H/Z-19

GRAPHICS
The Imaginator™

$445.
ASSEMBLED AND TESTED

H/Z-89
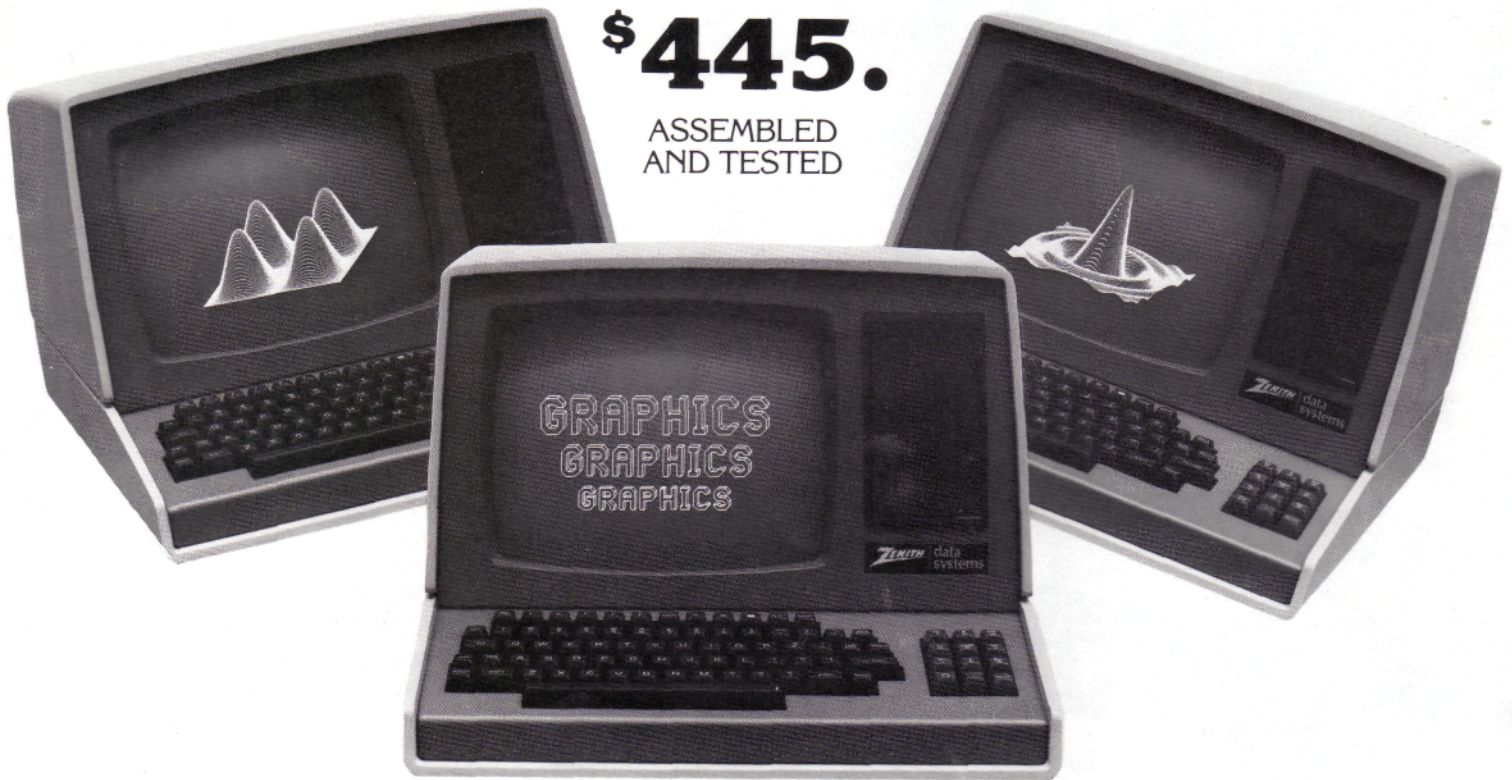
Professional Graphics at Practical Prices

IN USE THROUGHOUT INDUSTRY, EDUCATION AND GOVERNMENT

The Imaginator · the only intelligent, highly efficient, high resolution graphics retrofit unit for your Heath/Zenith. With The Imaginator's transparent operation, you haven't disturbed any of the normal capabilities of your terminal. Installation is a breeze. With pre-wired, plug-in jumpers and harnesses, conversion can be a simple field procedure involving a minimum of off-line time.

Performance is limited only by your imagination. With an on-board microprocessor and a rich instruction set, both you and your computer are free to concentrate on the problems at hand —not how to get it on the screen. Couple this with fully buffered communications (allowing asynchronous operation of terminal and host) and you have an intelligent, highly efficient method of displaying your data — whether it be business, scientific, or engineering. All at an easily imaginable price.

Features: ● Intelligent, high resolution (504 by 247 Pixel) Graphics Retrofit Unit ● Onboard microcomputer eliminates graphic processing load on host ● Fully buffered communications permits asynchronous operation of the graphics terminal and the host computer ● Transparent operation, all of the original terminal features are left intact ● Simple field installation ● Commands may be entered either when on-line via RS-232C or when off-line via keyboard ● Commands may be directly output from high level languages (i.e., Pl/I, Fortran, Pascal, Basic, etc.) ● Two modes of operation, easy to implement ASCII mode and high efficiency binary mode ● User expandable graphic command processor memory to 16K of E/P/ROM or to 8K of E/P/ROM and 8K of R/W RAM* ● Custom graphic commands may be downloaded from the host to reside in graphic command processor R/W RAM* ● Comprehensive documentation ● Source code available.

Rich Instruction Set: ● EnterGraphicsMode ● MoveTo(X,Y) ● PointAt(X,Y) ● LineTo(X,Y) ● AreaTo(X,Y) ● PriLineStyle(Z)-30 Styles ● SecLineStyle(Z)-30 Styles ● LineType(Z) On, Off, Complement, Read, Toggle to Alternate LineStyle at Boundary (Polyfill) ● DisplayToggle - Enable/Disable Graphics; Enable/Disable Alphanumerics; Erase Graphics; or any of eight combinations ● BringInProgram ● JumpToProgram ● ExitGraphicsMode ● **Economical**

*Expansion memory is an option. Heath H/Z-19 and H/Z-89 are registered trademarks of Heath Corporation, Benton Harbor, Michigan. Specifications subject to change without notice.

Cleveland Codonics, Inc.
18001 Englewood Dr., Cleveland, OH 44130   (216) 243-1198

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EXCERPTS FROM REMark
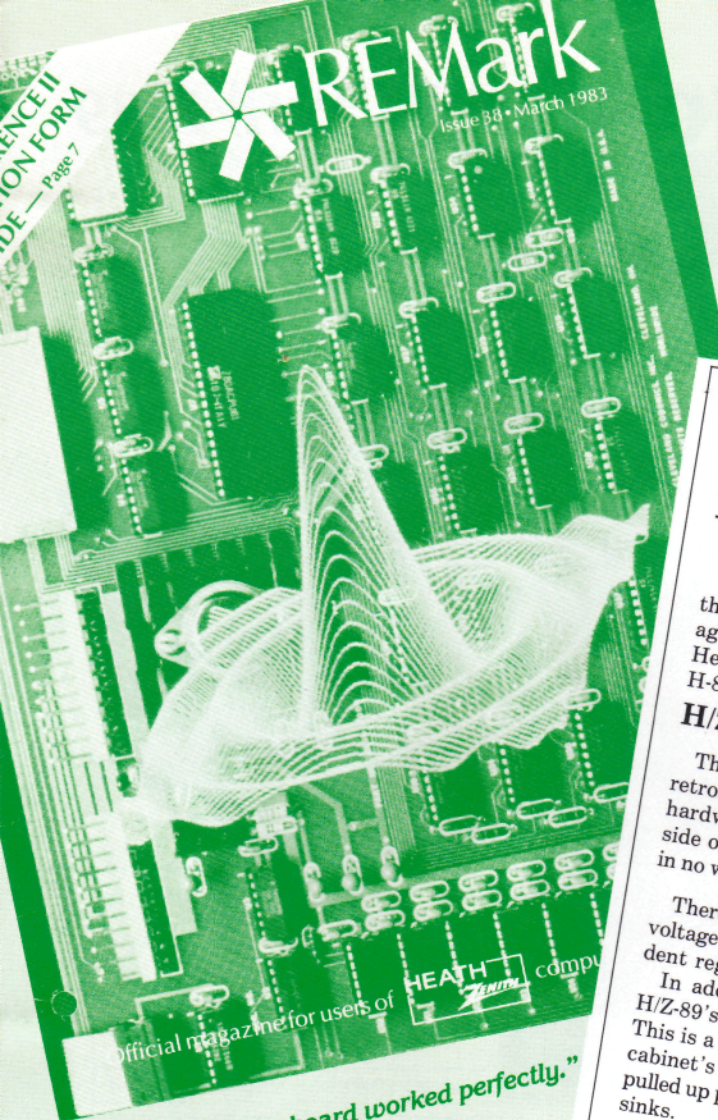
Imagination Gone Wild!

Review of Imaginator Graphics Board

by Jim Buszkiewicz
Technical Consultant
Heath Company

"Upon power up, the board worked perfectly."

"Construction and installation was quite simple and took a total of about three hours. No destructive modifications were necessary to the terminal logic board to install the kit. All that was necessary was the removal of two IC's and the insertion of two preassembled cables."

"The IMAGINATOR will have no problem finding its way into the worlds of business, science, education and that of the individual user. The possibilities for the IMAGINATOR are almost endless."

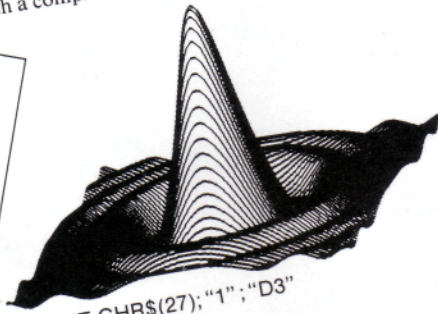"Construction and installation was quite simple."

The C C I Newsletter

Vol. 1, Issue 2

Cleveland Codonics, Inc. • P.O. Box 45259 • Cleveland, Ohio 44145

This newsletter was written to help answer some of the most frequently asked questions concerning the Imaginator retrofit graphics display board for the Heath/Zenith H-19, H-19A, and Z-19 terminals and the H-89, H-89A and Z-89 computers.

H/Z-89 Retrofit

The Imaginator is available in versions which permit retrofitting an H/Z-89 All-In-One-Computer. Mounting hardware is available for installing the Imaginator inside of the H/Z-89 cabinet. The addition of this board in no way interferes with Heath/Zenith's accessory line.

There is no additional burden placed on the H/Z-89's voltage regulators. The Imaginator has its own independent regulators.

In addition there is no heat problem. In fact, the H/Z-89's Terminal Logic and CPU boards run cooler. This is a result of aperaturing the cooling vents in the cabinet's cover. This forces greater air flow to be pulled up past the Terminal Logic and CPU board's heat sinks.

When ordering an Imaginator to retrofit an H/Z-89 remember to order the mounting hardware - it is not included.

Transparent operation

The Imaginator's transparent operation leaves all of the terminal's normal escape functions intact. The terminal's normal alphanumerics are totally independent of the Imaginator's graphics. The two displays can be overlayed on one another and may be individually altered under software control. Both alphanumeric and graphics images can be created in memory and restrained from being displayed on the screen. Once created they can be displayed instantaneously. Alternatively, the images may be displayed as they are created.

Graphics Modes

The graphics command processor (GCP) can be invoked to accept commands in either ASCII or BINARY format. ASCII mode has the advantage of easy user implementation of the graphics command language. All of the commands can be directly output by high level languages executing in the host computer (e.g. PL/I, FORTRAN, PASCAL, BASIC and, of course, ASSEMBLY languages). Standard, off the shelf, interpreters and compilers are all that are required (those languages need not have any special graphics instructions). No machine language driver programs are required.

The BINARY mode has the ad[...] ciency. A minimum of informat[...] specify an operation. Again, no sp[...] compilers are required but machine [...] suggested (even these are not requ[...]

Both of these modes are independ[...] puter, its operating system and the [...] used.

Command formats

All of the commands are describe[...] User's Guide Manual. Example progr[...] to clarify all of the concepts.

Graphics mode is entered by sending [...] ESC 1 (for ASCII mode, ESC 0 for B[...] These escape sequences normally perfo[...] in an unmodified terminal.

As an example of a typical command i[...] consider the PointAt (X,Y) command. I[...] form this command will draw a point at th[...] coordinate X,Y. If a point at 350,200 was [...] the host computer (or keyboard) would sen[...] ing ASCII characters; P 3 5 0 2 0 0. Once [...] is in graphics mode the following BAS[...] would suffice.

```
100 X = 350
110 Y = 200
120 PRINT "P";X;Y
```

Similarly, in BINARY mode, a PointAt (X[...] mand can be demonstrated. The command f[...]

Command Opcode							
7	6	5	4	3	2		
P	0	1	1	0	X₂		

First Operand

7	6	5	4	3	2	1	
P	Y₀	X₈	X₇	X₆	X₅	X	

Second Operand

7	6	5	4	3	2	1	
P	Y₇	Y₆	Y₅	Y₄	Y₃	Y₂	

P - parity

350 in binary notation is 101011110.
200 in binary notation is 011001000.

Therefore the command opcode is P0110110, the f[...] operand is P0101011 and the second operand [...] P1100100.

These are represented by the ASCII characters 6, [...] d, respectively. The host computer would send the thre[...] character sequence 6 + d to draw a point at 350,200 i[...] BINARY mode.

Contour Plot

The next program generates the contour plot seen in the following figure. Note how few steps are required to draw such a complicated shape.

```
010 PRINT CHR$(27);"1";"D3"
020 PRINT "P050023"
030 OY = 23 : OX = 50
040 FOR Y = 0 TO 100
050 FOR X = 0 TO 300
060 ZX = (X-150)*(X-150)/1790.5
070 ZY = (Y-50)*(Y-50)/199
080 Z = COS (ZX+ZY)/(SIN((ZX+ZY+.48)/82))
090 NX=X+Y+50
100 NY=Y+Z+20
110 IF F=1 THEN PRINT "M";NX;NY:F=0:GO TO 140
120 IF NY >= L(X+1) THEN PRINT "P";OX;OY;"L";
        NX;NY:GO TO 140
130 IF NY <= L(X+1) THEN L(X) = L(X+1): GO TO 150
140 L (X) =NY
150 OX=NX : OY=NY
160 NEXT X
170 F=1
180 NEXT Y
190 PRINT "E"
200 STOP
```

Tektronix 4010/4014 series graphics terminal emulation

We offer, as an option, a graphics command processor ROM that in addition to our native graphics commands emulates the Textronix® 4010/4014 series graphics terminals. This emulator provides instruction compatibility with most of the mainframe graphics packages available -PLOT 10™, ISSCO's TELLAGRAF®, DISSPLA®, etc.

Our Tektronix 4010/4014 emulator includes all of the standard features of the Tektronix terminals. Graphics Input Mode (GIN mode) is available with a keyboard controlled full screen crosshair graphics cursor. Dot-dashed line styles of OPTION 34 are present.

In addition to these standard Tektronix features our emulator permits selective erase, screen reads, alphanumeric scrolling and other enhancements. With this option the following modes are selectable either through host commands or keyboard commands, Heath/Zenith normal alpha mode, ANSI alpha mode, native graphics ASCII mode, native graphics BINARY mode, and the Tektronix 4010/4014 series, point mode, graph mode, bypass mode, and GIN mode.

Other Features

In addition to drawing points, lines and areas can be drawn by executing a single command.

Six different line types are available. These allow the user to draw lines, erase lines and complement lines, etc. These different line types equally effect PointAt, LineTo and AreaTo commands. For instance, setting the line type to OFF permits the user to selectively erase either a single point, an entire line or even an entire region. Setting the line type to READ allows the user to read information from the screen and send it to the host computer. This information can then be processed, stored on a disk, or sent to a printer to obtain a hard copy printout of the graphics image. Any portion of the screen can be randomly read. Either single pixels or display bytes may be read. All of this can be taking place with or without a graphics image being displayed on the CRT.

Dotted or dashed lines can be automatically generated by the GCP. There are 30 unique line styles available for drawing dotted or dashed lines and crosshatched areas. The line style pattern will stay in sync when drawing curves or when drawing lines that abruptly change directions.

These line styles also equally effect PointAt, LineTo and AreaTo commands just as the line types do. In fact, they work independently of the line type. For instance, a line drawn in the complement line type with a dotted line style will invert the pixels along its path in a dotted fashion.

Graphics processing and alphanumeric text output can be multiplexed to enable terminal prompts and graphics image formation to occur simultaneously.

There are several other instructions which permit the user to download custom graphics commands from the host computer into R/W RAM that may be mounted on the Imaginator.

All of the commands may be sent either from the host computer when the terminal is on-line or they may be entered by typing directly on the keyboard for off-line processing.

3.072 MHz Clock

The Imaginator is designed to run with either the terminal logic board's standard 2.048 MHZ CPU clock or the modified 3.072 MHZ CPU clock. (We are not implying that the terminal logic board itself was designed to run at the higher clock rate.)

Hard Copy Printout

It is a simple matter to obtain a hard copy printout of the graphics image on the screen if you have access to a printer/plotter. Most contemporary dot matrix printers permit the user to individually select which pins are to be impacted by using escape sequence commands. The Imaginator allows the user to READ the graphics image created. Therefore the host computer can read the graphics image, reorganize it (scale, clip, rotate, etc.) and transmit the image to a printer.

Pen plotters can be driven by the host computer with conditional subroutines that logically parallel the graphics terminal routines.

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January, 1983

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A FEW OF OUR CUSTOMERS . . .

ORDER FORM	Models		Unit Pice	Quantity	Part No.	Amount
Description	H-19, H-19A, and Z-19	H-89, H-90, Z-89, Z-90				
Assembled and Tested (All Manuals included)	9010-0000	9010-0010**	$445.00			
Kit (All manuals and parts included)	9000-0000	9000-0010**	$395.00			
Bare Board and Graphic Command Processor EPROM only	9500-0000	9500-0010**	$215.00			
Tektronix 4010/4014 Series Emulation Option	Append - T to part number		Add $75.00			
Source Code	9100-0050		$125.00			
User's Guide Manual - Price can be applied to later purchase of board	9100-0001	9100-0011	$25.00			
Assembly Manual	9100-0000	9100-0010	$18.00			
**Mounting Hardware Required for H/Z-89, etc.		9510-0010	$20.00			

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