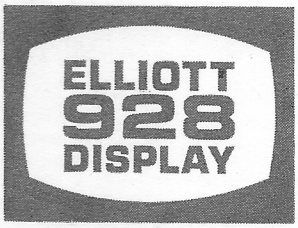


THE ELLIOTT 928 GRAPHICAL DISPLAY SYSTEM

SOFTWARE

ELLIOTT 928 DISPLAY

In the design of the flexible order code of the Elliott 928 Graphical Display, programming requirements have received as much consideration as the graphics. Although it is anticipated that most users will use one of the programming systems available, the display is nevertheless easily programmed directly by the user. One of the main features of the available programs is that the user does not need to have a detailed knowledge of the 928 hardware; a broad outline of its operation and features is sufficient to enable full use to be made of the system. The communication with, and the control of, the 928 is handled entirely by these graphic programs. The nucleus of all these program systems is the Elliott 905 program DISMAN 900, the Display Manipulation System. This is supplemented by ALGOL and FORTRAN routines.

the software system

The diagram shows the normal structure of the software system for the Elliott 928 display when it is used in a 'satellite' configuration.

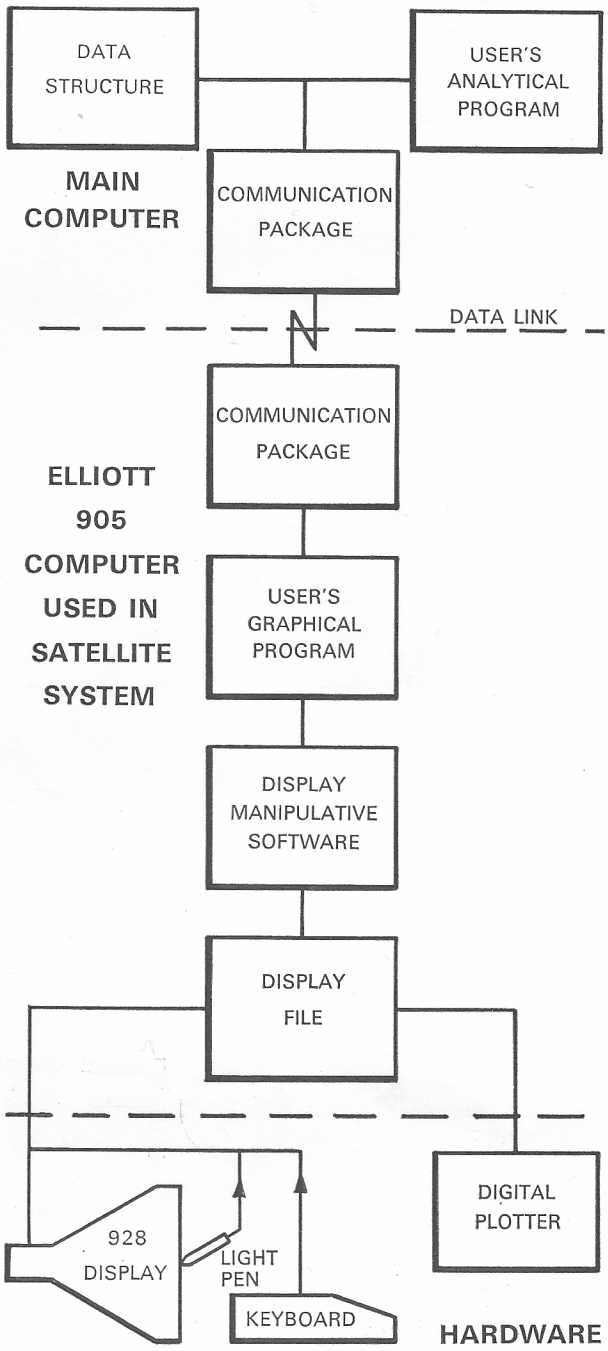
When the Elliott 928 display is used as a satellite to a central computer the data structure and the analytical routines for operating on the data structure are usually held in the central computer. The display file together with the Display Manipulation System, DISMAN 900, and the users' graphical routines reside in the core store of the Elliott 905 computer. It may also be necessary to hold certain parts of the data structure (for example those parts which are being viewed) in the satellite computer. For certain applications an Elliott 928 configuration with at least 16,384 words of store can be used on its own when the main computer is temporarily not available. Special data structure program aids are available which provide for the automatic linking of items and correct storage allocation.

DISMAN 900, the Display Manipulation package for use with programs written in SIR (Symbolic Input Routines) code, can be used on a 928 system with 8,192 words of core store. A system with 16,384 or more words of store allows use to be made of the powerful ALGOL and FORTRAN programming systems.

Other graphics programs include diagnostic routines, and programs to produce hard copy of the displayed picture on an on-line digital plotter.

DISMAN 900

DISMAN 900 is a comprehensive device routine package which acts as an interface between the users' SIR (Symbolic Input Routine) program and the 928 graphical display. It enables the programmer to utilise fully the capabilities of the display



without having a detailed knowledge of the hardware or the complex 'housekeeping' software.
DISMAN is written in Symbolic Input Code and as such can be used directly by another SIR program. The advantages of programming in this language are mainly in respect of efficiency in speed and use of core store. It is ideal for many real-time applications where speed is important. DISMAN consists of a modular group of routines; its main functions are the control of the 928 hardware and the maintenance of the display file.
The picture is built up as a series of display commands held in the main store. These commands, known collectively as the 'display file', are accessed autonomously by the display controller, which in turn sends signals to the viewing unit to draw a picture on the face of the cathode ray tube.
The picture can be altered by modifying the display file as necessary, and the user is freed from any of the routine problems of storage allocation associated with a dynamic display file.
The facilities provided by DISMAN form three main groups:

(i) Basic housekeeping routines to start the display and allocate areas in which to construct the display file.
(ii) Code generation routines to generate display commands for items such as points, lines, arcs and text.
(iii) An interrupt routine to react to the interrupts produced by the display and activate the appropriate users' routines.

DISMAN contains a number of display code generation routines which can be used to generate code for an 'item' in a buffer. The item can consist of any mixture of points, lines and alphanumeric characters as well as control functions. This item is then inserted into the display file where required and at the same time it is given an identifying name by the user. This name can be used later to reference the item if, for instance, it is required to delete it, or the name may be handed to the users' program as a reference if this item is seen by the light pen. Using DISMAN the user is able to insert items into or delete items from the display file, and items, once in the display file, can be replaced, renamed or modified at will by the user. Facilities exist for defining a collection of items as a subpicture, which can then be named and called up using that name within a subsequent item or items. This subpicture facility can be nested to any depth.
Besides the above-mentioned routines there are control routines mainly associated with the input hardware like the light pen and the function keys. These routines are set up by the user to cause entry to his own routines when an input occurs, making available all the information associated with it. Pen tracking can be initiated by the user at any time. The pen will be tracked automatically and continuously by a small cross on the screen, without further action on the part of the users' program. By this method the co-ordinates of the pen position are always available. Communication between the users' program and DISMAN is basically via a number of global identifiers and labels.
Objects on the screen may be at one of two brightness levels, thus certain features of the picture may be visually emphasised relative to the rest of the picture. Characters may be displayed in two sizes – small or normal. Lines may be plain or dotted, either at 16 or 32 increments frequency. Objects on the screen may be made to blink on and off to attract attention to any given part of the picture, and may be made visible or invisible to the light pen.

EDGAR 900 & FRED 900

All the facilities of DISMAN are available to the ALGOL user via a procedure package known as EDGAR 900 and to the FORTRAN user via a subroutine package known as FRED 900. These packages of procedures enable the ALGOL or FORTRAN programmer to use the Elliott 928 Graphical System for input and output of graphical information, including conversational operations using the light pen and console keys, and autonomous pen tracking. Procedures are provided for creating and modifying a file of display commands in the store, detecting when a picture part is indicated with the pen, interrogating the console keys in various modes, and tracking the pen.

Examples of the instructions for EDGAR 900 are

NEWBUF (A);	Start a new buffer: array A.
POINT (X, Y);	Generate display code for point (X, Y).
VECTOR (DX, DY, B);	Generate a vector with DX and DY as relative components.
ARC (X1, Y1, X2, Y2, WAY);	Generate an arc from X1, Y1, to X2, Y2.
DELETE (N);	Delete item N from display file.
SUBPIC (N);	Enter Subroutine N.
PENTRAK (X, Y);	Sets X and Y to the current position of the tracking cross.

Similar instructions are available to the FORTRAN user via FRED 900.

The provision of graphical features in ALGOL and FORTRAN gives the user a very powerful high level programming system which has the advantages of ease of writing and ease of understanding by other users and establishments. Using EDGAR 900 and FRED 900 the Graphical Display can be programmed with almost the same ease as any other input or output peripheral, while maintaining the unique interactive capabilities that make the display such a flexible and powerful device.

Although every effort has been made to ensure accuracy continuous development of Elliott products and Systems renders the information in this publication liable to alteration without notice. Elliott Sales and Technical staff will always be available with guaranteed current data to advise on any specific or proposed installation.

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