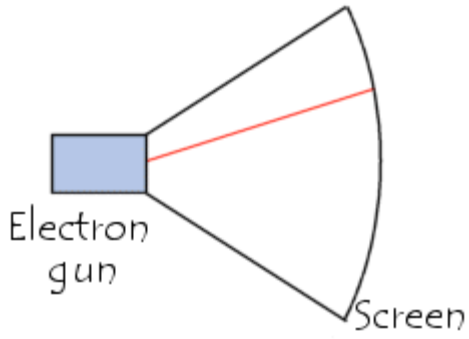
Cathode Ray Tube monitor (CRT)

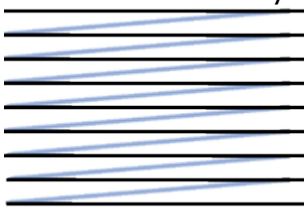
Cathode ray tube monitor

Most monitors (computer screens) use **cathode ray tubes** (or **CRT** for short), which are glass vacuum tubes into which an electron gun emits a flow of electrons guided by an electrical field towards a screen covered in small phosphorescent elements.



The electron gun is made up of a **cathode**, a negatively charged metallic electrode, and one or more **anodes** (positively charged electrodes). The cathode emits the electrons attracted by the anode. The anode acts as an accelerator and concentrator for the electrons, forming a flow of electrons aimed at the screen. A magnetic field guides the electrons from left to right and from top to bottom. It is created with two electrified X and Y plates (called *deflectors*) which send the flow horizontally and vertically, respectively.

The screen is covered with a fine layer of phosphorescent elements, called phosphors, which emit light by excitation when electrons strike them, creating a lit-up dot called a **pixel**.
Activating the magnetic field causes the electrons to follow a **scan pattern**, going from left to right and then down to the next row once they reach the end.

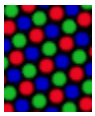


The human eye cannot see this scanning due to persistence of vision. Try waving your hand in front of your screen to view the phenomenon: You'll see several hands at once!
Combined with the firing and non-firing of the electron gun, scanning tricks your eyes into believing that only some pixels on the screen are lit up.

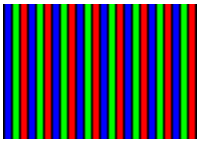
The color monitor

A black and white monitor can display different tones (shades of gray) by varying the intensity of the flow.
For color monitors, three electron beams (coming from three different cathodes) each strike a point with a specific color: red, green, and blue (RGB).
Three points of color are called a **triad** (or *dot trio*).
Blue phosphors use zinc sulfide, while green ones use zinc sulfide and cadmium sulfide. The red ones are hard to create, and are made from a mixture of yttrium and europium, or gadolinium oxide.
However, these phosphors are so close together than the eye cannot separate them enough to tell them apart; it sees a single color made up of these three colors. Try flicking a tiny drop of water onto the glass of your monitor: It will magnify the phosphors so that you can see them.
What's more, to avoid smearing (such as an electron meant to strike a green phosphor colliding with blue instead), a metallic grid called the **shadow mask** is placed in front of the phosphoric layer to guide the electron flow.
There are several different categories of CRT monitors, which are set apart by the mask used:

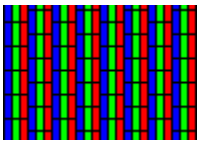
- **FST-Invar** (*Flat Square Tube*), whose phosphors are round. These monitors use a grid called a *shadow mask*. They give the right colors overall, but have the disadvantage of distorting and darkening the image at the corners.



- Mitsubishi's **Diamondtron** tubes and Sony's **Trinitron**, whose masks are made up of vertical slots (called an *aperture grille* or *tension mask*), which lets through more electrons and therefore gives a brighter image.



- Nec's **Cromaclear** tubes, whose mask is uses of a hybrid system with dimpled slots, is the best technology of the three.



Technical specifications

The specifications for CRT monitors include:

- The **definition**: The number of pixels that the screen can display. This number is generally between 640x480 (640 pixels long, 480 pixels wide) and 1600x1200, but higher resolutions are technically possible.
- The **size**: This is calculated by measuring the diagonal of the screen, and is expressed in inches (an inch is about 2.54 cm). Be careful not to confuse a screen's *definition* with its *size*. After all, a screen of a given size can display different definitions, although in general screens which are larger in size have a higher definition.
- The **dot pitch**: This represents the distance which separates two phosphors of the same color. The lower the dot pitch, the better the image quality. A dot pitch equal to or less than 0.25 mm will be comfortable to use, while monitors with a dot pitch equal to or greater than 0.28 mm should be avoided.
- The **resolution**: This determines the number of pixels per surface unit (given in linear inches). This is abbreviated **DPI**, for *Dots Per Inch*. A resolution of 300 dpi means 300 columns and 300 rows of pixels per square inch, which means that there are 90,000 pixels per square inch. By comparison, a resolution of 72 dpi means that one pixel is 1"/72 (one inch divided by 72) or 0.353 mm, which corresponds to one *pica* (a typographical unit). The terms "resolution" and "definition" are often confused in the media.
- The **refresh rate**: This represents the number of images which are displayed per second, or more precisely the number of times the image is refreshed each second. Also called the **vertical scan rate**, it is expressed in Hertz. The higher this value is, the better the visual comfort (the image does not appear to flicker), so it must be

much higher than 67 Hz (any lower than that, and the image appears to "blink"). Most people do not notice the flicker effect at 70 Hz or higher, so a value equal to or greater than 75 Hz is generally suitable.

Source: http://en.kioskea.net/contents/387-cathode-ray-tube-monitor-crt