Tektronix

Graphics

Solutions

The era of acceleration: In these times of computer technology, the speed of problem solving has become almost as important as the solutions themselves . . . because every obstacle to instant analysis delays and often distorts the final answers.

Graphics is solutions. Computer graphics is the response to an era when raw data can accumulate faster than the ability to use it. In many modern computer applications, manipulating alphanumeric data can be as bulky and impractical as roman numerals in modern mathematics. But Tektronix Graphics can eliminate the time lag between the acquisition and interpretation of information. It can maximize the interactivity between man and machine that makes creative solutions possible. It can reduce the opportunities for error throughout the decision-making process.

Tektronix is more than Graphics. We're solution specialists. We've introduced a line of terminals to support all kinds of applications in science, industry, government and education. We've developed a low-cost, intelligent graphic system that decreases dependency on central computers. We've introduced a versatile terminal that brings graphics within the price of alphanumerics. We've designed software that encourages interactivity. Peripherals that enhance speed and precision. And we've engineered all our equipment within simplified, proven packages.

The mind thinks in mental pictures —so should a technology that serves as an extension of the mind. Thousands of users around the world now rely on the power of Tektronix Graphics to bring problem-solving speed and observational precision to the mind's eye.

Cover Photo:
4014-1 display courtesy of
Dr. Eric Teicholz
Laboratory For Computers Graphics
and Spatial Analysis
Harvard University

Computer display terminals

	Hard Copy Unit Compatibility	Keyboard and Character Set	Alpha Mode Mode		
			Char. Matrix	Char/ Line	Lines/ Screen
4006-1	4631				
4010	No				
		64 CH. ASCII	5 x 7	75	35
4010-1	4631				
4012		96 CH. ASCII Auto Repeat			
	4631		7 x 9	74	35
4013		96 CH. ASCII 88 CH. APL Auto Repeat			
4014	No				
		96 CH. ASCII Auto Repeat			
4014-1	4631			74	35
			7 x 9	81	38
				121	58
4015	No			133	64
		96 CH. ASCII 88 CH. APL Auto Repeat			
4015-1	4631				
4023	4632, Opt. 5	96 CH. ASCII Auto Repeat	5 x 7	80	24

Feedback. The greater the opportunities for feedback between a machine and its operator, the greater its versatility as a tool. Rapid, reliable feedback between man and computer is what Tektronix Graphic Display Terminals are all about.

The mechanical process of translating reams of computer output into the language of forms and concepts can be a costly bottleneck to the dialogue between operator and computer. Spontaneity comes to a standstill; the user can wait days to use data that the computer has produced in seconds.

Tektronix Graphic Display Terminals eliminate that bottleneck—not only by their ability to produce speedy, pictorial graphic and alphanumeric representations of data, but also by the interactivity inherent in their engineering and software. In their high information density. In their reliability through all kinds of applications and environments.

Our reputation as graphics leaders has been built not only on our advanced technology, but also on our development of an expanding number of terminals and supportive peripherals to meet specific applications, programming sophistication and economic considerations. There's a terminal package that fits your picture perfectly.

Displays and densities. All Tektronix Graphic Display Terminals feature direct-view bi-stable storage tubes for exceptional resolution without refresh rate or core capacity restrictions. Alphanumerics are formed by a hardware generator operating on a dot matrix system. Characters are automatically spaced, or may be positioned at random by x-y coordinates. Screen sizes range from our 11″ diagonal terminals to the 19″ big screen 4014-1.

This patented storage tube technology permits the information density, curve forms and flicker-free detail that distinguish Tektronix graphics from any other visual presentation. Standard on all graphics terminals are 1024X x 780Y viewable points. An optional Enhanced Graphics Module is available for the 4014-1 to boost resolution to 4096X x 3120Y viewable points for component design, seismic exploration, mapping, integrated circuit masking and scores of other demanding applications.

Graphics Mode Mode			Graphics Mode with Factory Installed Enhanced Graphics Module			Graphic Input Mode (GIN)	Display in. (cm)		Dimensions ins/lbs (cm/kg)				Input Power	
Addressable Points	Displayable Points	Vector Type	Addressable Points	Displayable Points	Vector Types	Addressable Points	Screen Size;	Display Area	H	W	D	WT	Volts	Watts
						Not Applicable								
1024 x 1024	1024 x 780	Solid Line	Not Applicable			3-1023 x 0-780	11" (27.94)	7.5" x 5.6" (19.05 x 14.22)	41.5" (103.41)	19" (48.26)	28.5" (72.39)	78 lb. (31.10)	110/220	192
1024 x 1024	1024 x 780	Solid Line	Not Applicable			3-1023 x 0-780	11" (27.94)	8" x 6" (20.32 x 15.24)	41.5" (103.41)	19" (48.26)	29" (73.66)	90 lb. (40.50)	110/220	192
1024 x 1024	1024 x 780	Solid Line	4096 x 4096	4096 x 3120	Solid Dotted Short Dash Long Dash Dot-Dash Also Point Plot Incremental Plot	3-1023 x 0-780	19" (48.26)	15" x 11" (38.10 x 27.94)	43.5" (110.49)	20" (50.80)	32.5" (82.55)	150 lb. (67.50)	110/220	420
Forms Ruling Package			Not Applicable			Not Applicable	12" (30.5)	9" x 5.5" (32.8 x 13.9)	12.5" (31.7)	17.5" (44.4)	27.25" (69.2)	46 lb. (20.9)	110/220	220

Alphanumerics and beyond. The same technology that makes possible fine-line graphics makes possible alphanumerics of exceptional versatility and readability. Choose from upper case or full ASCII/APL keyboard terminals; from 2590 on-screen character capacity to 8912 on-screen characters as one of four selectable alphanumeric formats on the 19" 4014-1/4015-1.

Our refresh tube 4023 Alphanumeric Terminal also offers convenient graphing power: solid vertical and horizontal lines for convenient forms ruling and bar chart construction, plus visual and data security enhancements like inverted, blanked, blinking and reverse field formats.

Supportive arsenal. Choose your weapons: thumb-wheel controlled cross-hair cursor, standard on most models; APL-enhanced twins to the 4012 and 4014-1 terminals; special software packages for the non-programmer and the pro; and a systems-building package of proven interfaces and peripheral support, including hard copy, graphic tablets and local tape or disc memories.

Priced-less performance. Tektronix pioneered the development of low-cost graphics. Today, our effect has been to make graphics as practical for the stock room, classroom or conference room as for those areas where graphics has become a mainstay. Our new 4006-1 is priced no more than many alphanumeric terminals. Our top-of-the-line 4014-1 offers high-powered capabilities no other terminal can approach at anywhere near its price range . . . which is why it's become one of the most popular of all Tektronix graphics terminals.

Mode changing. Any combination of graphics and alphanumerics may be built up in any sequence. In the 4014's enhanced graphics mode, the vector generator also provides any combination of solid, dotted or dashed lines. Integrity of straightness and curvatures are second to none. Models with cross-hair cursors offer simplified display definition and support window routines, easy vertical and horizontal alignments as well as menu-picking capabilities.

Computer compatibility? Immediate in most cases, thanks to interfaces and software support that have been used and trusted for years. For general graphics functions and specific applications, we've written a library of software that includes all levels of sophistication . . . and which incorporates a programming ease and graphics versatility that adds new dimension even to everyday routines.

Opening the lines of communication. The chart on pages 8 and 9 enumerates interfaces and software available to link Tektronix terminals to specific computers. Our Standard Data Communications Interface is included with each terminal to provide the basic data communications control. Typically connected to phone lines via modem, it features full asynchronous communication with rates selectable from 110-9600 baud.

For more sophisticated requirements, our Optional Data Communications Interface provides half duplex and additional baud rate flexibility. It provides even parity, plus a loop-back mode that enables a complete terminal check out from the keyboard.

As your system needs expand, we can accommodate them. Our minibus extender allows up to five additional interfaces, options and/or peripherals to plug into the 4010 Family terminals. Our display multiplexer card furnishes display and control information for one to three remote storage display monitors, allowing individual or simultaneous addressing.

Hard line on software. All Tektronix software is designed for ease, reliability, and to make maximum use of your terminal's graphic capabilities. Our extensive PLOT 10 library, adaptable to all our graphic display terminals, offers many popular implementation and utility packages. These include the PLOT 10 Terminal Control System—FORTRAN IV subroutines that offer modular construction of simple to complex graphic displays; PLOT 10 Advanced Graphing II, for plotting shortcuts and enhanced graphic formats; PLOT 10 APL Graph-II to take full advantage of APL's programming versatility; plus many other applications and equipment-oriented packages.

Programming muscle for the non-programmer. Our PLOT 10 Interactive Graphing Package helps the layman move quickly into a wide-ranging, conversational relationship with the computer via an easy, English language command structure. Written primarily to help the user launch into a graphics system of data base management, IGP's simplified, problem-solving power will be appreciated even by the professional programmer. Like all Tektronix software, it has been designed to help the operator feel a part of the program.

Processor compatability

Computer	Interface	Terminal	Software
IBM 360/370 WITH TSO	OPT. 1, STD.	4006-1/4010-1 4012/4014-1 4051 Option 1	PLOT 10 Software Family[1,2,3,4,5]
	OPT. 1, STD., OPT. 15	4013/4015-1	PLOT 10 Software Family[2,3] plus APL Graph-II Implementation for APL 360
	OPT. 1, STD.	4023	Dataform Implementation for IBM with TSO
GE 635	OPT. 1, STD.	4006-1/4010-1 4012/4014-1 4051 Option 1	PLOT 10 Software Family[1,2,3,5]
	OPT. 1, STD.	4013/4015-1	PLOT 10 Software Family[2,3,] plus APL Graph-II
	OPT. 1, STD.	4023	Dataform
UNIVAC 1108	OPT. 1, STD.	4006-1/4010-1 4012/4014-1 4051 Option 1	PLOT 10 Software Family[2,3,5]
	OPT. 1, STD.	4013/4015-1	PLOT 10 Software Family[2,3] plus APL Graph-II
	OPT. 1, STD.	4023	Dataform
DEC PDP-10	OPT. 1, STD.	4006-1/4010-1 4012/4014-1 4051 Option 1	PLOT 10 Software Family[2,3,5]
	OPT. 1, STD.	4013/4015-1	PLOT 10 Software Family[2,3] plus APL Graph-II
	OPT. 1, STD.	4023	Dataform
XDS SIGMA 5, 6, 7, 8, 9	OPT. 1, STD.	4006-1/4010-1 4012/4014-1 4051 Option 1	PLOT 10 Software Family[2,3,5]
	OPT. 1, STD.	4013/4015-1	PLOT 10 Software Family[2,3] plus APL Graph-II
	OPT. 1, STD.	4023	Dataform
CDC 6000 WITH KRONOS	OPT. 1, STD.	4006-1/4010-1 4012/4014-1 4051 Option 1	PLOT 10 Software Family[2,3,5]
	OPT. 1, STD.	4013/4015-1	PLOT 10 Software Family[2,3] plus APL Graph-II
	OPT. 1, STD.	4023	Dataform
CDC 6000 WITH SCOPE/INTERCOM	OPT. 20, OPT. 1, STD.	4010-1/4012 4014 4051 Option 1 asynchronous only	PLOT 10 Software Family[2,3,5]
	OPT. 1, STD.	4006-1	PLOT 10 Software Family[2,3,5]
	OPT. 20, OPT. 1, STD.	4013/4015-1	PLOT 10 Software Family[2,3] plus APL Graph-II
	OPT. 1, STD.	4023	Dataform

Computer	Interface	Terminal	Software
DEC PDP-11 WITH KL-11 TTY CONTROLLER	OPT. 2	4010-1/4012/4013 4014-1/4015-1	Terminal Control System Implementation for PDP-11 with DOS. (062-1529-91, 062-1529-03, in FORTRAN and assembler; also 062-1750-01, 062-1750-03, in FORTRAN) ALS 062-1432-01[4]
DEC PDP-11 WITH DL-11A INTERFACE OR DEC PDP-11/05	OPT. 16	4010-1/4012 4013/4014-1 4015-1	Terminal Control System Implementation for PDP-11 with DOS (062-1529-01, 062-1529-03, in FORTRAN) ALS 062-1432-01[4]
DEC PDP-8/e WITH TTY CONTROLLER	OPT. 17	4010-1/4012 4013/4014-1 4015-1	ALS 062-1430-01[4]
DEC PDP-8i	OPT. 3	4010-1/4012 4013/4014-1 4015-1	ALS 062-1430-01[4]
DEC PDP-11 OR PDP-8 WITH RS-232-A OR RS-232-C INTERFACE	OPT. 1, STD.	4006-1/4010-1 4012/4013 4051 Option 1 4014-1/4015-1	As Described above for each computer
	OPT. 1, STD.	4023	None
DATA GENERAL WITH TTY INTERFACE OPTION 4077	OPT. 4	4010-1/4012 4013/4014-1 4015-1	ALS 062-1427-01[4]
DATA GENERAL WITH RS-232-A OR RS-232-C INTERFACE	OPT. 1, STD.	4006-1/4012 4012/4014-1 4014-1/4015 4051 Option 1	ALS 062-1427-01[4]
	OPT. 1, STD.	4023	None
HEWLETT PACKARD WITH TELEPRINTER INTERFACE 12531B, C, OR D	OPT. 6	4010-1/4012 4013/4014-1 4015-1	ALS 062-1428-01[4]
HEWLETT PACKARD WITH RS-232-A OR RS-232-C INTERFACE	OPT. 1, STD.	4006-1/4012 4012/4014-1 4014-1/4015 4051 Option 1	ALS 062-1428-01[4]
	OPT. 1, STD.	4023	None

Footnotes

1 Tektronix' Software Family of FORTRAN IV programs include Terminal Control System (TCS), Advanced Graphing II (AGII), Interactive Graphing Package (IGP), Character Generation System, Display Multiplexer Utility Routines, Preview Routines for CalComp® Plotters, Flexible Disc Memory Utility Routines and Graphics Tablet Utility Routines.

2 AGII requires Terminal Control System for implementation.

3 IGP requires Terminal Control System and AGII for implementation.

4 Access Level Software written in the native language of the machine.

5 4051 and 4006-1 will not support Display Multiplexer Utility Routines, Flexible Disc Memory Utility Routines, or Graphics Tablet Utility Routines.

6 RS-232 Interfaces are minor add-on, strap change, or connector pin out changes for most DEC, Data General, and Hewlett Packard teletype controllers. See your computer sales representative for details.

Peripherals and Monitors

The same engineering excellence you expect from Tektronix Graphic Display Terminals is what you also get from our line-up of peripherals and displays. Start with a terminal and build your own personalized system of information gathering, input, storage and duplication, with the assurance that all Tektronix equipment is backed by warranty and worldwide maintenance.

Our terminals and peripherals are made for each other, so you get plug-in interfacing and easy start-up.

Lasting impressions. We've made quick work of quality record keeping with our 4631 Hard Copy Unit. Featuring simplified circuitry, "flip-top" maintenance and a variety of format adjustments, it produces dry, high-resolution copies of any display within 18 seconds for the first copy, 10 seconds for subsequent copies. For customers with video display or our 4023 Alphanumeric Display Terminal, the 4632 Video Hard Copy Unit provides clean copies of any RS170 Standard video refreshed raster image, with gray scale or black-and-white reproduction.

Local storage facilities. Cartridge tape or "floppy disc," one of our storage peripherals will serve your specific requirements. The 4923 Digital Cartridge Tape Recorder stores up to 200K bytes per tape. Our 4921/4922 Flexible Disc Memory offers one or two disc drive units, each with 262K byte capacity. All are immediately compatible with Tektronix terminals. They can help you trim timesharing costs, and can vastly exceed the efficiency of paper tape in minicomputer applications.

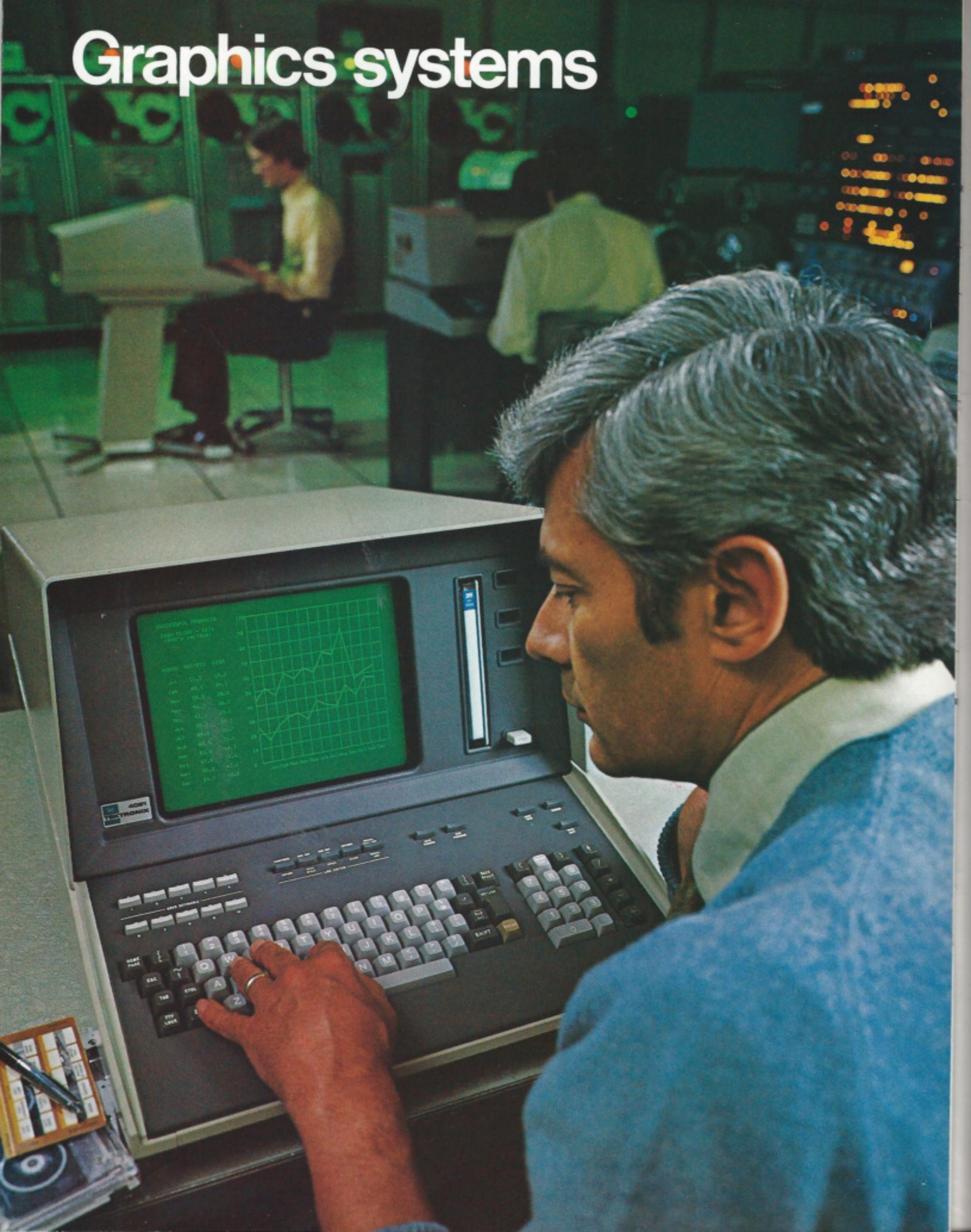
Aids to graphic input. Our 4953/4954 Graphic Tablets are 11" x 11" and 40" x 30" devices that enable tracing, digitizing or freehand graphics to be transferred to a terminal screen or the computer. You can input points—separately or continuously—with one of two instrument options: a pen or a push-button cursor.

The intelligent plotter. We offer one of the most advanced plotters in the industry, compatible with all Tektronix' terminals and within most RS-232-C environments. Our 4662 Interactive Digital Plotter features a built-in microprocessor that governs the stepping motors and internal vector generators. It draws alphanumerics in any size, digitizes with joystick control. It offers 6 character fonts for world alphabets. And dollar for dollar, it's got the quickest draw on the market.

Display line. Using our multiplexer card, up to three remote storage display monitors may be addressed at once. Two monitors are available. The 611 Storage Display Unit provides high resolution of high density displays, without flicker or drift. Our 613 Storage Display Unit offers bright display of large amounts of data.

Your local sales engineer can help you select the peripherals, options and accessories best for your system or terminal configuration, with the software to start it up. He will help prepare purchase and lease agreements, and provide the kind of technical expertise and applications awareness you appreciate.

Graphics systems



The 4081 Interactive Graphics System. (photo at right). The flexibility of refresh graphics systems has always come at a premium price: not only in terms of hardware, but also in the expensive and time-consuming task of designing operational and applications software.

The 4081 opens the possibilities of interactive graphic systems to more than an elite few. It offers the capabilities of $60,000 refresh-only systems for about one-half their price. It is the first device to merge the dynamic graphics of a refresh tube with the high-resolution, economical capabilities of storage tube technology. It is the first device to combine all hardware, firmware and operational software necessary for immediate start-up. Although it also offers a host of additional peripherals and enhanced capabilities, it's ready to work from the day you plug it in.

The complete picture. The 4081's two-in-one refresh and storage technology lets you minimize core requirements by moving, editing, enlarging, rotating and erasing selected portions of a display while the rest of the picture remains fixed. It offers 32K of local memory—expandable to 64K—for independent picture manipulation. It lets you further lower communications overhead, time-share costs and host loading charges with a built-in magnetic cartridge tape drive that supplies 250K bytes per cartridge of local storage.

Get working in a big way. The 4081's 19″ diagonal screen provides 2048 x 1536 displayable points, and allows up to 1600 vector centimeters of refresh graphics to be manipulated at any time in any combination with up to 50,000 vector centimeters of stored image. Emulator software allows the 4081 to duplicate the functions of the Tektronix 19″, 4041-1 Terminal.

A full complement of peripherals and programming support is

available . . . including the 4905 Mass Storage Module with flexible and hard disc for up to 40 megabytes of local storage, the 4641 Matrix Printer, our new 4662 interactive Digital Plotter—plus an additional cartridge memory, graphic tablets and our high-resolution, jam-free hard copy unit. PLOT 80 user software eases you into special applications functions.

Never before has so much picture processing capacity been available at anywhere near the price of the 4081. It's just one more frontier into which Tektronix has engineered an affordable first.

The 4051 Graphic Computing System. (shown on following page). The 4051 is an independent, compact, and graphic response to the practical problems of computer problem-solving. It brings immense observational and analytical capabilities right to your desktop, without high line cost, inflexible routines, waiting lines or large capital outlays.

Integrating many capabilities of terminal, mini and supercalculator, the 4051 combines enhanced, English-like BASIC language, built-in computing power and tape storage, with Tektronix' unique high-density graphics.

Independent laboratory. The 4051 gives any operator the elbow room to explore and experiment at his own pace, without worry about the costs of creativity. The 4051 offers an initial 8K of workspace, expandable in 8K increments to 32K. There's a built-in 300K byte mag tape unit for plenty of additional storage.

The 4051's BASIC vocabulary helps even the nonprogrammer relate to computer languages, allowing easy access to the computer. Special enhancements have been included to broaden BASIC's range and

power. Graphic extensions include WINDOW, VIEWPORT and ROTATE. We've added string capability, a wide choice of math functions, special formatting commands and a unique interrupt control of peripherals. BASIC lets you work in your own data units, not raster or machine units.

Supplement these basics with Tektronix' own state-of-the-art software and instantly compatible peripherals, and you've got the resources to give shape to whatever you've got in mind. Wherever you are in programming sophistication, there's a software package available to give you the introduction and applications interactivity you require.

You can customize your 4051 system with peripherals like these:

The 4631 Hard Copy Unit, 4924 Magnetic Tape Drive, our 4662 Interactive Digital Plotter, or the 4952 Option 2 Joystick for increased graphics precision and interactivity.

Communications capability. Our low-cost Data Communications Interface Option puts virtually unlimited processing power at your disposal, by allowing the 4051 to perform the functions of a graphic display terminal. Edit off-line in any language. Send and receive in batch via the internal tape unit at asynchronous speeds up to 2400 baud.

The communications backpack is a special RS-232-C interface, with built-in firmware for interactive data communications mode selection.

Graphics arts. On-line or off-line, the 4051 delivers graphics resolution that no one else can offer at anywhere near the cost . . . 1024 x 780 addressable points on an 11-inch diagonal screen. Enough information density to make pages of logged data come alive as graphs and charts, time plots, function plots and complex schematics.

Interfaces include our I/O connection at the back of the 4051, which conforms to IEEE standard 488-1975 to assure compatibility with a wide range of instruments; our RS-232-C connector option that drives your choice of printer or printing terminal.

Software. A growing library of software programs is available in mathematics, statistics and electrical engineering.

Whoever you are—manager, researcher, educator, engineer or analyst—the 4051 can become the nerve center of your personal intelligence network. Add to that Tektronix' worldwide service and software support, and you've got a fast, flexible system right at your fingertips.

Calculators

Numbers. Mathematics. Measurement data. If these are your stock-in-trade, our powerful 31 Programmable Calculator and 31/53 Instrumentation System can give you the processing power of a mini, without major software development costs, and at a highly competitive base price.

More approachable, more accessible than any mini, the 31 can be easily and inexpensively dedicated to a single task—to desktop math computation, for example. Or it can be integrated within an instrumentation system and quickly programmed as a processor/control for any number of data acquisition and analysis functions. It can capture, translate, transmit, compare, record and store information—and generate the results via printer or optional plotter.

Solutions come naturally to the 31, because it thinks the way you do, in natural mathematical terms. Thirty-five math functions are built into the machine, with another 24 user-definable keys, so you don't have to use algorithms or convert to and from a binary language.

The 31's basic 512-step program memory can be expanded to a mighty 8192 steps, a match for the most demanding tasks. In addition, all or part of each program can be stored on the unit's built-in cartridge tape system. Full edit capability is standard, so you can debug programs in the shortest possible time, via insertion, deletion, stepping forward or back.

Test and measurement tandem. When you match the 31 to the Tektronix family of test and measurement instruments, you've got a processing package that you can program to automatically list, log, calculate and control raw data from whatever significance level you choose, with unequalled flexibility.

The instrumentation system consists of the calculator, 153

instrumentation interface with built-in power supply, a digital translator and any of our compact digital multimeters and counters. Each mainframe holds two plug-ins, and the calculator can control up to 20 plug-ins simultaneously.

Rip and read. The 31/53 does away with manual logging, strip and chart recorders, analog dials, gauges and other time-consuming methods. Coupled with transducers, it monitors pressure, thickness, displacement, fluid flow, torque, temperature and much more. It receives direct electrical inputs relating to voltage, current, resistance, frequency, and compares these and others against time and time-related events. It then manipulates the data as per programming, automatically or interactively, as statistical parameters, averages, frequency distribution, group about the mean, curve fitting, and so on. It may convert input and label output on its alphanumeric printer.

Support to draw on. When solutions take shape the optional on-line 4661 Digital Plotter can quickly commit them to paper. You can make accurate presentation pieces of statistical data, histograms, schematics, sales and production curves—in any scale you choose, with exceptional repeatability.

For major program and data storage functions, plug in our 4921 single disc, or 4922 dual disc flexible disc memory. They make the 31's management, control and storage capabilities virtually unlimited.

Finally, a variety of interfaces and a library of reliable statistical and mathematical software routines are available, so your 31 calculator or instrumentation system can realize its full flexibility, right from the first day. We've put a small price tag on developing a highly personalized system.

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