CRT and Display Screen

Display Processor

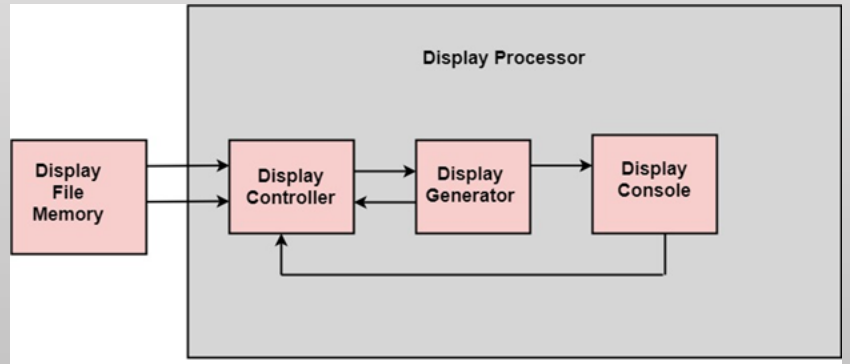
It is interpreter or piece of hardware that converts display processor code into pictures. It is one of the four main parts of the display processor.

1.Display File Memory

2.Display Processor

3.Display Generator

4.Display Console



Block diagram of Display System

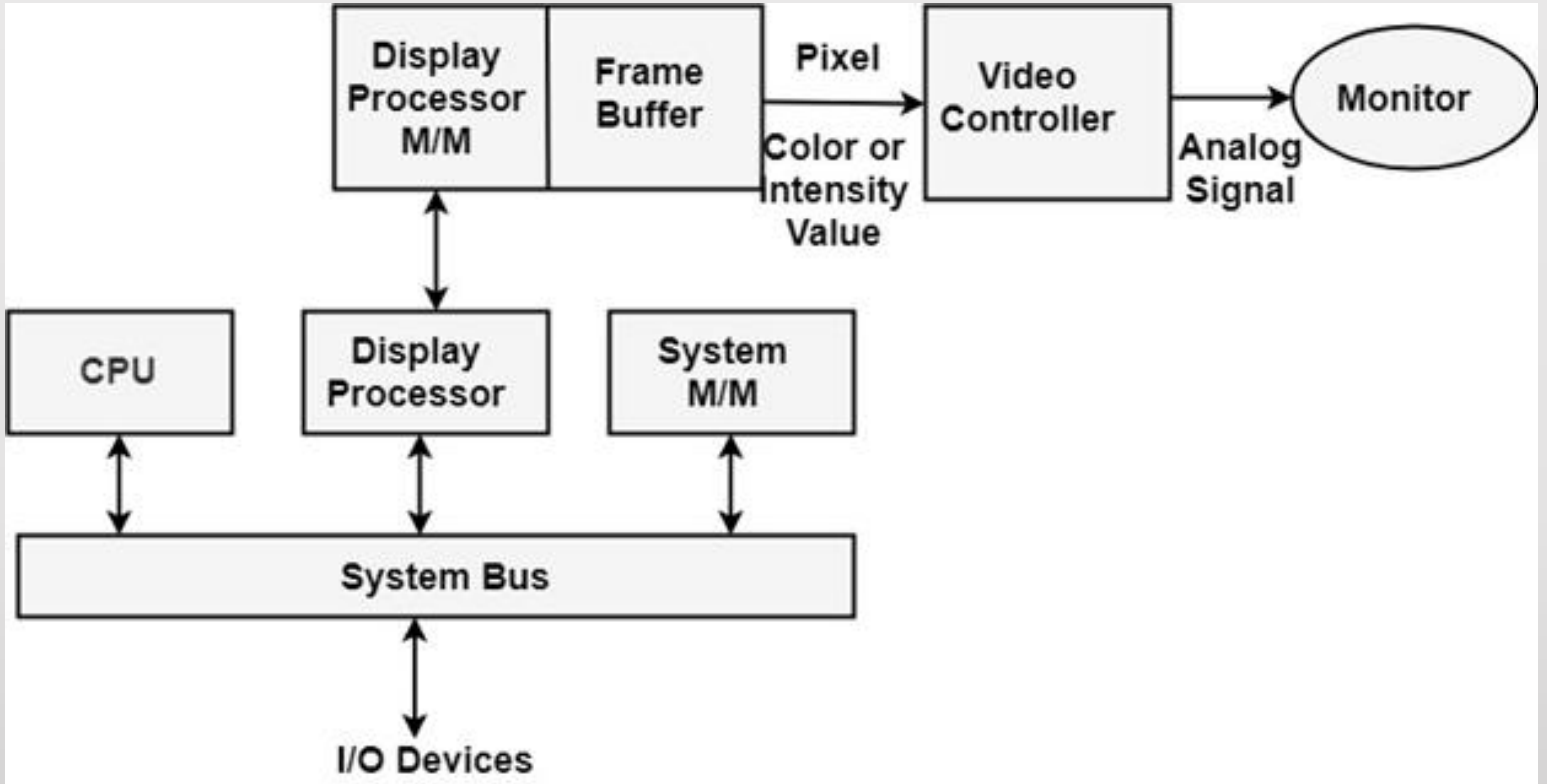
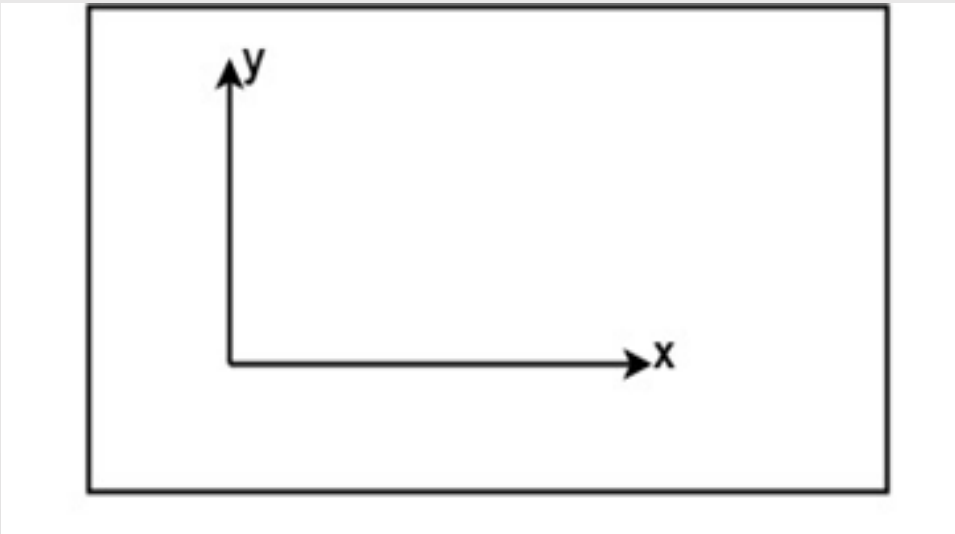
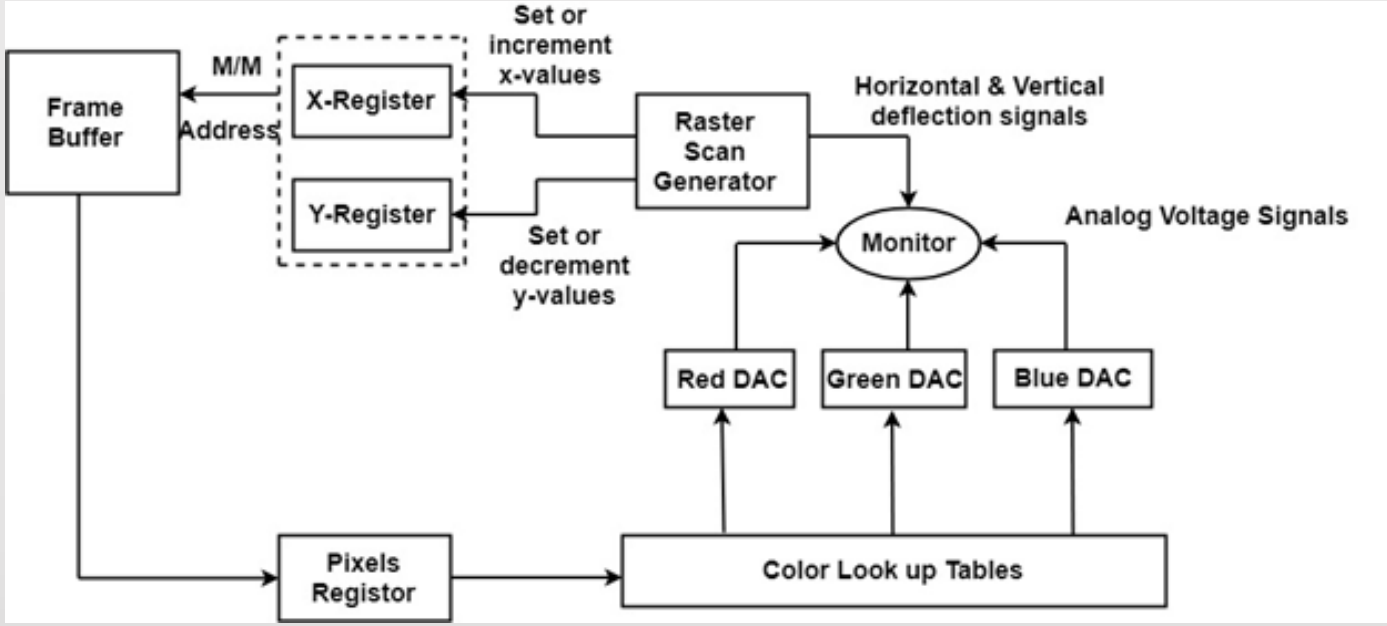


Fig: Architecture of a Raster Display System with a Display Processor


y
x


Frame Buffer
M/M
Address
X-Register
Y-Register
Set or increment x-values
Set or decrement y-values
Raster Scan Generator
Horizontal & Vertical deflection signals
Monitor
Analog Voltage Signals
Red DAC
Green DAC
Blue DAC
Pixels Registor
Color Look up Tables

Display Devices

- Refresh Cathode Ray Tube
- Random Scan and Raster Scan
- Color CRT Monitors
- Direct View Storage Tubes
- Flat Panel Display
- Lookup Table

CRT – Cathode Ray Tube

- Cathode Ray Tube is the abbreviation for Cathode Ray Tube. CRT stands for cathode ray tube, which is used in computer monitors and televisions.
- Electrons are fired from the back of the phosphorous tube towards the front of the screen to generate the image on a CRT display.
- They light up and are projected on a screen once the electron heats the phosphorus. A mixture of red, blue, and green light creates the color you see on the screen.

CRT & Beams

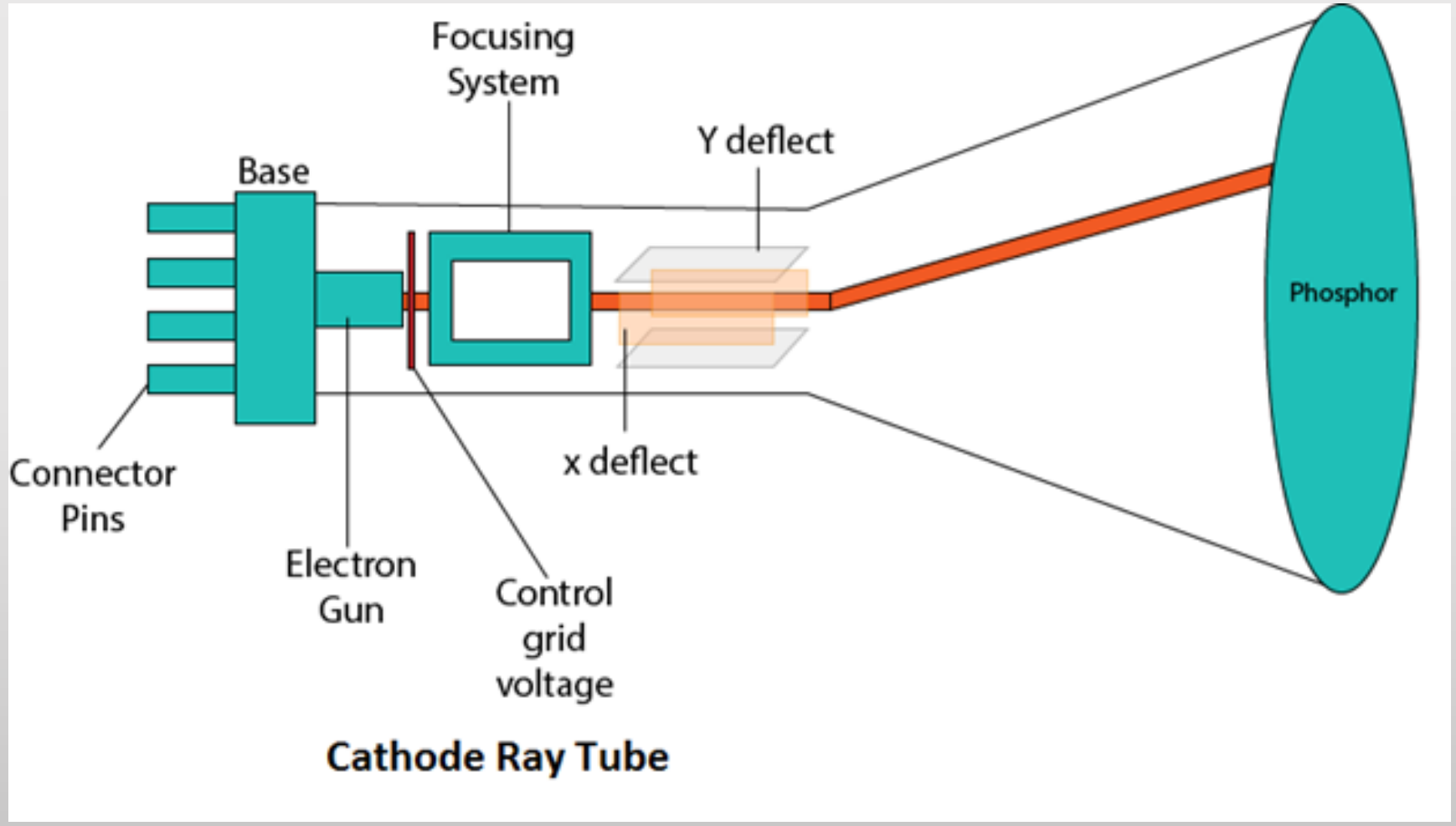
1. Electron Gun: Works on heating the filament and use a a narrow beam directed at the face of the CRT.

2. Control Electrode: The electron beam can be turn on and off.

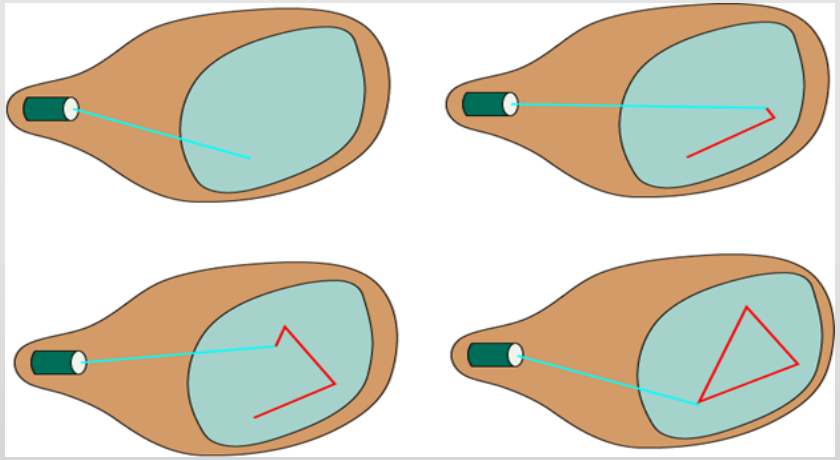
3. Focusing system: It creates a clear picture by putting the generated electrons into a narrow beam.

4. Deflection Yoke: It is used to control the direction of the electron beam. By using electric or magnetic field which will bend the electron beam as it passes through the area.

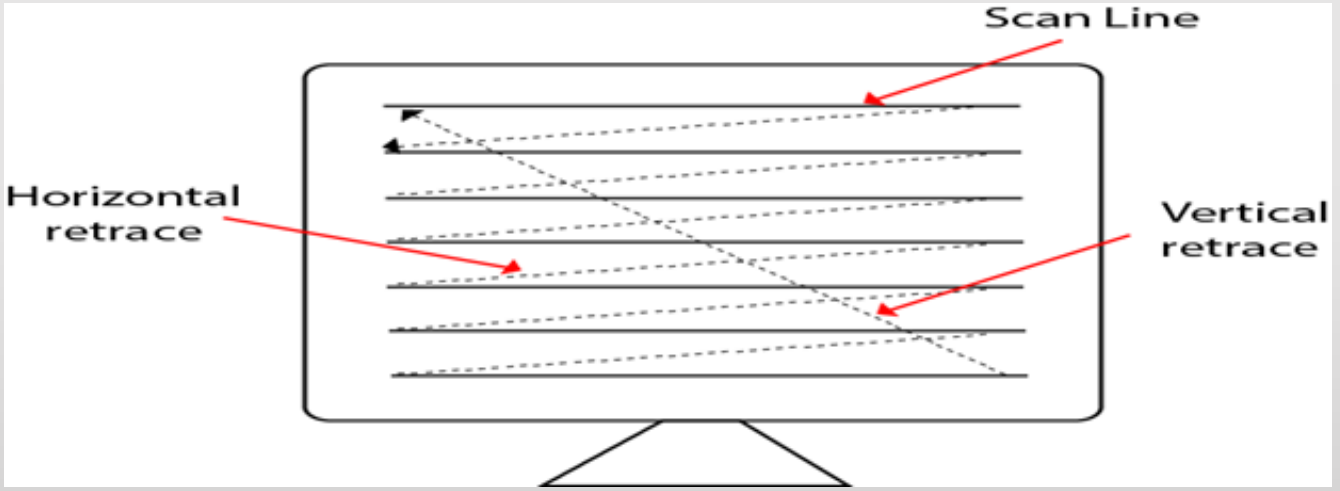
5. Phosphorus-coated screen: It is the surface of the screen located inside and it coated with phosphors. Also, phosphors glow when a high-energy electron beam hits them.


Focusing System
Y deflect
Base
Phosphor
Connector Pins
Electron Gun
Control grid voltage
x deflect
Cathode Ray Tube

Random Scan Vs. Raster Scan



Random Scan



Raster Scan

Random Scan

- The Random Scan System creates a line image on the CRT screen using an electron beam that works like a pencil.
- A series of straight-line segments are used to create the image.
- Each line segment is drawn on the screen by guiding the beam to move from one location on the screen to the next, with each point defined by its x and y coordinates.

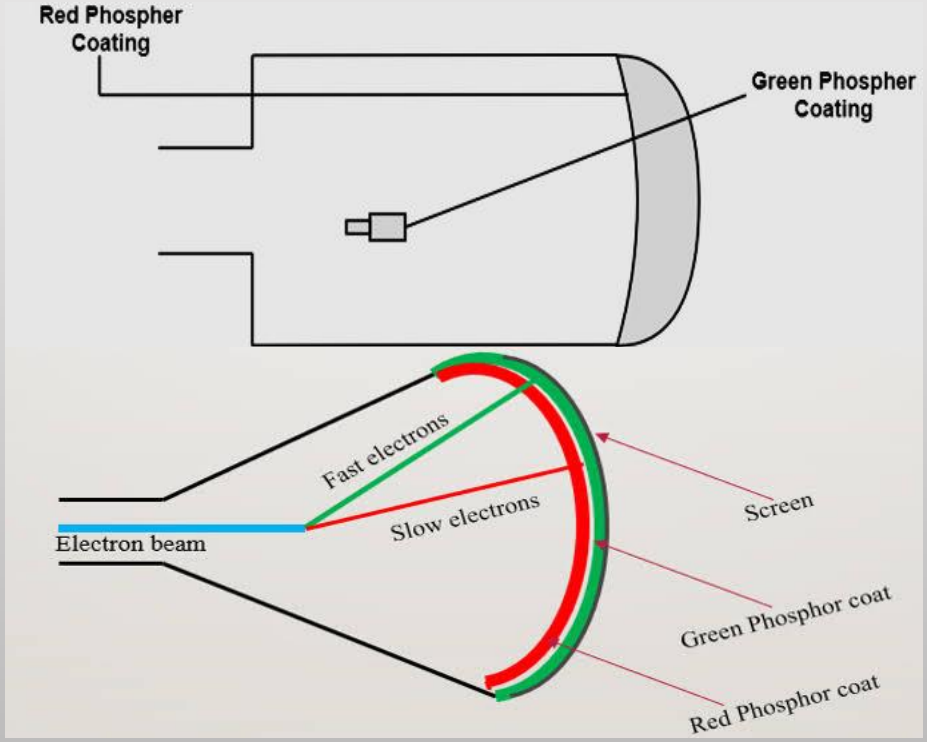
Raster Scan

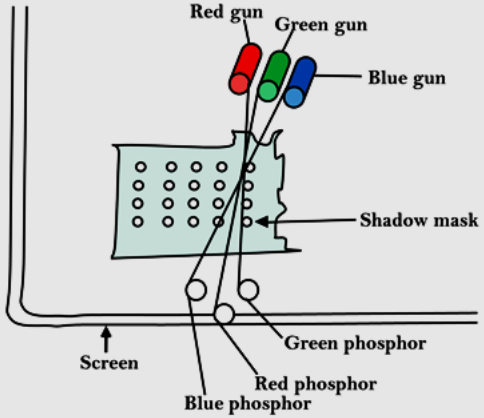
- A Raster Scan Display is based on pixel intensity control in the shape of a rectangular box on the screen called Raster. The refresh buffer, also known as the Frame buffer, stores information about on and off pixels.
- The Raster Scan Method is used on the televisions in our home. Because the raster scan system can save information about each pixel position, it is appropriate for displaying things in a realistic manner.
- A refresh rate of 60 to 80 frames per second is provided via Raster Scan.

Random Scan	Raster Scan
1. Resolution is high	1. Resolution is low.
2. It is more expensive	2. It is less expensive
3. It is easy to make modification	3. It is hard to make changes
4. Filling the pattern is hard to do	4. Filling pattern is easy to do
5. Only the part of screen with view on an area is displayed.	6. The whole screen will be used and scanned, and displayed.
6. Beam Penetration technology come under it.	7. Shadow mark technology came under this.
7. It does not use interlacing method.	8. It uses interlacing
8. It is limited to line drawing applications	9. It is suitable for realistic display.

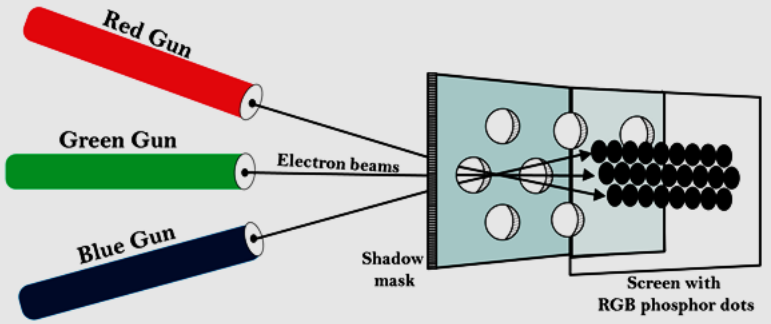
CRT – Cathode Ray Tube

- A combination of phosphors is used to display on a CRT monitor. The phosphors come in a variety of colors. With a CRT, there are two common methods for producing color displays.





The Shadow mask CRT



Beam Penetration Method

- There are two phosphorus layers- Red and Green are coated inside the screen.
- It is used with a **random scan** monitor for displaying pictures.
- A beam with the medium speed of electrons, a mixture of red and green light is emitted to display two more colors- orange and yellow.

Benefits:

1.Inexpensive

Bad points:

1.Only four colors are possible

2.Quality of pictures is not as good as with another method.

Shadow Mask Method

- A Shadow Mask is a metal plate with tiny holes present inside a color monitor.
- Shadow–Mask Method is used with a raster scan.
- It has more range of color than the beam penetration method. It is used in television sets and monitors.

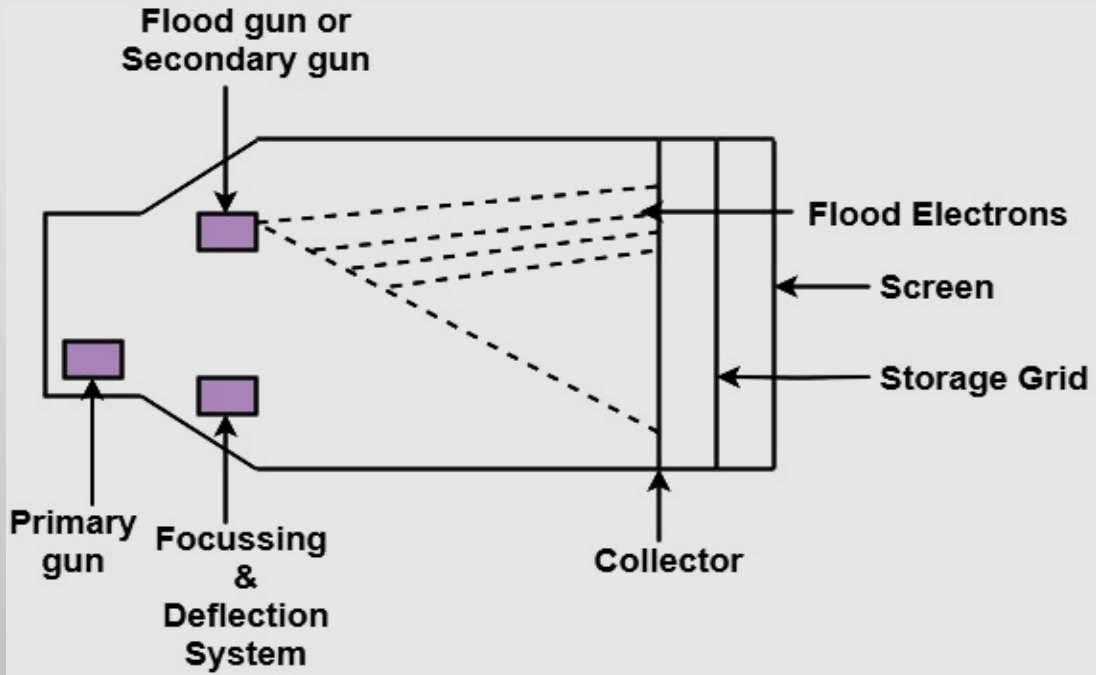
Benefits:
1.Realistic image
2.Million different colors to be generated
3.Shadow scenes are possible

Drawback:
1.Relatively expensive compared with the monochrome CRT.
2.Relatively poor resolution
3.Convergence Problem

BASIS OF COMPARISON	BEAM PENETRATION	SHADOW MASK
Application	It is used with Random Scan System to display color.	It is used with Raster scan system to display color.
Colors	It can display only four colors e.g Red, Green, Orange and Yellow.	It can display millions of colors because it depends upon the intensity value of three available guns.
Resolution	It gives high resolution.	It gives low resolution.
Picture Quality	Quality of the picture is not so good i.e poor with Beam Penetration Method.	Shadow Mask gives realism in picture with shadow effect and millions of color.
Color Display	In Beam Penetration method, color display depends on how far electron excites outer Red layer and then Green layer.	In Shadow Mask Method, there are no such criteria for producing colors.
Realistic View	This method is not suitable for providing the realistic view.	This method is suitable for providing the realistic view.
Electron Guns	In this method, only one electron gun is used.	In this method, three electron guns are use

The benefits:
1.No refreshing is needed.
2.High Resolution
3.Cost is very less

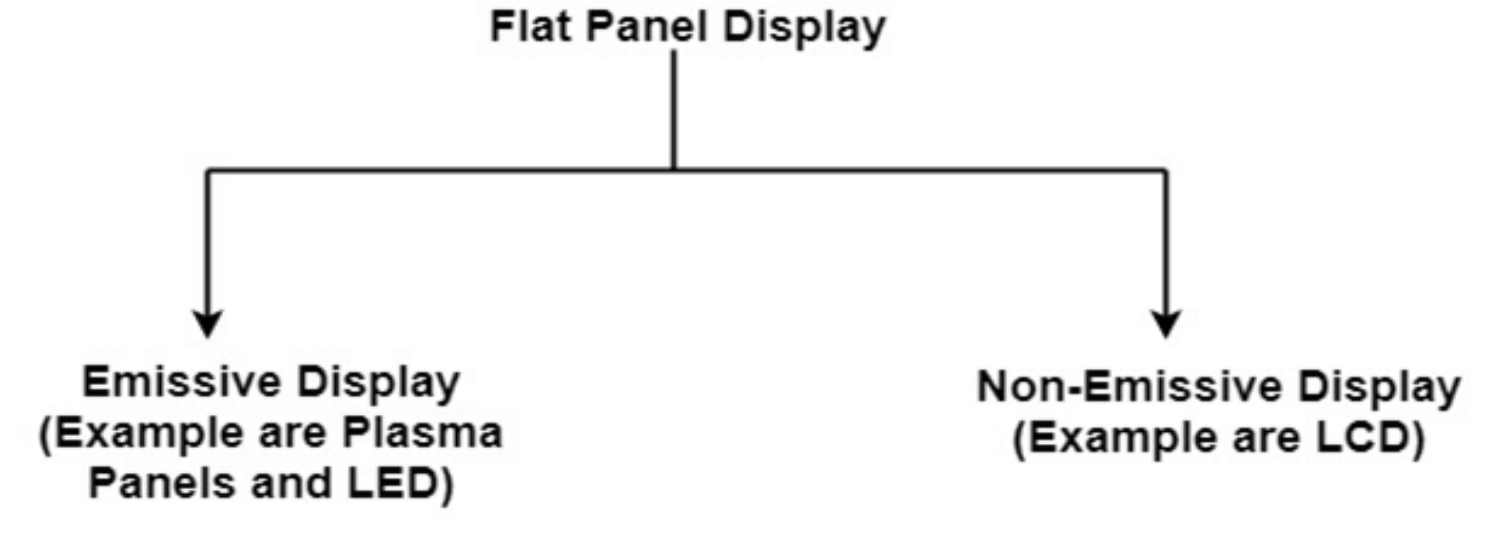
Drawback:
1.It is not possible to erase the selected part of a picture.
2.It is not suitable for dynamic graphics applications.
3.If a part of picture is to modify, then time is consumed.



Direct View Storage Tube

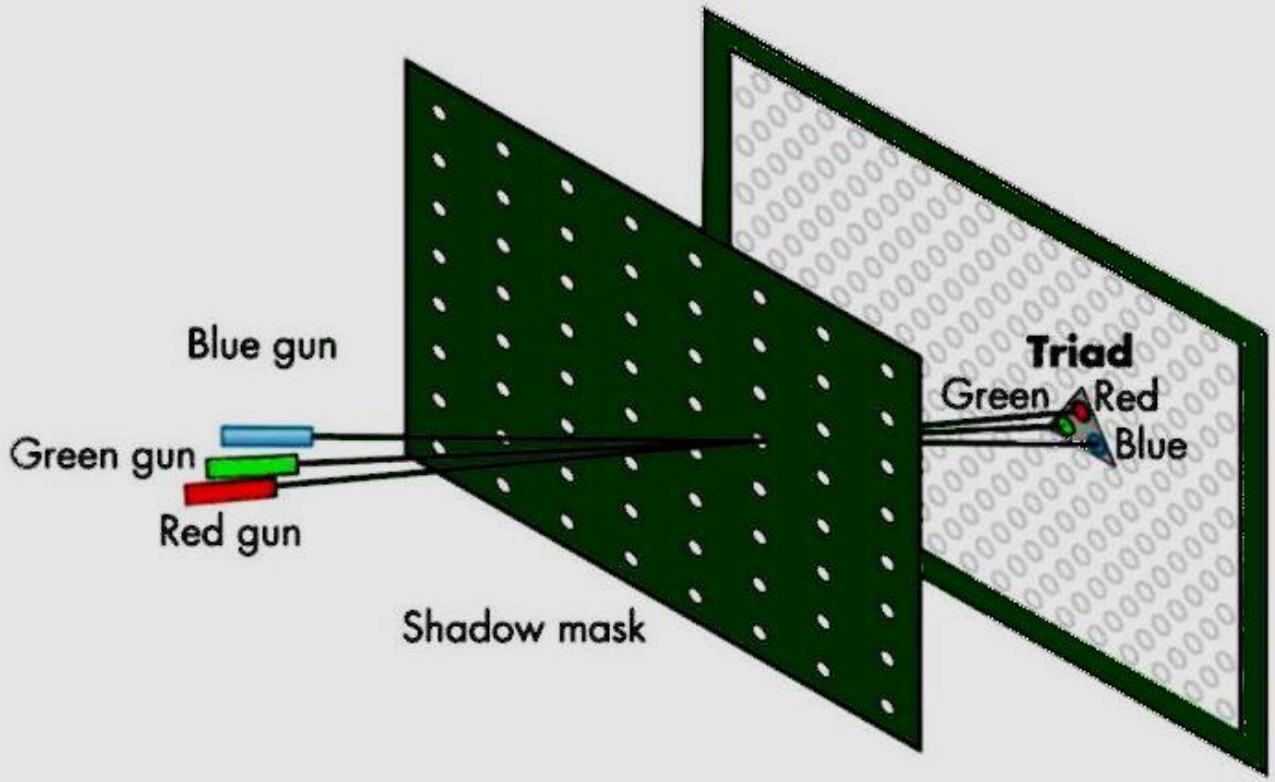
Flat Panel Display

- A flat-panel display is a type of video display that has a smaller size, weight, and power consumption than a CRT.



Small T.V. monitor, calculator, pocket video games, laptop computers

Colour CRT



Shadow mask techniques

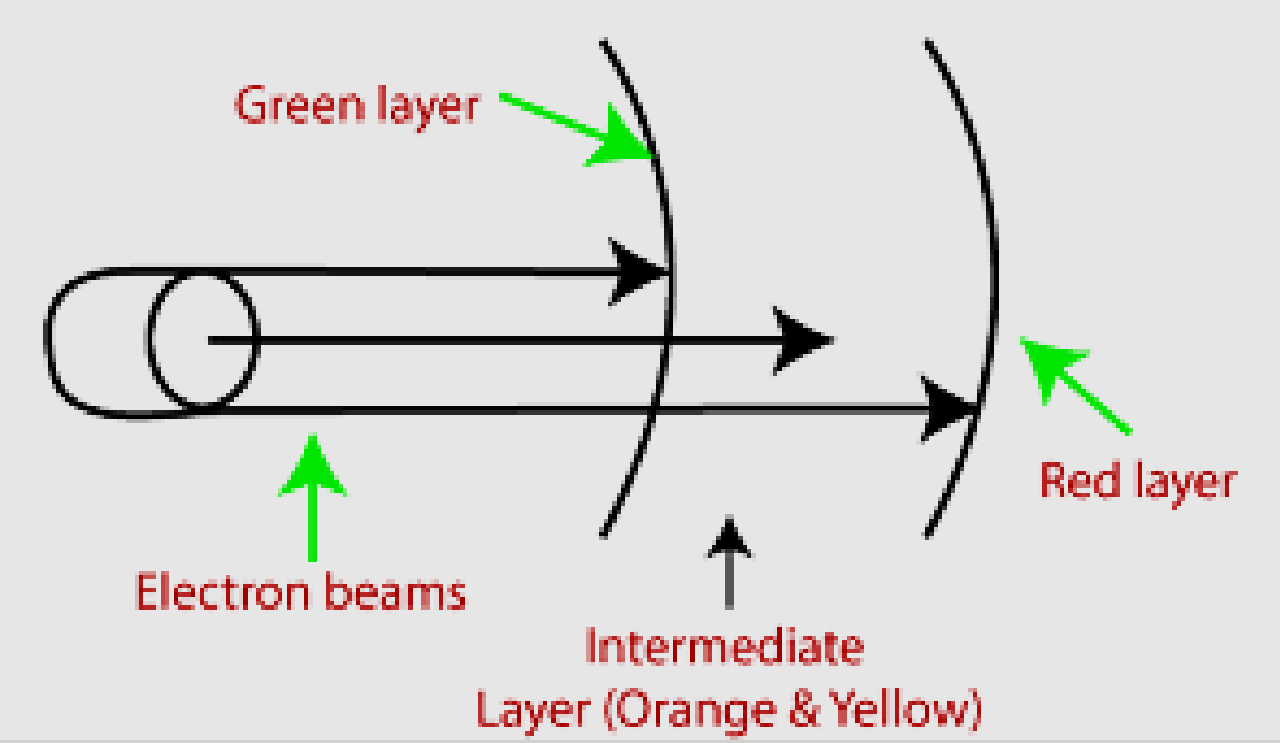
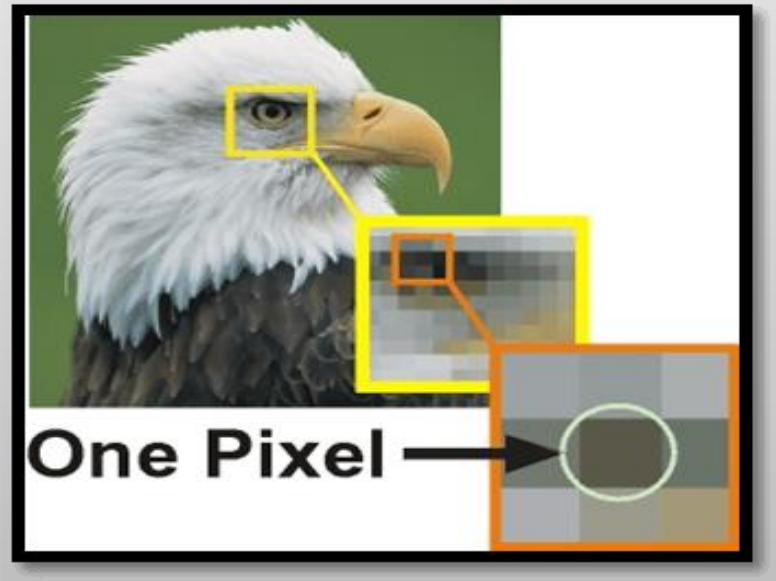

Green layer
Red layer
Electron beams
Intermediate
Layer (Orange & Yellow)

Image Pixels

What is Image Pixel

- The pixel's full name is "Picture Element." It's also referred to a Pixels are the tiniest elements of an image on a computer monitor, whether it's an LCD or a CRT.
- A screen is made up of thousands or millions of pixels arranged in a matrix. On a computer screen, a pixel is represented by a dot or a square.



Megapixels

- To form images, a digital camera set pixel elements. The higher the number of pixels, the higher the image's resolution.

1 Megapixel = 1000, 000, 000 Pixels

Column Pixels_Width X Row Pixels_Height / 1 Million

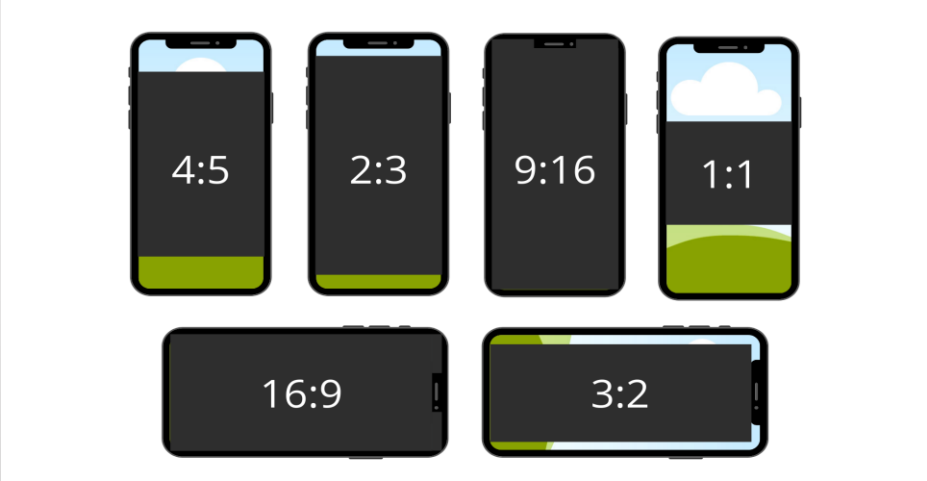
Example

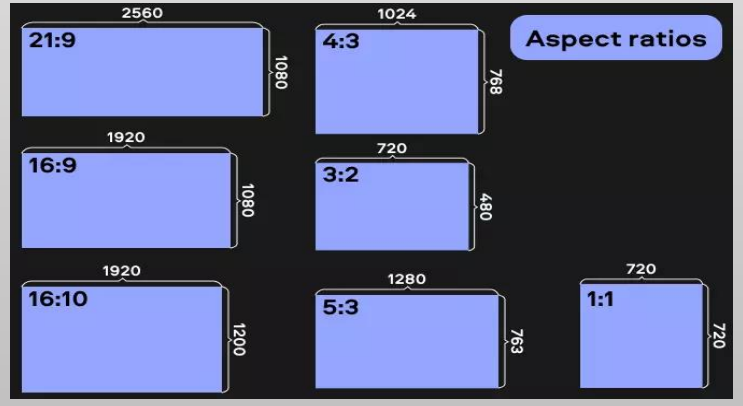
dimension of an image: 1500 X 1192 , How many megapixel?

1500 X 1192 /1000000000 = 1.788 megapixel

Aspect ratio

- The rate between width and height.
- Different image on different has different ratio.
- When the ratio is increased the image does not distorted.





Examples:

Aspect ratio: c : r = 5 : 2

Pixel resolution: [illegible] 0

Bits per pixel: grayscale image = 8bpp

Solution: Find Row - 1

Aspect ratio: c : r = 5 : 2

Pixel resolution: c = 5 r/2

c = 480000 / r

5 r/ 2 = 480000/ r

5 r^2 = 960000

r^2 = 960000/5

$$r = \sqrt{\frac{960000}{5}}$$

r = 438.17

Solution: Find Column - 2

C = 5 r/2

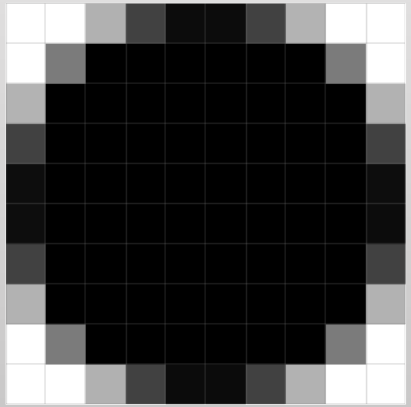
C = 5 * 438.17 / 2

C = 69.28

r = 438.17
C = 1095.425

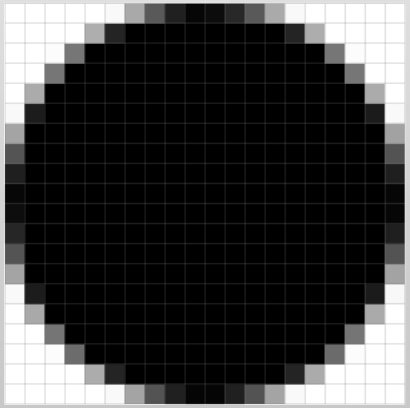
Pixel Resolution

- The total number of pixels in a digital image.
- Image has M rows and N columns.
- Quality image depends on pixel resolution



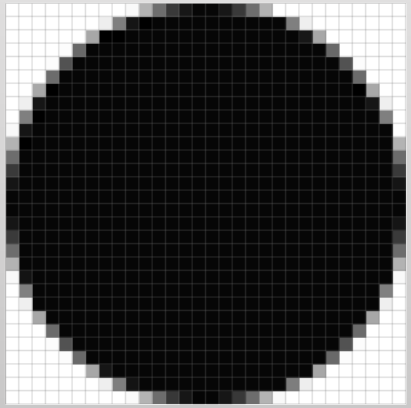
1x

(10 x 10 px)



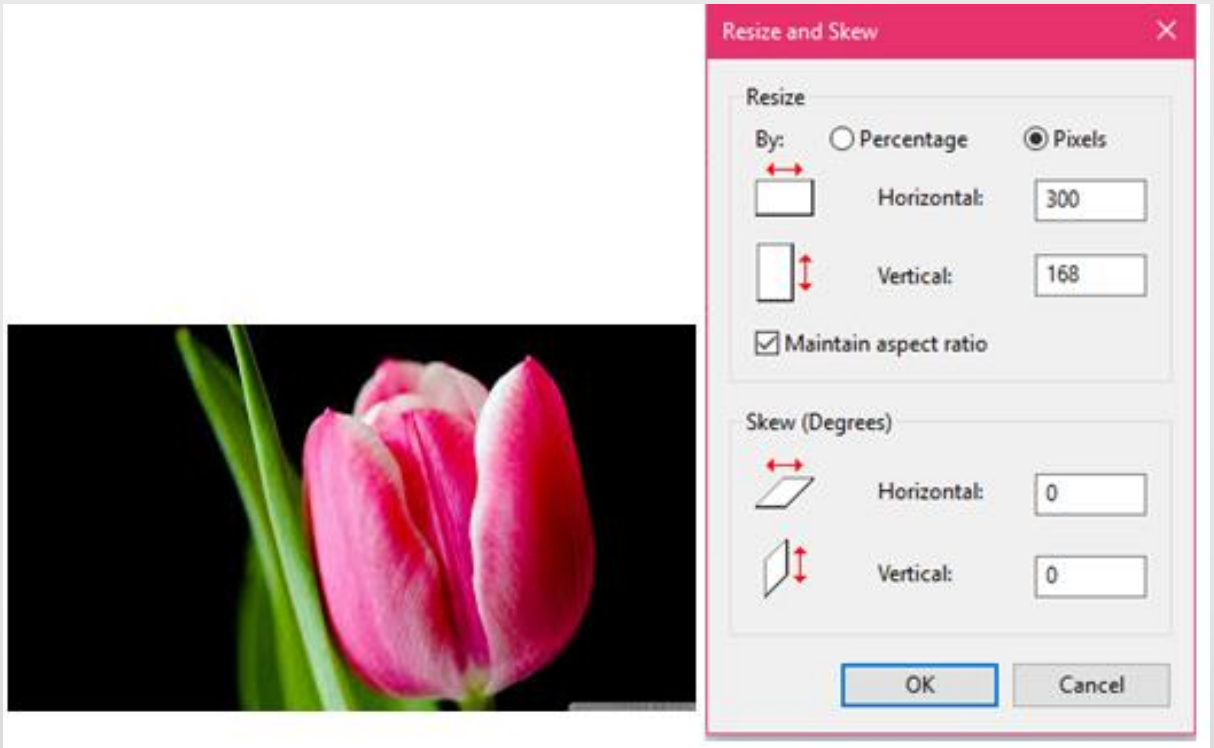
2x

(20 x 20 px)

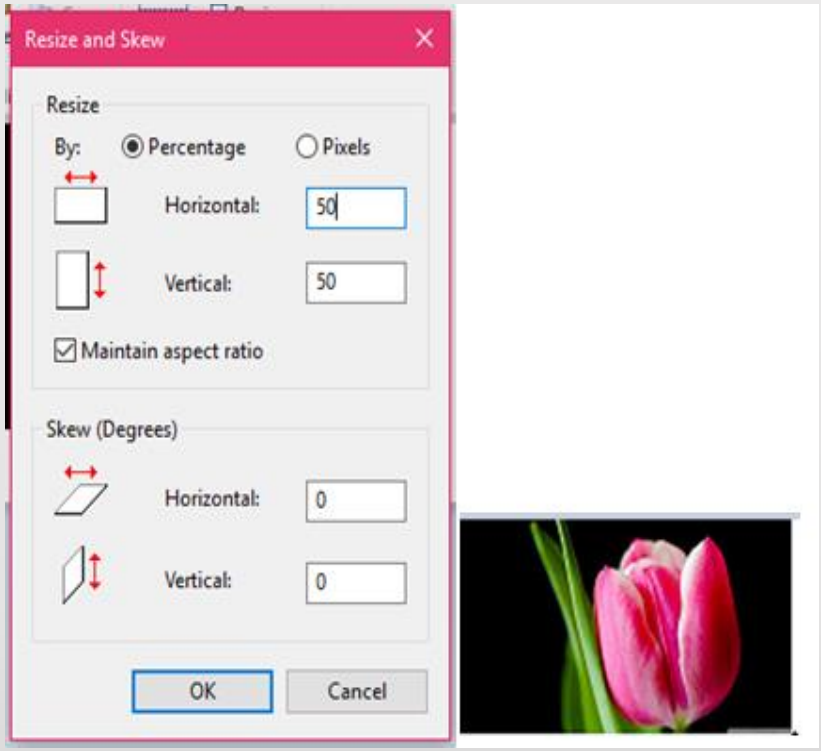


3x

(30 x 30 px)



Pixel Resolution



Aspect ratio

Pixel Per Inch

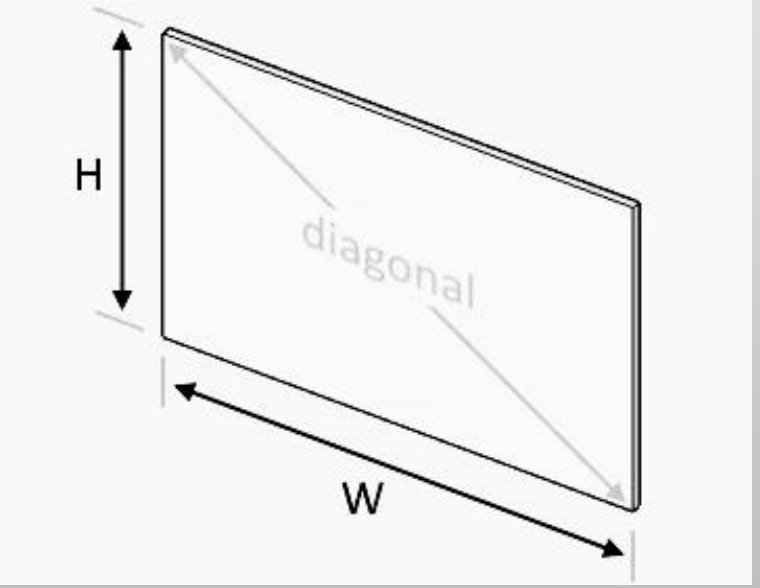
- The density of image on electronic device
- computer monitor or image digitizing device such as a camera.

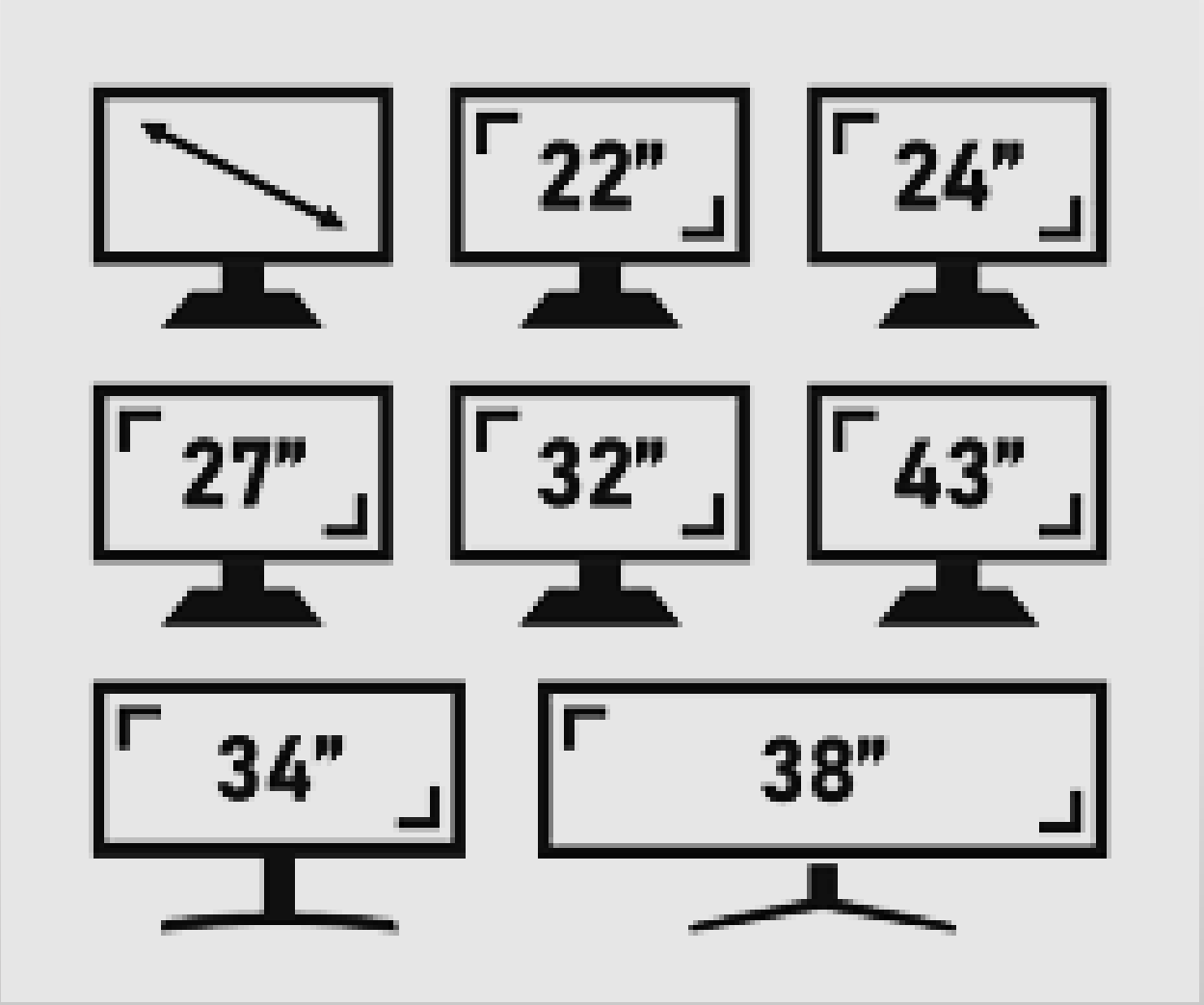
To find the pixel per inch the equation is $\mathrm{d} = \sqrt{w^2 + h^2}$

w is for horizontal pixel numbers

h is for vertical pixel numbers

d is Pixel number – fit diagonal




22"
24"
27"
32"
43"
34"
38"