

# Chapter 11: Input/Output Organisation

## Lesson 20:

### Peripheral Devices— Display Devices

# Objective

- Understand the video display unit
- Learn that VDU has a large area and it displays text and picture
- Learn how a cathode ray tube (CRT) generates three electron beams from three electron guns
- Understand the beam focusing on the screen on a set of three adjacent pixels of distinct colors — red, green, and blue
- Familiarize with LCD screen and TFT LCD

# Video display unit

# Colour Video display unit

- A large area and it displays text and picture in a large area
- A cathode ray tube (CRT) generates three electron beams from three electron guns
- The beam focuses on the screen on a set of three adjacent pixels
- Each set of pixels lights up in distinct colors — red, green, and blue

# Video display unit

- The sets of pixels are horizontally (X-axis) and vertically (Y-axis) arranged on the screen
- Each beam first moves horizontally and then vertically on the next odd lines
- All odd line set of pixels lights up sequentially
- Next the beam again starts scanning the even lines

# Video display unit raster scanning

- The pattern of lighting a set of pixels in the lines repeated continuously, 30/s in USA and 25/s in India (one half of electric supply frequency)
- Each electron beam scans through the screens and lights up a set of pixels 30 or 25 times each second
- Each pixel or line gets refreshed 30 or 25 times

# Video display unit display control

- In the path of each beam, there is a grid
- On application of a grid potential in the beam path, deflects the beam away from the screen and a beam, therefore, does not hit the pixel on the screen on those instances when the VDU signal applies the grid-potential.
- Therefore, the images are formed on the screen 30 times in one second

# Video display unit display

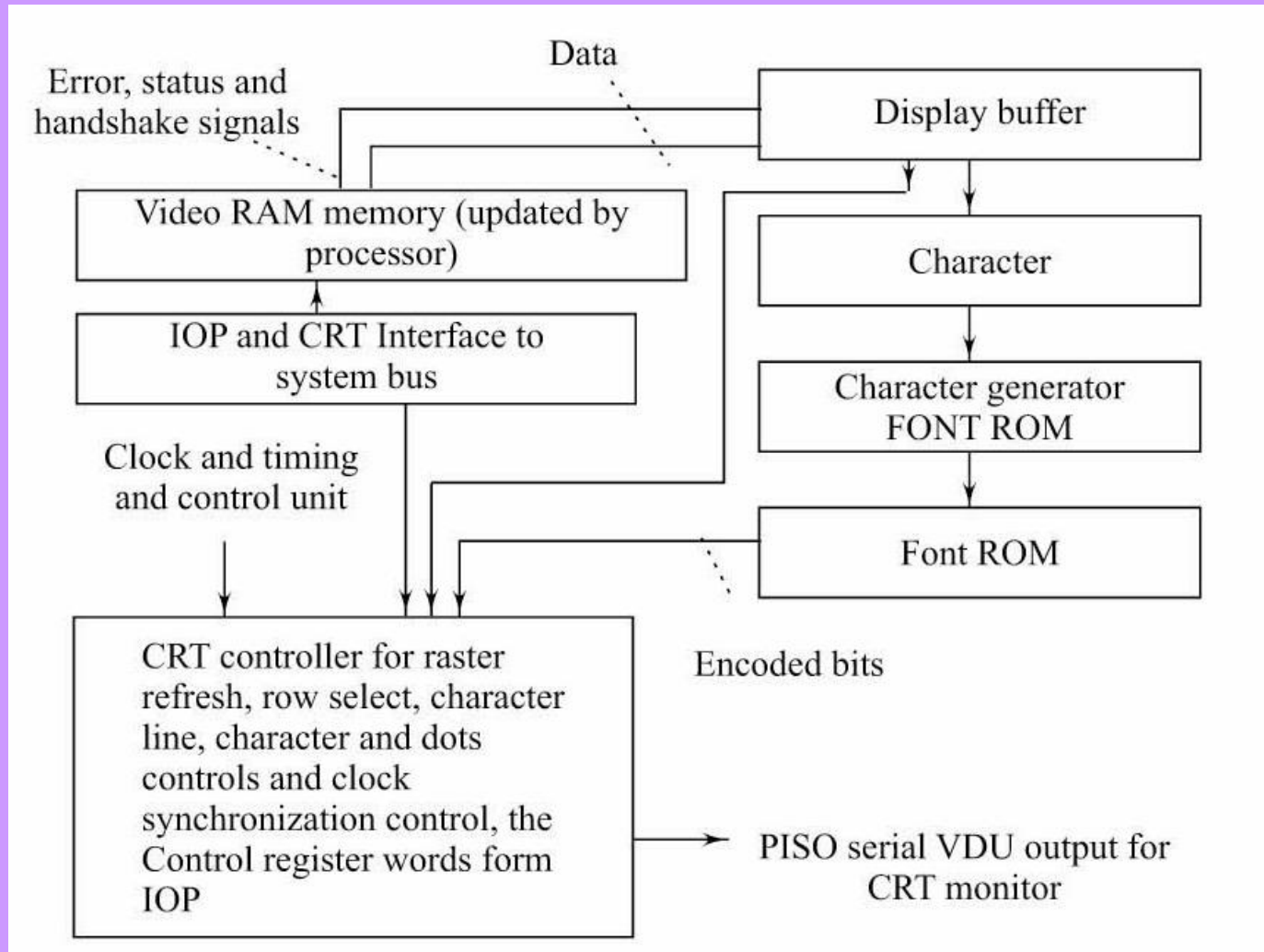
- The intensity of the beam can also be controlled, called Z-axis control



# CRT controller in Video display unit

- For the raster refresh, row-select, character line, character and dots, and clock synchronization

# CRT controller interface



# VDU screen in a computer

- Shows the text and pictures
- The VDU input is as per the bytes at the video RAM locations in the computer memory
- The computer simply updates the bytes at the video locations whenever the screen text changes or screen picture modifies

# The CRT controller in a computer

- Sequentially reads the video RAM (or its copy at the CRT interface) 30 or 25 times each second
- Maps the output and outputs such that the screen display also refreshes 30 or 25 times each second

# Colours

- Four bytes used in colored display for each set of pixels
- Z-axis control 8-bit for each color

# Colours

- A 24-bit control is thus needed for high color resolution
- For each color, there are 256 levels of intensities when using the highest resolution

# Resolution

- The number of  $X$  and  $Y$  positions of the sets of pixels vary
- VGA (Video Graphic Array) standard specifies  $X$ - $Y$  resolution of  $640 \times 480$
- XVGA (Extended Video Graphic Array) standard specifies  $X$ - $Y$  resolution of  $1024 \times 768$
- UXVGA (Ultra Extended Video Graphic Array) standard specifies  $X$ - $Y$  resolution of  $1600 \times 1200$

# Flat panel LCD display unit



# Flat Panel Displays

- LCD displays light in weight and are much thinner compared to CRT-based VDU displays

# Functioning

- When an alternating voltage of 2 V in phase applied at both end electrodes of an LCD segment (like a pixel), it does not show bright light due to a particular polarization of the crystal
- When an alternating voltage of 2 V in  $180^\circ$  phase difference is applied at both end electrodes of an LCD segment (like a pixel), it show bright light due to a change in polarization

# Speed of the on-off display

- The speed of the on-off display from a segment is small due to inter-electrode capacitances

# **TFT LCD display unit**

# TFT (thin-film transistor) display

- A new form of LCD display
- The display sharp, as using a transistor use results in a fast-control of the display

# Summary

# We learnt

- Video display unit and CRT controller functioning
- Learn that VDU has a large area and display of text and picture
- A cathode ray tube (CRT) generates three electron beams from three electron guns
- Beam focusing on the screen on a set of three adjacent pixels of distinct colors — red, green, and blue
- LCD screen and TFT LCD

End of Lesson 20 on  
**Peripheral Devices— Display Devices**