ROHINI
COLLEGE OF ENGINEERING AND TECHNOLOGY
Approved by AICTE and affiliated to Anna University,(An ISO Certified Institution)
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DEPARTMENT OF BIOMEDICAL ENGINEERING

III Semester

BM3301 SENSORS AND MEASUREMENTS

UNIT – 5

5.3 LCD Monitor

An LCD (Liquid Crystal Display) monitor is a type of flat-panel display technology that has become widely used in computer monitors, television screens, and other display devices. LCD monitors offer several advantages over older display technologies like cathode ray tube (CRT) monitors, including a slim profile, reduced power consumption, and the ability to produce sharper and clearer images.

The heart of all liquid crystal displays (LCDs) is a liquid crystal itself. A liquid crystal is a substance that flows like a liquid, but its molecules orient themselves in the manner of a crystal.

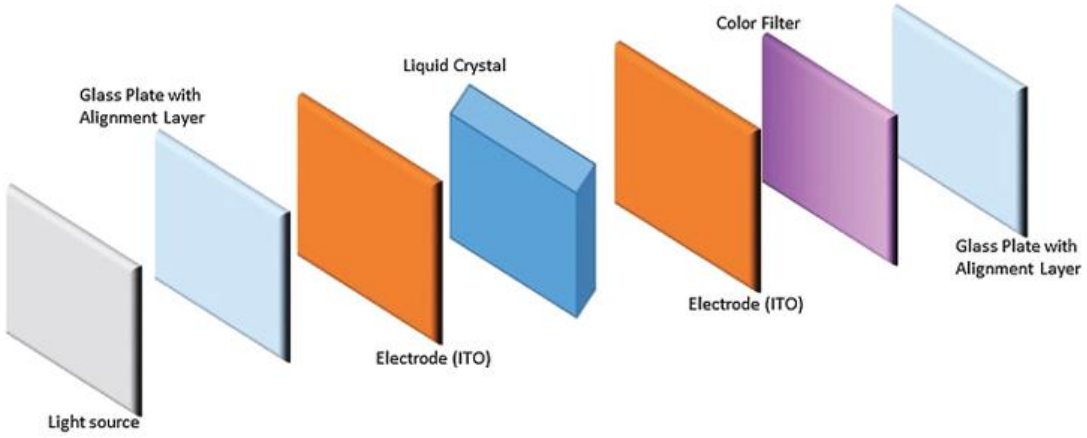

Fig. 5.3.1 A simplified design of a liquid crystal cell

The basic display using liquid crystals is composed of six main components:

i. a polarizing **filter**,

ii. **a glass plate** that has a transparent electrode pattern,
iii. the liquid **crystal** material,
iv. a clear common **electrode** on glass
v. a **polarizer** whose axis is crossed compared to the first polarizer, and
vi. either a **reflective surface** or a light source.

Without the liquid crystal between the polarizers, the crossed polarizers would block out the light, making the screen appear dark. Adjusting the voltages on the electrodes changes the amount of twist in the liquid crystal and varies the amount of light passing through. While most of the components of the LCD might be familiar, we will provide a brief overview of each component. A simplified design of a liquid crystal cell is shown in Fig.5.3.1. The order of the layers on the glass is shown in Fig. 5.3.1.

Liquid crystal cell displays (LCDs) are used in similar applications where LEDs are used. These applications are display of numeric and alphanumeric characters in dot matrix and segmental displays.

The LCDs are of two types

- A Dynamic scattering type, and
- A Field effect type.

The construction of a dynamic scattering liquid crystal cell is shown in Fig. 5.3.2. The liquid crystal material may be one of the several organic compounds which exhibit optical properties of a crystal though they remain in liquid form. Liquid crystal is layered between glass sheets with transparent electrodes deposited on the inside faces

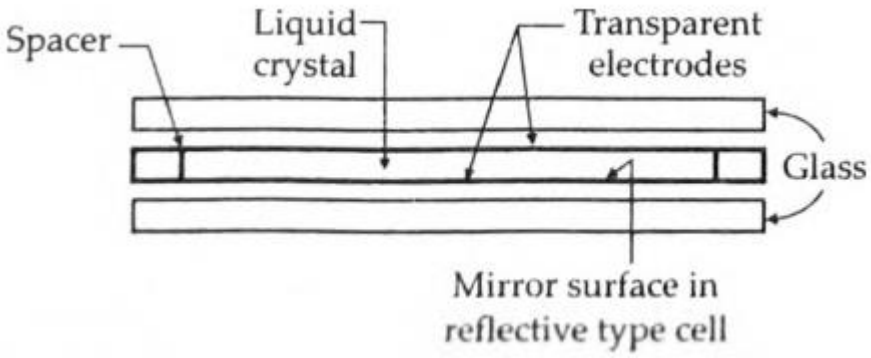

Fig. 5.3.2 Liquid crystal diode cell (LCD)

Dynamic scattering type:

When a potential is applied across the cell, charge carriers flowing through the liquid disturb the molecular alignment and produce turbulence. When the liquid is not activated, it is transparent. When the liquid is activated the molecular turbulence causes light to be scattered in all directions and the cell appears to be bright. The phenomenon is called dynamic scattering.

Field effect type:

The construction of a field effect liquid crystal display is similar to that of the dynamic scattering type, with the exception that two thin polarizing optical filters are placed at the inside of each glass sheet. The liquid crystal material in the field effect cell is also of different type from that employed in the dynamic scattering cell. The material used is twisted nematic type and actually twists the light passing through the cell when the latter is not energized. This allows the light to pass through the optical filters and the cell appears bright. When the cell is energised no twisting of light takes place and the cell appears dull.

Liquid crystal cells are of two types :

1. A Transmittive type, and
2. A Reflective type.

In the transmittive type cell, both glass sheets are transparent, so that light from a rear source is scattered in the forward direction when the cell is activated. The reflective type cell has a reflecting surface on one side of glass sheets. The incident light on the front surface of the cell is dynamically scattered by an activated cell. Both types of cells appear quite bright when activated even under ambient light conditions.

- The liquid crystals are light reflectors or transmitters and therefore they consume small amounts of energy (unlike light generators).
- Considering the case of seven segmental display, the current is about 25 pA for dynamic scattering cells and 300 pA for field effect cells.
- Unlike LEDs which can work on d.c. the LCDs require a.c. voltage supply.
- A typical voltage supply to dynamic scattering LCD is 30 V peak to peak with 50 Hz.

The advantages of LCDs are :

(i) They have a low power consumption. A seven segmental display requires about 140 pW (20 pW/segment). This is great advantage over LEDs which require about 40 mW per numeral.

(ii) They have a low cost.

The disadvantages of LCDs :

(i) LCDs are very slow devices. The turn on and the turn off times are quite large. The turn on time is typically of the order a few milliseconds while the turn-off is ten milliseconds.

(ii) When used on d.c. their life span is quite small. Therefore they are used with a.c. supplies having a frequency less than 500 Hz.

(iii) They occupy a large area.

Applications:

1. It is used as a display screen in calculators.
2. For displaying images used in digital cameras.
3. The television is main applications of LCD.
4. Mostly the computer monitor is made up of LCDs.
5. It is used in instruments panel where all the lab instruments use LCD screens for display.
6. The LCDs are commonly used in all the digital wrist watches for displaying time.
7. The LCDs are used in mobile screens.
8. It is also used in video players.

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