

User programmable computer graphics reducing host burden while optimizing the 4110 Series graphics capabilities.

4110 SERIES LOCAL PROGRAMMABILITY

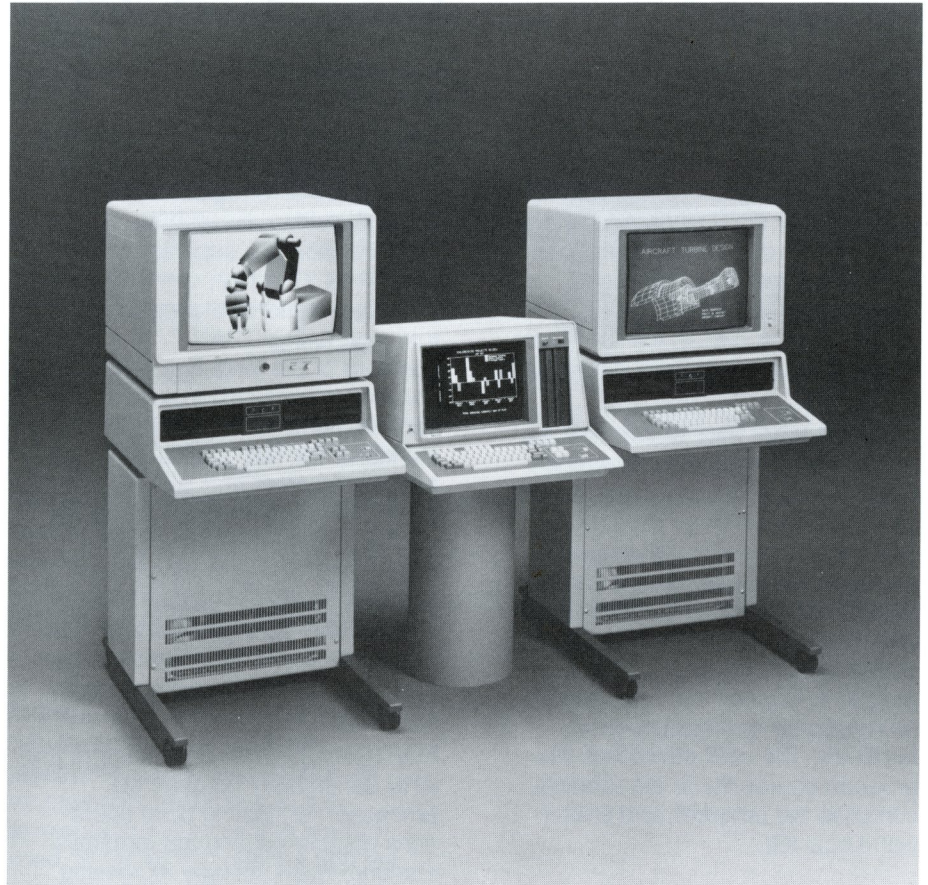
Tektronix' 4110 Local Programmability puts graphic computer power where it belongs, in the hands of the user. Providing direct, local access to all 4110 Series Computer Display Terminal features, Local Programmability reduces, or in some cases eliminates, dependence on host computers.

Local Programmability supplies all the elements required to locally write, edit, compile, link, debug, and run programs; to access all the graphic and alphanumeric features resident in the 4110 Series firmware; and, to control peripherals connected to the terminal.

The package consists of a disk-based CPM-86* operating system, a FORTRAN-86** compiler, utility programs and a library of Low-level Terminal Interface (LTI) subroutines. A local version of Tektronix' PLOT 10 Interactive Graphics Library (IGL) and a macro assembler are also available.

Older 4110 Series terminals are easily upgraded to Local Programmability. The recommended system configuration includes a minimum of 256K bytes of RAM. The user can expand local memory up to a total of 800K bytes on the 4114 and 4113 and up to a total of 672K bytes on the 4112.

For development of system and application programs, the terminal needs either two flexible disk drives or one flexible disk drive and one Winchester disk drive. However, to execute programs, only one disk



drive is required. The Winchester disk can store up to 10M bytes of data, and up to 4 drives can be connected to the terminal. Each 8-inch flexible disk provides up to 494K bytes of file storage.

Local Programmability delivers increased productivity by applying the benefits of "distributed processing" to graphics applications. The user has the flexibility to run entire programs locally or to connect the terminal to a host system. Though some applications, at least in part, require the compute capabilities and data base management of a main-frame computer, the terminal can still be used on a stand-alone basis for

the pre- and post-processing of graphics information.

By promoting more efficient use of the host system, Local Programmability cuts costly host-connect and host CPU time. The host is freed to do the processing it was designed for and can better serve the jobs that need its power. In a time-sharing environment, distributed processing allows the host to support more terminals.

**Preliminary Specifications.
Subject to Change.**

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Local Programmability also significantly reduces "down time". Even if the host computer is unavailable, the terminal can be used as a stand-alone unit to run or develop programs. Many applications such as mapping, CAD/CAM, data analysis and graphing can be written and run locally on a 4110 Series terminal without any host support. For example, digitizing a map on a graphic tablet can be performed locally on the terminal without the high costs of online communication with a host system.

One of the key features of Local Programmability is that it provides a convenient local access to the wealth of 4110 Series terminal-resident graphics functions.

The Low-level Terminal Interface (LTI) is a library of FORTRAN-callable sub-routines that correspond directly to each of the terminal's functions. Designed for efficiency, the LTI affords a quick path to the terminal's firmware while occupying a minimum of memory.

Optional local Plot 10 IGL has a rich set of graphics tools needed to turn an idea into a meaningful display in minimum time. Thus more time can be spent on application analysis and less on coding graphic's routines. Local IGL is compatible with similarly configured host versions of PLOT 10 IGL. Existing host programs that call IGL routines can be run locally on 4110 Series terminals. The user downloads the program source file to the terminal, compiles the program, and links it with Local IGL.

Local IGL also allows software designers to develop application programs on a 4110 Series terminal which can be run with other Tektronix terminals, such as the Tek 4010 or 4020 Series.

Based on SIGGRAPH's proposed core system of computer graphics standards, Local IGL's basic module, the Primary Command Set, contains the fundamental routines needed to output two-dimensional graphics and text on all 4110 Series terminals. Other modules include advanced features such as Graphic Segment Support; Panel Support and Emulation; and Graphics Text Composer and Emulation.

Local Programmability allows the user to develop programs using FORTRAN-86 or optionally the ASM86 macro assembler.

FORTRAN-86 is a superset of the FORTRAN 77 subset defined by the American National Standards Institute (ANSI). FORTRAN 77 is a new standard of the language which incorporates many extensions to and improvements of the 1966 FORTRAN standard. The new standard increases the scope of the language by supporting enhanced file structures as well as Free Format input/output, data declaration and subprogram facilities. There are several other enhancements such as IF/THEN/ELSE blocks, IF and ELSE IF statements, character data type and character functions.

FORTRAN-86 takes advantage of the 4110 Series 8087 numeric co-processor for floating point operations complementing the terminals' standard 8086, thereby increasing throughput.

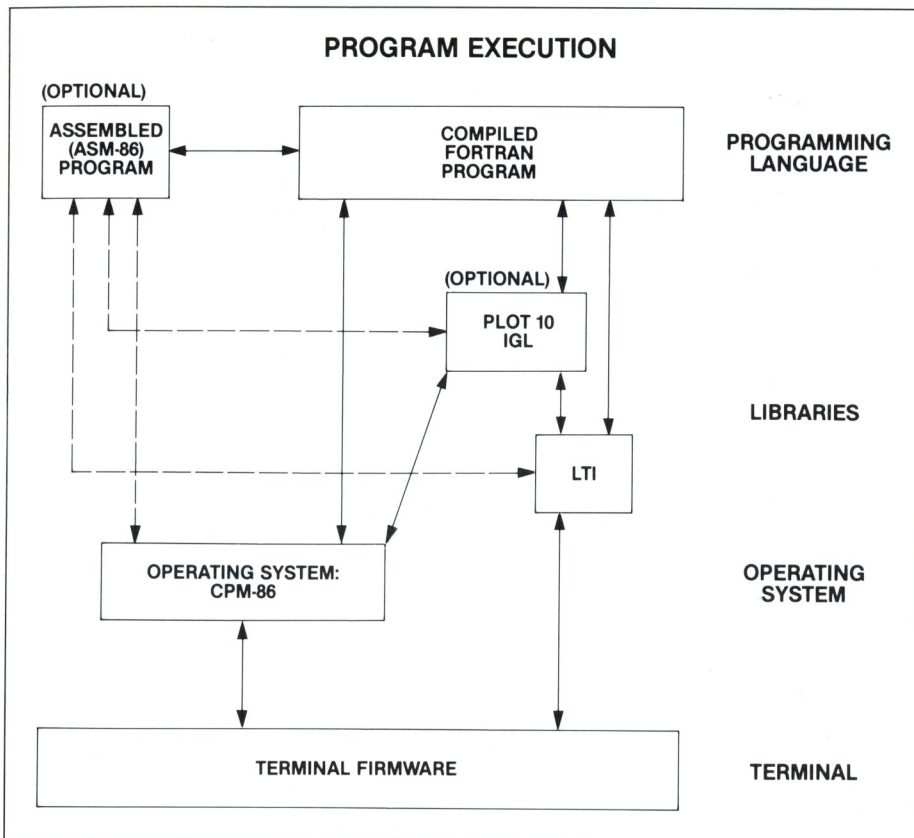
The optional ASM86 is a macro assembler for the terminal's processor, translating symbols and mnemonics to machine code instructions. Because it generates object modules compatible with FORTRAN-86, assembler output can be directly used by FORTRAN 86 programs.

Tektronix chose an industry standard 16 bit operating system, CP/M-86,

in implementing Local Programmability. Designed as a single-user, disk-based system, CP/M-86 is a computer program which allocates system resources. It allows the user to create and manipulate files, manage disk storage, control peripherals and even ask for help. Though the 4110 Series terminals are not intended as CP/M-86 workstations, the user may benefit from the large base of existing CP/M-86 compatible software and files.

CP/M-86 supports 2 powerful utilities — LIB86* and LINK86*. LIB86* allows the user to build and maintain a library of object modules. LINK86 combines object modules from FORTRAN-86, LTI and the optional IGL or ASM86 into load modules.

With the LINK 86-LIB86 sequence, Local Programmability gives the user the flexibility to completely control which modules comprise his program and where they are located in memory.



This diagram illustrates the relationships of software modules for a terminal with Local Programmability. As an example, the user can use FORTRAN to compile a program which accesses PLOT 10 IGL and LTI LIBRARIES, providing access to powerful terminal firmware features. The CP/M-86 Operating System allows the combination of these Tektronix supplied libraries with the user's program. The user's program may be written in either FORTRAN or with the optional ASM86 macroassembler. ASM86 can link to a FORTRAN program or directly to the Tektronix supplied libraries.

Other standard CPM utilities include DDT86* and PIP**. DDT86, the "debugging" program aids in detecting and correcting program errors. The PIP program performs important file transfer and processing operations. These standard utilities are supplemented by Tektronix developed programs including BATCH, BLKTRN, HOST and SPOOL. BATCH allows unattended execution of complex command sequences. BLKTRN gives the user a fast, efficient means to send large data files from one 4110 Series terminal to another. With the HOST utility, the user can transmit a file from the terminal to the host system (uploading) or receive data from the host and write it to a file on the terminal (downloading). SPOOL maximizes terminal operations by allowing files to be sent to a host or peripheral while the terminal performs other functions.

Tektronix' 4110 Series Local Programmability puts powerful graphic capabilities under user control. All the elements necessary to fully develop and run programs are provided. PLOT 10 IGL offers a rich set of graphic tools while LTI gives the user strict control of the terminal's firmware. Tek's Local Programmability has been specifically designed to fully optimize the graphics capabilities of the 4110 Series Computer Display Terminals.

Product Description

- Operating System
CP/M-86
- High Level Language
FORTRAN-86 by Intel
Superset of ANSI FORTRAN-77
Subset
- Low-Level Terminal Interface
Commands for
 - Local Segments
 - 2-D Transforms
 - Graphic and Alphanumeric Display
 - Peripheral Control
 - Data Communications
- Utilities (Tektronix Enhanced)
 - Editor
 - Upload-Download
 - 4110 Block Mode
 - Source Compare
 - Archive
 - Background Spooling
 - Help File
 - File Dump
- Numeric Data Processor
Intel 8087

Options

- Local Interactive Graphics Library (IGL)
 - Primary Command Set
 - Text and Fonts
 - Panels
 - Segments
 - Full Compatibility with host PLOT 10 IGL
- Mass Storage
 - 10M/Byte Winchester will be offered
 - Up to 8 drives per terminal

*A registered tradename of Intel Corp.

**A registered tradename of Digital Research, Inc.

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