Video Controller/Video Cards

The quality of the images that a monitor can display is defined by the video card (also called the video controller or the video adapter) and the monitor. The video controller is an intermediary device between the CPU and the monitor. It contains the **video-dedicated memory** and other circuitry necessary to send information to the monitor for display on the screen.

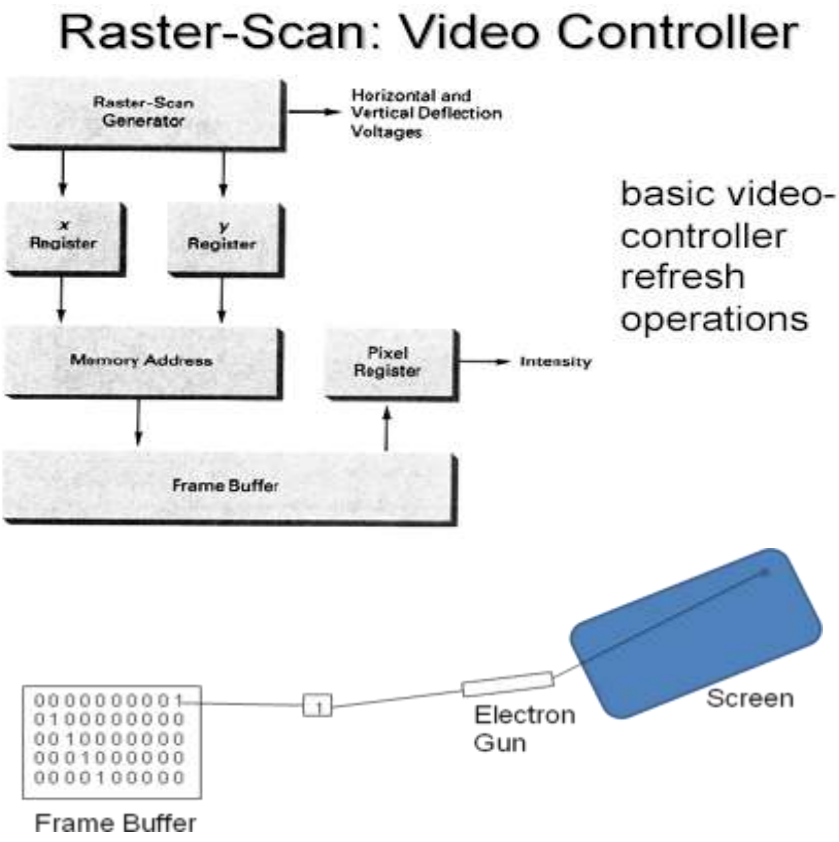
In most computers, the video card is a separate device that is plugged into the motherboard. In many newer computers, the video circuitry is built directly into the motherboard, eliminating the need for a separate card.

The screen changes constantly as a user works—the screen is updated many times each second, whether anything on the screen actually changes or not.

If the user wants more colors or a higher resolution, the amount of data can be much higher For example, for "**high color**" (24 bits, or 3 bytes per pixel will render 16 million colors) at a resolution of 1024 x 768, the computer must send 2,359,296 bytes to the monitor for each screen.

Today's video controllers feature their own built-in microprocessors , which frees the CPU from the burden of making the millions of calculations required for displaying graphics. The speed of the video controller's chip determines the speed at which the monitor can be refreshed.

Video controllers also feature their own built-in video RAM, or VRAM (which is separate from the RAM that is connected to the CPU). VRAM is dual-ported, meaning that it can send a screen full of data to the monitor and at the same time receive the next screen full of data from the CPU.



This diagram represents the structure of a Raster-Scan Display System and how pixel data is processed from memory to the screen. Below is an explanation of each block:

Raster-Scan Generator

Generates horizontal and vertical deflection voltages to control the electron beam movement in a raster-scan display.
It ensures that the beam moves from left to right and top to bottom to cover the entire screen in a repetitive manner.

X Register & Y Register:
These registers hold the current pixel coordinates (X, Y) that the raster-scan generator is accessing.
The X register stores the horizontal position, while the Y register stores the vertical position.

Memory Address
Combines the values from the X and Y registers to form a memory address.
This address is used to fetch the pixel data from the frame buffer.

Frame Buffer
A section of memory that holds pixel intensity (color) values for each position on the screen.
It continuously updates the pixel values that will be displayed.

Pixel Register
Fetches pixel intensity data from the frame buffer for the current raster position.
Sends the intensity value to control the brightness or color of the corresponding pixel on the display.

Intensity Output
The pixel intensity value determines how bright or colorful each pixel should be when displayed on the screen.
This entire system works in synchronization to convert stored image data into visible graphics on a raster-scan display.