Lesson 13

Understanding Display Devices

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Video Display Unit (*VDU*)

- *(VDU) is* the primary method of getting information out of a computer
- ***Video Display Types***
- CRT displays (*cathode ray tube)*
- LCD displays (*liquid crystal display*)
- Projection Systems

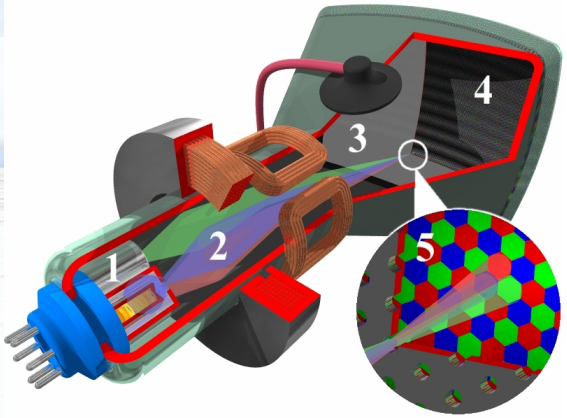
CRT displays

CRT displays

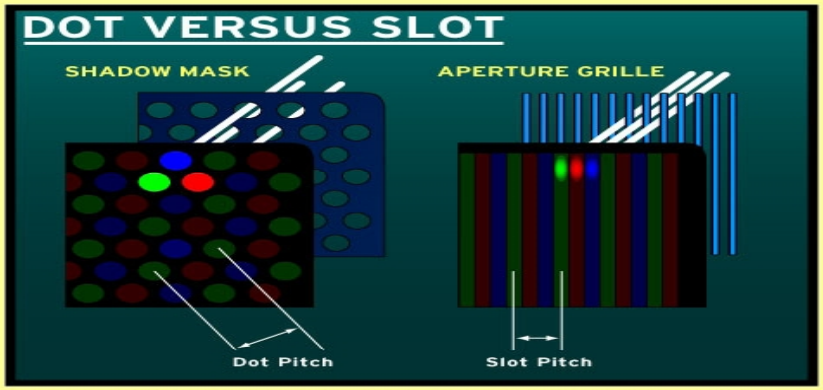
- At the very back of a monitor is an 3 electron gun. It is important to understand that the electron guns do not fire colored light; they simply fire electrons at different intensities, which then make the phosphors glow. The higher the intensity of the electron stream, the brighter the color produced by the glowing phosphor.
- When heated, the electron gun emits a stream of high-speed electrons that are attracted to the other end of the tube through a vacuum which exists in the tube of the monitor.
- At the neck of the funnel-shaped monitor is an anode, which is magnetised according to instructions from the display controller.
- As electrons pass the anode, they are shunted or pulled in one direction or the other depending on how magnetic the anode is at that time. This moves the electrons towards the correct part of the screen.
- The electrons pass through a mesh, and this mesh defines the individual pixels and resolution on the screen. Electrons that pass through the mesh then hit the phosphor coating which is on the inside of the glass screen from left to right and from top to bottom.
- When the particles hit the phosphor, they immediately light up - causing the light to shine through the front of the monitor, thus making up the picture on the screen.
- There are three differently coloured phosphours for each pixel (known as phosphor triads), and depending on which phosphor the electron hits, that's which

CRT interior

1.3 Electron guns
2. Electron beams
3. Mask for separating beams for red, green , and blue part of displayed image
4. Phosphor layer with red, green , and blue zones
5. Close-up of the phosphor-coated inner side of the screen.



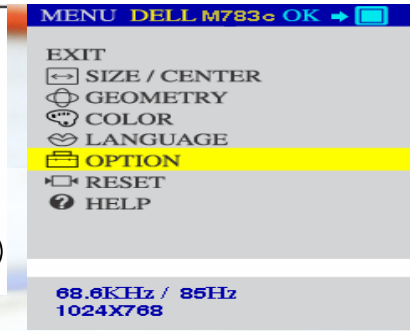
Shadow Mask

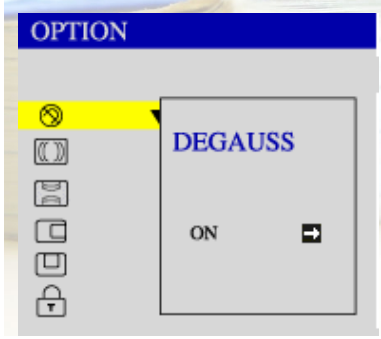


CRT monitors use one of two filtering devices to align electrons and phosphors: a shadow mask or an aperture grille. A shadow mask, a sheet of metal riddled with small holes, directs the electrons to circular phosphors lining the inside of the tube. The phosphors are grouped in threes (red, blue, and green), and each trio constitutes one pixel. An aperture grille is made of vertical wires, and the slots between these wires align the electrons. Instead of dots, aperture grille CRTs have long, vertical strips of red, blue, and green phosphors.

Degauss

- *Degaussing is the reduction of the magnetic field of an object.*
- degaussing a monitor is strictly a CRT-related practice Because CRTs use magnetic fields to guide the electron beams to their intended targets,
- internal degaussing coils are activated manually by a button on the monitor or through the monitor's internal menu system, the same noise can be heard. Additionally, because the monitor is already powered up and displaying an image, you will notice the image shaking at the same time.
- Do not use the Degauss feature more than once within a 30-minute period.

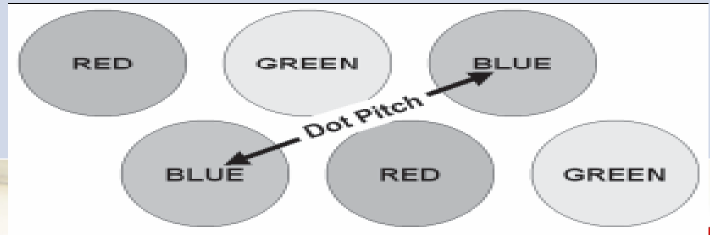




There are 3 ways to measure a CRT monitor's 1-image quality

1- Dot pitch

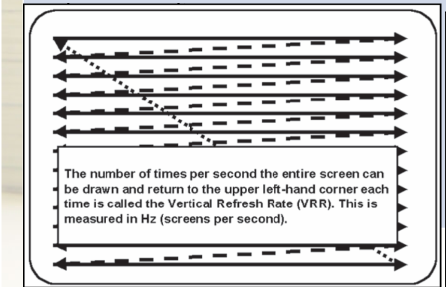
•Dot pitch is a physical characteristic of the monitor hardware,
•the distance (in millimeters) between <u>two pixels</u> of the <u>same color</u> on a monitor.
•The *dot pitch defines* the diagonal distance between phosphorous dots of the same color, and is measured in *<u>millimeters (mm)</u> or* <u>dots per inch</u>,
•The dot pitch can range from as high <u>as 0.39 mm</u> to as low as <u>0.18 mm</u>.
•lower dot pitch means more dots on the screen, it usually produces a <u>sharper</u>, more defined image

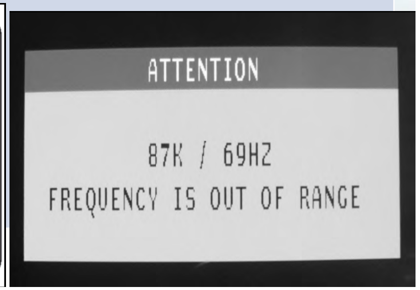


2- refresh rate
Vertical refresh rate

A monitor's *refresh rate refers to how* often the electron gun can redraw the entire screen — the faster it can redraw the screen, the smoother any moving objects appear.
refresh rate is configurable through software
•If your CRT monitor has a refresh rate of 72 Hertz (Hz), then it cycles through all the pixels from top to bottom 72 times a second
•increasing the refresh rate decreases flickering, thereby reducing eye strain.
•refresh rate you select must be supported by both your graphics adapter

An internal monitor error for an unsupported refresh rate





3-Resolution

Resolution is configurable through software.
Resolution is defined by how many software picture elements (pixels) are used to draw the screen.
Monitor *resolution is always shown as the number of horizontal pixels times the number* of vertical pixels.
A resolution of 640 × 480, therefore, indicates a horizontal resolution of 640 pixels and a vertical resolution of 480 pixels.
If you multiply the values together, you can see how many pixels are on each screen:
An <u>advantage</u> of higher resolutions is that more information can be displayed in the same screen area.
A <u>disadvantage</u> is that the same objects and text displayed at a higher resolution appear smaller and might be harder to see.

CAUTIOCAUTION

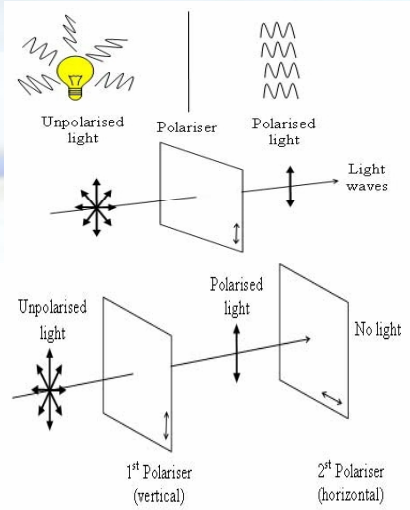
- The interior of a monitor might appear similar to the interior of a PC because of the printed circuit boards and related components, but that is where the similarity ends.
- No PC has voltages exceeding 15,000 to 30,000 V, but most monitors do. So let's get one thing perfectly clear: Opening up a monitor can kill you! Even when the power is disconnected, certain components retain a substantial voltage for an extended period of time.
- You can inadvertently short one of the components and fry yourself—to death.

LCD displays

- *Liquid crystal displays (LCDs) are the most common type of display technology for PCs.*
- LCDs used with desktop computer systems use the same technology as their laptop counterparts but potentially on a much larger scale.
- **LCD monitors have many advantages over CRTs.**
- Thinner
- Lighter
- use much less power(5 watts versus nearly 100 watts for an ordinary monitor).
- virtually flicker free
- don't emit potentially harmful radiation.

Polarizing

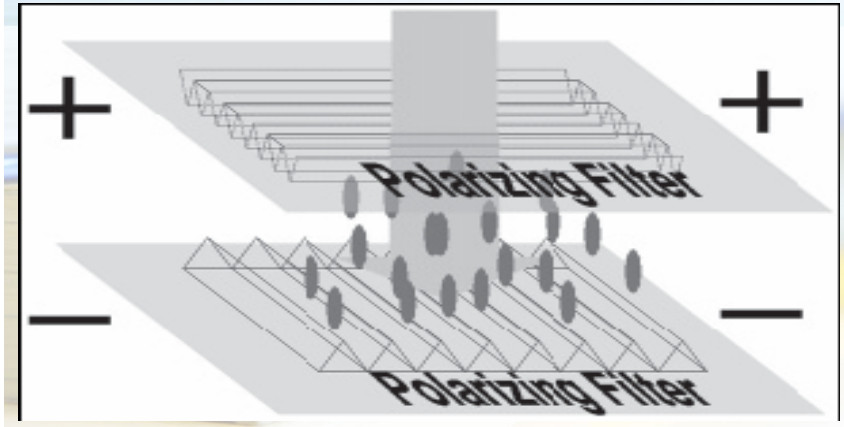
- The polarizing filter allows light waves that are aligned only with the filter to pass through.
- After passing through the polarizing filter, the remaining light waves are all aligned in the same direction.
- In an LCD, a filter creates two separate polarizing light waves.
- By aligning a second polarizing filter at a right angle to the first, all those



Liquid crystals

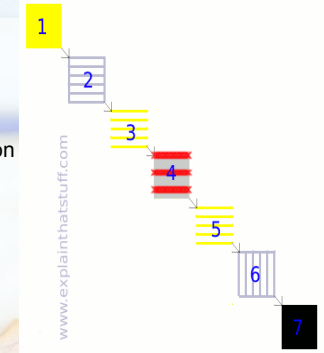
- Liquid crystals take advantage of the property of polarization.
- Liquid crystals are composed of a specially formulated liquid full of long, thin crystals that always want to orient themselves in the same direction
- This substance acts exactly like a liquid polarized filter.
- liquid crystals change their optical characteristics in response to electrical signals and
- liquid crystals can twist the light and enable it to pass

How color LCD works



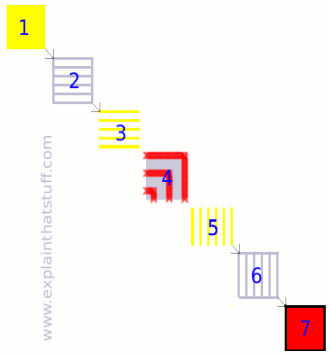
How pixels are switched off

1. Light travels from the back of the TV toward the front from a large bright light.
2. A horizontal polarizing filter in front of the light blocks out all light waves except those vibrating horizontally.
3. Only light waves vibrating horizontally can get through.
4. A transistor switches off this pixel by switching on the electricity flowing through its liquid crystal. That makes the crystal straighten out (so it's completely untwisted), and the light travels straight through it unchanged.
5. Light waves emerge from the liquid crystal still vibrating horizontally.
6. A vertical polarizing filter in front of the liquid crystal blocks out all light waves except those vibrating vertically. The horizontally vibrating light that travelled through the liquid crystal cannot get through the vertical filter.
7. No light reaches the screen at this point. In other



How pixels are switched on

1. The bright light at the back of the screen shines as before.
2. The horizontal polarizing filter in front of the light blocks out all light waves except those vibrating horizontally.
3. Only light waves vibrating horizontally can get through.
4. A transistor switches on this pixel by switching off the electricity flowing through its liquid crystal. That makes the crystal twist. The twisted crystal rotates light waves by 90° as they travel through it.
5. Light waves that entered the liquid crystal vibrating horizontally emerge from it vibrating vertically.
6. The vertical polarizing filter in front of the liquid crystal blocks out all light waves except those vibrating vertically. The vertically vibrating light that emerged from the liquid crystal can now get through the vertical filter.
7. The pixel is lit up. A red, blue, or green filter

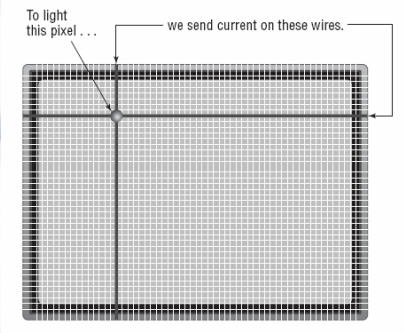


Major types of LCD displays

- passive-matrix screens
- dual scan “is a passive-matrix variant”
- active-matrix screens

Passive-matrix screens

- Within the passive-matrix screen are two rows of transistors: one at the top, another at the side.
- In simplified terms for a single pixel, when the display is instructed to change the crystalline alignment of a particular pixel, it sends a signal to the x- and y-coordinate transistors for that pixel,

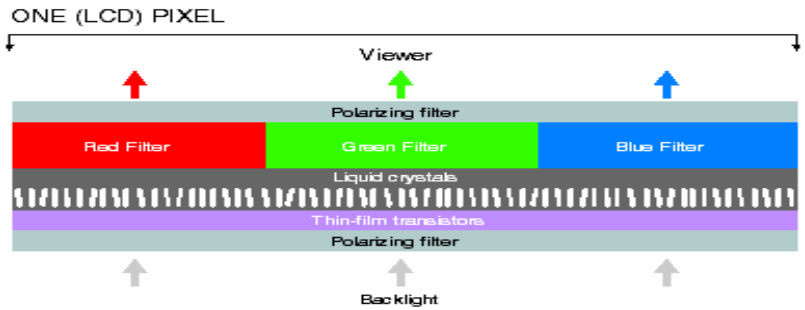


Dual scan

- Dual scan is a variation of the passive-matrix display.
- The classic passivematrix screen is split in half to implement a dual-scan display.
- Each half of the display is refreshed separately, leading to increased quality.

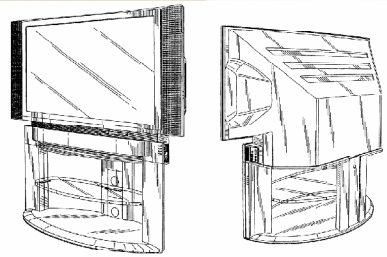
Active-matrix screens

- The screen is made up of several individual LCD pixels.
- A transistor behind each pixel, when switched on, activates two electrodes that align the crystals and alter the passage of light at that location.
- The major disadvantage of an active-matrix screen is that it requires large amounts of power to operate all the transistors.



Projection Systems

Portable *projectors*



Rear-projection Television,

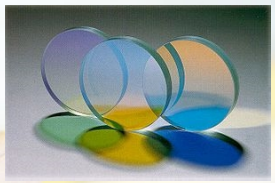
Data projectors use one of the following technologies:

- Liquid crystal display projectors
- Digital Light Processing (DLP) projectors

Liquid crystal display projectors

- use three LCD glass panels (red, blue and green).
- The panels consist of a sandwich of liquid crystals between two panes of glass.
- As light from a halogen bulb passes through and heats the panels, the molecules of each of the millions of crystals twist and untwist, opening to allow light to pass or closing to block the light, or somewhere in between, thereby producing millions of colors.

A **dichroic filter** or **thin-film filter** is a very accurate color filter used to selectively pass light of a small range of colors while reflecting other colors.



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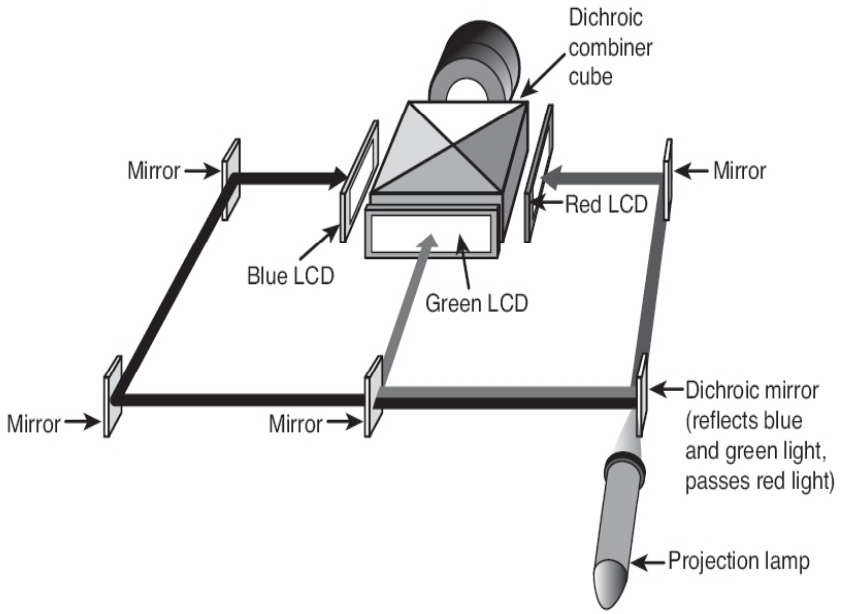
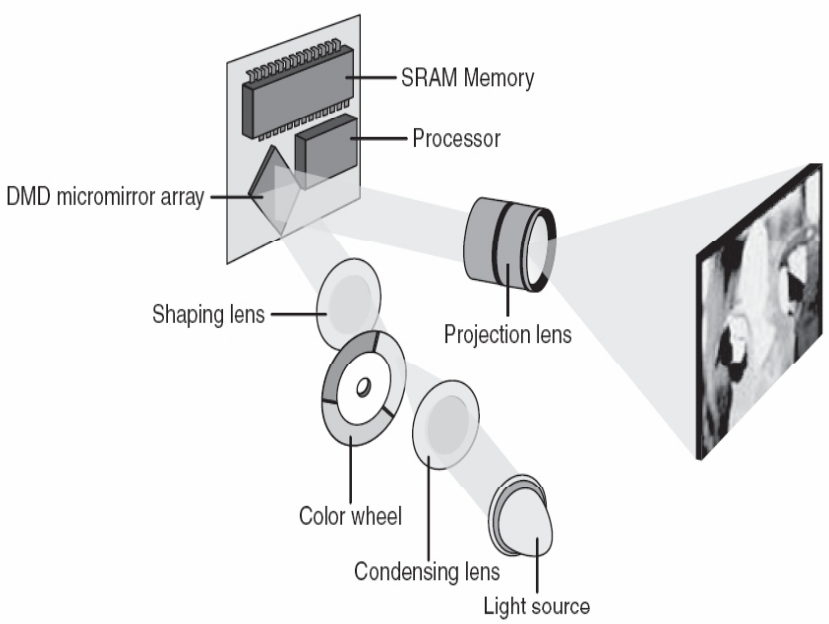


Digital Light Processing (DLP) projectors

- uses millions of microscopic mirrors arranged on a semiconductor chip, called Digital Micromirror Devices (DMD)
- use a spinning wheel with red, green, and blue sections to add color data to light being reflected from (DMD).
- Each mirror corresponds to a pixel, and the mirrors reflect light toward or away from the projector optics.
- The spinning wheel might use only 3 segments (RGB), 4segments (RGB+clear), or 6 segments (RGB+RGB).

More segments helps improve picture quality.

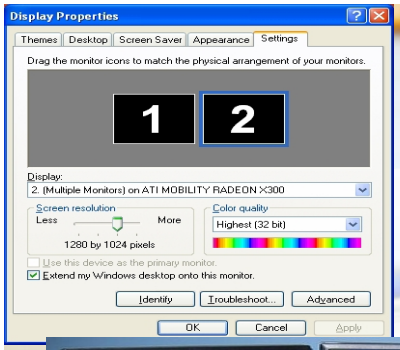


CAUTIOCAUTION

- LCD projectors use a relatively hot projection lamp, so LCD projectors include cooling fans that run both during projector operation and after the projector is turned off to cool down the lamp.
- One caveat with projectors is that you must never pull the electrical plug from the outlet until you hear the internal fan cut off. There is enough residual heat generated by the projector bulb that damage to the electronics or the bulb itself can occur if the fan is not allowed to remove enough heat before it stops running.
- Without a connection to an electrical outlet, the fan stops immediately.
- The electronics have enough heat shielding that the fan removes enough heat during normal operation to avoid damage to the shielded components.

Multi monitor

Dual View.


Display Properties
Themes
Desktop
Screen Saver
Appearance
Settings
Drag the monitor icons to match the physical arrangement of your monitors.
1
2
Display:
2. (Multiple Monitors) on ATI MOBILITY RADEON X300
Screen resolution
Less
More
1280 by 1024 pixels
Color quality
Highest (32 bit)
Use this device as the primary monitor.
Extend my Windows desktop onto this monitor.
Identify
Troubleshoot...
Advanced
OK
Cancel
Apply


Monitor 1
Monitor 2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