

A Look at SigmaSoft's Interactive Graphics Controller

Along with high-resolution graphics, SigmaSoft's board offers an eight-port parallel interface and a RAM disk.

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If you are the owner of a venerable H/Z89 or '90, you belong to a group of folks who'd rather fight than switch to another machine. In spite of the advances in technology, this machine continues to grace the workstations of those "in the know."

However, the siren song of high-resolution graphics is threatening to bring the '89's life cycle to a close.

Third-party vendors, though, are still introducing hardware and software designed to keep the '89's obsolescence at bay. Two years ago, SigmaSoft and Systems introduced a parallel interface board with software to allow owners to use less expensive (and faster) parallel printers.

That card was just the first stage of a much more ambitious project: a high-resolution pixel-graphics board. With its introduction in August of 1984, SigmaSoft gave '89 enthusiasts an alternative to trading up to an H/Z100 or H/Z150.

SigmaSoft's Interactive Graphics Controller (IGC) is an add-on peripheral board that expands the capabilities of the '89. With each day of ownership, I've found more ways to make it useful. It's not a dedicated device, able to accomplish just a single task, but a useful extension to the system, a tool.

SigmaSoft also markets an H8 version of the parallel-interface board. The IGC system can be installed in an H/Z19 as easily as in the '89 and '90. If you have a Heath/Zenith terminal, that means your H8 is *not* obsolete, regardless of whether your H8 has an 8080 or a Z80 central processor unit (CPU). The installation differs between the '8 and '89 versions, but H8 owners can get all the benefits discussed in this article.

The ability to address single dots of light on the screen (or picture elements—pixels) is just one of many advantages you'll gain with the IGC.

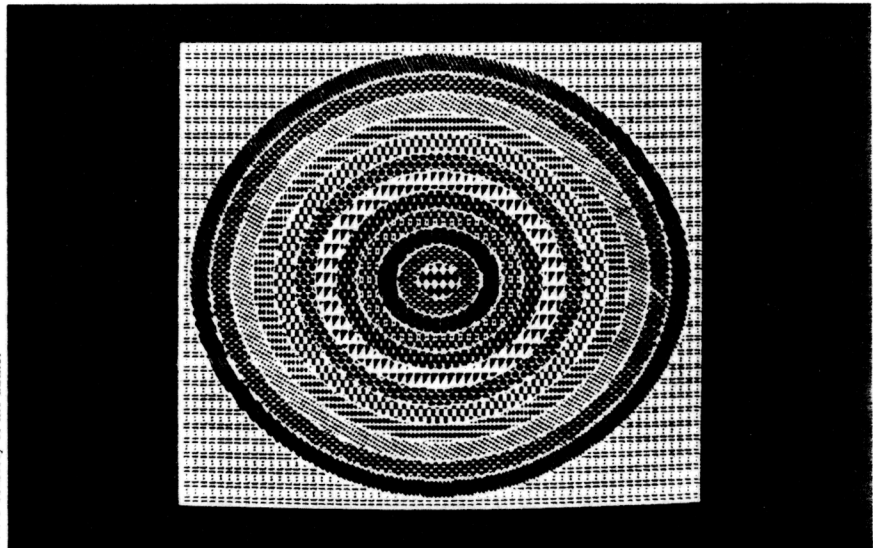


Photo courtesy of the author

Let's talk about the graphics first, though.

The '89 screen has a standard resolution of 80 characters by 25 lines. Independent vendors offer several sets of read-only memory (ROM) chips to control the character set the '89 displays. Using one of these ROM sets with modified graphics characters, a "medium resolution" is possible: 160 by 50 addressable blocks.

These blocks might be referred to as pixels, even though they are each made up of many dots of light. Each character on the standard 80 by 25 screen, however, is made up of an 8-wide by 10-high array of dots.

The '89's video board has enough random-access memory (RAM) to store a single byte (eight bits) of data for each character displayed, for 2,000 characters in all. The video controller board creates the character patterns using the character ROM as a guide (with a maximum of 256 different patterns).

To gain control of *every* dot on the screen, you'd need a "bit" of RAM to indicate the on-off state of its corresponding pixel. Simple multiplication ($80 \times 25 \times 10 \times 8 / 8$ bits per byte) indicates that 20,000 bytes of RAM would be required to fully map the video screen.

To take that much RAM from the normal workspace would be a hardship. SigmaSoft's IGC has its own RAM space, a full 64 kilobytes standard; this can be logically divided into three "pages" of video memory. Software can select both the page to be displayed and the page upon which read/write operations are effective.

What you get—the hardware

In the fall of 1984, a year after I saw the prototype, I got my board, the third one made, and only the second one in regular production. Since it was still a pre-release version, I got sketchy installation instructions and an incomplete user manual. Nevertheless, I had the

new board running within two hours. If you built your '89, installing this rig is a piece of cake. If not, here's a good time to get inside.

There are three basic components: the IGC board itself; a new auxiliary power supply; and SigmaSoft's now-venerable eight-port parallel interface (which mounts in one of the 89's left-side expansion positions). Those who have already purchased the parallel board can save \$95 on the IGC package.

The IGC requires six of the parallel board's eight input/output (I/O) ports, leaving two for your own use. SigmaSoft provides parallel printer driver software if that's how you wish to take advantage of one of the ports. The parallel interface board installs easily on the leftmost bus connector. A single chip is removed from the CPU board, and a cable from the parallel board takes its place.

The power supply is recommended if you have lots of boards in your '89 already. You have the option of deleting it for credit, but why tempt fate by overloading your existing supply? To install the new one, you must remove your internal drive and the large blue power capacitor mounted in the base of your machine.

I re-mounted the capacitor on the new power-supply board, and the new board eased back into the base plate like a knife into its sheath. No soldering is required:

you unplug the fan, plug its cable into the new supply, and run a new cable (supplied) back to the fan. Just replace the drive and you're done.

The IGC board is nothing less than a work of art. Mounted on two stainless steel hinged brackets, it neatly installs horizontally between the front panel and the CPU board, over the top of everything else. The hinged bracket allows access to your machine's innards. (See Figure 1.)

This location blocks the left air slots in the cover, which might seem unwise. But Clay Montgomery, the IGC's designer, contends that it actually improves cooling. That's an opinion others share.

The IGC requires cable attachments to your machine at several points. Again, no soldering is required, just removal of chips to allow cables to be plugged in. (Needless to say, observe the standard cautions to ensure you don't zap anything with static electricity.) One harness has four plugs for the terminal board, and another has a plug for the parallel board. Both cables attach at the rear of the IGC board to allow it to hinge.

As noted, the IGC comes standard with one 64K bank of memory. You can expand that to 128K by piggybacking memory chips on top of one another—or to 256K by putting in 256-kilobit RAM chips.

Being a guinea pig for the second production board, I chose to install my own 128K memory expansion. I recommend that you let SigmaSoft install it for you. The soldering, etc., is a pain. Besides, you might end up with marginal chips, as I did.

The expansion buys you double the IGC's normal resolution for bit graphics by allowing optional interlaced video, and you can have 128K of RAM disk rather than 64K. When the price came down for 256-kilobit chips, I upgraded my board for a rather effective RAM disk, with the option for graphics and/or spooling.

. . . and the software

Hardware freaks usually get lost in esoteric solutions to electronic problems, and forget Joe Average isn't on the same level. I bought a sophisticated serial/parallel/real-time clock board for my '89 several years ago. It took weeks to write my own software to access the clock. I have never tackled the parallel port for a printer. Thus it was with some trepidation that I opened the software guide for the IGC.

No problem. SigmaSoft has broken the facilities you need into three neat software packages, included with the board. These packages come in versions for CP/M and the Heath Disk Operating System (HDOS).

Graphics commands

In the descriptions below, the name of each command is given first in **boldface**, followed by a dash. The form of the basic command is shown in **boldface**; options follow immediately in *italics*. The form of a command shown below (e.g., A for Arc) is the minimum needed. IGC, however, will also recognize longer forms. (AR or ARC will also work.) Except where noted with an asterisk, an equal sign (=) may be substituted for the x,y coordinates; this invokes the current cursor position. Also, using a number-sign (#) specifies relative positioning rather than absolute.

Arc—A x,y,r1,a1,a2,r2,r3,...,rn
Draw an arc (or series thereof). Drawing modes Erase and Toggle are honored, as well as Scale.

Here, x,y is the radius center; a1 is the starting "degree" of the arc (1-360); a2 is the ending "degree," drawn counterclockwise; and r1,r2,...,rn is the radius of each arc to be drawn.

Box—B x1,y1,x2,y2,...,xn,yn
Draw a box (or series thereof) based on the coordinate pairs provided, using the current line STyle and Erase and Toggle modes.

Circle—C x,y,r1,r2,...,rn
Draw a circle (or series thereof) based on the center and radius (or radii) supplied. Erase and Scale modes are honored, STyle and Toggle are ignored.

Here, x,y is the center of the circle; r1...rn is the radius of each circle to be drawn.

CLear—CL
Clear all graphics pages to the currently selected CLear style. (See STyle.) Much faster than Erase, but limited in styles and scope.

CUrsor—CU x,y or CU ON or CU OFF

Control the graphics cursor, a crosshair that automatically overlays your graphics image. Used in developing your own interactive graphics tools.

DIsplay—DI p or DI s or DI p,s
Select one of three pages of graphics memory to display on the screen.

Here, p is a number (0-2) representing the screen to be displayed. Some limitations exist for the various hardware interlace options; s is an optional scan line number (0-255) from which to begin display. The s allows simple smooth scrolling or small vertical adjustments of the displayed image.

If DIsplay is used properly with

the Draw command, you can "hide" the actual construction of a screen. Just Draw your design on a page that's not being displayed on the screen; then DIsplay the page only when it's completed.

DOt—DO x1,y1,...,xn,yn

Place a single pixel dot at the coordinates specified. DOt honors the Erase and Toggle modes. Both absolute and relative addressing are available.

Draw—D p or D s or D p,s
Select the video page on which graphics commands are to take effect. (See DIsplay.)

Erase—E x1,y1,x2,y2,...,xn,yn *
Erase one or a series of rectangular areas on the current drawing screen. Erase replaces all pixels in the defined area with the current PAint style (whether or not that's the background color).

Here, x1,y1 defines the upper left corner of the rectangle; x2,y2 defines the lower right corner.

Additional rectangles can be cleared with additional sets of four coordinates.

Get—G x,y

Get a video image "word" (16 bits) from the address specified on the current drawing page.

IG: and IGC:—These are HDOS and CP/M modules that provide a high-level interface to control the graphics device. They are controlled by ASCII commands sent as if to a sequential file.

PD: and PDC:—These are HDOS and CP/M high-speed pseudo-disk drivers. Access to each is as though it were a standard disk drive, complete with directory. Under HDOS, you can even reboot from the pseudo disk.

SP: and SPC:—IGC also comes with HDOS and CP/M RAM spooler software that frees up your system during interminably long printouts. Under CP/M, the driver actually intercepts output to the logical LST: device and re-routes it to the spooler.

SigmaSoft provides printer support software for both HDOS and CP/M-80. Clever programming by SigmaSoft provides HDOS-like device drivers under CP/M, which even include the SET command.

Each module has options to specify which of your four possible memory banks are to be used. The IG: module has screen-dump support for most popular printers, including I.D.S., Epson, M.P.I., Okidata, Mannesmann Tally, and C. Itoh printers, with more coming.

The CP/M drivers are installed into RAM using SigmaSoft's LOADD.COM program. This can place the module into RAM above the operating system if you

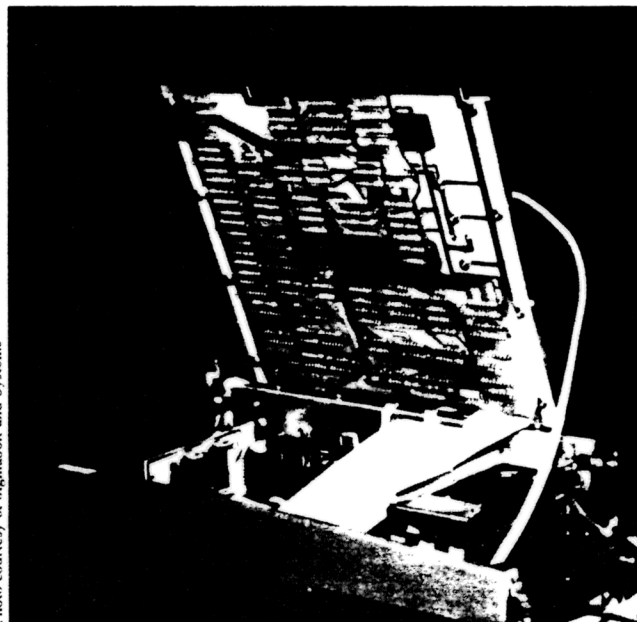


Figure 1. The IGC board can be flipped up, allowing access to your machine's innards.

have reserved space for it; or it can place it just under the operating system, adjusting memory pointers accordingly.

You get a RAM disk

You thought this was a review of a graphics controller, right?

Well, if you're like me, you won't use graphics more than 25% of the time, probably less; the rest of your time is

used for more productive things like compiling programs, bookkeeping, etc. Using software included in the purchase price, the IGC can double as a very fast RAM disk under both HDOS and CP/M.

There's nothing like seeing HDOS boot in less than two seconds, or a PL/I compile running at RAM speed, all in total silence. One practical use I have is

GO—GO x,y

Set the "current" coordinate to the defined pixel address.

Input—I Left or I Right

Read status from one of the two optional input devices (e.g., joystick, trackball).

Line—L x1,y1,x2,y2,...,xn,yn

Draw one or a series of lines between the coordinate pairs specified, using the current STyle, Erase, and Toggle settings.

Mode—M+ (options) or M- (options) or M= (options)

Set and clear various graphics-driver settings. A prefix toggles the mode on (+), off (-), or "exclusive" (=) (which sets all other modes not mentioned back to default settings).

The options are: P (Pixel) high-resolution graphics mode; C (Character) normal text mode; I (Inverse) same effect in graphics as H/Z19 and '89 inverse video; A (Alternate) use available alternate character set; E (Erase) plot "black" dots instead of white ones; and T (Toggle) reverse the state of each pixel addressed.

Origin—O C or O B or O T

Define the coordinate system desired.

With C (Center), point (0,0) is the center of screen; left is -x, down is -y,

range is (-320,-249) to (320,249). With B (Bottom), the lower left corner is point (0,0); right is +x, up is +y.; range is (0,0) to (639,499). And with T (Top) the upper-left corner is point (0,0); right is +x, down is +y.; range is (0,0) to (639,499). T is the same as the '100's coordinate system; it's not recommended by SigmaSoft except for compatibility.

PAint—PA x1,y1,...,xn,yn *

Fill any outlined regular or irregular polygon with the current PAint Style, beginning at the coordinate(s) specified. The object *must* be completely outlined by a *solid* border, or the PAint will "bleed."

The state of the defined pixel specifies the color of the area(s) to be PAinted, and the opposite color is regarded as the border color. A new feature is the ability to define a private PAint pattern in addition to the 49 STyles supplied. (See PATtern, below.)

PATtern—PAT n1,n2,...,n7,n8

Set private bit-map pattern for PAint STyle number 50; using an 8x8 dot matrix, eight decimal numbers specify separate lines of the pattern.

PRint—PR or PR p,s

Output the current display page to a supported dot-matrix printer. Here,

p is the desired page to be dumped; and s is the scan line from which dump is to commence.

PUt—PU x,y

Write a binary "word" (16 bits) at the coordinate specified on the current drawing page.

Reset—R

Reset the device driver to its default settings.

SCale—SC x,y

SC can be used to re-scale objects drawn using the relative addressing option. All relative coordinates supplied by the program after this command are rescaled by the supplied factors. Absolute addresses will not be affected.

Both x and y are integers. If x or y is negative, the resulting image has the appropriate axis "flopped."

STyle—ST s0,s1,s2

Selects the styles of lines and fill patterns used by subsequent graphics commands. Here, s0 is the line style, one of 12 (dots, for instance, or dashes); s1 is the area paint styles, one of 50; and s2 is the clear (rectangular) area styles, one of 4.

Test—T x,y

T returns a value of "0" or "1" for the "black" or "white" state of the tested pixel.

PL/I-80 Compile Times		
Source Drive	Compiler Drive	Elapsed Time
Z37	Z37	2:00
RAM	Z37	1:15
Z37	RAM	1:48
RAM	RAM	1:03
LINK Times		
LINK Libraries	Object Files	Elapsed Time
Z37	Z37	2:54
RAM	Z37	1:42
Z37	RAM	2:37
RAM	RAM	1:03

Table 1. Comparative times (in minutes) for compiling and LINKing a PL/I-80 program (under CP/M) with the program files on the Z37 floppy-disk drive and on the Interactive Graphics Controller acting as a RAM disk.

to load my master file catalog into the RAM disk while I'm doing my library maintenance. I can scan the whole 120K file with lightning speed, as many times as I wish, using an ordinary search utility.

How much performance can you expect from the RAM disk? Even a 256K RAM disk can limit you, since it is a fixed resource. To make it most effective, I found it a good policy to place only my most active files on the RAM disk.

A compile and LINK of a PL/I-80 program under CP/M is a good, reasonable exercise. By experimenting with different files on RAM disk and alternating the "default" CP/M drive, I got some surprising improvements over the floppy drive. The results are given in Table 1.

You can't boot the RAM disk (drive M:) under CP/M, but you can log onto it as the current drive. Under HDOS, the drive is PD0:. Examining the RAM disk with SZAP, a disk-dump utility from The Software Toolworks, reveals that it produces a convincing directory under either operating system. You can configure the RAM disk to use up to 256K. Or you can use selected 64K banks of the IGC memory, to allow other banks to be used for graphics and/or spooling. In any case, you'll see a significant improvement in the speed of I/O using the RAM disk.

And fast graphics

Enough about the RAM disk for now. The IGC is billed as a graphics device, and it fits the billing.

Having had a Z100 for the last two years encouraged me to make comparisons. Leaving the graphics aside, most will agree that an '89 with a 4-megahertz speed-up will run circles around the '100. It doesn't matter whether the '100 is running CP/M, CP/M-86, the Zenith Disk Operating System (Z-DOS), or even Newline Software's '100 emulation of HDOS.

Mind you, I'd never give up my '100's

32-megabyte hard disk, 8" drives, 768K RAM, and all the other features the new technology offers. The fact is, though, that for much of my work I still prefer the compact '89 with its 782K floppy drives and high speed. But why should I do without graphics?

SigmaSoft's board gives you superb graphics. With the standard RAM, you get 640 x 250 pixel resolution, a little better than the '100. No color, just very crisp monochrome. Each pixel is addressable, but we'll discuss the software that does that later.

You've heard of interlaced video, I'm sure. But if you're like me, you have never been sure exactly what it means. That is in part because the term is used ambiguously.

The IGC has two interlace modes. In the simpler form, the image on the screen continually shifts back and forth vertically by a distance of a half a pixel—giving you a much denser display. The more sophisticated form of interlace not only does this shift, but also causes the video controller to alternately use two different segments of video memory for display purposes. You can have two quite different sets of pixels displayed. The end result is a doubling of vertical resolution, from 250 to 500 lines in our case.

To take advantage of this capability, your terminal hardware must be able to display in interlaced mode. The stock '89 has the hardware; to display interlaced video, all it needs is the firmware, a ROM chip containing suitable program code.

Ingenious aftermarket suppliers have solved the problem. You can get interlace-mode support from GraphNet Systems' Super19 ROM, or from Software Wizardry's Ultra ROM. The IGC needs such support to handle interlace; both these ROMs are compatible with the IGC. Photographs of the interlaced picture (assuming appropriate exposure times) exhibit remarkable resolution.

As a bonus, the IGC board also sup-

ports the alternate character sets these two ROMs allow. SigmaSoft offers one character ROM that has script characters as the alternate set.

(To aid in hardware/software debugging, the Super19 ROM has a nice "transparent mode" to display a file's control characters, rather than let the terminal go berserk trying. Bob Willink of Dallas, the author of SigmaSoft's ROM, has made a more specialized character set for me. This set includes special characters for the control characters.)

SigmaSoft plans to release another ROM that can be used with interlaced video mode. It will feature only one character set, but those characters will be better formed, since they will have double the normal resolution.

Installing a new terminal ROM for interlaced video capability is not the final word for ultra-high resolution using IGC. The cathode-ray tube (CRT) in your Heath/Zenith computer has a very fast phosphor decay. That means a pixel quickly goes dark when it's turned off. Very quickly. In fact, so quickly that the screen will flicker when you use interlace mode, since the dots are refreshed only thirty times per second. Some people don't mind the flicker, but most do.

How do we resolve that problem? First, don't use interlaced mode. Second, a lower intensity on the screen can alleviate some of the problem.

The only right way to do it, though, is to replace your quick-phosphor CRT with one like the Langley-St. Clair that has a slower decay rate. For around \$100, you can have an amber medium-decay CRT (or a green slow-decay one) that gives your '89 a whole new personality. It may not eliminate the flicker entirely, but it's a big improvement.

Remember, though, a new CRT is not a necessary upgrade; it just makes things even better.

Use any language

Using IGC: graphics is like falling off a log. You use ASCII control strings; the device drivers handle translation into the machine-language code the graphics board expects. This means you can write in any language that can write an ASCII file or print to the screen. I've experimented with Benton Harbor BASIC, Microsoft BASIC, PIE, and PIP on the HDOS side; and MBASIC, Turbo Pascal, COBOL, and PL/I-80 on the CP/M side. All work equally well.

You can choose the language appropriate to your application, and use the very same graphics commands in all languages. This is a plus over the "new" Z100 and Z150 series that force you to use Z-BASIC or BASICA for graphics.

Some of the advantages

By providing the IGC's software inter-

face in his device driver, Clay Montgomery has made life a lot easier for programmers. A common alternative is to provide a software interface in a library of compiled subroutines. An interpreted application (such as one in BASIC) must usually CALL the subroutines. This requires you to pre-load the subroutines in a protected area of memory, prepare appropriate lists of control information, and use some form of CALL statement.

If you use a compiled language like PL/I or FORTRAN, you must INCLUDE these subroutines in the LINK step. A copy of the subroutines becomes part of your object module (.COM or .ABS file)—causing it to be significantly larger than it otherwise would be.

If the interface routines need to be updated (to fix bugs, provide performance improvements, or enhance capabilities), compiled programs must be re-LINKed to INCLUDE the new subroutines. That is a lot of work—and is impossible if you purchased your application program from a third party. So there are a number of advantages to the IGC's graphics interface:

No special steps are required when you compile and link your programs.

The graphics code causes no disproportionate increase in the size of your programs. (However, available memory may be decreased due to the resident device driver.)

Universal language compatibility: any program that can write to the screen or a text file can incorporate IGC graphics code.

Straightforward text commands mean even PIP can put graphics on the screen. Just send the file to PUN: under CP/M, or to IG: under HDOS.

All graphics functions are supported (including screen dumps) without sophisticated user programming.

If SigmaSoft upgrades the software support, you will be able to run your old

programs under the newer version. If new commands are added, your old programs still run perfectly all right without them. If the execution of old commands is speeded up, that's taken care of in the driver; your programs just run faster. In any event, there's no need for re-compiling user programs.

Simple graphics commands shorten the learning curve for the new user.

The IG: and IGC: modules install themselves dynamically, placing themselves in memory appropriately for the size of your RAM. You don't have to change your operating system disks, and modules are transportable to other users with the same board.

Flexible graphics commands

The list of commands accompanying this article shows the vast flexibility of IG: graphics commands. The whole scope is covered, from simple lines and circles to complex arcs (using degrees, not complicated radians) and a multitude of elegant "paint" patterns.

Also, IG: is written to minimize the number of commands and characters required to get your job done. For instance, a single CIRCLE command can draw numerous concentric circles of differing radii, and there are "shorthand" methods of re-using pixel addresses.

A flexible architecture

The architecture of the IGC is such that the graphics are on a separate memory plane from the character video, and the graphics plane does not "scroll" with the text plane. So you have independent control of text and graphics. If the clear-screen command (ESC E) is printed to the terminal, only the character data is cleared; the graphics stay.

IG: also allows you to choose either or both planes for display. In fact, you can select one of up to three "graphics pages," each of which is addressable.

You can draw on one page while displaying another, allowing for very smooth animation sequences.

You'll find commands similar to Z-BASIC's GET and PUT to move graphic objects around on the screen.

Lines are always drawn on the screen from left to right, a minor irritation in some cases.

It's a snap for your programs to manipulate individual pixels using your language's AND, OR, XOR, etc., logical operators. (Compare two pictures, say, and display only the differences.)

With IGC, you can address pixels both by their absolute positions and relative to your last position, to provide the most flexible graphics available. There's even a SCALE command that makes enlargements simple.

A bonus of the IG: driver (in either operating system) is that you have a choice of access modes: you can write to it as a file (IG: in HDOS, and PUN: in CP/M), or merely prefix a screen print line with 01 hexadecimal (CTRL-A, CHR\$(01) in BASIC).

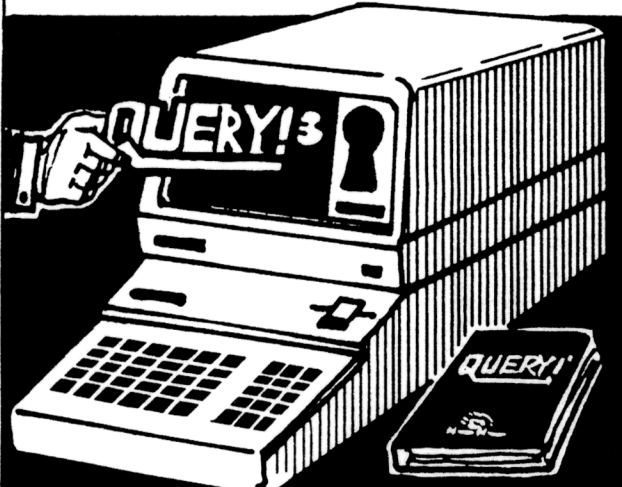
You can also have your program save its output to a file rather than sending it to the IGC. This means that your elegant graphics program (which takes two hours to do its calculations) can make a text file that can be displayed in graphics in seconds. Just copy the file to IG: at any time you want.

The IGC's design also makes for simple debugging. I just prefix all graphics PRINT lines with a variable named G\$. To debug, I set it to CHR\$(00), the null character. In that case, the text graphics commands are displayed on my screen. Merely by changing G\$ to CHR\$(01), the same commands are interpreted by IG: as pixel commands.

I'd like to see an extension to that for controlling the printer!

SigmaSoft calls it Interactive, and that it is. You get a graphics cursor built-in,

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with commands to place it. The GET and PUT commands allow you to move blocks of pixels.

Finally, you get an interactive device port (parallel) with commands in the IG: device driver to use it. You can choose a joystick or trackball. With a small amount of "guts level" programming, you can even be on your way to writing your own computer-aided design (CAD) package using a mouse or digitizer.

So what's the value of all these graphics?

Write your own game programs in hires. How about a full-screen pixel-graphics editor, including trackball or mouse? Design a plotter interface that allows you to preview the plot before committing it to paper. Include graphics lines, shadings, and other features for your business-application data-entry panels. Create superb business graphics on screen or on paper using standard language interfaces. (One thing I'd like to

see someone write is a program to convert Z-BASIC source code.)

Room for improvement?

Is IGC perfect? Not really. I had to give up my old Super19 escape sequence to change character fonts. True, IG: has a command to switch. But I'd like to have the old terminal escape sequence, too; it's easier when you can just embed a control sequence in a WordStar file.

When my '90 had an unrelated power-supply problem, it was a real pain to work around all the extra circuit boards. I'd like to see some minor engineering changes on the mounting brackets for just a little bit more clearance.

In addition, my service technician complained there was no easy way to electronically isolate the IGC board from the system for diagnostic purposes.

Though it's not SigmaSoft's fault, my white phosphor screen has too fast a decay to be usable in interlaced mode,

and I really *dislike* amber phosphors. The standard green phosphor used in Zenith units has a slower decay, but a very noticeable flicker is still present in interlaced mode. I've seen the medium-decay Langley-St. Clair amber CRT, and it still exhibits a disagreeable flicker. Perhaps the slow-decay green is better. I'm game for an external 15" or 19" high-persistence monochrome monitor that can really show the graphics off.

Clay's software is a marvelous invention. My complaints revolve around his refusal from the start to make it emulate the '100's Z-BASIC graphics command structure—or to use Digital Research's Graphics Systems Extension (GSX) for CP/M. Sure, some of his options, such as the command for concentric circles, are time-savers. But why isolate yourself in your own language world?

I'd rather lose some performance and gain compatibility with Z-BASIC or CB-80 programs already on the market. The

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 - A Professional Writer Looks at Budget Word Processing
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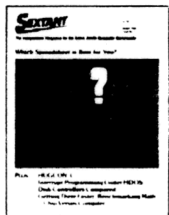
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most irritating omission is the ability to specify aspect ratios for circles and arcs. (You can work around that, though, using Scale commands.)

Documentation, etc.

The manual is excellent. You get a feature summary, complete installation and configuration instructions, detailed software descriptions for the IG: and PD: drivers, an advanced programmer's guide to the hardware, a troubleshooting guide, the warranty, and the parts list. Many BASIC program examples are included, which should make transition to IGC look like child's play.

There's little you won't know, or at least be able to look up. My only wish is for a couple of summary pages. It would be nice to have a command summary (sort of like the one I made for this article). And it would be nice to have a pattern page that identified each paint pattern, line style, and 'clear style' by name

and number. (You can get dashed lines, as well as light and heavy densities of dots. And when you clear the screen, you can get the screen striped, white, or gray, as well as the customary black.)

SigmaSoft's warranty is of the standard 90-day variety. It's written in plain English, though—unusual these high-tech days. SigmaSoft forewarns you that most problems are either configuration or software problems. I have installed two boards now, and had one bad cable, which was promptly replaced. The standard software update fee is \$10.

Simplicity helps

The most striking feature of the IGC is its versatility. Originally intended to put pixel graphics on your '89, Clay's functional design provides for a very flexible hardware peripheral.

Because the IGC uses simple, fast circuits, no hardware handshakes are required. The IGC can take anything a 4-

MHz CPU can throw at it. That makes for fast, simple software interfaces.

Because the board is accessed through a standard parallel interface, the on-board RAM is addressable without complicated bank-select algorithms. True, that RAM can't be used directly by the CPU. But most programmers understand port I/O better than bank-select techniques, anyway.

And look at the possibilities SigmaSoft is already supporting with supplied software.

First, the board's graphics are available through IG: and IGC: device drivers. The general ASCII sequential format of the data required to drive IG: allows you to write software in any language that can write an ASCII file or print to the screen.

Second, the die-hard can still choose to address the IGC board directly through port I/O for the ultimate in graphics speed. The documentation pro-

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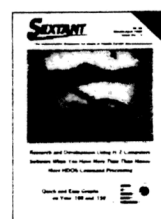
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vides you with the necessary control codes.

Third, a sophisticated RAM disk is easily implemented in either operating system through those same port I/O commands.

Fourth, excellent screen-dump utilities (in full graphics mode) provide a way to make a hard copy of your graphics development.

Fifth, system productivity can be increased by using the included RAM spooler software; it lets you output print files at CPU speed, and the printer catches up while you continue your work. (I've seen hardware versions of a 64K buffer alone costing as much as \$350!)

The future?

There are other possibilities. SigmaSoft is working on an alternate RAM disk driver that provides compatibility between HDOS and CP/M. Place the file to be transferred in the RAM disk, boot the other operating system, and copy the file back down.

Also in the works is a high-res graphics editor *à la* DR Graph, using the trackball interface. Clay displayed his prototype at a recent local Heath Users' Group meeting.

I've a few ideas for using IGC, too. For instance, my disk-intensive word processor races along at RAM speeds if the document file is on drive M:. If you have column-dependent data to enter, set up

the form in graphics RAM, safe from normal clear-screen calls. I use it to edit COBOL source code with PIE.

How do I rate it?

SigmaSoft's Interactive Graphics Controller provides a cost-effective alternative to trading in a perfectly good H/Z90 (or '89, or H8 with a '19 terminal) for one of the more sophisticated graphics machines.

As a bonus, you get a remarkable peripheral RAM device, addressable through normal parallel port I/O. Two parallel ports save your printer dollars; parallel printers *cost less!* The RAM-spooler software increases system productivity and availability. Add in a sprinkling of useful software, support for popular graphics printers, dual character set support, trackball and joystick support, and the ability to expand to 256K RAM when the price is right.

There's no question this peripheral beats all comers in the graphics world, and makes itself useful on its off-hours.

If it appears that I am not objective, sue me! I've used IGC for several months now, and would be lost without it. I must admit I'm prejudiced, both for the '89 and the IGC.

In my book, it rates *five stars*. How about five concentric circles, with "tread" fill? Fifty bucks to the first guy who implements Microsoft's Flight Simulator on it! (Provided I get a copy!)

Ordering Information

Interactive Graphics Controller: 64K model, \$129.95; 128K model, \$179.95; 256K model, \$229.95. Manual only, \$10. Include \$5 for U.P.S. shipping; Texas residents add 6% sales tax. Specify H/Z89 or H8. SigmaSoft and Systems
4488 Spring Valley, Suite 107
Dallas, TX 75234
214/392-1025

CRT replacements, \$99 + \$7 shipping. Langley-St. Clair Instrumentation Systems, Inc.
132 West 24th Street
New York, NY 10011
800/221-7070, 212/989-6876

Super19 ROM, \$49.95.
GraphNet Systems, Inc.
Country Lights Villas #1121
Bensalem, PA 19020
215/752-4604 or 215/376-5043 evenings

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The Software Toolworks
15233 Ventura Boulevard, Suite 1118
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