



**Product Information and Specifications**

# GEN.II Retro-Graphics for TeleVideo,<sup>®</sup> Lear Siegler, and ADDS.

## Graphics with Greater Intelligence, Versatility, and Ease of Use.

The first generation of Retro-Graphics terminal enhancements from Digital Engineering enabled Lear Siegler and DEC™ terminal owners to upgrade their displays to powerful bit-map graphics workhorses, without the loss of alphanumeric features. These advanced products provided Tektronix® 4010 Series graphics terminal emulation, standard to medium resolution, vector drawing, point plotting, selective erase, and graphics software compatibility — features that added up to performance benefits that many end users and OEMs were seeking.

## More Power, More Memory from the Second Generation.

Now Digital Engineering (DE™) has once again taken a pioneering step ahead. Our second generation of enhancement products, called GEN.II Retro-Graphics, gives you added bit-map graphics performance based on full emulation of the Tek® 4010 and emulation of the graphics functions of the Tek 4027 color graphics terminal, protocol familiar to most programmers, greater "resident" graphics intelligence, English-like commands, 8-bit microprocessing, larger memory capacity, and more efficient input and output features.

The GEN.II Retro-Graphics enhancement consists of a terminal-specific printed circuit adapter card connected to DE's model RG1000 Universal Graphics Card. The RG1000 provides a raster-scan, bit-mapped display format of 640 horizontal by 240 vertical, with a display area always in 4:3 aspect ratio. The complete user-

installable graphics kit, both adapter and RG1000 cards, can be plugged into the host terminal in a matter of minutes.

The list of alphanumeric terminals that can now be upgraded with monochromatic, model RG1000 GEN.II Retro-Graphics includes:

- TeleVideo's 910, 912, 920, 925, and 950
- Lear Siegler's ADM 3A, ADM 3A +, and ADM 5
- ADDS VIEWPOINT and VIEWPOINT/3A PLUS

A variety of GEN.II features bring full graphics capabilities to your work environment quickly and easily. With the increased local intelligence supplied to each upgraded terminal by GEN.II, dependence on host software and host computer resources is dramatically reduced, providing the speed that MIS managers and programmers appreciate.

## A Command Structure That Eases Graphics Programming.

The GEN.II Retro-Graphics enhancement gives you complete monochromatic emulation of the graphics functions of the Tek 4027 color graphics

terminal and full emulation of the monochromatic 4010 Series terminals. This means you can exercise such functions as circle and pie chart drawing, absolute and relative vector drawing, polygon construction, and area fill with up to 64 dithered shading patterns (in GEN.II's case, the 4027's colors are mapped to one-color shading patterns).

Each imaging function is available automatically, with just a few simple keystrokes, and each is based on the familiar English-like 4027 command structure for simple graphics operation and programming. For example, by typing or transmitting from the host the following command string:

**!PIE 200, 90, 120**

the GEN.II Retro-Graphics enhanced terminal will draw a pie chart sector with a radius of 200, and will fill in the area between 90 and 120 degrees with one of 64 dithered shades.

Or, the following command string:

**!RPO 0,0 200, 0 0,200 - 200, - 100**

will create a filled polygon — which resembles a cross-section of a shed with a sloped roof — using relative vector coordinates. All the other graphics functions can be performed with commands that are just as easy to understand and carry out. And if any



one chart or image is needed for viewing at a later time, Retro-Graphics will store it and retrieve it on command.

GEN.II's English-like commands are also used to define and shape text characters. Full ASCII, APL, and user-defined *dot-matrix* character sets are provided as well as ASCII and user-defined *vector-generated* character sets — special text-handling features allow 90-degree rotation, proportional spacing, variable height and width of characters, and italics.

In addition, GEN.II upgrades give you differing line formats, with your choice of solid, dotted, and dashed lines, plus mode-independent selective erase. Transparent mode permits use of the terminal's alphanumeric features. And status messages from the terminal, as well as an internally generated test display, are also standard GEN.II Retro-Graphics features.

### **Software Compatibility That Protects Your Hardware Investment.**

For the computer graphics user — either beginner or veteran — software is a critical consideration. The beginner needs to get graphics up and running easily, while the experienced programmer wants to take immediate advantage of the graphics terminal's power. Since the GEN.II products offer compatibility with the Tek 4027 and 4010, you're assured that Retro-Graphics will work with a variety of utility and applications programs, available now or in the future. And that means your investment in terminal hardware is well protected because you won't have to switch to new terminals as new software becomes available.

The programs developed in the future for Tek-compatible terminals will work with already existing programs — and they'll work on Retro-Graphics enhanced terminals as well. Software developed in-house, by your own programmers, will require no modification on future Tek-like and Retro-Graphics enhanced terminals. This also means that even if you move up from monochromatic or gray-scale Retro-Graphics to Color Retro-Graphics™ enhanced terminals, you can transport your graphics software as well. (See the side bar entitled "GEN.II Retro-Graphics Terminal Enhancements. High-Performance Graphics at Low Cost.")

And given the fact that the GEN.II upgrade already saves you from one-third to one-half the cost of a comparable graphics terminal, the added protection provided by software compatibility gives you the economical edge you're after.

Currently, Retro-Graphics products are successfully being used with ISSCO's® DISSPLA® and TELLAGRAF®, Tektronix' PLOT 10™, Megatek's Template™, Precision Visuals' DI-3000™, and Signal Technology's Interactive Laboratory System (ILS®). These popular applications and utility packages are widely used in a variety of business, engineering, and scientific applications, and of course, other graphics software packages now in development will become available for the Retro-Graphics enhancements of the future.

### **Versatile Graphics Input and Output.**

The GEN.II-fitted ADDS, Lear Siegler, and TeleVideo terminals are supported by a number of input and output devices available directly from DE. These I/O tools help you create

the graphics you want, and communicate them to others with ease, giving the computer user added versatility and flexibility.

Digital Engineering's input device offerings include an optional light pen which is triggered by touching its tip to the terminal screen. Once triggered, the light pen communicates the targeted X-Y coordinates to the host computer. The light pen emulates Tektronix' Graphics Input (GIN) mode, and is especially useful in applications employing menu selection. Likewise, a crosshair cursor — standard on all Retro-Graphics enhancements — is positioned by pressing one of four keyboard keys. GEN.II is also compatible with the Summagraphics™ Bit Pad One™ and Bit Pad 10™ digitizers — devices that are widely used for transforming X-Y coordinates to digital equivalents to be manipulated by the computer or for tracing continuous and complex graphics lines.

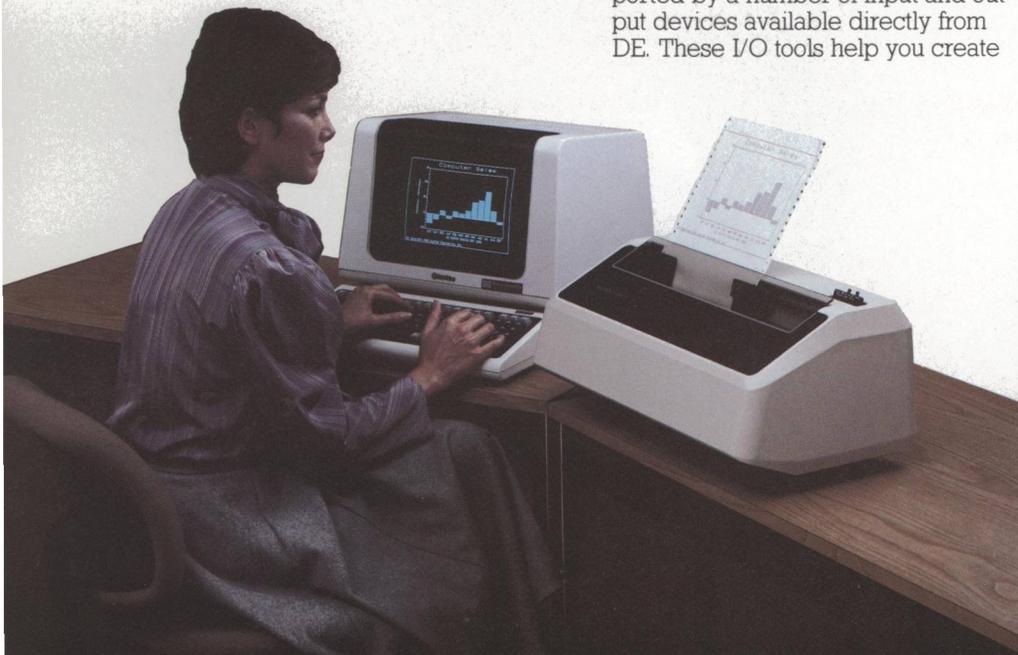
Graphics output devices help make the communication of difficult concepts easier by offering hardcopy presentation of designs and images. A number of printers with RS-232 serial interfaces are supported by GEN.II enhanced terminals, including thermal printers for low-cost operation and impact printers for fast, high-quality printing. An RS-170 composite video output can also transfer screen images to remote monitors, some printers, and to photographic devices for overhead transparencies, 35 mm slides, prints, and other video formats.

All of the I/O devices are interfaced to the GEN.II-enhanced terminals through a simple system of connectors. For starters, a light-pen port is standard on the GEN.II-enhanced Lear Siegler, TeleVideo, or ADDS terminal. If a serial printer or digitizer is to be connected to the upgraded terminal it is accomplished via an optional I/O Device Interface. For multiple input/output applications — including those that require RS-170 composite video output — DE offers an optional I/O Expander, which plugs into the I/O Device Interface connector.

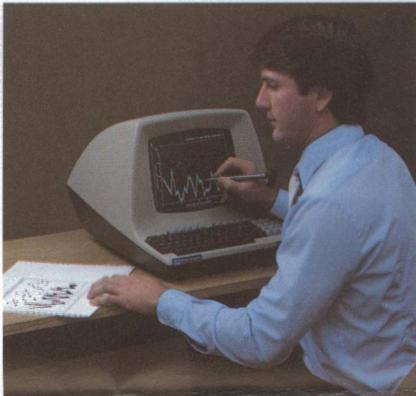
With these easily installed options, the addition of input and output devices to the user's system is as simple as plugging the right jack into the appropriate connection.

### **Support Services That Mean Business.**

Digital Engineering backs all of its Retro-Graphics enhancements and accessories with a full set of support services. To begin, we offer a com-



prehensive 90-day parts and labor warranty on each product, which



means you are assured of support right from the start. We also offer both factory and distributor-based main-

tenance services — as well as installation services — if needed.

Each authorized DE distributor in our worldwide network is backed by a fully trained DE customer service staff that can provide advice and technical assistance. A computerized shipping system also supports our distributors, assuring timely shipment of finished products and spare parts. In fact, factory repairs are turned around in 72 hours and spare parts are shipped within 24 hours of order. Finally, our in-house technical staff is always on hand to help customers — both end users and OEMs — solve whatever hardware or software problems may occur.

Complete documentation is also a vital ingredient provided by our sup-

port package. All of our products come with comprehensive operation and installation instructions, written and illustrated to ease the user through one simple plug-in procedure to the next and from one graphics operation to the next. This dedicated approach to documentation insures that you spend less time installing and learning our configuration and more time applying GEN.II Retro-Graphics to your immediate applications needs.

GEN.II Retro-Graphics from Digital Engineering. Combined with Tele-Video, ADDS, and Lear Siegler displays. The newest industry standard for cost-efficiency, local graphics intelligence, ease of operation, I/O support, and versatile performance in a bit-map graphics workstation.

## GEN.II Retro-Graphics Terminal Enhancements. High-Performance Graphics at Low Cost.

### The Graphics Advantage.

There's good reason for the growth in the use of graphics: Computer graphics makes it easier for managers, scientists, and engineers to understand and make use of the large amounts of complex data the computer is capable of generating.

**Graphics can help you define problems** — when you can see the rise and fall of sales figures on a bar chart you can quickly spot exceptions and variations.

**Graphics can help you solve problems** — for instance, with intelligent graphics software an optimum wing structure for high-altitude flight can be designed long before rivet meets metal.

**And graphics can help you communicate with others** — a picture or image can convince more quickly than a page of figures or words.

With computer graphics you can now master the problems of getting good information and using it to quickly make — and communicate — the right decisions. But you've still got the problem of choosing the right hardware and software to bring graphics to your business. And that problem often comes down to balancing the costs of computer graphics against the performance you need. Retro-Graphics terminal enhancements from Digital Engineering can help you solve the price/performance equation — to your advantage.

### Digital Engineering. The Industry Leader in Graphics Upgrades.

In 1978, Digital Engineering pioneered a concept that gave users a simple solution to the problem of providing cost-efficient graphics. With the addition of a printed circuit board to a standard alphanumeric terminal, that terminal is transformed into a full-featured, bit-map graphics terminal.

We began with our standard Retro-Graphics enhancement for the Lear Siegler ADM 3A and soon expanded the line to include DEC's VT100™ and VT132™ terminals, as well as Lear's ADM 5 terminal. These first generation products provided monochrome emulation of the Tektronix 4010 Series of graphics terminals in standard or medium resolution. Later we introduced our second generation of enhancements, GEN.II Retro-Graphics, based on Tek 4010 emulation and emulation of the graphics functions of Tek's 4027 color graphics terminal. This introduction was launched with our first gray-scale upgrade, configured for TI's OPTI 900™ Model 940 terminal. Our Color Retro-Graphics product for the Datamedia™ ColorScan™ color terminals was next, followed by GEN.II products for the DEC VT100, VT101™, VT102™, VT103™, VT131™, and VT132 video terminals, the TeleVideo 900 Series terminals, the Lear Siegler ADM 3A, 3A+, and 5 Dumb Terminal® displays, and the ADDS VIEWPOINT and VIEWPOINT/3A PLUS terminals.

With more than 20,000 Retro-Graphics terminal enhancements now in use, Digital Engineering has quickly become the industry leader in graphics add-ons.

With our low-cost Retro-Graphics cards, easily fitted into existing terminals, you can take advantage of the investment you've already made in display equipment. And because our enhancements are compatible with Tektronix terminals, you can get the same graphics performance for a relatively small investment. In fact, the Retro-Graphics upgrades often cost less than half the price of graphics terminals with comparable features.

The investment you make in Digital Engineering products insures both short- and long-term security. The final cost of your applications programs, including your investment in programming time and training, is well protected because the Retro-Graphics enhancements are fully compatible with industry-standard graphics software. Also, you lose none of the existing features of the terminal you have already installed, because adding graphics capabilities from Digital Engineering does not diminish the alphanumeric features you're now enjoying.

But in some applications having a powerful graphics terminal is not enough — interaction with the terminal is also needed. Here again Digital Engineering provides a variety of input/output tools that support the Retro-Graphics upgrade. In effect, Digital Engineering is a one-stop source for graphics. Further, Digital Engineering products are supported by complete documentation, full warranties, and maintenance services if needed.

Digital Engineering and Retro-Graphics. Our continued attention to the management of innovation is keeping us ahead. By making use of state-of-the-art technology, and building on our experience in graphics upgrading, we'll continue to bring our customers the advantage of sensible graphics — in monochrome, gray scale, and color, with full interactive capabilities.

## SPECIFICATIONS

### GEN.II Retro-Graphics for TeleVideo, Lear Siegler, and ADDS

**Product Configuration:** Model RG1000 universal graphics printed circuit board connected to terminal-specific GEN.II adapter board.\* GEN.II Retro-Graphics provides monochromatic emulation of the graphics functions of the Tektronix 4027 color graphics terminal and full emulation of the Tek 4010 Series of monochromatic graphics terminals.

Terminal Model	GEN.II Adapter Board Model	640 x 240 Resolution Universal Graphics Board
TeleVideo 925, 950	TV60	RG1000
910	TV61	RG1000
912	TV62	RG1000
920	TV63	RG1000
Lear Siegler		
ADM 3A, 3A +, 5	LS60	RG1000
ADDS		
VIEWPOINT	AD60+	RG1000
	AD60E+	RG1000
VIEWPOINT/ 3A PLUS	AD60+	RG1000
	AD60E+	RG1000

†Model AD60 accommodates 115V, 50/60 Hz operation only and model AD60E accommodates 230V, 50/60 Hz operation only. All other GEN.II adapter boards accommodate 115V and 230V, 50/60 Hz operation.

**Display Technology:** Bit-map raster scan.

**Display Medium:** Terminal's existing cathode ray tube.

**Display Area:** Dependent upon terminal enhanced with Retro-Graphics. Always 4:3 aspect ratio, typically 8 inches (20.3 cm) wide by 6 inches (15.2 cm) high.

**Resolution:** 640 horizontal by 240 vertical.

### Graphics Features

**Enhanced Text Features:** Five character sets (two are user-definable); two vector-character sets including standard ASCII and a user-definable set — characters are defined by height, width, line angle, fixed or proportional spacing; also three dot-matrix character sets including full ASCII, APL, and a user-definable set.

**Vector Drawing:** Draws vectors automatically from vector end-point coordinates. Maximum vector drawing time: 25 msec (25,600 pixels/sec.).

**Point Plotting:** Absolute addressing of points. Incremental point plotting — relative addressing, one of eight directions.

**Arc and Circle Drawing:** Defines arcs or circles by specifying center point, radius, and starting and ending angles.

**Polygon Drawing:** Defines arbitrary polygon up to 100 sides by specifying vertex points.

**Area Fill:** Automatically fills circles or polygons with one of 64 shading patterns — GEN.II maps Tek 4027 Color Standard colors to dithered shades.

**Line Formats:** Automatic generation of solid, dotted, or dashed lines.

**Selective Erase:** Mode-independent selection of light, dark, or complement of data intensity level.

**Interactive Graphics Cursor:** Crosshair cursor controlled by four cursor control keys. Cursor is used to transmit X-Y coordinate information to host computer or for drawing graphics logically. Emulates Tektronix' Graphics Input (GIN) mode.

**Light Pen (option):** Graphics interaction same as above (including GIN mode emulation) except light pen may be substituted for crosshair cursor. Light pen port is standard.

**I/O Device Interface (option):** Provides connection to a thermal or impact RS-232C serial printer or to a Summagraphics Bit Pad One or Bit Pad 10 digitizer. Summagraphics digitizer-only interface is also available.

**I/O Expander (option):** Required for interface to multiple serial I/O devices — connects directly to I/O Device Interface which supports both printers and digitizers (not compatible with digitizer-only interface). Includes two RS-232 ports and one RS-170 video port for connection to photographic hardcopy devices and remote video monitors. Also includes one light-pen port which may be substituted for GEN.II Retro-Graphics standard light-pen port.

**Transparent Mode:** The Retro-Graphics PC board can be logically "disconnected" from the terminal to permit use of the terminal's standard alphanumeric features.

**Computer Interfaces:** EIA RS-232C; non-volatile memory holds settings for parity (even, odd, none, high, or low), and independent transmit and receive rates of 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 9600 baud (bits/sec.).

**Power Requirement:** Dependent upon host terminal. Typically 115V and 230V, 50/60 Hz operation, with the exception of GEN.II Retro-Graphics for ADDS terminals — see "Product Configuration" section at the beginning of this specification sheet.

Specifications are subject to change without notice.

\*When ordering GEN.II Retro-Graphics terminal enhancements specify both the model RG1000 universal graphics board and the appropriate GEN.II adapter board. For example, by ordering models RG1000/TV60 the user's TeleVideo 925 or 950 terminal will be upgraded with GEN.II Retro-Graphics features on a 640 x 240 resolution screen format.

## PARTIAL LISTING OF GEN.II RETRO-GRAPHICS COMMANDS

MNEMONIC	INSTRUCTION	MNEMONIC	INSTRUCTION
<b>Graphics</b>		<b>Programming the Keyboard</b>	
GRAPHIC	Define graphics region	LEARN	Program keys and macros
ENABLE	Enter graphics input mode	EXPAND	Execute macros
VECTOR	Plot vectors	<b>Enhanced Text</b>	
RVECTOR	Plot relative vectors	CVSYMBOL	Define vector characters
LINE	Select line types	STRING	Display text string
POLYGON	Plot polygon	SYMBOL	Define dot-matrix symbols
RPOLYGON	Plot relative polygon	FONT	Download character font
PIE	Plot filled circles or sectors	DFONT	Delete user-defined font
CIRCLE	Plot circles or sectors	<b>Controlling the Display</b>	
INK	Plot with cursor	JUMP	Cursor address
SHRINK	Select scaling factors	ERASE	Erase screen
CMODE	Complement drawing mode	<b>Status Messages</b>	
DFLINE	User-defined line type	SYSTAT	Display status message
VIEW	Display graphics memory	TEST	Graphics test
<b>Block Transfer</b>		GTEST	Memory test
READBACK	Readback data to host	REPORT	Report terminal status
RASTER	Dump data to terminal	<b>Communications Status</b>	
MOVE	Duplicate part of the graphics memory	ECHO	Select local or remote echo
BITS	Set number of bits/pixel	<b>Input/Output Peripherals</b>	
<b>Color</b>		DIGITIZE	Digitizer input
COLOR	Select dithered shade	HCOPY	Print graphics hardcopy
PATTERN	Select dithered shading pattern	LPRINT	Printer option switches
MAP	Select dithered shading palette	<b>Retro-Graphics Characteristics</b>	
RMAP	Select dithered shading palette	PFKEY	Set local or remote use of function keys
MIX	Select dithered shading palette	TRAILER	Define trailer codes
<b>Terminal Status</b>		<b>Forms/Forms Fillouts</b>	
COMMAND	Select command character	ATTRIBUTE	Select character fonts
WORKSPACE	Define workspace	<b>Retro-Graphics Modes</b>	
MONITOR	Define monitor	ENTRY	Select entry mode
MARGINS	Define margins	INPUT	Select graphics input device
STOPS	Define tab stops		
SNOOPY	Display control characters		

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