3.091 e - BR

Permanent Displays with Liquid Crystals

Liquid crystals have been going strong: in many devices they allow permanent displays which cannot be implemented with conventional components such as gas discharge tubes, light-emitting diodes and incandescent lamps. Low voltages and currents allow the liquid crystal displays to be driven directly by MOS components. The Siemens sales program includes liquid crystal displays with a power dissipation of only 200 $\mu W/cm^2$. At the Paris component fair the type AN 4132 is shown in a desk clock. Development aims at lowering the operating voltage further by field effect technology to make the display components directly compatible even with C-MOS components. Also, special doping methods made it possible to bring the life expectancy of the display liquid up to more than 10^4 hours of operation.

On the basis of the orientation principle reigning in a liquid crystal, a difference is made between nematic, cholesteric and smectic liquid crystals. In nematic types, only one aligning principle is effective: the center axes of the oblong molecules are parallel to each other and can shift freely relative to each other as in a normal liquid. Molecules in a cholesteric structure behave similarly with the exception that the molecules in different layers are slightly rotated so that a helix structure is obtained. In the smectic type the planes with different molecules can be displaced relative to each other: otherwise they are rather similar to solid crystals.

Siemens have used the nematic type for their liquid crystal displays. The crystal is arranged between two parallel glass plates spaced by 10 microns. When an electric field is applied, the liquid goes from the original transparent to a milky, opaque state. A field strength of about 0.5 V/μm is required

Siemens Aktiengesellschaft, Zentralstelle für Information, Presseabteilung
D-8000 München 1, Postfach 103, Germany, Telephone: (0811) 234-3085, Telex: 0523121

to obtain the effect. Opacity increases as the field strength increases and reaches saturation between 3 and 5 V/ μm. In this form liquid crystal displays have been used in many devices such as electronic measuring instruments, cash registers, desk calculators and exchange rate displays in banks. In Paris, a desk clock comprising the liquid crystal display type AN 4132 is shown. Types AN 4131 and AN 1301 are also available. Type AN 4132 has been designed specifically for measuring instruments.

The development work at Siemens aims at reducing the susceptibility of such display components in particular to the effects of sun light. Special doping with chemical elements has enabled the present life expectancy of 10^4 operating hours to be multiplied. The present rated operating voltage of 25 V is a source of constant annoyance to scientists. By the extended use of field effect technology for driving it is hoped to achieve a reduction to 15 V and less to make the liquid crystal displays directly compatible even with C-MOS components without the use of level converters. Finally there is a trend towards storing components which retain the entered information even after the controlling field has been removed. For these components, however, cholesteric crystal structures would be used.