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LNF-82/48(NT)
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R. Bertoldi, O. Ciaffoni, M. Coli and L. Trasatti:

A COLOR GRAPHIC DISPLAY FOR CANDI

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We describe a high resolution (512 x 512 pixel), 8 color, 2 page display unit for the CANDI system[1-8]. The system uses a high resolution raster-scan video terminal and supports a hard-copy unit.

Graphic display units are growing very fast in popularity. The immediate reason is the rapidly decreasing cost of hardware in general (and of memories in particular), while the real need they serve is to answer the classic question: "Who will ever read all of those numbers ?", as referred to multi-kilogram computer printouts.

We have built a low-cost system which allows good resolution and easy operation using a new LSI integrated circuit. Pixel-by-pixel reads and writes are possible, both for the hard copy unit and for cursor display. Furthermore, the unit is capable of understanding high level commands, that is, point draw/erase, vector draw/erase and alphanumeric character display in various sizes and orientations (normal or italic characters and horizontal or vertical axis). This last capability is particularly suited for hystogram axis definition and the like.

Two separate pages of memory are available, allowing independent preparation of two separate displays. Alternate presentation is also possible, with some amount of "flickering"; this could still be useful, for example for comparison of two different curves. A light pen is also supported.

We are in the process of connecting the unit to an alphanumeric display processor and to a keyboard. This will allow presentation of both graphic displays (for example drawings of apparatuses, event display, plus miscellaneous hystogram and curves relating to

experimental results) and alphanumeric information (program listings, etc.). It is important that the two things are handled by separate processors, to allow scrolling, erasing and editing of alphanumeric data without disturbing the somewhat more complicated graphics underlying it. The alpha display color is automatically adjusted for maximum readability over different colored areas of the graphic display.

A block diagram of the display driver is shown in Fig. 1.

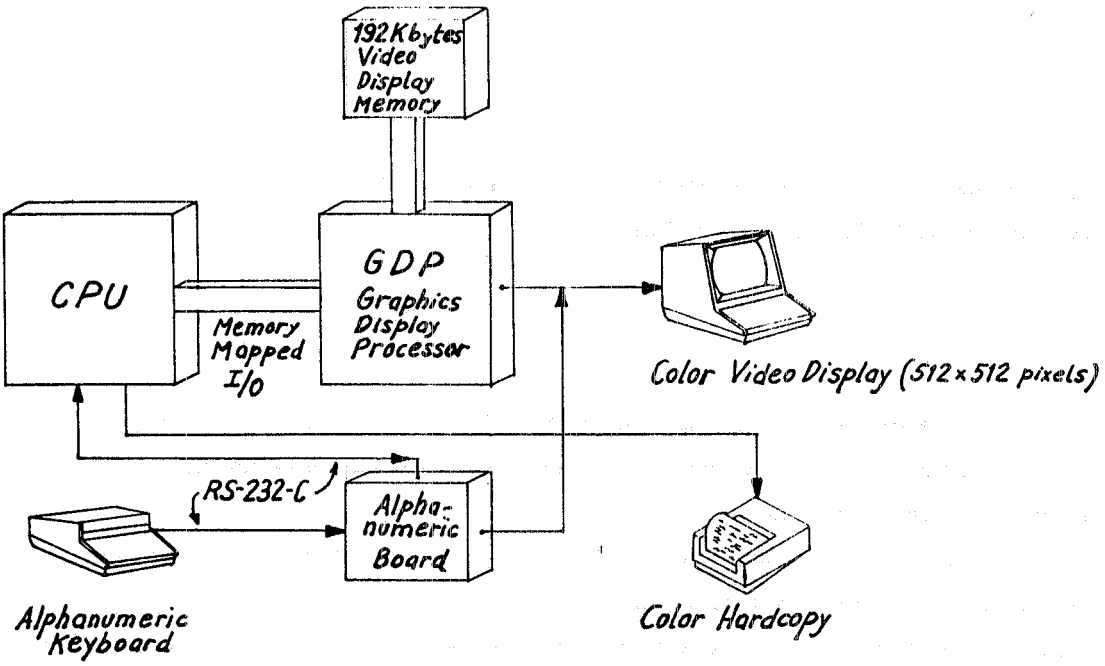

FIG. 1

The unit may be divided into four logical sections:

1. Graphics Display Processor (Thompson-EFCIS EF 9365), providing raster scan control, vector tracing, etc.
2. Graphic memory (24 x MCM 5665, 64 Kbit Dinamic Ram) for a total of 192 Kbytes. This constitutes the necessary memory for two independent pages of three bit (8 color) times 512 by 512 pixels.
3. CPU inteface, adapting the Thompson GDP processor to the Texas TMS 9900 CPU bus. The CPU sees the GDP processor as a set of 32 dedicated memory locations for maximum flexibility and speed of operation. Note that, although the video memory is handled directly by the GDP, and thus does not occupy CPU addressing space, the CPU can read or write the video memory through the dedicated register area.
4. Alphanumeric display board. This board produces the normal terminal like alphanumeric display, which is mixed with the graphic display only at the level of TV interface. The unit has its own 4 Kbyte memory.

5. Hard copy unit. A software interface has been developed, to implement a hard copy facility on a color dot printer. The full resolution of the graphic display can therefore be transferred on paper at a very reasonable cost.

The prototype of the graphic display unit has been built on a general purpose Texas board. A CAMAC printed circuit board version is almost ready for CANDI 2.

Various BASIC programs have been written, mainly for test purposes. A graphic subroutine library using a subset of PLOT 10 is going to be incorporated in the CANDI firmware. Furthermore, Tektronix 4006 emulator has been implemented for the system.

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