

SECTION 9

MONITORS

Introduction

What is a Monitor?

Monitors are electronic devices that display visual output from a computer, gaming console, or other devices. They come in various sizes, resolutions, and features depending on the intended use, such as general computing, gaming, or professional design work.

Types of Monitors

CRT (Cathode Ray Tube)

In CRT **screens**, electron guns send electron beams to the phosphor-coated screen to create the image. CRTs were large, heavy, and **energy-inefficient**.

CRT is an older technology, which is largely **obsolete** today. They were **widely used** until the early 2000s, have now been replaced by modern technologies such as LCD, LED, OLED, and QLED.

Plasma

Plasma screens generate light by electrically exciting gas cells. They are heavy and thick. Additionally, they have high energy **consumption**. Another disadvantage is that they have a short lifespan and experience a loss of brightness over time.

Plasma screens, which were quite popular in the early 2000s, are no longer used due to the disadvantages mentioned above.

LCD (Liquid Crystal Display)

LCD screens are the most common type today, using liquid crystals sandwiched between two layers of glass or plastic. They are **energy-efficient** and slim.

In LCD screens, white light is **emitted** from the back and passes through several layers, where it is transformed into colored light.

Fluorescent lamps are used as **backlighting** in LCD screens. Since fluorescent lamps contain **mercury**, they are harmful to the environment. Additionally, they have low energy efficiency and a short lifespan. Another **drawback** is that they cause **flickering**, which strains the eyes.

LED (Light Emitting Diode)

An LED screen is a type of LCD screen that uses LEDs for backlighting, offering better contrast, color **accuracy**, and energy efficiency compared to traditional LCDs.

OLED (Organic Light Emitting Diode)

The most important **feature** of OLED screens is that each pixel has its own individual backlight LED. Each pixel generates its own light, eliminating the need for a backlight. The **absence** of a backlight allows OLED screens to have a slimmer design.

In LCD screens, **achieving** true black is difficult because the liquid crystal layer cannot completely block the light, so it cannot fully prevent the light from the backlight. To obtain true black on a pixel, the LEDs in that pixel can simply be turned off.

Technical Specifications of Monitors

Screen Size

The size of screens is determined by measuring **diagonally** from corner to corner and is usually expressed in inches (e.g. 22”).

Aspect Ratio

The **aspect ratio** refers to the ratio of a screen's width to its height, typically expressed in a width:height format, such as 4:3 (standard screen), 16:9 (widescreen), or 21:9 (ultra-wide screen).

Dot Pitch (Pixel Pitch)

The distance between the centers of **adjacent** pixels is called the **dot pitch**. As this distance decreases, the unlit areas between the pixels become smaller. Therefore, the image quality improves.

Pixel Density (PPI: Pixels Per Inch)

Pixel density refers to the number of pixels in a one square inch area of the screen (1 inch x 1 inch). A higher pixel density means there are more pixels per inch, resulting in a **sharper** image.

Refresh Rate

The **refresh rate** refers to how many times per second a screen **updates** its display, measured in Hertz (Hz). A higher refresh rate results in smoother and more fluid visuals.

A low refresh rate (like 60 Hz) can cause eye strain, especially if you look at the screen for a long time.

Response Time

Response time measures how quickly pixels change from one color to another, usually in milliseconds (ms). A lower response time means the screen reacts faster, displaying smoother visuals.

In applications where images change quickly, such as games, screens with a low response time (e.g., 1 ms) are preferred. For everyday tasks like **web browsing**, watching

movies, office work, and software development, a 4 ms response time is generally sufficient.

Contrast Ratio

Contrast ratio measures the difference in brightness between the brightest (white) and darkest (black) pixels on a screen. It indicates how well the screen can show color differences and details in an image.

The contrast ratio is typically presented in the format x:1. For instance, a 1000:1 contrast ratio means the brightest white is 1000 times brighter than the darkest black.

Resolution

Resolution indicates the number of pixels on a screen, measured horizontally and vertically. It is typically expressed as the number of horizontal pixels by vertical pixels (e.g. 1920 x 1080).

A higher resolution means the screen has more pixels, resulting in clearer and more detailed images.