



Input and Output

Input

- Input is any data and instructions entered into the memory of a computer.



Input

- Instructions can be entered into the computer in the form of programs, commands, and user responses.
 - Program: A series of related instructions that tells a computer what tasks to perform and how to perform them.
 - Command: An instruction that causes a program to perform a specific action.
 - User Response: An instruction a user issues by replying to a question displayed by a program.

Input Devices

- An input device is any hardware component that allows users to enter data and instructions into a computer.
- Depending on the application and your particular requirements, the input devices selected may vary.

The Keyboard

- A keyboard is an input devices that contains keys users press to enter data and instructions into a computer.
- Usually have from 101 to 105 keys, including the letters of the alphabet, numbers, punctuation marks, and other basic keys.
- Many have a numeric keypad on the right side of the keyboard.

The Keyboard

- An enhanced keyboard has twelve or more function keys along the top, two CTRL keys, two ALT keys, and a set of arrow and additional keys.



The Keyboard

- Function keys, labeled with the letter F followed by a number, are special keys programmed to issue commands to a computer.
- To issue commands, users often can press a function key in combination with other special keys (SHIFT, CTRL, ALT, and others)

The Keyboard

- Keyboards also often have a **WINDOWS** key(s) and an **APPLICATION** key.
 - The **WINDOWS** key displays the Windows Start menu.
 - The **APPLICATION** key displays an item's shortcut menu.
- A toggle key is a key that switches between two states each time a user presses the key.
 - Num Lock, Caps Lock, Scroll Lock

The Keyboard

- The insertion point, also known as a cursor, in some programs, is a symbol on the screen, usually a blinking vertical bar, that indicates where the next character you type will appear.

The Keyboard

- Desktop computer keyboards often attach via a cable to a USB port or a keyboard port on the system unit.
- A wireless keyboard is a battery-powered device that transmits data to the system unit using wireless technology.

Keyboard Ergonomics

- Many keyboards have a rectangular shape with the keys aligned in straight, horizontal rows.
- Users who spend a lot of time typing on these keyboards sometimes experience repetitive strain injuries (RSI).
- An ergonomic keyboard has a design that reduces the chance of wrist and hand injuries.

Keyboard Ergonomics

- The goal of ergonomics is to incorporate comfort, efficiency, and safety in the design of the workplace.



Keyboards for Mobile Computers and Mobile Devices

- On notebook computers and some handheld computers the keyboard is built in the top of the system unit.
- To fit in these mobile computers and devices, the keyboards usually are smaller and have fewer keys.
- Many smart phones can display an on-screen keyboard, where you can press the on-screen keys using a stylus or your finger.
- Some have predictive text input, where you start to type a word and software predicts the word you want.

Pointing Devices

- A pointing devices is an input devices that allows a user to control a pointer on the screen.
- In a graphical user interface, a pointer is a small symbol on the screen, whose location and shape change as a user moves a pointing device.
- They are used to move the insertion point, select objects, and click buttons.

Mouse

- A mouse is a pointing device that fits under the palm of your hand comfortably.
- It is the most widely used pointing device on desktop computers.
- With a mouse, users control the movement of the mouse pointer.



Mouse

- The top and sides of a mouse have one to four buttons; some also have a wheel.
- An optical mouse uses devices that emit and sense light to detect the mouse's movement.

Mouse

- Many types connect with a cable that attaches to a USB port or a mouse port on the system unit.
- A wireless mouse is a battery-powered device that transmits data using wireless technology, such as Bluetooth or IrDA.

Using a Mouse

Mouse Operations

Operation	Mouse Action	Example
Point	Move the mouse until the pointer on the desktop is positioned on the item of choice.	Position the pointer on the screen.
Click	Press and release the primary mouse button, which usually is the left mouse button.	Select or deselect items on the screen or start a program or program feature.
Right-click	Press and release the secondary mouse button, which usually is the right mouse button.	Display a shortcut menu.
Double-click	Quickly press and release the left mouse button twice without moving the mouse.	Start a program or program feature.
Triple-click	Quickly press and release the left mouse button three times without moving the mouse.	Select a paragraph.
Drag	Point to an item, hold down the left mouse button, move the item to the desired location on the screen, and then release the left mouse button.	Move an object from one location to another or draw pictures.
Right-drag	Point to an item, hold down the right mouse button, move the item to the desired location on the screen, and then release the right mouse button.	Display a shortcut menu after moving an object from one location to another.
Rotate wheel	Roll the wheel forward or backward.	Scroll vertically (up and down).
Free-spin wheel	Whirl the wheel forward or backward so that it spins freely on its own.	Scroll through hundreds of pages in seconds.
Press wheel	Press the wheel button while moving the mouse.	Scroll continuously.
Tilt wheel	Press the wheel toward the right or left.	Scroll horizontally (left and right).
Press thumb button	Press button on side of mouse with your thumb.	Move forward or backward through Web pages and/or control media, games, etc.

Other Pointing Devices

- Trackball, Touchpad, Pointing Stick, Touch Screen, Touch-sensitive Pads, Stylus, Pen, Signature Capture Pad, and Graphics Tablet.

Trackball

- A trackball is a stationary pointing device with a ball on its top or side.
- To move the pointer, rotate the ball.



Touchpad

- A touchpad is a small, flat, rectangular pointing device that is sensitive to pressure and motion.



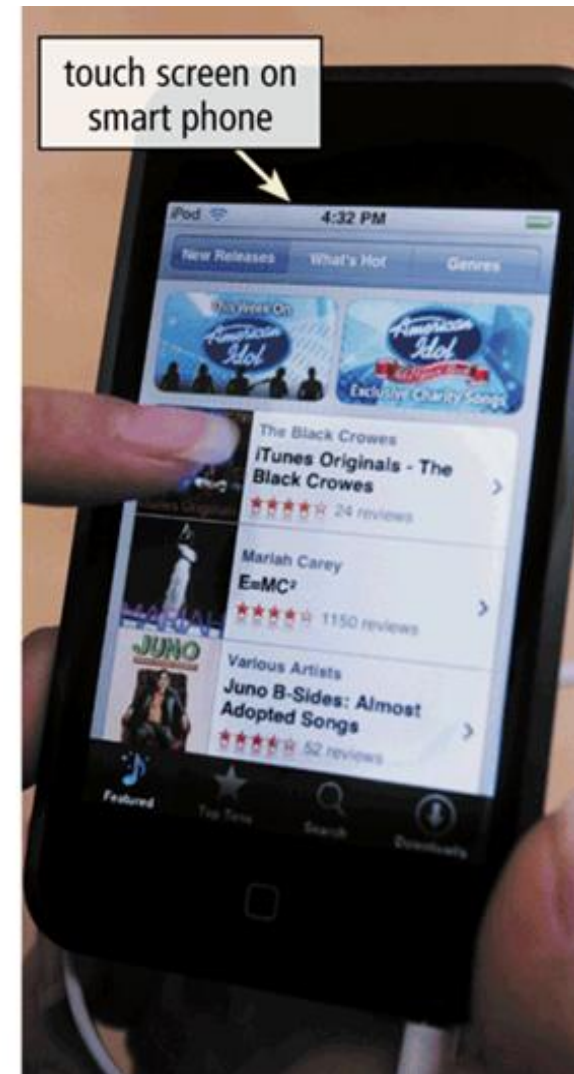
Pointing Stick

- A pointing stick is a pressure-sensitive pointing device shaped like a pencil eraser that is positioned between keys on a keyboard.



Touch Screens and Touch-Sensitive Pads

- A touch screen is a touch-sensitive display device.
- Multi-touch can recognize multiple points of contact at the same time.
- Some models of desktop computers and many mobile devices have touch screens.
- A kiosk, a free standing computer, usually includes touch screens.



Touch-Sensitive Pads

- A touch-sensitive pad is an input device that enables users to scroll through and play music, view pictures, watch videos, etc., found in portable media players.
- They typically contain buttons and/or wheels that are operated with a thumb or finger.



Pen Input

- With pen input, you touch a stylus or digital pen on a flat surface to write, draw, or make selections
- A stylus is a small metal or plastic devices that looks like a tiny ink pen but uses pressure instead of ink.
- A digital pen, which is slightly larger than a stylus, typically provides more functionality than a stylus: erasers, programmable buttons.

Pen Input

- A signature capture pad is used to capture a handwritten signature with a stylus.
- A graphics tablet is a flat, rectangular, electronic, plastic board that is used on computers that do not have a touch screen.

Other Input for Smart Phones

obtain maps and directions on the phone by attaching this navigation receiver to your vehicle's window



speak into the microphone that wirelessly communicates with the phone



take a picture using the digital camera built into the back of the phone



use one end of the stylus to write on the phone's screen and the other end as a ballpoint pen



transfer data and instructions to and from the computer and phone by connecting it to the computer with a cable



enter text-based messages via a wireless keyboard



Game Controllers

- Video games and computer games use a game controller as the input device that directs movements and actions of on-screen objects.
- They include gamepads, joysticks and wheels, light guns, dance pads, and a variety of motion sensing controllers.

Game Controllers

- Gamepad: held with both hands; controls actions of players or objects in games.
- Joystick: handheld vertical lever mounted on a base.
- Wheel: a steering-wheel type input device.
- Light Gun: used to shoot targets and moving objects when the trigger is pulled.
- Dance Pad: flat electronic device divided into panels that users press with their feet.
- Motion-Sensing Game Controllers: allow the user to guide on-screen elements by moving hand held input device in predetermined directions through the air.

Game Controllers



Digital Cameras

- A digital camera is a mobile device that allows users to take pictures and store the photographed images digitally, instead of on traditional film.
- Some look like traditional cameras, others are built into mobile devices.
- Contents can be downloaded and stored into computers.
- Resolution is the number of horizontal and vertical pixels in a display device.

Voice Input

- Voice input is the process of entering input by speaking into a microphone.
- Voice recognition, or speech recognition, is the computer's capability of distinguishing spoken words.
- Voice recognition programs recognize a vocabulary of preprogrammed words, ranging from two to millions of words.

Audio Input

- Voice input is part of a larger category called audio input.
- Audio input is the process of entering any sound into the computer such as speech, music, and sound effects.
- Music production software allows users to record, compose, mix, and edit music and sounds.

Video Input

- Video input is the process of capturing full-motion images and storing them on a computer's storage medium.
- Computers record digital signals from digital devices, such as digital video (DV) cameras, or convert analog signals to digital signals.

Web Cams

- A Web cam is a type of digital video camera that enables a home or small business user to capture video and still images and broadcast them over the Internet.
- They attach to the computer's USB port or FireWire port.
- Some can display their output on a Web page by streaming.

Video Conferencing

- A video conference is a meeting between two or more geographically separated people who use a network or the Internet to transmit audio and video data.



Scanners and Reading Devices

- An optical scanner, usually called a scanner, is a light-sensing input device that reads printed text and graphics and then translates the results into a form the computer can process.
 - Flatbed
 - Pen or Handheld
 - Sheet-Fed
 - Drum

Scanners and Reading Devices

- Once you scan a document or picture, you can display the scanned object on the screen, modify its appearance, and store it.
- Many scanners include OCR (optical character recognition) software, which can read and convert text documents into electronic files, which is useful if you need to modify a document.

Optical Character Recognition

- Optical character recognition is a technology that involves reading typewritten, computer printed, or hand-printed characters from ordinary documents and translating the images into a form that the computer can process.
- A turnaround document is a document that you return to the company that creates and sends it.

Optical Mark Recognition

- Optical Mark Recognition (OMR) is a technology that reads hand-drawn marks such as small circles or rectangles.
- A person places these marks on a form, such as a test or survey.

Bar Code Readers

- An optical reader that uses laser beams to read bar codes by using light patterns that pass through the bar code lines.



RFID Readers

- RFID (radio frequency identification) is a technology that uses radio signals to communicate with a tag placed in or attached to an object, animal, or person.
- An RFID reader reads information on the tag via radio waves.

Magnetic Stripe Card Readers and MICR Readers

- A magnetic stripe card reader reads the magnetic stripe on the back of credit cards, entertainment cards, bank cards, and other similar cards.
- A MICR reader converts MICR characters into a form the computer can process.
- MCIR (magnetic-ink character recognition devices read text printed with magnetic ink.

Biometric Input

- Biometrics is the technology of authenticating a person's identity by verifying a personal characteristic.
- A biometric identifier is a physiological or behavioral characteristic.
- A biometric device translates a personal characteristic into a digital code.
- A fingerprint reader captures curves and indentations of a fingerprint.
- Others: face recognition, hand geometry, voice verification, signature verification, iris recognition.

Terminals

- A terminal is a computer, usually with limited processing power, that enables users to send data to and/or receive information from a host computer.
- Most retail stores use a POS Terminal (point of sale) to record purchases, process credit or debit cards, and update inventory.
- An automated teller machine (ATM) is a self-service banking machine that connects to a host computer through a network.

Output

- Output is data that has been processed into a useful form.
- Computers process data into information.
- Four basic types: text, graphics, audio, and video.

Output

- An output device is any type of hardware component that conveys information to one or more people.
- Common types are display devices, printers, speakers, data projectors, interactive whiteboards, and force-feedback game controllers.

Display Devices

- A display devices is an output device that visually conveys text, graphics, and video information.
- A monitor is a display devices that is packaged as a separate peripheral that is typically used by desktop computers.
- Monitor controls permit users to adjust the brightness, contrast, positioning, height, and width of the images.
- Most mobile computers integrate the display into the same physical case.

LCD Monitors and LCD Screens

- An LCD monitor is a desktop monitor that uses a liquid crystal display to produce images.
- They produce sharp, flicker-free images.
- They take up less space than older CRT monitors.
- Measuring a monitor is done the same way you would measure a television, diagonally from one corner to the other.

LCD Monitors and LCD Screens

- For a wider screen area, some users position two or more monitors side by side or stacked.



LCD Technology

- Liquid crystal display (LCD) uses a liquid compound to present information on a display device.
- Computer LCDs typically contain fluorescent tubes that emit light waves toward the liquid crystal cells, which are sandwiched between two sheets of material.

LCD Quality

- The quality depends primarily on its resolution, response time, brightness, dot pitch and contrast ratio.
- Resolution is the number of horizontal and vertical pixels in a display device.
- A pixel (short for picture element) is a single point in an electronic image.
- Higher resolutions use a greater number of pixels.

LCD Quality

- Response time of an LCD monitor or screen is the time in milliseconds that it takes to turn a pixel on or off.
- They range from 3 to 16 ms. (The lower the faster)
- Brightness is measured in nits, a unit of visible light intensity equal to one candela per square meter.
- Dot pitch is the distance in millimeters between pixels on a display device.
- Contrast ratio describes the difference in light intensity between the brightest white and darkest black that can be displayed.

Graphics Chips, Ports, and LCD Monitors

- The graphics chip, called the graphics processing unit (GPU), controls the manipulation and display of graphics on a display device.
- Highest quality images use DVI (digital video interface) or HDMI (high-definition media interface) ports.
- Aspect Ratio: defines a display's width relative to its height.
- Bit/Color depth: is the number of bits used to store information about each pixel.

Plasma Monitors

- A plasma monitor is a display device that uses gas plasma technology, which sandwiches a layer of gas between two glass plates. When voltage is applied, the gas releases ultraviolet light, which causes the pixels on the screen to glow and form an image.



Televisions

- HDTV (high-definition television) is the most advanced form of digital television, working with digital broadcast signals, transmitting digital sound, supporting wide screens, and providing resolutions up to 1920x1080.

CRT Monitors

- A CRT monitor is a desktop monitor that contains a cathode-ray tube.
- A CRT is a large, sealed glass tube with tiny dots of phosphor material coating the screen.
- Inside the CRT, an electron beam moves back and forth across the back of the screen causing the dots on the front of the screen to glow, producing an image.

CRT Monitors

- They have a much larger footprint than LCD monitors. That is, they take up much more room.



Printers

- A printer is an output device that produces text and graphics on a physical medium such as paper.
- A hard copy, or printout, is either in portrait or landscape orientation.
 - Portrait: taller than wide
 - Landscape: wider than tall

Producing Printed Output

- Before printing a document required connecting a computer to a printer with a cable. (serial then USB)
- Today, wireless printing makes the task of printing from a notebook, smart phone, or digital camera easier.

Nonimpact Printers

- A nonimpact printer forms characters and graphics on a piece of paper without actually striking the paper.
- Some spray ink while others use heat.
- Common types: Ink-jet printers, photo printers, laser printers, thermal printers, mobile printers.

Ink-Jet Printers

- An ink-jet printer is a type of nonimpact printer that forms characters and graphics by spraying tiny drops of liquid ink onto a piece of paper
- Printer resolution is measured in dots per inch (dpi). A dot is a drop of ink, so a higher dpi means smaller dots which leads to better quality.

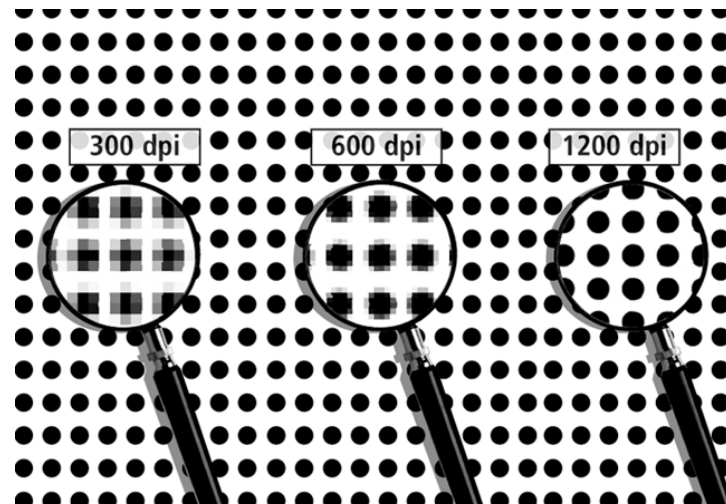


Photo Printers

- A photo printer is a color printer that produces photo-lab-quality pictures.

Laser Printers

- A laser printer is a high-speed, high quality nonimpact printer.
- They are available in both black-and-white (~1200 dpi) and color (~2400 dpi).

Multifunction Peripherals

- A multifunction peripheral (MFP), also called an all-in-one device, is a single device that looks like a printer or copy machine but provides the functionality of a printer, scanner, copy machine, and sometimes a fax machine.

Other Printers

- A thermal printer generates images by pushing electrically heated pins against heat sensitive paper.
- A mobile printer is a small, lightweight, battery powered printer that allows a mobile user to print from a notebook, or other mobile device.
- A label printer is a small printer that prints on an adhesive-type material.
- Plotters are sophisticated printers used to produce high-quality drawings such as blue prints, maps, and circuit diagrams.
- Large-format printers create photo-realistic-quality color prints.

Impact Printers

- An impact printer forms characters and graphics on a piece of paper by striking a mechanism against an inked ribbon that physically contacts the paper.
- A dot-matrix printer produces printed images when tiny wire pins on a print head mechanism strike an inked ribbon,
- A line printer is a high-speed impact printer that prints an entire line at a time.

Speakers, Headphones, and Earbuds

- An audio output device is a component of a computer that produces music, speech or other sounds.
- Speakers and subwoofers are attached for surround sound systems.
- Headphones cover or are placed over the ear.
- Earbuds rest inside the ear canal.

Other Output Devices

- A data projector is a device that takes the text and images displaying on a computer screen and projects them on a larger screen so that an audience can see the image clearly.
- An interactive whiteboard is a touch-sensitive device, resembling a dry-erase board, that displays the image on a connected computer screen.
- Force-Feedback Game Controllers and Tactile Output both provide physical response from the device, such as a vibration.