

LIQUID CRYSTAL DISPLAYS (LCDS)

The liquid crystals are one of the most fascinating material systems in nature, having properties of liquids as well as of a solid crystal. The terms liquid crystal refers to the fact that these compounds have a crystalline arrangement of molecules, yet they flow like a liquid. Liquid crystal displays do not emit or generate light, but rather alter externally generated illumination. Their ability to modulate light when electrical signal is applied has made them very useful in flat panel display technology.

The crystal is made up of organic molecules which are rod-like in shape with a length of $\sim 20 \text{ \AA}$ - 100 \AA . The orientation of the rod like molecule defines the "director" of the liquid crystal. The different arrangements of these rod-like 'molecules leads to (three main categories of liquid crystals.

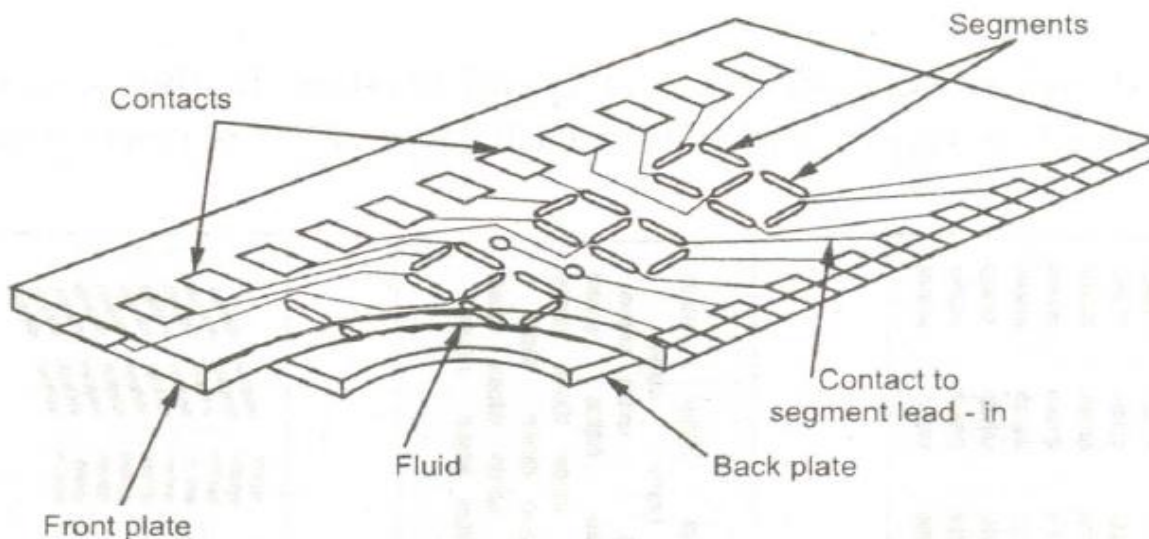
1. Smectic 2. Nematic 3. Cholesteric

Types of LCDs:

There are two types of liquid crystal displays (LCDs) according to the theory of operation: 1. Dynamic scattering 2. Field effect.

Dynamic Scattering Type LCD:

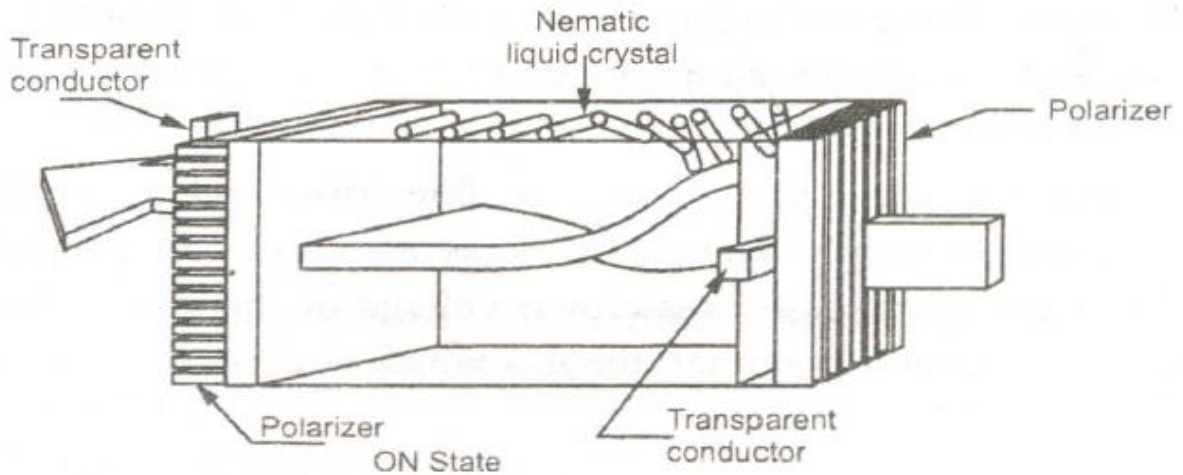
Fig. shows the construction of a typical liquid crystal display. It consists of two glass plates with a liquid crystal fluid in between. The back plate is coated with thin transparent layer of conductive material, where as front plate has a photoetched conductive coating with seven segment pattern as shown in Fig



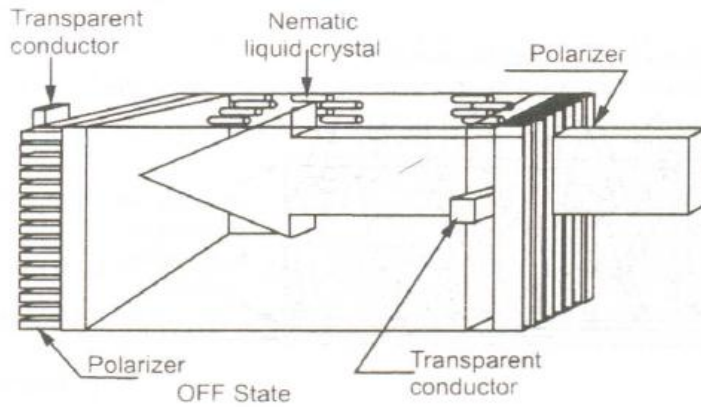
Field Effect Display:

In these displays nematic liquid crystals are used. Fig shows operation of field effect liquid crystal display with nematic crystals. It consists of two glass plates, a liquid crystal fluid, polarizers and transparent conductors. The liquid crystal fluid is sandwiched between two glass plates. Each glass plate is associated with light polarizer. The light polarizers are placed at right angle to each other. In the absence of electrical excitation, the light coming through the front polarizer is rotated through 90° in the fluid and passed through the rear polarizer. It is then reflected to the viewer by the back mirror as shown in Fig. (a).

On the application of electrostatic field, the liquid crystal fluid molecules get aligned and therefore light through the molecules is not rotated by 90° and it is absorbed by the rear polarizer as shown in Fig. (b). This causes the appearance of dark digit on a light background as shown in Fig. (c).



(a) Field effect display "ON state"



(b)



(c)

Advantages of LCDs:

1. Less power consumption
2. Low cost
3. Uniform brightness with good contrast

Source : <http://elearningatria.files.wordpress.com/2013/10/ece-iii-electronic-instrumentation-10it35-notes.pdf>