Gas Discharge Self-Scan Panel Displays

. . . tomorrow's alternative to the CRT?

It is not inconceivable that advancing technology may one day render the cathode ray tube obsolete. Already, a great deal of research has gone into producing a flat panel display which would overcome the inherent disadvantages of the CRT, and several companies are active in this field. This article takes a look at one promising new development that has recently been made available — the Burroughs "Self-Scan" gas discharge flat panel display.

by GREG SWAIN

Starting with Ferdinand Braun's invention of an elementary form some 75 years ago, the cathode ray tube or CRT has since developed into the sophisticated reliable, mass producible device known today. Because of its versatility and relatively moderate cost, it has become the most common display device used in computer systems and a wide ranging field of other applications. However, notwithstanding the fact that it is an excellent display device capable of presenting grey-scale, colour, or monochrome images, graphics, and alphanumeric characters, the CRT is a bulky device that takes up valuable space.

There are also other disadvantages inherent in CRTs in addition to bulkiness. These include high voltage power supply requirements, fragile construction, and a limitation on the maximum practical size that can be constructed — about 25 inches in diameter. This latter restriction is due to the limitations imposed by atmospheric pressure on the wide area of glass enclosing the vacuum, and makes it impractical for the CRT to satisfy the demand for larger displays.

In an effort to reduce the bulk of such devices, early research centred on designing a flat screen CRT. Although several experimental devices were constructed, this approach presented considerable difficulties and was generally not accepted. Since then, a considerable amount of research has gone into developing a flat panel display which could perform those functions considered impossible with CRTs, and which could seriously challenge the CRT in a wide range of other applications. A viable alternative, at this stage, would appear to be the gas discharge display panel.

The first serious attempt to develop a multi-element gas discharge display was undertaken at the University of Illinois in 1964. The original plasma panel consisted of an X-Y addressable, capacitively-driven gas discharge matrix with inherent memory. However, the drawbacks of this system were multiple: driving potentials were complex and necessitated rigorous phasing relationships; it required high driving voltages at high AC frequencies which created electromagnetic interference; and the thin glass faceplates imposed a size limitation with respect to handling and fabrication.

After further research by Westinghouse Corporation, the AC plasma panel was developed into a commercial form under the name "Digivue." Announcement of this was made in 1971. This resulted in considerably lower drive potentials and frequencies as well as a practical resistor/diode multiplex drive and sustain system which drastically reduced the number of driver elements required. At the same time, the resolution achieved was comparable to that exhibited by some forms of CRT displays.

Shortly after the announcement of the original AC plasma panel, the Burroughs Corporation undertook the development of an alternative form of gas discharge display. By the end of 1967, a pulsed DC-driven dot matrix panel had been developed which appeared to have several advantages over the AC plasma panel. It possessed a memory in the form of metastable atoms having a relatively long decay time (atoms raised to an intermediate energy level from which they cannot return without interacting with and ionising other particles); it was rugged and less likely to sustain damage during fabrication and handling; and it exhibited wider operating margins.

In 1968, a random access memory panel was built in the form of a 75 x 75 dot matrix display, and with a resolution of 16 elements to the linear inch. This feasibility model — fully operational and tape addressable — required 2n drivers for an array of n x n elements, or n + m drivers for a display of n x m elements, making the cost of associated electronics considerable.

A significant breakthrough was achieved in late 1968 with the concept of scanning the display along one axis. This involved entering the data on a column-to-column basis from the first column to the last, and then resetting the display back to the first column to repeat the process. The scanning concept reduced electronic drive circuitry costs, since all vertical columns in a display could be sequentially driven by a 3-phase driving circuit and a single reset circuit, necessitating a total of four active drive elements for the columns and individual drive elements for the rows. This sequential drive was based on a cathode glow transfer phenomenon.

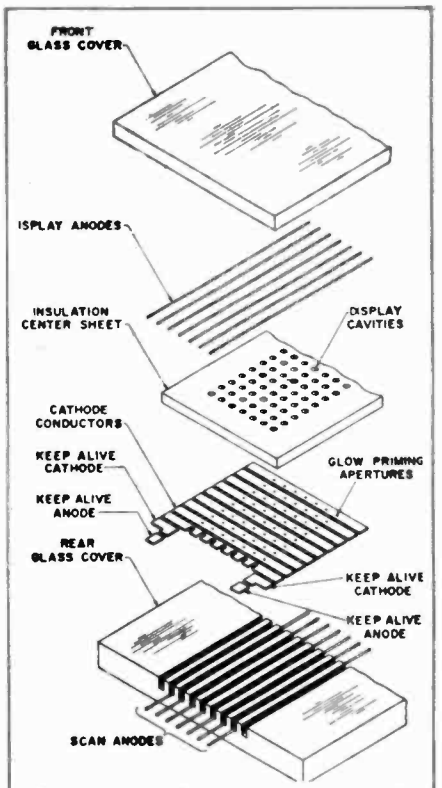

Fig 1: an exploded view of a pulsed DC gas discharge display panel showing the organisation of electrodes and display cavities.

Using the above concept a range of commercial multi-element dot matrix devices, designated by Burroughs as "Self-Scan" panel displays, were developed and announced in 1970. Since they do not possess an inherent memory, however, these devices require an external memory and must be continually refreshed. It is with the Burroughs Self-Scan range that this article is concerned.

Before launching into a generalised discussion on the characteristics and applications of gas discharge display panels, it may be as well to gain some understanding