RJ - 11



Used as an interface for telephone, modem or ADSL connections.

16. E - SATA



Is an external serial AT Attachment connector

Used as an interface for connecting external mass storage devices.

Working of I/O system

The Working Process:

Input: When you interact with an I/O device, like pressing a key on the keyboard, the device generates a signal.

Device Controller: The device controller intercepts the signal and translates it into a format the computer understands. It then sends the data to the CPU through the bus.

Operating System: The OS receives the data and identifies the relevant device driver.

Device Driver: The device driver processes the data and prepares it for the application that requested it.

Application: The application receives the processed data and uses it for its intended purpose, like displaying text on the screen or saving a file to storage.

Output (Optional): If the application needs to send data back to the I/O device, the process reverses, with the data flowing from the application to the device driver, OS, and ultimately the output device.