Keyboards

A **keyboard** is one of the primary input devices that allows users to input text into a computer or any other electronic machinery. It is a peripheral device that is the most basic way for the user to communicate with a computer. Using a keyboard is often called typing. It consists of multiple buttons, which create numbers, symbols, and letters, and special keys like the Windows and Alt key, including performing other functions.

The design of the keyboard comes from the typewriter keyboards, and numbers and letters are arranged on the keyboard in that way, which helps to type quickly. It contains many mechanical switches or push-buttons called "keys". When one of these is pushed, an electrical circuit is closed, and the keyboard sends a signal to the computer that tells it what letter, number, or symbol it would like to be shown on the screen. The computer then shows the character on the screen, usually at the place where the flashing text cursor is.

Besides entering characters, computer keyboards also have special keys that change the symbol (such as shift or caps lock or give the computer special commands (such as the arrow keys, CTRL and ALT). Different computer operating system use different special keys or use them differently. Special commands can also be activated through combinations of keys, called keyboard shortcuts. Some of the most common shortcuts on Windows programs are: Ctrl + C, to copy some text or a picture; Ctrl + V, to paste what was copied; and Ctrl + F, to find a certain word on a document or web page.

A keyboard can be joined to a computer using a wire, but can also be wireless (like those that use Bluetooth). Most wired 21st-century keyboards connect to a USB socket on the computer, but older ones use a round, purple DIN connector.

Figure 1: A Mechanical Keyboard

The above keyboard design is called QWERTY design because of its first six letters across in the upper-left-hand corner of the keyboard.

External Overview of a Keyboard

There are different types of keyboards. They can be based on the way the keys work. Most computer keyboards have the keys in six rows, but some laptops use only five or even four rows to save space. The most popular layout is called QWERTY, which is based on the first six letters on them. The QWERTY design was made so that the most common letters would not make the moving parts of a mechanical typewriter "jam", or stop working. Now, even though most people do not use typewriters anymore, the design stayed because people were used to it. Other layouts have been developed, for example the Dvorak keyboard, which puts the most common letters in the places that are easiest to reach.

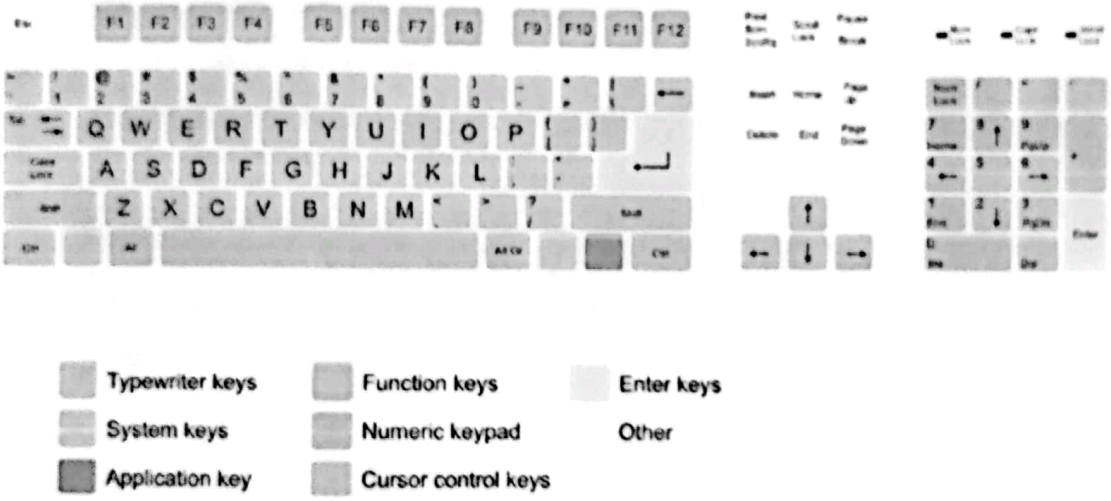


Figure 2: This picture shows the way keys are laid out on a keyboard in general

Overview of each section of the keyboard

1. Alphanumeric keys

Most of the keyboard, which includes letters, numbers, punctuation, and certain symbol keys, is alphanumeric. There are rows of keys for each group of alphanumeric keys. These layouts are usually named after the first six letters on the first row: AZERTY, QWERTY, QWERTZ, QZERTY and national variants thereof.

2. Function keys

Programs employ the function keys, sometimes known as the F1 through F12 or F19 keys, as shortcuts for frequently used actions. By using the F1 key, you may access online assistance for most programs. The function keys on some keyboards can be used to launch extra computer features.

3. Control and toggle keys

The user has more cursor and text manipulation control thanks to the control and toggles keys. In many programs, they can also be used as shortcut keys. Ctrl keys are distinct from control keys.

4. Keypad

The keypad allows the user easy access to numbers and mathematical operations like plus, divide, times, and subtract, despite not being included on all computer keyboards, particularly laptops.

5. Wrist pad

The Saitek keyboard contains a wrist pad to assist the user's wrists. Hundreds of different wrist pads are available at a computer store or online, even though many keyboards do not come with one.

6. Arrow keys

The cursor can be moved, or a highlighted selection can be changed using the four arrow keys. Visit our arrow keys page for further details.

7. Special keys or media keys on a multimedia keyboard

Additional buttons on multimedia keyboards are absent from standard keyboards. Information on our special keys can be found there.

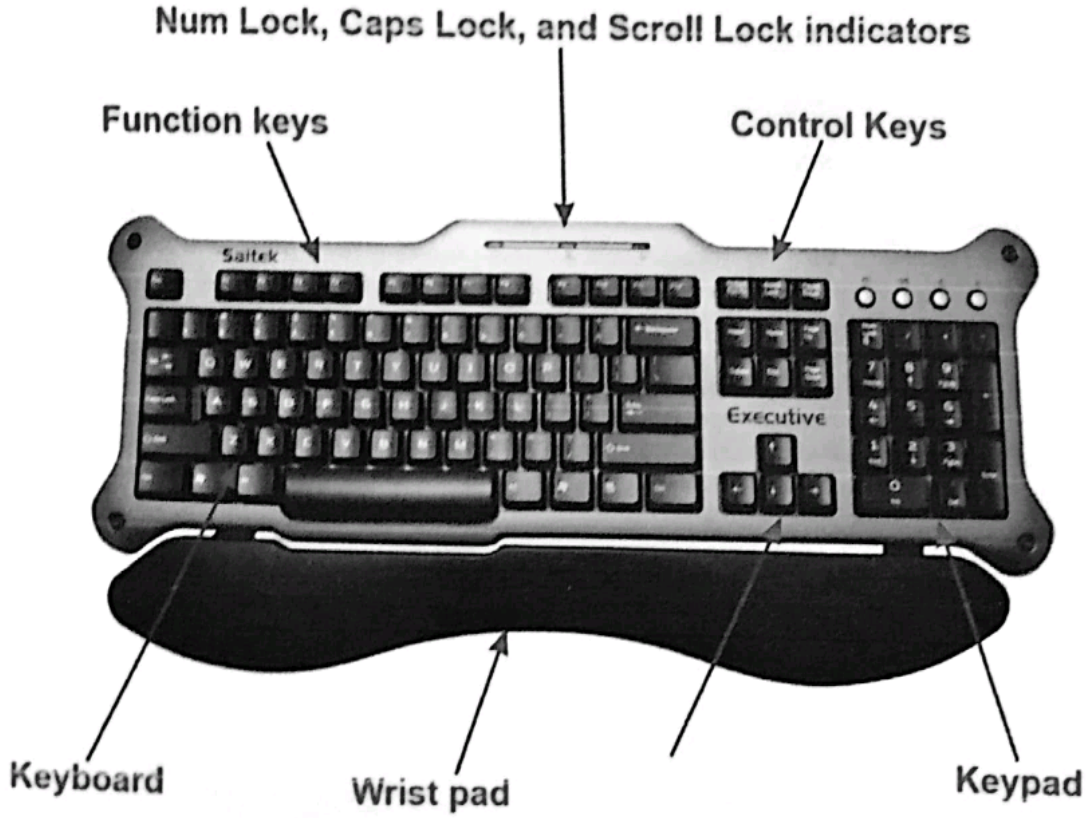
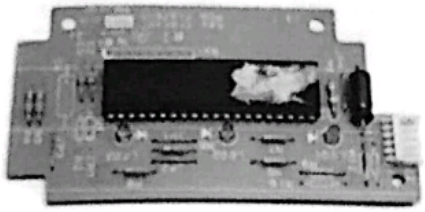


Figure 3: The image shows a 104-key Saitek keyboard with arrows pointing to each section, including the control keys, function keys, LED indicators, wrist pad, arrow keys, and keypad.

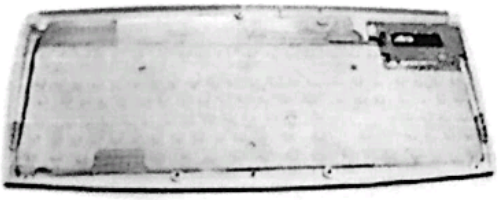
Internal structure of a Keyboard

A keyboard is a lot like a miniature computer. It has its own processor and circuitry that carries information to and from that processor. A large part of this circuitry makes up the key matrix.

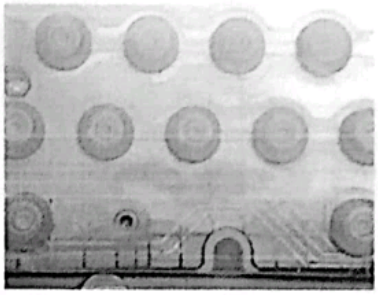


microprocessor and controller circuitry of a keyboard

rubber dome switches



key matrix



rubber dome

The **key matrix** is a grid of circuits underneath the keys. In all keyboards, each circuit is broken at a point below each key. When you press a key, it presses a switch, completing the circuit and allowing a tiny amount of current to flow through. The mechanical action of the switch causes some vibration, called bounce, which the processor filters out. If you press and hold a key, the processor recognizes it as the equivalent of pressing a key repeatedly.

When the processor finds a circuit that is closed, it compares the location of that circuit on the key matrix to the character map in its ROM. A character map, a comparison chart or lookup table, tells the processor the position of each key in the matrix and what each keystroke or combination of keystrokes represents. The character map lets the processor know that pressing the "a" key by itself corresponds to a small letter "a" but the Shift and a keys pressed together correspond to a capital "A."

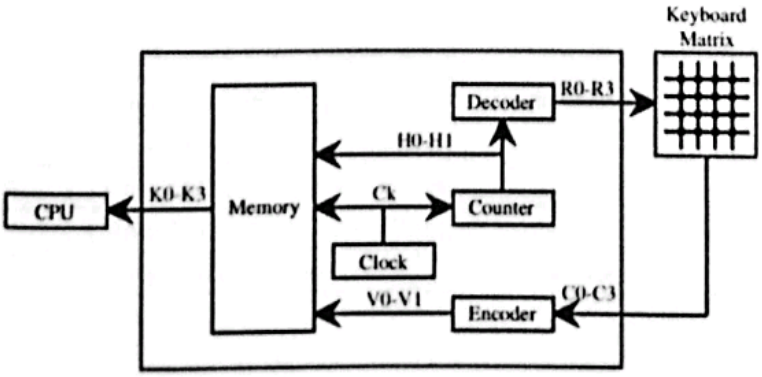


Figure 4: Keyboard Controller Design

There are many types of keyboard, usually differentiated by the switch technology employed in their operation such as: Dome-switch keyboard, Scissor-switch keyboard, Capacitive keyboard, Mechanical-switch keyboard, Hall-effect keyboard, Laser keyboard, Membrane keyboard. Here is given a description of a Mechanical Keyboard.

Important Components of a Mechanical Keyboard

The different parts of a keyboard work together to convert keystrokes into electrical signals and send them to a computer. Each part has a critical function and can significantly impact keyboard performance, comfort, and aesthetics.

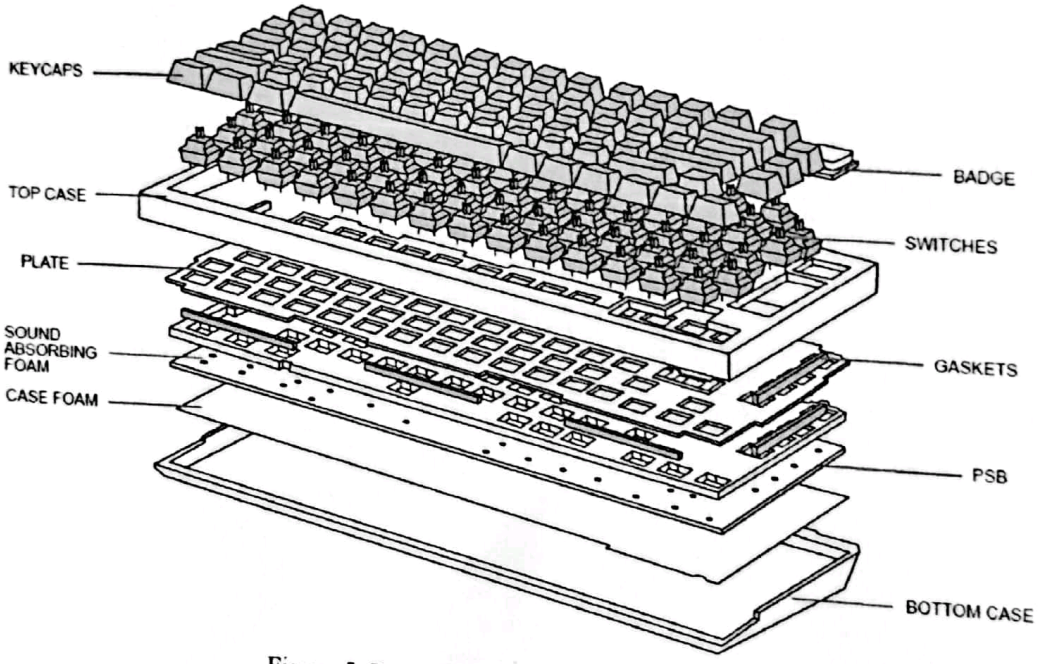


Figure 5: Parts of a Mechanical Keyboard

Keyboard Part	Function
Keycaps	Visible keys that activate underlying switches
Switches	Transfer keystrokes to Printed Circuit Board (PCB)
Case	Holds everything together and protects internal components
Gaskets	Protect internal components from dust and liquids
Plate	Aligns and stabilizes switches
PCB	Converts keystrokes into electrical signals and sends them to a computer
Stabilizers	Keep large keys stable while typing (spacebar, shift, enter, delete)
Power Cable	Plugs into the computer with a USB connection

Connection Types

There are mainly three wired keyboard connector types

1. 5-PIN DIN Connector: This type of keyboard connector has been the first prevalent non-proprietary keyboard cable connector. It could be called the AT connector, or even the IBM system that popularized this structure. Now, these connectors are not widely used.

2. 6-PIN Mini DIN Connector: 6-PIN Mini DIN connector is generally known as a PS/2 connector. In particularly, its color always be purple and its size is bigger, which is designed to distinguish from the same mouse connector.

3. USB: USB connector is one of keyboard connector types. This miniature rectangular connector is a significant upgrade over the DIN connector form. It's worth noticing that USB connectors are hot-swappable, which means you can plug in or out without turning the machine on or off.

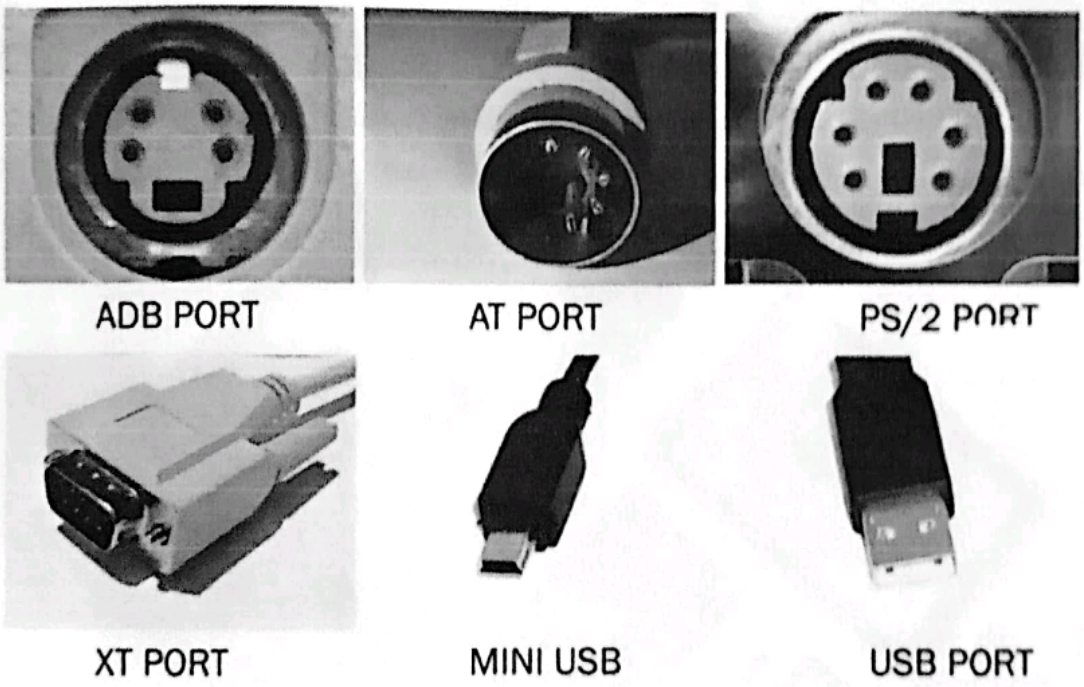


Figure 6: Different types of computer keyboards available in the market

Wireless keyboards:

Wireless keyboards connect to the computer through infrared (IR), radio frequency (RF) or Bluetooth connections. IR and RF connections are similar to what you'd find in a remote control. Regardless of which sort of signal they use, wireless keyboards require a receiver, either built in or plugged in to the USB port, to communicate with the computer. Since they don't have a physical connection to the computer, wireless keyboards have an AC power connection or use batteries for power.

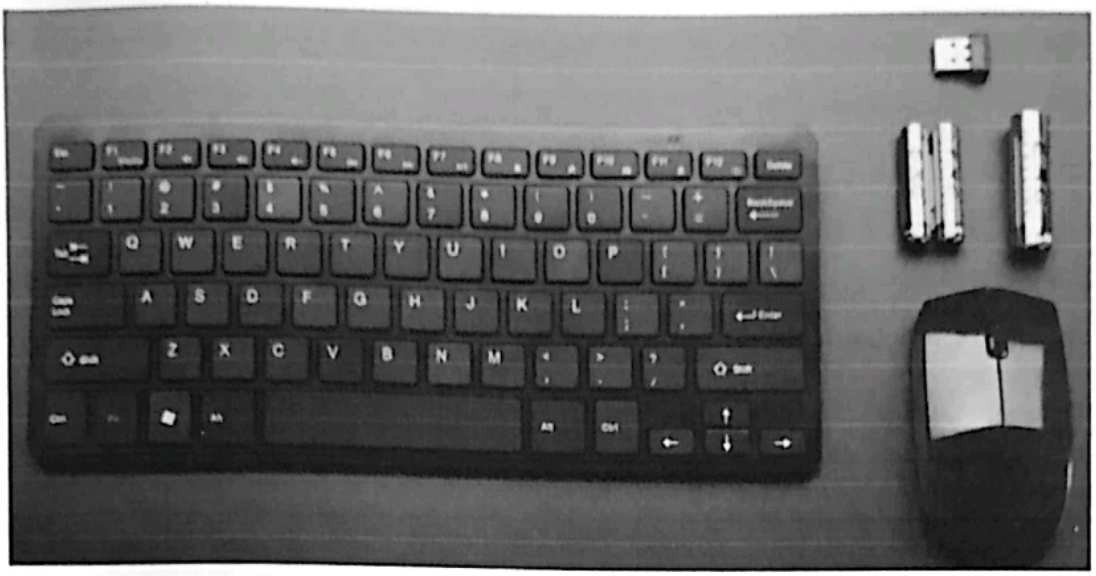


Figure 7: Wireless Keyboard and Mouse Combo with Batteries

Figure 8: Multi-device connectivity via a Bluetooth Keyboard

CRT Color Monitor

The color CRT display is a device used for presenting information to a user. The CRT produces images by projecting an electron beam onto the screen and using the phosphor colors to produce colors or light.

A color television display often referred to as a TV or simply as "the telly" is an electrical appliance that emits images in order to present content, predominantly as part of consumer media rather than professional equipment. Although color televisions were used for the first time in Europe in 1928 and in North America in 1929, the first commercially successful television which could be purchased by a consumer was not available until 1939.

The use of electronic devices for displaying information has become less common with the advance of computers and other digital media, but televisions are still very popular.

CRT stands for "cathode ray tube". The CRT is a display device that uses a focused beam of electrons to produce images. The images can be transferred into various other output devices, like video projectors or computer monitors (see also: Digital television). The display is built of colored phosphor dots or diodes; each dot is called a "picture element", or "pel" for short.

Cathode ray tube (CRT) displays are now fading in popularity but are still in widespread use on older systems. CRTs use a picture tube that is similar to the picture tube in a tube-based TV set. The narrow end of the tube contains an electron gun that projects three electron beams (red, blue, green) toward the wide end, which is coated with phosphors that glow when they are hit by the electron beams. Just before the phosphor coating, a metal plate called a shadow mask is used to divide the image created by the electron guns into red, green, and blue pixels or stripes that form the image. Shadow masks use one of three technologies:

- A phosphor triad (a group of three phosphors—red, green, and blue). The distance between each triad is called the dot pitch.
- An aperture grill, which uses vertical red, green, and blue phosphor strips. The distance between each group is called the stripe pitch.
- A slotted mask, which uses small blocks of red, green, and blue phosphor strips. The distance between each horizontal group is also called stripe pitch.

If you look closely at a CRT display, you can see the individual triads or strips. However, from normal viewing distances, they blend into a clear picture

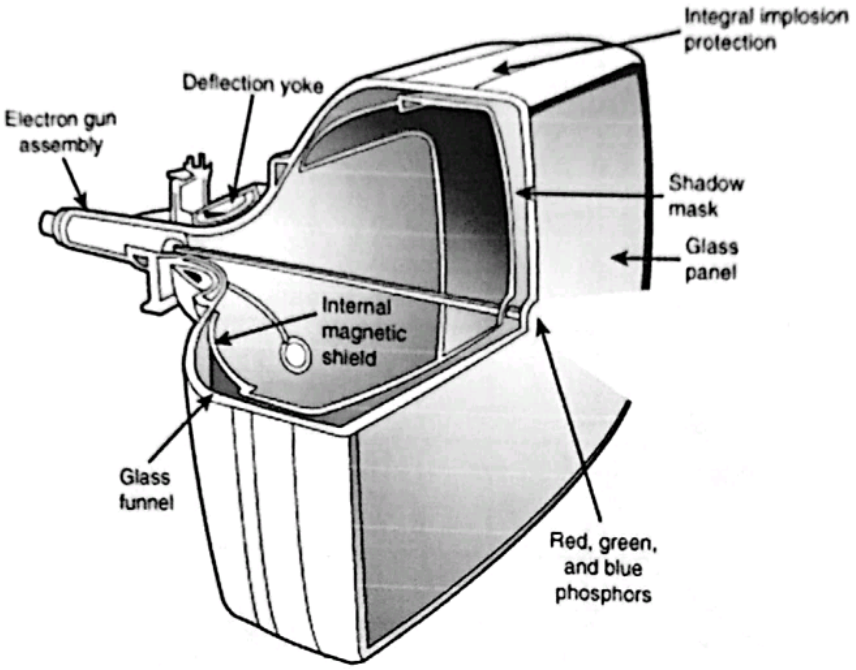


Figure 1: The design of a typical CRT monitor.

Generally, the smaller the dot or stripe pitch, the clearer and sharper the onscreen image will be. Typical standards for CRT monitors call for a dot pitch of .28 millimeters (mm) or smaller. Generally, low-cost monitors have poorer picture quality than higher-cost monitors of the same size because of wider dot pitch, low refresh rates at their highest resolutions, and poor focus at their highest resolutions.

Typical CRT displays range in size from 15 inches (diagonal measure) to 19 inches, and feature support for a wide range of resolutions. CRTs are analog display devices that can display an unlimited range of colors, and use the 15-pin VGA connector. To learn more about VGA connectors, see the section "VGA," later in this chapter.

Internal structure of CRT Monitor

The device which allows, the amplitude of such signals, to be displayed primarily as a function of time, is called cathode ray oscilloscope. The cathode ray tube (CRT) is the heart of the C.R.O. The CRT generates the electron beam, accelerates the beam, deflects the beam and also has a screen where beam becomes visible as a spot. The main parts of the CRT are

1. Electron gun
2. Deflection system
3. Fluorescent screen
4. Glass tube or envelope
5. Base

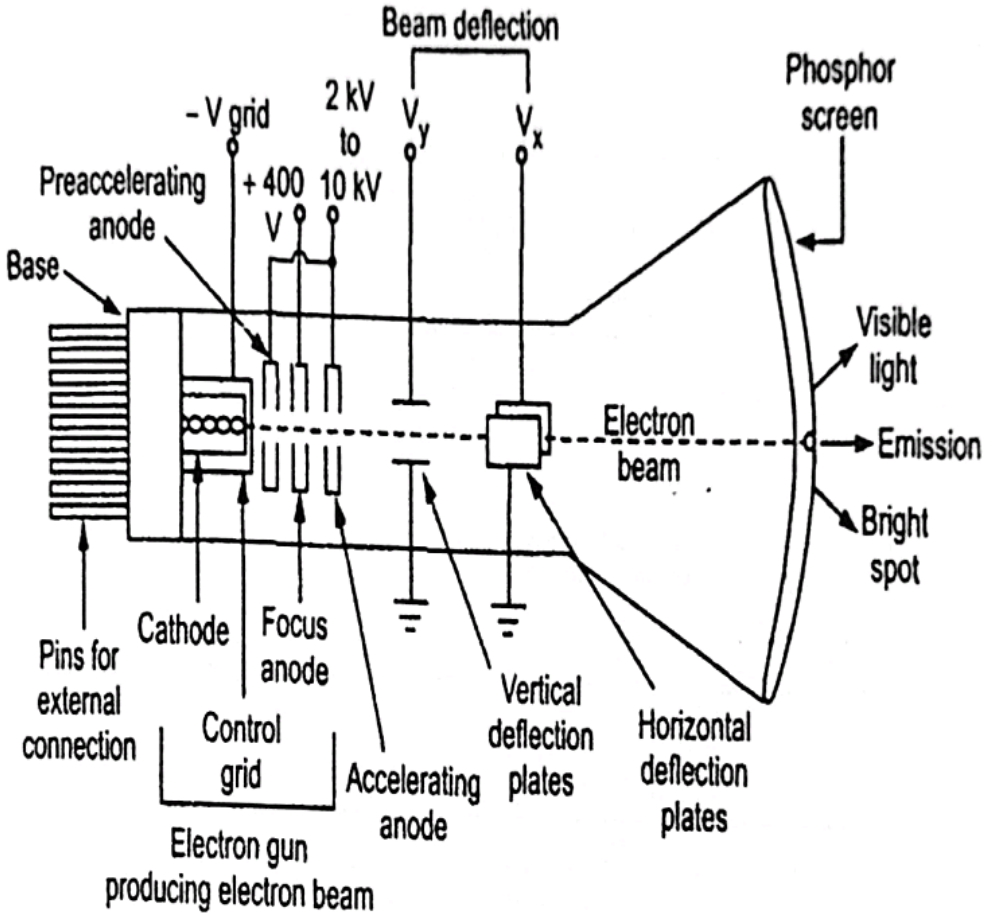


Figure 2: internal structure mechanism of CRT Monitor

Electron gun

- The electron gun section of the cathode ray tube provides a sharply focused, electron beam directed towards the fluorescent-coated screen.
- This section starts from thermally heated cathode, emitting the electrons.
- The control grid is given negative potential with respect to cathode.
- This grid controls the number of electrons in t beam, going to the screen.
- The momentum of the electrons (their number x their speed) determines the intensity, or brightness, of the light emitted from the fluorescent screen due to the electron bombardment.
- The light emitted is usually of the green colour.

Deflection System

- It is used to control the direction of the electron beam.
- It creates an electric or magnetic field which will bend the electron beam as it passes through the area.
- In a conventional CRT, the yoke is linked to a sweep or scan generator.

- The deflection yoke which is connected to the sweep generator creates a fluctuating electric or magnetic potential.

Fluorescent Screen

- The light produced by the screen does not disappear immediately when bombardment by electrons ceases, i.e., when the signal becomes zero.
- The time period for which the trace remains on the screen after the signal becomes zero is known as "persistence or fluorescence" .
- The persistence may be as short as a few microsecond, or as long as tens of seconds or even minutes.
- Medium persistence traces are mostly used for general purpose applications.
- Long persistence traces are used in the study of transients.
- Long persistence helps in the study of transients since the trace is still seen on the screen after the transient has disappeared.

Glass Tube

- All the components of a CRT are enclosed in an evacuated glass tube called envelope.
- This allows the emitted electrons to move about freely from one end of the tube to the other end.

Base

- The base is provided to the CRT through which the connections are made to the various parts.

Color CRT Monitors

The CRT Monitor display by using a combination of phosphors. The phosphors are different colors. There are two popular approaches for producing color displays with a CRT are:

1. Beam Penetration Method
2. Shadow-Mask Method

Beam Penetration Method

The Beam-Penetration method has been used with random-scan monitors. In this method, the CRT screen is coated with two layers of phosphor, red and green and the displayed color depends on how far the electron beam penetrates the phosphor layers. This method produces four colors only, red, green, orange and yellow. A beam of slow electrons excites the outer red layer only; hence screen shows red color only. A beam of high-speed electrons excites the inner green layer. Thus screen shows a green color.

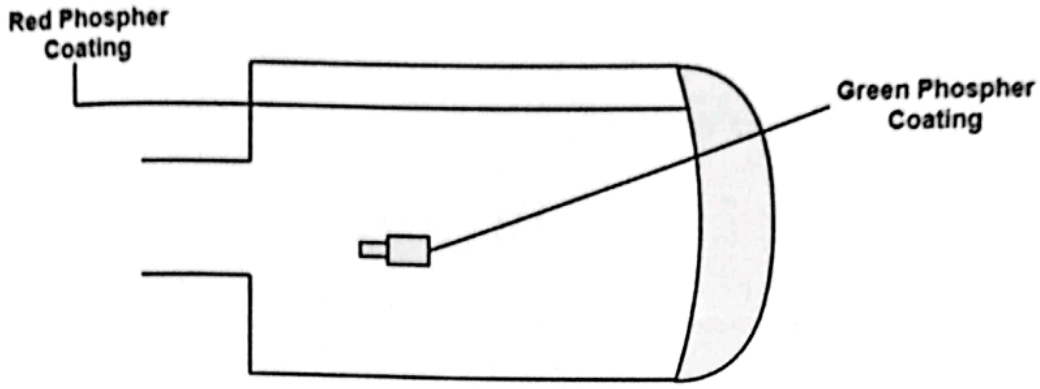


Figure 3: Beam Penetration Mechanism

Shadow-Mask Method

Shadow Mask Method is commonly used in Raster-Scan System because they produce a much wider range of colors than the beam-penetration method. It is used in the majority of color TV sets and monitors.

Construction: A shadow mask CRT has 3 phosphor color dots at each pixel position.

1. One phosphor dot emits: - red light
2. Another emits: - green light
3. Third emits: - blue light

This type of CRT has 3 electron guns, one for each color dot and a shadow mask grid just behind the phosphor coated screen. Shadow mask grid is pierced with small round holes in a triangular pattern.

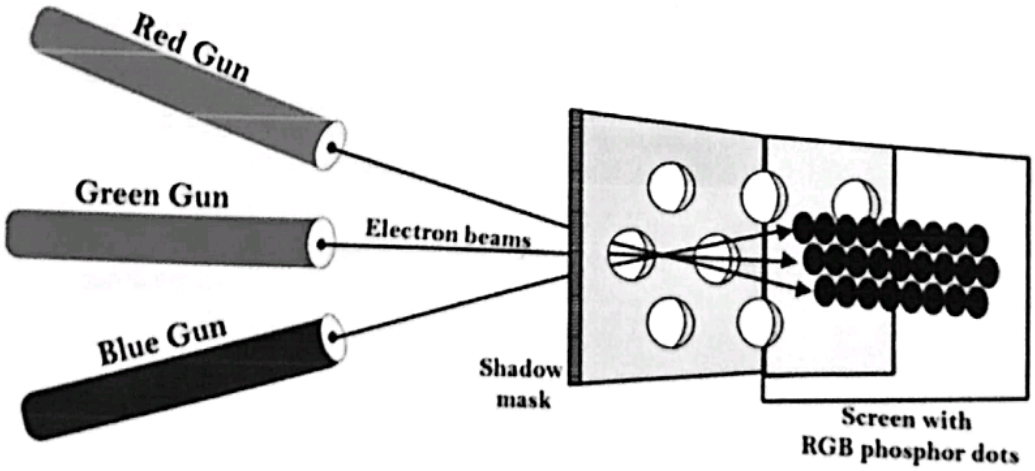
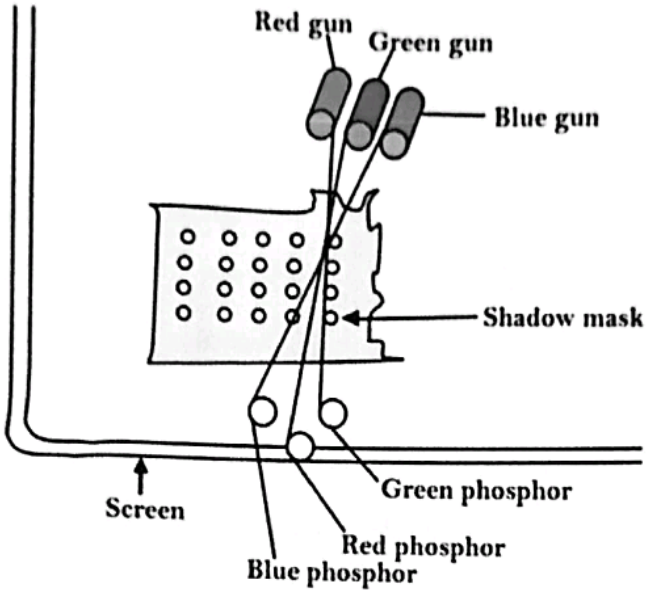


Figure 4: shows the delta-delta shadow mask method commonly used in color CRT system.



The Shadow mask CRT

Figure 5: Shadow-Mask Method

Triad arrangement

The deflection system of the CRT operates on all 3 electron beams simultaneously; the 3 electron beams are deflected and focused as a group onto the shadow mask, which contains a sequence of holes aligned with the phosphor- dot patterns. When the three beams pass through a hole in the shadow mask, they activate a dotted triangle, which occurs as a small color spot on the screen. The phosphor dots in the triangles are organized so that each electron beam can activate only its corresponding color dot when it passes through the shadow mask.

Inline arrangement

Another configuration for the 3 electron guns is an Inline arrangement in which the 3 electron guns and the corresponding red-green-blue color dots on the screen, are aligned along one scan line rather of in a triangular pattern.

This inline arrangement of electron guns in easier to keep in alignment and is commonly used in high-resolution color CRT's.

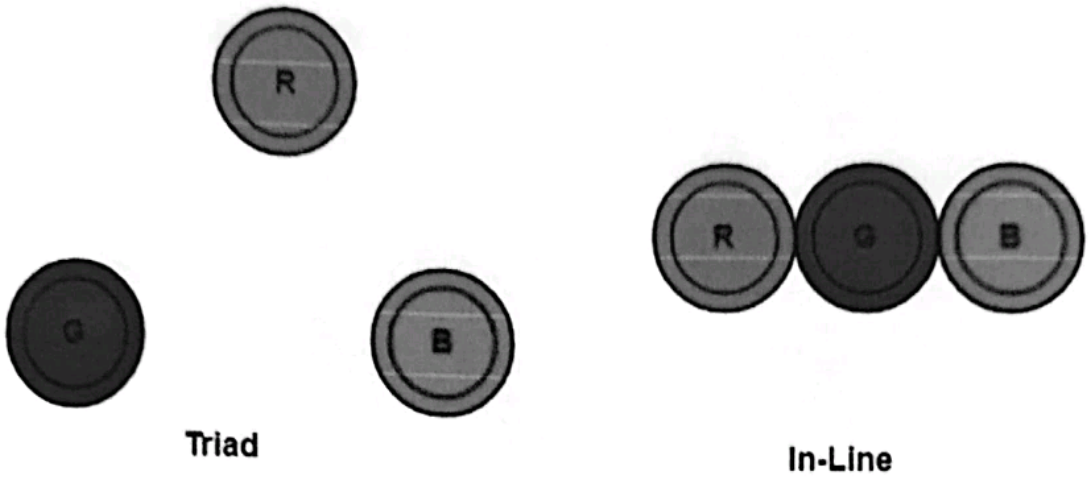
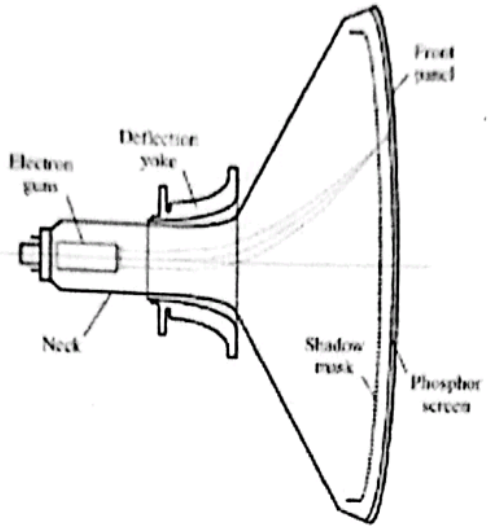
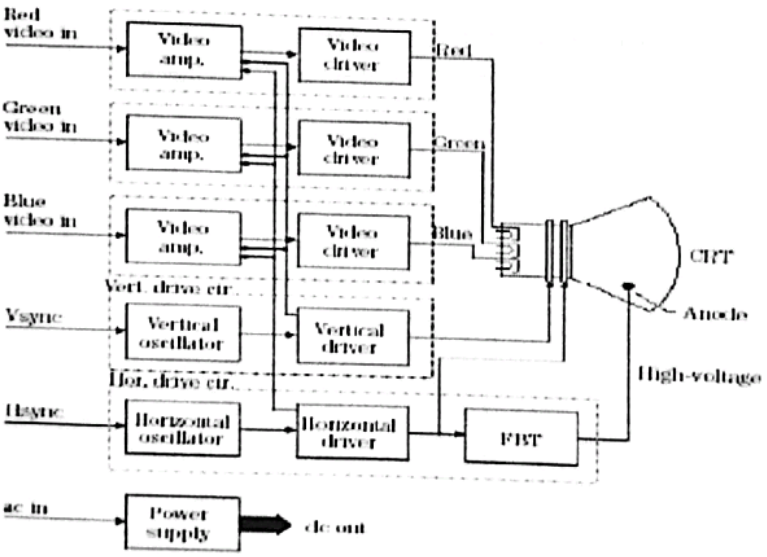


Figure 6: Triad and inline arrangements of red, green and blue electron guns of CRT for color monitors

Locate of the major parts and components of a color monitor.



Block Diagram of a Color Monitor



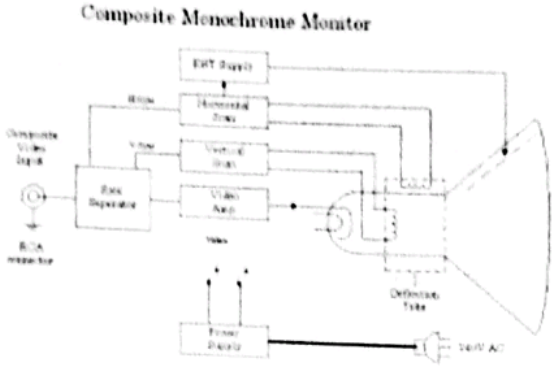
Pic: Structure of a color monitor.

A color monitor is a display monitor that can display many colors. They use the RGB color model, which uses three different phosphors that appear red, green, and blue when activated. Color monitors can display text and graphics in multiple colors through the use of alternating-intensity red, green, and blue phosphors.

Color monitor can be divided into two groups. They are:

1. Composite color monitor
2. RGB color monitor

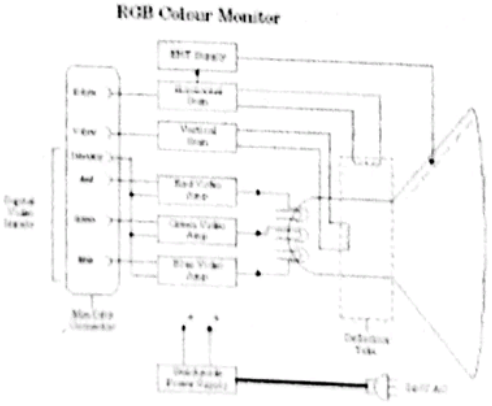
Composite color monitor:



Pic: Block diagram of a composite color monitor.

A composite color monitor is an analog video display that receives input in the form of an analog composite video signal. A composite video signal encodes all information on a single conductor.

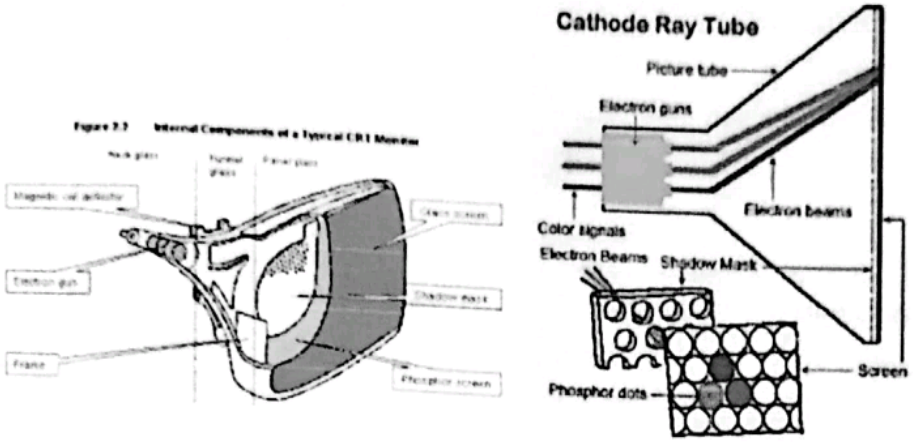
RGB color monitor:



Pic: Block diagram of RGB color monitor.

An RGB color monitor is a computer screen with a lighting system that illuminates the back of the monitor. RGB stands for red, green, and blue, which are light sources that can be combined to create millions of colors on a screen.

Internal parts of a color monitor:



Pic: Internal Parts of a color monitor.

Display panel

Usually made of glass or plastic, the display panel contains pixels that are illuminated by the backlighting system.

Backlighting system

Illuminate the pixels in the display panel.

Electronic circuits

Include the motherboard, which decodes signals from the computer's graphics card, controls the power supply, and controls the LCD screen.

Liquid crystal

Each sub-pixel is associated with a liquid crystal that changes its molecular structure when an electric field is applied.

Phosphor dots

The glass envelope contains a broad array of three types of phosphor dots, each precisely located.

Data cables

Transmit data from the hub card to the full color LED module, and connect each full color LED module.

Pixel Grid

The monitor screen is composed of pixels arranged in a grid. Each pixel consists of red, green, and blue sub-pixels that combine to produce a wide range of colors.

The resolution of a monitor is determined by the number of pixels it has, with higher resolutions providing sharper and more detailed images.

Color Filters

Filters are used to control the passage of light through each pixel. RGB (Red, Green, Blue) color filters are common, allowing the manipulation of individual color intensities to create a full spectrum.

Signal Processing Circuitry

This circuitry interprets incoming electrical signals from the computer's graphics card, converting them into instructions for the display to render images.

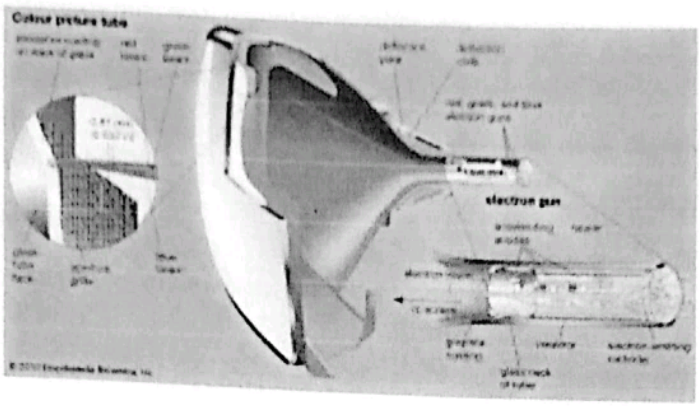
Graphics Card Connection Ports

Ports such as HDMI, DisplayPort, and VGA connect the monitor to the graphics card on the computer, facilitating the transmission of video signals.

Power Supply

The power supply unit provides the necessary electrical power to the monitor, converting external power to the required voltages for the internal components.

External parts of a color monitor:



Pic: Color monitor.

Screen:

The screen is the visible display area where images and content are presented. It can be flat or curved, and its size is usually measured diagonally in inches.

Bezel:

The bezel is the frame around the screen. It can be slim or wide, and its design may vary between models and manufacturers.

Stand/Base:

The stand or base supports the monitor and allows users to adjust its height, tilt, and sometimes swivel for ergonomic positioning.

Controls/Buttons:

Physical buttons or touch-sensitive controls are located on the front or side of the monitor. They allow users to navigate menus, adjust settings, and power the monitor on/off.

Ports:

Input/output ports on the monitor allow connectivity with external devices. Common ports include HDMI, DisplayPort, USB, and audio jacks.

Built-in Speakers:

Some monitors come with integrated speakers, providing audio output without the need for external speakers.

VESA Mounting Holes:

VESA (Video Electronics Standards Association) mounting holes on the back of the monitor allow it to be attached to a compatible wall mount or monitor arm.

Cables:

Monitors come with various cables for connecting to the computer, such as power cables, HDMI, DisplayPort, or USB cables.

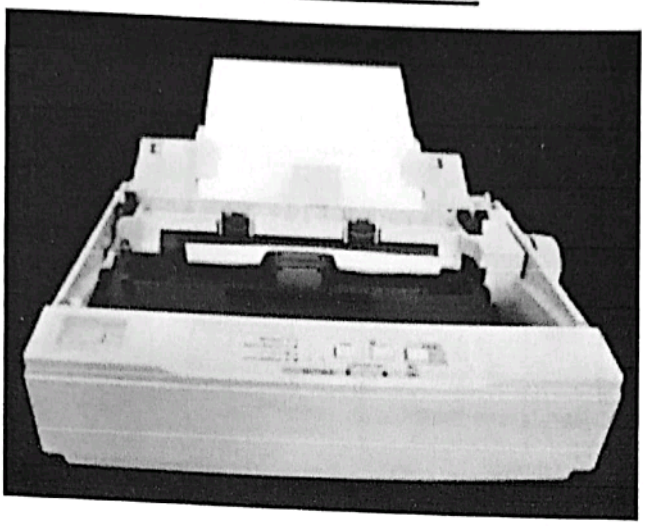
Power Button/Indicator:

The power button turns the monitor on/off, and an indicator light often shows the power status (on, standby, or off).

On-Screen Display (OSD) Menu:

The OSD menu is accessed through the monitor's controls and allows users to adjust settings such as brightness, contrast, color balance, and more.

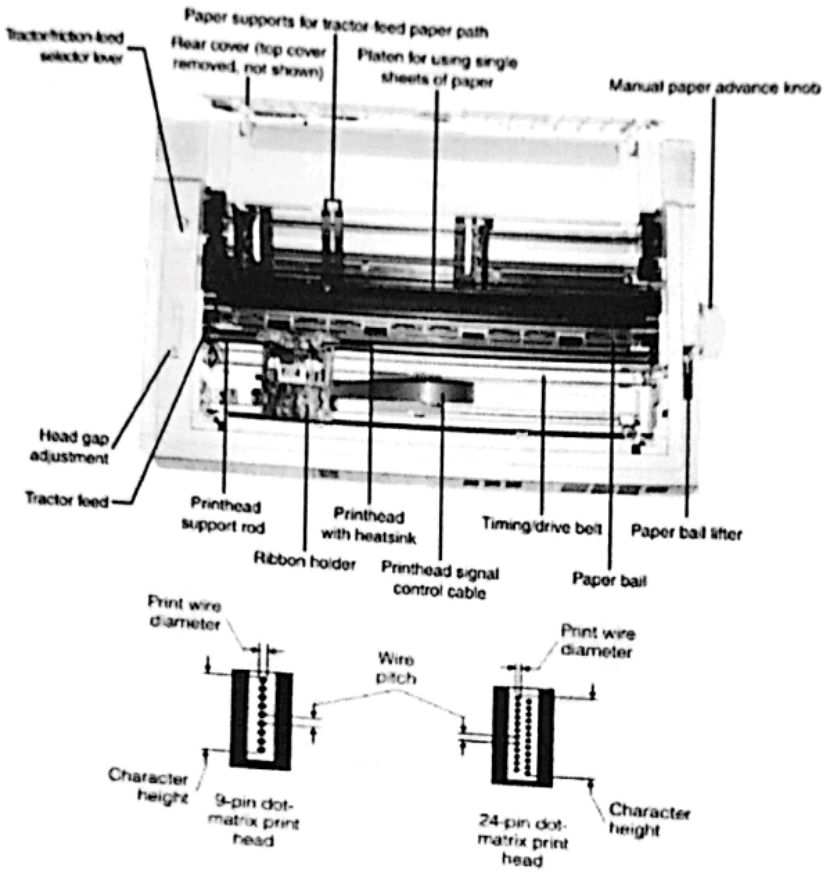
Identification of the mechanical assembly and electronic parts of a Dot-Matrix Printer



Pic: A dot-matrix printer.

Dot-Matrix Printer: A dot matrix printer is a type of impact printer that uses a fixed number of pins or wires to print. It works by striking an ink-soaked cloth ribbon against the paper, which produces small dots. The print head, which contains the pins, moves across the page to produce characters.

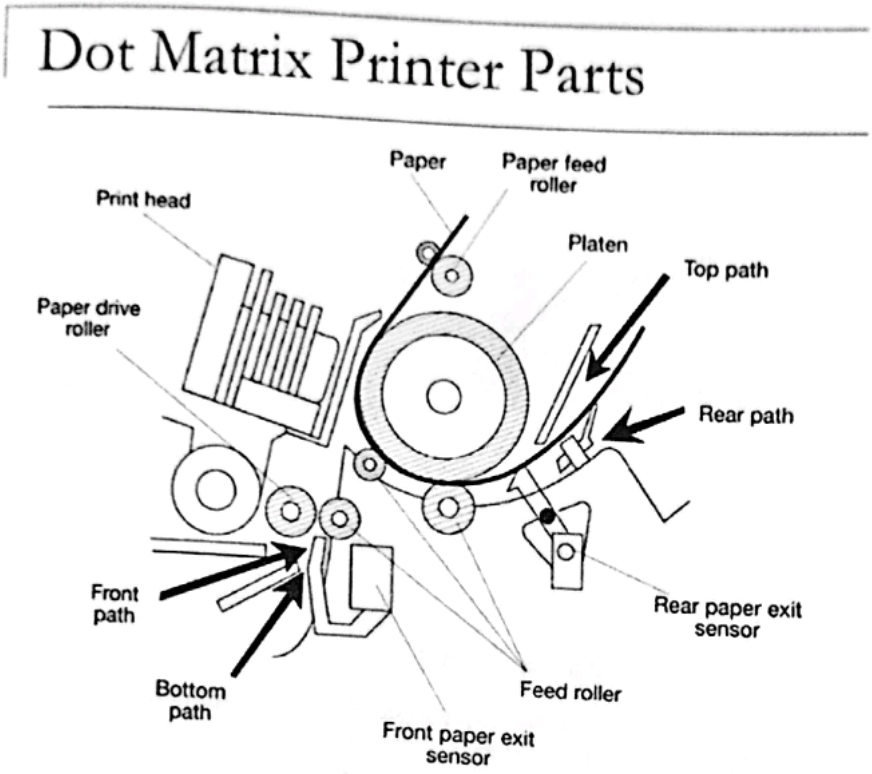
Dot matrix printers each bestow a matrix of pins, which are used to produce the characters on the page. When it comes to variation in this regard, you can choose from either 9 pins or 24 pins – 9 pin is usually the fastest option, meanwhile 24 pin boasts the highest resolution.



Pic: Disassembly of a Dot-Matrix printer.

Mechanical and electronic parts of a Dot-Matrix Printer:

1. Printer Body
2. Cartridge
3. Power Supply Unit
4. Power Transformer
5. Motherboard
6. Stepper Motor
7. Print Head
8. Timing Belt
9. Sensor
10. Paper Feed Roller
11. Tractor
12. Control Panel



Pic: Parts in a dot-matrix printer.

Printer Body:

Pic: Printer Body.

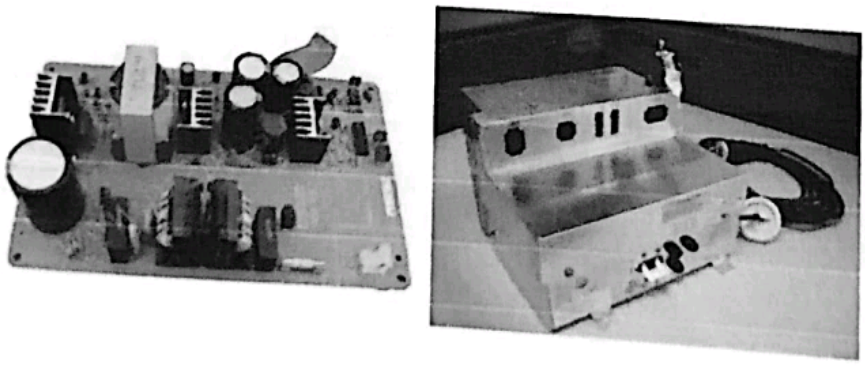
The body of a dot-matrix printer has a print head that contains a matrix of pins or wires arranged n a grid pattern. The pins are driven forward through an ink-soaked ribbon by electromagnets or olenoids. The print head moves from left to right to generate text.

Cartridge:

Pic: Printer cartridge.

A dot-matrix printer cartridge is made up of a cassette and a fabric ribbon that is inked. The ribbon is a long strip of material with holes in it. When the cartridge is installed, the holes line up with the print head, and ink flows through the holes onto the paper.

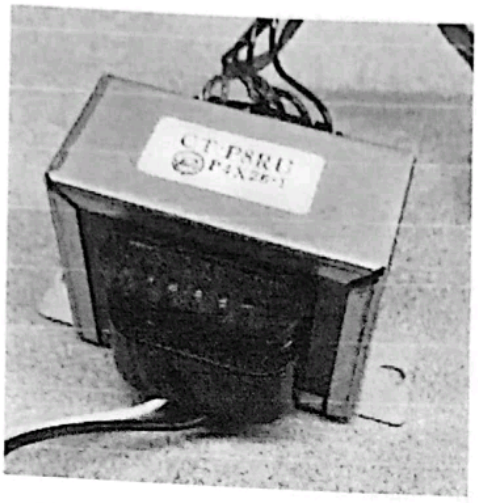
Power Supply Unit:



Pic: Dot-matrix power supply unit.

The power supply unit of a dot-matrix printer contains two DC power outlets that supply DC 12V power to the printer.

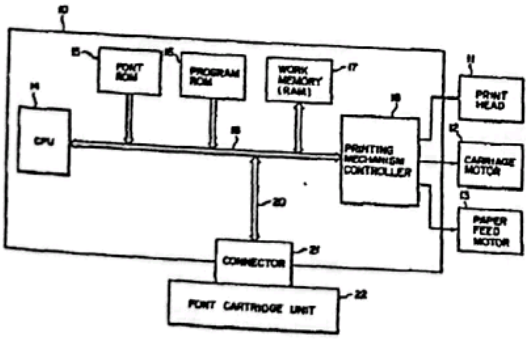
Power Transformer:

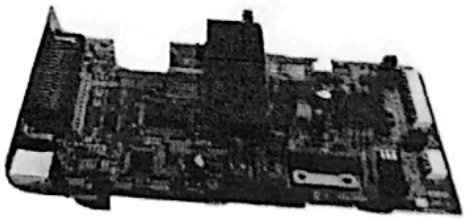


Pic: Dot-matrix power transformer.

A 2-inch dot matrix printer RMP130 has power modules, which include an AC DC converter, optoelectronics, buzzers, MOSFETs, IGBTs, inductors, coils, and transformers.

Motherboard:

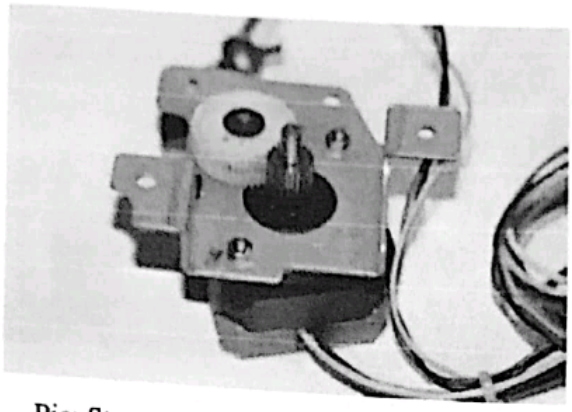




Pic: Motherboard of a dot-matrix printer.

A motherboard can be used as a main board for printers and as a baseboard for paper.

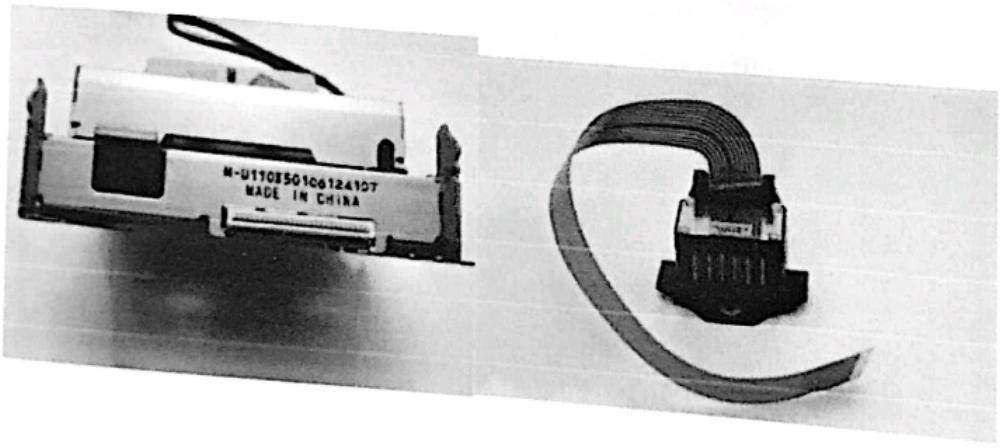
Stepper Motor:



Pic: Stepper motor of a dot-matrix printer.

A stepper motor is a brushless DC motor that can rotate in small angles, known as steps. Stepper motors are often used in printers and robotics because they can move an object to a repeatable position.

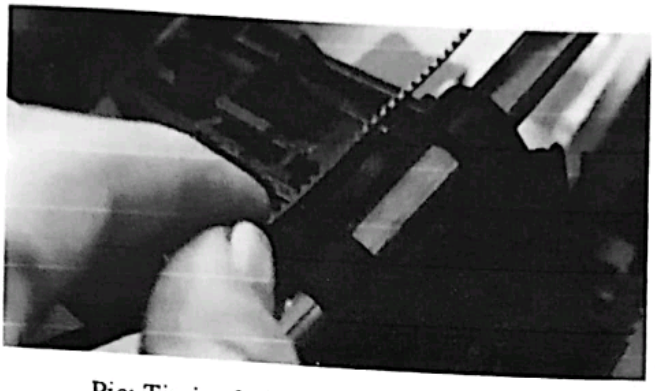
Print Head:



Pic: Print head of a dot-matrix printer.

A dot-matrix printer's print head is a matrix of pins that moves across the paper. The print head contains 9–24 fine wires, called pins, arranged in one, two, or three columns. The pins are thin metal wires with a tip less than a 50th of an inch across.

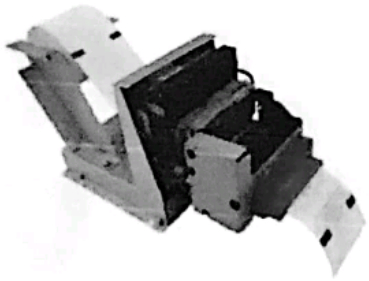
Timing Belt:



Pic: Timing belt of a dot-matrix printer.

Timing belts are essential components of many types of machinery, including printers. Epson timing belts are responsible for synchronizing the movement of the printer's carriage and print head, ensuring that they move together and produce accurate prints.

Sensor:



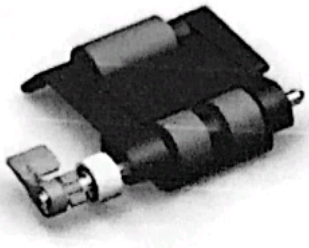
Pic: Sensor of a dot-matrix printer.

Dot-matrix printers have many different types of sensors, including:

- Paper out sensors
- Print head position sensors
- Ribbon end sensors

Each sensor has a unique function, such as detecting paper presence or monitoring the print ribbon's lifespan.

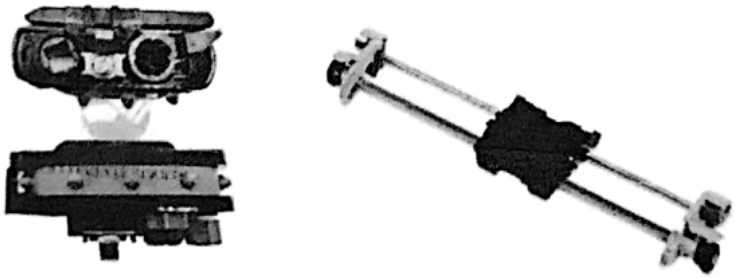
Paper Feed Roller:



Pic: Paper feed roller of a dot-matrix printer.

A dot-matrix printer's paper feed roller is a steel roller that supports the platen assembly. It moves in a direction to and from the printing means.

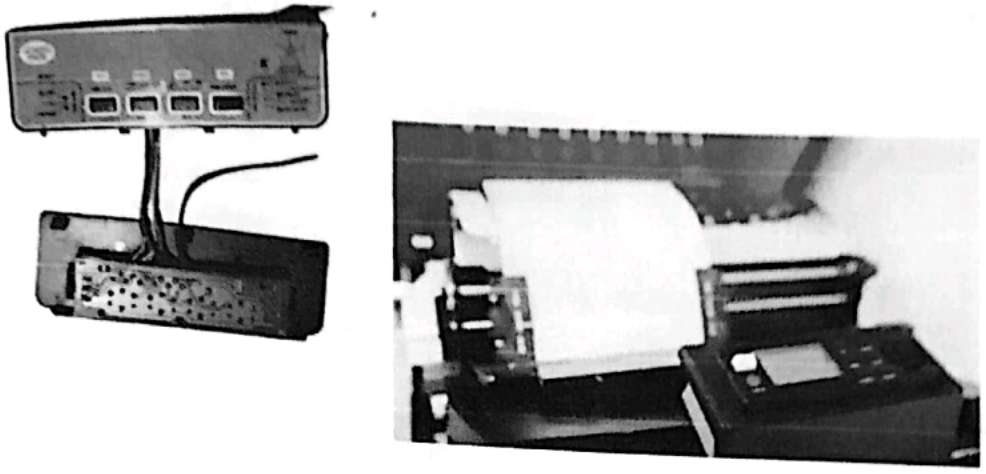
Tractor:



Pic: Tractor of a dot-matrix printer.

A tractor feed is a common feature of dot matrix printers. It allows the printer to pull paper through. Dot matrix printers can use fanfold continuous paper with tractor holes.

Control Panel:



Pic: Control Panel of a dot-matrix printer.

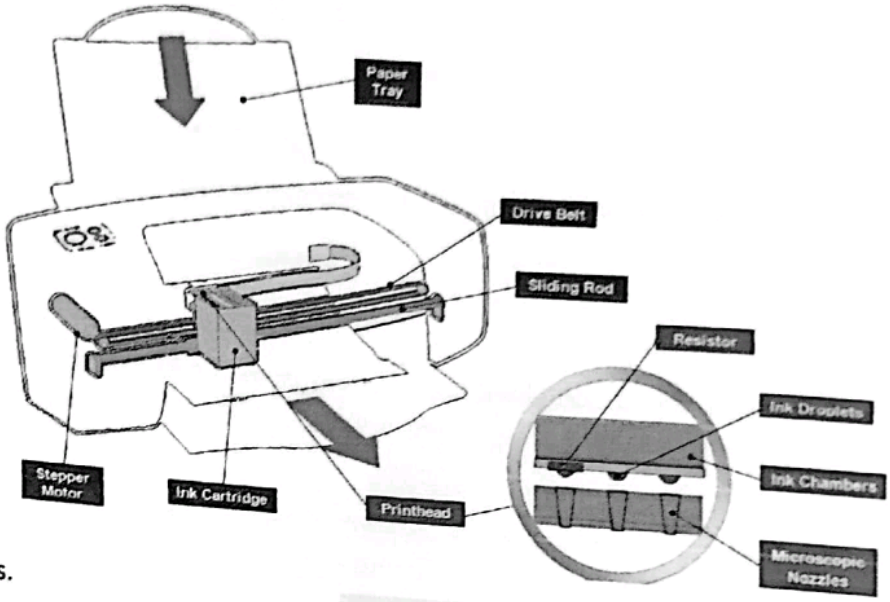
A dot matrix printer's control panel is located on the front of the printer. It is made up of three elements:

- Liquid crystal display (LCD) panel
- Indicator lights
- Buttons

Inkjet printer

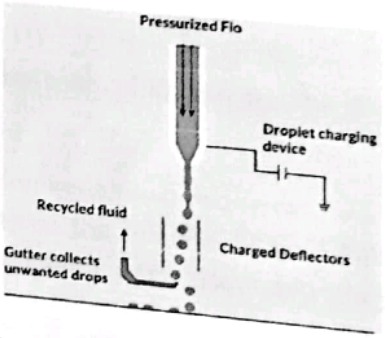
Introduction:

Inkjet printing is a common and versatile method of printing that is used in various applications. Here's an overview of the inkjet printing process:

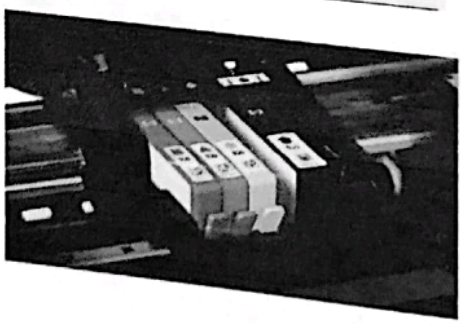


Data Input: The printing process begins with a digital file containing the content you want to print. This file can be created in various software applications or generated from scanned images or digital cameras.

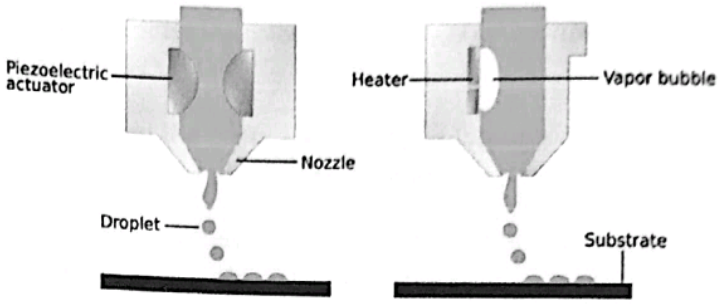
Rasterization: The digital file is converted into a series of dots or pixels that the printer can understand. This process is called rasterization. Each dot corresponds to a specific location and color on the page.



Ink Cartridges: Inkjet printers use one or more ink cartridges that contain different colored inks (typically cyan, magenta, yellow, and **black**, often abbreviated as CMYK). Some printers also include additional ink colors for enhanced color accuracy.



Printhead Assembly: It contains one or more tiny nozzles that eject ink droplets onto the paper. There are two main types of printhead like;



i. Thermal Inkjet: In this technology, tiny resistors in the printheads are heated, causing the ink to expand and be expelled through the nozzles

ii. Piezoelectric Inkjet: It is used to push ink out of the nozzles.

Positioning and Movement: The printhead assembly moves horizontally across the page while the paper or substrate is fed through the printer. This movement allows precise placement of ink droplets.

Ink Ejection: The ink is ejected from the nozzles in the printhead as it passes over the paper. The ink is released in tiny droplets with high precision, and the combination of different ink colors at specific positions creates the desired image or text.

Drying and Absorption: Generally, heaters or fans may be used to accelerate the drying process, depending on the printer technology and ink type.

Resolution and Quality: The final print quality and resolution depend on factors such as the number of nozzles, the size of the droplets, and the quality of the ink and paper. Higher-resolution prints have more dots per inch (DPI) and therefore provide more detail and sharper images.

Color Mixing: Inkjet printers can create a wide range of colors by combining the primary colors (CMYK). Additional colors can be achieved through advanced color management and printing techniques.

Output: The printed document or image is the final output of the inkjet printing process.

Several components of Inkjet printer

Print Head: The print head is a crucial component that ejects ink onto the paper. It contains tiny nozzles through which ink droplets are sprayed onto the paper in precise patterns to form text and images.

Ink Cartridges: Inkjet printers use ink cartridges that contain the ink required for printing. These cartridges can be either individual tanks for different colors (cyan, magenta, yellow, and black) or a single cartridge containing multiple colors.

Paper Feeder: The paper feeder is where you load the paper for printing. It typically consists of a tray or cassette that holds the paper and feeds it into the printer in a controlled manner.

Platen: The platen is a flat surface inside the printer where the paper rests during printing. It ensures that the paper stays in place and maintains proper alignment while the print head moves across it.

Rollers: Rollers are used to feed the paper through the printer. They grip the paper and move it along the paper path as it is printed upon. Proper alignment and tension of these rollers are crucial for smooth paper feeding.

Control Panel: Many inkjet printers have a control panel for user interaction. This panel typically includes buttons or a touchscreen display for selecting print options, adjusting settings, and monitoring the printer's status.

Logic Board: The logic board, also known as the control board or motherboard, is the central component that controls the printer's operation. It processes print commands from the computer, controls the movement of the print head and paper feed mechanism, and manages other printer functions.

Power Supply: The power supply unit provides the necessary electrical power to operate the printer's components. It converts AC power from the outlet into the appropriate DC voltage levels required by the printer.

Encoder Strip: The encoder strip is a thin, transparent strip located parallel to the print head carriage. It contains markings that are read by sensors to precisely position the print head as it moves across the paper.

Waste Ink Pad: Some inkjet printers have a waste ink pad or waste ink tray. This component absorbs excess ink that is purged from the print head during cleaning cycles to prevent it from dripping onto other printer components or the printed page.

Motor: Inkjet printers utilize various motors to drive the movement of components such as the carriage and paper feed mechanism. These motors are controlled by the printer's logic board to ensure smooth and precise movement.

Heating Element: In some inkjet printers, especially those designed for specialized printing tasks like photo printing, a heating element may be included. This element helps to dry the ink quickly, allowing for faster printing and preventing smudging or smearing of prints.

Identification of the Major Parts and Components of a LASER Printer

Laser printers are ubiquitous in modern office environments and play a crucial role in various industries due to their efficiency, reliability, and high-quality output. Unlike traditional printers such as inkjet or dot matrix printers, which rely on ink or impact mechanisms for printing, laser printers utilize advanced laser technology to produce crisp, clear prints at high speeds.

One of the key features that sets laser printers apart is their ability to handle large volumes of printing tasks efficiently. This makes them ideal for environments where there is a constant need for printing documents, such as corporate offices, educational institutions, publishing houses, and commercial printing facilities. Laser printers excel in producing professional-quality documents, including text-heavy reports, business presentations, marketing materials, and graphics-rich documents.

Figure 1: LASER Printer

Moreover, laser printers offer several advantages over other types of printers. They are known for their fast printing speeds, significantly reducing the time required to produce multiple copies of documents. Additionally, laser printers produce smudge-free prints with sharp, precise text and graphics, making them suitable for printing documents that require high levels of clarity and readability.

- **Efficiency**: Laser printers handle large volumes of printing tasks efficiently, making them ideal for corporate offices, educational institutions, and commercial printing facilities.
- **Reliability**: Laser printers produce smudge-free prints with sharp text and graphics, ensuring high levels of clarity and readability.
- **High-Speed Printing**: Laser printers offer fast printing speeds, reducing the time required to produce multiple copies of documents.
- **Versatility**: Laser printers are compatible with a wide range of paper types and sizes, offering versatile printing options to meet diverse business needs.
- **Cost-effectiveness**: Laser printers are cost-effective in the long run due to their lower cost per page compared to other types of printers, making them a practical choice for businesses with high-volume printing needs.

Components of a LASER Printer

Laser printers are sophisticated devices that rely on a combination of mechanical and electronic components to produce high-quality printed documents efficiently. The main components of a laser printer include the toner cartridge, drum unit, fuser assembly, transfer roller, laser scanning unit, paper tray and feed mechanism, and control panel and interface.

The main 7 components are-

1. Toner Cartridge
2. Drum Unit
3. Fuser Assembly
4. Transfer Roller
5. Laser Scanning Unit
6. Paper Tray & Feed Mechanism
7. Control Panel and Interface

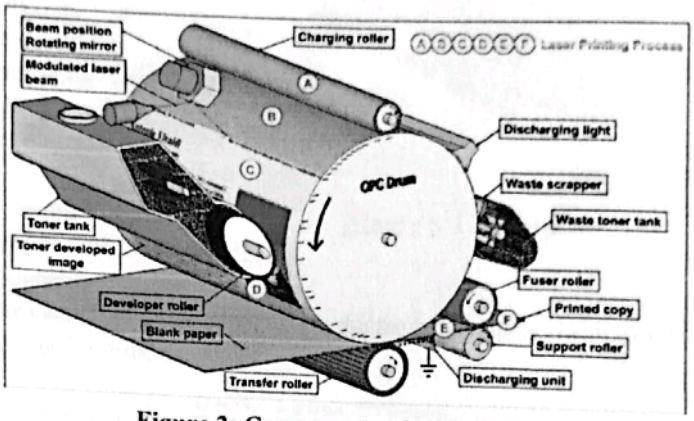


Figure 2: Components of LASER Printer

Some other components are-

i. Power Supply Unit
ii. Control Board
iii. Paper Feed Motor
iv. Paper Feed Roller
v. System Sensor
vi. Control Panel Board

1. **Toner Cartridge**: The toner cartridge contains powdered toner, a mixture of plastic particles and pigment. During printing, it releases toner onto the drum unit to create the image on paper.
   - Contains powdered toner for image creation.
   - Easily replaceable component.
   - Ensures precise toner distribution for high-quality prints.

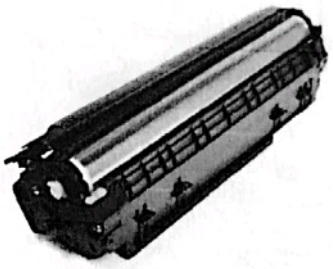


Figure 3: toner cartridge and roller

2. **Drum Unit**: The drum unit is a cylindrical component with a photosensitive coating that receives a charge from the laser scanning unit, attracting toner particles to form the image.
   - Receives charge from laser scanning unit.
   - Coated with photosensitive material for image formation.
   - Critical for transferring toner onto paper accurately.
3. **Fuser Assembly**: The fuser assembly contains heated rollers that melt toner and bond it to the paper, ensuring durability and smudge-resistance of the printed image.
   - Heated rollers for toner fusion.
   - Ensures permanent bonding of toner to paper.

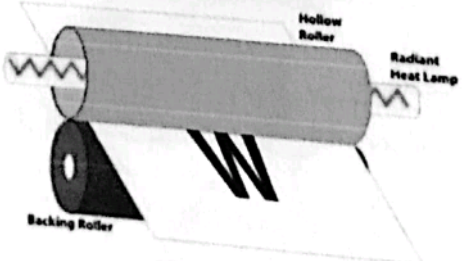


Figure 4:Fuser

- Essential for producing durable prints.

4. **Transfer Roller**: The transfer roller applies pressure to transfer toner from the drum unit to paper, ensuring accurate and consistent image transfer onto the paper.
    - Applies pressure for toner transfer.
    - Ensures consistent image quality.
    - Critical for precise image reproduction.
5. **Laser Scanning Unit**: The laser scanning unit includes a laser diode and rotating mirror, controlling the laser beam to create an electrostatic image on the drum unit.
    - Controls laser beam for image creation.
    - Contains laser diode and rotating mirror.
    - Crucial for accurate image reproduction.
6. **Paper Tray and Feed Mechanism**: The paper tray stores paper, while the feed mechanism, with rollers and guides, transports paper into the printer for printing.
    - Stores paper for printing.
    - Includes rollers and guides for paper feeding.
    - Facilitates smooth and accurate paper handling.
7. **Control Panel and Interface**: The control panel serves as the printer's user interface, containing buttons, LED indicators, and a display screen for controlling printer functions.
    - User-friendly interface for printer control.
    - Includes buttons and LED indicators.
    - Allows for easy monitoring and management of print jobs.

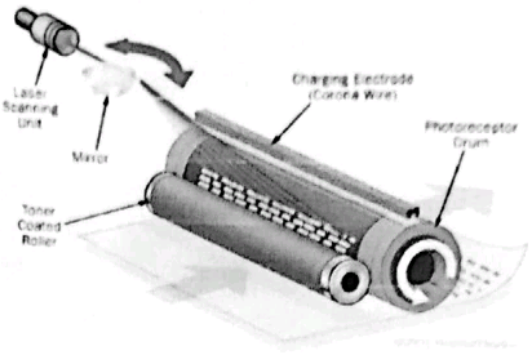


Figure 5: LASER scan

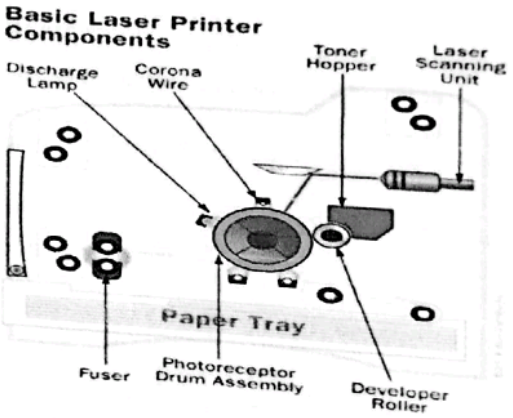


Figure 6: Printer internal component

Printing process of a LASER printer

Static Electricity: Static electricity plays a crucial role in laser printers, starting with the initial positive charge applied to the photosensitive drum. Toner particles, which are negatively charged, are then attracted to these discharged areas due to electrostatic forces.

The subsequent electrostatic repulsion ensures that the toner adheres only to the positively charged regions on the drum, forming the desired image. As the paper, carrying a slightly stronger positive charge, passes close to the drum, the electrostatic attraction facilitates the transfer of toner particles onto the paper, ultimately leading to the creation of the final printed output.

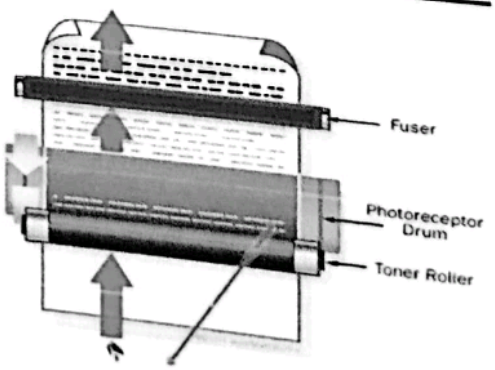


Figure7: Laser printing

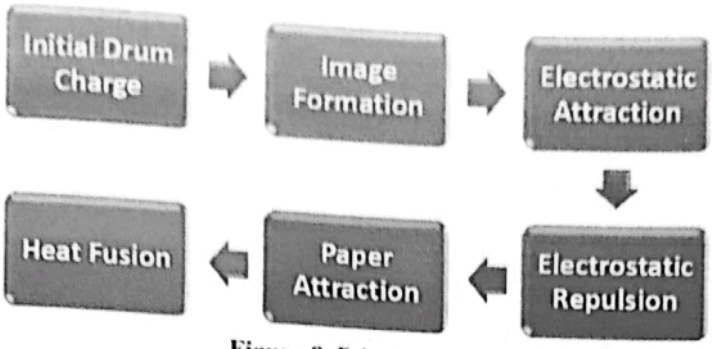


Figure 8: Printing process

i. **Image Formation**: A laser selectively discharges specific areas on the drum according to the image to be printed. This creates regions of lower positive charge.
ii. **Electrostatic Attraction**: Toner particles, which are negatively charged, are attracted to the positively charged (discharged) areas of the drum due to electrostatic forces.
iii. **Electrostatic Repulsion**: The negatively charged toner particles are repelled from the negatively charged areas of the drum, adhering only to the positively charged (discharged) areas where the laser has drawn the image.
iv. **Paper Attraction**: As the paper moves close to the drum, it carries a slightly stronger positive charge than the discharged areas of the drum. This electrostatic attraction causes the toner particles to transfer from the drum to the paper.
v. **Transfer of Toner to Paper**: The toner particles are transferred from the drum to the paper, creating a temporary image on the paper surface.
vi. **Heat Fusion**: The paper, now with toner particles, passes through a fuser unit. The fuser unit uses heat and pressure to melt and permanently fuse the toner onto the paper, creating the final printed image.
vii. **Completion of Printing**: The paper with the fused toner image exits the printer, completing the printing process.

These steps illustrate how static electricity plays a crucial role in the laser printing process, facilitating the precise transfer of toner particles to create a printed image on paper.

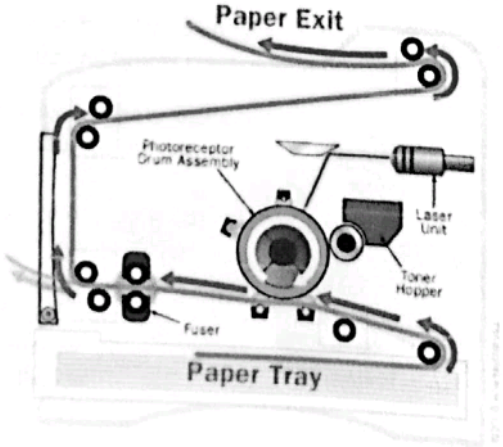


Figure 9: Paper travel path

Block diagram of a LASER Printer

A block diagram of a laser printer typically consists of several key components interconnected to facilitate the printing process. At the core of the diagram is the processing unit, responsible for interpreting data received from the input interface, which could be a computer or a network connection. Processed data stored temporarily in the printer's memory.

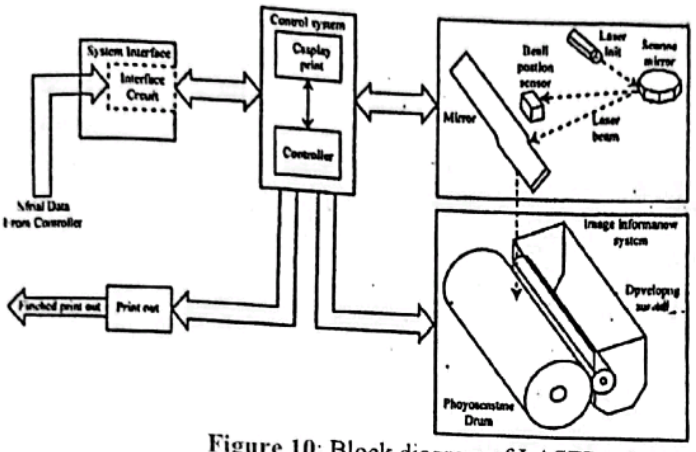


Figure 10: Block diagram of LASER printer

- The laser scanning unit directs a laser beam onto the rotating drum, creating an electrostatic image.
- Drum transfers image onto paper as it passes through the printer.
- Toner cartridge deposits toner onto electrostatically charged areas of the drum, adhering to an image.
- Paper with toner particles moves through a fusing unit for permanent fusion.
- Paper handling mechanism controls the movement of paper through the printer.
- Output interface manages the delivery of the printed document to the destination.
- Components form block diagrams illustrating data flow and functions in the printing process.

Maintenance & Troubleshooting

Regular Maintenance Practices: Regular maintenance ensures optimal printer performance and print quality by addressing dust buildup and timely replacement of consumables.

- Clean printer components regularly using a soft cloth and mild solution to prevent dust accumulation.
- Replace toner cartridges promptly when low to maintain consistent print quality and prevent print defects.
- Follow manufacturer guidelines for proper cleaning and maintenance procedures to prolong the printer's lifespan.

Figure 11: Clean printer

Troubleshooting Common Issues: Troubleshooting involves addressing paper jams and print quality problems to ensure uninterrupted printing operations.

- Clear paper jams by gently removing jammed paper and identifying potential causes such as misaligned paper or worn rollers.
- Regularly inspect and clean areas prone to paper jams, such as the paper feed path, to prevent future incidents.
- Improve print quality by cleaning the drum unit with a soft, lint-free cloth and adjusting print settings for optimal results.
- Refer to the printer's manual or online resources for specific troubleshooting steps and seek professional assistance if issues persist

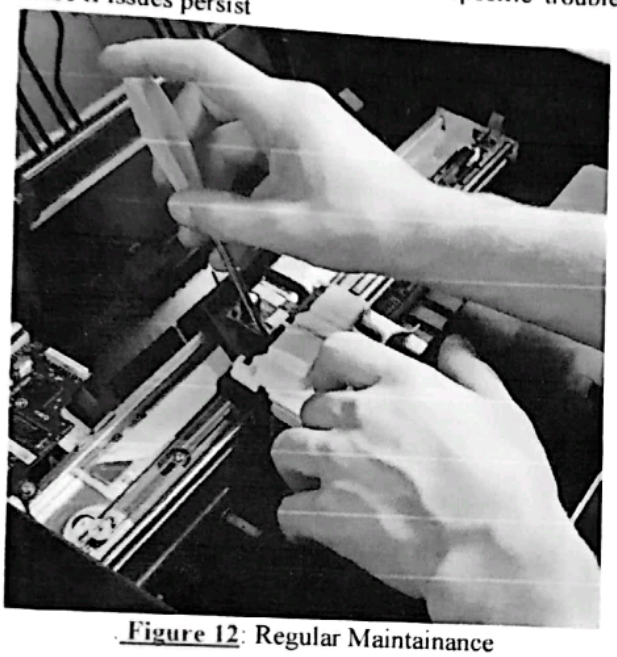


Figure 12: Regular Maintainance

Observation of External and Internal Parts of a Computer Mouse

Introduction

A computer mouse (plural mice, also mouses) is a hand-held pointing device that detects two-dimensional motion relative to a surface. This motion is typically translated into the motion of the pointer (called a cursor) on a display, which allows a smooth control of the graphical user interface of a computer.

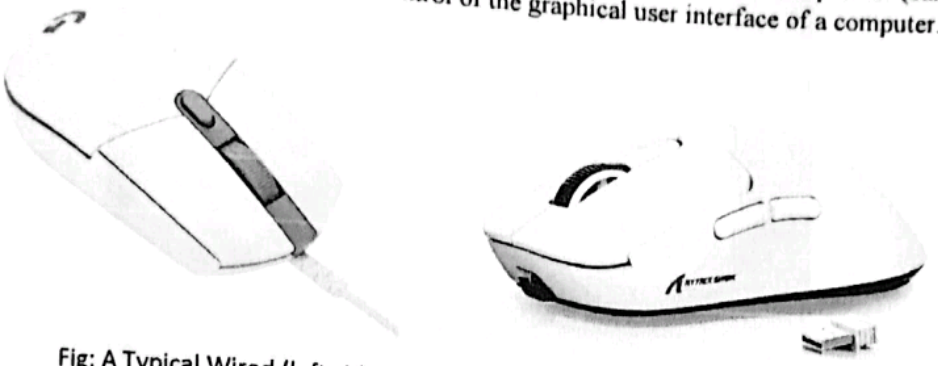


Fig: A Typical Wired (left side) and Wireless (right side) Computer Mouse.

This report details the examination of a computer mouse, focusing on its external design and internal components.

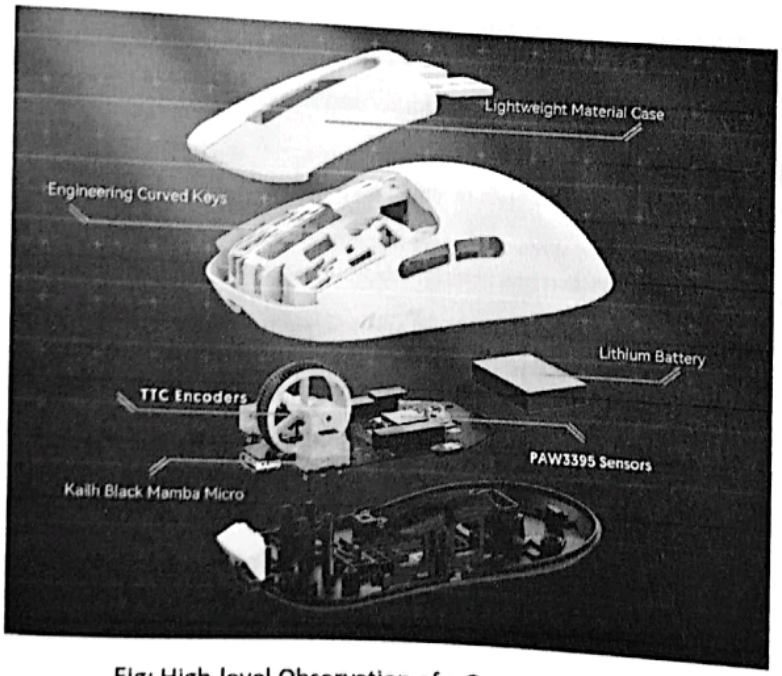


Fig: High-level Observation of a Computer Mouse.

External Parts Observation:

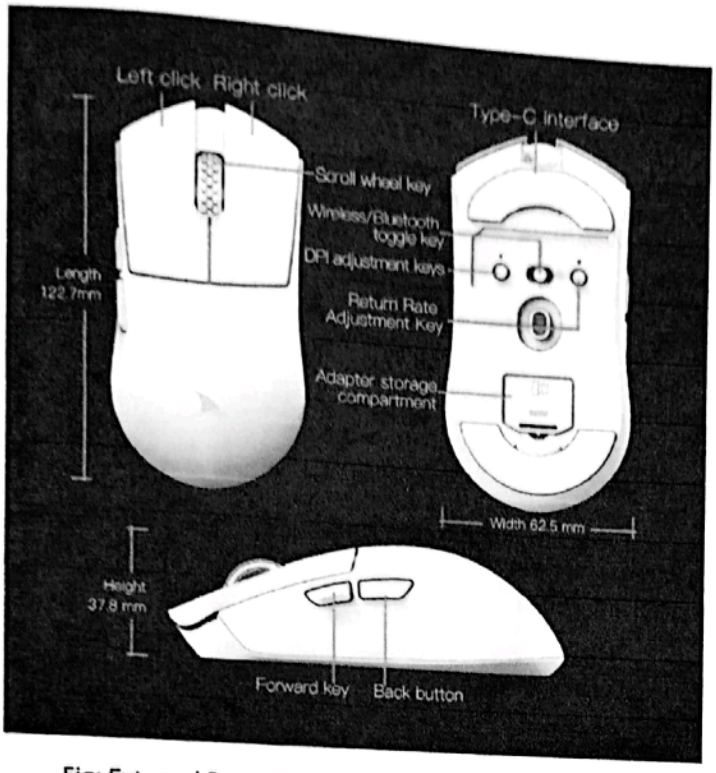


Fig: External Parts Observation of a Computer Mouse.

Body: The body of the mouse serves as the primary housing for all internal components. It is typically sculpted to fit comfortably in the user's hand and can vary in shape and size depending on the model.

Buttons: Most mice have two primary buttons, the left and right-click buttons, located on the top surface of the mouse. These buttons are used for executing commands and actions within software applications.

Scroll Wheel: Positioned between the primary buttons, the scroll wheel allows users to navigate through documents and web pages vertically. It also serves as a button itself, often used for functions such as opening links in new tabs or zooming in and out.

Side Buttons (if applicable): Some mice feature additional buttons on the side, typically used for navigating forward and backward in web browsers or other software applications. These buttons enhance user convenience and productivity.

DPI/CPI Button (if applicable): High-end mice may include a DPI (dots per inch) or CPI (counts per inch) button, allowing users to adjust the sensitivity of the mouse cursor movement. This feature is particularly useful for gamers and graphic designers.

Cable or Wireless Receiver: Depending on the mouse's connectivity type, it may have a USB cable for wired connections or a wireless receiver for wireless connections. The cable or receiver facilitates communication between the mouse and the computer. Nowadays, every wireless mouse has a adapter storage compartment for storing the 2.4GHz wireless receiver.

Feet Pads: The underside of the mouse features small pads or feet, typically made of Teflon or similar materials, to reduce friction and enable smooth movement across surfaces.

Internal Parts Observation:

Sensor: The sensor is one of the most critical components of the mouse, responsible for tracking its movement. Optical mice use LED or laser sensors to detect surface textures and movements accurately. Some well-known optical mouse sensors are PixArt PAW3395, Razer Focus+ Sensor, Logitech Hero Sensor, SteelSeries TrueMove Pro+ sensor, Logitech PMW-3389 sensor.

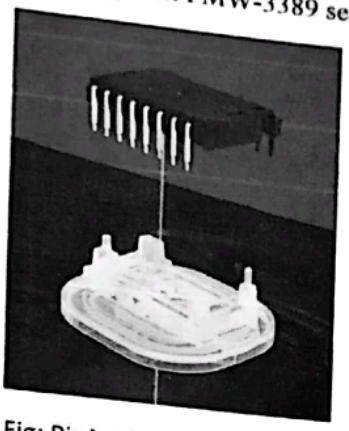


Fig: PixArt PAW3395 Sensor.

Microswitches: Microswitches are located beneath the primary buttons and are responsible for registering clicks. When a button is pressed, the microswitch is actuated, sending a signal to the computer. Some well-known optical mouse microswitches are Omron D2F Series, Kailh GM 8.0, Huano Blue Shell Pink Dot (BSPD), TTC Gold Pink Dot.

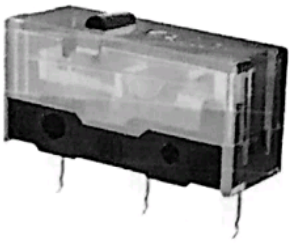


Fig: Kailh GM 8.0 BLACK MAMBA Micro Switch.

Scroll Wheel Mechanism: Inside the scroll wheel, there is a mechanism consisting of sensors and gears to detect rotation and translate it into vertical movement on the screen. A scroll wheel encoder is a small electronic device that translates the physical rotation of the scroll wheel into digital signals. However, some popular gaming mice use TTC gold-plated encoder switches within the scroll wheel mechanism. These gold-plated switches are not the actual encoder itself, but rather high-quality electrical contacts within the encoder that improve signal reliability and reduce wear and tear.

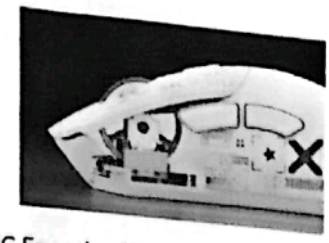


Fig: TTC Encoder (Scroll Wheel Mechanism).

Printed Circuit Board (PCB): The PCB serves as the central hub for all electronic components of the mouse. It houses the microcontroller, sensor, switches, and other circuitry necessary for the mouse's operation.

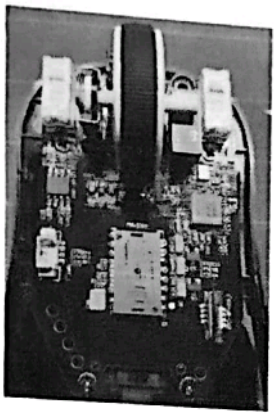


Fig: Printed Circuit Board.

Microcontroller: The microcontroller is the brain of the mouse, responsible for processing input signals from the sensor and buttons and sending corresponding commands to the computer.

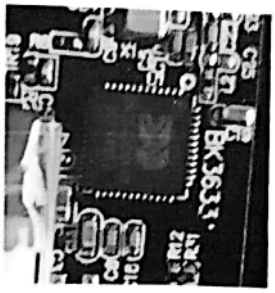


Fig: The Brain of The Mouse.

attery (for wireless mice): In the case of wireless mice, a battery powers the device. This battery is may may not removable. If it is non-removable then it is rechargeable and is often integrated into the PCB housed in a compartment within the mouse body.

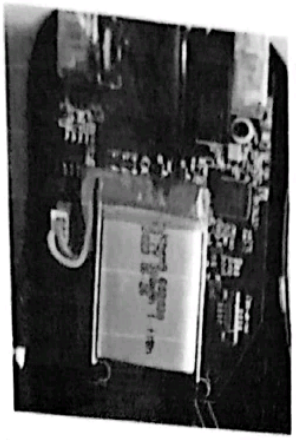


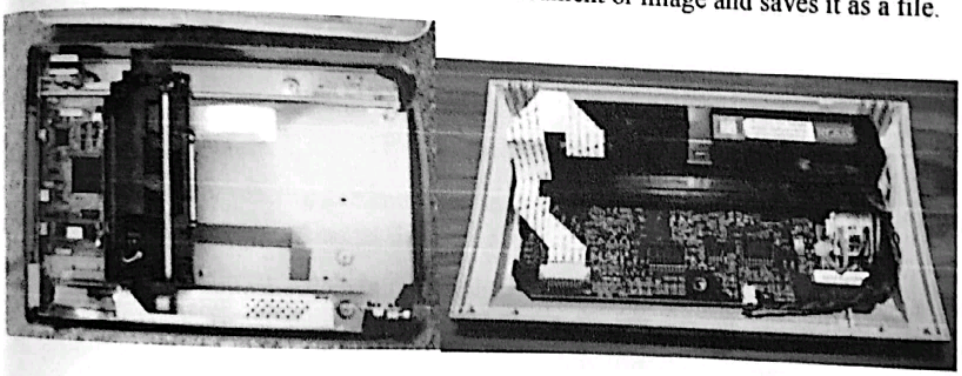
Fig: Integrated rechargeable battery.

Conclusion

This observation provides a basic understanding of the external design and internal components that work together to enable a computer mouse to function. The external features facilitate user interaction, while the internal components translate physical movements and clicks into digital signals understood by the computer.

Identifying of internal and external structure of a computer scanner

A scanner is a device that allows you to digitize physical documents, images, or even objects, and convert them into a digital format that can be viewed, edited, and stored on a computer. It's like a digital photocopier that captures the content of a document or image and saves it as a file.



Pic: Inside of a computer scanner.

A scanner has several components, including:

Optical reading device: A charge coupled device (CCD) or CIS is a common type of optical reading device. A CCD uses light to generate an electrical charge that is sent to the computer as digital data. Darker areas of the page, like text, reflect less light than blank areas.

Analog-to-digital (A/D) converter: Another core component of a scanner.

Most scanners have nonvolatile storage (NVRAM) and volatile memory (SDRAM). NVRAM stores program data, scanner settings, and calibration data. SDRAM stores data from scanned documents.

Here are some types of scanners:

Flatbed scanners:

Pic: Flatbed scanner.

Have a flat glass bed for placing documents or images. A flatbed scanner is a computer-controlled device that scans images placed on its flat plate and stores them digitally.

Flatbed scanners are optical scanners that can scan various types of documents, such as photos, books, magazines, film, and negatives. They can also be used for fragile documents such as older photographs or any document which has degraded slightly over time.

Flatbed scanners create an image slightly differently to a camera. The imaging head of the scanner gradually builds up an image by scanning backwards and forwards below a glass plate.

There are two main types of flatbed scanners: CCD and CIS. CCD, or charge-coupled device, scanners contain an array of sensors that create an electrical charge when light touches them. The charge is then converted into a digital value, creating a finished image.

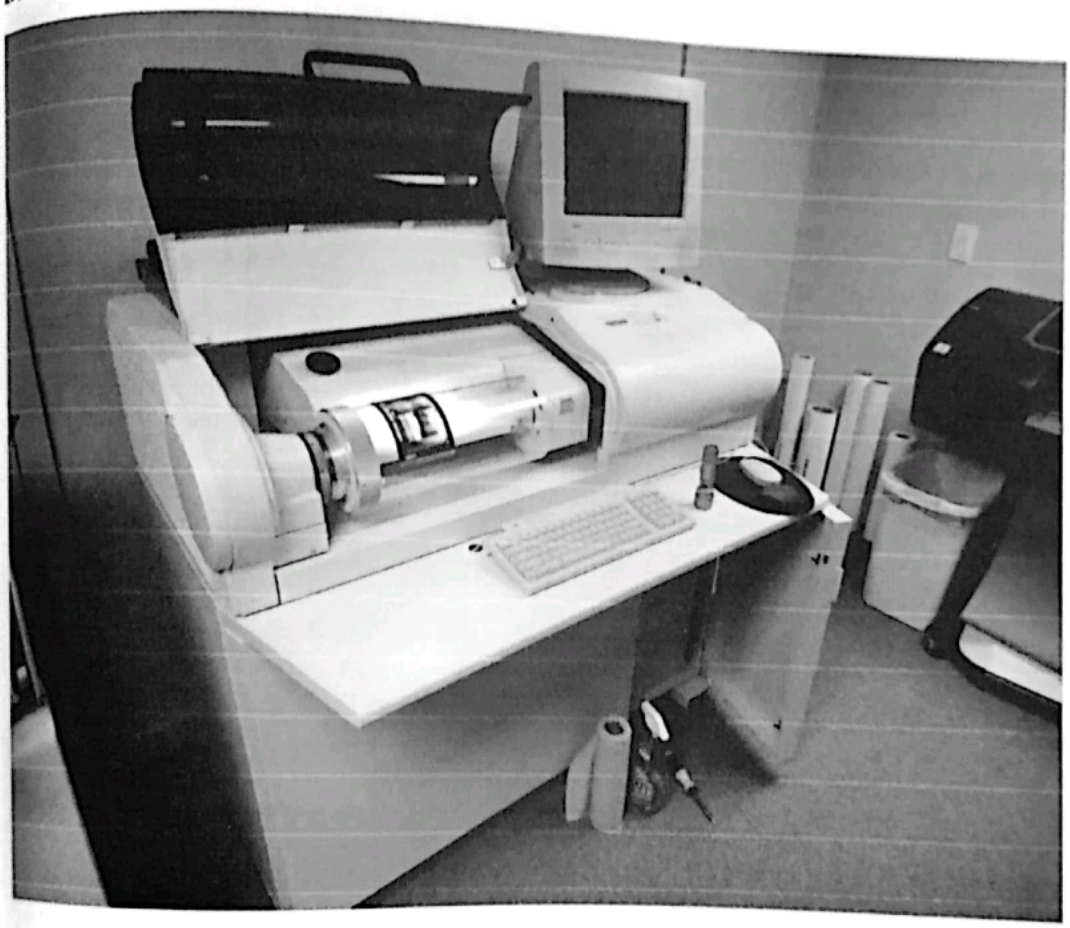
Sheet-fed scanners:

Pic: A sheet-fed scanner.

Designed to handle multiple documents in a stack. They resemble inkjet printers, drawing pages from a feeder and passing them across image sensors to an output tray.

Sheet-fed scanners are similar to flatbed scanners except the document is moved and the scan head is immobile. A sheet-fed scanner looks a lot like a small portable printer. Handheld scanners use the same basic technology as a flatbed scanner, but rely on the user to move them instead of a motorized belt.

Drum scanners:



Pic: A drum Scanner.

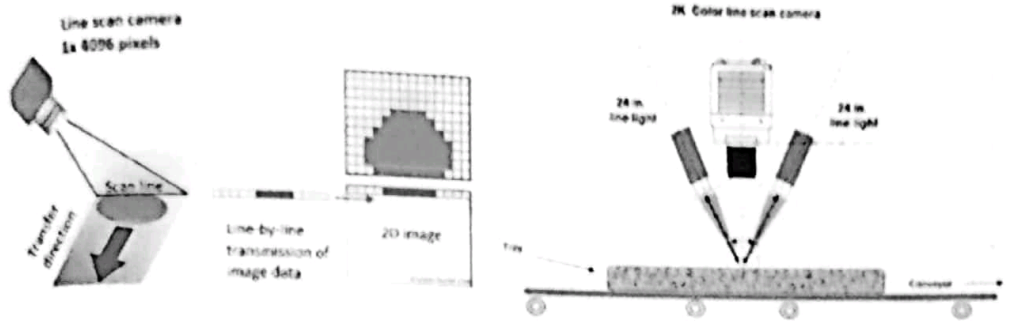
Similar to flatbed scanners, but instead of a glass platen, they have a rotating drum coated with a reflective material. The document is placed inside the drum and moved past the scanning head.

A drum scanner is a document scanner that captures high-resolution images. It works by spinning a clear cylinder at high speeds, while a light source focuses on one pixel and moves down the drum. The light is split, passed through red, green, and blue filters, and picked up by a photomultiplier tube. The scanner then captures the image with analog light and converts it to a digital file.

Here's how a drum scanner works:

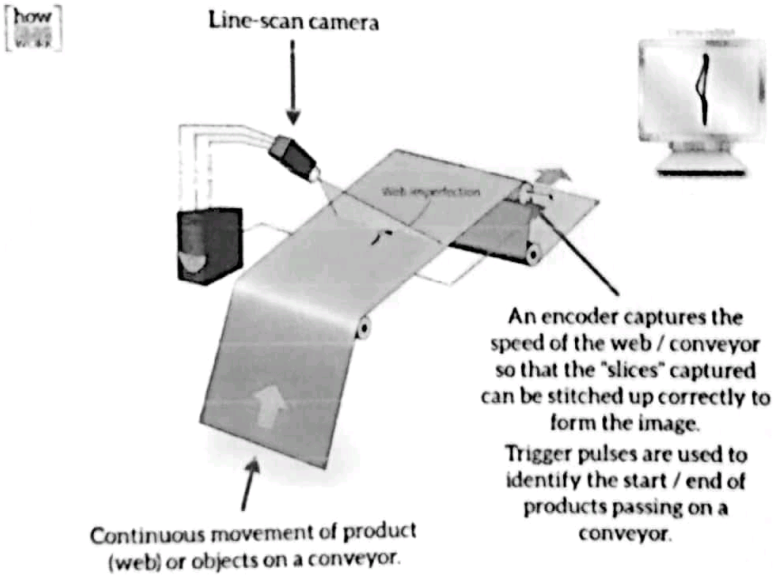
- Attach a film or print image to the outside of the cylinder
- Power up the drum to spin at high speed
- A light source inside the cylinder outputs a focused spot of light that passes through the glass cylinder and traverses the film
- The light is split, passed through red, green, and blue filters, and picked up by a photomultiplier tube
- The scanner captures the image with analog light, producing the most detail possible in each color channel
- The scanner converts the image to a digital file
- Drum scanners are often used for commercial graphics production and to turn photos into posters and wall-sized images. They are used where the highest resolution is required, as in scanning high-quality photographs for print reproduction.

Line Scanner:



Pic: Line scanning technique.

Line scan cameras use a single line of sensor pixels to create a two-dimensional image. The second dimension comes from the motion of the object being imaged.



Pic: Line scanning technique.

Hard Disk Drive

The history of hard disk drives (HDDs) traces back to the mid-20th century, with the first patent for a magnetic storage device filed by IBM in 1954. However, it was not until 1956 that IBM introduced the IBM 305 RAMAC, the world's first commercially available HDD. This pioneering device utilized a stack of 50 platters, each 24 inches in diameter, and had a total capacity of just 5 megabytes. Over the decades, HDD technology evolved rapidly, with improvements in storage density, speed, and reliability. Innovations such as the introduction of thin-film heads, which replaced earlier bulky magnetic heads, and the transition to smaller form factors, like the 3.5-inch and 2.5-inch drives, contributed to the widespread adoption of HDDs in various computing applications. Despite the emergence of solid-state drives (SSDs) in the 21st century, HDDs continue to be a crucial component in the storage industry, offering cost-effective solutions for storing vast amounts of data in personal computers, servers, and data centers.

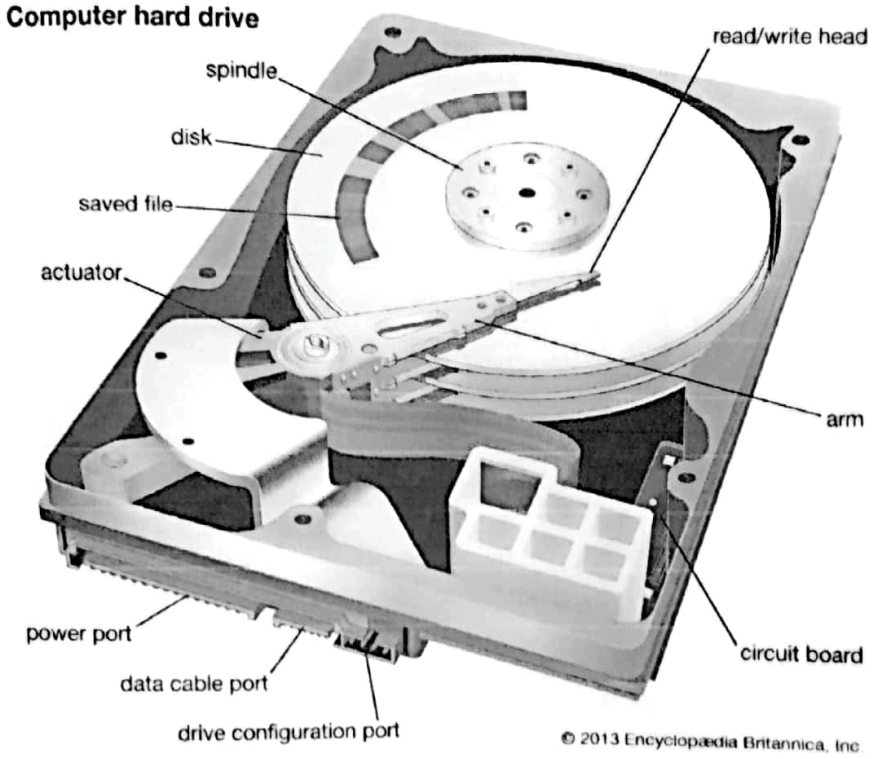
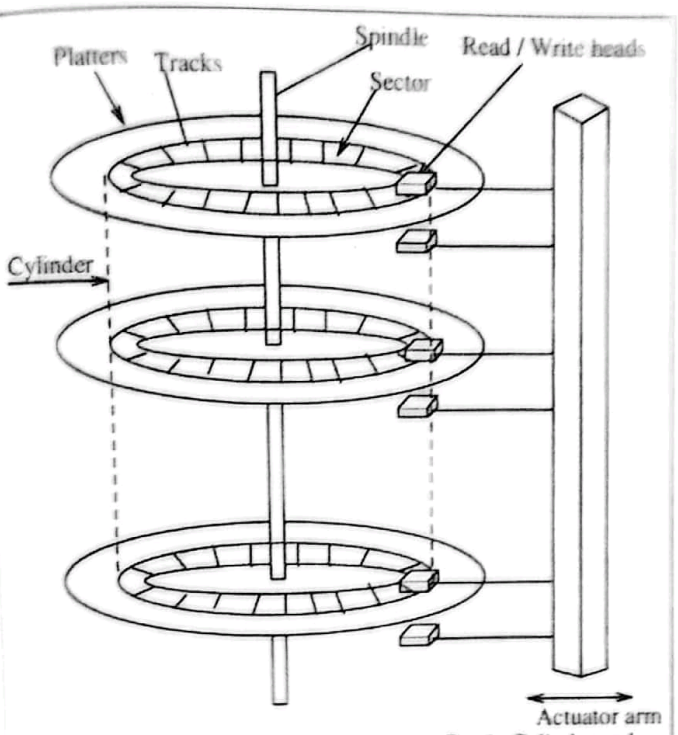


Figure 1: Computer Hard Disk Drive

Disk structure

The data on a hard disk are stored on at platters coated with a magnetic recording material. The platters are mounted on a spindle as shown in Figure 2. While the disk spins rapidly, read/write heads on an actuator arm move in tandem, toward the disk's center and back, reading and writing data.



Disk Structure--Platter, Spindle, Sector, Track, Cylinder and Read/Write heads.

Figure 1: Internal structure of a disk

The top and bottom surfaces of most platters (bottom only for top platter top only for the bottom platter) are divided into circular tracks. There may be several thousand tracks on a single platter. Tracks are divided into sectors. The number of sectors on a track can vary, depending on the properties of a platter, but is likely to be in the area of 35 or 40. All the platters making up a given disk will have the same number of tracks and sectors, but di different disks may vary in both of these respects.

The tracks on each platter are numbered, starting with the outermost track as number zero and moving inward. All the tracks of a given number, across all platters, make up a cylinder. For example cylinder number five is made up of track number five on all the platters belonging to the disk.

A sector can be uniquely addressed by the combination of surface, track and its sector number. The time taken by the read/write heads to move to a specified track from its present position is knowns as seek time. The time taken for a specified sector to rotate and position itself just below the head is known as latency time.

Internal parts/components of HDD

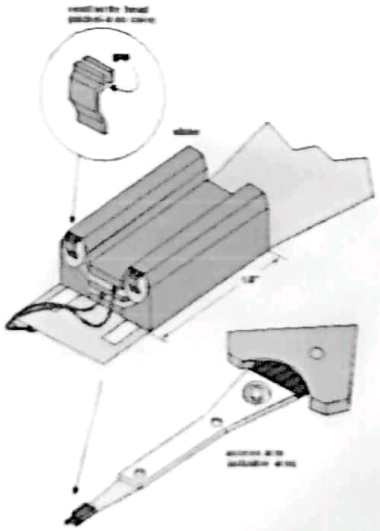
A hard drive (HDD) is a fundamental component of a computer's storage system, and it consists of several key parts that work together to store and retrieve data. Here are the main components of a typical hard drive and an overview of how it functions to store data on a computer:

1. Platters:

- The platters are typically made of glass or aluminum and coated with a magnetic material.
- Data is stored in binary format on the platters using magnetic fields. Each platter has a circular recording surface divided into tracks and sectors.
- The platters spin at a constant speed, typically between 5400 and 7200 revolutions per minute (RPM), allowing for data access.

2. Read/Write Heads:

- Each platter has its own read/write head, which is a small electromagnet mounted on an actuator arm.
- The read/write heads move above the platters to read and write data.
- They are responsible for reading data from the platters and writing new data onto them.

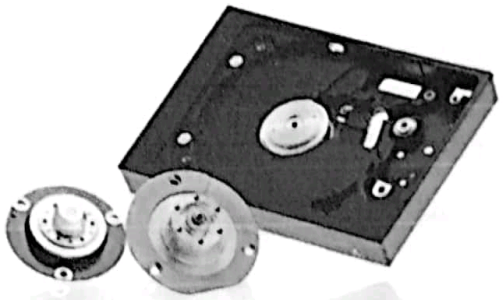


3. Actuator Arm:

- The actuator arm is responsible for positioning the read/write heads over the correct track on the platters.
- It moves the heads rapidly to access different areas of the platters, allowing the drive to read or write data at specific locations.

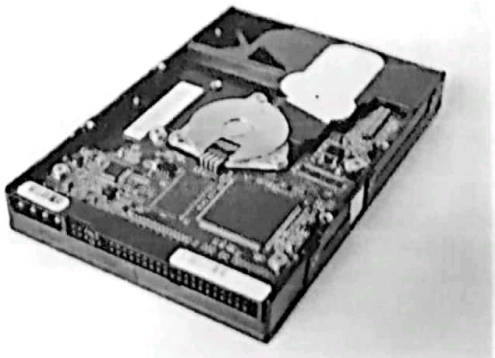
4. Spindle Motor:

- The spindle motor is responsible for spinning the platters at a constant speed.
- Hard drives typically rotate at speeds of 5,400 RPM (Revolutions Per Minute) or 7,200 RPM, although faster speeds are available in some enterprise drives.
- The spinning platters create the necessary momentum for the read/write heads to access data quickly.



5. Controller Board (PCB):

- The controller board, also known as the logic board or PCB (Printed Circuit Board), is responsible for controlling the drive's operations.
- It manages data access, interfaces with the computer's motherboard through a connector (e.g., SATA or IDE), and contains firmware that controls the drive's functions.



6. Cache (Buffer):

- The cache, also known as the buffer, is a small amount of high-speed volatile memory (RAM) located on the PCB.
- It temporarily stores frequently accessed data to improve read and write performance.
- cache helps reduce latency by prefetching and buffering data before it is transferred to or from the platters.

7. Connectors:

- HDDs typically have connectors for both data transfer and power supply.
- SATA (Serial ATA) connectors are common for data transfer, providing a high-speed interface between the drive and the computer.
- Power connectors supply electricity to the drive, typically using standardized connectors such as SATA power connectors.

8. Firmware:

- Firmware is software embedded in the controller board that controls the operation of the HDD.
- It manages data storage, retrieval, and error correction.
- Firmware updates can enhance drive performance, add new features, or address security vulnerabilities.

9. Spindle:

- The spindle is the central shaft on which the platters are mounted.
- It provides support and stability to the platters, ensuring they rotate smoothly and accurately.
- Spindle design is critical for maintaining proper alignment and balance to minimize vibration and noise.

10. Casing/Enclosure:

- The casing or enclosure houses all the internal components of the hard drive, providing physical protection.
- It shields the delicate components from dust, moisture, and physical damage.
- Casing design may include shock-absorbing materials to protect the drive from impacts and vibrations.

In summary, a hard drive stores data by magnetizing regions on spinning platters and retrieves data by reading the magnetic patterns with read/write heads. The controller board and actuator arm work together to manage and access data efficiently.

CD Drive

❖ Introduction:

A CD drive, also known as a CD-ROM drive (Compact Disc Read-Only Memory), is a hardware device used to read data from compact discs (CDs). CDs are optical storage media that can store various types of data, including music, software, videos, and other digital content.

The CD drive contains several components, including a spindle motor, laser assembly, controller board, buffer memory, and interface connectors. When a CD is inserted into the drive, the spindle motor spins the disc at a constant speed, while the laser assembly emits a laser beam onto the surface of the CD. The laser reads data from the CD, which is then processed by the controller board and transferred to the computer via the interface connection.

CD drives are commonly found in computers, laptops, and standalone devices such as CD players and stereo systems. They have been widely used for decades as a means of distributing and accessing digital content. While CD drives were once the primary method of installing software and playing audio CDs, they have become less common in recent years with the rise of digital downloads and streaming services. However, they are still used in many situations where CDs are the preferred or only available medium for accessing data.

❖ Components of the CD Drive

The CD drive consists of different parts that enable it to read data from the disc. The Computer CD drive is a precision device because the timing of sending the laser beam and collecting the laser beam reflected from the CD must be precise. A misalignment in the structure or working of any part of the CD drive will result in an error in reading the data from the CD.

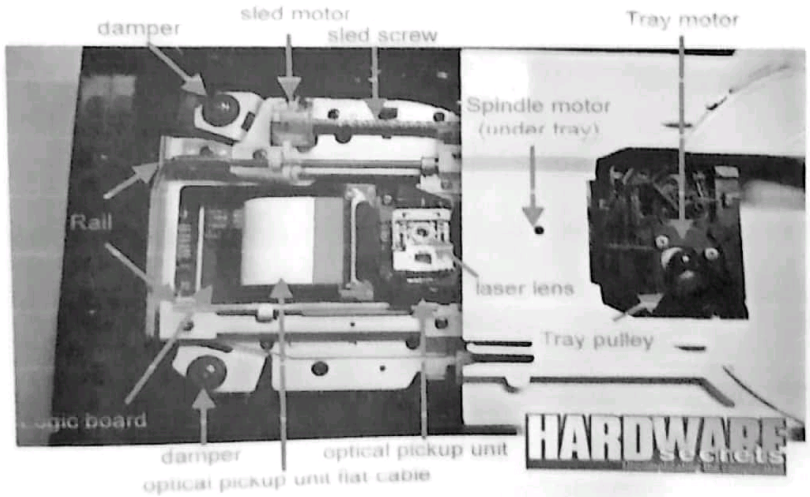


Figure01: Components of the CD Drive

Here are the main parts and components typically found in a CD drive

1. **Tray or Slot:** This is where you insert the CD into the drive. It may either be a tray that slides out or a slot where you directly insert the CD.

2. **Spindle Motor:** The spindle motor is responsible for spinning the CD at a constant speed while it's being read. The spindle motor catches the CD when it is inserted in the CD drive and spins it. The circumference of the CD at its center is less than the circumference CD at the outer edge. This means that more data is stored on the CD near the outer side than the inner side. The optical head covers more distance at the outer track of the CD-ROM disc, to enable the CD-ROM drive to read data from the CD-ROM disc at a constant speed. The spindle motor reduces the spinning speed as the head actuator moves from the center outward.

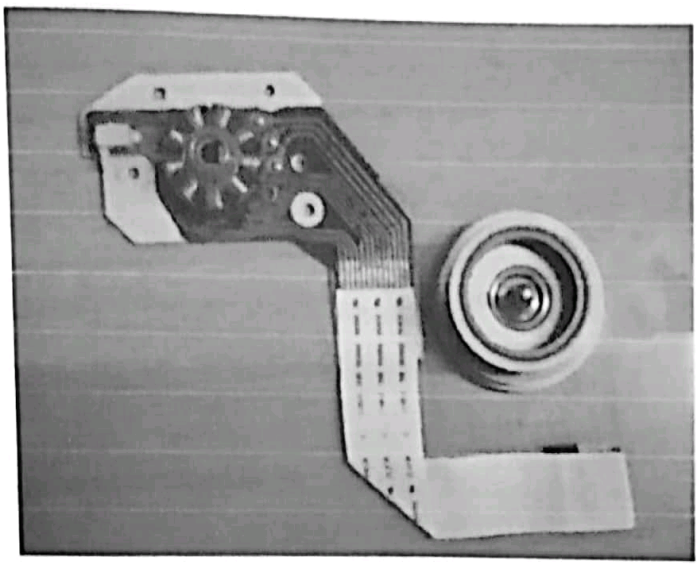
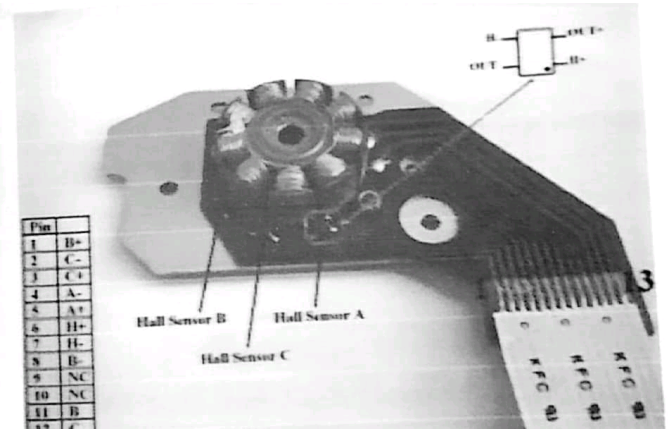


Figure 02.

This topic shows an easy way for controlling cd-rom drive (or dvd-rom) spindle motor using PIC18F4550 microcontroller.

There are different spindle motor types used in the cd-rom drives and the one used here is sensored brushless DC motor (BLDC motor), so be careful with your BLDC motor type and if it has less than 11 pins that means your motor is not concerned.

This motor is three phase motor, it has three stator phases that are excited two at a time to create arotating electric field. This method is fairly easy to implement, but to prevent the permanent magnet rotor from getting locked with the stator, the excitation on the stator must be sequenced in a specific manner while knowing the exact position of the rotor magnets.


B-
OUT
OUT+
B+
Hall Sensor B
Hall Sensor A
Hall Sensor C
Pin
1 B+
2 C-
3 C+
4 A-
5 A+
6 H+
7 H-
8 B-
9 NC
10 NC
11 B

required motor drive voltages for phases A, B and C.

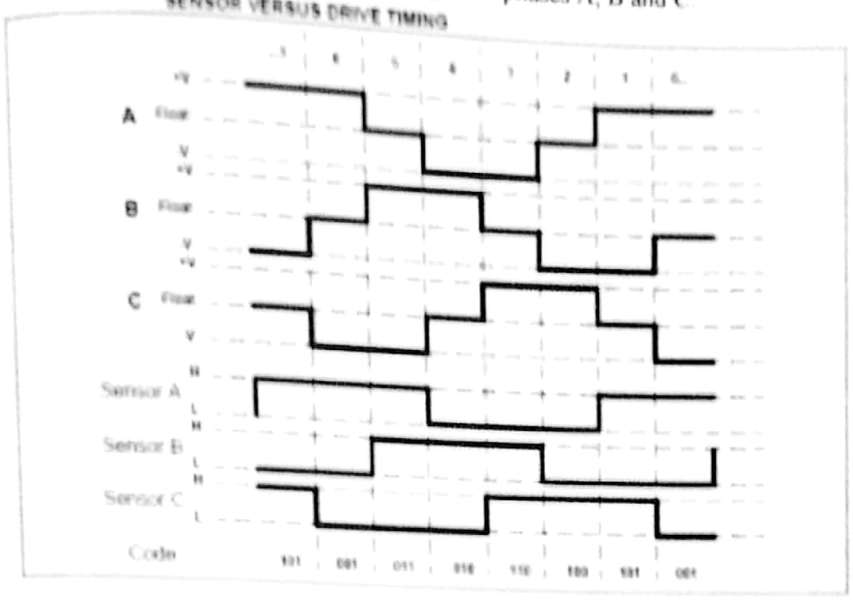


Figure 05:

A three phase bridge is used to energize the BLDC motor windings.

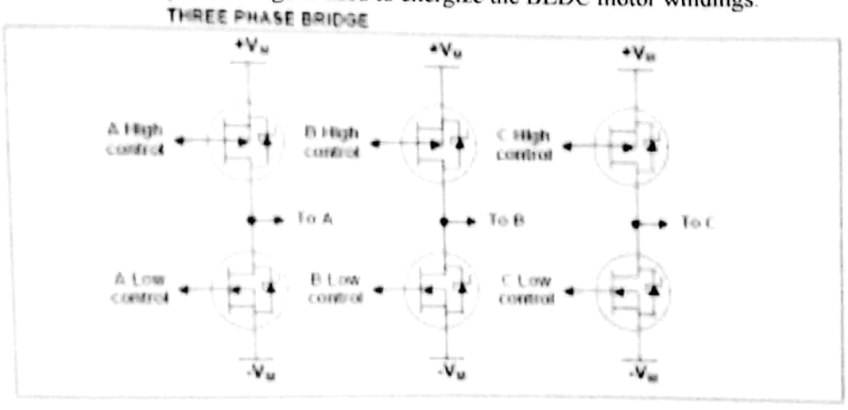


Figure 06:

3. Laser Assembly: This assembly contains a laser diode and optical components that emit a laser beam to read data from the surface of the CD. It includes:

- **Laser Diode:** Emits the laser beam that reads data pits on the CD.
- **Lens:** Focuses the laser beam onto the surface of the CD.
- **Tracking Mechanism:** Moves the laser assembly radially across the surface of the CD to access different tracks.

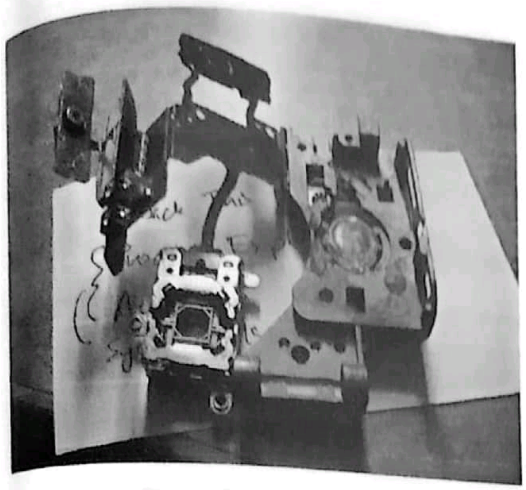


Figure 07:

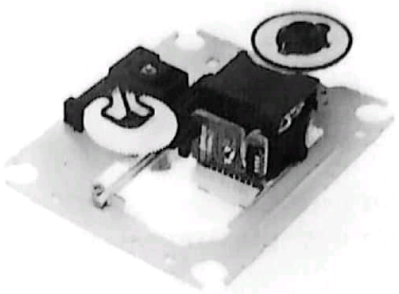


Figure 08:

Controller Board: This is the circuit board that controls the operation of the CD drive. It manages data ansfer between the drive and the computer, as well as motor control and laser positioning.

Drive Interface: The interface through which the CD drive connects to the computer's motherboard or ther components. Common interfaces include IDE (Integrated Drive Electronics), SATA (Serial ATA), SCSI (Small Computer System Interface).

Buffer: A small amount of memory used to temporarily store data as it is transferred between the CD ive and the computer. This helps to smooth out data flow and prevent interruptions during playback or opying.

Power Connector: This connector supplies power to the CD drive from the computer's power supply nit.

Eject Button: A button or software command that activates the mechanism to open the tray or eject the D from the drive.

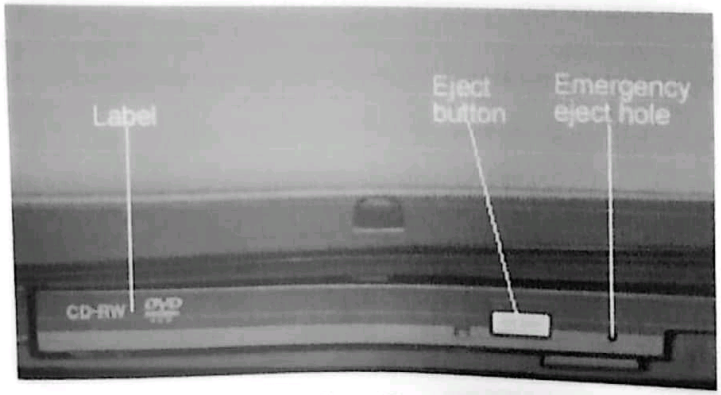


Figure 09:

LED Indicator: An LED light that indicates when the drive is in use or if there is an error.

These are the main components of a typical CD drive, although the exact design and configuration may vary depending on the manufacturer and specific model

❖ Advantages of CD-ROMs

There are several advantages to using CD-ROMs for software distribution. These include:

Large storage capacity. CD-ROMs can hold large amounts of data, making them ideal for storing and distributing software. A standard CD-ROM can hold up to 700 megabyte (MB) of data, while a dual-layer disc can hold up to 8.5 gigabyte (GB) of data.

Durability. CD-ROMs are relatively durable compared to other storage media. They can withstand scratches and minor physical damage without losing their data.

Widely compatible. CD-ROMs can be read by most computers and CD drives, making them a widely compatible software distribution method.

Offline access. CD-ROMs allow users to access software offline, which is important for businesses that might not have a reliable internet connection.

❖ Disadvantages of CD-ROMs

There are also some disadvantages to using CD-ROMs. These include:

Limited storage capacity. While CD-ROMs have a large storage capacity compared to floppy disks, they are still limited compared to other storage options like USB drives and hard drives.

Fragility. While CD-ROMs are relatively durable, they can still be easily damaged by scratches or physical trauma.

Slow data transfer. CD-ROMs have a slower data transfer rate compared to other storage options, which can make installation and use of software more time-consuming.

Limited updating capability. Once a CD-ROM has been distributed, it cannot be updated. If a software bug is discovered or a new feature is added, a new version of the software must be created and distributed on a new CD-ROM.